ExtremeWireless™ External Antenna with Wave 2

Site Preparation and Installation Guide

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About This Guide

This guide describes the requirements for the successful installation of the ExtremeWireless external antennas used in a wireless network. An ExtremeWireless network consists of access points, controllers, antennas, and associated accessories.

Warning
Only qualified personnel should perform installation procedures.

Intended Audience

The ExtremeWireless external antennas must be installed by an antenna installation professional who can determine, provide, and install the necessary support structure and grounding system. The antenna installation professional should be licensed or certified in accordance with local regulations.

This preface provides an overview of this guide and a brief summary of each chapter; defines the conventions used in this document; and instructs how to obtain technical support from Extreme Networks.

Text Conventions

The following tables list text conventions that are used throughout this guide.

Table 1: Notice Icons

Icon	Notice Type	Alerts you to...
	General Notice	Helpful tips and notices for using the product.
	Note	Important features or instructions.
	Caution	Risk of personal injury, system damage, or loss of data.
	Warning	Risk of severe personal injury.
New!	New Content	Displayed next to new content. This is searchable text within the PDF.

Table 2: Text Conventions

Convention	Description
`Screen displays`	This typeface indicates command syntax, or represents information as it appears on the screen.
The words **enter** and **type**	When you see the word “enter” 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 “type.”

Table 2: Text Conventions (continued)

Convention	Description
[Key] names	Key names are written with brackets, such as **[Return]** or **[Esc]**. If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example: Press **[Ctrl]**+**[Alt]**+**[Del]**
Words in italicized type	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.

Providing Feedback to Us

We are always striving to improve our documentation and help you work better, so we want to hear from you! We welcome all feedback but especially want to know about:

- Content errors or confusing or conflicting information.
- Ideas for improvements to our documentation so you can find the information you need faster.
- Broken links or usability issues.

If you would like to provide feedback to the Extreme Networks Information Development team about this document, please contact us using our short online feedback form. You can also email us directly at documentation@extremenetworks.com.

Getting Help

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

- GTAC (Global Technical Assistance Center) for Immediate Support
  - Phone: 1-800-998-2408 (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
  - Email: support@extremenetworks.com. To expedite your message, enter the product name or model number in the subject line.
- Extreme Portal — Search the GTAC 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.

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

- Your Extreme Networks service contract number and/or serial numbers for all involved Extreme Networks products
- A description of the failure
- A description of any action(s) 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

Related Publications

ExtremeWireless and ExtremeWireless AP documentation can be found on Extreme Documentation page at: www.extremenetworks.com/documentation/

Extreme recommends the following guides for users of ExtremeWireless products:

- *ExtremeWireless AP3916ic Installation Guide*
- *ExtremeWireless AP3912i Installation Guide*
- *ExtremeWireless AP3965i & AP3965e Installation Guide*
- *ExtremeWireless AP3935i & AP3935e Installation Guide*
- *ExtremeWireless AP3825i & AP3825e Installation Guide*
- *ExtremeWireless AP3805i FCC/ROW Installation Guide*
- *ExtremeWireless AP3801i Quick Reference Guide*
- *ExtremeWireless Appliance C5210 Quick Reference*
- *ExtremeWireless Appliance C5110 Quick Reference*
- *ExtremeWireless Appliance C4110 Quick Reference*
- *ExtremeWireless Appliance C25 Quick Reference*
- *ExtremeWireless Appliance C35 Quick Reference*
- *ExtremeWireless CLI Reference Guide*
- *ExtremeWireless End User License Agreements*
- *ExtremeWireless External Antenna Site Preparation and Installation Guide*
- *ExtremeWireless External Antenna with Wave 2 Site Preparation and Installation Guide*
- *ExtremeWireless Getting Started Guide*
- *ExtremeWireless Integration Guide*
- *ExtremeWireless Maintenance Guide*
- *ExtremeWireless Open Source Declaration*
- *ExtremeWireless User Guide*
- *IdentiFi Wireless WS-AP3865e Installation Guide*
- *IdentiFi Wireless WS-AP3825i & WS-AP3825e Installation Guide*
- *IdentiFi Wireless WS-AP3805i & WS-AP3805e Installation Guide*

1 AP Site Preparation

This chapter describes the site requirements for the successful installation of ExtremeWireless antennas. This information is intended for sales engineers or site evaluators.

Warning

Site prerequisites should be verified by a person familiar with national codes, local electrical codes, and with other regulations governing this type of installation. Extreme Networks, its channel partners, resellers, and distributors assume no liability for personal injury, property damage, or violation of government regulations that may arise from failing to comply with the instructions in this guide.

ExtremeWireless Access Points that Support External Antennas

Not all antennas listed in this document can be used by all wireless access points. If the name of the access point ends with an "e", the access point supports external antennas. For example, the AP3935e supports external antennas. For legacy access points, refer to *ExtremeWireless™ External Antenna Site Preparation and Installation Guide (P/N 9034559-09)* to determine if your legacy access point supports external antennas. Antenna Models identifies which antennas are supported by each AP.

Table 3: Legacy Access Points that Support External Antennas

Access Point	External Antenna Support
WS-AP2605	No
WS-AP2610	No
WS-AP2620	Yes
WS-AP2650	No
WS-AP2660	Yes (but requires Siemens Industry antennas)
WS-AP3605	No
WS-AP3610	No
WS-AP3620	Yes
WS-AP3630	No

Table 3: Legacy Access Points that Support External Antennas (continued)

Access Point	External Antenna Support
WS-AP3640	Yes
WS-AP3660	Yes

Table 4: Access Points that Support External Antennas

Access Point	External Antenna Support
WS-AP3705i	No
WS-AP3710i	No
WS-AP3710e	Yes
WS-AP3725e	Yes
WS-AP3715i	No
WS-AP3715e	Yes
WS-AP3765i	No
WS-AP3765e	Yes
WS-AP3767e	Yes
WS-AP3805 i/e	
WS-AP3801i	
WS-AP3825i	No
WS-AP3825e	Yes
WS-AP3865e	Yes

Note
In the rest of this book, for simplicity, references to legacy access point model numbers will not include the “WS-” prefix.

Choosing Antennas for Wireless Network Configurations

The type and number of antennas that you need depend on the configuration of your wireless network. The following table lists the general type of antenna to use for various wireless network configurations.

Table 5: Antennas for Wireless Network Configurations

Network Configuration	Description	Antenna Type
LAN-to-LAN Point-to-Point	This is a wireless link between two WDS APs that connects two separate wired LANs. (WDS APs are configured to operate as Workgroup bridges.)	Directional antennas
LAN-to-LAN Point-to-Multipoint	In a point-to-multipoint network, up to nine WDS APs provide wireless links to connect up to nine LANs. One AP is designated as the root (multipoint) AP connected to a wired infrastructure. The other APs are called child APs. Child APs establish a backhaul connection with the root AP and, at the same time, provide LAN switching.	Omni-Directional antenna— to which the root AP connects. Directional antennas— to which the child APs connect.
Wireless Infrastructure	This is an inside/outside wireless network where one or more WDS APs are used to establish a wireless backhaul and connect clients or LAN segments to the wired LAN.	An Omni-Directional or a sectored antenna.

Determining the Antenna Locations

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

- Type of antennas. The ExtremeWireless antennas are described in Antenna Installation on page 30.
- Length of cable connecting the antenna to the AP.
- 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 AP.

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.

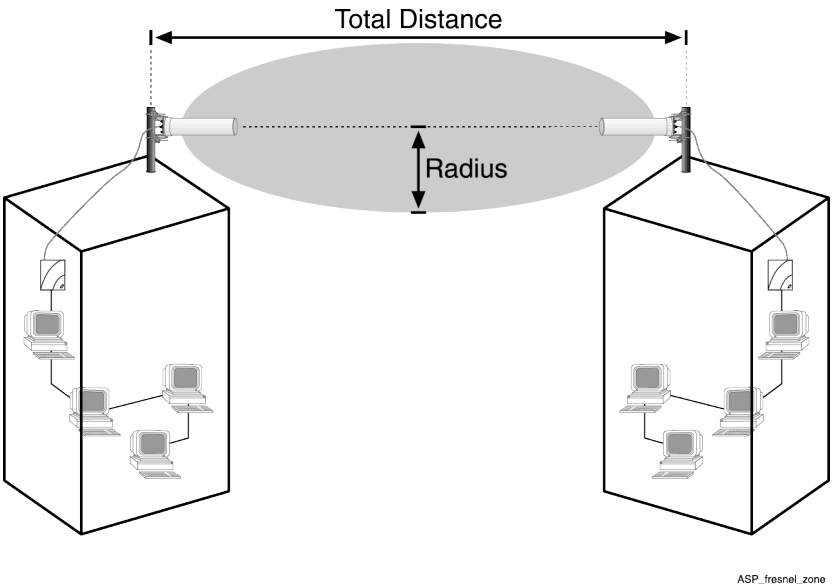


Figure 1: Fresnel Zone and Line of Sight Clearance

The radius can be calculated using the following formula:

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

Where

D = Distance between the antennas in kilometers

f = Frequency in GHz

60% of the Fresnel Zone has to 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

and Table 7 on page 11 lists typical antenna height requirements.

Table 6: Typical Antenna Height Requirements—2.4 GHz

Distance between Tx and Rx antennas (km)	Fresnel Zone radius (meters)	Earth curvature (meters)	Minimum antenna height requirements (meters)
2	7.9	0.08	7.98
5	12.5	0.49	12.99
10	17.67	1.94	19.61
15	21.64	4.37	26.01

Table 6: Typical Antenna Height Requirements—2.4 GHz (continued)

Distance between Tx and Rx antennas (km)	Fresnel Zone radius (meters)	Earth curvature (meters)	Minimum antenna height requirements (meters)
20	25	7.77	32.77
25	28	12.14	40.14
30	30.6	17.48	48.08

Table 7: Typical Antenna Height Requirements—5 GHz

Distance between Tx and Rx antennas (km)	Fresnel Zone radius (meters)	Earth curvature (meters)	Minimum antenna height requirements (meters)
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:

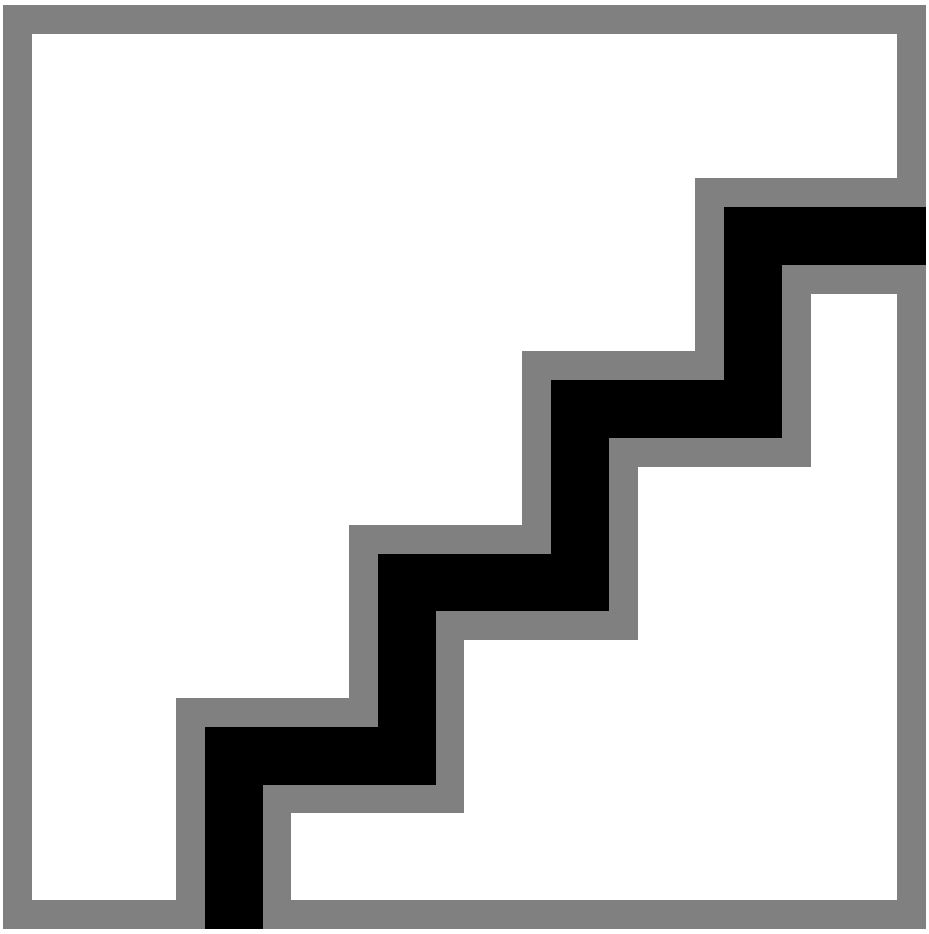


Figure 2: Potential Obstacles to Line of Sight (not to scale)

Additional 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

  Direct earth grounding of the antenna and the lightning protector is necessary to protect the installation from lightning and the build-up of static electricity. The wireless device 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.

  Ensure that the cable between the antenna and lightning protector is at least 0.9 meters (3 feet) away from high-voltage or high-current cable. For more information about the lightning protector, see Grounding System on page 31.

- Antenna Height

  If you are mounting the antenna on a roof, the antenna must have minimum clearance as specified in Table 6 on page 10 and Table 7 on page 11.

  If you are mounting the directional antenna to a wall of a building, it must be high enough to achieve a clear line of sight. Mounting an omni-directional antenna to the side of a building can cause signal reflection and reduce distance.

  Note
  The installer is responsible for local building codes.

- AP Placement

  The AP should be located indoors, and connected to the outdoor antenna using the shortest cable possible to reduce the loss of the cable.

Antenna Models

This section provides a brief description of the antenna models offered by Extreme Networks for use with ExtremeWireless APs. Table 8 lists antennas supported by the 39xx series APs. Table 9 on page 15 lists antennas for the AP38xx series . Refer to Antenna Installation on page 30 for antenna installation instructions.

Table 8: AP39xx External Antennas Listed by AP

					Antenna Gain (dBi)	
Extreme Networks Wireless AP	Antenna Model	Type	Description	Frequency (GHz)	2.4G	5G
3965e The AP3965 uses Standard Polarity, Type-N Plug and Type N Jack connectors. For optional cables, see Table 64 on page 165.	30711 (WS-AO-DQ05120N)	Outdoor	120 degree, Sector	2.4G/5G	5.5	5.5
	30712 (WS-AO-5Q04060N)	Outdoor	60 degree, Sector	5G	N/A	4
	30713 (WS-AO-2Q05060N)	Outdoor	60 degree, Sector	2.4G	5	N/A
	30714 (WS-AO-DE07025N)	Outdoor	Sector	2.4G/5G	7.5	6.5
	30715 (WS-AO-DE13025N)	Outdoor	Sector	2.4G/5G	13	12
	30716 (WS-AO-5Q05025N)	Outdoor	Sector	5G	N/A	4.5
	30717 (WS-AO-5Q11025N)	Outdoor	Sector	5G	N/A	11.5
	30718 (WS-AO-DE10055N)	Outdoor	Sector	2.4G/5G	10.5	7.5
	30720 (WS-AO-DE07100N)	Outdoor	Panel. Includes eight, five-foot adapter cables.	2.4G/5G	7	6
	30724 (WS-AO-DQ04360N)	Outdoor	Omni	2.4G/5G	5.5	6
	WS-AO-5D23009N (WS-AO-5D23009N)	Outdoor	9 degree, panel, dual polarization, point-to-point. Includes two, five-foot adapter cables	5G	N/A	23
3935e The AP3935 uses Reverse Polarity SMA connectors.	30702 (WS-AI-DQ05120)	Indoor	120 degree, Sector	2.4G/5G	5.5	5.5
	30703 (WS-AI-5Q04060)	Indoor	60 degree, Sector	5G	N/A	4
	30704 (WS-AI-2Q05060)	Indoor	60 degree, Sector	2.4G	5	N/A
	30705 (WS-AI-DE07025)	Indoor	25 degree, Sector	2.4G/5G	7.5	6.5
	30706 (WS-AI-5Q05025)	Indoor	25 degree, Sector	5G	N/A	4.5
	30707 (WS-AI-DE10055)	Indoor	55 degree, Sector	2.4G/5G	10.5	7.5
	30709 (WS-ANT-2DIP-4)	Indoor	DIPOLE	2.4G	4.66	N/A
	30710 (WS-ANT-5DIP-4)	Indoor	DIPOLE	5G	N/A	4.67
	WS-AI-DQ04360 (WS-AI-DQ04360)	Indoor	Ceiling Mount Omni	2.4G/5G	4	7

The following table lists existing antennas supported by AP38xx models.

Table 9: AP38xx External Antennas Listed by AP

					Antenna Gain (dBi)	
Extreme Networks Wireless AP	Antenna Model	Type	Description	Frequency (GHz)	2.4G	5G
AP3865e The AP3865 uses Standard Polarity, Type-N Plug and Type N Jack connectors. For optional cables see Table 64 on page 165.	WS-AO-DT05120N	Outdoor	120 degree, sector, triple-feed, MIMO.	2.3–2.7/4.9–6.1	5	5
	WS-AO-5D23009N	Outdoor	9 degree, panel, dual polarization, point-to-point. Includes two, five-foot adapter cables.	5.15–5.875	N/A	23
	WS-AO-DX13025N	Outdoor	27/30 degree, panel, six-feed.	2.4–2.5/5.15–5.875	12	11
	WS-AO-DX10055N	Outdoor	55 degree, panel, six-feed.	2.4–2.5/5.15–5.875	9	8
	WS-AO-DS02360N3	Outdoor	Omni baton, single feed, 3 pack.	2.4–2.5/5.15–5.875	2	2
	WS-AO-2DIPN3	Outdoor	Dipole, 3 pack.	2.4	5	N/A
	WS-AO-5DIPN3	Outdoor	Dipole, 3 pack.	5.0	N/A	7
	WS-AO-DX07180N	Outdoor	180 degree, panel, six feed. Includes six, five-foot adapter cables.	2.4–2.5/5.15–5.875	7	7
AP3825e The AP3825 uses Reverse Polarity SMA connectors.	WS-ANT-2DIP-3	Indoor	MIMO; Single-band, 3 connector ports.	2.4	3	N/A
	WS-ANT-5DIP3	Indoor	MIMO; Single-band, 3 connector ports.	5.0	N/A	3
	WS-AI-DX02360	Indoor	MIMO; Dual-band.	2.4–2.5/5.15–5.85	2	N/A
	WS-AI-DT05120	Indoor	MIMO, Sector, Dual-band, 3 connector ports.	2.3–2.7/4.9–6.1	5	2.1
	WS-AI-DX10055	Indoor	MIMO; Sector, Dual-band.	2.4–2.5/5.1–5.9	10	6
	WS-AI-DX07025	Indoor	MIMO; Sector; Dual-band.	2.4–2.5/5.1–5.9	6.5	5.5

Table 9: AP38xx External Antennas Listed by AP (continued)

					Antenna Gain (dBi)	
Extreme Networks Wireless AP	Antenna Model	Type	Description	Frequency (GHz)	2.4G	5G
AP3805e The AP3805 uses Reverse Polarity SMA connectors.	WS-AI-DQ04360	Indoor	MIMO; Dual-band, 802.11n, 4 connector ports.	2.4-2.5/4.9-5.9	4	7
	WS-AI-DD05120	Indoor	MIMO, Dual-Feed, 120 degree sector.	2.4/5.0	6	5
	WS-ANT-2DIP2	Indoor	Dipole, 2 pack.	2.4	3	N/A
	WS-ANT-5DIP2	Indoor	Dipole 2 pack.	5.0	3	N/A
AP3715e	WS-ANT-2DIP-3	Indoor	MIMO; Single-band, 3 connector ports	2.4	3 dBi	
	WS-ANT-5DIP-3	Indoor	MIMO; Single-band	5.0	3 dBi	
	WS-AI-DX02360	Indoor	MIMO; Dual-band	2.4–2.5, 5.15–5.85	2 dBi	
	WS-AI-DT05120	Indoor	MIMO; Sector; Dual-band	2.3–2.7, 4.9–6.1	5 dBi x 3, 2:1	
	WS-AI-DX10055	Indoor	MIMO; Sector, Dual-band	2.4–2.5, 5.1–5.9	10 dBi 6 dBi	
	WS-AI-DX07025	Indoor	MIMO; Sector; Dual-band	2.4–2.5, 5.1–5.9	6.5 dBi 5.5 dBi	
AP3710e	WS-AI-DT04360	Indoor	Omni-Directional, 3 inputs	2400–2500 4900–5990	4 3	
	WS-AI-DT05120	Indoor	120 Degree Sector Directional, 3 inputs	2300–2700 4900–6100	5 5	
	WS-AI-DX02360	Indoor	Omni-Directional	2400–2500 5.1–5.85	2 2	
	WS-AO-DX10055N	Outdoor	Directional MIMO Panel	2400–2500	6.5 5.5	
	WS-AO-DX10055	Outdoor	Directional MIMO Panel	5100–5900	9.5/8	
	WS-AI-DX10055	Indoor	Directional MIMO Panel	2400–2500 5100–5900	6.5 5.5	

Table 9: AP38xx External Antennas Listed by AP (continued)

					Antenna Gain (dBi)	
Extreme Networks Wireless AP	Antenna Model	Type	Description	Frequency (GHz)	2.4G	5G
AP3725e	WS-AI-DT04360	Indoor	Omni-Directional, 3 inputs	2400-2500 4900-5990	4 3	
	WS-AI-DT05120	Indoor	120 Degree Sector Directional, 3 inputs	2300-2700 4900-6100	5 5	
AP3765e/AP3767e	WS-AO-DX13025	Outdoor, stadium	Directional MIMO Panel	2400–2500 5100–5900	12.5 11.5	
	WS-AO-5D16060	Outdoor, sector	Dual-polarization Panel 802.11a/bg	5150–5875	16	
	WS-AO-5D23009	Outdoor, point-to-point	Dual-polarization Panel 802.11a	5000	23	
	WS-AO-DT05120- 1	Outdoor, sector	120 Degree Sector, Triple-Feed	2300–2700 4900–6100	5	
	WS-AIO-2S18018	Indoor/ Outdoor	Panel	2300–2500	18	
	WS-AO-2S10360	Outdoor	Omni-Directional	2400	10	
	WS-AO-5S10360	Outdoor	Omni-Directional	5000	10	
	WS-AO-DS05360	Outdoor	Omni-Directional Baton	2400–2500 5150–5350	5	
	WS-AO-DX10055	Outdoor	Dual-band, Directional, MIMO	2400–2500 5100–5900	9.5/8	
AP3620/AP3640	WS-ANT02	indoor	Omni-Directional	2400–2500 5150–5900	4	
	WS-AO-DS05360	outdoor	Omni-Directional	2400–2500 5150–5350	5	
	WS-AO-5D16060	outdoor	60 Degree Sector Directional, 2 Inputs	5150–5875	16	
	WS-AO-5D23009	outdoor	Panel, 2 Inputs	5150–5875	23	
	WS-AI-DT04360	indoor	Omni, 3 Inputs	2400–2500 4900–5990	3 4	
	WS-AI-DT05120	indoor	120 Degree Sector Directional, 3 Inputs	2300–2700 4900–6100	5	

Table 9: AP38xx External Antennas Listed by AP (continued)

					Antenna Gain (dBi)	
Extreme Networks Wireless AP	Antenna Model	Type	Description	Frequency (GHz)	2.4G	5G
AP3660	WS-AO-DS05360	outdoor	Omni-Baton	2400–2500 5150–5350	5	
	WS-AO-2S10360	outdoor	Omni-Baton	2400–2500	10	
	WS-AO-DT05120	outdoor	120 Degree Sector, Triple-Feed, MIMO	2300–2700 4900–6100	5	
	WS-AO-5S10360	outdoor	Omni-Baton	5000	10	
	WS-AO-5D16060	outdoor	60 Degree Sector Dual Polarization	5150–5875	16	
	WS-AO-5D23009	outdoor	9 Degree Panel, dual polarization, point-to-point	5150–5875	23	
	WS-AIO-2S18018	indoor/ outdoor	18 Degree Panel	2300–2500	18	
	WS-AODT05120- 1	outdoor	120 Degree Sector, Triple-Feed	2300–2700 4900–6100	5	
	WS-ANT21	outdoor	Omni-Baton	2400–2500 4940–5925	5 7	
	WS-AO-DX13025	outdoor, stadium	Directional MIMO Panel	2400–2500 5100–5900	12.5 11.5	

Table 9: AP38xx External Antennas Listed by AP (continued)

					Antenna Gain (dBi)	
Extreme Networks Wireless AP	Antenna Model	Type	Description	Frequency (GHz)	2.4G	5G
AP2620	WS-ANT01	indoor	Omni-Directional 802.11a/bg	2400–2500 5150–5900	4	
	WS-AO-DS05360	outdoor	Omni-Directional Baton	2400–2500 5150–5350	5	
	WS-AIO-5S12060	indoor	Panel	2400–2500 4900–5990	12	
	WS-AI-2S03360	indoor	Omni-Directional 802.11a/bg	2400–2500	3.5	
	WS-AI-DS06360	indoor	Omni-Directional 802.11a/bg	2300–2700 4900–6000	5 6	
	WS-AIO-DS05120	indoor/ outdoor	Panel (ceiling) Antenna 802.11a/bg	2400–2500	5	
	WS-AIO- 2S07060	indoor/ outdoor	Panel Antenna 802.11a	2300–2600 4900–6000	7.5	
	WS-AIO-5S17017	indoor/ outdoor	Panel	5470–5850	17	
	WS-AIO-2S14090	indoor/ outdoor	Panel Antenna 802.11bg	2400–2485	14	
	WS-AIO-5S15090	indoor/ outdoor	Panel Antenna 802.11a	4900–6000	15	
	WS-AIO-2S18018	indoor/ outdoor	Panel	2300–2500	18	

Cable Options

Extreme Networks offers optional low-loss, outdoor and indoor cables. The outdoor cables are watertight cables to connect the outdoor APs to an antenna. The optional outdoor cables have a Standard Polarity Type-N Plug and Type-N Jack. The indoor cables have a Reverse Polarity SMA-Type connector. Carefully determine the distance between the locations where you intend to mount the external antenna to ensure that you order the right cable length.

Note
Extreme Networks recommends using PFP600 (Cables: WS-CAB-L600C25N and WS-CAB-L600C50N) for 5 GHz.

For more information about antenna cables, see:

- Table 64 on page 165
- Indoor Antenna Cables with Reverse Polarity SMA-Type Connectors on page 166

Contacting an Antenna Installation Company

Have an antenna installation professional install the outdoor antennas. The antenna installer provides the expertise to properly install, secure, and ground your antenna. The following checklists describe tasks that the installer may need to perform.

Note
The antenna installation professional should be licensed or certified in accordance with local regulations.

Ligtning Proteciton

- Determine the mounting location for the lightning rod (positioned near the antenna).
- Ensure an earth ground location for the antenna structure and lightning protector.

Mounting Requirements

- Determine the type of mounting that is required (tripod, wall mount, and so on).
- Determine the guy wires needed. Typically, three guy wires are needed for each 3 meter (10 foot) section of the mast; for example, 6 meters (20 feet) of mast requires six guy wires.

Line of Sight

- Determine the mounting location for the antenna.
- Ensure that the back of the antenna is clear.
- Ensure that remote and local antennas can see each other.
- Ensure that no obstacles are in the direct path or within the defined zone of the two sites.
- Consider whether any Radio Frequency (RF) interference is present.

Installation Requirements

- Determine the best location for the AP.
- Determine the length of cable required from the antenna to the AP.
- Ensure the location has an accessible Ethernet connection.
- Determine the distance between buildings.
- You may need to provide the following distances when contacting the antenna installation company.

Distance to Provide to Antenna Installation Company

Coverage area required (wireless infrastructure network configuration): Height of building A:
Height of building B: All possible obstacles that can interfere with the defined radius.

2 ExtremeWireless APs That Support External Antennas

This section provides an illustration of each ExtremeWireless AP with information about how to determine where to place the AP.

Determining the Location of the AP

An ExtremeWireless AP connects to a lightning protector with a 51-centimeter (20-inch) cable. The lightning protector connects to the outdoor antenna with a standard 6.1-meter (20-foot), 7.6-meter (25-foot), 15.24-meters (50-foot), or a 22-meter (75-foot) low-loss cable. A longer cable decreases the distance achievable between antennas.

The ideal location to install your ExtremeWireless AP must satisfy the following requirements:

- For indoor APs, the location must be indoors to protect the AP from extreme weather conditions, excessive heat and humidity, and to keep the unit free from vibration and dust. For a list of ExtremeWireless indoor APs and the supported antennas, see External Antennas for Use with Indoor APs on page 112.

  Note
  This requirement does not apply to the AP3660, AP3765, AP3767e, and AP3865, which are outdoor access points.

- The lightning protector and antenna mast must be connected to the same earth ground (using separate grounds) as the AC wall outlet ground using an equipotential bonding conductor.
- The location must provide a connection to the network backbone via an Ethernet LAN cable going to a hub, bridge, or directly into a patch panel. An AP in a WDS does not require an Ethernet connection since backhaul is established over the wireless medium.
- For an outdoor AP, the location must be close to where the low-loss antenna cable will enter the building. The low-loss cable connecting the antenna to the lightning protector should not exceed 22 meters in length for 2.4 GHz, or 15.24 meters in length for 5 GHz, due to the distance reduction with longer cables. For a list ofExtremeWireless outdoor APs and the supported antennas, see External Antennas for Use with Outdoor APs on page 51.

- Extreme Networks recommends using PFP240 or PFP400 cable for 2.4 GHz and PFP600 for 5GHz. For more information, see Cable Specifications on page 166.
- External Wave 2 antennas have built-in lightening protectors.

Extreme Wireless AP3915e

The AP3915e is an 802.11AC Wave 2 Access Point featuring dual 2x2:2 radios. The all-metal design supports high operating temperatures, external antennas, and flexible mounting options for wall mount, ceiling mount, beam, and T-bar. The AP can be powered by 802.3af or by using a 12VDC wall brick power source.

The AP3915e comes with three external antenna ports and an integrated BLE/802.15.4 radio (Requires ExtremeWireless V10.41.01)

The following features are present in AP3915e:

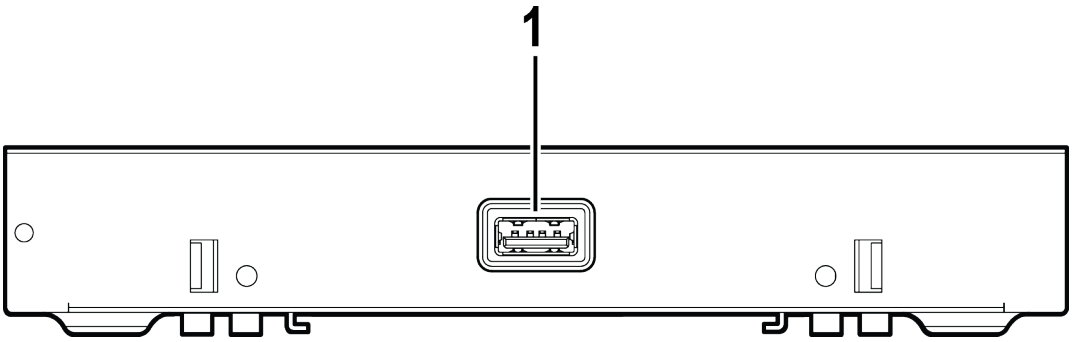


Figure 3: AP3915e Front View

Table 10: AP3915e Front View Feature

Item	Description
1	USB Port

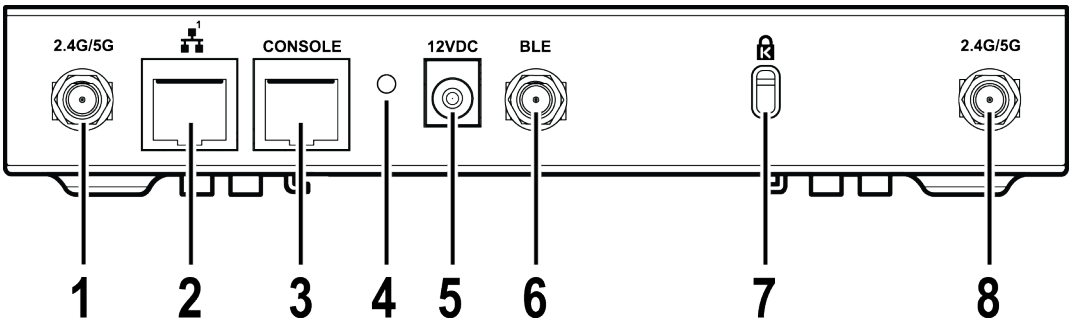


Figure 4: AP3915e Rear View

Table 11: AP3915e Rear View Feature

Item	Description
1 - 2.4G/5G	Radio
2 - GE1/PoE	Use this port to power on the AP.
3 - Console RJ45 Port	Console RJ45 Connector.
4 - Reset button	Use a tool to access this button to reset the AP settings.
5 - Optional 12V DC Power Supply	The AP can be powered on using this optional power supply.
6	IoT/BLE Antenna Connector.
7	Kensington Lock Slot.
8	2.4/5G Radio Antenna Connector.

Refer to the *Extreme NetworksAP3915e Installation Guide* for information about AP installation procedures.

Extreme Wireless AP3917e

The AP3917 is an IP67 rated outdoor Access Point with 802.11ac dual band 2:2 radios. The AP3917 is easy to install, lightweight, and is available in an internal (AP3917i) and external (AP3917e) antenna model. Each model includes 802.11 radios, an IoT radio, and a GPS radio. The antennas are built into the AP3917i while you need to install external antennas or terminators for the AP3917e model.

The AP3917e has five external antenna ports and an integrated, BLE/802.15.4 radio.

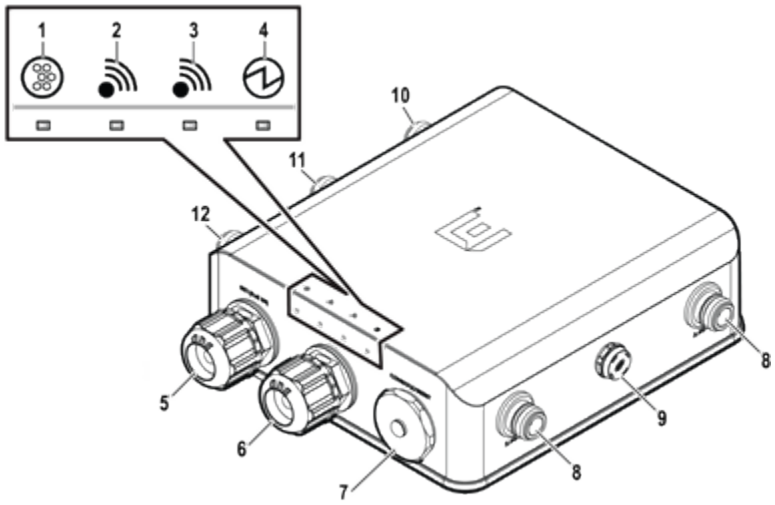


Figure 5: Top and Side Views of AP3917e

1	IoT/BLE Radio
2	Radio - 5 GHz
3	Radio - 2.4 GHz
4	Status

5	GE1 (PoE IN)
6	GE2
7	Console/Reset
8	2.4 G - Antenna 1 and 2
9	Vent
10	5G - Antenna 1
11	BLE/802.15.4 Antenna
12	5 G - Antenna 2

Refer to the *Extreme NetworksAP3917ie Installation Guide* for information about AP installation procedures.

ExtremeWireless AP3965e

The AP3965 enables you to extend your wireless LAN beyond the boundaries of indoor locations. It is resistant to harsh outdoor conditions and extreme temperatures. Using the advanced full mesh wireless distribution feature of the wireless LAN, the AP3965 can extend your wireless LAN to outdoor locations without Ethernet cabling. A mounting bracket is available to enable quick and easy mounting of the AP3965 to walls and poles. The ExtremeWireless 3965e offers 8 connections for external antennas.

The AP3965 is an 802.11ac AP that supports 802.11a/802.11g and 802.11b legacy devices. It is delivered in a rugged enclosure. The AP3965 interoperates fully with the wireless LAN, including support for wireless VoWLAN, branch office mode, availability and mobility features. The AP3965i provides eight internal antennas, and the AP3965e (Figure 6) supports a variety of external antennas, providing range and coverage versatility. For a list of supported antennas for the AP3965, see Table 8 on page 14.

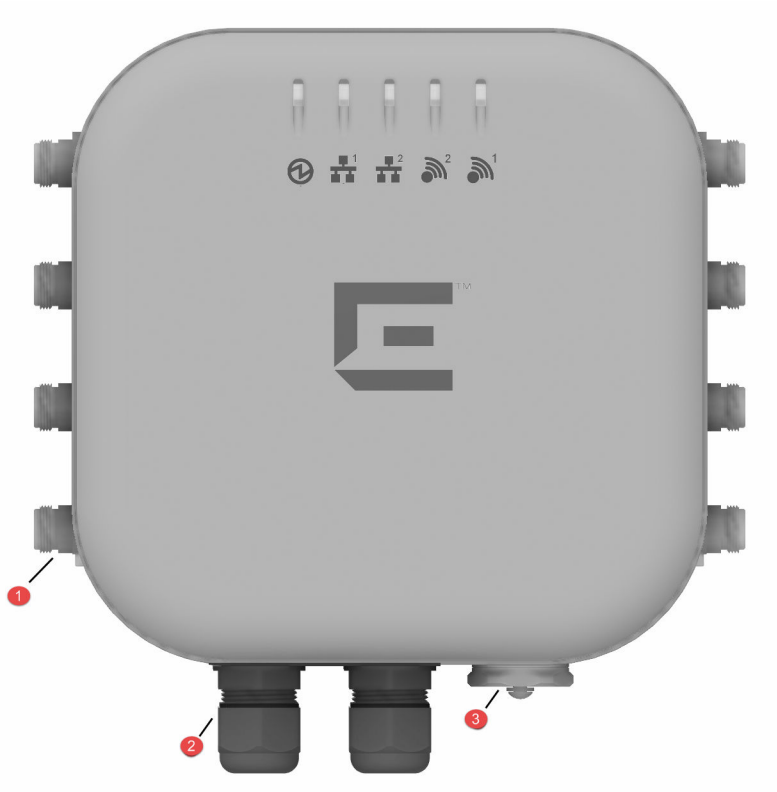


Figure 6: AP3965e Front View

Component	Description
1	4 Radio Antenna Connection ports on each side
2	LAN Ports (POE) • LAN 1 PDE Port • LAN 2 PSE Port output of DC48V, 0.26A
3	Console Port and Reset Button

Refer to the *ExtremeWireless AP3965i & AP3965e Installation Guide* for information about AP installation procedures.

ExtremeWireless AP3935e

The AP3935 is designed to extend your Wireless LAN around indoor locations. The AP3935 supports the 802.11ac and 802.11n wireless standards, with full backward compatibility with legacy 802.11a, and 802.11b/g devices.

The AP3935 interoperates fully with Wireless LANs, including support for VoWLAN, branch office mode, guest services, RTLS, availability, and mobility features. The operating temperature: 0 - 50C. The AP3935 offers the following features:

- Support for two MIMO 4x4 (up to four 802.11ac spatial streams).
- Two single band radios for dual-band, concurrent operation, optimized for indoor antenna coverage:
  - 5 GHz (Radio 1) in any of the following modes: IEEE802.11ac, a/b/g and/or n

  - 2.4 GHz (Radio 2) in any of the following modes: IEEE802.11ac, a/b/g and/or n
- Enclosed in a rectangular, compact case.
- Can be mounted on walls and drop/suspended ceilings.
- Provides 80 MHz Bandwidth at 2.4/5 GHz operation (Channel Bonding).
- Power is provided through two Ethernet ports (LAN port). This is the preferred method of powering the AP on ceiling and wall installations. The AP3935 can also be powered by an external DC power supply by plugging the supply's input jack into the DC-In port.
- The ExtremeWireless 3935e offers eight connections for external antennas.

For a list of supported antennas for the AP3935, see Table 8 on page 14.

Figure 7: AP3935e Top View

Refer to the *ExtremeWireless AP3935i & AP3935e Installation Guide* for more information about AP installation procedures.

ExtremeWireless AP3865e

The WS-AP3865e is designed to extend your wireless LAN around indoor locations. It operates fully with the Extreme Networks wireless LAN, including support for Extreme Networks wireless VoWLAN, branch office mode, availability and mobility features. This AP operates in 802.11ac and 802.11n mode and also support 802.11a/802.11g and 802.11b standard legacy devices. It includes mounting brackets. It can be powered directly through the LAN using Power over Ethernet (PoE), or by an external adapter.

Using the advanced full mesh wireless distribution feature of the wireless LAN, the WS-AP3865e can extend your wireless LAN to outdoor locations without Ethernet cabling. It is resistant to harsh outdoor conditions and extreme temperatures.

For a list of supported antennas for the AP3865, see Table 9 on page 15.

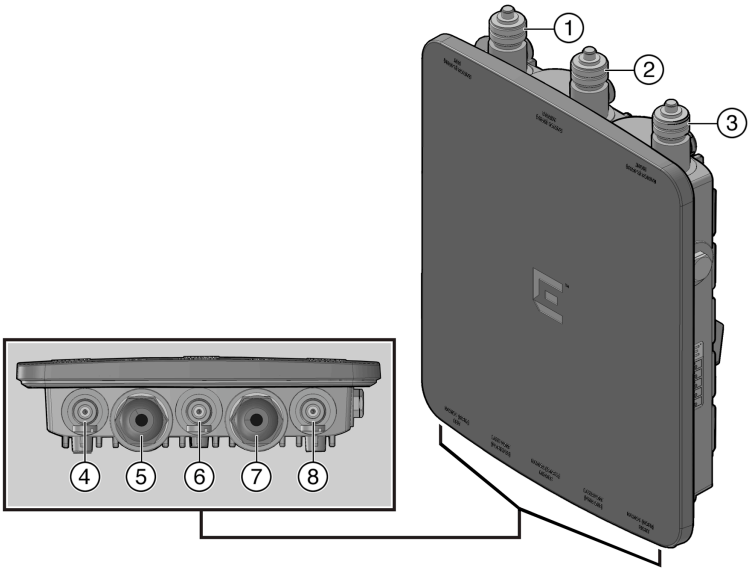


Figure 8: WS-AP3865e Top/Bottom View

1	Radio 2—Left Antenna (2.4 GHz)	5	LAN 1 Port (POE Input)
2	Radio 1—Middle Antenna (5.0 GHz)	6	Radio 2—Middle Antenna (2.4 GHz)
3	Radio 2—Right Antenna (2.4 GHz)	7	LAN 2 Port (Pwr Out)
4	Radio 1—Left Antenna (5.0 GHz)	8	Radio 1—Right Antenna (5.0 GHz)

Refer to the *IdentiFi Wireless WS-AP3865e Installation Guide* for information about AP installation procedures.

Note

The AP3660 provides six external antenna ports. The network administrator determines which antenna port will be used based on the external antenna selected. The AP3660 can also be configured to select the antenna that provides the best possible data transmission (diversity).

ExtremeWireless AP3825e

The AP3825e is designed to extend your wireless LAN around indoor locations. It operates fully with the Extreme Networks wireless LAN, including support for Extreme Networks wireless VoWLAN, branch office mode, availability and mobility features. This AP operates in 802.11ac and 802.11n mode and also support 802.11a/802.11g and 802.11b standard legacy devices. It includes mounting brackets. It can be powered directly through the LAN using Power over Ethernet (PoE), or by an external adapter. (110/240V AC/DC)

WS-AP3825e supports two MIMO 3x3 (up to three 802.11ac spatial streams). It provides two single band radios for dual-band, concurrent operation, optimized for indoor antenna coverage.It provides 40MHz Bandwidth at 2.4/5 GHz operation (Channel Bonding).

The WS-AP3825e has dual Ethernet (LAN) ports for fault-tolerant network connection and failover.

For a list of supported antennas for the WS-AP3825e, see Table 9 on page 15.

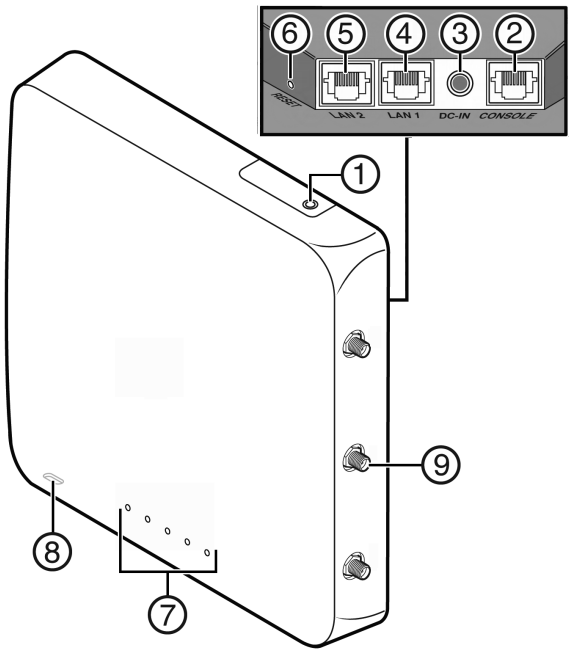


Figure 9: AP3825e External Antenna Cable Installation

1	(not used)	6	Reset Switch
2	Console Port	7	LEDs
3	External DC Power Supply Port	8	(bottom) Kensington Lock Slot
4	LAN Port 1	9	External antenna connectors (6 R-SMA)
5	LAN Port 2		

Refer to the *IdentiFi Wireless WS-AP3825i & WS-AP3825e Installation Guide* for information about AP installation procedures.

ExtremeWireless AP3805e

The WS-AP3805 is designed to extend your wireless LAN around indoor locations. It operates fully with the Extreme Networks wireless LAN, including support for Extreme Networks wireless VoWLAN, branch office mode, availability and mobility features. This AP operates in 802.11ac and 802.11n mode and also support 802.11a/802.11g and 802.11b standard legacy devices. It includes mounting brackets. It can be powered directly through the LAN using Power over Ethernet (PoE), or by an external adapter. An optional, external 12V DC power supply (WS-PSI12V-MR1) may be ordered separately to power the WS-AP3805 from a standard AC wall outlet.

For a list of supported antennas for the WS-AP3805e, see Table 9 on page 15.

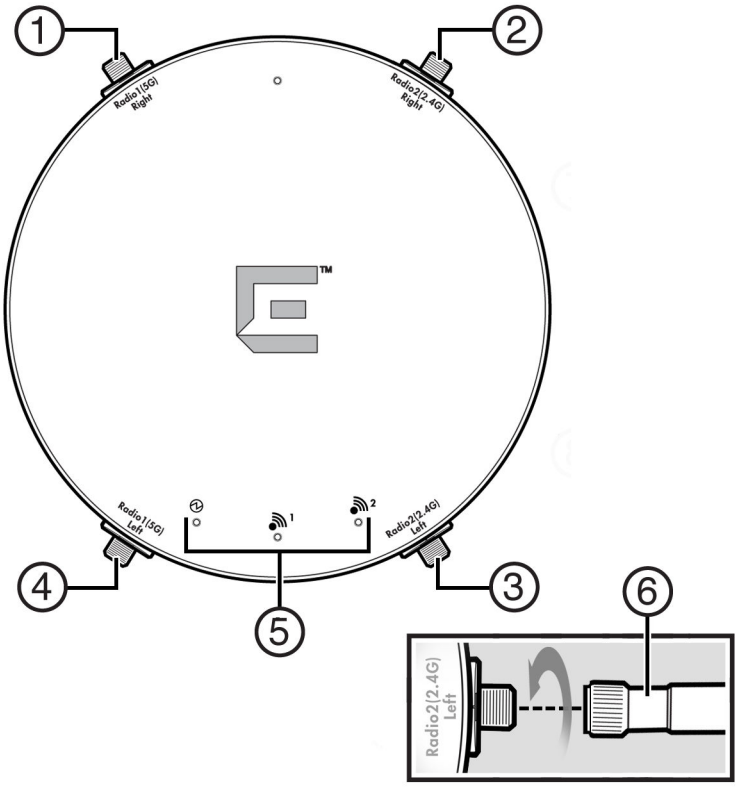


Figure 10: AP3805e External Antenna Cable Installation

Component	Description
1	Antenna Port Radio 1 - Right (5 GHz)
2	Antenna Port Radio 2 - Right (2.4 GHz)
3	Antenna Port, Radio 2 - Left (2.4GHz,)
4	Antenna Port, Radio 1 - Left (5 GHz
5	LEDs
6	External Antenna (1 of 4)

Refer to the *IdentiFi Wireless WS-AP3805i & WS-AP3805e Installation Guide* for the AP3805e installation procedures.

3 Antenna Installation

This section provides the information necessary for a professional antenna installer to install the Extreme Networks antennas.

Warning

Antennas should only be installed by a qualified antenna installer. The antenna installation professional should be licensed or certified in accordance with local regulations.

Do not install the antenna in wet, windy, icy, or otherwise unsafe weather conditions.

Outdoor Antenna Kits

The ExtremeWireless outdoor antenna kits do NOT provide the following items, which may be necessary to install the antenna:

- Mast or other antenna support structure
- Guy wires
- All cables or other hardware necessary for a complete grounding system
- Waterproof tape

Note

It is the customer's responsibility to ensure that an outdoor antenna installation complies with local radio regulations.

Installation Overview

Note

Not all antennas described in this chapter can be used by every wireless access point. Refer to Antenna Models on page 13 to determine if your access point supports the specified antenna.

The installation process is summarized in the following steps. The following sections in this chapter provide additional details.

1 Make sure the APs are mounted and configured as specified.

2 Plan and implement a grounding system (if applicable) that meets local electrical codes and safety standards.

3 Install the lightning protector (if applicable).
4 Provide and install an antenna support structure as necessary. Make sure that the support structure is connected to the grounding system (if applicable).
5 Connect the exposed metal connectors of the low-loss antenna cable to the grounding system (if applicable).
6 Mount the antenna to the support structure.
7 Connect the antenna cables.
8 Route and connect the low-loss antenna cable to the lightning protector that has been installed indoors (if applicable).
9 Connect the cable assembly from the AP to the lightning protector (if applicable).
10 After verifying that the communications link is fully operational, secure all cables and use weatherproofing tape to seal all outdoor connectors.

Grounding System

Direct earth grounding of the antenna and the lightning protector is necessary to protect the installation from lightning and the build-up of static electricity.

Caution
The antenna mast, ExtremeWireless AP, and lightning protector must be connected to the same earth ground (with separate grounds), using an equipotential bonding conductor. A good electrical connection should be made to one or more ground rods using at least a 6AWG ground wire and non-corrosive hardware. The grounding system must comply with the National Electrical Code and safety standards that apply in your country. Always check with a qualified electrician to determine whether your outdoor installation is properly grounded.

The grounding system must satisfy the following requirements:

- The antenna mast, ExtremeWireless AP, and lightning protector must be connected to the same earth ground using an equipotential bonding conductor.
- The antenna and the mounting structure require a separate earth ground connection. Check with a certified antenna installer to make sure the antenna is properly grounded.
- Ensure that the cable between the antenna and lightning protector is at least 0.9 meters (3 feet) away from high-voltage or high-current cable.
- A good electrical connection must be made to one or more ground rods, using at least a 10 AWG ground wire and noncorrosive hardware.
- The grounding system must comply with electrical codes and safety standards that apply in your locality.
- Have a qualified electrician verify that your outdoor installation is properly grounded.

Caution
A properly installed safety grounding system is necessary to protect your ExtremeWireless outdoor installation from lightning strikes and static electricity build-up.

Mounting the Antenna

This section includes requirements and mounting guidelines for the ExtremeWireless outdoor antennas. Each antenna mounting section contains an illustration of the antenna, component description, and a mounting procedure.

Selecting a Mast

Note
You must supply your own mast on which to mount an ExtremeWireless antenna. ExtremeWireless antennas do not come with masts.

To minimize the influence of obstacles, signal interference or reflections, install the antenna at least 2 meters (6 feet) away from all other antennas.

If you need to mount multiple antennas on a single mast, alternate the mounting of directional antennas for vertical and horizontal polarization.

In subfreezing conditions, the communications link could fail if an antenna is exposed to ice buildup or covered with snow.

The mast must satisfy the following requirements:

- The mast must be constructed of sturdy, weatherproof, noncorrosive material such as galvanized or stainless steel construction pipe.
- Antenna mast length must be sufficient to allow an antenna height at least 1.5 meters (5 feet) above the roof peak. If the roof is metal, the antenna height should be a minimum of 3 meters (10 feet) above the roof.

Antenna Polarization

It does not matter what type of polarization you choose for your ExtremeWireless antennas as long as the antenna at one end of the communications link is mounted in the same plane as the antenna at the other end.

Vertical polarization is standard for the ExtremeWireless 14 dBi directional antenna.

To minimize the influence of cross-talk between antennas, you might need to mount the antenna for horizontal polarization when:

- Multiple antennas are mounted on the same antenna mast.
- The wireless link transmissions cross another radio beam from a neighboring installation.

Approved Antennas for the ExtremeWireless APs

Extreme Networks APs using certified external antennas must comply with local laws and regulations. An approval may be required by the local regulatory authorities. Antenna Models on page 13 lists and describes the optional antennas that have been tested and approved for use with the APs compatible with external antennas.

To mount the antennas on the AP2620, refer to the following sections:

Table 12: AP2620 Approved Antennas

External Antenna	Mounting Instructions
WS-AO-DS05360	Mounting Antenna Model WS-AO-DS05360
WS-AI-2S03360	Mounting Antenna Model WS-AI-2S03360
WS-AI-DS06360	Mounting Antenna Model WS-AI-DS06360
WS-AIO-DS05120	Mounting Antenna Model WS-AIO-DS05120
WS-AIO-2S07060	Mounting Antenna Model WS-AIO-2S07060 and WS-AIO-5S12060
WS-AIO-5S12060	Mounting Antenna Model WS-AIO-2S07060 and WS-AIO-5S12060
WS-AIO-5S17017	Mounting Antenna Model WS-AIO-5S17017
WS-AIO-2514090	Mounting Antenna Model WS-AIO-2S14090
WS-AIO-5S15090	Mounting Antenna Model WS-AIO-5S15090
WS-AIO-2S18018	Mounting Antenna Model WS-AIO-2S18018

To mount the antennas on the AP3620 and AP3640, refer to the following sections:

Table 13: AP3620 and AP3640 Approved Antennas

External Antenna	Mounting Instructions
WS-AO-DS05360	Mounting Antenna Model WS-AO-DS05360
WS-AO-5D16060	Mounting Antenna Model WS-AO-5D16060
WS-AO-5D23009	Mounting Antenna Model WS-AO-5D23009
WS-AI-DT04360	Mounting Antenna Model WS-AI-DT04360
WS-AI-DT05120	Mounting Antenna Model WS-AI-DT05120

To mount the antennas on the AP3660, refer to the following sections.

Table 14: AP3660 Approved Antennas

External Antenna	Mounting Instructions
WS-AO-DS05360	Mounting Antenna Model WS-AO-DS05360
WS-AIO-2S18018	Mounting Antenna Model WS-AIO-2S18018
WS-AO-5D16060	Mounting Antenna Model WS-AO-5D16060
WS-AO-5D23009	Mounting Antenna Model WS-AO-5D23009
WS-AO-DT05120	Mounting Antenna Models WS-AO-DT05120, WS-AO-DT05120-1, and WS-AO-DT05120N
WS-AO-DT05120-1	Mounting Antenna Models WS-AO-DT05120, WS-AO-DT05120-1, and WS-AO-DT05120N

Table 14: AP3660 Approved Antennas (continued)

External Antenna	Mounting Instructions
WS-AO-5S10360	Mounting Antenna Model WS-AO-2S10360 and WS-AO-5S10360
WS-AO-2S10360	Mounting Antenna Model WS-AO-2S10360 and WS-AO-5S10360
WS-ANT21	Mounting Antenna Model WS-ANT21
WS-AO-DX13025	Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025

To mount the antennas on the AP3765e and AP3767e, refer to the following sections.

Table 15: AP3765e and AP3767e Approved Antennas

External Antenna	Mounting Instructions
WS-AO-DS05360	Mounting Antenna Model WS-AO-DS05360
WS-AIO-2S18018	Mounting Antenna Model WS-AIO-2S18018
WS-AO-5D16060	Mounting Antenna Model WS-AO-5D16060
WS-AO-5D23009	Mounting Antenna Model WS-AO-5D23009
WS-AO-DT05120-1	Mounting Antenna Models WS-AO-DT05120, WS-AO-DT05120-1, and WS-AO-DT05120N
WS-AO-5S10360	Mounting Antenna Model WS-AO-2S10360 and WS-AO-5S10360
WS-AO-2S10360	Mounting Antenna Model WS-AO-2S10360 and WS-AO-5S10360
WS-AO-DX13025	Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025
WS-AO-DX10055N	Mounting Antenna Model WS-AO-DX10055N and WS-AO-DX10055

To mount the antennas on the AP3710e, refer to the following sections, and AP3725e

Table 16: AP3710e Approved Antennas and AP3725e

External Antenna	Mounting Instructions
WS-ANT03	N/A
WS-AI-DT04360	Mounting Antenna Model WS-AI-DT04360
WS-AI-DT05120	Mounting Antenna Model WS-AI-DT05120
WS-AI-DX02360	Mounting Antenna Model WS-AI-DX02360
WS-AI-DX07025	Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025

To mount the antennas on the AP3715e, refer to the following sections. and AP3725e

Table 17: AP3715e Approved Antennas and AP3725e

External Antenna	Mounting Instructions
WS-ANT03	N/A
WS-ANT-2DIP-3	Mounting Antenna Model WS-ANT-2DIP-3
WS-ANT-5DIP-3	Mounting Antenna Model WS-ANT-5DIP-3
WS-AO-DX10055N	Mounting Antenna Model WS-AO-DX10055N and WS-AO-DX10055
WS-AI-DT05120	Mounting Antenna Model WS-AI-DT05120
WS-AI-DX02360	Mounting Antenna Model WS-AI-DX02360
WS-AI-DX07025	Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025

To mount the antennas on the AP3825e, refer to the following sections.

Table 18: AP3825e Approved Antennas

External Antenna	Mounting Instructions
WS-ANT-2DIP-3	Mounting Antenna Model WS-ANT-2DIP-3
WS-ANT-5DIP-3	Mounting Antenna Model WS-ANT-5DIP-3
WS-AI-DX10055	Mounting Antenna Model WS-AO-DX10055N and Related Antenna Models
WS-AI-DT05120	Mounting Antenna Model WS-AI-DT05120
WS-AI-DX02360	Mounting Antenna Model WS-AI-DX02360
WS-AI-DX07025 and WS-AI-DX07025N	Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025

To mount the antennas on the AP3865e, refer to the following sections.

Table 19: AP3865e Approved Antennas

External Antenna	Mounting Instructions
WS-AO-2DIPN3	Mounting Antenna Model WS-AO-2DIPN3
WS-AO-5DIPN3	Mounting Antenna Model WS-AO-5DIPN3
WS-AO-DX10055N	Mounting Antenna Model WS-AO-DX10055N and WS-AO-DX10055
WS-AO-DT05120N	Mounting Antenna Model WS-AI-DT05120
WS-AO-DX02360N3	Mounting Antenna Model WS-AI-DX02360
WS-AO-5D23009N	Mounting Antenna Model WS-AO-5D23009
WS-AO-DX13025N	Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025
WS-AO-DX07180N	Mounting Antenna Model WS-AO-DX07180N

For specific information on antennas that support the AP3805e and information on each Wave 2 antenna, refer to Antenna Specifications on page 51.

Mounting Antenna Model WS-AO-DX10055N and Related Antenna Models

The WS-AO-DX10055N is dual-band six port (three for each band) MIMO antennas providing spatial diversity coverage of 2.4–2.5 GHz WiFi and 5.1–5.9 GHz WiFi WiMAX broadband wireless frequencies in a low profile housing. This antenna provides optimal coverage for areas or events with a large number of mobile data users. It designed for outdoor installations utilizing 802.11n multi-band wireless LAN access point radios. The following figure shows the WS-AO-DX10055N antenna. Table 20 lists the cable and connector type for each antenna.

Note
The WS-AO-DX10055N and the WS-AI-DX10055 are the same antenna. The WS-AO-DX10055N is intended for outdoor use. The WS-AI-DX10055 is intended for indoor use.

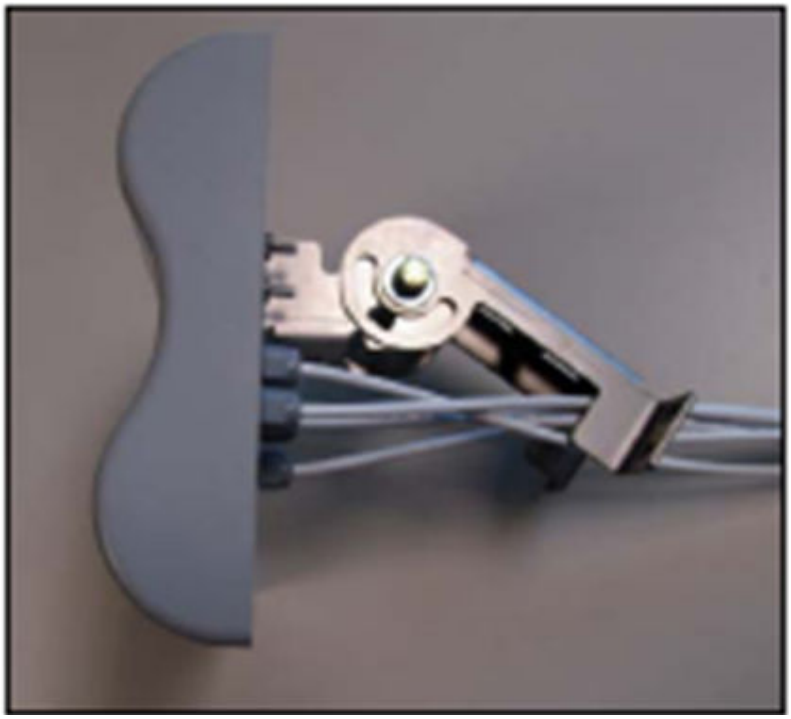


Figure 11: WS-AO-DX10055N Antenna

Table 20: Antenna Cable and Connector Information

Antenna Model	Cable Type	Cable Length	Connector Type
WS-AO-DX10055N	RG316 Outdoor	39 inches	Standard Polarity, Type N Plug
WS-AI-DX10055	RG316 Indoor	39 inches	Reverse Polarity SMA Plug Connector

Mounting Instructions: WS-AO-DX10055N, WS-AI-DX10055

The antenna includes a fully adjustable mount for pipe or wall mounting. Hardware for wall mounting is not included in the kit. The table below lists the parts required for installation. The mount allows the antenna to be vertically or horizontally polarized.

Table 21: Mount Kit Contents

Item	Quantity	Description
1	4	Nut, 5/16-18,1/2" Hex. 17/64" Thick, Steel Grade 2,NIZN Trivalent
2	1	Bolt, Carriage, 5/16-18 x 3/4
3	1	Bracket, Mount. Antenna
4	1	Bolt, 5/16-18 x 2 1/2", Hex Head, Steel, NI ZN Trivalent
5	1	Tube, Aluminum, 0.37" ID x 0.50" OD x 1.415"
6	4	Washer, Flat, 5/16, 5/8" OD x 11/32" ID x 0.065", Steel, Zinc
7	4	Washer, Split Lock, 5/16, Steel Grade 2, NI ZN Trivalent
8	1	Bracket, Mount, Antenna
9	1	Screw, Hex Head, 1/4-20 x 2.0,18-8 SS
10	1	Nut, Hex, Nylock, 1/4-20 UNC
11	1	V-Bolt, 5/16-18 UNC-2A, Med. Carbon Steel, NI ZN Trivalent
12	4	Washer, 1/4 Flat, Steel Grade 2, NI ZN Trivalent
13	4	Nut, Hex 1/4-20, Steel Grade 2, NI ZN Trivalent
14	4	Washer, 1/4, Split Lock, Steel Grade 2, NI ZN Trivalent

Tools required for attaching mount to antenna and securing to pole:

- 7/16 inch wrench

- 1/2 inch wrench

To install the antenna:

1 Remove the antenna and mount kit from the packaging, and remove the mount kit contents from its packaging. Confirm that the mount kit includes the contents listed in Table 21.

2 Install 1/4-20 x 2" screw (item 9) into the bracket (item 8) with one hole on each flange. Secure with lock nut (item 10). Tighten only until the nut contacts the bracket. Do not over tighten.

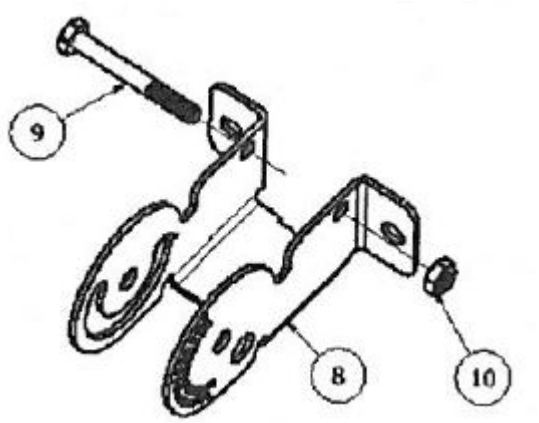


Figure 12: Install Screw in Bracket

3 Assemble the brackets item 3) with the arc toward the outside. Slide aluminum spacer (item 5) in between and feed pivot bolt (item 4) through. Install washers and nut (items 1, 6, 7), but do not tighten at this point.

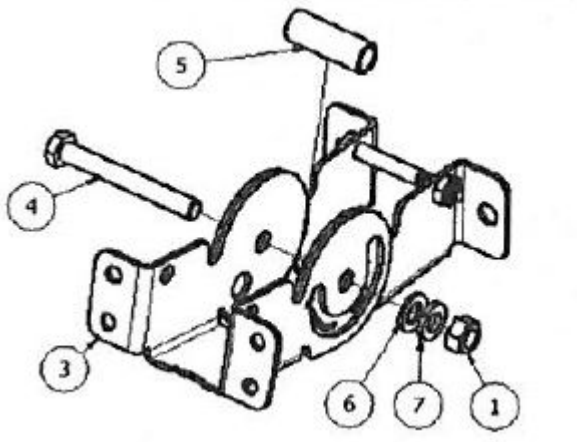


Figure 13: Assemble the Brackets

4 Assemble locking carriage bolt (item 2) and attach washers and nut (items 1, 6, 7), but do not tighten at this point.

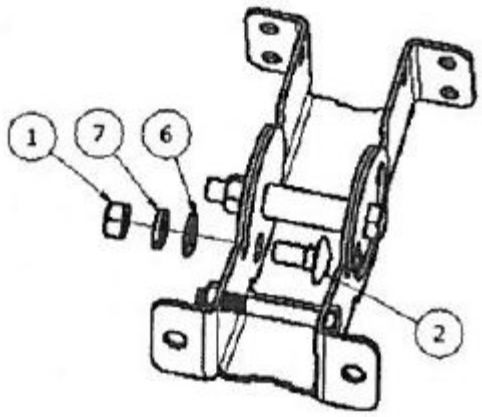


Figure 14: Install Carriage Bolt

5 If mounting hole can be slid over pipe, install V-bolt (item 11) into the pole side bracket (one hole in flange) and loosely secure the washers and nuts (items 1, 6, 7). Otherwise, locate bracket assembly on pipe, and feed the V-bolt through and secure with washers and nut.

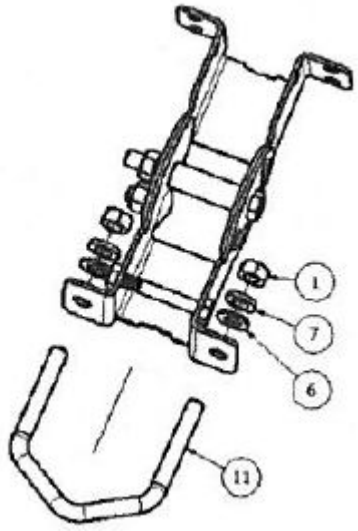


Figure 15: Install V-bolt

6 Attach mount assembly to the antenna using the 1/4-20 hardware in the hardware kit (Items 12, 13, 14). Mount can go on in either direction.

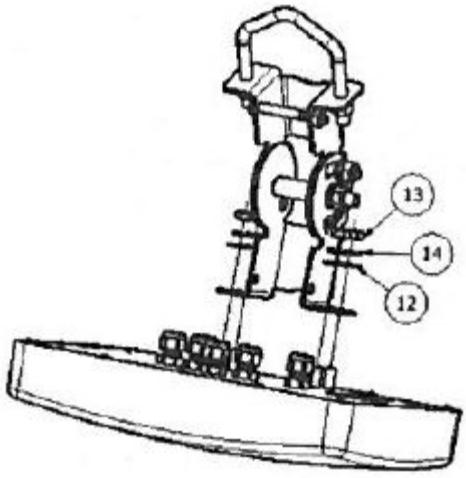


Figure 16: Attach Assembly

7 Set down tilt angle and tighten pivot and carriage bolts.

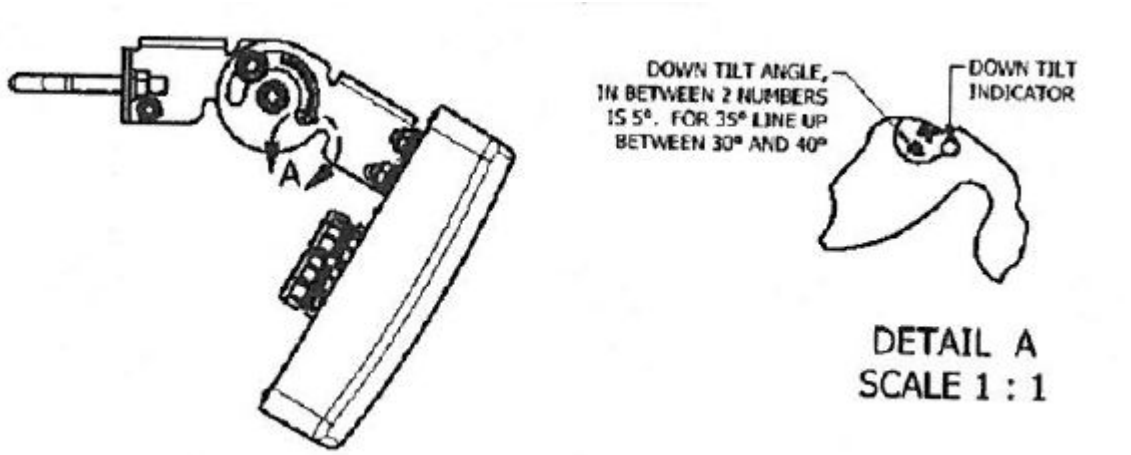


Figure 17: Set Angle

Mounting Antenna Model WS-ANT-2DIP-3

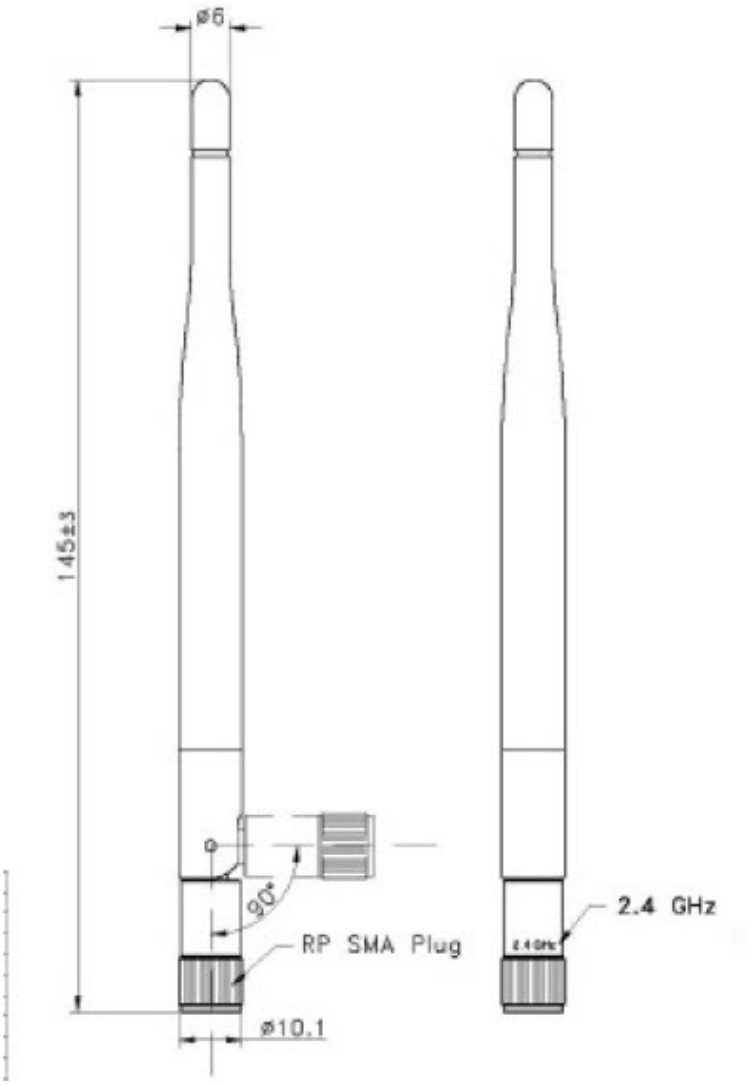


Figure 18: WS-ANT-2DIP-3 Antenna

To install the antenna, secure the antenna in place by tightening the single nut.

Note

The AP3825 supports up to six antennas. One 3-pack of WS-ANT-2DIP-3 antennas and one 3-pack of WS-ANT-5DIP-3 antennas.

Mounting Antenna Model WS-ANT-5DIP-3

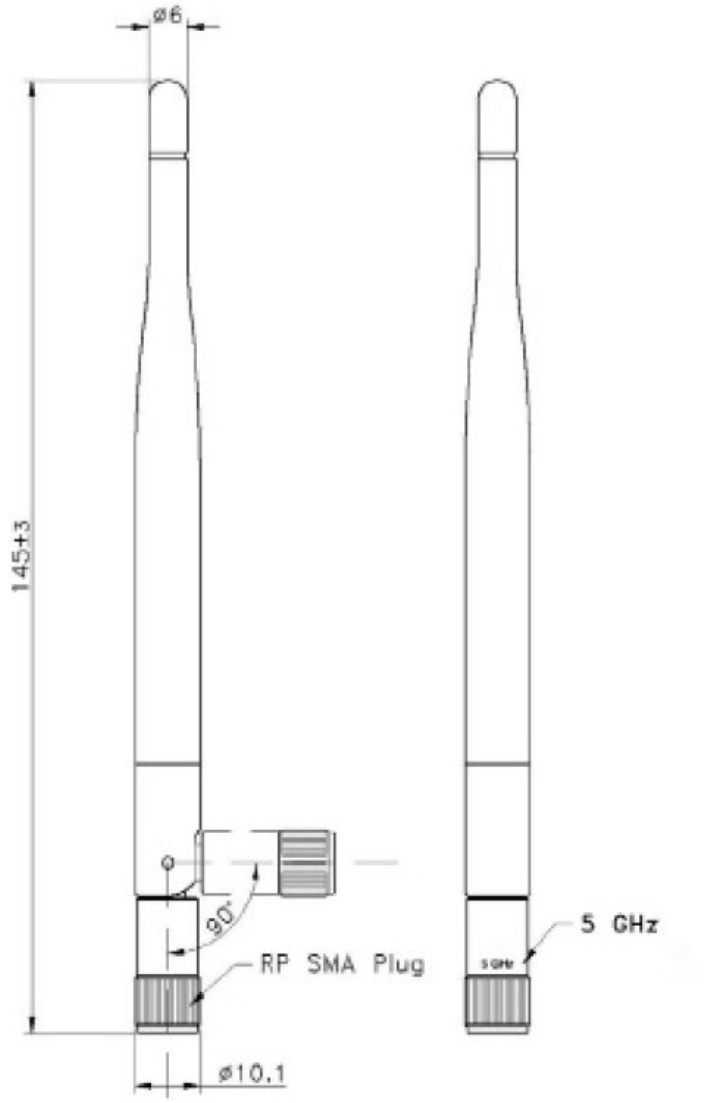


Figure 19: WS-ANT-5DIP-3 Antenna

To install the antenna, secure the antenna in place by tightening the single nut.

Note
The AP3825 supports up to six antennas. One 3-pack of WS-ANT-2DIP-3 antennas and one 3-pack of WS-ANT-5DIP-3 antennas.

Mounting Antenna Model WS-AO-2DIPN3

You can mount the WS-AO-2DIPN3 antenna directly to the AP3865e.

Note
This antenna is packaged in 3 antennas to a package (3-pack).

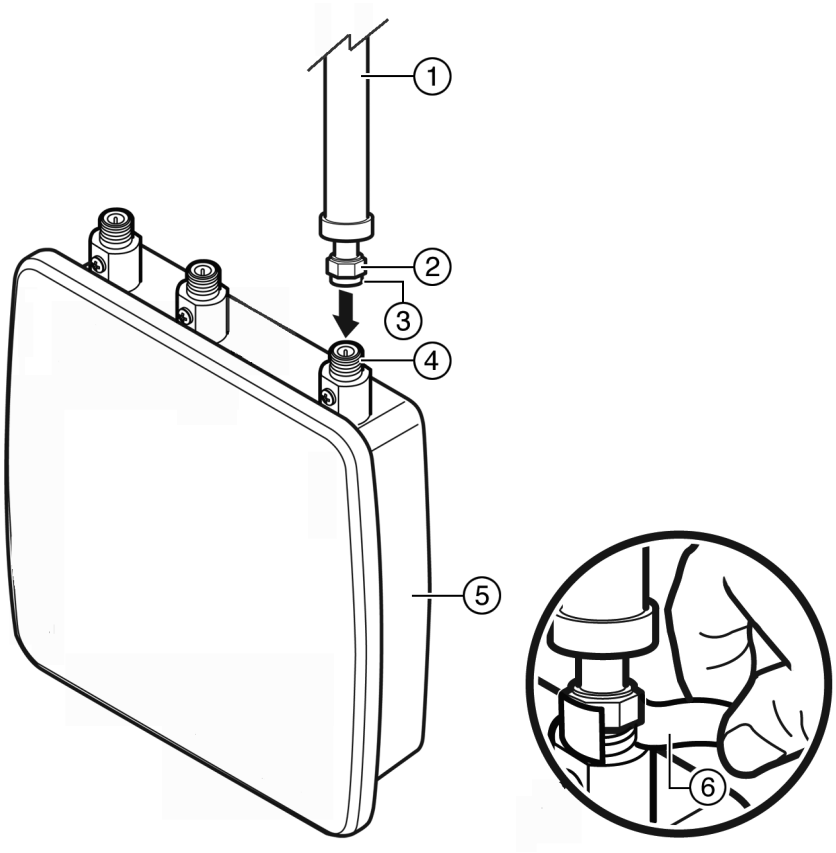


Figure 20: Mounting the WS-AO-2DIPN3 Antenna to the AP3865e

1	Antenna	4	Standard polarity Type-N jack
2	Nut	5	AP3865e
3	Standard polarity Type-N plug	6	Sealing tape (recommended, but not supplied)

To install the antenna:

1 Secure the antenna in place by tightening the single nut (item 2).

2 Seal the connection between the Type-N jack (item 4) of the AP3865e and the Type-N plug (item 3) of the antenna by wrapping a layer of sealing tape (item 6).

Note

The AP3865e supports one package of WS-AO-2DIPN3 antennas (one 3-pack) as shown in Figure 20 on page 43.

Mounting Antenna Model WS-AO-5DIPN3

You can mount the WS-AO-5DIPN3 antenna directly to the AP3865e. The AP3865e supports one package of three WS-AO-5DIPN3 antennas (one 3-pack).

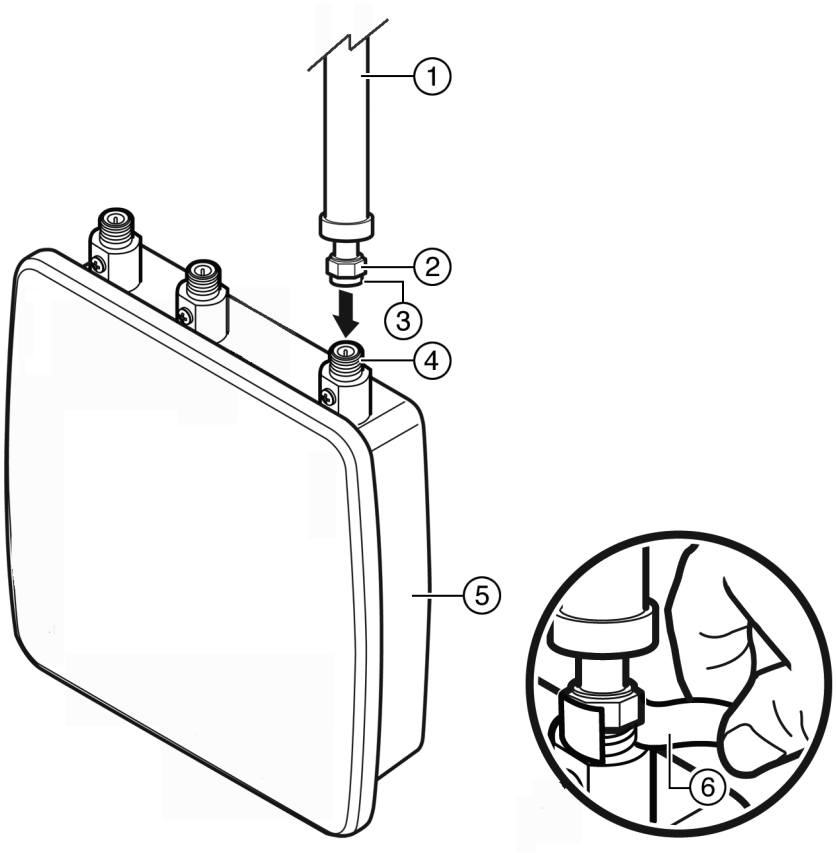


Figure 21: Mounting the WS-AO-5DIPN3 Antenna to the AP3865e

1	Antenna	4	Standard polarity Type-N jack
2	Nut	5	AP3865e
3	Standard polarity Type-N plug	6	Sealing tape (recommended, but not supplied)

To install the antenna:

1 Secure the antenna in place by tightening the single nut (item 2).

2 Seal the connection between the Type-N jack (item 4) of the AP3865e and the Type-N plug (item 3) of the antenna by wrapping a layer of sealing tape (item 6).

Mounting Antenna Model WS-AO-DX07180N

The WS-AO-DX07180N is a dual-band, six port (three for each band) Sector antenna providing coverage of 2.4 GHz and 5 GHz broadband wireless frequencies in a low profile housing. The antenna provides optimal coverage for areas or events with a large number of mobile data users. It is designed for outdoor installations using 802.11a/b/g/n multi-band wireless LAN access point radios. Table 22 lists connector and cable information for the antenna.

The mounting kit includes a heavy duty articulating mount for a wall or mast mount installation. UL 94-HB materials are used for compliance with strict building code safety specifications.

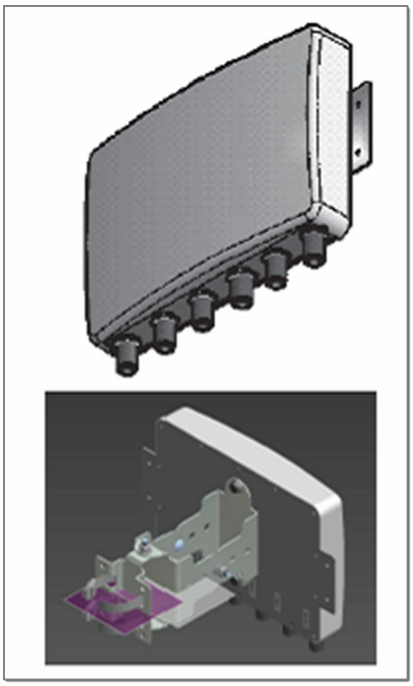


Figure 22: Outdoor Antenna WS-AO-DX07180N with Mounting Bracket

Table 22: Antenna Cables and Connectors

Antenna Model	Cable Type	Cable Length	Qty	Connector Type
WS-AO-DX07180N	PFP240UF	5 ft	6	Standard Polarity, Type N Plug

Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025

The WS-AO-DX13025 is designed for outdoor installations, and the WS-AI-DX07025 is designed for indoor installations. Both antennas use 802.11n multi-band wireless LAN access point radios. Table 23 lists the connector type for each antenna.

Figure 23: WS-AO-DX13025 and WS-AI-DX07025 Antennas

Table 23: Antenna Connector Connectors

Antenna Model	Type	Connector Type
WS-AO-DX13025	Outdoor	Reverse Polarity, Type N Plug
WS-AI-DX07025	Indoor	Reverse Polarity, Type SMA Plug

Mounting Antenna Model WS-AI-DX02360

The WS-AI-DX02360 is a dual-band six port omni-directional MIMO antenna. With separate ports that are designed to operate at 2.4 GHz and 5 GHz. Each of the MIMO antenna R-SMA ports can be connected to an access point by means of a coax pigtail.

The antenna is designed for ceiling mounting in indoor locations.

Figure 24: WS-AI-DX02360 Antenna

Mounting the WS-AI-DX02360

For best results, mount the WS-AI-DX02360 at ceiling level near the center of the coverage area. A line-of-sight path between the antenna and active floor locations work best. Avoid mounting next to a column or vertical support that could create a shadow zone and reduce coverage to one portion of the room.

A threaded post on the back side of the Antenna and a mounting nut (supplied with the antenna) are the primary mounting configuration when access is available to both sides of the mounting surface, such as suspended ceiling tile.

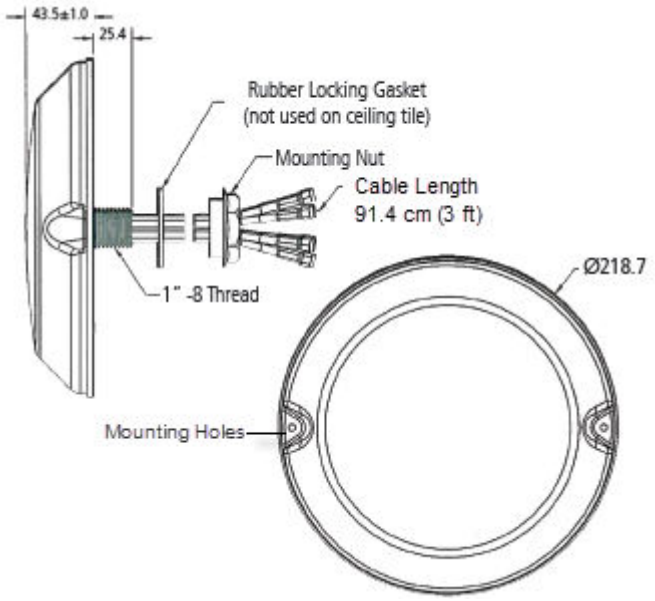


Figure 25: WS-AI-DX02360 Mounting Post and Mounting Nut

To install the antenna in a suspended ceiling:

1 Mark the desired mounting location on the suspended ceiling tile and cut a 40 mm (1.57 in) hole in the tile.
2 Feed the six antenna cables through the hole and press the antenna to the ceiling tile.
3 Secure the antenna with the mounting nut, as shown in the previous figure.
4 Connect the cables to an access point by means of coax pigtails.

The cables are marked by colored heat-shrink wrap and labels, indicating the three cables for 2.4 GHz connections and the three cables for 5 GHz connections.

A rubber locking gasket is also supplied with the antenna. Use this gasket with the mounting nut only when mounting the antenna to a hard surface.

If access to the back of the mounting surface is not available, use the two mounting holes shown in the previous figure to attach the antenna with #8 screws and expanding anchors (not supplied).

Mounting Antenna Model WS-AO-DT05120 and Related Antenna Models

The WS-AO-DT05120 and related models is a 2.4 and 5 GHz dual-band sector antenna that can be mounted in an outdoor location. The WS-AI-DT05120 antenna model is intended for indoor locations. Each antenna has three connectors and is especially designed for MIMO APs. Table 24 shows connector and cable information. These antennas can also be mounted on a wall or on a pole.

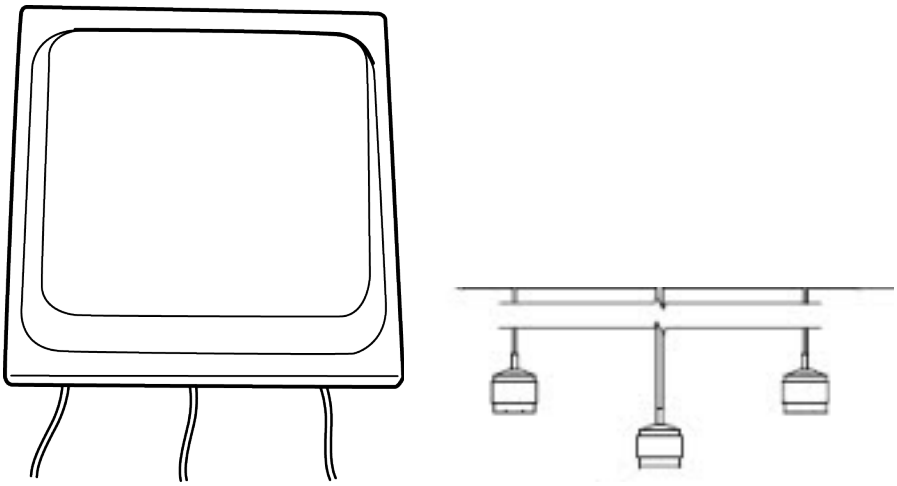


Figure 26: WS-AO-DT05120 and Related Antenna Models

Table 24: Antenna Cable and Connector Information

Antenna Model	Cable Type	Cable Length	Connector Type
WS-AO-DT05120	RG316	32 inches	Reverse Polarity, Type N Jack
WS-AO-DT05120-1	RG316	32 inches	Reverse Polarity, Type N Plug
WS-AO-DT05120N	RG316	32 inches	Standard Polarity, Type N Plug
WS-AI-DT05120	RG316	32 inches	Reverse Polarity SMA Plug

Wave 2 Antennas

For specific information on antennas that support the AP3805e and information on each AP39XX series antenna, refer to Antenna Specifications on page 51.

Cable Installation Guidelines

The cable configuration that you use to connect an AP to an antenna varies. Use the following sections as guidelines for cabling your AP to an antenna.

Do not install the cable in tight positions, as bending or applying excessive force to the connectors may damage the antenna cable. Always allow the cable to bend naturally around corners.

The low-loss antenna cable must be secured along its complete length. Do not allow any part of the cable to hang free. This is particularly important for cable parts that are installed outdoors. The antenna cables and cable connectors are not designed to withstand excessive force:

- Do not use connectors as cable grips to pull cable through raceways or conduits.
- Do not use cable connectors to support the weight of the cable during or after installation.
- Do not use tools to tighten connectors (finger-tighten only).

Connecting the Cables

Once the antenna is properly installed, you can connect the antenna to the ExtremeWireless AP via the lightning protector.

Take the following steps to connect cables:

1 Verify that the low-loss cable is properly connected to the antenna pigtail.

2 Secure the low-loss cable to the mast such that the cable connectors do not support the full weight of the cable.

Caution

To avoid damage to the antenna cable and connectors, do not use tools to tighten cable connectors.

Precaución: para evitar daños en los cables y el conector de la antena, no use herramientas para apretar los conectores.

Achtung: Verwenden Sie kein Werkzeug zum Anziehen der Kabelanschlüsse. Durch Werkzeug können das Kabel und die Anschlüsse beschädigt werden.

3 Provide a drip-loop at the bottom of the low-loss cable just before it enters the building.

4 Connect the opposite end of the low-loss cable to the lightning protector.

Caution

To avoid damage to the antenna cable and connectors, do not use tools to tighten cable connectors.

Precaución: para evitar daños en los cables y el conector de la antena, no use herramientas para apretar los conectores.

Achtung: Verwenden Sie kein Werkzeug zum Anziehen der Kabelanschlüsse. Durch Werkzeug können das Kabel und die Anschlüsse beschädigt werden.

5 Prior to securing the cable along its complete length, refer to Optimizing Outdoor Point-to-Point Antenna Placement on page 49. If required, adjust the direction of the antenna.

6 After fully testing the installation, tighten the antenna mounting nuts to lock the antenna into its position.

Caution

To prevent damage, avoid over-tightening the connectors, nuts, and screws used to mount the antenna.

Precaución: evite apretar demasiado los conectores, tuercas y tornillos usados para instalar la antena, para no dañarlos.

Achtung: Beugen Sie Schaden vor, indem Sie die Anschlüsse, Muttern und Schrauben für die Antenne nicht zu fest anziehen.

7 Secure the cable along its complete length. Do not allow any part of the cable to hang free.

8 Using waterproof stretch tape, seal all outdoor connectors.

Optimizing Outdoor Point-to-Point Antenna Placement

If an AP is connected to an outdoor directional antenna, the antenna must point directly at the antenna for the other AP. A misaligned antenna can decrease the signal level or prevent communications.

Aligning an omni-directional antenna is less critical due to its wide radiation pattern. For optimal performance, make sure the antennas are properly aligned by using a pair of binoculars to point the antennas at each other.

Routine Maintenance

Routine maintenance is required for each lightning protector in your outdoor antenna installation. Maintenance involves replacing the lightning protector at some interval depending on the lightning/transient discharge activity in your area.

Note

Contact a local antenna installation company to determine the maintenance schedule for each lightning protector in your outdoor antenna installation.

4 Antenna Specifications

External Antennas for Use with Outdoor APs
External Antennas for Use with Indoor APs

This section lists the specifications and radiation patterns for the external antennas supported by various ExtremeWireless AP models. The antenna specifications are organized in this section by their design capability:

- Strictly outdoor
- Combined indoor/outdoor
- Strictly indoor

ExtremeWireless antenna part numbers/descriptions indicate the indoor/outdoor capability of the antenna:

- WS-AO: outdoor
- WS-AIO: indoor/outdoor
- WS-AI: indoor

External Antennas for Use with Outdoor APs

The following antennas are intended for use with outdoor APs only:

Table 25: Outdoor Antennas

Antenna Part Number	Supported APs
30711 (WS-AO-DQ05120N)	AP3965e
30712 (WS-AO-5Q04060N)	AP3965e
30713 (WS-AO-2Q05060N)	AP3965e
30714 (WS-AO-DE07025N)	AP3965e
30715 (WS-AO-DE13025N)	AP3965e
30716 (WS-AO-5Q05025N)	AP3965e
30717 (WS-AO-5Q11025N)	AP3965e
30718 (WS-AO-DE10055N)	AP3965e
30720 (WS-AO-DE07100N)	AP3965e
30724 (WS-AO-DQ04360N)	AP3965e
WS-AO-DS02360N3	AP3865e
WS-AO-DX07180N	AP3865e
WS-AO-DT05120	AP3865e
WS-AO-DT05120-1	AP3765e, AP3767e

Table 25: Outdoor Antennas (continued)

Antenna Part Number	Supported APs
WS-AO-DT05120N	AP3865e
WS-AO-5S10360	AP3765e, AP3767e,
WS-AO-2S10360	AP3765e, AP3767e,
WS-AO-5D23009	AP3765e, AP3767e
WS-AO-5D16060	AP3765e, AP3767e
WS-AO-2S08360	AP3620, AP3640
WS-AO-DS05360	AP3765e, AP3767e
WS-ANT21	AP3660
WS-AO-DX13025	AP3865e, AP3765e, AP3767e
WS-AO-DX13025N	AP3865e, AP3765e, AP3767e
WS-AO-DX10055	AP3710e, AP3767e
WS-AO-DX10055N	AP3765e, AP3767e, AP3825e, AP3865e
WS-AO-2DIPN3	AP3865e
WS-AO-5DIPN3	AP3865e

30711 (WS-AO-DQ05120N)

This 4-port sector antenna can be used for 802.11ac MIMO applications. The four ports can be used individually or in combination with legacy 802.11 access points.

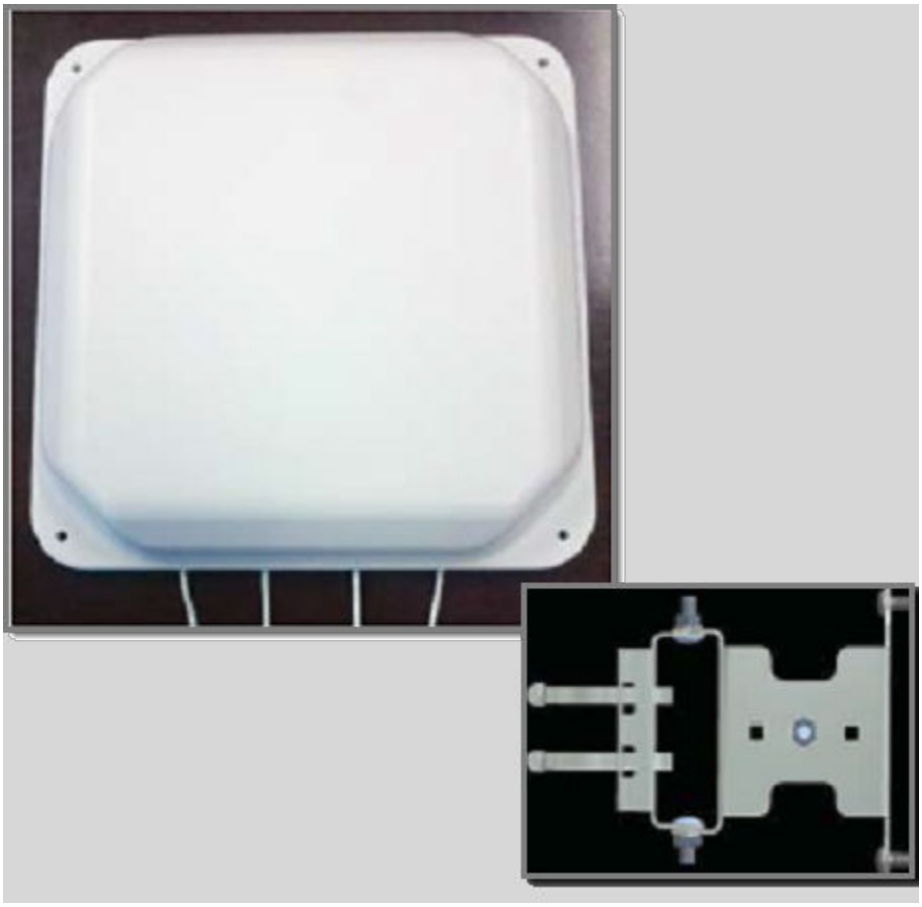


Figure 27: Outdoor Antenna 30711 (WS-AO-DQ05120N) with Mounting Bracket

Specifications

Table 26: 30711 (WS-AO-DQ05120N) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	5-5.5 dBi	4.5-5.5 dBi
Vertical Beamwidth	90°	65°
Horizontal Beamwidth	100°	80°
VSWR	1.5-2.0	
Operating Temperature Range	-40°C to +70°C	
Polarization	Dual-slant linear +-45	
Weight	.45kg	
Mounting Style	Wall or pipe mount	
Power	20 watts	

Table 26: 30711 (WS-AO-DQ05120N) Specifications (continued)

	Value	
Specification	2.4 GHz	5GHz
Dimensions	200 x 200 x 34 mm	
Nominal Impedance	50 ohms	

Radiation Patterns

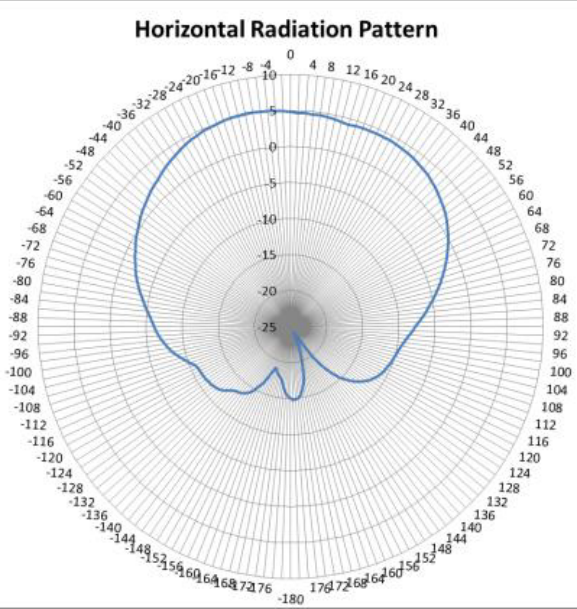


Figure 28: 2.4 GHz Horizontal Pattern

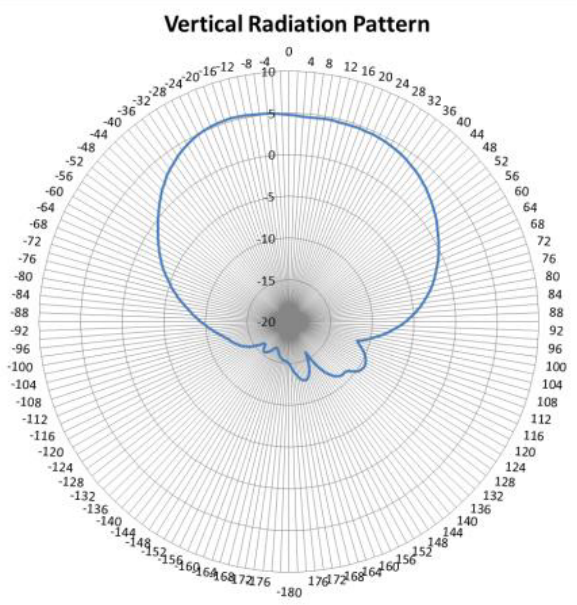


Figure 29: 2.4 GHz Vertical Pattern

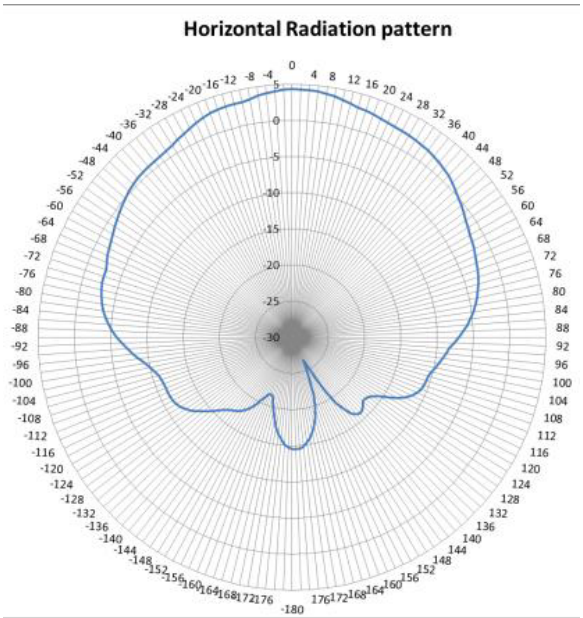


Figure 30: 5GHz Horizontal Pattern

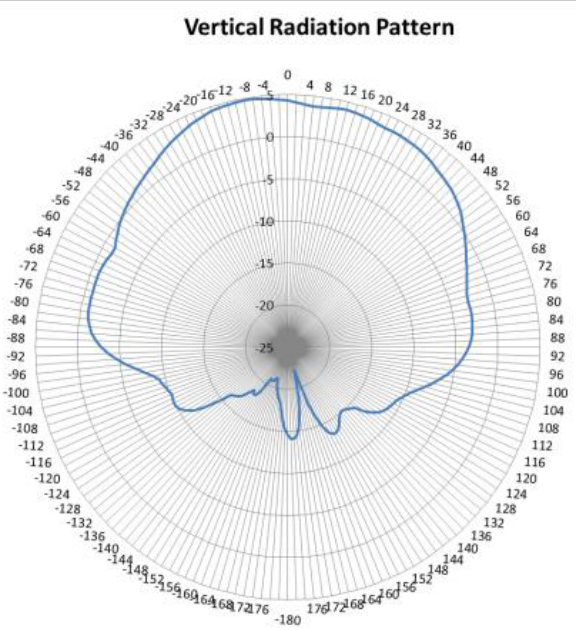


Figure 31: 5GHz Vertical Pattern

30712 (WS-AO-5Q04060N)

This 4-port sector antenna 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 32: Outdoor Antenna 30712 (WS-AO-5Q04060N)

Specifications

Table 27: 30712 (WS-AO-5Q04060N) Specifications

Specification	Value
Frequency	5.15-5.85 GHz
Gain	3-4 dBi
Vertical Beamwidth	33°
Horizontal Beamwidth	50°
VSWR	1.5-2.0
Operating Temperature Range	-40°C to +70°C
Polarization	Dual-slant linear +-45°
Weight	.45kg
Mounting Style	Wall or pipe mount
Power	20 watts
Dimensions	200 mm x 200 x 34mm
Nominal Impedance	50 ohms

Radiation Patterns

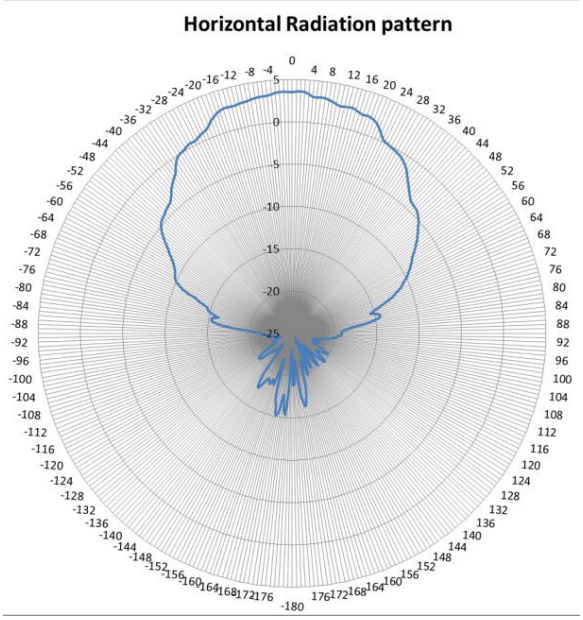
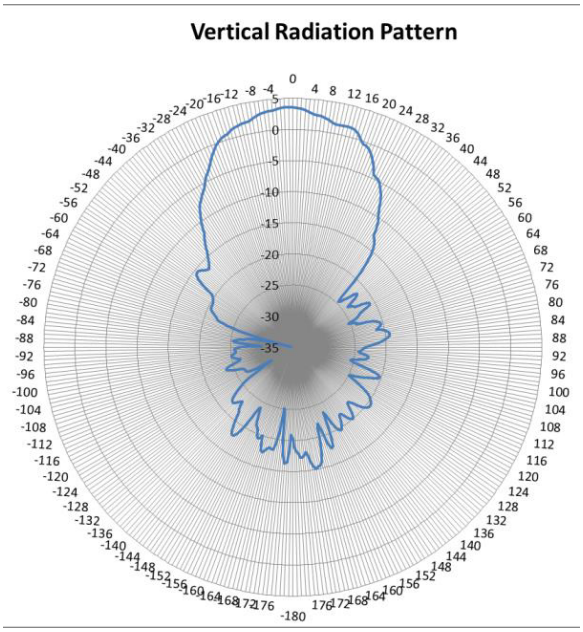


Figure 33: 5 GHz Radiation Patterns



30713 (WS-AO-2Q05060N)

This 4-port sector antenna 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 34: Outdoor Antenna 30713 (WS-AO-2Q05060N) with Mounting Bracket

Specifications

Table 28: 30713 (WS-AO-2Q05060N) Specifications

Specification	Value
Frequency	2.4-2.5 GHz
Gain	4-5 dBi
VSWR	2.0 Max (1.5 Typ)
Vertical Beamwidth	34°
Horizontal Beamwidth	73°
Operating Temperature Range	-40°C to +70°C
Polarization	Dual-slant, linear +-45°
Weight	0.45 kg
Mounting Style	Wall or pipe mount
Power	20 watts
Dimensions	7.9 in x 7.9 in x 1.25 in (200 mm x 200 mm x 34 mm)
Nominal Impedance	50 ohms

Radiation Patterns

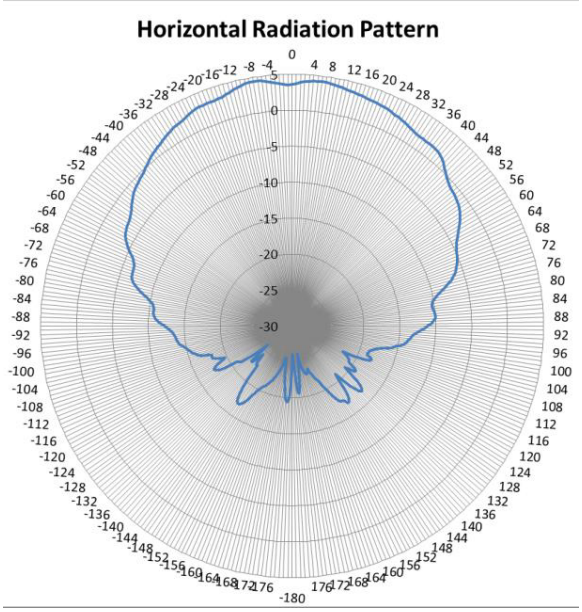


Figure 35: 2.4 GHz Horizontal Pattern

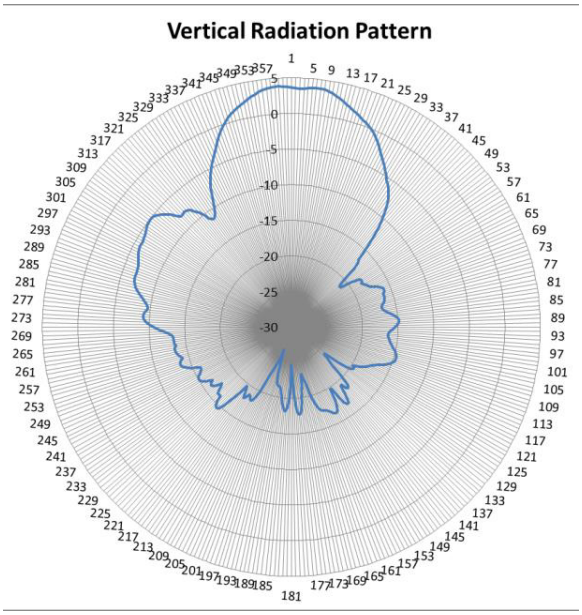


Figure 36: 2.4 GHz Vertical Pattern

30714 (WS-AO-DE07025N)

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 eight ports can be used individually or in combination for use with legacy 802.11 access points.

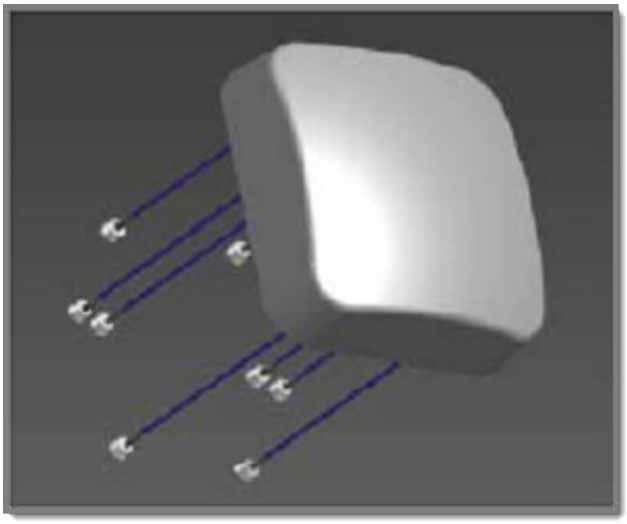


Figure 37: Outdoor Antenna 30714 (WS-AO-DE07025N)

Specifications

Table 29: 30714 (WS-AO-DE07025N) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	6.5-7.5 dBi	5.5-6.5 dBi
Vertical Beamwidth	43°	37°
Horizontal Beamwidth	31°	29°
VSWR	< 2.25:1	
Operating Temperature Range	-30°C to +80°C	
Polarization	Dual linear	
Weight	2.27kg	
Mounting Style	Wall or pipe mount	
Power	25 watts	
Dimensions	305 mm x 305 x 110.5mm	
Nominal Impedance	50 ohms	

Radiation Patterns

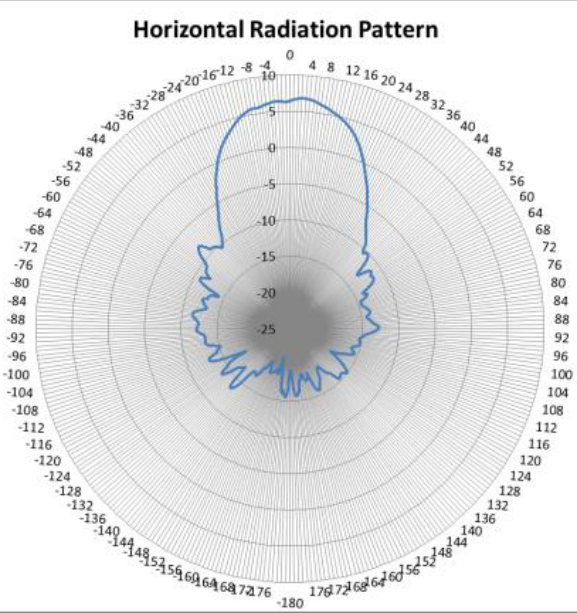


Figure 38: 2.4GHz Horizontal Pattern

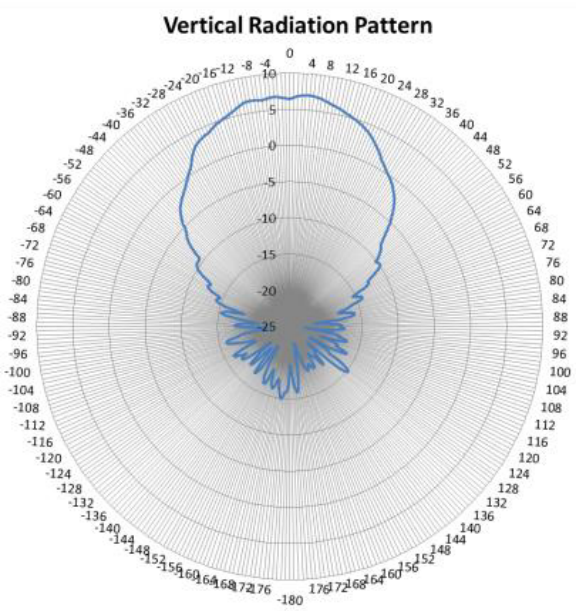


Figure 39: 2.4GHz Vertical Pattern

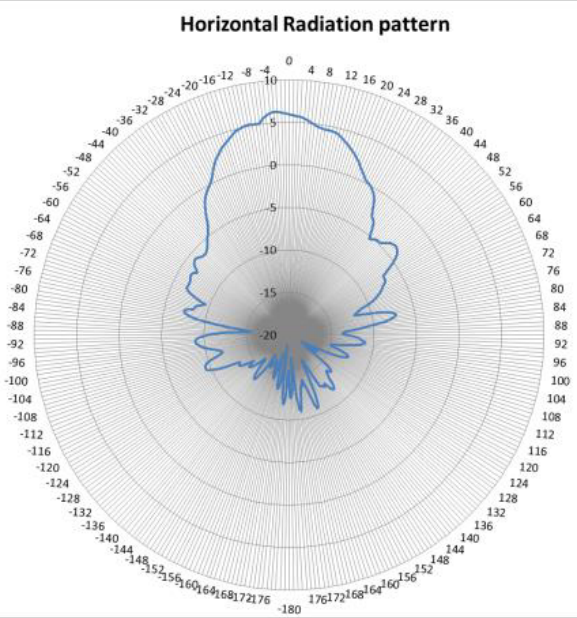


Figure 40: 5GHz Horizontal Pattern

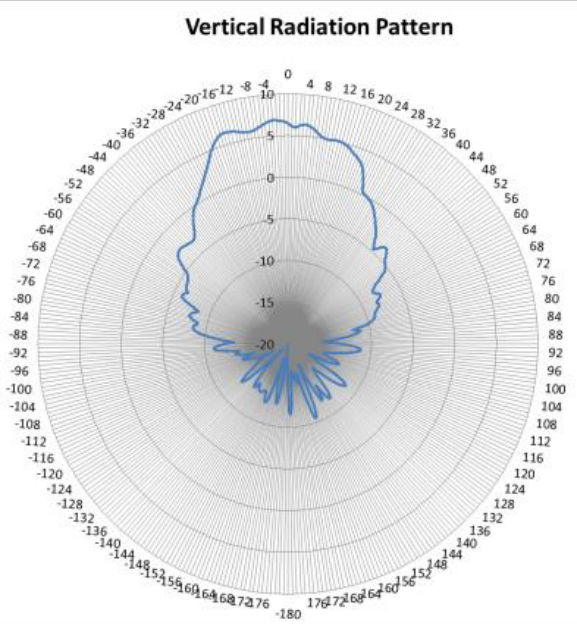


Figure 41: 5GHz Vertical Pattern

30715 (WS-AO-DE13025N)

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 eight ports can be used individually or in combination for use with legacy 802.11 access points.

Specifications

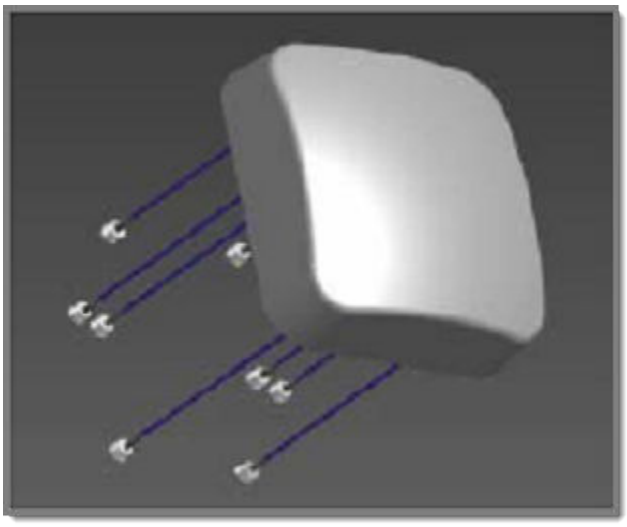


Figure 42: Outdoor Antenna 30715 (WS-AO-DE13025N)

Table 30: 30715 (WS-AO-DE13025N) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	12-13 dBi	11-12 dBi
Vertical Beamwidth	43°	37°
Horizontal Beamwidth	31°	29°
VSWR	< 2.25:1	
Operating Temperature Range	-30°C to +80°C	
Polarization	Dual linear	
Weight	2.27kg	
Mounting Style	Wall or pipe mount	
Power	25 watts	
Dimensions	305 mm x 305 x 110.5mm	
Nominal Impedance	50 ohms	

Radiation Patterns

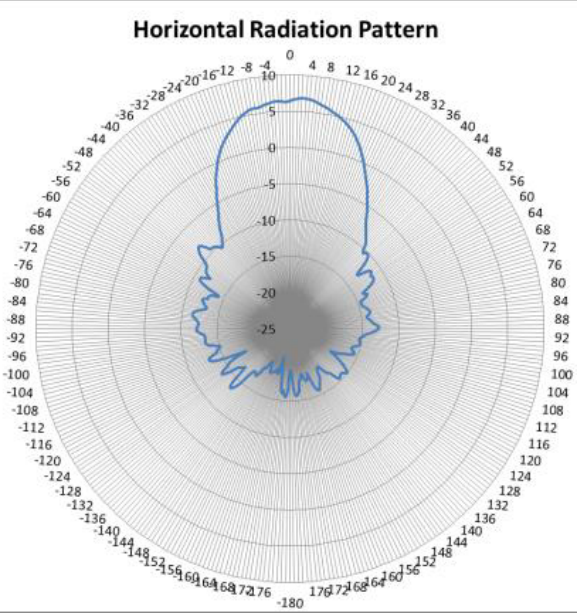


Figure 43: 2.4GHz Horizontal Pattern

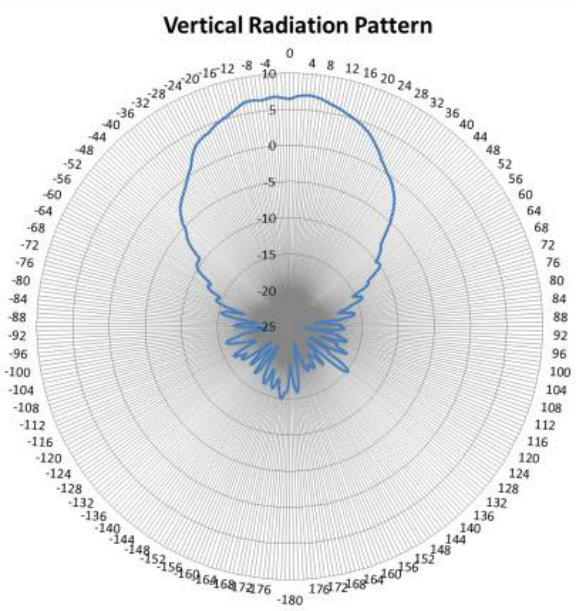


Figure 44: 2.4GHz Vertical Pattern

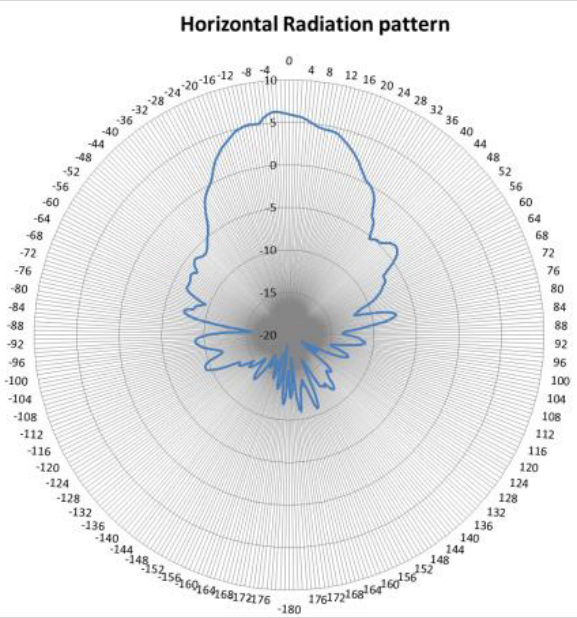


Figure 45: 5GHz Horizontal Pattern

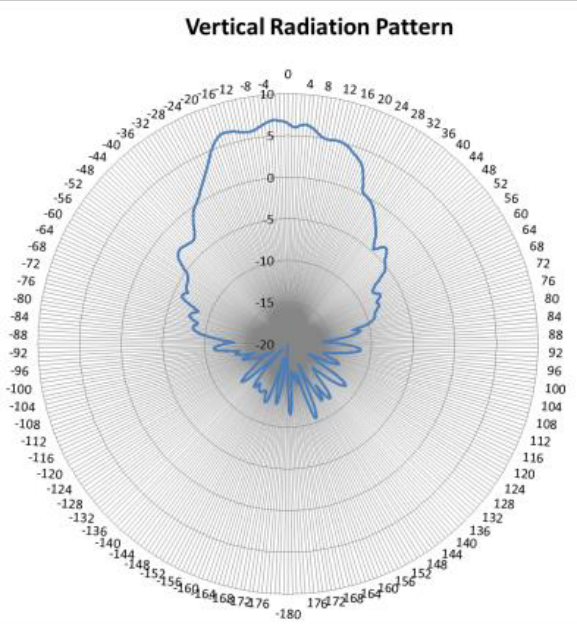


Figure 46: 5GHz Vertical Pattern

30716 (WS-AO-5Q05025N)

The four port sector antennas 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.

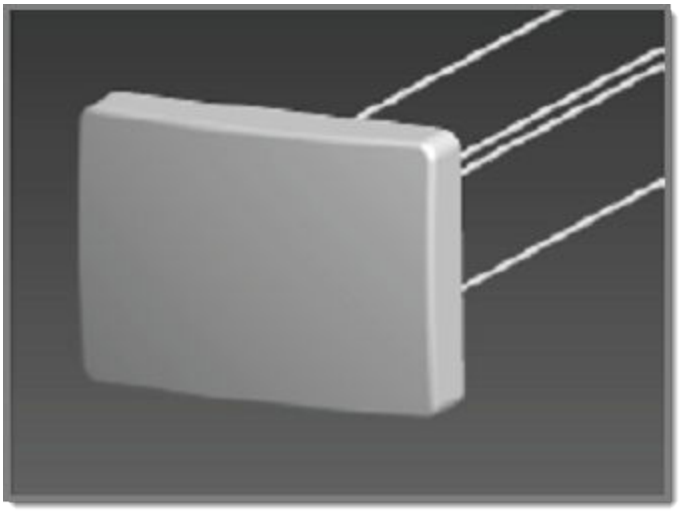


Figure 47: Outdoor Antenna 30716 (WS-AO-5Q05025N)

Specifications

Table 31: 30716 (WS-AO-5Q05025N) Specifications

Specification	Value
Frequency	5.1-5.9 GHz
Gain	3.5 - 4.5 dBi
Vertical Beamwidth	40°
Horizontal Beamwidth	30°
VSWR	< 2.0:1
Operating Temperature Range	-30°C to +80°C
Polarization	Dual linear
Weight	1.36 kg
Mounting Style	Wall or pipe mount
Power	25 watts
Dimensions	18.1 x 24.9 x 12.9 cm
Nominal Impedance	50 ohms

Radiation Patterns

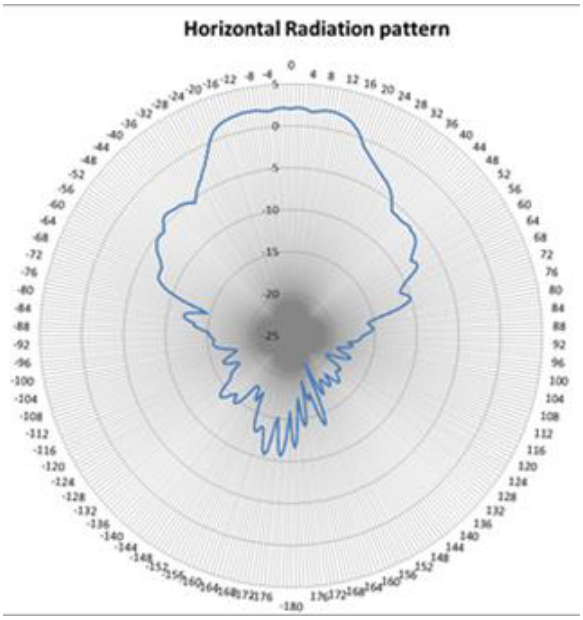


Figure 48: 5 GHz Horizontal Pattern

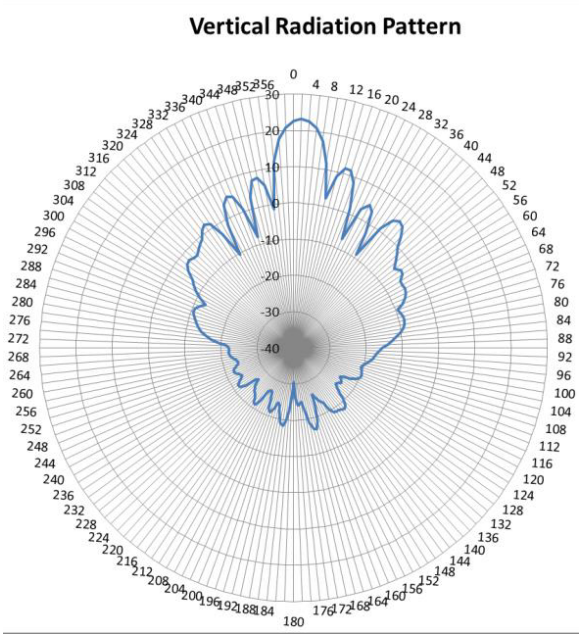


Figure 49: 5GHz Vertical Pattern

30717 (WS-AO-5Q11025N)

The four port sector antennas 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.

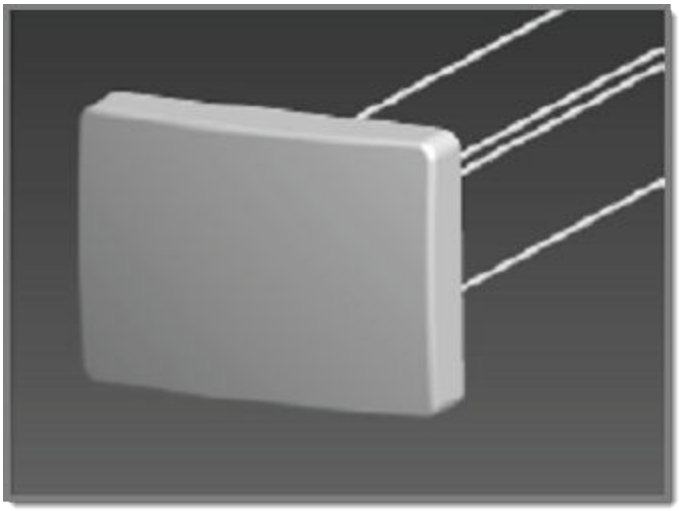


Figure 50: Outdoor Antenna 30717 (WS-AO-5Q11025N)

Specifications

Table 32: 30717 (WS-AO-5Q11025N) Specifications

Specification	Value
Frequency	5.1-5.9 GHz
Gain	10.5 - 11.5 dBi
Vertical Beamwidth	40°
Horizontal Beamwidth	30°
VSWR	< 2.0:1
Operating Temperature Range	-30°C to +80°C
Polarization	Dual linear
Weight	1.36 kg
Mounting Style	Wall or pipe mount
Power	25 watts
Dimensions	18.1 x 24.9 x 12.9 cm
Nominal Impedance	50 ohms

Radiation Patterns

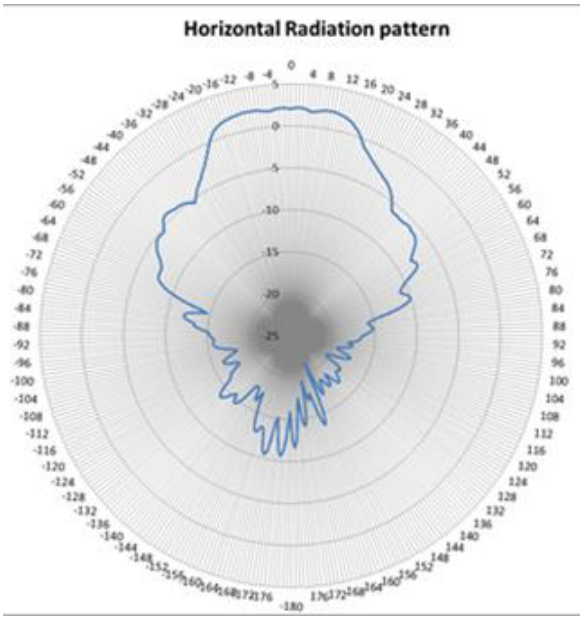


Figure 51: 5 GHz Horizontal Pattern

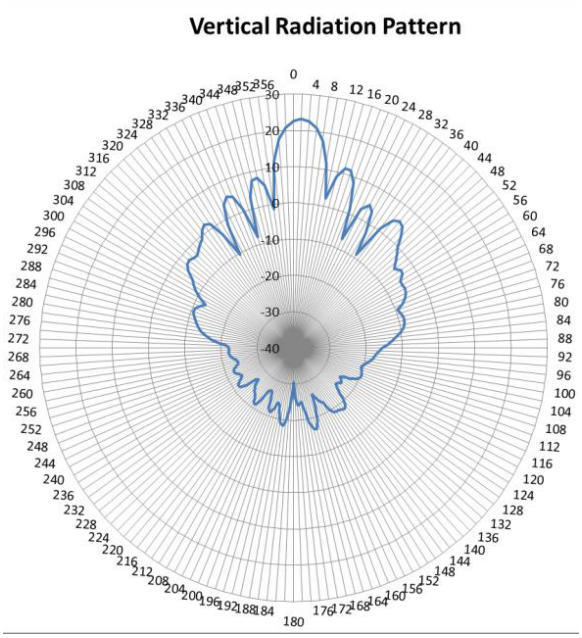


Figure 52: 5GHz Vertical Pattern

30718 (WS-AO-DE10055N)

The dual-band, 8 port, sector antenna provides spatial diversity coverage of 2.4 and 5 GHz broadband wireless frequencies in a low profile housing. Designed for outdoor installations utilizing 802.11ac MIMO applications. The elements can be used individually or in combination for use with legacy 802.11 access points.

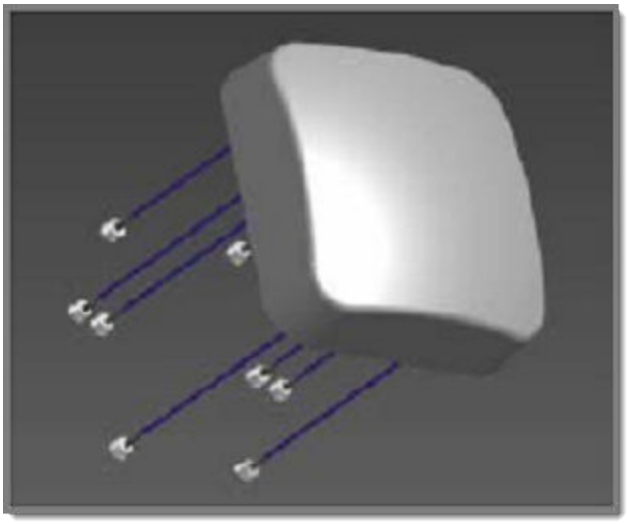


Figure 53: 30718 (WS-AO-DE10055N)

Specifications

Table 33: 30718 (WS-AO-DE10055N) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	10-10.5 dBi	6-7.5 dBi
Vertical Beamwidth	44°	43°
Horizontal Beamwidth	51°	53°
VSWR	< 2.25:1	
Operating Temperature Range	-30°C to +80°C	
Polarization	Dual linear	
Weight	2.3kg	
Mounting Style	Wall or pipe mount	
Power	25 watts	
Dimensions	305 mm x 305 x 110.5mm	
Nominal Impedance	50 ohms	

Radiation Patterns

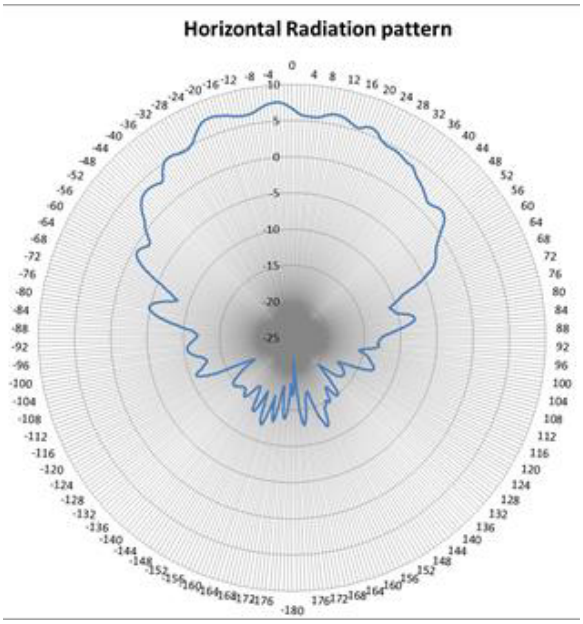


Figure 54: 2.4 GHz Horizontal Pattern

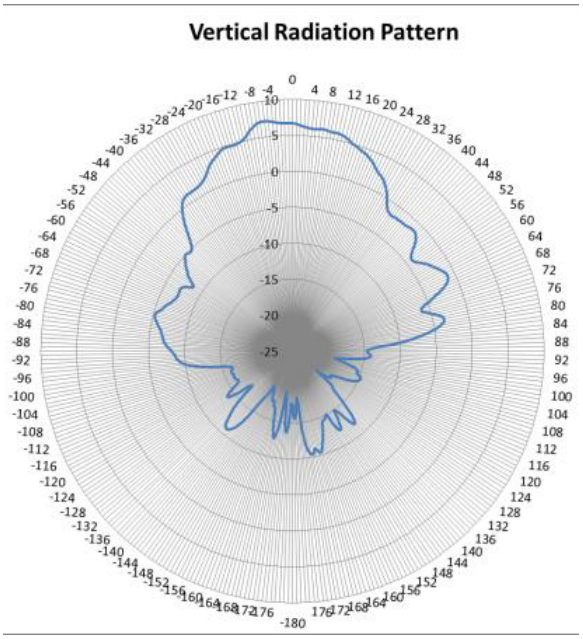


Figure 55: 2.4 GHz Vertical Pattern

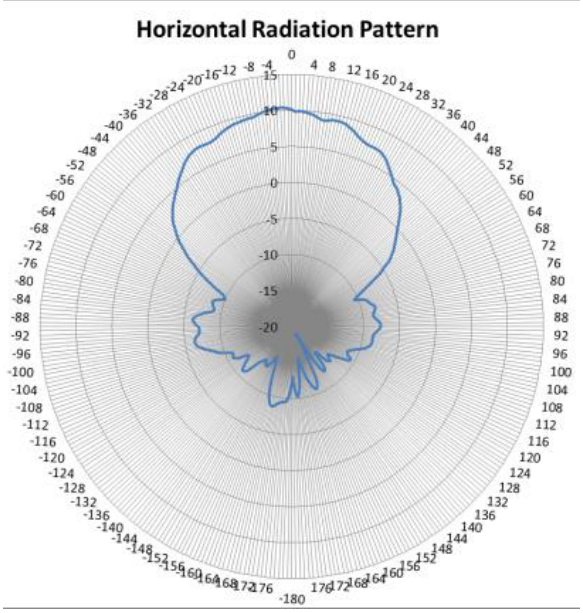


Figure 56: 5GHz Horizontal Pattern

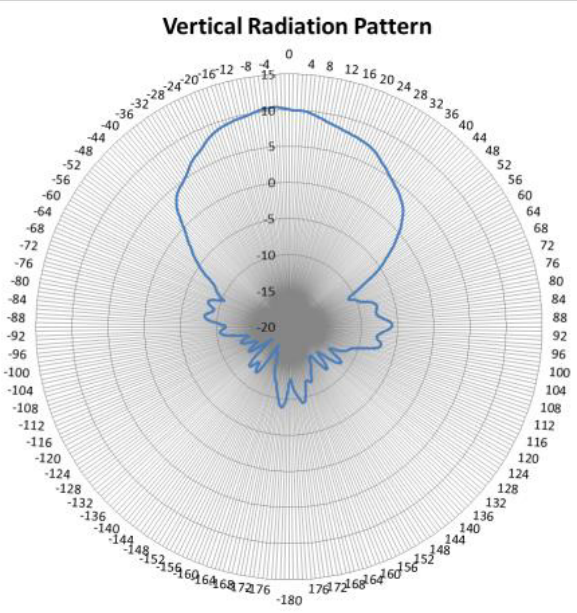


Figure 57: 5GHz Vertical Pattern

30720 (WS-AO-DE07100N)

The dual-band, 8 port, sector antenna provides spatial diversity coverage of 2.4 and 5 GHz broadband wireless frequencies in a low profile housing. Designed for outdoor installations utilizing 802.11n multi-band wireless LAN access point radios, it provides coverage for venues with many mobile data users.

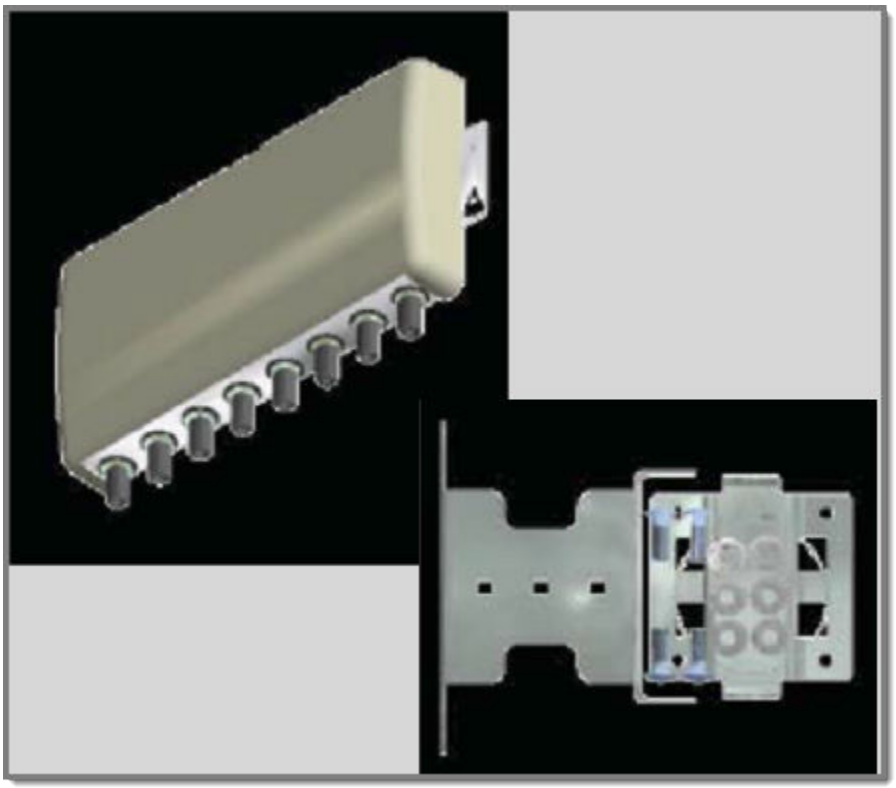


Figure 58: Outdoor Antenna 30720 (WS-AO-DE07100N) and Mounting Bracket

Specifications

Table 34: WS-AO-DE07100N Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	5.7-7 dBi	4-6 dBi
Vertical Beamwidth	90°	60°
Horizontal Beamwidth	100°	75°
VSWR	< 2.0:1	
Operating Temperature Range	-40°C to +70°C	
Polarization	Vertical	
Weight	1.3kg	
Mounting Style	Wall or pipe mount	
Power	25 watts	
Dimensions	18.1 x 39.9 x 5.1 cm	
Nominal Impedance	50 ohms	

Radiation Patterns

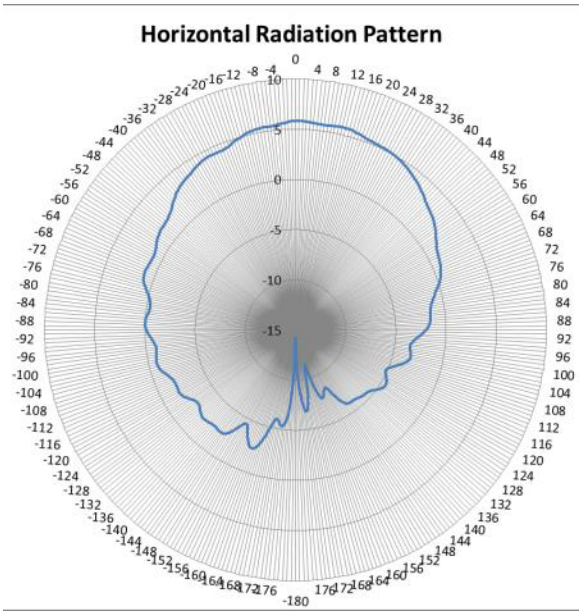
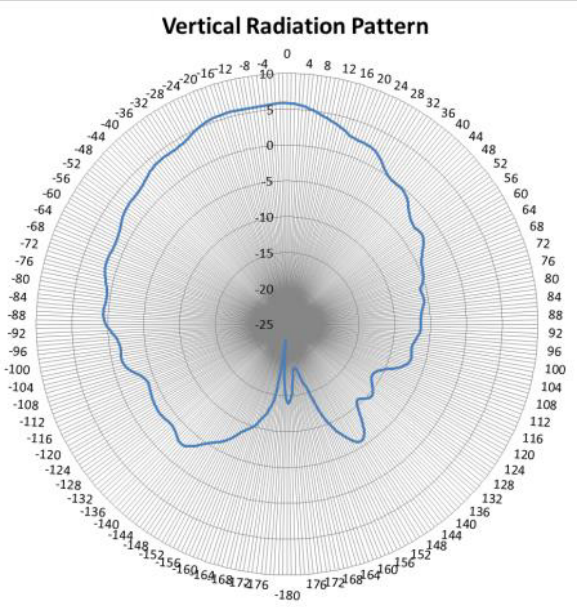


Figure 59: 2.4 GHz Radiation Patterns



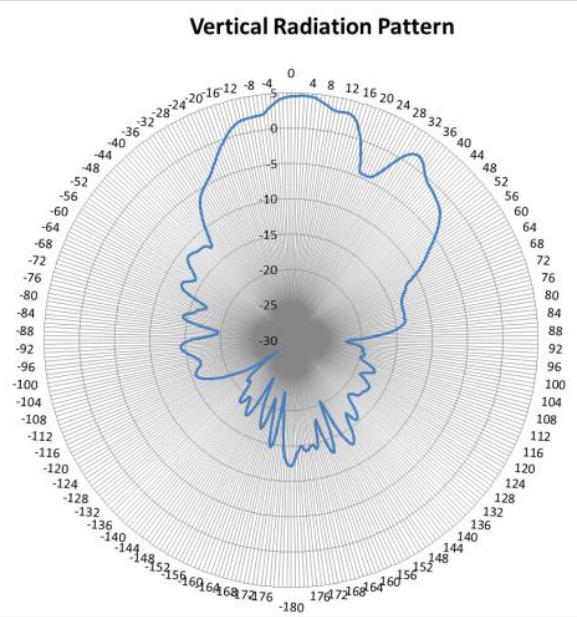
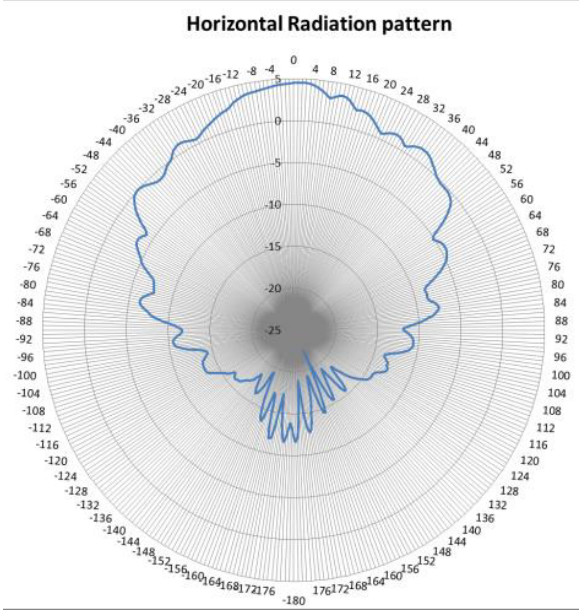


Figure 60: 5 GHz Radiation Patterns



30724 (WS-AO-DQ04360N)

The 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 61: 30724 (WS-AO-DQ04360N)

Specifications

Table 35: 30724 (WS-AO-DQ04360N) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	4.25-5.5 dBi	5-6 dBi
Vertical Beamwidth	60°	33°
Horizontal Beamwidth	Omnidirectional	Omnidirectional
VSWR	2:1	
Operating Temperature Range	-40°C to +85°C	
Polarization	Linear, vertical	
Weight	1.45kg	
Mounting Style	Wall or mast mount	
Power	5 watts	
Dimensions	8.6 x 6.3 inches 21.8 x 16 cm	
Nominal Impedance	50 ohms	

Radiation Patterns

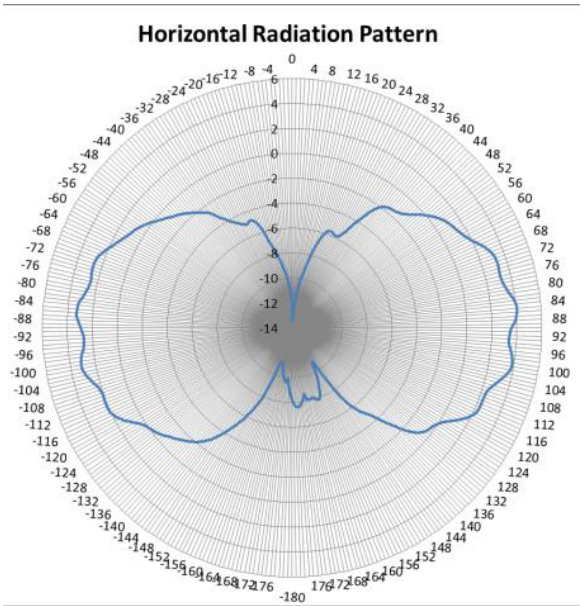


Figure 62: 2.4G Horizontal Pattern

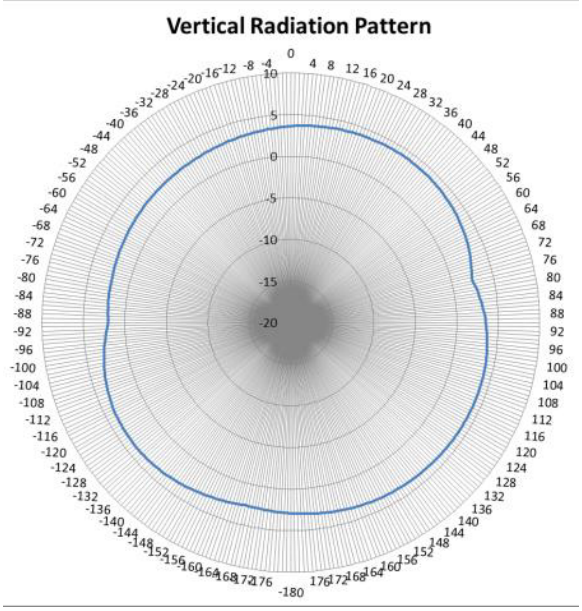


Figure 63: 2.4 GHz Vertical Pattern

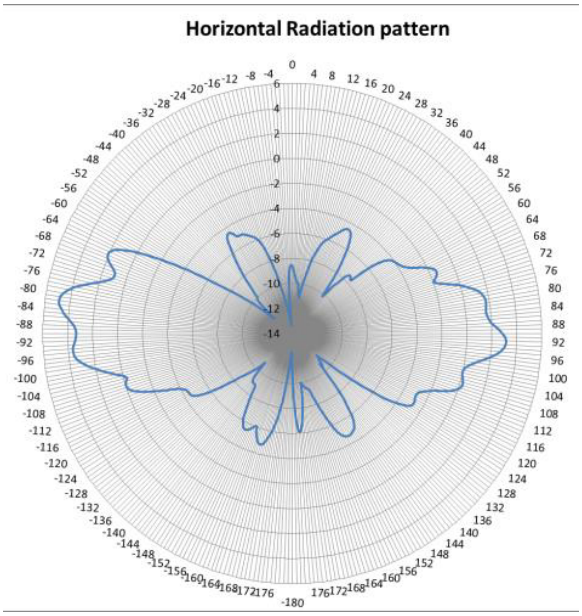


Figure 64: 5GHz Horizontal Pattern

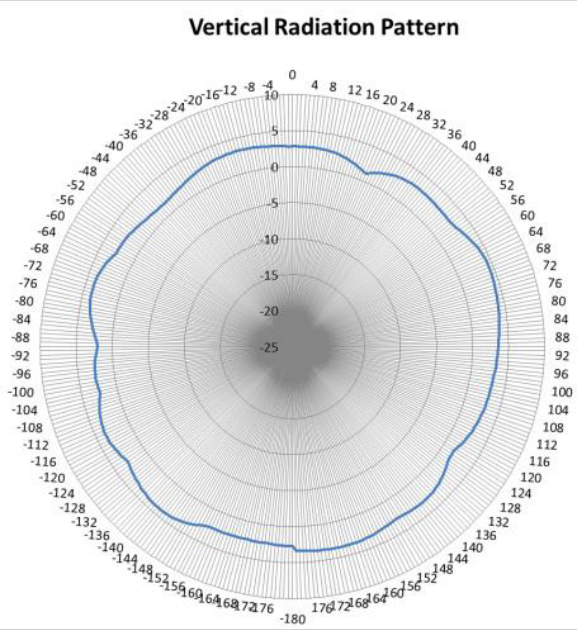


Figure 65: 5GHz Vertical Pattern

WS-AO-5D23009N (WS-AO-5D23009N)

This antenna provides efficient and stable performance across the band and can be mounted on a pole or wall, indoors and outdoors.

Figure 66: Indoor/Outdoor Antenna WS-AO-5D23009N with Mounting Bracket

Specifications

Table 36: WS-AO-5D23009N Specifications

Specification	Value
Frequency	5 GHz
Gain	23 dBi
VSWR	1.5:1 > 2.0:1
Vertical Beamwidth	9°
Horizontal Beamwidth	9°
Operating Temperature Range	-40°C-85°C
Polarization	
Weight	1.6 kg
Mounting Style	Wall or pipe mount, optional heavy -duty mount

Table 36: WS-AO-5D23009N Specifications (continued)

Specification	Value
Power	20 watts
Dimensions	340 mm x 340 mm x 30mm
Nominal Impedance	50 ohms

Radiation Patterns

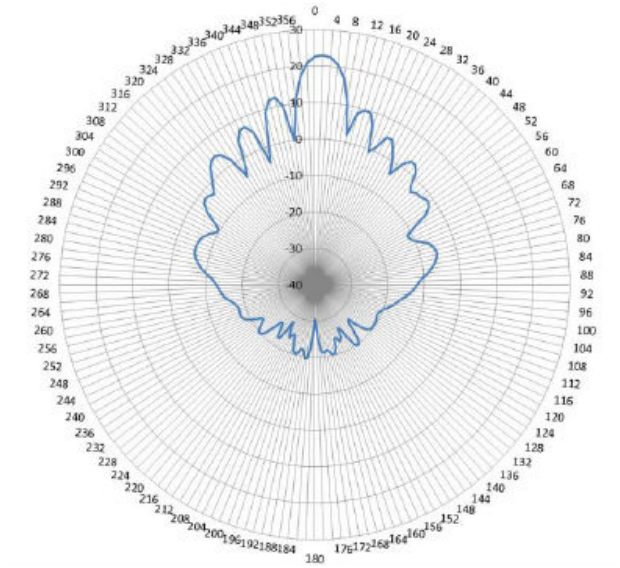


Figure 67: Horizontal Radiation Pattern 5GHz

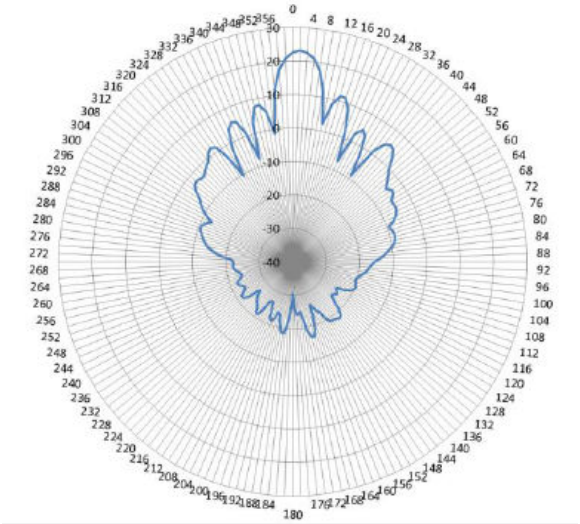


Figure 68: Vertical Radiation Pattern 5GHz

WS-AO-DS02360N3

This is a 3-pack of omni-directional antennas with high performance, low profile fixed mount for outdoor applications. The N-male connector at the base allows this antenna to be mounted directly on the radio equipment or other enclosures with the mating bulkhead connector.

Figure 69: Outdoor Antenna WS-AO-DS02360N3

Specifications

Table 37: WS-AO-DS02360N3 Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	4.9-5.9 GHz
Gain	2 dBi	
Vertical Beamwidth	60°	
Horizontal Beamwidth	360°	
VSWR		
Operating Temperature Range		
Polarization	Vertical linear	
Weight	85g	
Mounting Style	Direct mount	
Power	25 watts	
Dimensions		
Nominal Impedance	50 ohms	

Radiation Patterns

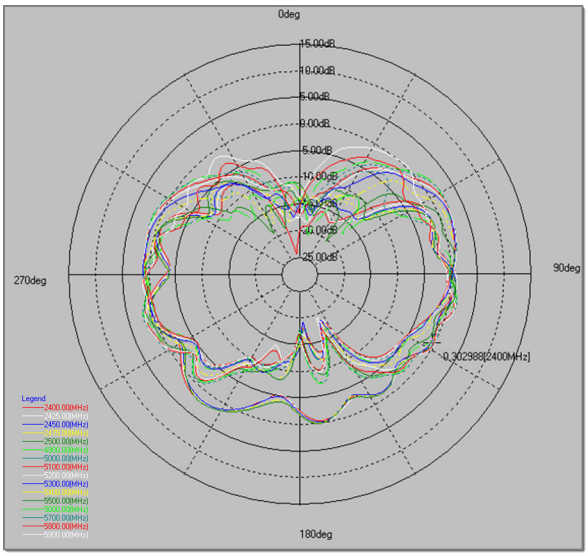


Figure 70: WS-AO-DS02360N3 E-Plane

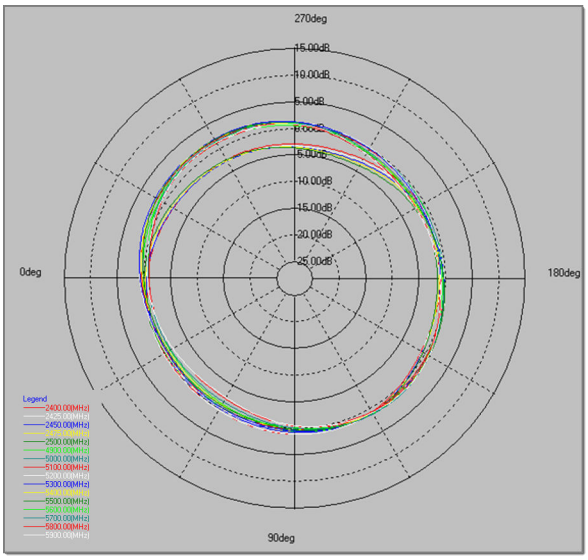


Figure 71: WS-AO-DS02360N3 H-Plane

WS-AO-DT05120

The WS-AO-DT05120, WS-AO-DT05120-1, and WS-AO-DT05120N antennas are 2.4 GHz and 5 GHz dual-band sector antennas that can be mounted in an outdoor location. These antennas can be used for 802.11n MIMO applications. This antenna can be used with a single access point to provide full dual-band 802.11a/b/g/n MIMO coverage. The three elements can also be used individually or in combination to provide diversity and non-diversity coverage with legacy 802.11a/b/g access points. For mounting instructions, see Mounting Antenna Model WS-AO-DT05120 and Related Antenna Models on page 47.

Figure 72: Outdoor Antenna WS-AO-DT05120

Specifications

Table 38: WS-AO-DT05120 Specifications

Specification	Value
Frequency	2.3–2.7 GHz and 4.9–6.1 GHz
Gain	5 dBi x3 Typ.
VSWR	2:1 Max (1.5:1 Typ)
Vertical Beamwidth	70°, 3 dB
Horizontal Beamwidth	120°, 3 dB
Operating Temperature Range	-40°C to +70°C
Polarization	Vertical and 2 x Dual Slant
Weight	260 grams
Mounting Style	Wall mount
Power	20 watts
Dimensions	7.9 in x 7.9 in x 1.25 in (200 mm x 200 mm x 33 mm)
Nominal Impedance	50 ohms

Radiation Patterns

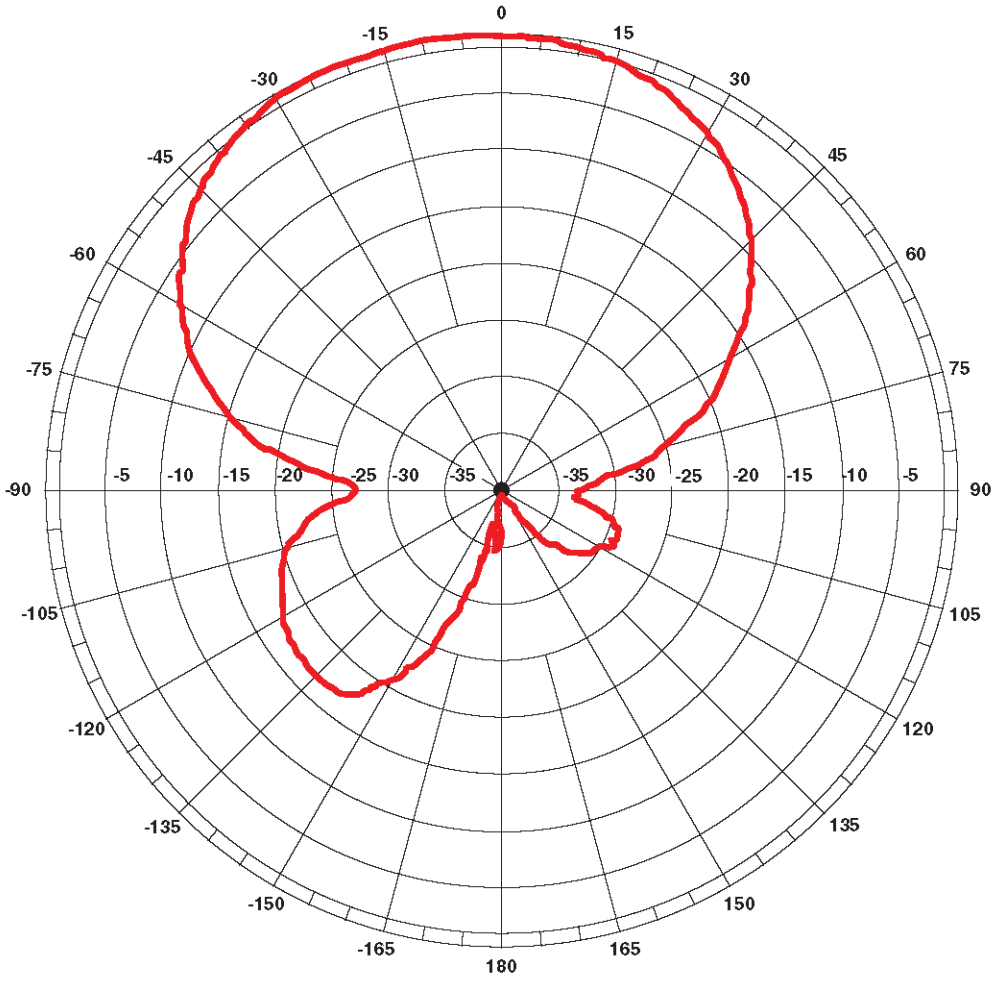


Figure 73: WS-AO-DT05120 2.5 GHz E-Plane Radiation Pattern

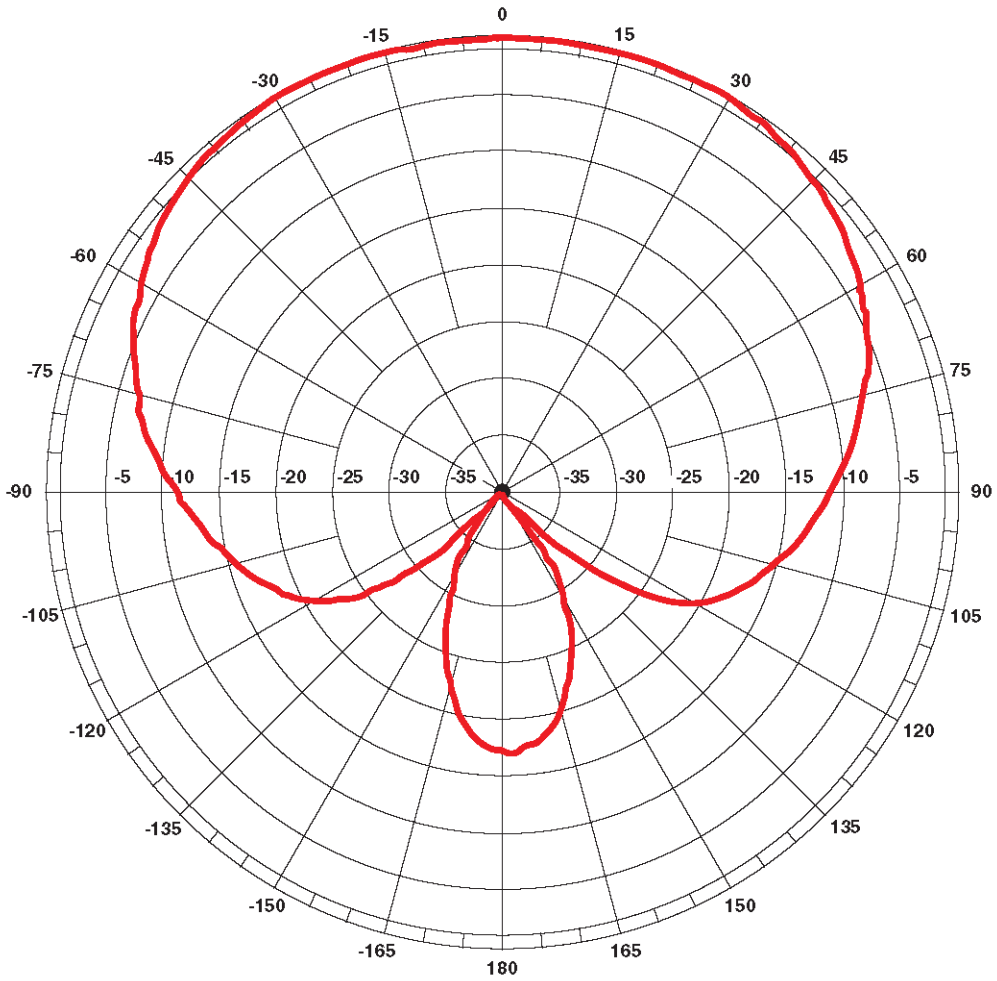


Figure 74: WS-AO-DT05120 2.5 GHz H-Plan Radiation Pattern

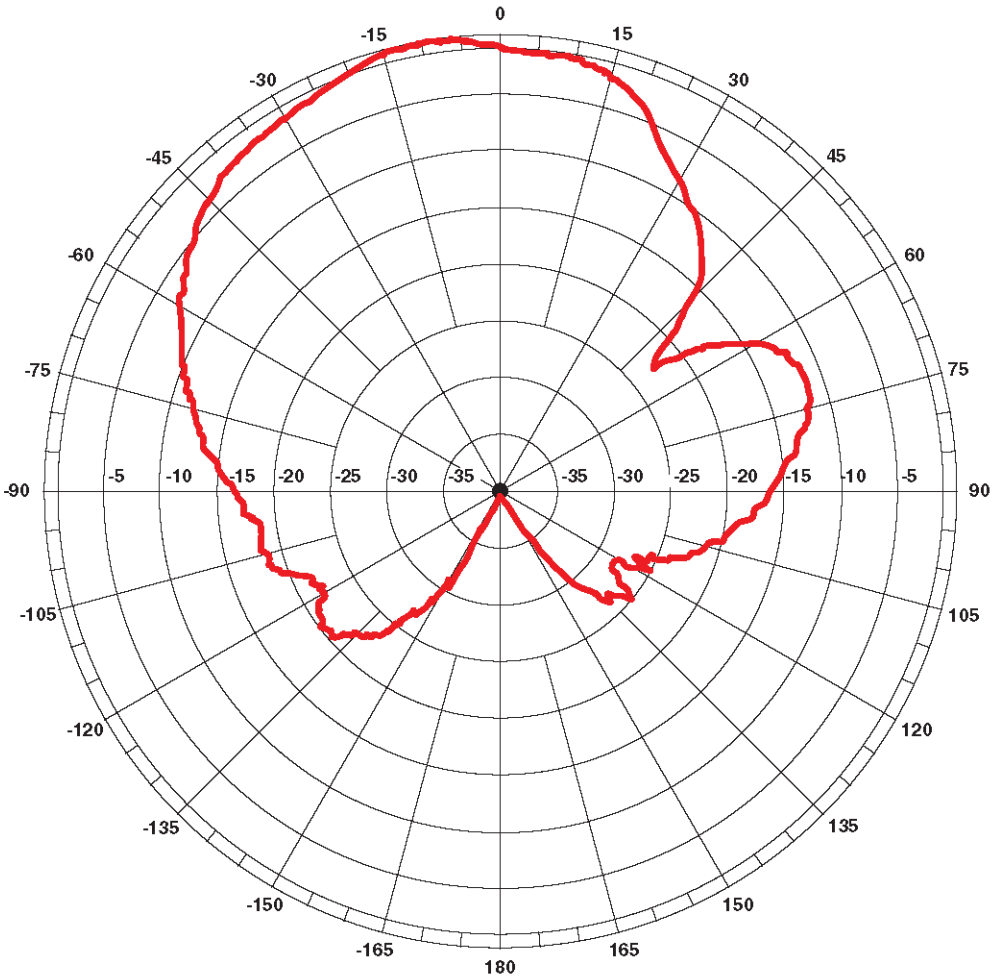


Figure 75: WS-AO-DT05120 5.5 GHz E-Plane Radiation Pattern

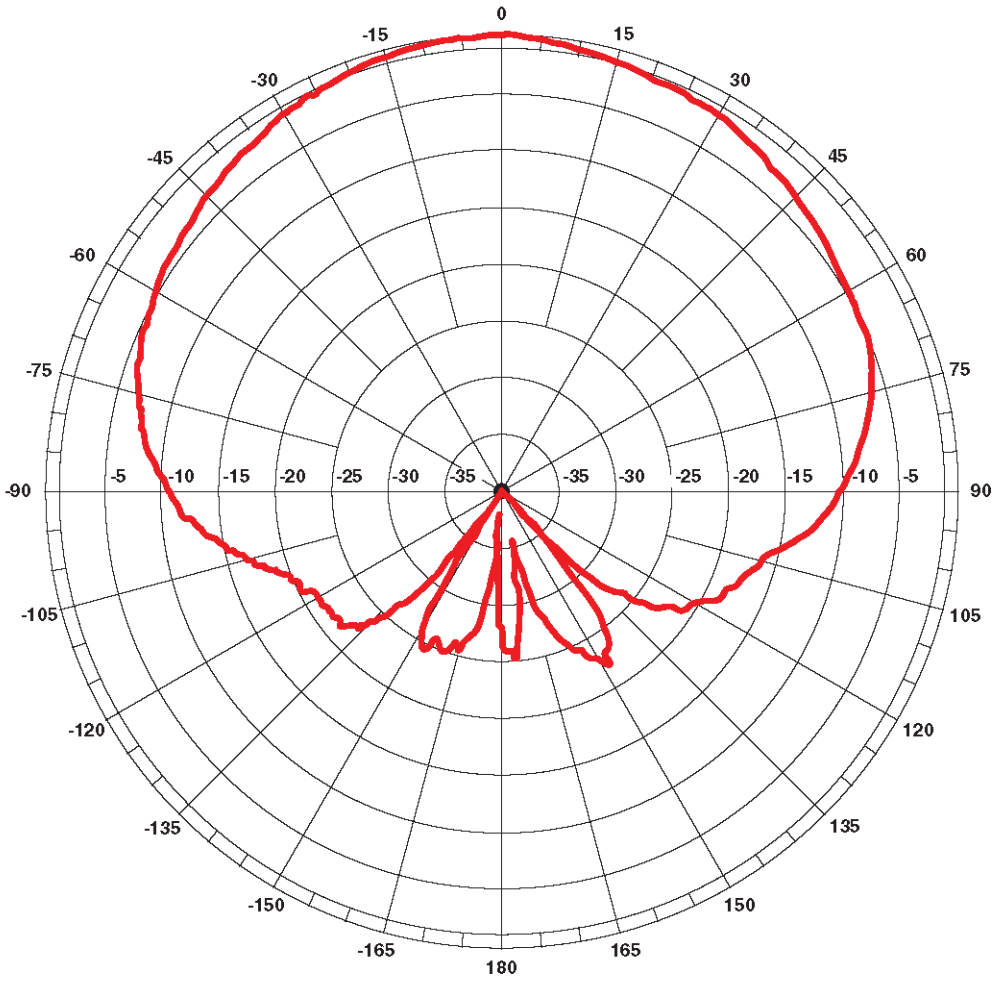


Figure 76: WS-AO-DT05120 5.5 GHz H-Plane Radiation Pattern

WS-AO-DT05120N

This antenna is the WS-AO-DT05120 antenna with a Standard Polarity Type-N Plug Connector. For full information about this antenna, see WS-AO-DT05120 on page 83. For mounting instructions, see Mounting Antenna Model WS-AO-DT05120 and Related Antenna Models on page 47.

Specifications

Table 39: WS-AO-DT05120N Specifications

Specification	Value
Frequency	2.4-2.5 GHz
Gain	5 dBi
VSWR	1.8 Max (1.5 Typ)
Vertical Beamwidth	90°/60°
Horizontal Beamwidth	100°/75°

Table 39: WS-AO-DT05120N Specifications (continued)

Specification	Value
Operating Temperature Range	-40°C to +70°C
Polarization	Vertical, linear +-45° slant linear
Weight	0.45 kg
Mounting Style	Wall mount
Power	20 watts
Dimensions	7.9 in x 7.9 in x 1.25 in (200 mm x 200 mm x 34 mm)
Nominal Impedance	50 ohms

Radiation Patterns

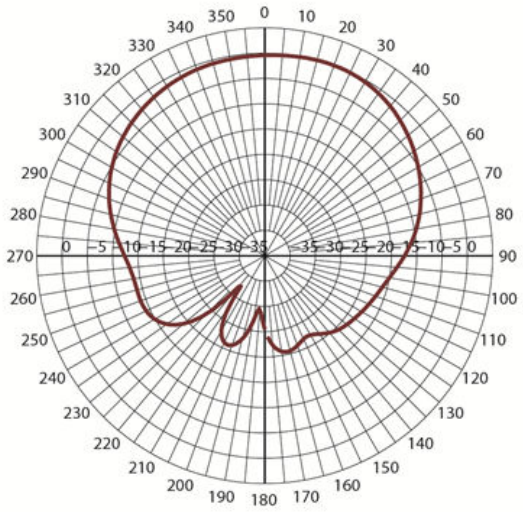


Figure 77: 2.5GHz Elevation Pattern

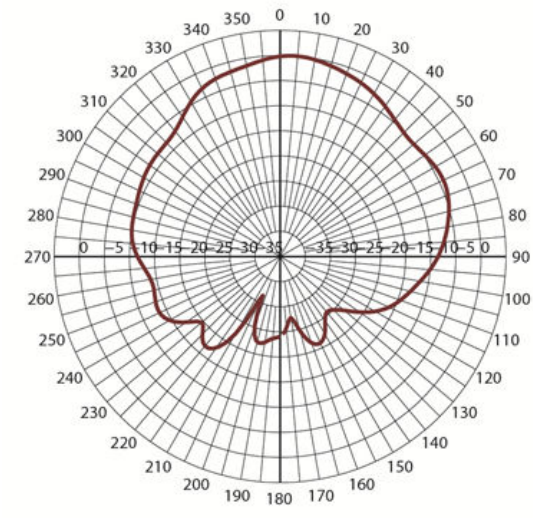


Figure 78: 5 GHz Elevation Pattern

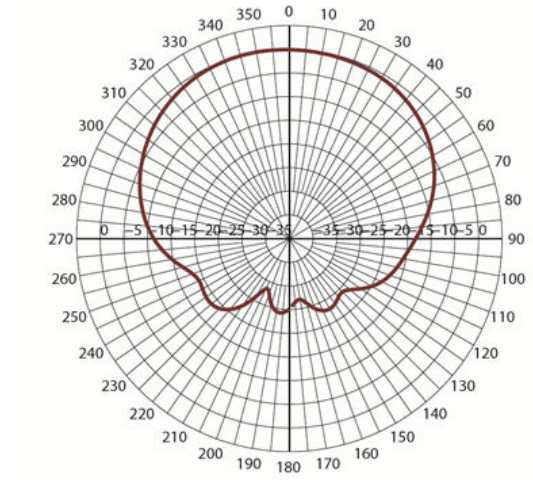


Figure 79: 2.5GHz Azimuth Pattern

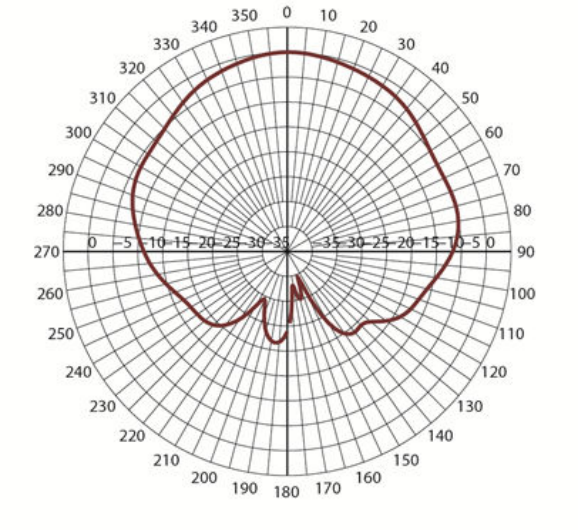


Figure 80: 5 GHz Azimuth Pattern

WS-AO-DX07180N

This antenna is a dual-band six port (three for each band) Sector antenna providing coverage of 2.4 GHz and 5 GHz broadband wireless frequencies in a low profile housing. The antenna provides optimal coverage for areas or events with a large number of mobile data users. It is designed for outdoor installations using 802.11a/b/g/n multi-band wireless LAN access point radios. Table 22 on page 45 lists the connector and cable information for the antenna.

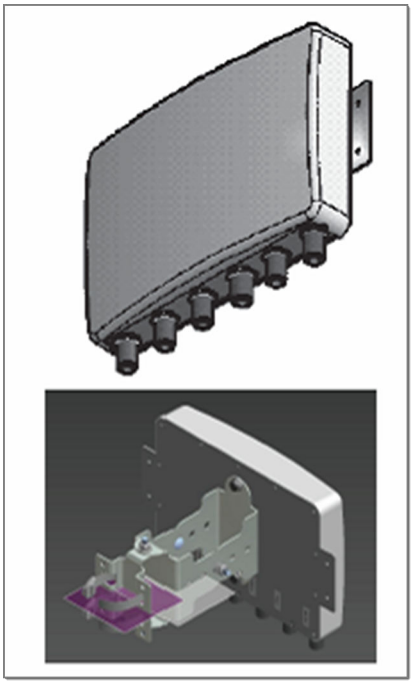


Figure 81: Outdoor Antenna WS-AO-DX07180N with Mounting Bracket

Specifications

Table 40: WS-AO-DX07180N Specifications

Specification	Value
Frequency Range	2.4–2.5 GHz and 5.1–5.9 GHz
Impedance	50 ohms
Gain	6 dBi @ 2.4 GHz 7.2 dBi @ 5 GHz
VSWR	< 1.5:1 (or > 14 dB)
Vertical Beamwidth (3 dB)	70 @ 2.4 GHz / 30 @ 5 GHz
Horizontal Beamwidth (3 dB)	100 @ 2.4 GHz / 90 @ 5 GHz
Operating Temperature Range	-40 to +70 C
Polarization	Vertical
Max Power	20 W
Dimensions	11.5 x 8.0 x 2.0 (inches) 29.21 x 20.44 X 5.08 (cm)
Weight	2.5 (lbs) 1.13 (kg)
Mount	Wall or Mast Mount
Connector	Female, Type-N, Bottom Feed

Radiation Patterns

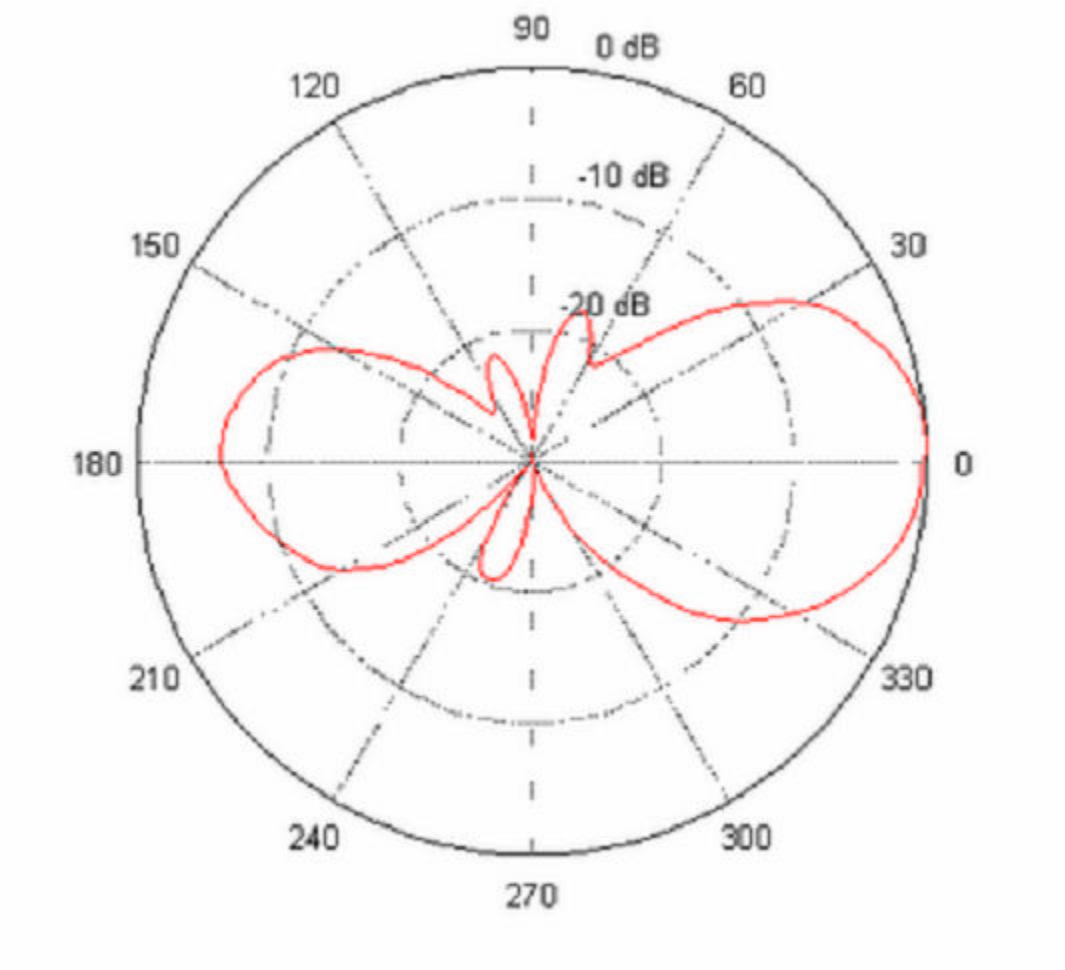


Figure 82: WS-AO-DX0718N E-Plane

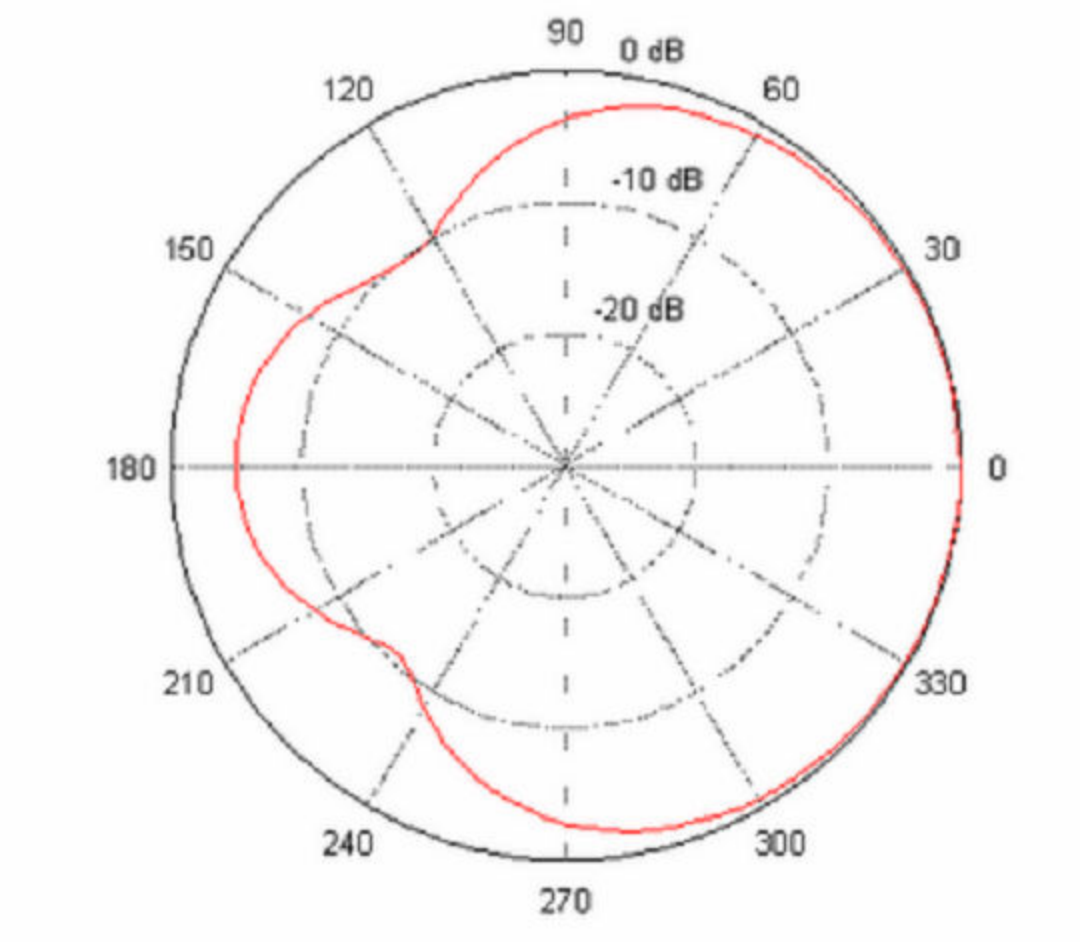


Figure 83: WS-AO-DX0718N H-Plane

WS-AO-DX13025

This dual-band MIMO antenna provides spatial diversity coverage of 2.4 GHz and 5 GHz WiFi. It is designed to provide optimal coverage for areas with many mobile users. Designed for outdoor or in-building installations that utilize 802.11n multi-band wireless LAN access point radios. This antenna uses a Reverse Polarity Type-N Plug Connector. For mounting instructions, see Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025 on page 45.

Figure 84: Outdoor Antenna WS-AO-DX13025

Specifications

Table 41: WS-AO-DX13025 Specifications

Specification	Value
Frequency	2.4–2.5 GHz and 5.1–5.9 GHz
Gain	12.5 dBi / 11.5 dBi
VSWR	1.7 typical, 2.0 maximum
Vertical Beamwidth	48/ 40
Horizontal Beamwidth	27/ 30
Operating Temperature Range	-40C to +85C
Polarization	Dual Linear (2 x V / 1 X H) for each band
Weight	8.0 lb (2.99 kg)
Mounting Style	Pipe or wall installation

Table 41: WS-AO-DX13025 Specifications (continued)

Specification	Value
Power	25 watts
Dimensions	18.75 in x 18.75 in x 5.125 in (476.25 x 476.25 x 130.18 mm)
Nominal Impedance	50 ohms

Radiation Patterns

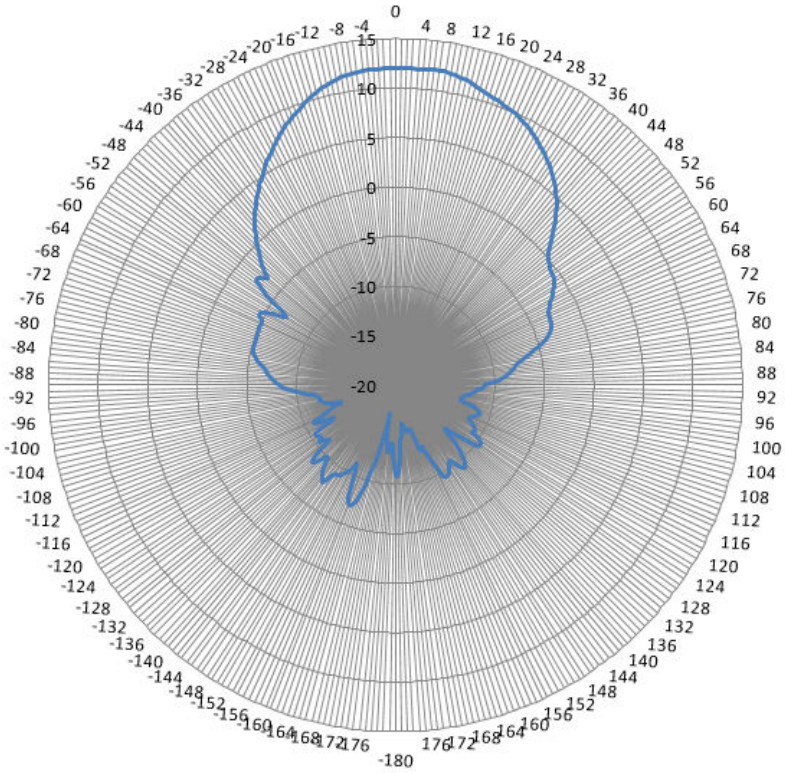


Figure 85: WS-AO-DX13025 2.4 GHz Vertical Radiation Pattern

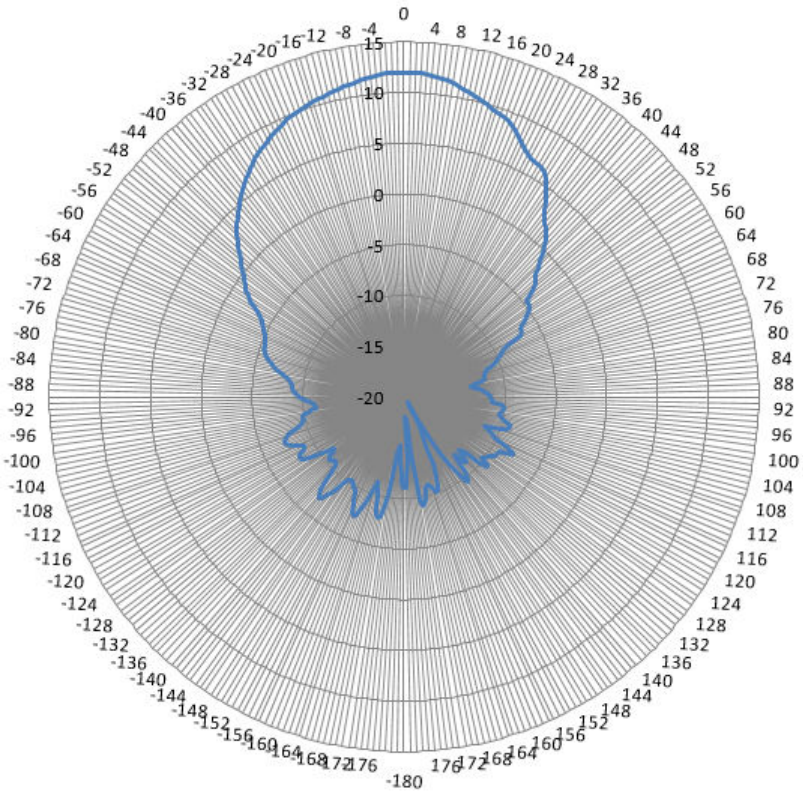


Figure 86: WS-AO-DX13025 2.4 GHz Horizontal Radiation Pattern

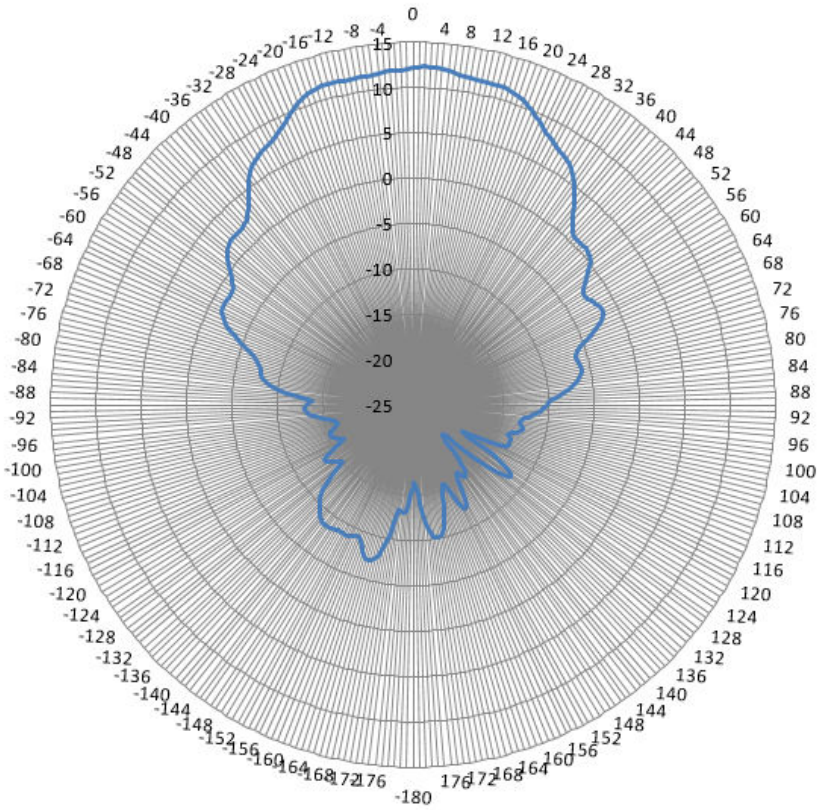


Figure 87: WS-AO-DX13025 5 GHz Vertical Radiation Pattern

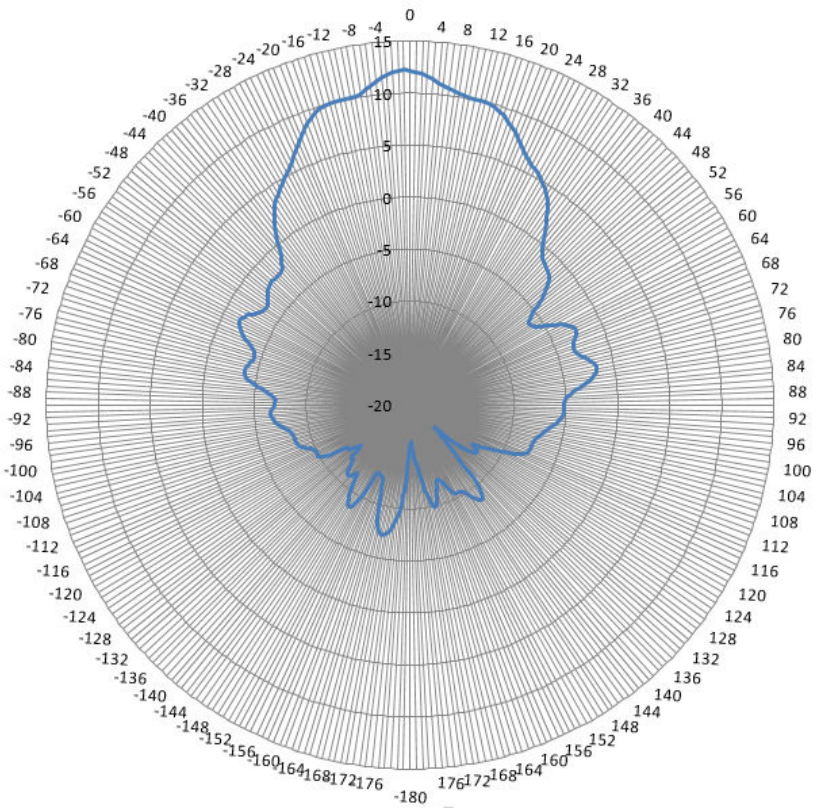


Figure 88: WS-AO-DX13025 5 GHz Horizontal Radiation Pattern

WS-AO-DX13025N

This antenna is the WS-AO-DX13025 standard antenna with a Standard Polarity Type-N Plug Connector on a 58 inch cable. For more information, see WS-AO-DX13025 on page 94.

Specifications

Table 42: WS-AO-DX13025N Specifications

Specification	Value
Frequency	2.4–2.5 GHz and 5.1–5.9 GHz
Gain	12.5 dBi / 11.5 dBi
VSWR	1.7 typical, 2.0 maximum
Vertical Beamwidth	48/ 40
Horizontal Beamwidth	27/ 30
Operating Temperature Range	-40C to +85C
Polarization	Dual Linear (2 x V / 1 X H) for each band
Weight	1.6 kg
Mounting Style	Pipe or wall installation

Table 42: WS-AO-DX13025N Specifications (continued)

Specification	Value
Power	25 watts
Dimensions	340 x 340 x 30 mm
Nominal Impedance	50 ohms

Radiation Patterns

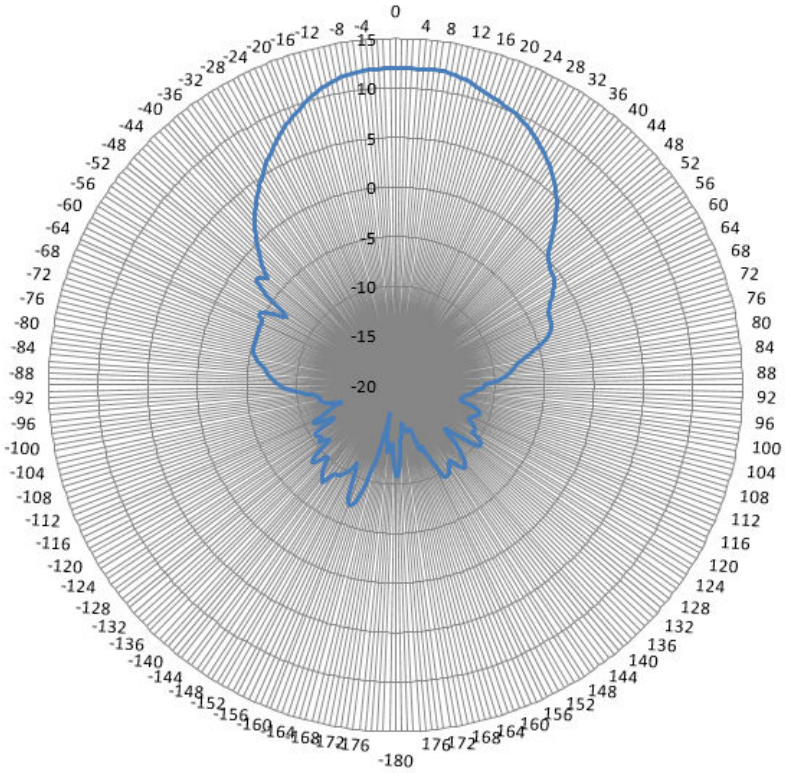


Figure 89: WS-AO-DX13025 2.4 GHz Vertical Radiation Pattern

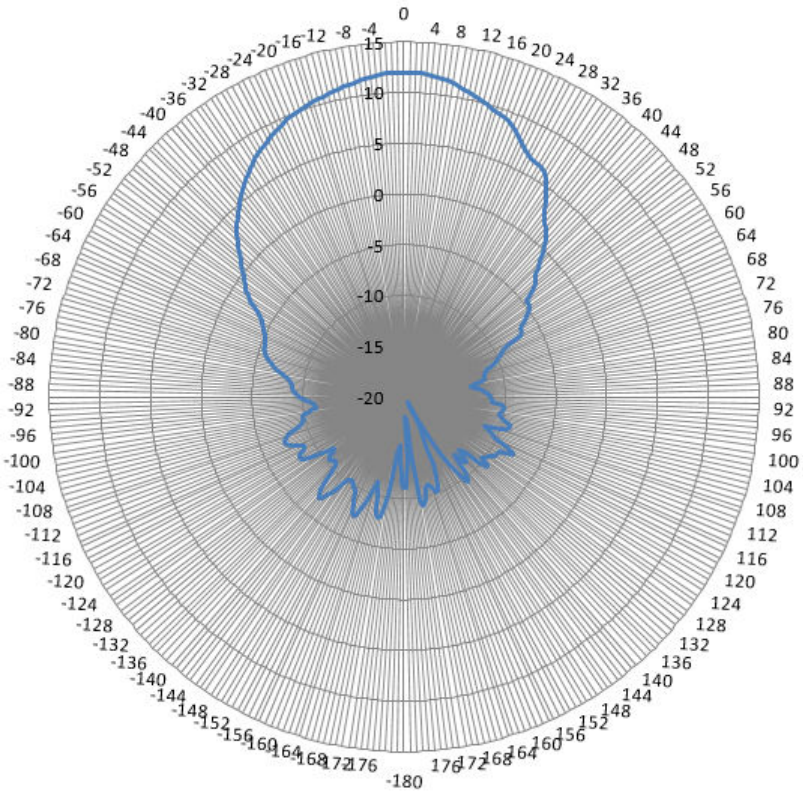


Figure 90: WS-AO-DX13025 2.4 GHz Horizontal Radiation Pattern

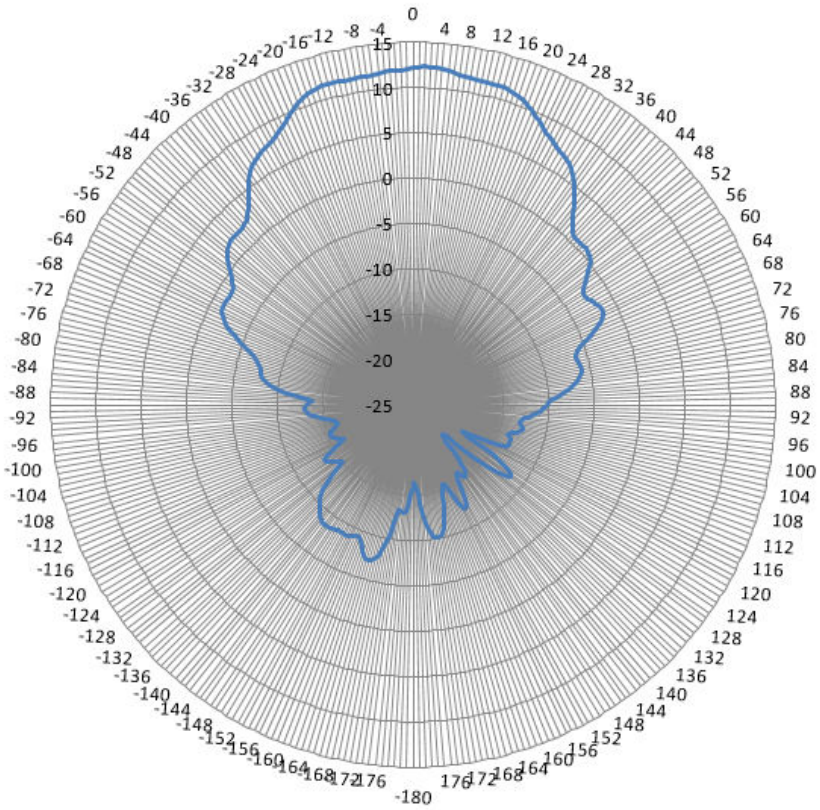


Figure 91: WS-AO-DX13025 5 GHz Vertical Radiation Pattern

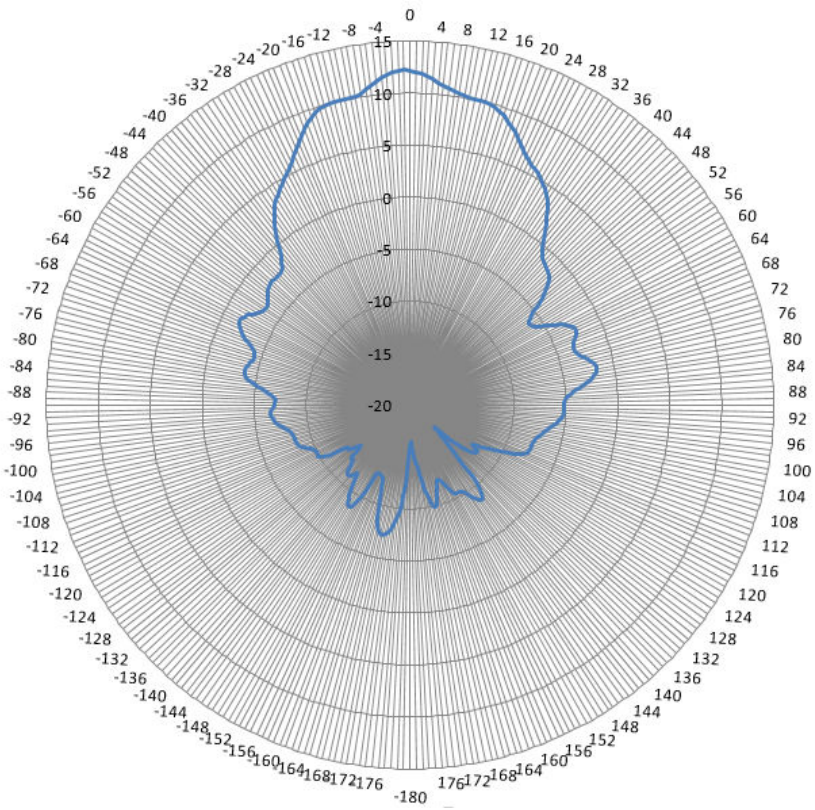


Figure 92: WS-AO-DX13025 5 GHz Horizontal Radiation Pattern

WS-AO-DX10055N

This dual-band MIMO antenna provides spatial diversity coverage of 2.4 GHz and 5 GHz WiFi. This antenna uses a Standard Polarity Type-N Plug Connector on a 39 inch cable. For mounting instructions, see Mounting Antenna Model WS-AO-DX10055N and Related Antenna Models on page 36.

For information about the indoor model of this antenna, see WS-AI-DX10055 on page 149.

Note
The WS-AO-DX10055N and the WS-AI-DX10055 are the same antenna. The WS-AO-DX10055N is intended for outdoor use. The WS-AI-DX10055 is intended for indoor use.

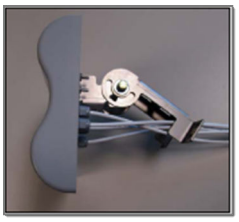


Figure 93: Outdoor Antenna WS-AO-DX10055N

Specifications

Table 43: WS-AO-DX10055N Specifications

Specification	Value
Frequency	2.4–2.5 GHz and 5.15–5.85 GHz
Gain	10 dBi / 6 dBi
VSWR	< 2.0:1
Vertical Beamwidth	30/ 35
Horizontal Beamwidth	60/ 55
Operating Temperature Range	-40C to +70C
Polarization	Linear, vertical
Mounting Method	Heavy duty articulating mount (included)
Power	25 watts
Dimensions	9.1 in x 6.6 in x 1.6 in (231.14 x 167.64 x 40.64 mm)
Input Impedance	50 ohms

Radiation Patterns

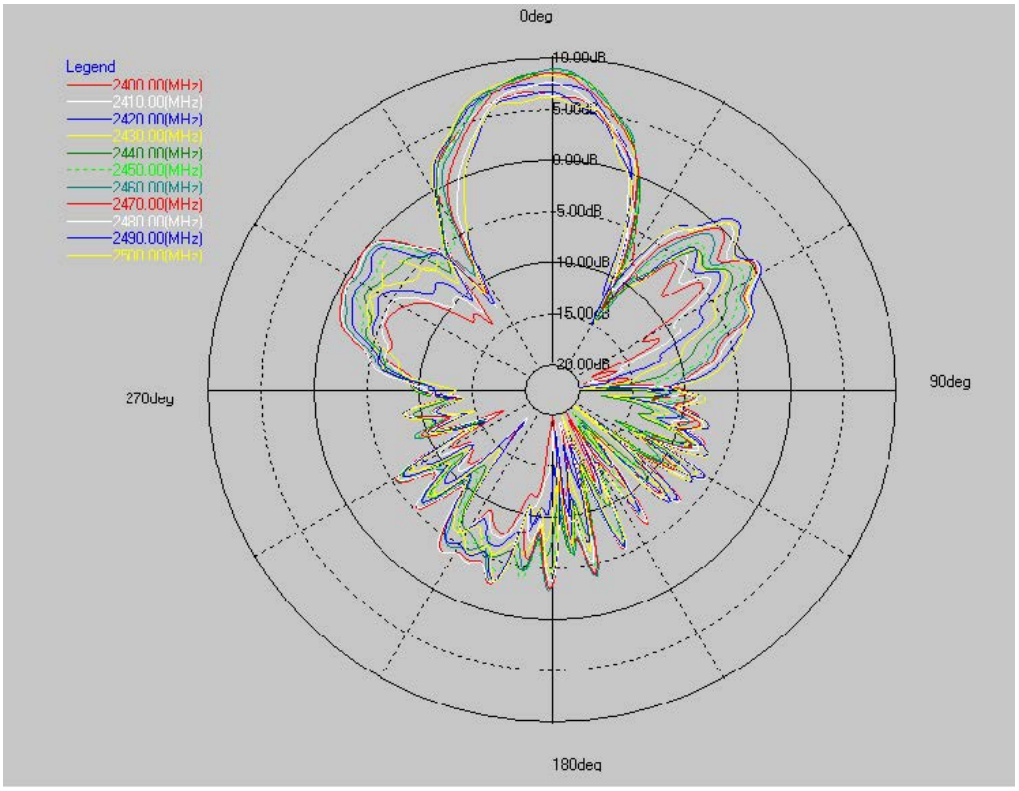


Figure 94: WS-AO-DX10055N 2.4 GHz Vertical Radiation Pattern

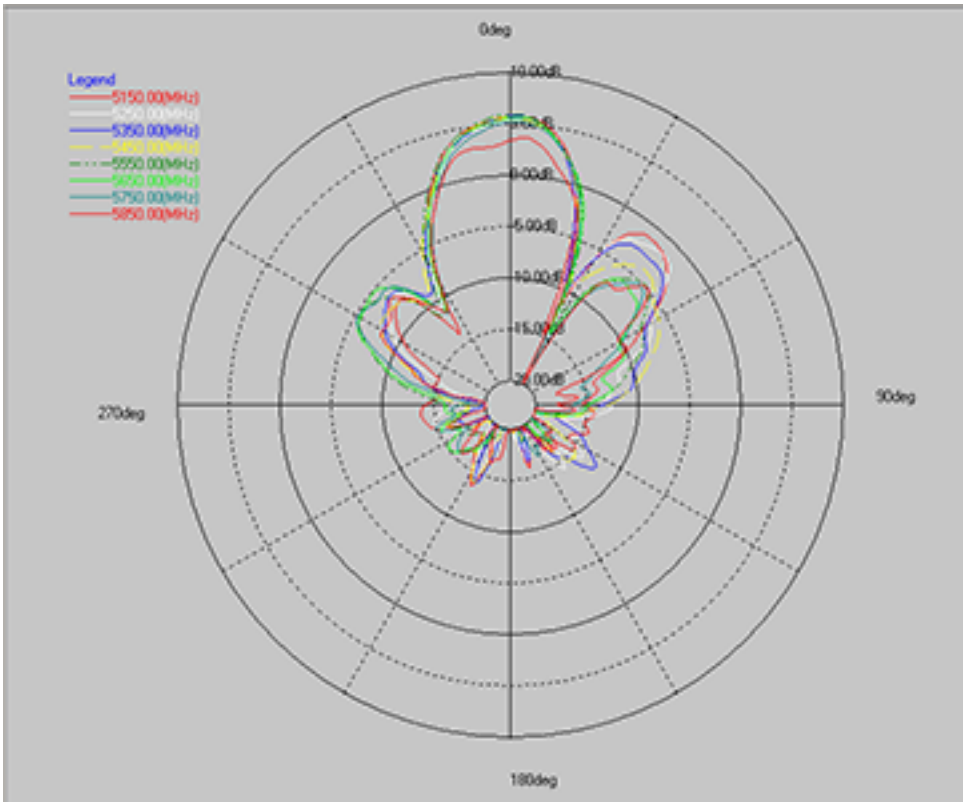


Figure 95: WS-AO-DX10055N 5.0 GHz Vertical Radiation Pattern

WS-AO-2DIPN3

This antenna is packaged three antennas to a package (3-pack). For more information, see Mounting Antenna Model WS-AO-2DIPN3 on page 42.

Specifications

Table 44: WS-AO-2DIPN3 Specifications

Specification	Value
Frequency Range	0–6 GHz
Working Voltage.	</- 1000 Vrms
V.S.W.R	</- 1.5
Dielectric Withstanding	</- 2500 Vrms
Voltage Insulation Resistance	>/- 5000 Megohms
Operating Temperature Range	-65°C to +165°C
Recommended coupling nut torque	6.0 in-lb–10.0 in-lb
Coupling nut retention force	>/- 100 lb
Impedance	50 ohms

Radiation Patterns

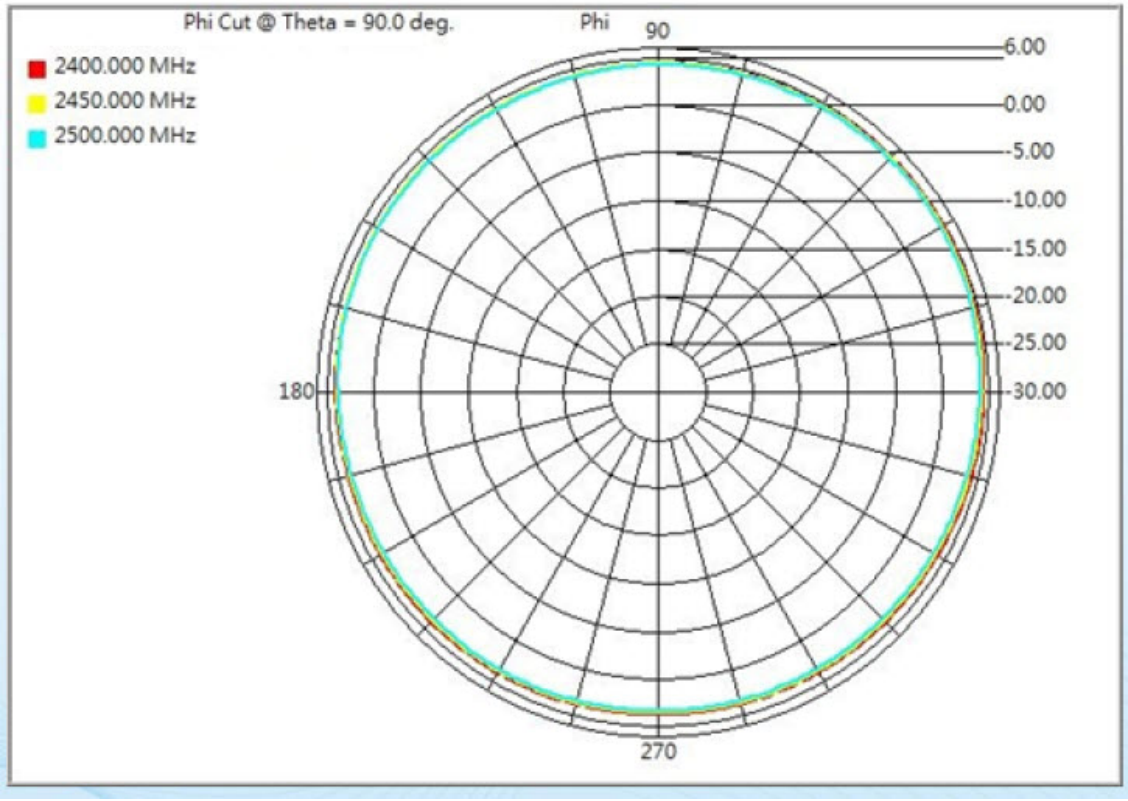


Figure 96: WS-AO-2DIPN3 H-Plane Radiation Pattern

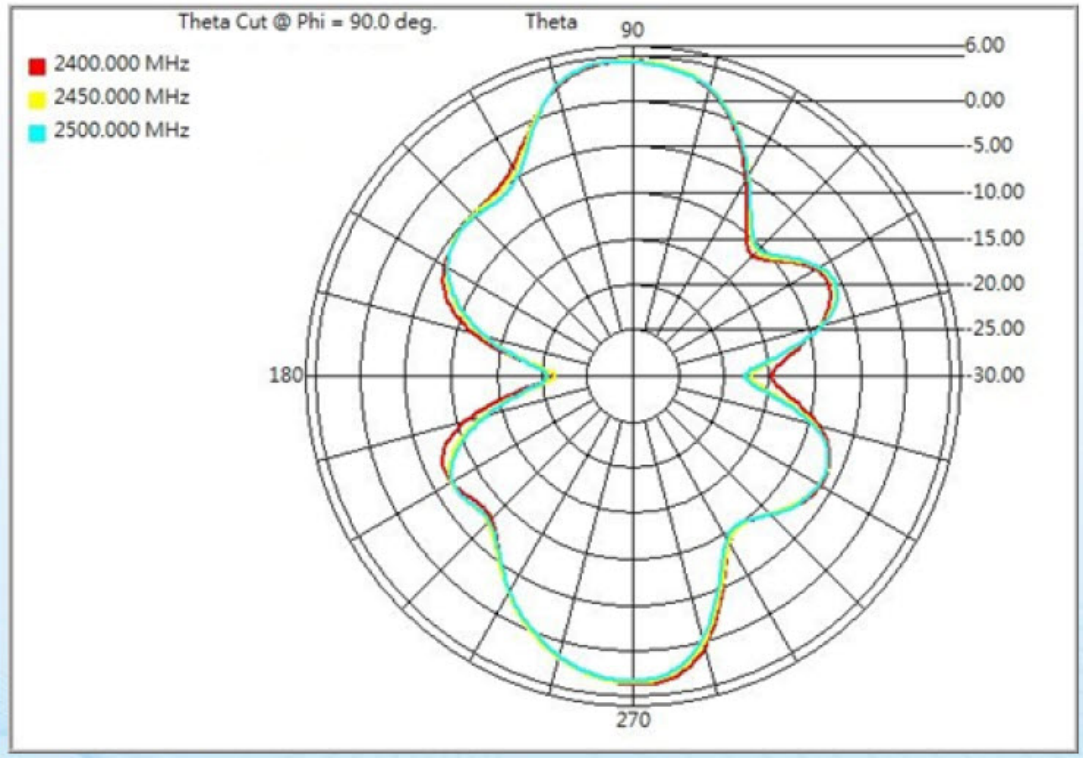


Figure 97: WS-AO-2DIPN3 E-Plane Radiation Pattern

WS-AO-5DIPN3

This 5 GHz Dipole antenna is packaged three antennas to a package (3-pack).

Specifications

Table 45: WS-AO-5DIPN3 Specifications

Specification	Value
Frequency Range	0–6 GHz
Working Voltage.	</- 1000 Vrms
V.S.W.R	</- 1.5
Dielectric Withstanding	</- 2500 Vrms
Voltage Insulation Resistance	>/- 5000 Megohms
Operating Temperature Range	-65°C to +165°C
Recommended coupling nut torque	6.0 in-lb–10.0 in-lb
Coupling nut retention force	>/- 100 lb
Impedance	50 ohms

Radiation Patterns

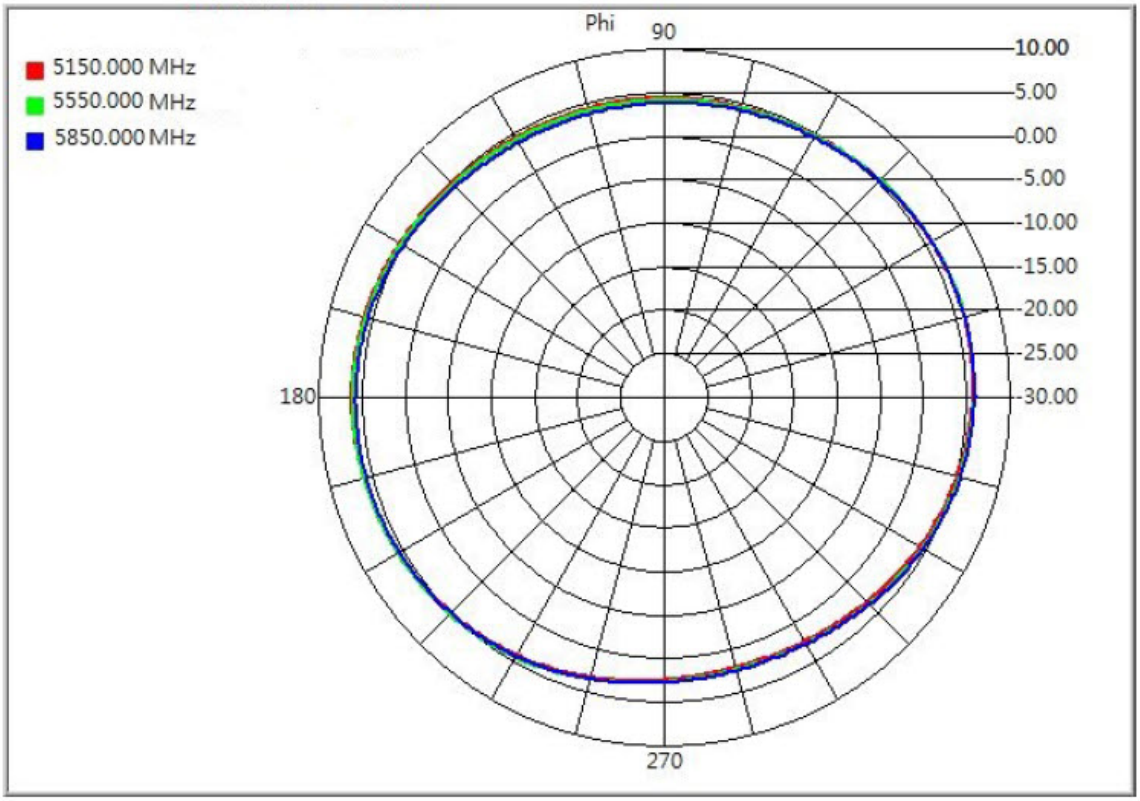


Figure 98: WS-AO-5DIPN3 2D Radiation Pattern

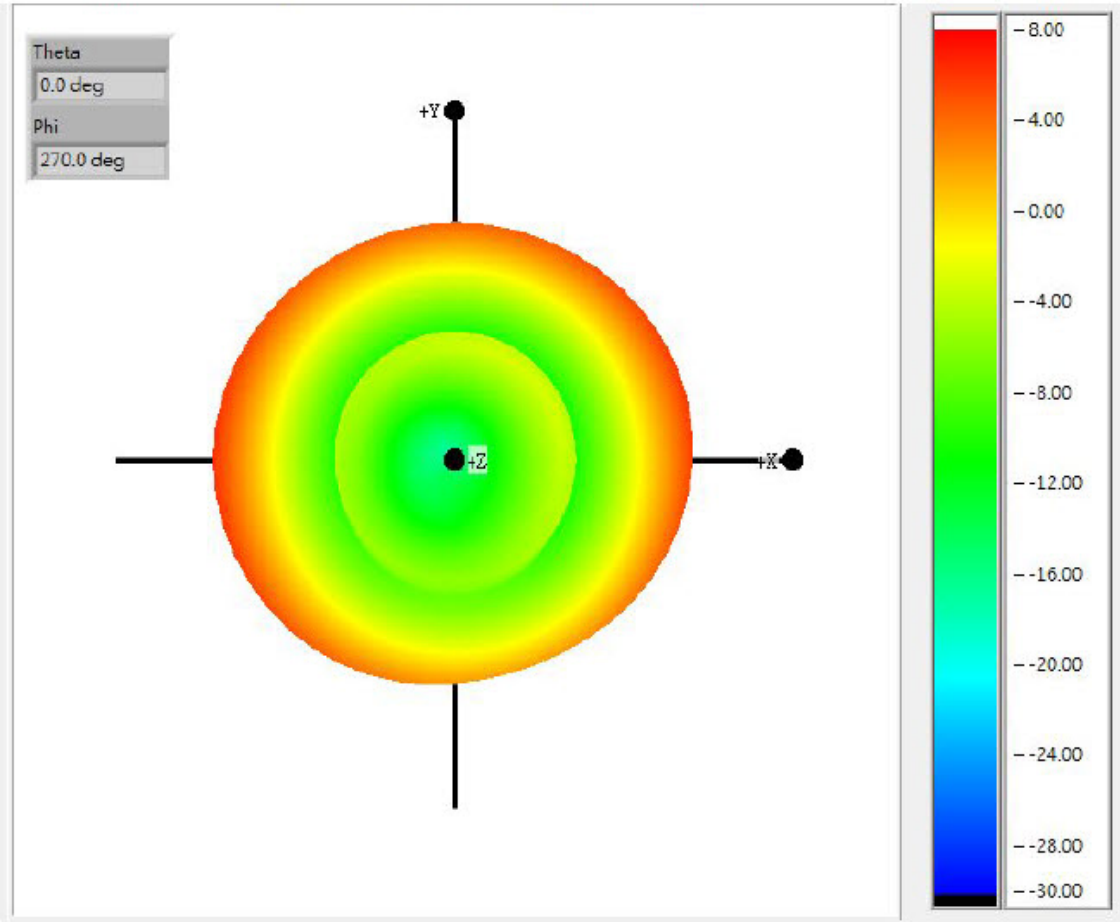


Figure 99: WS-AO-5DIPN3 5150 MHz 3D Radiation Pattern

AP3917e Antenna Patterns

Table 46: Antennas Required for AP3917e

ML-2452-HPAG5A8-01	Dipole Omni, 7.5dBi/8dBi, dual band, outdoor with standard N Plug connector (up to 5 per AP)
ML-2452-HPAG4A6-01	Dipole Omni, 4dBi/7.3dBi, dual band, outdoor with standard N Plug connector (up to 5 per AP)
ML-2452-HPA6X6-036	Dipole Omni Array, 4dBi/6dBi, dual band, outdoor with six feed 36" leads and standard N Plug connectors
30724 WS-AO-DQ04360N	Dipole Omni Array, 4dBi/7.3dBi, dual band, outdoor with quad feed 36" leads and standard N Plug connectors
ML-2499-HPA4-01	Dipole Omni, 4.5dBi, 2.4GHz only, outdoor with standard N Plug connector (up to 5 per AP)
ML-2452-HPA6-01	Dipole Omni, 5.3/4.6/6.1dBi, dual band, outdoor with standard N Plug connector (up to 5 per AP)

Table 46: Antennas Required for AP3917e (continued)

ML-5299-HPA5-01	Dipole Omni, 5.6dBi, 5GHz only, outdoor with standard N Plug connector (up to 5 per AP)
ML-2499-HPA8-01	Dipole Omni, 8dBi, 2.4GHz only, outdoor with standard N Plug connector (up to 5 per AP)
ML-2499-FHPA5-01R	Dipole Omni, 5dBi, 2.4GHz only, outdoor with single feed 48" lead and standard N Plug connector (up to 5 per AP)
ML-5299-FHPA6-01R	Dipole Omni, 8.25dBi, 5GHz only, outdoor with standard N Plug connector (up to 5 per AP)
ML-2452-PNA5-01R	Panel, 120 deg, 5.5dBi/6dBi, dual band, outdoor with single feed 12" lead and standard N Plug connector (up to 5 per AP)
ML-2452-PNA7-01R	Panel, 52 deg, 8dBi/12dBi, dual band, outdoor with single feed 12" lead and standard N Plug connector (up to 5 per AP)
ML-2452-PNL6M4-N36	Polarized Panel, 90 deg, 5.7/6.7/5.5dBi, dual band, outdoor with quad feed 30" leads and standard N Plug connectors
ML-2452-SEC6M4-N36	Polarized Panel, 100 deg, 6.92dBi/7.23dBi, dual band, outdoor with quad feed 32" leads and standard N Plug connectors
ML-2452-SEC6M4-N30	Polarized Panel, 60 deg, 5.5dBi/6dBi, dual band, outdoor with quad feed 30" leads and standard N Plug connectors
ML-2452-PNL9M3-N36	Polarized Panel, 75/55 deg, 11dBi/10.7dBi, dual band, outdoor with triple feed 36" leads and standard N Plug connectors (cannot be used on BLE port)

Radiation Patterns

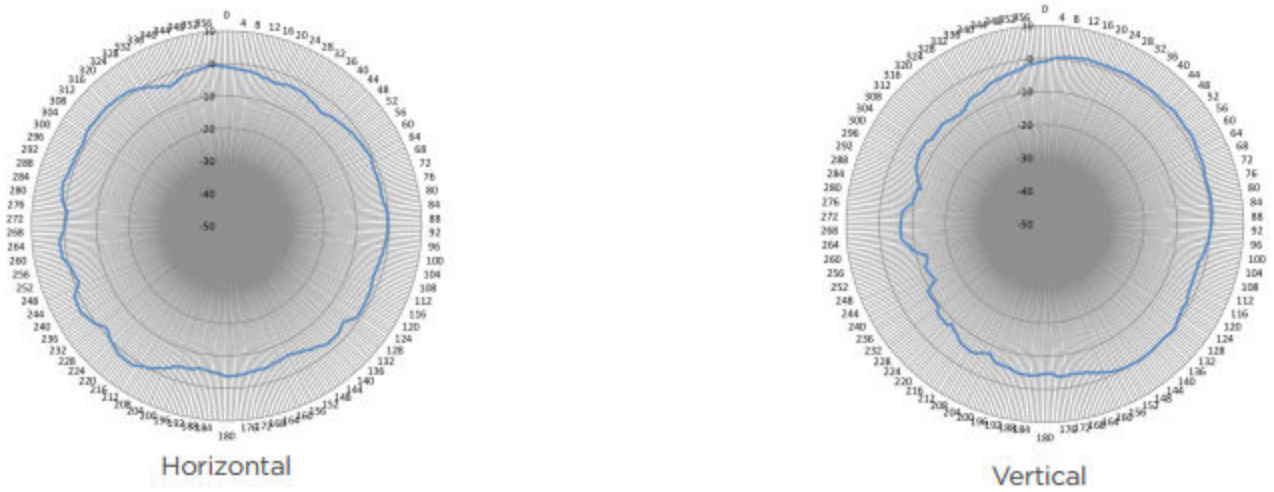


Figure 100: 2.4 GHz Horizontal and Vertical Pattern

Figure 101: 5 GHz Horizontal and Vertical Pattern

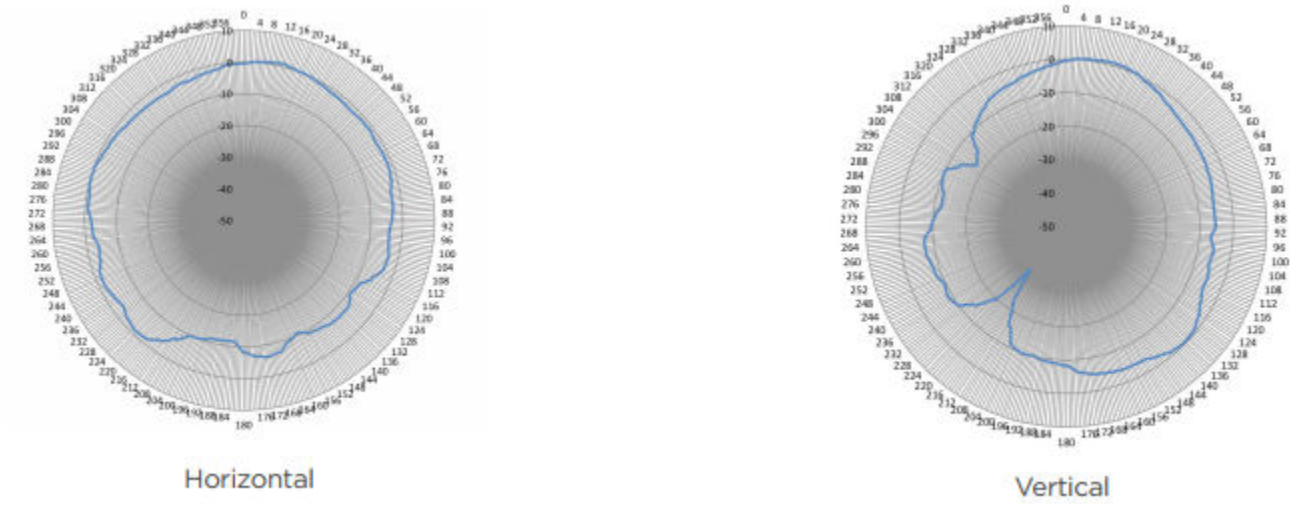


Figure 102: IoT Horizontal and Vertical Pattern

External Antennas for Use with Indoor APs

The following antennas are intended for use with indoor APs only:

Table 47: Indoor Antennas

Antenna Part Number	Supported APs
30702 (WS-AI-DQ05120)	AP3935e
30703 (WS-AI-5Q04060)	AP3935e
30704 (WS-AI-2Q05060)	AP3935e
30705 (WS-AI-DE07025)	AP3935e
30706 (WS-AI-5Q05025)	AP3935e
30707 (WS-AI-DE10055)	AP3935e
30709 (WS-ANT-2DIP-4)	AP3935e
30710 (WS-ANT-5DIP-4)	AP3935e
WS-AI-DD05120	AP3805e
WS-AI-DQ04360	AP3935e, AP3805e
WS-AI-DT05120	AP3710e, AP3825e
WS-AI-DT04360	AP3710e, AP3805e
WS-AI-DS06360	AP2620
WS-AI-2S03360	AP2620
WS-AI-DX02360	AP3825e, AP3710e
WS-AI-DX07025	AP3825e
WS-AI-DX10055	AP3825e, AP3710e, AP3715e

Table 47: Indoor Antennas (continued)

Antenna Part Number	Supported APs
WS-ANT01	AP2620
WS-ANT02	AP3620, AP3640
WS-ANT-2DIP-2	AP3805e
WS-ANT-5DIP-2	AP3805e
WS-ANT-2DIP3	AP3825e, AP3715e
WS-ANT-5DIP3	AP3825e, AP3715e

30702 (WS-AI-DQ05120)

This dual-band, 4-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 randome. The randome is constructed from lightweight, durable UV stable plastic. The four elements can also be used individually or in combination for use with legacy 802.11 access points.

Figure 103: Indoor Antenna 30702 (WS-AI-DQ05120) With Mounting Bracket

Specifications

Table 48: 30702 (WS-AI-DQ05120) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	5-5.5 dBi	4.5-5.5 dBi
Vertical Beamwidth	90°	65°
Horizontal Beamwidth	100°	80°
VSWR	1.5-2.0	
Operating Temperature Range	-40°C to +70°C	
Polarization	Dual-slant linear +-45	
Weight	.45 kg	
Mounting Style	Wall or pipe mount	
Power	20 watts	
Dimensions	200 x 200 x 34 mm	
Nominal Impedance	50 ohms	

Radiation Patterns

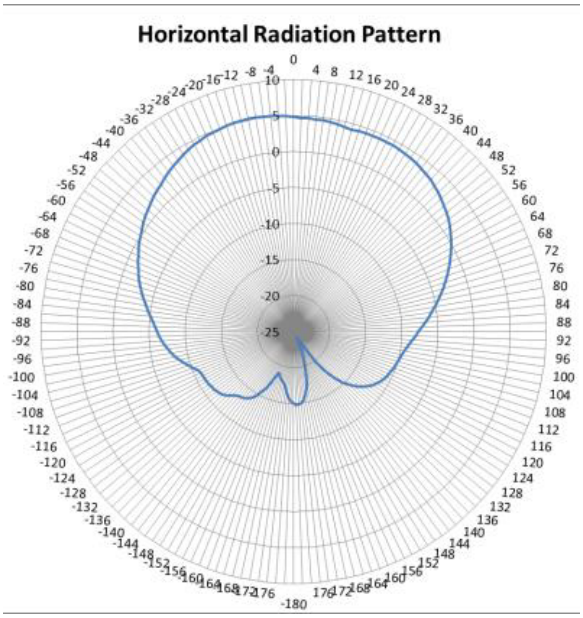


Figure 104: 2.4 GHz Horizontal Pattern

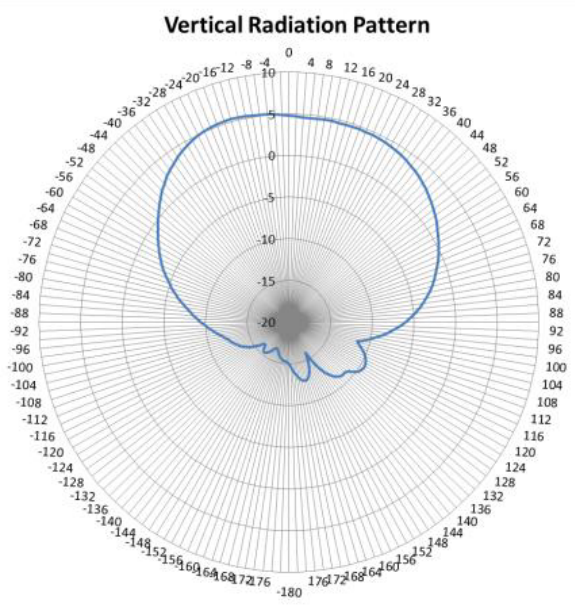


Figure 105: 2.4 GHz Vertical Pattern

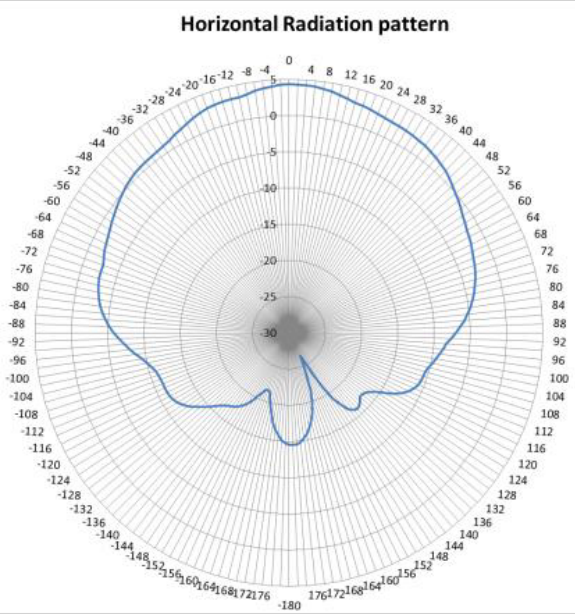


Figure 106: 5GHz Horizontal Pattern

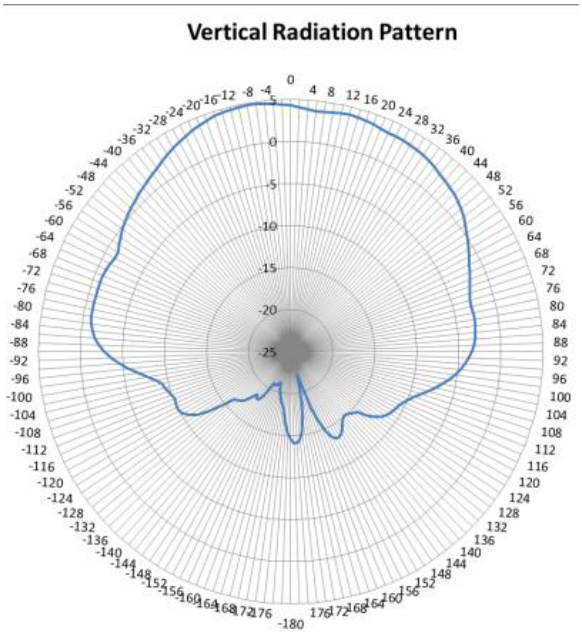


Figure 107: 5GHz Vertical Pattern

30703 (WS-AI-5Q04060)

This 4-port sector antenna can be used for 802.11ac MIMO applications. The randome 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 108: Indoor Antenna 30703 (WS-AI-5Q04060) With Bracket

Specifications

Table 49: 30703 (WS-AI-5Q04060) Specifications

Specification	Value
Frequency	5.15-5.85 GHz
Gain	3-4 dBi
Vertical Beamwidth	33°
Horizontal Beamwidth	50°
VSWR	1.5-2.0
Operating Temperature Range	-40°C to +70°C
Polarization	Dual-slant linear +-45°
Weight	.45kg
Mounting Style	Wall or pipe mount
Power	20 watts
Dimensions	200 mm x 200 x 34mm
Nominal Impedance	50 ohms

Radiation Patterns

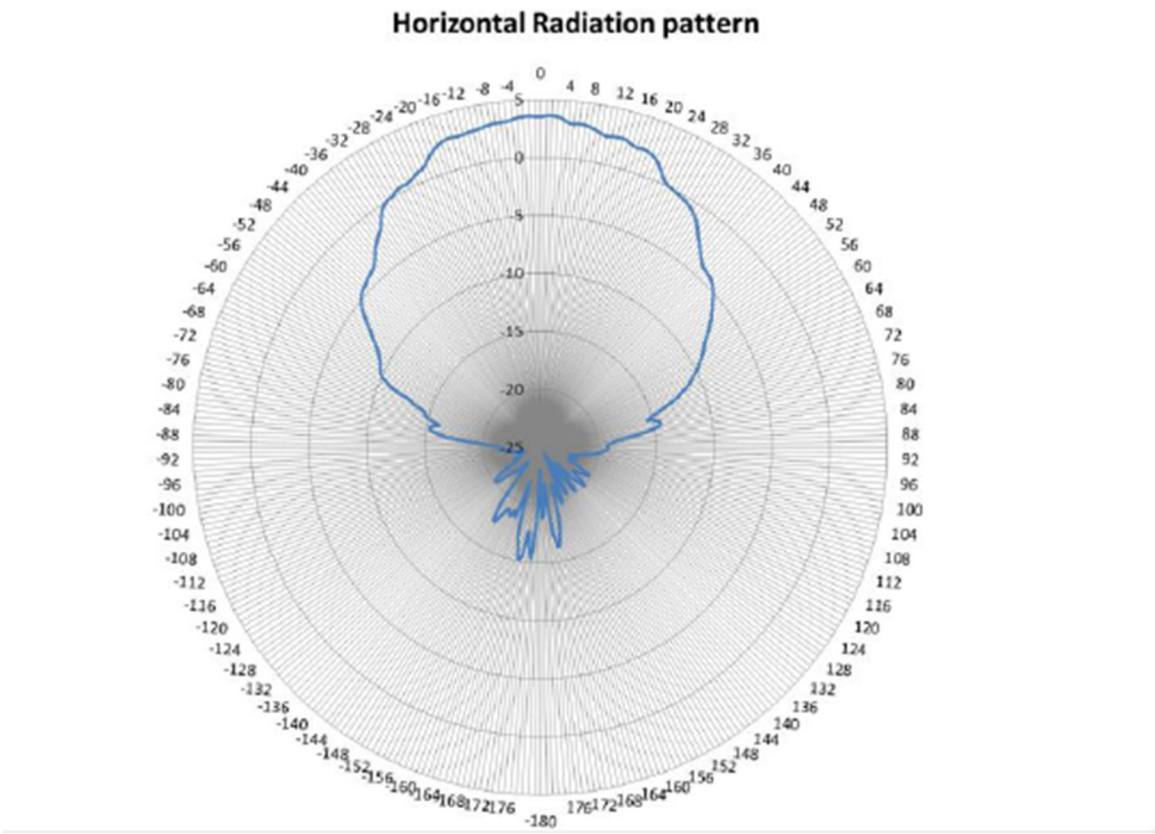


Figure 109: 30703 5GHz Horizontal Pattern

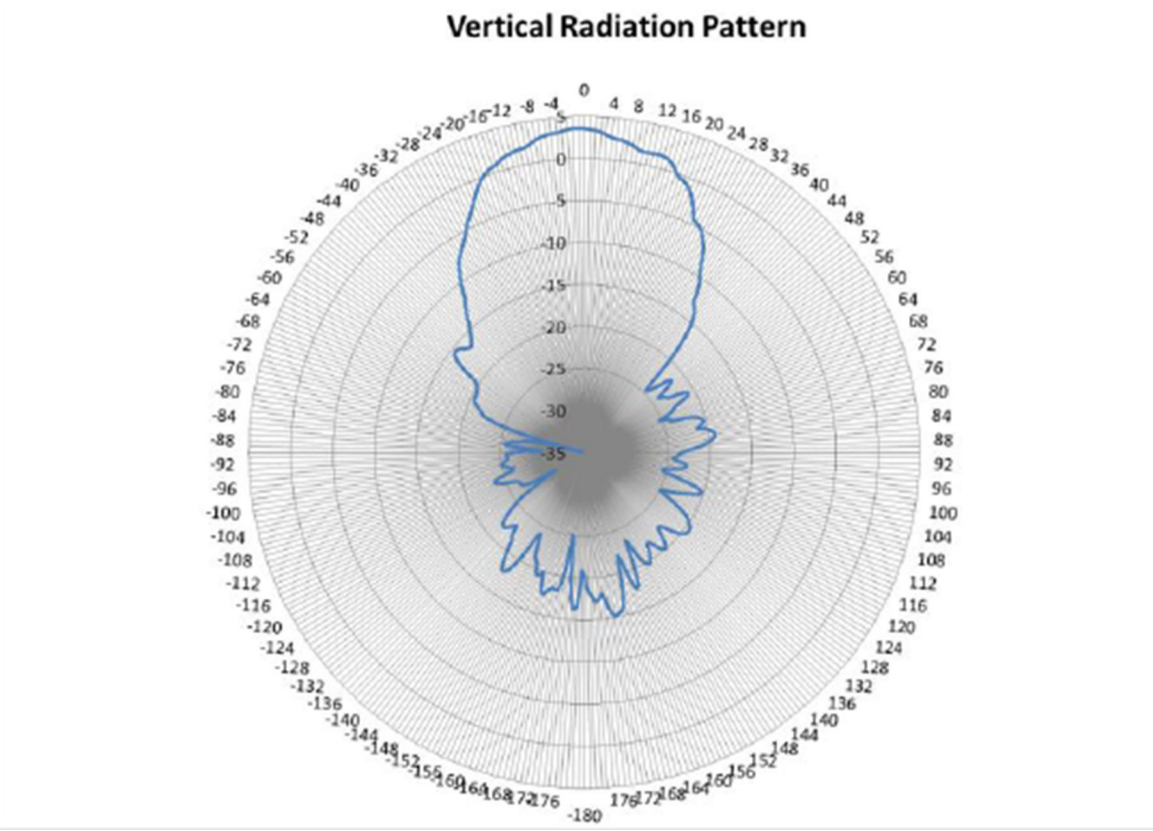


Figure 110: 30703 5GHz Vertical Pattern

30704 (WS-AI-2Q05060)

This 4-port sector antenna can be used for 802.11ac MIMO applications. The randome 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 111: Indoor Antenna 30704 (WS-AI-2Q05060)

Specifications

Table 50: 30704 (WS-AI-2Q05060) Specifications

Specification	Value
Frequency	2.4-2.5 GHz
Gain	4-5 dBi
VSWR	2.0 Max (1.5 Typ)
Vertical Beamwidth	34°
Horizontal Beamwidth	73°
Operating Temperature Range	-40°C to +70°C
Polarization	Dual-slant, linear +-45°
Weight	0.45 kg
Mounting Style	Wall or pipe mount
Power	20 watts
Dimensions	7.9 in x 7.9 in x 1.25 in (200 mm x 200 mm x 34 mm)
Nominal Impedance	50 ohms

Radiation Patterns

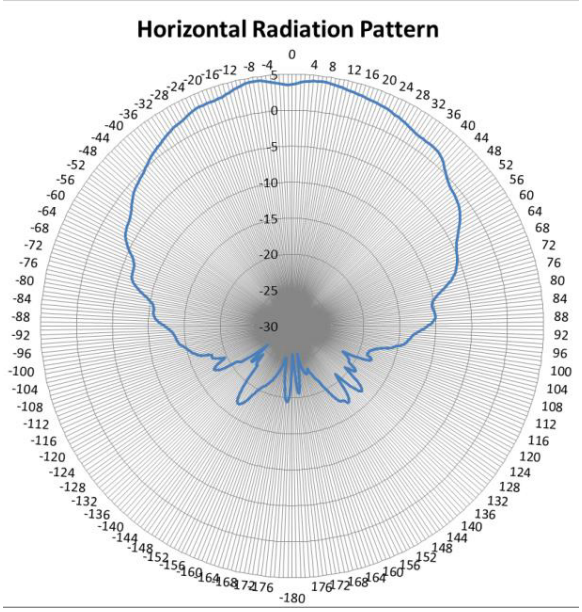


Figure 112: 2.4 GHz Horizontal Pattern

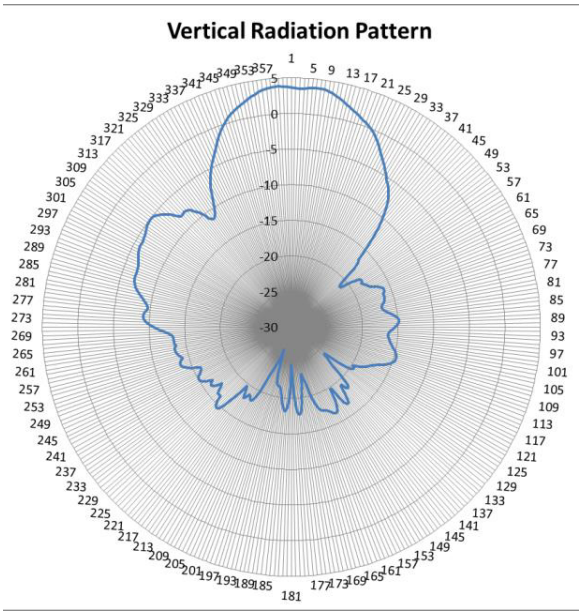


Figure 113: 2.4 GHz Vertical Pattern

30705 (WS-AI-DE07025)

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 eight ports can be used individually or in combination for use with legacy 802.11 access points.

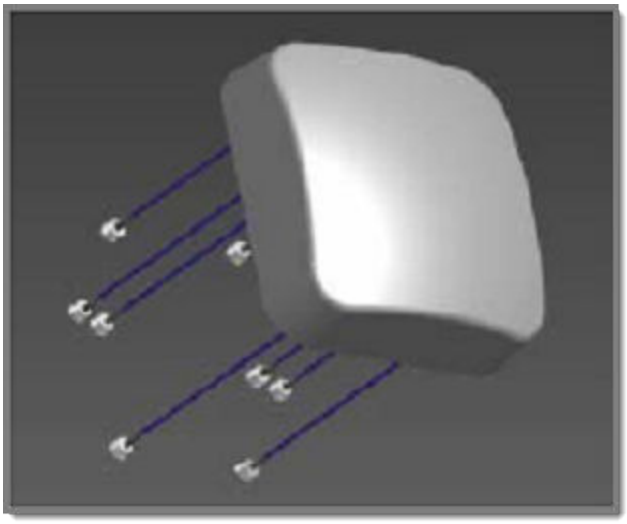


Figure 114: Indoor Antenna 30705 (WS-AI-DE07025)

Specifications

Table 51: 30705 (WS-AI-DE07025) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	6.5-7.5 dBi	5.5-6.5 dBi
Vertical Beamwidth	43°	37°
Horizontal Beamwidth	31°	29°
VSWR	< 2.25:1	
Operating Temperature Range	-30°C to +80°C	
Polarization	Dual linear	
Weight	2.27kg	
Mounting Style	Wall or pipe mount	
Power	25 watts	
Dimensions	305 mm x 305 x 110.5mm	
Nominal Impedance	50 ohms	

Radiation Patterns

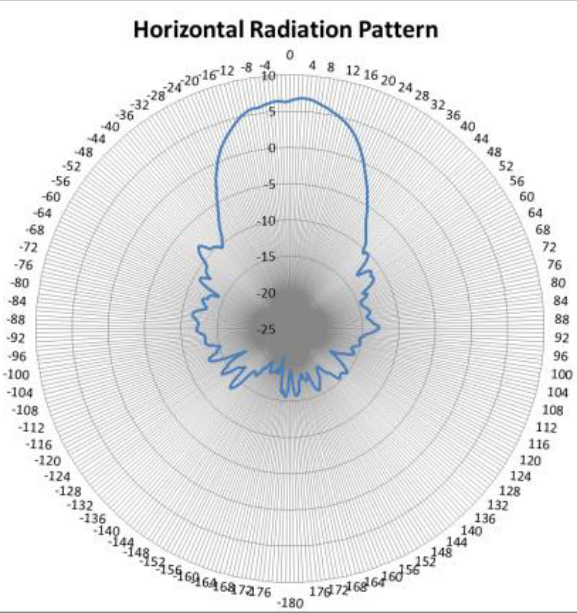


Figure 115: 2.4GHz Horizontal Pattern

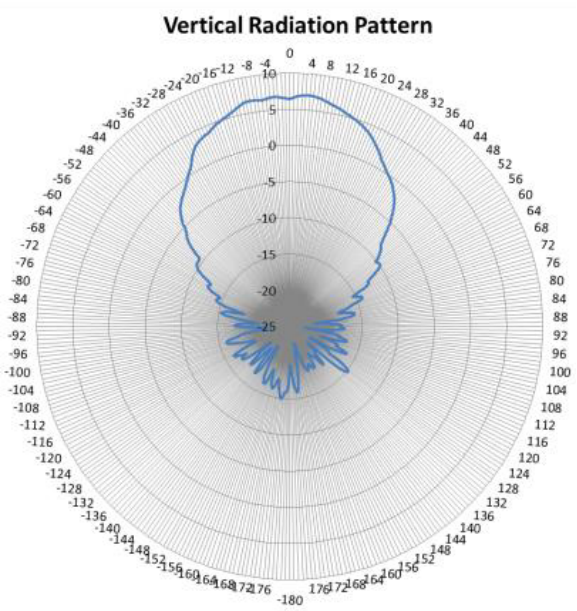


Figure 116: 2.4GHz Vertical Pattern

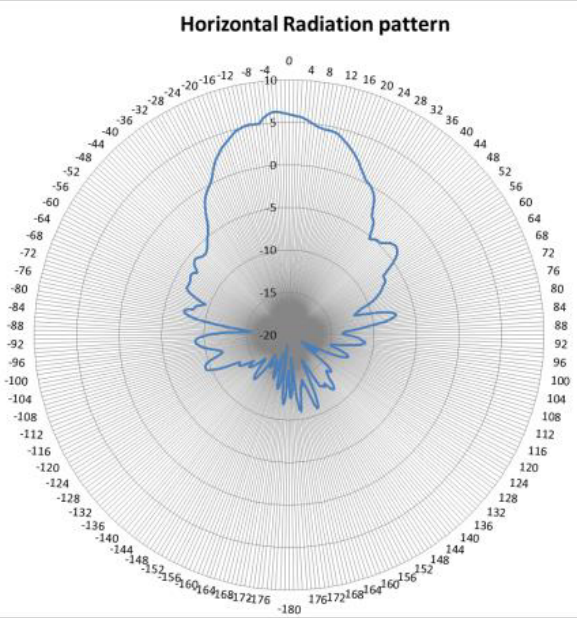


Figure 117: 5GHz Horizontal Pattern

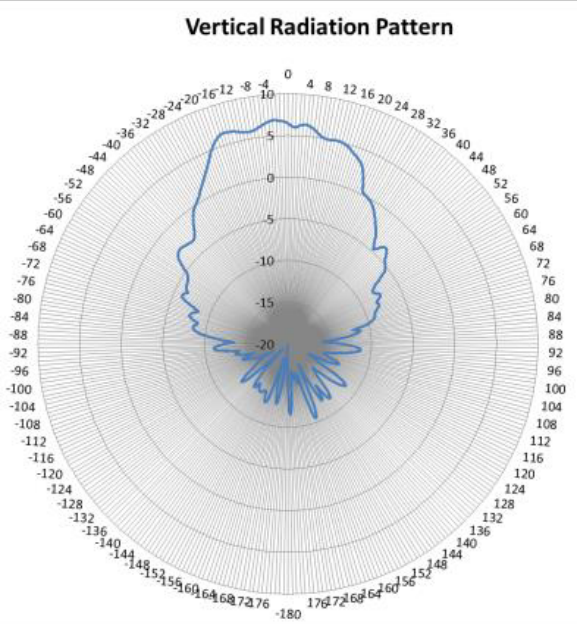


Figure 118: 5GHz Vertical Pattern

30706 (WS-AI-5Q05025)

The four port sector antennas 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.

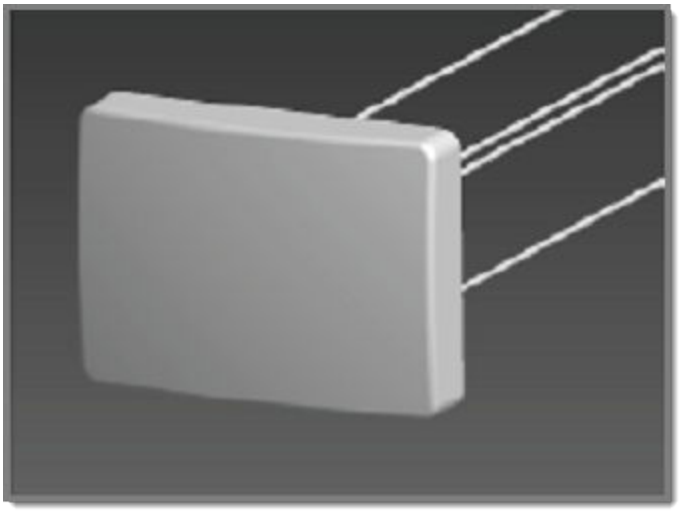


Figure 119: Indoor Antenna 30706 (WS-AI-5Q05025)

Specifications

Table 52: 30706 (WS-AI-5Q05025) Specifications

Specification	Value
Frequency	5.1-5.9 GHz
Gain	3.5 - 4.5 dBi
Vertical Beamwidth	40°
Horizontal Beamwidth	30°
VSWR	< 2.0:1
Operating Temperature Range	-30°C to +80°C
Polarization	Dual linear
Weight	1.36 kg
Mounting Style	Wall or pipe mount
Power	25 watts
Dimensions	18.1 x 24.9 x 12.9 cm
Nominal Impedance	50 ohms

Radiation Patterns

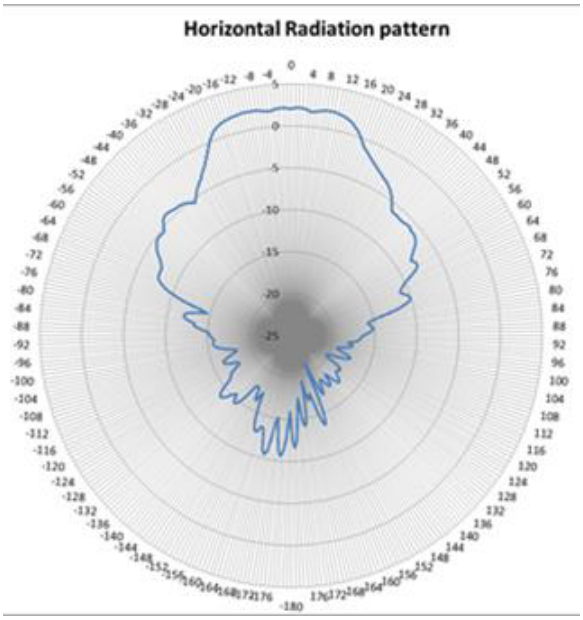


Figure 120: 5 GHz Horizontal Pattern

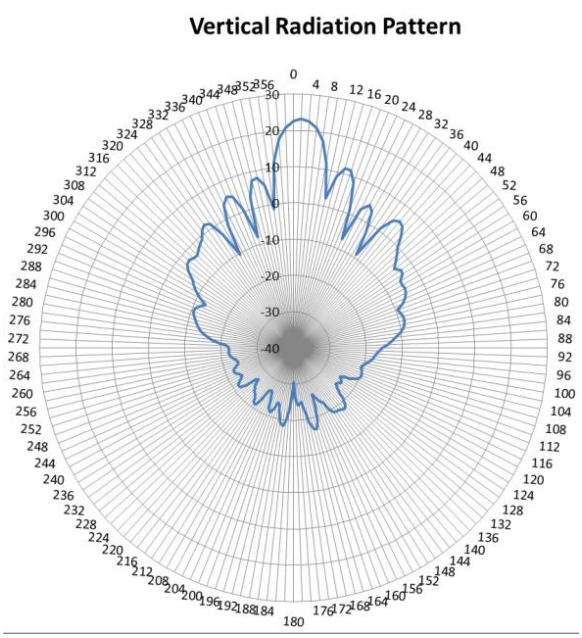


Figure 121: 5GHz Vertical Pattern

30707 (WS-AI-DE10055)

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 randome. The randome is constructed from lightweight, durable, UV stable plastic. The elements can be used individually or in combination for use with legacy 802.11 access points.

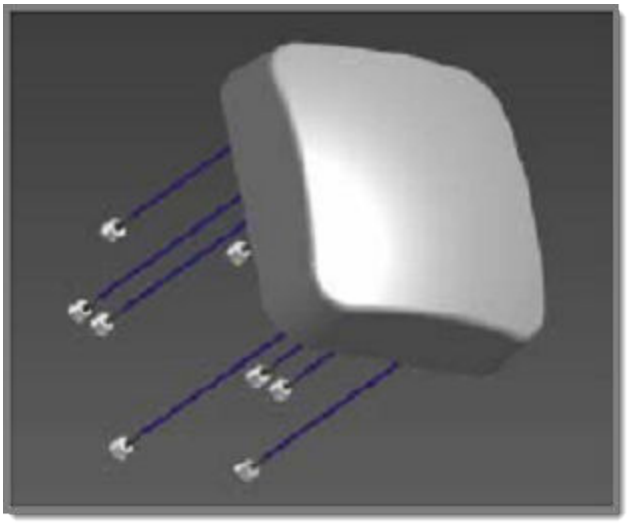


Figure 122: Indoor Antenna 30707 (WS-AI-DE10055)

Specifications

Table 53: 30707 (WS-AI-DE10055) Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	5.1-5.9 GHz
Gain	10-10.5 dBi	6-7.5 dBi
Vertical Beamwidth	44°	43°
Horizontal Beamwidth	51°	53°
VSWR	< 2.25:1	
Operating Temperature Range	-30°C to +80°C	
Polarization	Dual linear	
Weight	2.3kg	
Mounting Style	Wall or pipe mount	
Power	25 watts	
Dimensions	305 mm x 305 x 110.5mm	
Nominal Impedance	50 ohms	

Radiation Patterns

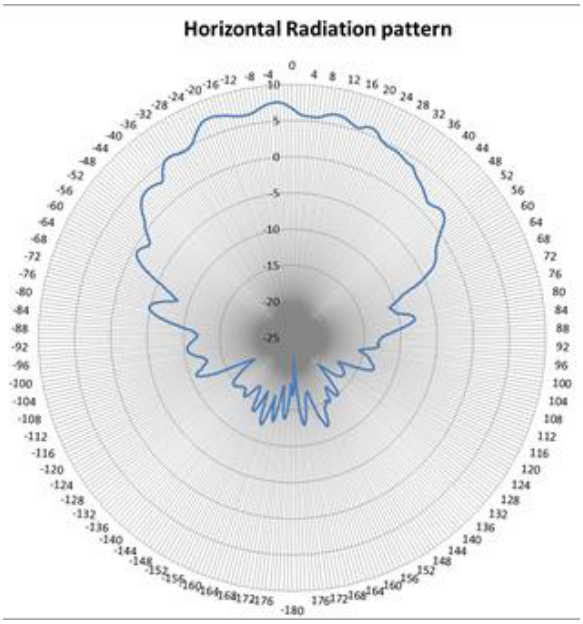


Figure 123: 2.4 GHz Horizontal Pattern

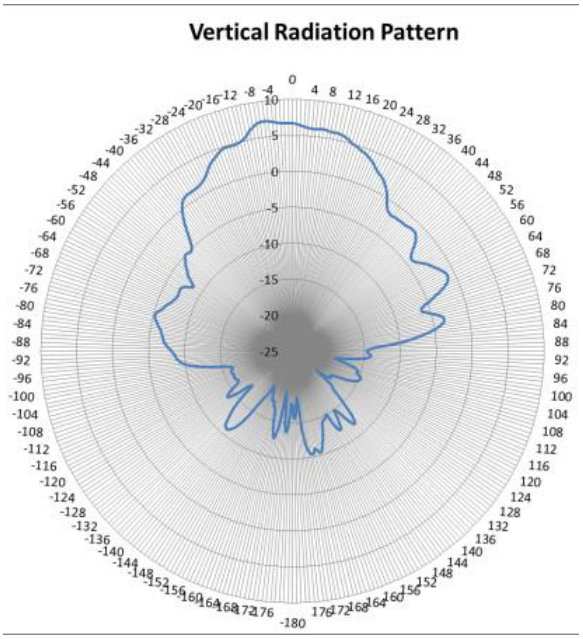


Figure 124: 2.4 GHz Vertical Pattern

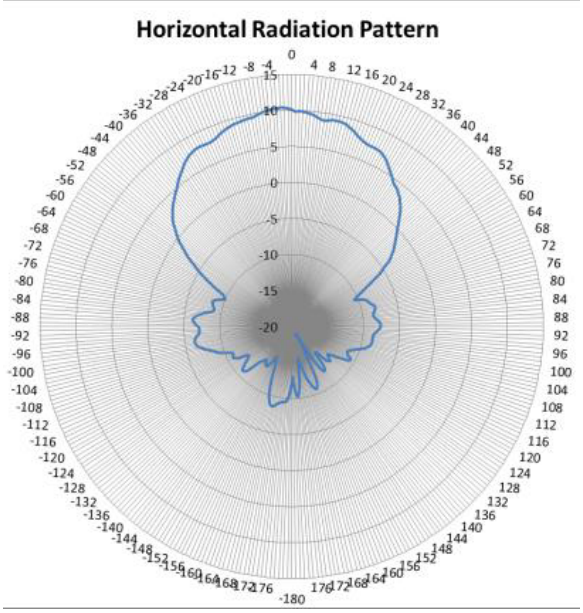


Figure 125: 5GHz Horizontal Pattern

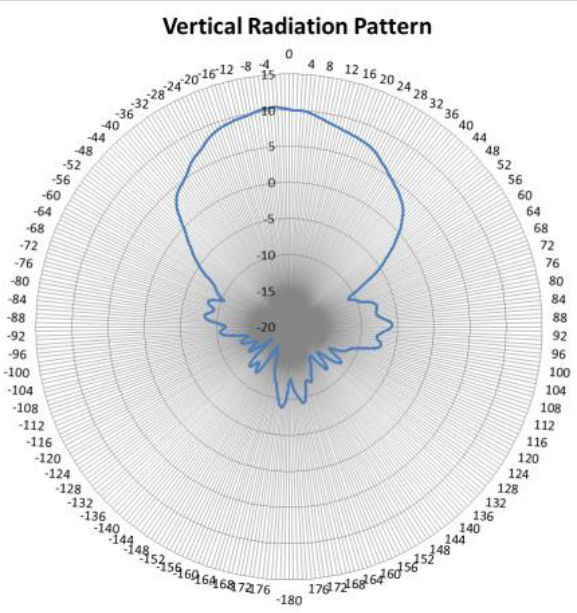


Figure 126: 5GHz Vertical Pattern

30709 (WS-ANT-2DIP-4)

This 2.4 GHz Dipole antenna is provided in a 4-pack of antennas supporting the AP3935 indoor access point. For more information, see WS-ANT-2DIP-2 on page 153.

30710 (WS-ANT-5DIP-4)

This 5 GHz Dipole antenna is provided in a 4-pack of antennas supporting the AP3935 indoor access point. For more information, see WS-ANT-5DIP-2 on page 157.

WS-AI-DD05120

This dual-band, two-element sector antenna can be used for 802.11n MIMO applications. The antenna covers both 2.4-2.5 GHz and 4.9-5.875 GHz in one radome. This antenna can be used with a single access point to provide full dual-band 802.11a/b/g/n MIMO coverage. The two elements can also be used individually or in combination to provide diversity and non-diversity coverage with legacy 802.11a/b/g access points.

Figure 127: Indoor Antenna WS-AI-DD05120

Specifications

Table 54: WS-AI-DD05120 Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.3-2.7 GHz	4.9-6.1 GHz
Gain	6 dBi	5 dBi
Vertical Beamwidth	60°	75°
Horizontal Beamwidth	90°	110°
VSWR	1.5-1.8	
Operating Temperature Range	-40°C to +70°C	
Polarization	+-45° slant linear	
Weight	0.45kg	

Table 54: WS-AI-DD05120 Specifications (continued)

	Value	
Specification	2.4 GHz	5GHz
Mounting Style	Wall mount	
Power	20 watts	
Dimensions	200 mm x 200 x 32mm	
Nominal Impedance	50 ohms	

Radiation Patterns

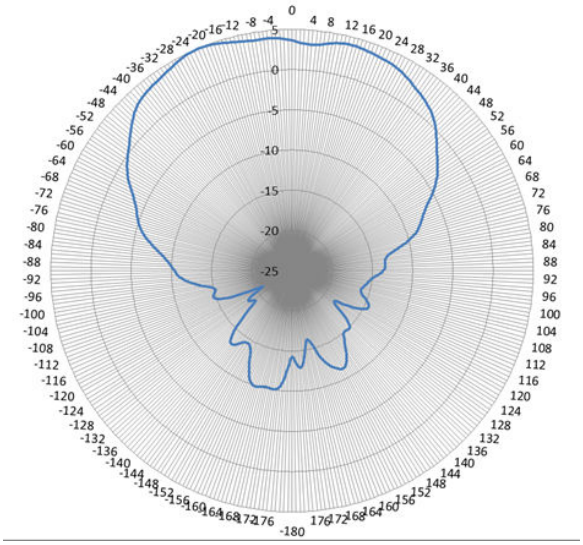


Figure 128: WS-AI-DD05120 2.4 GHz E-Plane

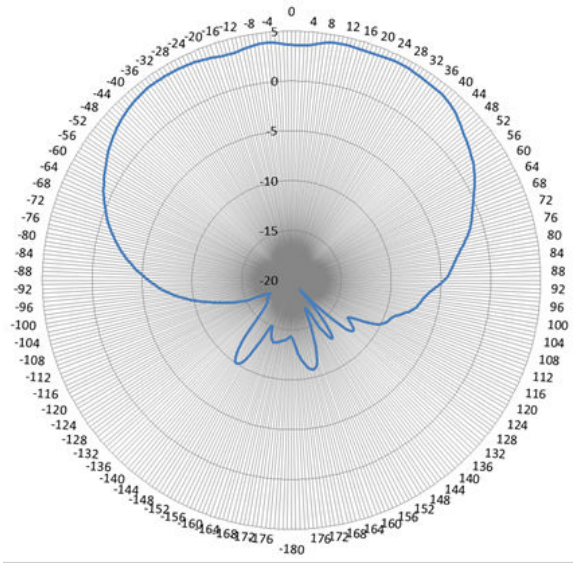


Figure 129: WS-AI-DD05120 2.4 GHz H-Plane

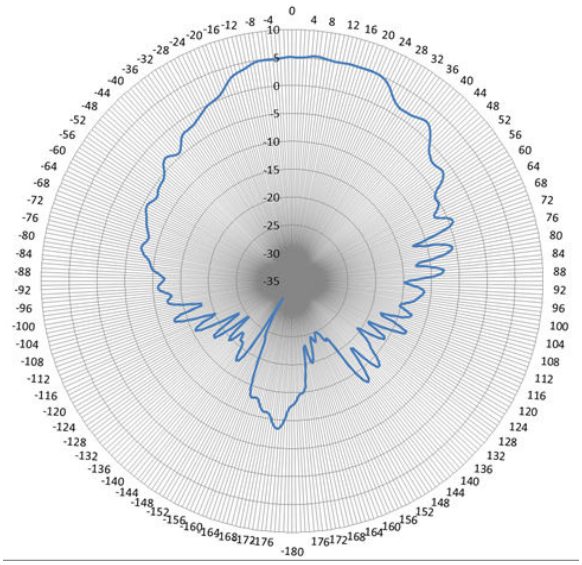


Figure 130: WS-AI-DD05120 5GHz E-Plane

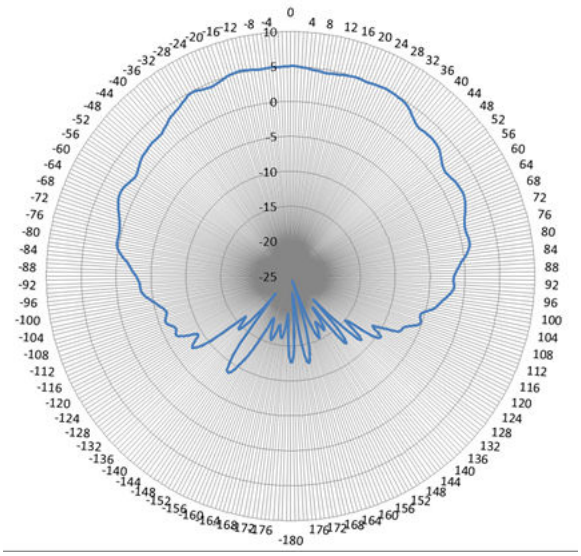


Figure 131: WS-AI-DD05120 5 GHz H-Plane

WS-AI-DQ04360

This dual-band 802.11n MIMO antenna provides 4-port diversity coverage of 2.4-2.5 GHz Wifi and 4.9-5.9 GHz broadband wireless frequencies. It is designed for indoor installations.

Figure 132: Indoor Antenna WS-AI-DQ04360

Specifications

Table 55: WS-AI-DQ04360 Specifications

	Value	
Specification	2.4 GHz	5GHz
Frequency	2.4-2.5 GHz	4.9-5.9 GHz
Gain	4 dBi	7 dBi
Vertical Beamwidth	45°	30°
Horizontal Beamwidth	60°	50°
VSWR	< 2.0:1	
Operating Temperature Range	-40°C to +80°C	
Polarization	Linear, vertical	
Weight		
Mounting Style	Wall or pole mount	
Power	5 watts	
Dimensions	17.96 x 12.88 x 3.30 cm	
Nominal Impedance	50 ohms	

Radiation Patterns

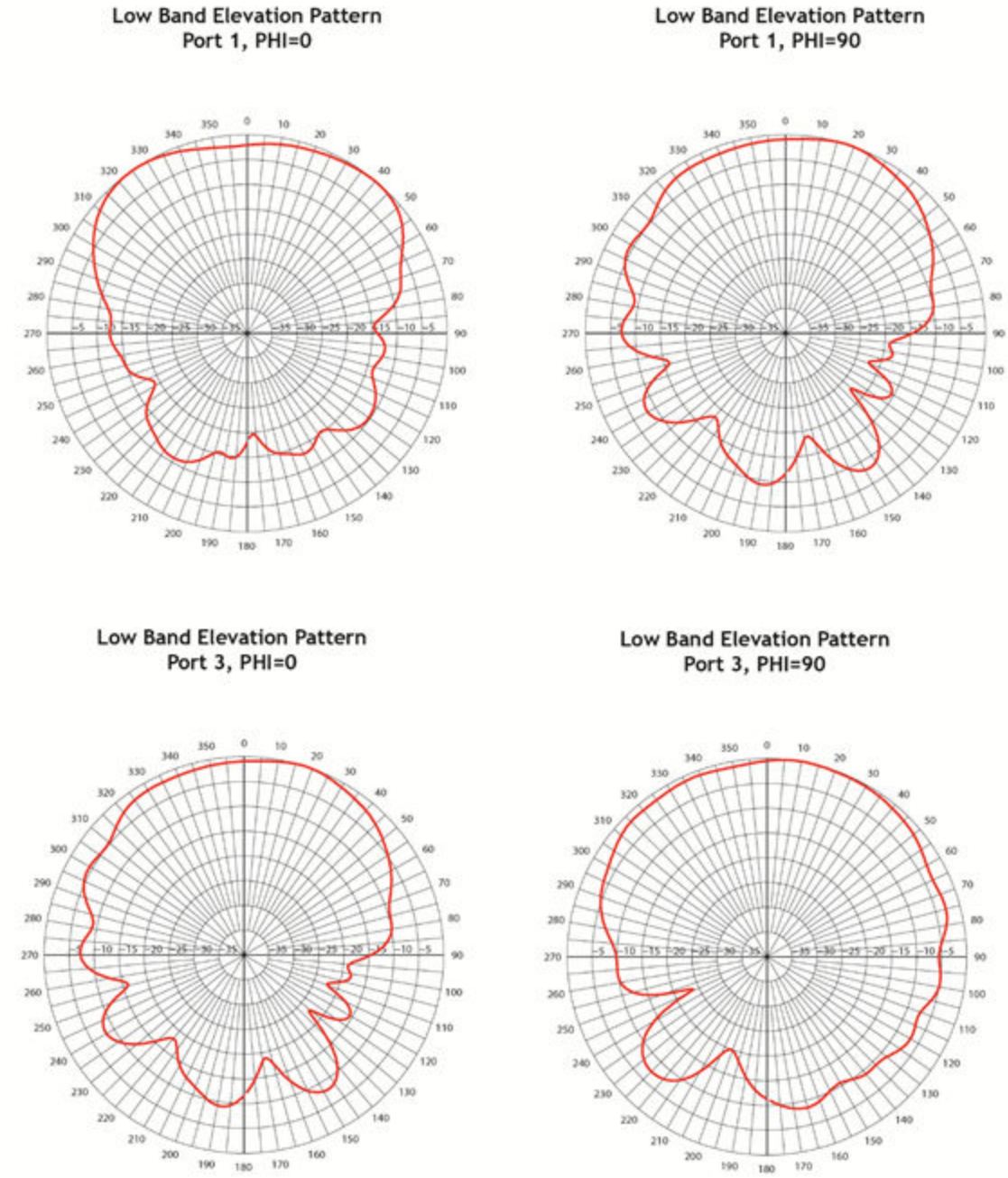


Figure 133: WS-AI-DQ04360 2.4GHz

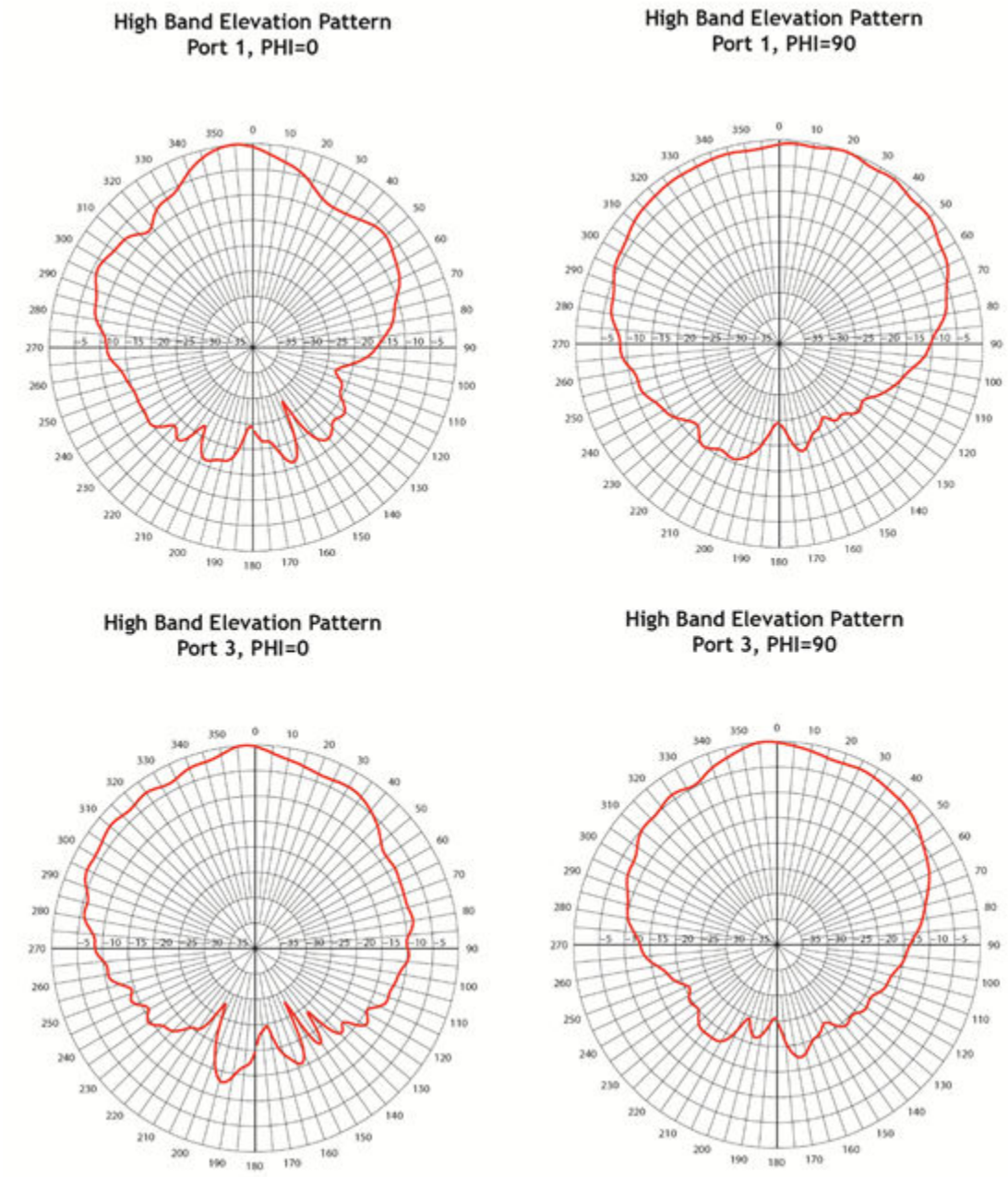


Figure 134: WS-AI-DQ04360 5GHz

WS-AI-DT05120

This dual-band 3-element sector antenna can be used for 802.11n MIMO applications. The antenna covers both 2.4-2.5 GHz and 4.9-5.9 GHz in one randome. This antenna can be used with a single access point to provide full dual-band 802.11a/g/b/n MIMO coverage. The three elements can be used individually or in combination to provide diversity/non-diversity coverage with legacy 802.11a/g/b/n access points. For more information, see #unique_112.

Figure 135: Indoor Antenna WS-AI-DT05120

Specifications

Table 56: WS-AI-DT05120 Specifications

Specification	Value
Antenna Type	MIMO; Sector; Dual-band
Frequency	2.3–2.7 GHz and 4.9–6.1 GHz
Gain	5 dBi x 3 Typical
VSWR	2:1 (typ. 1.5:1)
Polarization	Vertical and Dual Slant
H-Plane Beamwidth	120°
E-Plane Beamwidth	70°
Operating Temperature	-40°C to +70°C (-40°F to +158°F)
Weight	0.6 lb (0.26 kg)
Dimensions	7.9 in x 7.9 in x 1.25 in (200 mm x 200 mm x 33 mm)
Mounting Style	Wall mount
Power	20 watts
Nominal Impedance	50 ohms
Service Life	10 years

Radiation Patterns

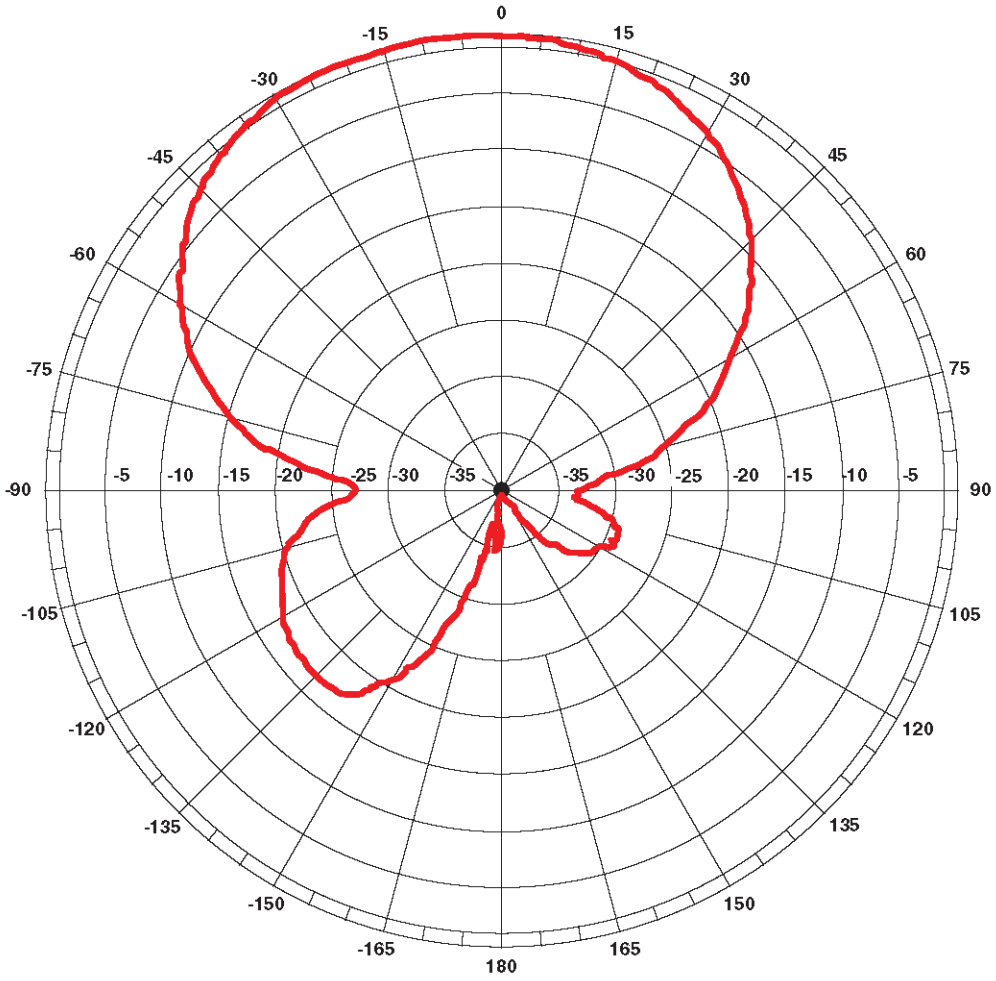


Figure 136: WS-AI-DT05120 2.5 GHz E-Plane Radiation Pattern

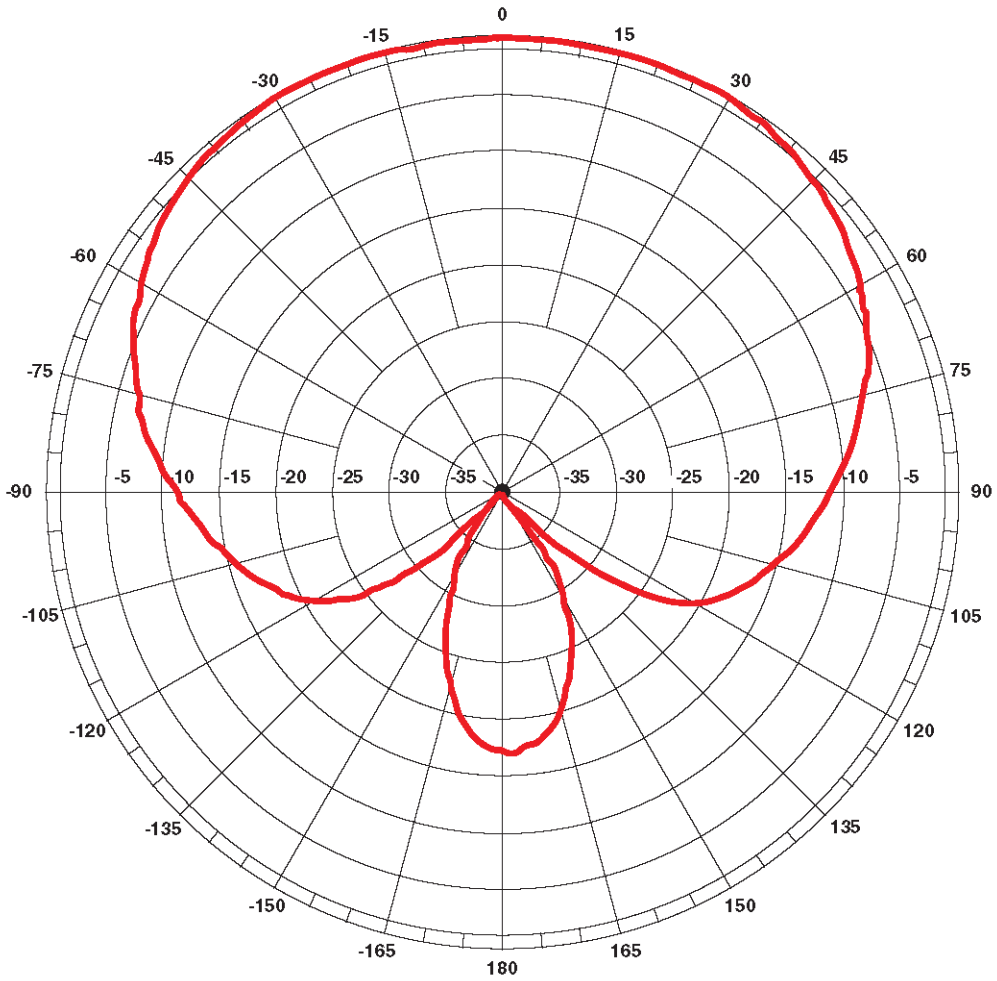


Figure 137: WS-AI-DT05120 2.5 GHz H-Plan Radiation Pattern

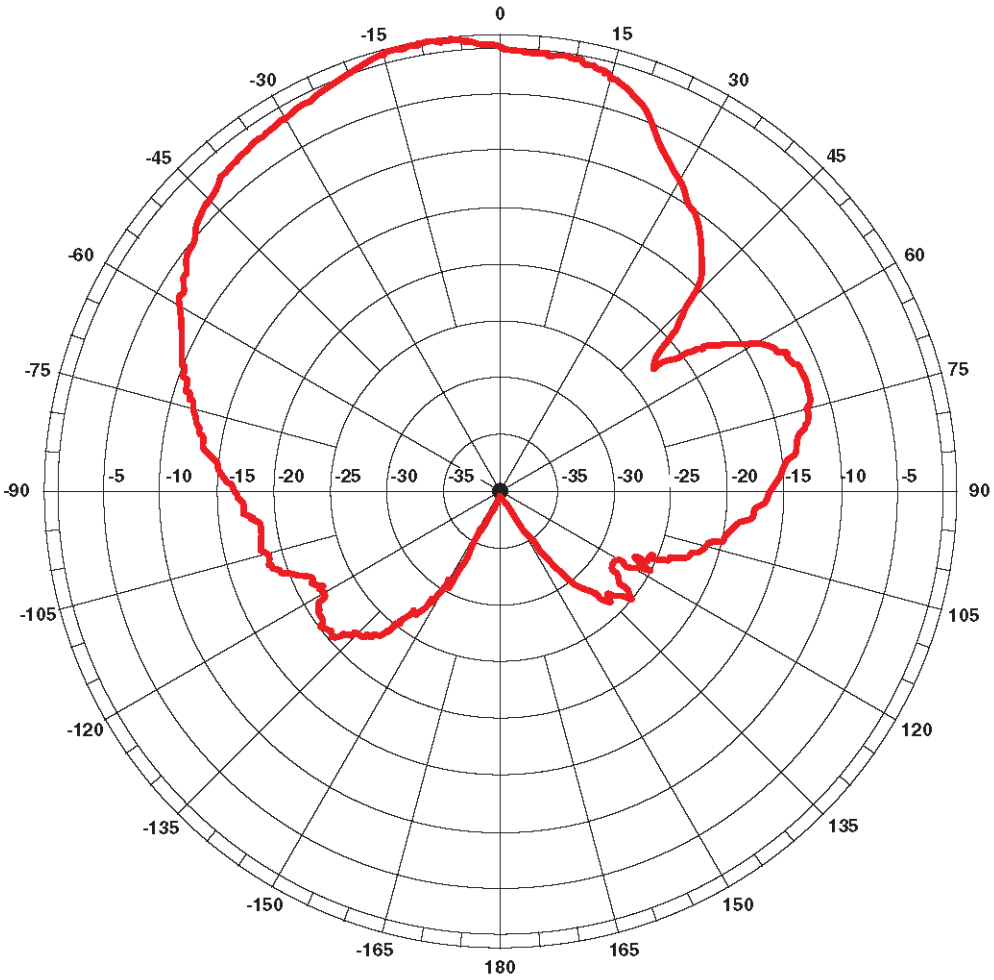


Figure 138: WS-AI-DT05120 5.5 GHz E-Plane Radiation Pattern

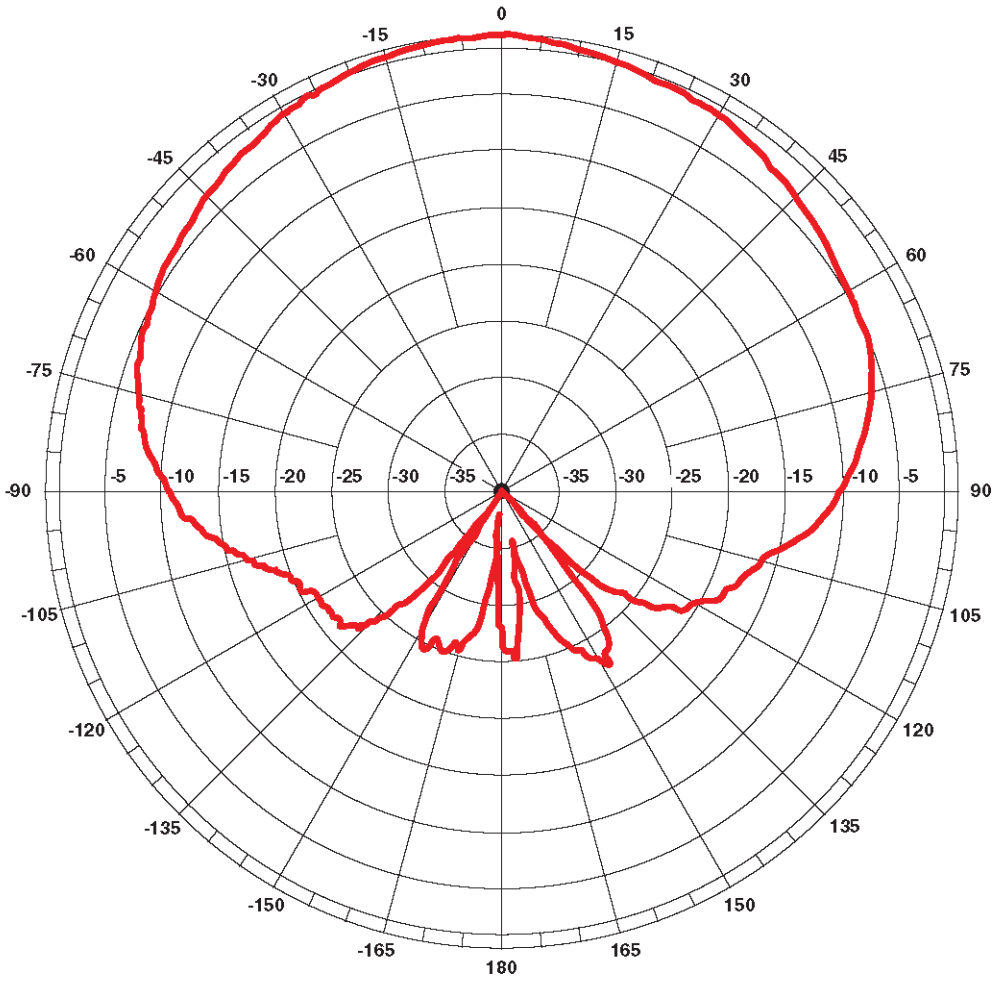


Figure 139: WS-AI-DT05120 5.5 GHz H-Plane Radiation Pattern

WS-AI-DT04360

This is a ceiling mounted 2.4 and 5 GHz omnidirectional antenna. It has three connectors and is especially designed for MIMO APs. For more information, see #unique_111.

Specifications

Table 57: WS-AI-DT04360 Specifications

Specification	Value
Antenna Type	MIMO; Panel
Frequency	2.4–2.5 GHz and 4.9–5.9 GHz
Gain	
2.4 GHz	3.0 dBi
5 GHz	4.0 dBi

Table 57: WS-AI-DT04360 Specifications (continued)

Specification	Value
VSWR	2.0:1
Polarization	Linear
Elevation Beamwidth	60°
Azimuth Beamwidth	Omnidirectional
Mounting Style	Ceiling grid/Suspension tile
Power	2 watts
Dimensions	12.1 in x 8.6 in x 3.6 in (308 mm x 22 m x 92 mm)

Radiation Patterns

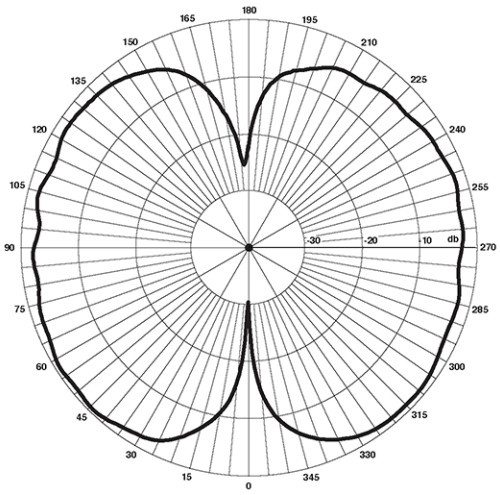


Figure 140: WS-AI-DT04360 2.5 GHz E-Plane Radiation Pattern

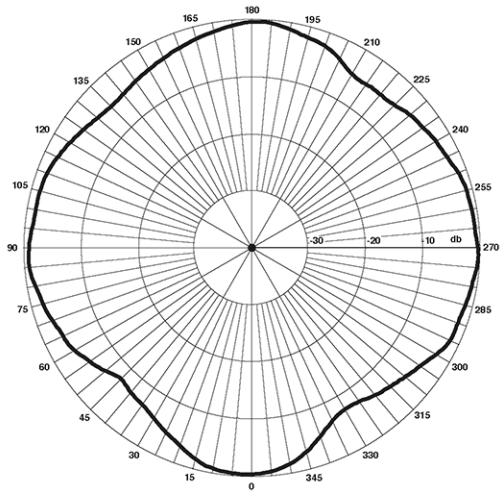


Figure 141: WS-AI-DT04360 2.5 GHz H-Plane Radiation Pattern

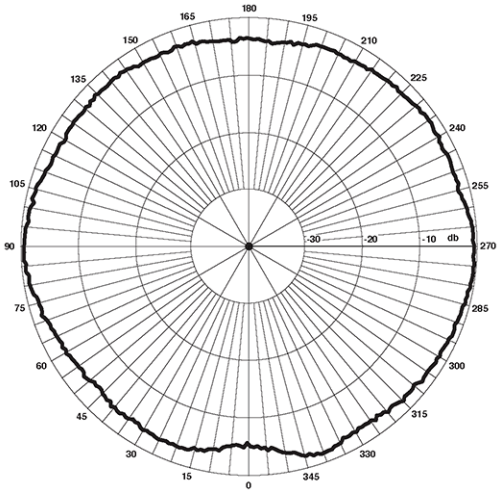


Figure 142: WS-AI-DT04360 5.47 GHz E-Plane Radiation Pattern

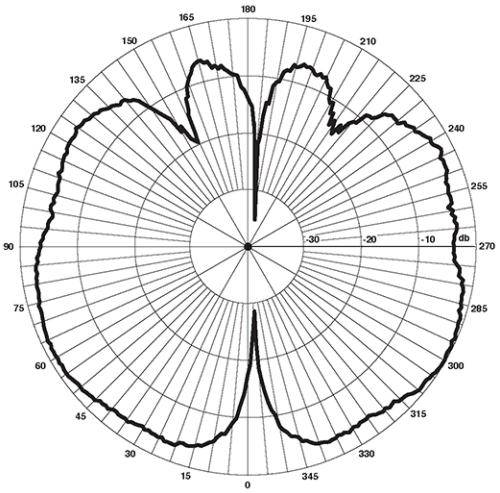


Figure 143: WS-AI-DT04360 5.47 GHz H-Plane Radiation Pattern

WS-AI-DX02360

This is a dual-band six port omni-directional MIMO antenna. Three ports are designed to operate at 2.4 GHz and three ports are designed to operate at 5 GHz. Each of the MIMO antenna R-SMA ports can be connected to an access point by means of a coax pigtail. For more information, see Mounting Antenna Model WS-AI-DX02360 on page 46.

Specifications

Table 58: WS-AI-DX02360 Specifications

Specification	Value
Antenna Type	MIMO; Dual-band
Frequency	2.4–2.5 GHz and 5.15–5.85 GHz

Table 58: WS-AI-DX02360 Specifications (continued)

Specification	Value
Gain @ 45° from horizon	2 dBi
VSWR	2:1
Polarization	Linear, 6 Vertical
H-Plane (3dB Beamwidth)	Omnidirectional
E-Plane (3dB Beamwidth)	75° @ 2.4–2.5 GHz/42° @ 5.15–5.85 GHz
Operating Temperature	-xx°C to +xx°C (-xx°F to +xxx°F)
Weight	1.5 lb (0.7 kg)
Dimensions	8.6 in x 1.7in (219 mm x 44 mm)
Mounting Style	Ceiling suspended tile
Power	5 watts

Radiation Patterns

In the following figures, the E0-plane pattern is blue, the E90-plane pattern is red, and the H-plane pattern is green.

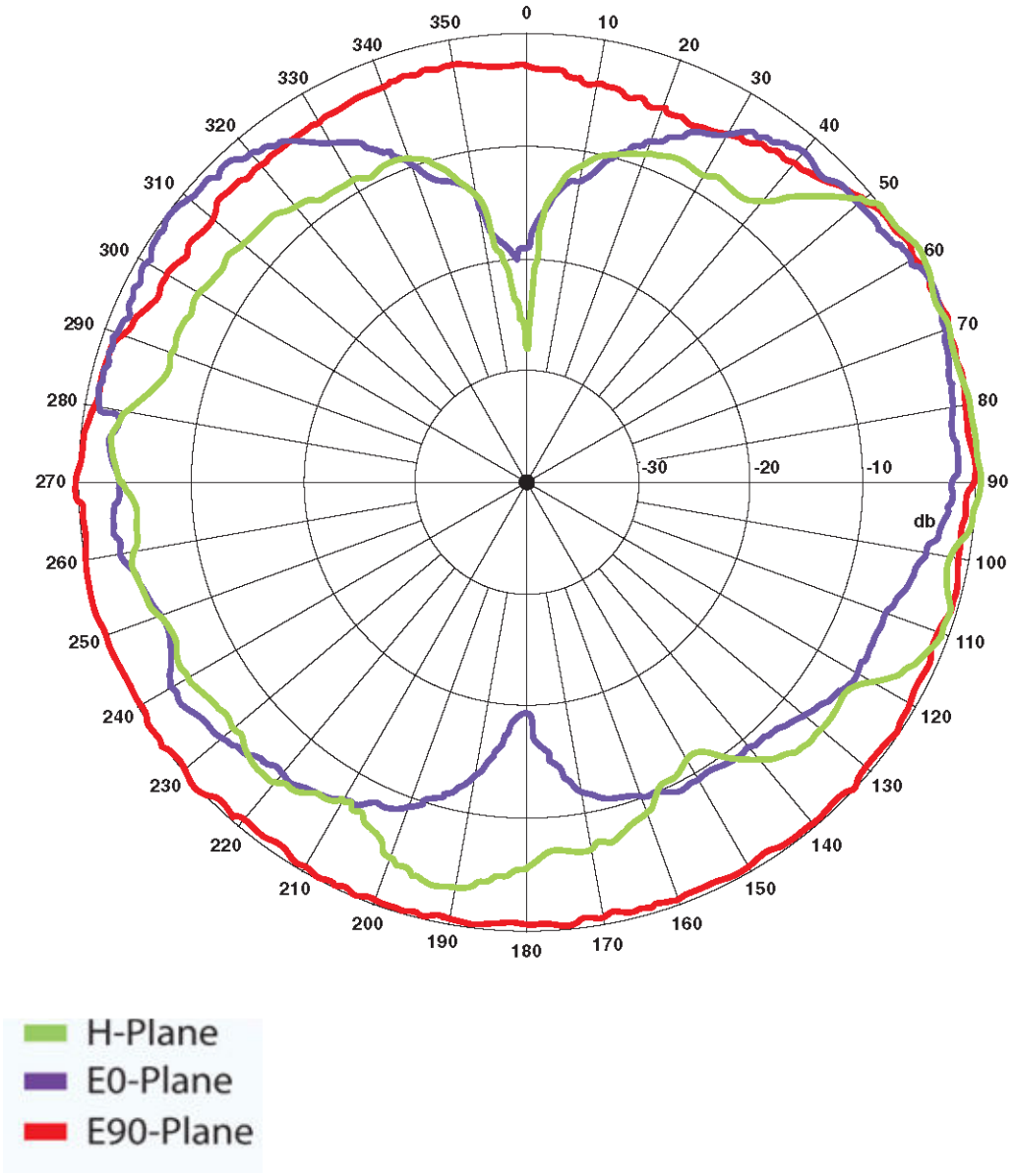


Figure 144: WS-AI-DX02360 2.4 MHz Radiation Pattern

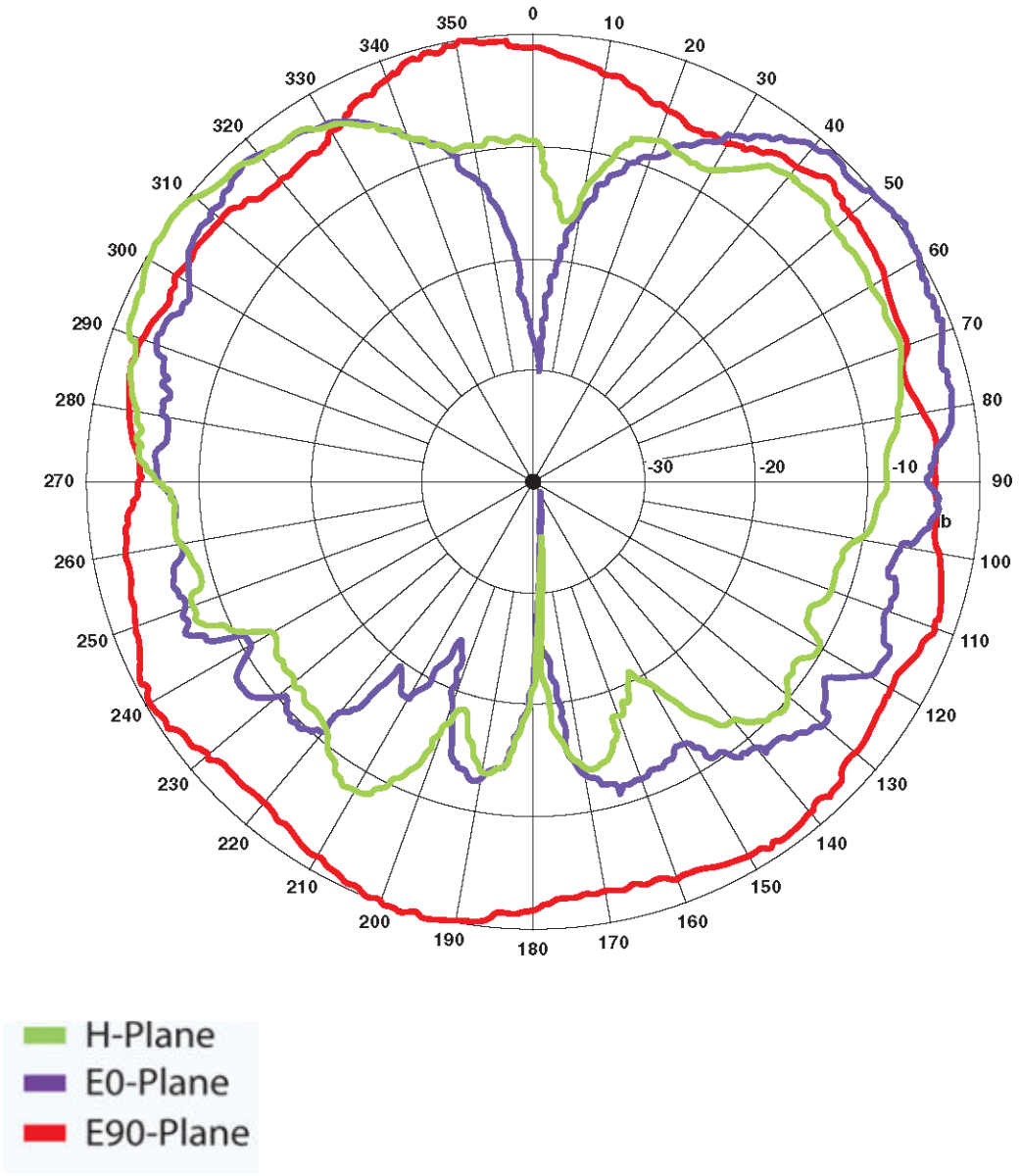


Figure 145: WS-AI-DX02360 5.15 MHz Radiation Pattern

WS-AI-DX07025

This is a dual-band, six port (three for each band) MIMO antenna providing spatial diversity coverage of 2.4–2.5 GHz WiFi and 5.1–5.9 GHz WiFi WiMAX broadband wireless frequencies in a low profile housing. The antennas provide optimal coverage for areas or events with a large number of mobile data users. For more information, see WS-AO-DX13025 on page 94. For mounting instructions, see Mounting Antenna Models WS-AO-DX13025 and WS-AI-DX07025 on page 45.

Specifications

Table 59: WS-AI-DX07025 Specifications

Specification	Value
Frequency	2.4–2.5 GHz and 5.1–5.9 GHz
Gain	6.5 dBi / 5.5 dBi
VSWR	1.7 typical, 2.0 maximum
Vertical Beamwidth	48/ 40
Horizontal Beamwidth	27/ 30
Operating Temperature Range	-40C to +85C
Polarization	Dual Linear (2 x V / 1 X H) for each band
Weight	8.0 lb (2.99 kg)
Mounting Style	Pipe or wall installation
Power	25 watts
Dimensions	18.75 in x 18.75 in x 5.125 in (476.25 x 476.25 x 130.18 mm)
Nominal Impedance	50 ohms

Radiation Patterns

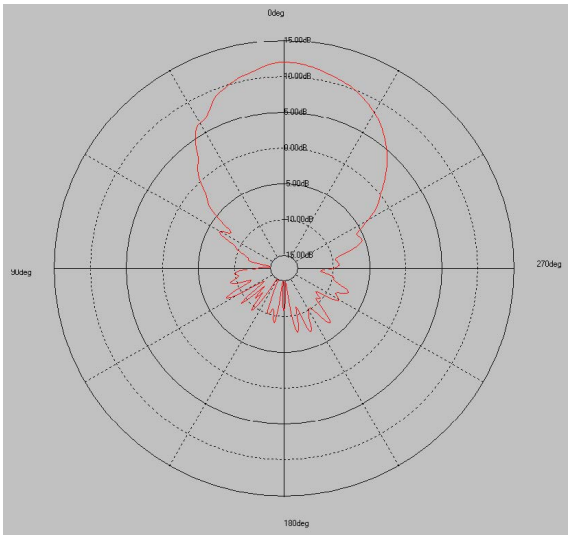


Figure 146: WS-AI-DX07025 2.4 GHz E-Plane Radiation Pattern

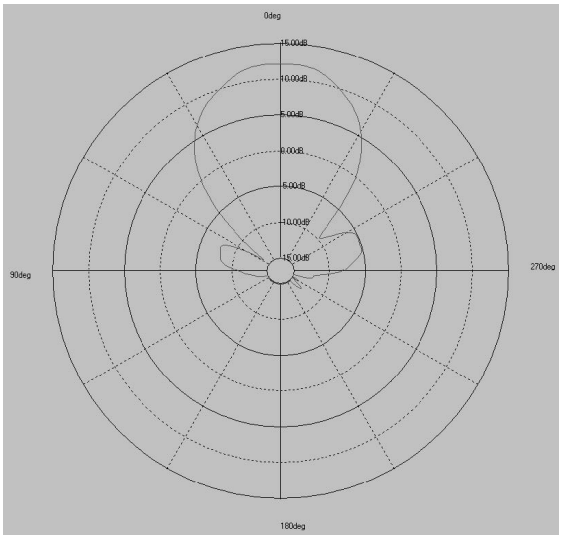


Figure 147: WS-AI-DX07025 2.4 GHz H-Plane Radiation Pattern

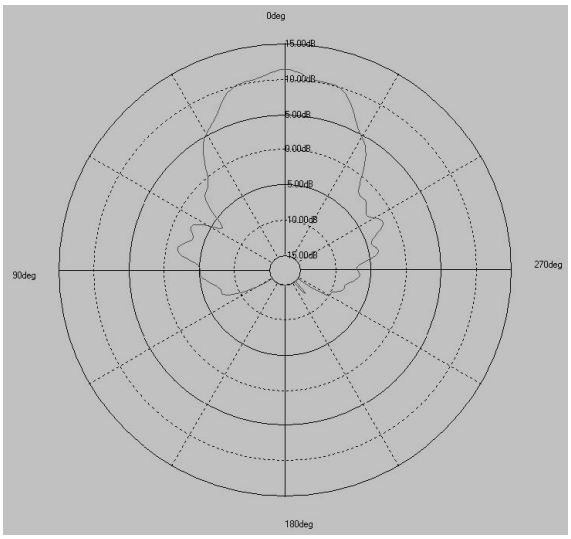


Figure 148: WS-AI-DX07025 5 GHz E-Plane Radiation Pattern

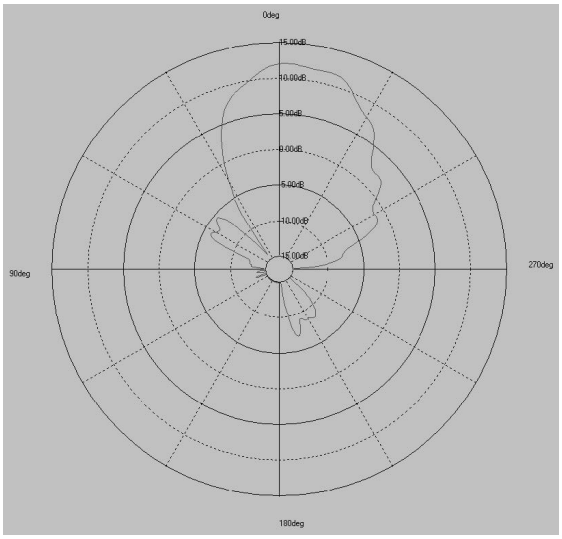


Figure 149: WS-AI-DX07025 5 GHz H-Plane Radiation Pattern

WS-AI-DX10055

This dual-band MIMO antenna provides spatial diversity coverage of 2.4 GHz and 5 GHz WiFi.

- This antenna is for indoor use.
- This antenna uses a Reverse Polarity SMA Plug Connector on a 39 inch cable.

For more information, see WS-AO-DX10055N on page 103.

Note
The WS-AO-DX10055N and the WS-AI-DX10055 are the same antenna. The WS-AO-DX10055N is intended for outdoor use. The WS-AI-DX10055 is intended for indoor use.

Specifications

Table 60: WS-AI-DX10055 Specifications

Specification	Value
Frequency	2.4–2.5 GHz and 5.15–5.85 GHz
Gain	10 dBi / 6 dBi
VSWR	< 2.0:1
Vertical Beamwidth	30/ 35
Horizontal Beamwidth	60/ 55
Operating Temperature Range	-40C to +70C
Polarization	Linear, vertical
Mounting Method	Heavy duty articulating mount (included)
Power	25 watts

Table 60: WS-AI-DX10055 Specifications (continued)

Specification	Value
Dimensions	9.1 in x 6.6 in x 1.6 in (231.14 x 167.64 x 40.64 mm)
Input Impedance	50 ohms

Radiation Patterns

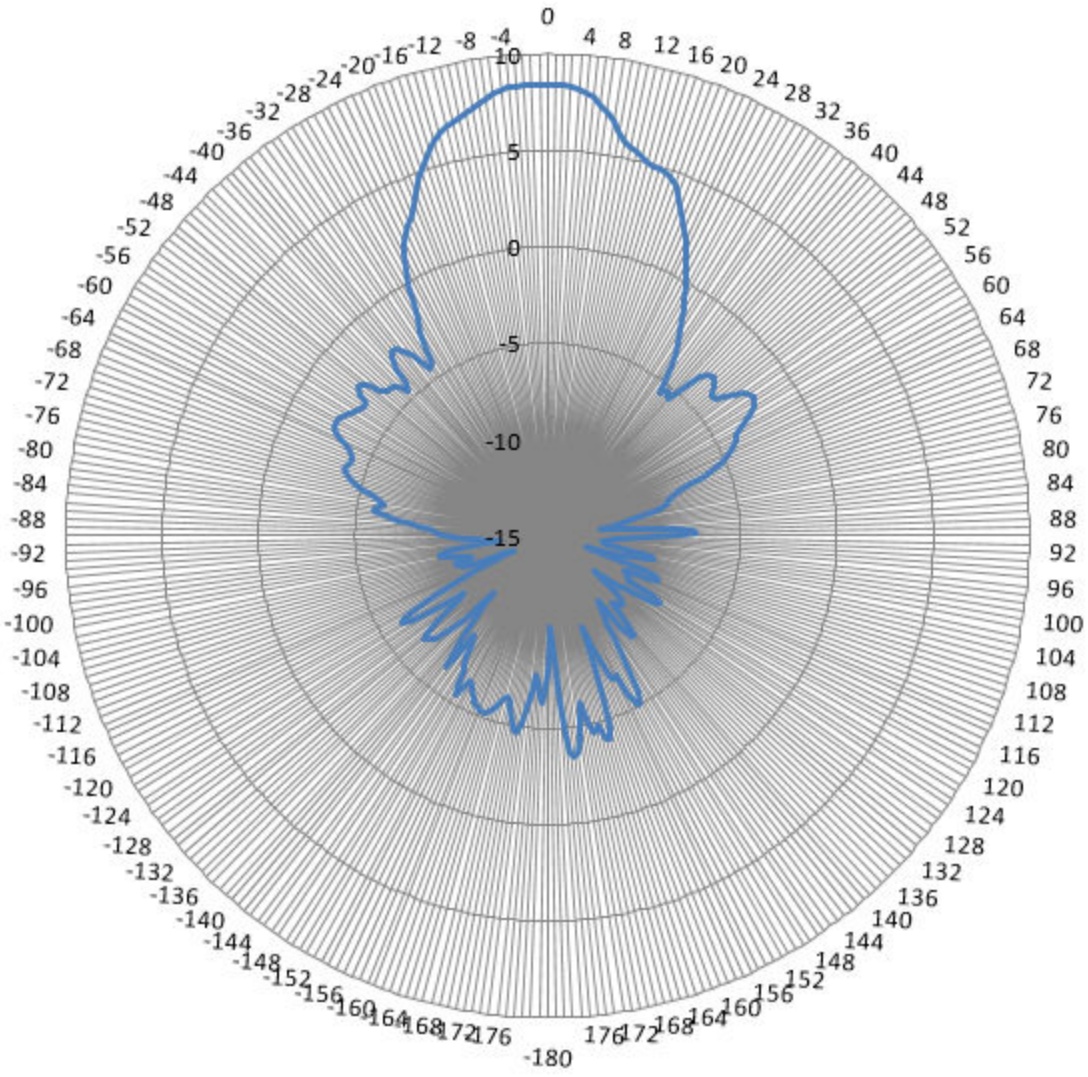


Figure 150: WS-AI-DX10055 2.5 GHz Vertical Radiation Pattern

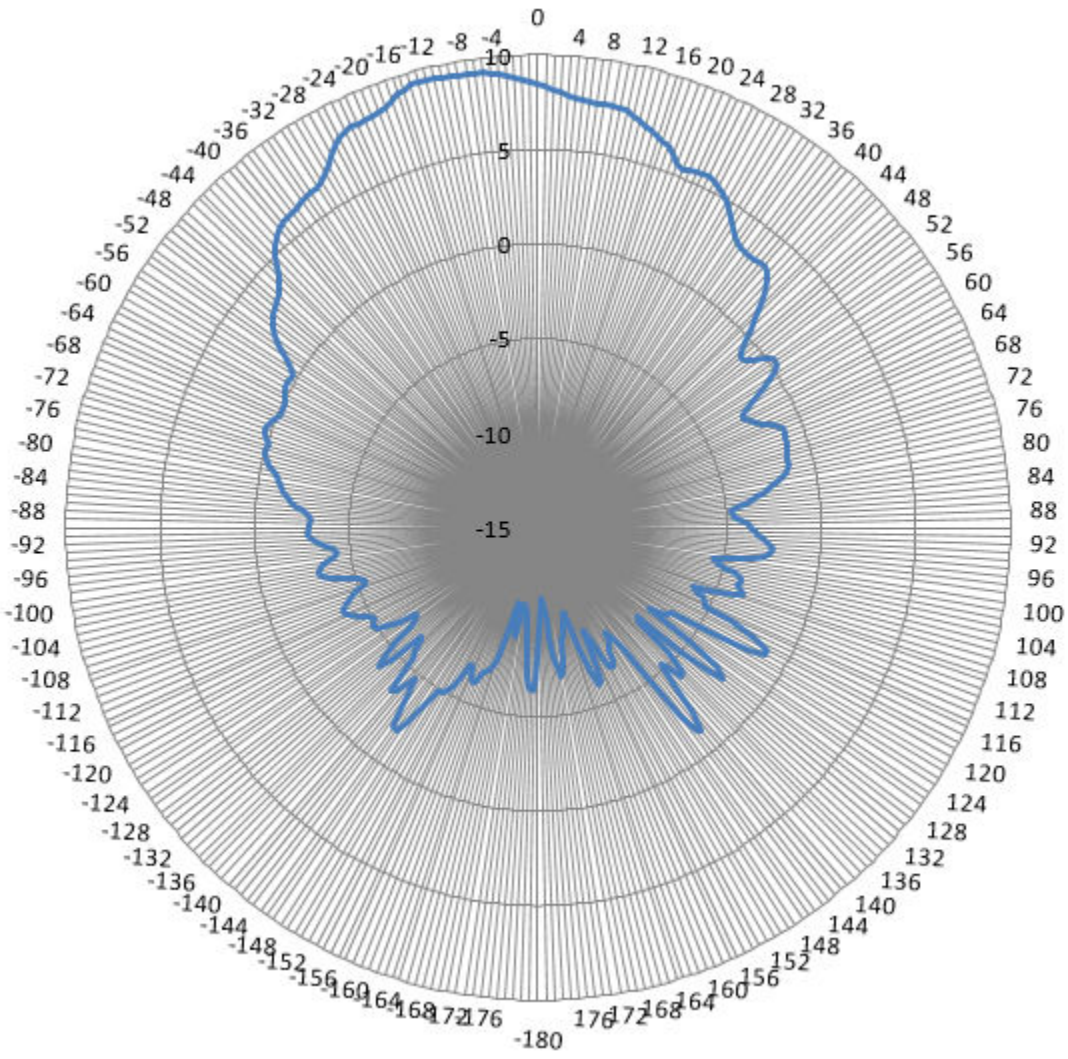


Figure 151: WS-AI-DX10055 2.5 GHz Horizontal Radiation Pattern

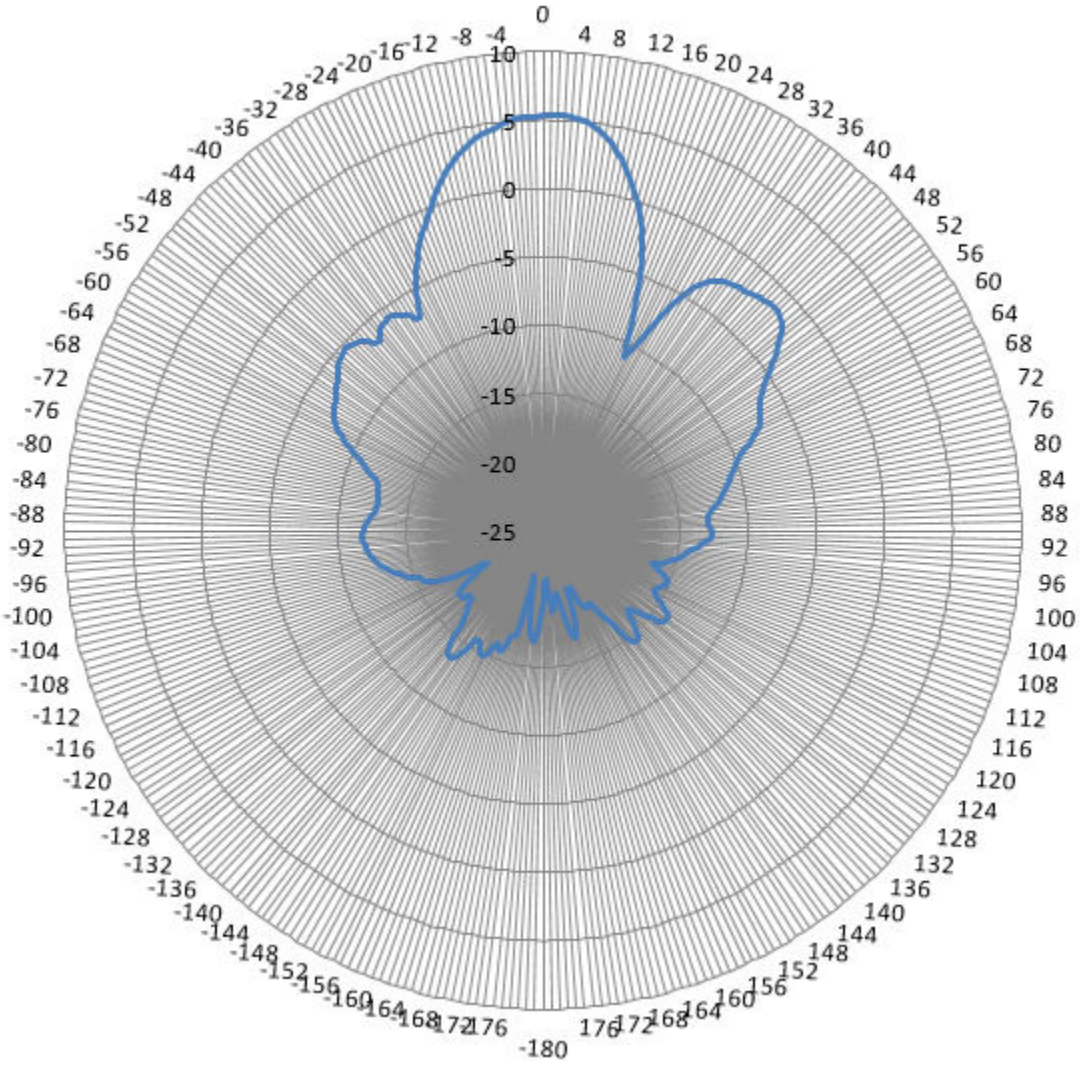


Figure 152: WS-AI-DX10055 5.5 GHz Vertical Radiation Pattern

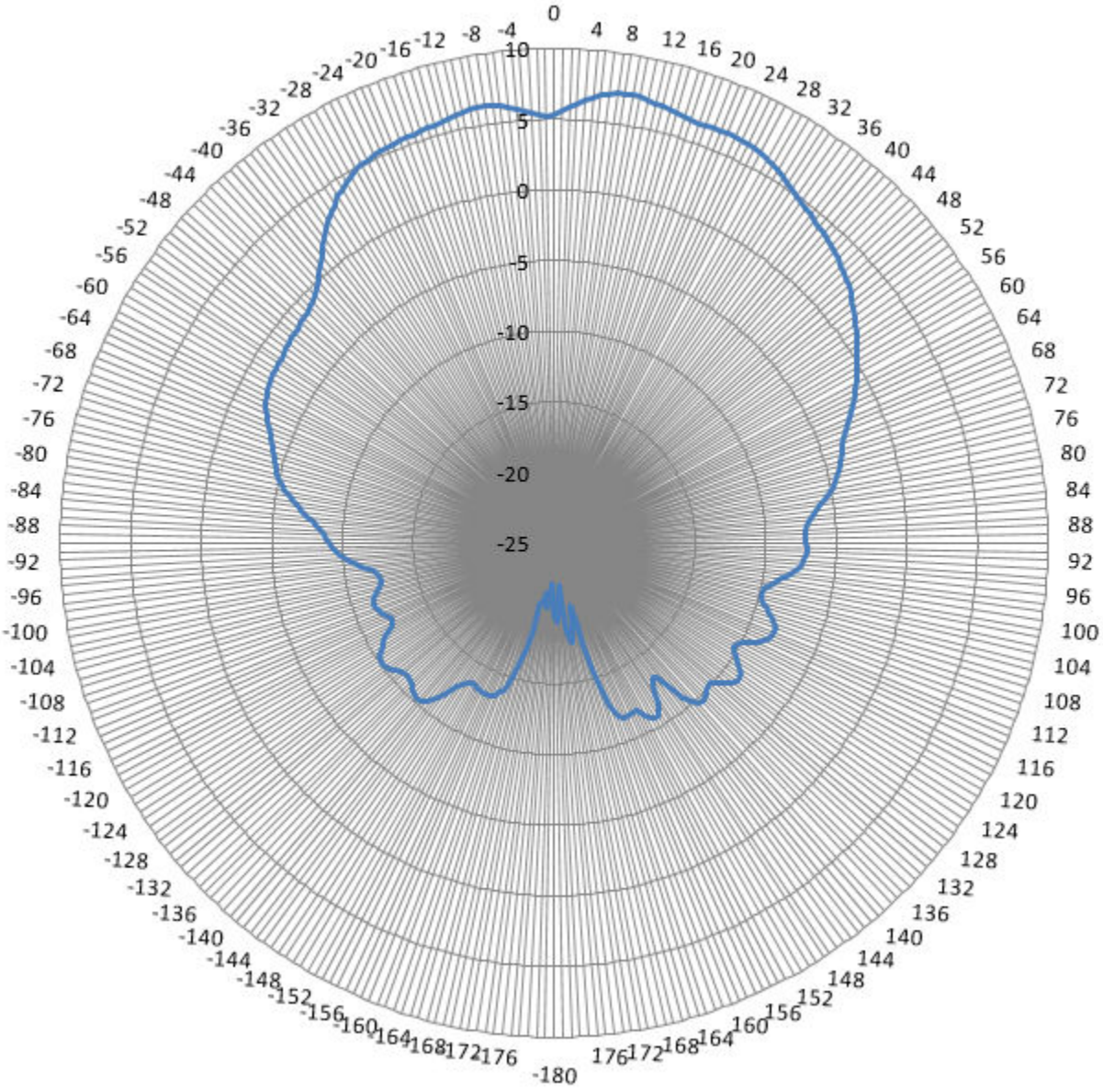


Figure 153: WS-AI-DX10055 5.5 GHz Horizontal Radiation Pattern

WS-ANT-2DIP-2

This two-pack, 2.4 GHz antenna assembly is used for indoor installations to support the AP3805e. This antenna is also packaged in a 3-pack under product number WS-ANT-2DIP-3, and packaged in a 4-pack under product number 30709 (WS-ANT-2DIP-4). Refer to the information provided in this topic for these antennas.

Figure 154: Indoor Antenna WS-ANT-2DIP-2

Specifications

Table 61: WS-ANT-2DIP-2 Specifications

Specification	Value
Frequency Range	0–6 GHz
Working Voltage	</- 170 Vrms
V.S.W.R.	</- 1.5

Table 61: WS-ANT-2DIP-2 Specifications (continued)

Specification	Value
Dielectric Withstanding	</- 500 Vrms
Voltage Insulation Resistance	>/- 2000 Megohms
Operating Temperature Range	-65°C to +165°C
Recommended coupling nut torque	4.0 in-lb–8.8 in-lb
Coupling nut retention force	>/- 60 lb
Contact Proof Torque	15 in-lb min.
Durability (mating)	>/- 500 cycles
Impedance	50 ohms

Radiation Patterns

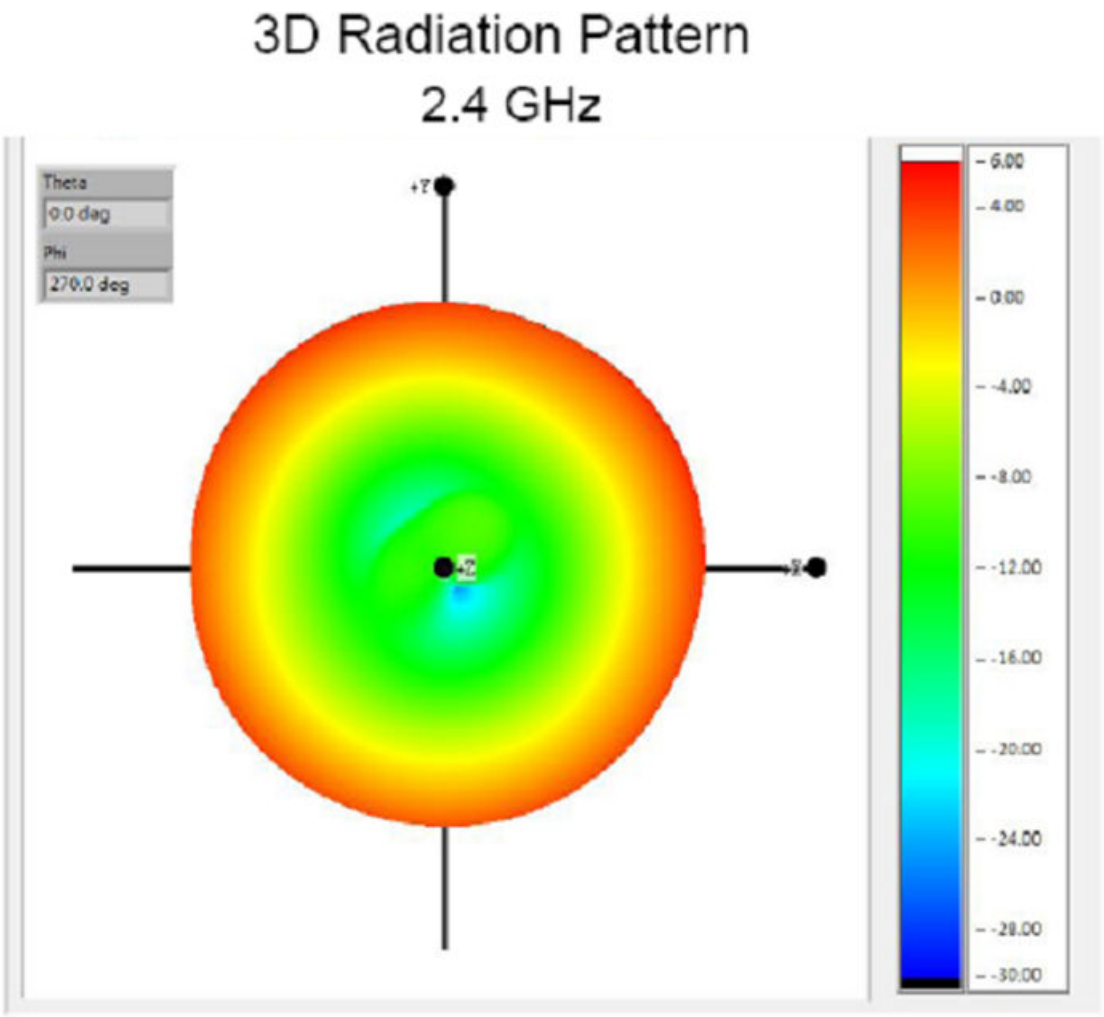


Figure 155: 3D Radiation Pattern 2.4GHz

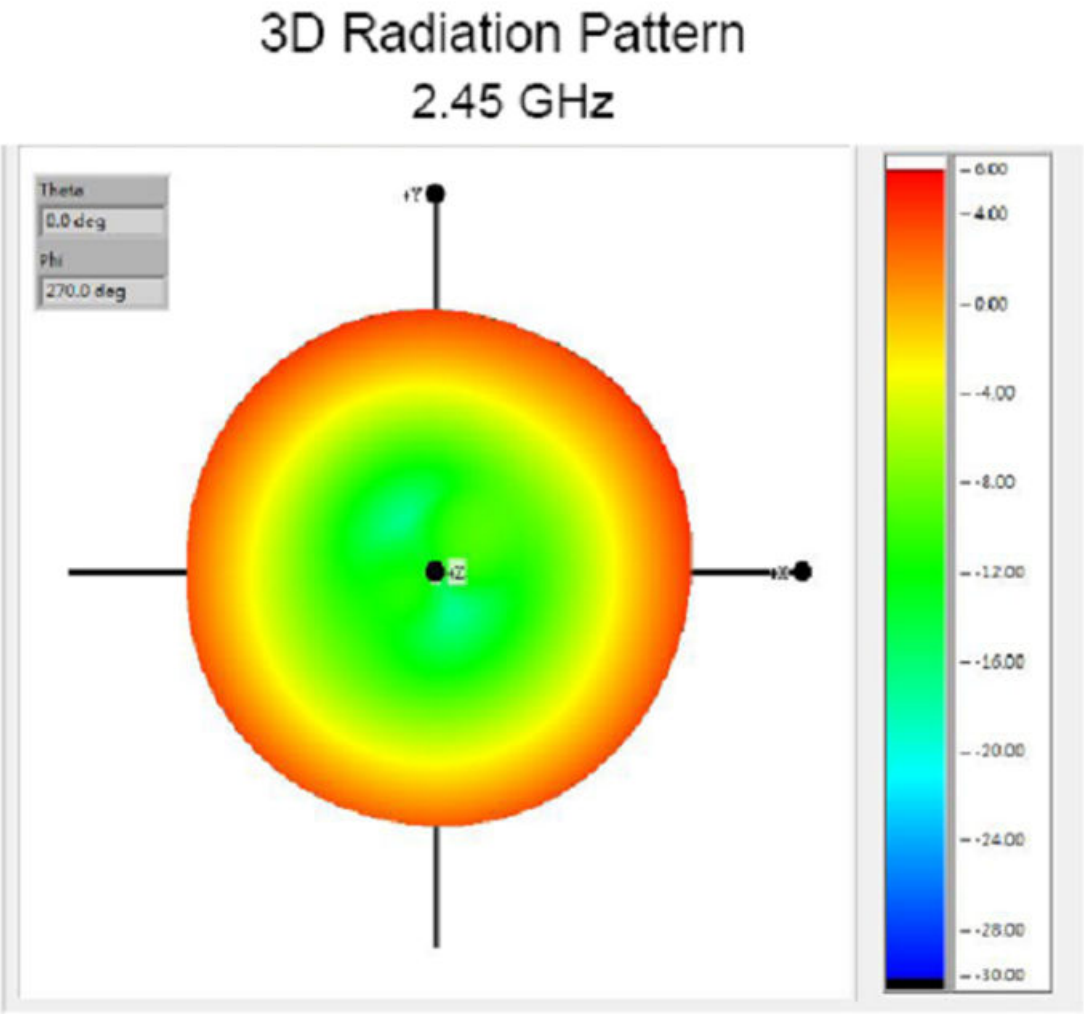


Figure 156: 3D Radiation Pattern 2.45GHz

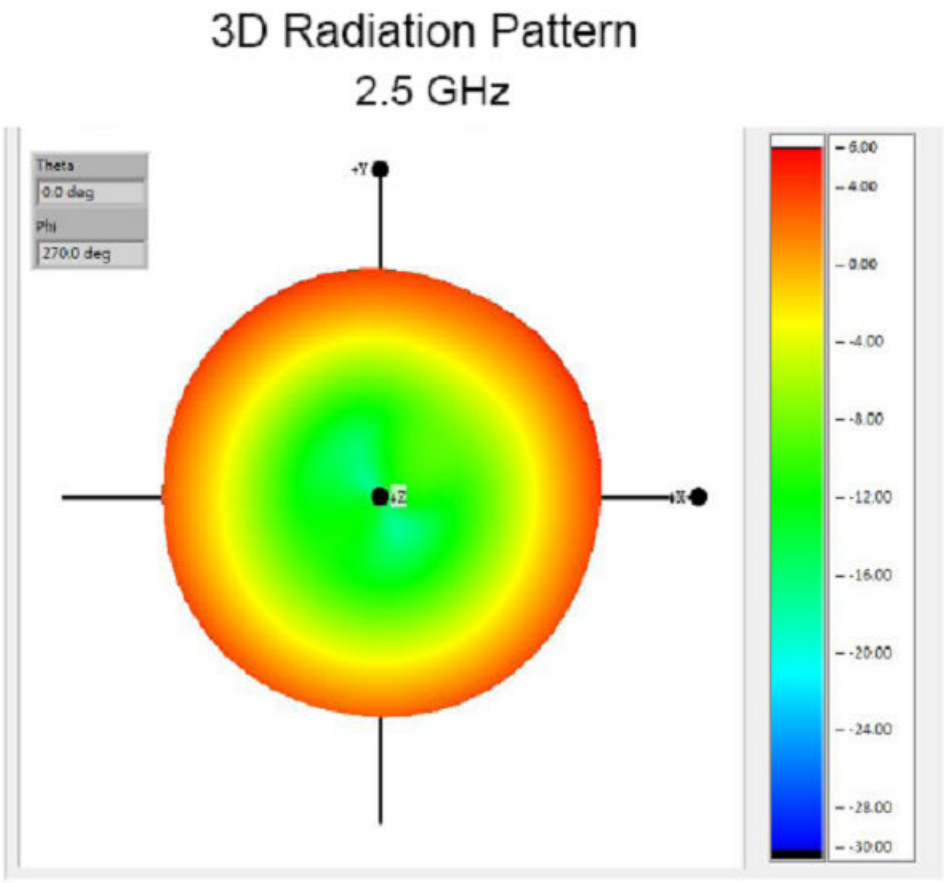


Figure 157: 3D Radiation Pattern 2.5GHz

WS-ANT-5DIP-2

This two-pack, 5GHz antenna assembly is used for indoor installations to support the AP3805e. This antenna is packaged in a 3-pack under product number WS-ANT-5DIP-3, and packaged in a 4-pack under product number 30710 (WS-ANT-5DIP-4). Refer to the information provided here for all these antennas.

Figure 158: Indoor Antenna WS-ANT-5DIP-2

Specifications

Table 62: WS-ANT-5DIP-2 Specifications

Specification	Value
Frequency Range	0–6 GHz
Working Voltage	</- 170 Vrms
V.S.W.R.	</- 1.5

Table 62: WS-ANT-5DIP-2 Specifications (continued)

Specification	Value
Dielectric Withstanding	</- 500 Vrms
Voltage Insulation Resistance	>/- 2000 Megohms
Operating Temperature Range	-65°C to +165°C
Recommended coupling nut torque	4.0 in-lb–8.8 in-lb
Coupling nut retention force	>/- 60 lb
Contact Proof Torque	15 in-lb min.
Durability (mating)	>/- 500 cycles
Impedance	50 ohms

Radiation Patterns

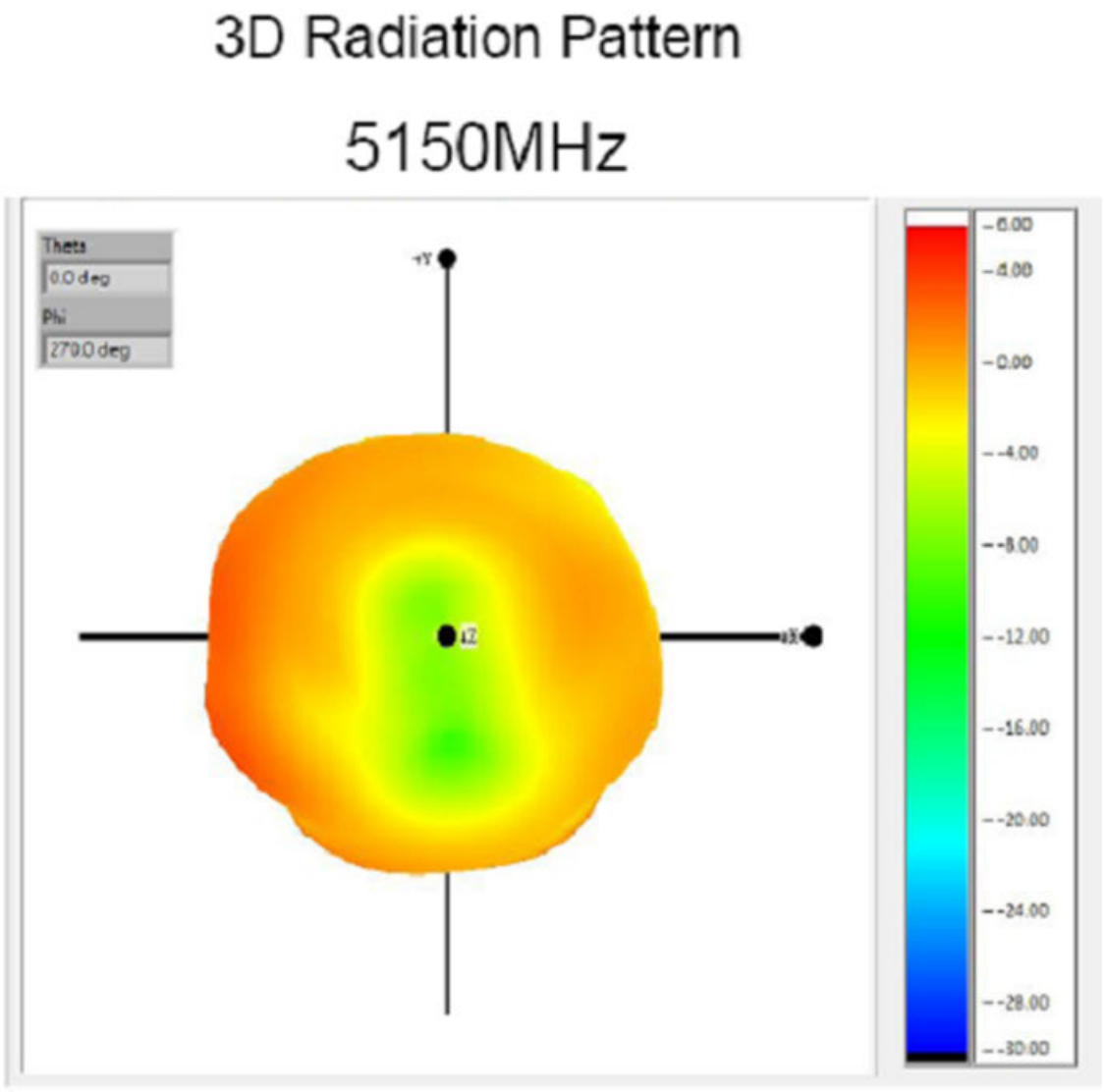


Figure 159: 3D Radiation Pattern 5150 MHz

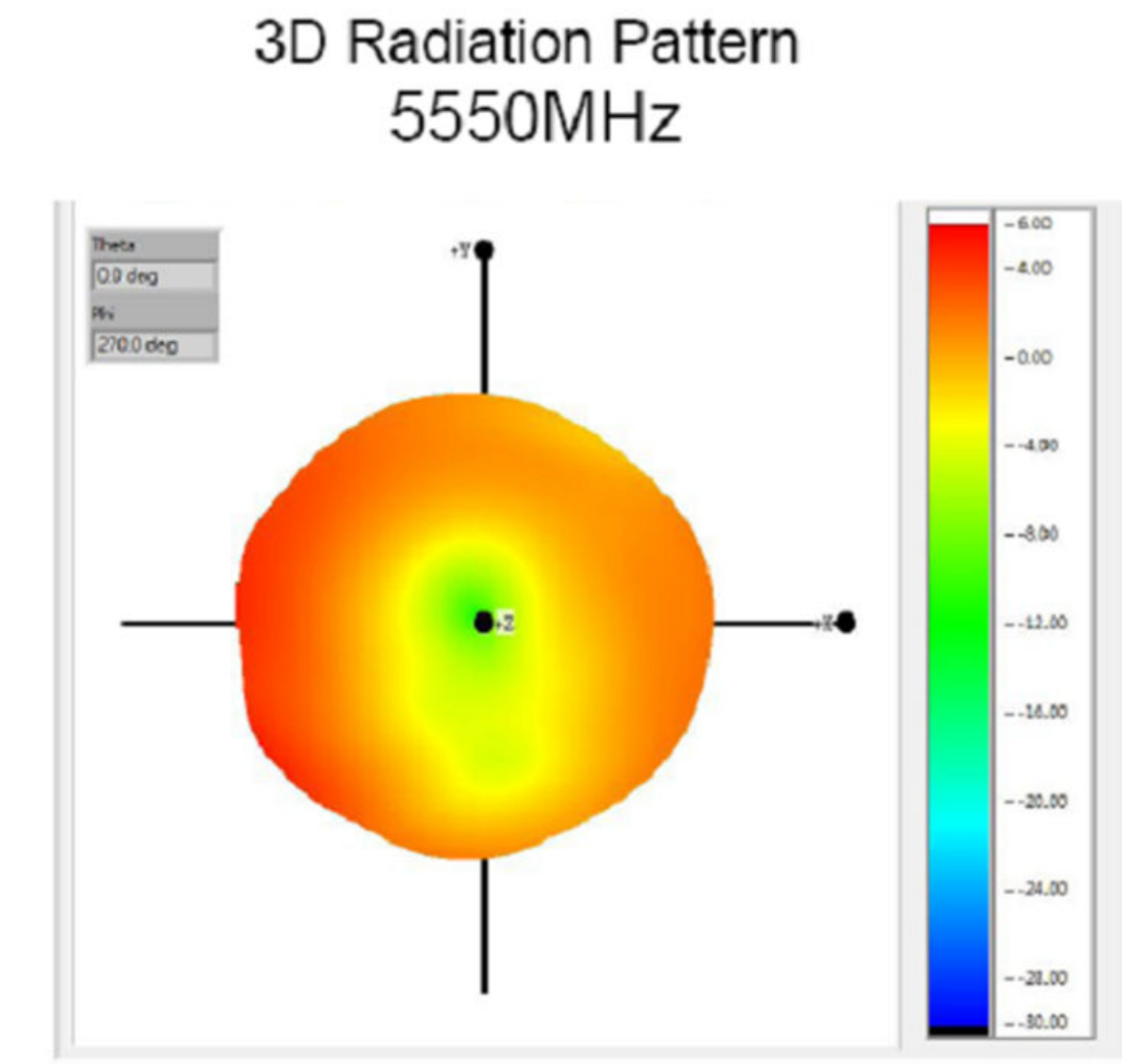


Figure 160: 3D Radiation Pattern 5550 MHz

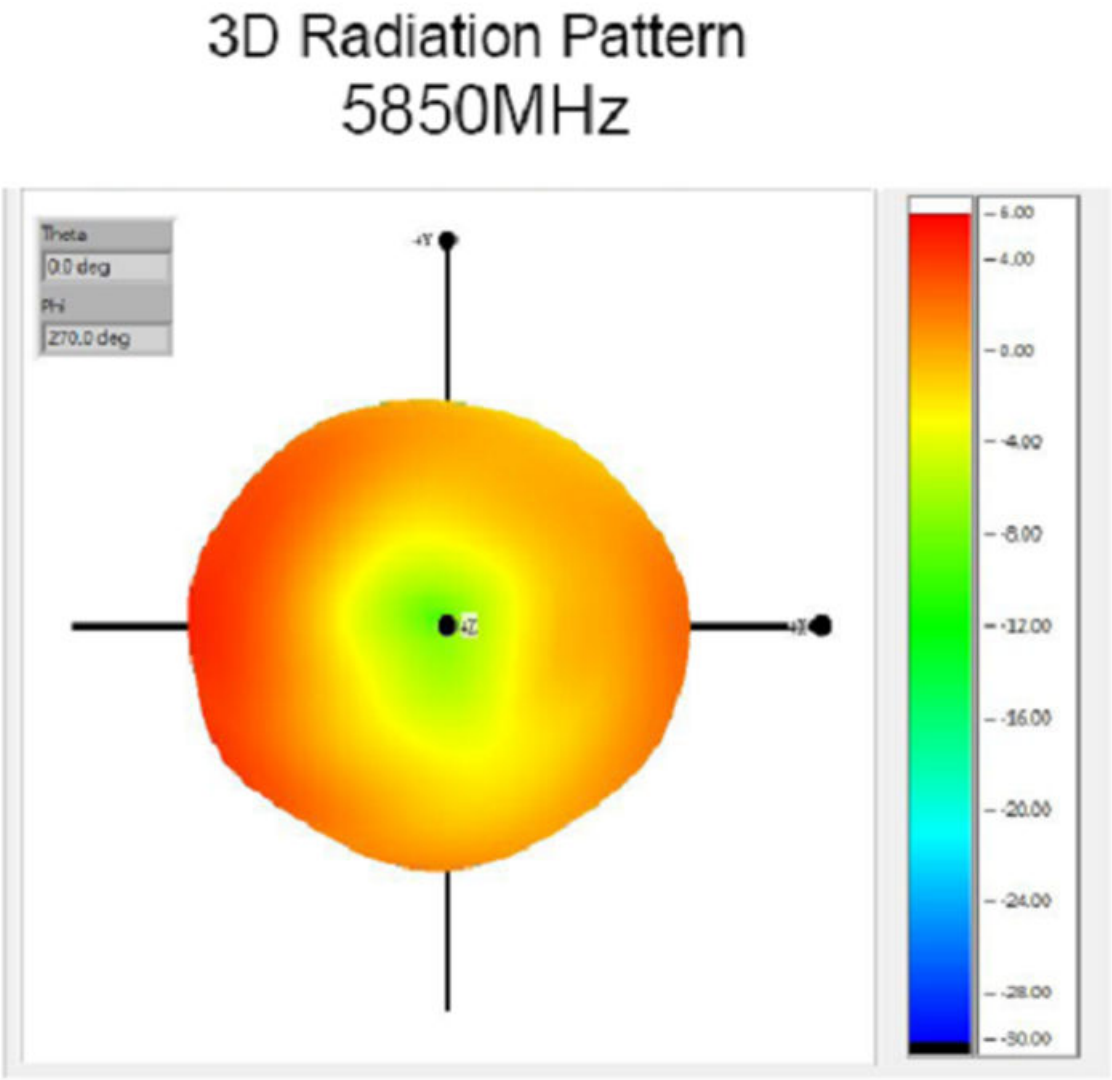


Figure 161: 3D Radiation Pattern 5850 MHz

WS-ANT-2DIP-3

This 2.4 GHz Dipole antenna is provided in a 3-pack of antennas. For more information, see WS-ANT-2DIP-2 on page 153. For mounting instructions, see Mounting Antenna Model WS-ANT-2DIP-3 on page 41.

WS-ANT-5DIP-3

This 5 GHz Dipole antenna is provided in a 3-pack of antennas. For more information, see WS-ANT-5DIP-2 on page 157. For mounting instructions, see Mounting Antenna Model WS-ANT-5DIP-3 on page 42.

AP3915e Antenna Patterns

Table 63: Antennas Required for AP3915e

ML-2452-APA2-01	Dipole, 3 dBi/4.85dBi, dual band, black with RPSMA plug connector (up to 3 per AP)
ML-2452-APA2-02	Dipole, 3 dBi/4.85dBi, dual band, white with RPSMA plug connector (up to 3 per AP)
ML-2452-HPA5-036	Dipole, 3dBi/5 dBi, dual band, outdoor, white with RPSMA plug connector (up to 3 per AP)
ML-2452-HPAG4A6-01	Dipole, 4dBi/7.3dBi, dual band, outdoor, white with standard N plug connector (up to 3 per AP)
ML-2452-HPA6M4-S36	Omni, 6dBi/6dBi, indoor, quad feed dual Band, 36" leads with RPSMA plug connectors (one per AP)
ML-2452-PNL6M3-N36	Polarized Panel 120deg sector, 6dBi/6dBi, dual band, indoor, triple feed, dual band, 36" leads with standard N jack connectors (one per AP)
ML-2452-PNL9M3-036	Polarized Panel 75/55 deg sector, 11dBi/10.7 dBi, dual band, indoor, triple feed, dual band, 36" leads with RPSMA plug connectors (one per AP – cannot be used on BLE port)
ML-2452-PNA5-01R	Panel, 120 deg sector, 5.5/6 dBi, dual band, outdoor, 36" lead with standard N plug connector (up to 3 per AP)
ML-2452-PNA7-01R	Panel, 68 deg sector, 8/12 dBi, dual band, outdoor, 36" lead with standard N plug connector
ML-2452-PTA2M2-036	Patch, 360 deg, 4/5 dBi, dual band, indoor, with dual feed 36" leads and RP SMA plug connectors
ML-2452-PTA4M4-036	Patch, 360 deg, 4/5 dBi, dual band, indoor, with quad feed 36" leads and RP SMA plug connectors

Radiation Patterns

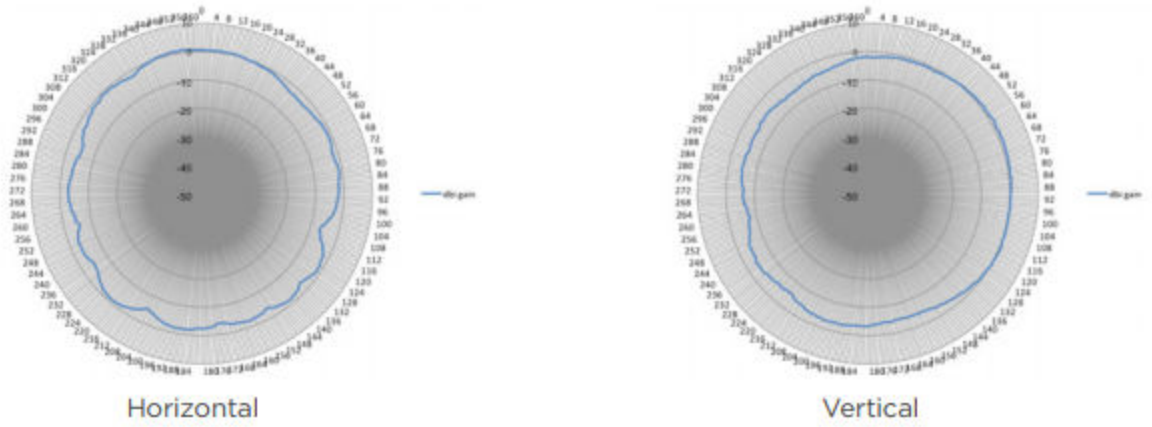


Figure 162: 2.4 GHz Horizontal and Vertical Pattern

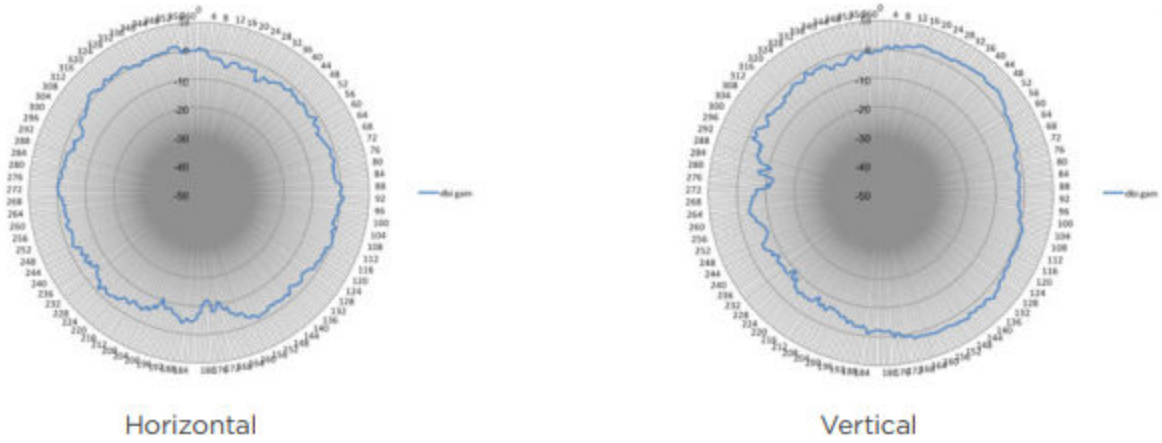


Figure 163: 5 GHz Horizontal and Vertical Pattern

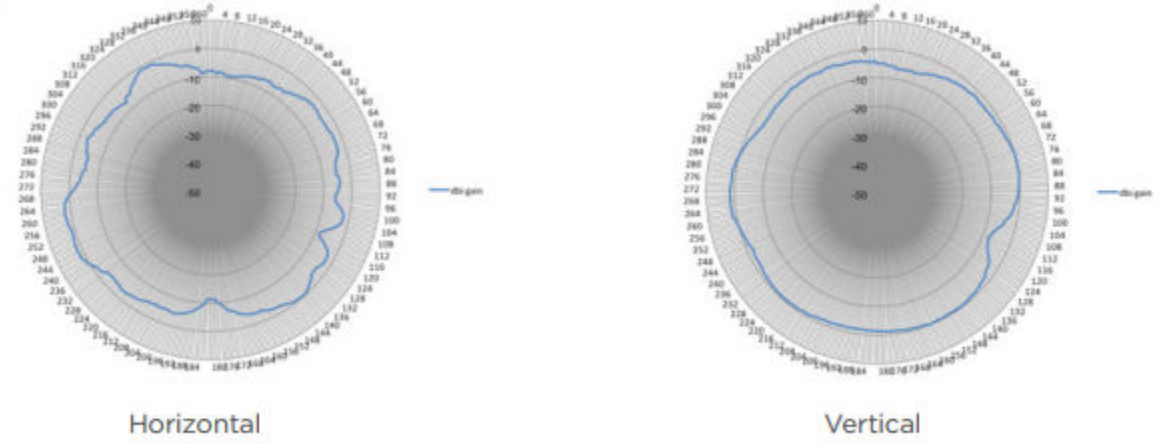


Figure 164: IoT Horizontal and Vertical Pattern

5 Accessory Specifications

Low-Loss Antenna Cables
Terminator: WS-CAB-RPSMATERM
Terminator: WS-CAB-NTERM
Attenuators
Extension Bracket: 30515 (WS-MB-WALLEXT01)

This section lists the specifications for cables, terminators, attenuators, and extension brackets.

Low-Loss Antenna Cables

This section outlines the outdoor and indoor optional antenna cables available for use with the antennas. The cables that support the Wave 2 antennas are optional. The Wave 2 antennas can be mounted without the use of cables.

Outdoor Antenna Cables with Standard N-Type Plug and Jack Connectors

The outdoor cables used with the Wave 2 antennas use a Type-N Plug and Type-N Jack; therefore, the part numbers end with "N". Specifications for each cable are listed under the base cable.

Note
The Wave 2 antennas can be mounted outside without the use of cables. If using optional cables, carefully determine the distance between the locations where you intend to mount the ExtremeWireless AP and the outdoor antenna, to ensure that you order the right cable length. The low-loss, outdoor, watertight cable is available in standard lengths.

Table 64: Outdoor Antenna Cables with Standard N-Type Plug and Jack Connectors

Cable	Refer To
20 feet (6.1 meters) PFP240 cable (WS-CAB-L200C20N)	Table 66 on page 166
6 feet (1.83 meters) PFP400 cable (WS-CAB-L400C06N)	Table 67 on page 167
20 feet (6.1 meters) PFP400 cable (WS-CAB-L400C20N)	Table 67 on page 167
50 feet (15.24 meters) PFP400 cable (WS-CAB-L400C50N)	Table 67 on page 167
75 feet (22 meters) PFP400 cable (WS-CAB-L400C75N)	Table 67 on page 167

Table 64: Outdoor Antenna Cables with Standard N-Type Plug and Jack Connectors (continued)

Cable	Refer To
25 feet (7.6 meters) PFP600 cable (WS-CAB-L600C25N)	Table 68 on page 168
50 feet (15.24 meters) PFP600 cable (WS-CAB-L600C50N)	Table 68 on page 168

Indoor Antenna Cables with Reverse Polarity SMA-Type Connectors

The indoor cables used with the Wave 2 antennas use a Standard Reverse Polarity SMA-Type Plug connector. Specifications for each cable are listed under the base cable.

Table 65: Indoor Antenna Cables with Standard RPSMA-Type Plug Connector

Cable	Refer To
10 feet (3.05 Meters) PFP240 cable (WS-CAB240-P10RP)	Table 66 on page 166
25 feet (7.62 Meters) PFP240 cable (WS-CAB240-P25RP)	Table 66 on page 166

Cable Specifications

This section outlines the specifications for each base cable. The outdoor cables support Standard Polarity Type-N Plug and Type-N Jack. The indoor cables support Reverse Polarity SMA-Type Plug connectors. Each cable listed in this guide is based off of one of the base specifications.

Table 66: WS-CAB-L200C20xx/WS-CAB240xx Cable Specifications

Specification	Value
Mechanical	
Length	6.1 meter (20 ft)
Weight	0.002 lb/ft (0.03 kg/m)
Bend Radius	0.5 in (12.7mm)
Tensile Strength	40 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 of Propagation	83%
Shielding Effectiveness	Greater than 90 dBi

Table 66: WS-CAB-L200C20xx/WS-CAB240xx Cable Specifications (continued)

Specification	Value
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
Connector Type	Outdoor antennas support optional cables with Standard Polarity Type-N Plug and Type-N Jack. For example, these cables are used with antennas that support the AP3965e and AP3865e. Indoor antennas support optional cables with Standard Reverse Polarity SMA-Type Plug connectors. For example, these cables are used with antennas that support the AP3935e.
Cable Loss	2.4 GHz: 3.3 dB 5.3 GHz: 5 dB 5.8 GHz: 5.3 dB

Table 67: WS-CAB-L400Cxx Cable Specifications

Specification	Value
Mechanical	
Length: WS-CAB-L400C06 WS-CAB-L400C50 WS-CAB-L400C75	6 ft (1.83 m) 50 ft (15.24 m) 75 ft (22.9 m)
Weight	0.068 lb/ft (0.10 kg/m)
Bend Radius	1.00 in (25.4 mm)
Tensile Strength	160 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 of Propagation	85%
Shielding Effectiveness	Greater than 90 dBi
DC Resistance	Inner Conductor: 1.39 ohms/1000ft (4.6 ohms/km) Outer Conductor: 1.65 ohms/1000ft (5.4 ohms/km)
Peak Power	16 kW

Table 67: WS-CAB-L400Cxx Cable Specifications (continued)

Specification	Value
Connector Type	Outdoor antennas support optional cables with Standard Polarity Type-N Plug and Type-N Jack. For example, these cables are used with antennas that support the AP3965e and AP3865e.
Cable Loss	50 feet: 2.4 GHz: 3.3 dB 5.3 GHz: 5.2 dB 5.8 GHZ: 5.4 dB 75 feet: 2.4 GHz: 5 dB 5.3 GHz: 7.7 dB 5.8 GHZ: 8.1 dB

Table 68: WS-CAB-L600Cxx Cable Specifications

Specification	Value
Mechanical	
Length WS-CAB-L600C25 WS-CAB-L600C50	25 ft (7.6 m) 50 ft (15.24 m)
Weight	0.131 lb/ft (0.20 kg/m)
Bend Radius	1.50 in (38.1 mm)
Tensile Strength	350 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 of Propagation	87%
Shielding Effectiveness	Greater than 90 dBi
DC Resistance	Inner Conductor: 0.53ohms/1000ft (1.7 ohms/km) Outer Conductor: 1.2 ohms/1000ft (3.9 ohms/km)
Peak Power	40 kW
Connector Type	Outdoor antennas support optional cables with Standard Polarity Type-N Plug and Type-N Jack. For example, these cables are used with antennas that support the AP3965e and AP3865e.
Cable Loss	25 feet: 2.4 GHz: 1.1 dB 5.3 GHz: 1.7 dB 5.8 GHz: 1.8 dB 50 feet: 2.4 GHz: 2.2 dB 5.3 GHz: 3.5 dB 5.8 GHz: 3.6 dB

Terminator: WS-CAB-RPSMATERM

This Terminator is intended to be used with Extreme Networks Wireless products. This Terminator uses a Reverse Polarity SMA Plug, female contact. (See the following figure.)

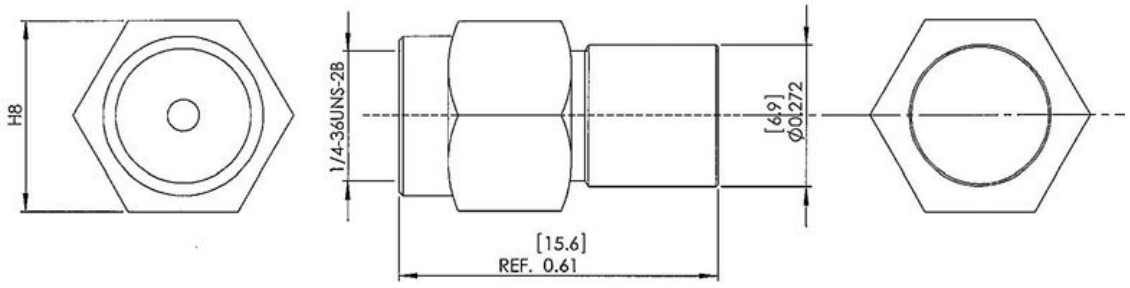


Figure 165: Terminator Detail View

Table 69: Terminator Specifications

Specification	Value
Shell and Body material	Brass
Connector Type	Reverse Polarity SMA Plug
Frequency Range	0–6.0 GHz
Impedance	50 ohms (nominal)
VSWR	</- 1.50 @ 0–6.0 GHz
Power Rating	1 watt

Terminator: WS-CAB-NTERM

This Terminator is intended to be used with Extreme Networks Wireless Products. This Terminator is a 0-6 GHz, 50 Ohm, Type-N Terminator with a 1 Watt power rating.

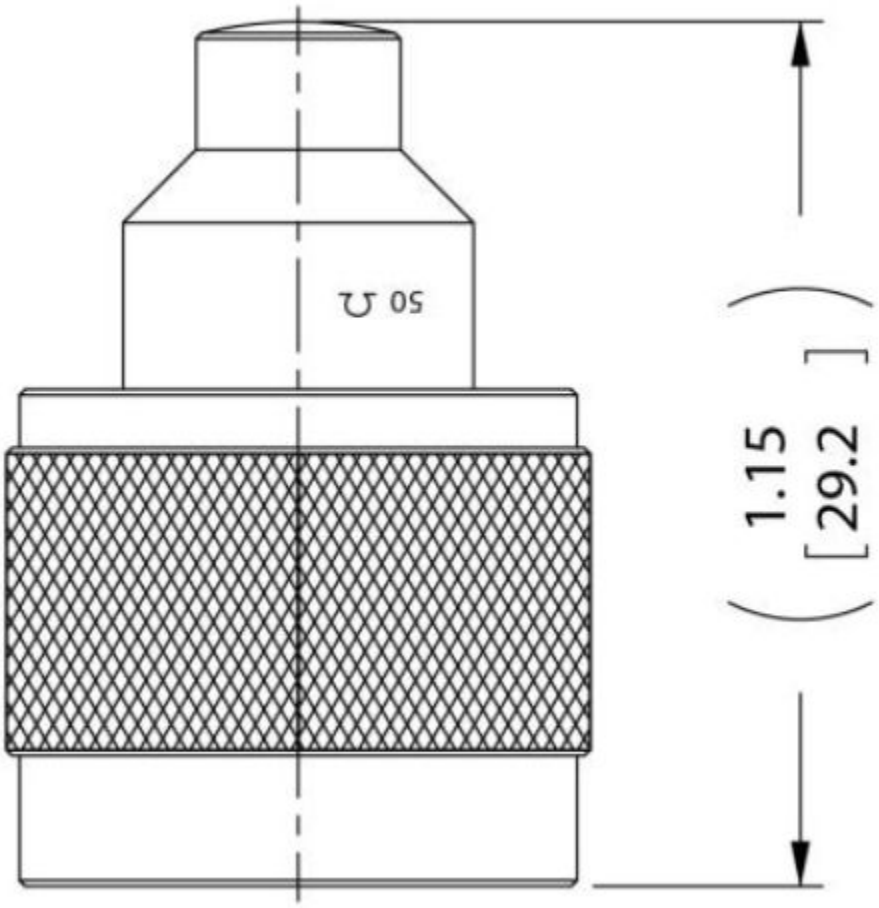


Figure 166: WS-CAB-NTERM

Table 70: Terminator Specifications

Specification	Value
Shell and Body material	Brass
Connector Type	Standard Type-N
Frequency Range	0–6.0 GHz
Impedance	50 ohms (nominal)
VSWR	1.5: 1 max
Power Rating	1 watt

Attenuators

Optional attenuators are available. There is a 6dB attenuator and a 10dB attenuator available with different connector types: Reverse Polarity SMA Plug-Female contact/Reverse Polarity SMA Jack-Male contact and a Type-N plug-Female/Jack-Male contact. For details, see Table 71 on page 171.

Optional Attenuators:

- WS-CAB-06DBATN with Reverse Polarity SMA Plug/Jack, Female/Male contacts
- WS-CAB-10DBATN with Reverse Polarity SMA Plug/Jack, Female/Male contacts
- WS-CAB-06DBATN-SN with Type-N plug-Female/Jack-Male contacts
- WS-CAB-10DBATN-SN with Type-N plug-Female/Jack-Male contacts

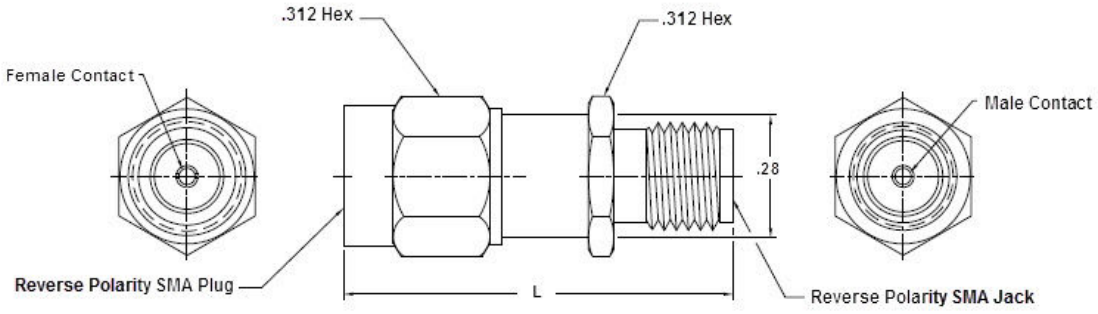


Figure 167: Attenuator Detail View Showing a Reverse Polarity SMA Plug and Jack

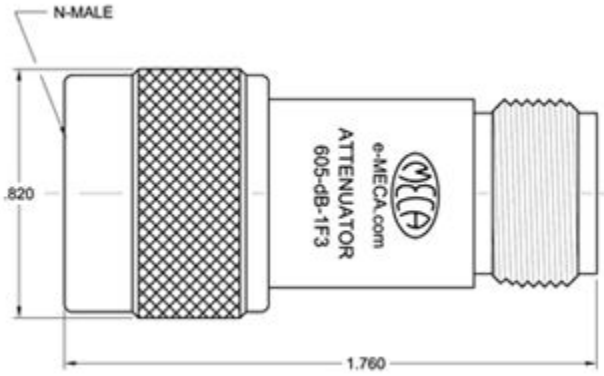


Figure 168: Attenuator Detail View Showing a Standard N-Type Plug and Jack

Table 71: Attenuator Specifications

	Value	
Specification	WS-CAB-06DBATN, WS-CAB-10DBATN	WS-CAB-6DBATN-SN, WS-CAB-10DBATN-SN
Mechanical		
Length (L)	.86 in. +/- .03 in.	
Weight	0.2 ounces	2.1 ounces
Housing	Stainless Steel, Passivated	Brass Nickel Plated
Connector Type	Reverse Polarity SMA Plug/Jack, Female/Male contacts	Type-N plug-Female/Jack-Male contacts
Environmental		
Operating Temperature Range	-55°C to +85°C (-67°F to +185°F)	

Table 71: Attenuator Specifications (continued)

	Value	
Specification	WS-CAB-06DBATN, WS-CAB-10DBATN	WS-CAB-6DBATN-SN, WS-CAB-10DBATN-SN
Electrical		
Frequency Range	Hz-6.000 GHz	
Impedance	50 ohms (nominal)	
VSWR	1.20:1 Max	Hz-6.01.25:1
Power Rating		
Average	2 watts (5 uSec Pulse, 0.05% duty cycle)	
Peak	250 watts	
Attenuation	Value	
WS-CAB-06DBATN, WS-CAB-6DBATN-SN	6 +/- 0.50 dB	
WS-CAB-10DBATN, WS-CAB-10DBATN-SN	10 +/- 0.50 dB	

Extension Bracket: 30515 (WS-MB-WALLEXT01)

The WS-MB-WALLEXT01 Extension Bracket Kit (P/N: 30515) supports the Wave 2 antennas that are listed in the following table, extending the antenna tilt up to 90 degrees for these antennas when mounted on a pole or wall.

All of these antennas ship with a standard antenna mounting kit that allows for approximately a 70 degree tilt. The optional WS-MB-WALLEXT01 Extension Bracket Kit works with the standard kit to allow a greater tilt, up to 90 degrees.

The standard mounting kit includes instructions on how to use the optional WS-MB-WALLEXT01 Extension Bracket Kit (P/N: 30515).

Table 72: Wave 2 Antennas that support the WS-MB-WALLEXT01 Extension Bracket Kit (P/N: 30515)

Antenna	Supported AP Model
30702	3935
30705	3935
30707	3935
30711	3965
30714	3965
30715	3965
30718	3965
30720	3965
WS-AO-5D23009N	3965