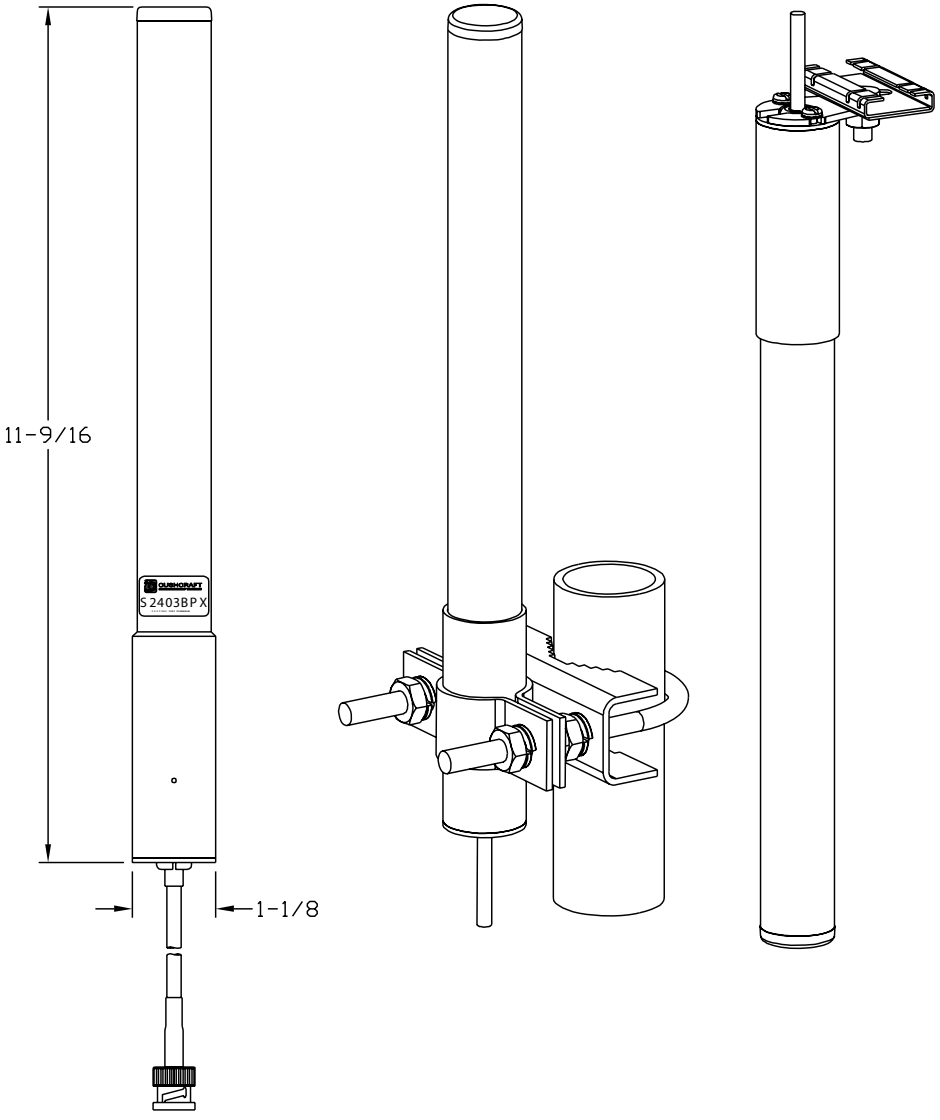
MOTOROLA

Enterprise Wireless LAN Antenna

Specification Guide

Version 1.1 October 2008



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About This Guide

Introduction

This guide provides an RF engineer a catalog of antenna parts and accessories to complete a customized RF environment. This guide specifically addresses the antennas used for 802.11a, 802.11b, and 802.11g implementations for *Wireless Local Area Networks* (WLANs).

It is important to understand that antenna and accessory selection should be qualified by on-site testing with the actual components used. Signal attenuation is cumulative with each connection and component added between the antenna and the radio, so careful study should verify the given arrangement delivers the expected results.

NOTE: Illustrations displayed in this guide are samples and can differ from the actual antenna.

Document Conventions

The following conventions are used in this document to draw your attention to important information:

NOTE: Indicate tips or special requirements.

CAUTION: Indicates conditions that can cause equipment damage or data loss.

WARNING! Indicates a condition or procedure that could result in personal injury or equipment damage.

Notational Conventions

The following additional notational conventions are used in this document:

- *Italics* are used to highlight the following:
  - Chapters and sections in this and related documents
  - Dialog box, window and screen names
  - Drop-down list and list box names
  - Check box and radio button names
  - Icons on a screen.
- **GUI** text is used to highlight the following:
  - Screen names
  - Menu items
  - Button names on a screen.
- bullets (•) indicate:
  - Action items
  - Lists of alternatives
  - Lists of required steps that are not necessarily sequential
- Sequential lists (those that describe step-by-step procedures) appear as numbered lists.

1

Antenna Selection and Description

1.1 Antenna Selection

While several antennas may work in a given environment, some will provide better coverage than others. Using the right antenna in the right location will maximize both the performance and coverage of your network. Understanding the key characteristics that describe how an antenna sends and receives radio frequency signals is critical to finding the ideal antenna for your deployment. This guide supports the antennas used for an AP-5131 or AP-5181 model access point and an AP300 (non-integrated antenna) model access port.

Motorola Enterprise Wireless LAN products operate in the 2.4 GHz and 5 GHz ISM bands allocated for unlicensed use. Access point and access port products available today support either the 802.11b/g or the 802.11a standard, or both. Wireless devices conforming to the 802.11b/g standard operate in the 2.4 GHz ISM band, while 802.11a devices operate in the 5 GHz band. The antennas in this guide are grouped according to the frequency band they support. Some antennas are designed to operate on either band. These antennas (described as "Dual-band") may be connected to radios operating in either the 2.4 or 5 GHz bands, although a single antenna may not be connected to two radios at the same time.

1.1.1 Access Points and Access Ports Supported

The antennas and accessories referenced in this guide are intended to customize the radiated signal lobes of Motorola's WLAN product suite.

The *access port* (AP) supported is the AP300 (Part No. WSAP-5100-100-WWR). This access port has no integrated antennas and some antenna must be added to the device. The AP300 supports both 5 GHz (802.11a) and 2.4 GHZ (802.11b/g). The AP300 has two sets of antenna connectors providing diversity (for each spectrum supported.

The two 5 GHz connectors on the AP300 are - **RPSMA-Female**

The two 2.4 GHz connectors on the AP300 are - **RPBNC-Female**

The AP-5131 and AP-5181 access points are also addressed in this document. For an AP-5131, there are several different part number configurations unrelated to the actual antenna connections. An AP-5131 and AP-5181 supports both 5 GHz (802.11a) and 2.4 GHZ (802.11b/g). Valid AP-5131 part numbers include:

The AP-5131 supports both 5 GHz and 2.4 GHZ spectrums, but the antenna connectors implemented on the AP provide dual spectrum capability - both spectrums on one physical connector.

The connectors on the AP-5131are **RP-SMA-Female**.

The AP-5181 is used outdoors and only one part number is currently available (AP-5181-13040-WWR). Since this device is intended to be mounted outside in unpredeicable weather, lightening protection is integrated into the device design. As such, no additional lightning protection is required.

The connectors on the AP-5181are **N-Type-Female**.

NOTE:

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AP Antenna Port Connectors

AP	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6
AP-7131	R1-A	R1-B	R1-C	R2-A	R2-B	R2-C
	11n 2.4 GHz and 5 GHz (dual band)					
	RP-SMA(f)					
AP-300	● 2.4GHz	●● 2.4GHz	● 5GHz	●● 5GHz		
	11bg		11a			
	RP-BNC(f)		RP-SMA(f)			
AP-5131	Radio 1 ●	Radio 1 ●●	Radio 2 ●	Radio 2 ●●		
	11bg		11a			
	RP-SMA(f)					
AP-5181	Radio 1 ●	Radio 1 ●●	Radio 2 ●	Radio 2 ●●		
	11bg		11a			
	Type N(f)					

1.1.2 Connector Types and Definitions

There are combinations of antenna types and cables required to provide a satisfactory connection to the AP. One confusing factor is “reverse polarity”. Reverse polarity is the FCC's requirement for each WLAN manufacturer to have unique access point connectors. Motorola (Symbol) had previously standardized our offerings for access points/ports:

- 2.4 GHz is Reverse polarity BNC female (RP-BNC-F)
- 5 GHz is reverse polarity SMA female (RP-SMA-F)
- Dual Band is reverse polarity SMA female (for AP-5131), and N-Female (for AP-5181).

NOTE: Reverse polarity presents confusion because of a lack of a standardized definition from connector manufactures. Reverse polarity provides a center element, which should not be confused with a male connector. A male connector is defined by the outer jacket of the connector rather than the center element .

The following displays the connectors used within this antenna specification guide:

Figure 1.1 RP-BNC-F

Figure 1.2 RP-BNC-M

Figure 1.3 RP-SMA-F

Figure 1.4 RP-SMA-M

Additionally, antennas deployed outdoors and industry standard accessories like lightening arrestors use Type-N connectors (as displayed below). Therefore, with the combinations devices required (access points/ports, antennas, cable extensions, and lightening arrestors), various adapter cables are required to connect an antenna to an access point/port.

Figure 1.5 Type N-F

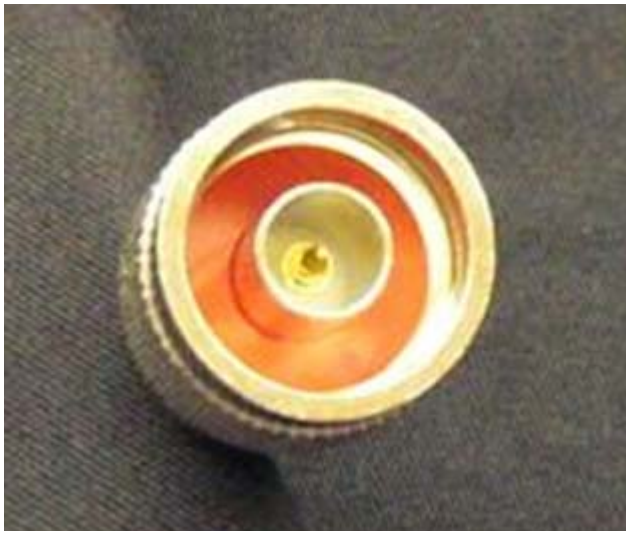


Figure 1.6 Type N-M

1.1.3 Indoor and Outdoor Antennas

One important aspect of an antenna is whether it is weather sealed to protect it from the environment Because of this extra protection, outdoor antennas are typically more expensive than those rated for indoor use. Outdoor antennas can be used for indoor applications, such as freezers and cooler where moisture is common. Outdoor antennas can be used for indoor applications, but indoor applications should not be used in outdoor applications.

One common distinction of outdoor antennas is the connector. Since lightning protection is always advised for outdoor antennas, these antennas typically have Type N Male to directly attach the lightning arrestor. This is tru of the 2.4 GHz, 5 GHz, and the dual-band outdoor antennas.

1.1.4 Spectrum and Part Number Designations

The antennas listed in this document are ultimately referenced by part number. A numerical sequence is used within each antenna's part number to identify the spectrum supported by the antennas.

- The antenna part numbers with a 2499 indicates a 2.4 GHz antenna. For more informaion on the 2.4 GHz antenna suite, see *802.11b/g Antenna Suite on page 3-1*.
- The antenna part numbers with a 5299 indicates a 5 GHz antenna. For more informaion on the 2.4 GHz antenna suite, see *802.11a Antenna Suite on page 4-1*.
- The antenna part numbers with a 2452 indicates a dual band antenna (2.4GHz and 5 GHz). For more informaion on the 2.4 GHz antenna suite, see *2.4GHz - 5.2GHz Dual Band Antenna Suite on page 5-1*.

1.1.5 Extended AP to Antenna Cable Lengths

Most indoor antennas are intended to be mounted directly to the AP's connectors. Some mounting arrangements call for positioning the AP a significant distance away from the antenna due to serviceability or other reason. In these situations, various adapters and cable extensions are required.

In these situations be mindful of:

- The connector on the AP
- The connector on the Antenna
- The spectrum being implemented
- Signal loss due to multiple connectors and long cable lengths

Combinations of these attributes present different parts required to complete the connection. The Product Compatibility matrix in addresses the parts required to make a proper connection. For more information, see *on page -First Page*.

1.2 Antenna Selection Criteria

In addition to antenna frequency, there is other criteria to consider when selecting an antenna for the AP-5131, AP-5181 or AP300 (non-integrated antenna) model access port.

1.2.1 Antenna Pattern

1.2.1.1 Omni-Directional

Signal radiates from the antenna in all directions on the horizontal plane.

1.2.1.2 Directional

Signal radiates in a specific direction, typically described as a beam of given width, expressed in degrees in the horizontal and vertical plane. For more information, see *Azimuth 3dB Beamwidth on page 1-8* and *Elevation 3dB Beamwidth on page 1-8*.

1.2.2 Antenna Type

1.2.2.1 Panel

A panel antenna is a flat antenna mounted to a wall or other vertical surface and radiates RF energy (radio waves) directionally away from the wall. They usually have gain greater than 5 dBi and are not suitable for omni-directional situations. Ideally suited for long hallways.

1.2.2.2 Patch

A patch antenna is a flat antenna mounted on the ceiling but whose pattern is omni-directional. Most of the energy goes out horizontally to the sides of the antenna and equal in all directions.

1.2.2.3 Dipole

A dipole antenna is a tubular antenna that can be either a pipe shape, a straight flexible rod or a paddle. This antenna has an omni-directional pattern when placed in a vertical position. It usually has 2 dBi of gain.

1.2.2.4 Dipole Array

Essentially a dipole, a dipole array is two or more dipoles that are placed one on top of the other, requiring a longer tube to hold them. The advantage of a dipole array is that it has higher gain.

1.2.2.5 Parobolic Grid

A paraobolic grid antenna is a very directional, dish-like antenna. Its parabolic reflector focuses the RF energy like a flashlight. Most of the time the radiating element is a dipole, but when combined with the dish, it becomes very directional with gain up to 24 dBi. Usually used in long point-to-point systems.

1.2.2.6 Yagi

A yagi antenna is a antenna that has an internal structure resembling that of typical antennas used for TV reception (a series of rods perpendicular to a main rod, making a triangular shape). This is a directional antenna with less gain than the PGA, typically around 13 dBi. It may be used in either point-to-point situations, or to cover a very long, narrow area in point-to-multi-point situations.

1.2.3 Antenna Performance Characteristics

1.2.3.1 Frequency

The frequency band within which the antenna performs at the stated specifications

1.2.3.2 Gain (dBi)

The relative amplification of the antenna with respect to an equivalent isotropic antenna, expressed on the decibel logarithmic scale.

1.2.3.3 Cable loss (dB)

The signal strength loss introduced by the cable connected to the antenna expressed on the decibel logarithmic scale.

1.2.3.4 Net gain (dBi)

The resulting amplification of the antenna paired with its cable.

1.2.3.5 Polarization

The orientation of the electrical field which the antenna is optimized to receive. If the transmitting and receiving antennas are both linear polarized, then turning one 90° so that they are cross polarized will reduce the range significantly.

1.2.3.6 VSWR

Voltage Standing Wave Ratio (VSWR) is the ratio of maximum voltage to minimum voltage along the line. Expresses the degree of match between the transmission line and the terminating element (antenna). When VSWR is 1:1 the match is perfect, a VSWR of 1.5:1 corresponds to 96% power efficiency.

1.2.3.7 Azimuth 3dB Beamwidth

Width of the antenna beam on the horizontal plane expressed in degrees.

1.2.3.8 Elevation 3dB Beamwidth

Height of the antenna beam on the vertical plane expressed in degrees.

1.3 Antenna Accessories for Motorola Enterprise WLANs

Motorola offers a complete selection of antennas and accessories to ensure optimal coverage and performance for 802.11a/b/g wireless LANs. Regardless of the size or layout of your environment, from a small office or storefront to campus-wide, multiple-site, indoor and outdoor deployments, Motorola offers the antennas, cables and accessories designed to fit your needs.

By combining this portfolio with a broad line of wireless switches, access ports, access points, client connectivity cards, ruggedized mobile voice/data devices and network management software, as well as wireless mobility planning and deployment services, Motorola offers comprehensive end-to-end wireless enterprise LAN solutions, giving you secure, reliable access to your critical business data and applications at the point of activity. For more information on Motorola's wireless products, visit *www.motorola.com*.

1.3.1 Choosing the Right Antenna and accessories for your WLAN

It is important to consider a number of factors when choosing an antenna and accessories for your Motorola enterprise WLAN. To choose the right components, you'll need to know:

- Where is the antenna to be installed, and what type of coverage is required. Knowing the intended radio band is central. Determine if the intended radio coverage area supports dual 2.4/5.2 band traffic. Has the antenuation of the coverage been discerned in respect to known barriers.
- In which band (802.11b/g or 802.11a) your network operates
- Which Motorola AP to use
- Whether you will be deploying the network indoors or outdoors
- The distance between AP and antenna, to determine extender cable length, if any
- the serviceablity requirement for each AP and antenna deployment

Review the chart to determine which antennas suit your needs. Using the part numbers provided, determine which of the antennas will work with your hardware in your environment.

2

Product Compatibility

To find the right antenna and accessories for your AP-5131, AP-5181 or AP300 (non-integrated antenna) deployment:

- Find your Motorola access point or access point model at the top of the chart (refer to the chart on the following page). Follow that column down to find the antennas, cables and lightning arrestors compatible with that model access port or access point. Write those part numbers down.
- Follow the row antenna across the table to the columns for the lightning arrestors and cables you wrote down to confirm that they compatible with the antenna you've chosen and determine if an adaptor is required to connect the two selected parts.

			AP Radios								Cables					LAs		
			AP300 A	AP300 B/G	AP-5131 A	AP-5131 B/G	AP-5181 A	AP-5181 B/G	AP-7131 A/N	AP-7131 B/G/N	ML-1499-100JK-01R	ML-1499-10JK-01R	ML-1499-25JK-01R	ML-1499-50JK-01R	ML-1499-72PJ-01R	ML-1499-LAK1-01R	ML-1499-LAK2-01R	ML-2452-LAK1-01R
Antennas	2.4 GHz	ML-2499-11PNA2-01R	X	*	X	3	X	X	X	3	1	1	1	1	*	2	2	2
		ML-2499-5PNL-72-N	X	8	X	7	X	*	X	7	A	A	A	A	X	*	*	*
		ML-2499-7PNA2-01R	X	*	X	3	X	X	X	X	1	1	1	1	*	2	2	2
		ML-2499-APA2-01	X	*	X	3	X	X	X	X	X	X	X	X	X	X	X	X
		ML-2499-BPNA3-01R	X	9	X	6	X	X	X	X	*	*	*	*	X	X	*	X
		ML-2499-BYGA2-01R	X	9	X	6	X	X	X	6	*	*	*	*	X	X	*	X
		ML-2499-FHPA5-01R	X	8	X	9	X	*	X	X	A	A	A	A	X			
		ML-2499-FHPA9-01R	X	8	X	9	X	*	X	X	A	A	A	A	X			
		ML-2499-HPA3-01R	X	*	X	3	X	X	X	3	1	1	1	1	*	2	2	2
		ML-2499-PNAHD-01R	X	*	X	3	X	X	X	X	1	1	1	1	*	2	2	2
		ML-2499-SD3-01R	X	*	X	3	X	X	X	3	1	1	1	1	*	2	2	2
	5 GHz	ML-5299-APA1-01R	*	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X
		ML-5299-FHPA10-01R	X	X	A	X	*	X	X	X	A	A	A	A	X			
		ML-5299-FHPA6-01R	X	X	X	X	*	X	X	X	A	A	A	A	X			
		ML-5299-HPA1-01R	*	X	*	X	X	X	*	X	4	4	4	4	X	5	5	5
		ML-5299-PTA1-01R	*	X	*	X	X	X	*	X	4	4	4	4	X	5	5	5
		ML-5299-WPNA1-01R	*	X	*	X	X	X	*	X	4	4	4	4	X	5	5	5
	Dual	ML-2452-APA2-01	*	X	*	*	X	X	*	*	X	X	X	X	X	X	X	X
		ML-2452-PNA5-01R	X	X	X	X	*	*	X	X	A	A	A	A	X			
		ML-2452-PNA7-01R	X	X	X	X	*	*	X	X	A	A	A	A	X			
		ML-2452-PTA2M3X3-1	X	X	X	X	X	X	*	*								
		ML-2452-PTA3M3-036	X	X	X	X	X	X	*	*								
LAs		ML-1499-LAK1-01R	X	*	X	X			X	X	*	*	*	*	X			
		ML-1499-LAK2-01R	X	X	X	X			X	X	*	*	*	*	X			
		ML-2452-LAK1-01R	*	X	*	*			*	*	*	*	*	*	X			
Cables		ML-1499-100JK-01R	7	X	7	7	*	*	7	7								
		ML-1499-10JK-01R	7	X	7	7	*	*	7	7								
		ML-1499-25JK-01R	7	X	7	7	*	*	7	7								
		ML-1499-50JK-01R	7	X	7	7	*	*	7	7								
		ML-1499-72PJ-01R	X	*	X	X	X	X	X	X								

1	ML-1499-RBNCA1-01R
2	ML-1499-RBNCA2-01R
3	25-72178-01
4	25-90262-01R
5	25-90263-01R
6	25-85391-01R
7	25-85392-01R
8	must use ML-1499-LAK1-01R
9	25-97261-01R
A	25-99175-01R
*	Compatible
X	Not compatible
	Not required

2.1 Antenna Suite Summary

The following aligns Motorola's antenna suite with their respective part numbers, description, band, gain, mounting orientation, radiation patterns, outdoor versus indoor deployment and plenum rating.

Band	Part Number	Description	Cable	Gain (dBi)	Mount	Az BW	Outdoor	Plenum
5 GHz	ML-5299-APA1-01R	ANT:5.5 GHZ, DP AJ,2DBI,CBL 0,SMARP-F	none	2	S	360	No	No
	ML-5299-PTA1-01R	ANT:5.5GHZ,PTCH,0 DBI,CBL 36",SMARP-F	36 in	2	H	360	No	Yes
	ML-5299-HPA1-01R	ANT:5.5 GHZ, DPA, 5DBI, CBL 36" RPSMA-F	36 in	5	V	360	Yes	Yes
	ML-5299-FHPA6-01R	ANT:4.9-5.9 GHZ,FIXED DP,6DBI,TYPE N-M	none	6	V	360	Yes	No
	ML-5299-FHPA10-01R	ANT:5.8 GHZ,FIXED DP,10DBI,TYPE N-M	none	10	V	360	Yes	No
	ML-5299-WPNA1-01R	ANT:5.5 GHZ, PNL, 13DBI, CBL 36" RPSMA-F	36 in	13	V	31	TBD	TBD
2.4 GHz	ML-2499-APA2-01	ANT:OMNI,2DBI,2400-2500MHZ	none	2	S	60	No	No
	ML-2499-HPA3-01R	ANT:S24,DP,3.3DBI,CBL 48",BNCRP-F	48 in	3	V	360	Yes	TBD
	ML-2499-SD3-01R	ANT:S24,PTCH,3.5DBI,CBL 48",BNCRP-F	48 in	4	H	360	No	Yes
	ML-2499-PNAHD-01R	ANT:S24,PNL,6.3DBI,CBL 48",BNCRP-F	48 in	6	V	55	No	TBD
	ML-2499-7PNA2-01R	ANT:2.4GHZ,7DBI,INDOOR,65 DEGREE PNL	48 in	6	V	60	No	Yes
	ML-2499-5PNL-72-N	ANT:2.4GHZ,PNL,5.5DBI,LP,CBL 72" TYPE N	72 in	6	V	135	Yes	Yes
	ML-2499-11PNA2-01R	ANT:S24,SECTR PNL,8.5 DBI,CBL 96",BNCRPF	96 in	8	V	97	No	Yes
	ML-2499-FHPA5-01R	ANT:2.4 GHZ,FIXED DP,5DBI,TYPE N-M	none	5	V	360	Yes	No
	ML-2499-FHPA9-01R	ANT:2.4 GHZ,FIXED DP,9DBI,TYPE N-M	none	9	V	360	Yes	No
	ML-2499-BPNA3-01R	ANT:S24,PNL,13.5DBI,CBL 12",TYP N-F	12 in	11	V	31	Yes	--
	ML-2499-BYGA2-01R	ANT:S24,YAGI,13.9DBI,CBL 12",TYP N-F	12 in	11	V	34	Yes	--
	ML-2499-BPDA1-01R	ANT:S24,DISH,24DBI,TYP N-F	none	20	V	10	Yes	--
Dual Band	ML-2452-PTA2M3X3-1	ANT:11ABG,AP7131,MIMO3X3,2DBI,1IN,RPSMA	n/a	1 / 2	S	360	No	No
	ML-2452-APA2-01	ANT:2.4-5.2GHZ DUALBAND,DP,2DBI,SMARP-F	none	3 / 4	S	360	No	No
	ML-2452-PTA3M3-036	ANT:11ABG,MIMO3,PTCH,3 DBI,36IN,RPSMA	36 in	3 / 4	H	360	No	Yes
	ML-2452-PNA5-36R	ANT:DUAL BAND PANEL, 5 DBI, RP-SMA(M)	36 in	4 / 6	V	60	TBD	Yes
	ML-2452-PNA5-01R	ANT:2.4/5 GHZ,SECTOR 120,5DBI,TYPE N-M	12 in	5 / 7	V	120	Yes	Yes
	ML-2452-PNA7-01R	ANT:2.4/5 GHZ,SECTOR 60,7DBI,TYPE N-M	12 in	7 / 9	V	360	Yes	Yes

H - ceiling mount (Patches)
V - Wall or mast mount (Panels, Yagi, Dishes)
S - Switchable (elbow jointed)

Omnidirectionals
Directionals
Outdoor

Plenum
Bridge

3

802.11b/g Antenna Suite

3.1 Supported 802.11b/g/n Antenna Suite

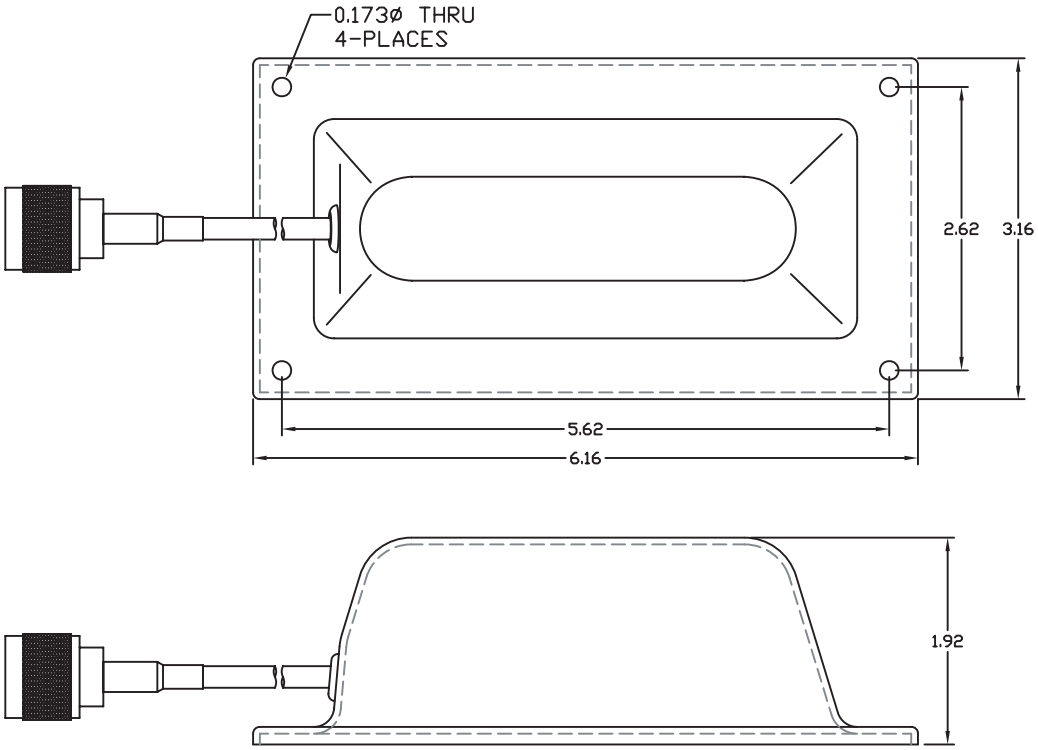
Motorola supports numerous single-band 2.4 GHz 802.11b/g/n antennas to suit the requirements of your unique AP-5131, AP-5181 or AP 300 (non-integrated antenna) deployment. Check the Motorola Web site periodically, as newly supported 802.11b/g/n antennas will be added to this document as they are released. For more information, go to *http://support.symbol.com/support/product/manuals.do*.

For detailed information on supported 802.11b/g/n antenna models, refer to:

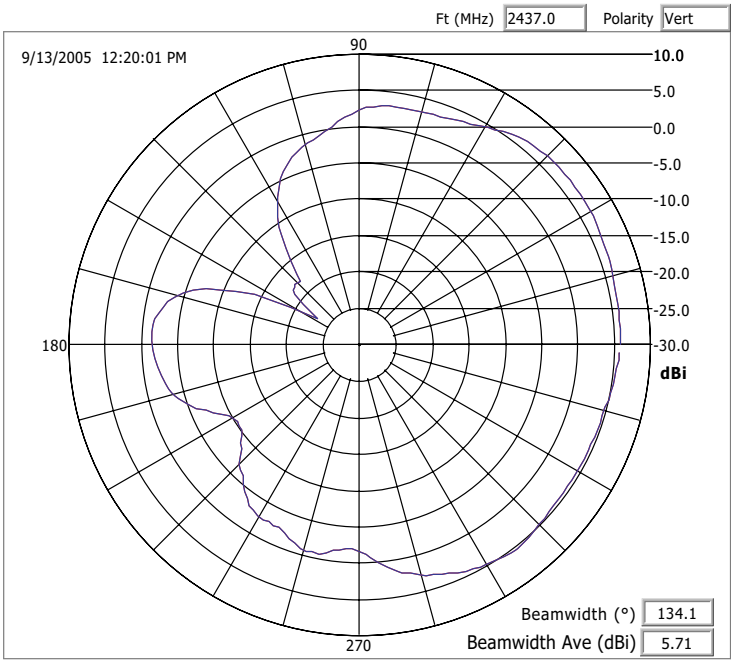
- *ML-2499-5PNL-72-N High Performance 135 Degree Panel Antenna - 5.5 dBi; N Male Connector*
- *ML-2499-7PNA2-01R 65 Degree H-Plane Diversity Directional Panel - 7 dBi, RP-BNC Male*
- *ML-2499-11PNA2-01R High-Gain 97 Degree H-Plane Directional Panel - 11 dBi, RP-BNC Male*
- *ML-2499-APA2-01R High Performance Omni-Directional 'Fixed Point' Dipole - 3.5 dBi, RP-BNC Male*
- *ML-2499-BPDA1-01R Heavy-Duty 35 Degree High-Gain Directional Panel - 14.5 dBi, N Female*
- *ML-2499-BPNA3-01R Heavy-Duty 35 Degree High-Gain Directional Panel - 14.5 dBi, Type N - Female*
- *ML-2499-BYGA2-01R Heavy-Duty 35 Degree High-Gain Directional Yagi - 15 dBi, N Female*
- *ML-2499-HPA3-01R High Performance Omni-Directional "Pipe" Antenna - 5 dBi, RP-BNC Male*
- *ML-2499-PNAHD-01R Heavy-Duty 65 Degree H-Plane Directional Panel - 6.3 dBi, RP-BNC Male*
- *ML-2499-SD3-01R Low Profile Ceiling/Surface Mount Omni-Directional Patch - 3.5 dBi, RP-BNC Male*
- *ML-2499-FHPA5-01R Omni-Directional "Pipe" Antenna - 7.7 dBi, N Male Connector*
- *ML-2499-FHPA9-01R High Performance Fixed Point Dipole - 9 dBi, Male Connector*

NOTE: For examples on how various antenna and connectors are deployed in a 2.4 GHz AP-5131 installation, see *2.4 GHz AP-5131 Antenna Connections*.

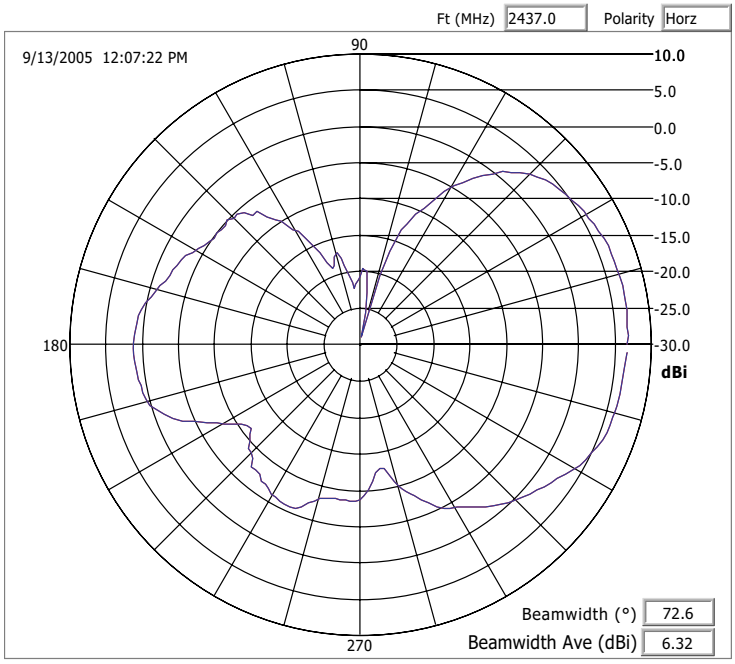
3.1.1 ML-2499-5PNL-72-N High Performance 135 Degree Panel Antenna - 5.5 dBi; N Male Connector



Type	Panel
Frequency	2400-2500 MHz
Gain (dBi)	5.5
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 135°
Elevation	3dB Beamwidth: 56°
Cable Length (in.)	72
Cable Type	RG-58 Ultralink
Connector Type	Type N Male
Weight	0.5 lb
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	Yes

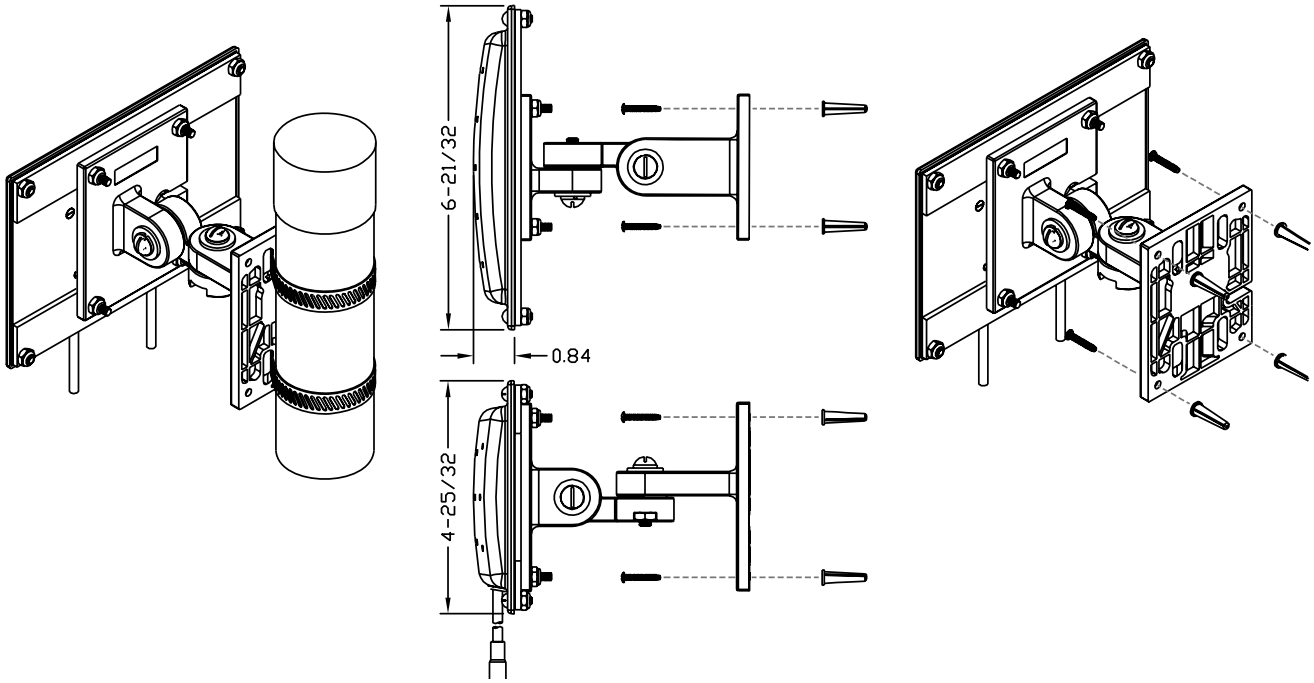


Azimuth Pattern

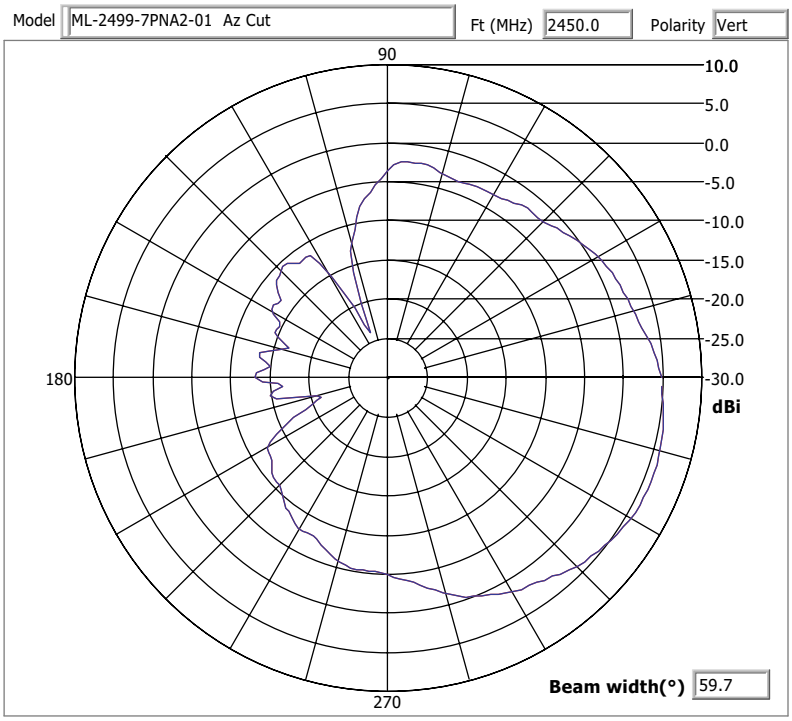


Elevation Pattern

3.1.2 ML-2499-7PNA2-01R 65 Degree H-Plane Diversity Directional Panel - 7 dBi, RP-BNC Male

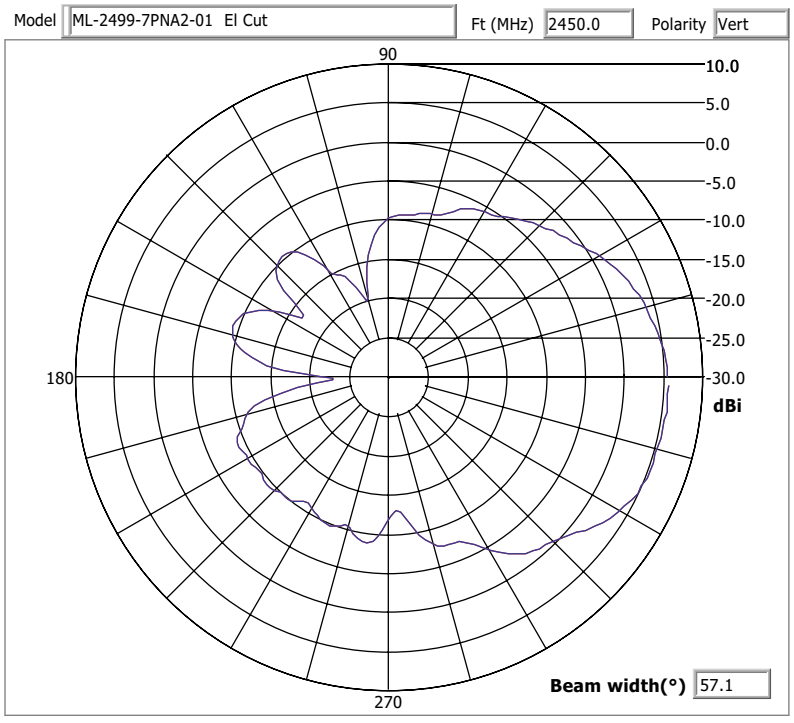


Type	Panel
Frequency	2400-2500 MHz
Gain (dBi)	6.3
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 60°
Elevation	3dB Beamwidth: 60°
Cable Length (in.)	48
Cable Type	RG-58 Ultralink
Connector Type	RP-BNC Male
Weight	0.6 lbs
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	No



11/12/2003 2:50:29 PM

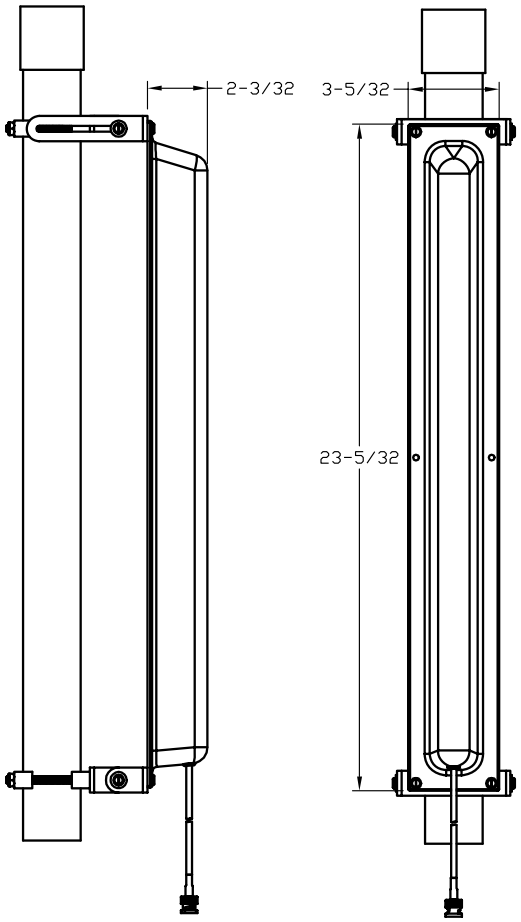
Azimuth Cut



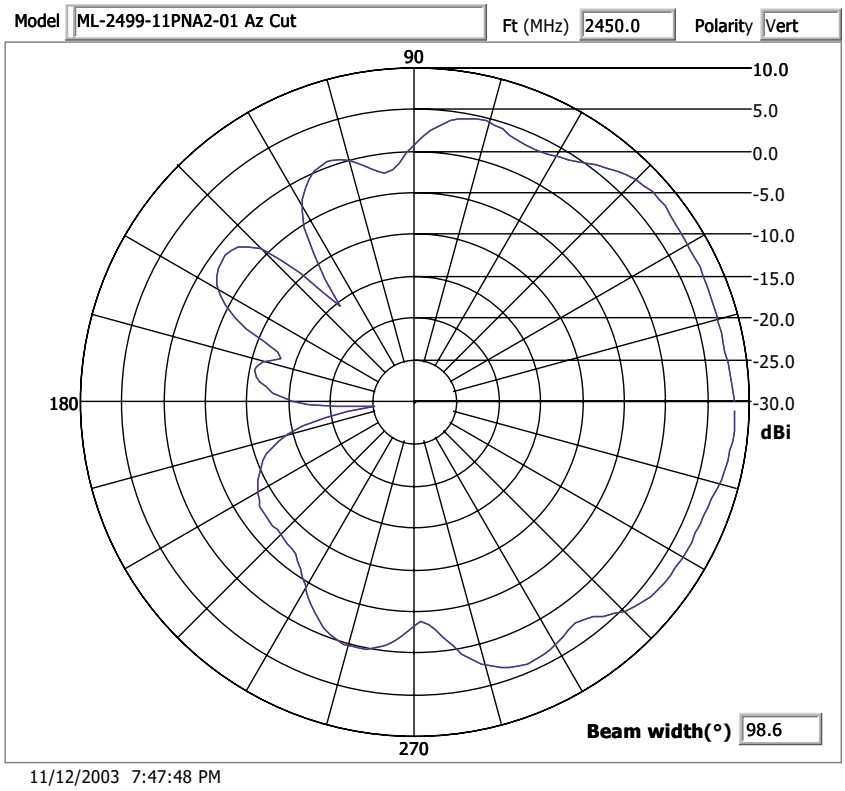
11/12/2003 2:53:26 PM

Elevation Cut

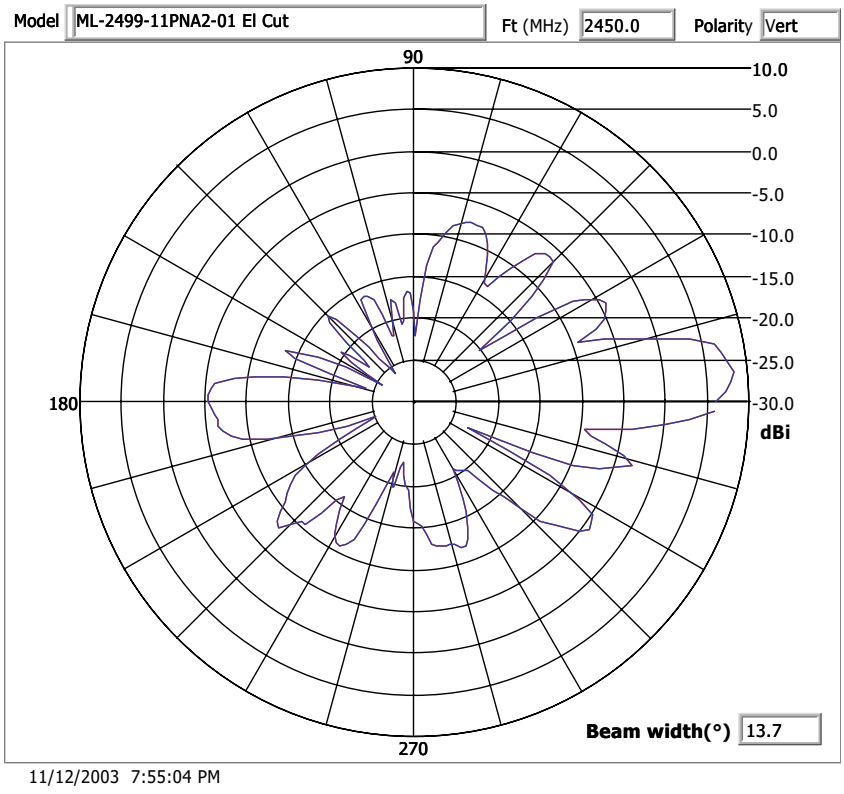
3.1.3 ML-2499-11PNA2-01R High-Gain 97 Degree H-Plane Directional Panel - 11 dBi, RP-BNC Male



Type	Panel
Frequency	2400-1500 MHz
Gain (dBi)	8.5
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 97°
Elevation	3dB Beamwidth: 14°
Cable Length (in.)	96
Cable Type	RG-58 Ultralink
Connector Type	RP-BNC Male
Weight	1.5 lb
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	Yes

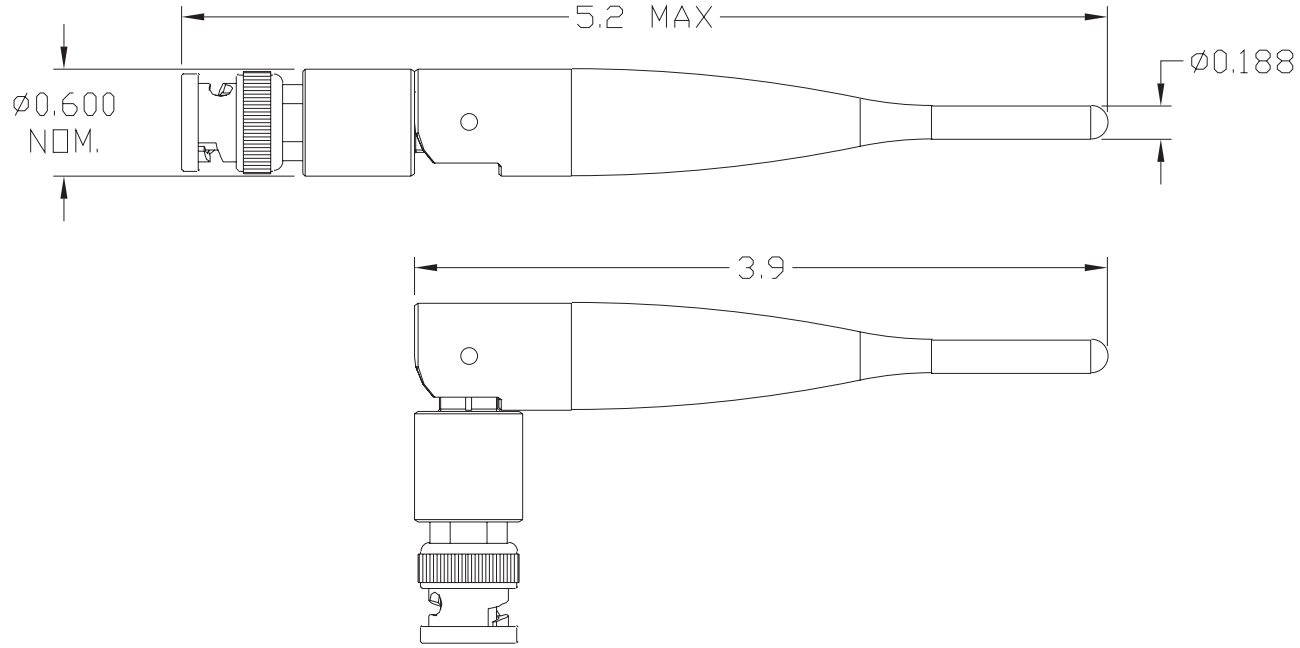


Azimuth Pattern

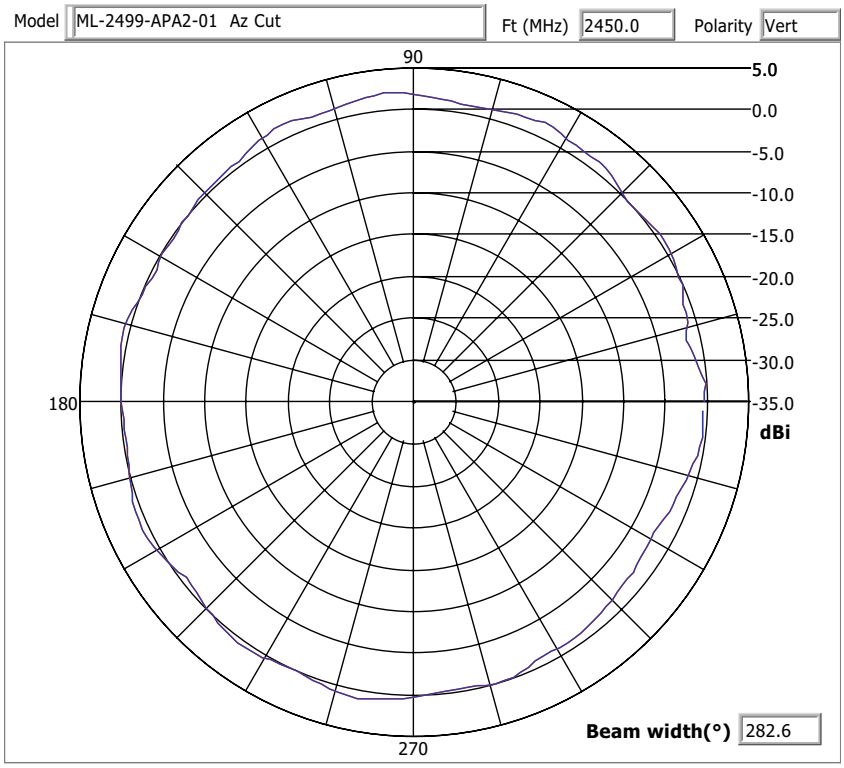


Elevation Pattern

3.1.4 ML-2499-APA2-01R High Performance Omni-Directional 'Fixed Point' Dipole - 3.5 dBi, RP-BNC Male

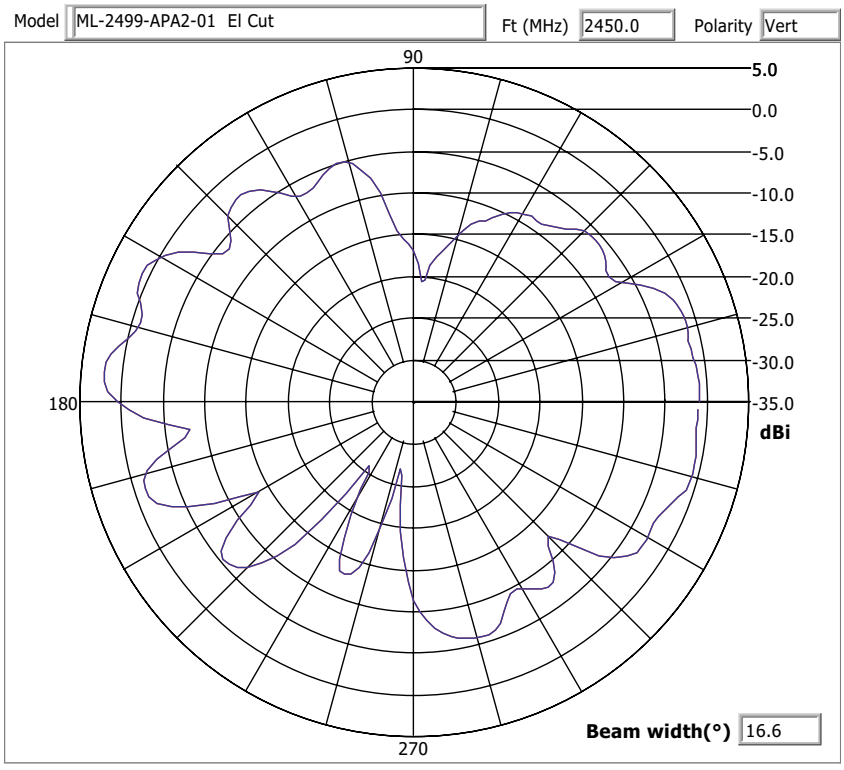


Type	Dipole
Frequency	2400-2500 MHz
Gain (dBi)	2
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 60°
Cable Length (in.)	0
Cable Type	N/A
Connector Type	RP-BNC Male
Weight	0.075 lbs
Plenum Antenna	No
Plenum Cable	N/A
Outdoor	No



11/12/2003 4:13:41 PM

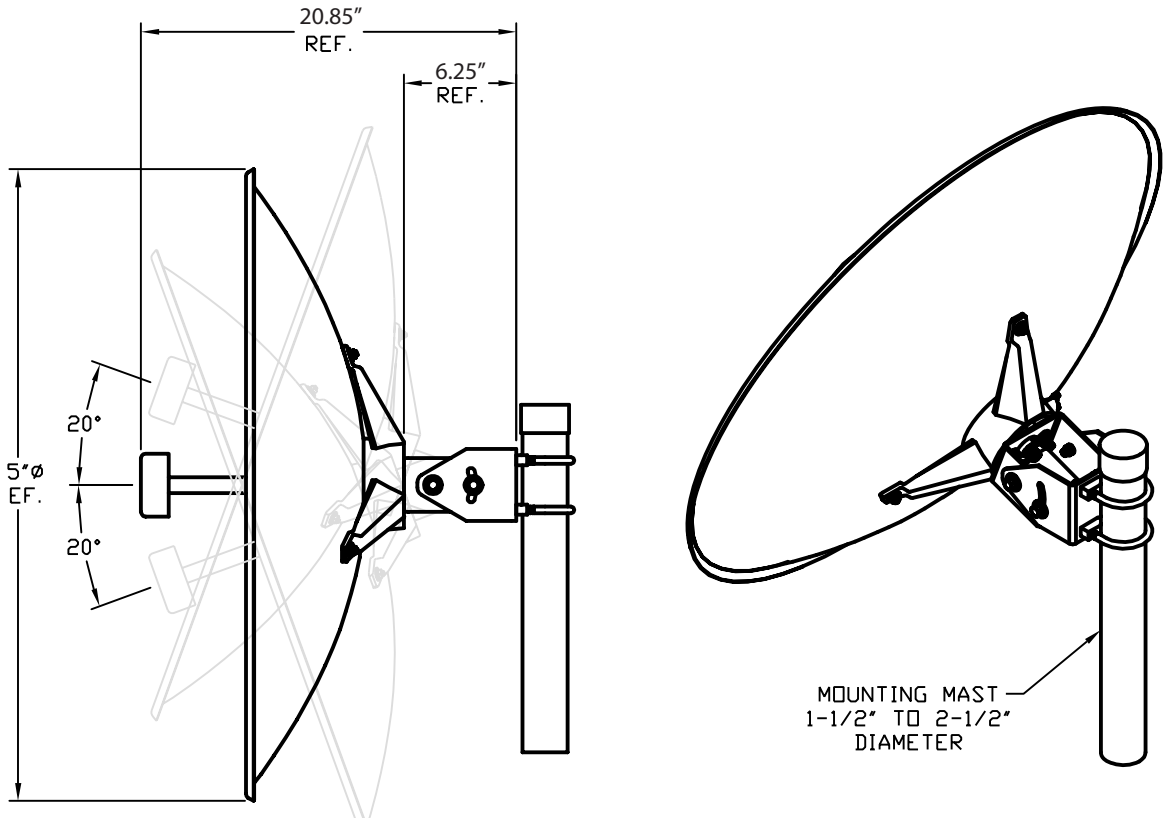
Azimuth Pattern



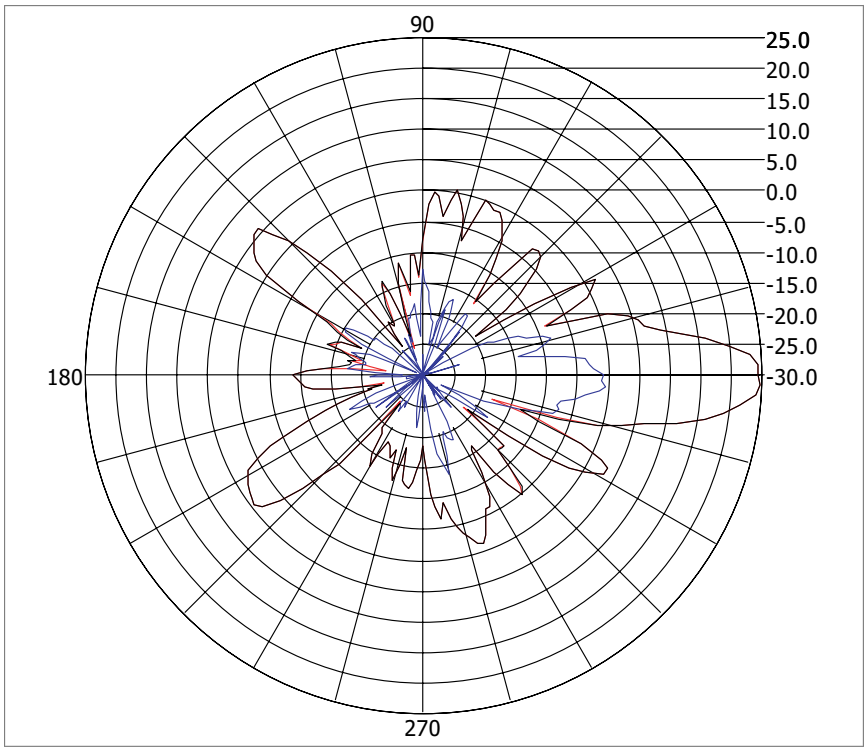
11/12/2003 4:08:24 PM

Elevation Pattern

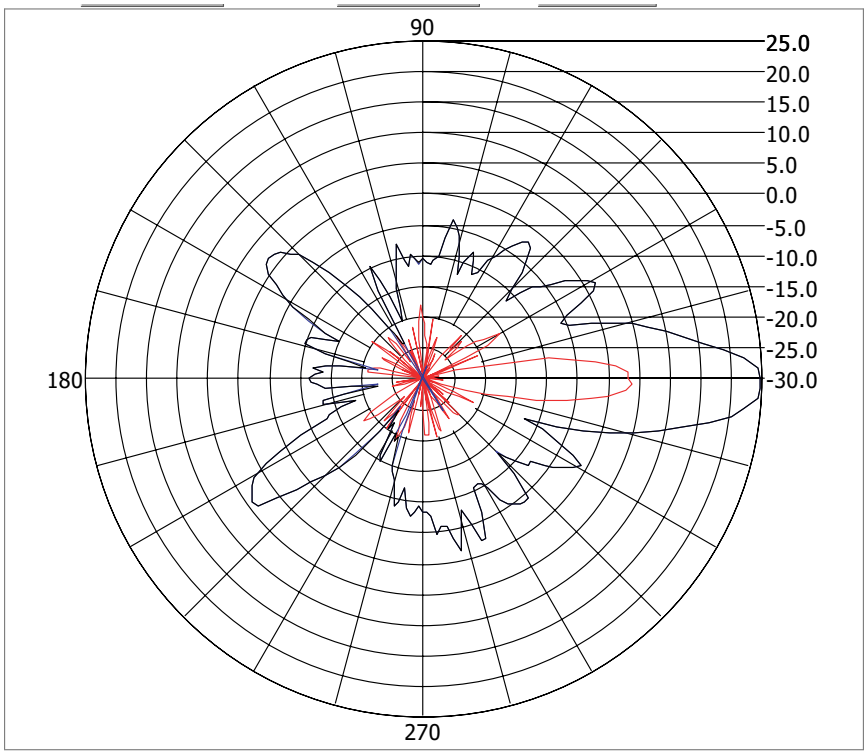
3.1.5 ML-2499-BPDA1-01R Heavy-Duty 35 Degree High-Gain Directional Panel - 14.5 dBi, N Female



Type	Parabolic Dish
Frequency	2400-2500 MHz
Gain (dBi)	23.5
Net Gain (dBi)	20.5 (minimum cable configuration)
Cable Loss (dB)	3 (minimum cable configuration)
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 10°
Elevation	3dB Beamwidth: 11°
Cable Length (in.)	Use minimum configuration (or more)
Cable Type	Varies per cable configuration
Connector Type	Type N Female
Weight	13 lb
Plenum Antenna	N/A
Plenum Cable	N/A
Outdoor	Yes

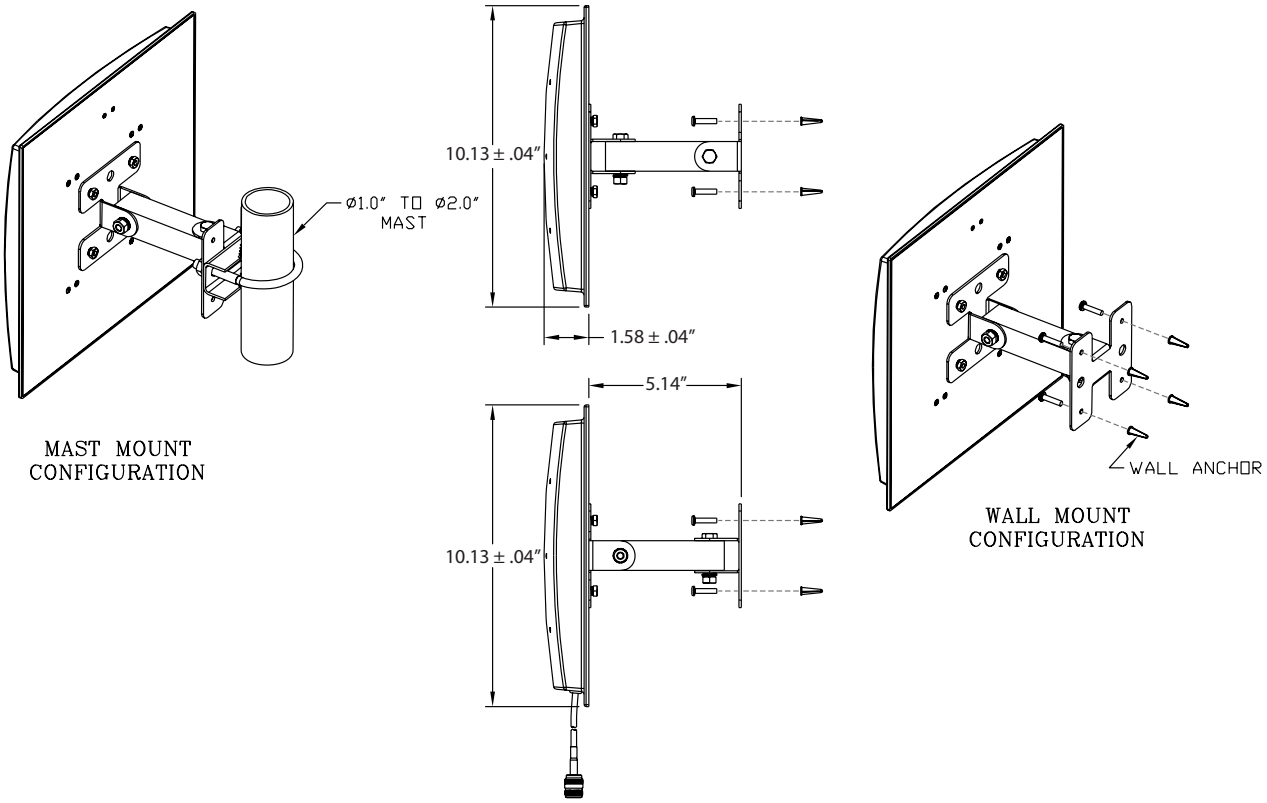


Azimuth Pattern

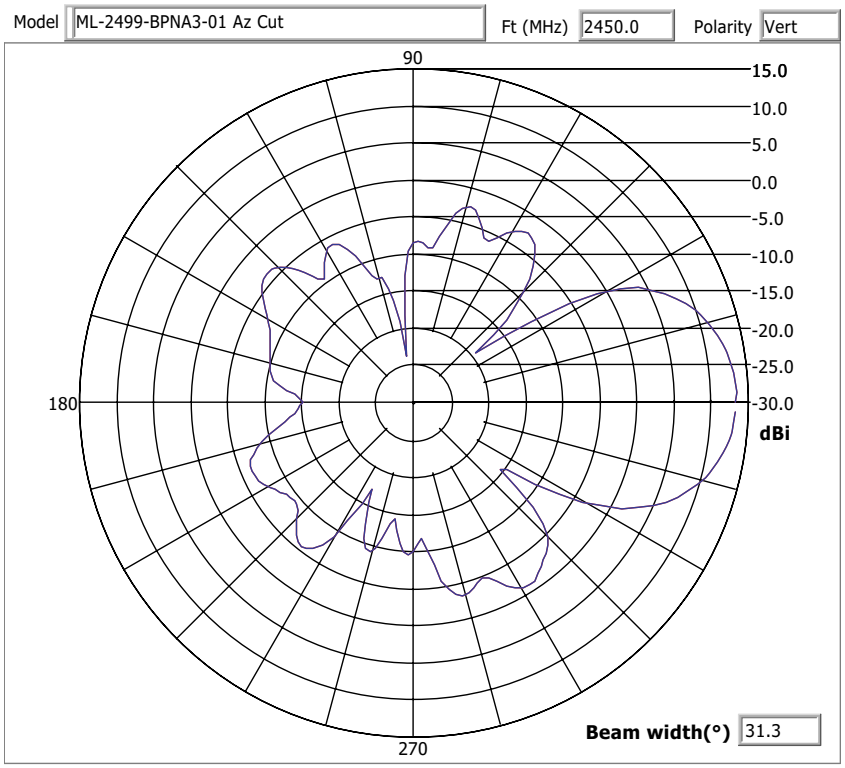


Elevation Pattern

3.1.6 ML-2499-BPNA3-01R Heavy-Duty 35 Degree High-Gain Directional Panel - 14.5 dBi, Type N - Female

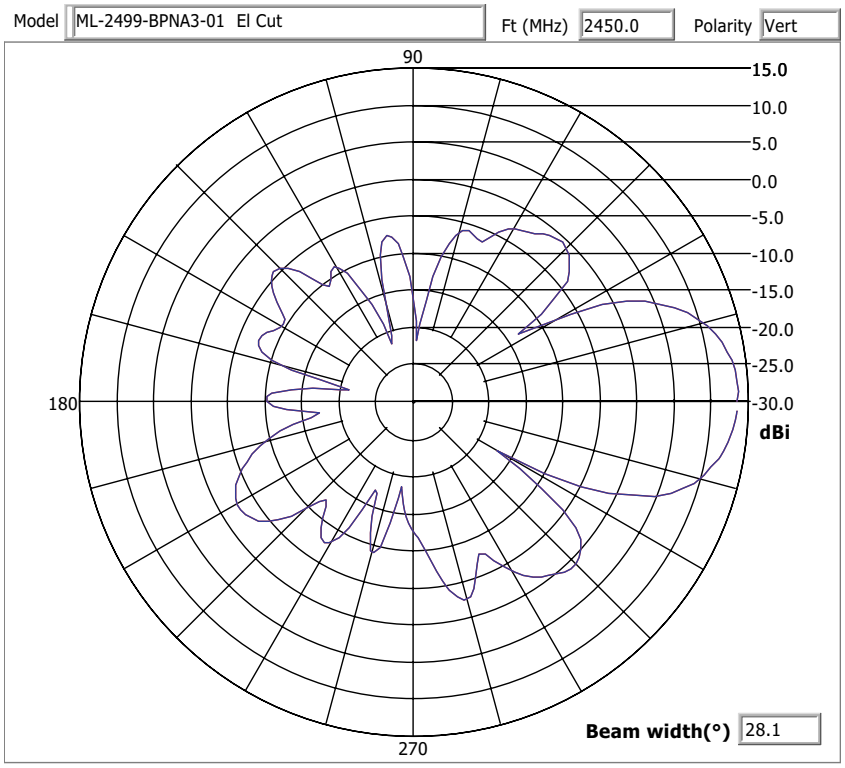


Type	Panel (Outdoor)
Frequency	2400-2500 MHz
Gain (dBi)	13.9
Net Gain (dBi)	10.9 (minimum cable configuration)
Cable Loss (dB)	3 (minimum cable configuration)
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 31°
Elevation	3dB Beamwidth: 28°
Cable Length (in.)	Use minimum configuration (or more)
Cable Type	Varies per cable configuration
Connector Type	Type N Female
Weight	1.5 lb
Plenum Antenna	N/A
Plenum Cable	N/A
Outdoor	Yes



11/12/2003 4:49:00 PM

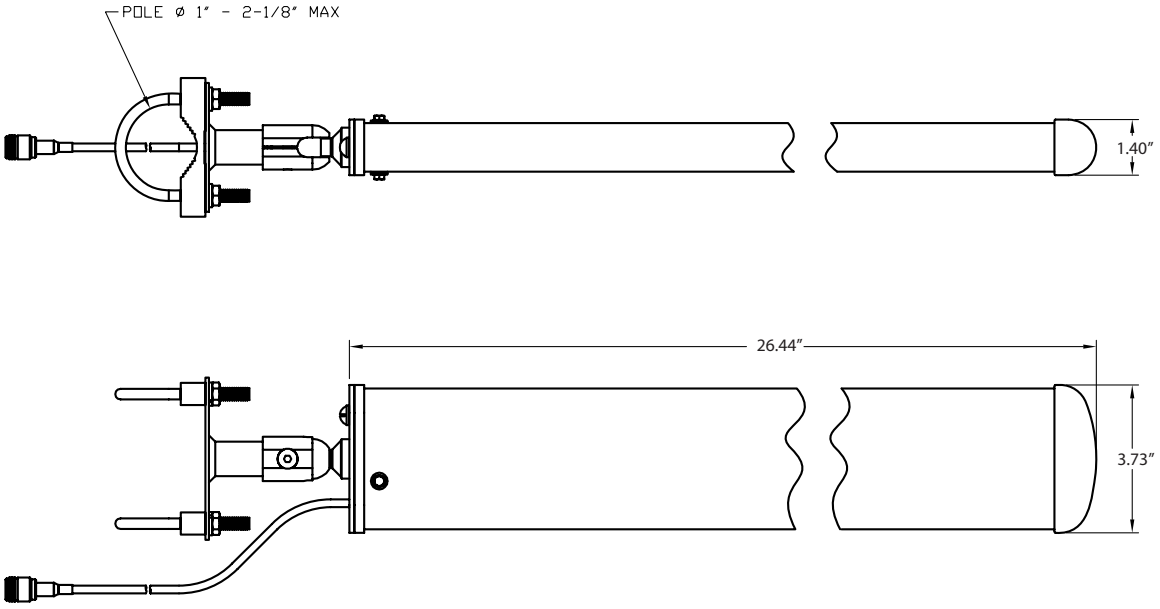
Azimuth Pattern



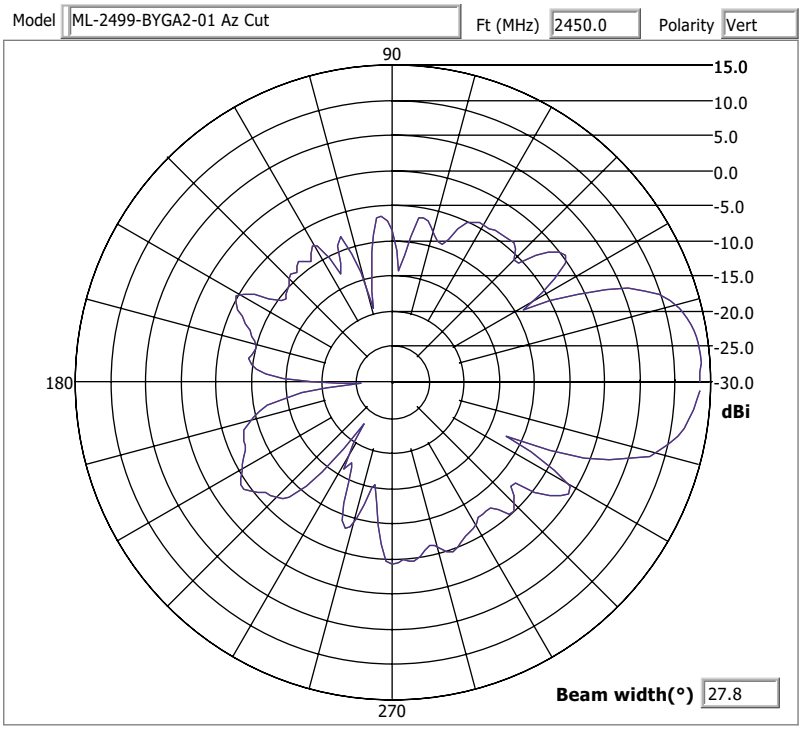
11/12/2003 4:44:40 PM

Elevation Pattern

3.1.7 ML-2499-BYGA2-01R Heavy-Duty 35 Degree High-Gain Directional Yagi - 15 dBi, N Female

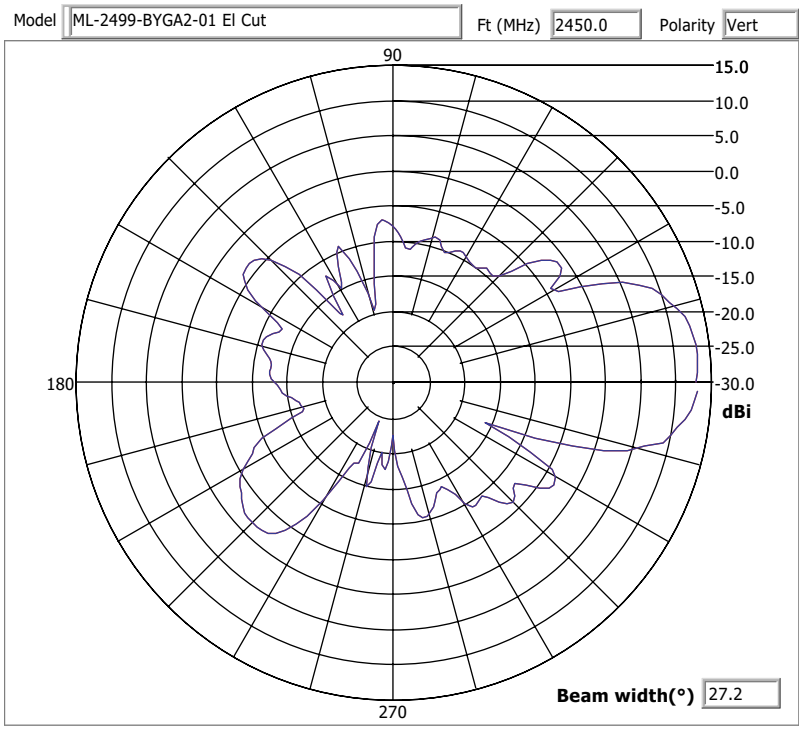


Type	Yagi (Outdoor)
Frequency	2400-2500 MHz
Gain (dBi)	14.1
Net Gain (dBi)	11.1 (minimum cable configuration)
Cable Loss (dB)	3 (minimum cable configuration)
Polarization	Linear, Vertical
VSWR	1.5:1 Typical
Azimuth	3dB Beamwidth: 34°
Elevation	3dB Beamwidth: 30°
Cable Length (in.)	12
Cable Attenuation (dB/100 ft.)	33.5
Cable Type	RG-58 Ultralink
Connector Type	Type N - Female
Power	50 W
Weight	1.25 lb



11/12/2003 5:58:10 PM

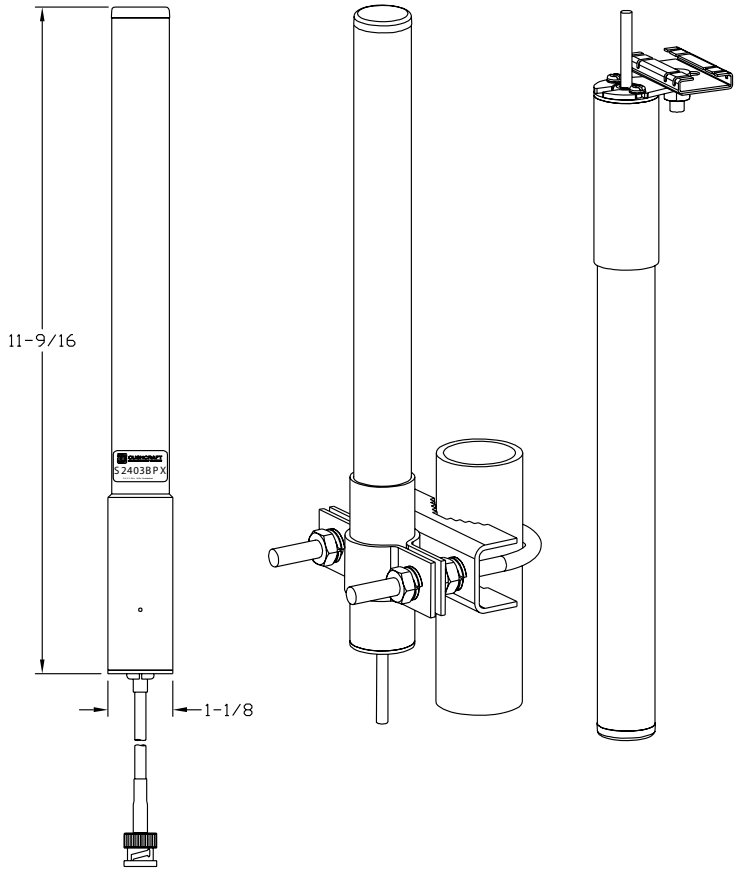
Azimuth Pattern



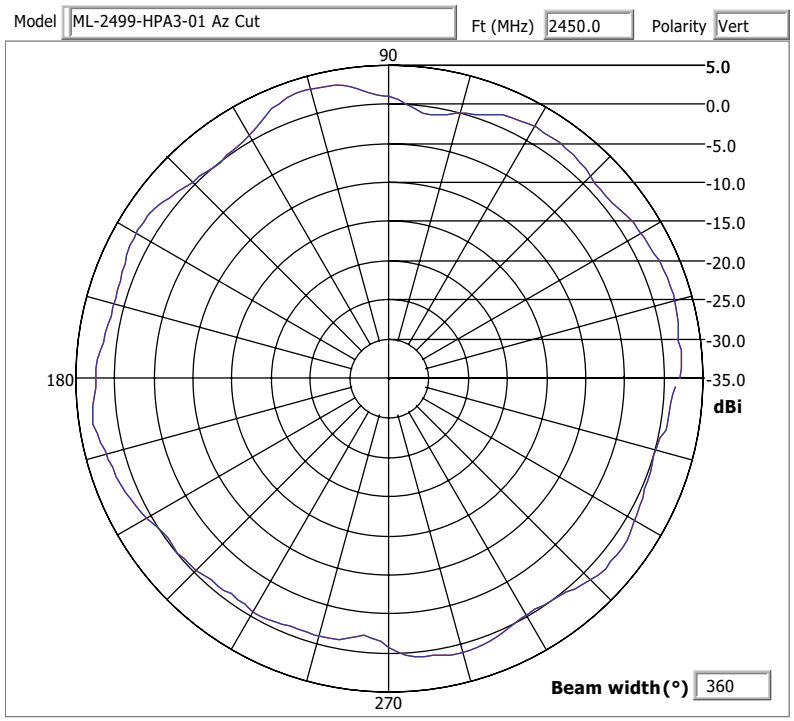
11/12/2003 6:00:02 PM

Elevation Pattern

3.1.8 ML-2499-HPA3-01R High Performance Omni-Directional "Pipe" Antenna - 5 dBi, RP-BNC Male

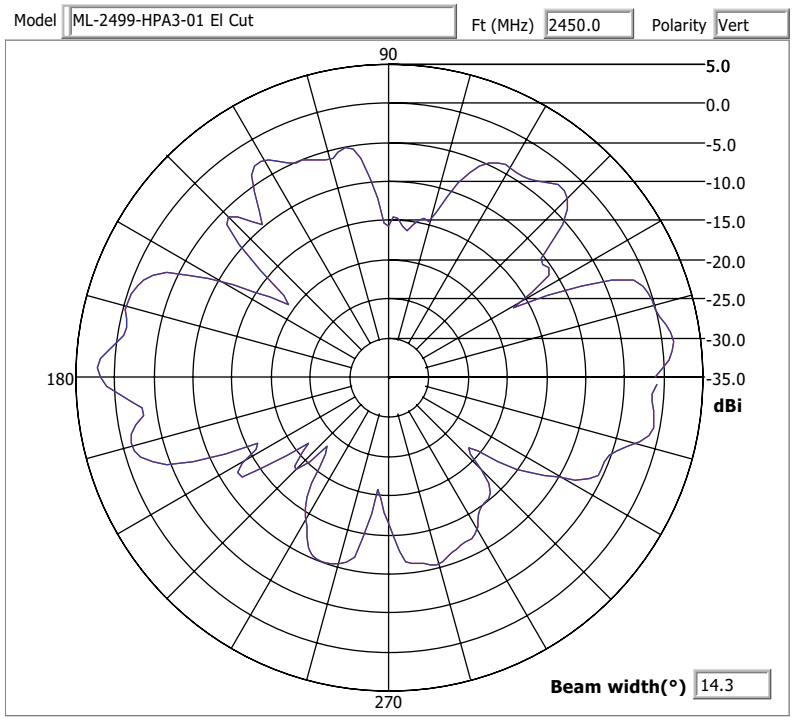


Type	Dipole Array
Frequency	2400-2500 mhZ
Gain (dBi)	3.3
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 31°
Cable Length (in.)	48
Cable Type	RG-58 Ultralink
Connector Type	RP-BNC Male
Weight	.0.3 lb
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	Yes (in a cable down orientation)



11/12/2003 6:22:13 PM

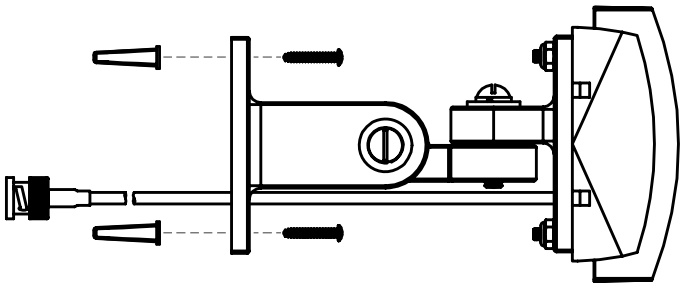
Azimuth Pattern

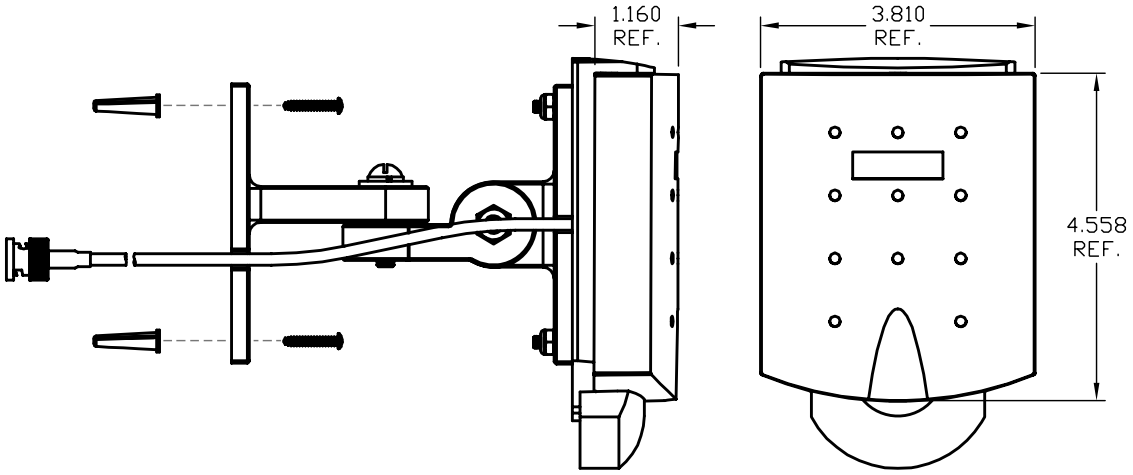


11/12/2003 6:19:10 PM

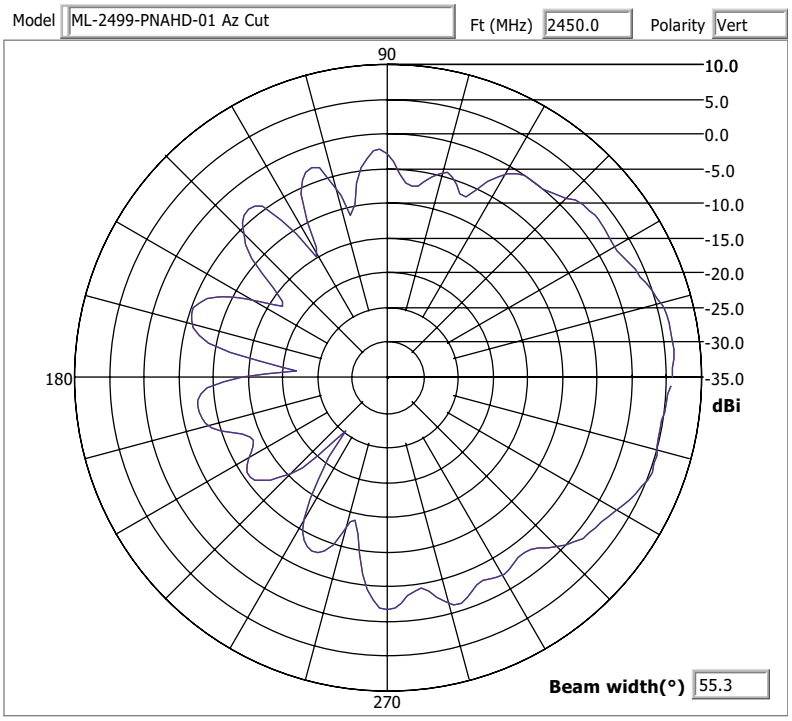
Elevation Pattern

3.1.9 ML-2499-PNAHD-01R Heavy-Duty 65 Degree H-Plane Directional Panel - 6.3 dBi, RP-BNC Male





Type	Panel
Frequency	2400-2500 Mhz
Gain (dBi)	6.3
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 55°
Elevation	3dB Beamwidth: 56°
Cable Length (in.)	48
Cable Type	RG-58 Ultralink
Connector Type	RP-BNC Male
Weight	0.5 lb
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	No



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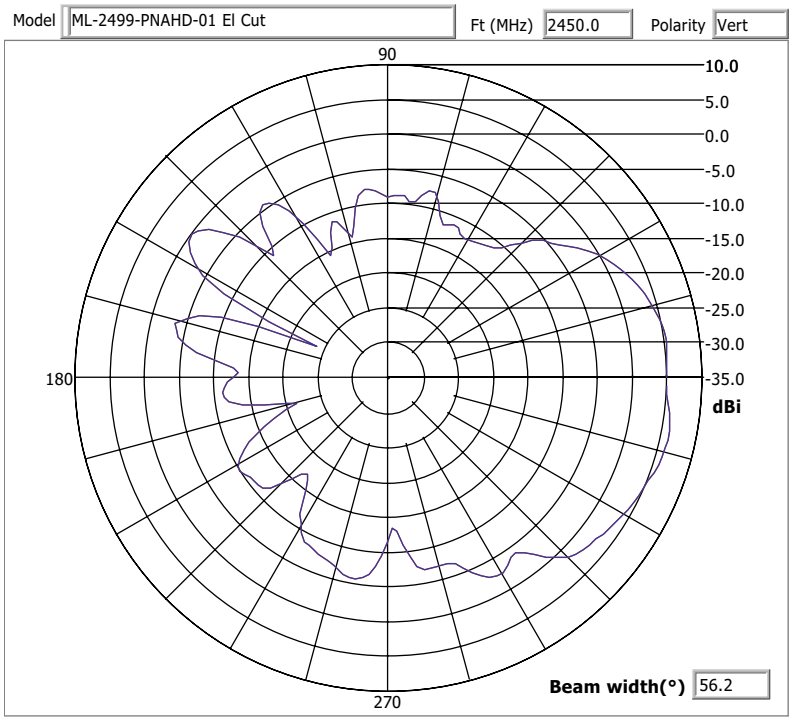
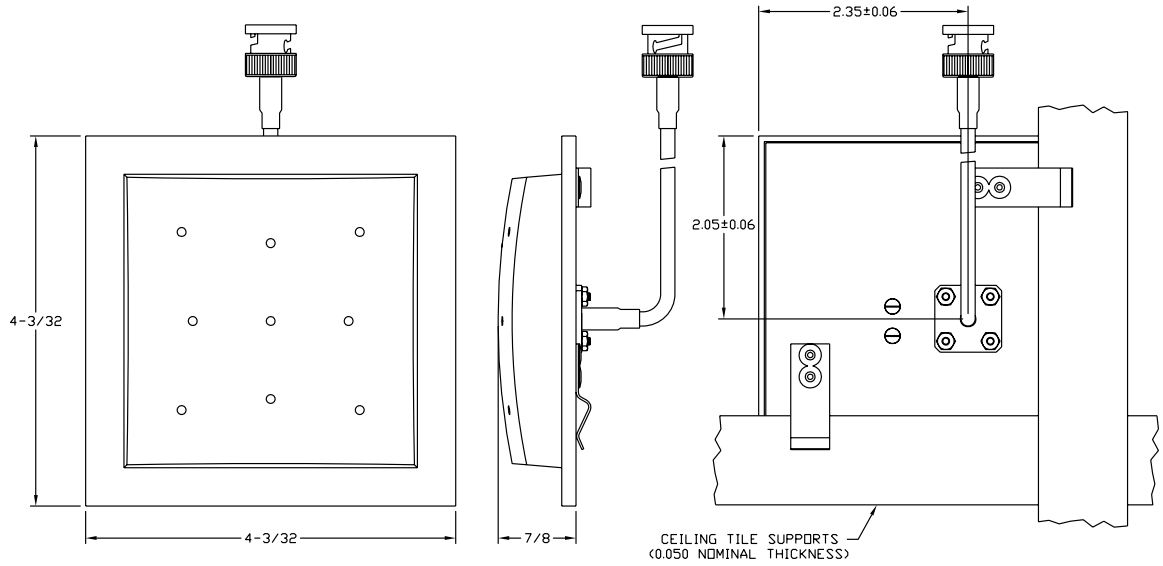
Azimuth Pattern



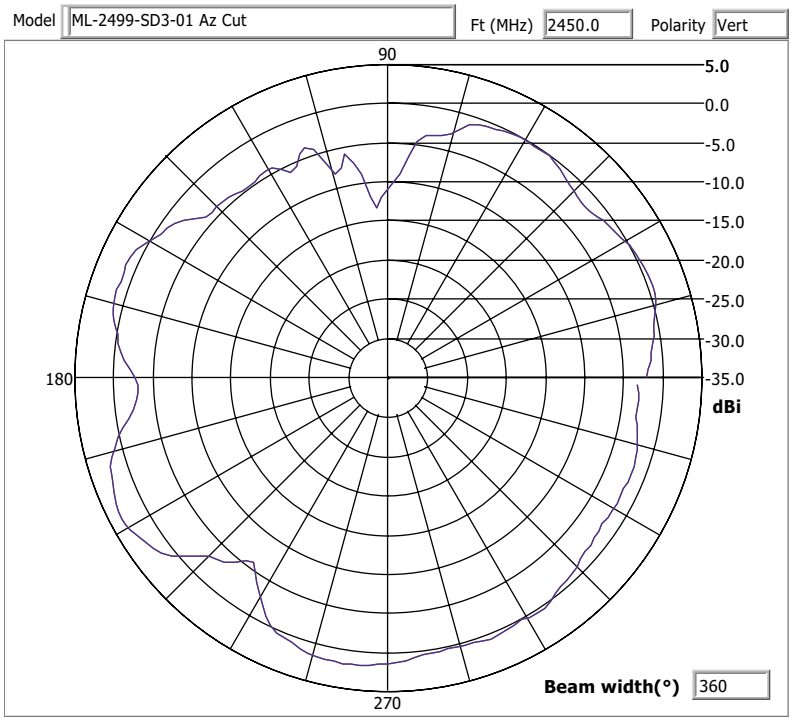
11/12/2003 6:44:37 PM

Elevation Pattern

3.1.10 ML-2499-SD3-01R Low Profile Ceiling/Surface Mount Omni-Directional Patch - 3.5 dBi, RP-BNC Male

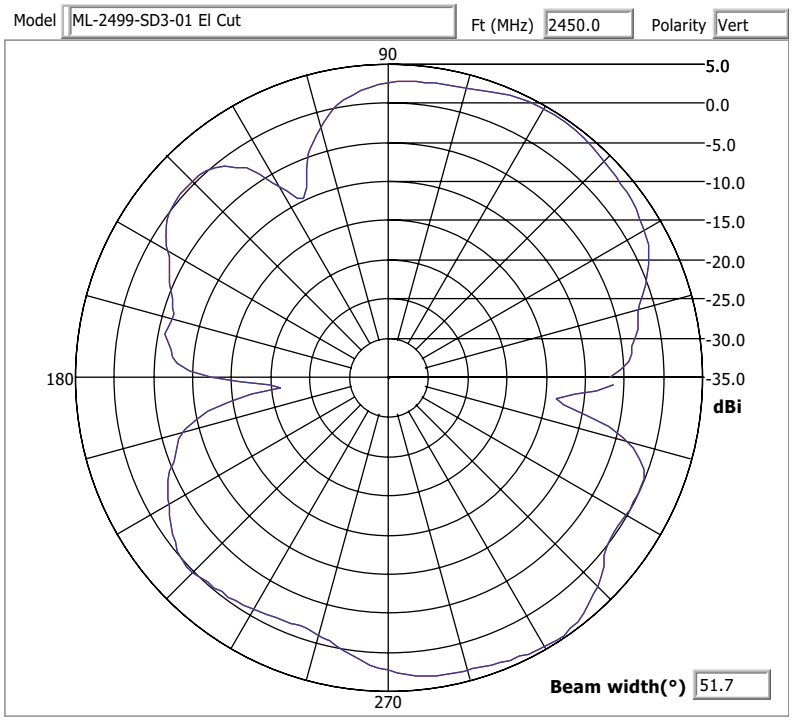


Type	Patch (ceiling mount)
Frequency	2400-2500 MHz
Gain (dBi)	3.5
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 52°
Cable Length (in.)	48
Cable Type	RG-58 Ultralink
Connector Type	RP-BNC Male
Weight	0.21 lbs
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	No



11/24/2003 4:14:27 PM

Azimuth Pattern



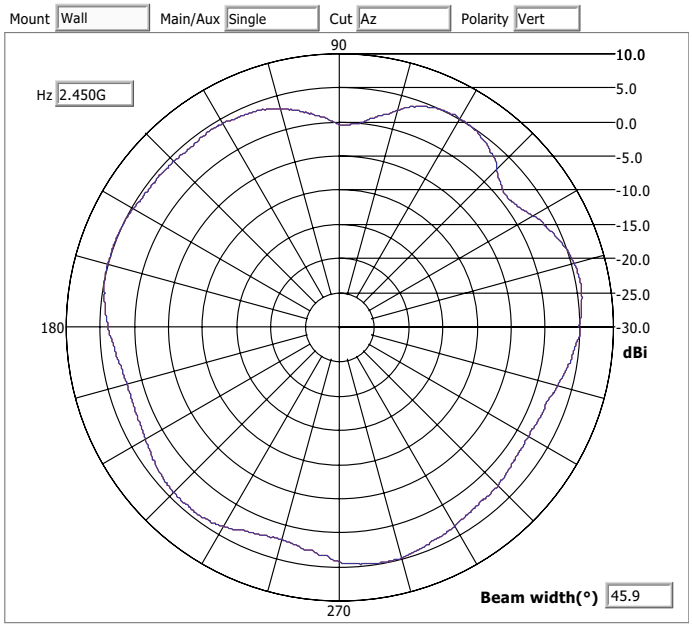
11/12/2003 6:54:30 PM

Elevation Pattern

3.1.11 ML-2499-FHPA5-01R Omni-Directional "Pipe" Antenna - 7.7 dBi, N Male Connector

ML-2499-FHPA5-01R

Type	Dipole Array
Frequency	2400-2500 MHz
Gain (dBi)	5
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 25°
Cable Length (in.)	N/A
Cable Type	N/A
Connector Type	Type N Male
Weight	0.7 lb
Plenum Antenna	No
Plenum Cable	N/A
Outdoor	Yes

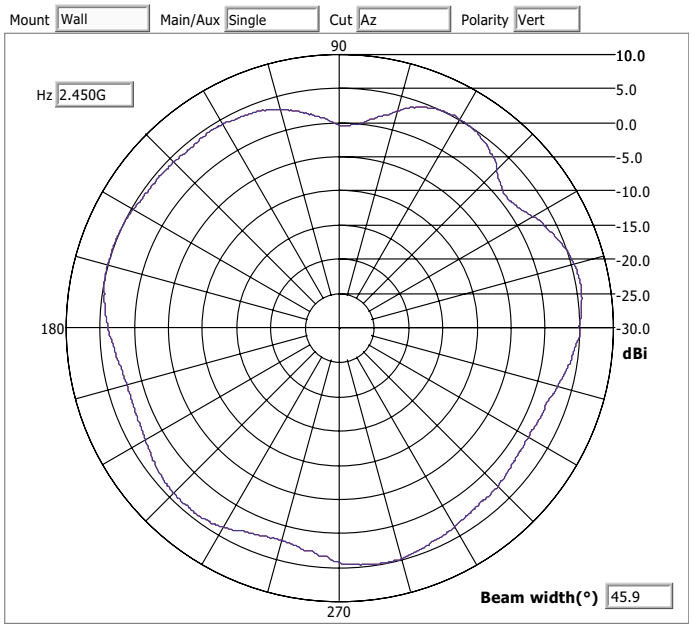


Azimuth Pattern

3.1.12 ML-2499-FHPA9-01R High Performance Fixed Point Dipole - 9 dBi, Male Connector

ML-2499-FHPA9-01R

Type	Dipole Array
Frequency	2400-2500 MHz
Gain (dBi)	9.0
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 14°
Cable Length (in.)	N/A
Cable Type	N/A
Connector Type	Type N Male
Weight	1.1 lb
Plenum Antenna	No
Plenum Cable	N/A
Outdoor	Yes



Azimuth Pattern 2450 MHz

4

802.11a Antenna Suite

4.1 Supported 802.11a Antenna Suite

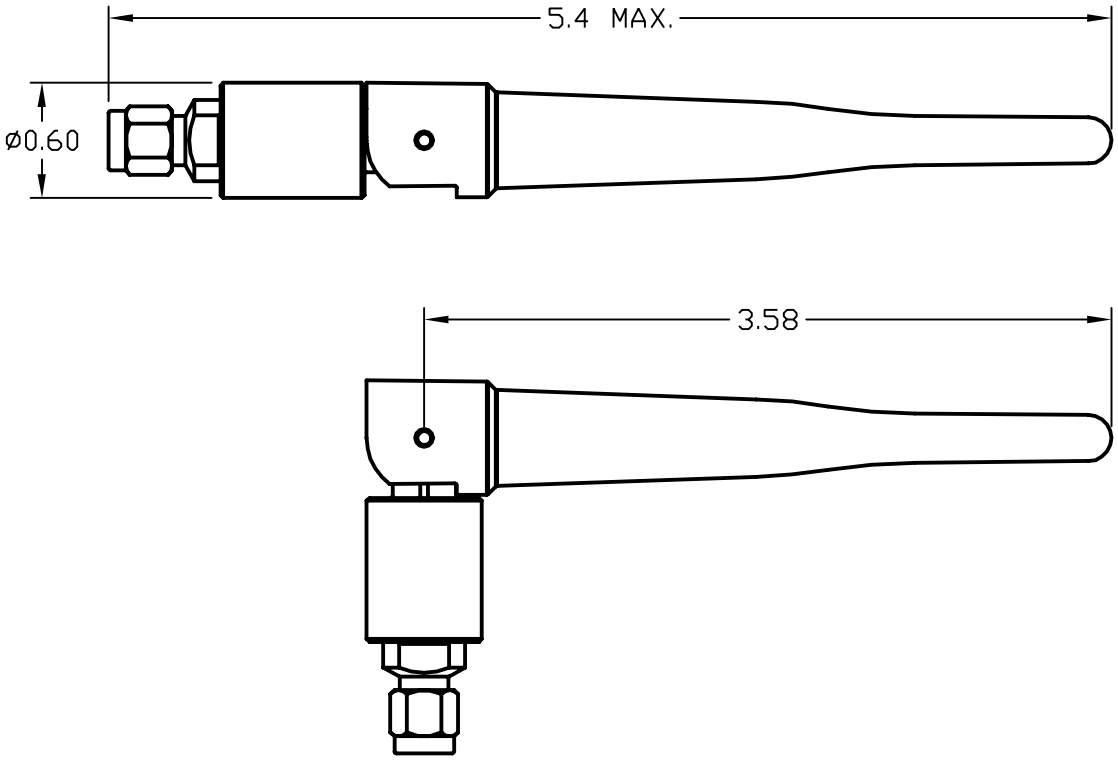
Motorola supports numerous 802.11a antennas to suit the requirements of your unique AP-5131, AP-5181 or AP300 (non-integrated antenna) deployment. Check the Motorola Web site periodically, as newly supported 802.11a antennas will be added to this document as they are released. For more information, go to *http://support.symbol.com/support/product/manuals.do*.

For detailed information on supported 802.11a antenna models, refer to:

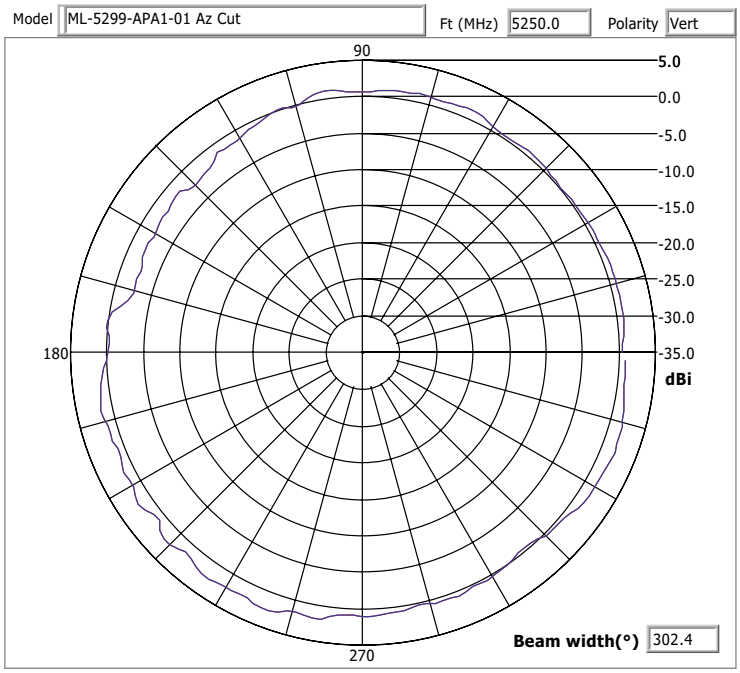
- *ML-5299-APA1-01R High Performance Fixed Point Dipole - 2 dBi, RP-SMA Male Connector*
- *ML-5299-HPA1-01R High Performance Omni-Directional Antenna - 5 dBi, RP-SMA Male Connector*
- *ML-5299-PTA1-01R Low Profile Ceiling-Tile Mount Panel - 2 dBi, RP-SMA Male Connector*
- *ML-5299-WPNA1-01R Wall Mount Panel Antenna w/Articulating Mount - 13 dBi, RP-SMA Male*
- *ML-5299-FHPA10-01R Omni-Directional "Pipe" Antenna, 10 dBi, N-Male Connector*
- *ML-5299-FHPA6-01R Omni-Directional "Pipe" Antenna, 8 dBi, N-Male Connector*

NOTE: For examples on how various antenna and connectors are deployed in a 5 GHz AP-5131 installation, see *5 GHz AP-5131 Antenna Connections*.

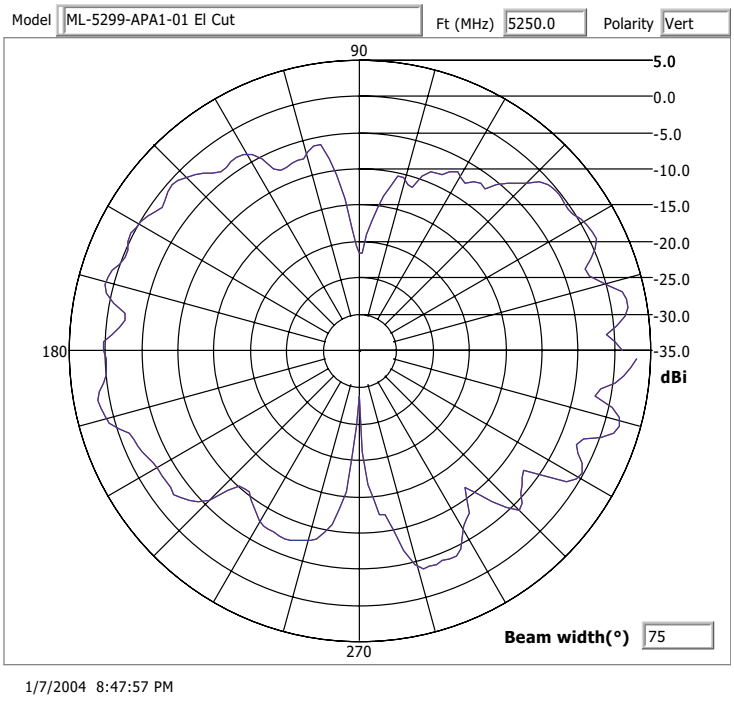
4.1.1 ML-5299-APA1-01R High Performance Fixed Point Dipole - 2 dBi, RP-SMA Male Connector



Type	Dipole
Frequency	4900-5875 MHz
Gain (dBi)	2.0
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 75°
Cable Length (in.)	N/A
Cable Type	N/A
Connector Type	RP-SMA Male
Weight	0.063 lb
Plenum Antenna	No
Plenum Cable	N/A
Outdoor	No

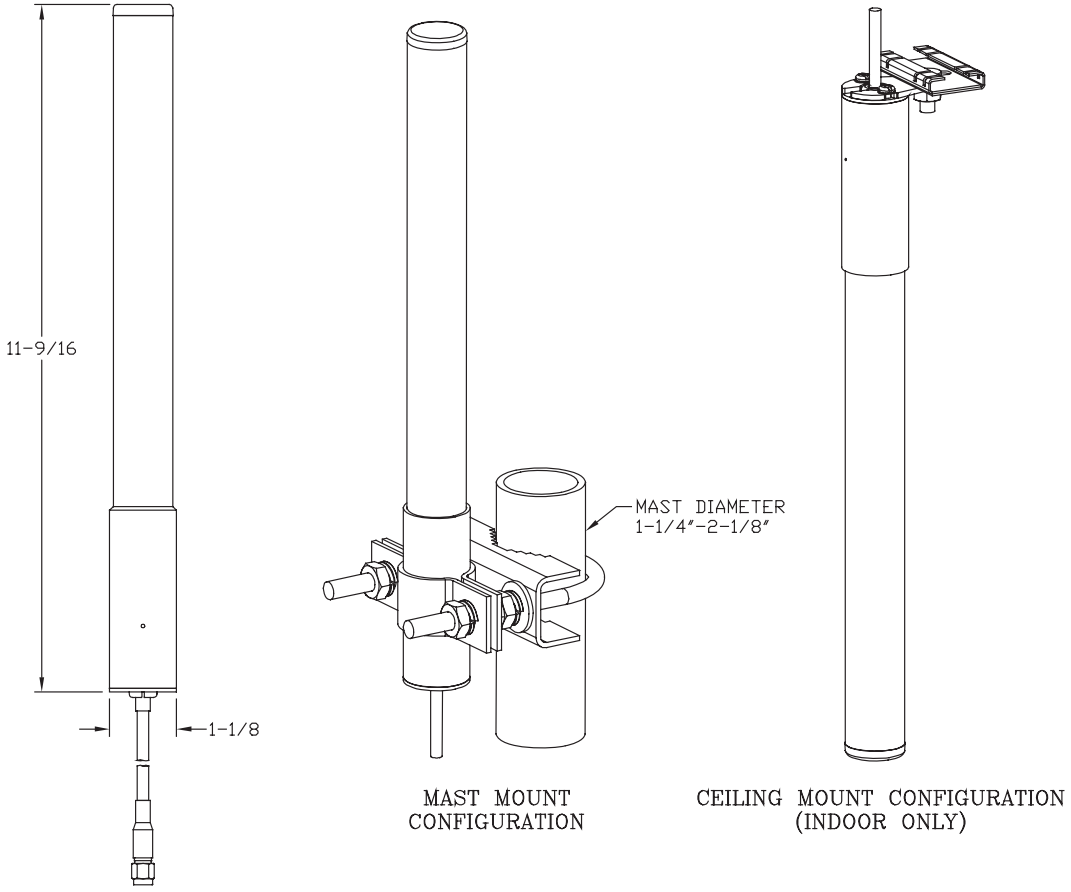


Azimuth Pattern

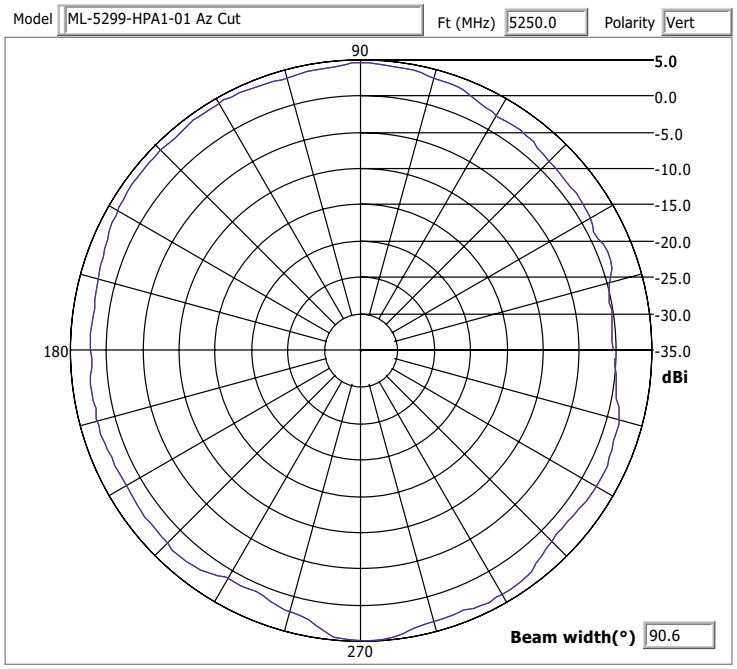


Elevation Pattern

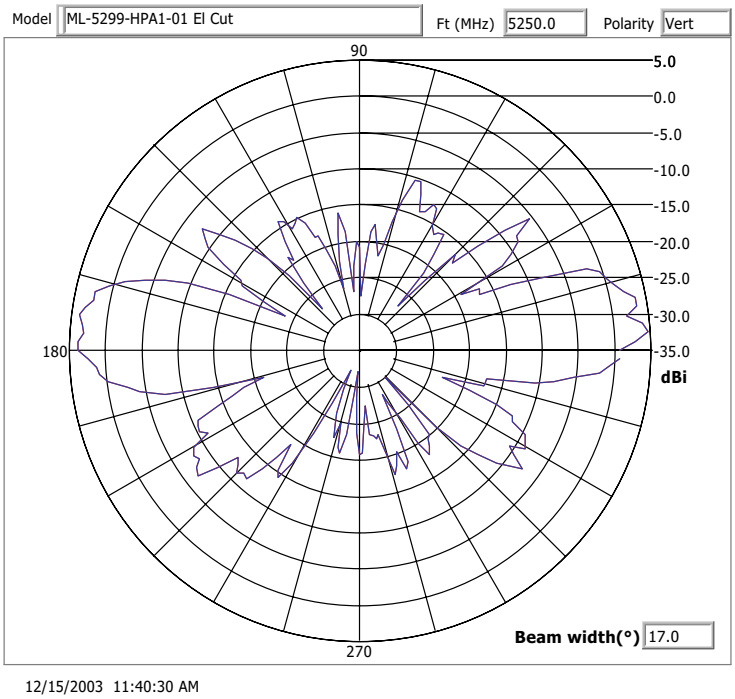
4.1.2 ML-5299-HPA1-01R High Performance Omni-Directional Antenna - 5 dBi, RP-SMA Male Connector



Type	Dipole Array
Frequency	4900-5875 MHz
Gain (dBi)	5.0
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 17°
Cable Length (in.)	36
Cable Type	LMR195
Connector Type	RP-SMA Male
Weight	0.3 lb.
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	Yes (cable down orientation only)

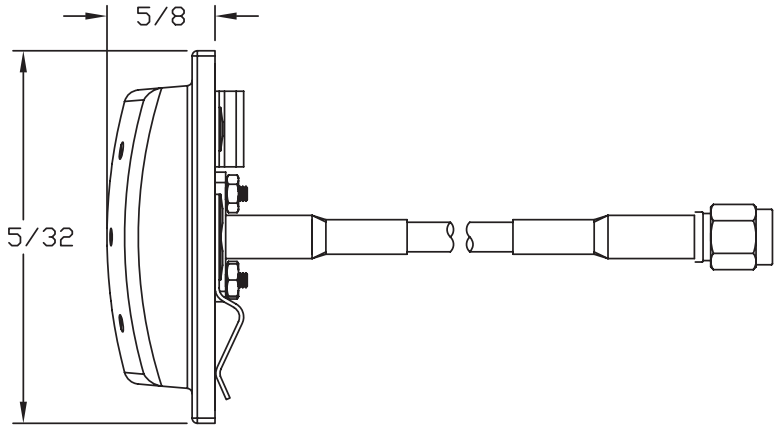


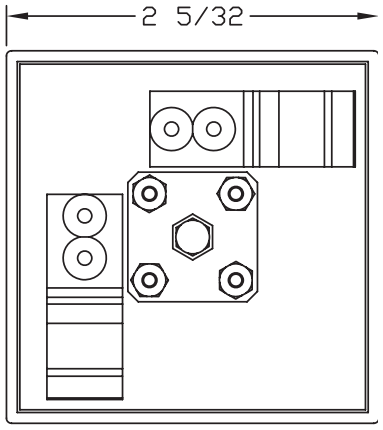
Azimuth Pattern



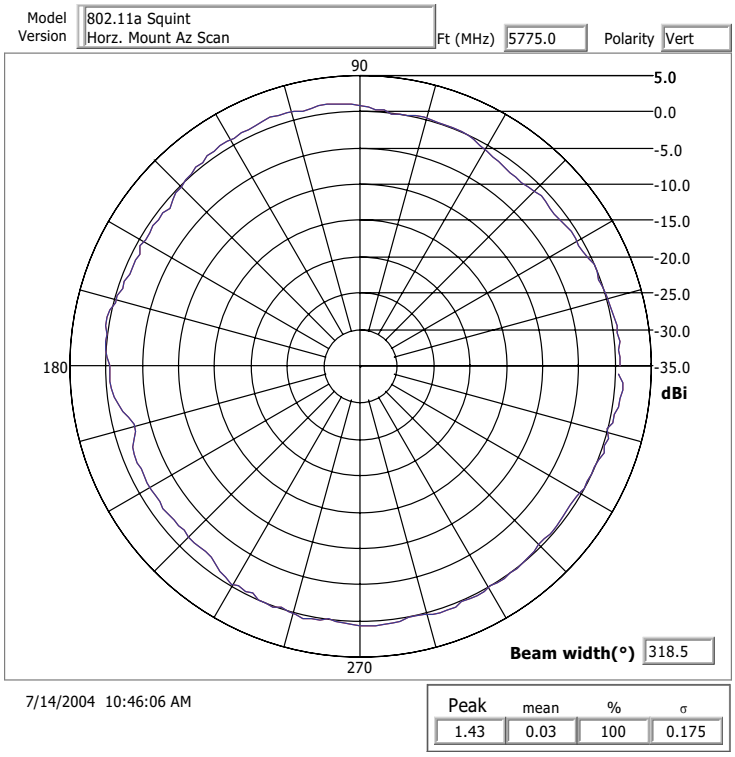
Elevation Pattern

4.1.3 ML-5299-PTA1-01R Low Profile Ceiling-Tile Mount Panel - 2 dBi, RP-SMA Male Connector

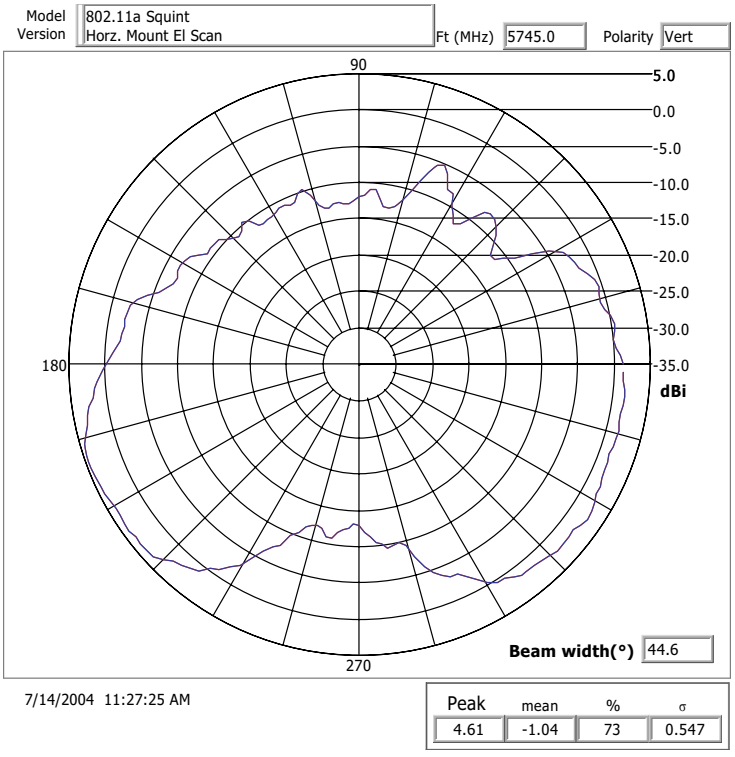




Type	Patch
Frequency	5150-5875 MHz
Gain (dBi)	2.0
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 45°
Cable Length (in.)	36
Cable Type	RG-58
Connector Type	RP-SMA Male
Weight	0.15 lb.
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	No

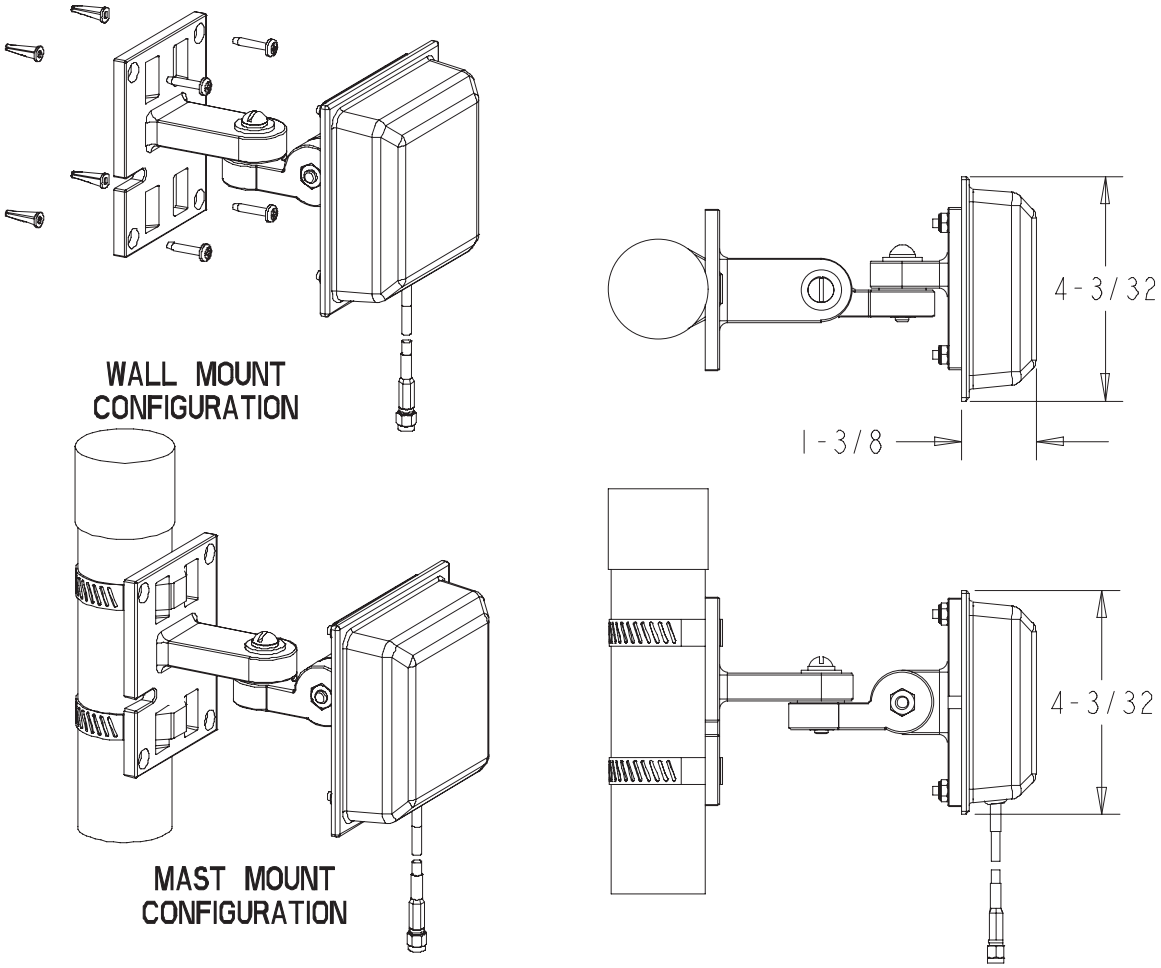


Azimuth Pattern

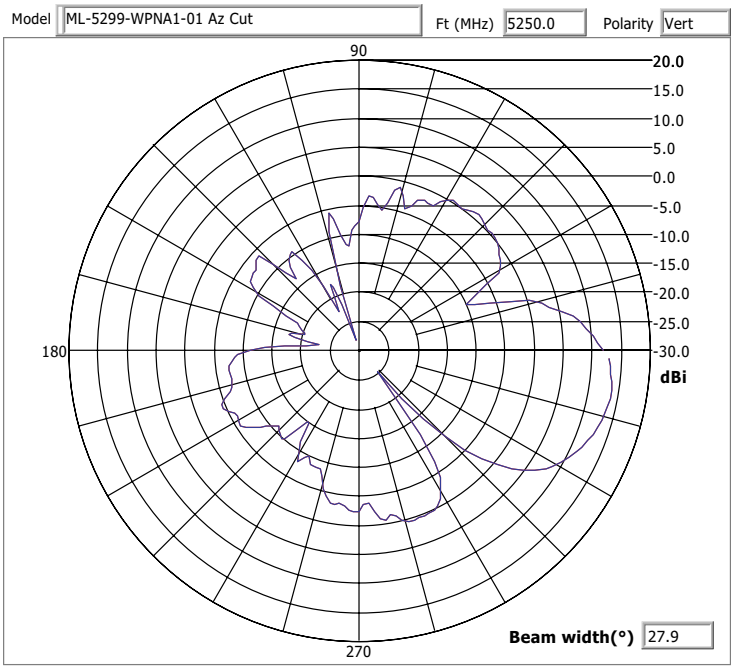


Elevation Pattern

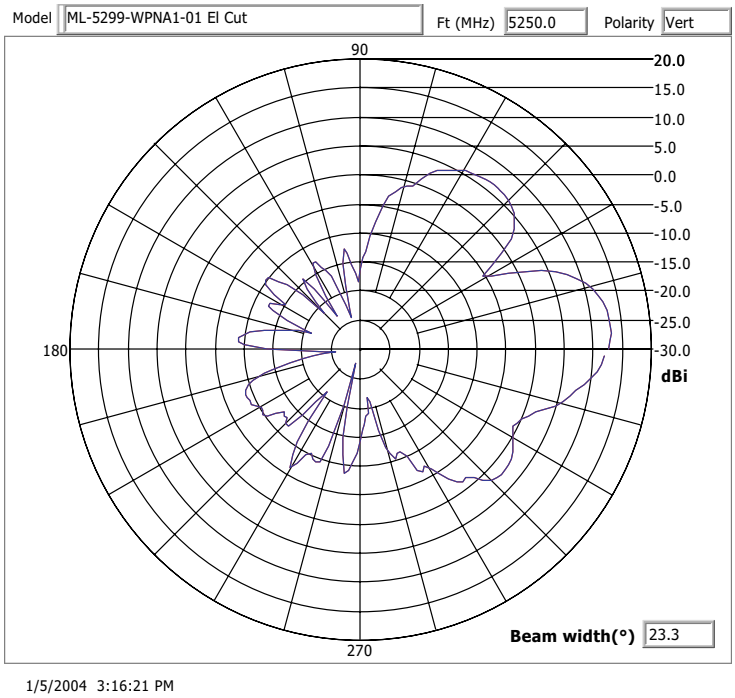
4.1.4 ML-5299-WPNA1-01R Wall Mount Panel Antenna w/Articulating Mount - 13 dBi, RP-SMA Male



Type	Panel
Frequency	5150-5875 MHz
Gain (dBi)	12.5
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 31°
Elevation	3dB Beamwidth: 27°
Cable Length (in.)	36
Cable Type	RG-303
Connector Type	RP-SMA Male
Weight	0.7 lb.
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	Yes



Azimuth Pattern

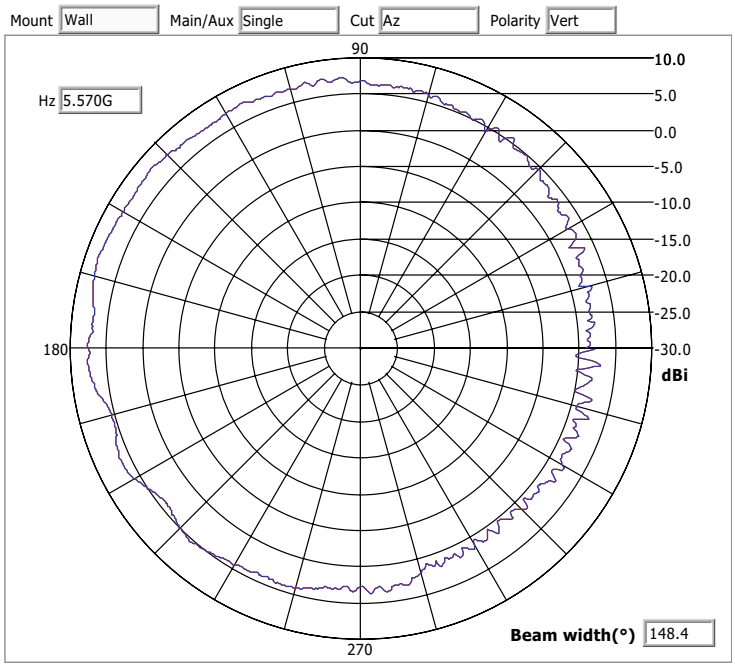


Elevation Pattern

4.1.5 ML-5299-FHPA10-01R Omni-Directional "Pipe" Antenna, 10 dBi, N-Male Connector

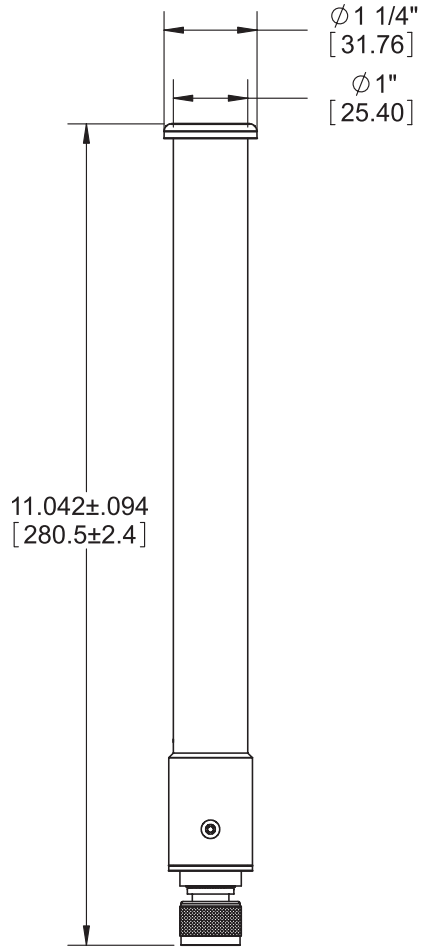
ML-5299-FHPA10-01R

Type	Dipole Array
Frequency	4900-5850 MHz
Gain (dBi)	10.0
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 13
Cable Length (in.)	N/A
Cable Type	N/A
Connector Type	Type N Male
Weight	.37 lb
Plenum Antenna	No
Plenum Cable	N/A
Outdoor	Yes

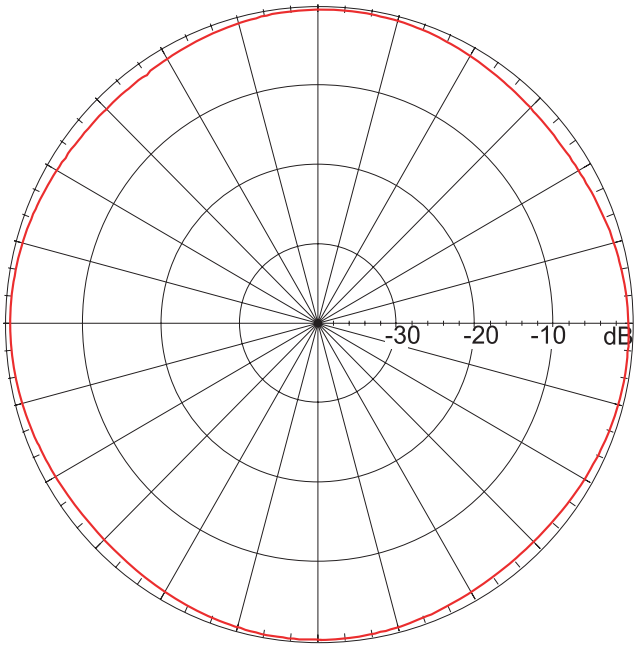


Azimuth Pattern 5570 MHz

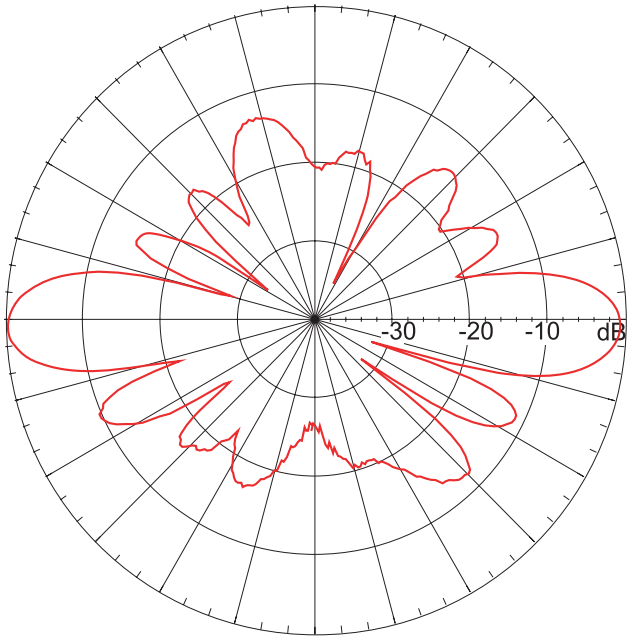
4.1.6 ML-5299-FHPA6-01R Omni-Directional "Pipe" Antenna, 8 dBi, N-Male Connector



Type	Dipole Array
Frequency	5150-5850
Gain (dBi)	8.0
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 16°
Cable Length (in.)	N/A
Cable Type	N/A
Connector Type	Type N Male
Weight	.37 lb
Plenum Antenna	No
Plenum Cable	N/A
Outdoor	Yes



Azimuth Pattern 5500 MHz



Elevation Pattern 5500MHz

5

2.4GHz - 5.2GHz Dual Band Antenna Suite

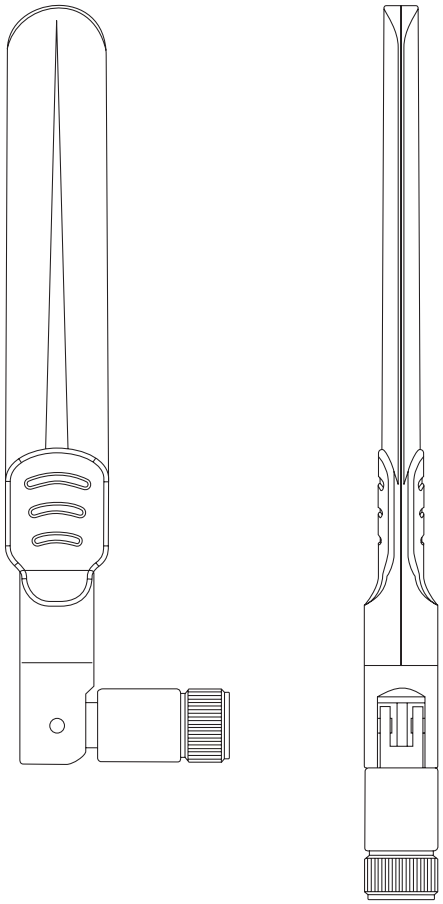
5.1 Supported 2.4GHz - 5.2GHz Dual Band Antennas

Motorola supports several 2.4GHz - 5.2GHz Dual Band antennas to suit the requirements of your unique AP-5131, AP-5181 or AP 300 (integrated antenna) deployment. Check the Motorola Web site periodically, as newly supported 2.4GHz - 5.2GHz Dual Band antennas will be added to this document as they are released. For more information, go to *http://support.symbol.com/support/product/manuals.do*.

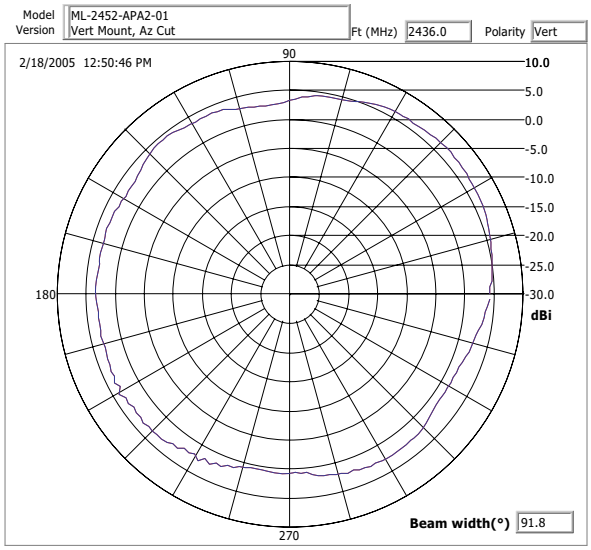
For detailed information on supported 2.4GHz - 5.2GHz Dual Band antenna models, refer to:

- *ML-2452-APA2-01 High Performance Dual Band Fixed Point Dipole - 3 dBi/4 dBi, RP-SMA Male*
- *ML-2452-PNA5-01R Dual Band Panel, 5 dBi, Connector Type N-Male*
- *ML-2452-PNA7-01R Dual Band Panel, 7 dBi, Connector Type N-Male*
- *ML-2452-PTA2M3X3-1 ANT:11ABG, AP7131, MIMO3X3, 2DBI 1 IN, RPSMA*
- *ML-2452-PTA3M3-036 ANT:11ABG, MIMO3, PTCH, 3 DBI, 36IN, RPSMA*

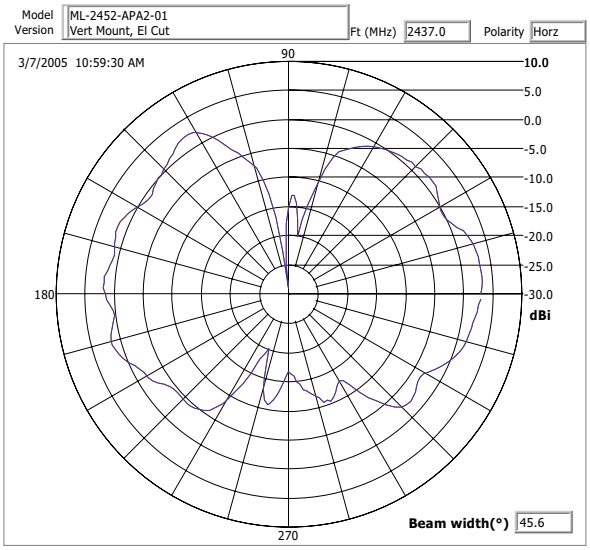
5.1.1 ML-2452-APA2-01 High Performance Dual Band Fixed Point Dipole - 3 dBi/4 dBi, RP-SMA Male



Type	Dipole
Frequency	2400-2500/5150-5850 MHz
Gain (dBi)	3 / 4
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 35°
Cable Length (in.)	N/A
Cable Type	N/A
Connector Type	RP-SMA Male
Weight	0.7 oz
Plenum Antenna	No
Plenum Cable	N/A
Outdoor	No

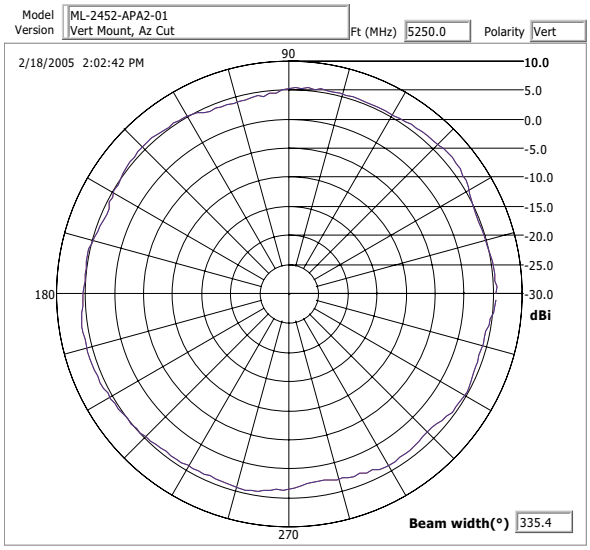


Azimuth Pattern

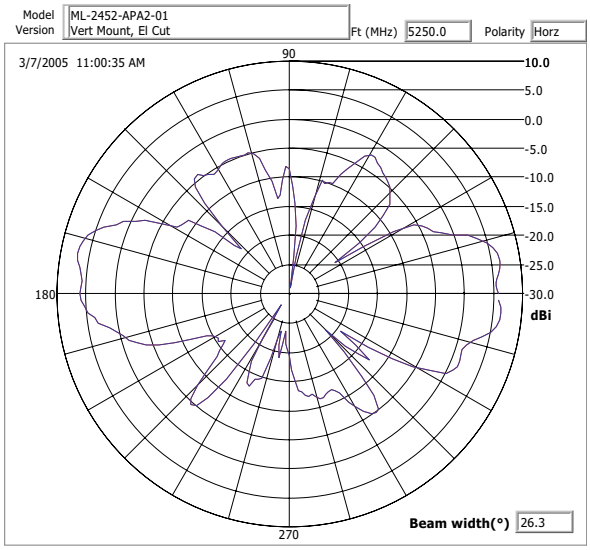


Elevation Pattern

802.11b Band



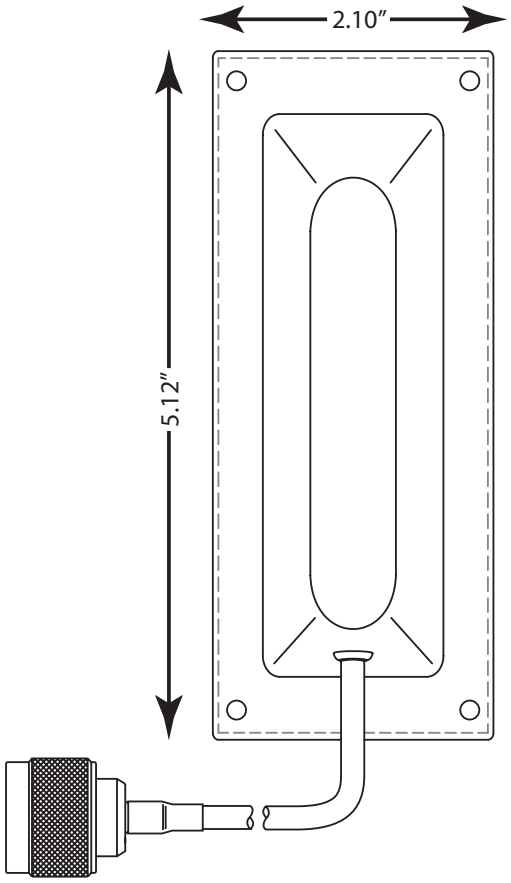
Azimuth Pattern



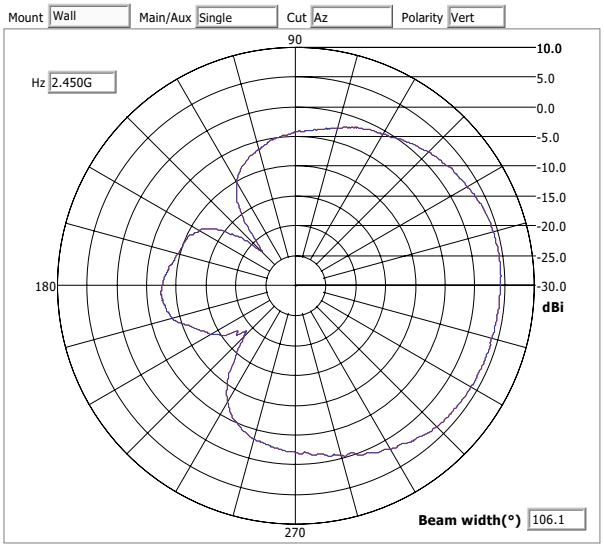
Elevation Pattern

802.11a Band

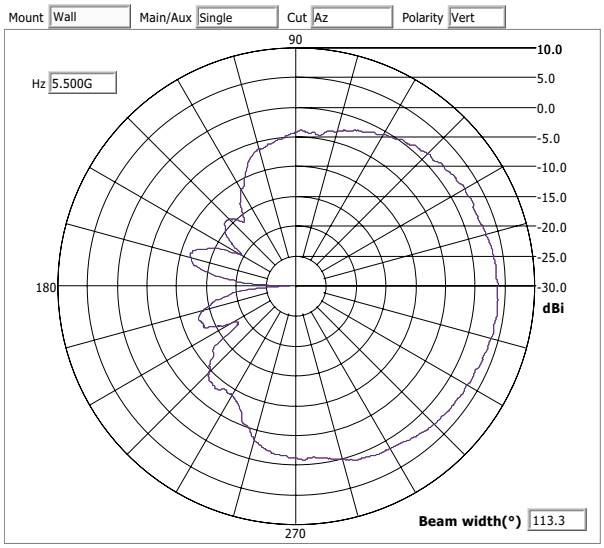
5.1.2 ML-2452-PNA5-01R Dual Band Panel, 5 dBi, Connector Type N-Male



Type	Panel
Frequency	2400-2500/4900-5900 MHz
Gain (dBi)	4.5 (2400-2500); 5.0 (4900-5250); 7.5 (5250-5900)
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 120°
Elevation	3dB Beamwidth: 65°
Cable Length (in.)	12
Cable Type	RG-58 Ultralink
Connector Type	Type N Male
Weight	0.2 lb
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	Yes

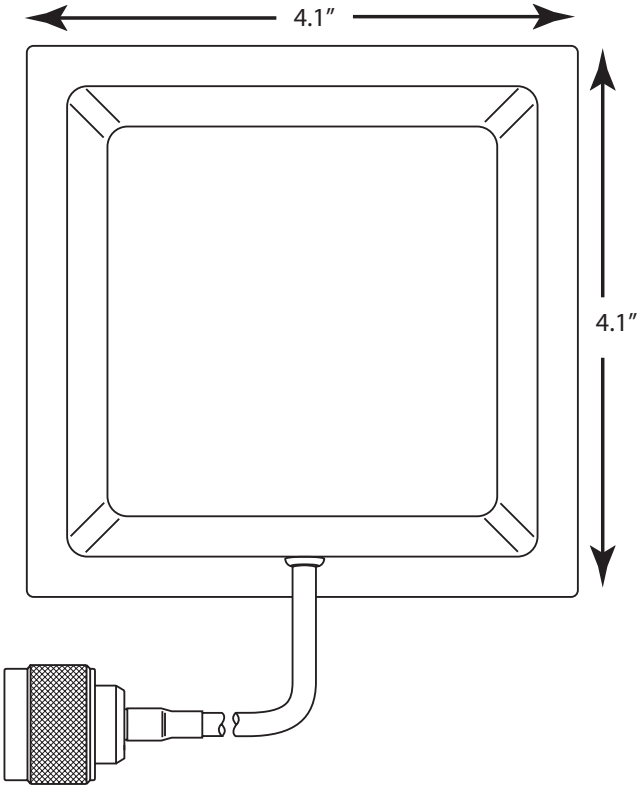


Azimuth Pattern 2450 MHz
(Reference Only)

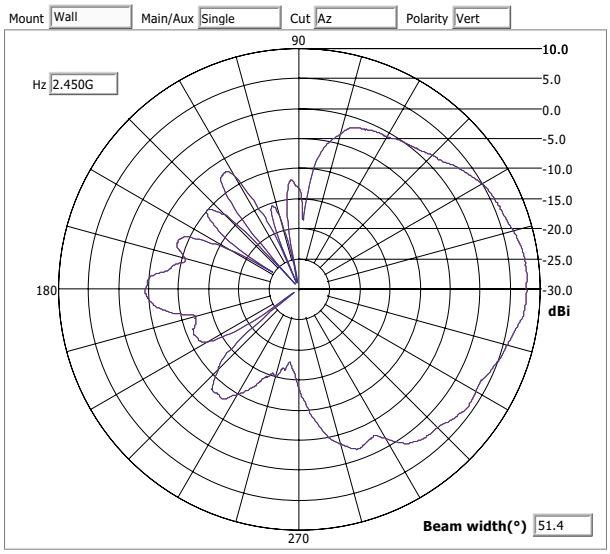


Azimuth Pattern 5500MHz
(Reference Only)

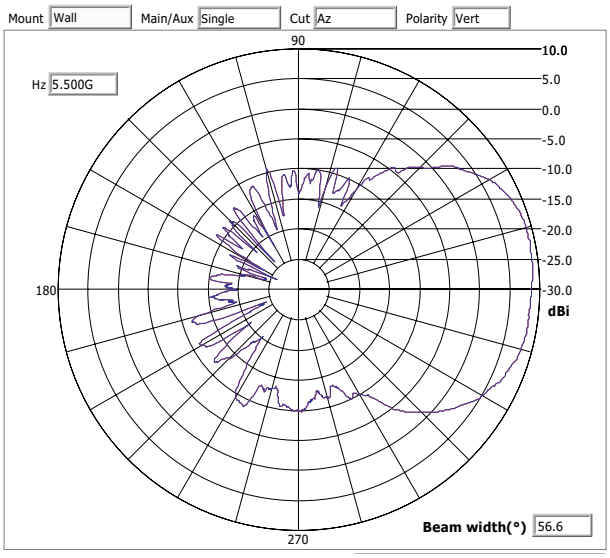
5.1.3 ML-2452-PNA7-01R Dual Band Panel, 7 dBi, Connector Type N-Male



Type	Panel
Frequency	2400-2500/4900-5900 MHz
Gain (dBi)	7.5 (2400-2500); 6.3 (4900-5250); 10 (5250-5900)
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 68°/ 52°
Elevation	3dB Beamwidth: 66°/ 60°
Cable Length (in.)	12
Cable Type	RG-58 Ultralink
Connector Type	Type N Male
Weight	0.5 lb
Plenum Antenna	No
Plenum Cable	Yes
Outdoor	Yes

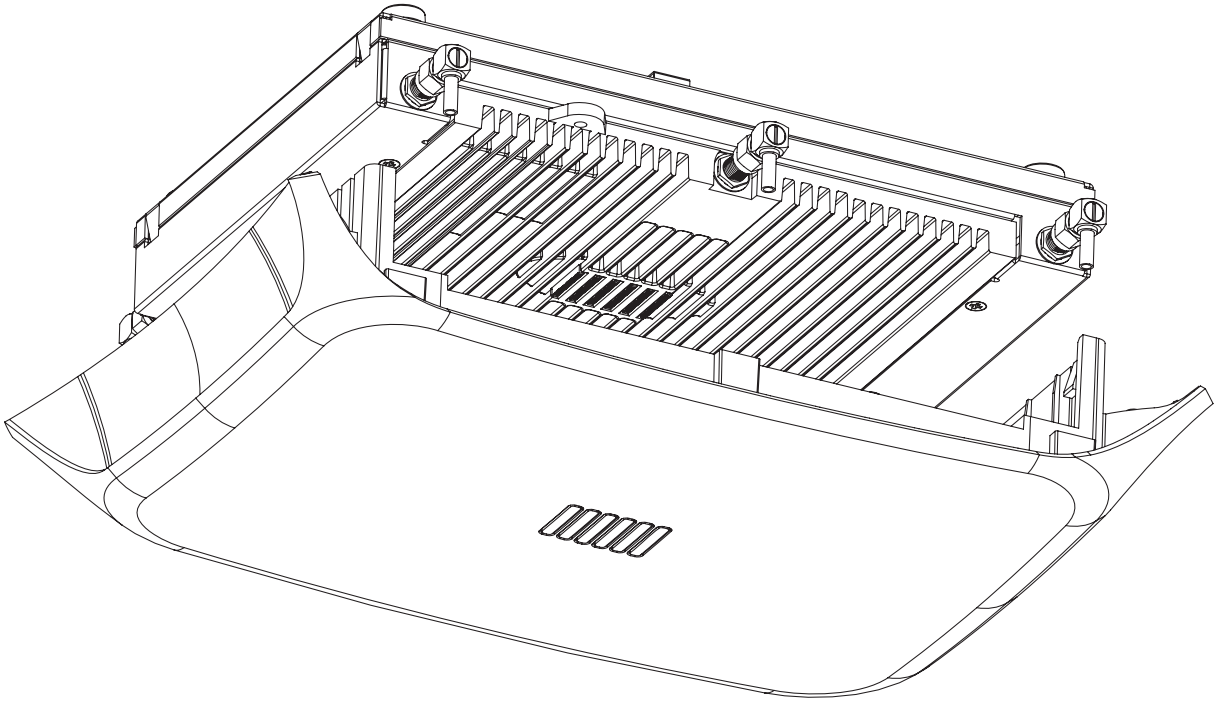


Azimuth Pattern 2450 MHz
(Reference Only)



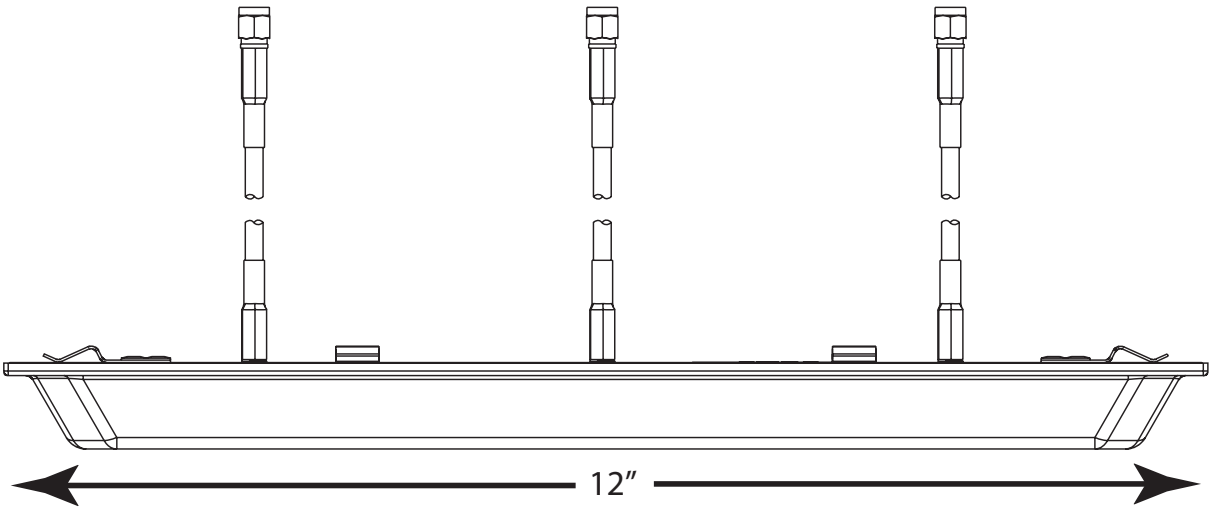
Azimuth Pattern 5500MHz
(Reference Only)

5.1.4 ML-2452-PTA2M3X3-1 ANT:11ABG, AP7131, MIMO3X3, 2DBI 1 IN, RPSMA



Type	Patch x 6 in snap-on facade
Frequency	2400-2500/4900-5990 MHz
Gain (dBi)	1 dBi 2 dBi
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 90° (southern hemisphere pattern)
Cable Length (in.)	Integrated into snap-on facade
Cable Type	1.20 mm coax
Connector Type	RP-SMA Male
Antenna Plenum Rated	No
Cable Plenum Rated	No
Outdoor	No
Weight	0.79 lb

5.1.5 ML-2452-PTA3M3-036 ANT:11ABG, MIMO3, PTCH, 3 DBI, 36IN, RPSMA



Type	Patch x3
Frequency	2400-2500/4900-5990 MHz
Gain (dBi)	3 dBi 4 dBi
Polarization	Linear, Vertical
Azimuth	3dB Beamwidth: 360°
Elevation	3dB Beamwidth: 90° (southern hemisphere pattern)
Cable Length (in.)	36
Cable Type	RG-58 50 Ohm coax
Connector Type	RP-SMA Male
Antenna Plenum Rated	No
Cable Plenum Rated	Yes
Outdoor	No
Weight	0.7 lb

6

Antenna Cables

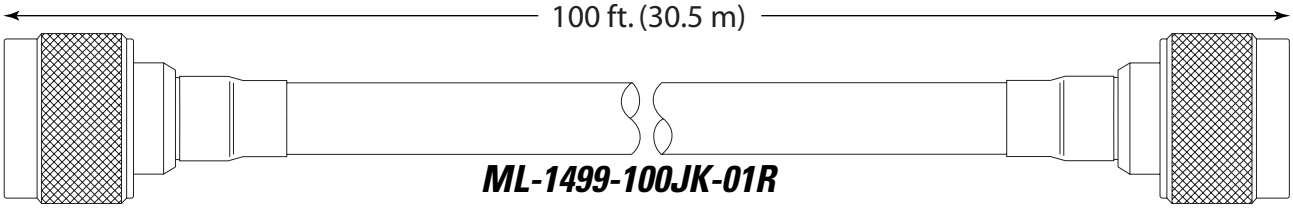
6.1 Supported Antenna Cables

Motorola supports numerous cables to suit your unique AP-5131, AP-5181 or AP 300 (non-integrated antenna) deployment. Check the Motorola Web site periodically, as new cables will be added to this document as they are released. For more information, go to *http://support.symbol.com/support/product/manuals.do*.

For detailed information on supported cables, refer to:

- *ML-1499-100JK-01R 100 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits*
- *ML-1499-10JK-01R 10 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male*
- *ML-1499-25JK-01R 25 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits*
- *ML-1499-50JK-01R 50 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits*
- *ML-1499-72PJ-01R 6 ft. RP BNC Female to RP BNC Male Plenum Coaxial Jumper*

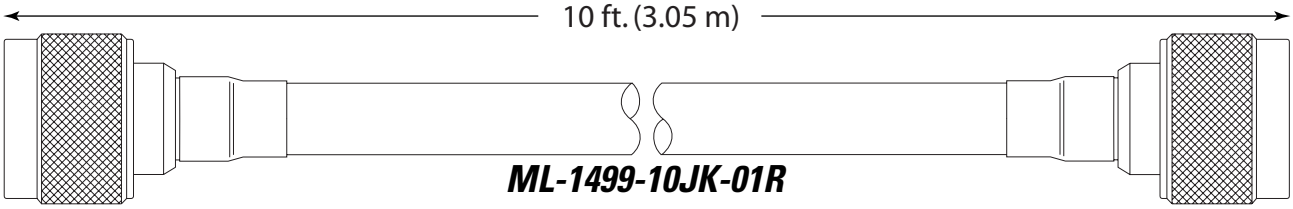
6.1.1 ML-1499-100JK-01R 100 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits



ML-1499-100JK-01R

Type	Ultralink TL 93605
RF Connectors	N (m) to N (m)
Cable Attenuation (dB)	10.6 @ 2.4 GHz; 15.5 @ 5.8 GHz
Frequency	2 - 6 GHz

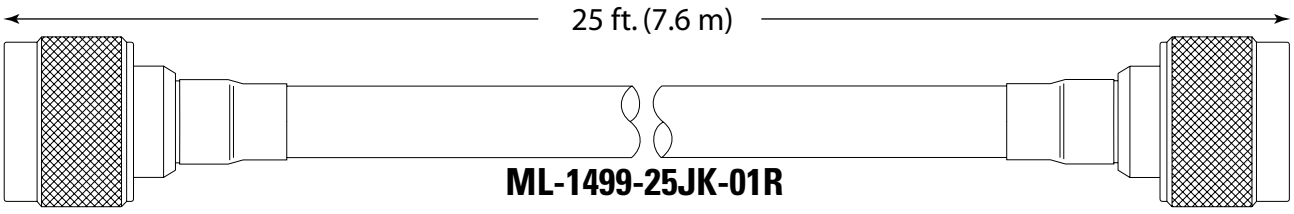
6.1.2 ML-1499-10JK-01R 10 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male



ML-1499-10JK-01R

Type	Ultralink TL 93605
RF Connectors	N (m) to N (m)
Cable Attenuation (dB)	2.0 @ 2.4 GHz; 2.9 @ 5.8 GHz
Frequency	2 - 6 GHz

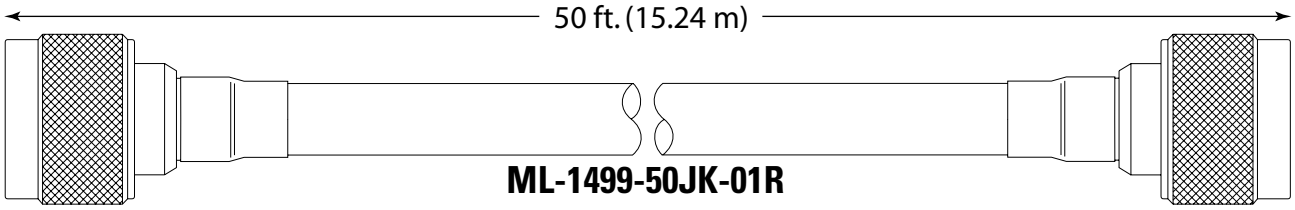
6.1.3 ML-1499-25JK-01R 25 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits



ML-1499-25JK-01R

Type	Ultralink TL 93605
RF Connectors	N (m) to N (m)
Cable Attenuation (dB)	2.5 @ 2.4 GHz; 4.0 @ 5.8 GHz
Frequency	2 - 6 GHz

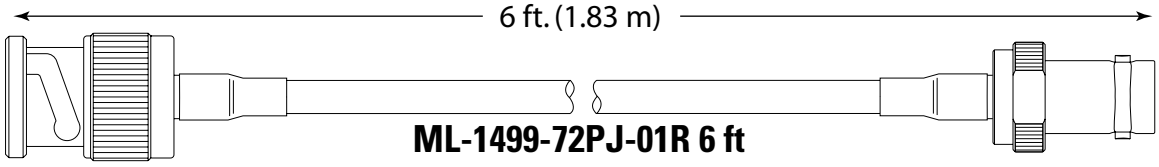
6.1.4 ML-1499-50JK-01R 50 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits



ML-1499-50JK-01R

Type	Ultralink TL 93605
RF Connectors	N (m) to N (m)
Cable Attenuation (dB)	4.5 @ 2.4 GHz; 7.0 @ 5.8 GHz
Frequency	2 - 6 GHz

6.1.5 ML-1499-72PJ-01R 6 ft. RP BNC Female to RP BNC Male Plenum Coaxial Jumper



Type	CMP Plenum, RG-58
RF Connectors	RP BNC (f) to RP. BNC (m)
Cable Attenuation (dB)	2.3 dB
Frequency	2400-2500 Mhz

7

Supported Antenna Adapters

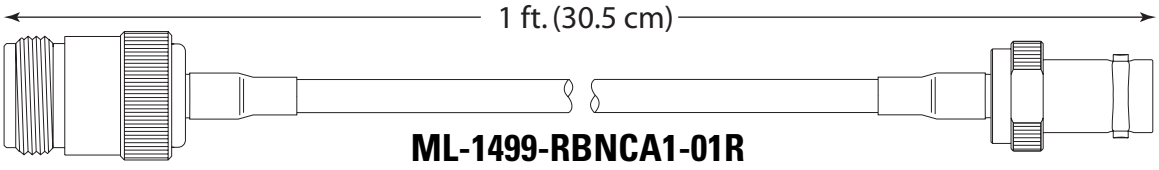
7.1 Supported Adapters

Motorola supports many adapters to suit your unique AP-5131, AP-5181 or AP 300 (non-integrated antenna) deployment. Check the Motorola Web site periodically, as new adapters will be added to this document as they are released. For more information, go to *http://support.symbol.com/support/product/manuals.do*.

For detailed information on supported antenna adapters, refer to:

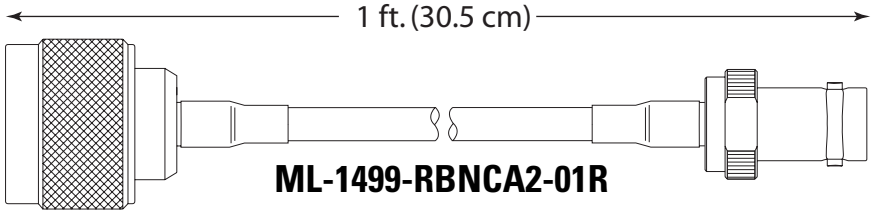
- *ML-1499-RBNCA1-01R 1 ft. N Female to RP BNC Female Cable Adapter with Connector Seal Kit*
- *ML-1499-RBNCA2-01R 1 ft. N Male to RP BNC Female Cable Adapter with Connector Seal Kit*
- *25-85391-01R 3.5 in. Jumper Cable, RP-SMA (Male) to Type N (Male) Adaptor*
- *25-85392-01R 3.5 in. Jumper Cable, RP-SMA (Male) to Type N (Female) Adaptor*
- *25-72178-01 Jumper, RP-SMA(M) to RP-BNC(F)*
- *25-90262-01R RP-SMA (Female) to Type N (Female) Adapter*
- *25-90263-01R Type N (Male) to RP-SMA (Female) Bulkhead Adapter*

7.1.1 ML-1499-RBNCA1-01R 1 ft. N Female to RP BNC Female Cable Adapter with Connector Seal Kit



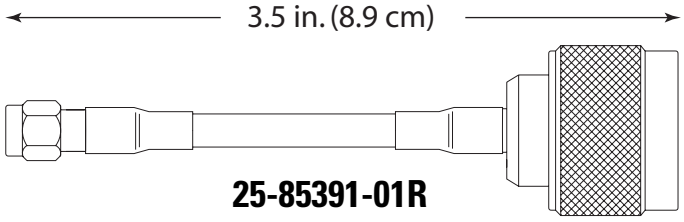
Type	Black, Ultralink, RG-58
RF Connectors	N (f) to RP. BNC (f)
Frequency	2400-2500 MHz
Attenuation	0.2 dB

7.1.2 ML-1499-RBNCA2-01R 1 ft. N Male to RP BNC Female Cable Adapter with Connector Seal Kit



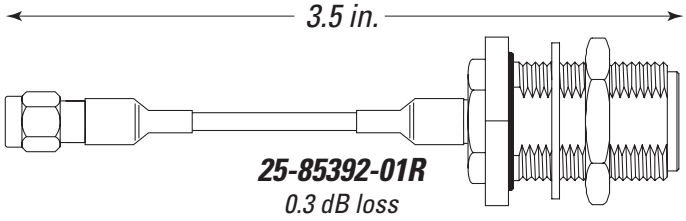
Type	RG-58
Frequency	2400-2500 MHz
Cable Loss (dB)	0.85 dB
Cable Length (in.)	12
Connector 1	N - Male
Connector 2	RP-BNC-F
Color	Black

7.1.3 25-85391-01R 3.5 in. Jumper Cable, RP-SMA (Male) to Type N (Male) Adaptor



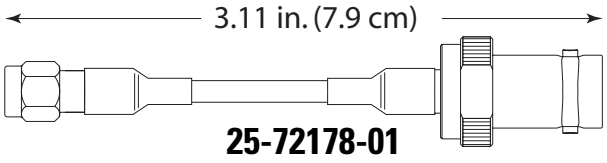
Type	Clear Jacket, RG-316
Connector 1	RP-SMA, Male
Connector 2	Type N, Male
Insertion Loss	2.4 GHz: 0.2 dB MIN
Insertion Loss	5.2 GHz: 0.3 dB MIN

7.1.4 25-85392-01R 3.5 in. Jumper Cable, RP-SMA (Male) to Type N (Female) Adaptor



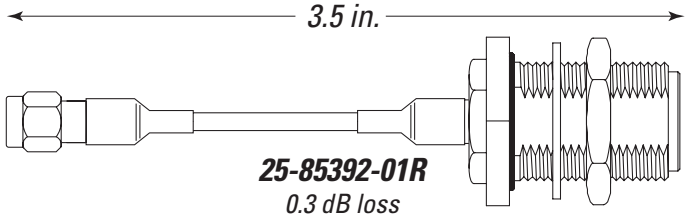
Type	Clear Jacket, RG-316
Connector 1	RP-SMA, Male
Connector 2	Type N, Female, Bulkhead
Insertion Loss	2.4 GHz: 0.2 dB MIN
Insertion Loss	5.2 GHz: 0.3 dB MIN

7.1.5 25-72178-01 Jumper, RP-SMA(M) to RP-BNC(F)



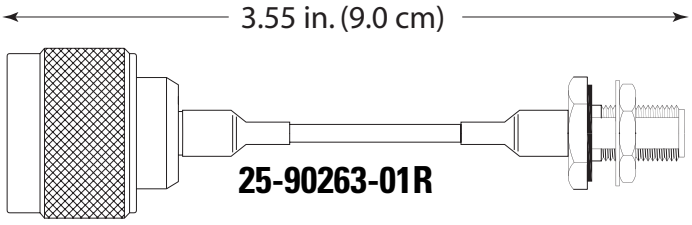
Type	RG-316
Connector 1	RP-SMA, Male
Connector 2	RP-BNC, Female
Insertion Loss	2.4 GHz: .2 dB
Insertion Loss	5.2 GHz: .3 dB

7.1.6 25-90262-01R RP-SMA (Female) to Type N (Female) Adapter



Type	RG-316
Connector 1	RP-SMA, Female, Bulkhead
Connector 2	Type N, Female, Bulkhead
Insertion Loss	2.4 GHz: .2 dB
Insertion Loss	5.2 GHz: .3 dB

7.1.7 25-90263-01R Type N (Male) to RP-SMA (Female) Bulkhead Adapter



Type	RG-316
Connector 1	Type N, Male
Connector 2	RP-SMA, Female, Bulkhead
Insertion Loss	2.4 GHz: 0.2 dB MIN
Insertion Loss	5.2 GHz: 0.3 dB MIN

8

Supported Lightning Arrestors

8.1 Lightning Arrestors

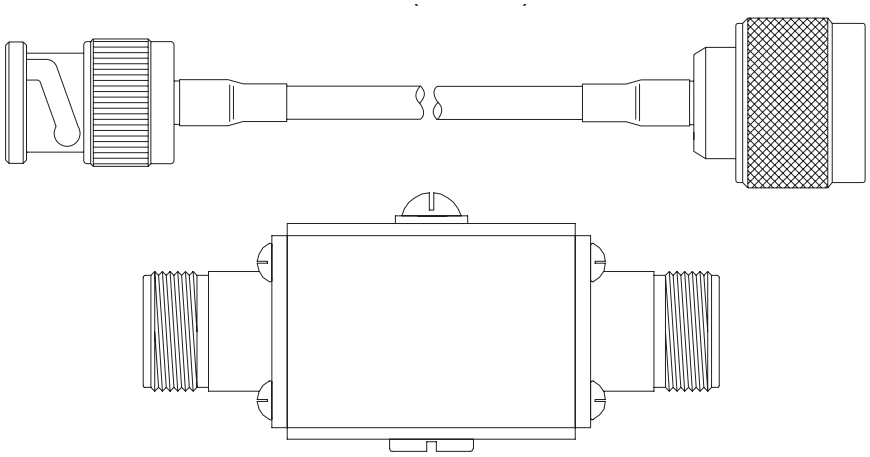
Motorola supports several lightning arrestors to support your unique AP-5131, AP-5181 or AP 300 (non-integrated antenna) deployment safety requirements. Check the Motorola Web site periodically, as new lightning arrestors will be added to this document as they are released. For more information, go to *http://support.symbol.com/support/product/manuals.do*.

For detailed information on supported lightning arrestors refer to:

- *ML-1499-LAK1-01R 1 ft. N Male to RP BNC Male Lightning Arrestor with Connector Seal Kit*
- *ML-1499-LAK2-01R Lightning Arrestor Kit with N Male to N Male Barrel Adapter*
- *ML-2452-LAK1-01R Lightning Arrestor (N Female to N Female) with N Male to RP-SMA Male Adapter*

WARNING! The grounding lug on a lightning arrestor must be grounded in compliance with local electrical codes.

8.1.1 ML-1499-LAK1-01R 1 ft. N Male to RP BNC Male Lightning Arrestor with Connector Seal Kit

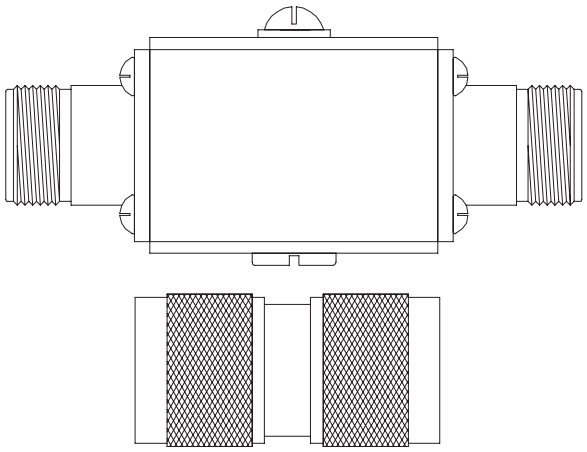


ML-1499-LAK1-01R

Cable	Black, Ultralink, RG-58
RF Connectors	N (m) to RP. BNC (m)
Arrestor RF Connectors	N (f) to N (f)
Frequency	2400-2500 MHz
Insertion Loss - Lightning Arrestor	0.25 dB @ 2.4 GHz
Insertion Loss - Cable	0.6 dB @ 2.4 GHz

NOTE: Not for use above 2500 MHz.

8.1.2 ML-1499-LAK2-01R Lightning Arrestor Kit with N Male to N Male Barrel Adapter

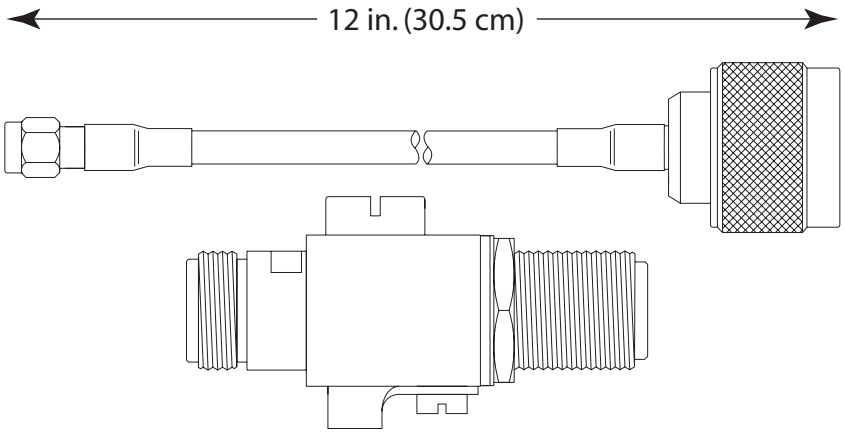


ML-1499-LAK2-01R

RF Connectors	N (m) to N (m)
Arrestor RF Connectors	N (f) to N (f)
Frequency	2400-2500 MHz
Maximum RF Power	100 W
Insertion Loss - Lightning Arrestor	0.25 dB @ 2.4 GHz / 14 dB @ 5.5GHz

NOTE: Not for use above 2500 MHz.

8.1.3 ML-2452-LAK1-01R Lightning Arrestor (N Female to N Female) with N Male to RP-SMA Male Adapter



ML-2452-LAK1-01R

Cable	Black, Ultralink, RG-58
Connectors - Cable	N (m) to RP. SMA (m)
Frequency	100-6000 MHz
Insertion Loss - Cable	0.6 @ 2.4 GHz, 1.4 @ 5.5 GHz
Insulation Resistance	50 M-ohms
Connectors - Lightning Arrestor	Type N (f) to N (f)
Weight	4.5 oz
Operating Temperature	- 40° to 85°C
Insertion Loss - Lightning Arrestor	0.14 @ 2.4 GHz, 0.35 @ 5.5 GHz

9

Mounting Kits

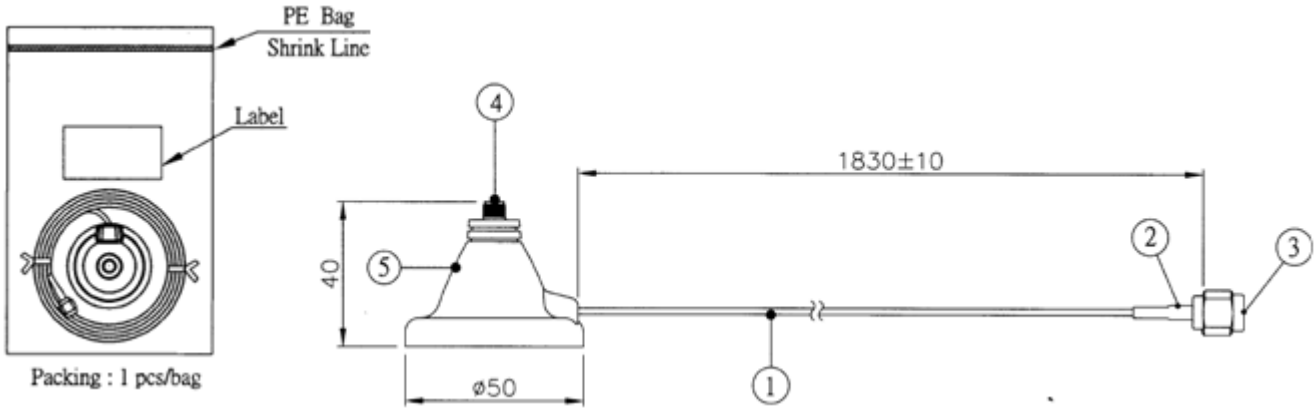
9.1 Mounting Kit Support

Motorola supports mounting kits to support your unique AP-5131, AP-5181 or AP 300 (non-integrated antenna) deployment. Check the Motorola Web site periodically, as new kits will be added to this document as they are released. For more information, go to http://support.symbol.com/support/product/manuals.do.

For detailed information on supported mounting kits refer to:

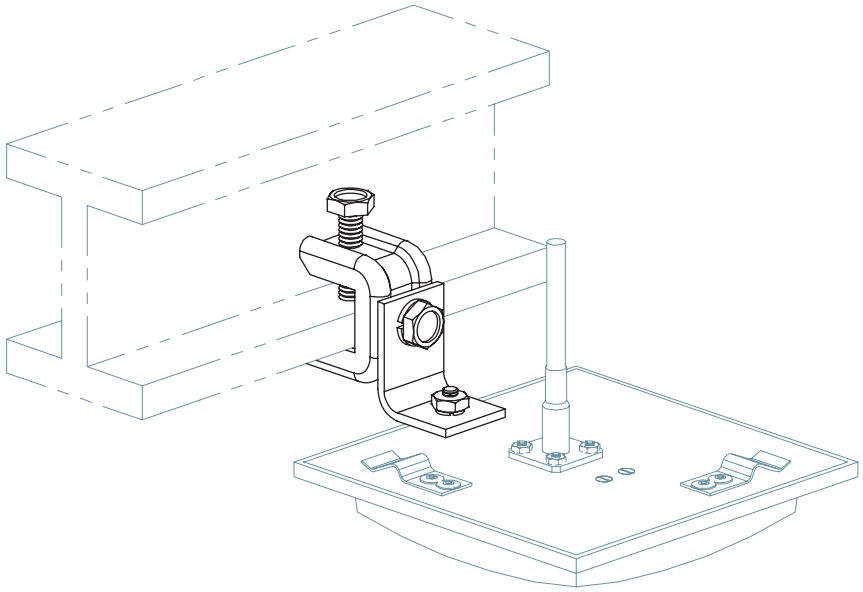
- *ML-1499-APAMK-01R Magnetic Base for ML-2452-APA2-01 with 6 Ft. Cable RP-SMA (Male)*
- *ML-1499-SD3MK-01R Articulating I-Beam Mount Kit for ML-2499-SD3-01 Omni Antenna*

9.1.1 ML-1499-APAMK-01R Magnetic Base for ML-2452-APA2-01 with 6 Ft. Cable RP-SMA (Male)



Cable	RG-178
Connector 3	RP-SMA, Male
Connector 4	RP-SMA, Female
Attenuation (dB)	2.6 @ 2.4 GHz; 4.6 @ 5.5 Ghz

9.1.2 ML-1499-SD3MK-01R Articulating I-Beam Mount Kit for ML-2499-SD3-01 Omni Antenna



Functionality	Mounts Part No. ML-2499-SD3-01 to an I-beam.

10

AP-5131 Antenna Connections

This chapter describes how the 2.4 and 5 GHz antennas described within this guide are physically connected to an AP-5131 model access point. Central in this discussion are descriptions of the single and dual-band antennas supported, their supported connector models and how lightning arrestors are supported for specific antenna and connector combinations.

For more information, see:

- *2.4 GHz AP-5131 Antenna Connections*
- *5 GHz AP-5131 Antenna Connections*

P/N	Length	Conn 1	Conn 2	Attn 2.4	Attn 5.5
25-72178-01	3.1 in.	RSMA-m	RBNC-f	0.2	N/A
25-85391-01R	3.5 in	RSMA-m	N-m	0.2	0.3
25-85392-01R	3.5 in	RSMA-m	N-f bulkhead	0.2	0.3
25-90262-01R	3.55 in.	RSMA-f	N-f bulkhead	0.2	0.3
25-90263-01R	3.55 in.	RSMA-f	N-m	0.2	0.3
25-97261-01R	48 in.	N-m	RBNC-m	1.5	N/A
25-99175-01R	1.5 in.	N-f	N-f	0.2	0.3
ML-1499-100JK-01R	100 ft	N-m	N-m	10.6	15.5
ML-1499-10JK-01R	10 ft	N-m	N-m	2	2.9
ML-1499-25JK-01R	25 ft	N-m	N-m	2.5	4
ML-1499-50JK-01R	50 ft	N-m	N-m	4.5	7
ML-1499-72PJ-01R	6 ft	RPBNC-f	RBNC-m	2.3	N/A
ML-1499-LAK1 Cable	12 in.	N-m	RBNC-m	0.6	N/A
ML-1499-LAK1/2 Arrestor	2.25 in	N-f	N-f	0.24	N/A
ML-1499-LAK2 Adapter	1.5 in.	N-m	N-m	0.15	N/A
ML-1499-RBNCA1-01R	1 ft	N-f	RBNC-f	0.85	N/A
ML-1499-RBNCA2-01R	1 ft	N-m	RBNC-f	0.85	N/A
ML-2452-LAK1 Arrestor	1.75 in.	N-m	N-m	0.14	0.35
ML-2452-LAK1 Cable	12 in.	N-m	RSMA-m	0.6	1.4

10.1 2.4 GHz AP-5131 Antenna Connections

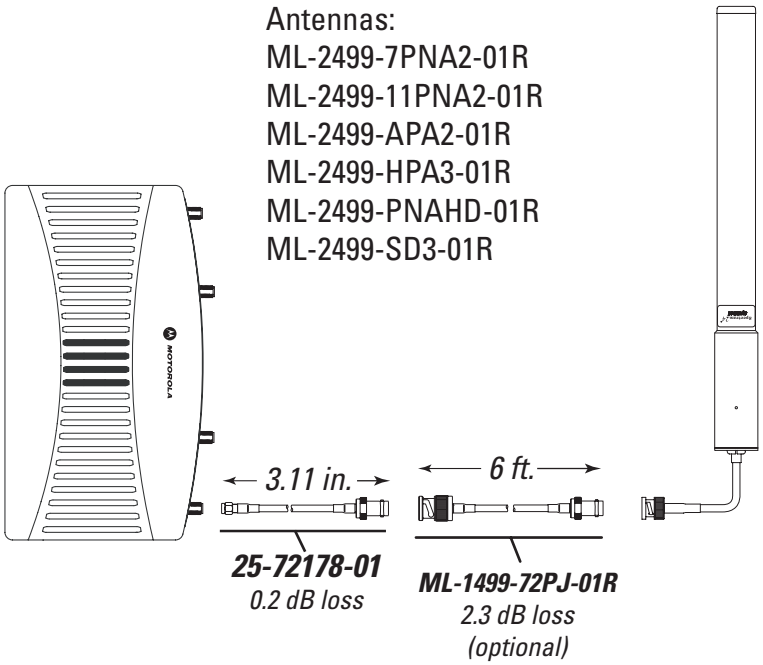
This section describes how the components described within this guide are used collectively in the following AP-5131 installation scenarios supporting the 2.4 GHz band:

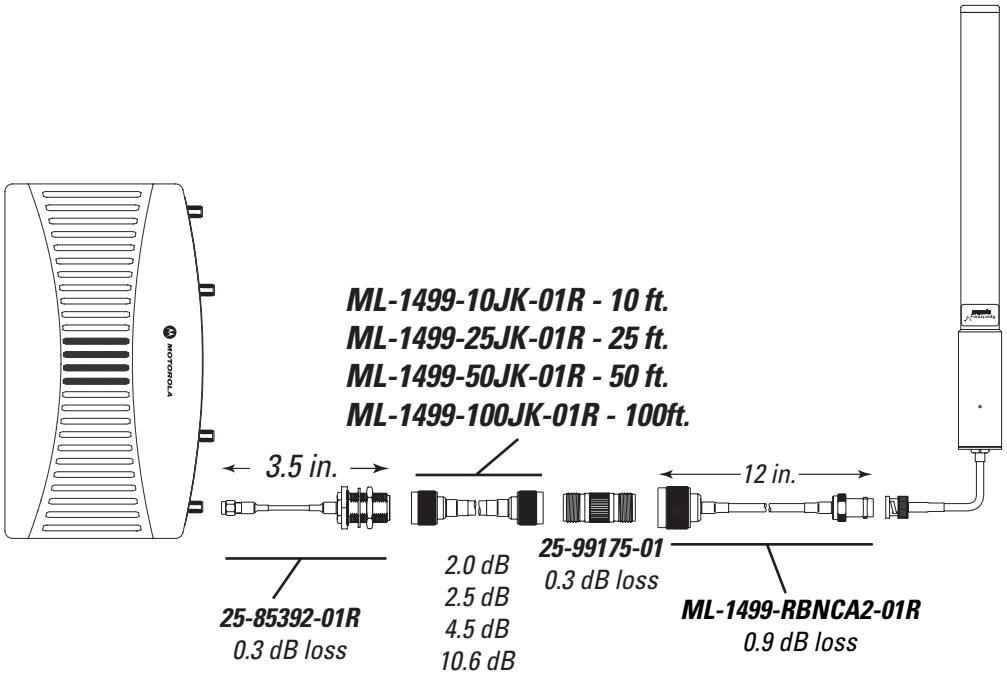
- *RP-BNC Male Antenna Installation*
- *Type N Female Connector Installation*
- *Type N Male Connector Installation*

NOTE: For information on the individual 2.4 GHz antennas approved for use with an AP-5131, see *802.11b/g Antenna Suite*.

10.1.1 RP-BNC Male Antenna Installation

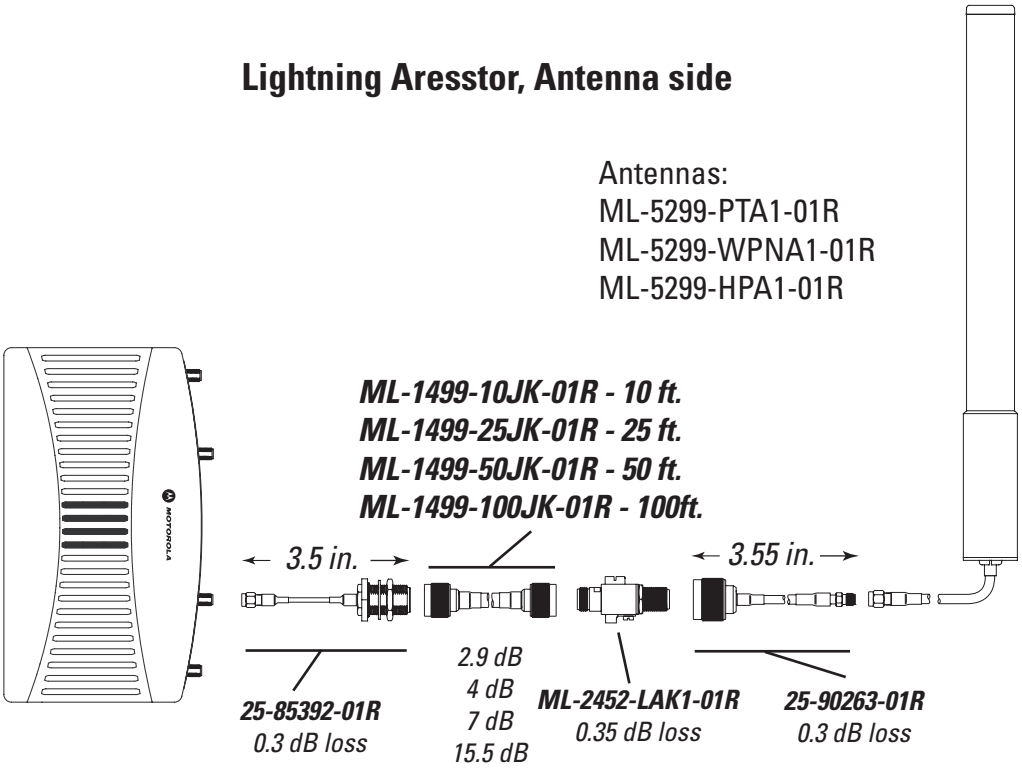
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 2.4 GHz AP-5131 model access point using RP-BNC male antennas:





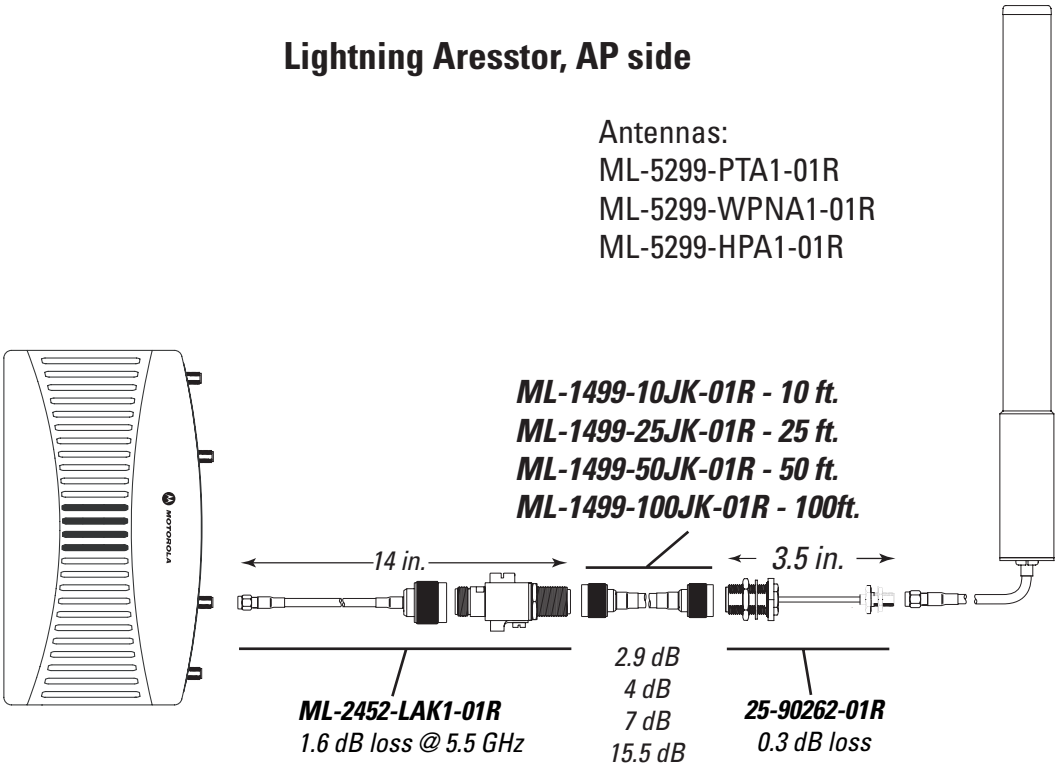
Lightning Aresstor, Antenna side

Antennas:
ML-5299-PTA1-01R
ML-5299-WPNA1-01R
ML-5299-HPA1-01R



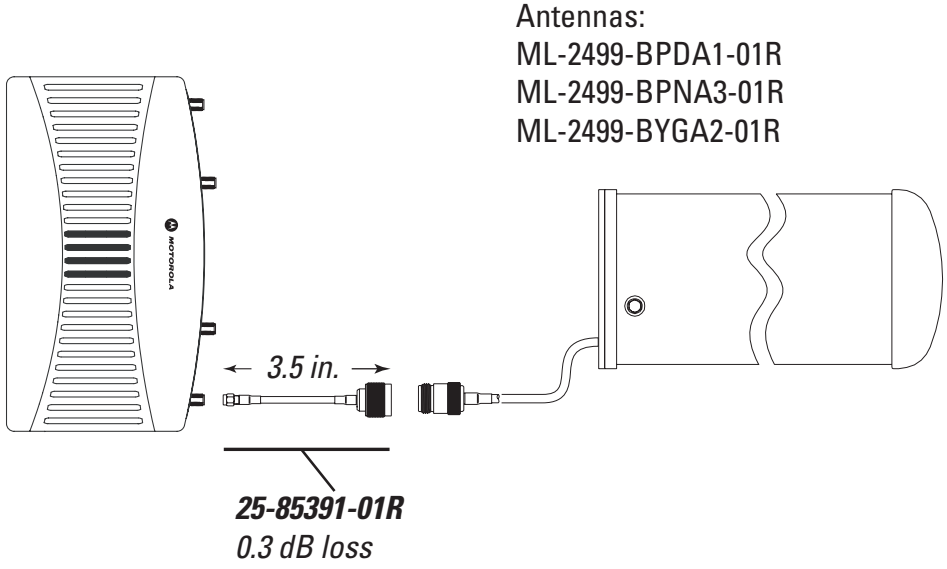
Lightning Aresstor, AP side

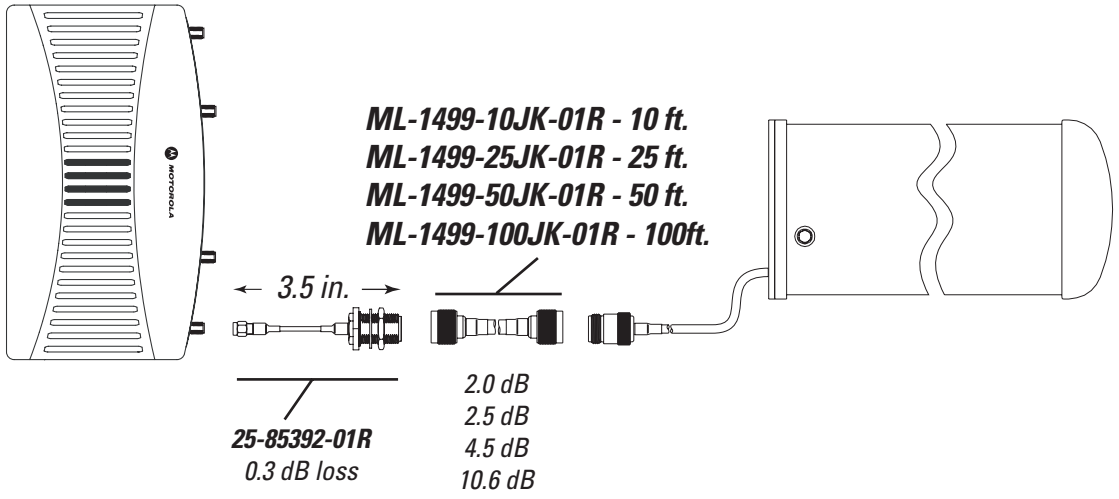
Antennas:
ML-5299-PTA1-01R
ML-5299-WPNA1-01R
ML-5299-HPA1-01R



10.1.2 Type N Female Connector Installation

Refer to the following for a graphical depiction of the parts and connection options available for cabling an 2.4 GHz AP-5131 model access point using Type N female connectors:



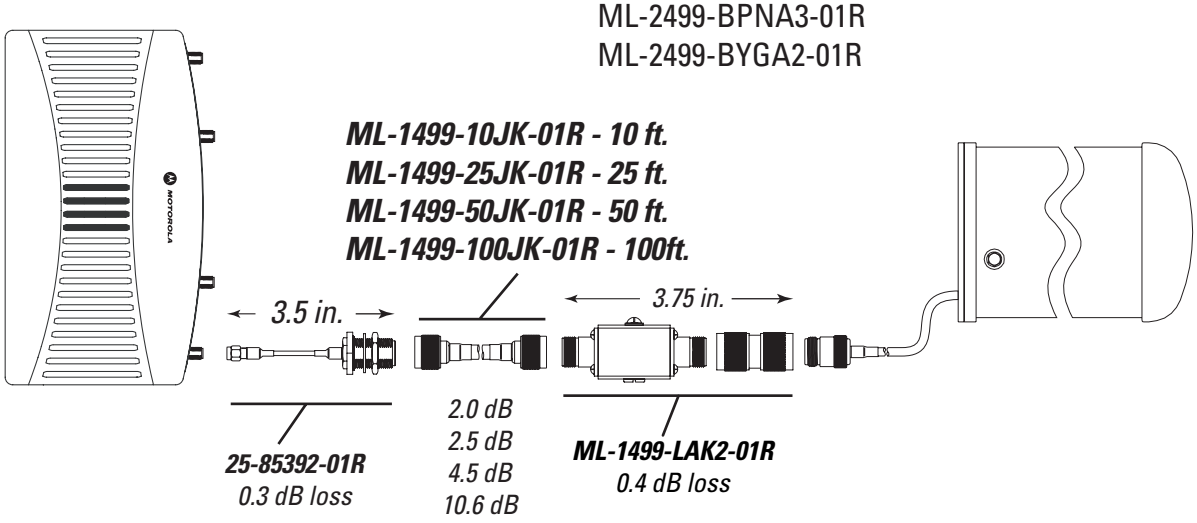


CAUTION: The minimum cable configuration is required to meet regulatory requirements.

CAUTION: The installation of lightning arrestors must meet local electrical codes.

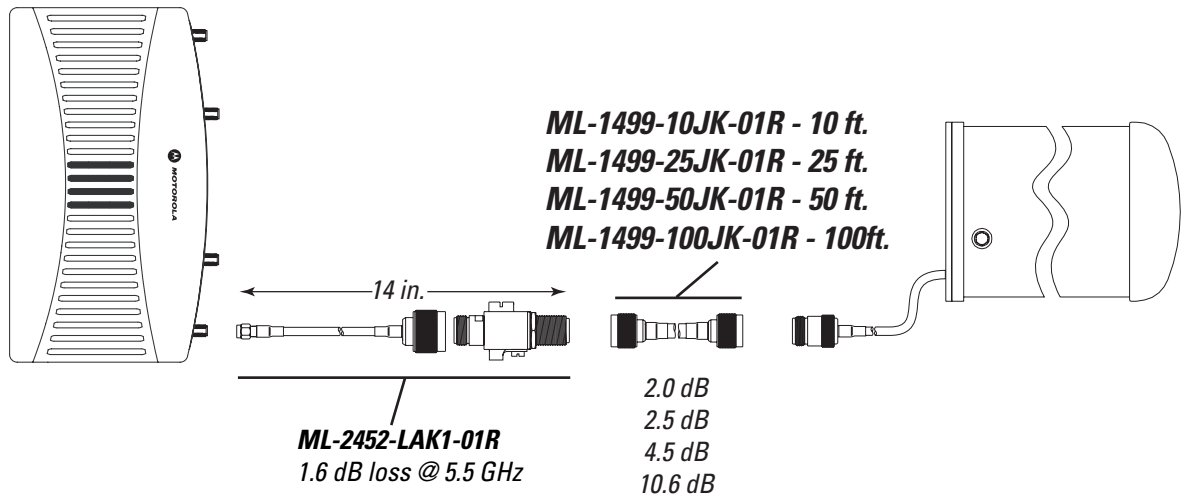
Lightning Aresstor, Antenna side

Antennas:
ML-2499-BPDA1-01R
ML-2499-BPNA3-01R
ML-2499-BYGA2-01R



Lightning Aresstor, AP side

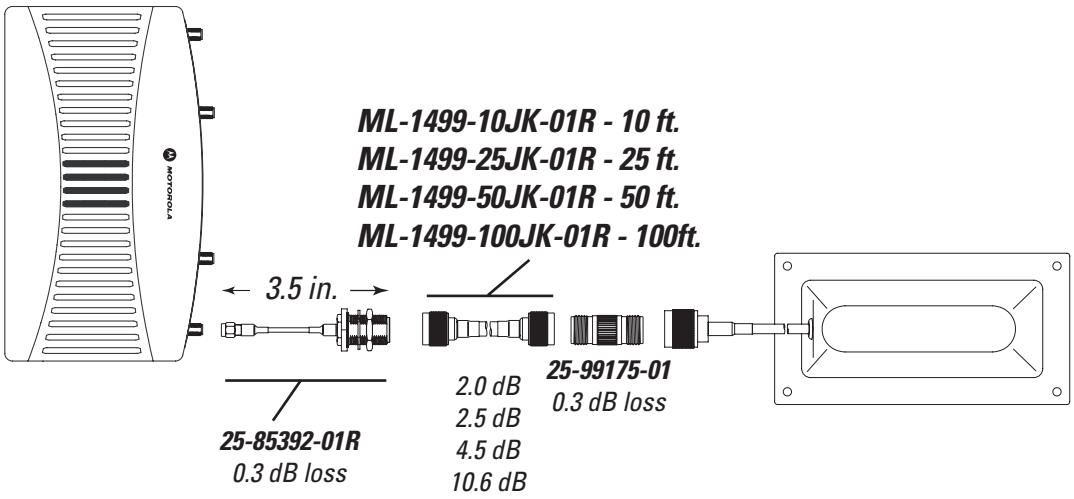
Antennas:
ML-2499-BPDA1-01R
ML-2499-BPNA3-01R
ML-2499-BYGA2-01R



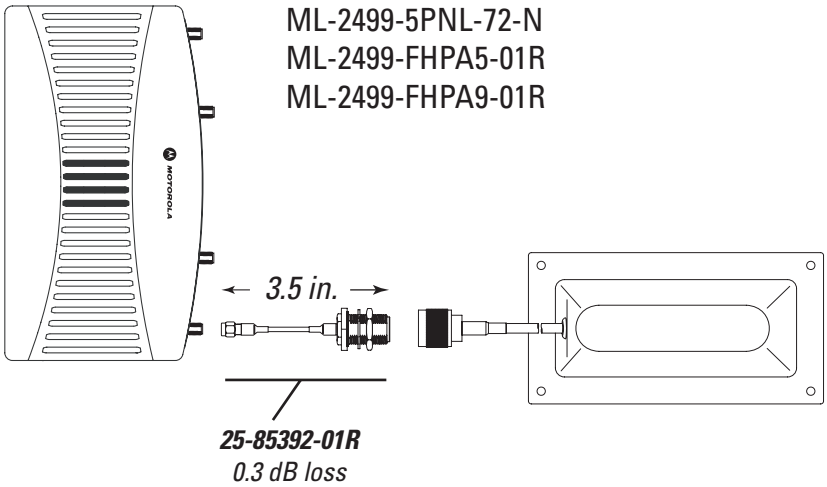
10.1.3 Type N Male Connector Installation

Refer to the following for a graphical depiction of the parts and connection options available for cabling an 2.4 GHz AP-5131 model access point using Type N male connectors:

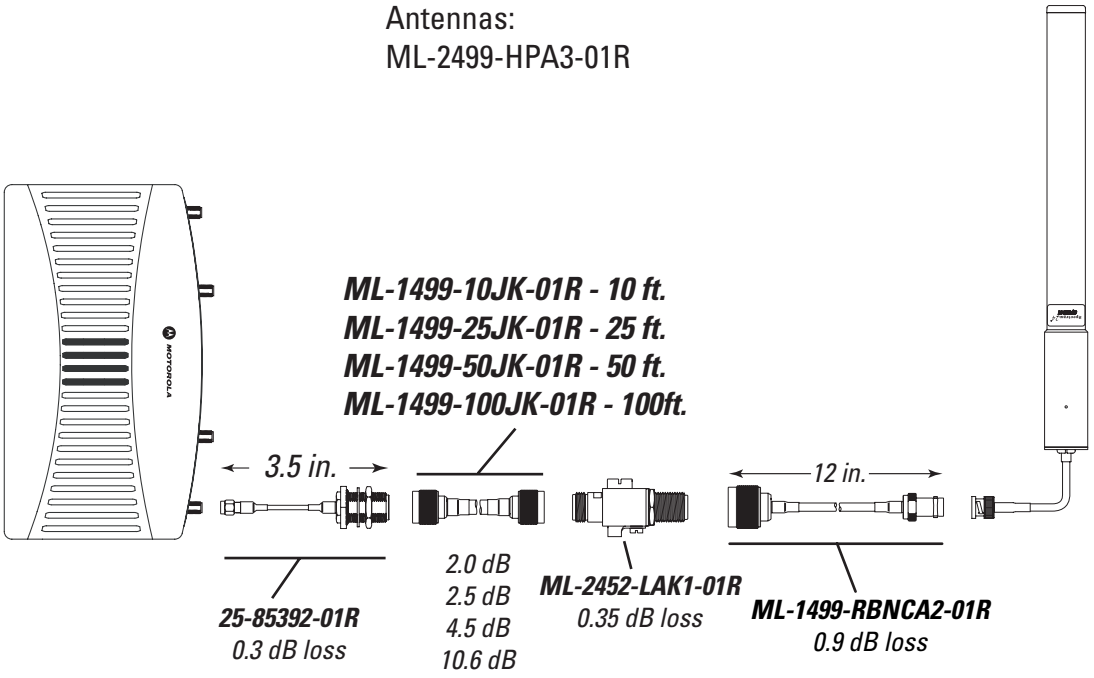
Antennas:
ML-2499-5PNL-72-N
ML-2499-FHPA5-01R
ML-2499-FHPA9-01R



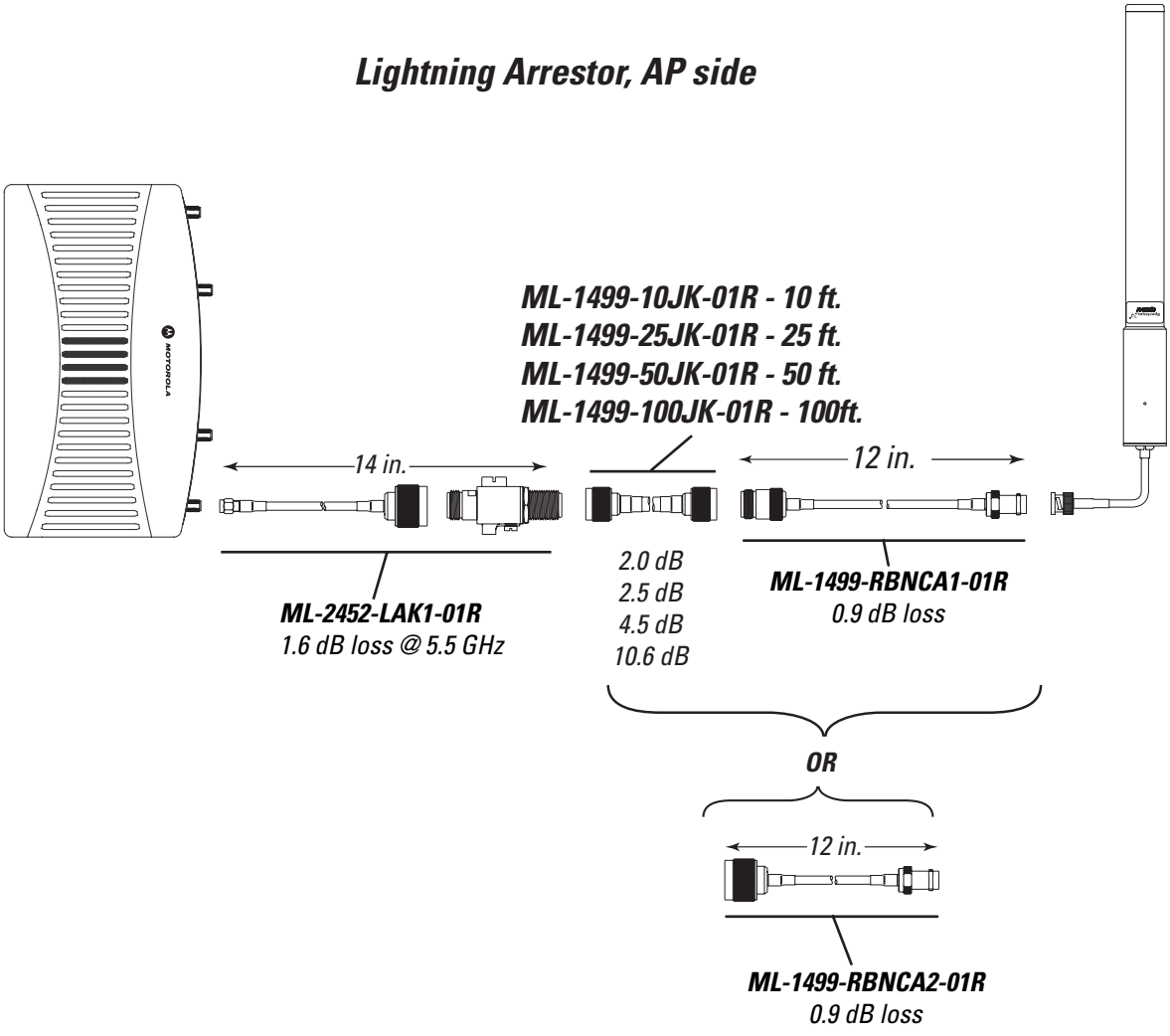
Antennas:
ML-2499-5PNL-72-N
ML-2499-FHPA5-01R
ML-2499-FHPA9-01R



Antennas:
ML-2499-HPA3-01R



Lightning Arrestor, AP side



10.2 5 GHz AP-5131 Antenna Connections

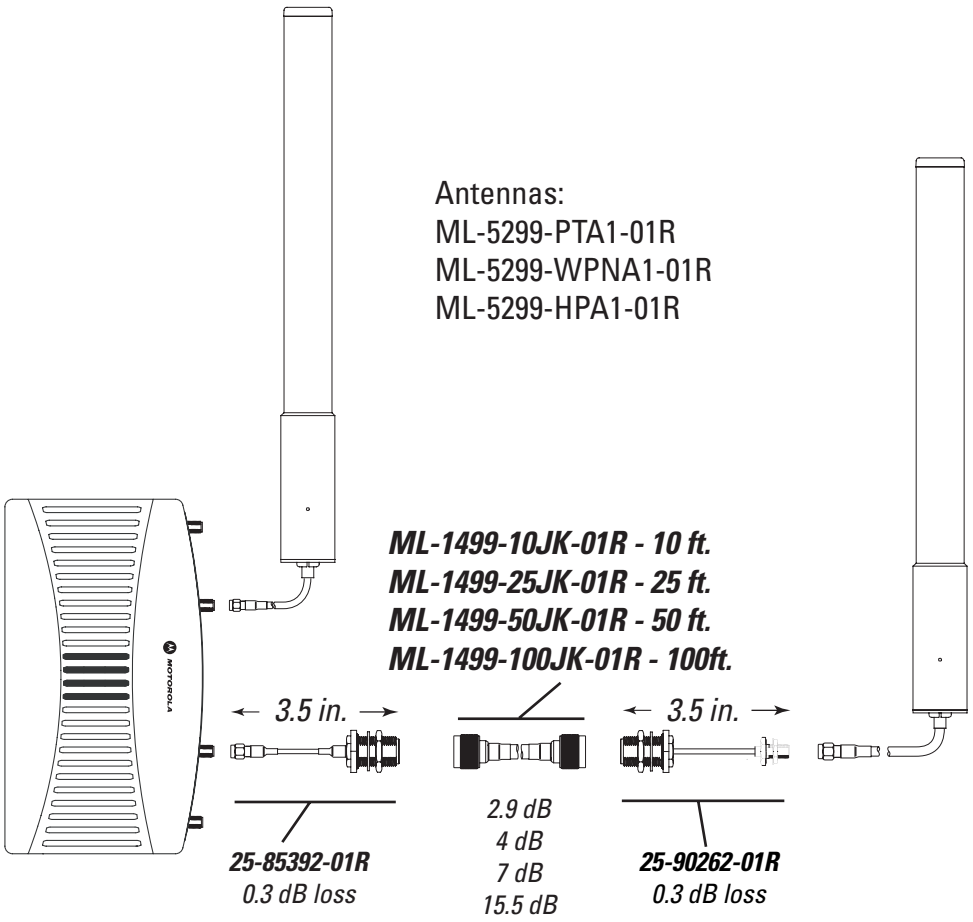
This section describes how the components described within this guide are used collectively in the following AP-5131 installation scenarios supporting the 5 GHz band:

- *RP-SMA Male Antenna Installation*
- *Type N Male Connector Installation*

NOTE: For information on the individual 5 GHz antennas approved for use with an AP-5131, see *802.11a Antenna Suite*.

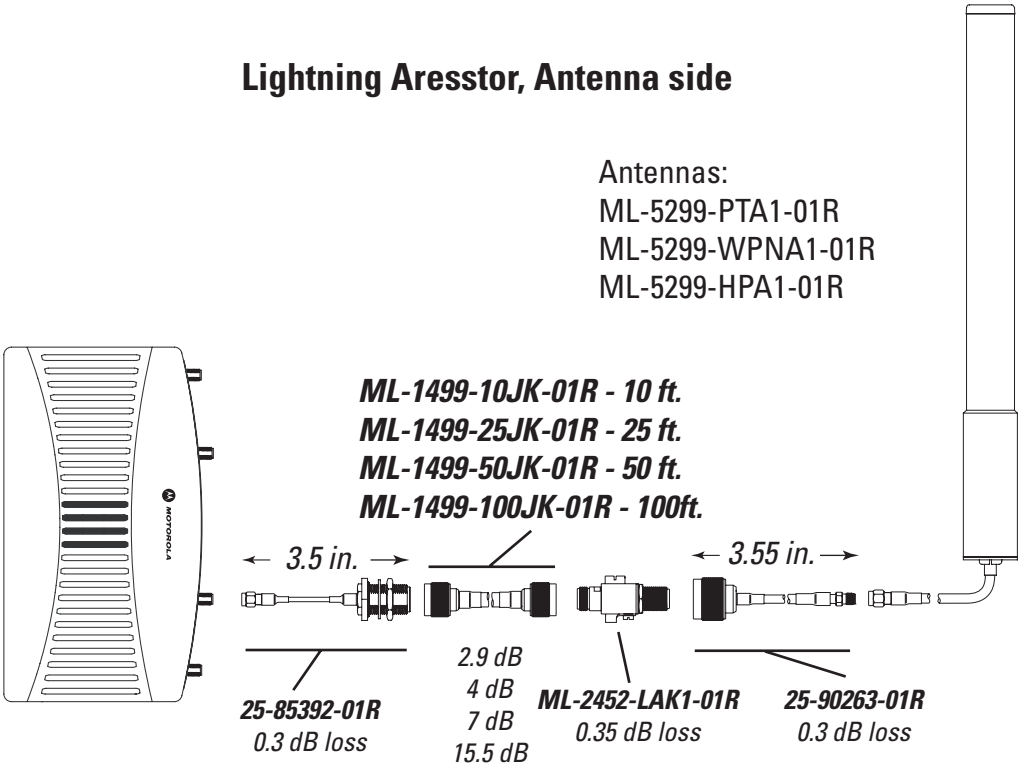
10.2.1 RP-SMA Male Antenna Installation

Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP-5131 model access point using a RP-SMA male antenna (with no lightning arrestor):

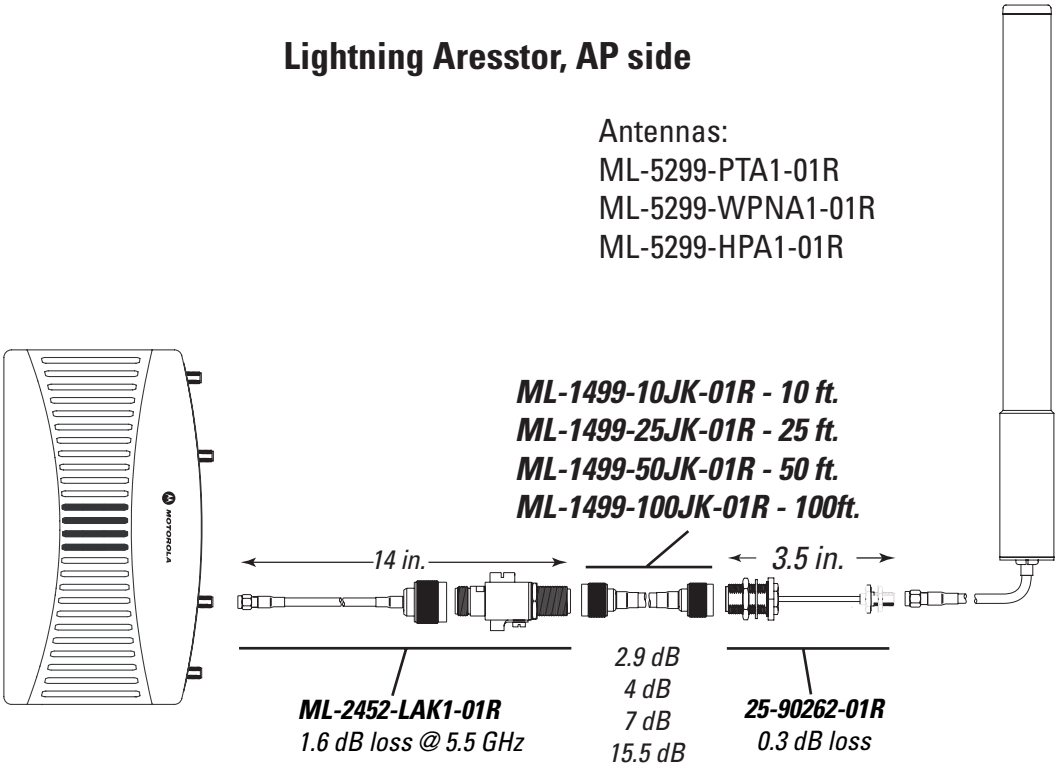


Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP-5131 model access point using a RP-SMA male antenna (with a lightning arrestor):

Lightning Aresstor, Antenna side

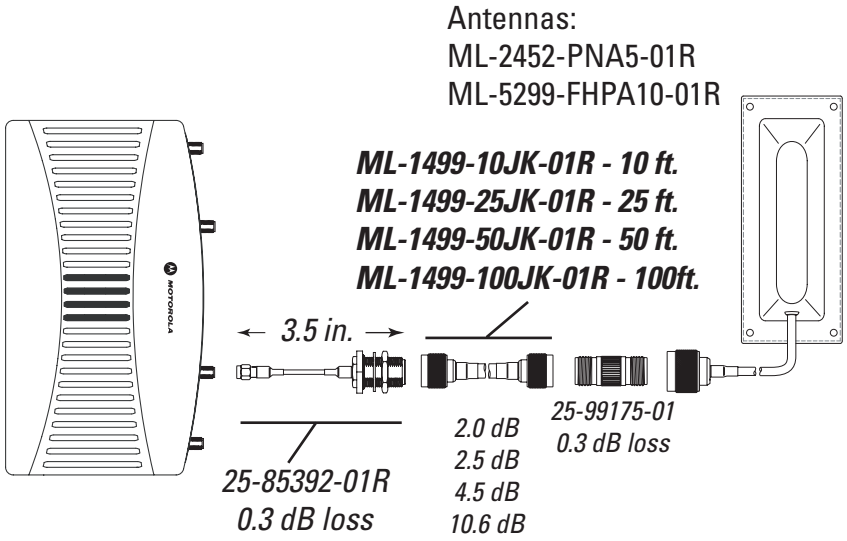


Lightning Aresstor, AP side

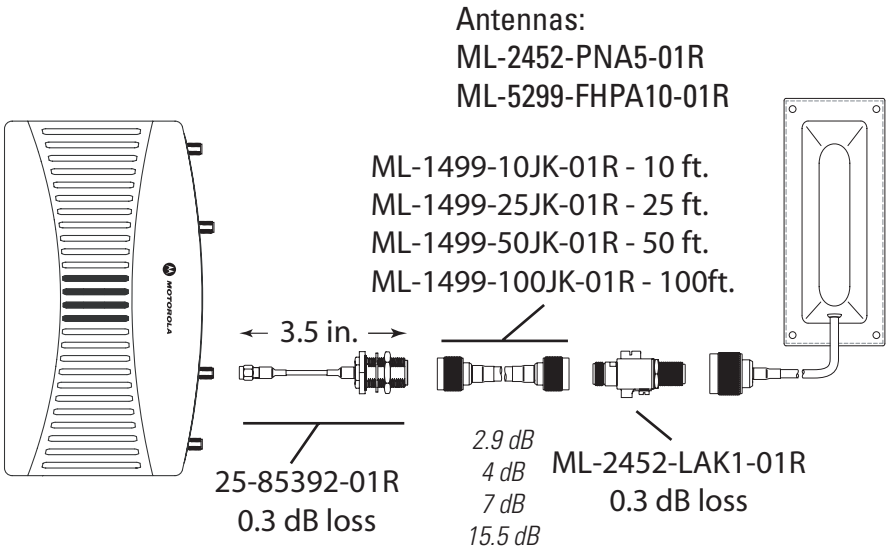


10.2.2 Type N Male Connector Installation

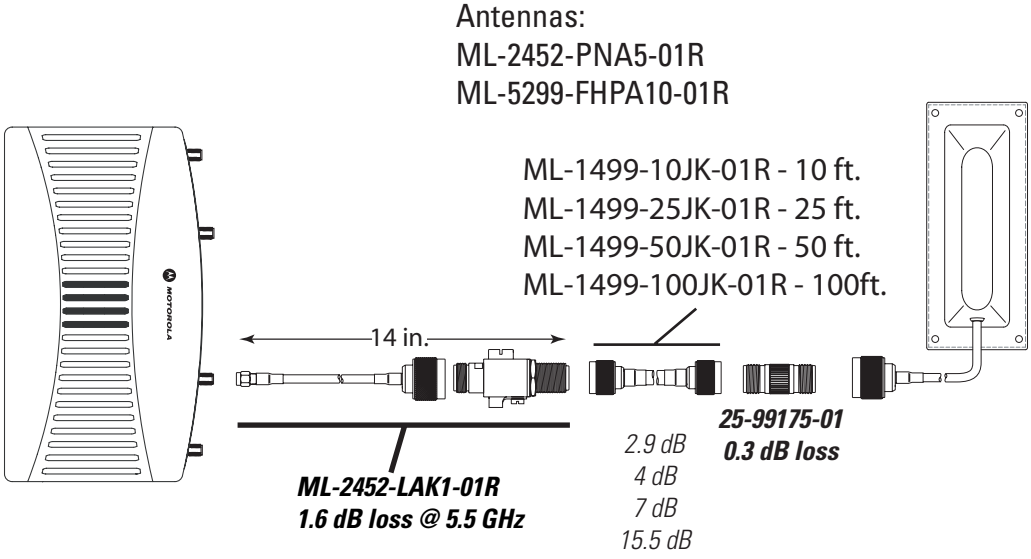
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP-5131 model access point using Type N male connectors:



Lightning Aresstor, Antenna side



Lightning Aresstor, AP side



11

AP300 Antenna Connections

This chapter describes how the 2.4 and 5 GHz antennas described within this guide are physically connected to an AP300 model access port. The information in this chapter supports an AP300 external antenna model only.

For more information, see:

- *2.4 GHz AP300 Antenna Connections*
- *5 GHz AP300 Antenna Connections*

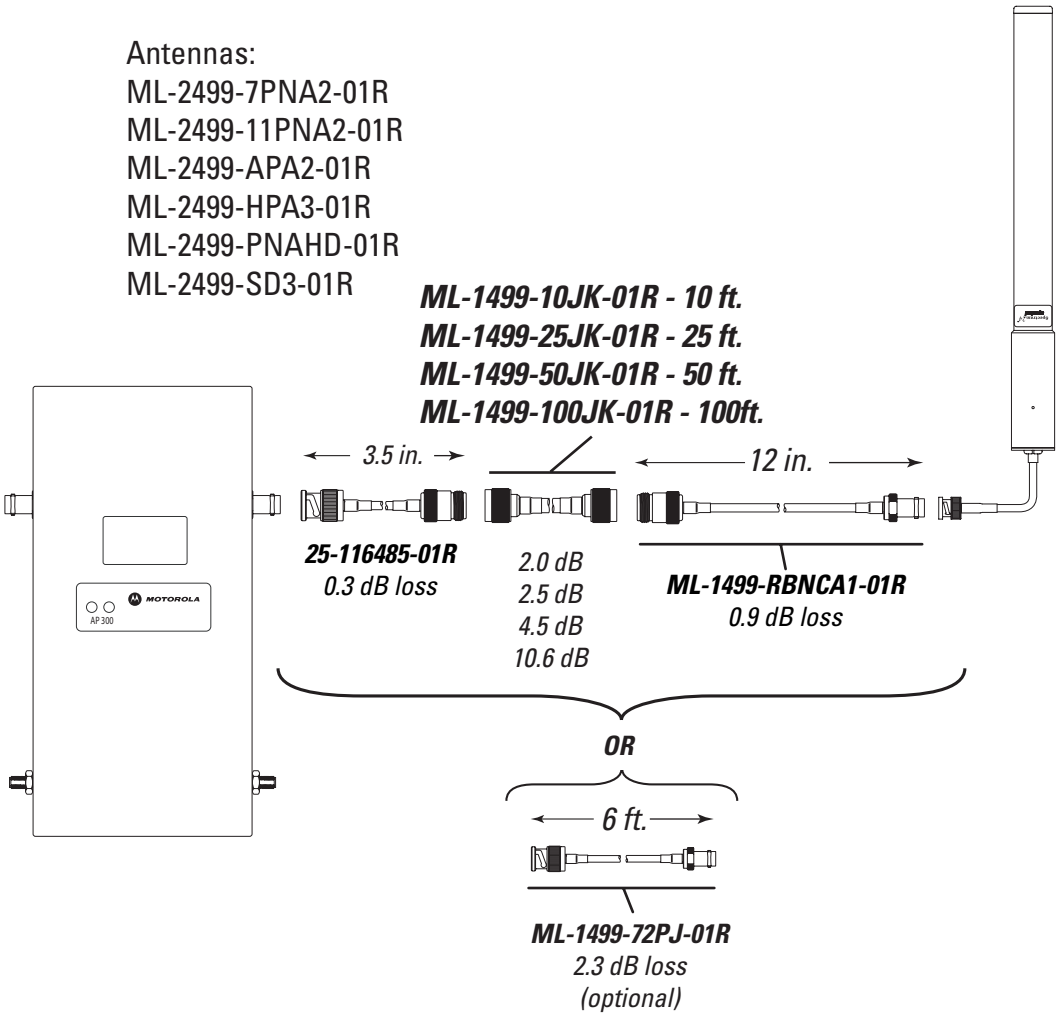
11.1 2.4 GHz AP300 Antenna Connections

This section describes how the components described within this guide are used collectively in the following AP300 installation scenarios supporting the 2.4 GHz band:

- *RP-BNC Male Antenna Installation*
- *Type N Female Connector Installation*
- *Type N Male Connector Installation*

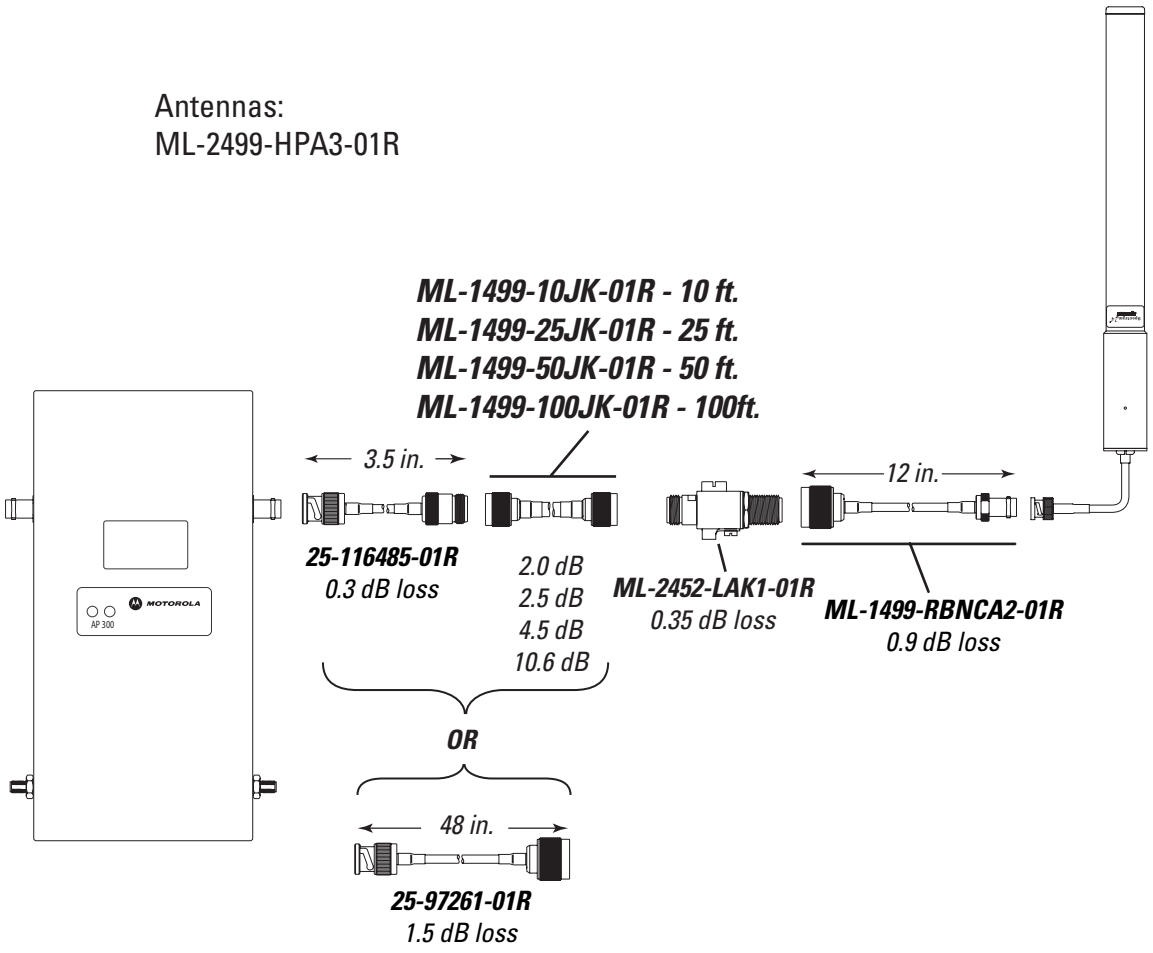
11.1.1 RP-BNC Male Antenna Installation

Refer to the following for a graphical depiction of the parts and connection options available for cabling an 2.4 GHz AP300 model access port using RP-BNC male antennas:

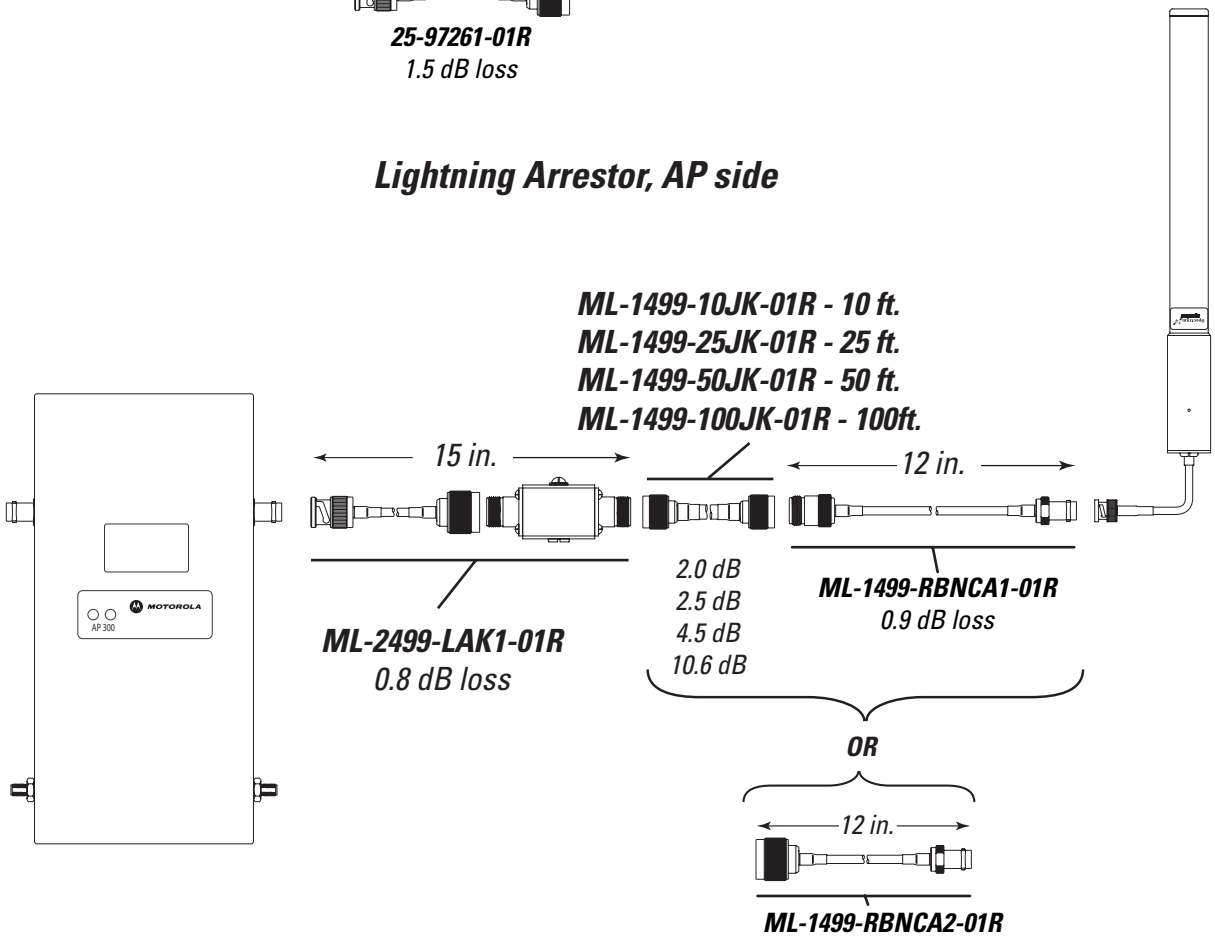


Lightning Arrestor, Antenna side

Antennas:
ML-2499-HPA3-01R

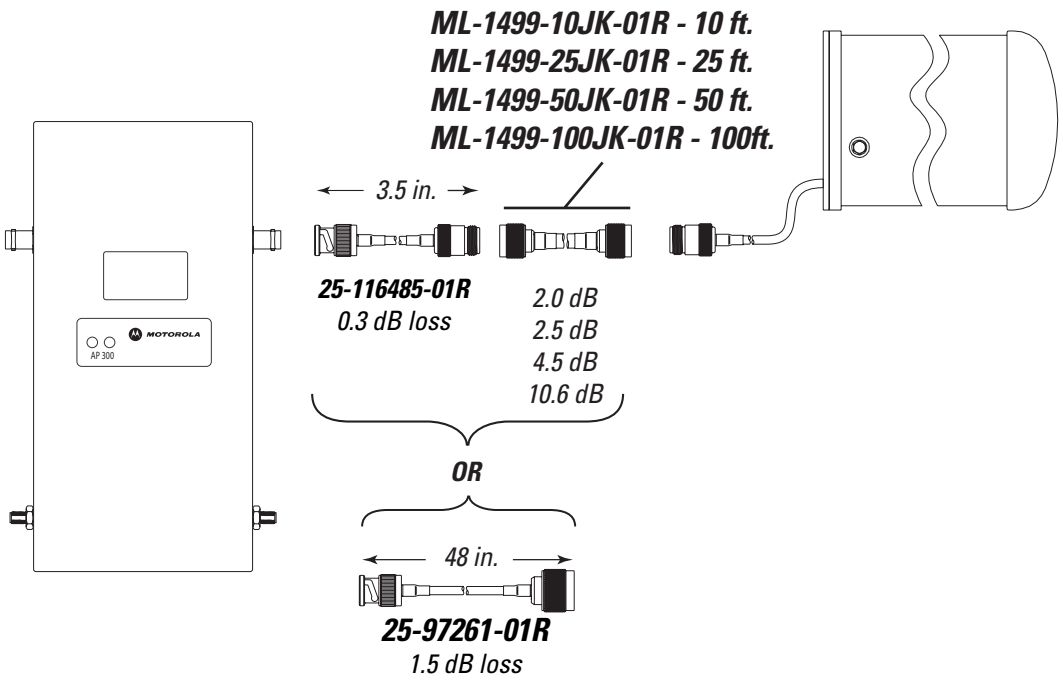


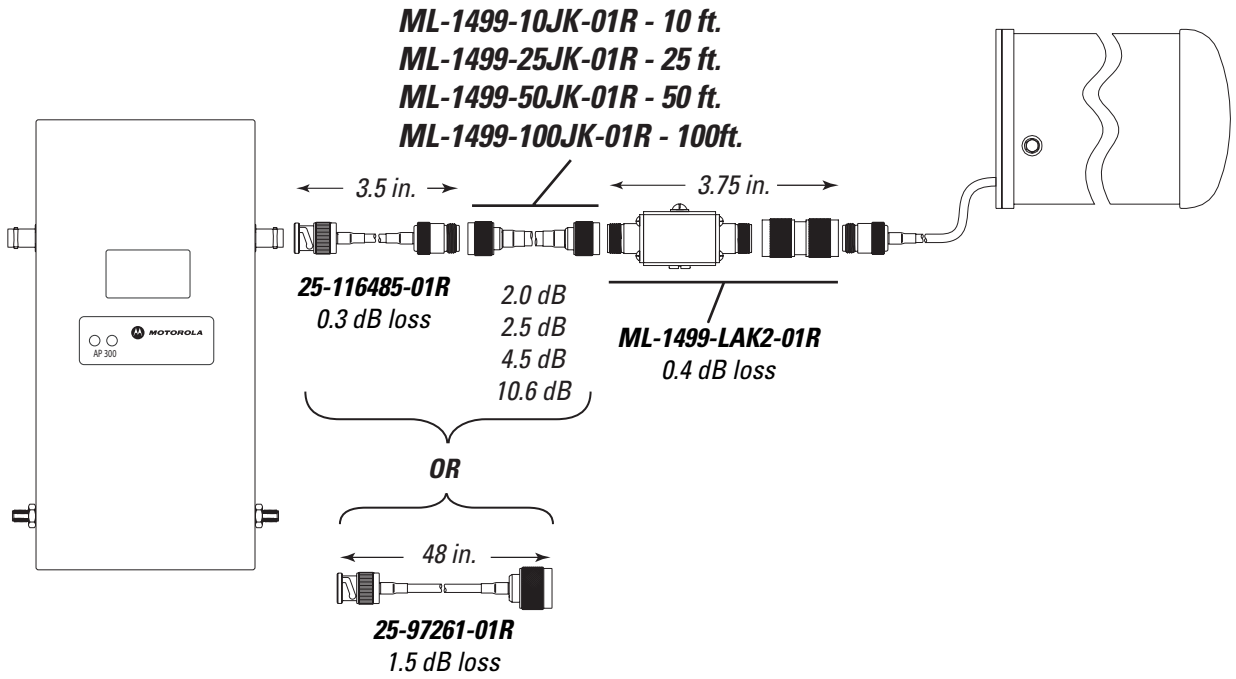
Lightning Arrestor, AP side



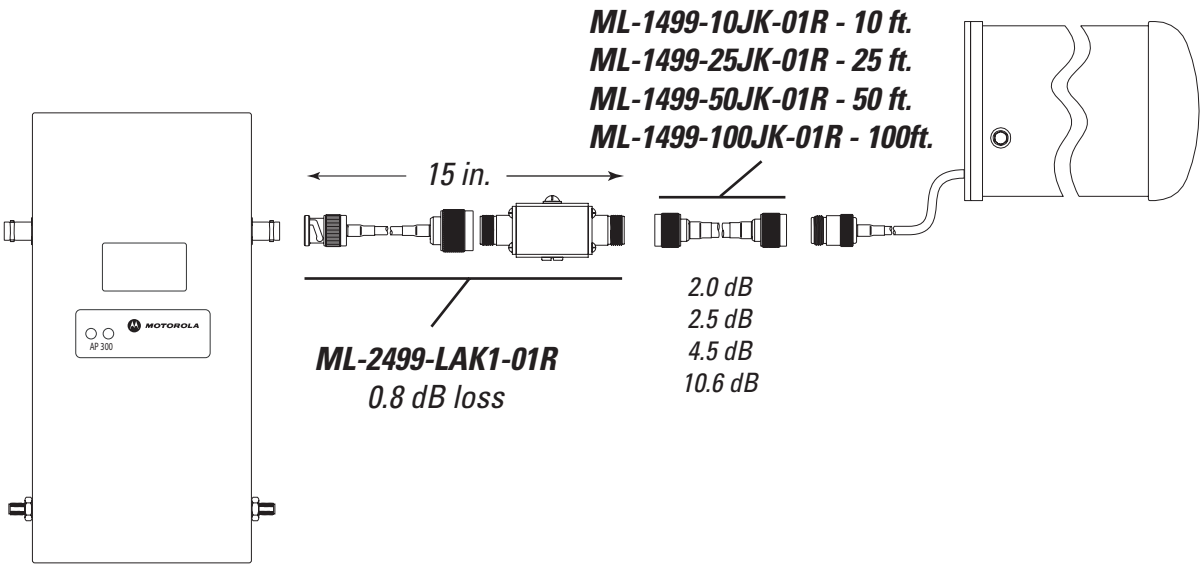
11.1.2 Type N Female Connector Installation

Refer to the following for a graphical depiction of the parts and connection options available for cabling an 2.4 GHz AP300 model access port using Type N female connectors.



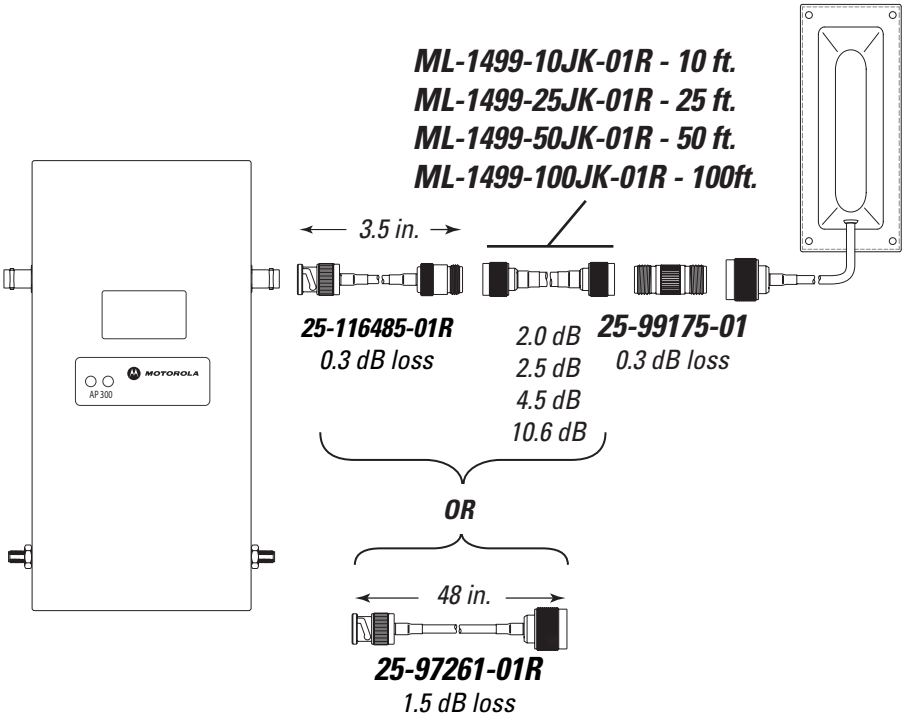


Lightning Aresstor, AP side

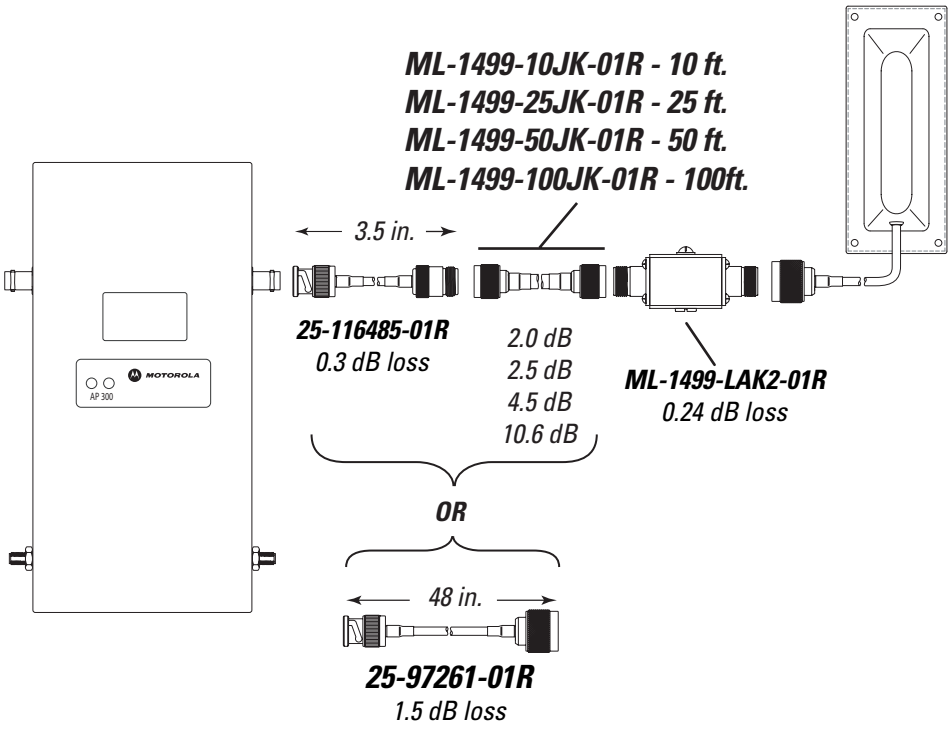


11.1.3 Type N Male Connector Installation

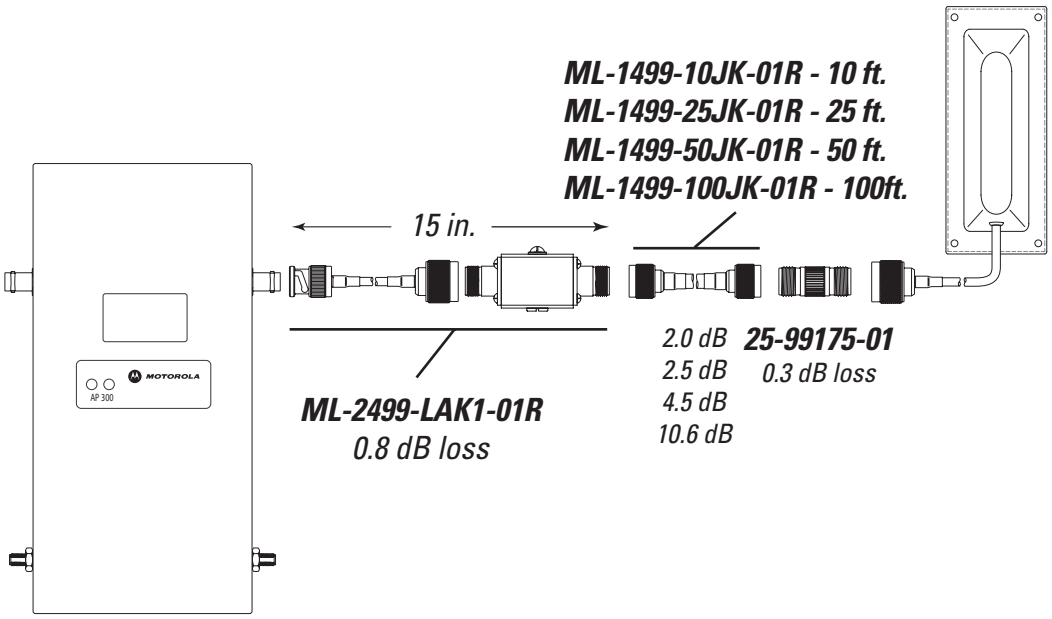
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 2.4 GHz AP300 model access port using Type N male connectors:



Lightning Arrestor, Antenna side



Lightning Arrestor, AP side



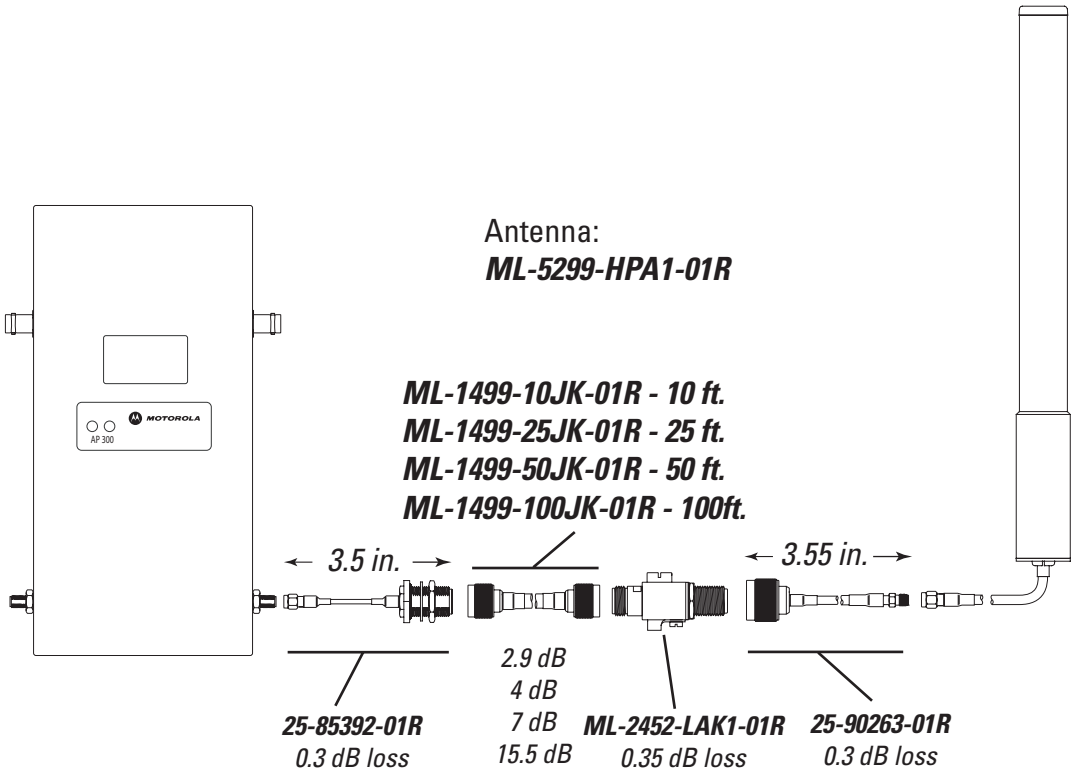
11.2 5 GHz AP300 Antenna Connections

This section describes how the components described within this guide are used collectively in the following AP300 installation scenarios supporting the 5 GHz band:

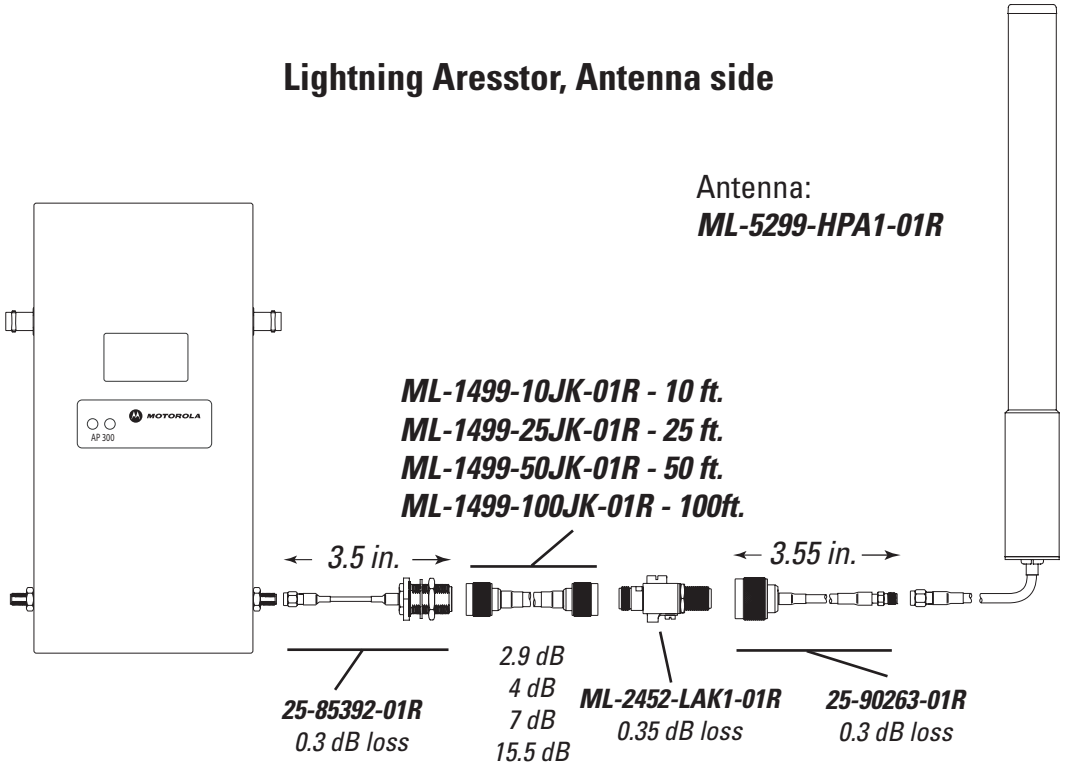
- *RP-SMA Male Antenna Installation*
- *Type N Male Connector Installation*

11.2.1 RP-SMA Male Antenna Installation

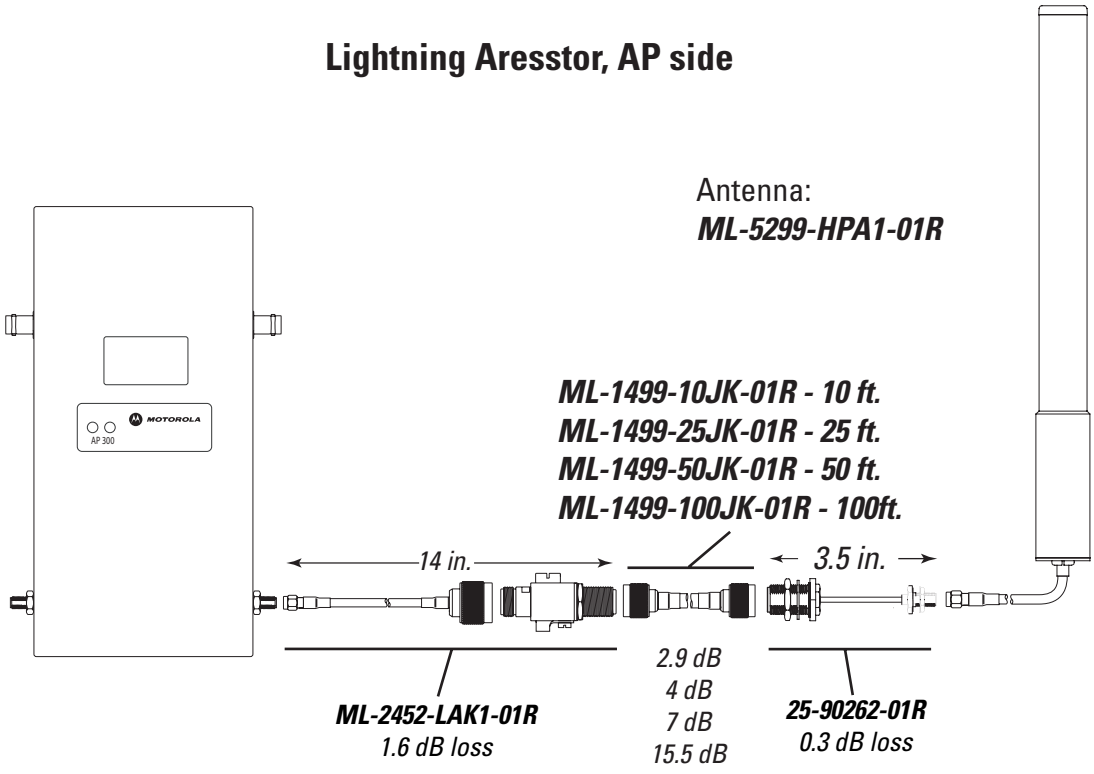
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP300 model access port using a RP-SMA male antenna.



Lightning Aresstor, Antenna side

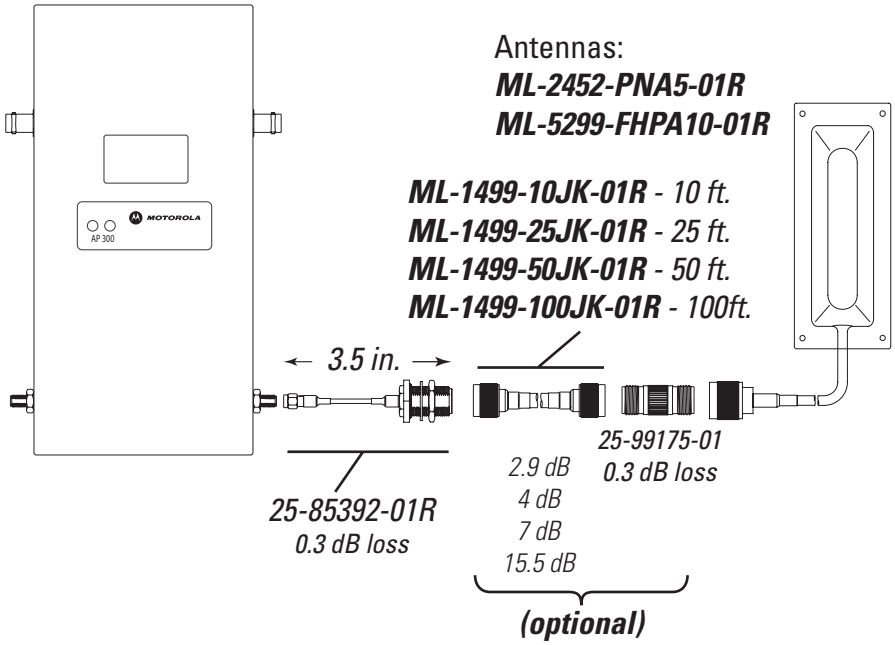


Lightning Aresstor, AP side

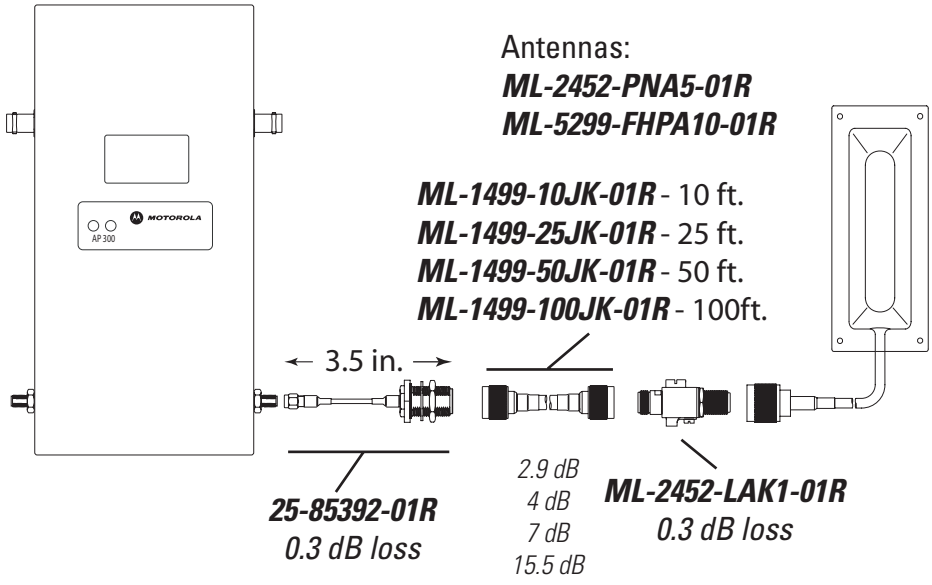


11.2.2 Type N Male Connector Installation

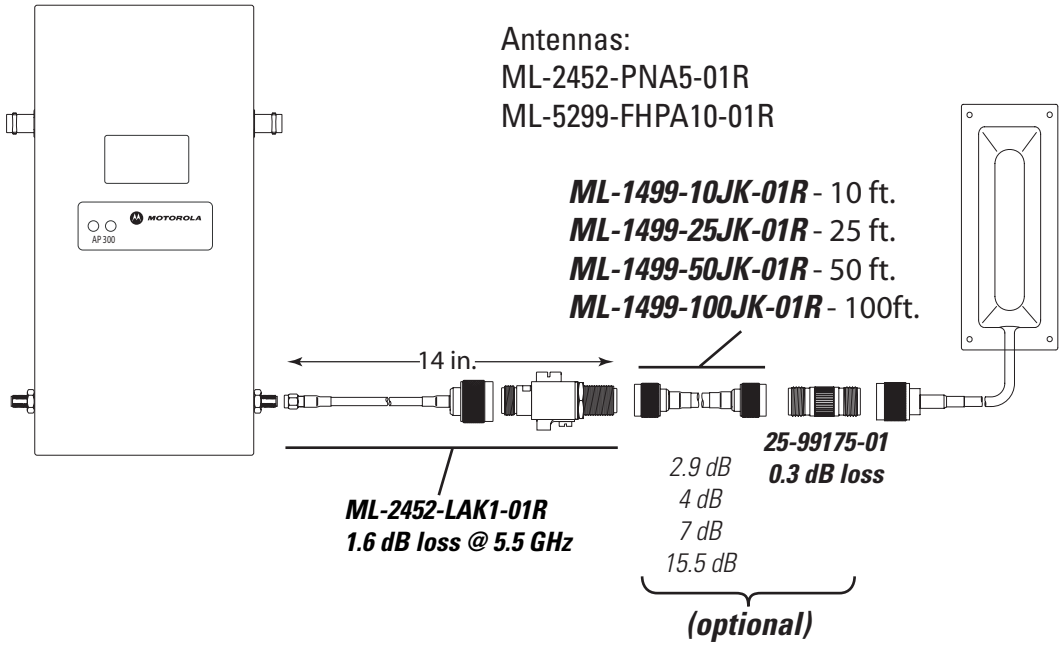
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP300 model access port using Type N male connectors:



Lightning Aresstor, Antenna side



Lightning Aresstor, AP side



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Technical Support

Comprehensive on-line support is available at the Support Central site at http://www.symbol.com/support/. Support Central provides our customers with a wealth of information and online assistance including developer tools, software downloads, product manuals and online repair requests.

When contacting the Motorola Support Center, please provide the following information:

- *serial number of unit*
- *model number or product name*
- *software type and version number.*

North American Contacts

Support (for warranty and service information):

telephone: 1-800-653-5350

fax: (631) 738-5410

Email: *emb.support@motorola.com*

International Contacts

Outside North America:

Motorola, inc.

Symbol Place

Winnersh Triangle, Berkshire, RG41 5TP

United Kingdom

0800-328-2424 (Inside UK)

+44 118 945 7529 (Outside UK)

Web Support Sites

Product Downloads

http://www.symbol.com/downloads

Manuals

http://support.symbol.com/support/product/manuals.do

Additional Information

Obtain additional information by contacting Motorola at:

1-800-722-6234, inside North America

+1-516-738-5200, in/outside North America

http://www.motorola.com/

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