

Enterasys® Wireless

External Antenna

Site Preparation and Installation Guide



Electrical Hazard: Only qualified personnel should perform installation procedures.

Riesgo Electrico: Solamente personal calificado debe realizar procedimientos de instalacion.

Elektrischer Gefahrenhinweis: Installationen sollten nur durch ausgebildetes und qualifiziertes Personal vorgenommen werden.

Notice

Enterasys Networks reserves the right to make changes in specifications and other information contained in this document and its web site without prior notice. The reader should in all cases consult Enterasys Networks to determine whether any such changes have been made.

The hardware, firmware, or software described in this document is subject to change without notice.

IN NO EVENT SHALL ENTERASYS NETWORKS BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING BUT NOT LIMITED TO LOST PROFITS) ARISING OUT OF OR RELATED TO THIS DOCUMENT, WEB SITE, OR THE INFORMATION CONTAINED IN THEM, EVEN IF ENTERASYS NETWORKS HAS BEEN ADVISED OF, KNEW OF, OR SHOULD HAVE KNOWN OF, THE POSSIBILITY OF SUCH DAMAGES.

Enterasys Networks, Inc.
9 Northeastern Boulevard
Salem, NH 03079

© 2013 Enterasys Networks, Inc. All rights reserved.

Part Number: 9034559-08 June 2013

ENTERASYS, ENTERASYS NETWORKS, ENTERASYS WIRELESS and any logos associated therewith, are trademarks or registered trademarks of Enterasys Networks, Inc., in the United States and other countries. For a complete list of Enterasys trademarks, see <http://www.enterasys.com/company/trademarks.aspx>.

All other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies.

Documentation URL: <https://extranet.enterasys.com/downloads/>

Contents

About This Guide

Intended Audience	xi
Related Documents	xii
Conventions Used in This Guide	xii
Getting Help	xii

Chapter 1: AP Site Preparation

Enterasys Wireless Access Points that Support External Antennas	1-1
Choosing Antennas for Wireless Network Configurations	1-2
Determining the Antenna Locations	1-3
Outdoor Distances with Cables	1-3
Line of Sight	1-11
Additional Location Requirements	1-13
Antenna Models	1-14
Cable Options	1-18
Lightning Protector	1-18
Pigtail Connection Options	1-19
Contacting an Antenna Installation Company	1-19
Lightning Protection	1-19
Mounting Requirements	1-19
Line of Sight	1-20
Installation Requirements	1-20
Distance to Provide to Antenna Installation Company	1-20

Chapter 2: AP Placement and Configuration

Determining the Location of the AP	2-1
Enterasys Wireless AP2620	2-2
Enterasys Wireless AP3620 and AP3640	2-4
Enterasys Wireless AP3660	2-6
Enterasys Wireless AP3765e and AP3767e	2-7
Enterasys Wireless AP3710e	2-9

Chapter 3: Antenna Installation

Outdoor Antenna Kits	3-2
Installation Overview	3-2
Grounding System	3-3
Lightning Protector Installation	3-4
Mounting the Antenna	3-5
Selecting a Mast	3-5
Antenna Polarization	3-5
Approved Antennas for the Enterasys Wireless APs	3-5
AP2620 Approved Antennas	3-5
AP3620 and AP3640 Approved Antennas	3-6
AP3660 Approved Antennas	3-6
AP3765e and AP3767e Approved Antennas	3-7
AP3710e Approved Antennas	3-7
Mounting Antenna Model WS-AO-DS05360	3-8
Mounting Antenna Model WS-AI-2S03360	3-10
Mounting Antenna Model WS-AI-DS06360	3-12
Mounting Antenna Model WS-AIO-DS05120	3-14

Mounting Antenna Model WS-AIO-2S07060 and WS-AIO-5S12060	3-16
Mounting Antenna Model WS-AIO-5S17017	3-20
Mounting Antenna Model WS-AIO-2S14090	3-24
Mounting Antenna Model WS-AIO-5S15090	3-25
Mounting Antenna Model WS-AIO-2S18018	3-28
Mounting Antenna Model WS-AO-5D16060	3-30
Mounting Antenna Model WS-AO-5D23009	3-33
Mounting Antenna Model WS-AI-DT04360	3-38
Mounting Antenna Model WS-AI-DT05120	3-40
Mounting Antenna Model WS-AO-DT05120 and WS-AO-DT05120-1	3-43
Mounting Antenna Model WS-AO-2S10360 and WS-AO-5S10360	3-47
Mounting Antenna Model WS-ANT21	3-49
Mounting Antenna Model WS-AO-DX13025	3-51
Mounting Antenna Model WS-AI-DX02360	3-55
Mounting Antenna Model WS-AI-DX07025	3-56
Connecting Antenna Cables	3-60
Using the Plug Pigtail (Reverse Polarity Type-N Plug)	3-60
Using the Jack Pigtail (Reverse Polarity Type-N Jack)	3-61
Cable Installation Guidelines	3-62
Connecting the Cables	3-62
Optimizing Outdoor Point-to-Point Antenna Placement	3-64
AP3660 Antenna Alignment Using Internal Buzzer	3-64
Routine Maintenance	3-65

Appendix A: Antenna Specifications

External Antennas for Use with Outdoor APs	A-2
WS-AO-DT05120	A-2
Specifications	A-2
Radiation Patterns	A-3
WS-AO-DT05120-1	A-5
Specifications	A-5
Radiation Patterns	A-5
WS-AO-5S10360	A-7
Specifications	A-7
Radiation Pattern	A-8
WS-AO-2S10360	A-8
Specifications	A-8
Radiation Pattern	A-9
WS-AO-5D23009	A-9
Specifications	A-9
WS-AO-5D16060	A-11
Specifications	A-11
WS-AO-2S08360	A-13
Specifications	A-13
WS-AO-DS05360	A-14
Specifications	A-14
Radiation Patterns	A-15
WS-ANT21	A-17
Specifications	A-17
Radiation Patterns	A-17
WS-AO-DX13025	A-19
Specifications	A-19
Radiation Patterns	A-20
External Antennas for Use with Indoor/Outdoor APs	A-24
WS-AIO-2S18018	A-24

Specifications	A-24
Radiation Patterns	A-25
WS-AIO-5S15090	A-26
Specifications	A-26
Radiation Patterns	A-27
WS-AIO-2S14090	A-29
Specifications	A-29
Radiation Patterns	A-30
WS-AIO-5S17017	A-31
Specifications	A-31
Radiation Patterns	A-31
WS-AIO-2S07060	A-32
Specifications	A-32
Radiation Patterns	A-32
WS-AIO-DS05120	A-33
Specifications	A-33
WS-AIO-5S12060	A-35
Specifications	A-35
Radiation Patterns	A-35
External Antennas for Use with Indoor APs	A-36
WS-AI-DT05120	A-36
Specifications	A-36
Radiation Patterns	A-37
WS-AI-DT04360	A-39
Specifications	A-39
Radiation Patterns	A-39
WS-AI-DS06360	A-41
Specifications	A-41
Radiation Patterns	A-42
WS-AI-2S03360	A-45
Specifications	A-45
Radiation Patterns	A-45
WS-AI-DX02360	A-46
Specifications	A-46
Radiation Patterns	A-46
WS-ANT01	A-48
Specifications	A-48
Radiation Patterns	A-48
WS-ANT02	A-50
Specifications	A-50
WS-AI-DX07025	A-53
Specifications	A-53
Radiation Patterns	A-54

Appendix B: Accessory Specifications

Pigtail Connection	B-2
Low-Loss Antenna Cable	B-3
Lightning Protector	B-6
Attenuators	B-7

Figures

1-1	Fresnel Zone and Line of Sight Clearance	1-11
1-2	Potential Obstacles to Line of Sight (not to scale)	1-13
2-1	AP2620 Installation Overview	2-2
2-2	AP3620 and AP3640 Installation Overview	2-4

2-3	AP 3660 Installation.....	2-6
2-4	AP3765e and AP3767e External Antenna Cable Installation	2-7
2-5	AP3765e and AP3767e Installation Overview	2-8
2-6	AP3710e External Antenna Cable Installation.....	2-9
3-1	Lightning Protector Installation	3-4
3-2	WS-AO-DS05360 Antenna.....	3-8
3-3	Mounting the WS-AO-DS05360 Antenna to a Pole	3-9
3-4	WS-AI-2S03360 Antenna	3-10
3-5	Example Location for WS-AI-2S03360 Antenna	3-11
3-6	Mounting the WS-AI-2S03360 Antenna to a Ceiling	3-11
3-7	Mounting the Antenna Clips	3-12
3-8	WS-AI-DS06260 Antenna.....	3-12
3-9	WS-AI-DS06260 Antenna Mounting Alignment.....	3-13
3-10	WS-AIO-DS05120 Antenna.....	3-14
3-11	Mounting the WS-AIO-DS05120 Antenna on a Mast	3-15
3-12	Mounting the WS-AIO-DS05120 Antenna on a Wall	3-16
3-13	WS-AIO-2S07060 and WS-AIO-5S12060 Antennas	3-17
3-14	Mounting Template for the WS-AIO-2S07060 and WS-AIO-5S12060 Antennas	3-17
3-15	Cabling Options for the WS-AIO-2S07060 and WS-AIO-5S12060 Antenna.....	3-18
3-16	Articulating Wall Mount for the WS-AIO-2S07060 and WS-AIO-5S12060 Antennas.....	3-18
3-17	Articulating Wall Mount for the WS-AIO-2S07060 and WS-AIO-5S12060 Antennas.....	3-19
3-18	Antenna Model WS-AIO-5S17017.....	3-20
3-19	WS-AIO-5S17017 Mounted on a Pole.....	3-21
3-20	WS-AIO-5S17017 Antenna Mounting Kit and Assembly	3-21
3-21	WS-AIO-5S17017 Pole Mounting.....	3-22
3-22	WS-AIO-2S14090 Antenna	3-24
3-23	WS-AIO-2S14090 Adjustable Brackets	3-24
3-24	WS-AIO-2S14090 Tilt Angle	3-25
3-25	WS-AIO-5S15090 Antenna	3-25
3-26	WS-AIO-5S15090 Installation.....	3-26
3-27	WS-AIO-5S15090 Mounting Bracket.....	3-27
3-28	WS-AIO-5S15090 Tilt Angles	3-27
3-29	WS-AIO-2S18018 Antenna	3-28
3-30	WS-AIO-2S18018 Mounting Bracket.....	3-29
3-31	WS-AIO-2S18018 Tilt Angles	3-29
3-32	WS-AO-DS16060 Antenna.....	3-30
3-33	Attaching the L Bracket	3-31
3-34	Attaching the Grooved Bracket.....	3-31
3-35	Attach Antenna to Pole.....	3-32
3-36	Adjusting the Tilt	3-32
3-37	WS-AO-5D23009 Antenna	3-33
3-38	Attaching the Bracket to the Antenna	3-34
3-39	Mounting the Antenna to a Pole	3-35
3-40	Mounting the Antenna to a 1.75" to 3.00" Pole.....	3-36
3-41	Mounting the Antenna to a 1 to 1.75 Inch Pole	3-36
3-42	Mounting the Antenna on a Wall	3-37
3-43	WS-AI-DT04360 Antenna.....	3-38
3-44	Installing on Ceiling Support Rails.....	3-39
3-45	Mounting the Antenna Clips	3-39
3-46	WS-AI-DT05120 Antenna.....	3-40
3-47	Mounting the WS-AI-DT05120 Antenna on a Wall	3-40
3-48	WS-AI-DT05120 Antenna Drilling Template.....	3-41
3-49	Mounting the Adapters on the WS-AI-DT05120 Antenna.....	3-42
3-50	Mounting the WS-AI-DT05120 Antenna on a Pole.....	3-43
3-51	WS-AO-DT05120 and WS-AO-DT05120-1 Antennas.....	3-43
3-52	Mounting the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas on a Wall	3-44

3-53	WS-AO-DT05120 and WS-AO-DT05120-1 Antenna Drilling Template.....	3-45
3-54	Mounting the Adapters on the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas.....	3-46
3-55	Mounting the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas on a Pole.....	3-47
3-56	WS-AO-2S10360 and WS-AO-5S10360 Antennas.....	3-47
3-57	Mounting the WS-AO-2S10360 and WS-AO-5S10360 Antennas to a Pole.....	3-48
3-58	WS-ANT21 Antenna.....	3-49
3-59	Mounting the WS-ANT21 Antenna to the AP3660.....	3-50
3-60	WS-AO-DX13025 Antenna.....	3-51
3-61	Bracket Attachment for Various Mounting Configurations.....	3-52
3-62	Attaching Antenna Mount Bracket.....	3-52
3-63	Attaching Elevation Bracket.....	3-53
3-64	Attaching Azimuth Bracket to Pipe.....	3-53
3-65	Attaching Antenna Assembly to Azimuth Bracket.....	3-54
3-66	Bracket Adjustable for Lower Profiles.....	3-54
3-67	WS-AI-DX02360 Antenna.....	3-55
3-68	WS-AI-DX02360 Mounting Post and Mounting Nut.....	3-55
3-69	WS-AI-DX07025 Antenna.....	3-56
3-70	Bracket Attachment for Various Mounting Configurations.....	3-57
3-71	Attaching Antenna Mount Bracket.....	3-58
3-72	Attaching Elevation Bracket.....	3-58
3-73	Attaching Azimuth Bracket to Pipe.....	3-59
3-74	Attaching Antenna Assembly to Azimuth Bracket.....	3-59
3-75	Bracket Adjustable for Lower Profiles.....	3-60
3-76	Plug Pigtail Cable (Reverse Polarity Type-N plug) with Lightning Protector.....	3-60
3-77	Plug Pigtail Cable (Reverse Polarity Type-N plug) without Lightning Protector.....	3-61
3-78	Jack Pigtail Cable (Reverse Polarity Type-N Jack) with Lightning Protector.....	3-61
3-79	Male Pigtail Cable without Lightning Protector.....	3-62
3-80	AP3660 Buzzer Frequency and Received Signal Strength (RSS).....	3-65
A-1	WS-AO-DT05120 2.5 GHz E-Plane Radiation Pattern.....	A-3
A-2	WS-AO-DT05120 2.5 GHz H-Plan Radiation Pattern.....	A-3
A-3	WS-AO-DT05120 5.5 GHz E-Plane Radiation Pattern.....	A-4
A-4	WS-AO-DT05120 5.5 GHz H-Plane Radiation Pattern.....	A-4
A-5	WS-AO-DT05120-1 2.5 GHz E-Plane Radiation Pattern.....	A-5
A-6	WS-AO-DT05120-1 2.5 GHz H-Plan Radiation Pattern.....	A-6
A-7	WS-AO-DT05120-1 5.5 GHz E-Plane Radiation Pattern.....	A-6
A-8	WS-AO-DT05120-1 5.5 GHz H-Plane Radiation Pattern.....	A-7
A-9	WS-AO-5S10360 5.0 GHz Radiation Pattern.....	A-8
A-10	WS-AO-2S10360 2.4 GHz Radiation Pattern.....	A-9
A-11	WS-AO-5D23009 Azimuth Radiation Pattern Midband Freq. 5.47 GHz.....	A-10
A-12	WS-AO-5D23009 Elevation Radiation Pattern Midband Freq. 5.47 GHz.....	A-11
A-13	WS-AO-5D16060 Azimuth Radiation Pattern Midband Freq. 5.35 GHz.....	A-12
A-14	WS-AO-5D16060 Elevation Radiation Pattern Midband Freq. 5.35 GHz.....	A-13
A-15	WS-AO-DS05360 E-Plane 2.45 GHz Radiation Pattern.....	A-15
A-16	WS-AO-DS05360 H-Plane 2.45 GHz Radiation Pattern.....	A-15
A-17	WS-AO-DS05360 E-Plane 5.47 GHz Radiation Pattern.....	A-16
A-18	WS-AO-DS05360 H-Plane 5.47 GHz Radiation Pattern.....	A-16
A-19	WS-ANT21 E-Plane 2.5 GHz Radiation Pattern.....	A-17
A-20	WS-ANT21 H-Plane 2.5 GHz Radiation Pattern.....	A-18
A-21	WS-ANT21 E-Plane 5.5 GHz Radiation Pattern.....	A-18
A-22	WS-ANT21 H-Plane 5.5 GHz Radiation Pattern.....	A-19
A-23	WS-AO-DX13025 2.4 GHz E-Plane Radiation Pattern.....	A-20
A-24	WS-AO-DX13025 2.4 GHz H-Plane Radiation Pattern.....	A-21
A-25	WS-AO-DX13025 5 GHz E-Plane Radiation Pattern.....	A-22
A-26	WS-AO-DX13025 5 GHz H-Plane Radiation Pattern.....	A-23
A-27	WS-AIO-2S18018 Elevation Cut Radiation Pattern.....	A-25
A-28	WS-AIO-2S18018 Azimuth Cut Radiation Pattern.....	A-25

A-29	WS-AIO-5S15090 Azimuth at 120° Radiation Pattern.....	A-27
A-30	WS-AIO-5S15090 Azimuth at 90° Radiation Pattern.....	A-27
A-31	WS-AIO-5S15090 Azimuth at 60° Radiation Pattern.....	A-28
A-32	WS-AIO-5S15090 Azimuth at 45° Radiation Pattern.....	A-28
A-33	WS-AIO-5S15090 Elevation Radiation Pattern	A-29
A-34	WS-AIO-2S14090 Elevation Cut Radiation Pattern.....	A-30
A-35	WS-AIO-2S14090 Azimuth Cut Radiation Pattern	A-30
A-36	WS-AIO-5S17017 5.66 GHz E-Plane and H-Plane Radiation Patterns	A-31
A-37	WS-AIO-2S07060 Radiation Patterns	A-33
A-38	WS-AIO-DS05120 2.4 GHz E-Plane and H-Plane Radiation Patterns.....	A-34
A-39	WS-AIO-DS05120 5.4 GHz E-Plane and H-Plane Radiation Patterns.....	A-34
A-40	WS-AIO-5S12060 5.25 GHz E-Plane and H-Plane Radiation Patterns	A-35
A-41	WS-AI-DT05120 2.5 GHz E-Plane Radiation Pattern	A-37
A-42	WS-AI-DT05120 2.5 GHz H-Plan Radiation Pattern	A-37
A-43	WS-AI-DT05120 5.5 GHz E-Plane Radiation Pattern	A-38
A-44	WS-AI-DT05120 5.5 GHz H-Plane Radiation Pattern	A-38
A-45	WS-AI-DT04360 2.5 GHz E-Plane Radiation Pattern	A-39
A-46	WS-AI-DT04360 2.5 GHz H-Plane Radiation Pattern	A-40
A-47	WS-AI-DT04360 5.47 GHz E-Plane Radiation Pattern	A-40
A-48	WS-AI-DT04360 5.47 GHz H-Plane Radiation Pattern	A-41
A-49	WS-AI-DS06360 Radiation Pattern—Elevation Cut at 776 MHz.....	A-42
A-50	WS-AI-DS06360 Radiation Pattern—Elevation Cut at 905 MHz.....	A-42
A-51	WS-AI-DS06360 Radiation Pattern—Elevation Cut at 1940 MHz.....	A-43
A-52	WS-AI-DS06360 Radiation Pattern—Elevation Cut at 2450 MHz.....	A-43
A-53	WS-AI-DS06360 Radiation Pattern—Elevation Cut at 3550 MHz.....	A-44
A-54	WS-AI-DS06360 Radiation Pattern—Elevation Cut at 5450 MHz.....	A-44
A-55	WS-AI-2S03360 2.4 GHz E-Plane and H-Plane Radiation Patterns	A-45
A-56	WS-AI-DX02360 2.4 MHz Radiation Pattern.....	A-47
A-57	WS-AI-DX02360 5.15 MHz Radiation Pattern.....	A-47
A-58	WS-ANT01 E-Plane 2.45 GHz	A-48
A-59	WS-ANT01 H-Plane 2.45 GHz	A-49
A-60	WS-ANT01 E-Plane 5.25 GHz	A-49
A-61	WS-ANT01 H-Plane 5.25 GHz	A-50
A-62	WS-ANT02 E-Plane 2.45 GHz	A-51
A-63	WS-ANT02 E-Plane 5.25 GHz	A-51
A-64	WS-ANT02 H-Plane 2.45 GHz	A-52
A-65	WS-ANT02 H-Plane 5.25 GHz	A-52
A-66	WS-AI-DX07025 2.4 GHz E-Plane Radiation Pattern	A-54
A-67	WS-AI-DX07025 2.4 GHz H-Plane Radiation Pattern	A-55
A-68	WS-AI-DX07025 5 GHz E-Plane Radiation Pattern	A-56
A-69	WS-AI-DX07025 5 GHz H-Plane Radiation Pattern	A-57
B-1	Attenuator Detail View	B-7

Tables

1-1	Access Points that Support External Antennas	1-2
1-2	Antennas for Wireless Network Configurations	1-2
1-3	Distance Between AP3620/AP3640 Antennas (LAN to LAN/Multipoint)	1-4
1-4	Distance Between AP2620 Antennas (LAN to LAN/Point-to-Point)	1-5
1-5	Distance Between AP3660 Antennas (LAN to LAN/MultiPoint)	1-6
1-6	Distance Between AP3765e and AP3767e Antennas (LAN to LAN/MultiPoint).....	1-9
1-7	Typical Antenna Height Requirements — 2.4 GHz	1-12
1-8	Typical Antenna Height Requirements — 5 GHz	1-12
1-9	Supported External Antennas Listed by AP	1-14
1-10	Cable Options and Model Numbers	1-18
1-11	Lightning Protector	1-18

1-12	Pigtail Options	1-19
2-1	Enterasys Wireless AP2620 Installation Components	2-3
2-2	Enterasys Wireless AP3620 and AP3640 Installation Components.....	2-5
2-3	Enterasys Wireless AP3660 Installation Components	2-6
2-4	AP3765e and AP3767e Installation Components	2-8
3-1	WS-AO-DS05360 Pole Mounting Kit	3-9
3-2	Mounting Kit Components for the WS-AIO-DS05120 Antenna	3-15
3-3	Mounting Kit Components for the WS-AIO-5S17017	3-21
3-4	WS-AO-DS16060 Mounting Kit	3-30
3-5	WS-AO-5D23009 Mounting Kit.....	3-33
3-6	WS-AI-DT05120 Wall Mounting Kit	3-41
3-7	WS-AI-DT05120 Pole Mounting Parts List	3-42
3-8	WS-AO-DT05120 and WS-AO-DT05120-1 Wall Mounting Kit	3-44
3-9	WS-AO-DT05120 and WS-AO-DT05120-1 Pole Mounting Parts List	3-46
3-10	WS-AO-2S10360 and WS-AO-5S10360 Pole Mounting Kit.....	3-48
3-11	WS-AO-DX13025 Mount Kit Contents.....	3-51
3-12	WS-AI-DX07025 Mount Kit Contents	3-56
3-13	Plug Pigtail Cable (Reverse Polarity Type-N Plug) Components	3-61
3-14	Jack Pigtail Cable Components.....	3-62
3-15	AP3660 Buzzer Frequency and Pulse Width	3-64
A-1	Outdoor Antennas	A-2
A-2	WS-AO-DT05120 Specifications	A-2
A-3	WS-AO-DT05120-1 Specifications	A-5
A-4	WS-AO-5S10360 Specifications.....	A-7
A-5	WS-AO-2S10360 Specifications.....	A-8
A-6	WS-AO-5D23009 Specifications	A-9
A-7	WS-AO-5D16060 Specifications	A-11
A-8	WS-AO-2S08360 Specifications.....	A-13
A-9	WS-AO-DS05360 Specifications	A-14
A-10	WS-ANT21 Specifications	A-17
A-11	WS-AO-DX13025 Specifications	A-19
A-12	Indoor/Outdoor Antennas	A-24
A-13	WS-AIO-2S18018 Specifications.....	A-24
A-14	WS-AIO-5S15090 Specifications.....	A-26
A-15	WS-AIO-2S14090 Specifications.....	A-29
A-16	WS-AIO-5S17017 Specifications.....	A-31
A-17	WS-AIO-2S07060 Specifications.....	A-32
A-18	WS-AIO-DS05120 Specifications	A-33
A-19	WS-AIO-5S12060 Specifications.....	A-35
A-20	Indoor Antennas	A-36
A-21	WS-AI-DT05120 Specifications	A-36
A-22	WS-AI-DT04360 Specifications	A-39
A-23	WS-AI-DS06360 Specifications	A-41
A-24	WS-AI-2S03360 Specifications	A-45
A-25	WS-AI-DX02360 Specifications	A-46
A-26	WS-ANT01 Specifications	A-48
A-27	WS-ANT02 Specifications	A-50
A-28	WS-AI-DX07025 Specifications	A-53
B-1	Pigtail Connection Specification	B-2
B-2	WS-CAB-L200C20 Cable Specification.....	B-3
B-3	WS-CAB-L400Cxx Cable Specifications	B-4
B-4	WS-CAB-L600Cxx Cable Specifications	B-5
B-5	Lightning Protector Specifications	B-6
B-6	Attenuator Specifications.....	B-7

About This Guide

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



Electrical Hazard: Only qualified personnel should perform installation procedures.

Riesgo Eléctrico: Solamente personal calificado debe realizar procedimientos de instalacion.

Elektrischer Gefahrenhinweis: Installationen sollten nur durch ausgebildetes und qualifiziertes Personal vorgenommen werden.

Intended Audience

The Enterasys Wireless 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 Enterasys Networks. To locate information about various subjects in this guide, refer to the following table.

For information about...	Refer to ...
Information for a sales engineer or site evaluator to determine the type of outdoor equipment needed to satisfy the customer's outdoor wireless requirements.	Chapter 1, AP Site Preparation
Information for an antenna installation professional and network manager to determine where to place the APs and lightning protection, and for an overview of cabling for the AP.	Chapter 2, AP Placement and Configuration
Instructions for an antenna installation professional to set up, install, and test the external antennas and cables.	Chapter 3, Antenna Installation
Specifications and radiation patterns for antennas.	Appendix A, Antenna Specifications
Specifications for the cables, pigtails, lightning protectors, and attenuators.	Appendix B, Accessory Specifications

Related Documents

Wireless documentation can be downloaded from the Enterasys download site.

<https://extranet.enterasys.com/downloads/>

Conventions Used in This Guide

The following conventions are used in this guide.



Note: Calls the reader's attention to any item of information that may be of special importance.



Caution: Contains information essential to avoid damage to the equipment.

Precaución: Contiene información esencial para prevenir dañar el equipo.

Achtung: Verweist auf wichtige Informationen zum Schutz gegen Beschädigungen.



Electrical Hazard: Warns against an action that could result in personal injury or death due to an electrical hazard.

Riesgo Electrico: Advierte contra una acción que pudiera resultar en lesión corporal o la muerte debido a un riesgo eléctrico.

Elektrischer Gefahrenhinweis: Warnung vor sämtlichen Handlungen, die zu Verletzung von Personen oder Todesfällen – hervorgerufen durch elektrische Spannung – führen können!



Warning: Warns against an action that could result in personal injury or death.

Advertencia: Advierte contra una acción que pudiera resultar en lesión corporal o la muerte.

Warnhinweis: Warnung vor Handlungen, die zu Verletzung von Personen oder gar Todesfällen führen können!

Getting Help

For additional support related to the antennas, or this document, contact Enterasys Networks using one of the following methods:

World Wide Web	http://www.enterasys.com/services/support/
Phone	1-800-872-8440 (toll-free in U.S. and Canada) or 1-603-952-5000 For the Enterasys Networks Support toll-free number in your country: http://www.enterasys.com/services/support/contact/
Email	support@enterasys.com To expedite your message, please type [Wireless] in the subject line.

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

- Your Enterasys Networks service contract number
- A description of the failure
- A description of any action(s) already taken to resolve the problem (for example, changing mode switches or rebooting the unit)
- The serial and revision numbers of all involved Enterasys Networks products in the network

-
- A description of your network environment (such as layout, cable type, other relevant environmental information)
 - Network load and frame size at the time of trouble (if known)
 - The device history (for example, if you have returned the device before, or if this a recurring problem)
 - Any previous Return Material Authorization (RMA) numbers

AP Site Preparation

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

For information about...	Refer to page...
Enterasys Wireless Access Points that Support External Antennas	1-1
Choosing Antennas for Wireless Network Configurations	1-2
Determining the Antenna Locations	1-3
Antenna Models	1-14
Cable Options	1-18
Lightning Protector	1-18
Pigtail Connection Options	1-19
Contacting an Antenna Installation Company	1-19



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. Enterasys 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.

Advertencia: los prerequisites del sitio debe verificarlos una persona que esté familiarizada con los códigos nacionales, códigos eléctricos locales y cualquier otra regulación que aplique con referencia a este tipo de instalación. Enterasys Networks, sus socios, revendedores y distribuidores no se hacen responsables por cualquier daño o perjuicio personal, daños a la propiedad o por la violación de las regulaciones gubernamentales que puedan surgir por no acatar las instrucciones de esta guía.

Warnhinweis: Der Installationsort muss von einer qualifizierten Person geprüft werden, die mit den landesweiten und örtlichen Vorschriften und Richtlinien für Installationen dieser Art vertraut ist. Weder Enterasys Networks noch dessen Channel Partner, Reseller oder Distributoren haften für Personen- oder Sachschaden oder Gesetzesverstöße, die auf eine unzureichende Befolgung dieser Anleitung zurückzuführen sind.

Enterasys Wireless Access Points that Support External Antennas

Not all antennas listed in this document can be used by all wireless access points. Use [Table 1-1](#) to determine if your access point supports external antennas. [Table 1-9](#) on page 1-14 identifies which antennas are supported by each AP.

Table 1-1 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
WS-AP3640	Yes
WS-AP3660	Yes
WS-AP3705i	No
WS-AP3710i	No
WS-AP3710e	Yes
WS-AP3765i	No
WS-AP3765e	Yes
WS-AP3767e	Yes



Note: In the rest of this book, for simplicity, references to 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. [Table 1-2](#) lists the general type of antenna to use for various wireless network configurations.

Table 1-2 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

Table 1-2 Antennas for Wireless Network Configurations (continued)

Network Configuration	Description	Antenna Type
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 sector 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 Enterasys Wireless antennas are described in [Chapter 3](#).
- 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.

Outdoor Distances with Cables

[Table 1-3](#) on page 1-4 lists the outdoor distances for AP3620 and AP3640. [Table 1-4](#) on page 1-5 lists the outdoor distances for AP2620. [Table 1-5](#) on page 1-6 lists the outdoor distances for AP3660. [Table 1-6](#) on page 1-9 lists the outdoor distances for AP3765e and AP3767e.

- All calculations account for outdoor RF links between two APs configured with the same antenna and cabling on both ends.
- The transmit power used for each antenna is the minimum allowed power for that antenna in the frequency band (country is US).
- The distance between the APs is calculated based on the free space Line of Sight and include the Fade margin. A Fade margin of 10 dB is used to account for different environmental conditions.
- The throughput for the AP2620 is estimated as theoretical throughput with unidirectional traffic, no retries, and a 15% packet error rate (PER).

- The throughput for the AP3620, AP3640, and AP3660 is estimated as theoretical throughput with A-MPDU aggregated, unidirectional traffic, no retries, and a 15% packet error rate (PER).



Notes: The distances listed in [Table 1-3](#), [Table 1-4](#), [Table 1-5](#), and [Table 1-6](#) are approximate and are not meant to replace a general RF survey tool. Use this information only as a guideline for the maximum distances between APs and throughput on point-to-point links.

The signal rates listed in tables [Table 1-3](#) and [Table 1-5](#), are 400ns short guard interval (GI) data rates.

Table 1-3 Distance Between AP3620/AP3640 Antennas (LAN to LAN/Multipoint)

GHz	Antenna Model	Pigtail and Cable	Gain	Signal Rate (Mbps)	Modulation	Maximum Distance (meters)	Maximum Throughput (Mbps)
2.4	WS-AO-DS05360	WS-CAB-L600C25	5	300	HT40 MCS15	21	171.8
		WS-CAB-L600C25	5	45	HT40 MCS2	168	35.7
		WS-CAB-L600C25	5	130	HT20 MCS15	38	91.3
		WS-CAB-L600C25	5	21	HT20 MCS2	266	17.3
		WS-CAB-L600C25	5	300	HT40 MCS15	16	171.8
		WS-CAB-L600C25	5	45	HT40 MCS2	130	35.7
		WS-CAB-L600C25	5	130	HT20 MCS15	29	91.3
		WS-CAB-L600C25	5	21	HT20 MCS2	206	17.3
5.7 to 5.8	WS-AO-5D16060	WS-CAB-L600C25	16	300	HT40 MCS15	93	171.8
		WS-CAB-L600C25	16	45	HT40 MCS2	785	35.7
		WS-CAB-L600C25	16	130	HT20 MCS15	148	91.3
		WS-CAB-L600C25	16	21	HT20 MCS2	1108	17.3
		WS-CAB-L600C25	16	300	HT40 MCS15	62	171.8
		WS-CAB-L600C25	16	45	HT40 MCS2	518	35.7
		WS-CAB-L600C25	16	130	HT20 MCS15	98	91.3
		WS-CAB-L600C25	16	21	HT20 MCS2	732	17.3
	WS-AO-5D23009	WS-CAB-L600C25	23	300	HT40 MCS15	417	171.8
		WS-CAB-L600C25	23	45	HT40 MCS2	2088	35.7
		WS-CAB-L600C25	23	130	HT20 MCS15	660	91.3
		WS-CAB-L600C25	23	21	HT20 MCS2	2949	17.3
		WS-CAB-L600C25	23	300	HT40 MCS15	275	171.8
		WS-CAB-L600C25	23	45	HT40 MCS2	1379	35.7
		WS-CAB-L600C25	23	130	HT20 MCS15	436	91.3
		WS-CAB-L600C25	23	21	HT20 MCS2	1948	17.3

Table 1-4 Distance Between AP2620 Antennas (LAN to LAN/Point-to-Point)

GHz	Antenna Model	Pigtail and Cable	Gain	Signal Rate (Mbps)	Maximum Distance (meters)	Maximum Throughput (Mbps)
2.4	WS-AIO-2S14090	WS-CAB-L600-C25	14	54	335	26.3
		WS-CAB-L600-C25	14	36	944	20.3
		WS-CAB-L600-C25	14	6	3348	4.6
		WS-CAB-L600C50	14	54	260	26.3
		WS-CAB-L600C50	14	36	732	20.3
		WS-CAB-L600C50	14	6	2599	4.6
	WS-AIO-2S18018	WS-CAB-L600-C25	18	54	841	26.3
		WS-CAB-L600-C25	18	36	2370	20.3
		WS-CAB-L600-C25	18	6	8410	4.6
		WS-CAB-L600C50	18	54	653	26.3
		WS-CAB-L600C50	18	36	1840	20.3
		WS-CAB-L600C50	18	6	6528	4.6
5.7 to 5.8	WS-AIO-5S15090	WS-CAB-L600-C25	15	54	148	26.3
		WS-CAB-L600-C25	15	36	417	20.3
		WS-CAB-L600-C25	15	6	1478	4.6
		WS-CAB-L600C50	15	54	98	26.3
		WS-CAB-L600C50	15	36	275	20.3
		WS-CAB-L600C50	15	6	976	4.6
	WS-AIO-5S17017	WS-CAB-L600-C25	17	54	234	26.3
		WS-CAB-L600-C25	17	36	660	20.3
		WS-CAB-L600-C25	17	6	2342	4.6
		WS-CAB-L600C50	17	54	155	26.3
		WS-CAB-L600C50	17	36	436	20.3
		WS-CAB-L600C50	17	6	1548	4.6

Table 1-5 Distance Between AP3660 Antennas (LAN to LAN/MultiPoint)

GHz	Antenna Model	Pigtail and Cable	Antenna Gain	11n Rate	Channel Width (MHz)	Signal Rate (Mbps)	Maximum Distance (meters)	Maximum Thruput (Mbps)
2.4	WS-AO-DS05360	WS-CAB-L600C25	5	MCS15	40	300	67	171.8
		WS-CAB-L600C25	5	MCS2	40	45	355	35.7
		WS-CAB-L600C25	5	MCS15	20	130	119	91.3
		WS-CAB-L600C25	5	MCS2	20	21	944	17.3
		WS-CAB-L400-C06	5	MCS15	40	300	87	171.8
		WS-CAB-L400-C06	5	MCS2	40	45	462	35.7
		WS-CAB-L400-C06	5	MCS15	20	130	155	91.3
		WS-CAB-L400-C06	5	MCS2	20	21	1230	17.3
2.4	WS-AO-DT05120	WS-CAB-L600C25	5	MCS15	40	300	54	171.8
		WS-CAB-L600C25	5	MCS2	40	45	339	35.7
		WS-CAB-L600C25	5	MCS15	20	130	85	91.3
		WS-CAB-L600C25	5	MCS2	20	21	676	17.3
		WS-CAB-L400-C06	5	MCS15	40	300	87	171.8
		WS-CAB-L400-C06	5	MCS2	40	45	549	35.7
		WS-CAB-L400-C06	5	MCS15	20	130	138	91.3
		WS-CAB-L400-C06	5	MCS2	20	21	1096	17.3
2.4	WS-AO-DT05120-1	Direct Connect	5	MCS15	40	300	100	171.8
		Direct Connect	5	MCS2	40	45	891	35.7
		Direct Connect	5	MCS15	20	130	158	91.3
		Direct Connect	5	MCS15	40	300	100	171.8
2.4	WS-ANT21	Direct Connect	5	MCS15	40	300	100	171.8
		Direct Connect	5	MCS2	40	45	891	35.7
		Direct Connect	5	MCS15	20	130	158	91.3
		Direct Connect	5	MCS2	20	21	1258	17.3
2.4	WS-AO-2S10360	WS-CAB-L600C25	10	MCS15	40	300	170	171.8
		WS-CAB-L600C25	10	MCS2	40	45	1011	35.7
		WS-CAB-L600C25	10	MCS15	20	130	269	91.3
		WS-CAB-L600C25	10	MCS2	20	21	2137	17.3
		WS-CAB-L400-C06	10	MCS15	40	300	275	171.8
		WS-CAB-L400-C06	10	MCS2	40	45	1640	35.7
		WS-CAB-L400-C06	10	MCS15	20	130	436	91.3
		WS-CAB-L400-C06	10	MCS2	20	21	3466	17.3

Table 1-5 Distance Between AP3660 Antennas (LAN to LAN/MultiPoint) (continued)

GHz	Antenna Model	Pigtail and Cable	Antenna Gain	11n Rate	Channel Width (MHz)	Signal Rate (Mbps)	Maximum Distance (meters)	Maximum Thruput (Mbps)
2.4	WS-AIO-2S18018	WS-CAB-L600-C25	18	MCS15	40	300	851	171.8
		WS-CAB-L600-C25	18	MCS2	40	45	4264	35.7
		WS-CAB-L600-C25	18	MCS15	20	130	1697	91.3
		WS-CAB-L600-C25	18	MCS2	20	21	8507	17.3
		WS-CAB-L400-C06	18	MCS15	40	300	1380	171.8
		WS-CAB-L400-C06	18	MCS2	40	45	6915	35.7
		WS-CAB-L400-C06	18	MCS15	20	130	2753	91.3
		WS-CAB-L400-C06	18	MCS2	20	21	13797	17.3
5.7-5.8	WS-AO-5S10360	WS-CAB-L600C25	10	MCS15	40	300	74	171.8
		WS-CAB-L600C25	10	MCS2	40	45	660	35.7
		WS-CAB-L600C25	10	MCS15	20	130	117	91.3
		WS-CAB-L600C25	10	MCS2	20	21	932	17.3
		WS-CAB-L400-C06	10	MCS15	40	300	120	171.8
		WS-CAB-L400-C06	10	MCS2	40	45	1071	35.7
		WS-CAB-L400-C06	10	MCS15	20	130	190	91.3
		WS-CAB-L400-C06	10	MCS2	20	21	1512	17.3
5.7-5.8	WS-AO-5D16060	WS-CAB-L600C25	16	MCS15	40	300	295	171.8
		WS-CAB-L600C25	16	MCS2	40	45	2481	35.7
		WS-CAB-L600C25	16	MCS15	20	130	467	91.3
		WS-CAB-L600C25	16	MCS2	20	21	3505	17.3
		WS-CAB-L400-C06	16	MCS15	40	300	478	171.8
		WS-CAB-L400-C06	16	MCS2	40	45	4024	35.7
		WS-CAB-L400-C06	16	MCS15	20	130	758	91.3
		WS-CAB-L400-C06	16	MCS2	20	21	5684	17.3
5.7-5.8	WS-AO-5D23009	WS-CAB-L600C25	23	MCS15	40	300	1478	171.8
		WS-CAB-L600C25	23	MCS2	40	45	13172	35.7
		WS-CAB-L600C25	23	MCS15	20	130	2342	91.3
		WS-CAB-L600C25	23	MCS2	20	21	18605	17.3
		WS-CAB-L400-C06	23	MCS15	40	300	2397	171.8
		WS-CAB-L400-C06	23	MCS2	40	45	21362	35.7
		WS-CAB-L400-C06	23	MCS15	20	130	3799	91.3
		WS-CAB-L400-C06	23	MCS2	20	21	30174	17.3

Table 1-5 Distance Between AP3660 Antennas (LAN to LAN/MultiPoint) (continued)

GHz	Antenna Model	Pigtail and Cable	Antenna Gain	11n Rate	Channel Width (MHz)	Signal Rate (Mbps)	Maximum Distance (meters)	Maximum Thruput (Mbps)
5.7-5.8	WS-AO-DS05360	WS-CAB-L600C25	5	MCS15	40	300	29	171.8
		WS-CAB-L600C25	5	MCS2	40	45	206	35.7
		WS-CAB-L600C25	5	MCS15	20	130	52	91.3
		WS-CAB-L600C25	5	MCS2	20	21	327	17.3
		WS-CAB-L400-C06	5	MCS15	40	300	38	171.8
		WS-CAB-L400-C06	5	MCS2	40	45	269	35.7
		WS-CAB-L400-C06	5	MCS15	20	130	68	91.3
		WS-CAB-L400-C06	5	MCS2	20	21	426	17.3
5.7-5.8	WS-AO-DT05120	WS-CAB-L600C25	5	MCS15	40	300	23	171.8
		WS-CAB-L600C25	5	MCS2	40	45	209	35.7
		WS-CAB-L600C25	5	MCS15	20	130	37	91.3
		WS-CAB-L600C25	5	MCS2	20	21	295	17.3
		WS-CAB-L400-C06	5	MCS15	40	300	38	171.8
		WS-CAB-L400-C06	5	MCS2	40	45	339	35.7
		WS-CAB-L400-C06	5	MCS15	20	130	60	91.3
		WS-CAB-L400-C06	5	MCS2	20	21	478	17.3
5.7-5.8	WS-AO-DT05120-1	Direct Connect	5	MCS15	40	300	44	171.8
		Direct Connect	5	MCS2	40	45	389	35.7
		Direct Connect	5	MCS15	20	130	69	91.3
		Direct Connect	5	MCS15	40	300	44	171.8
5.7-5.8	WS-ANT21	Direct Connect	7	MCS15	40	300	69	171.8
		Direct Connect	7	MCS2	40	45	616	35.7
		Direct Connect	7	MCS15	20	130	110	91.3
		Direct Connect	7	MCS2	20	21	870	17.3

Table 1-6 Distance Between AP3765e and AP3767e Antennas (LAN to LAN/MultiPoint)

GHz	Antenna Model	Pigtail and Cable (All connections need Lightning Protectors)	Antenna Gain	11n Rate	Channel Width (MHz)	Signal Rate (Mbps)	Max Dist (meters)	Max Thruput (Mbps)
2.4	WS-AO-DS05360	WS-CAB-L600C25	5	MCS15	40	300	67	171.8
		WS-CAB-L600C25	5	MCS2	40	45	355	35.7
		WS-CAB-L600C25	5	MCS15	20	130	119	91.3
		WS-CAB-L600C25	5	MCS2	20	21	944	17.3
		WS-CAB-L400-C06	5	MCS15	40	300	87	171.8
		WS-CAB-L400-C06	5	MCS2	40	45	462	35.7
		WS-CAB-L400-C06	5	MCS15	20	130	155	91.3
		WS-CAB-L400-C06	5	MCS2	20	21	1230	17.3
2.4	WS-AO-DT05120-1	Direct Connect+LP	5	MCS15	40	300	112	171.8
		Direct Connect+LP	5	MCS2	40	45	1777	35.7
		Direct Connect+LP	5	MCS15	20	130	224	91.3
		Direct Connect+LP	5	MCS15	20	300	224	171.8
2.4	WS-AO-2S10360	WS-CAB-L600C25+LP	10	MCS15	40	300	190	171.8
		WS-CAB-L600C25+LP	10	MCS2	40	45	2264	35.7
		WS-CAB-L600C25+LP	10	MCS15	20	130	380	91.3
		WS-CAB-L600C25+LP	10	MCS2	20	21	3800	17.3
		WS-CAB-L400-C06+LP	10	MCS15	40	300	309	171.8
		WS-CAB-L400-C06+LP	10	MCS2	40	45	3671	35.7
		WS-CAB-L400-C06+LP	10	MCS15	20	130	616	91.3
		WS-CAB-L400-C06+LP	10	MCS2	20	21	6163	17.3
2.4	WS-AIO-2S18018	WS-CAB-L600-C25+LP	18	MCS15	40	300	955	171.8
		WS-CAB-L600-C25+LP	18	MCS2	40	45	9545	35.7
		WS-CAB-L600-C25+LP	18	MCS15	20	130	2398	91.3
		WS-CAB-L600-C25+LP	18	MCS2	20	21	16974	17.3
		WS-CAB-L400-C06+LP	18	MCS15	40	300	1548	171.8
		WS-CAB-L400-C06+LP	18	MCS2	40	45	15481	35.7
		WS-CAB-L400-C06+LP	18	MCS15	20	130	3889	91.3
		WS-CAB-L400-C06+LP	18	MCS2	20	21	27529	17.3

Table 1-6 Distance Between AP3765e and AP3767e Antennas (LAN to LAN/MultiPoint) (continued)

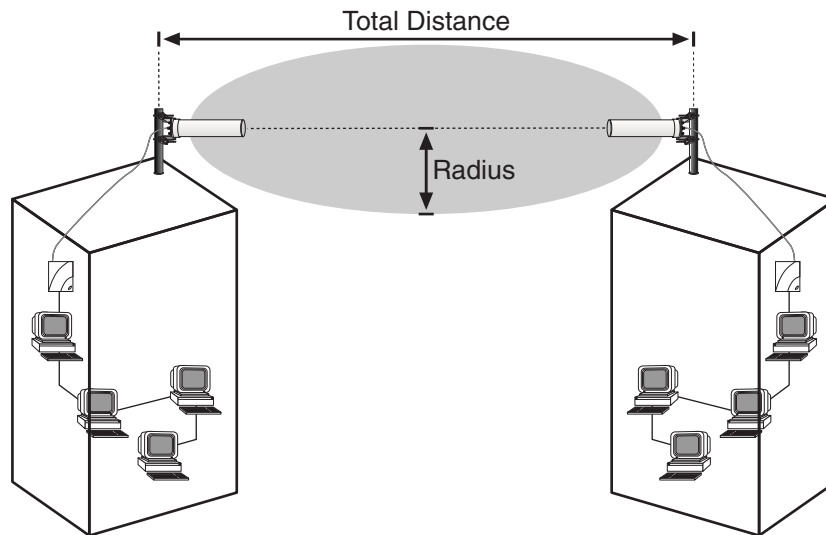
GHz	Antenna Model	Pigtail and Cable (All connections need Lightning Protectors)	Antenna Gain	11n Rate	Channel Width (MHz)	Signal Rate (Mbps)	Max Dist (meters)	Max Thruput (Mbps)
2.4	WS-AO-DS05360	WS-CAB-L600C25+LP	5	MCS15	40	300	84	171.8
		WS-CAB-L600C25+LP	5	MCS2	40	45	1000	35.7
		WS-CAB-L600C25+LP	5	MCS15	20	130	168	91.3
		WS-CAB-L600C25+LP	5	MCS2	20	21	1883	17.3
		WS-CAB-L400-C06+LP	5	MCS15	40	300	110	171.8
		WS-CAB-L400-C06+LP	5	MCS2	40	45	1303	35.7
		WS-CAB-L400-C06+LP	5	MCS15	20	130	219	91.3
		WS-CAB-L400-C06+LP	5	MCS2	20	21	2454	17.3
5.7-5.8	WS-AO-5S10360	WS-CAB-L600C25+LP	10	MCS15	40	300	116	171.8
		WS-CAB-L600C25+LP	10	MCS2	40	45	1839	35.7
		WS-CAB-L600C25+LP	10	MCS15	20	130	232	91.3
		WS-CAB-L600C25+LP	10	MCS2	20	21	2315	17.3
		WS-CAB-L400-C06+LP	10	MCS15	40	300	151	171.8
		WS-CAB-L400-C06+LP	10	MCS2	40	45	2397	35.7
		WS-CAB-L400-C06+LP	10	MCS15	20	130	302	91.3
		WS-CAB-L400-C06+LP	10	MCS2	20	21	3017	17.3
5.7-5.8	WS-AO-DS05360	WS-CAB-L600C25+LP	5	MCS15	40	300	37	171.8
		WS-CAB-L600C25+LP	5	MCS2	40	45	582	35.7
		WS-CAB-L600C25+LP	5	MCS15	20	130	73	91.3
		WS-CAB-L600C25+LP	5	MCS2	20	21	732	17.3
		WS-CAB-L400-C06+LP	5	MCS15	40	300	48	171.8
		WS-CAB-L400-C06+LP	5	MCS2	40	45	758	35.7
		WS-CAB-L400-C06+LP	5	MCS15	20	130	95	91.3
		WS-CAB-L400-C06+LP	5	MCS2	20	21	954	17.3
5.7-5.8	WS-AO-DT05120-1	Direct Connect+LP	5	MCS15	40	300	49	171.8
		Direct Connect+LP	5	MCS2	40	45	776	35.7
		Direct Connect+LP	5	MCS15	20	130	98	91.3
		Direct Connect+LP	5	MCS15	40	300	98	171.8

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 [Figure 1-1](#). 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 1-1 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 in order to be line of sight. In addition to the Fresnel Zone height requirement, earth curvature may become a factor in paths longer than 2 Km. The additional antenna height can be calculated using the following formula:

$$H = D^2 / 51499$$

Where

D = Distance between the antennas in kilometers

H = Height required to overcome earth curvature

[Table 1-7](#) on page 1-12 and [Table 1-8](#) on page 1-12 list typical antenna height requirements.

Table 1-7 Typical Antenna Height Requirements — 2.4 GHz

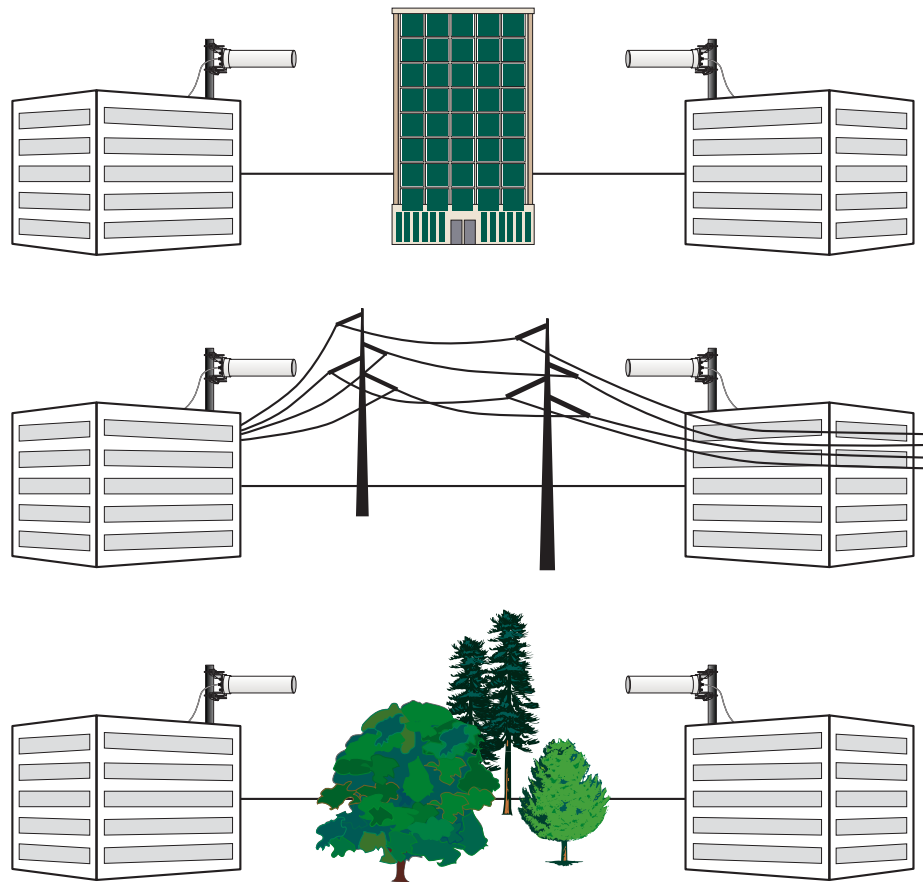
2.4 GHz			
Distance between Tx and Rx antennas (km)	Fresnel Zone radius (meters)	Earth curvature (meters)	Minimum antenna height requirements (meters)
2	7.9	0.08	7.98
5	12.5	0.49	12.99
10	17.67	1.94	19.61
15	21.64	4.37	26.01
20	25	7.77	32.77
25	28	12.14	40.14
30	30.6	17.48	48.08

Table 1-8 Typical Antenna Height Requirements — 5 GHz

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 [Figure 1-2](#) on page 1-13.

Figure 1-2 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 3-3.

- **Antenna Height**

If you are mounting the antenna on a roof, the antenna must have minimum clearance as specified in [Table 1-7](#) on page 1-12 and [Table 1-8](#) on page 1-12.

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

Table 1-9 on page 1-14 lists and provides a brief description of the antenna models offered by Enterasys Networks for use with Enterasys Wireless APs. Refer to [Chapter 3](#) for antenna installation instructions.

Table 1-9 Supported External Antennas Listed by AP

Enterasys Wireless AP	Model	Application	Description	Gain (dBi)	Frequency (MHz)	Connector Type
AP3710e	WS-AI-DT04360	Indoor	Omni-Directional, 3 inputs	4 3	2400-2500 4900-5990	Reverse Polarity SMA Plugs, 3 each
	WS-AI-DT05120	Indoor	120 Degree Sector Directional, 3 inputs	5 5	2300-2700 4900-6100	Reverse Polarity SMA Plugs, 3 each
	WS-AI-DX02360	Indoor	Omni-Directional	2 2	2400-2500 5.1-5.85	Reverse Polarity SMA Plugs, 6 each
	WS-AI-DX07025	indoor	Directional MIMO Panel	6.5 5.5	2400-2500 5100-5900	Reverse Polarity SMA Plugs, 6 each
AP3765e/ AP3767e	WS-AO-DX13025	outdoor, stadium	Directional MIMO Panel	12.5 11.5	2400-2500 5100-5900	Reverse Polarity Type-N Plug
	WS-AO-5D16060	outdoor, sector	Dual-polarization Panel 802.11a/bg	16	5150-5875	Reverse Polarity Type-N Jack
	WS-AO-5D23009	outdoor, point-to-point	Dual-polarization Panel 802.11a	23	5000	Reverse Polarity Type-N Jack

Table 1-9 Supported External Antennas Listed by AP (continued)

Enterasys Wireless AP	Model	Application	Description	Gain (dBi)	Frequency (MHz)	Connector Type
AP3765e/ AP3767e	WS-AO-DT05120-1	outdoor, sector	120 Degree Sector, Triple-Feed	5	2300-2700 4900-6100	Reverse Polarity Type-N Plugs
	WS-AIO-2S18018	indoor/ outdoor	Panel	18	2300-2500	Reverse Polarity Type-N Jack
	WS-AO-2S10360	outdoor	Omni-Directional	10	2400	Reverse Polarity Type-N Jack
	WS-AO-5S10360	outdoor	Omni-Directional	10	5000	Reverse Polarity Type-N Jack
	WS-AO-DS05360	outdoor	Omni-Directional Baton	5	2400-2500 5150-5350	Reverse Polarity Type-N Jack
AP3620/ AP3640	WS-ANT02	indoor	Omni-Directional	4	2400-2500 5150-5900	Reverse Polarity SMA Plug
	WS-AO-DS05360	outdoor	Omni-Directional	5	2400-2500 5150-5350	Reverse Polarity Type-N Jack
	WS-AO-5D16060	outdoor	60 Degree Sector Directional, 2 Inputs	16	5150-5875	Reverse Polarity Type-N Jack, 2 each
	WS-AO-5D23009	outdoor	Panel, 2 Inputs	23	5150-5875	Reverse Polarity Type-N Jack, 2 each
	WS-AI-DT04360	indoor	Omni, 3 Inputs	3	2400-2500	Reverse Polarity SMA Plugs, 3 each
				4	4900-5990	
	WS-AI-DT05120	indoor	120 Degree Sector Directional, 3 Inputs	5	2300-2700 4900-6100	Reverse Polarity SMA Plugs, 3 each

Table 1-9 Supported External Antennas Listed by AP (continued)

Enterasys Wireless AP	Model	Application	Description	Gain (dBi)	Frequency (MHz)	Connector Type
AP3660	WS-AO-DS05360	outdoor	Omni-Baton	5	2400-2500 5150-5350	Reverse Polarity Type- N Jack
	WS-AO-2S10360	outdoor	Omni-Baton	10	2400-2500	Reverse Polarity Type- N Jack
	WS-AO-DT05120	outdoor	120 Degree Sector, Triple-Feed, MIMO	5	2300-2700 4900-6100	Reverse Polarity Type- N Jacks, 3 each
	WS-AO-5S10360	outdoor	Omni-Baton	10	5000	Reverse Polarity Type- N Jack
	WS-AO-5D16060	outdoor	60 Degree Sector Dual Polarization	16	5150-5875	Reverse Polarity Type- N Jacks, 2 each
	WS-AO-5D23009	outdoor	9 Degree Panel, dual polarization, point-to-point	23	5150-5875	Reverse Polarity Type- N Jacks, 2 each
	WS-AIO-2S18018	indoor/ outdoor	18 Degree Panel	18	2300-2500	Reverse Polarity Type-N Jacks
	WS-AO-DT05120-1	outdoor	120 Degree Sector, Triple-Feed	5	2300-2700 4900-6100	Reverse Polarity Type- N Plugs on 12" pigtailed, 3 each
	WS-ANT21	outdoor	Omni-Baton	5 7	2400-2500 4940-5925	Reverse Polarity Type- N Plug
	WS-AO-DX13025	outdoor, stadium	Directional MIMO Panel	12.5 11.5	2400-2500 5100-5900	Reverse Polarity Type- N Plug

Table 1-9 Supported External Antennas Listed by AP (continued)

Enterasys Wireless AP	Model	Application	Description	Gain (dBi)	Frequency (MHz)	Connector Type
AP2620	WS-ANT01	indoor	Omni-Directional 802.11a/bg	4	2400-2500 5150-5900	Reverse Polarity SMA Plug
	WS-AO-DS05360	outdoor	Omni-Directional Baton	5	2400-2500 5150-5350	Reverse Polarity Type-N Jack
	WS-AIO-5S12060	indoor	Panel	12	2400-2500 4900-5990	Reverse Polarity Type-N Jack
	WS-AI-2S03360	indoor	Omni-Directional 802.11a/bg	3.5	2400-2500	Reverse Polarity SMA Plugs
	WS-AI-DS06360	indoor	Omni-Directional 802.11a/bg	5 6	2300-2700 4900-6000	Reverse Polarity Type-N Jack
	WS-AIO-DS05120	indoor/ outdoor	Panel (ceiling) Antenna 802.11a/bg	5	2400-2500	Reverse Polarity Type-N Jack
	WS-AIO-2S07060	indoor/ outdoor	Panel Antenna 802.11a	7.5	2300-2600 4900-6000	Reverse Polarity Type-N Jack
	WS-AIO-5S17017	indoor/ outdoor	Panel	17	5470-5850	Reverse Polarity Type-N Jack
	WS-AIO-2S14090	indoor/ outdoor	Panel Antenna 802.11bg	14	2400-2485	Reverse Polarity Type-N Jack
	WS-AIO-5S15090	indoor/ outdoor	Panel Antenna 802.11a	15	4900-6000	Reverse Polarity Type-N Jack
	WS-AIO-2S18018	indoor/ outdoor	Panel	18	2300-2500	Reverse Polarity Type-N Jack

Cable Options

The low-loss, outdoor, watertight cables that you use to connect the outdoor APs to an antenna are available in the lengths listed in [Table 1-10](#). All cables have Reverse Polarity Type-N plugs on both ends.



Note: Watertight cables are not required when using external antennas WS-AO-DT05120-1 and WS-ANT21 with the AP3660. These antennas can be directly connected to the AP3660.

Table 1-10 Cable Options and Model Numbers

Model Number	Description
WS-CAB-L200C20	20 feet (6.1 meters) LMR400
WS-CAB-L400C06	6 feet (1.8 meters) LMR400
WS-CAB-L400C50	50 feet (15.24 meters) LMR400
WS-CAB-L400C75	75 feet (22 meters) LMR400 Before choosing the WS-CAB-L400C75 low-loss cable, see Table 1-3 on page 1-4, Table 1-4 on page 1-5, or Table 1-5 on page 1-6 to make sure this cable is appropriate for your network.
WS-CAB-L600C25	25 feet (7.6 meters) LMR600
WS-CAB-L600C50	50 feet (15.24 meters) LMR600

To ensure you order the right cable length, carefully determine the distance between the locations where you intend to mount the external antenna.



Note: Enterasys Networks recommends using LMR600 (part numbers WS-CAB-L600C25 and WS-CAB-L600C50) for 5 GHz.

Cable specifications are provided in [Appendix B](#).

Lightning Protector

[Table 1-11](#) provides information about the lightning protector for use with Enterasys Wireless external antennas. For more information about the lightning protector, see “[Grounding System](#)” on page 3-3.

Table 1-11 Lightning Protector

Model Number	Description
WS-CAB-LPM	Reverse Polarity Type-N Jack

Lightning protector specifications are provided in [Appendix B](#), *Lightning Protector* on page B-6.

Pigtail Connection Options

The Pigtail Connection is a proprietary cable used to connect the AP to an external antenna system.

One end of the cable has a Reverse Polarity SMA (RPSMA) plug that connects to the AP. The other end has a Reverse Polarity Type-N (Reverse-N) jack or plug to connect to your antenna cabling system. Select the connector type based on your cable configuration. [Table 1-12](#) lists the pigtail options.

Table 1-12 Pigtail Options

Model Number	Connectors	Description
WS-CAB-PT20P	Reverse Polarity SMA Plugs to a Reverse Polarity Type-N Plug. Both connectors have a male body/ female center contact (LMR100).	Used when connecting the AP directly to an antenna, or to the lightning protector. Used when not using a cable between the AP and the antenna.
WS-CAB240-PT20P	Reverse Polarity SMA Plugs to a Reverse Polarity Type-N Plug. Both connectors have a male body/ female center contact (LMR240).	Used when connecting the AP directly to an antenna, or to the lightning protector. Used when not using a cable between the AP and the antenna.
WS-CAB-PT20J	Reverse Polarity SMA Plugs to a Reverse Polarity Type-N Jack. Both connectors have a male body/ female center contact (LMR100).	Used when connecting the pigtail cable to a cable before connecting it to the lightning protector or antenna.

Pigtail connections are described in [Appendix B, Pigtail Connection](#) on page B-2.

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.

Lightning Protection

- ☒ 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.

AP Placement and Configuration

This chapter provides information for the antenna installer and network manager to determine where to place Enterasys Wireless APs and lightning protectors. This chapter also shows how to attach external antennas to the APs.

For information about...	Refer to page...
Determining the Location of the AP	2-1
Enterasys Wireless AP2620	2-2
Enterasys Wireless AP3620 and AP3640	2-4
Enterasys Wireless AP3660	2-6
Enterasys Wireless AP3765e and AP3767e	2-7
Enterasys Wireless AP3710e	2-9

Determining the Location of the AP

An Enterasys Wireless 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 Enterasys Wireless AP and lightning protector must satisfy the following requirements:

- 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.



Note: This requirement does not apply to the AP3660, AP3765, and AP3767e, 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.
- 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.
- Enterasys Networks recommends using LMR200 or LMR400 cable for 2.4 GHz and LMR600 for 5GHz.

Enterasys Wireless AP2620

Figure 2-1, illustrates the Enterasys Wireless AP2620 to antenna cable configurations. Table 2-1 on page 2-3 lists the AP2620 to antenna cable components.

Figure 2-1 AP2620 Installation Overview

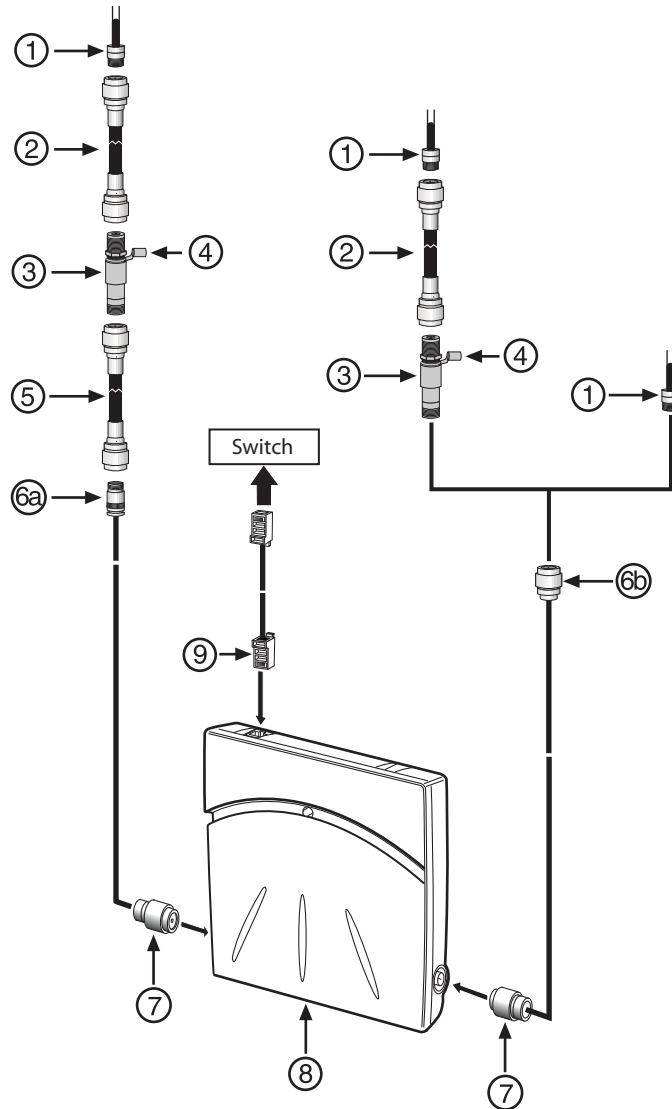


Table 2-1 Enterasys Wireless AP2620 Installation Components

Component	Description
1	Antenna connector (Reverse Polarity Type-N jack)
2	Cable from antenna to lightning protector (Reverse Polarity Type-N plugs on both ends)
3	Lightning protector (Reverse Polarity Type-N jacks on both ends)
4	Lightning protector ground terminal
5	Cable from lightning protector to AP pigtail (Reverse Polarity Type-N plugs on both ends)
6a	AP pigtail (Reverse Polarity SMA plug to Reverse Polarity Type-N jack)
6b	AP pigtail (Reverse Polarity SMA plug to Reverse Polarity Type-N plug)
7	AP pigtail connector to AP external antenna connector
8	AP2620 Access Point
9	Connection to switch

Enterasys Wireless AP3620 and AP3640

Figure 2-2 illustrates the Enterasys Wireless AP3620 and AP3640 to antenna cable configurations. Table 2-2 on page 2-5 lists the AP3620 and AP3640 installation components.

Figure 2-2 AP3620 and AP3640 Installation Overview

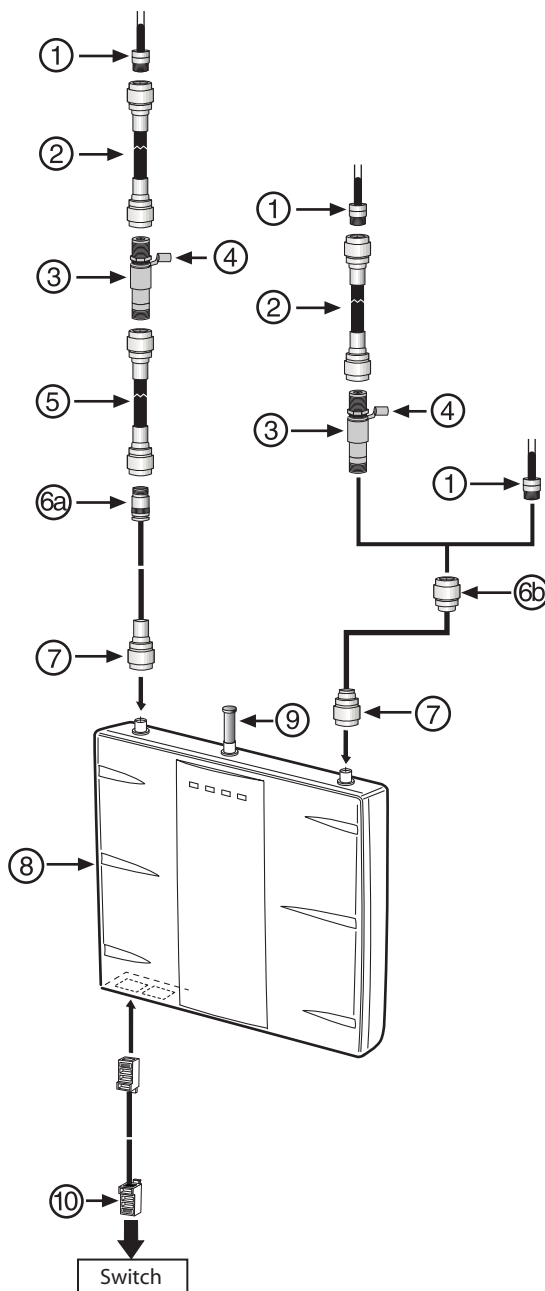


Table 2-2 Enterasys Wireless AP3620 and AP3640 Installation Components

Component	Description
1	Antenna connector (Reverse Polarity Type-N jack)
2	Cable from antenna to lightning protector (Reverse Polarity Type-N plugs on both ends)
3	Lightning protector (Reverse Polarity Type-N jacks on both ends)
4	Lightning protector ground terminal
5	Cable from lightning protector to AP pigtail (Reverse Polarity Type-N plugs on both ends)
6a	AP pigtail (Reverse Polarity SMA plug to Reverse Polarity Type-N jack)
6b	AP pigtail (Reverse Polarity SMA plug to Reverse Polarity Type-N plug)
7	AP pigtail connector to AP external antenna connector
8	AP3620/AP3640 Access Point
9	Terminator cap used when the AP does not perform wireless data transmission on this connector
10	Connection to switch

Enterasys Wireless AP3660

Figure 2-3 illustrates the Enterasys Wireless AP3660 to antenna cable configurations. Table 2-3 on page 2-6 lists the AP3660 installation components.

Figure 2-3 AP 3660 Installation

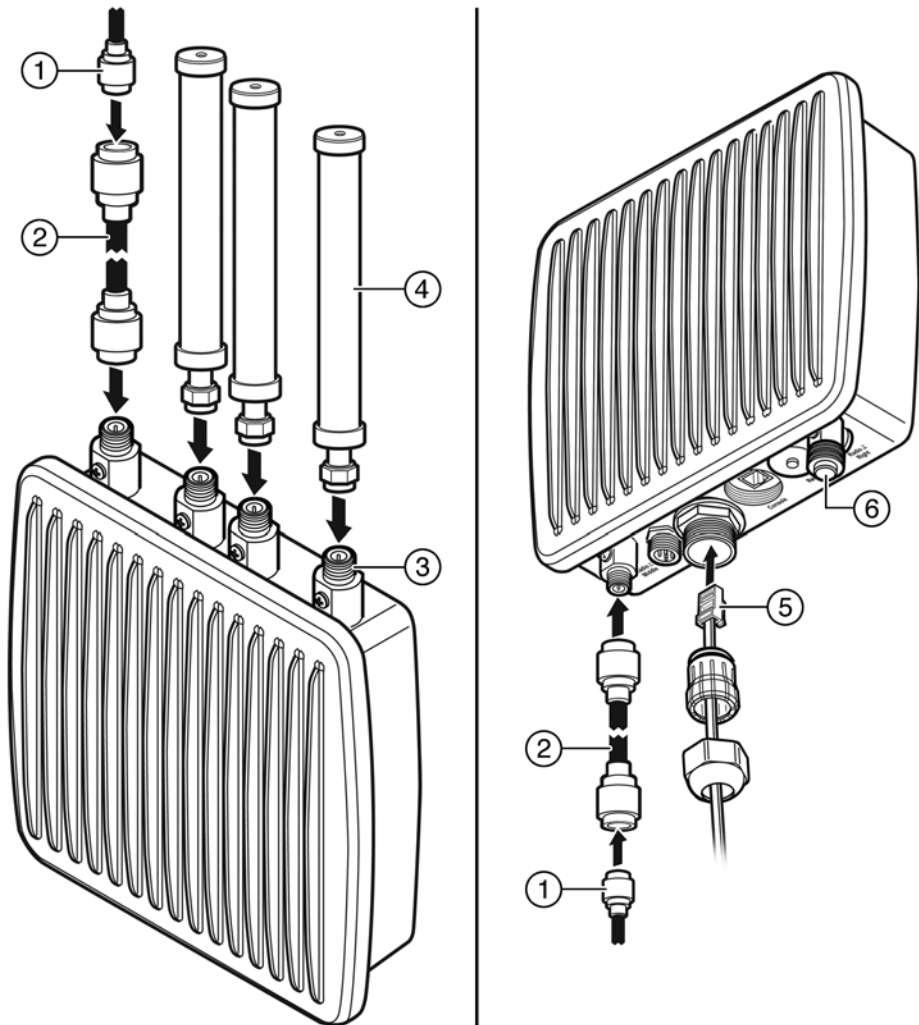


Table 2-3 Enterasys Wireless AP3660 Installation Components

Component	Description
1	Antenna connector (Reverse Polarity Type-N jack)
2	Cable from antenna to AP3660 (Reverse Polarity Type-N plugs on both ends)
3	Reverse Polarity Type-N jack (X6) with built-in lightning protection
4	Direct connect external antenna model WS-ANT21 (Reverse Polarity Type-N plug)
5	Connection to switch
6	Terminator cap used when the AP does not perform wireless data transmission on this connector

Enterasys Wireless AP3765e and AP3767e



Note: The AP3765e and AP3767e must be professionally installed. Refer to the *Enterasys Wireless Outdoor Access Point Installation Guide* for the AP3765 and AP3767e access points for more information about installation procedures.

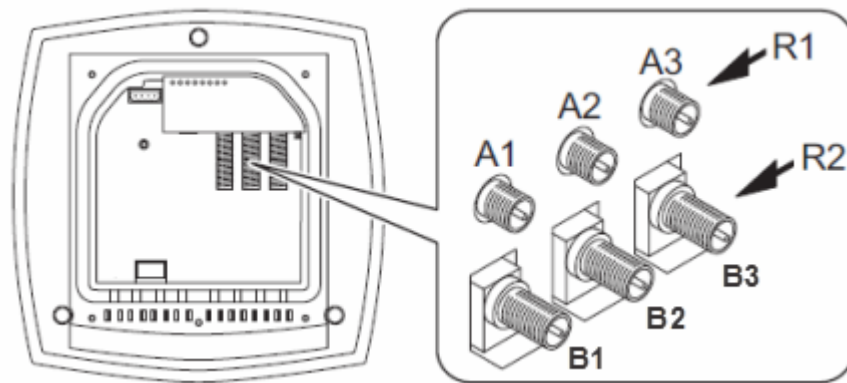
Figure 2-4 shows the location of the Reverse SMA sockets on the APs to which the external antennas should be connected. The housing cover of the AP must be removed to access the R-SMA sockets.

Figure 2-5 on page 2-8 illustrates the AP3765e and AP3767e to antenna cable configurations.

Table 2-4 on page 2-8 lists the installation components.

First connect the cable for antenna "B" if you want to use two antennas for an interface. Once the cable for antenna "A" is connected, it is difficult to reach socket "B".

Figure 2-4 AP3765e and AP3767e External Antenna Cable Installation

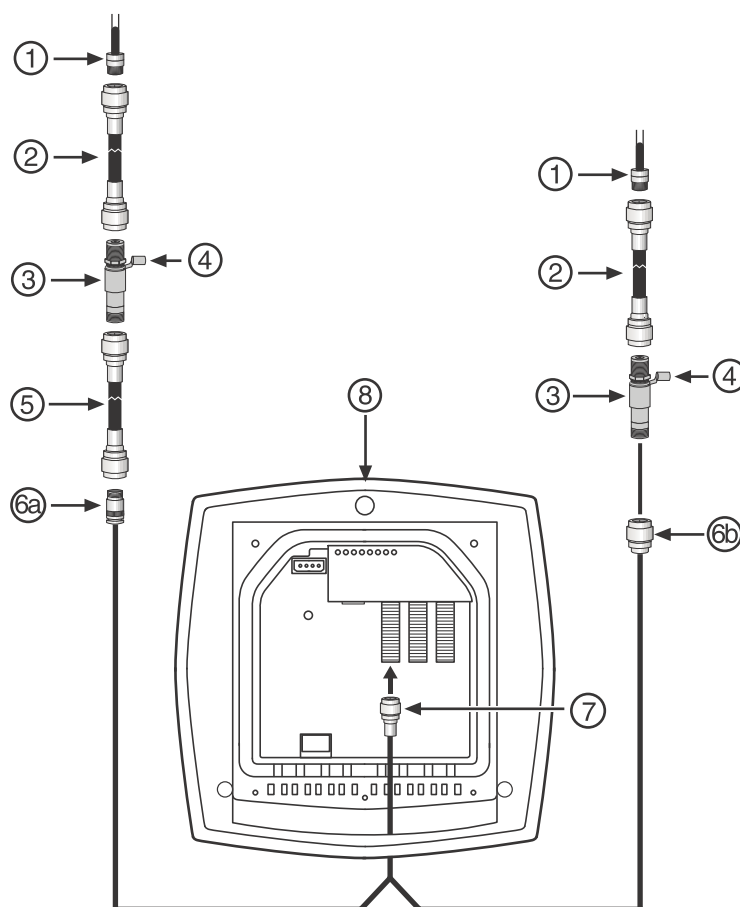


"R1" is mapped to Radio 1 and "R2" is mapped to Radio 2 on the user interface of the Enterasys Wireless Controller.

The antenna "A1" and "B1" connectors are mapped to the Left antenna and the antenna "A2" and "B2" connectors are mapped to the Middle antenna on the user interface of the Enterasys Wireless Controller. The "A3" and "B3" connectors are mapped to the Right antenna.

Screw a terminating resistor to the unused socket if you use only one antenna on a port.

You can secure the antenna cable(s) with a strain relief clamp. Refer to the *Enterasys Wireless Outdoor Access Point Installation Guide* for the AP3765 and AP3767e access points for more information.

Figure 2-5 AP3765e and AP3767e Installation Overview**Table 2-4 AP3765e and AP3767e Installation Components**

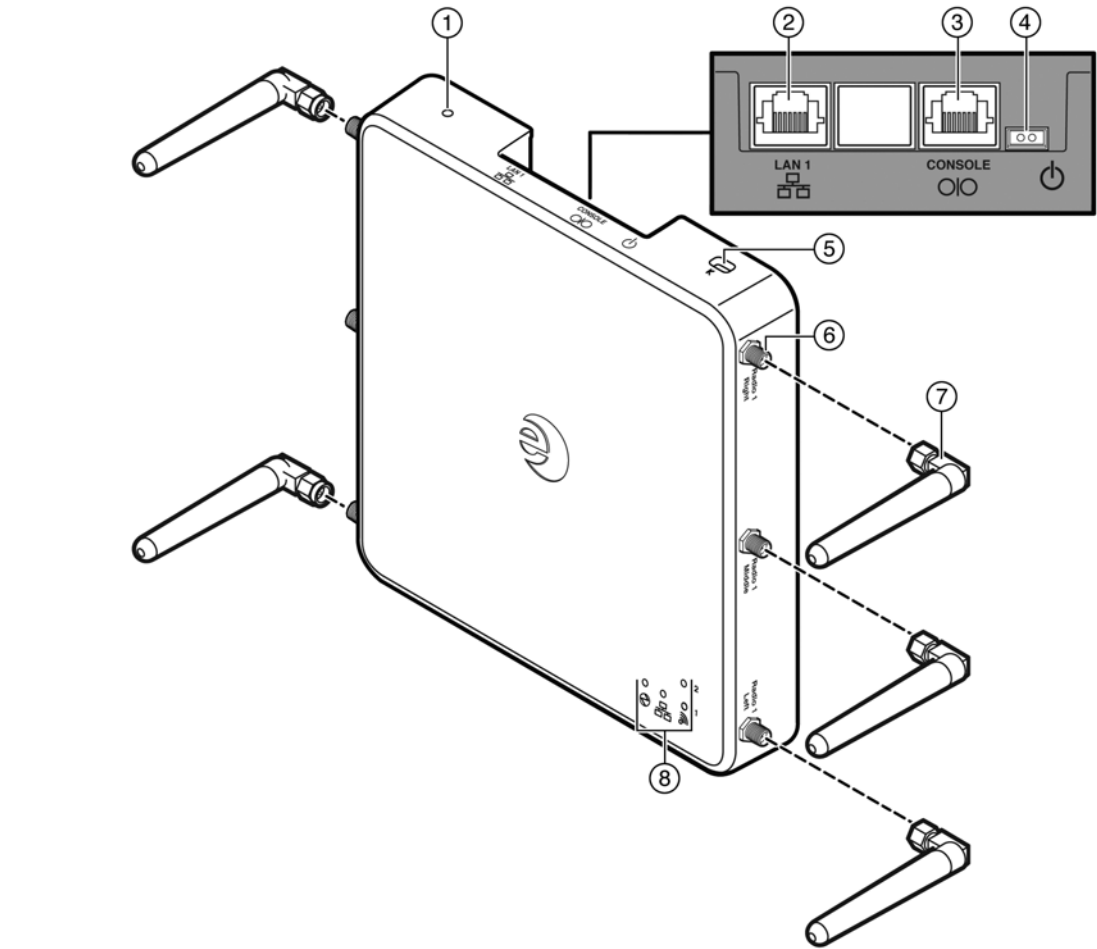
Component	Description
1	Antenna connector (Reverse Polarity Type-N jack)
2	Cable from antenna to lightning protector (Reverse Polarity Type-N plugs on both ends)
3	Lightning protector (Reverse Polarity Type-N jacks on both ends) (WS-CAB-LPM)
4	Lightning protector ground terminal
5	Cable from lightning protector to AP pigtail (Reverse Polarity Type-N plugs on both ends)
6a	AP pigtail (Reverse Polarity SMA plug to Reverse Polarity Type-N jack) (WS-CAB-PT20J)
6b	AP pigtail (Reverse Polarity SMA plug to Reverse Polarity Type-N plug) (WS-CAB-PT20P)
7	AP pigtail connector to AP external antenna connector
8	AP3765e/AP3767e with housing cover removed

Enterasys Wireless AP3710e

Refer to the *Enterasys Wireless Access Point Installation Guide* for the AP3710 access points for more information about installation procedures.

Figure 2-6 on page 2-9 shows the location of the Reverse SMA connectors on the AP to which the external antennas should be connected.

Figure 2-6 AP3710e External Antenna Cable Installation



- | | | | |
|---|----------------------------|---|---------------------------------------|
| 1 | Reset switch | 5 | Slot for Kensington lock |
| 2 | LAN ports (2) | 6 | External antenna connectors (6 R-SMA) |
| 3 | Console port | 7 | External antennas |
| 4 | External power supply port | 8 | LEDs |

Figure 2-2 on page 2-4 and Table 2-2 on page 2-5 describe the installation components that apply to the AP3710e.

Antenna Installation

This chapter provides the information necessary for a professional antenna installer to install the Enterasys Wireless antennas.

For information about...	Refer to page...
Outdoor Antenna Kits	3-2
Installation Overview	3-2
Grounding System	3-3
Lightning Protector Installation	3-4
Mounting the Antenna	3-5
Connecting Antenna Cables	3-60
Optimizing Outdoor Point-to-Point Antenna Placement	3-64



Electrical Hazard: 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.

Peligro de descarga eléctrica: la colocación de la antena debe realizarla un instalador de antenas calificado y con las licencias correspondientes en las regulaciones locales. No instale la antena en condiciones climatológicas adversas, como lluvia, viento, heladas, nieve, etc., que podrían resultar peligrosas.

Elektrische Spannung: Antennen dürfen nur von qualifiziertem Fachpersonal installiert werden. Antenneninstallateure müssen den geltenden Vorschriften entsprechend lizenziert oder zugelassen sein. Von Installationsarbeiten bei Nässe, Wind, Frost oder anderen gefährlichen Wetterbedingungen ist abzusehen.

Outdoor Antenna Kits

The Enterasys Wireless 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 responsibility of the end-user 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 [Table 1-9](#) on page 1-14 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, Enterasys Wireless 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 10AWG 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.

Precaución: el mástil de la antena, Enterasys Wireless AP y el pararrayos deben estar conectados al mismo punto de tierra (con tierras separadas), usando un conductor equipotencial. Se debe lograr una buena conexión eléctrica a una o más de las barras de tierra, usando cable para conexiones a tierra de 10 AWG y equipos inoxidable. El sistema de conexión a tierra debe cumplir con los estándares de seguridad del Código nacional eléctrico que exista en su país. Siempre debe consultar con un electricista calificado para determinar si su instalación de exteriores está conectada a tierra correctamente.

Achtung: Der Antennenmast, Enterasys Wireless AP und der Blitzableiter müssen über eine Verbindung mit Potenzialausgleich und einheitlichem Bezugspotenzial separat geerdet sein. Eine sichere elektrische Verbindung zu mindestens einem Erdungsstab ist über ein 10 AWG-Erdungskabel und korrosionsgeschützte Werkstoffe herzustellen. Das Erdungssystem muss den landesweit geltenden Sicherheitsstandards für Elektrizität entsprechen. Lassen Sie die ordnungsgemäße Erdung einer Installation im Freien stets von einem qualifizierten Elektriker prüfen.

The grounding system must satisfy the following requirements:

- The antenna mast, Enterasys Wireless 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 Enterasys Wireless outdoor installation from lightning strikes and static electricity build-up.

Precaución: debe instalar correctamente el sistema de conexión a tierra para proteger su instalación de exteriores Enterasys Wireless contra rayos y acumulación de electricidad estática.

Achtung: Die Enterasys Wireless-Installation im Freien muss durch ein ordnungsgemäß installiertes, sicheres Erdungssystem vor Blitzschlag und Statikaufbau geschützt sein.

Lightning Protector Installation

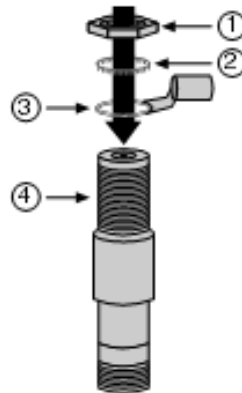
Lightning protection is designed to protect people, property, and equipment by providing a path to the ground whenever lightning strikes your antenna installation. The lightning protector is an indispensable part of such a grounding system to protect your electronic equipment from transients and/or electrostatic discharges at the antenna.

For optimal protection, locate the lightning protector as follows:

- As close as possible to the point where the antenna cable enters the building.
- Connect to the same grounding system as the Enterasys Wireless AP and the antenna mast.

Figure 3-1 illustrates how to install the mounting components for the lightning protector.

Figure 3-1 Lightning Protector Installation



1	Hex nut	2	Lock washer	3	Ring terminal	4	Lightning protector
---	---------	---	-------------	---	---------------	---	---------------------

To install the lightning protector, perform the following steps:

1. Determine a suitable location for the lightning protector.
2. Use the lock washer and hex nut to secure the ring-terminal to the longer of the threaded ends of the lightning protector.
3. Connect the ground-wire to the ring terminal.
4. Connect the longer threaded end of the protector to the cable with the Reverse Polarity Type-N plug to the Enterasys Wireless Access Point.
5. Connect the shorter threaded end of the protector to the cable with a Reverse Polarity Type-N plug.



Caution: To avoid damage to the Enterasys Wireless equipment, always install the Enterasys Wireless lightning protector between the outdoor antenna installation and the Enterasys Wireless AP or other computing device connected to the outdoor antenna.

Precaución: para evitar daños a los equipos Enterasys Wireless, debe asegurarse de instalar el pararrayos Enterasys Wireless lightning protector entre la antena para exteriores y el Enterasys Wireless AP o cualquier otro dispositivo electrónico conectado a la antena.

Achtung: Zum Schutz der Enterasys Wireless-Ausrüstung ist der Enterasys Wireless-Blitzableiter zwischen der Außenantenne und dem Enterasys Wireless AP oder sonstigen an die Antenne angeschlossenen Computergeräten zu installieren.

Mounting the Antenna

This section includes requirements and mounting guidelines for the Enterasys Wireless 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 Enterasys Wireless antenna. Enterasys Wireless 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 Enterasys Wireless 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 Enterasys Wireless 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 Enterasys Wireless APs

Enterasys APs using certified external antennas must comply with local laws and regulations. An approval may be required by the local regulatory authorities. [Table 1-9](#) on page 1-14 lists and describes the optional antennas that have been tested and approved for use with the APs compatible with external antennas.

AP2620 Approved Antennas

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

External Antenna	Mounting Instructions
WS-AO-DS05360	Go to page 3-8
WS-AI-2S03360	Go to page 3-10
WS-AI-DS06360	Go to page 3-12
WS-AIO-DS05120	Go to page 3-14
WS-AIO-2S07060	Go to page 3-16
WS-AIO-5S12060	Go to page 3-16
WS-AIO-5S17017	Go to page 3-20
WS-AIO-2514090	Go to page 3-24
WS-AIO-5S15090	Go to page 3-25
WS-AIO-2S18018	Go to page 3-28

AP3620 and AP3640 Approved Antennas

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

External Antenna	Mounting Instructions
WS-AO-DS05360	Go to page 3-8
WS-AO-5D16060	Go to page 3-30
WS-AO-5D23009	Go to page 3-33
WS-AI-DT04360	Go to page 3-38
WS-AI-DT05120	Go to page 3-40

AP3660 Approved Antennas

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

External Antenna	Mounting Instructions
WS-AO-DS05360	Go to page 3-8
WS-AIO-2S18018	Go to page 3-28
WS-AO-5D16060	Go to page 3-30
WS-AO-5D23009	Go to page 3-33
WS-AO-DT05120	Go to page 3-43
WS-AO-DT05120-1	Go to page 3-43
WS-AO-5S10360	Go to page 3-47
WS-AO-2S10360	Go to page 3-47
WS-ANT21	Go to page 3-49
WS-AO-DX13025	Go to page 3-51

AP3765e and AP3767e Approved Antennas

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

External Antenna	Mounting Instructions
WS-AO-DS05360	Go to page 3-8
WS-AIO-2S18018	Go to page 3-28
WS-AO-5D16060	Go to page 3-30
WS-AO-5D23009	Go to page 3-33
WS-AO-DT05120-1	Go to page 3-43
WS-AO-5S10360	Go to page 3-47
WS-AO-2S10360	Go to page 3-47
WS-AO-DX13025	Go to page 3-51

AP3710e Approved Antennas

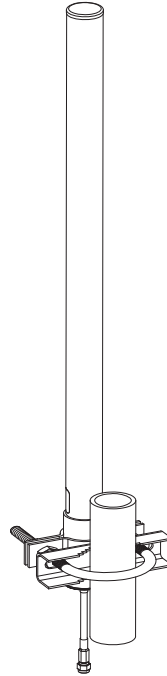
To mount the antennas on the AP3710e, refer to the following sections.

External Antenna	Mounting Instructions
WS-AI-DT04360	Go to page 3-38
WS-AI-DT05120	Go to page 3-40
WS-AI-DX02360	Go to page 3-55
WS-AI-DX07025	Go to page 3-56

Mounting Antenna Model WS-AO-DS05360

Antenna model WS-AO-DS05360 is a ruggedized high-performance 2.4 and 5 GHz omnidirectional baton antenna. [Figure 3-2](#) shows the WS-AO-DS05360 antenna.

Figure 3-2 WS-AO-DS05360 Antenna



The WS-AO-DS05360 antenna can be mounted to a pole in exterior locations. Its flattened radiation pattern focuses energy along the horizontal plane to provide extended coverage in large rooms or vaulted areas.

For best results, mount the WS-AO-DS05360 antenna at ceiling or roof level near the center of the coverage area.

Mounting the WS-AO-DS05360 Antenna on a Pole

Figure 3-3 shows how to mount the WS-AO-DS05360 antenna on a pole. Table 3-1 lists the components of the pole mounting kit.

Figure 3-3 Mounting the WS-AO-DS05360 Antenna to a Pole

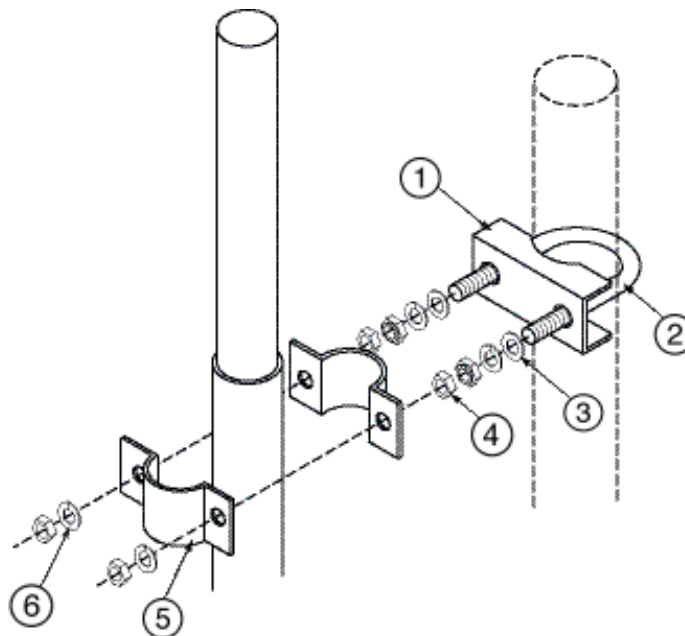


Table 3-1 WS-AO-DS05360 Pole Mounting Kit

Item	Quantity	Description
1	1	V-Bracket
2	1	U-Bolt
3	2	Flat washer, 5/16 inch
4	6	Stainless steel hex nut, 5/16 inch x 18
5	1	Base bracket
6	4	Stainless steel lock washer, 5/16 inch

To install the antenna using the pole mount bracket:

1. Find the U-bolt (item 2), V-bracket (item 1), plus two 5/16 inch nuts (item 4) lockwashers (item 6) and (item 3) flat washers.
2. At the top of the pipe, using a 1/2 inch wrench or adjustable wrench, secure the U-bolt to the clamp using the hardware provided (see Figure 3-3).
3. Find two more 5/16 inch nuts (item 4). Install these nuts by turning them down against the nuts securing the U-bolt to the mast.
4. Find two antenna clamps (item 5), plus two 5/16 inch lock washers (item 6) and the two remaining 5/16 inch nuts (item 4).
5. Sandwich the antenna between the two clamps at its base and slide this assembly onto the U-bolt (see Figure 3-3). Secure in place using hardware provided.

6. Secure the coaxial cable along the mast or pole using tape or cable ties.
7. If installing one antenna, attach the connector to the AP unit's primary antenna connection. If installing a diversity system, attach the leads from the two antennas to the AP unit's primary and secondary jacks.

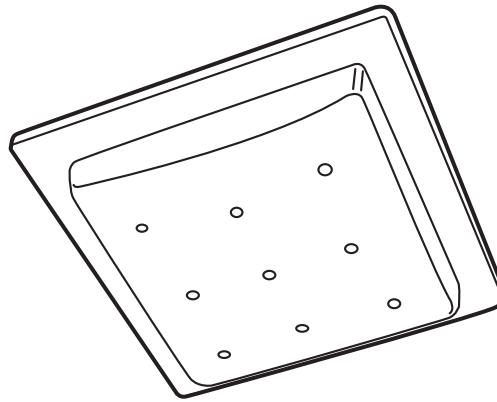


Note: For exterior installation, always orient the antenna upright to prevent water from entering weep holes at the base and damaging internal components.

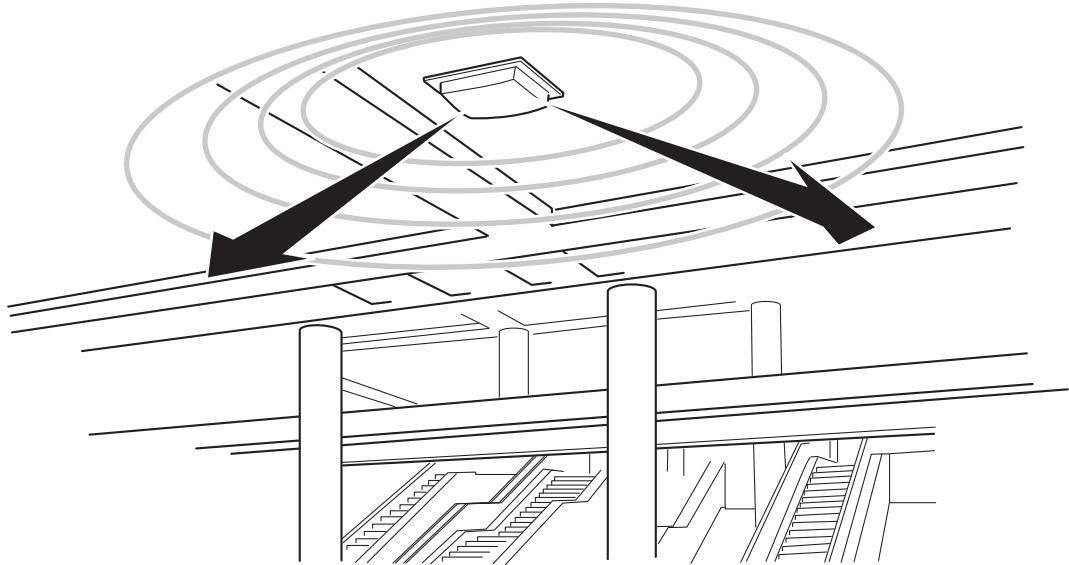
Mounting Antenna Model WS-AI-2S03360

The WS-AI-2S03360 antennas are ceiling-mounted omni-directional panel radiators used for interior RF-distribution systems. The unique umbrella-shaped radiation pattern tilts downward and spreads out to provide uniform coverage to all parts of a room or interior space. [Figure 3-4](#) shows the WS-AI-2S03360 antenna.

Figure 3-4 WS-AI-2S03360 Antenna

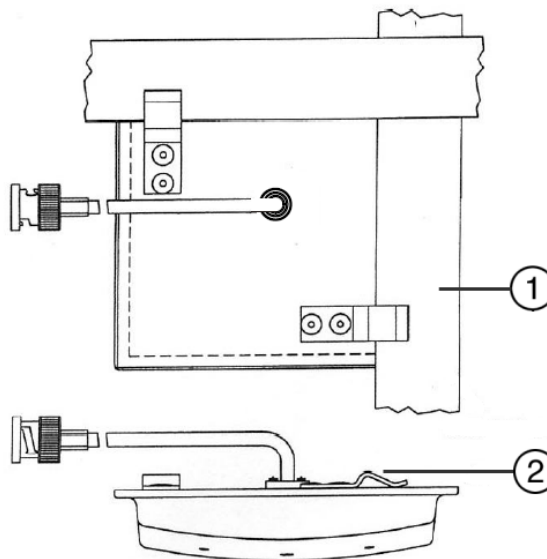


For best results, mount this antenna at ceiling level near the center of the coverage area. A line-of-sight path between the radome and active floor locations generally works best. Although signals in the 2.4 GHz region penetrate cubical dividers and interior walls with little attenuation, reinforced block walls, banks of metal cabinets, or steel shelving may attenuate signals or cause multipath, a condition where reflected signals interfere with the primary signal path. Avoid mounting the antenna next to a column or vertical support that could create a shadow zone of reduced coverage to one portion of the room. [Figure 3-5](#) on page 3-11 shows an example of a suitable location for WS-AI-2S03360 antenna installation.

Figure 3-5 Example Location for WS-AI-2S03360 Antenna

Mounting the WS-AI-2S03360 Antenna on a Ceiling

Figure 3-6 shows how to mount the WS-AI-2S03360 antenna on a ceiling.

Figure 3-6 Mounting the WS-AI-2S03360 Antenna to a Ceiling

1 Ceiling grid

2 Antenna clip

To mount the antenna on a ceiling:

1. Make a small hole in the tile to pass the feedline above the ceiling, then install the antenna at the tile corner, as shown in Figure 3-6.
2. For installation on tiles with a recessed edge, use the plastic adapter clips provided.

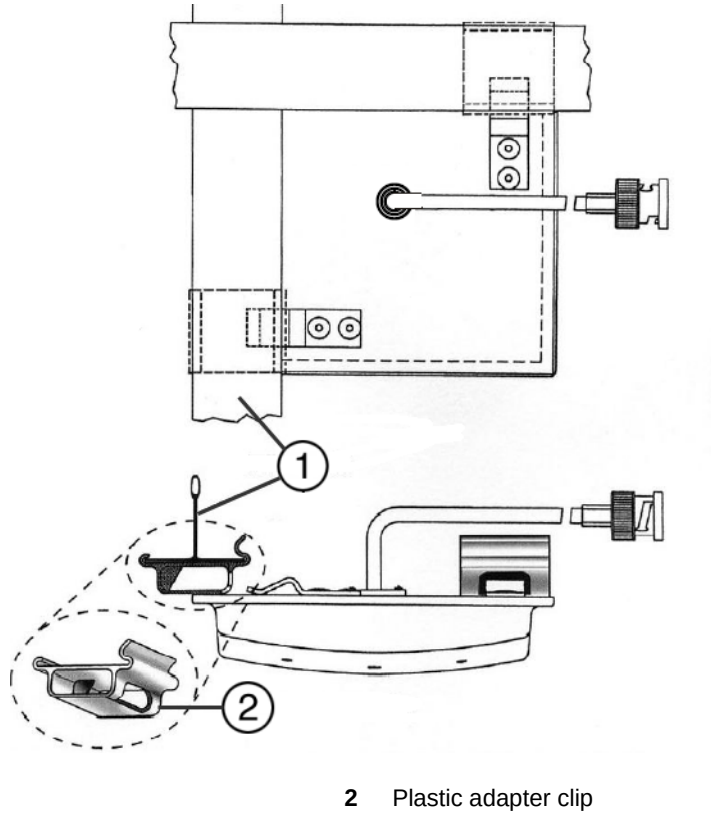


Note: Suspended-ceiling mounting clips are provided on the rear panel of the antenna package.

3. Snap the clip onto the ceiling tile grid and then mount the antenna to the clips as shown in [Figure 3-7](#).

For installation on 9/16" rectangular mounting profile grid, install the supplied clips in the same manner.

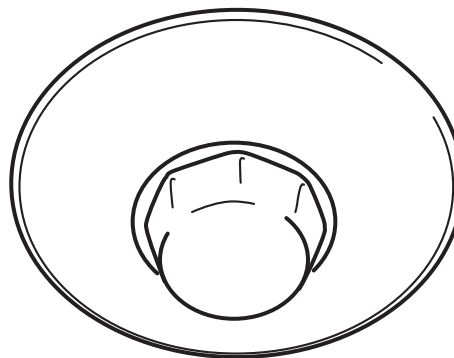
Figure 3-7 Mounting the Antenna Clips



Mounting Antenna Model WS-AI-DS06360

The WS-AI-DS06360 antenna is a ceiling-mounted omni-directional radome used for interior RF-distribution systems. [Figure 3-8](#) shows the WS-AI-DS06360 antenna.

Figure 3-8 WS-AI-DS06260 Antenna

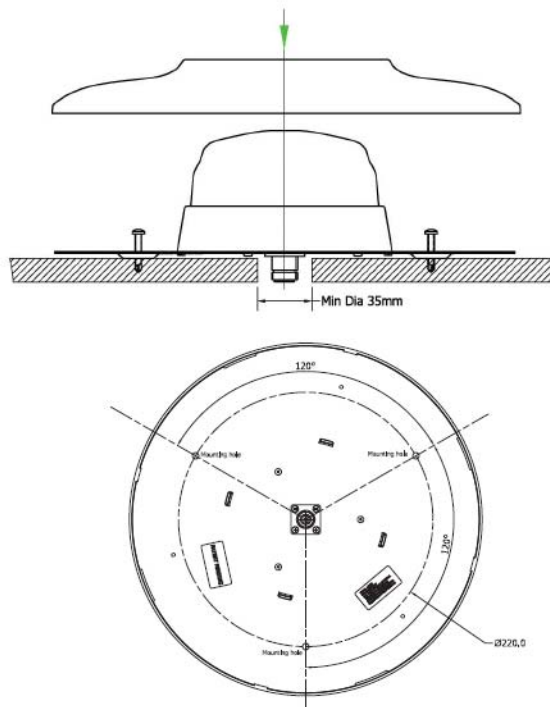


Mounting the WS-AI-DS06260 Antenna on a Ceiling

To install the WS-AI-DS06260 on a ceiling, refer to [Figure 3-9](#) and proceed as follows:

1. Rotate radome until tabs at the bottom of the radome line up with slots on the back plate. Pull back the radome gently from antenna assembly.
2. Identify the location for the connector access hole. Ensure a minimum 35 mm OD hole is drilled on the surface (see [Figure 3-9](#)).
3. Place the antenna on the ceiling tile.
4. Following the guiding holes found on the metal backplate of the antenna, use the included tapping screws to install antenna to the mounting surface. Recommended assembly torque is 3.0 N.M.
5. Rotate the radome into place.

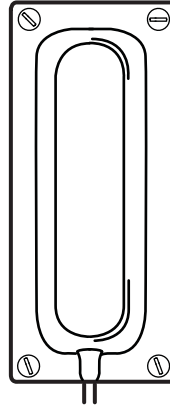
Figure 3-9 WS-AI-DS06260 Antenna Mounting Alignment



Mounting Antenna Model WS-AIO-DS05120

The WS-AIO-DS05120 is a linearly polarized antenna that delivers controlled 120- degree sector coverage from 2.4-2.5 / 4.9-5.9 GHz. [Figure 3-10](#) shows the WS-AIO-DS05120 antenna.

Figure 3-10 **WS-AIO-DS05120 Antenna**



The antenna mounts to any flat vertical surface with wall-anchors or it can be mounted to a pole. A pole mounting kit is included to allow attachment to a vertical pole. The antenna's 120-degree fan-shaped radiation pattern is especially suited for enhanced coverage of lecture halls, auditoriums, meeting rooms, department stores, and work areas.

For best performance, position above major obstructions on a surface facing the desired coverage zone.

Mounting the WS-AIO-DS05120 Antenna on a Pole

Figure 3-11 shows how to mount the WS-AIO-DS05120 antenna on a pole. Table 3-2 lists the components of the mounting kit.

Figure 3-11 Mounting the WS-AIO-DS05120 Antenna on a Mast

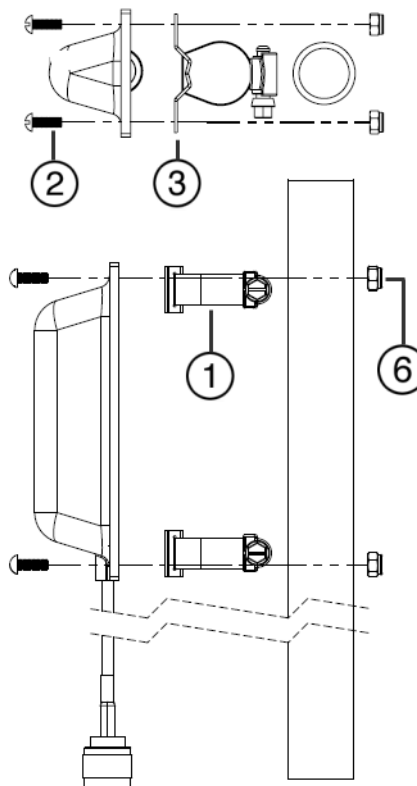


Table 3-2 Mounting Kit Components for the WS-AIO-DS05120 Antenna

Item	Quantity	Description
1	2	Hose clamp
2	4	Stainless steel machine screw, #8-32 x 3/8 inch
3	2	MTE bracket
4	4	Plastic wall anchor, #8
5	4	Stainless steel self tap machine screw, #8-18 x 3/4 inch (shown in Figure 3-12 on page 3-16)
6	4	Stainless steel nylon hex nut, #8-32 (shown in Figure 3-12 on page 3-16)

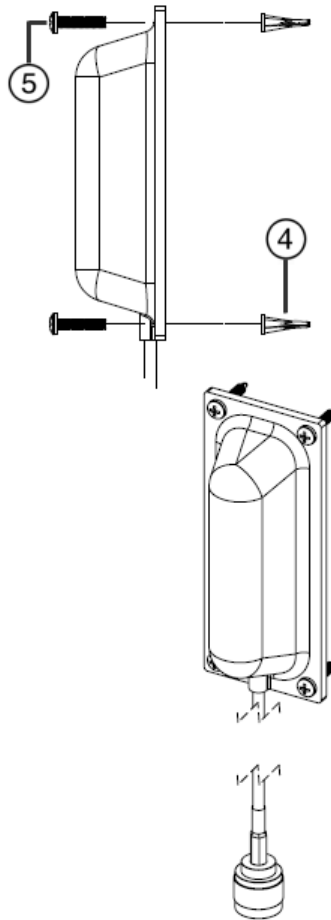
To install the antenna to a mast:

1. Locate the MTE brackets (item 3) and two hose clamps (item 1).
2. Slide the clamp band through the slot in the bracket and place the clamps on the mast at the desired position, just tight enough to prevent them from sliding.
3. Align and fasten antenna, MTE brackets and clamps as shown in [Figure 3-11](#) using the 4 machine screws (item 2) and locknuts (item 6) provided.
4. Tighten hardware securely.

Mounting the WS-AIO-DS05120 Antenna on a Wall

Figure 3-12 shows how to mount the WS-AO-DS05120 antenna on a wall. Table 3-2 on page 3-15 lists the components of the mounting kit.

Figure 3-12 Mounting the WS-AIO-DS05120 Antenna on a Wall

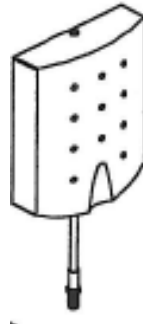


To install the antenna to the wall:

1. Locate four 8-18 self-tapping screws (item 5) and four plastic wall anchors (item 4) in the mounting kit. Contents of the mounting kit are listed in Table 3-2 on page 3-15.
2. Position the antenna at the desired location and mark the mounting-hole locations.
3. Drill 3/16 inch diameter pilot holes and install wall anchors.
4. Install mount using the supplied self-tapping screws as shown in Figure 3-12.

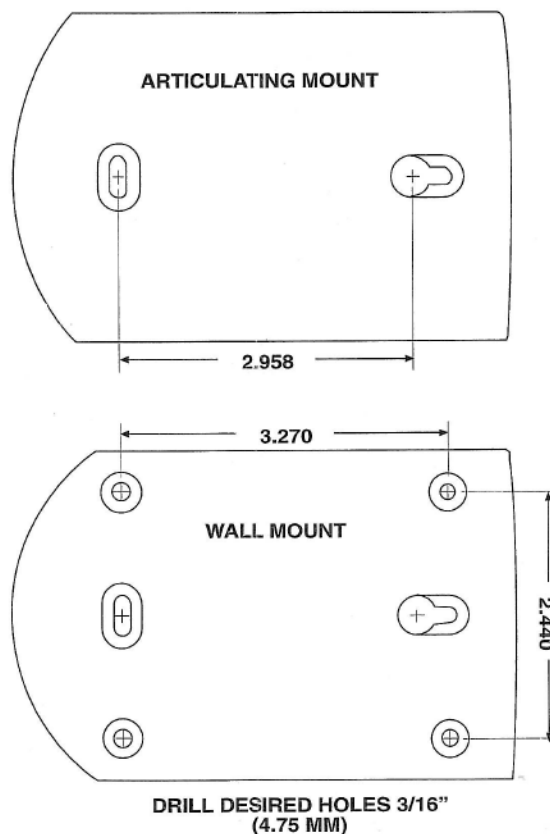
Mounting Antenna Model WS-AIO-2S07060 and WS-AIO-5S12060

The WS-AIO-2S07060 the WS-AIO-5S12060 antennas are both articulating wall-mounted panel antennas used for interior or exterior RF-distribution systems. Both antenna models look identical. However, the WS-AIO-2S07060 is a 2.5 GHz antenna and the WS-AIO-5S12060 is a 5 GHz antenna. Use the same mounting instructions for both antennas. Figure 3-13 on page 3-17 shows the WS-AIO-2S07060 and WS-AIO-5S12060 antennas.

Figure 3-13 WS-AIO-2S07060 and WS-AIO-5S12060 Antennas**Mounting the WS-AIO-2S07060 and WS-AIO-5S12060 Antenna on a Wall**

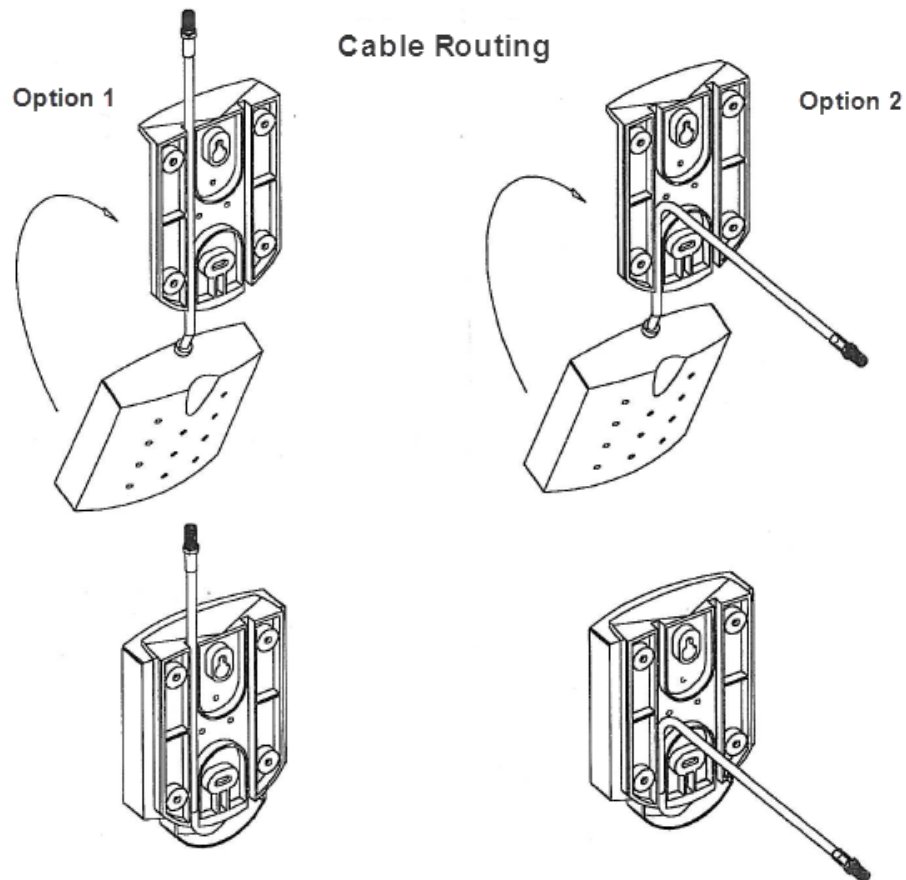
To mount the antenna:

1. Drill two 3/16 inch holes for the pilot hole anchors. Use the template in [Figure 3-14](#) to align the holes properly.

Figure 3-14 Mounting Template for the WS-AIO-2S07060 and WS-AIO-5S12060 Antennas

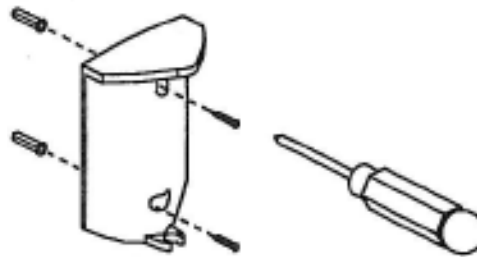
2. Insert the wall anchors in the pilot holes.
3. Route the antenna through the back of the mounting bracket. Cable routing options are shown in [Figure 3-15](#) on page 3-18.

Figure 3-15 Cabling Options for the WS-AIO-2S07060 and WS-AIO-5S12060 Antenna



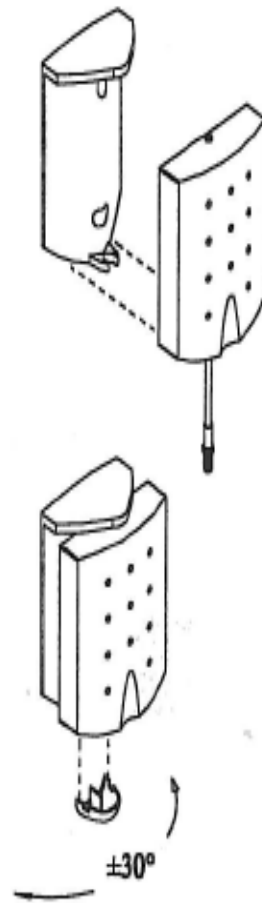
4. Install the mounting brackets as shown in [Figure 3-16](#).

Figure 3-16 Articulating Wall Mount for the WS-AIO-2S07060 and WS-AIO-5S12060 Antennas



5. Install the antenna in the mounting bracket as shown in [Figure 3-17](#).

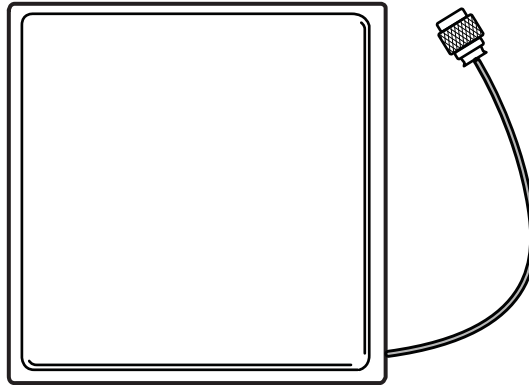
Figure 3-17 Articulating Wall Mount for the WS-AIO-2S07060 and WS-AIO-5S12060 Antennas



Mounting Antenna Model WS-AIO-5S17017

The WS-AIO-5S17017 is a 5.5 GHz panel antenna that can be mounted indoors or outdoors. [Figure 3-18](#) shows a WS-AIO-5S17017 antenna.

Figure 3-18 Antenna Model WS-AIO-5S17017



The WS-AIO-5S17017 antenna can be mounted indoors or outdoors. For link installations, a line-of-sight path between antennas works best. Although 5.5 GHz signals penetrate cubical dividers and interior partitions with little attenuation, reinforced block walls, banks of metal cabinets, or steel shelving may attenuate signals or cause multipass, a condition where reflected signals interfere with the primary signal. Because antenna beam width is restricted to 15-degrees to each side of center, the antenna must be aimed accurately during installation to provide optimum gain and best performance.

The WS-AIO-5S17017 antenna comes with a universal articulating mount that accepts mast sizes up to 2 inches (5.1 cm). This mount, which mounts flat against any vertical surface, is especially designed to provide wide-range articulation in both the azimuth and elevation planes. You can mount the WS-AIO-5S17017 antenna on a wall or on a pole.

Mounting the WS-AIO-5S17017 Antenna on a Pole

[Figure 3-19](#) shows the WS-AIO-5S17017 antenna mounted on a pole. [Figure 3-20](#) on page 3-21 shows the mounting component assembly. [Figure 3-21](#) on page 3-22 shows how to install the

articulating mount to the WS-AIO-5S17017 antenna backplane and how to install the mount on a pole. [Table 3-3](#) on page 3-21 lists the components of the mounting kit.

Figure 3-19 WS-AIO-5S17017 Mounted on a Pole

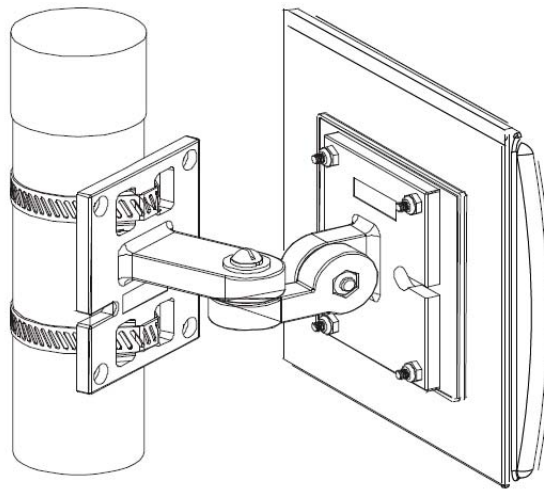


Figure 3-20 WS-AIO-5S17017 Antenna Mounting Kit and Assembly

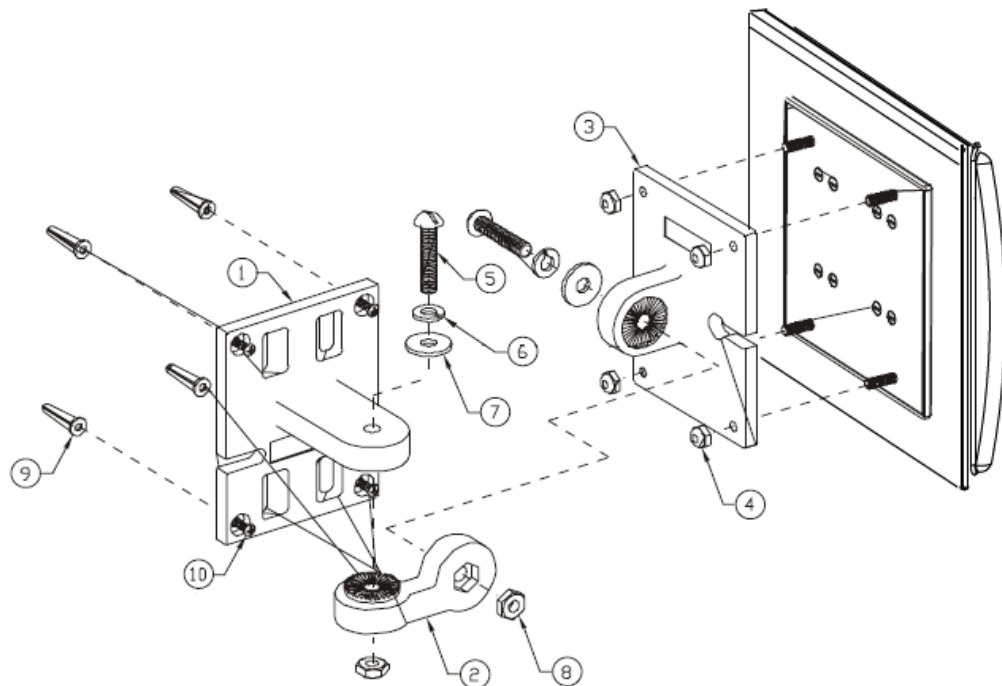


Table 3-3 Mounting Kit Components for the WS-AIO-5S17017

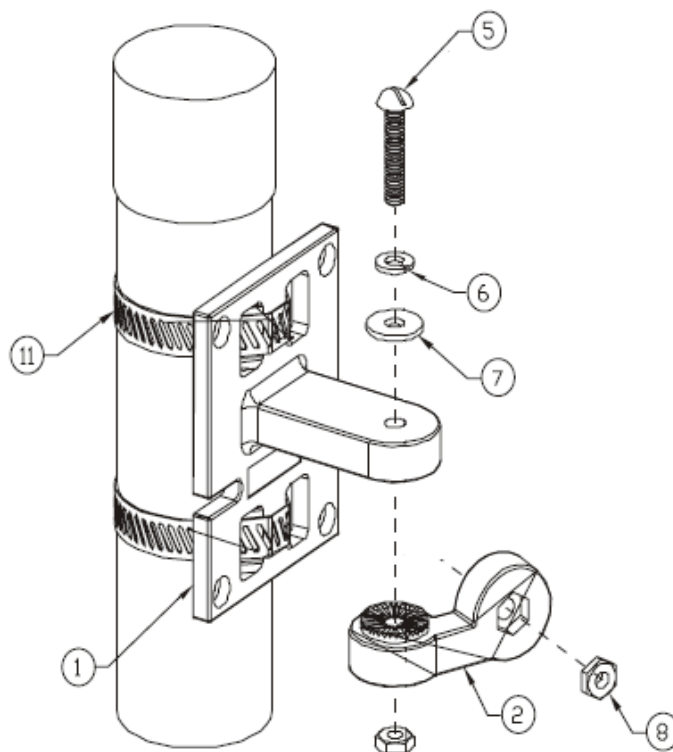
Item	Quantity	Description
1	1	Wall/Mast mount
2	1	Articulating arm
3	3	Antenna mount
4	4	Stainless steel nylon hex nut, 8/32 inch

Table 3-3 Mounting Kit Components for the WS-AIO-5S17017

Item	Quantity	Description
5	2	Machine screw, 1/4 inch-20 x 1-1/4 inch
6	2	Stainless steel split lock washer, 1/4 inch
7	4	Flat washer, 1/4 inch
8	2	Stainless steel hex nut, 1/4 inch-20
9	4	Plastic wall anchor, #8
10	4	Stainless steel machine screw, #8-18 x 3/4 inch
11	2	Hose clamp

To install the articulating mount to the antenna back plane (see [Figure 3-20](#)):

1. Find the molded antenna mount (item 3) and four 8-32 nylon lock nuts (item 4). Use the nuts to attach the mount to the exposed studs on the back of the antenna.
2. Find the molded articulating arm (item 2). Also, find a 1/4 inch-20 x 1-1/4 inch machine screw (item 5), 1/4 inch lock washer (item 6), 1/4 inch flat washer (item 7), and 1/4 inch-20 hex nut (item 8).
3. For installation on flat surfaces, find the molded wall/mast mount (item 1) and use it as a drill template to mark hole locations. Drill four 3/16 inch diameter pilot holes and install wall anchors (item 9). Install the mount using four 8-18 x 3/4 inch self-tapping screws (item 10).

Figure 3-21 WS-AIO-5S17017 Pole Mounting

To install the articulating mount to a pole (see [Figure 3-21](#)):

1. Find two worm clamps (item 11) and install on the molded wall-mast mount (item 1).
2. Encircle pole with each band and tighten.
3. To attach the antenna assembly to the wall/mast mount:
 - a. find a 1/4 inch x 1-1/4 inch machine screw (item 5)
 - b. install a 1/4 inch lock washer (item 6) and a 1/4 inch- flat washer (item 7) as shown.
4. Use the screw to attach the free end of the articulating arm to the mount, securing in place with a 1/4 inch-20 nut (item 8).
5. Loosen 1/4 inch pivot screws as needed to position antenna for desired azimuth and elevation steering.
6. When antenna is adjusted, tighten all hardware securely.

Mounting Antenna Model WS-AIO-2S14090

The WS-AIO-2S14090 is a 2.4 GHz dual-band sector antenna that can be mounted indoors or outdoors. [Figure 3-22](#) shows a WS-AIO-2S14090 antenna. The WS-AIO-5S15090 antenna can also be installed on a pole.

Figure 3-22 WS-AIO-2S14090 Antenna



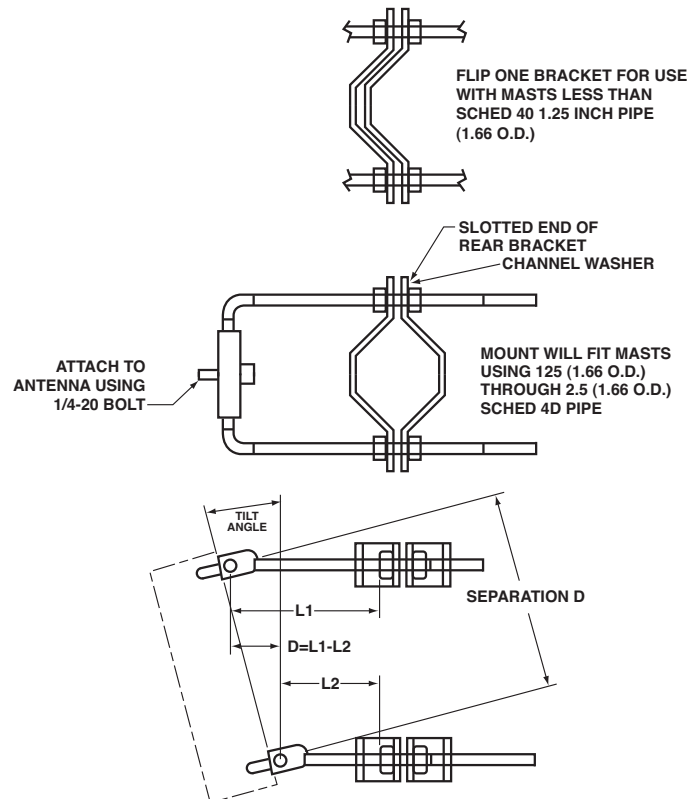
Mounting the WS-AIO-2S14090 Antenna on a Pole

The adjustable mounting bracket (see [Figure 3-23](#)) included with your WS-AO-5S14090 antenna provides down or uptilt mounting to a mast up to 2.88 inch O.D. (2.5 inch sched 40 pipe).

To mount the antenna on a pole:

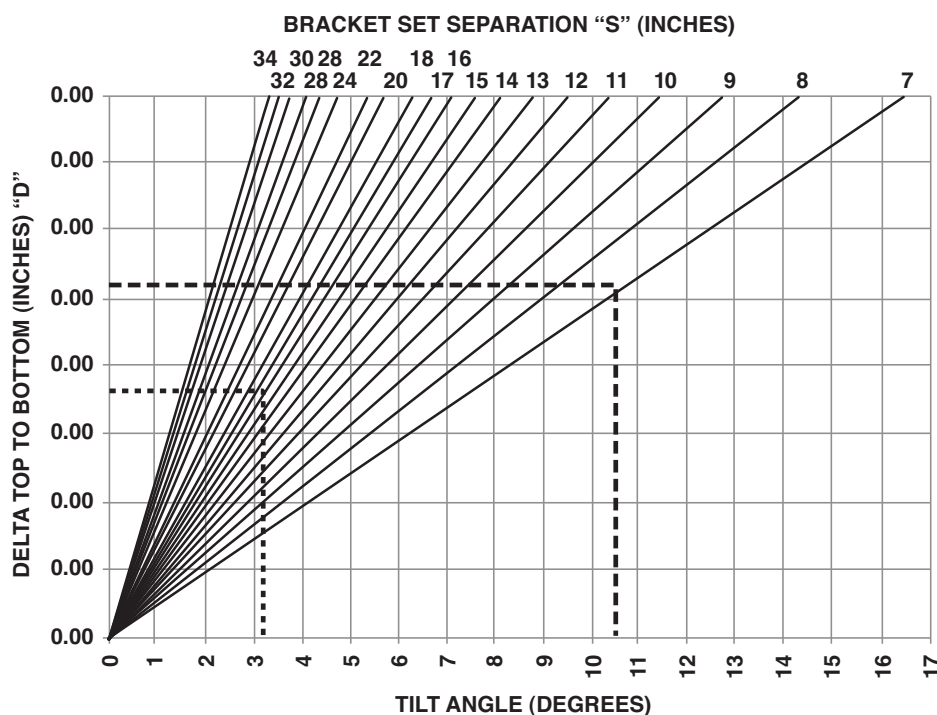
1. Assemble mount to antenna using the hardware provided.
2. Adjust the nuts nearest the antenna to positions that will provide the tilt angle required.
3. Assemble the antenna to the mast as shown in [Figure 3-23](#).

Figure 3-23 WS-AIO-2S14090 Adjustable Brackets



- Make fine adjustments to the tilt angle after mounting the antenna to the mast. Spacing references for downtilt (L1, L2) are shown in [Figure 3-24](#). The uptilt (L1, L2) will be opposite as shown in [Figure 3-24](#).

Figure 3-24 WS-AIO-2S14090 Tilt Angle



Mounting Antenna Model WS-AIO-5S15090

The WS-AIO-5S15090 is a 2.4 and 5 GHz dual-band sector antenna that can be mounted in an exterior location. [Figure 3-25](#) shows a WS-AIO-5S15090 antenna. The WS-AIO-5S15090 antenna can also be installed on a pole.

Figure 3-25 WS-AIO-5S15090 Antenna



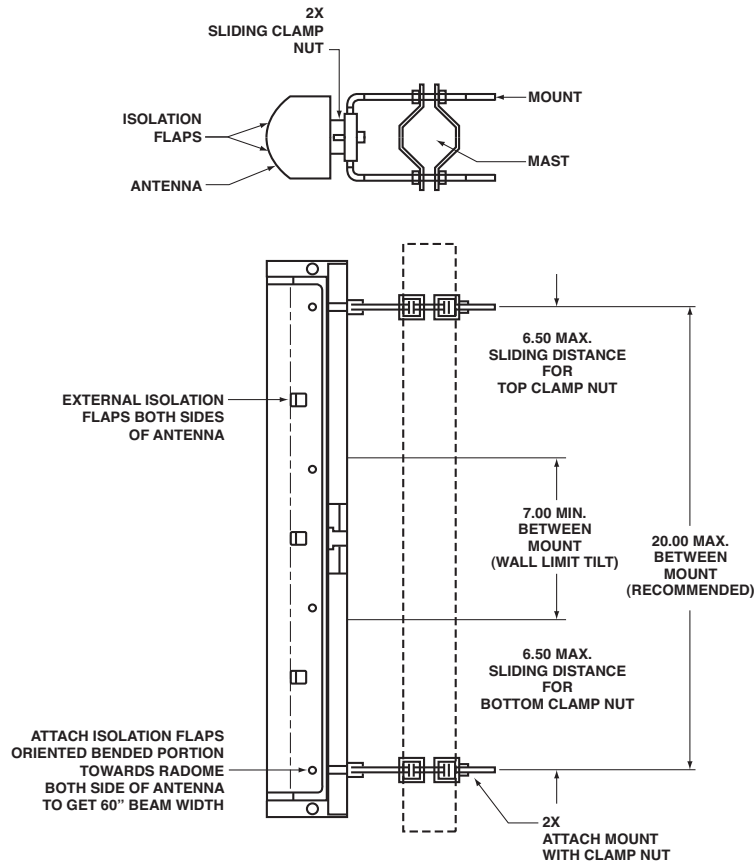
Mounting the WS-AIO-5S15090 Antenna on a Pole

The adjustable mounting bracket (see [Figure 3-26](#)) included with your WS-AIO-5S15090 antenna provides down or uptilt mounting to a mast up to 2.88 inch O.D. (2.5 inch sched 40 pipe).

To install the WS-AIO-5S15090 antenna to a pole:

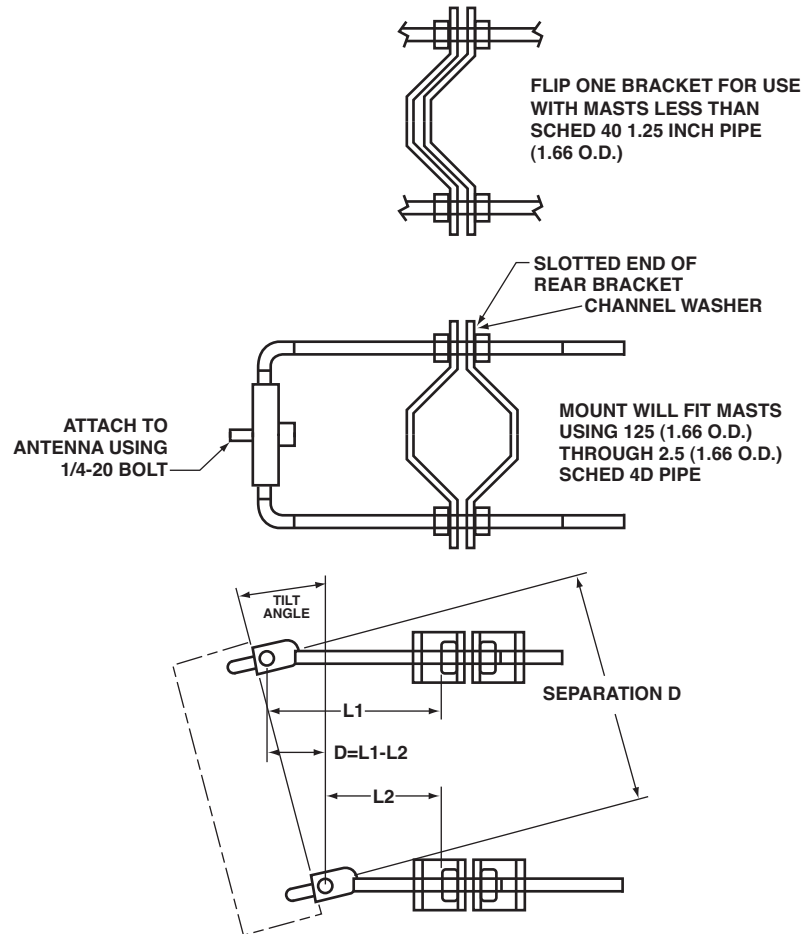
1. Assemble mount to antenna using the hardware provided as shown in [Figure 3-26](#).

Figure 3-26 WS-AIO-5S15090 Installation



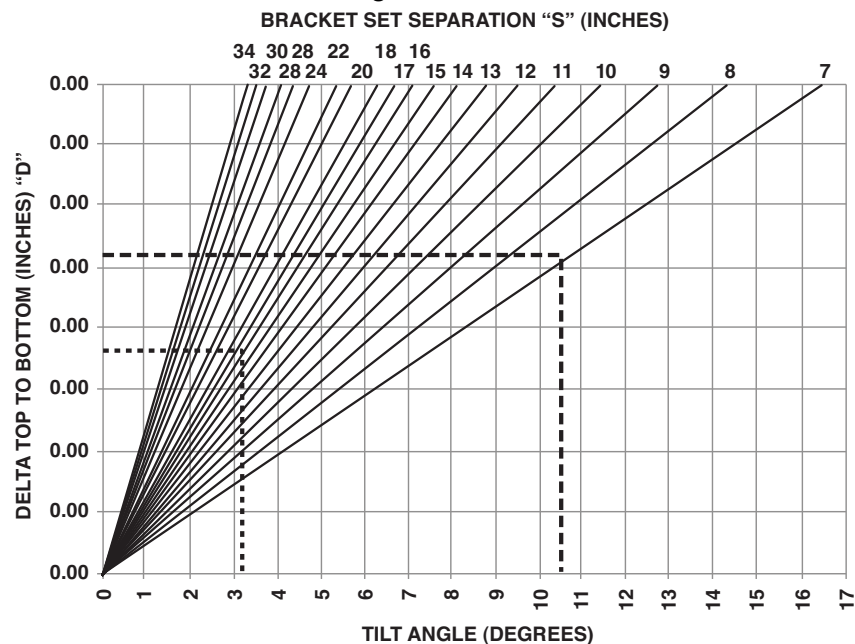
2. Adjust the nuts nearest the antenna to positions that will provide the tilt angle required.
3. Assemble the antenna to the mast as shown in [Figure 3-27](#) on page 3-27.

Figure 3-27 WS-AIO-5S15090 Mounting Bracket



4. Make fine adjustments to the tilt angle after mounting the antenna to the mast. Spacing references for downtilt (L1, L2) are shown in [Figure 3-28](#). The uptilt (L1, L2), will be opposite as shown in [Figure 3-28](#).

Figure 3-28 WS-AIO-5S15090 Tilt Angles

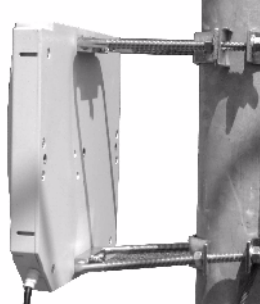


Mounting Antenna Model WS-AIO-2S18018

The WS-AIO-2S18018 is a 2.4 GHz sector antenna that can be mounted in an exterior location.

[Figure 3-29](#) shows a WS-AIO-2S18018 antenna. The WS-AIO-2S18018 antenna can also be installed on a pole.

Figure 3-29 WS-AIO-2S18018 Antenna



Mounting the WS-AIO-2S18018 Antenna to a Pole

The adjustable mounting bracket (see [Figure 3-30](#) on page 3-29) included with your WS-AIO-2S18018 panel antenna provides down or uptilt mounting to a mast up to 2.88 inch O.D. (2.5 inch sched 40 pipe).

To mount the WS-AIO-2S18018 antenna on a pole:

1. Assemble mount to antenna using the hardware provided.
2. Adjust the nuts nearest the antenna to positions that will provide the tilt angle required.
3. Assemble the antenna to the mast as shown in [Figure 3-30](#) on page 3-29.
4. Fine adjustment to the tilt angle can be made after the antenna has been mounted to the mast. Spacing references for downtilt (L1, L2) are shown in [Figure 3-31](#) on page 3-29. The uptilt (L1, L2) will be opposite as shown in [Figure 3-31](#) on page 3-29.

Figure 3-30 WS-AIO-2S18018 Mounting Bracket

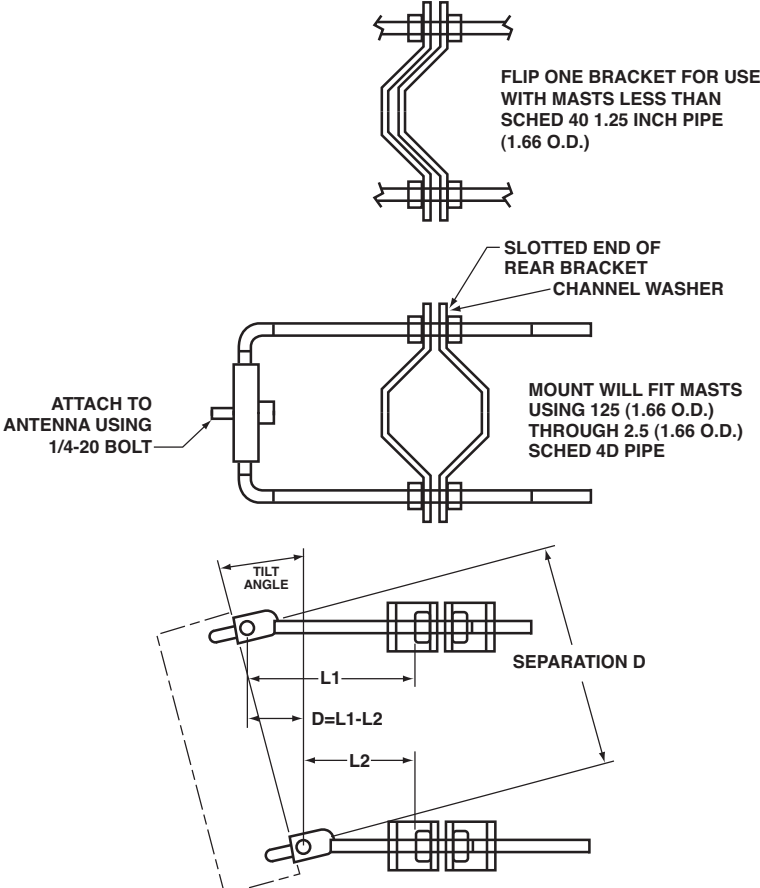
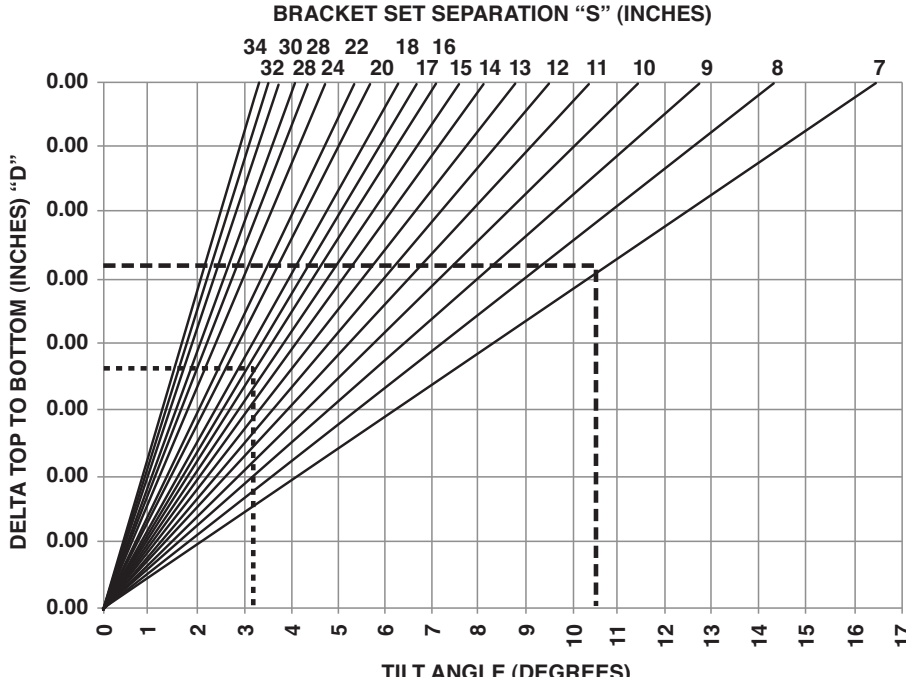


Figure 3-31 WS-AIO-2S18018 Tilt Angles



Mounting Antenna Model WS-AO-5D16060

The WS-AO-5D16060 is a 5 GHz sector antenna that has 2 connectors for dual polarization. This antenna can be mounted in an exterior location. [Figure 3-32](#) shows a WS-AO-5D16060 antenna. [Table 3-4](#) describes the mounting kit for the WS-AO-DS16060 antenna. The WS-AO-DS16060 antenna can also be installed on a pole.

Figure 3-32 WS-AO-DS16060 Antenna

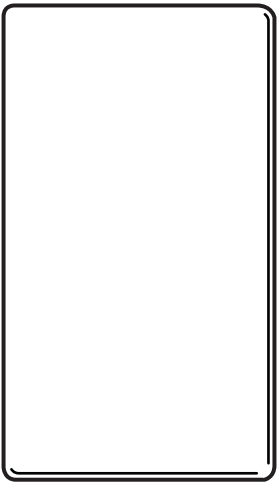


Table 3-4 WS-AO-DS16060 Mounting Kit

Item	Quantity	Description
1	1	Elevation bracket
2	9	1/4 inch flat washer
3	9	1/4 inch spring washer
4	9	1/4 inch nut
5	1	Pole bracket mechanical assembly
6	2	Steel bolt, carriage 5/16 inch x 16 inch
7	1	U-Bracket
8	2	5/16 inch steel flat washer
9	2	5/16 inch steel spring washer
10	2	5/16 inch steel hex nut washer

Mounting the WS-AO-DS16060 Antenna on a Pole

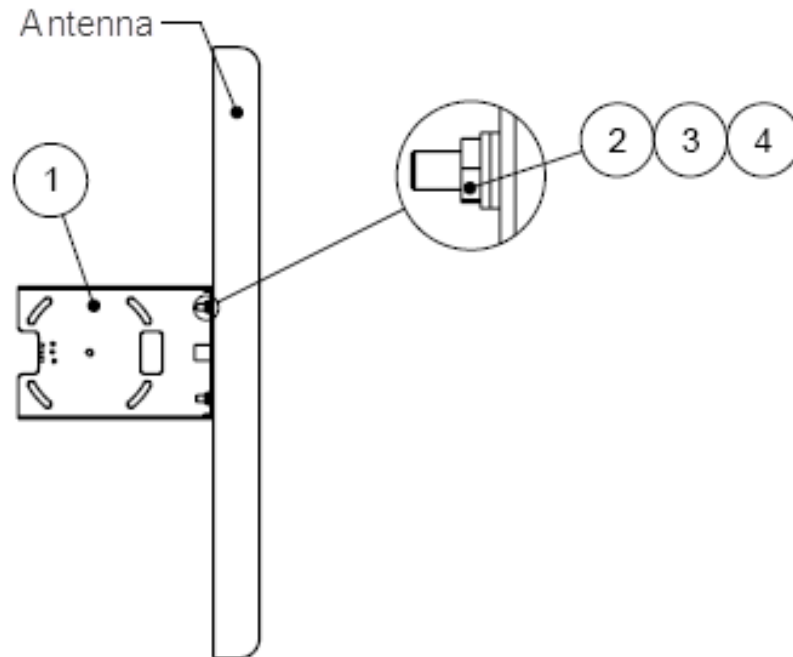


Note: Refer to [Table 3-4](#) on page 3-30 for a complete list of items referenced in this procedure.

To mount the antenna to a pole:

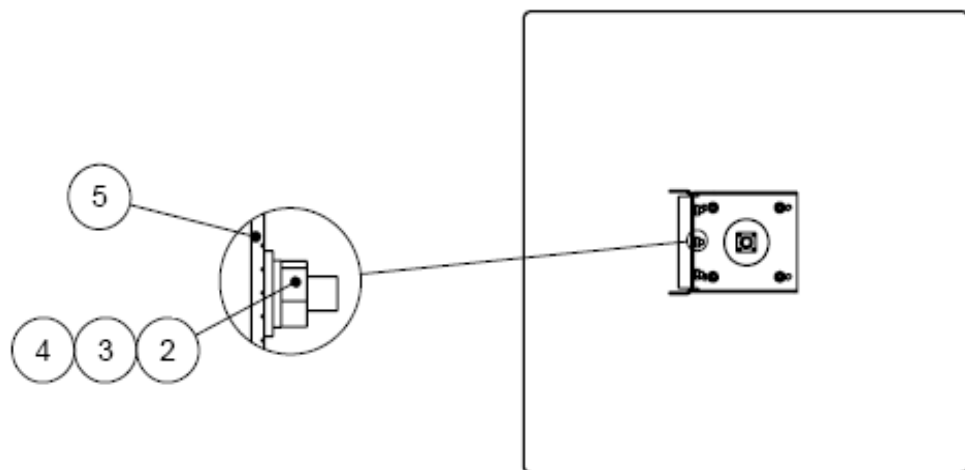
1. Attach the L bracket to the back of the antenna using items 2, 3, and 4 as shown in [Figure 3-33](#). Use a tightening torque of 59 kg-cm.

Figure 3-33 Attaching the L Bracket



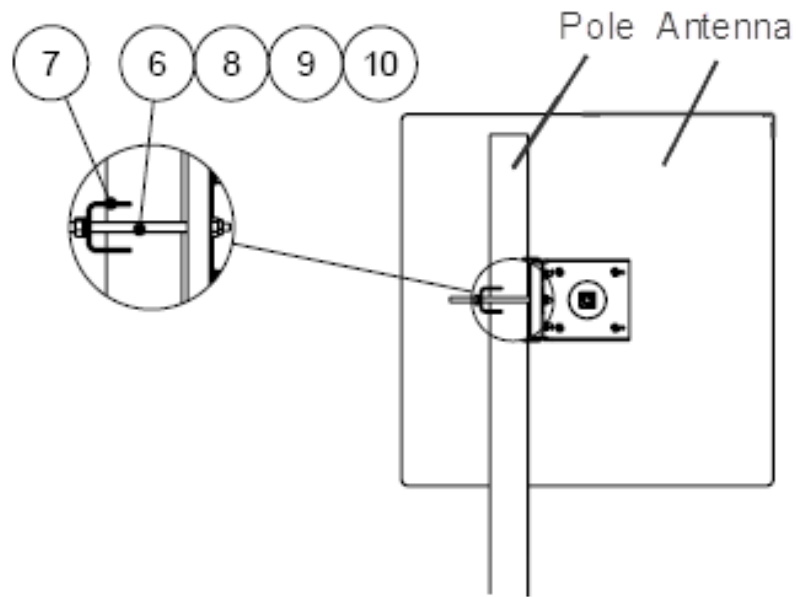
2. Attach the grooved bracket to the L bracket using items 2, 3, 4, and 5 as shown in [Figure 3-34](#). Do not fasten the screws.

Figure 3-34 Attaching the Grooved Bracket



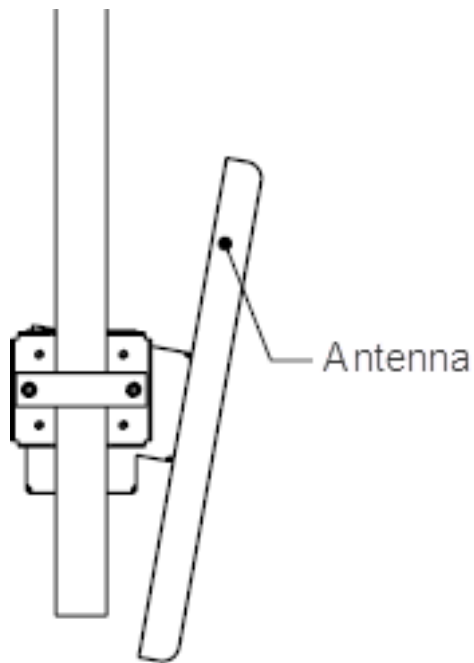
3. Attach the antenna to the pole using items 6, 7, 8, 9, and 10 as shown in [Figure 3-35](#). Use tightening torque of 76 kg-cm.

Figure 3-35 Attach Antenna to Pole



4. Adjust the required tilt using the angular scale and fasten all screws and nuts at the required position as shown in [Figure 3-36](#). Use tightening torque of 68 kg-cm.

Figure 3-36 Adjusting the Tilt



Mounting Antenna Model WS-AO-5D23009

The WS-AO-5D23009 is a 5 GHz panel antenna with two connectors for dual polarization. This antenna is especially designed for exterior installation. [Figure 3-37](#) shows a WS-AO-5D23009 antenna. [Table 3-5](#) describes the mounting kit for the WS-AO-5D23009 antenna. The WS-AO-5D23009 antenna can also be mounted to a pole or on a wall.

Figure 3-37 WS-AO-5D23009 Antenna

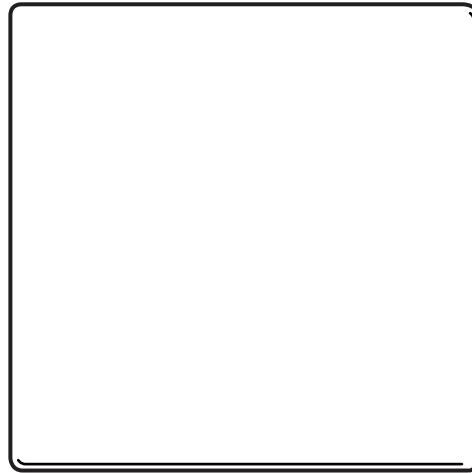


Table 3-5 WS-AO-5D23009 Mounting Kit

Item	Quantity	Description
1	1	Antenna base bracket
2	4	Flat washer M5
3	4	Spring washer M5
4	4	Nut M5
5	1	Arm bracket
6	4	Bolt M8 x 40
7	1	Flat washer M8
8	4	Spring washer M8
9	2	Nut M8
10	1	Wall/Pole bracket
11	1	Clamping bracket
12	2	Bolt M8 x 70

Mounting the WS-AO-5D23009 Antenna to a Pole



Note: Refer to [Table 3-5](#) on page 3-33 for a complete list of parts that come with the WS-AO-5D23009 antenna.

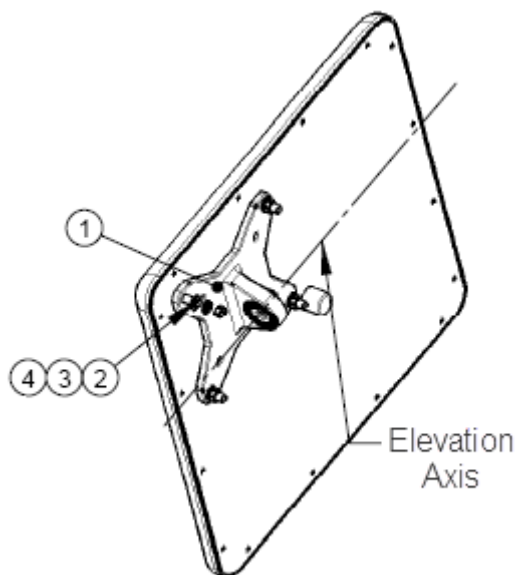
To attach the WS-AO-5D23009 antenna to a pole, you must:

- Attach the base bracket to the back of the antenna
- Attach the wall/pole bracket to the back of the antenna
- Attach the antenna to a pole, or to a wall. You can mount the antenna on pole sizes 1.75 to 3.00 inches or 1 to 1.75 inches in diameter.

To attach the base bracket to the back of the antenna:

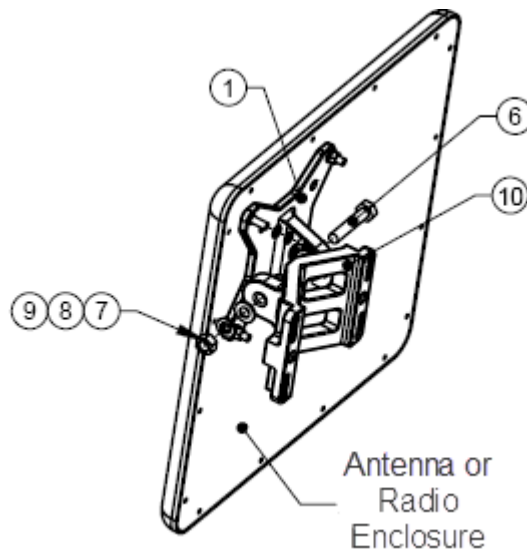
1. Attach the antenna base bracket (item 1) to the back of the antenna using items 2,3, and 4 as shown in [Figure 3-38](#).
2. Verify that the orientation of the hole in item 1 is aligned with the elevation axis.
3. Tighten using a torque of 5.7 N/m.

Figure 3-38 Attaching the Bracket to the Antenna



To attach the wall/pole bracket to the back of the antenna:

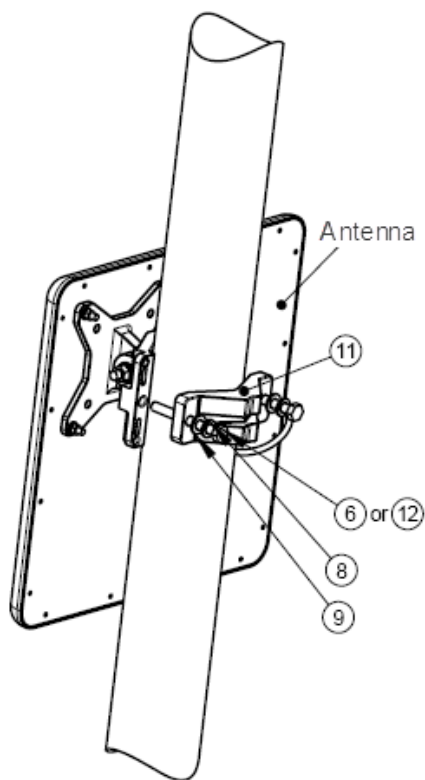
1. Connect the wall/pole bracket (item 10) to the antenna bracket (item 1)(mate knurled surfaces) using items 6, 7, 8, and 9 as shown in [Figure 3-39](#) on page 3-35.
2. Position the bolt head (item 6) in the socket on the bracket (item 1).
3. Tighten using a torque of 24 N/m.

Figure 3-39 Mounting the Antenna to a Pole

To mount the antenna to pole sizes 1.75 to 3.00 inches in diameter:

1. Install the antenna to the pole using a clamping bracket (item 11). Tighten the bracket using items 8, 9 and 12 as shown in [Figure 3-40](#).
2. Tighten using a torque of 14N/m.
3. Alternately and equally tighten two M8 bolts up to its defined torque to prevent unequal pressure on the cast clamps.

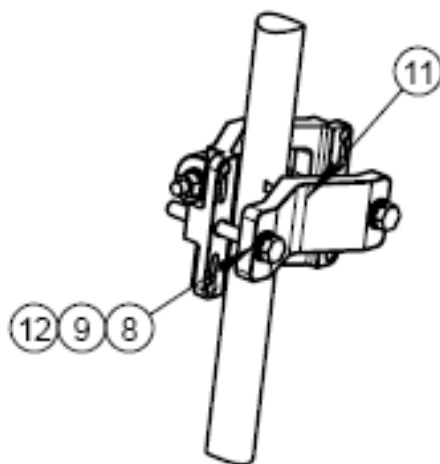
Figure 3-40 Mounting the Antenna to a 1.75" to 3.00" Pole



To mount the antenna to pole sizes 1 to 1.75 inches in diameter:

1. Install the antenna to the pole using a clamping bracket (item 11) as shown in [Figure 3-41](#).
2. Tighten the bracket (items 8, 9 and 12) using a torque of 14N/m.
3. Alternately and equally tighten two M8 bolts (item 9) up to their defined torque to prevent unequal pressure on the cast clamps.

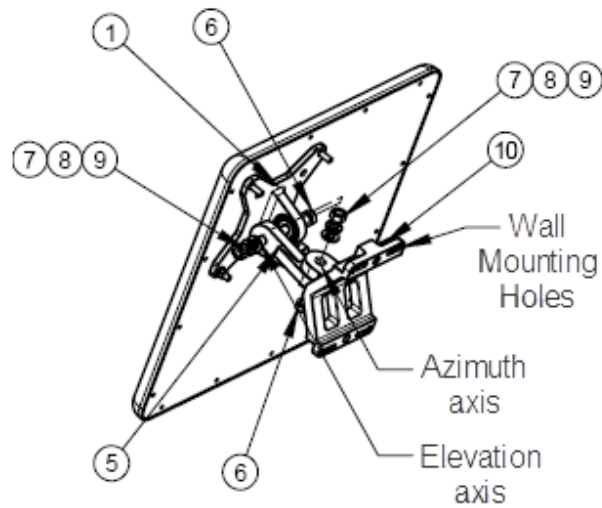
Figure 3-41 Mounting the Antenna to a 1 to 1.75 Inch Pole



To mount the antenna to a wall:

1. Connect the base bracket as shown in [Figure 3-38](#) on page 3-34.
2. Connect the arm bracket (item 5) to the antenna base bracket (item 1) (mate-knurled surfaces) using items 6, 7, 8, and 9. Position the bolt head in the socket of the base bracket (item 1). See [Figure 3-42](#) on page 3-37.
3. Mount the wall/pole bracket (item 10) on the wall in the desired position, noting the azimuth axis orientation.
4. Attach the arm bracket (item 5) to the wall/pole bracket (item 10) (mate the knurled surfaces) using items 6, 7, 8, and 9 as shown.
5. Position the bolt in the socket of the arm bracket (item 5).
6. Use a tightening torque of 24 N/m to the azimuth and elevation hardware.

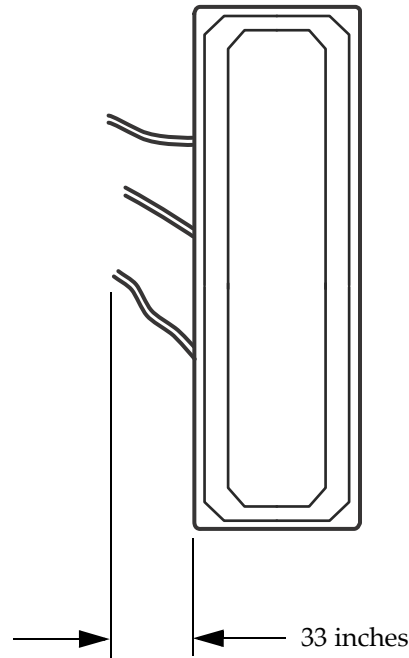
Figure 3-42 Mounting the Antenna on a Wall



Mounting Antenna Model WS-AI-DT04360

The WS-AI-DT04360 is a ceiling mounted 2.4 and 5 GHz omnidirectional antenna. It has three connectors and is especially designed for MIMO APs. [Figure 3-43](#) shows a WS-AI-DT04360 antenna.

Figure 3-43 WS-AI-DT04360 Antenna



Mounting the WS-AI-DT04360 Antenna to the Ceiling

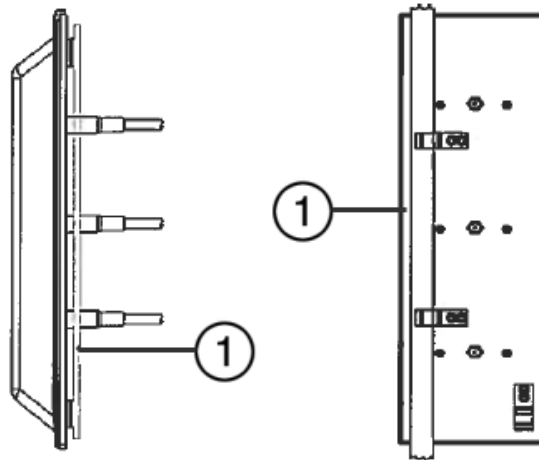
For best results, mount the WS-AI-DT04360 antenna near the center of the coverage area. A line-of-sight path between the antenna and active floor locations works best. Avoid mounting the antenna next to a column or vertical support that could create a shadow zone or reduce coverage to one portion of the room.

To mount the WS-AI-DT04360 antenna:

1. Make two slots in the ceiling tile to pass the feed lines through.

2. Install the antenna on the tile support rail as shown in [Figure 3-44](#).

Figure 3-44 Installing on Ceiling Support Rails

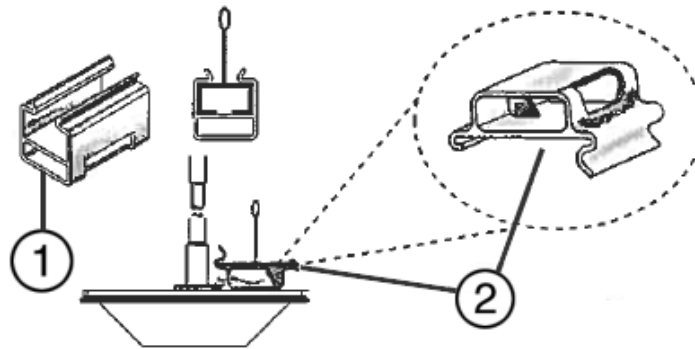


1 Ceiling grid I-beam

For installations using recessed edge tiles:

1. Use the supplied plastic recessed tile adapter clips. Snap the clips onto the ceiling tile grid.
2. Mount the antenna to the clips as shown in [Figure 3-45](#).

Figure 3-45 Mounting the Antenna Clips



1 Rectangular profile clip

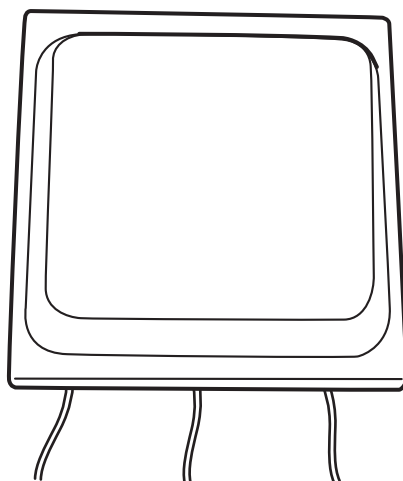
2 Recessed tile grid clip

For 9/16" rectangular profile grid, install the supplied clips in the same manner.

Mounting Antenna Model WS-AI-DT05120

The WS-AI-DT05120 is a 2.4 and 5 GHz dual-band sector antenna that can be mounted in an indoor location. It has three connectors and is especially designed for MIMO APs. [Figure 3-46](#) shows a WS-AI-DT05120 antenna. The WS-AI-DT05120 antenna can also be mounted on a wall or on a pole.

Figure 3-46 WS-AI-DT05120 Antenna



Mounting the WS-AI-DT05120 Antenna on a Wall

[Figure 3-47](#) shows how to mount the WS-AI-DT05120 antenna on a wall. [Table 3-6](#) on page 3-41 describes the mounting kit for the WS-AI-DT05120 antenna.

Figure 3-47 Mounting the WS-AI-DT05120 Antenna on a Wall

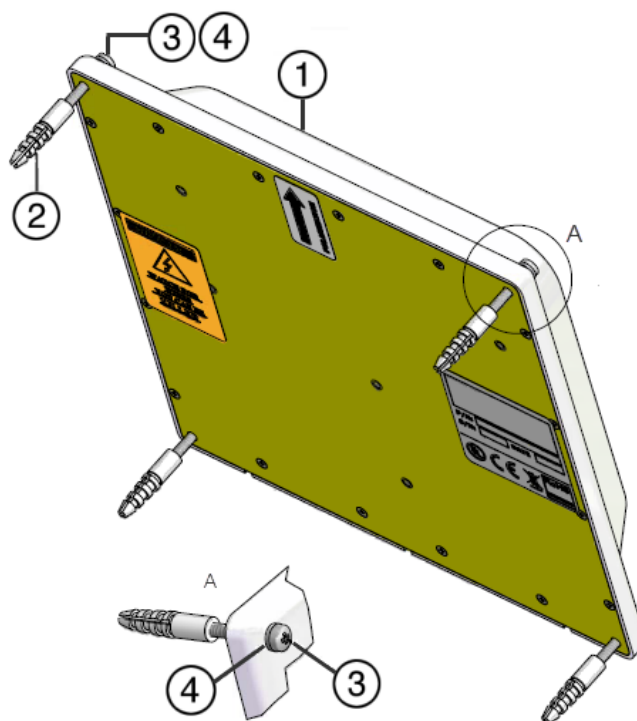
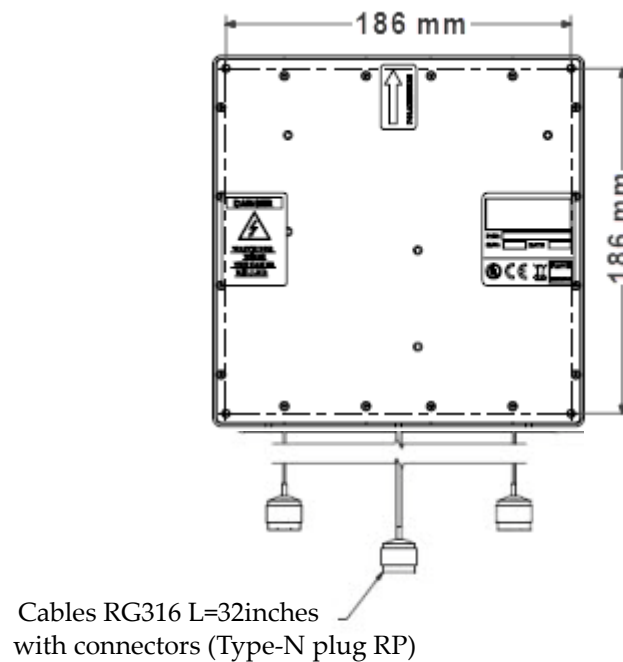


Table 3-6 WS-AI-DT05120 Wall Mounting Kit

Item	Quantity	Description
1	1	Antenna
2	4	Plastic wall insert (diameter 6 x 29 mm)
3	4	Phillips pan head tap. screw 5.3 x 1.25 inches
4	4	Plain washer #6 normal

To mount the WS-AI-DT05120 antenna on a wall:

1. Drill in the wall four holes 6 x 29 mm for plastic inserts (item 2) using the provided drilling template (see [Figure 3-48](#)). The drilling template was drawn to scale. Enlarge it before using it.

Figure 3-48 WS-AI-DT05120 Antenna Drilling Template

2. Put plastic inserts (item 2) into the holes in the wall.
3. With the antenna polarization arrow directed up, fit the bracing holes of the antenna (item 1) to the holes in the plastic inserts.
4. Secure the antenna in the plastic wall inserts with items 3 and 4.

Mounting the WS-AI-DT05120 Antenna on a Pole

Figure 3-49 shows how to mount the adapters on the WS-AI-DT05120 antenna. Table 3-7 lists the parts that come with the WS-AI-DT05120 antenna. Figure 3-50 on page 3-43 shows how to mount the WS-AI-DT05120 antenna on a pole.

Figure 3-49 Mounting the Adapters on the WS-AI-DT05120 Antenna

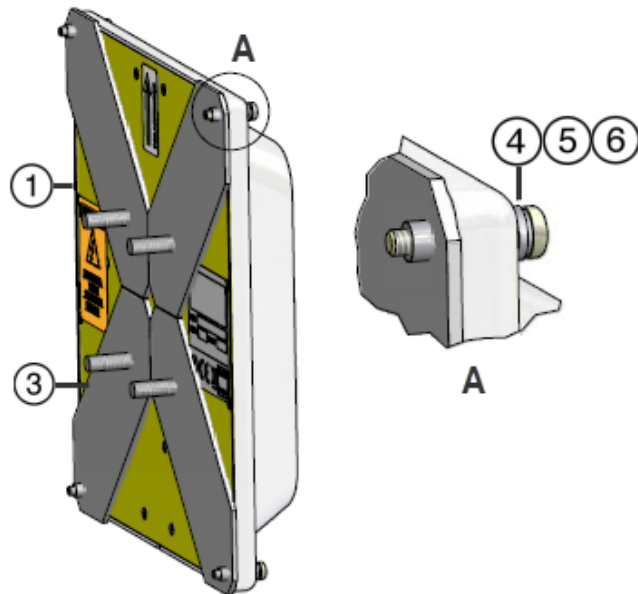
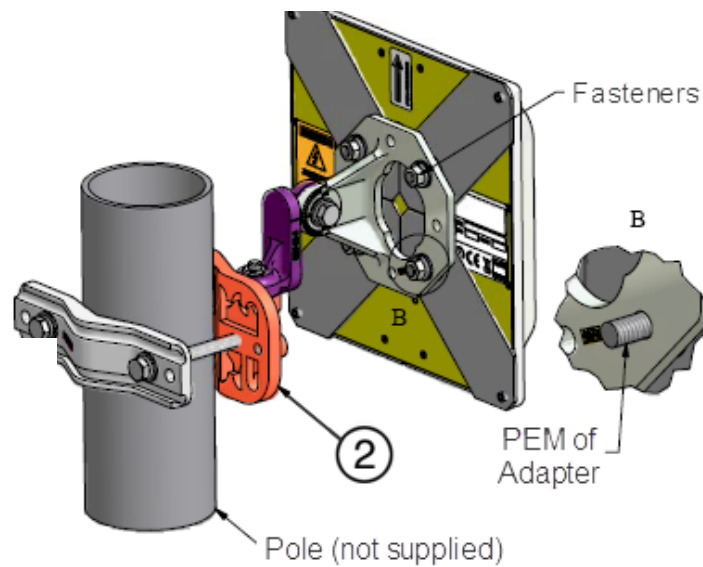


Table 3-7 WS-AI-DT05120 Pole Mounting Parts List

Item	Quantity	Description
1	1	Antenna
2	1	Mount MNT-22 (shown in Figure 3-50 on page 3-43)
3	4	Adapter
4	4	Plain washer #6 normal
5	4	Spring washer #6 Regular
6	4	Phillips pan screw UNC 6-32 x 3/4"

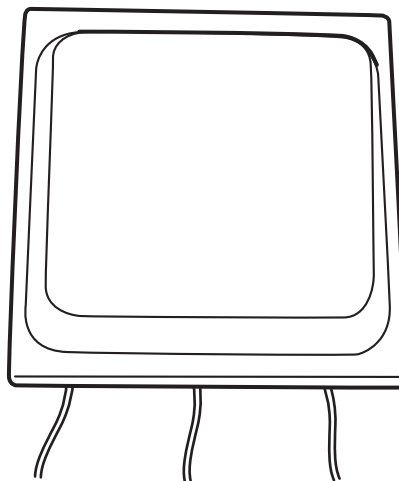
To mount the WS-AI-DT05120 to a pole:

1. Join 4 adapters (item 3) to the antenna (item 1) with items 4, 5, and 6.
2. Tighten screws (item 6) to keep the adapters (not finally).
3. Fix MNT-22 (item 2) onto Pole (see Figure 3-50 on page 3-43).
4. Put PEMs of the adapters (item 3) into bracing holes of MNT-22.
5. Connect the adapters using the supplied fasteners of MNT-22.
6. Torque the nuts to 30 inch pounds.
7. Tighten the screws (item 6) at each corner of the antenna.

Figure 3-50 Mounting the WS-AI-DT05120 Antenna on a Pole

Mounting Antenna Model WS-AO-DT05120 and WS-AO-DT05120-1

The WS-AO-DT05120 and WS-AO-DT05120-1 are 2.4 and 5 GHz dual-band sector antennas that can be mounted in an outdoor location. Each has three connectors and is especially designed for MIMO APs. [Figure 3-51](#) shows a WS-AO-DT05120 and WS-AO-DT05120-1 antenna. The WS-AO-DT05120 and WS-AO-DT05120-1 antennas can also be mounted on a wall or on a pole.

Figure 3-51 WS-AO-DT05120 and WS-AO-DT05120-1 Antennas

Mounting the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas on a Wall

[Figure 3-52](#) on page 3-44 shows how to mount the WS-AO-DT05120 and WS-AO-DT05120-1 antennas on a wall. [Table 3-8](#) on page 3-44 shows the mounting kit for the WS-AO-DT05120 and WS-AO-DT05120-1 antennas.

Figure 3-52 Mounting the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas on a Wall

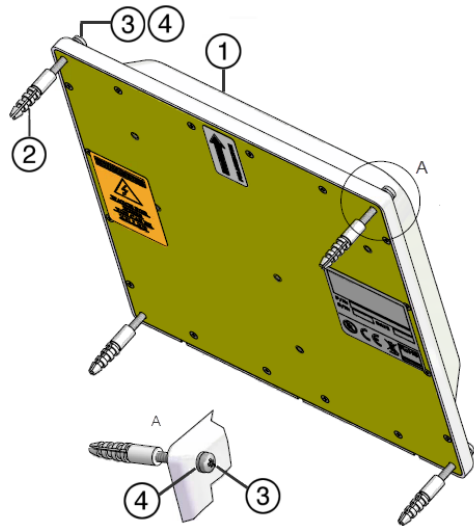
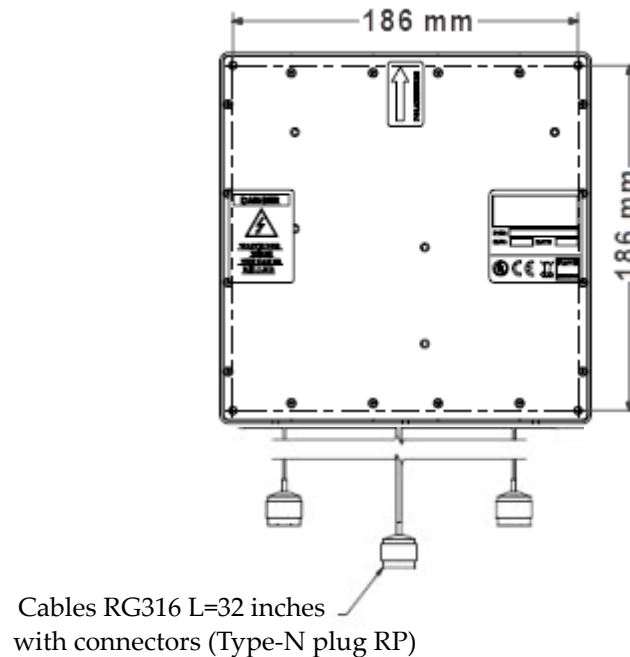


Table 3-8 WS-AO-DT05120 and WS-AO-DT05120-1 Wall Mounting Kit

Item	Quantity	Description
1	1	Antenna
2	4	Plastic wall insert (diameter 6 x 29 mm)
3	4	Phillips pan head tap. screw 5.3 x 1.25 inches
4	4	Phillips washer #6 normal

To mount the WS-AO-DT05120 and WS-AO-DT05120-1 antennas on a wall:

1. Drill in the wall four holes 6 x 29 mm for plastic inserts (item 2) using the provided drilling template (see [Figure 3-53](#)). The drilling template was drawn to scale. Enlarge it before using it.

Figure 3-53 WS-AO-DT05120 and WS-AO-DT05120-1 Antenna Drilling Template

2. Put plastic inserts (item 2) into the holes in the wall.
3. With the antenna polarization arrow directed up, fit the bracing holes of the antenna (item 1) to the holes in the plastic inserts.
4. Secure the antennas in the plastic wall inserts with items 3 and 4.

Mounting the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas on a Pole

Figure 3-54 shows how to mount the adapters on the WS-AO-DT05120 and WS-AO-DT05120-1 antennas. Table 3-9 lists the parts provided with the WS-AO-DT05120 and WS-AO-DT05120-1 antennas. Figure 3-55 on page 3-47 shows how to mount the WS-AO-DT05120 and WS-AO-DT05120-1 antennas on a pole.

Figure 3-54 Mounting the Adapters on the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas

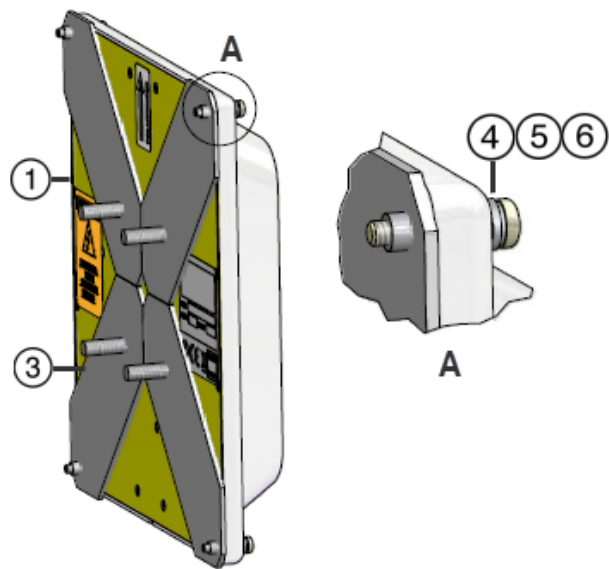
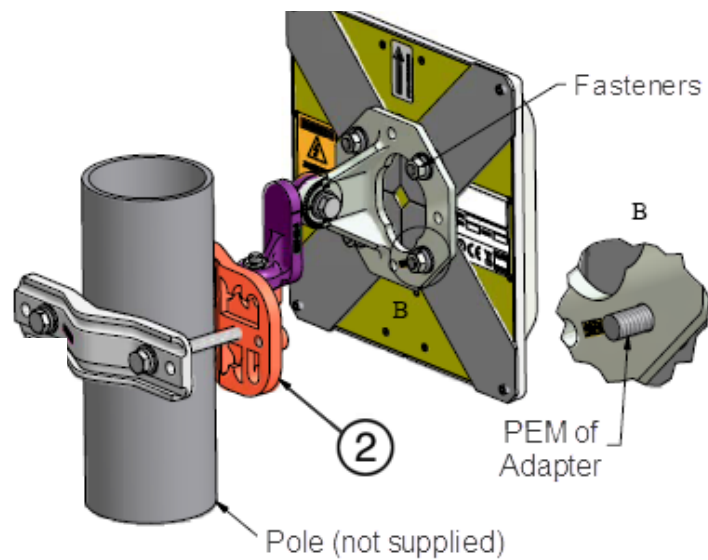


Table 3-9 WS-AO-DT05120 and WS-AO-DT05120-1 Pole Mounting Parts List

Item	Quantity	Description
1	1	Antenna
2	1	Mount MNT-22 (shown in Figure 3-55 on page 3-47)
3	4	Adapter
4	4	Plain washer #6 normal
5	4	Spring washer #6 regular
6	4	Phillips pan screw UNC 6-32 x 3/4"

To mount the WS-AO-DT05120 and WS-AO-DT05120-1 to a pole:

1. Join 4 adapters (item 3) to the antenna (item 1) with items 4, 5, and 6.
2. Tighten screws (item 6) to keep the adapters (not finally).
3. Fix MNT-22 (item 2) onto Pole (see [Figure 3-55](#) on page 3-47).
4. Put PEMs of the adapters (item 3) into bracing holes of MNT-22.
5. Connect the adapters using the supplied fasteners of MNT-22.
6. Torque the nuts to 30 inch pounds.
7. Tighten the screws (item 6) at each corner of the antenna.

Figure 3-55 Mounting the WS-AO-DT05120 and WS-AO-DT05120-1 Antennas on a Pole

Mounting Antenna Model WS-AO-2S10360 and WS-AO-5S10360

Antenna model WS-AO-2S10360 and WS-AO-5S10360 are ruggedized high-performance 2.4 and 5 GHz omni-directional baton antennas. [Figure 3-56](#) shows the WS-AO-2S10360 and WS-AO-5S10360 antennas.

Figure 3-56 WS-AO-2S10360 and WS-AO-5S10360 Antennas

The WS-AO-2S10360 and WS-AO-5S10360 antennas can be mounted to a pole in exterior locations. Its flattened radiation pattern focuses energy along the horizontal plane to provide extended coverage in large rooms or vaulted areas.

For best results, mount the WS-AO-2S10360 and WS-AO-5S10360 antennas at ceiling or roof level near the center of the coverage area. You can also mount the WS-AO-2S10360 and WS-AO-5S10360 antennas on a pole.

Mounting the WS-AO-2S10360 and WS-AO-5S10360 Antenna on a Pole

Figure 3-57 shows how to mount the WS-AO-2S10360 and WS-AO-5S10360 antennas on a pole. Table 3-10 lists the components of the pole mounting kit.

Figure 3-57 Mounting the WS-AO-2S10360 and WS-AO-5S10360 Antennas to a Pole

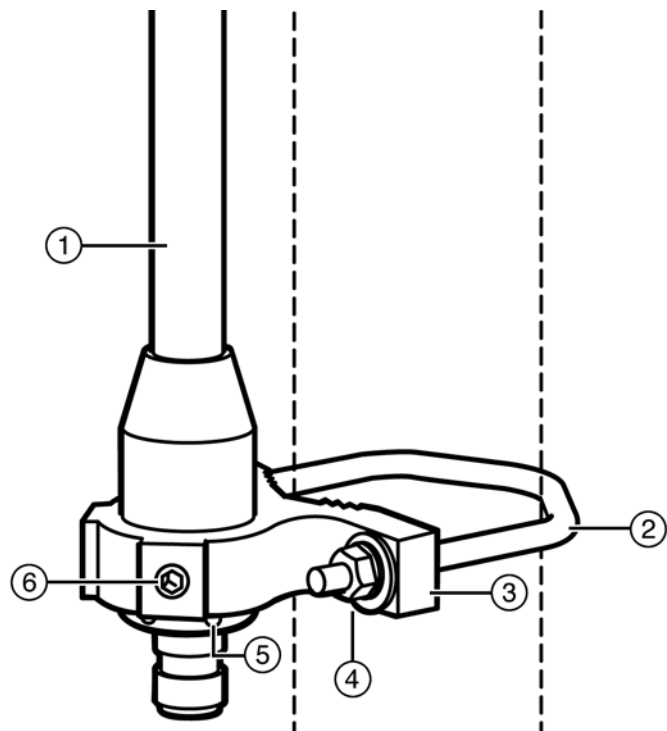


Table 3-10 WS-AO-2S10360 and WS-AO-5S10360 Pole Mounting Kit

Item	Quantity	Description
1	1	Antenna
2	1	U-Bolt (up to 2.5" O.D. - mast not supplied)
3	1	Bracket, cast aluminum
4	2	Hex nuts, spring lock washers, flat washers
5	2	Drain holes
6	2	Set screws

To install the antenna using the pole mount bracket:

1. Find the U-bolt (item 2), bracket (item 3), plus two hex nuts, spring lock washers, and flat washers (item 4).
2. At the top of the pipe, using an adjustable wrench, secure the U-bolt to the clamp using the hardware provided.
3. Slide the antenna assembly onto the U-bolt.
4. Secure in place by tightening both set screws (item 6).

5. Secure the coaxial cable along the mast or pole using tape or cable ties.
6. If installing one antenna, attach the connector to the AP unit's primary antenna connection. If installing a diversity system, attach the leads from the two antennas to the AP unit's primary and secondary jacks.

Mounting Antenna Model WS-ANT21

Antenna model WS-ANT21 is a ruggedized high-performance 2.4 and 5 GHz omni-directional baton antenna. [Figure 3-58](#) shows the WS-ANT21 antenna.

Figure 3-58 WS-ANT21 Antenna



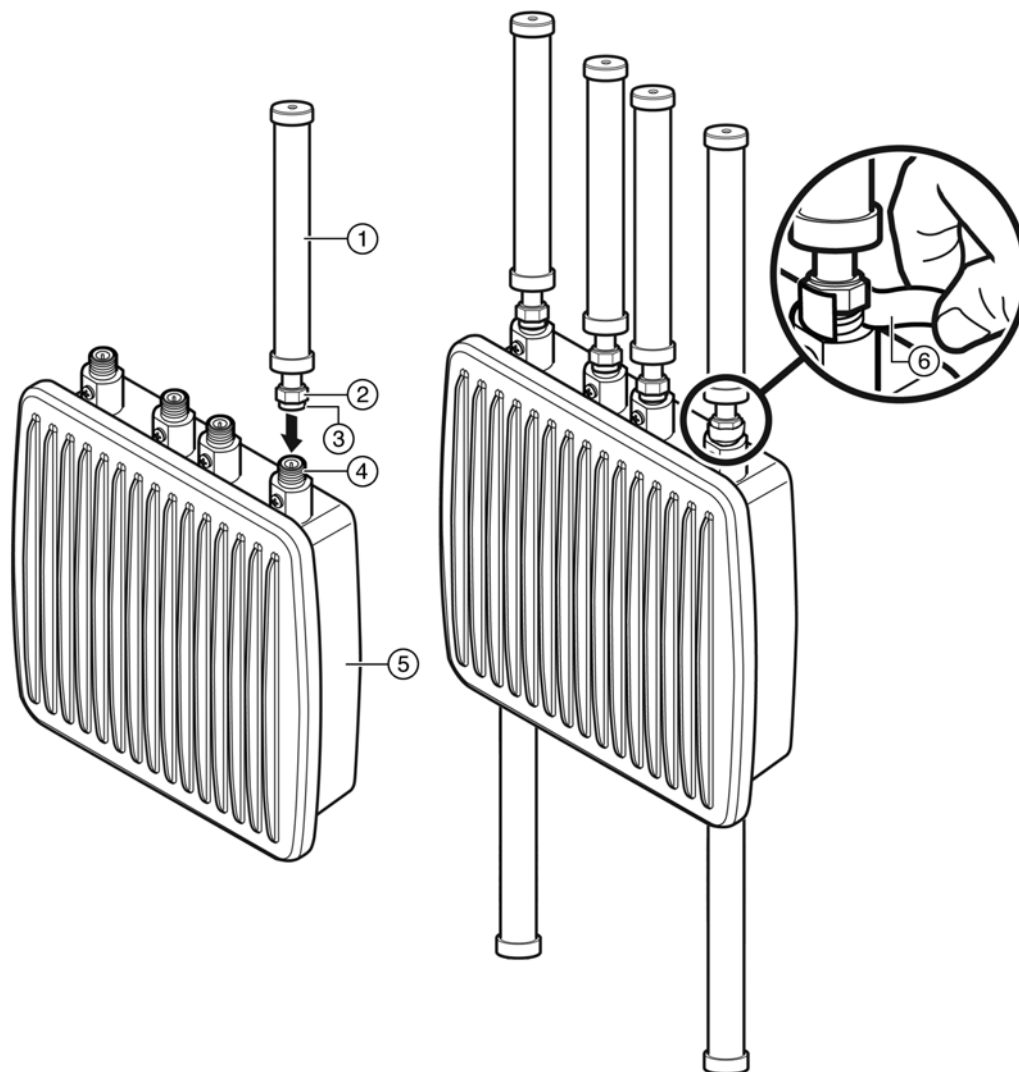
The WS-ANT21 antenna can be connected directly to the AP3660 in an exterior location. Its flattened radiation pattern focuses energy along the horizontal plane to provide extended coverage in large rooms or vaulted areas.

For best results, mount the WS-ANT21 antenna at ceiling or roof level near the center of the coverage area.

Mounting the WS-ANT21 Antenna

Figure 3-59 shows how to mount the WS-ANT21 antenna directly to the AP3660.

Figure 3-59 Mounting the WS-ANT21 Antenna to the AP3660



- | | | | |
|---|------------------------------|---|--|
| 1 | Antenna | 4 | Reverse polarity Type-N jack |
| 2 | Nut | 5 | AP3660 |
| 3 | Reverse polarity Type-N plug | 6 | Sealing tape (recommended, but not supplied) |

To install the antenna (refer to [Figure 3-59](#)):

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 AP3660 and the Type-N plug (item 3) of the antenna by wrapping a layer of sealing tape (item 6).



Note: The AP3660 supports up to six WS-ANT21 antennas as shown in [Figure 3-59](#).

Mounting Antenna Model WS-AO-DX13025

The WS-AO-DX13025 dual-band six port (3 for each band) MIMO antenna provides 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 antenna provides optimal coverage for areas or events with a large number of mobile data users. It is designed for outdoor installations utilizing 802.11n multi-band wireless LAN access point radios. [Figure 3-60](#) shows the WS-AO-DX13025 antenna.

Figure 3-60 WS-AO-DX13025 Antenna



Mounting the WS-AO-DX13025

The antenna includes a fully adjustable mount for pipe or wall mounting. The mounting fits pole sizes from 1.63 inches to 2.3 inches. Hardware for wall mounting is not included in the kit.

The mount allows the antenna to be vertically or horizontally polarized.

Table 3-11 WS-AO-DX13025 Mount Kit Contents

Item	Quantity	Description
A	1	Antenna mount bracket
B	1	Elevation adjustable bracket
C	1	Azimuth adjustable bracket
D	4	1/4 inch 20 x 3/4 carriage bolts
E	6	1/4 inch 20 hex nuts
F	6	1/4 inch 20 spring lock washers
G	6	1/4 inch 20 flat washers
H	2	Pipe clamps

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

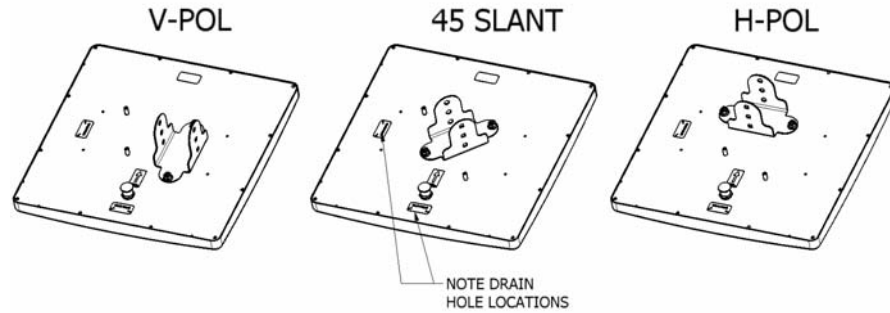
- 7/16 inch wrench
- 8 mm nut driver or flat head screwdriver for hose clamps

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 3-11](#) above.

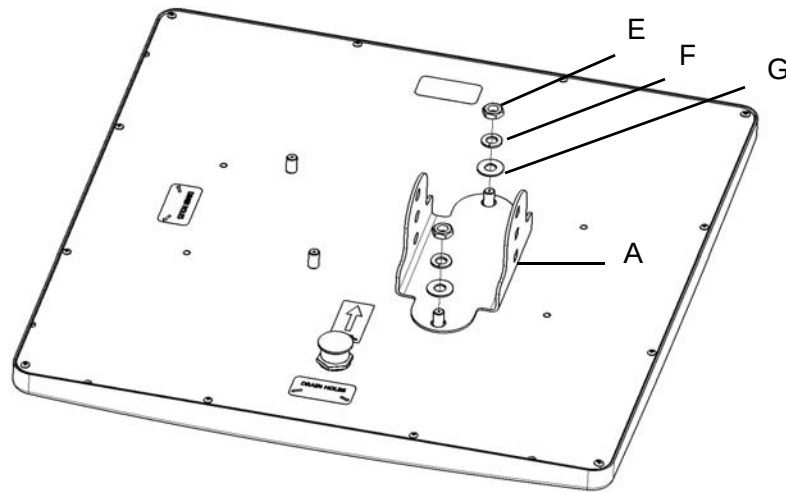
- Determine the mount configuration. The bracket attachments for vertical polarization, 45° slant, and horizontal polarization mounting configurations are shown in [Figure 3-61](#) on page 3-52 below.

Figure 3-61 Bracket Attachment for Various Mounting Configurations

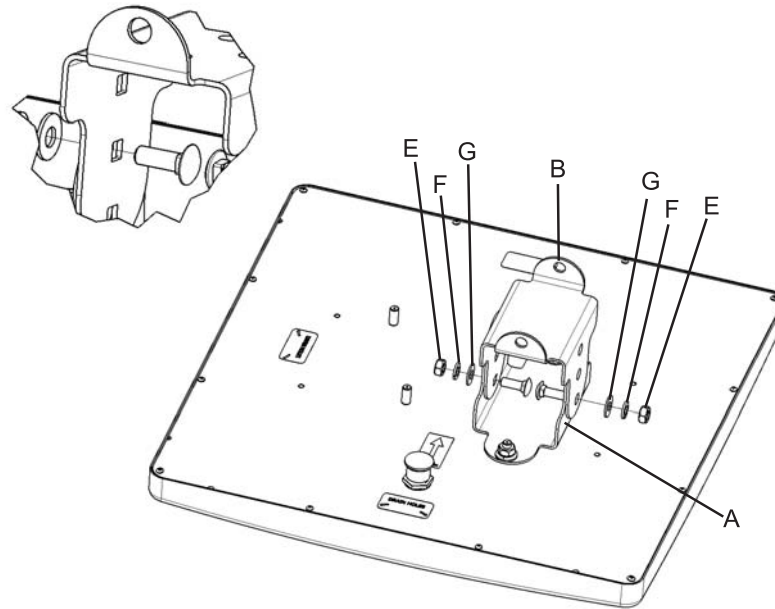


- Attach antenna mount bracket (item A in [Table 3-11](#) on page 3-51) to the back of the antenna as shown in [Figure 3-62](#) below, applying a maximum nut-tightening torque of 55 in-lbf (6.2 Nm). Items E, F, and G are described in [Table 3-11](#) on page 3-51.

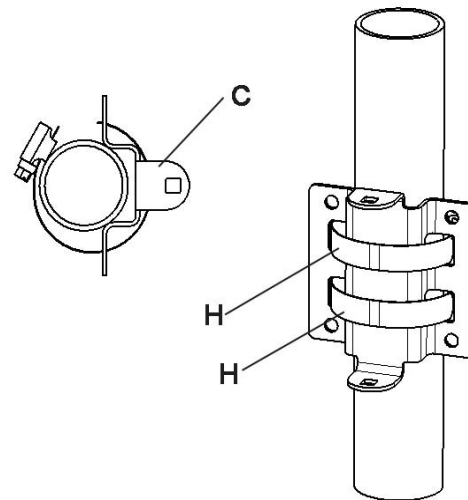
Figure 3-62 Attaching Antenna Mount Bracket



- Attach the elevation adjustable bracket (B) as shown in [Figure 3-63](#) on page 3-53 and loosely secure the hardware. The carriage bolt square holes must be on the inside.

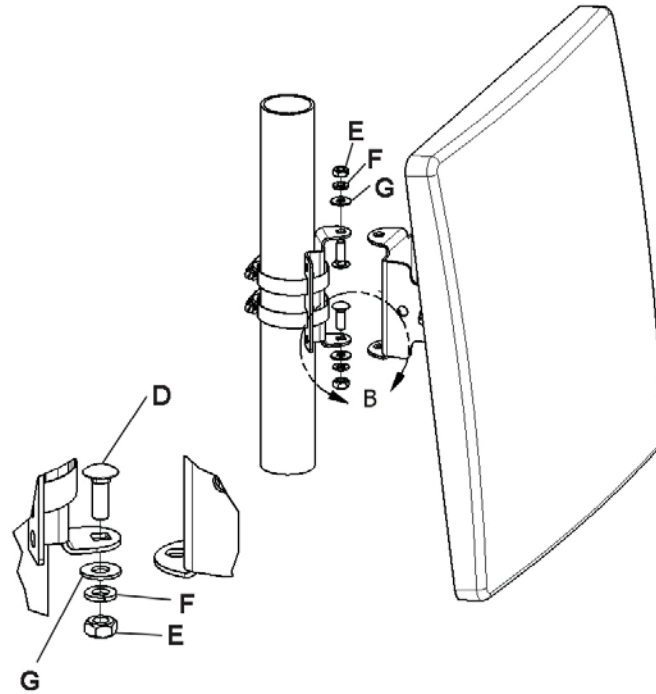
Figure 3-63 Attaching Elevation Bracket

5. Attach the azimuth adjustable bracket (C) to the pipe, using the routing band clamps (H) as shown in [Figure 3-64](#). Pipe clamp recommended torque is 43 – 51 in-lbf (4.9 – 5.8 Nm).

Figure 3-64 Attaching Azimuth Bracket to Pipe

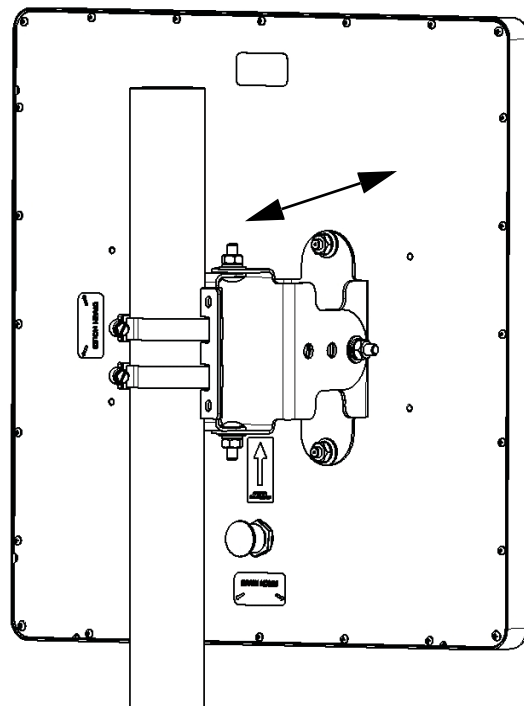
6. Attach the antenna assembly to the azimuth bracket on the pipe as shown in [Figure 3-65](#) on page 3-54.

Figure 3-65 Attaching Antenna Assembly to Azimuth Bracket



7. Adjust to the desired azimuth and elevation angles and tighten all pivot hardware (4 places). The bracket is adjustable for lower profiles off the pipe, as shown in [Figure 3-66](#).

Figure 3-66 Bracket Adjustable for Lower Profiles



Mounting Antenna Model WS-AI-DX02360

The WS-AI-DX02360 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.

The antenna is designed for ceiling mounting in indoor locations.

Figure 3-67 WS-AI-DX02360 Antenna

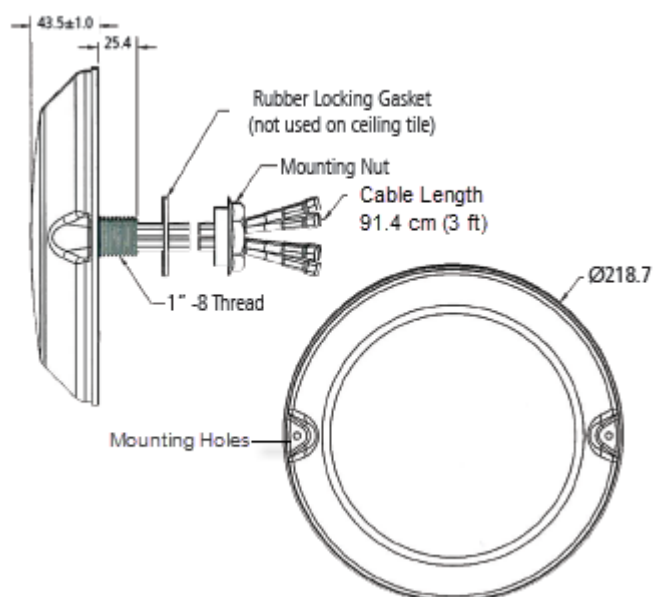


Mounting the WS-AI-DX02360

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), shown in [Figure 3-68](#), are the primary mounting configuration when access is available to both sides of the mounting surface, such as suspended ceiling tile.

Figure 3-68 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 [Figure 3-68](#).
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 [Figure 3-68](#) to attach the antenna with #8 screws and expanding anchors (not supplied).

Mounting Antenna Model WS-AI-DX07025

The WS-AI-DX07025 dual-band six port (3 for each band) MIMO antenna provides 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 antenna provides optimal coverage for areas or events with a large number of mobile data users. It is designed for indoor installations utilizing 802.11n multi-band wireless LAN access point radios. [Figure 3-69](#) shows the WS-AI-DX07025 antenna.

Figure 3-69 WS-AI-DX07025 Antenna



Mounting the WS-AI-DX07025

The antenna includes a fully adjustable mount for pipe or wall mounting. The mounting fits pole sizes from 1.63 inches to 2.3 inches. Hardware for wall mounting is not included in the kit.

The mount allows the antenna to be vertically or horizontally polarized.

Table 3-12 WS-AI-DX07025 Mount Kit Contents

Item	Quantity	Description
A	1	Antenna mount bracket
B	1	Elevation adjustable bracket
C	1	Azimuth adjustable bracket
D	4	1/4 inch 20 x 3/4 carriage bolts
E	6	1/4 inch 20 hex nuts

Table 3-12 WS-AI-DX07025 Mount Kit Contents

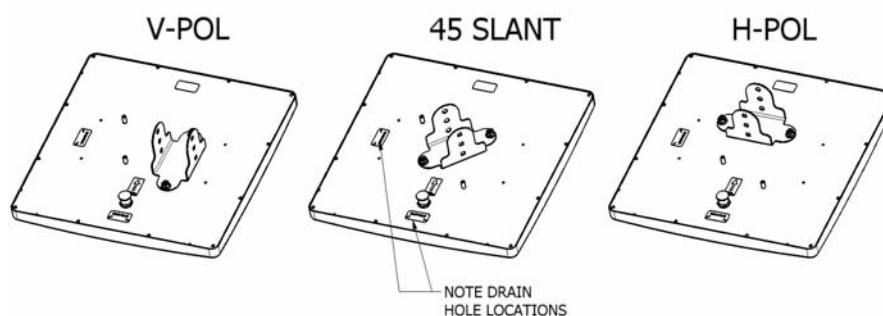
Item	Quantity	Description
F	6	1/4 inch 20 spring lock washers
G	6	1/4 inch 20 flat washers
H	2	Pipe clamps

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

- 7/16 inch wrench
- 8 mm nut driver or flat head screwdriver for hose clamps

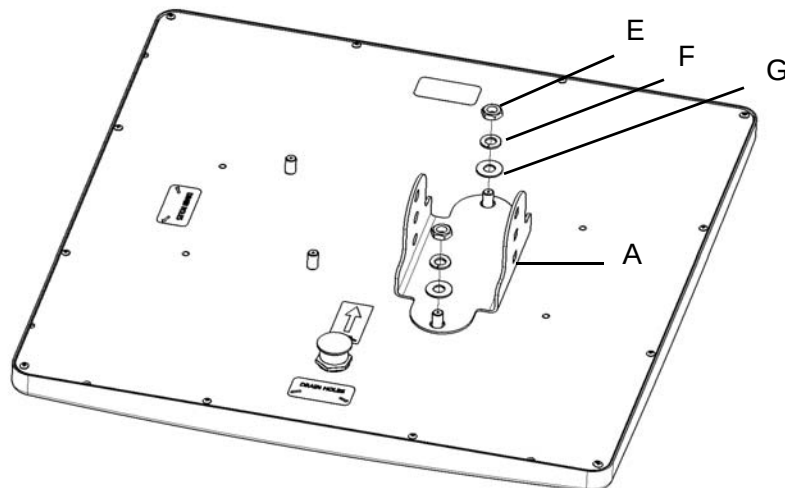
To install the antenna:

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 3-12](#) above.
2. Determine the mount configuration. The bracket attachments for vertical polarization, 45° slant, and horizontal polarization mounting configurations are shown in [Figure 3-70](#) on page 3-57 below.

Figure 3-70 Bracket Attachment for Various Mounting Configurations

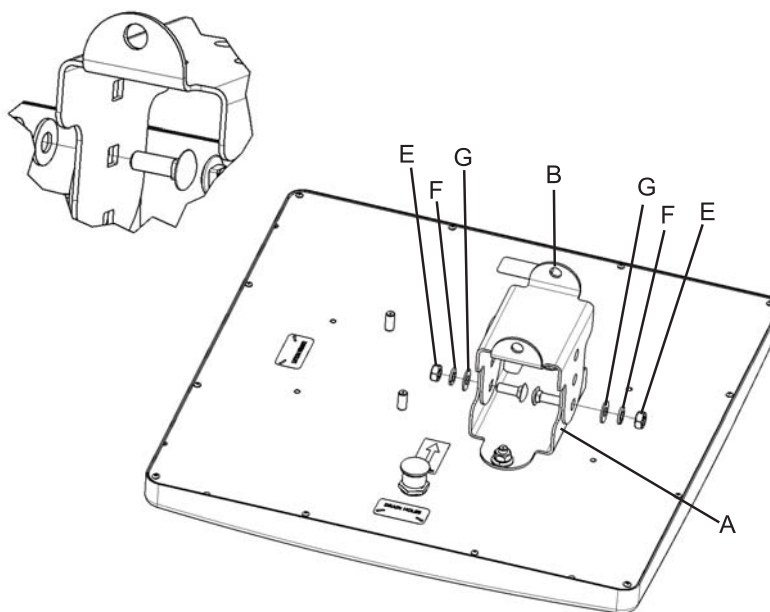
3. Attach antenna mount bracket (item A in [Table 3-12](#) on page 3-56) to the back of the antenna as shown in [Figure 3-71](#) below, applying a maximum nut-tightening torque of 55 in-lbf (6.2 Nm). Items E, F, and G are described in [Table 3-12](#) on page 3-56.

Figure 3-71 Attaching Antenna Mount Bracket

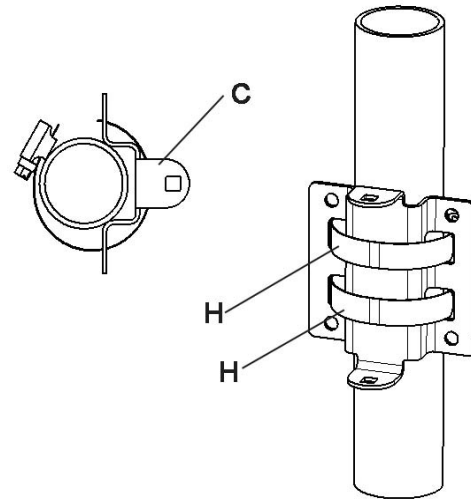


4. Attach the elevation adjustable bracket (B) as shown in [Figure 3-72](#) on page 3-58 and loosely secure the hardware. The carriage bolt square holes must be on the inside.

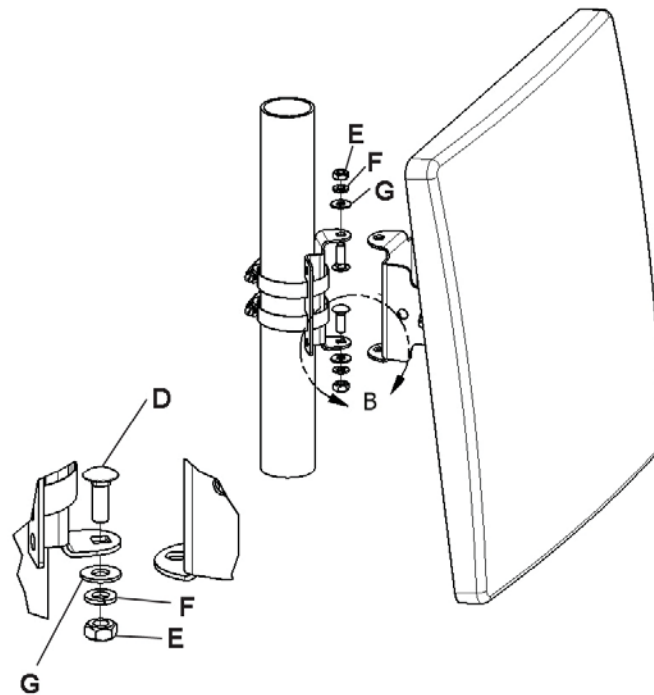
Figure 3-72 Attaching Elevation Bracket



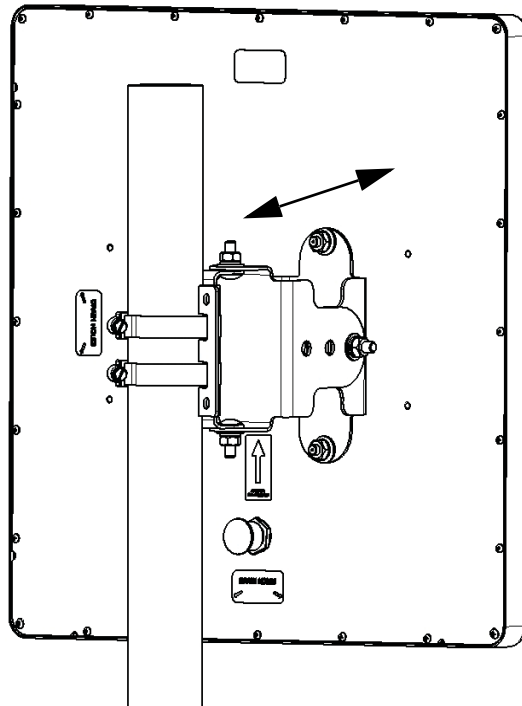
5. Attach the azimuth adjustable bracket (C) to the pipe, using the routing band clamps (H) as shown in [Figure 3-73](#). Pipe clamp recommended torque is 43 – 51 in-lbf (4.9 – 5.8 Nm).

Figure 3-73 Attaching Azimuth Bracket to Pipe

6. Attach the antenna assembly to the azimuth bracket on the pipe as shown in [Figure 3-74](#) on page 3-59.

Figure 3-74 Attaching Antenna Assembly to Azimuth Bracket

7. Adjust to the desired azimuth and elevation angles and tighten all pivot hardware (4 places). The bracket is adjustable for lower profiles off the pipe, as shown in [Figure 3-75](#).

Figure 3-75 Bracket Adjustable for Lower Profiles

Connecting Antenna Cables

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.

Using the Plug Pigtail (Reverse Polarity Type-N Plug)

[Figure 3-76](#) and [Figure 3-77](#) show the cable configurations for using the female pigtail connector (WS-CAB-PT20P) to connect an AP to an outdoor antenna.

[Figure 3-76](#) shows the configuration for using a lightning protector. [Figure 3-77](#) shows the configuration when not using a lightning protector. [Table 3-13](#) describes the configurations.

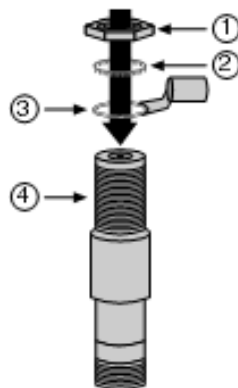
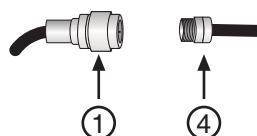
Figure 3-76 Plug Pigtail Cable (Reverse Polarity Type-N plug) with Lightning Protector

Figure 3-77 Plug Pigtail Cable (Reverse Polarity Type-N plug) without Lightning Protector**Table 3-13 Plug Pigtail Cable (Reverse Polarity Type-N Plug) Components**

Item	Component	Connectors
1	Pigtail connection (20-inch) - Plug	- Reverse Polarity SMA plug to AP - Reverse Polarity Type-N plug to antenna - Male body and female center contact
2	Lightning protector	- Reverse Polarity Type-N jack on both ends - Female body and male center contact
3	Low-loss antenna cable (lengths of 20, 25, 50 or 75 feet)	- Reverse Polarity Type-N plug on both ends - Male body and female center contact
4	Antenna Pigtail or Antenna Connector	- Reverse Polarity Type-N jack - Female body and male center contact

Using the Jack Pigtail (Reverse Polarity Type-N Jack)

[Figure 3-78](#) and [Figure 3-79](#) show the cable configurations for using a jack pigtail connector (WS-CAB-PT20J) to connect an AP to an outdoor antenna.

[Figure 3-78](#) shows the configuration for using a lightning protector. [Figure 3-79](#) shows the configuration when not using a lightning protector. [Table 3-14](#) describes the configurations.

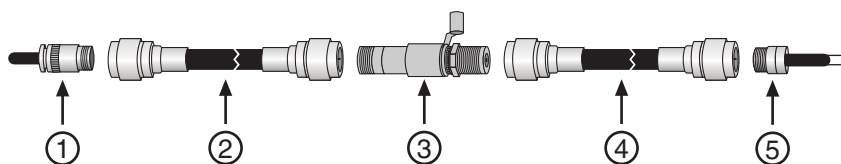
Figure 3-78 Jack Pigtail Cable (Reverse Polarity Type-N Jack) with Lightning Protector

Figure 3-79 Male Pigtail Cable without Lightning Protector

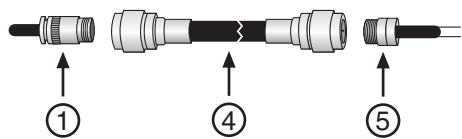


Table 3-14 Jack Pigtail Cable Components

Item	Component	Connectors
1	Pigtail connection (50 cm) - Male	• Right Angle MC Card to AP • Reverse Polarity Type-N jack to antenna • Female body and male center contact
2	Low-loss antenna cable (lengths of 6, 20, 25, 50 or 75 feet) Note: Enterasys Networks does not recommend using the 75 ft. cable due to the loss factor.	• Reverse Polarity Type-N plug on both ends • Male body and female center contact
3	Lightning protector	• Reverse Polarity Type-N jack on both ends • Female body and male center contact
4	Low-loss antenna cable (lengths of 6, 20, 25, 50 or 75 feet) Note: Enterasys Networks does not recommend using the 75 ft. cable due to the loss factor.	• Reverse Polarity Type-N plug on both ends • Male body and female center contact
5	Antenna Pigtail or Antenna Connector	• Reverse Polarity Type-N jack • Female body and male center contact

Cable Installation Guidelines

The cable should not be installed into 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 Enterasys Wireless AP via the lightning protector.

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.
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 3-64. If required, adjust the direction of the antenna.
6. Once the installation has been fully tested, 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. No part of the cable should be allowed to hang free.
8. Use waterproof stretch tape to seal all outdoor connectors.

Optimizing Outdoor Point-to-Point Antenna Placement

If an AP is connected to an outdoor directional antenna, the antenna must be pointed 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.

AP3660 Antenna Alignment Using Internal Buzzer

The AP3660 includes an audible buzzer used when aligning an antenna with a remote AP. The volume of the buzzer changes based on the received signal strength (RSS) related to the antenna alignment. The sound is a beep followed by a pause, where the cycle is shorter for stronger signal strength and longer for weaker signals. The pause ranges from 0.04 seconds (strongest signal strength) to 1 second (weakest signal strength).

The buzzer is enabled when the AP3660 LED mode is set to “WDS Signal Strength” in the Enterasys Wireless Assistant software.

To change the AP3660 LED mode:

1. From the main menu, click **Wireless AP Configuration**. The **Enterasys Wireless AP** screen displays.
2. In the **Wireless APs** list, select the AP3660 from the list of APs. The **AP Properties** tab displays Wireless AP information.
3. In the **AP Properties** dialog, click **Advanced**. The Advanced dialog displays.
4. In the LED drop-down list, select **WDS Signal Strength**, and click Close.
5. To save your changes, click **Save**.



Note: For more information on the Enterasys Wireless Manager, refer to the *Enterasys Wireless Convergence Software User Guide*. This document is available in Adobe Acrobat Portable Document Format (PDF) at the following site: <https://extranet.enterasys.com/downloads/>

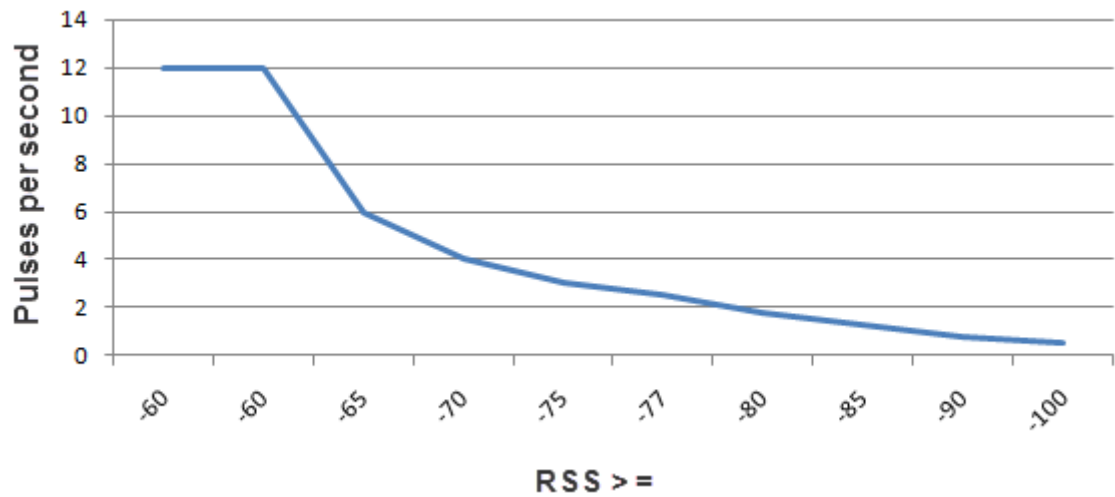
The buzzer pause is set to 50% duty cycle and the frequency of the buzzer pulse is exponential to the RSS as shown in Table 3-15 and Figure 3-80 on page 3-65. For example, if RSS is in the range from -65dbm to -70dbm, buzzer frequency is 4 pulses per second and each pulse is 0.12 seconds.



Warning: The Enterasys Wireless Outdoor AP buzzer volume will reach volumes between 80 and 90 db. Sustained exposure above 90 db may result in hearing loss.

Table 3-15 AP3660 Buzzer Frequency and Pulse Width

	RSS >=								
	-60	-65	-70	-75	-77	-80	-85	-90	-100
Frequency (pulses per second	12.00	6.00	4.00	3.00	2.5	1.75	1.25	0.75	0.5
Pulse Width (seconds)	0.04	0.08	0.12	0.16	0.20	0.28	0.40	0.68	1.00

Figure 3-80 AP3660 Buzzer Frequency and Received Signal Strength (RSS)

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.



Antenna Specifications

This appendix lists the specifications and radiation patterns for the external antennas supported by various Enterasys AP models. The antenna specifications are organized in this appendix by their strictly outdoor, combined indoor/outdoor, or strictly indoor design capability.

For information about...	Refer to page...
External Antennas for Use with Outdoor APs	A-2
External Antennas for Use with Indoor/Outdoor APs	A-24
External Antennas for Use with Indoor APs	A-36

Enterasys antenna part numbers indicate the indoor/outdoor capability of the antenna in the second field of the part number:

- 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 A-1 Outdoor Antennas

Antenna Part Number	Supported APs
WS-AO-DT05120	AP3660
WS-AO-DT05120-1	AP3765e, AP3767e, AP3660
WS-AO-5S10360	AP3765e, AP3767e, AP3660
WS-AO-2S10360	AP3765e, AP3767e, AP3660
WS-AO-5D23009	AP3765e, AP3767e, AP3620, AP3640, AP3660
WS-AO-5D16060	AP3765e, AP3767e, AP3620, AP3640, AP3660
WS-AO-2S08360	AP3620, AP3640
WS-AO-DS05360	AP3765e, AP3767e, AP3620, AP3640, AP3660, AP2620
WS-ANT21	AP3660
WS-AO-DX13025	AP3765e, AP3767e, AP3660

WS-AO-DT05120

Specifications

Table A-2 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 A-1 WS-AO-DT05120 2.5 GHz E-Plane Radiation Pattern

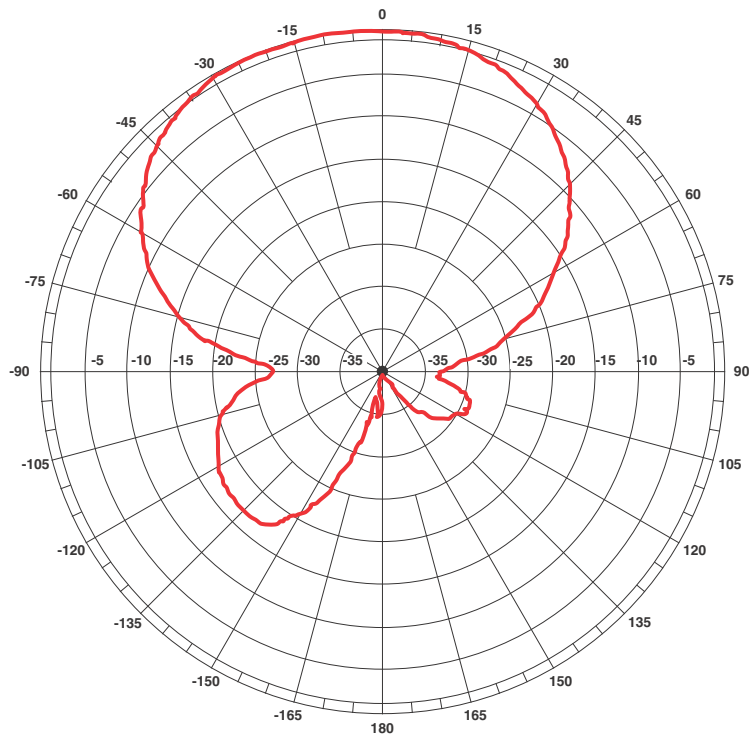


Figure A-2 WS-AO-DT05120 2.5 GHz H-Plan Radiation Pattern

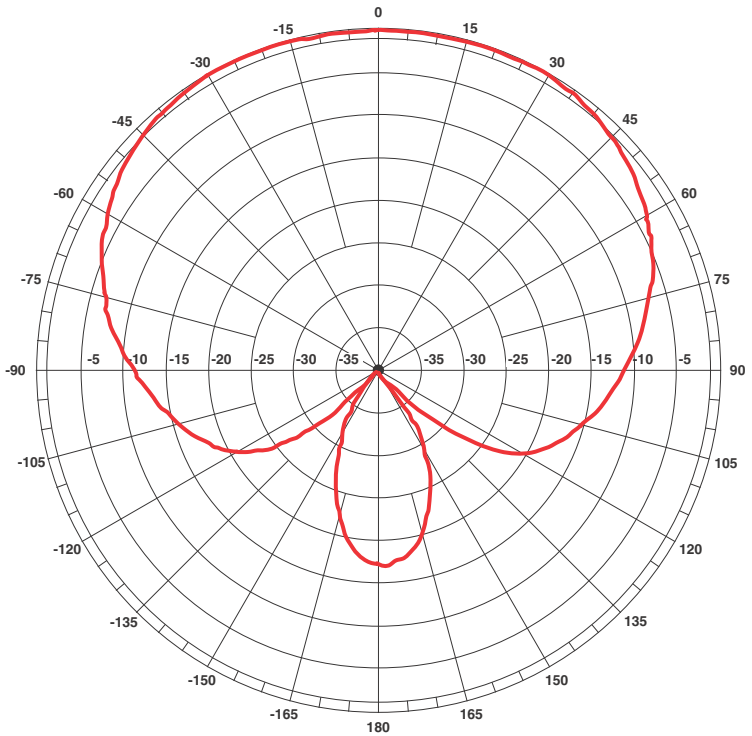


Figure A-3 WS-AO-DT05120 5.5 GHz E-Plane Radiation Pattern

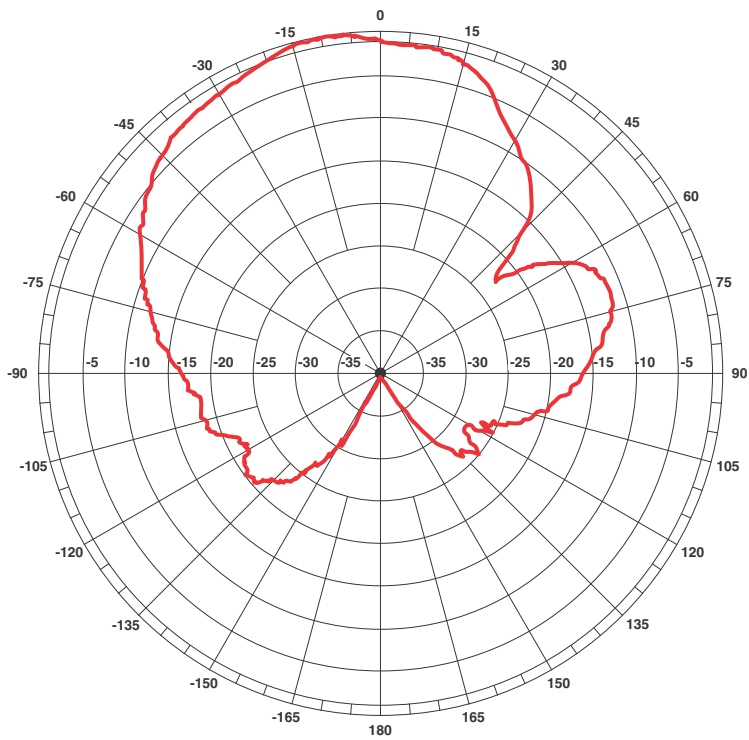
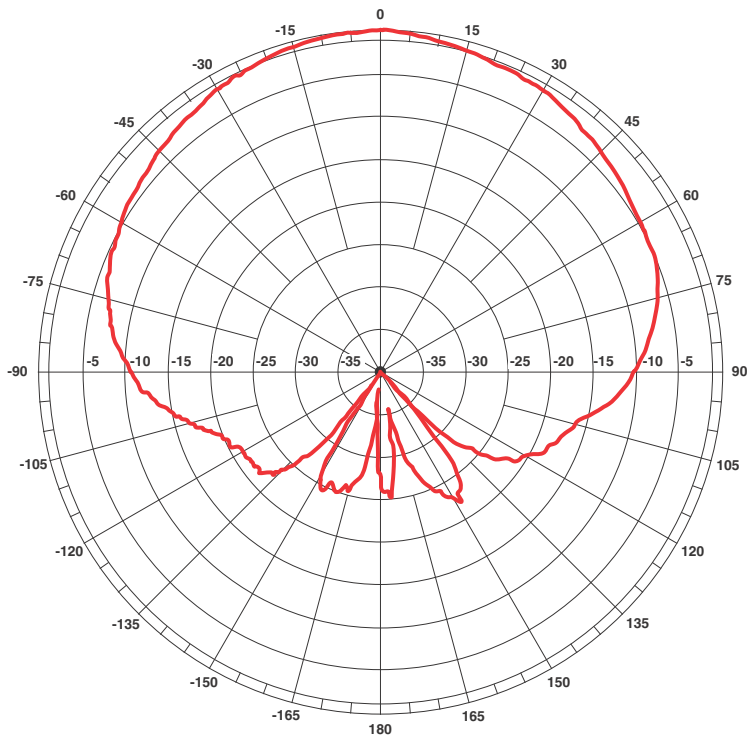


Figure A-4 WS-AO-DT05120 5.5 GHz H-Plane Radiation Pattern



WS-AO-DT05120-1

Specifications

Table A-3 WS-AO-DT05120-1 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 A-5 WS-AO-DT05120-1 2.5 GHz E-Plane Radiation Pattern

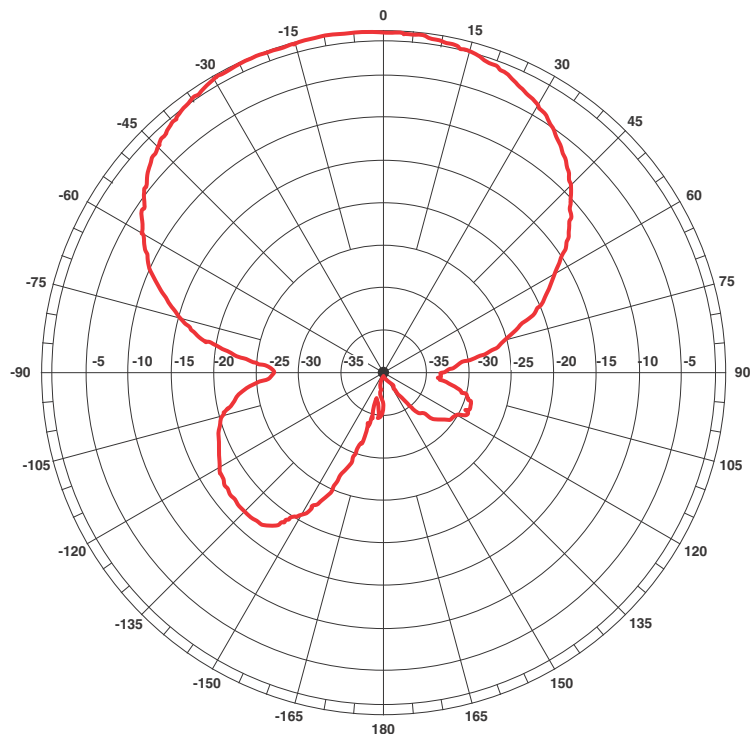


Figure A-6 WS-AO-DT05120-1 2.5 GHz H-Plan Radiation Pattern

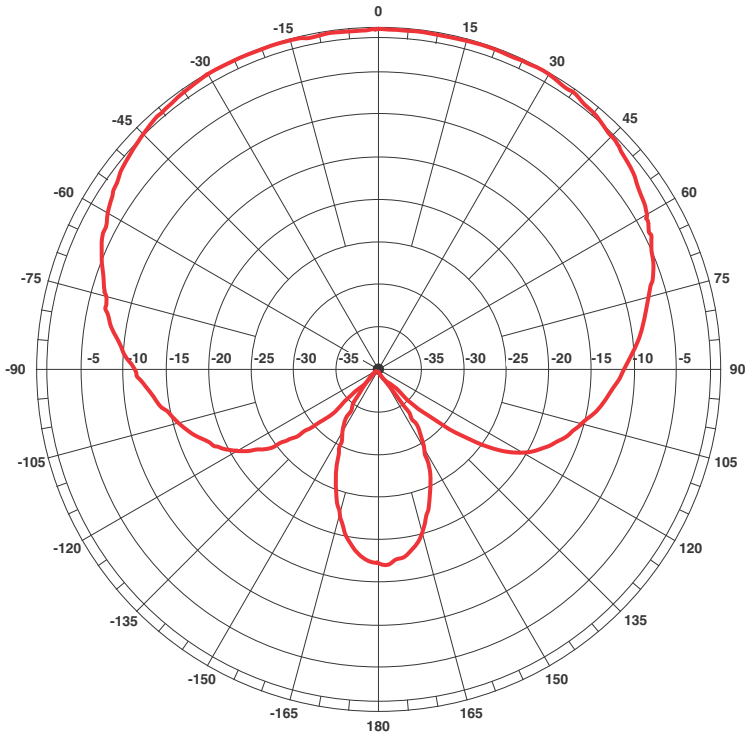


Figure A-7 WS-AO-DT05120-1 5.5 GHz E-Plane Radiation Pattern

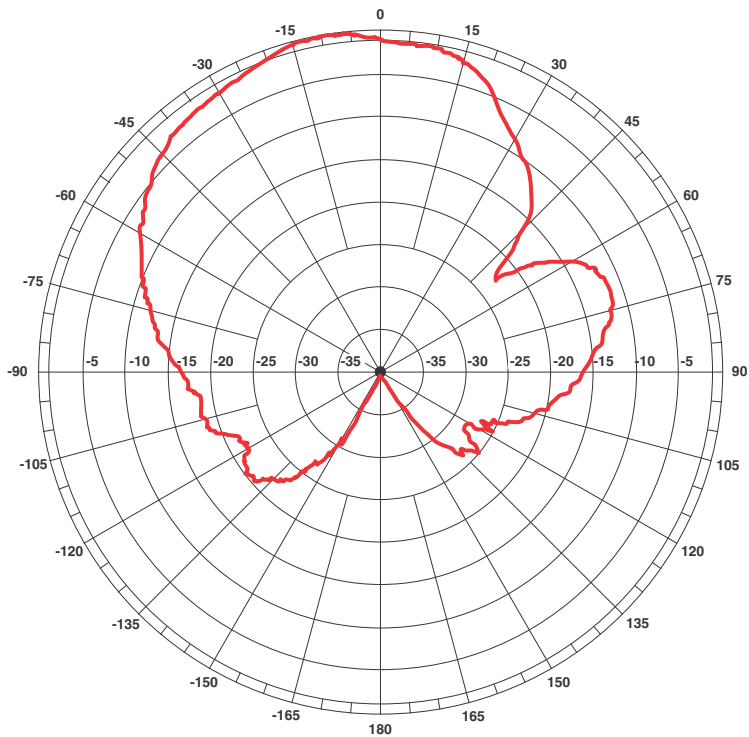
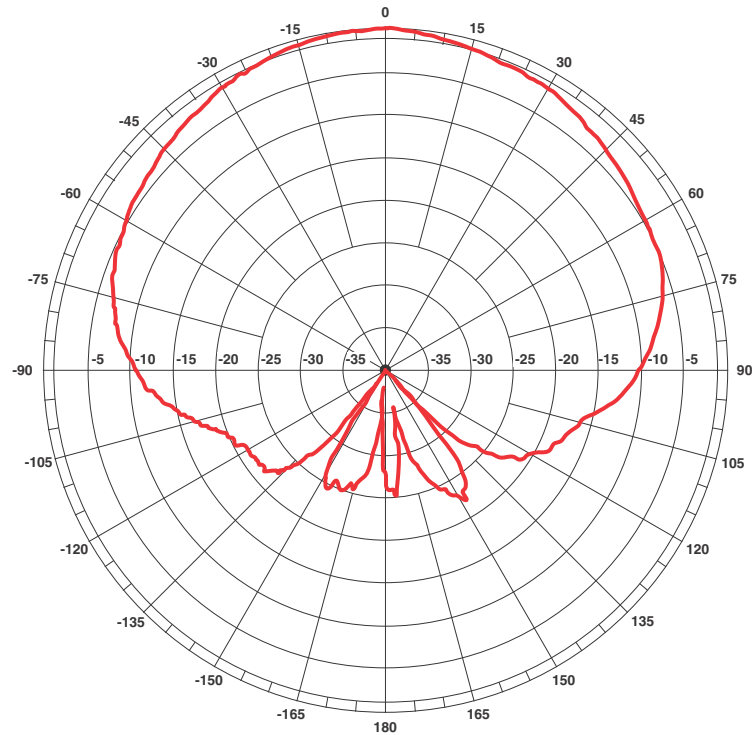


Figure A-8 WS-AO-DT05120-1 5.5 GHz H-Plane Radiation Pattern

WS-AO-5S10360

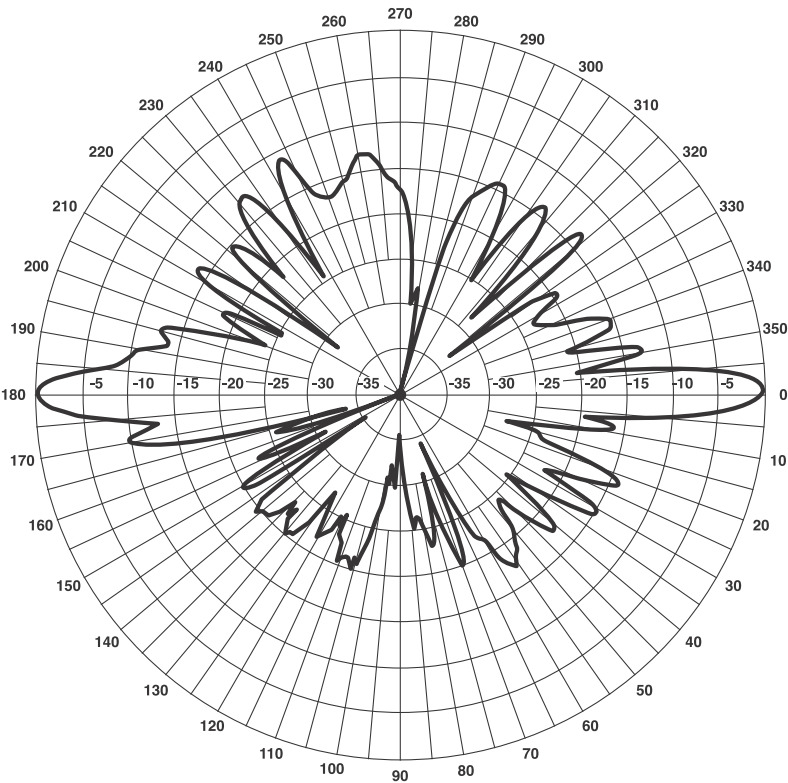
Specifications

Table A-4 WS-AO-5S10360 Specifications

Specification	Value
Frequency	5.725 – 5.825 GHz
Gain	10 dBi
Bandwidth	100 MHz (at 1.5:1 vswr)
Vertical Beamwidth	6° (at 1/2 power)
Horizontal Beamwidth	Omnidirectional
Wind Survival	125 mph (201 km/h)
Weight	.5 lb (.226 kg)
Bending moment	4.4 ft-lbs at rated wind
Lateral thrust	5.2 lbs at rated wind
Power	25 watts
Height	20.2 in (513mm)
Nominal Impedance	50 ohms

Radiation Pattern

Figure A-9 WS-AO-5S10360 5.0 GHz Radiation Pattern



WS-AO-2S10360

Specifications

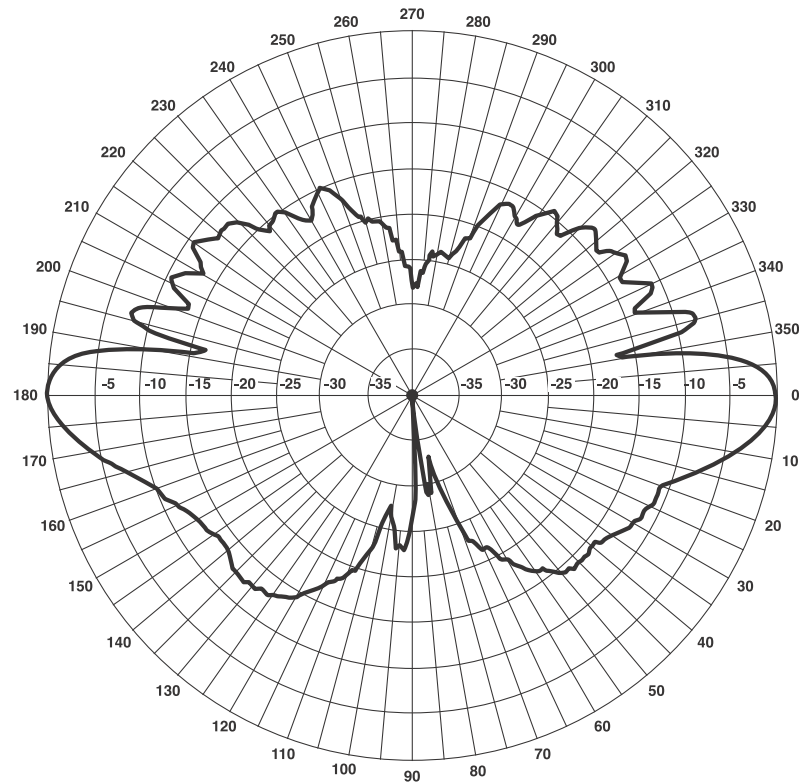
Table A-5 WS-AO-2S10360 Specifications

Specification	Value
Frequency	2.4–2.484 GHz
Gain	10 dBi
Bandwidth	100 MHz (at 1.5:1 vswr)
Vertical Beamwidth	9° (at 1/2 power)
Horizontal Beamwidth	Omnidirectional
Wind Survival	125 mph (201 km/h)
Weight	.65 lb (.295 kg)
Bending moment	14.7 ft-lbs at rated wind
Lateral thrust	10.1 lbs at rated wind
Power	25 watts
Height	36.0 in (914 mm)

Table A-5 WS-AO-2S10360 Specifications (continued)

Specification	Value
Nominal Impedance	50 ohms

Radiation Pattern

Figure A-10 WS-AO-2S10360 2.4 GHz Radiation Pattern

WS-AO-5D23009

Specifications

Table A-6 WS-AO-5D23009 Specifications

Specification	Value
Frequency	5.15–5.875 GHz
Gain:	
Port H (5.15–5.25 GHz)	22.5 dBi $\pm$ 0.5
Port H (5.25–5.875 GHz)	23 dBi $\pm$ 0.5
Port V	23 dBi
VSWR	1.7:1 (max) 1.5:1 (typ)
Polarization	Dual linear vertical and horizontal
3dB Beamwidth	9° (typ)

Table A-6 WS-AO-5D23009 Specifications (continued)

Specification	Value
Port to Port Isolation	40 dB (min.)
F/B Ration	-35 dB (min.)
Wind Survival	136 mph (220 km/h)
Weight	5.5 lb (2.5 kg)
Dimensions	14.6 in x 14.6 in x 1.6 in (371 mm x 371 mm x 40 mm)
Input Power	6 watts
Input Impedance	50 ohms
Temperature Range	-45°C to +70°C (-49°F to +158°F)

Radiation Patterns

In both [Figure A-11](#) and [Figure A-12](#), the E-plane pattern is blue and the H-plane pattern is red.

Figure A-11 WS-AO-5D23009 Azimuth Radiation Pattern Midband Freq. 5.47 GHz

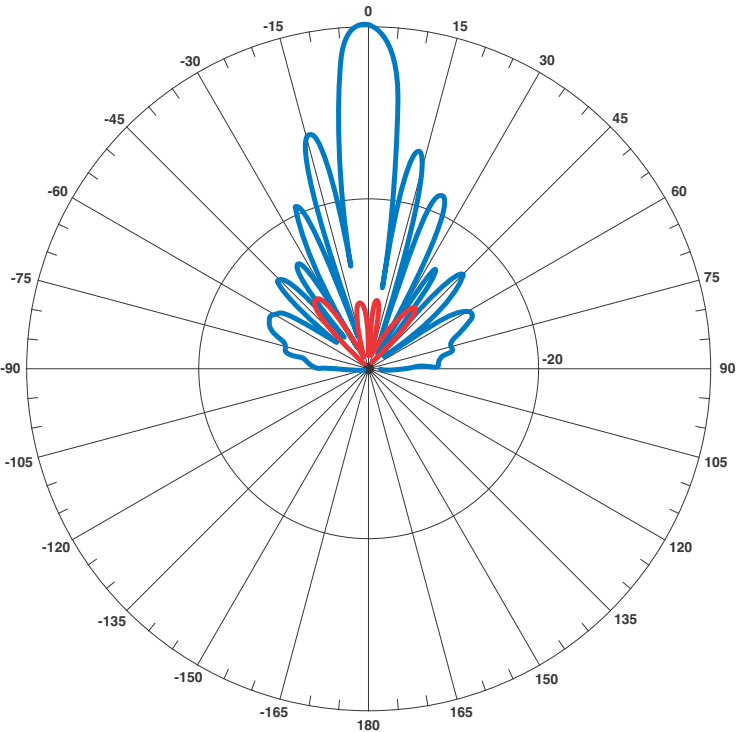
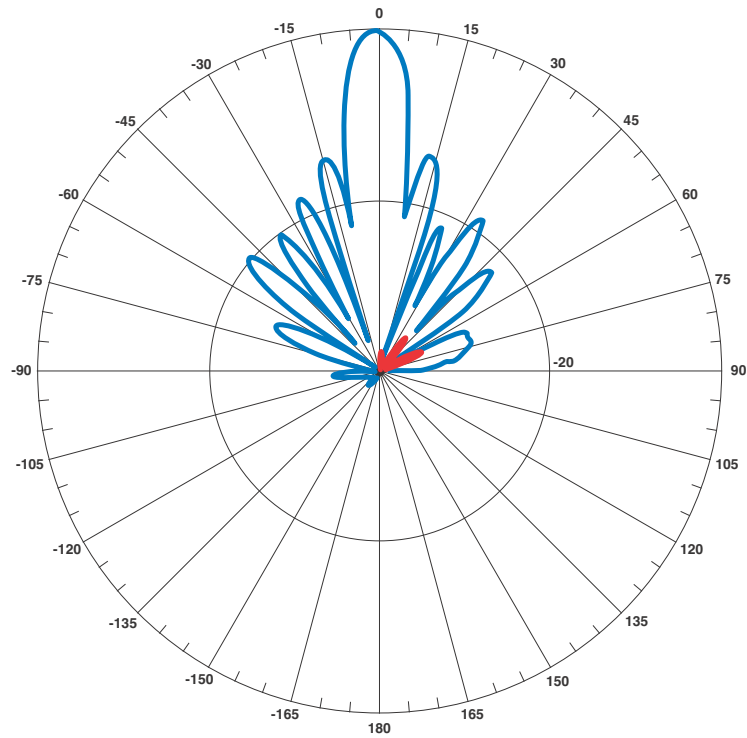


Figure A-12 WS-AO-5D23009 Elevation Radiation Pattern Midband Freq. 5.47 GHz

WS-AO-5D16060

Specifications

Table A-7 WS-AO-5D16060 Specifications

Specification	Value
Frequency	5.15 – 5.875 GHz
Gain:	
Port H	15 dBi
Port V	16 dBi (min.)
VSWR	1.7:1 (max)
Polarization	Dual vertical and horizontal
Elevation Beamwidth	10° ±4°
Azimuth Beamwidth	
Port H	ETSI EN 302 085 V1.1.2 CS1-CS3 13 dBi 60° ±4
Port V	ETSI EN 302 085 V1.1.2 CS1-CS3 12 dBi -4/ +7
Elevation Null Fill Below Horizon	ETSI EN 302 085 V1.1.2 CS1-CS3
1st Null	-15 dB (min.) @ 10°
2nd Null	-25 dB (min.) @ 20°
Cross Polarization	ETSI EN 302 085 V1.1.2 CS1-CS3 -24 dB (max)

Table A-7 WS-AO-5D16060 Specifications (continued)

Specification	Value
Port to Port Isolation	-35 dB
F/B Ratio	-30 dB (max)
Wind Survival	136 mph (220 km/h)
Weight	4.85 lb (2.2 kg)
Dimensions	17.16 in x 9.84 in x in (436 mm x 250 mm x 10 mm)
Input Power	6 watts
Input Impedance	50 ohms
Temperature Range	-45°C to +70°C (-49°F to +158°F)
Connector	2 x N-Type Female
Lightning Protection	DC grounded

Radiation Patterns

In both [Figure A-13](#) and [Figure A-14](#), the E-plane pattern is blue and the H-plane pattern is red.

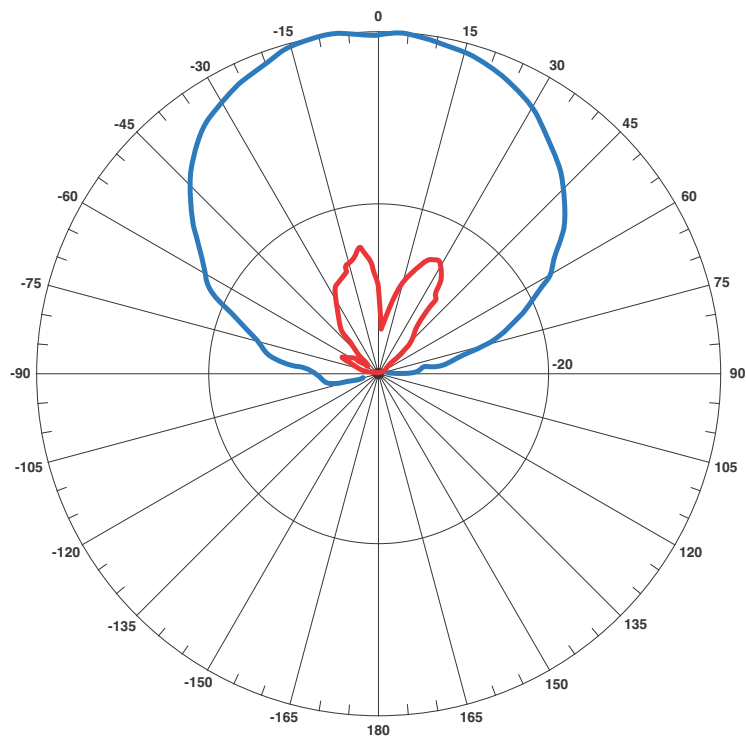
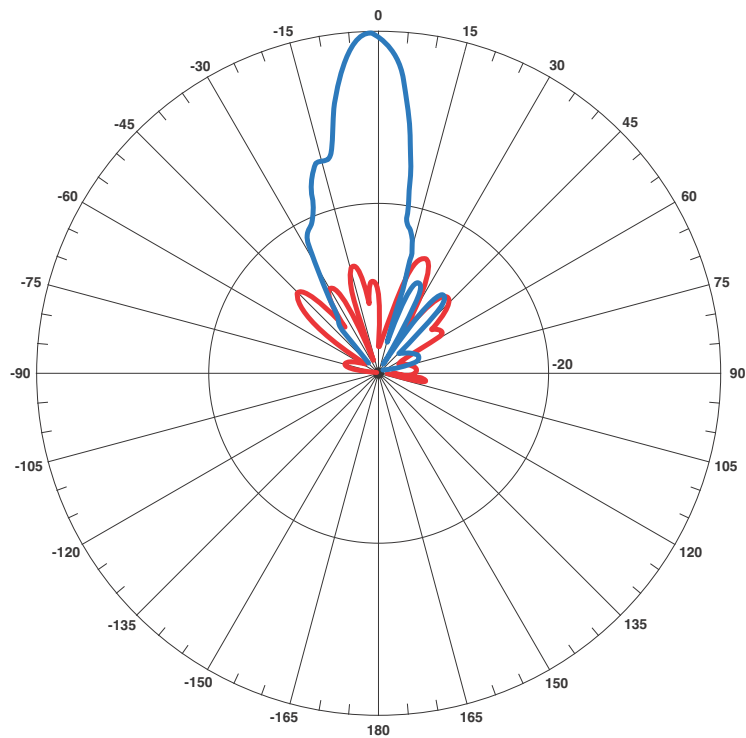
Figure A-13 WS-AO-5D16060 Azimuth Radiation Pattern Midband Freq. 5.35 GHz

Figure A-14 WS-AO-5D16060 Elevation Radiation Pattern Midband Freq. 5.35 GHz



WS-AO-2S08360

2.4 GHz ISM omnidirectional base station antenna. This antenna was formerly distributed by Enterasys as RBTES-BG-M08M; intended for use with legacy Wireless 802.11a/b/g RoamAbout Outdoor APs.

Specifications

Table A-8 WS-AO-2S08360 Specifications

Specification	Value
Frequency	2400–2483.5 MHz
Gain	8 dBi
Impedance	50 Ohms
Vertical beamwidth at 1/2 power	13°
Azimuth (3 dB beamwidth)	Omni-directional (360°)
Bandwidth at 1:5:1 VSWR	100 MHz
VSWR	<1.5:1
Polarization	Linear vertical
Input Impedance	50 ohms
Mounting Style	Extruded bracket for mast mounting.
Weight	0.5 lb (0.226 kg)
Height	20.2 in (513.1 mm)

Table A-8 WS-AO-2S08360 Specifications (continued)

Specification	Value
Wind Survival Rating	125 mph (201 km/h)
Lateral Thrust	5.2 lbs.
Bending Moment	4.4 ft. lbs
Maximum Power	25 Watts
Connector	Reverse Polarity Type-N Jack

WS-AO-DS05360

Specifications

Table A-9 WS-AO-DS05360 Specifications

Specification	Value
Frequency	2.4–2.4 GHz and 4.9–5.9 GHz
Gain	5 dBi
E-Plane (3 dB beamwidth)	
Low-band	25°
High-band	17°
Azimuth (3 dB beamwidth)	Omni-directional
Maximum VSWR	2.0:1
Polarization	Linear vertical
Input Impedance	50 ohms
Mounting Style	Pole
Weight (antenna only)	0.4 lb (0.18 kg)
Dimensions	35.9 in x 6.4 in x 4 in (912 mm x 163 mm x 102 mm)
Wind Survival Rating	
Operation	100 mph (160 km/h)
Survival	136 mph (218 km/h)
Operating Temperature	-30°C to +65°C (-22°F to +149°F)

Radiation Patterns

Figure A-15 WS-AO-DS05360 E-Plane 2.45 GHz Radiation Pattern

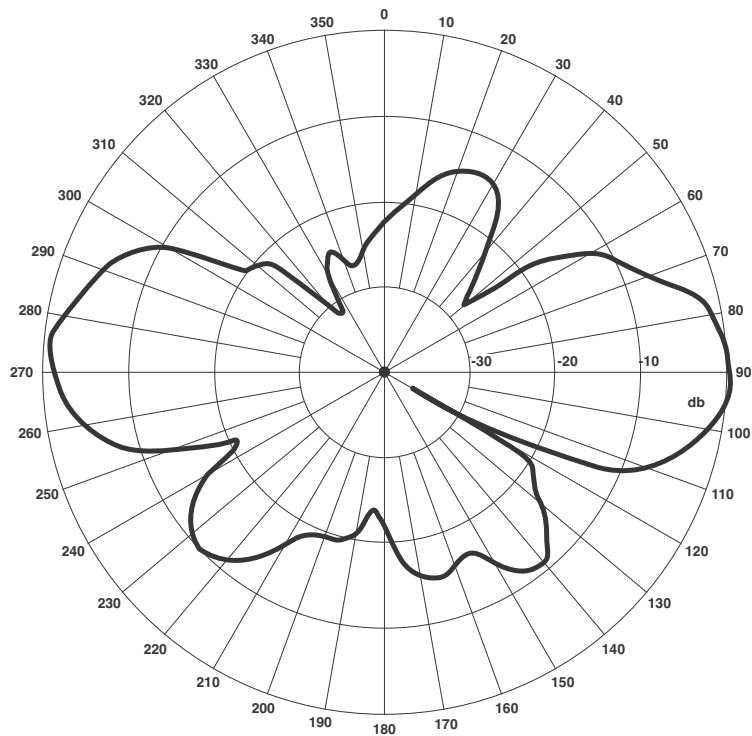


Figure A-16 WS-AO-DS05360 H-Plane 2.45 GHz Radiation Pattern

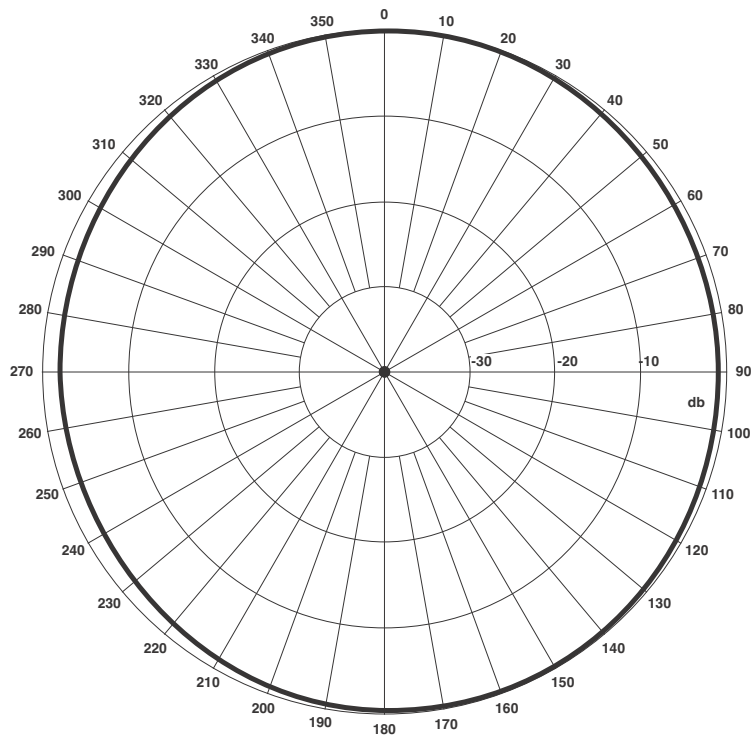


Figure A-17 WS-AO-DS05360 E-Plane 5.47 GHz Radiation Pattern

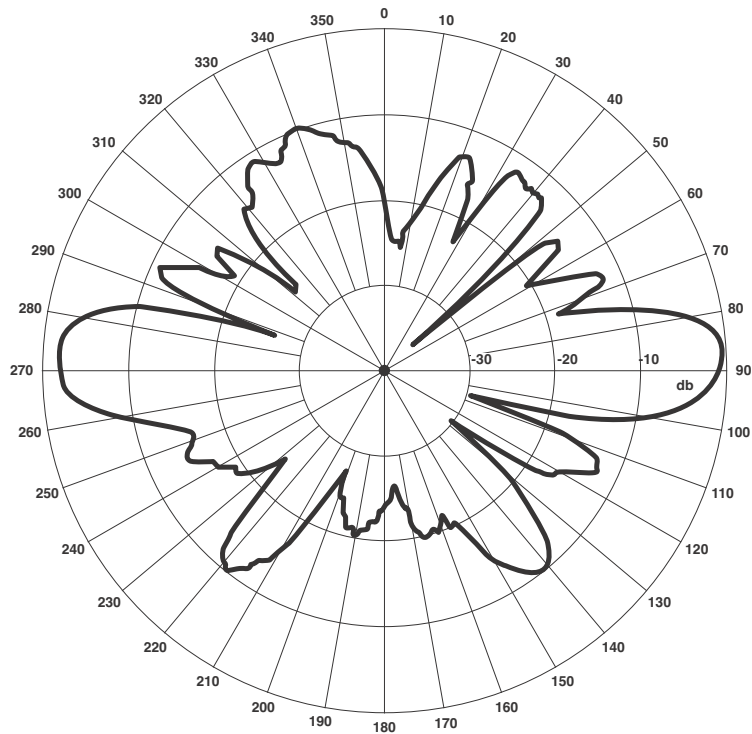
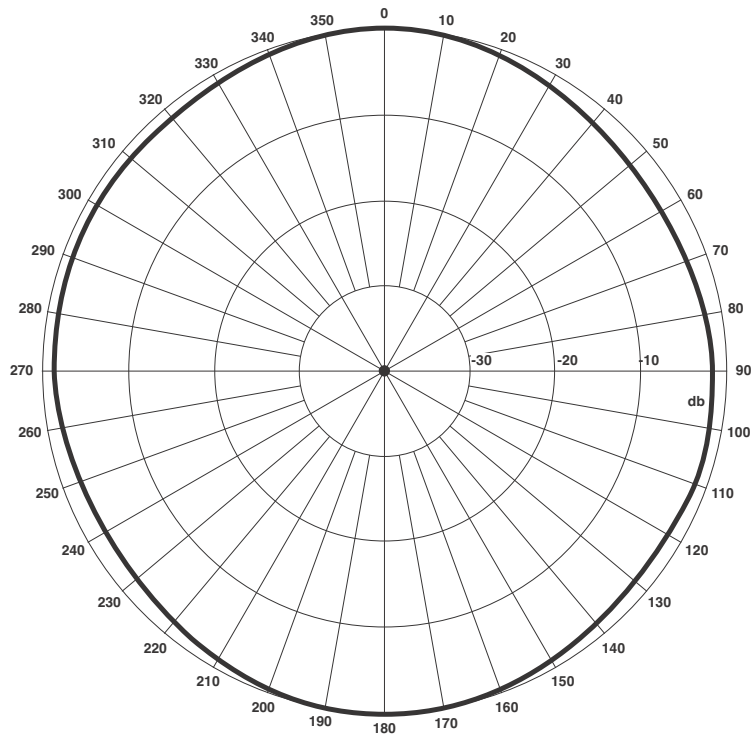


Figure A-18 WS-AO-DS05360 H-Plane 5.47 GHz Radiation Pattern



WS-ANT21

Specifications

Table A-10 WS-ANT21 Specifications

Specification	Value
Frequency	2.4-2.5GHz and 4.94-5.925GHz
Gain	5 dBi (2.4-2.5GHz) 7 dBi (4.94-5.925GHz)
VSWR	2:1 max
Polarization	Linear Vertical
Weight	0.3 lbs (0.136 grams)
Power	25 watts
Dimensions	11 in x 1.25 in (279.4 x 31.75 mm)
Nominal Impedance	50 ohms
Operating Temperature Range	-40°C to +70°C

Radiation Patterns

Figure A-19 WS-ANT21 E-Plane 2.5 GHz Radiation Pattern

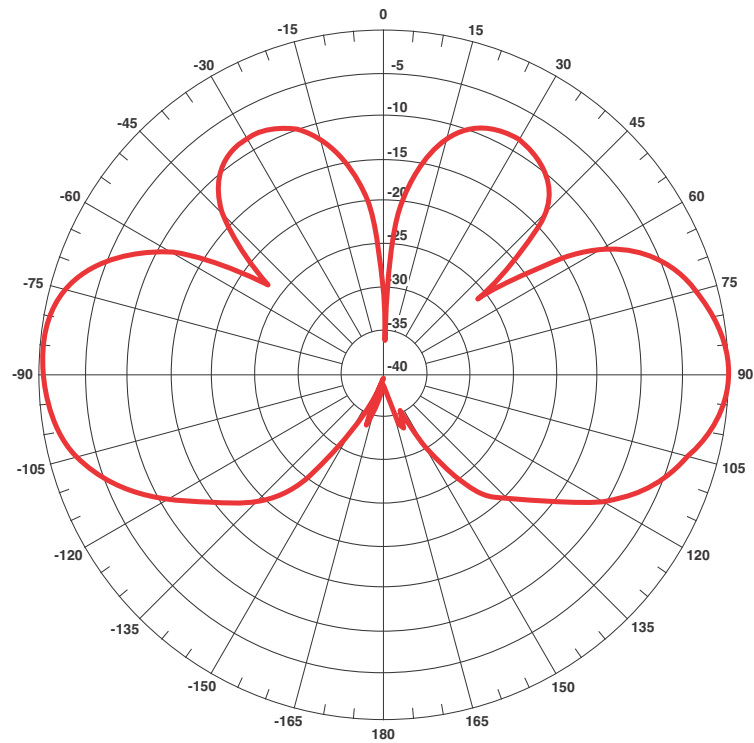


Figure A-20 WS-ANT21 H-Plane 2.5 GHz Radiation Pattern

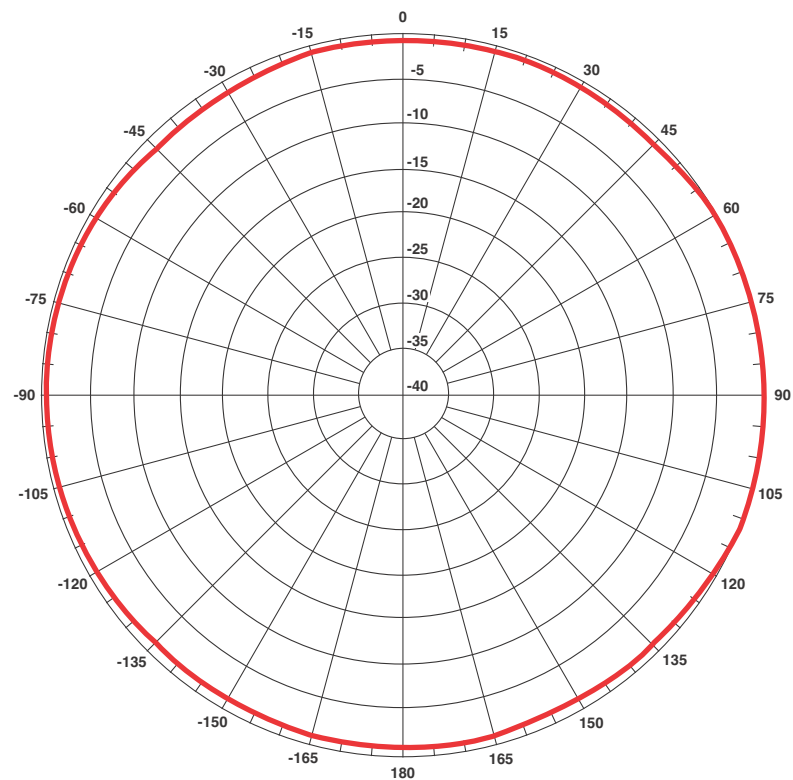


Figure A-21 WS-ANT21 E-Plane 5.5 GHz Radiation Pattern

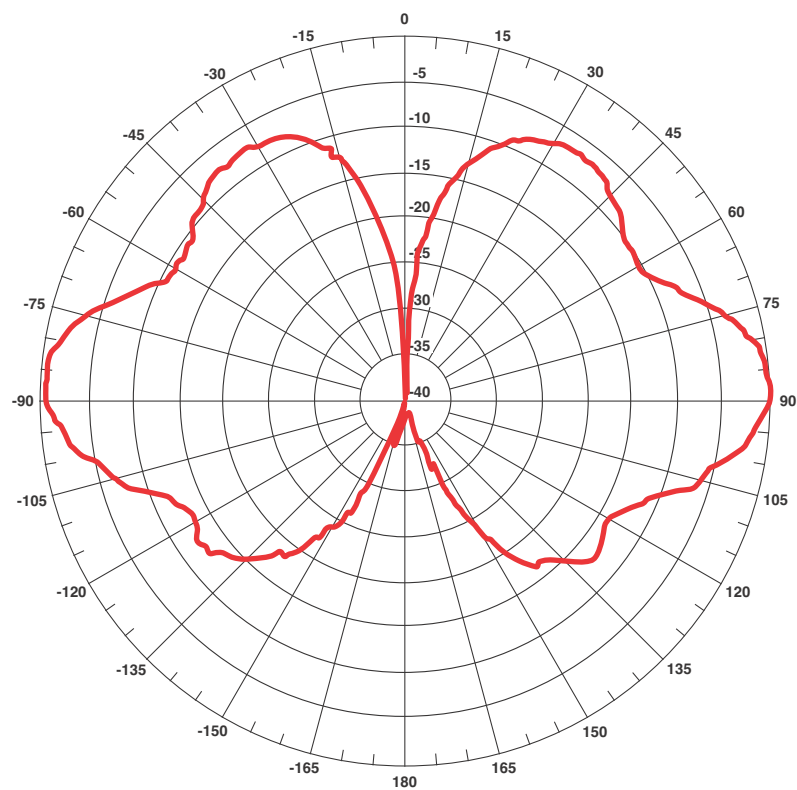
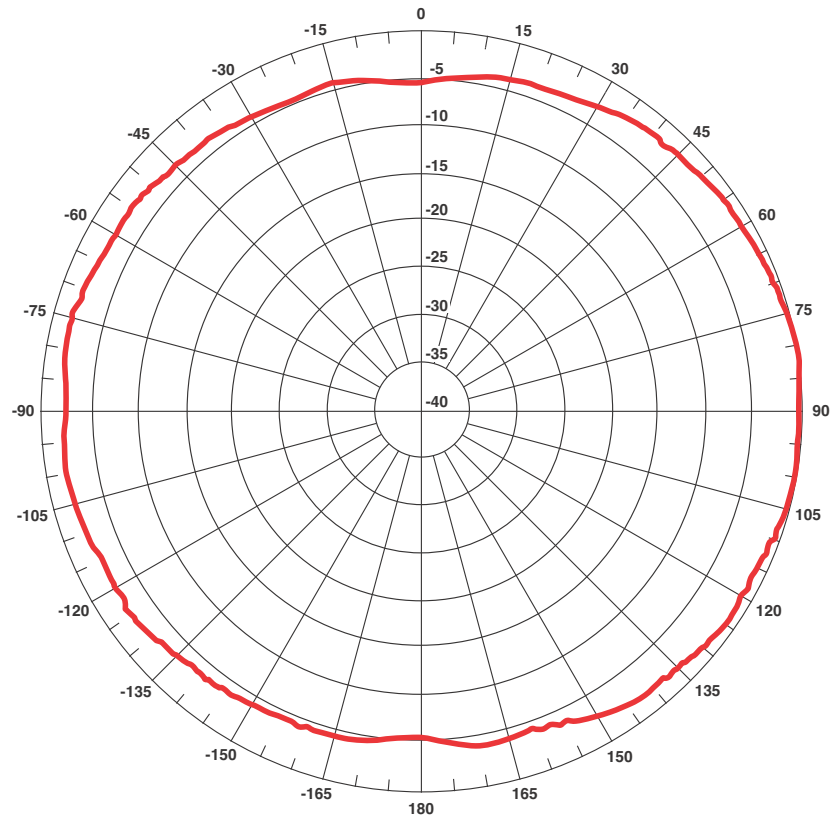


Figure A-22 WS-ANT21 H-Plane 5.5 GHz Radiation Pattern

WS-AO-DX13025

Specifications

Table A-11 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	-40° C to +85° C
Polarization	Dual Linear (2 x V / 1 X H) for each band
Weight	8.0 lbs (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 A-23 WS-AO-DX13025 2.4 GHz E-Plane Radiation Pattern

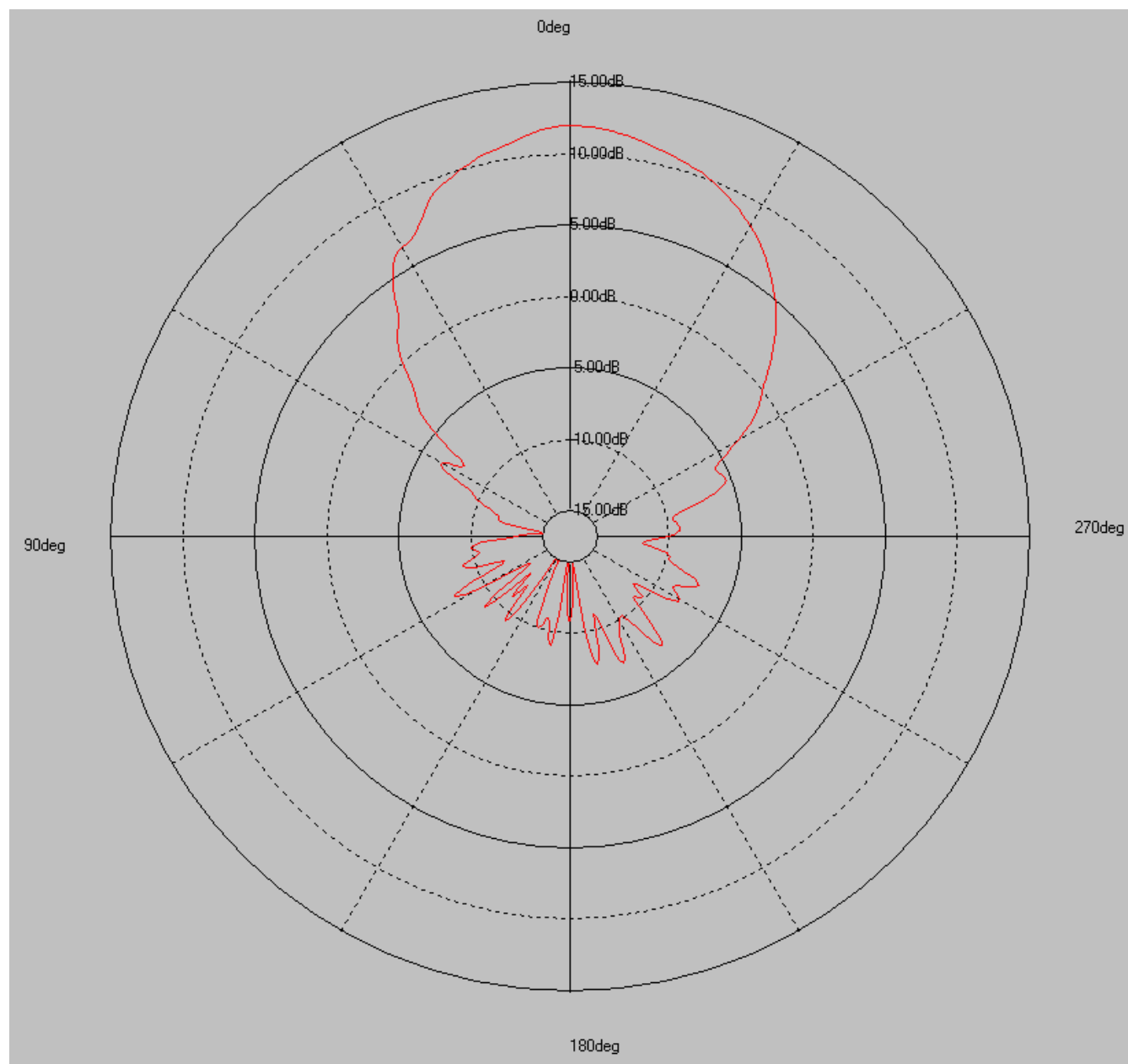


Figure A-24 WS-AO-DX13025 2.4 GHz H-Plane Radiation Pattern

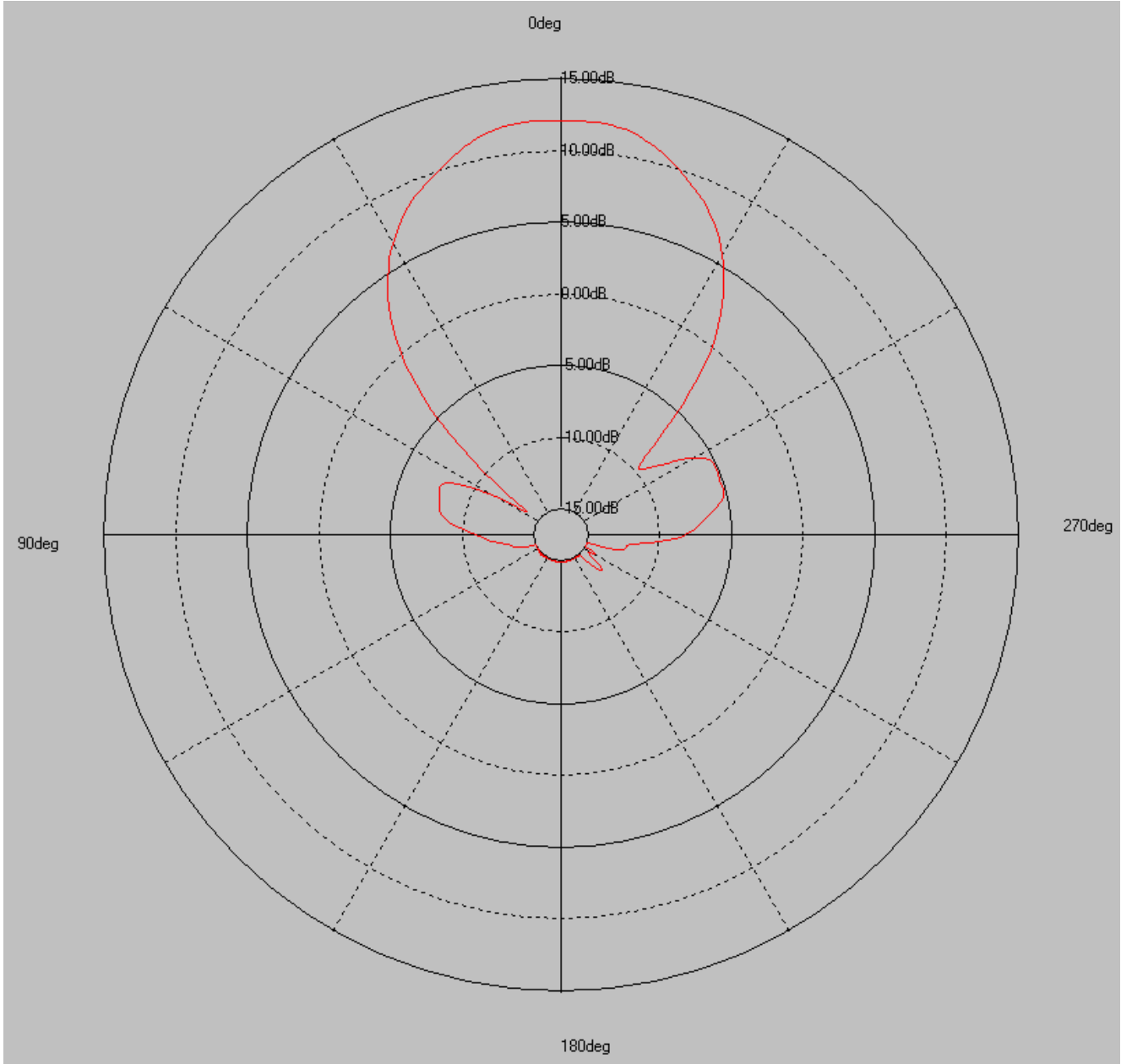


Figure A-25 WS-AO-DX13025 5 GHz E-Plane Radiation Pattern

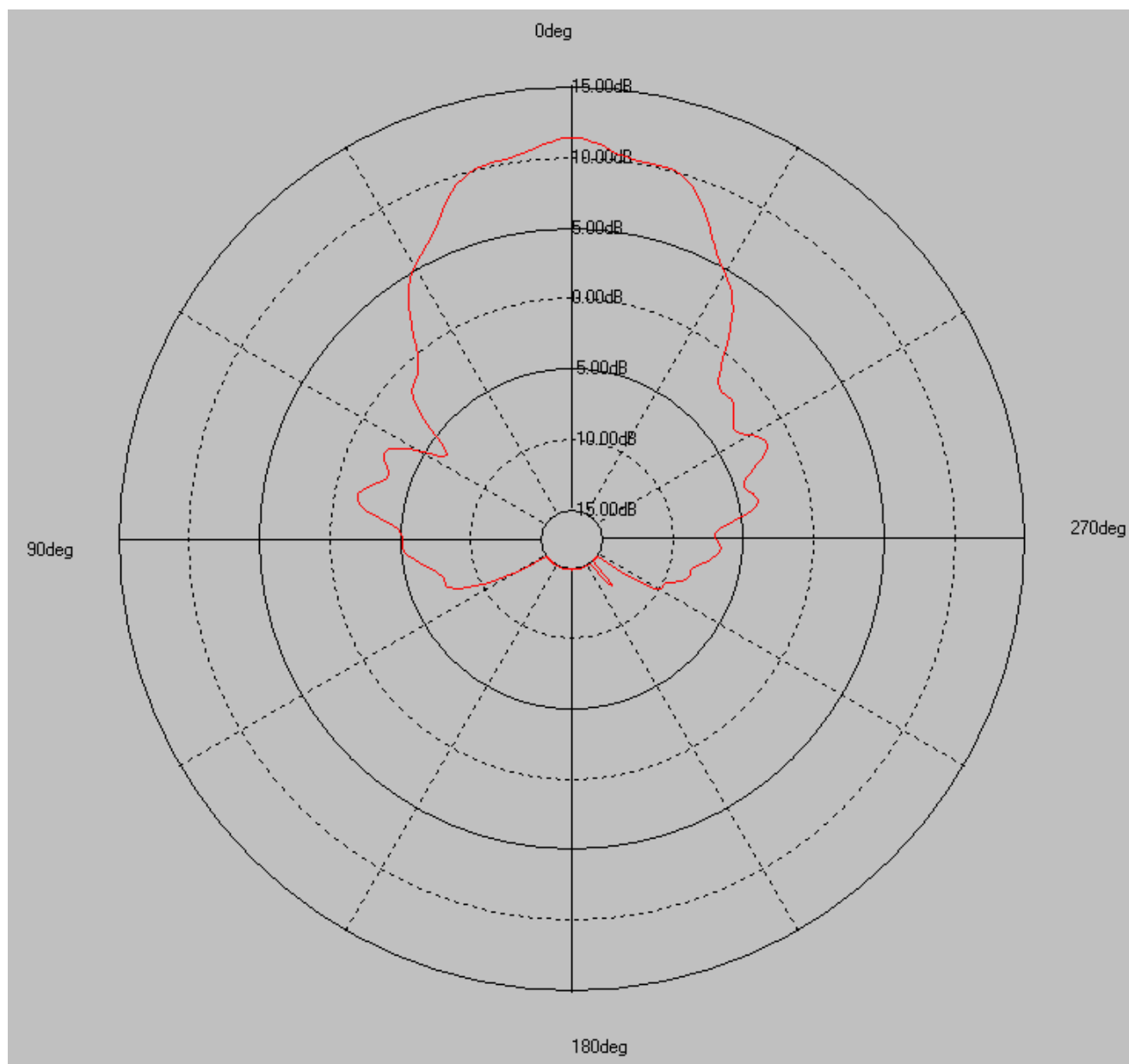
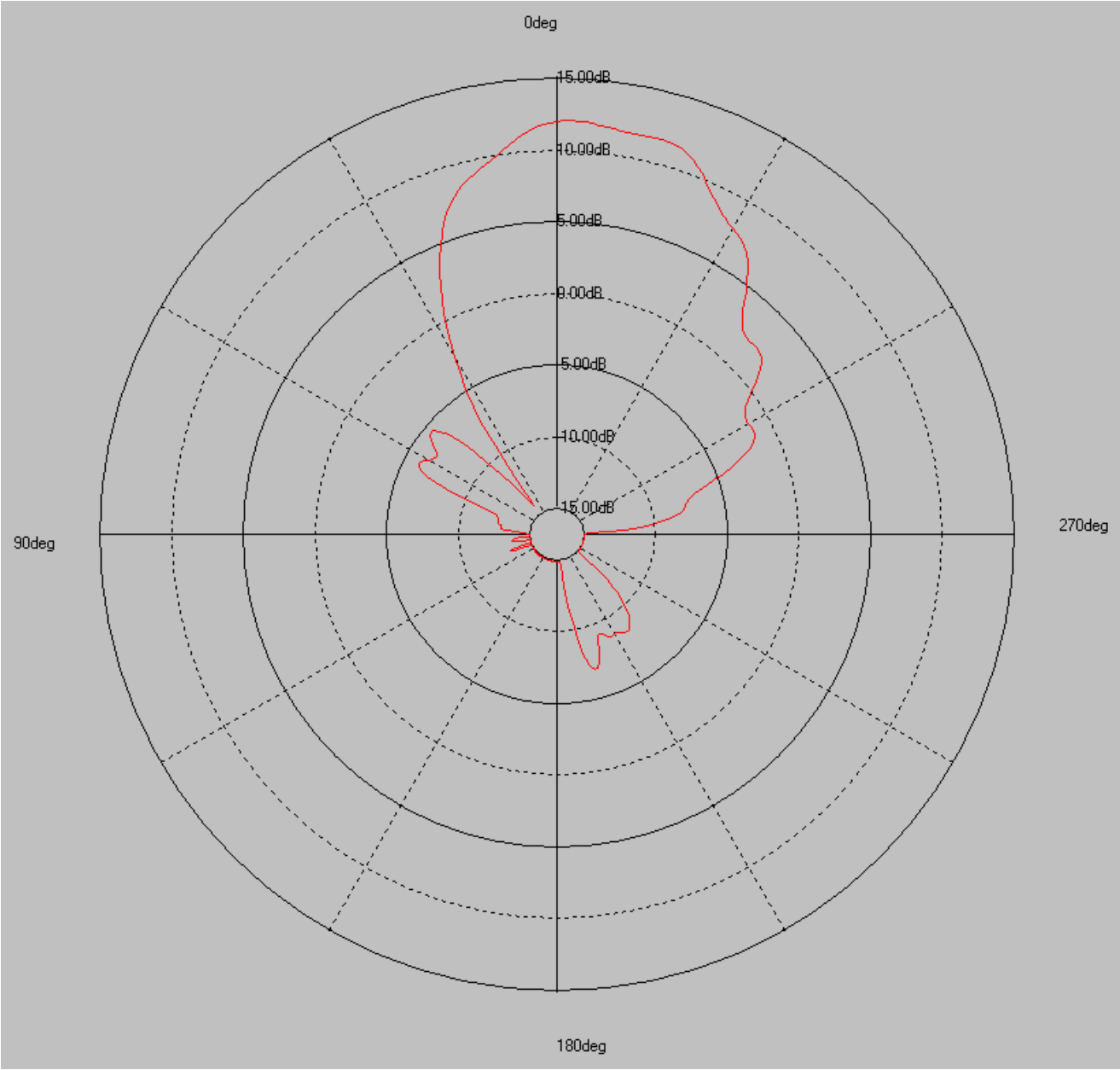


Figure A-26 WS-AO-DX13025 5 GHz H-Plane Radiation Pattern



External Antennas for Use with Indoor/Outdoor APs

The following antennas are intended for use with either indoor or outdoor APs:

Table A-12 Indoor/Outdoor Antennas

Antenna Part Number	Supported APs
WS-AIO-2S18018	AP3765e, AP3767e, AP3660, AP2620
WS-AIO-5S15090	AP2620
WS-AIO-2S14090	AP2620
WS-AIO-5S17017	AP2620
WS-AIO-2S07060	AP2620
WS-AIO-DS05120	AP2620
WS-AIO-5S12060	AP2620

WS-AIO-2S18018

Specifications

Table A-13 WS-AIO-2S18018 Specifications

Specification	Value
Frequency	2.3–2.7 GHz
Gain	18 dBi (nominal)
Nominal SWR	<1.8
Front-to-back ratio	>25 dB
Polarization	Linear, vertical/horizontal
Vertical Beamwidth	19°
Horizontal Beamwidth	18°
Wind Survival	125 mph (201 km/h)
Weight	3.9 lb (1.8 kg)
Mounting Style	Mast
Wind Loading (frontal)	85 lb at 100 mph winds
Maximum Power Input	20 watts
Dimensions	15.1 in x 13.9 in x 1.9 in (384 mm x 353 mm x 48 mm)
Nominal Impedance	50 ohms
Temperature Range	-40°C to +70°C (-40°F to +158°F)

Radiation Patterns

Figure A-27 WS-AIO-2S18018 Elevation Cut Radiation Pattern

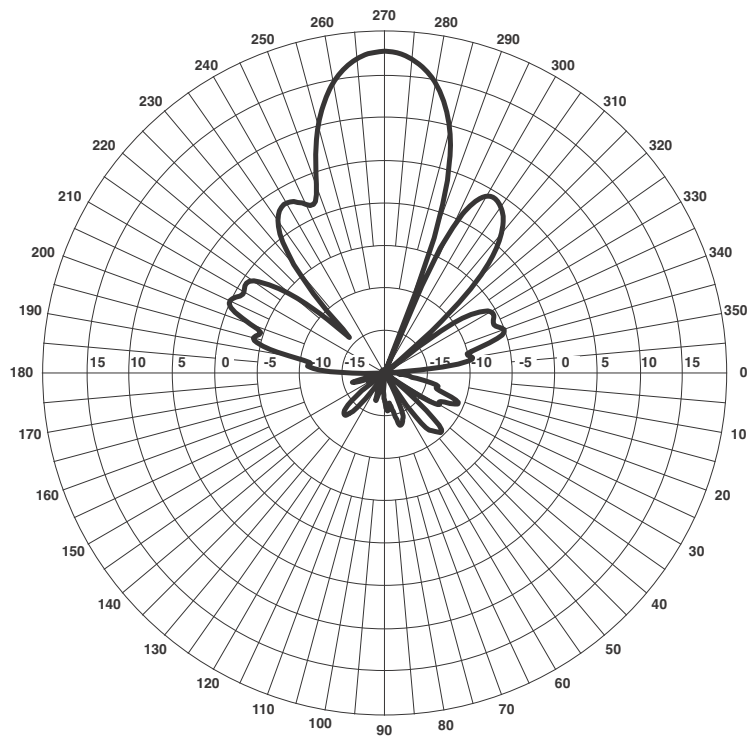
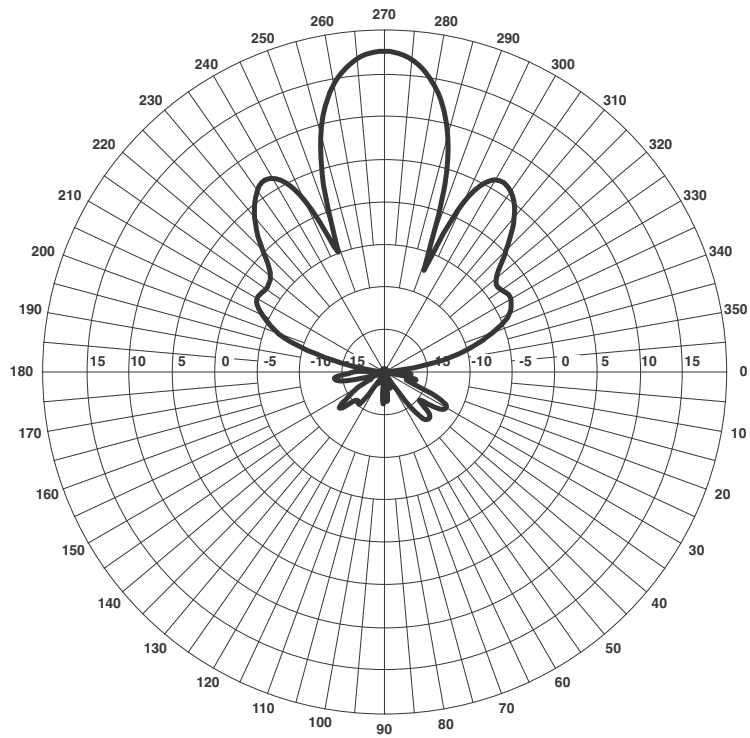


Figure A-28 WS-AIO-2S18018 Azimuth Cut Radiation Pattern



WS-AIO-5S15090

Specifications

Table A-14 WS-AIO-5S15090 Specifications

Specification	Value
Frequency	4.9–6.0 GHz
Nominal Gain	15 dBi @ 90° 16 dBi @ 60°
VSWR	<1.7:1
Front-to-Back Ratio	> 32 dB
Typical Cross Poll Discrimination	> 20 dB
Polarization	Vertical
E-Plane (3 dB Beamwidth)	8°
H- Plane (3 dB Beamwidth)	60 or 90° (adjustable)
Wind Survival	125 mph (201 km/h)
Weight	4.5 lb (2.04 kg)
Mounting Style	Mast
Power	10 watts
Dimensions	24 in x 6 in x 3 in (609 mm x 152 mm x 76 mm)
Nominal Impedance	50 ohms
Temperature Range	-30°C to +75°C (-22°F to +167°F)

Radiation Patterns

Figure A-29 WS-AIO-5S15090 Azimuth at 120° Radiation Pattern

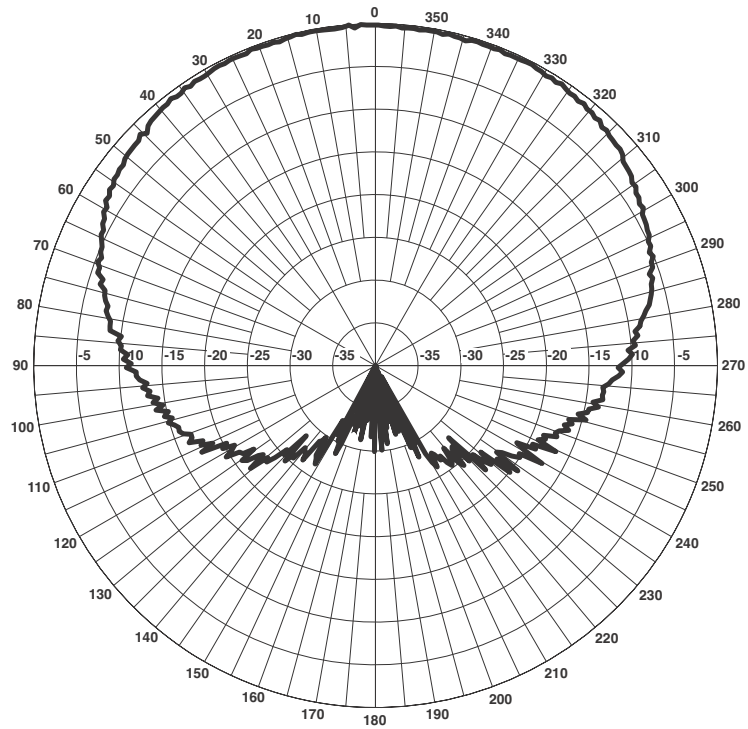


Figure A-30 WS-AIO-5S15090 Azimuth at 90° Radiation Pattern

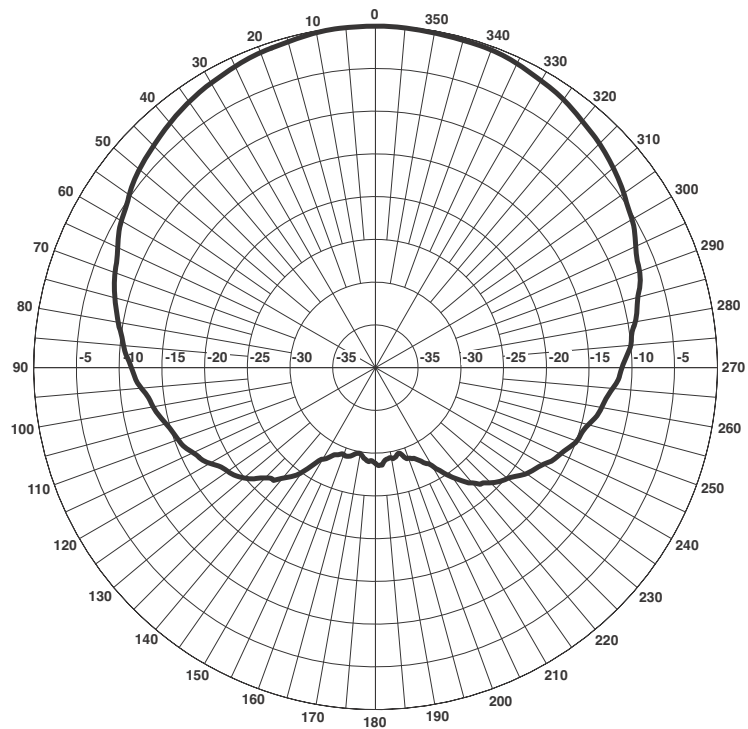


Figure A-31 WS-AIO-5S15090 Azimuth at 60° Radiation Pattern

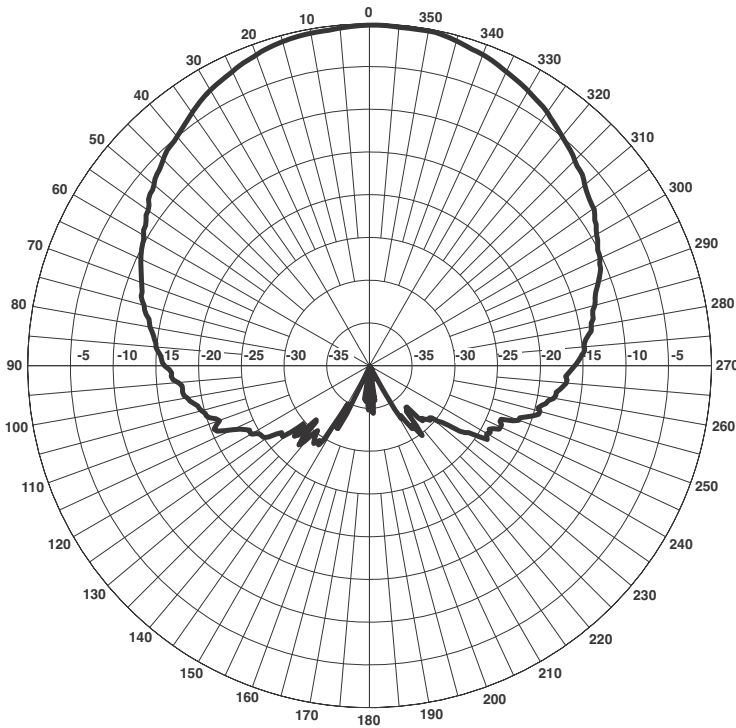


Figure A-32 WS-AIO-5S15090 Azimuth at 45° Radiation Pattern

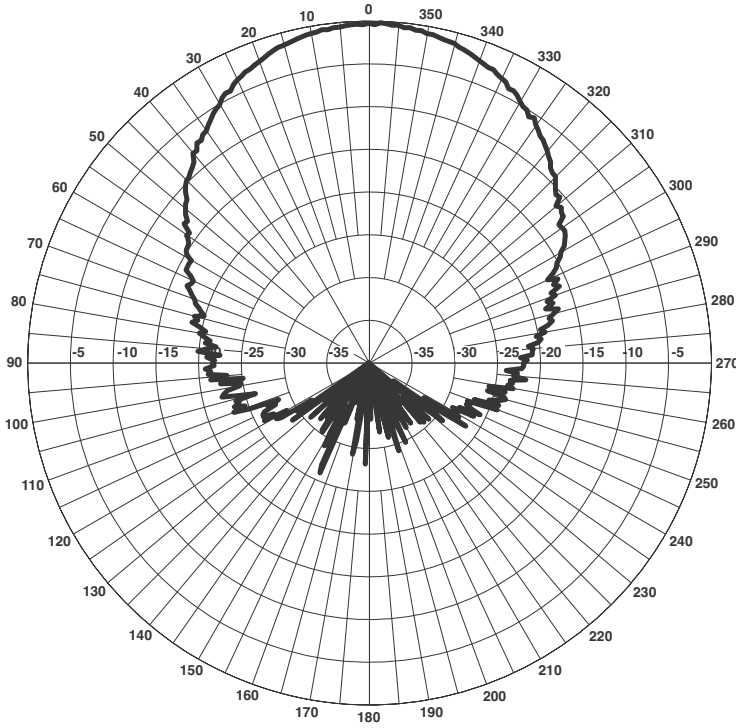
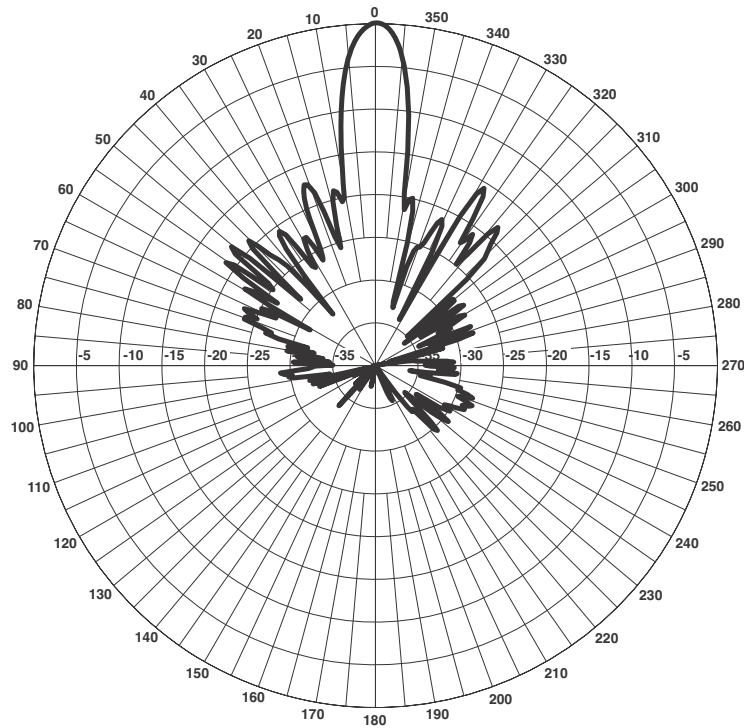


Figure A-33 WS-AIO-5S15090 Elevation Radiation Pattern

WS-AIO-2S14090

Specifications

Table A-15 WS-AIO-2S14090 Specifications

Specification	Value
Frequency	2.4 – 2.485 GHz
Gain	14 dBi (nominal)
VSWR	<1.5:1
Polarization	Vertical
Front-to-Back Ratio	23 dB
Horizontal Plane Beamwidth	90°
E Plane Beamwidth	14°
Mounting Style	Wall or Mast
Power	10 watts
Nominal Impedance	50 ohms
Wind Survival	125 mph (201 km/h)
Dimensions	19.8 in x 3.1 in x 1.5 in (50.29 cm x 7.87 cm x 3.81 cm)
Weight	2.5 lb (1.134 kg)

Radiation Patterns

Figure A-34 WS-AIO-2S14090 Elevation Cut Radiation Pattern

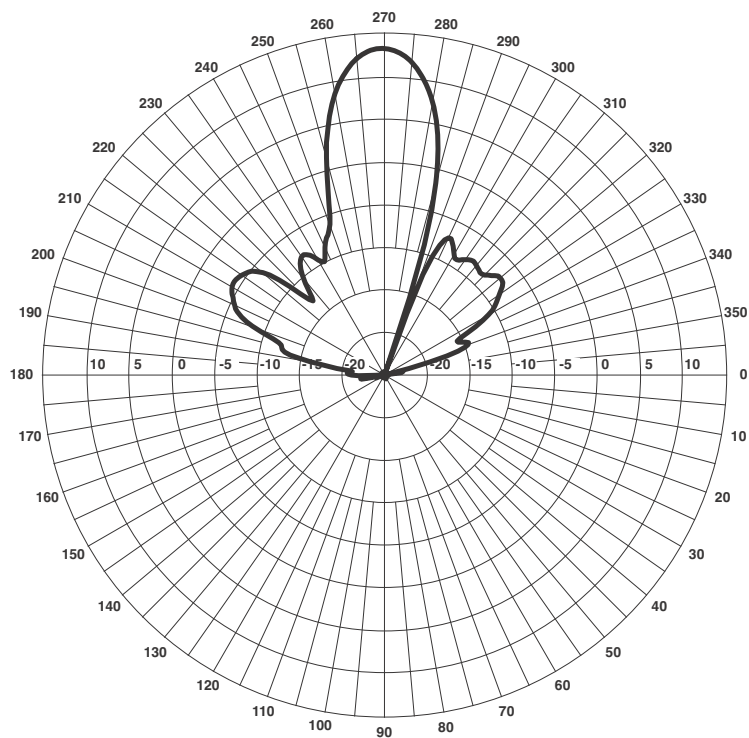
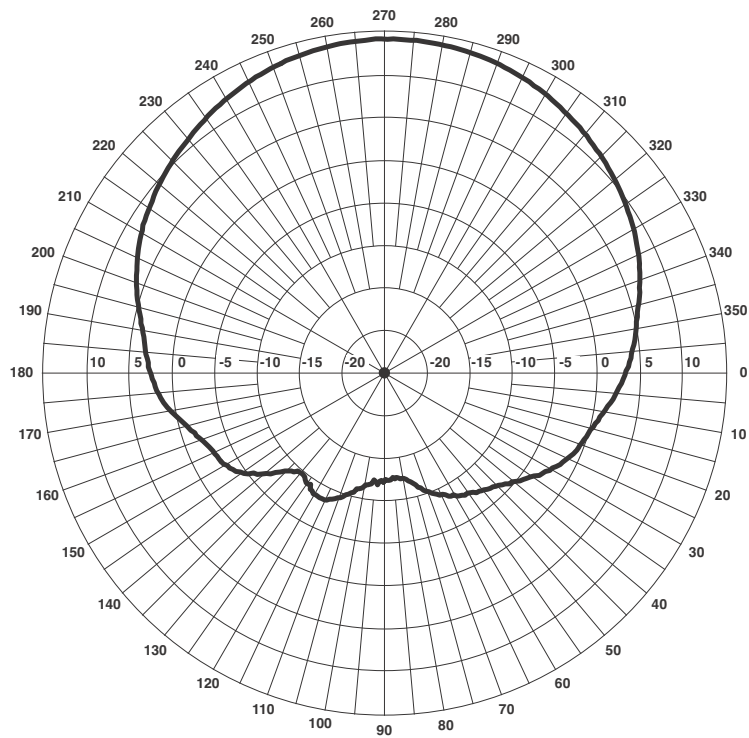


Figure A-35 WS-AIO-2S14090 Azimuth Cut Radiation Pattern



WS-AIO-5S17017

Specifications

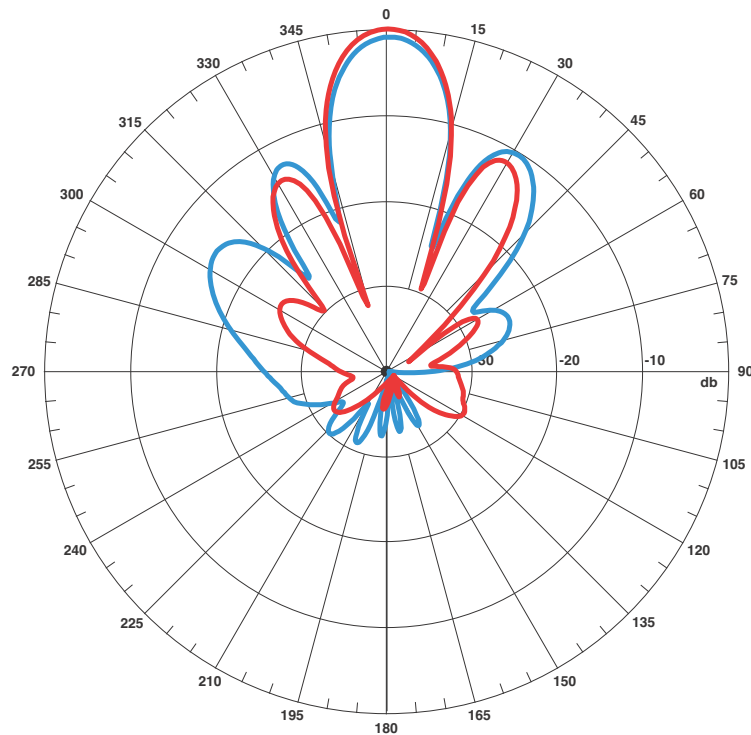
Table A-16 WS-AIO-5S17017 Specifications

Specification	Value
Frequency	5.47–5.85 GHz
Gain	17 dBi (nominal)
VSWR	1.5:1
Polarization	Linear Vertical
Azimuth (3 dB beamwidth)	17°
Elevation (3 dB beamwidth)	17°
Mounting Style	Wall/Mast
Power	10 watts
Dimensions	6.7 in x 6.7 in x 1.9 in (171 mm x 171mm x 48 mm)

Radiation Patterns

In [Figure A-36](#), the E-plane pattern is blue and the H-plane pattern is red.

Figure A-36 WS-AIO-5S17017 5.66 GHz E-Plane and H-Plane Radiation Patterns



WS-AIO-2S07060

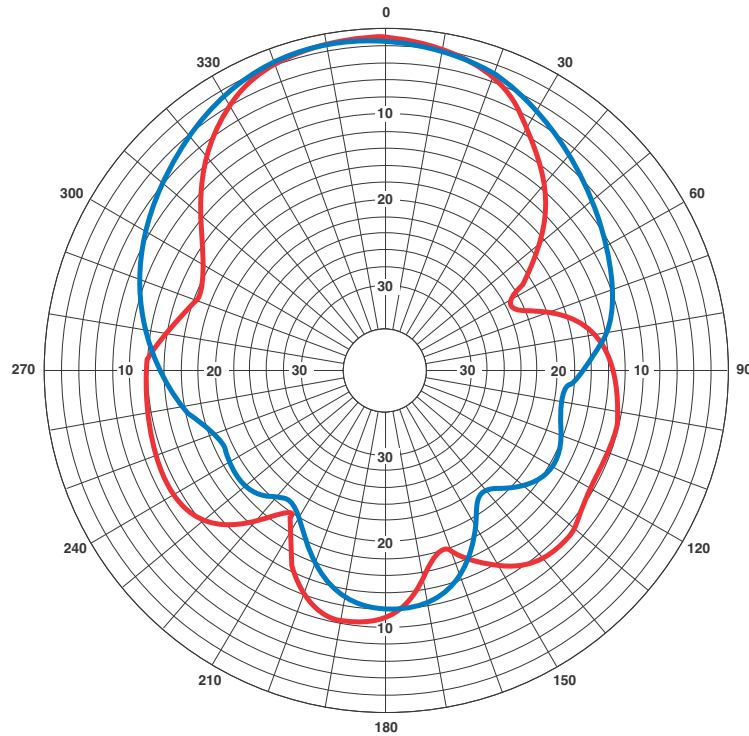
Specifications

Table A-17 WS-AIO-2S07060 Specifications

Specification	Value
Frequency	2.3–2.5 GHz
Gain	7.5 dBi (nominal)
VSWR	1.5:1
Polarization	Linear
E-Plane (3 dB beamwidth)	60°
H-Plane (3 dB beamwidth)	65°
Mounting Style	Wall/Mast
Power	75 watts (25 watts at 5 GHz)
Dimensions and Weight	
Standard Wall Mount	5.7 in x 3.81 in x 1.50 in (14.48 cm x 9.68 cm x 3.8 cm) 5 oz (0.14 kg)
Articulating Wall Mount	5.8 in x 3.81 in x 2.26 in (14.73 cm x 9.68 cm x 5.74 cm) 8 oz (0.23 kg)

Radiation Patterns

In [Figure A-37](#) on page A-33, the E-plane pattern is blue and the H-plane pattern is red.

Figure A-37 WS-AIO-2S07060 Radiation Patterns

WS-AIO-DS05120

Specifications

Table A-18 WS-AIO-DS05120 Specifications

Specification	Value
Frequency	2.4–2.4 GHz and 4.9–5.9 GHz
Gain	5 dBi (nominal)
VSWR	<1.5:1
Polarization	Linear Vertical
Azimuth (3 dB Beamwidth)	120°
Elevation (3 dB Beamwidth)	120°
Mounting Style	Wall or Mast
Power	5 watts
Dimensions	5.1 in x 2.1 in x 1.4 in (131 mm x 55 mm x 35 mm)

Radiation Patterns

In both [Figure A-38](#) and [Figure A-39](#), the E-plane pattern is blue and the H-plane pattern is red.

Figure A-38 WS-AIO-DS05120 2.4 GHz E-Plane and H-Plane Radiation Patterns

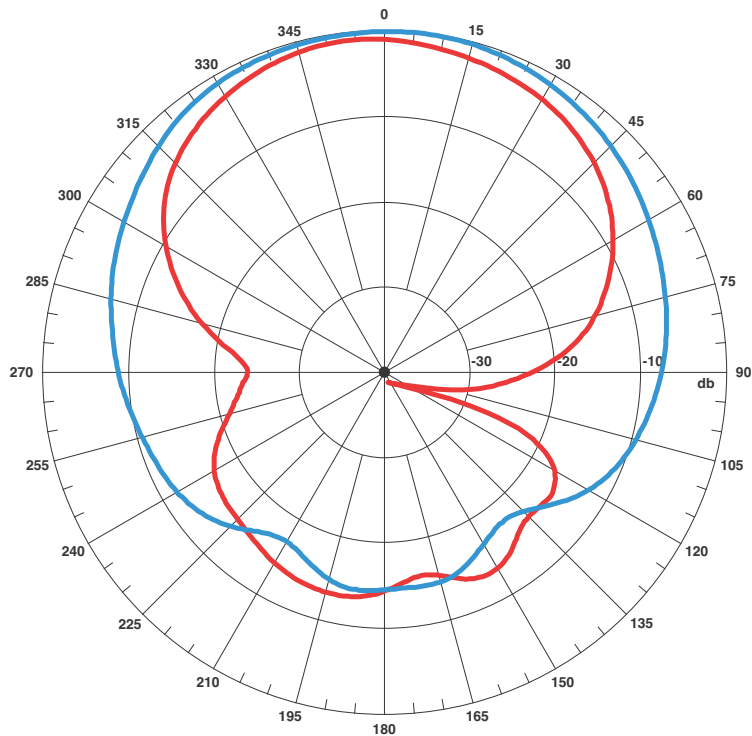
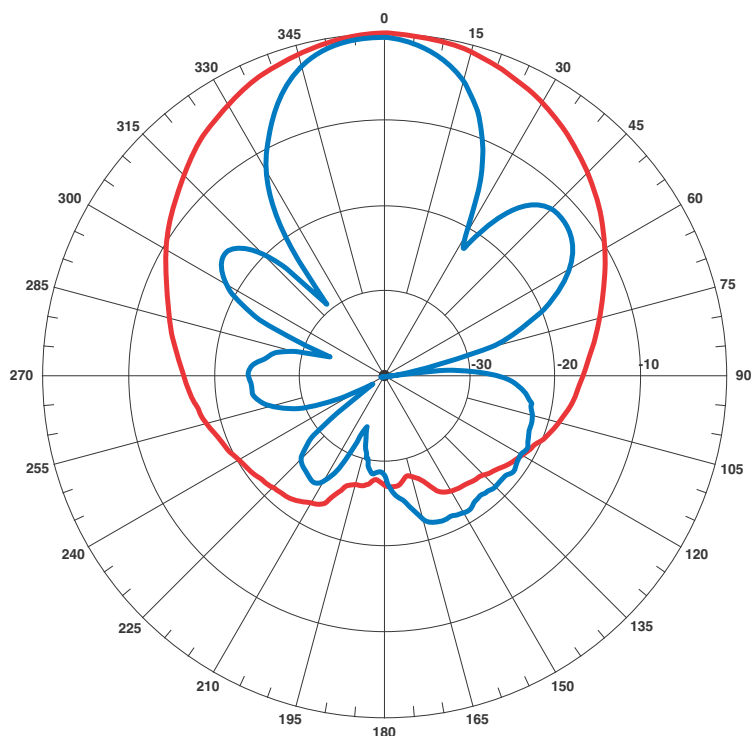


Figure A-39 WS-AIO-DS05120 5.4 GHz E-Plane and H-Plane Radiation Patterns



WS-AIO-5S12060

Specifications

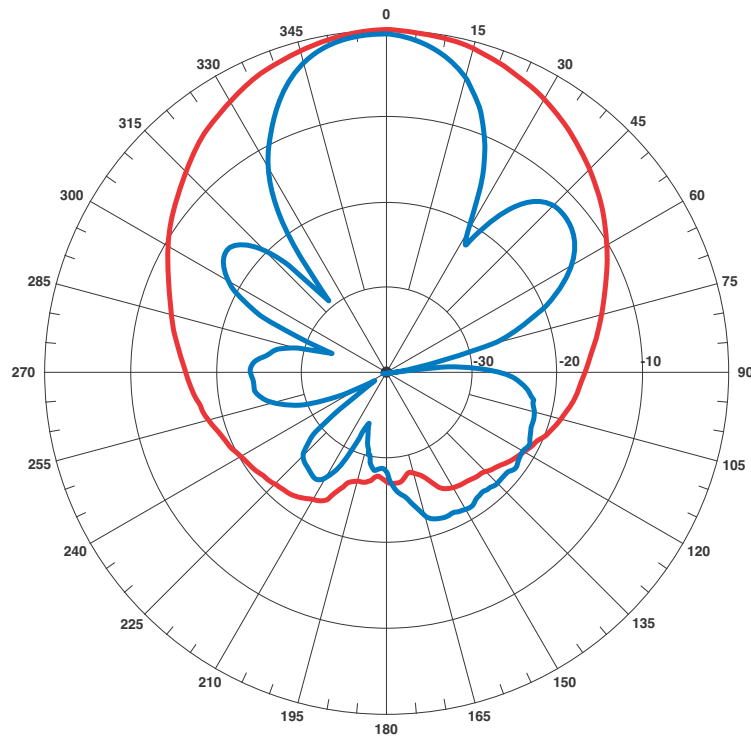
Table A-19 WS-AIO-5S12060 Specifications

Specification	Value
Frequency	5.150–5.350 GHz
Gain	12.0 dBi (nominal)
VSWR	1.5:1
Polarization	Linear Vertical
Azimuth (3 dB beamwidth)	58°
Elevation (3 dB beamwidth)	30°
Mounting Style	Wall/Mast
Power	75 watts
Dimensions	5.7 in x 3.8 in x 1.5 in (144 mm x 97 mm x 38 mm)

Radiation Patterns

In [Figure A-40](#), the E-plane pattern is blue and the H-plane pattern is red.

Figure A-40 WS-AIO-5S12060 5.25 GHz E-Plane and H-Plane Radiation Patterns



External Antennas for Use with Indoor APs

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

Table A-20 Indoor Antennas

Antenna Part Number	Supported APs
WS-AI-DT05120	AP3710e, AP3620, AP3640
WS-AI-DT04360	AP3710e, AP3620, AP3640
WS-AI-DS06360	AP2620
WS-AI-2S03360	AP2620
WS-AI-DX02360	AP3710e
WS-AI-DX07025	AP3710e
WS-ANT01	AP2620
WS-ANT02	AP3620, AP3640

WS-AI-DT05120

Specifications

Table A-21 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 dB1 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 A-41 WS-AI-DT05120 2.5 GHz E-Plane Radiation Pattern

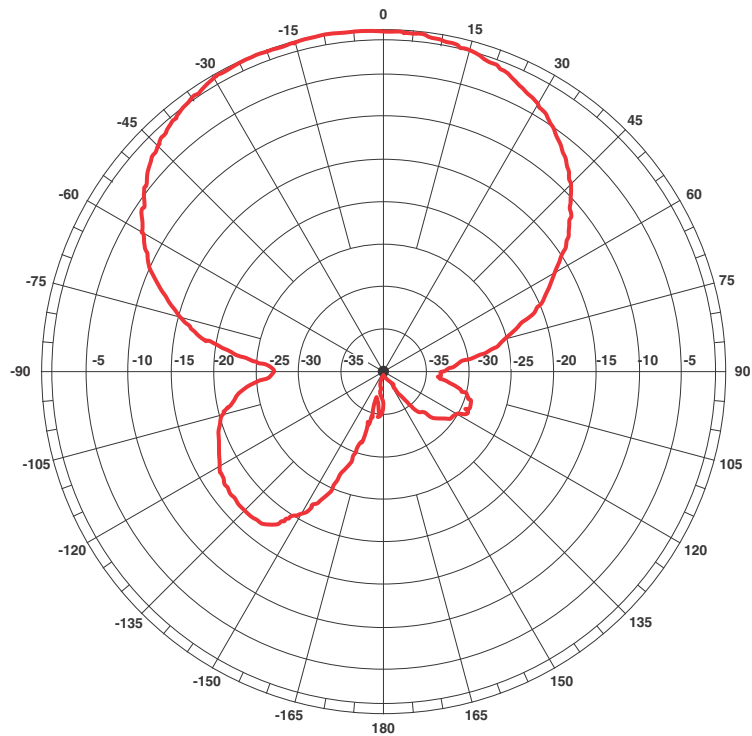


Figure A-42 WS-AI-DT05120 2.5 GHz H-Plan Radiation Pattern

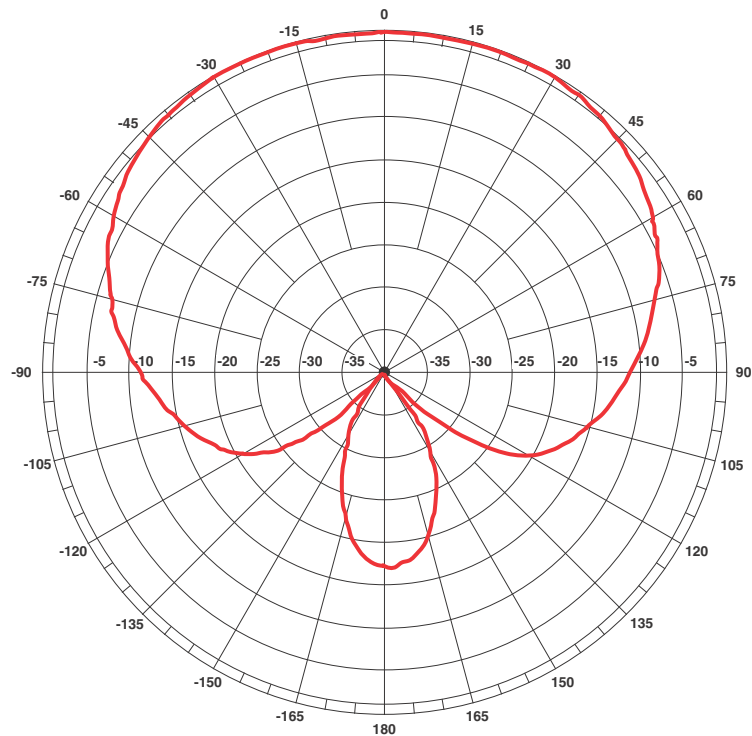


Figure A-43 WS-AI-DT05120 5.5 GHz E-Plane Radiation Pattern

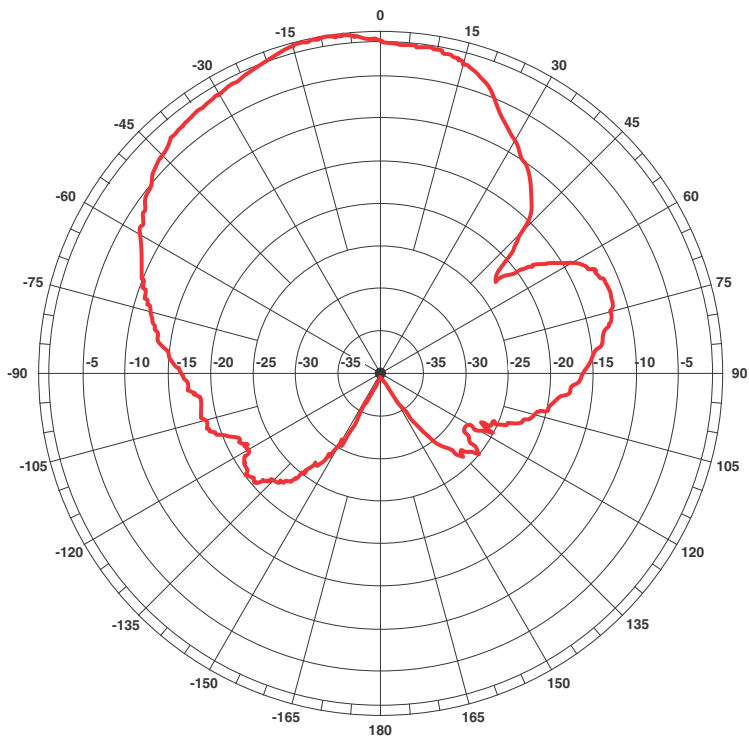
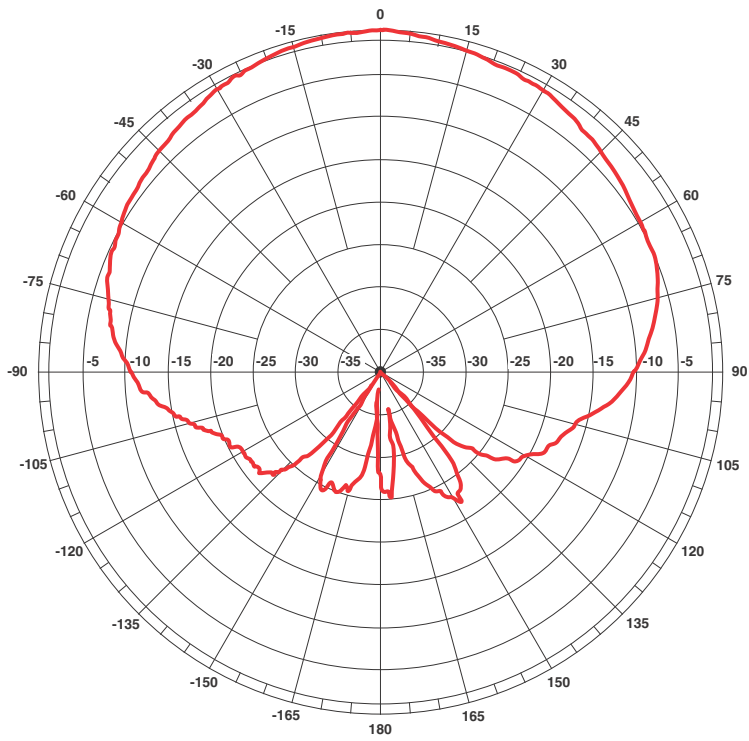


Figure A-44 WS-AI-DT05120 5.5 GHz H-Plane Radiation Pattern



WS-AI-DT04360

Specifications

Table A-22 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
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 A-45 WS-AI-DT04360 2.5 GHz E-Plane Radiation Pattern

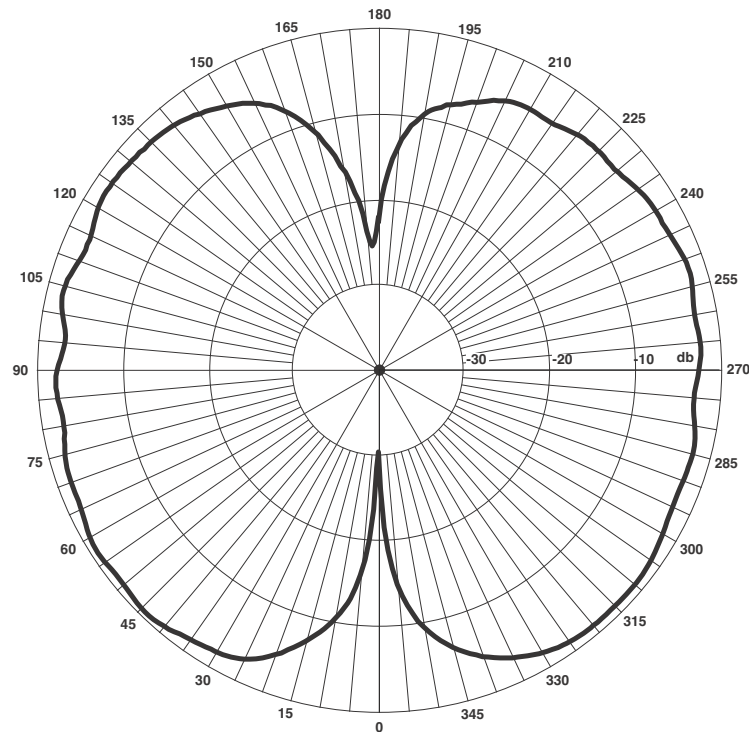


Figure A-46 WS-AI-DT04360 2.5 GHz H-Plane Radiation Pattern

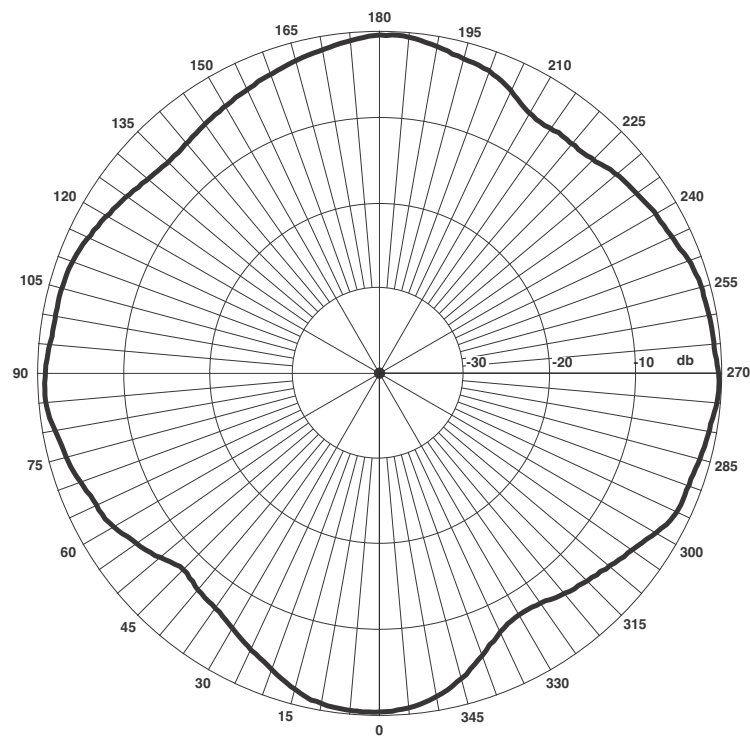


Figure A-47 WS-AI-DT04360 5.47 GHz E-Plane Radiation Pattern

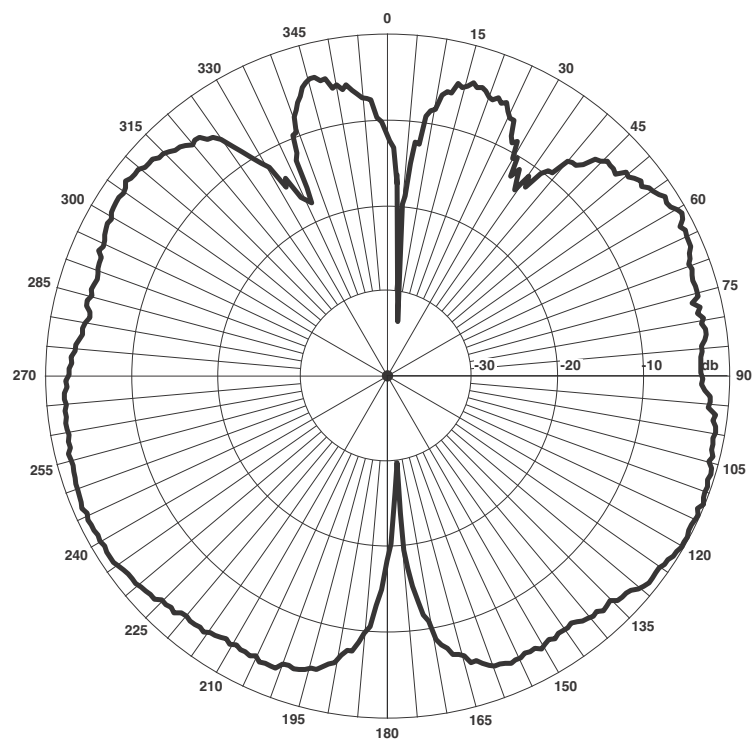
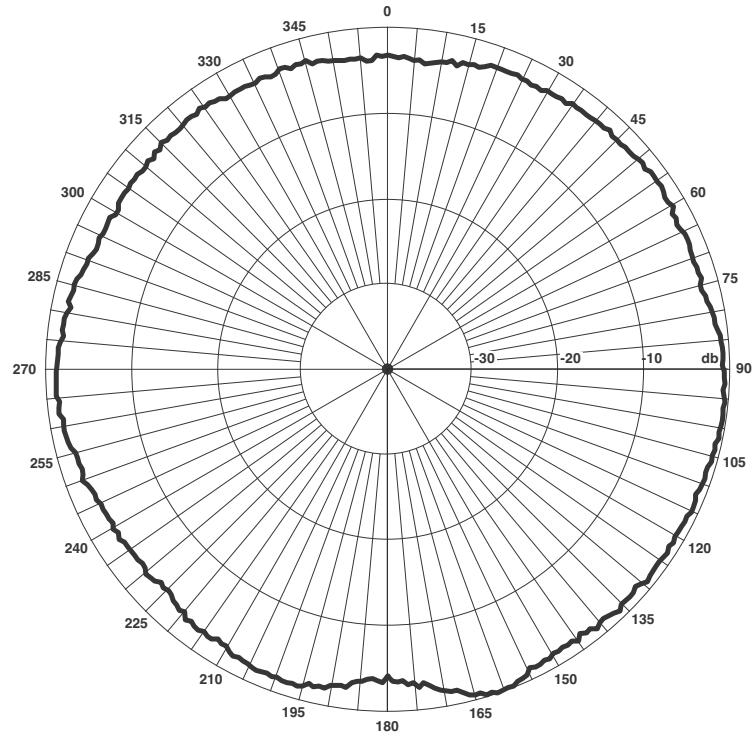


Figure A-48 WS-AI-DT04360 5.47 GHz H-Plane Radiation Pattern

WS-AI-DS06360

Specifications

Table A-23 WS-AI-DS06360 Specifications

Specification	Value
Frequency	2.3 – 2.7 GHz and 4.9 – 6 GHz
Nominal Gain	
2.3–2.7 GHz	5 dBi
4.9–6 GHz	6 dBi
VSWR	<2.0:1 Across the Band
Polarization	Linear Vertical
Nominal Impedance	50 ohms
Maximum Power	50 watts
Weight	1.1 lb. (0.5 kg)
Dimensions	3.2 in x 12 in (82 mm x 305 mm)
Temperature Range	-40°C to +80°C

Radiation Patterns

Figure A-49 WS-AI-DS06360 Radiation Pattern—Elevation Cut at 776 MHz

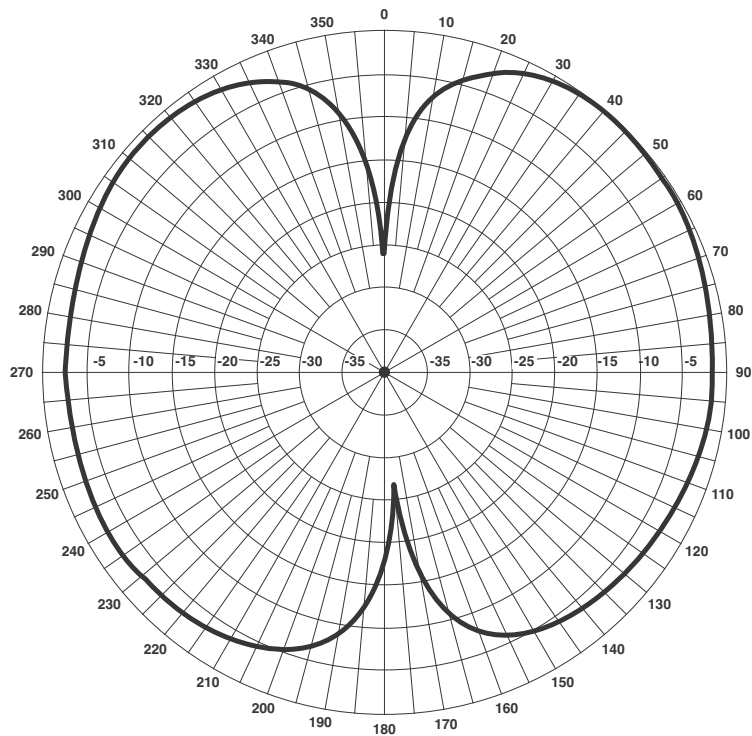


Figure A-50 WS-AI-DS06360 Radiation Pattern—Elevation Cut at 905 MHz

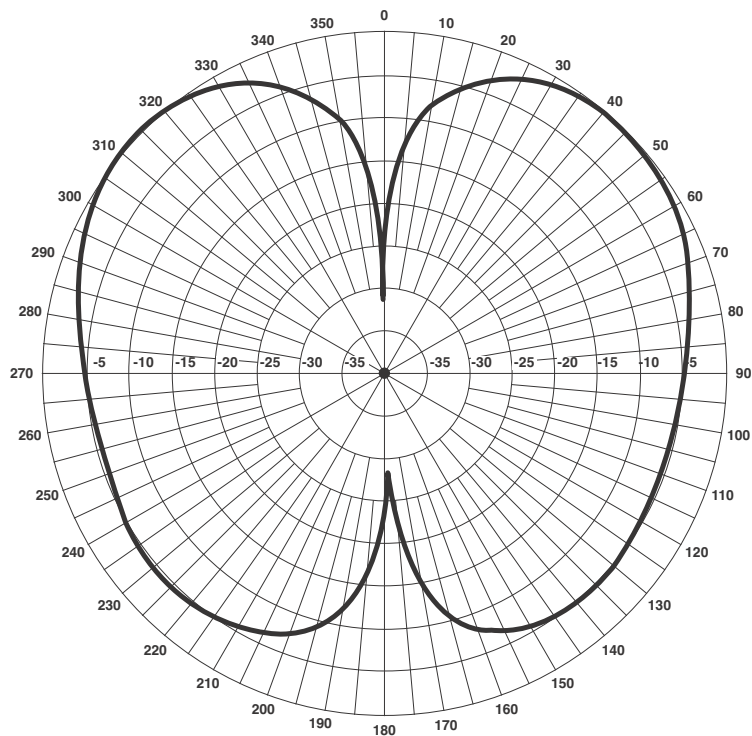


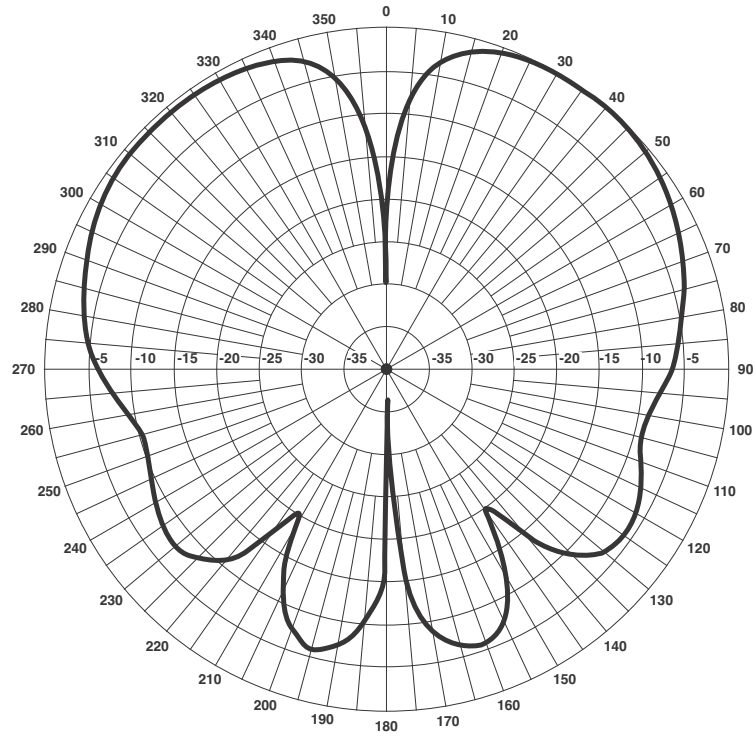
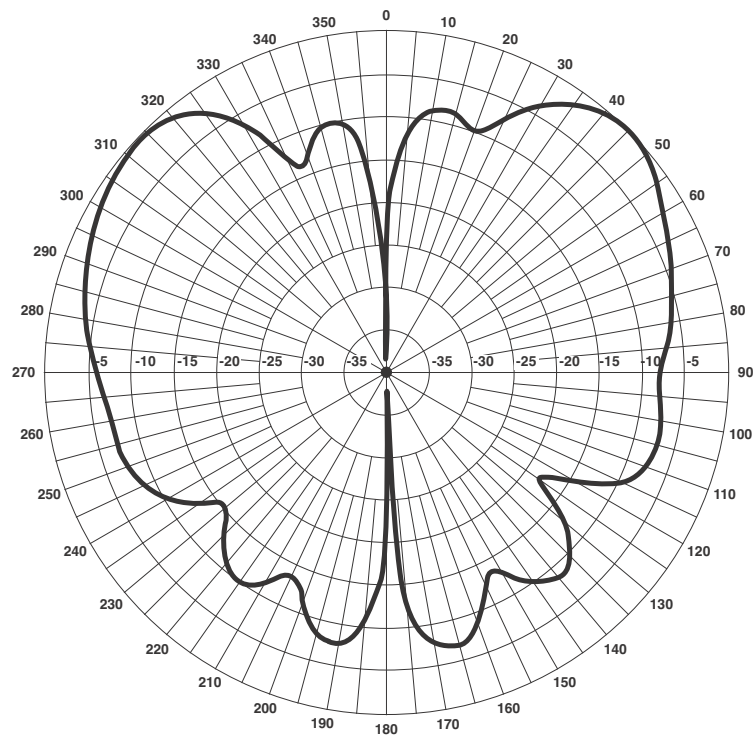
Figure A-51 WS-AI-DS06360 Radiation Pattern—Elevation Cut at 1940 MHz**Figure A-52 WS-AI-DS06360 Radiation Pattern—Elevation Cut at 2450 MHz**

Figure A-53 WS-AI-DS06360 Radiation Pattern—Elevation Cut at 3550 MHz

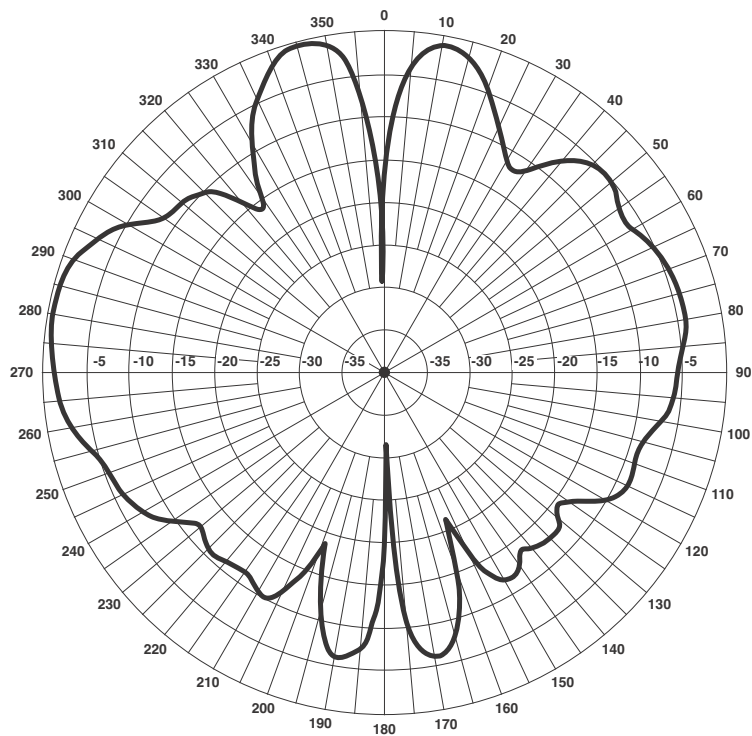
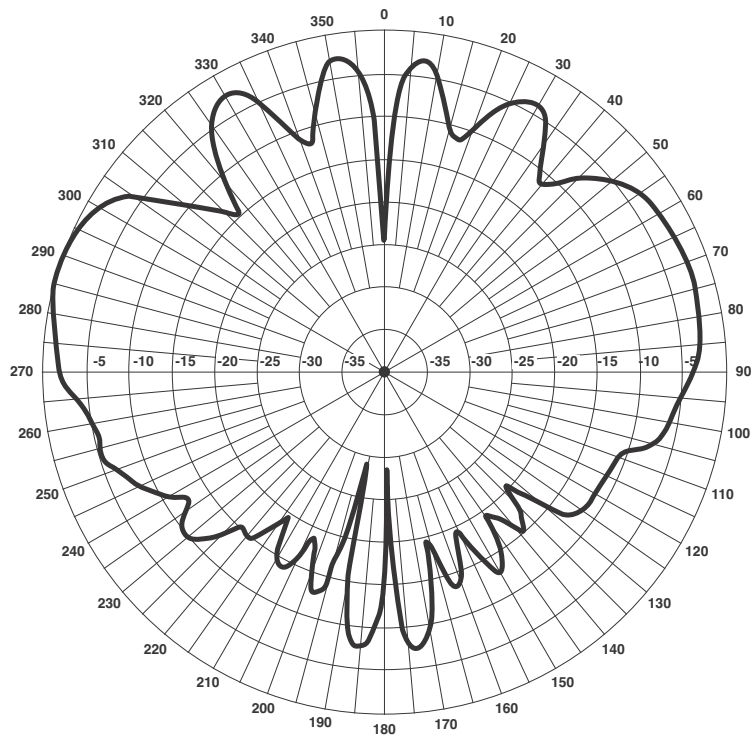


Figure A-54 WS-AI-DS06360 Radiation Pattern—Elevation Cut at 5450 MHz



WS-AI-2S03360

Specifications

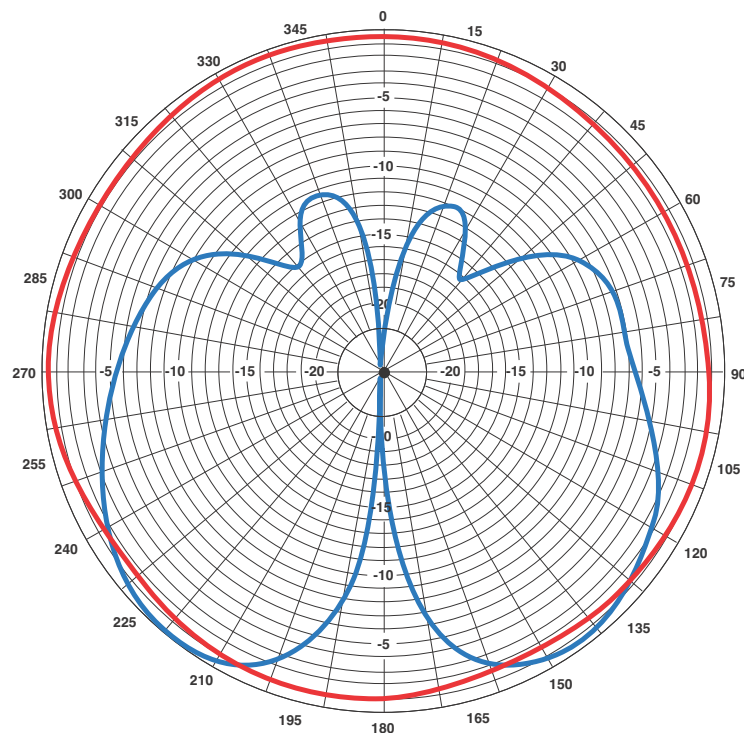
Table A-24 WS-AI-2S03360 Specifications

Specification	Value
Frequency	2.4–2.5 GHz
Gain	3.5 dBi (nominal)
VSWR	<1.5:1
Polarization	Linear
Azimuth (3 dB beamwidth)	Omnidirectional
Elevation (3 dB beamwidth)	50° (peak @45°)
Input Impedance	50 ohms
Operating Temperature	-40°C to +65°C
Mounting Style	Ceiling mount
Power	10 watts
Dimensions	11.5 in x 1 in (292 mm x 25 mm)

Radiation Patterns

In [Figure A-55](#), the E-plane pattern is blue and the H-plane pattern is red.

Figure A-55 WS-AI-2S03360 2.4 GHz E-Plane and H-Plane Radiation Patterns



WS-AI-DX02360

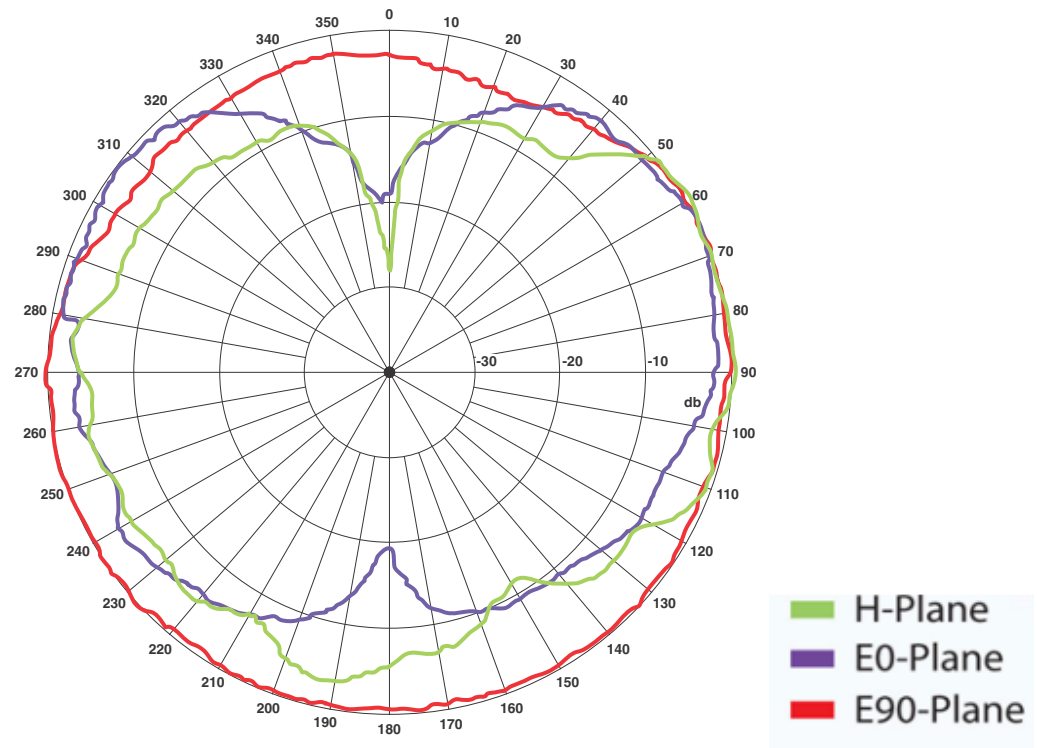
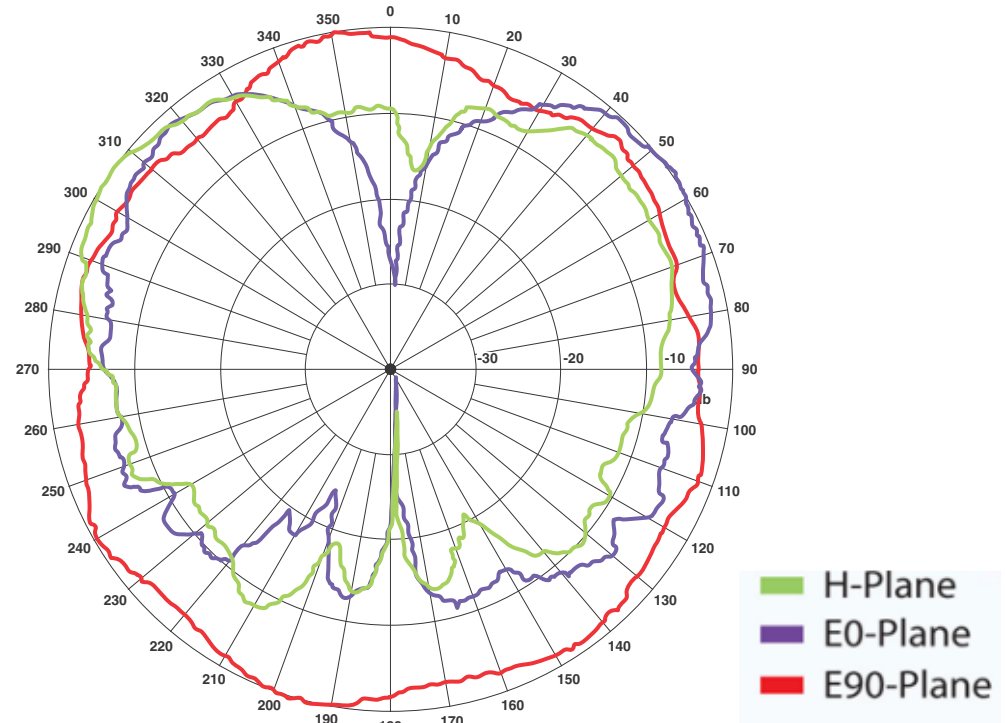
Specifications

Table A-25 WS-AI-DX02360 Specifications

Specification	Value
Antenna Type	MIMO; Dual-band
Frequency	2.4–2.5 GHz and 5.15-5.85 GHz
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 both [Figure A-56](#) and [Figure A-57](#), the E0-plane pattern is blue, the E90-plane pattern is red, and the H-plane pattern is green.

Figure A-56 WS-AI-DX02360 2.4 MHz Radiation Pattern**Figure A-57 WS-AI-DX02360 5.15 MHz Radiation Pattern**

WS-ANT01

Specifications

Table A-26 WS-ANT01 Specifications

Specification	Value
Frequency	2.4-2.4835 GHz and 5.15-5.35 GHz
Gain	4 dBi @ 2.45 GHz
	5 dBi @ 5.25 GHz
VSWR	≤ 2.0
Polarization	Linear Vertical
Azimuth (3 dB beamwidth)	Omnidirectional
Input Impedance	50 ohms
Power	≤ 2.0 watts
Dimensions	130 mm x 21 mm

Radiation Patterns

Figure A-58 WS-ANT01 E-Plane 2.45 GHz

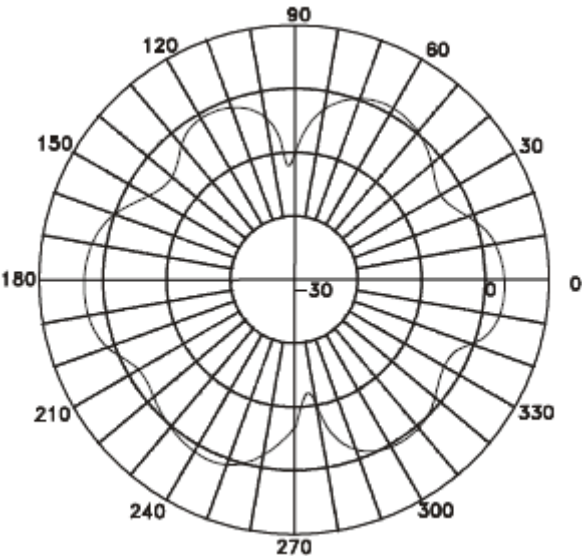


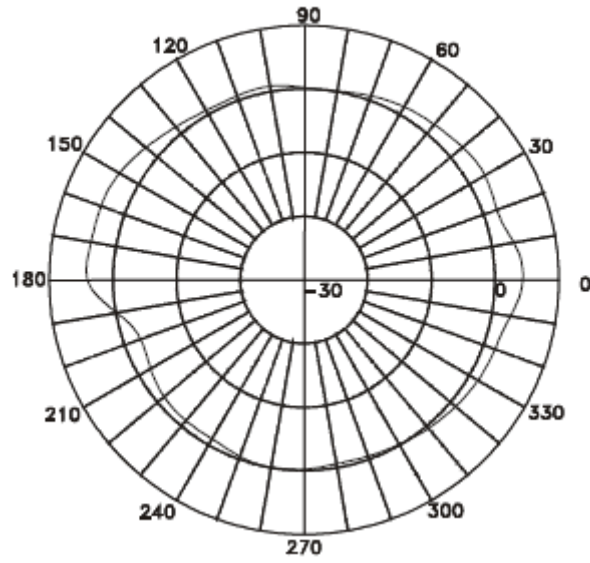
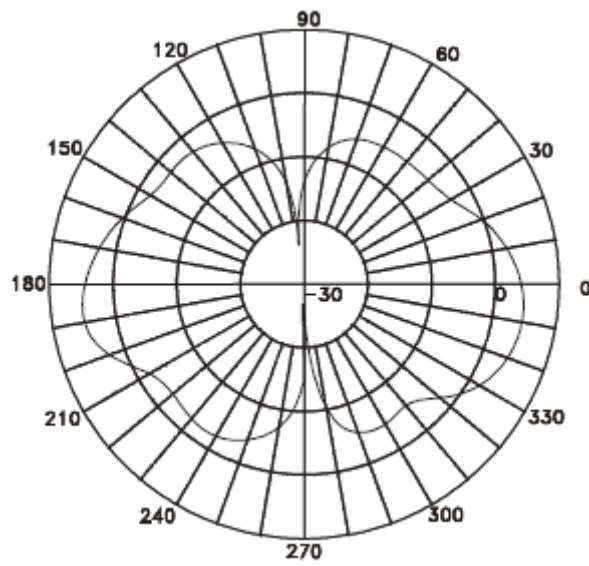
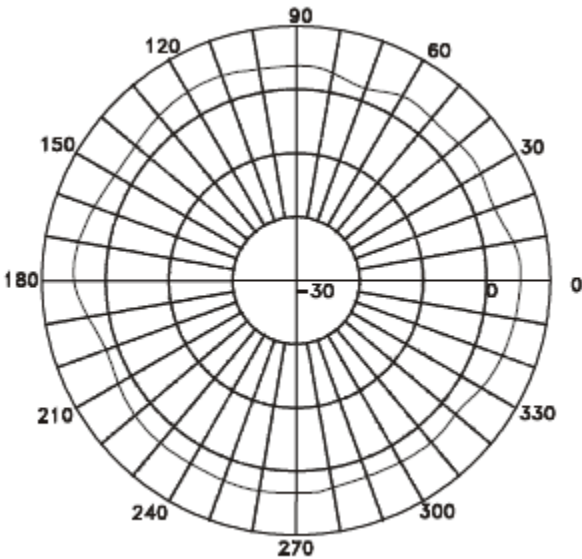
Figure A-59 WS-ANT01 H-Plane 2.45 GHz**Figure A-60 WS-ANT01 E-Plane 5.25 GHz**

Figure A-61 WS-ANT01 H-Plane 5.25 GHz



WS-ANT02

Specifications

Table A-27 WS-ANT02 Specifications

Specification	Value
Frequency	2.4 GHz and 5.x GHz
Gain	4 dBi @ 2.45 GHz
	5 dBi @ 5.25 GHz
VSWR	≤ 2.0
Polarization	Vertical
Azimuth	Omnidirectional
Input Impedance	50 ohms
Power	≤ 2.0 watts
Dimensions	130 mm x 21.2 mm

Figure A-62 WS-ANT02 E-Plane 2.45 GHz

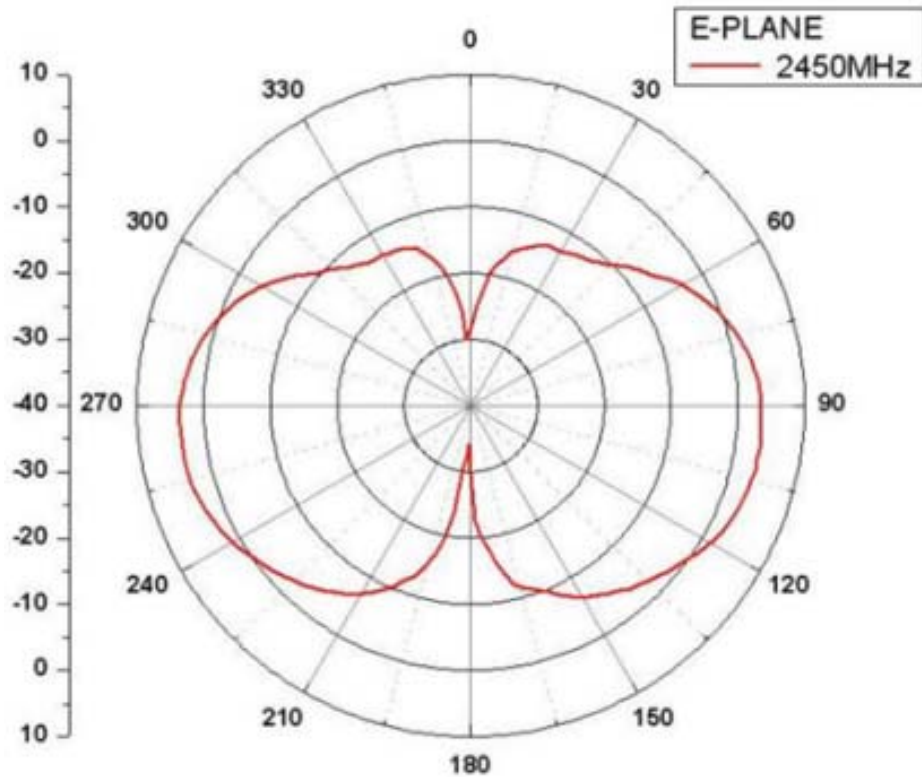


Figure A-63 WS-ANT02 E-Plane 5.25 GHz

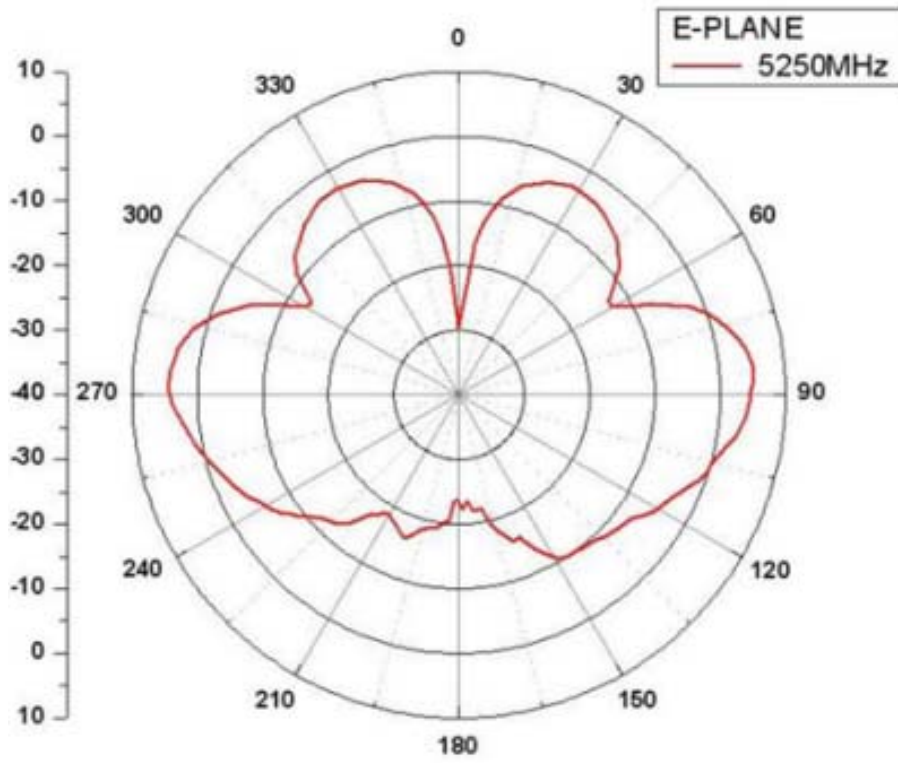


Figure A-64 WS-ANT02 H-Plane 2.45 GHz

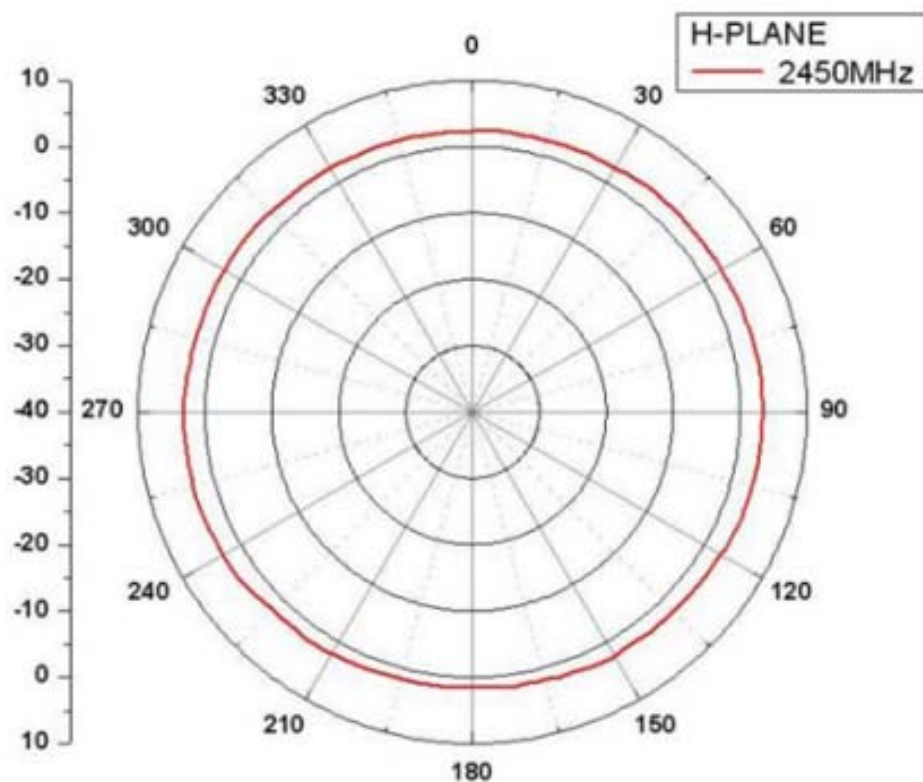
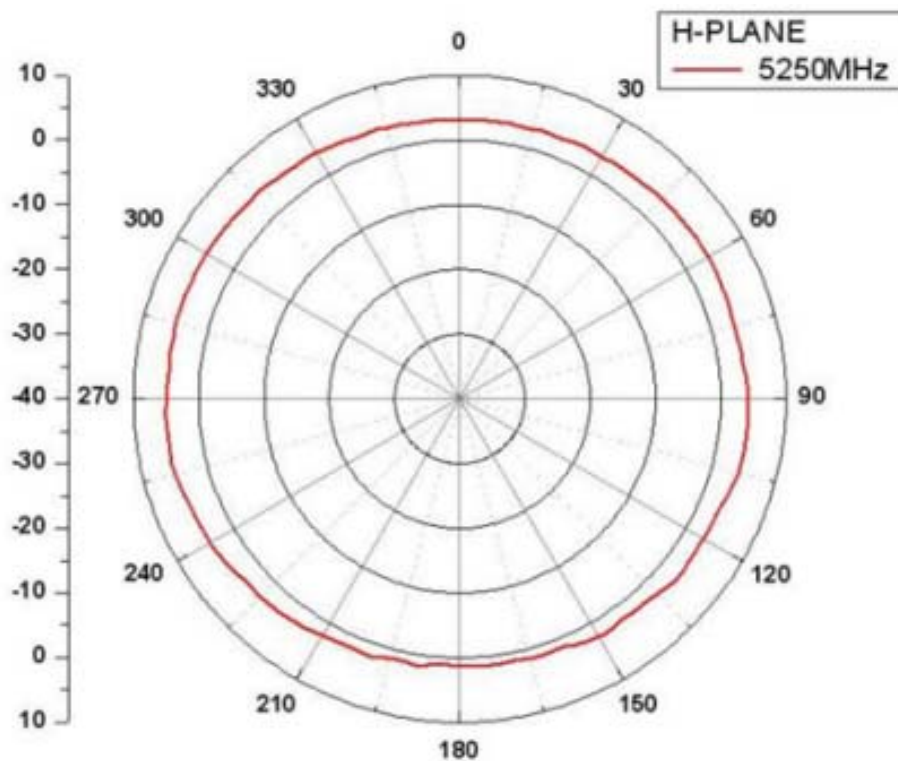


Figure A-65 WS-ANT02 H-Plane 5.25 GHz



WS-AI-DX07025

Specifications

Table A-28 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	-40° C to +85° C
Polarization	Dual Linear (2 x V / 1 X H) for each band
Weight	8.0 lbs (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 A-66 WS-AI-DX07025 2.4 GHz E-Plane Radiation Pattern

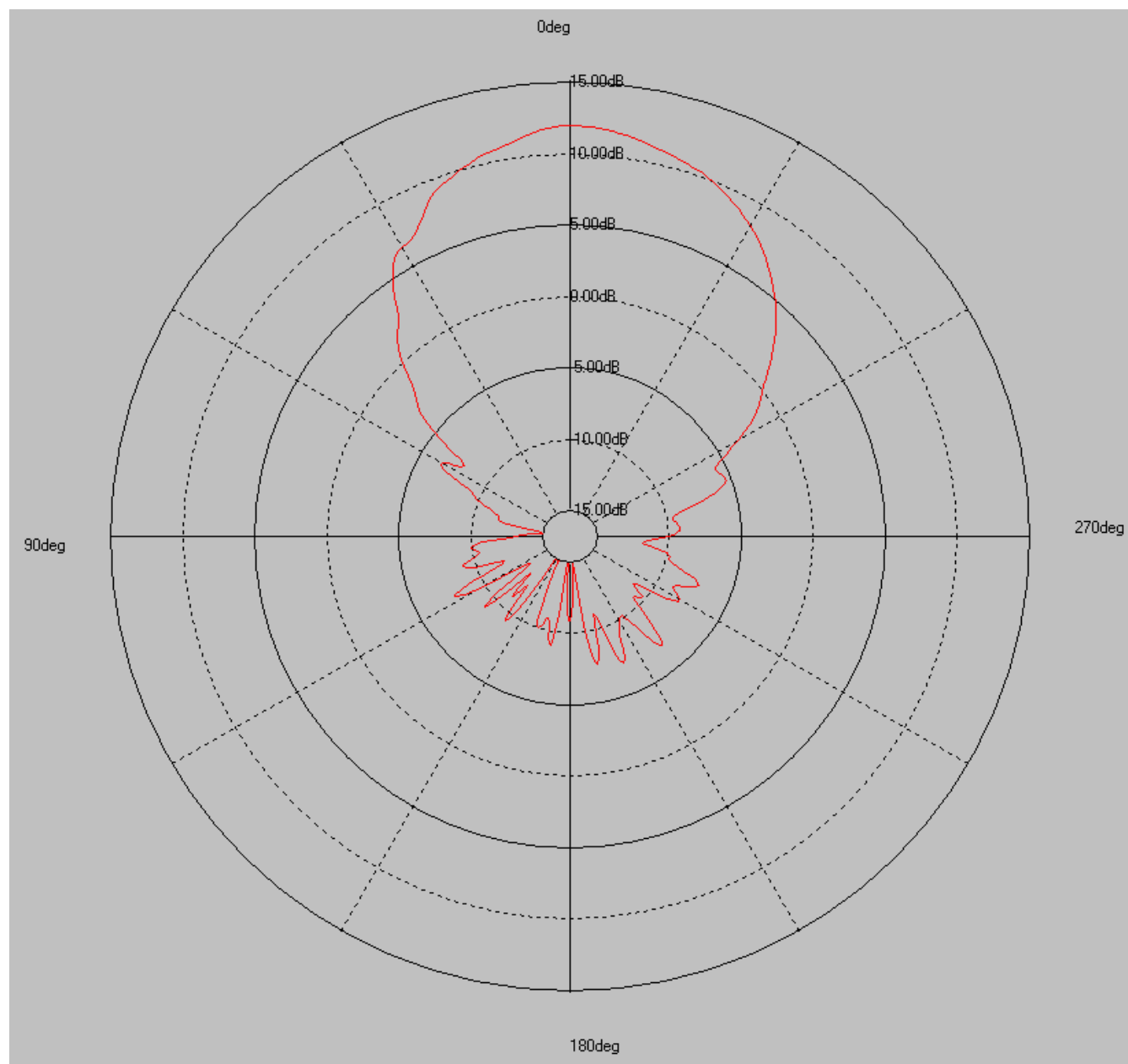


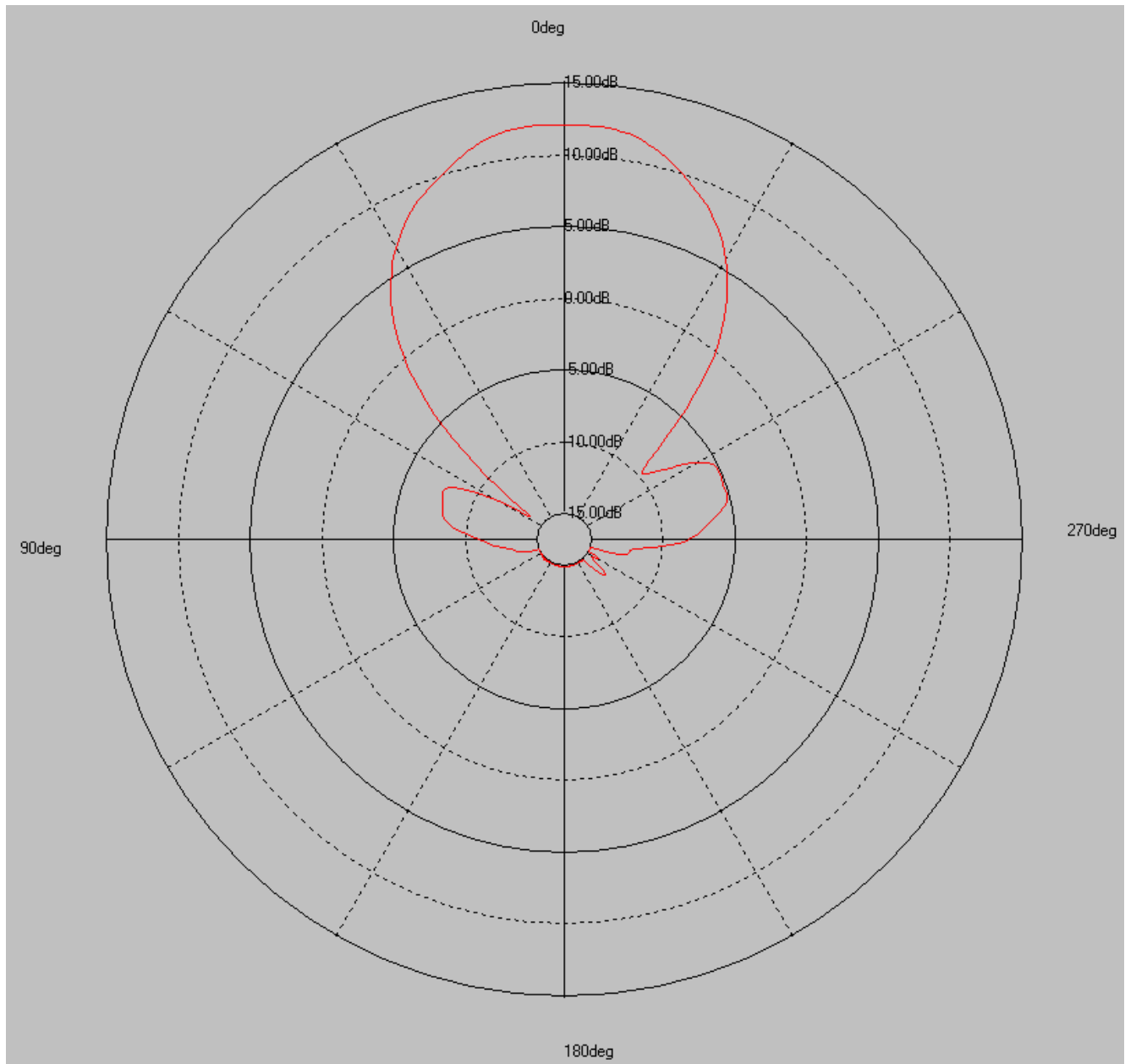
Figure A-67 WS-AI-DX07025 2.4 GHz H-Plane Radiation Pattern

Figure A-68 WS-AI-DX07025 5 GHz E-Plane Radiation Pattern

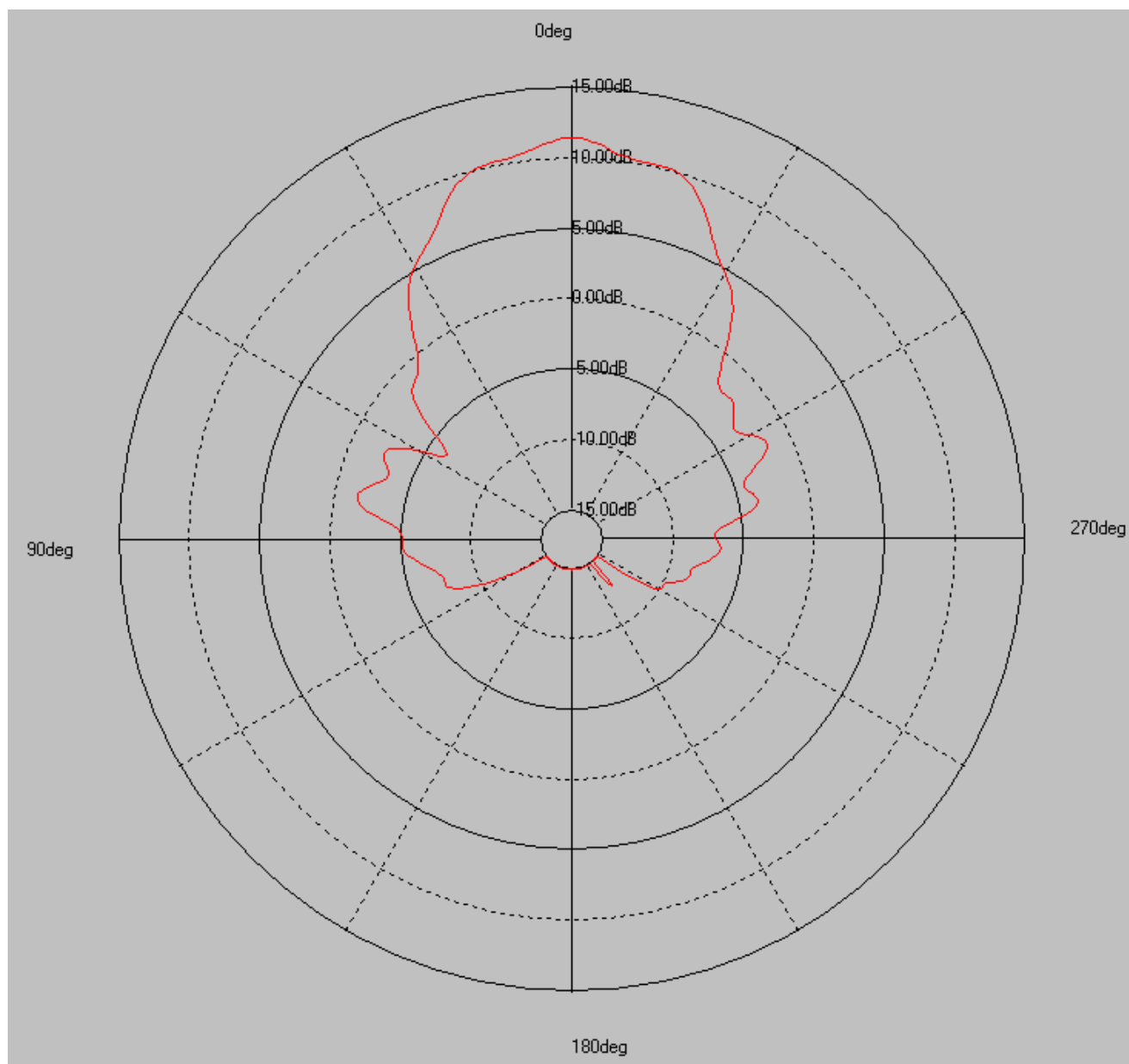
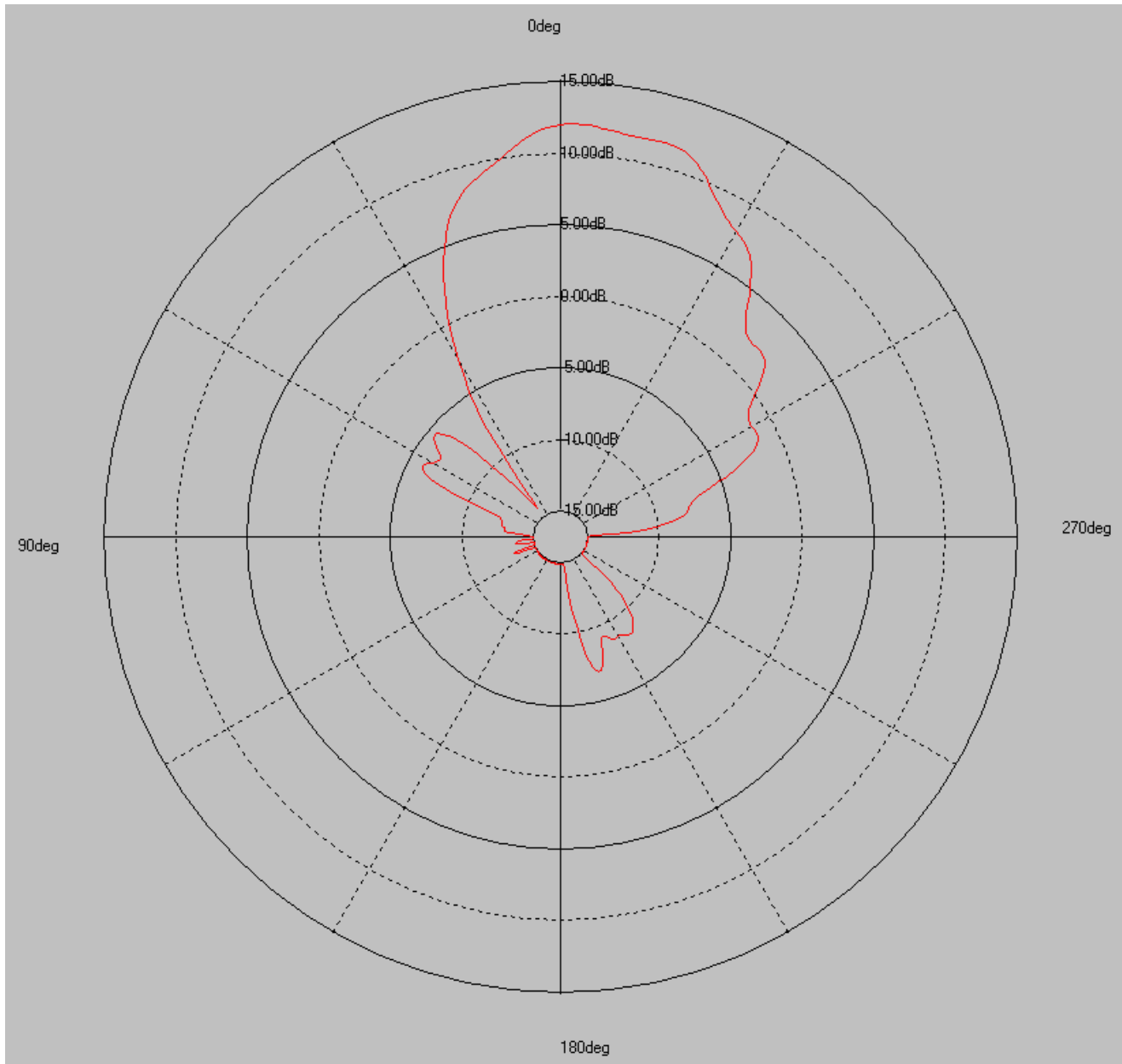


Figure A-69 WS-AI-DX07025 5 GHz H-Plane Radiation Pattern

Accessory Specifications

This appendix lists the specifications for the cables, pigtails, and lightning protector.

For information about...	Part Number	Refer to page...
Pigtail Connection	WS-CAB-PT20P WS-CAB-PT20J	B-2
Low-Loss Antenna Cable	WS-CAB-LxxxCxx	B-3
Lightning Protector	WS-CAB-LPM	B-6
Attenuators	WS-CAB-06DBATN WS-CAB-10DBATN	B-7

Pigtail Connection

Part Number: WS-CAB-PT20P or WS-CAB-PT20J. One end is a Reverse Polarity SMA plug, and the other end is Reverse Polarity Type-N plug or jack, respectively.

The end with the Reverse Polarity SMA plug connects to the AP. The Reverse-Polarity Type-N connector at the opposite end of the pigtail matches the polarity of the Reverse-Polarity Type-N connectors of the other components that are part of your antenna cabling system.

Table B-1 Pigtail Connection Specification

Specification	Value
Mechanical	
Length	20 in. (50.8 cm)
Weight	0.0092 lb/ft (0.014 kg/m)
Bend Radius	0.25 in. (6.4 mm)
Tensile Strength	15 lb (6.8 kg)
Environmental	
Temperature Range:	
Operating	-40 to +85 °C (-40 to +185 °F)
Storage	-70 to +85 °C (-94 to +185 °F)
Electrical	
Cutoff Frequency	90 GHz
Velocity of Propagation	66%
Shielding Effectiveness	Greater than 90 dBi
DC Resistance	
Inner Conductor	81.0 ohms/1000ft (266 ohms/km)
Outer Conductor	9.5 ohms/1000ft (31.2 ohms/km)
Peak Power	0.6 kW
Connector Type	
WS-CAB-PT20P	Reverse Polarity SMA plug, Reverse Polarity Type-N plug
WS-CAB-PT20J	Reverse Polarity SMA plug, Reverse Polarity Type-N jack
Cable Loss	
	2.4 GHz: 0.65 dB
	5.3 GHz: 1.0 dB
	5.8 GHz: 1.1 dB

Low-Loss Antenna Cable

The low-loss, outdoor, watertight cable is available in the following standard lengths:

- 20 feet (6.1 meters) (WS-CAB-L200C20) — refer to [Table B-2](#).
- 6 feet (1.83 meters) (WS-CAB-L400C06) — refer to [Table B-3](#).
- 50 feet (15.24 meters) (WS-CAB-L400C50) — refer to [Table B-3](#).
- 75 feet (22 meters) (WS-CAB-L400C75) — refer to [Table B-3](#).
- 25 feet (7.6 meters) (WS-CAB-L600C25) — refer to [Table B-4](#).
- 50 feet (15.24 meters) (WS-CAB-L600C50) — refer to [Table B-4](#).

To ensure you order the right cable length, carefully determine the distance between the locations where you intend to mount the Enterasys Wireless AP and outdoor antenna.

Table B-2 WS-CAB-L200C20 Cable Specification

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 to +85 °C (-40 to +185 °F)
Storage	-70 to +85 °C (-94 to +185 °F)
Electrical	
Cutoff Frequency	39 GHz
Velocity of Propagation	83%
Shielding Effectiveness	Greater than 90 dBi
DC Resistance	
Inner Conductor	5.36 ohms/1000ft (17.6 ohms/km)
Outer Conductor	4.9 ohms/1000ft (16.1 ohms/km)
Peak Power	2.5 kW
Connector Type	Reverse Polarity Type-N Plug (on both ends)
Cable Loss	
	2.4 GHz: 3.3 dB
	5.3 GHz: 5 dB
	5.8 GHz: 5.3 dB

Table B-3 WS-CAB-L400Cxx Cable Specifications

Specification	Value
Mechanical	
Length	
WS-CAB-L400C06	6 ft (1.83 m)
WS-CAB-L400C50	50 ft (15.24 m)
WS-CAB-L400C75	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 to +85 °C (-40 to +185 °F)
Storage	-70 to +85 °C (-94 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
Connector Type	Reverse Polarity Type-N Plug (On both ends)
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 B-4 WS-CAB-L600Cxx Cable Specifications

Specification	Value
Mechanical	
Length	
WS-CAB-L600C25	25 ft (7.6 m)
WS-CAB-L600C50	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 to +85 °C (-40 to +185 °F)
Storage	-70 to +85 °C (94 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	Reverse Polarity Type-N Plug (On both ends)
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

Lightning Protector

Part number: WS-CAB-LPM.

The lightning protector is a surge arrester that protects your sensitive Enterasys Wireless equipment from high-voltage currents caused by discharge and transients at the antennas.

[Table B-5](#) lists the specifications for the lightning protector.

Table B-5 Lightning Protector Specifications

Specification	Value
Mechanical	
Height	2.7 in. (69 mm)
Dimension	1 in. (26 mm)
Weight	4.7 oz (133 g)
Environmental	
Temperature Range (Operating and Storage)	-40 to +85 °C (-40 to +185 °F)
Electrical	
Frequency Range	2.0 GHz to 6.0 GHz
Return Loss	> 20 dB
Insertion Loss	≤0.1 dB typical (≤0.2 dB maximum)
Surge	10 kA IEC 1000–4–5 8/20 waveform
VSWR	≤ 1.2 to 1 typical (≤ 1.3 to 1 maximum)
Continuous Power	10 W
Let Through Voltage	≤±3 Volts for 3 kA @ 8/20 waveform

Attenuators

Part Number: WS-CAB-06DBATN or WS-CAB-10DBATN. One end is a Reverse Polarity SMA Plug-Female contact, and the other end is a Reverse Polarity SMA Jack-Male contact (see [Figure B-1](#)).

Figure B-1 Attenuator Detail View

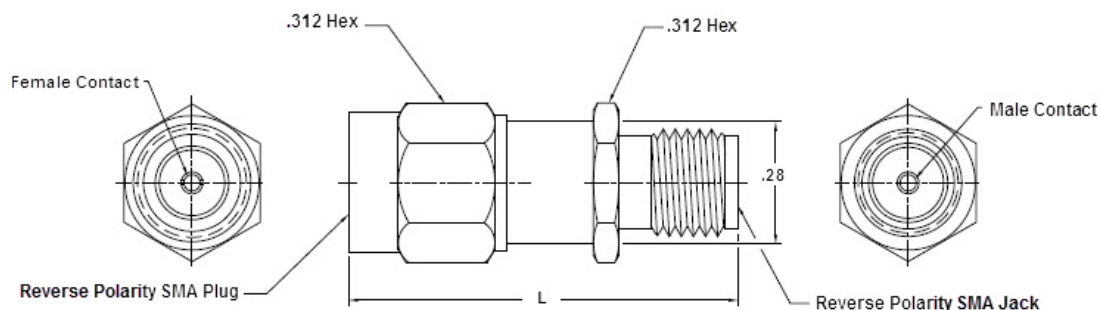


Table B-6 Attenuator Specifications

Specification	Value
Mechanical	
Length (L)	.86 in. +/- .03 in.
Weight	0.2 ounces
Housing	Stainless Steel, Passivated
Connector Type	
WS-CAB-06DBATN	Reverse Polarity SMA Plug/Jack, Female/Male contacts
WS-CAB-10DBATN	Reverse Polarity SMA Plug/Jack, Female/Male contacts
Environmental	
Operating Temperature Range	-55 to +85 °C (-67 to +185 °F)
Electrical	
Frequency Range	Hz-6.000 GHz
Impedance	50 Ohms (nominal)
VSWR	1.20:1 Max
Power Rating	
Average	2 watts (5 uSec Pulse, 0.05% duty cycle)
Peak	250 Watts
Attenuation	
WS-CAB-06DBATN	6 +/- 0.50 dB
WS-CAB-10DBATN	10 +/- 0.50 dB

