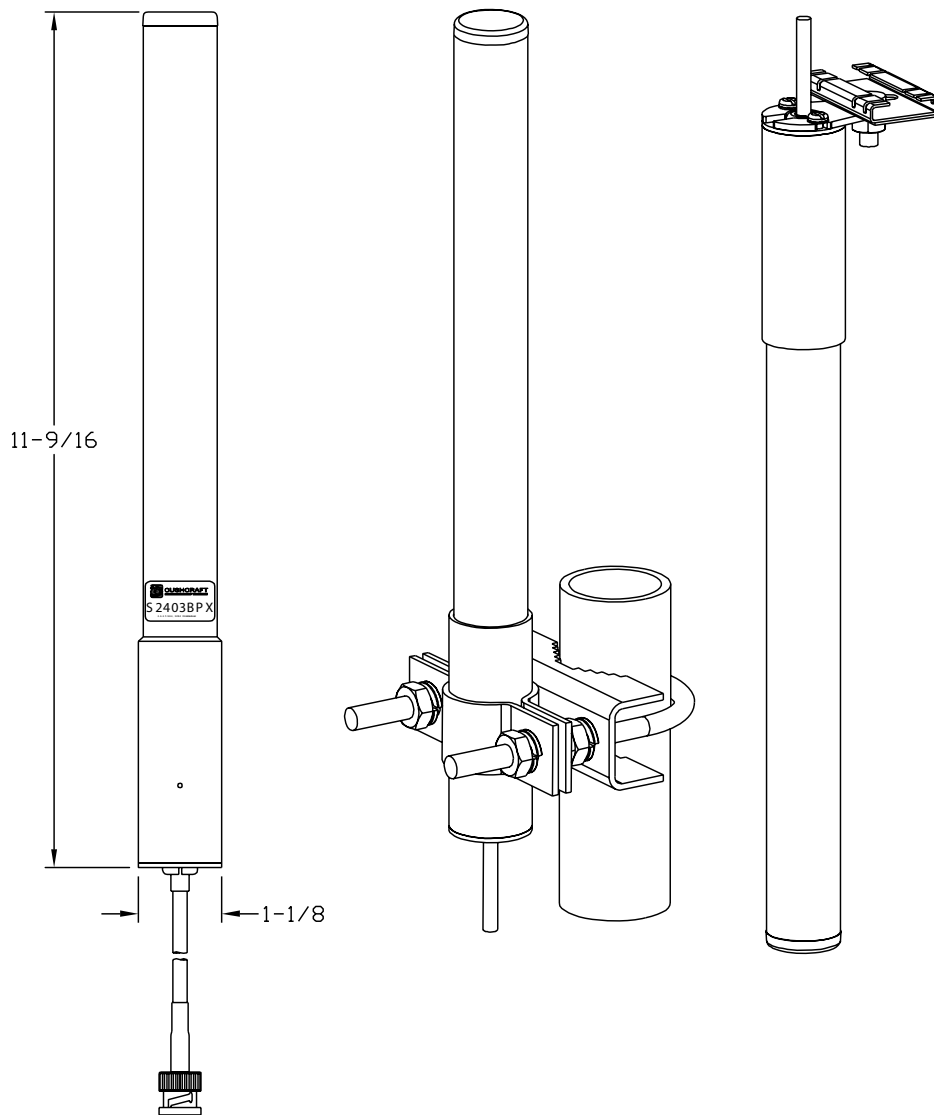


Enterprise Wireless LAN Antenna

Specification Guide

Version 1.4 August 2009



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Appendix A. Technical Support

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.

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, AP-5181 or AP-7131 series 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-5131 are **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 unpredictable weather, lightning protection is integrated into the device design. As such, no additional lightning protection is required.

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

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 | X | |
| | 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 true 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 information 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 information on the 5 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 information 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.

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 Parabolic Grid

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

1.2.2.6 Yagi

A yagi antenna is an 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 attenuation 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 serviceability 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.

Product Compatibility

To find the right antenna and accessories for your AP-5131, AP-5181, AP-7131 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.



NOTE: The product compatibility chart on the next displays a global compatibility matrix, and does not apply to FCC USA specific compatibility. For information specific to FCC USA compatibility, see [Antenna Suite Summary on page 2-3](#).

2.1 FCC/USA Compatibility

The following displays Motorola's FCC approved AP radio, antenna, cable and accessory combinations for use in the United States:

2.2 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.

| Part Number | Description | Cable | Gain (dBi) | Mount | Az BW | Outdoor | Plenum |
|--------------------|---|-------|------------|-------|-------|---------|--------|
| ML-5299-APA1-01R | ANT:5.5 GHZ, DP AJ,2DBI,CBL 0,SMARTP-F | none | 2 | S | 360 | No | No |
| ML-5299-PTA1-01R | ANT:5.5GHZ,PTCH,0 DBI,CBL 36",SMARTP-F | 36 in | 4.6 | 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 | 0 | V | 360 | Yes | No |
| ML-5299-FHPA10-01R | ANT:5.8 GHZ, FIXED DP, 10DBI, TYPE N-M | none | 8 | 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 |
| 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 | 6 | 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 | -- |
| ML-2452-PTA2M3X3-1 | ANT:11ABG,AP7131,MIMO3X3,2DBI,1IN,RPSMA | n/a | 3 / 5 | S | 360 | No | No |
| ML-2452-APA2-01 | ANT:2.4-5.2GHZ DUALBAND,DP,2DBI,SMARTP-F | none | 6 / 7 | S | 360 | No | No |
| ML-2452-PTA3M3-036 | ANT:11ABG,MIMO3,PTCH,3 DBI,36IN,RPSMA | 36 in | 3 / 7 | 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 | 4.5/5.0 | 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 |



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>.

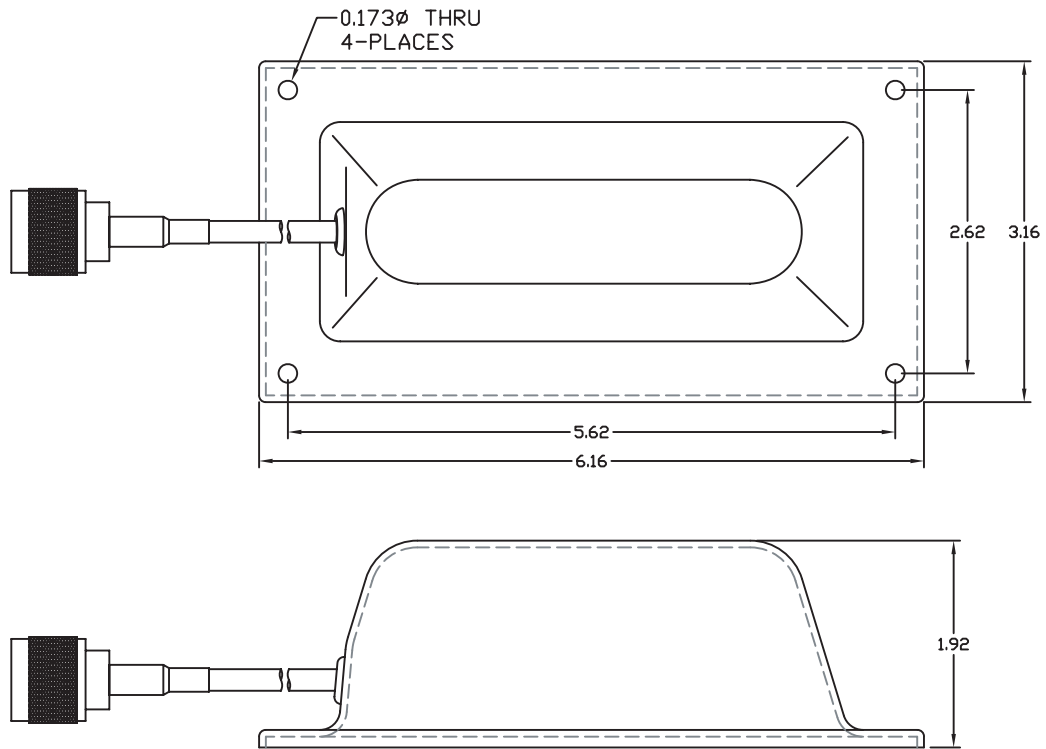
For detailed information on supported 802.11b/g/n antenna models, refer to:

- *ML-2499-5PNL-72-N Outdoor 135° Panel Antenna: Male Connector*
- *ML-2499-7PNA2-01R Indoor 60° Diversity Panel: RP-BNC Male*
- *ML-2499-11PNA2-01R Outdoor 97° Sector Panel: RP-BNC Male*
- *ML-2499-APA2-01R Indoor Rubber Flex, Elbow Joint Dipole: RP-BNC Male*
- *ML-2499-BPDA1-01R Outdoor 10° High-Gain Dish: 20.5 N Female*
- *ML-2499-BPNA3-01R Outdoor 35° High-Gain Directional Panel: Type N - Female*
- *ML-2499-BYGA2-01R Outdoor 35° High-Gain Directional Yagi: N Female*
- *ML-2499-HPA3-01R High Performance Omni-Directional "Pipe" Antenna: RP-BNC Male*
- *ML-2499-PNAHD-01R Indoor 55° Directional Panel: RP-BNC Male*
- *ML-2499-SD3-01R Low Profile Ceiling/Surface Mount Omni-Directional Patch: RP-BNC Male*
- *ML-2499-FHPA5-01R Omni-Directional "Pipe" Antenna: N Male Connector*
- *ML-2499-FHPA9-01R High Performance Fixed Point Dipole: Male Connector*

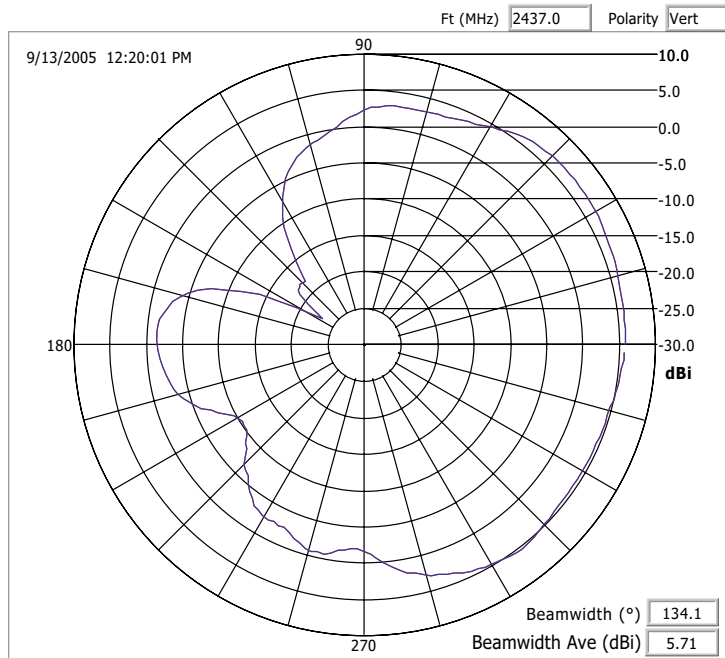


NOTE: For examples on how various antenna and connectors are deployed in a 2.4 GHz AP-5131 installation, see [2.4 GHz AP-5131 Antenna Connections](#).

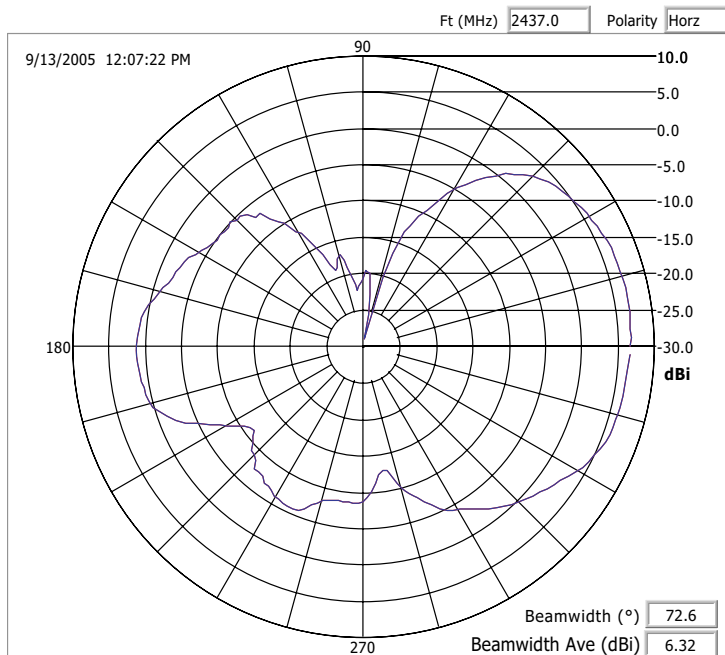
3.1.1 ML-2499-5PNL-72-N Outdoor 135° Panel Antenna: Male Connector



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

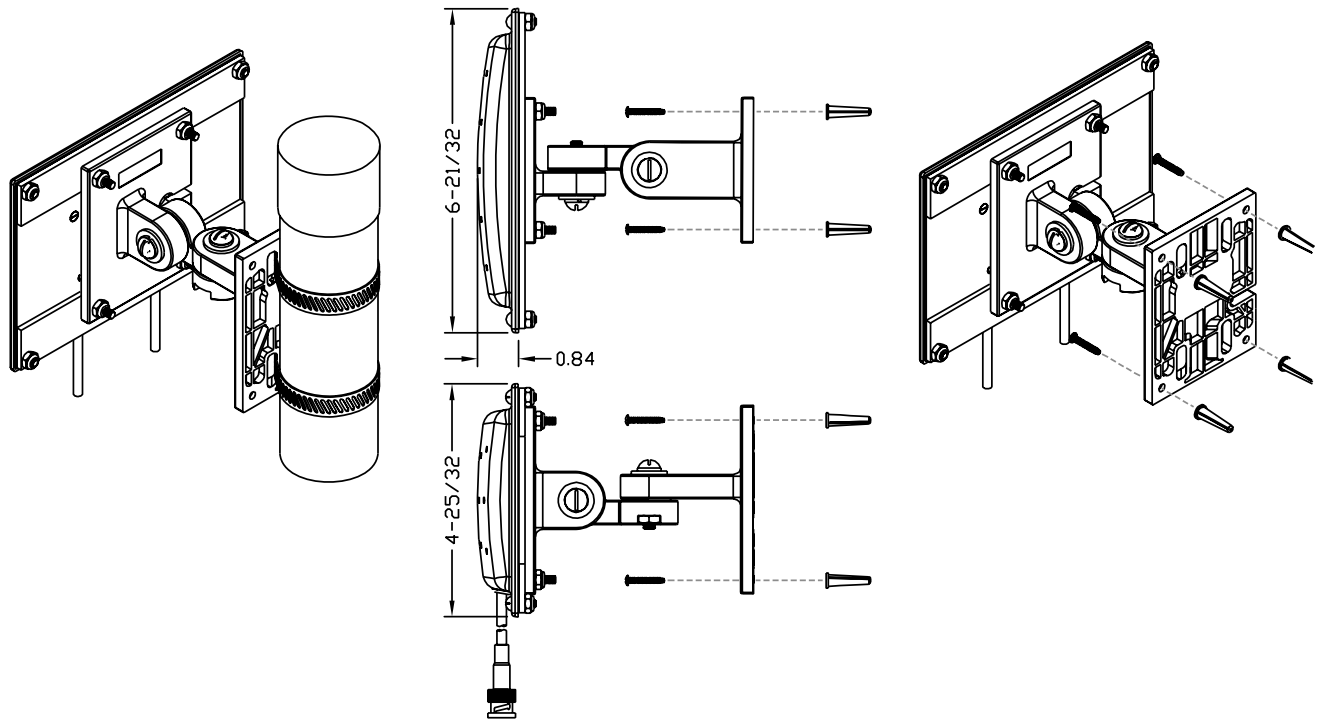


Azimuth Pattern

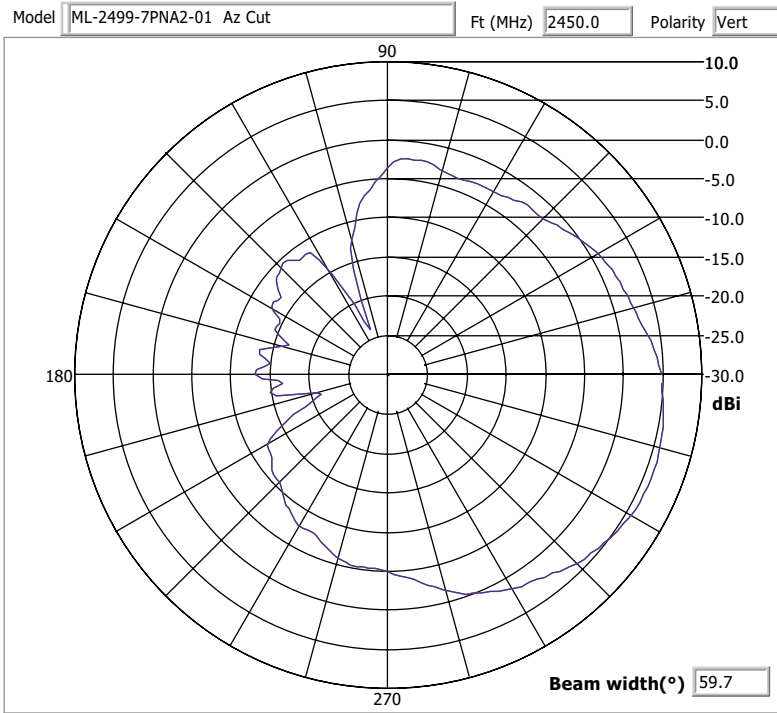


Elevation Pattern

3.1.2 ML-2499-7PNA2-01R Indoor 60° Diversity Panel: RP-BNC Male

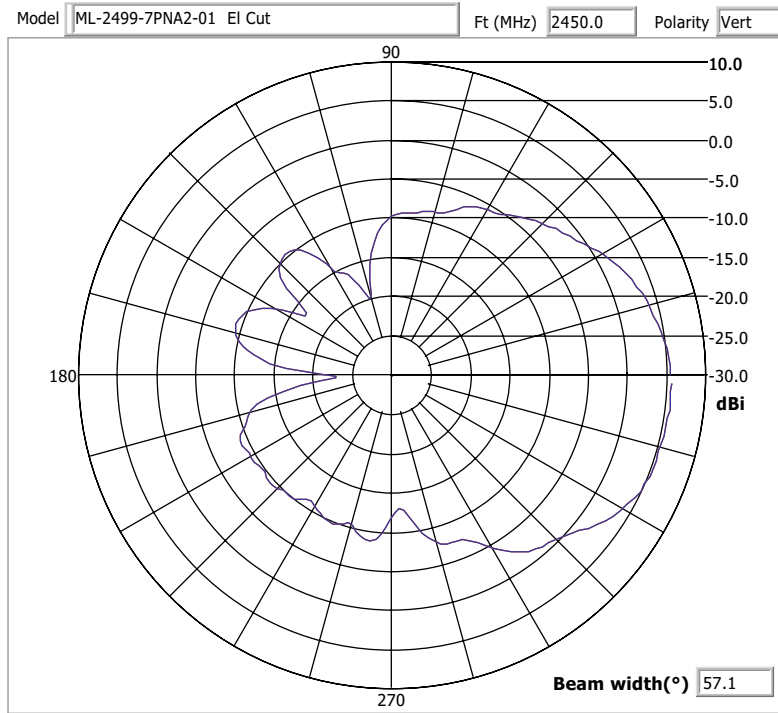


| | |
|--------------------|-----------------------|
| Type | Panel x 2 (Diversity) |
| Frequency | 2400-2500 MHz |
| Gain (dBi) | 6.3 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 60° |
| Elevation | 3dB Beamwidth: 60° |
| Cable Length (in.) | 48 |
| Cable Type | RG-58 Ultralink |
| Connector Type | RP-BNC Male x 2 |
| Weight | 0.6 lbs |
| Plenum Antenna | No |
| Plenum Cable | Yes |
| Outdoor | No |



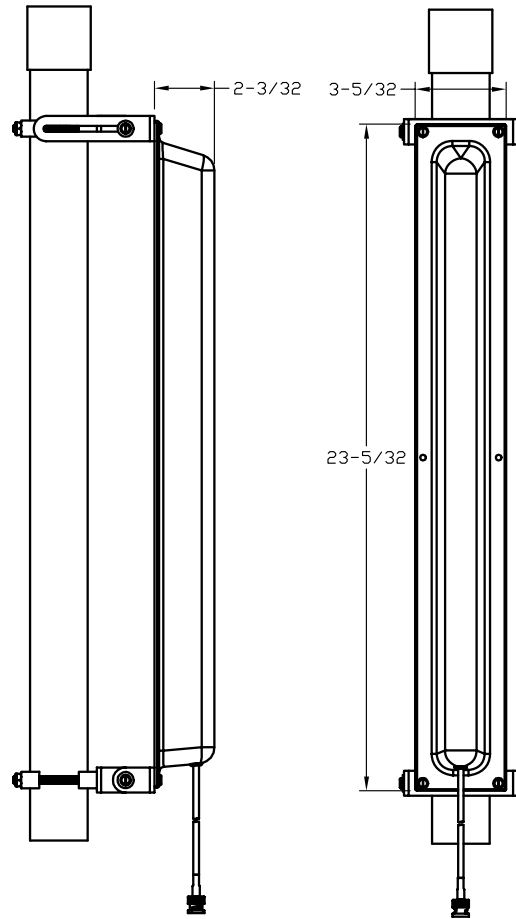
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Azimuth Cut

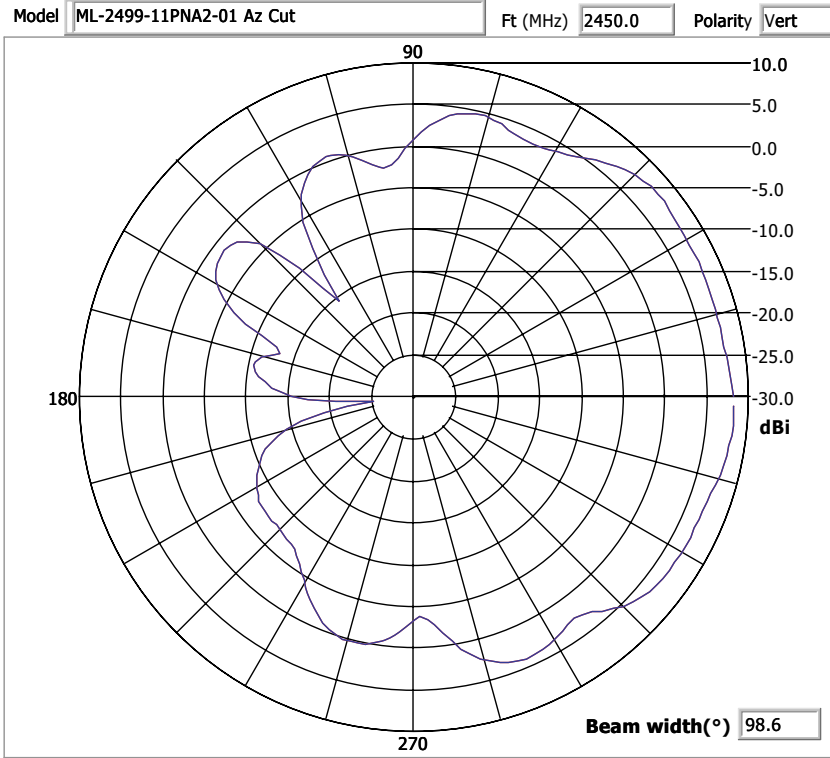


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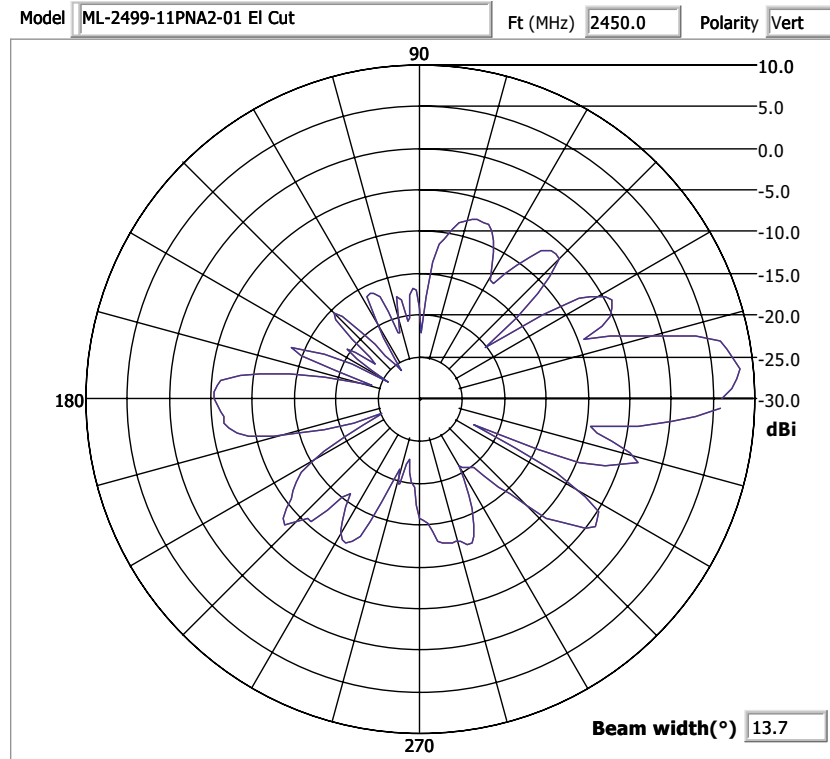
Elevation Cut

3.1.3 ML-2499-11PNA2-01R Outdoor 97° Sector Panel: RP-BNC Male

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

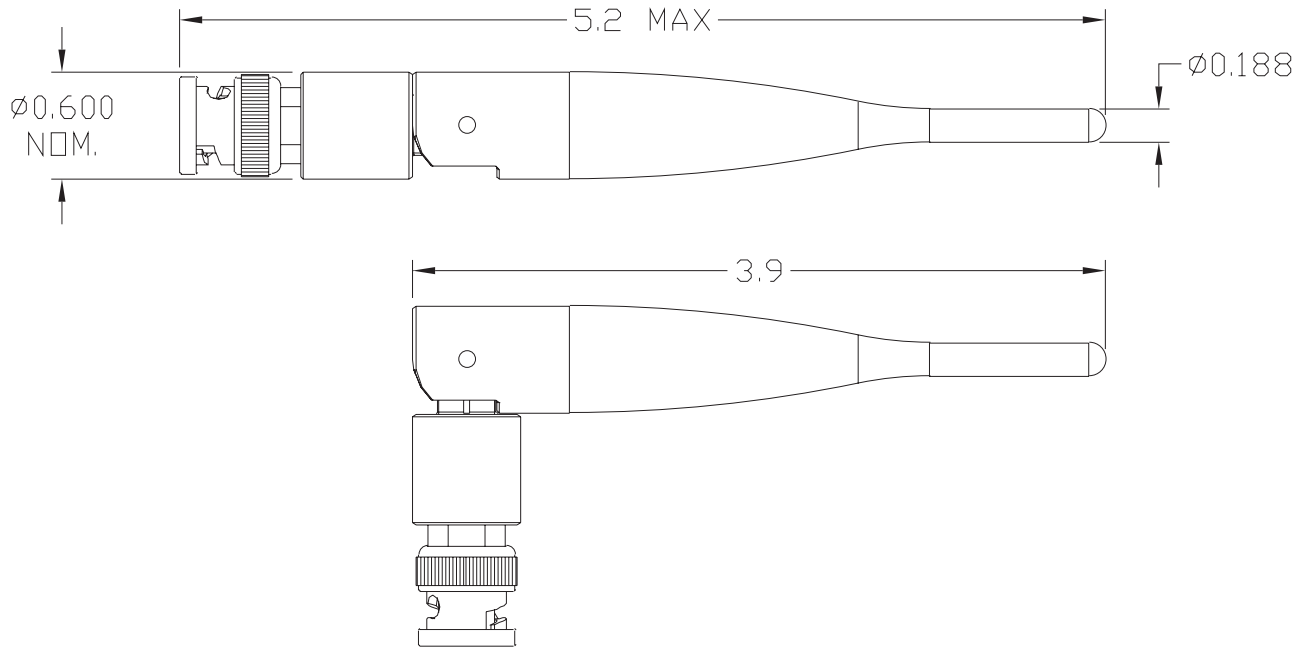


Azimuth Pattern

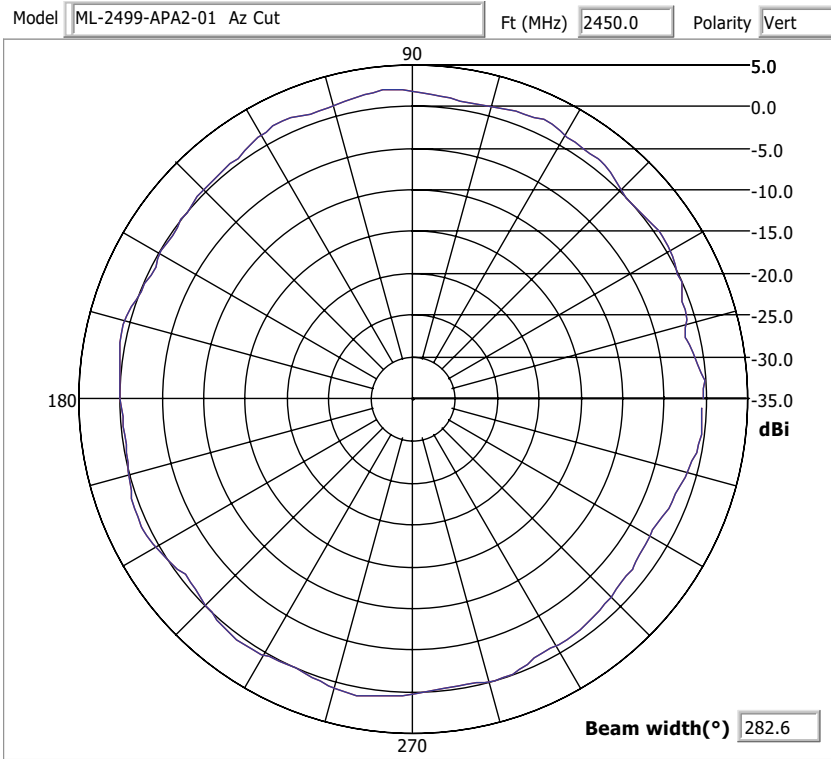


Elevation Pattern

3.1.4 ML-2499-APA2-01R Indoor Rubber Flex, Elbow Joint Dipole: RP-BNC Male

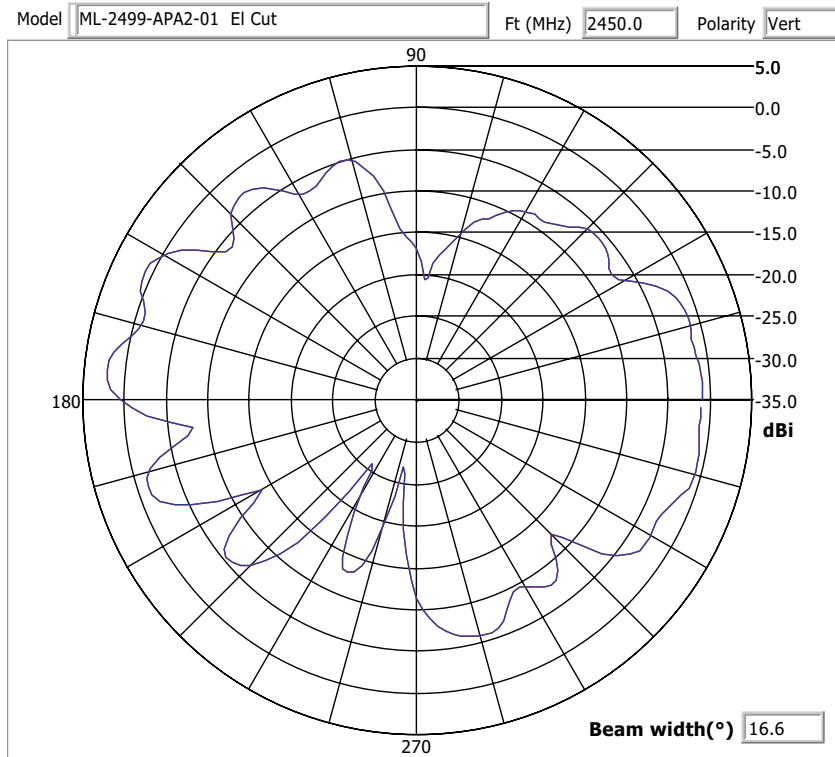


| | |
|--------------------|---------------------|
| Type | Dipole |
| Frequency | 2400-2500 MHz |
| Gain (dBi) | 2 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 360° |
| Elevation | 3dB Beamwidth: 60° |
| Cable Length (in.) | 0 |
| Cable Type | N/A |
| Connector Type | RP-BNC Male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



11/12/2003 4:13:41 PM

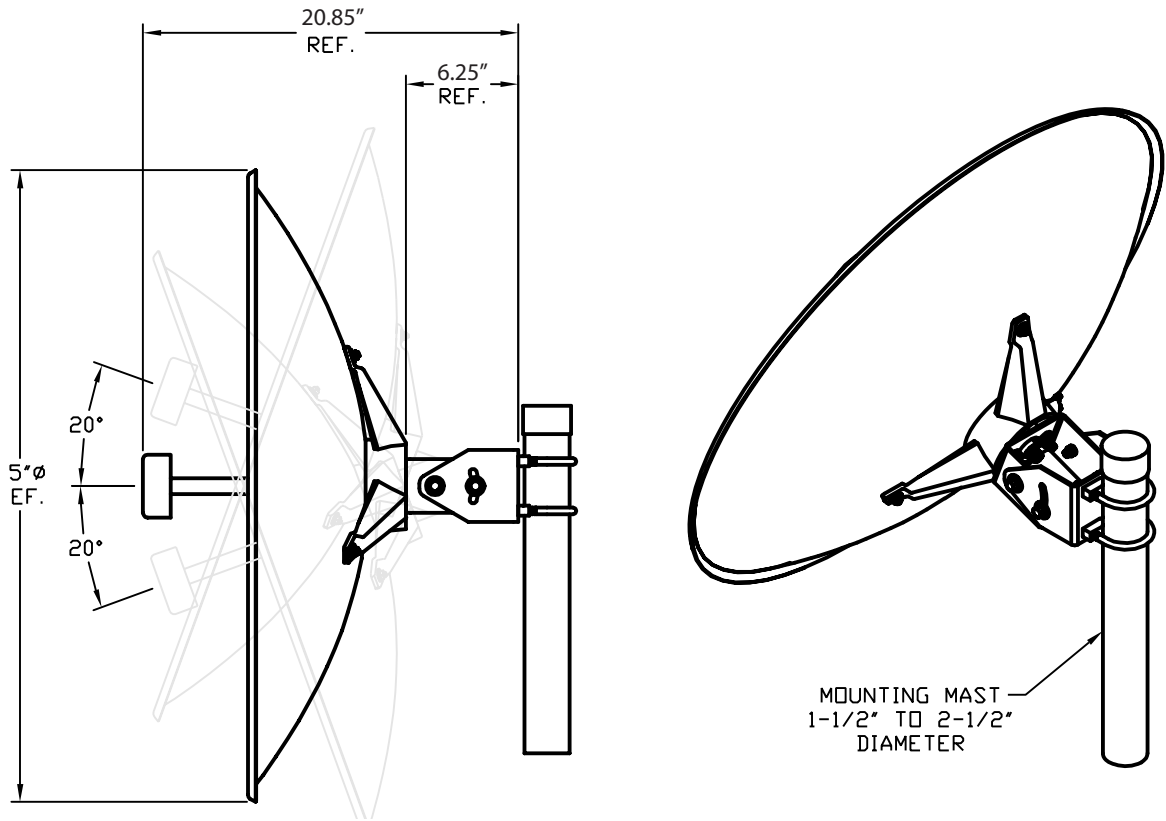
Azimuth Pattern



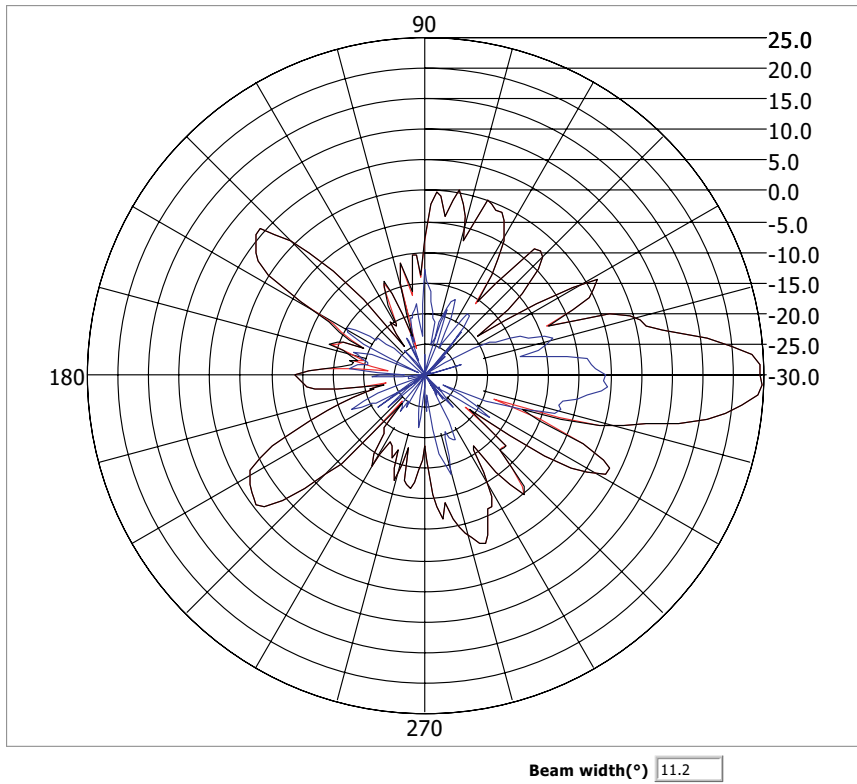
11/12/2003 4:08:24 PM

Elevation Pattern

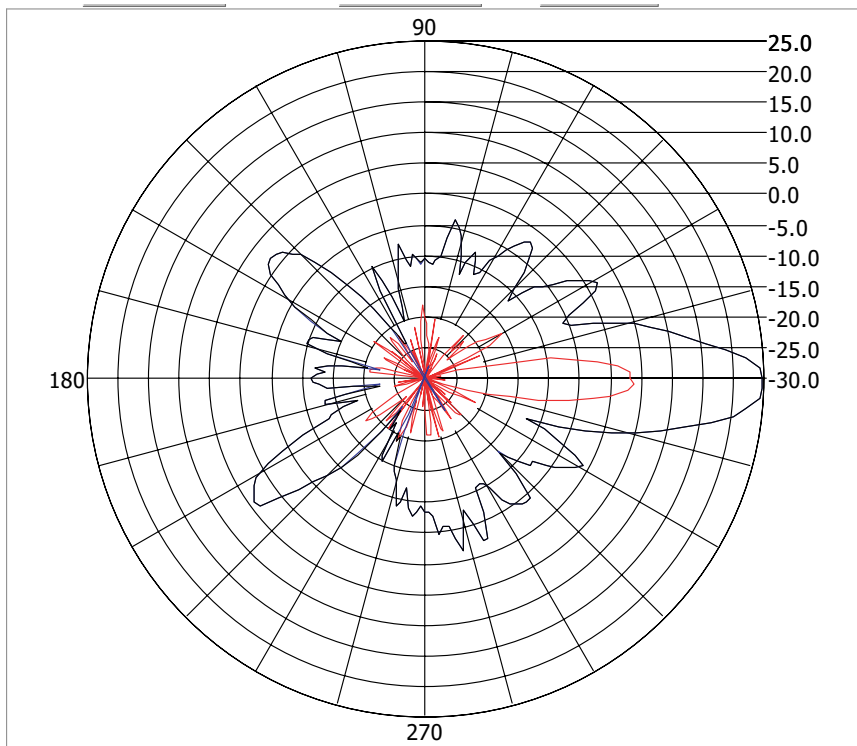
3.1.5 ML-2499-BPDA1-01R Outdoor 10° High-Gain Dish: 20.5 N Female



| | |
|--------------------|-------------------------------------|
| 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 |

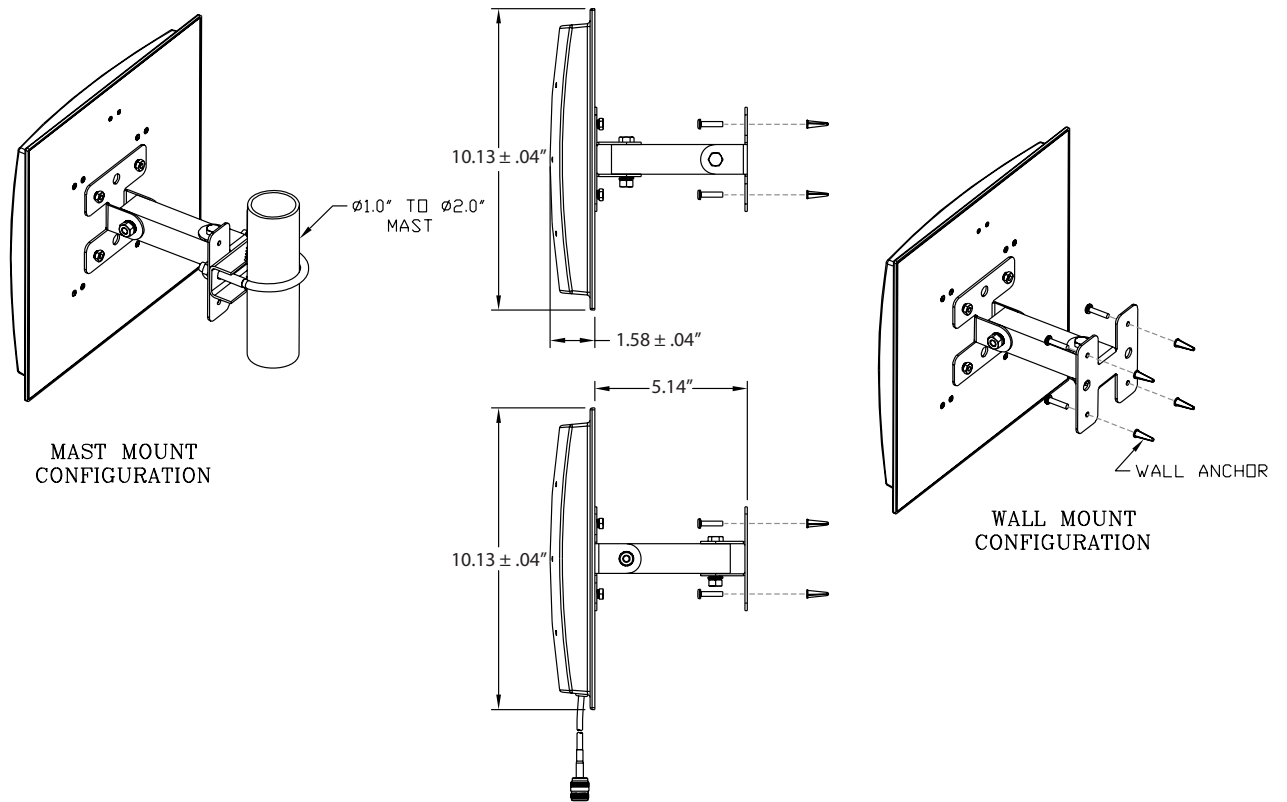


Azimuth Pattern

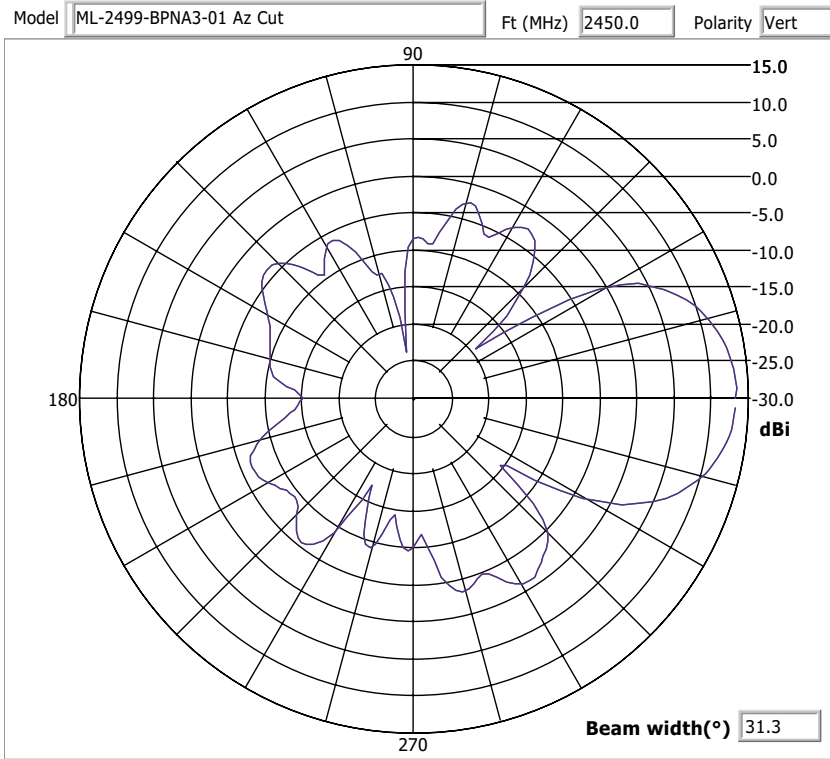


Elevation Pattern

3.1.6 ML-2499-BPNA3-01R Outdoor 35° High-Gain Directional Panel: Type N - Female

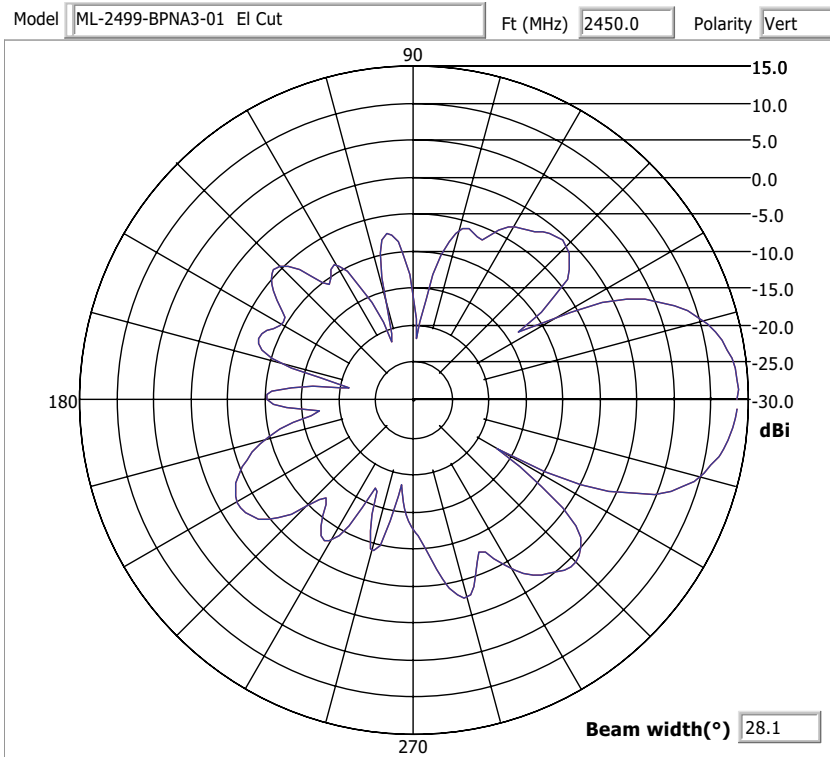


| | |
|--------------------|-------------------------------------|
| Type | Panel (Outdoor) |
| Frequency | 2400-2500 MHz |
| Gain (dBi) | 13.9 |
| Net Gain (dBi) | 10.9 (minimum cable configuration) |
| Cable Loss (dB) | 3 (minimum cable configuration) |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 35° |
| 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

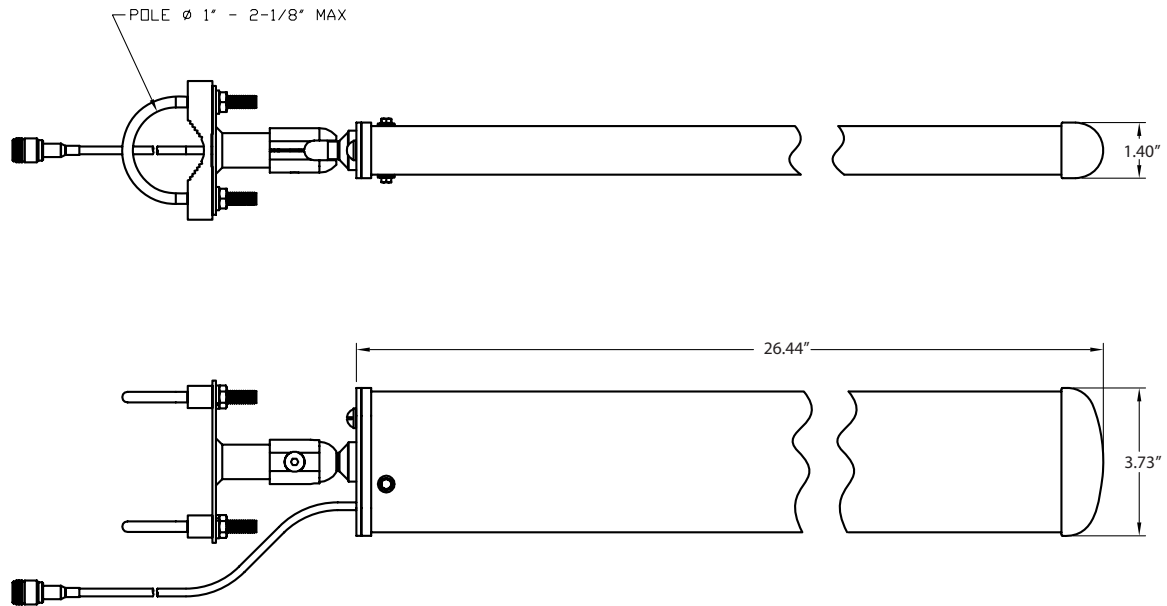
Azimuth Pattern



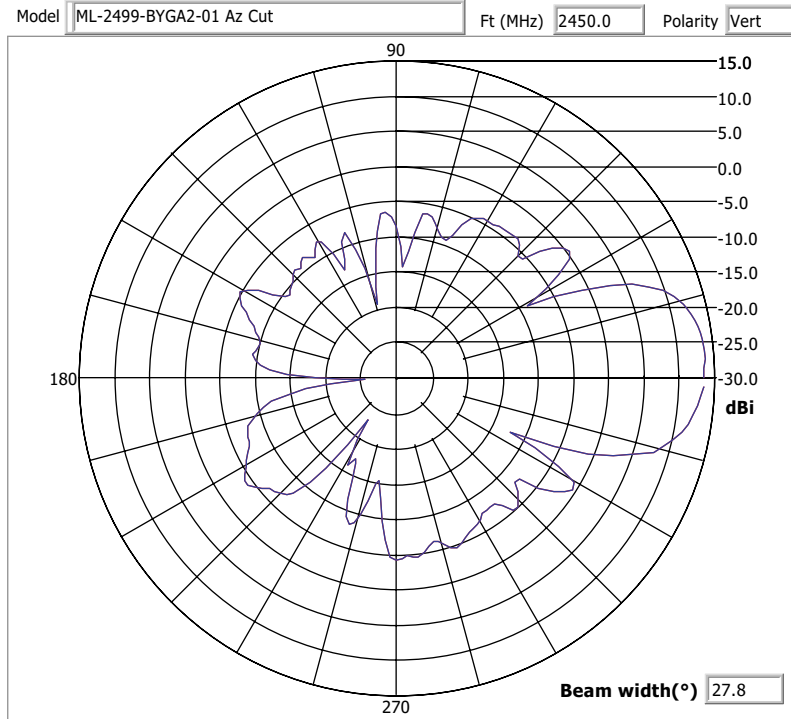
11/12/2003 4:44:40 PM

Elevation Pattern

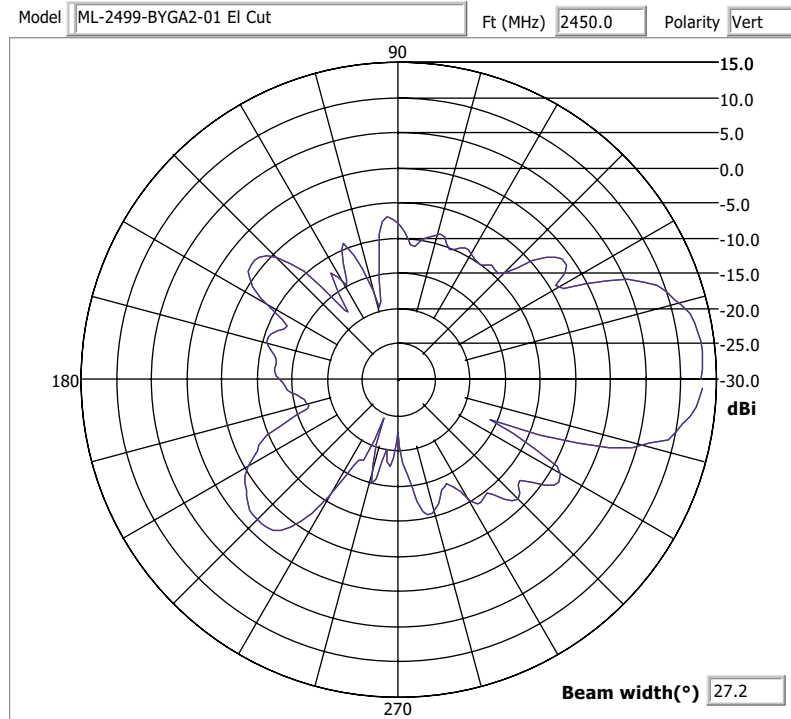
3.1.7 ML-2499-BYGA2-01R Outdoor 35° High-Gain Directional Yagi: N Female



| | |
|--------------------|---|
| 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 |
| Azimuth | 3dB Beamwidth: 35° |
| Elevation | 3dB Beamwidth: 30° |
| Cable Length (in.) | 12 |
| Cable Type | Varies per the cable configuration used |
| Connector Type | Type N - Female |
| Power | 50 W |
| Weight | 1.25 lb |

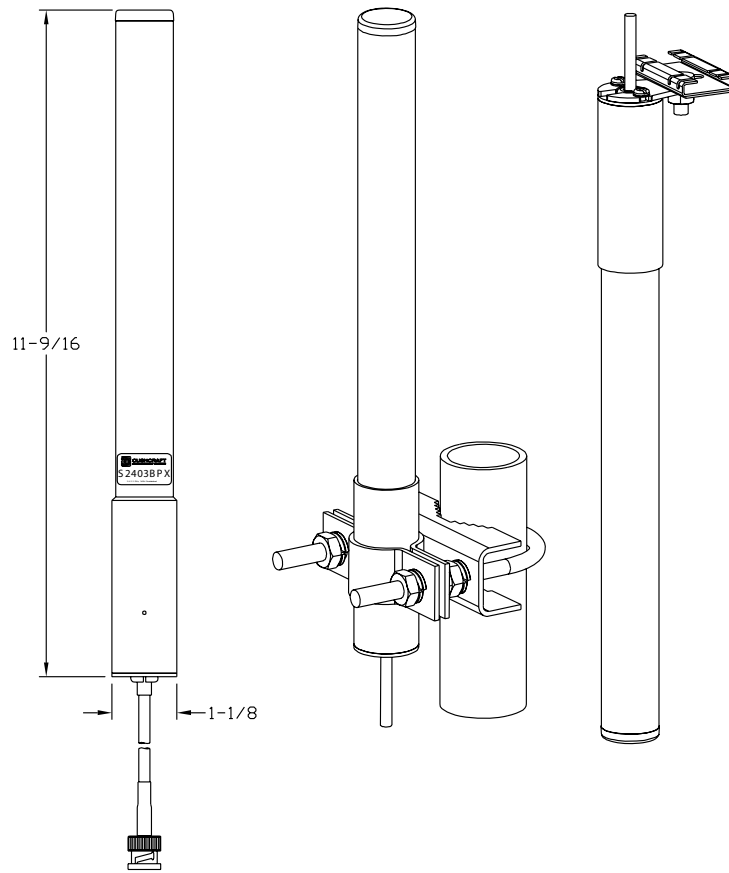


Azimuth Pattern

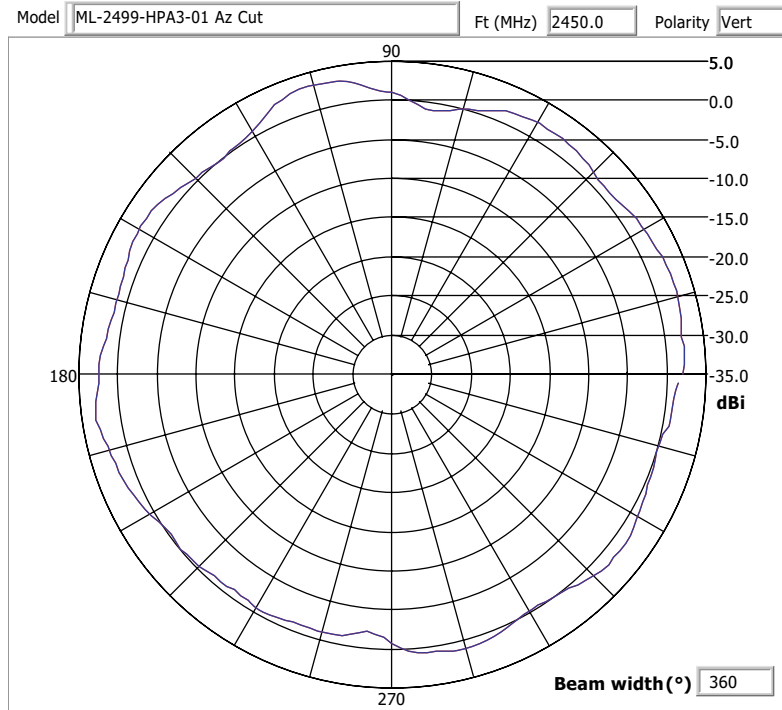


Elevation Pattern

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

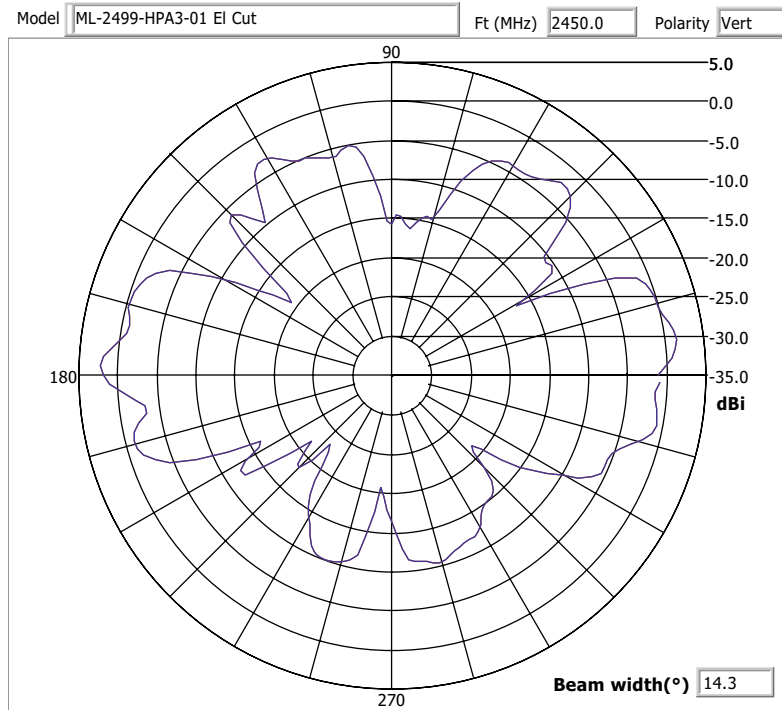


| | |
|--------------------|-----------------------------------|
| Type | Dipole Array |
| Frequency | 2400-2500 MHz |
| Gain (dBi) | 3.3 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 360° |
| Elevation | 3dB Beamwidth: 31° |
| Cable Length (in.) | 48 |
| Cable Type | RG-58 Ultralink |
| 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

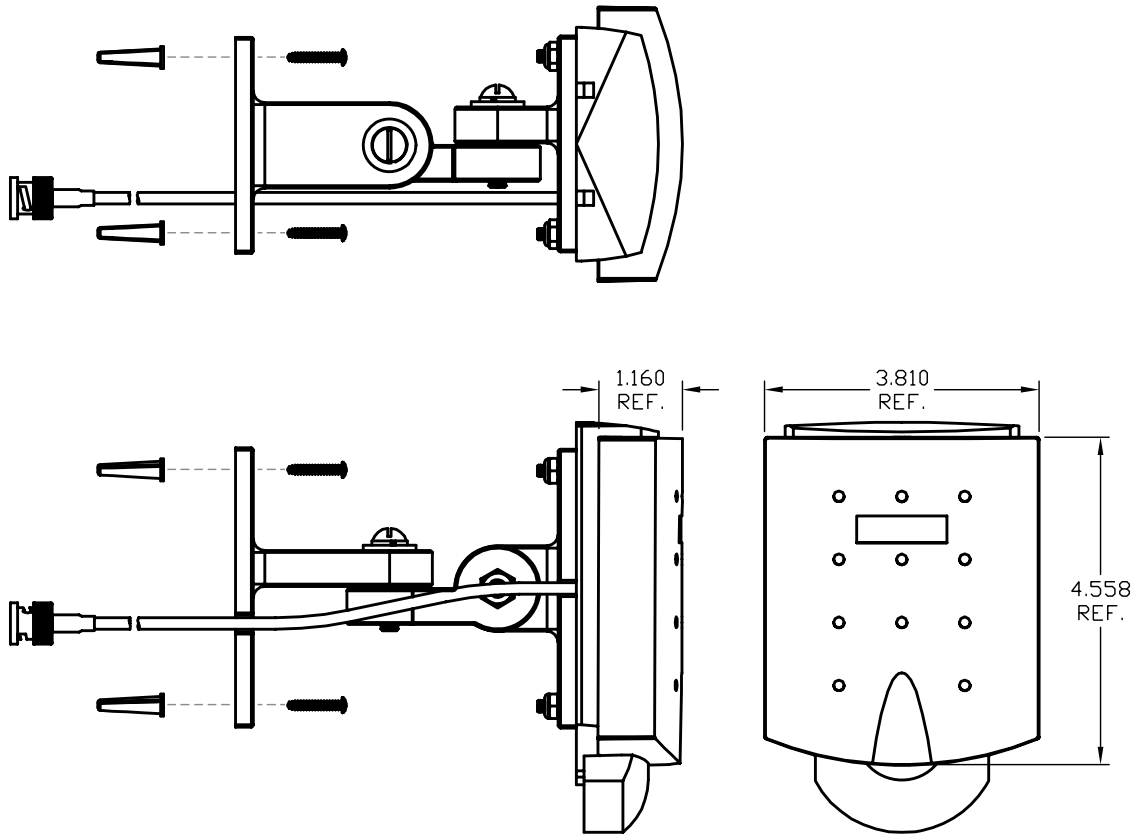
Azimuth Pattern



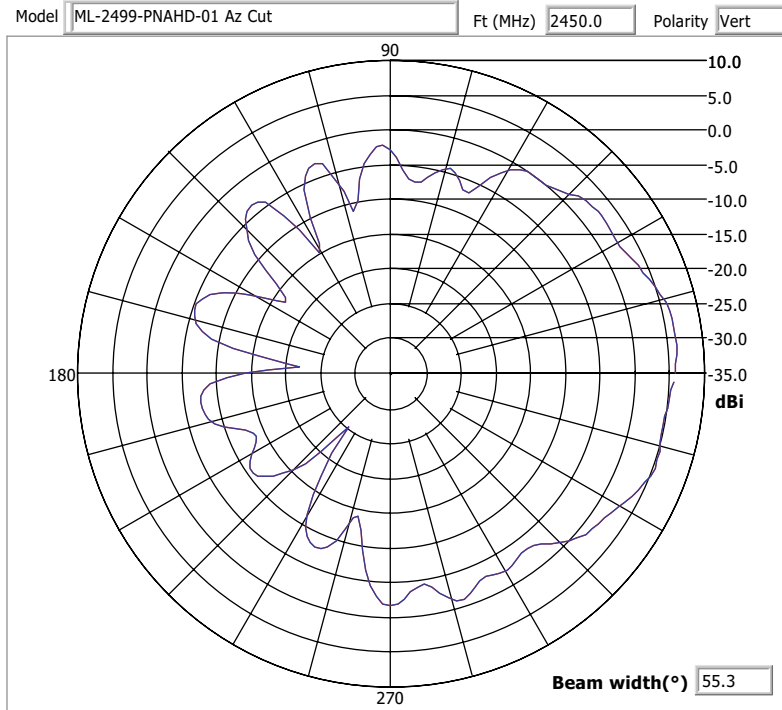
11/12/2003 6:19:10 PM

Elevation Pattern

3.1.9 ML-2499-PNAHD-01R Indoor 55° Directional Panel: RP-BNC Male

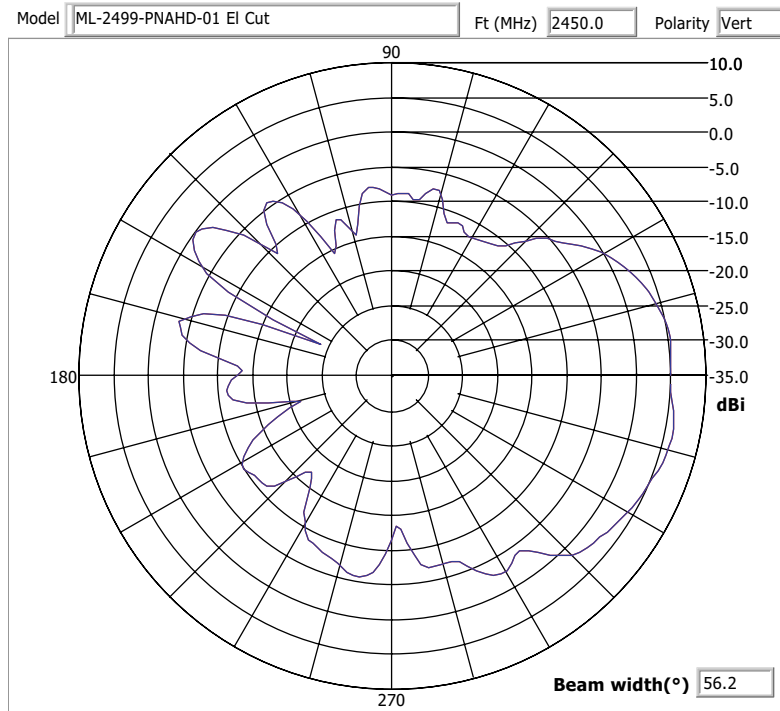


| | |
|--------------------|--------------------|
| Type | Panel |
| Frequency | 2400-2500 Mhz |
| Gain (dBi) | 6.3 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 55° |
| Elevation | 3dB Beamwidth: 56° |
| Cable Length (in.) | 48 |
| Cable Type | RG-58 Ultralink |
| Connector Type |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



11/12/2003 6:41:17 PM

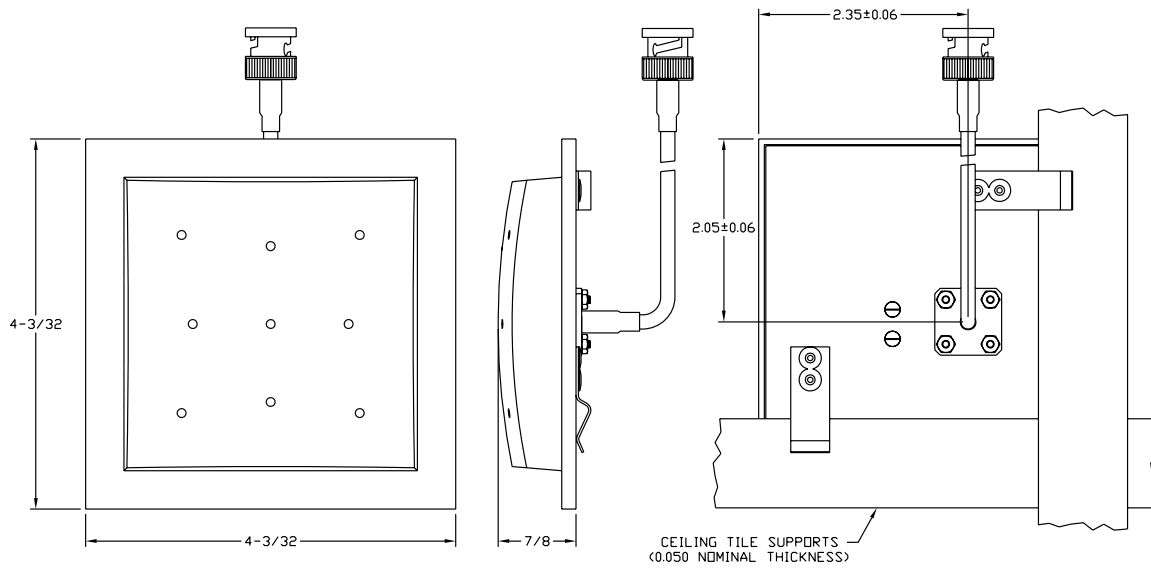
Azimuth Pattern



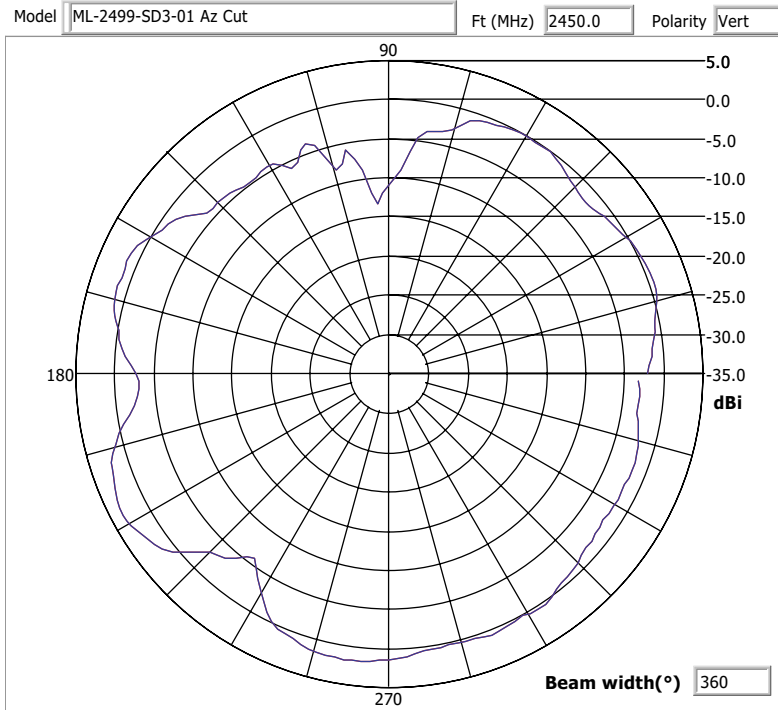
11/12/2003 6:44:37 PM

Elevation Pattern

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

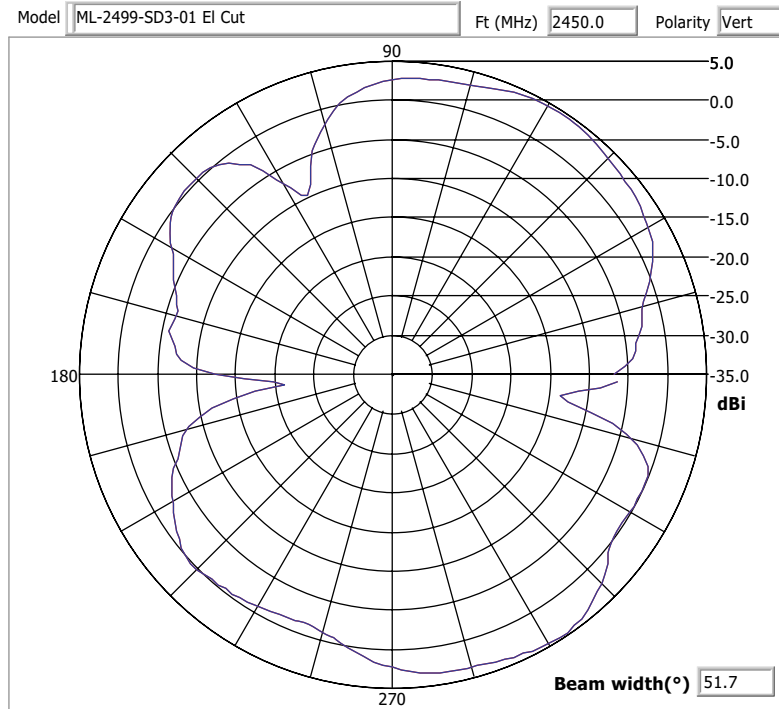


| | |
|--------------------|-----------------------|
| Type | Patch (ceiling mount) |
| Frequency | 2400-2500 MHz |
| Gain (dBi) | 3.5 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 360° |
| Elevation | 3dB Beamwidth: 52° |
| Cable Length (in.) | 48 |
| Cable Type | RG-58 Ultralink |
| 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

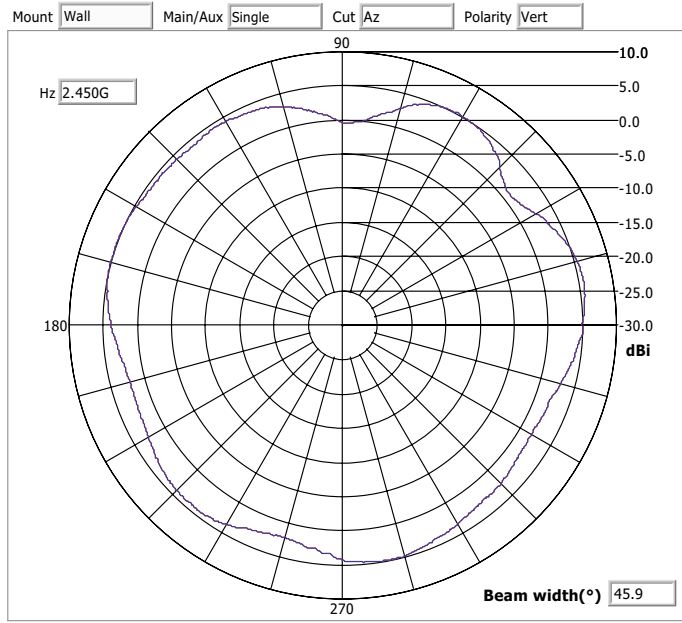


11/12/2003 6:54:30 PM

Elevation Pattern

3.1.11 ML-2499-FHPA5-01R Omni-Directional "Pipe" Antenna: N Male Connector**ML-2499-FHPA5-01R**

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



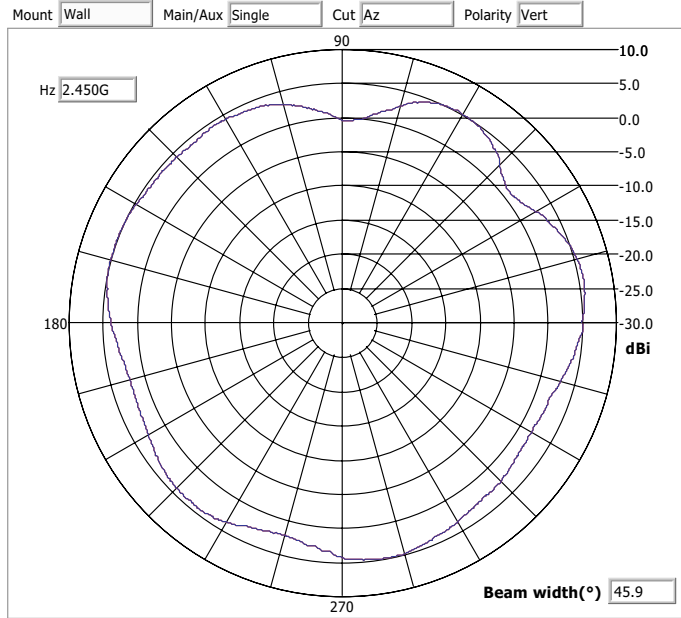
Azimuth Pattern

3.1.12 ML-2499-FHPA9-01R High Performance Fixed Point Dipole: Male Connector



ML-2499-FHPA9-01R

| | |
|--------------------|---------------------|
| Type | Dipole Array |
| Frequency | 2400-2500 MHz |
| Gain (dBi) | 6 |
| 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

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>.

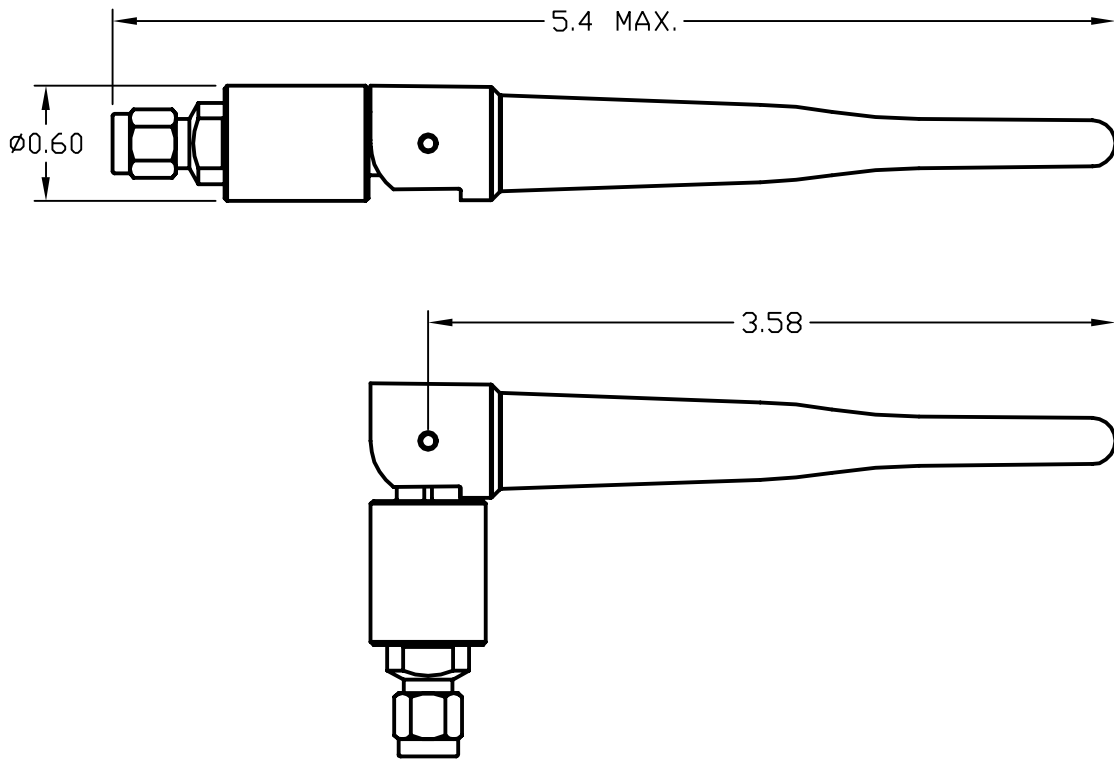
For detailed information on supported 802.11a antenna models, refer to:

- *ML-5299-APA1-01R Indoor Rubber Flex Jointed Dipole: RP-SMA Male Connector*
- *ML-5299-HPA1-01R High Performance Omni-Directional Dipole Antenna: RP-SMA Male Connector*
- *ML-5299-PTA1-01R Low Profile Ceiling-Tile Mount Patch: RP-SMA Male Connector*
- *ML-5299-WPNA1-01R Wall Mount Panel Antenna w/Articulating Mount: RP-SMA Male*
- *ML-5299-FHPA10-01R Omni-Directional "Pipe" Antenna: N-Male Connector*
- *ML-5299-FHPA6-01R Omni-Directional "Pipe" Antenna: N-Male Connector*

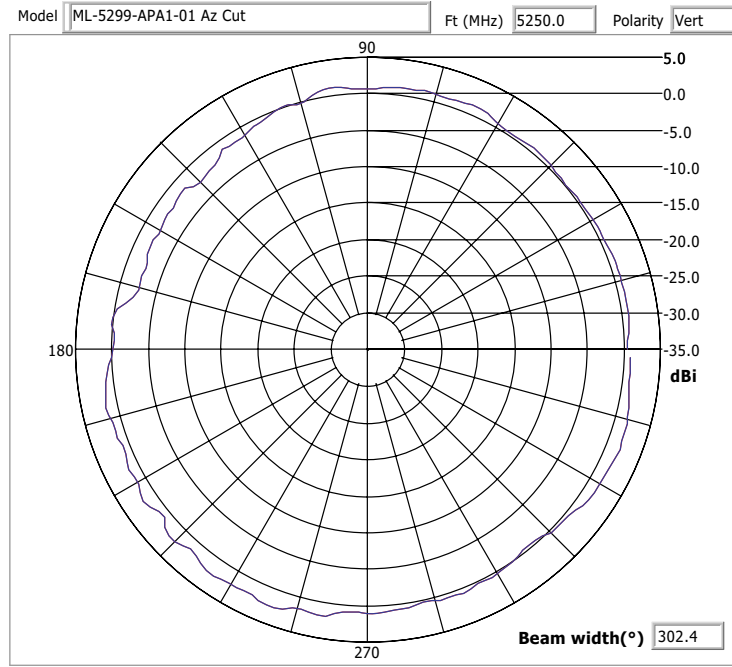


NOTE: For examples on how various antenna and connectors are deployed in a 5 GHz AP-5131 installation, see [5 GHz AP-5131 Antenna Connections](#).

4.1.1 ML-5299-APA1-01R Indoor Rubber Flex Jointed Dipole: RP-SMA Male Connector

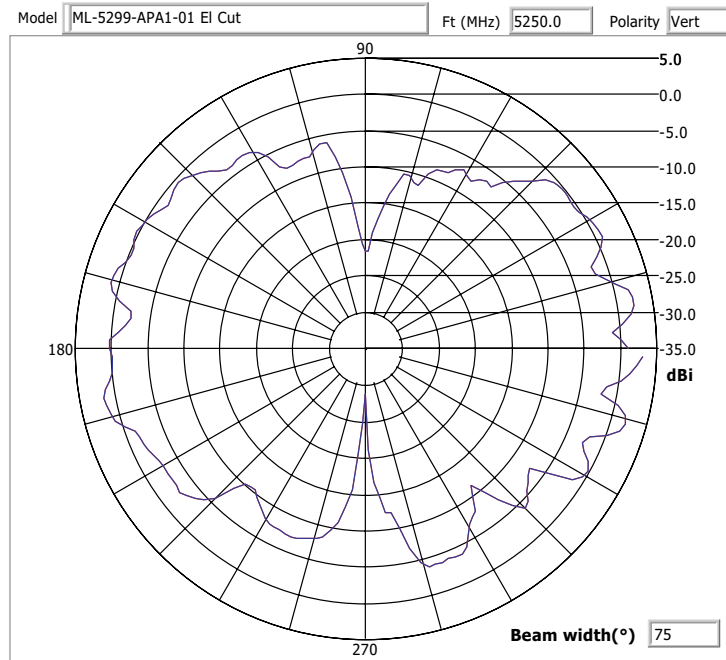


| | |
|--------------------|---------------------|
| Type | Dipole |
| Frequency | 4900-5875 MHz |
| Gain (dBi) | 2 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 360° |
| Elevation | 3dB Beamwidth: 75° |
| Cable Length (in.) | N/A |
| Cable Type | N/A |
| Connector Type | RP-SMA Male |
| Weight | 0.063 lb |
| Plenum Antenna | No |
| Plenum Cable | N/A |
| Outdoor | No |



1/7/2004 8:42:26 PM

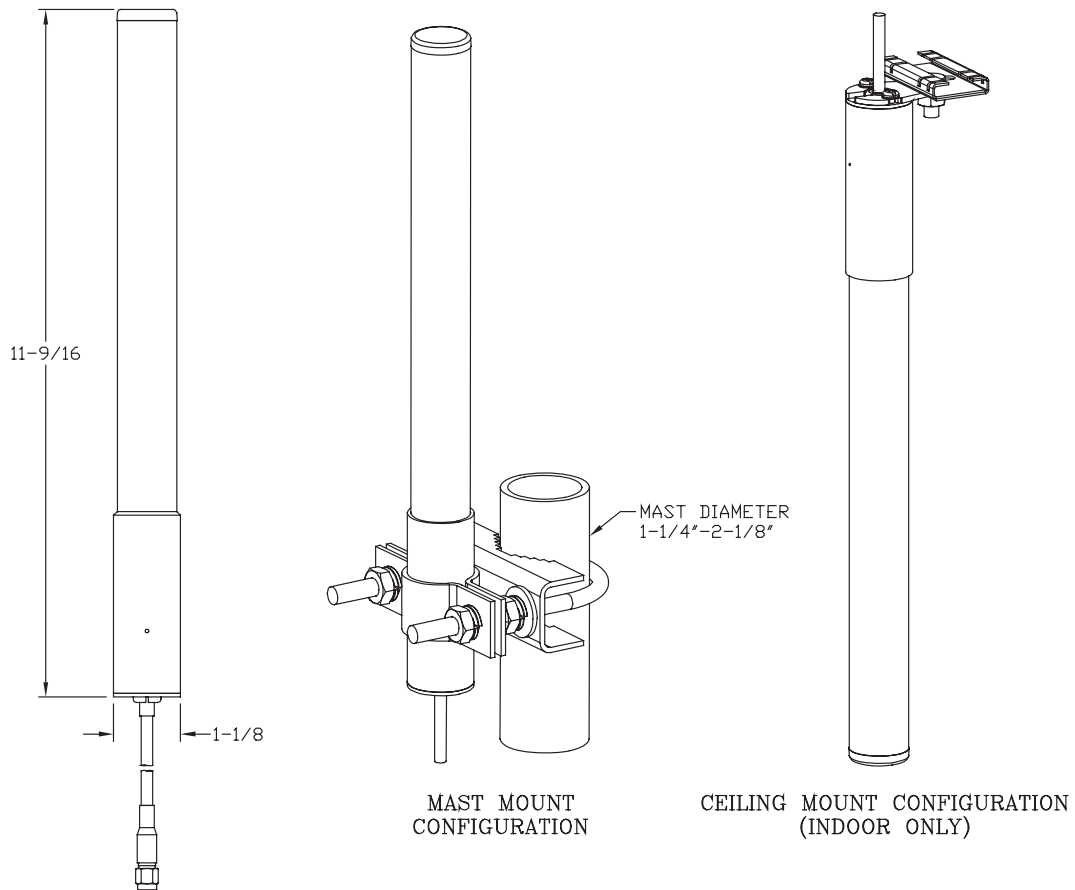
Azimuth Pattern



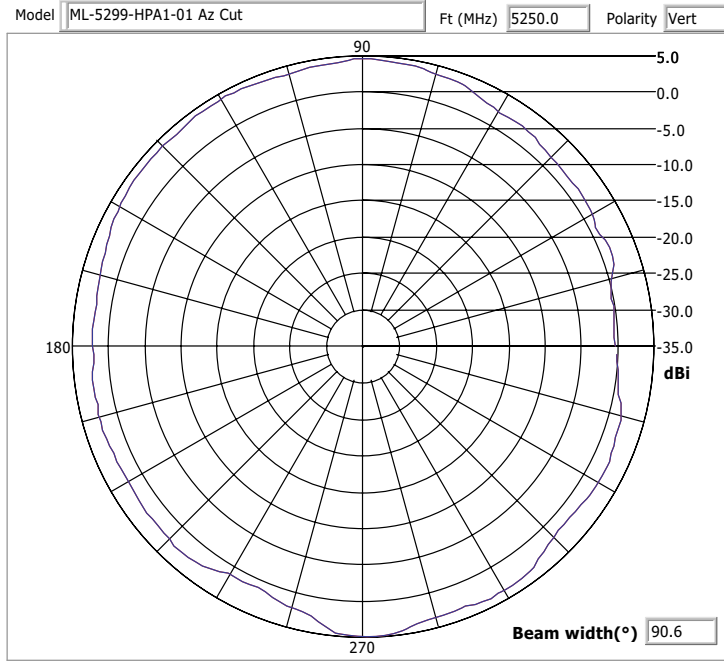
1/7/2004 8:47:57 PM

Elevation Pattern

4.1.2 ML-5299-HPA1-01R High Performance Omni-Directional Dipole Antenna: RP-SMA Male Connector

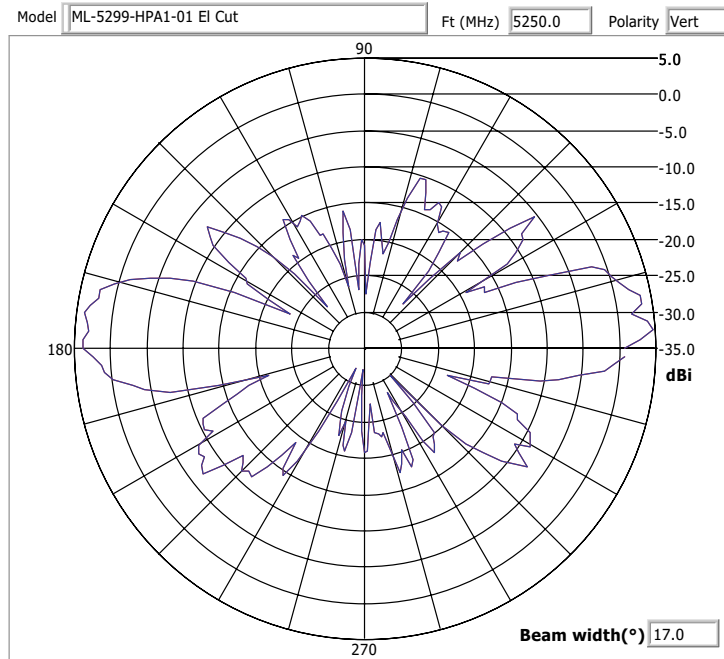


| | |
|--------------------|-----------------------------------|
| Type | Dipole Array |
| Frequency | 4900-5875 MHz |
| Gain (dBi) | 5 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 360° |
| Elevation | 3dB Beamwidth: 17° |
| Cable Length (in.) | 36 |
| Cable Type | LMR195 |
| Connector Type | RP-SMA Male |
| Weight | 0.3 lb. |
| Plenum Antenna | No |
| Plenum Cable | Yes |
| Outdoor | Yes (cable down orientation only) |



12/15/2003 11:48:02 AM

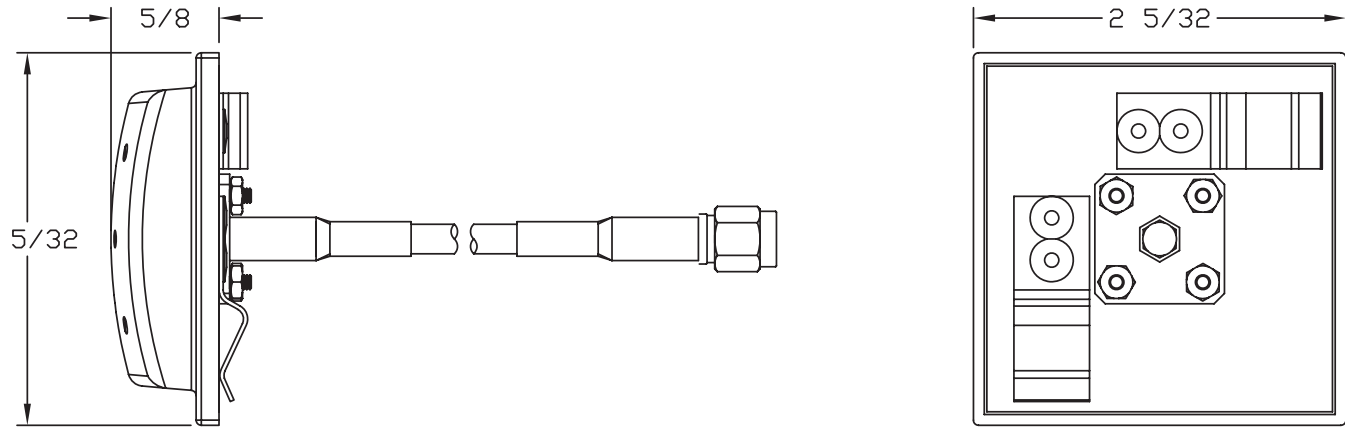
Azimuth Pattern



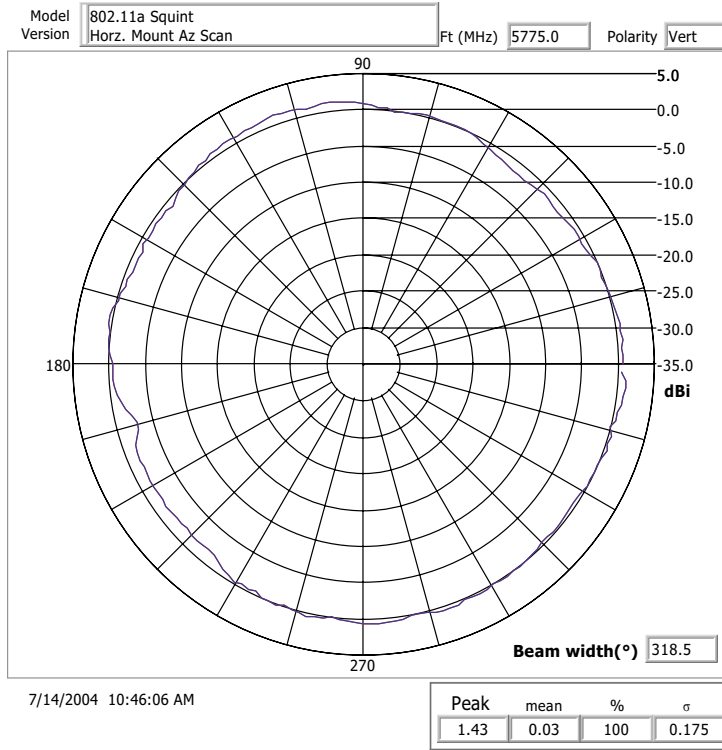
12/15/2003 11:40:30 AM

Elevation Pattern

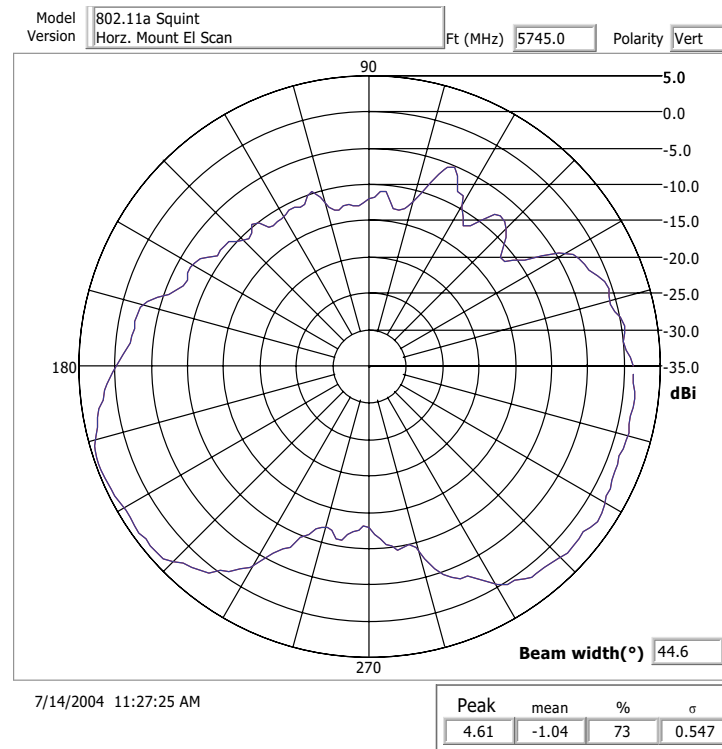
4.1.3 ML-5299-PTA1-01R Low Profile Ceiling-Tile Mount Patch: RP-SMA Male Connector



| | |
|---------------------------|---------------------|
| <i>Type</i> | Patch |
| <i>Frequency</i> | 5150-5875 MHz |
| <i>Gain (dBi)</i> | 4.6 |
| <i>Polarization</i> | Linear, Vertical |
| <i>Azimuth</i> | 3dB Beamwidth: 360° |
| <i>Elevation</i> | 3dB Beamwidth: 45° |
| <i>Cable Length (in.)</i> | 36 |
| <i>Cable Type</i> | RG-58 |
| <i>Connector Type</i> | RP-SMA Male |
| <i>Weight</i> | 0.15 lb. |
| <i>Plenum Antenna</i> | No |
| <i>Plenum Cable</i> | Yes |
| <i>Outdoor</i> | No |

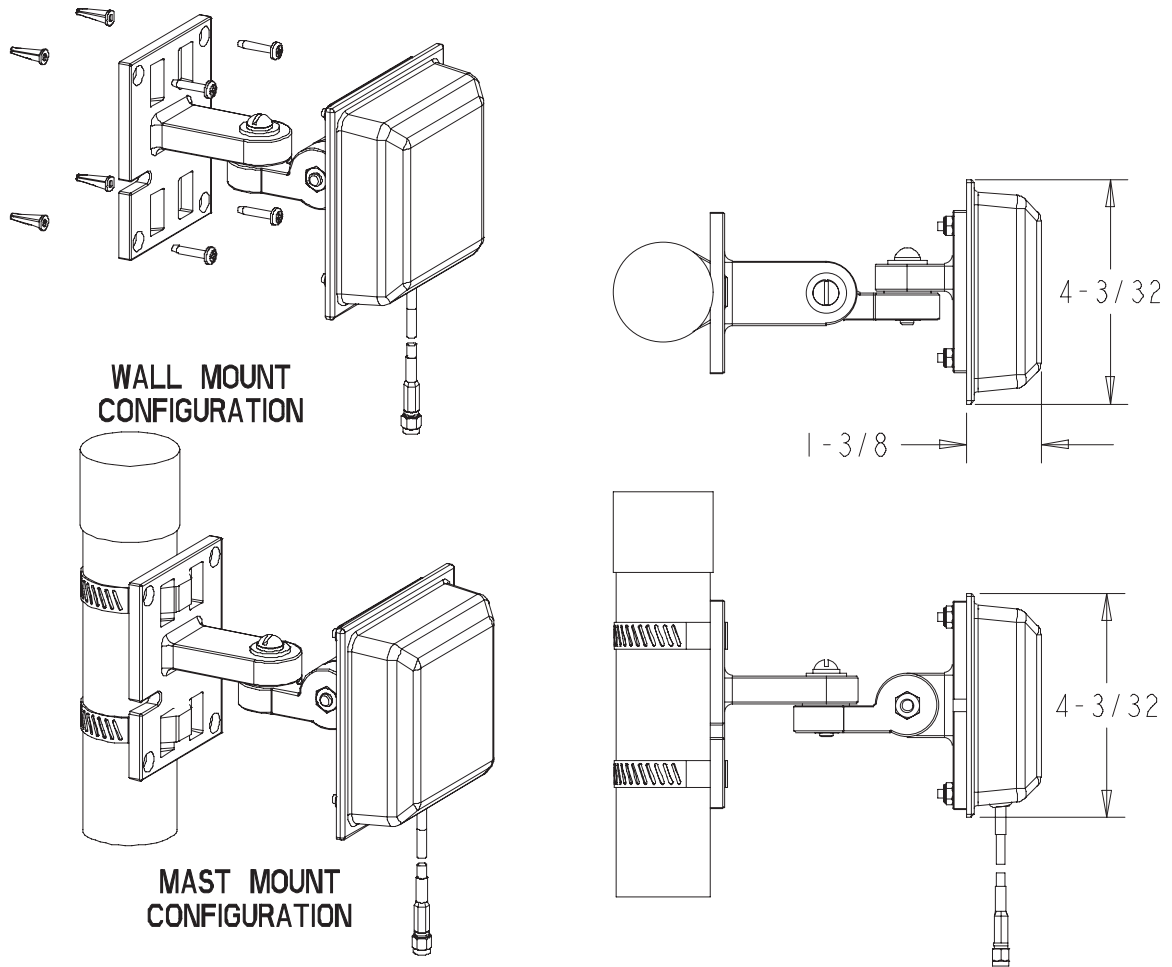


Azimuth Pattern

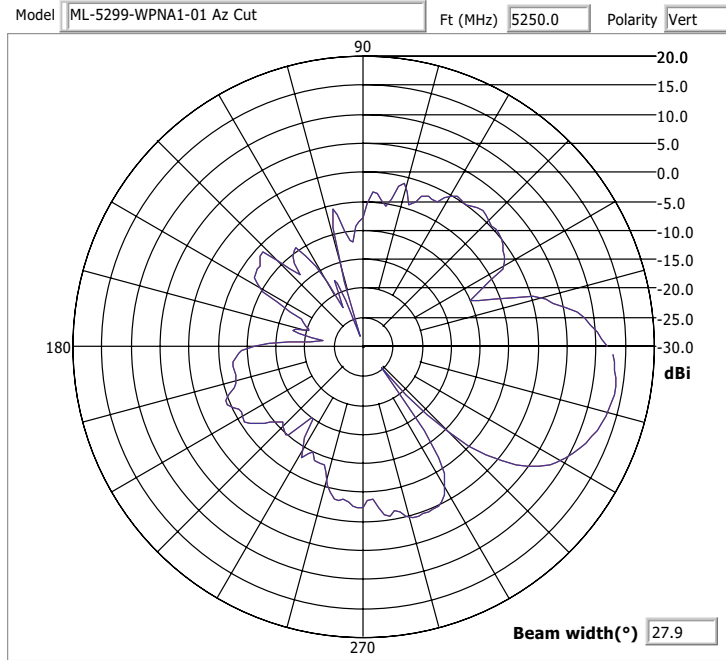


Elevation Pattern

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

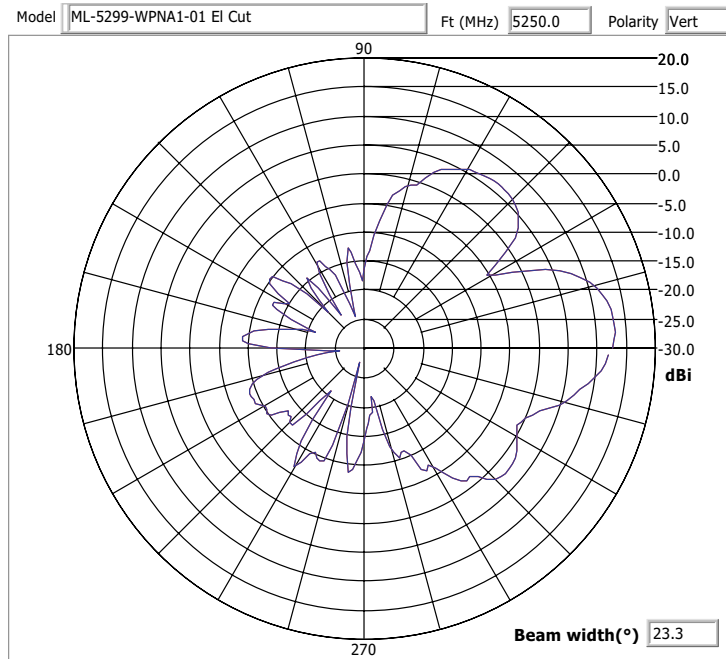


| | |
|--------------------|--------------------|
| Type | Panel |
| Frequency | 5150-5875 MHz |
| Gain (dBi) | 12.5 |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 31° |
| Elevation | 3dB Beamwidth: 27° |
| Cable Length (in.) | 36 |
| Cable Type | RG-303 |
| Connector Type | RP-SMA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



1/5/2004 3:09:33 PM

Azimuth Pattern



1/5/2004 3:16:21 PM

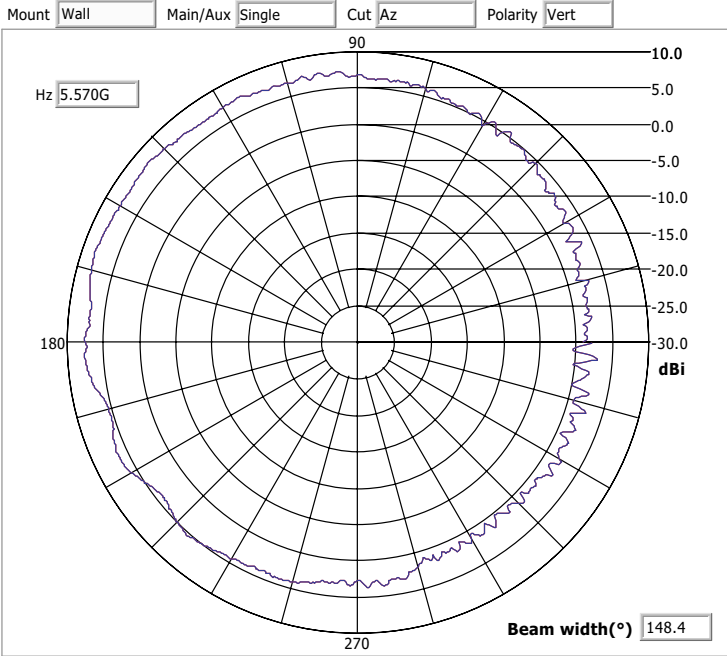
Elevation Pattern

4.1.5 ML-5299-FHPA10-01R Omni-Directional "Pipe" Antenna: N-Male Connector



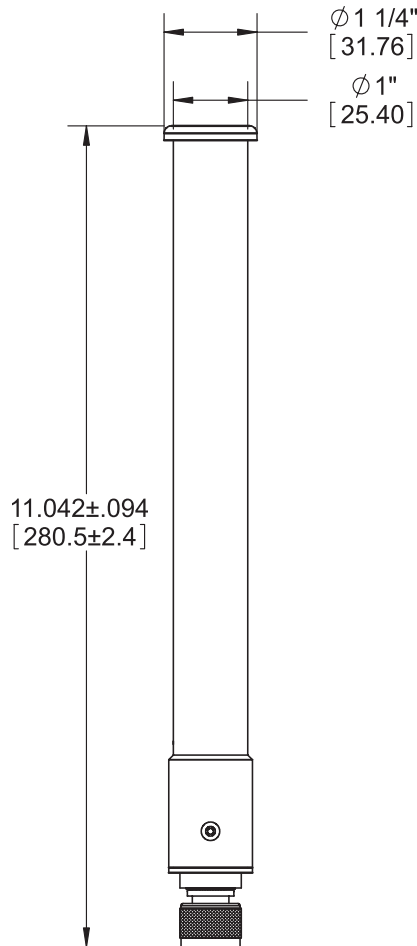
ML-5299-FHPA10-01R

| | |
|---------------------------|---------------------|
| <i>Type</i> | Dipole Array |
| <i>Frequency</i> | 4900-5850 MHz |
| <i>Gain (dBi)</i> | 8 |
| <i>Polarization</i> | Linear, Vertical |
| <i>Azimuth</i> | 3dB Beamwidth: 360° |
| <i>Elevation</i> | 3dB Beamwidth: 13 |
| <i>Cable Length (in.)</i> | N/A |
| <i>Cable Type</i> | N/A |
| <i>Connector Type</i> | Type N Male |
| <i>Weight</i> | 0.37 lb |
| <i>Plenum Antenna</i> | No |
| <i>Plenum Cable</i> | N/A |
| <i>Outdoor</i> | Yes |

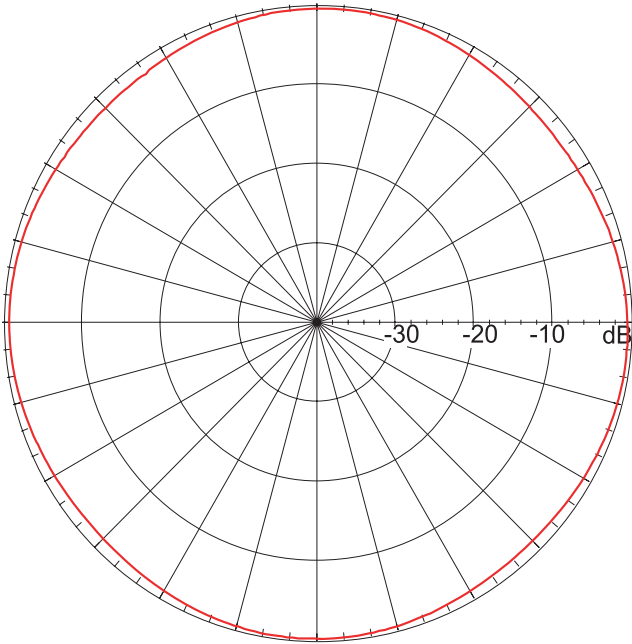


Azimuth Pattern 5570 MHz

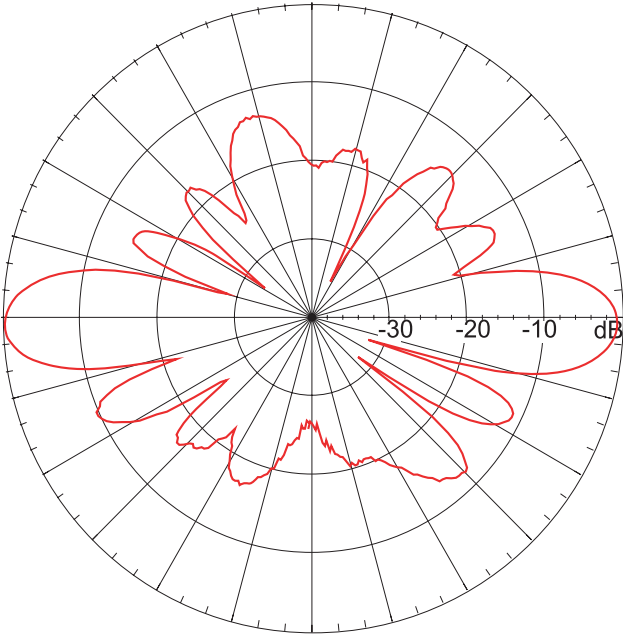
4.1.6 ML-5299-FHPA6-01R Omni-Directional "Pipe" Antenna: N-Male Connector



| | |
|--------------------|---------------------|
| Type | Dipole Array |
| Frequency | 5150-5850 |
| Gain (dBi) | 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 | 0.37 lb |
| Plenum Antenna | No |
| Plenum Cable | N/A |
| Outdoor | Yes |



Azimuth Pattern 5500 MHz



Elevation Pattern 5500MHz

2.4GHz - 5.2GHz Dual Band Antenna Suite

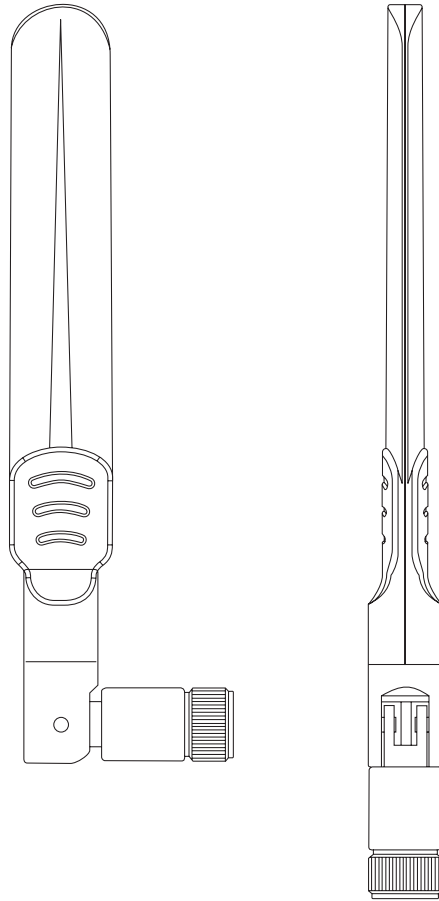
5.1 Supported 2.4GHz - 5.2GHz Dual Band Antennas

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>.

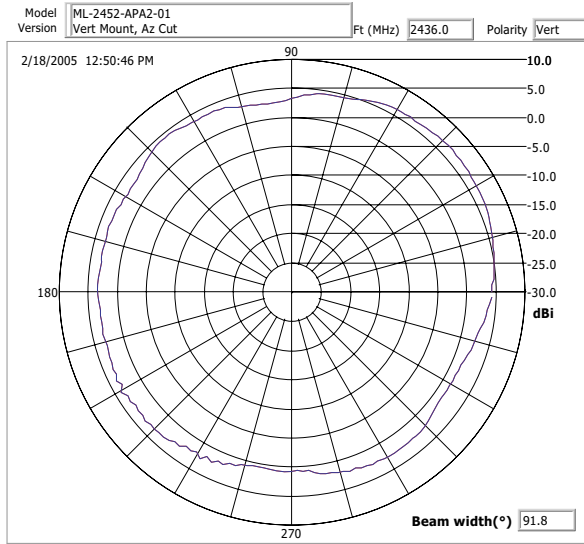
For detailed information on supported 2.4GHz - 5.2GHz Dual Band antenna models, refer to:

- *ML-2452-APA2-01 Indoor Dual Band Elbow Jointed Dipole: RP-SMA Male*
- *ML-2452-PNA5-01R Dual Band Panel: Connector Type N-Male*
- *ML-2452-PNA7-01R Dual Band Panel: Connector Type N-Male*
- *ML-2452-PTA2M3X3-1 AP-7131 MIMO Facade: 1 IN, RPSMA*
- *ML-2452-PTA3M3-036 Ceiling Mount, Dual Band, MIMO Patch: RPSMA*
- *ML-2452-APA6J-01 Dual Band Dipole, Microcell: RP-SMA Male*

5.1.1 ML-2452-APA2-01 Indoor Dual Band Elbow Jointed Dipole: RP-SMA Male

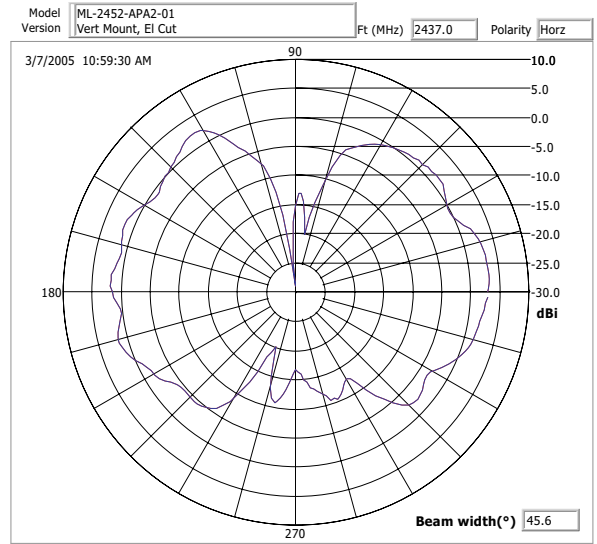


| | |
|---------------------------|-------------------------|
| <i>Type</i> | Dipole |
| <i>Frequency</i> | 2400-2500/5150-5850 MHz |
| <i>Gain (dBi)</i> | 6 / 7 |
| <i>Polarization</i> | Linear, Vertical |
| <i>Azimuth</i> | 3dB Beamwidth: 360° |
| <i>Elevation</i> | 3dB Beamwidth: 35° |
| <i>Cable Length (in.)</i> | N/A |
| <i>Cable Type</i> | N/A |
| <i>Connector Type</i> | RP-SMA Male |
| <i>Weight</i> | 0.7 oz |
| <i>Plenum Antenna</i> | No |
| <i>Plenum Cable</i> | N/A |
| <i>Outdoor</i> | No |

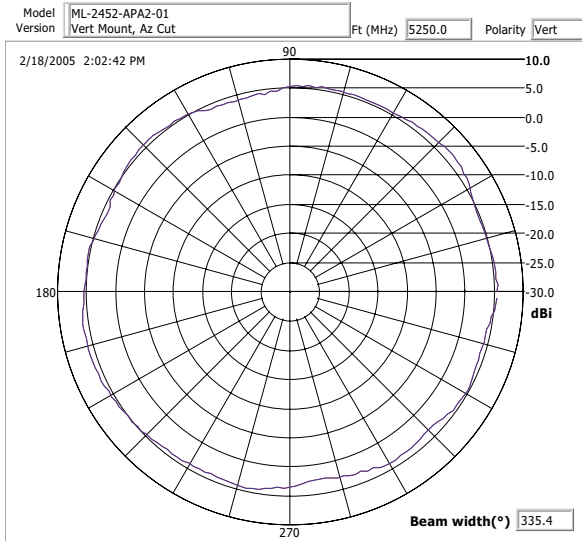


Azimuth Pattern

802.11b Band

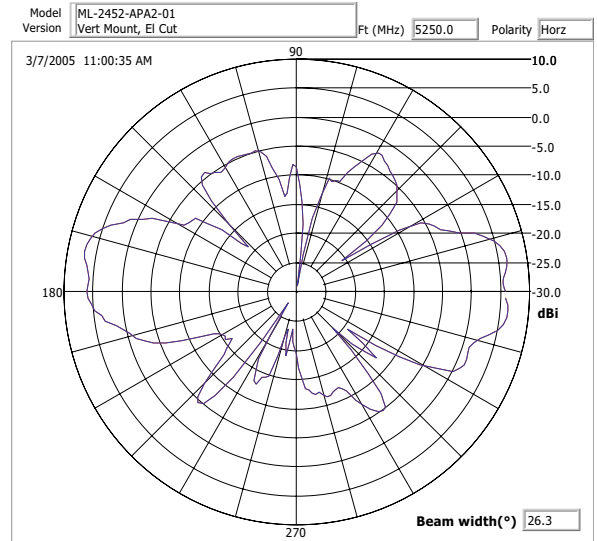


Elevation Pattern



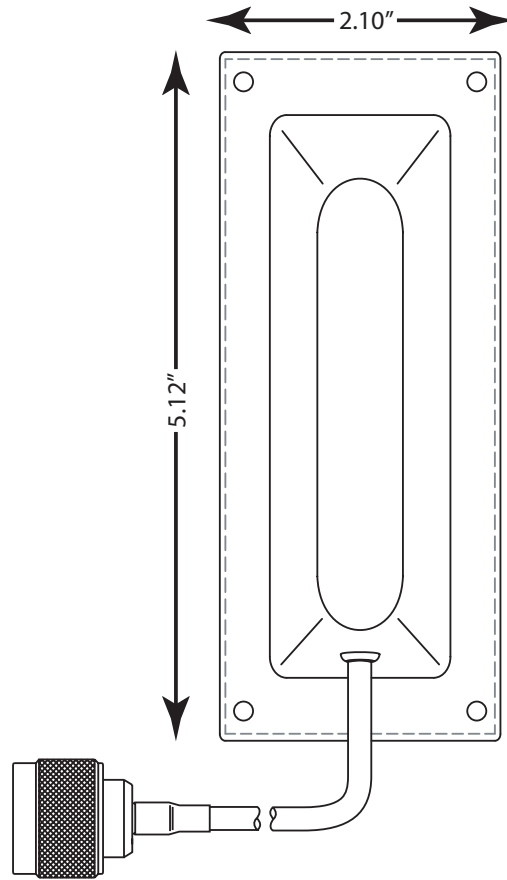
Azimuth Pattern

802.11a Band

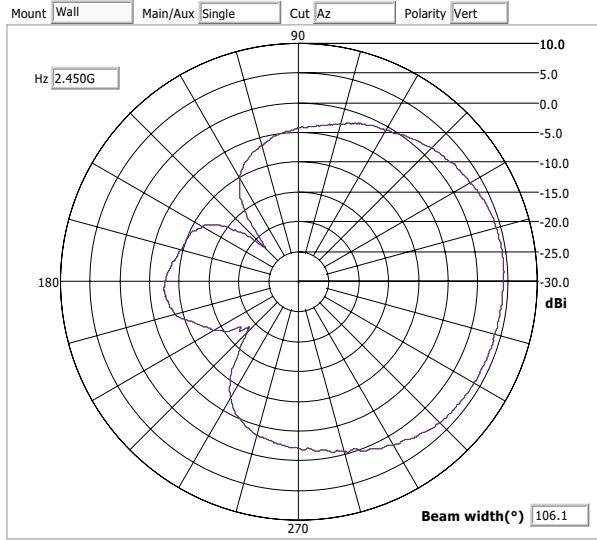


Elevation Pattern

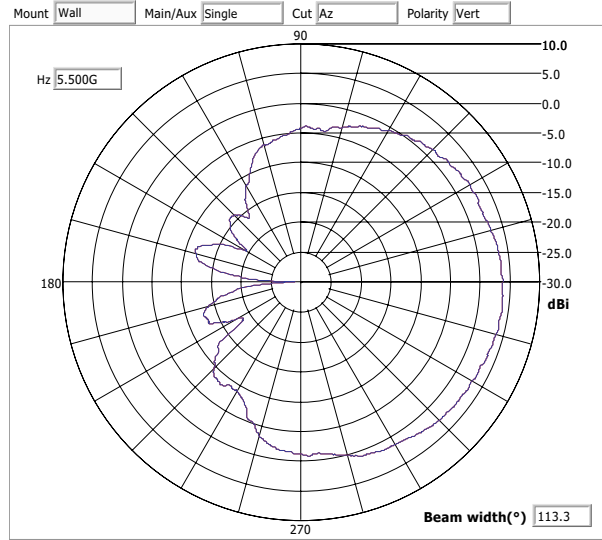
5.1.2 ML-2452-PNA5-01R Dual Band Panel: Connector Type N-Male



| | |
|--------------------|---|
| Type | Panel |
| Frequency | 2400-2500/4900-5900 MHz |
| Gain (dBi) | 4.5 (2400-2500); 5.0 (4900-5250); 4.0 (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 |

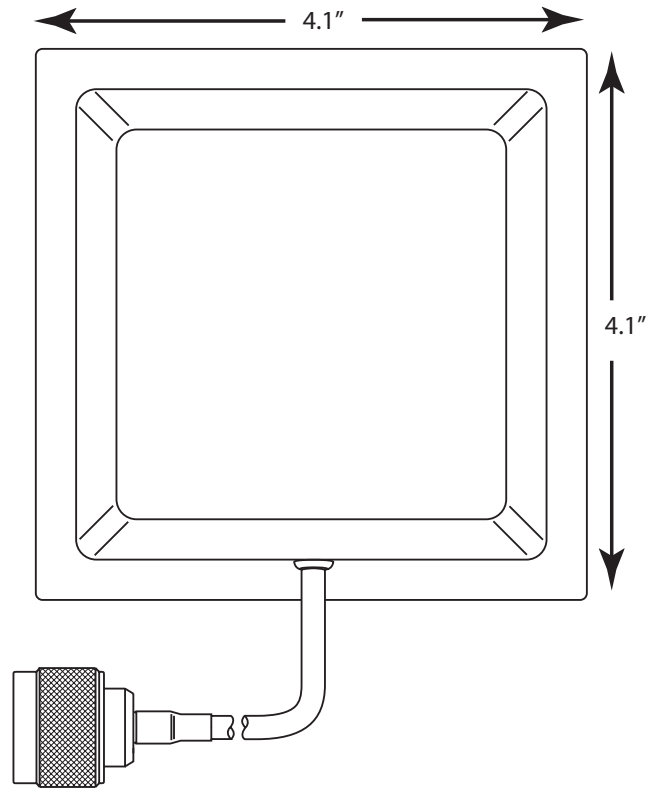


Azimuth Pattern 2450 MHz
(Reference Only)

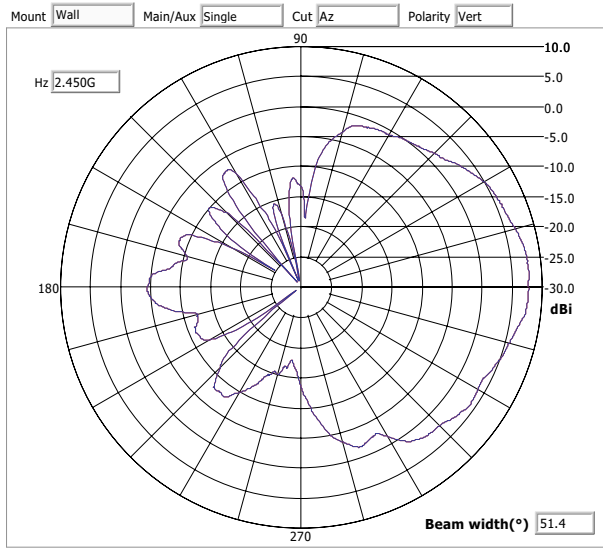


Azimuth Pattern 5500MHz
(Reference Only)

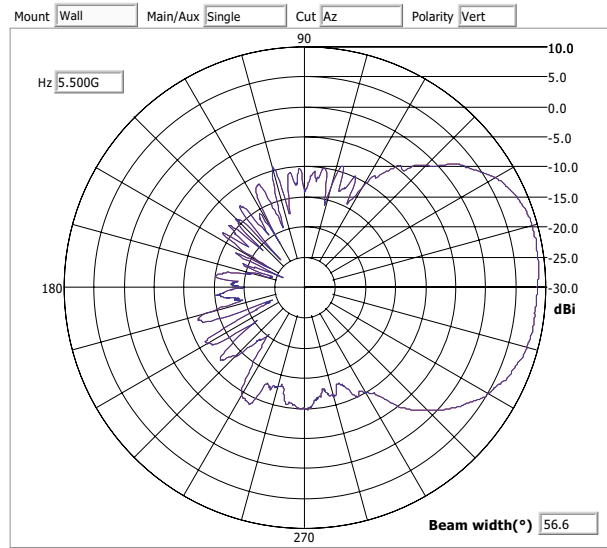
5.1.3 ML-2452-PNA7-01R Dual Band Panel: Connector Type N-Male



| | |
|---------------------------|---|
| <i>Type</i> | Panel |
| <i>Frequency</i> | 2400-2500/4900-5900 MHz |
| <i>Gain (dBi)</i> | 7 (2400-2500); 6.3 (4900-5250); 9 (5250-5900) |
| <i>Polarization</i> | Linear, Vertical |
| <i>Azimuth</i> | 3dB Beamwidth: 68° / 52° |
| <i>Elevation</i> | 3dB Beamwidth: 66° / 60° |
| <i>Cable Length (in.)</i> | 12 |
| <i>Cable Type</i> | RG-58 Ultralink |
| <i>Connector Type</i> | Type N Male |
| <i>Weight</i> | 0.5 lb |
| <i>Plenum Antenna</i> | No |
| <i>Plenum Cable</i> | Yes |
| <i>Outdoor</i> | Yes |

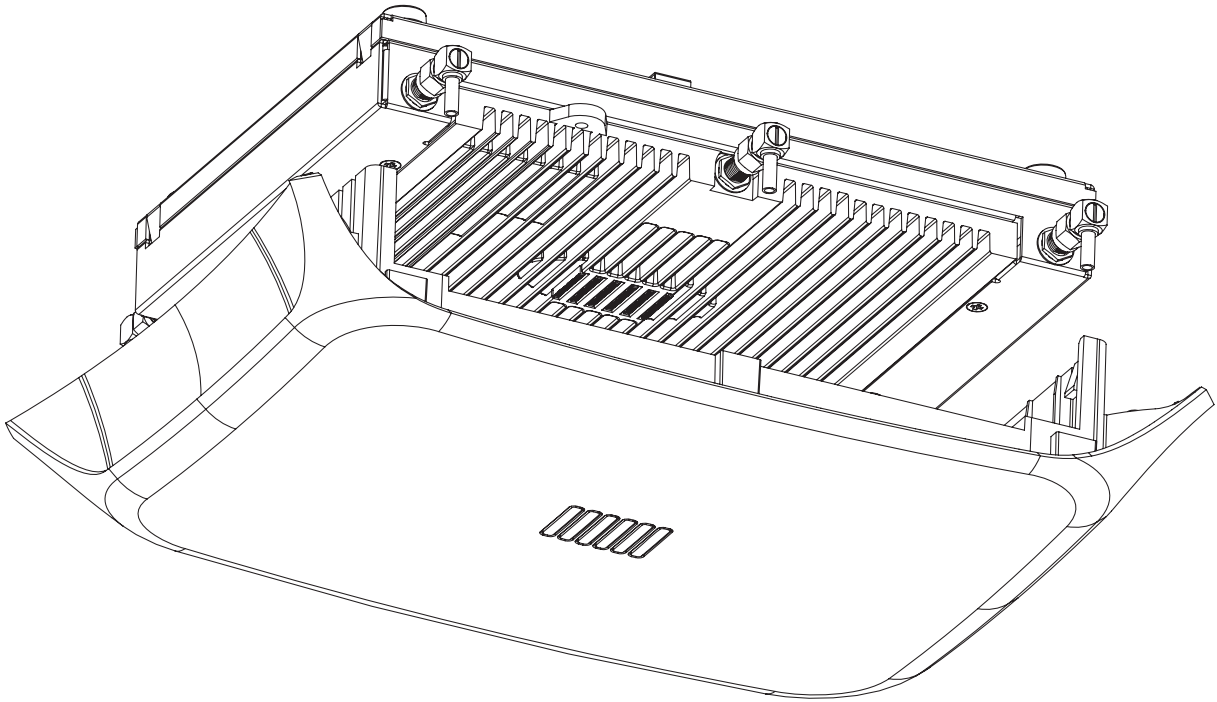


Azimuth Pattern 2450 MHz
(Reference Only)



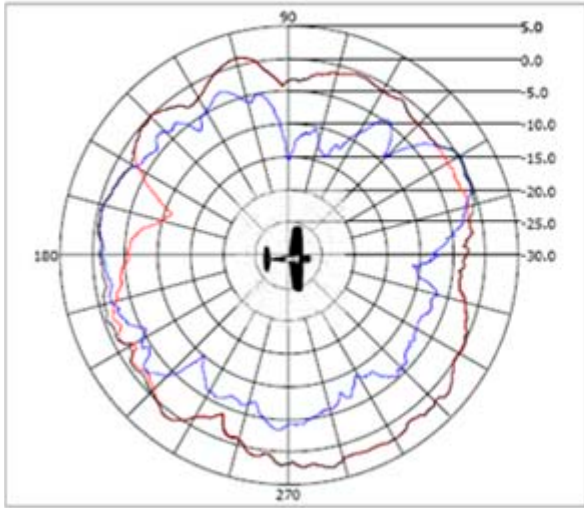
Azimuth Pattern 5500MHz
(Reference Only)

5.1.4 ML-2452-PTA2M3X3-1 AP-7131 MIMO Facade: 1 IN, RPSMA

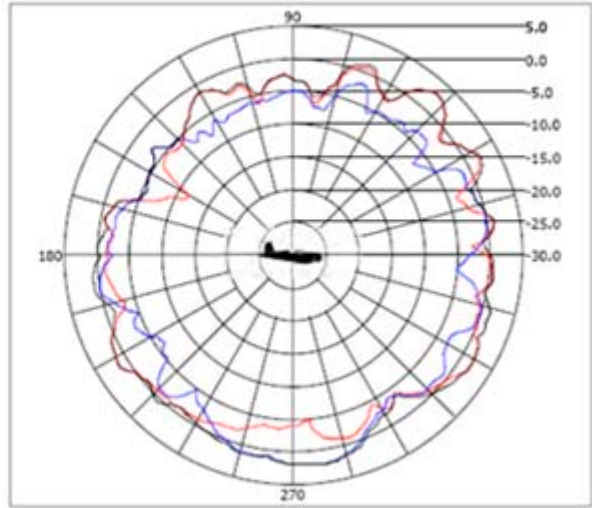


NOTE: ML-2452-PTA2M3x3-1 was formally released as Motorola part number ML-2452-APA2-FAC.

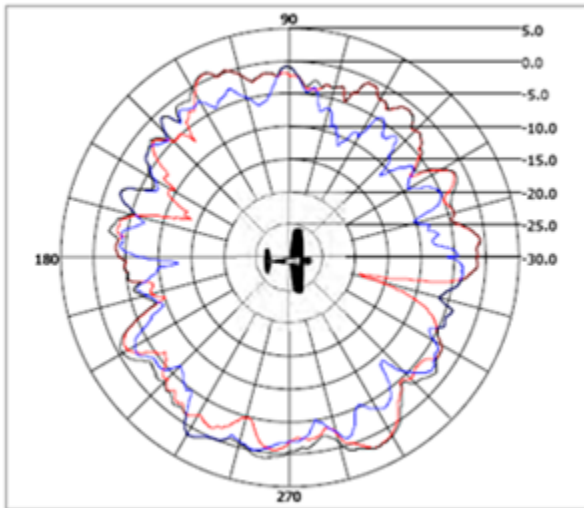
| | |
|-----------------------------|--|
| <i>Type</i> | Patch x 6 in snap-on facade |
| <i>Frequency</i> | 2400-2500/4900-5990 MHz |
| <i>Gain (dBi)</i> | 3 dBi 5 dBi |
| <i>Polarization</i> | Linear, Vertical |
| <i>Azimuth</i> | 3dB Beamwidth: 360° |
| <i>Elevation</i> | 3dB Beamwidth: 90° (southern hemisphere pattern) |
| <i>Cable Length (in.)</i> | Integrated into snap-on facade |
| <i>Cable Type</i> | 1.20 mm coax |
| <i>Connector Type</i> | RP-SMA Male |
| <i>Antenna Plenum Rated</i> | No |
| <i>Cable Plenum Rated</i> | No |
| <i>Outdoor</i> | No |
| <i>Weight</i> | 0.79 lb |



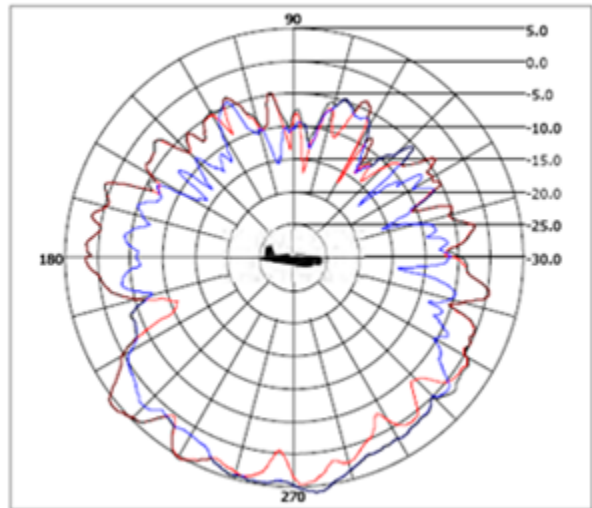
Azimuth Pattern 2436 MHz



Elevation Pattern 2436 MHz

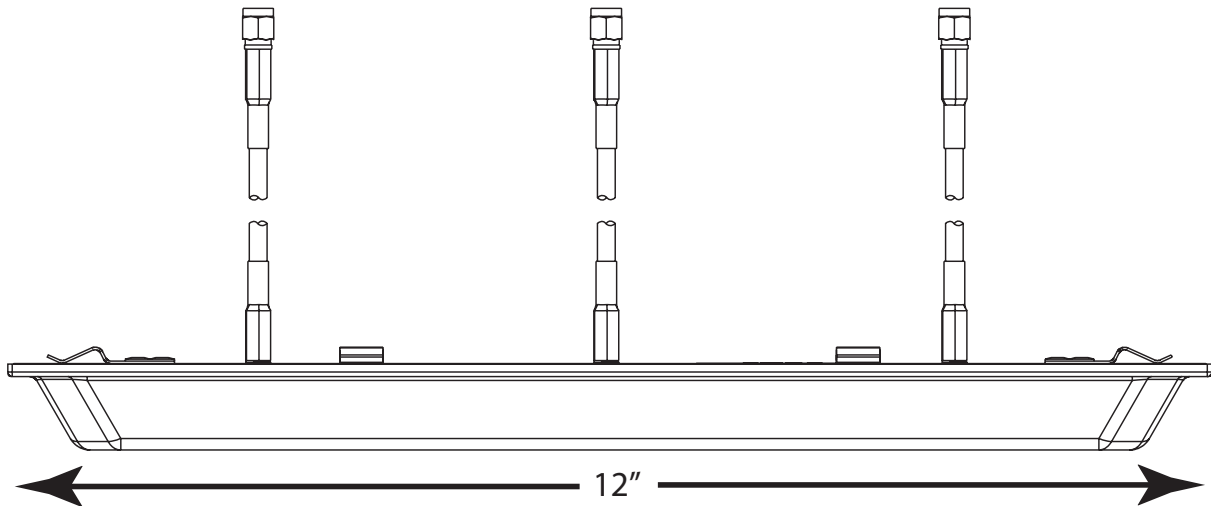


Azimuth Pattern 5500 MHz

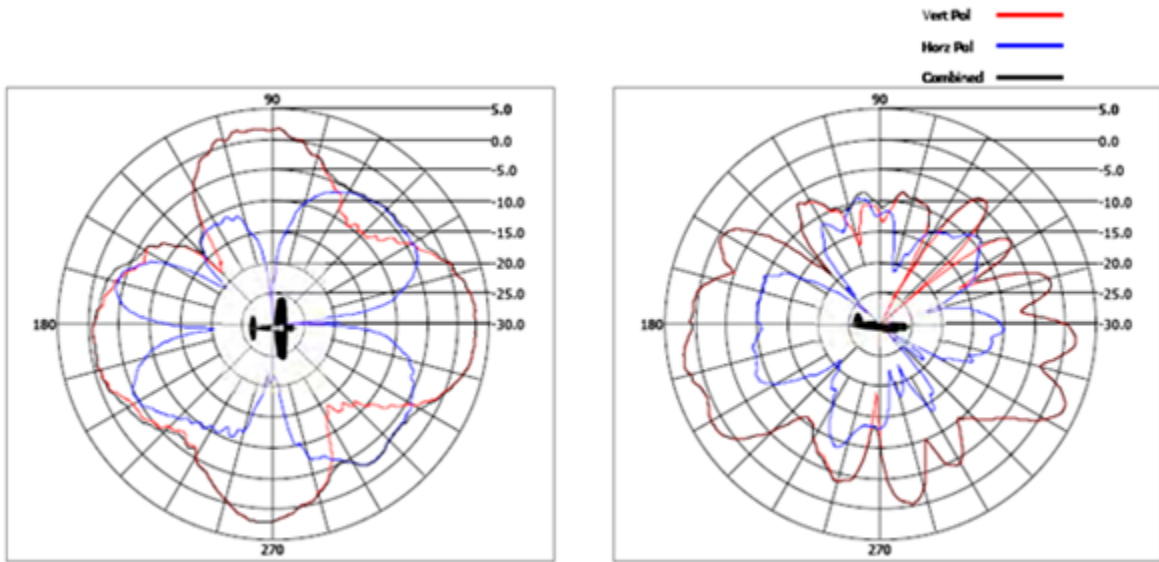


Elevation Pattern 5500MHz

5.1.5 ML-2452-PTA3M3-036 Ceiling Mount, Dual Band, MIMO Patch: RPSMA

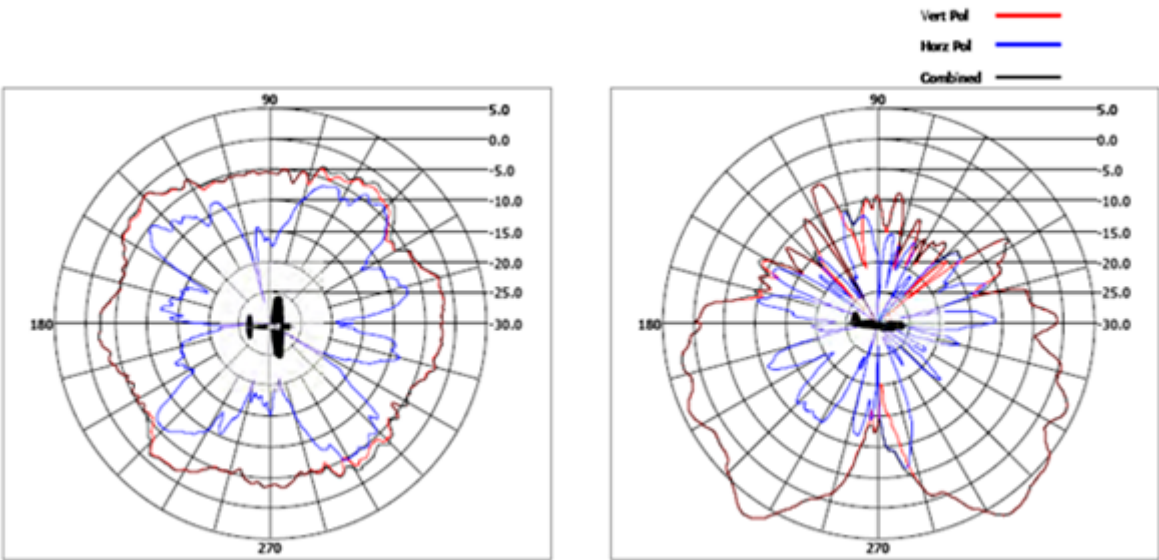


| | |
|----------------------|--|
| Type | Patch x 3 |
| Frequency | 2400-2500/4900-5990 MHz |
| Gain (dBi) | 3 dBi 7 dBi |
| Polarization | Linear, Vertical |
| Azimuth | 3dB Beamwidth: 360° |
| Elevation | 3dB Beamwidth: 90° (southern hemisphere pattern) |
| Cable Length (in.) | 36 |
| Cable Type | RG-58 50 Ohm coax |
| Connector Type | RP-SMA Male |
| Antenna Plenum Rated | No |
| Cable Plenum Rated | Yes |
| Outdoor | No |
| Weight | 0.7 lb |



Azimuth Pattern 2436 MHz

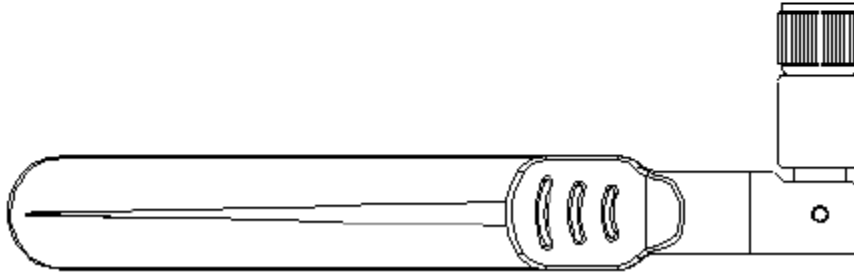
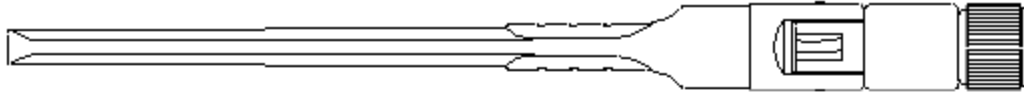
Elevation Pattern 2436 MHz



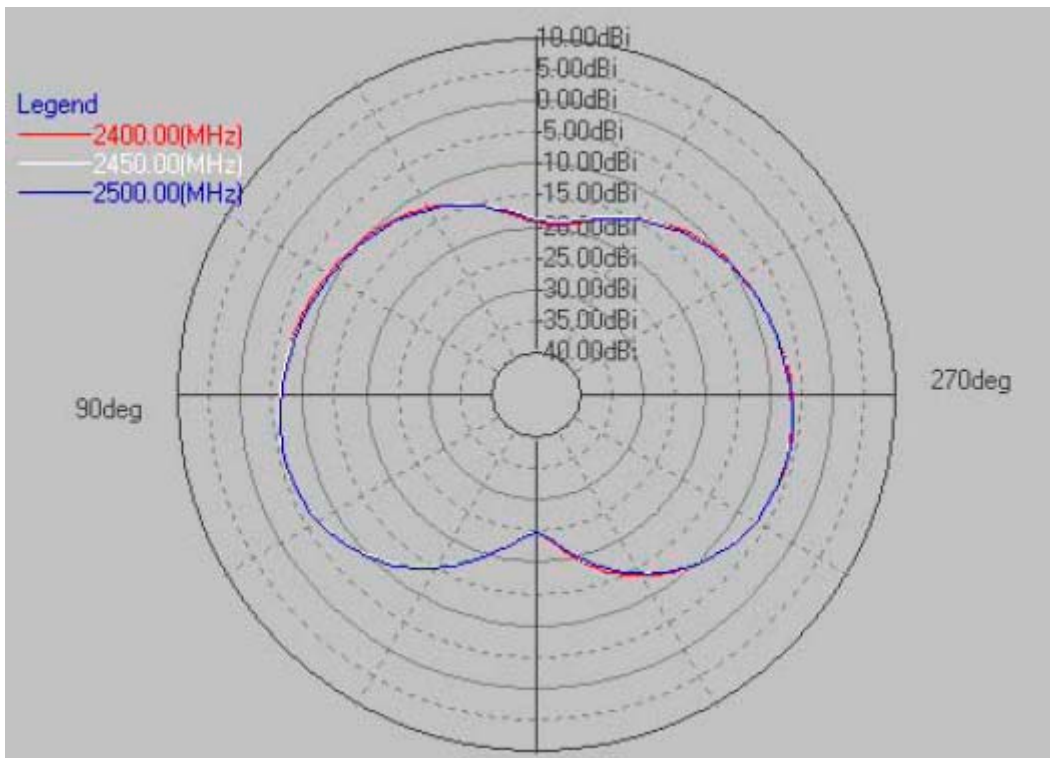
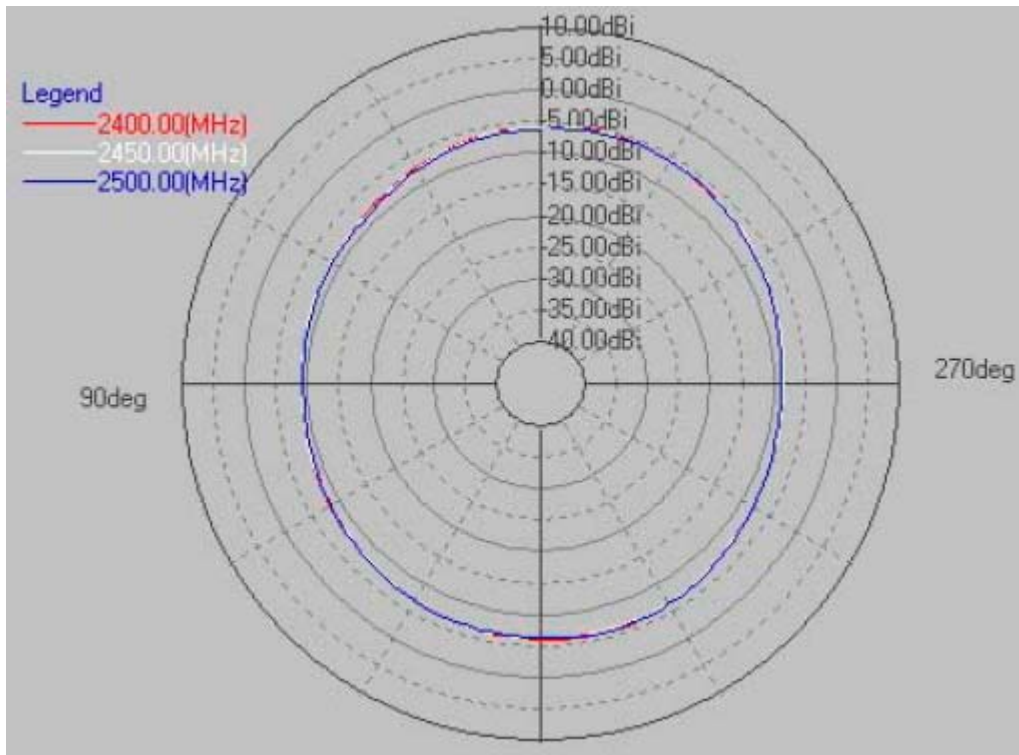
Azimuth Pattern 5500 MHz

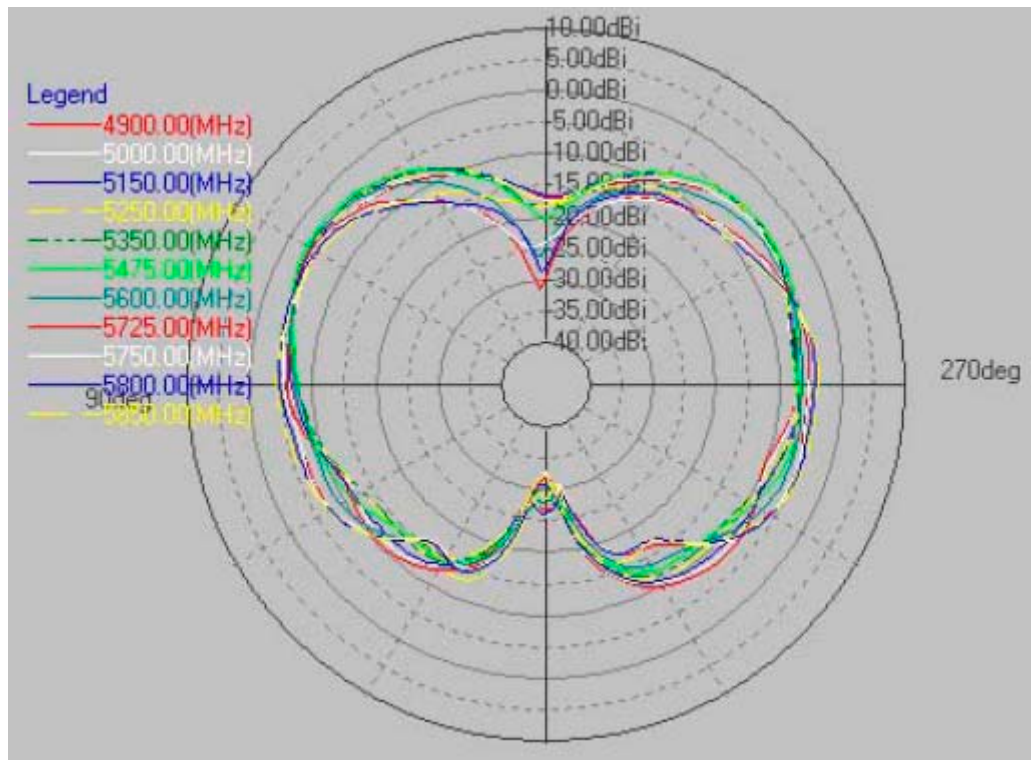
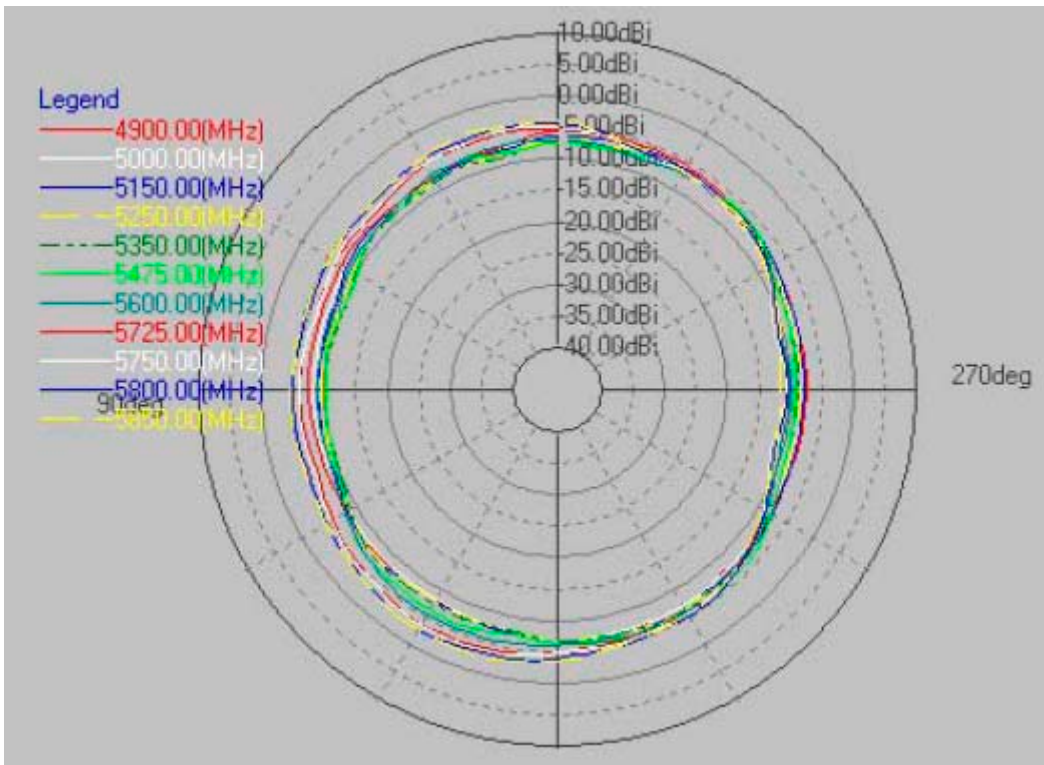
Elevation Pattern 5500MHz

5.1.6 ML-2452-APA6J-01 Dual Band Dipole, Microcell: RP-SMA Male



| | |
|-----------------------------|-------------------------|
| <i>Type</i> | Dipole |
| <i>Frequency</i> | 2400-2500/4900-5850 MHz |
| <i>Gain (dBi)</i> | -6 / -8 |
| <i>Polarization</i> | Linear, Vertical |
| <i>Azimuth</i> | 3dB Beamwidth: 360° |
| <i>Elevation</i> | 3dB Beamwidth: 35° |
| <i>Cable Length (in.)</i> | N/A |
| <i>Cable Type</i> | N/A |
| <i>Connector Type</i> | RP-SMA Male |
| <i>Antenna Plenum Rated</i> | N/A |
| <i>Cable Plenum Rated</i> | No |
| <i>Outdoor</i> | N/A |
| <i>Weight</i> | 0.76 oz |





Antenna Cables

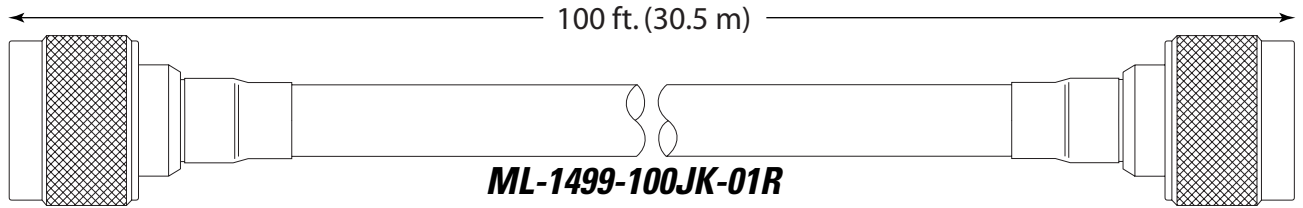
6.1 Supported Antenna Cables

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:

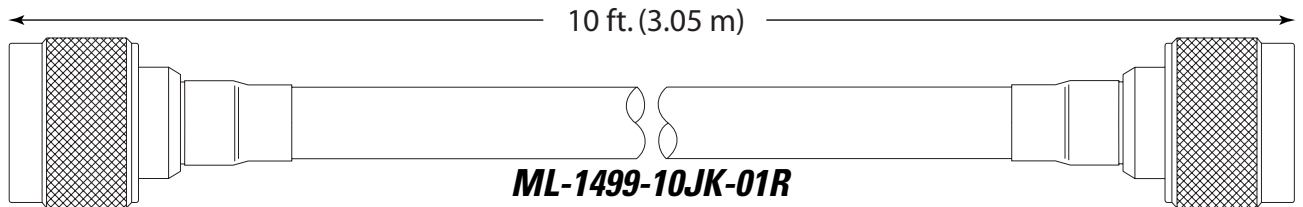
- *ML-1499-100JK-01R 100 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits*
- *ML-1499-10JK-01R 10 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male*
- *ML-1499-25JK-01R 25 ft. Low-Loss Coaxial Cable Jumper: N Male to N Male with 2 Connector Seal Kits*
- *ML-1499-50JK-01R 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



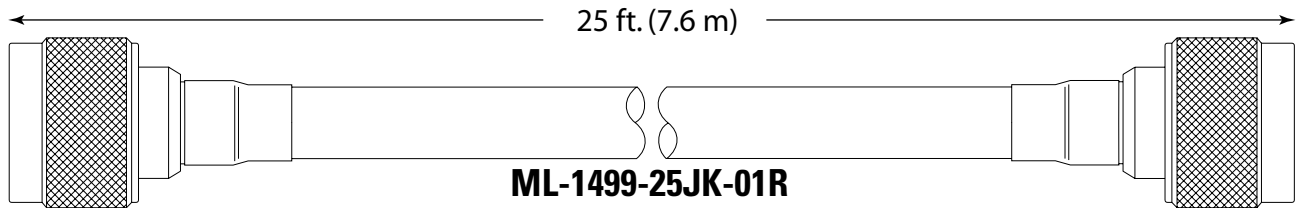
| | |
|------------------------|--------------------------------|
| Type | Ultralink TL 93605 |
| RF Connectors | N (m) to N (m) |
| Cable Attenuation (dB) | 10.6 @ 2.4 GHz; 15.5 @ 5.8 GHz |
| Frequency | 2 - 6 GHz |

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



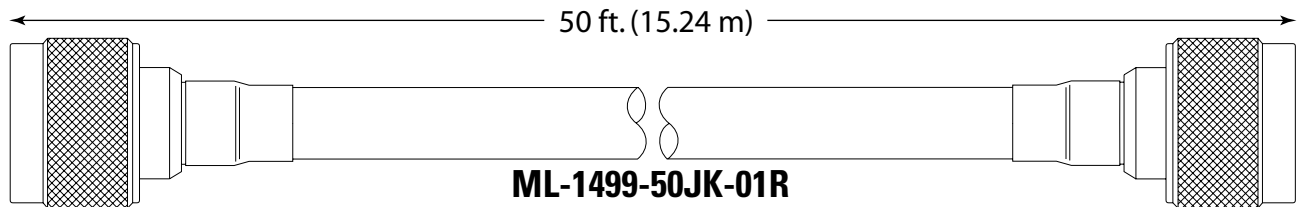
| | |
|------------------------|------------------------------|
| Type | Ultralink TL 93605 |
| RF Connectors | N (m) to N (m) |
| Cable Attenuation (dB) | 2.0 @ 2.4 GHz; 2.9 @ 5.8 GHz |
| Frequency | 2 - 6 GHz |

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



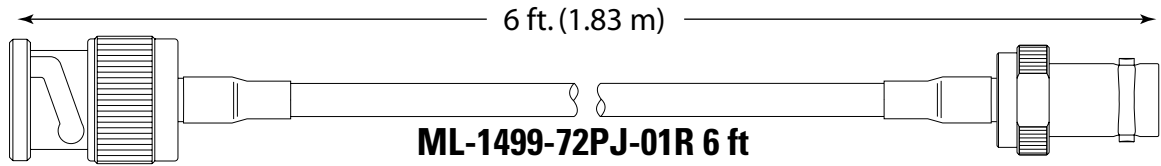
| | |
|------------------------|------------------------------|
| Type | Ultralink TL 93605 |
| RF Connectors | N (m) to N (m) |
| Cable Attenuation (dB) | 2.5 @ 2.4 GHz; 4.0 @ 5.8 GHz |
| Frequency | 2 - 6 GHz |

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



| | |
|------------------------|------------------------------|
| 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



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

Supported Antenna Adapters

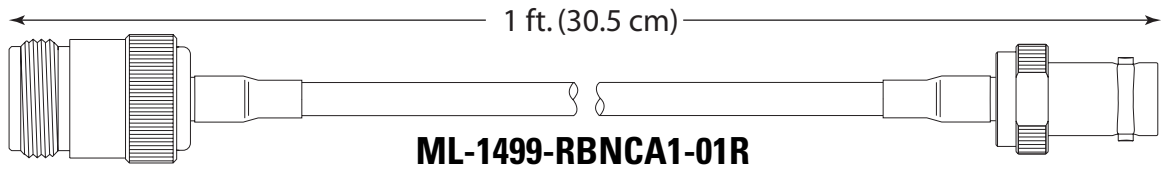
7.1 Supported Adapters

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:

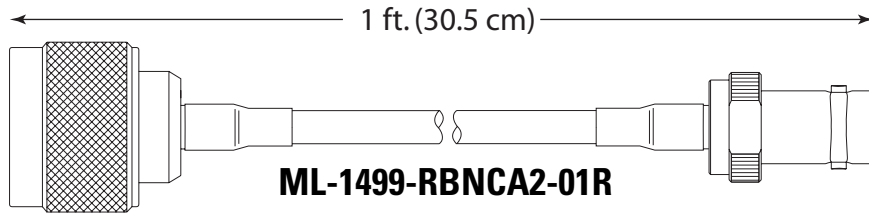
- *ML-1499-RBNCA1-01R 1 ft. N Female to RP BNC Female Cable Adapter with Connector Seal Kit*
- *ML-1499-RBNCA2-01R 1 ft. N Male to RP BNC Female Cable Adapter with Connector Seal Kit*
- *25-85391-01R 3.5 in. Jumper Cable, RP-SMA (Male) to Type N (Male) Adaptor*
- *25-85392-01R 3.5 in. Jumper Cable, RP-SMA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

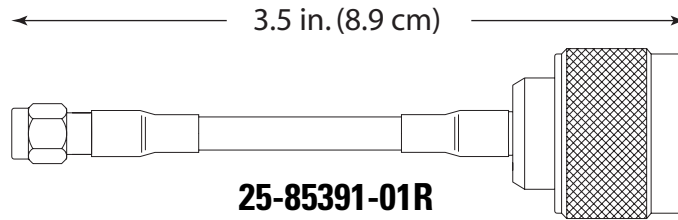


| | |
|---------------|-------------------------|
| Type | Black, Ultralink, RG-58 |
| RF Connectors | N (f) to RP. BNC (f) |
| Frequency | 2400-2500 MHz |
| Attenuation | 0.2 dB |

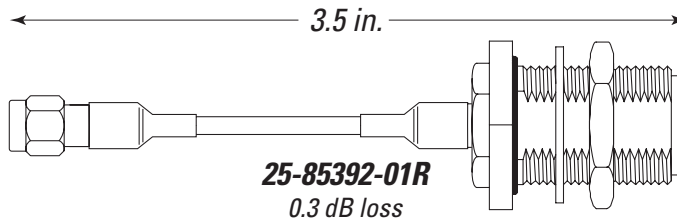
7.1.2 ML-1499-RBNCA2-01R 1 ft. N Male to RP BNC Female Cable Adapter with Connector Seal Kit



| | |
|--------------------|---------------|
| 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 |

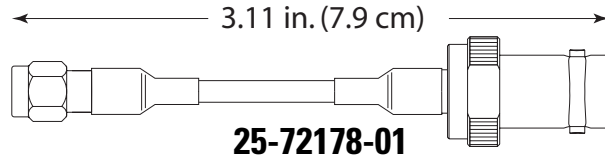
7.1.3 25-85391-01R 3.5 in. Jumper Cable, RP-SMA (Male) to Type N (Male) Adaptor

| | |
|----------------|----------------------|
| 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

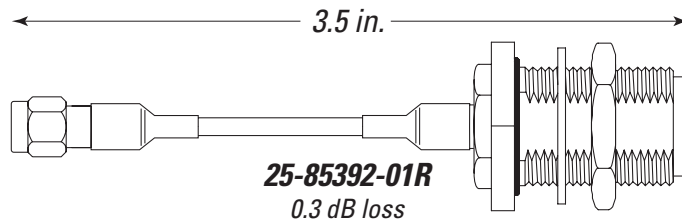
| | |
|----------------|--------------------------|
| Type | Clear Jacket, RG-316 |
| Connector 1 | RP-SMA, Male |
| Connector 2 | Type N, Female, Bulkhead |
| Insertion Loss | 2.4 GHz: 0.2 dB MIN |
| Insertion Loss | 5.2 GHz: 0.3 dB MIN |

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



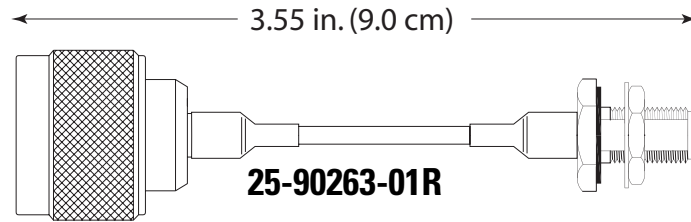
| | |
|----------------|----------------|
| Type | RG-316 |
| Connector 1 | RP-SMA, Male |
| Connector 2 | RP-BNC, Female |
| Insertion Loss | 2.4 GHz: .2 dB |
| Insertion Loss | 5.2 GHz: .3 dB |

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



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

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>.

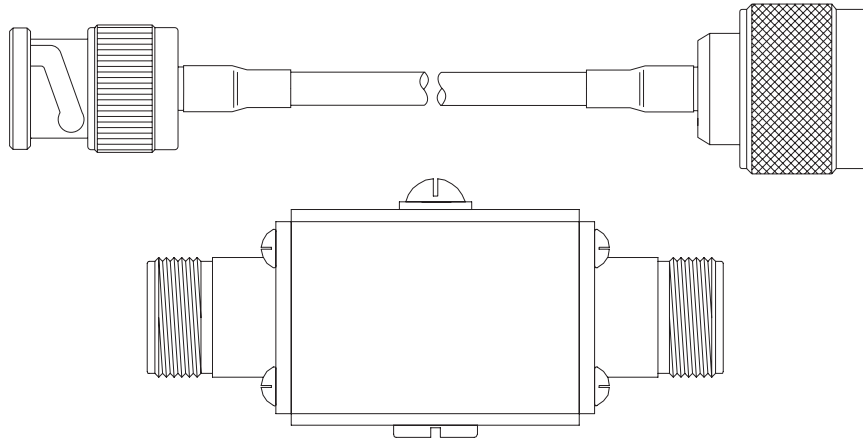
For detailed information on supported lightning arrestors refer to:

- *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



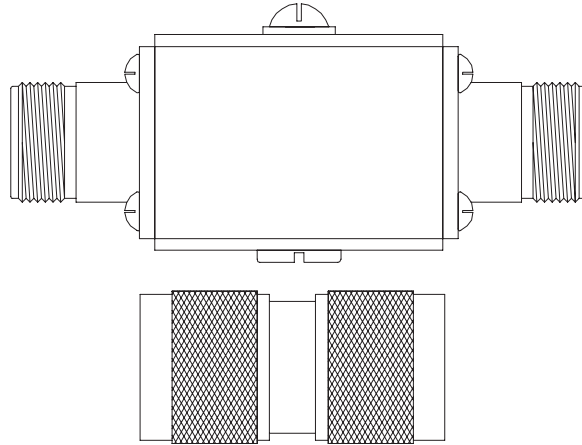
ML-1499-LAK1-01R

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



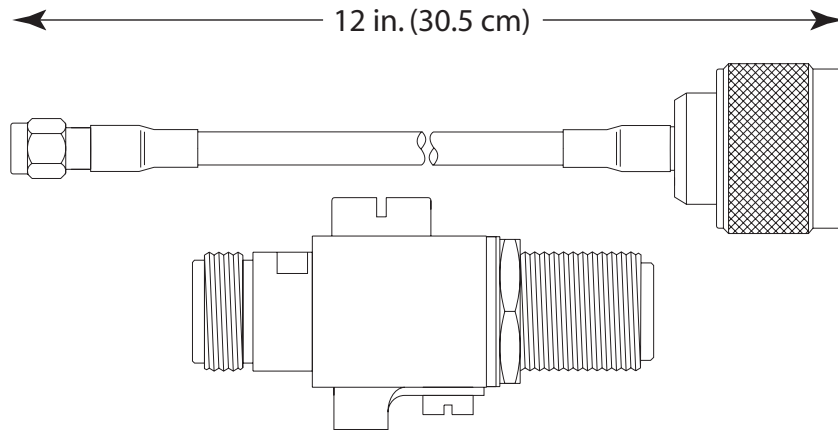
ML-1499-LAK2-01R

| | |
|--|------------------------------------|
| <i>RF Connectors</i> | N (m) to N (m) |
| <i>Arrestor RF Connectors</i> | N (f) to N (f) |
| <i>Frequency</i> | 2400-2500 MHz |
| <i>Maximum RF Power</i> | 100 W |
| <i>Insertion Loss - Lightning Arrestor</i> | 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

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

Mounting Kits

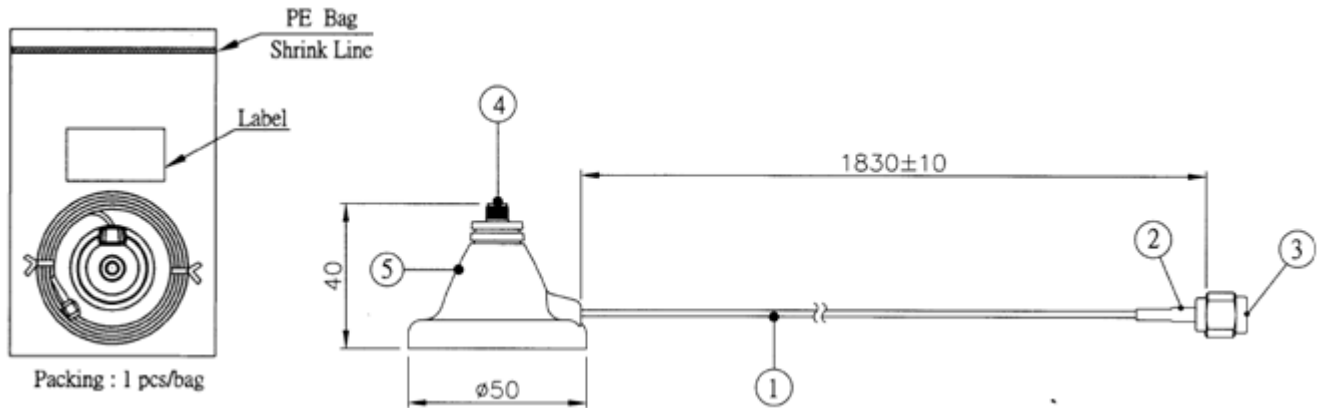
9.1 Mounting Kit Support

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:

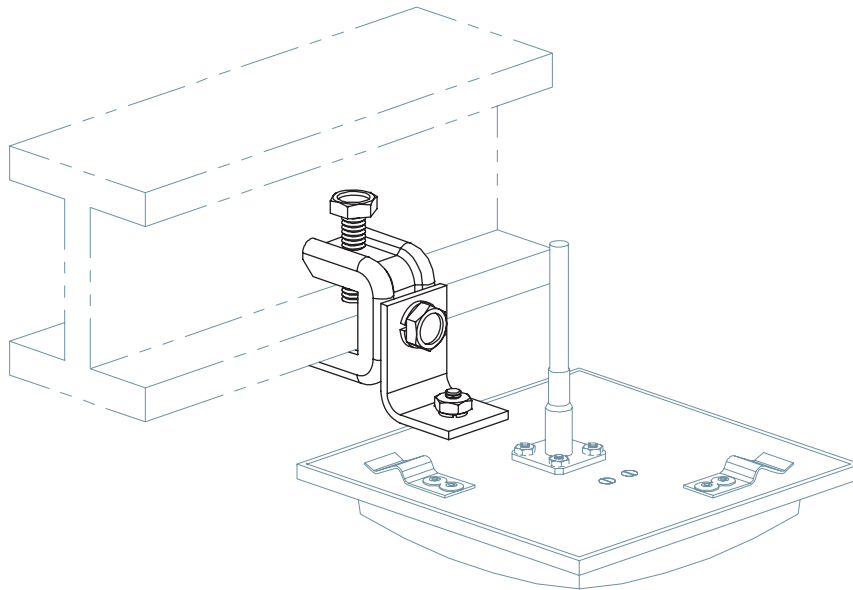
- *ML-1499-APAMK-01R Magnetic Base for ML-2452-APA2-01 with 6 Ft. Cable RP-SMA (Male)*
- *ML-1499-SD3MK-01R Articulating I-Beam Mount Kit for ML-2499-SD3-01 Omni Antenna*

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. |
|---------------|--|

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:

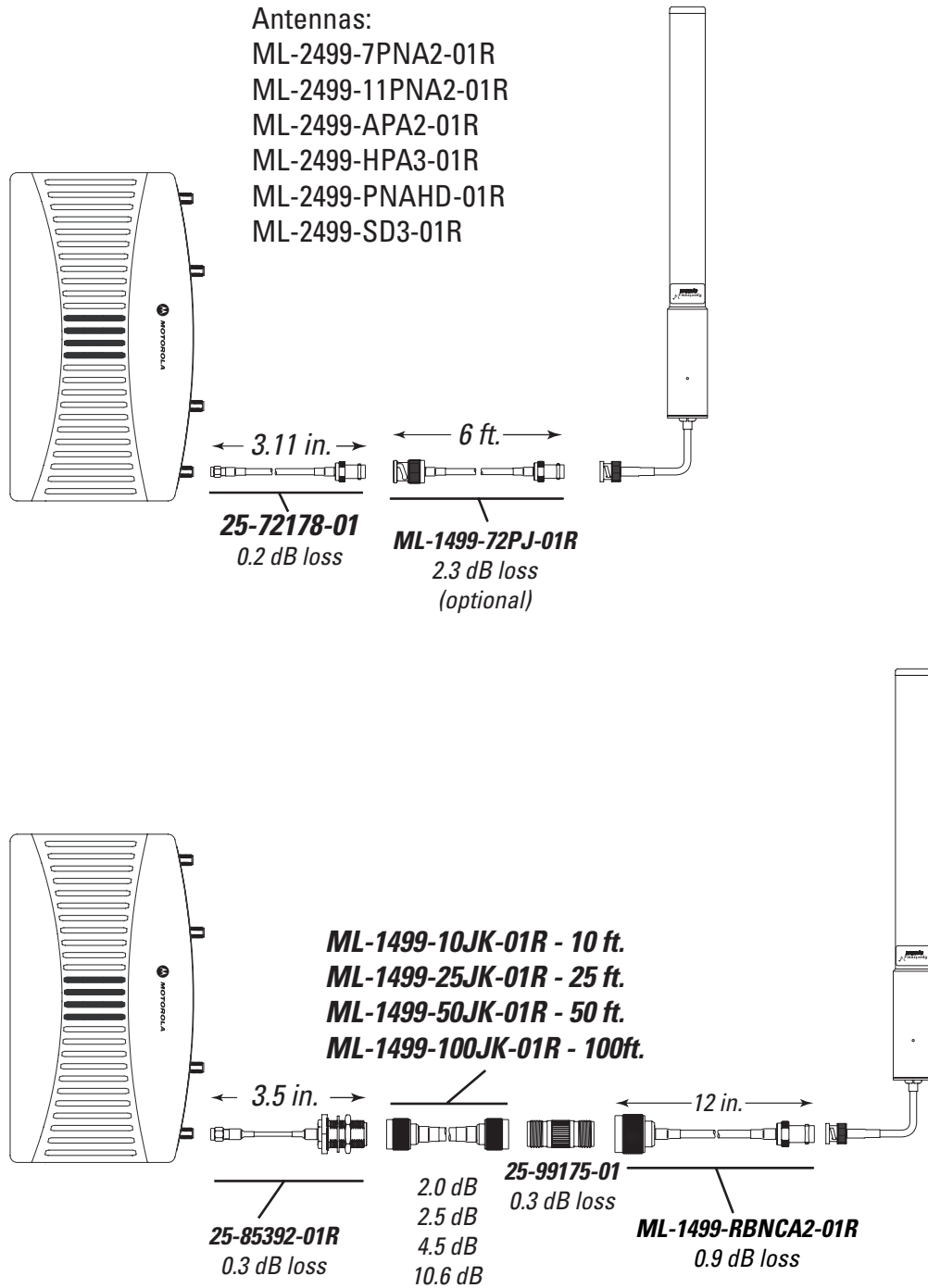
- [RP-BNC Male Antenna Installation](#)
- [Type N Male Connector Installation](#)



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

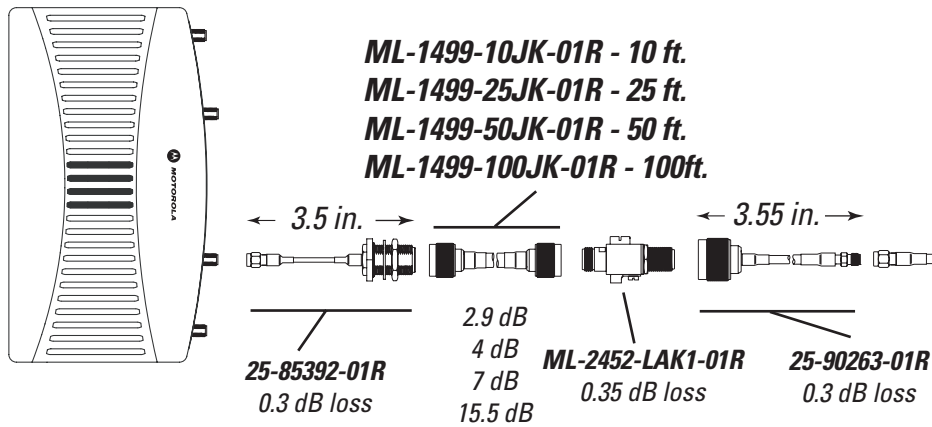
10.1.1 RP-BNC Male Antenna Installation

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:



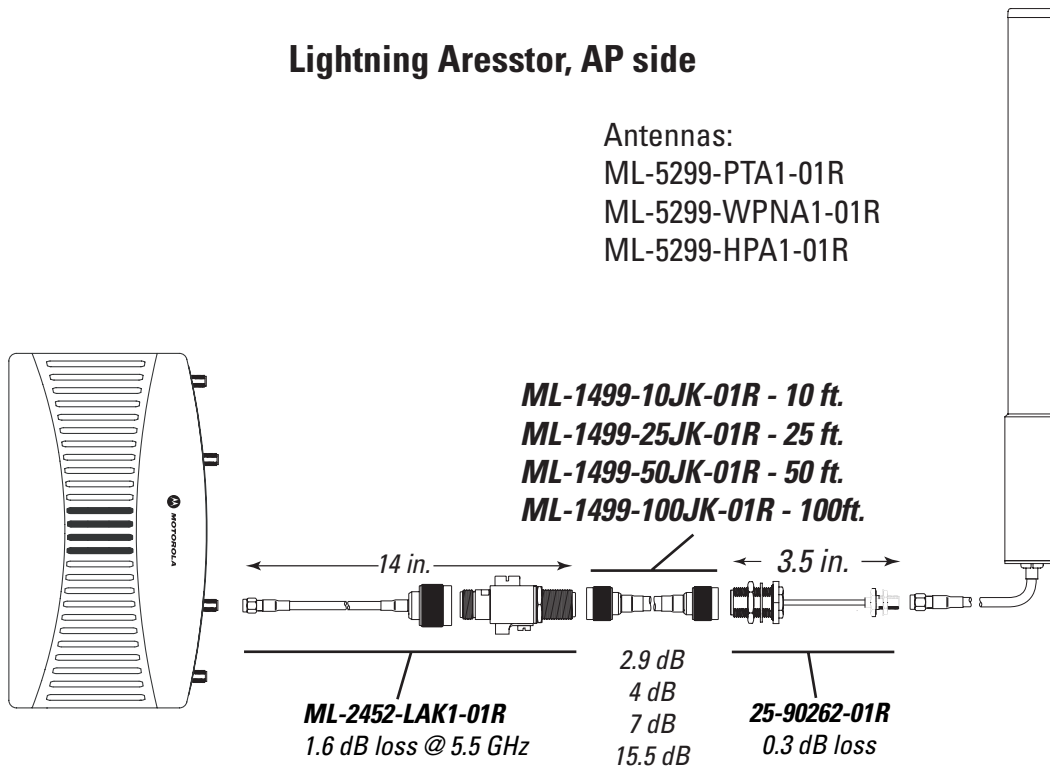
Lightning Aresstor, Antenna side

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



Lightning Aresstor, AP side

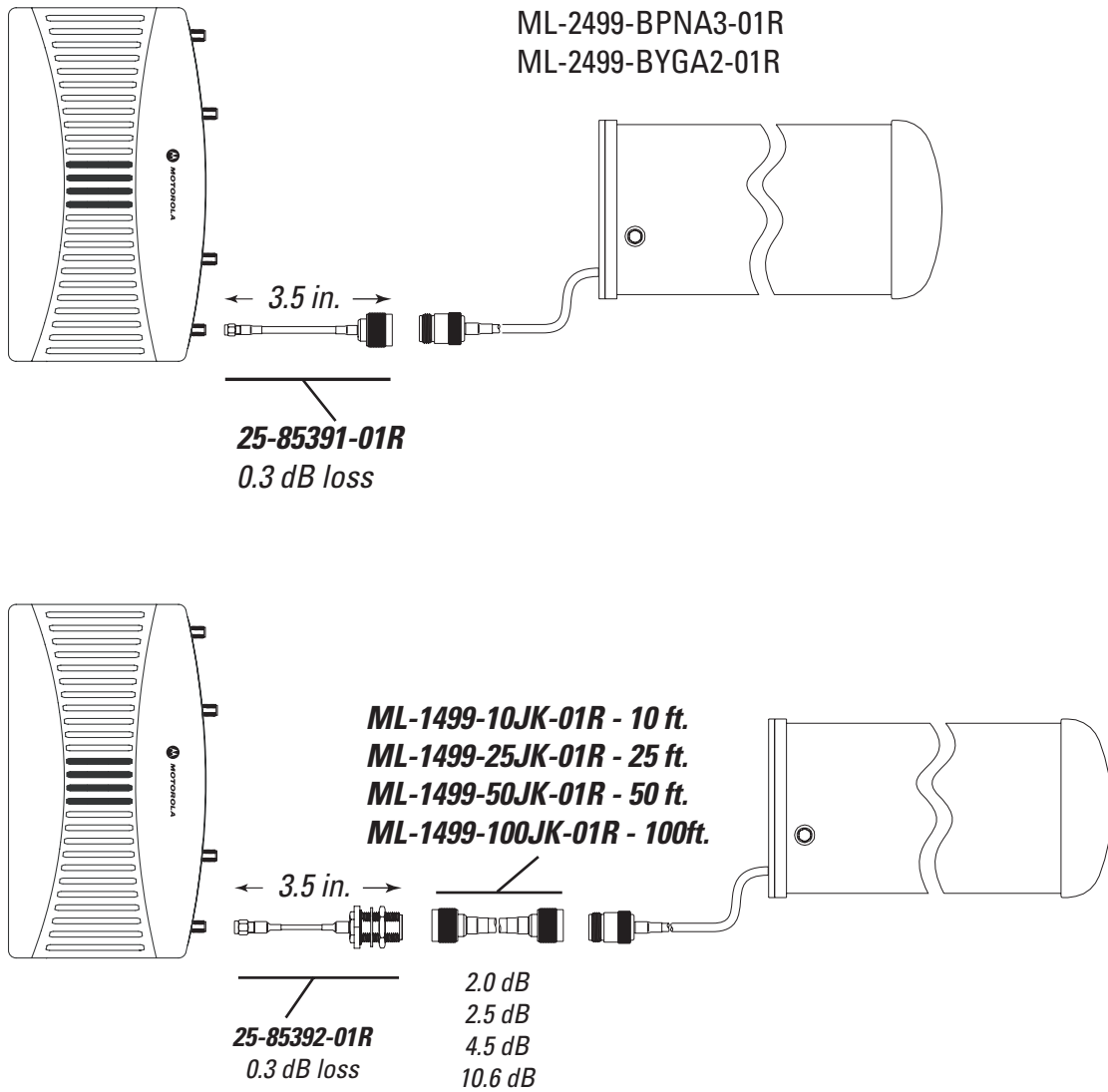
Antennas:
 ML-5299-PTA1-01R
 ML-5299-WPNA1-01R
 ML-5299-HPA1-01R




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:

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

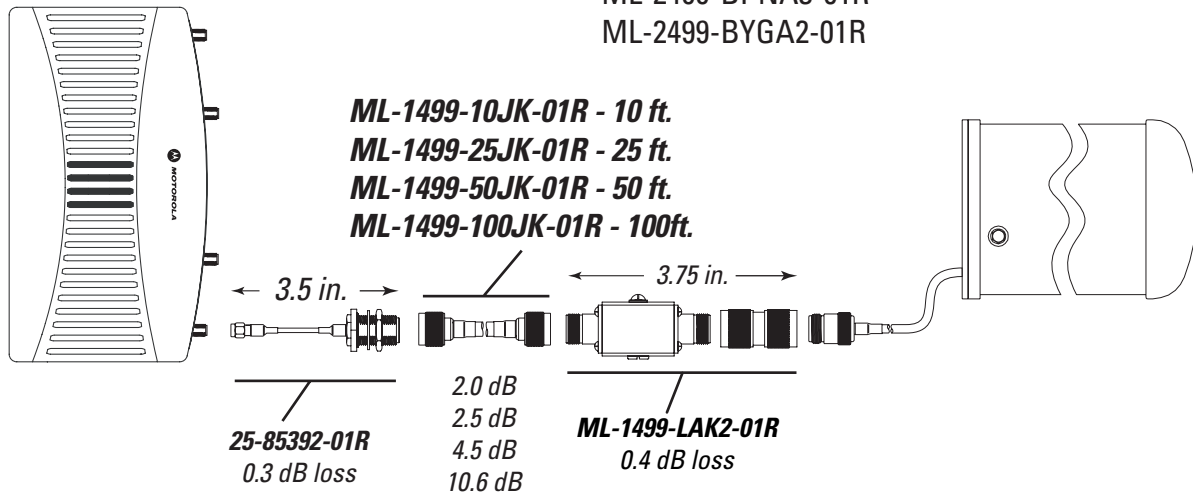


 **CAUTION:** The minimum cable configuration is required to meet regulatory requirements.

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

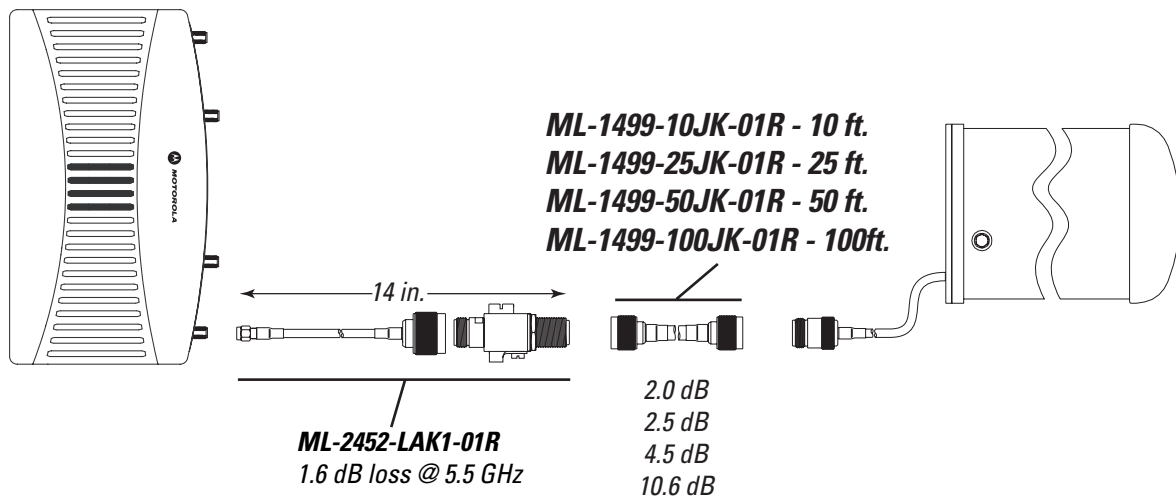
Lightning Aresstor, Antenna side

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



Lightning Aresstor, AP side

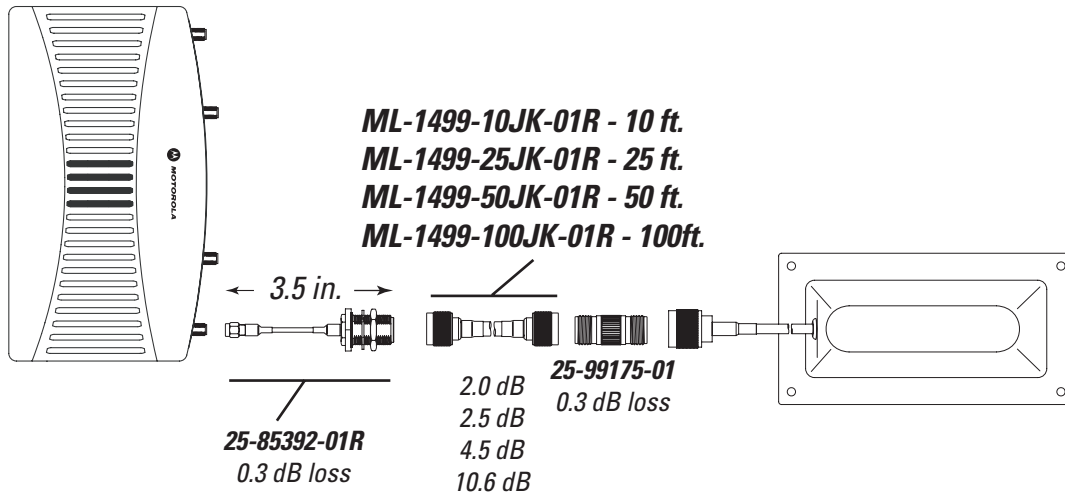
Antennas:
 ML-2499-BPDA1-01R
 ML-2499-BPNA3-01R
 ML-2499-BYGA2-01R



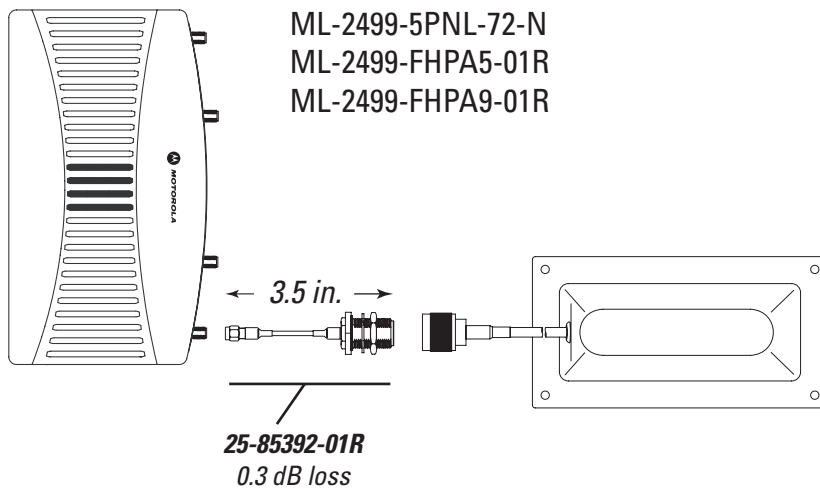
10.1.3 Type N Male Connector Installation

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:

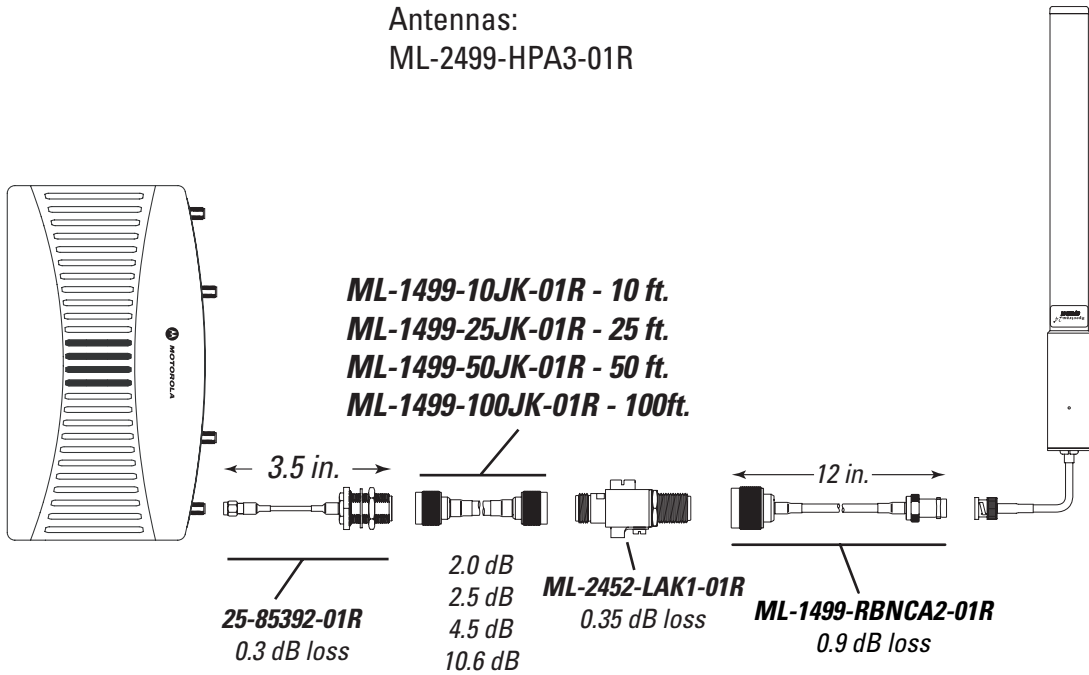
Antennas:
 ML-2499-5PNL-72-N
 ML-2499-FHPA5-01R
 ML-2499-FHPA9-01R



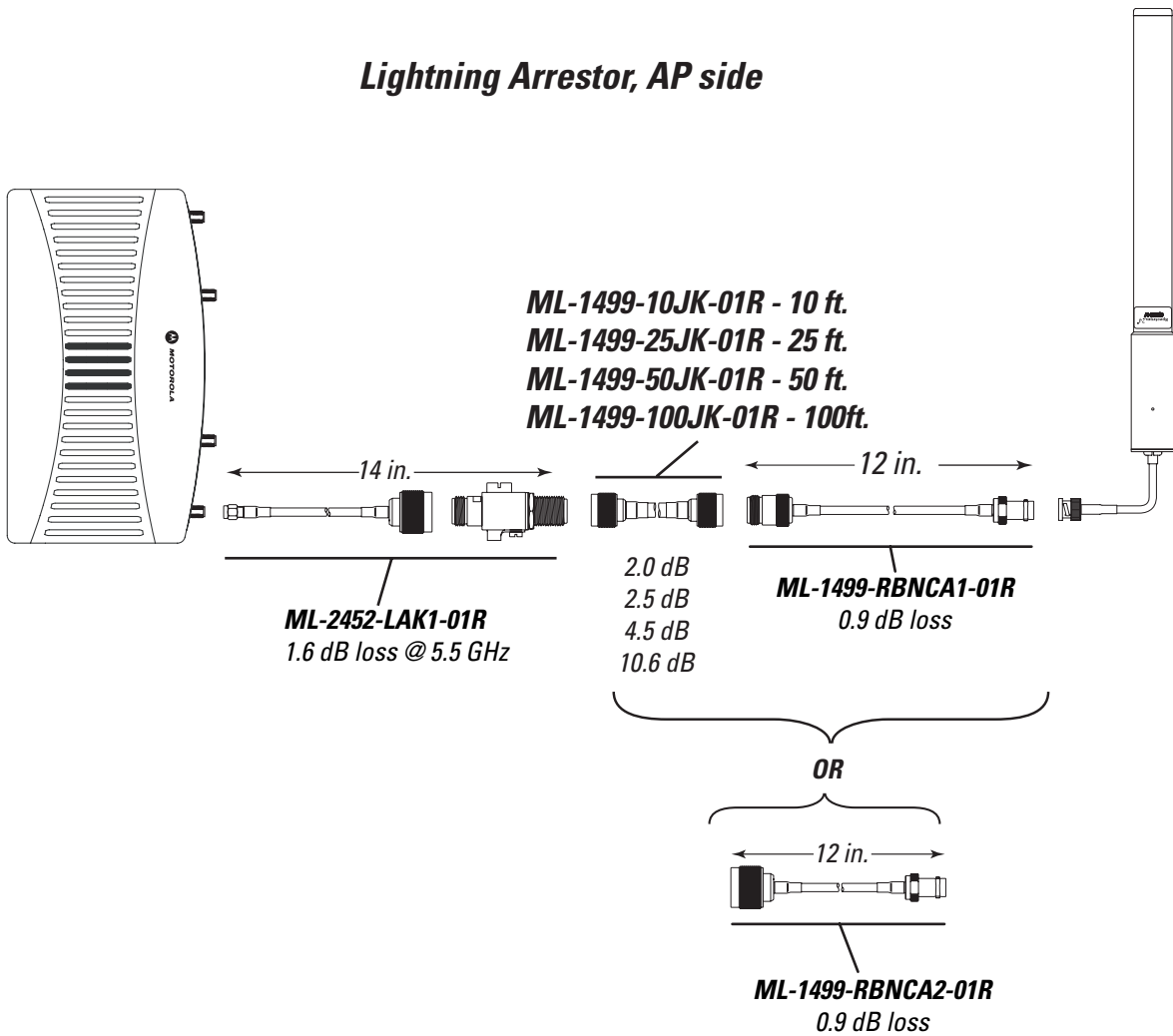
Antennas:
 ML-2499-5PNL-72-N
 ML-2499-FHPA5-01R
 ML-2499-FHPA9-01R



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:

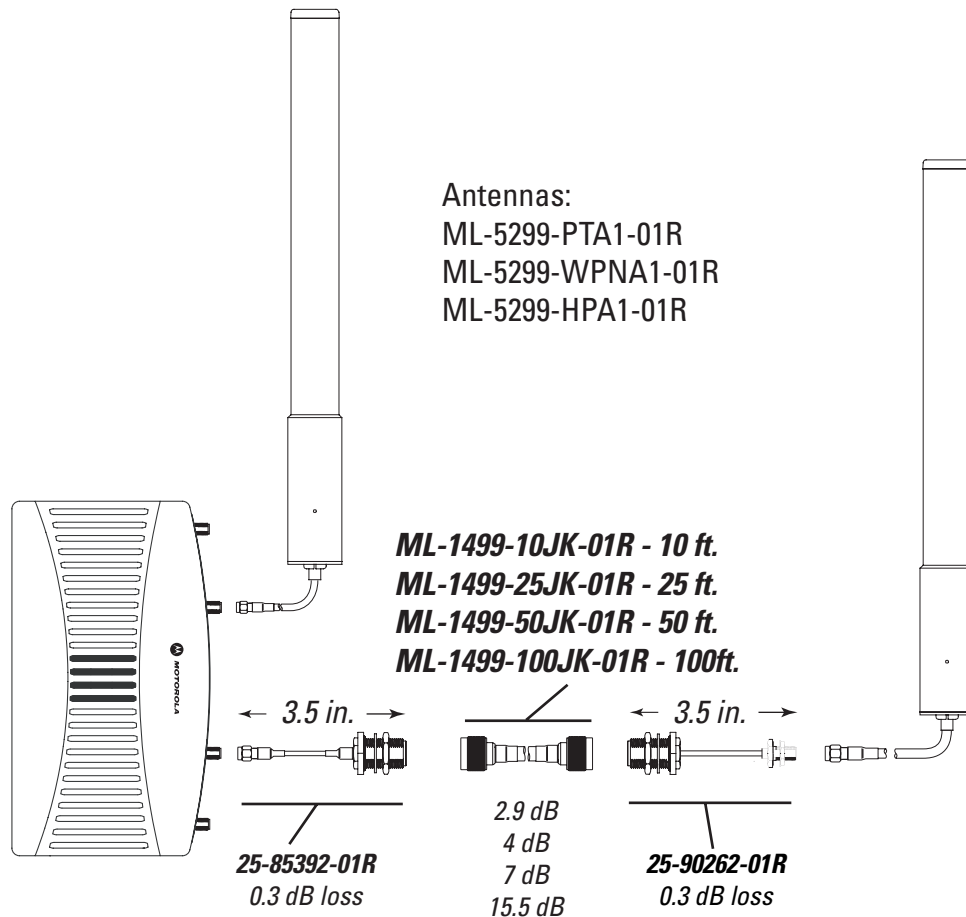
- [RP-SMA Male Antenna Installation](#)
- [Type N Male Connector Installation](#)



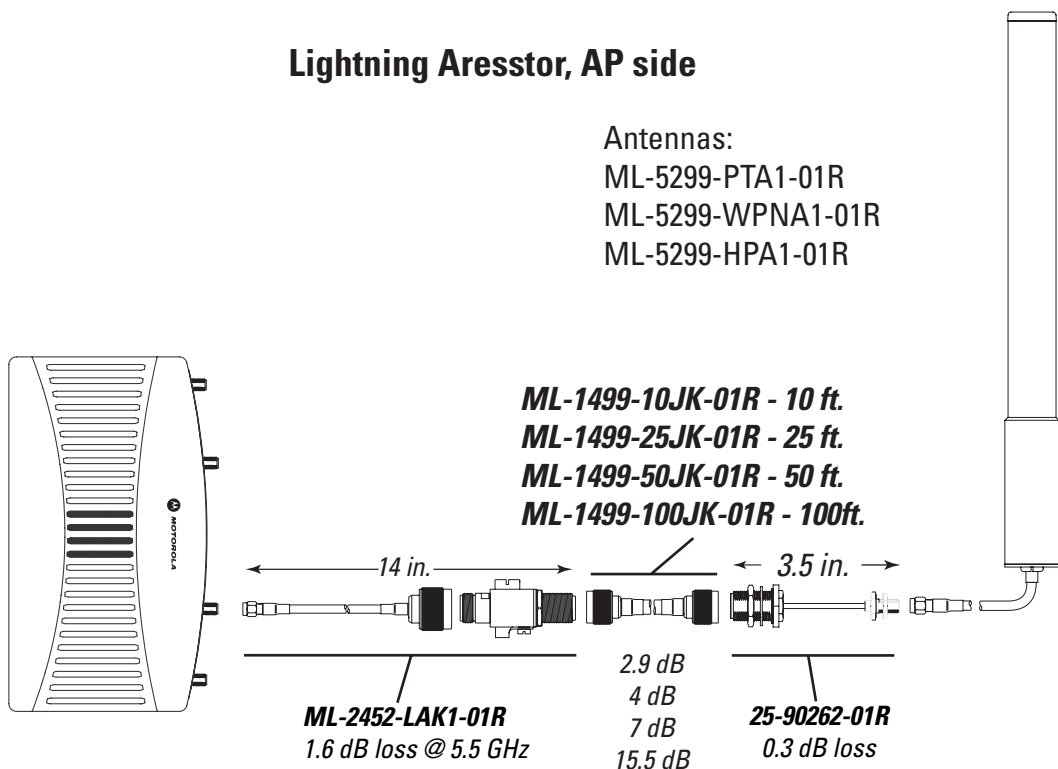
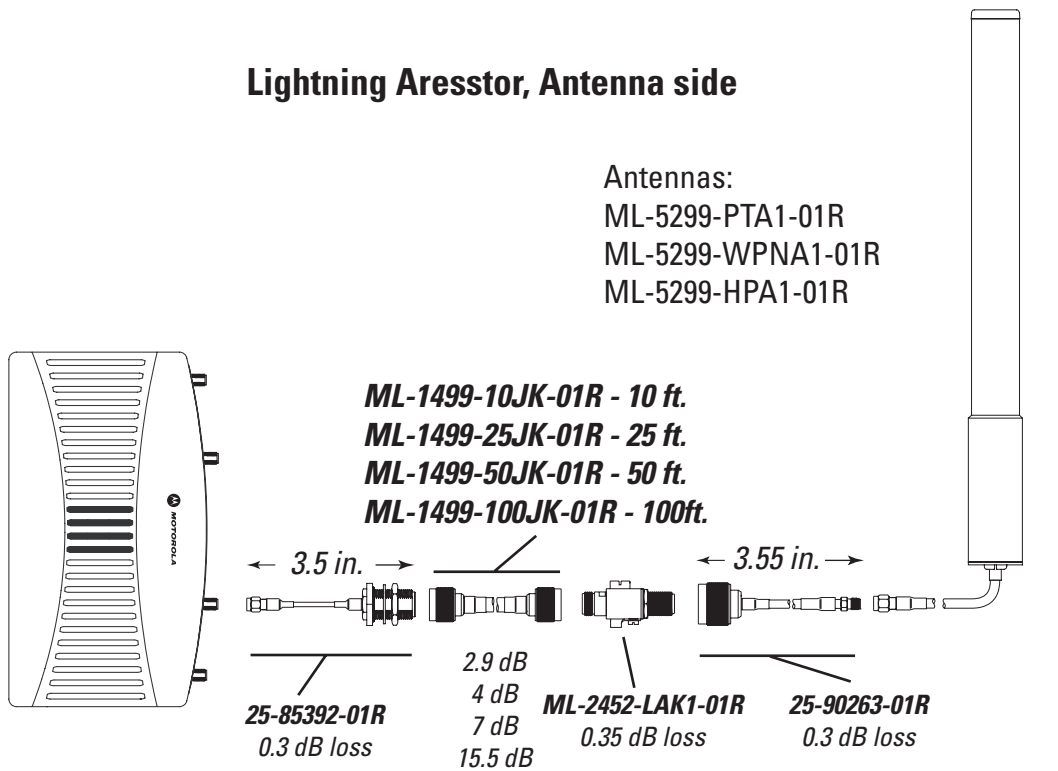
NOTE: For information on the individual 5 GHz antennas approved for use with an AP-5131, see [802.11a Antenna Suite](#).

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):

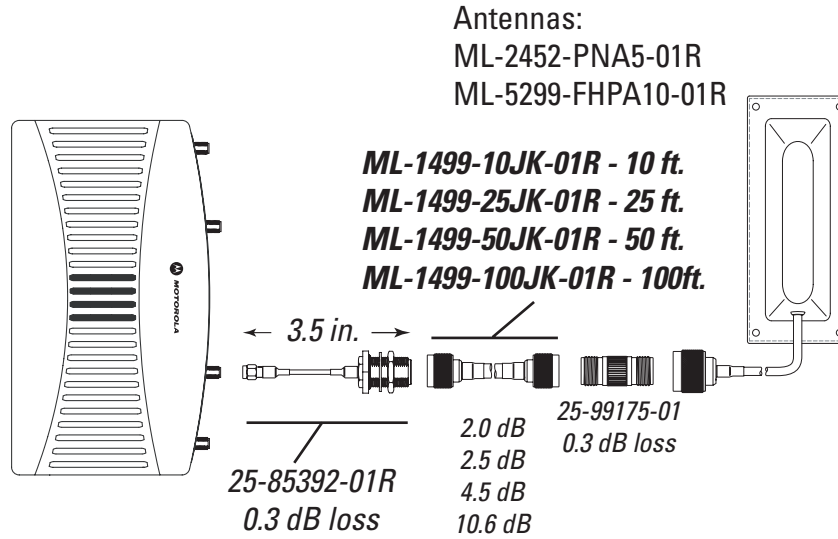


Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP-5131 model access point using a RP-SMA male antenna (with a lightning arrestor):

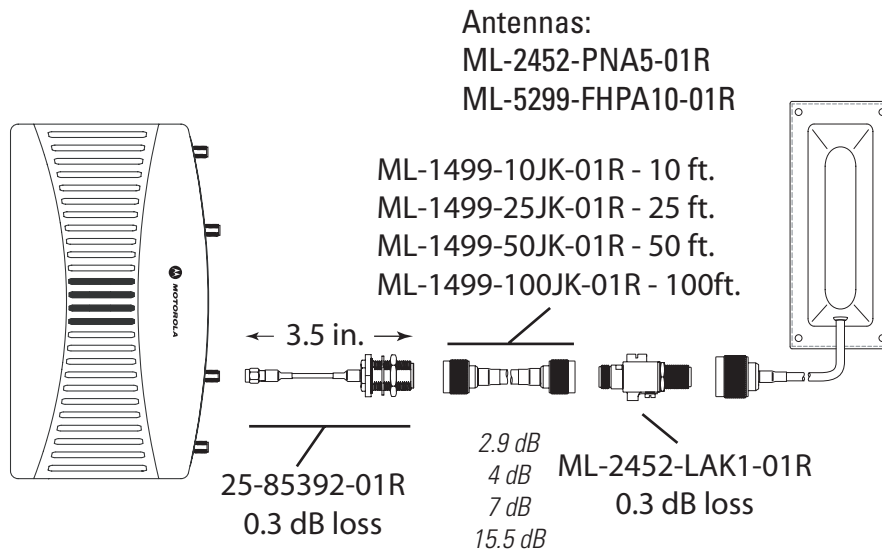


10.2.2 Type N Male Connector Installation

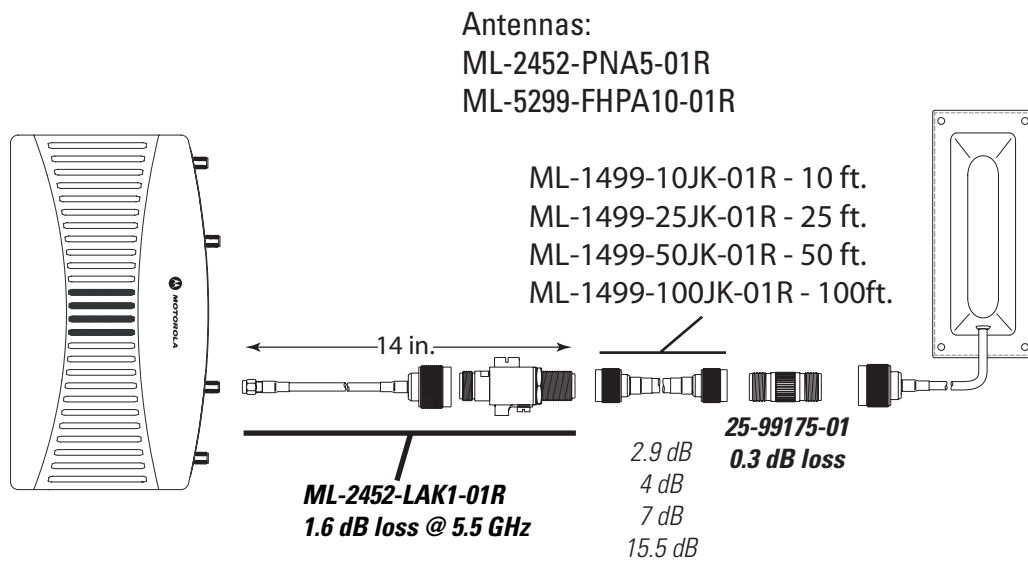
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP-5131 model access point using Type N male connectors:



Lightning Aresstor, Antenna side



Lightning Aresstor, AP side



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:

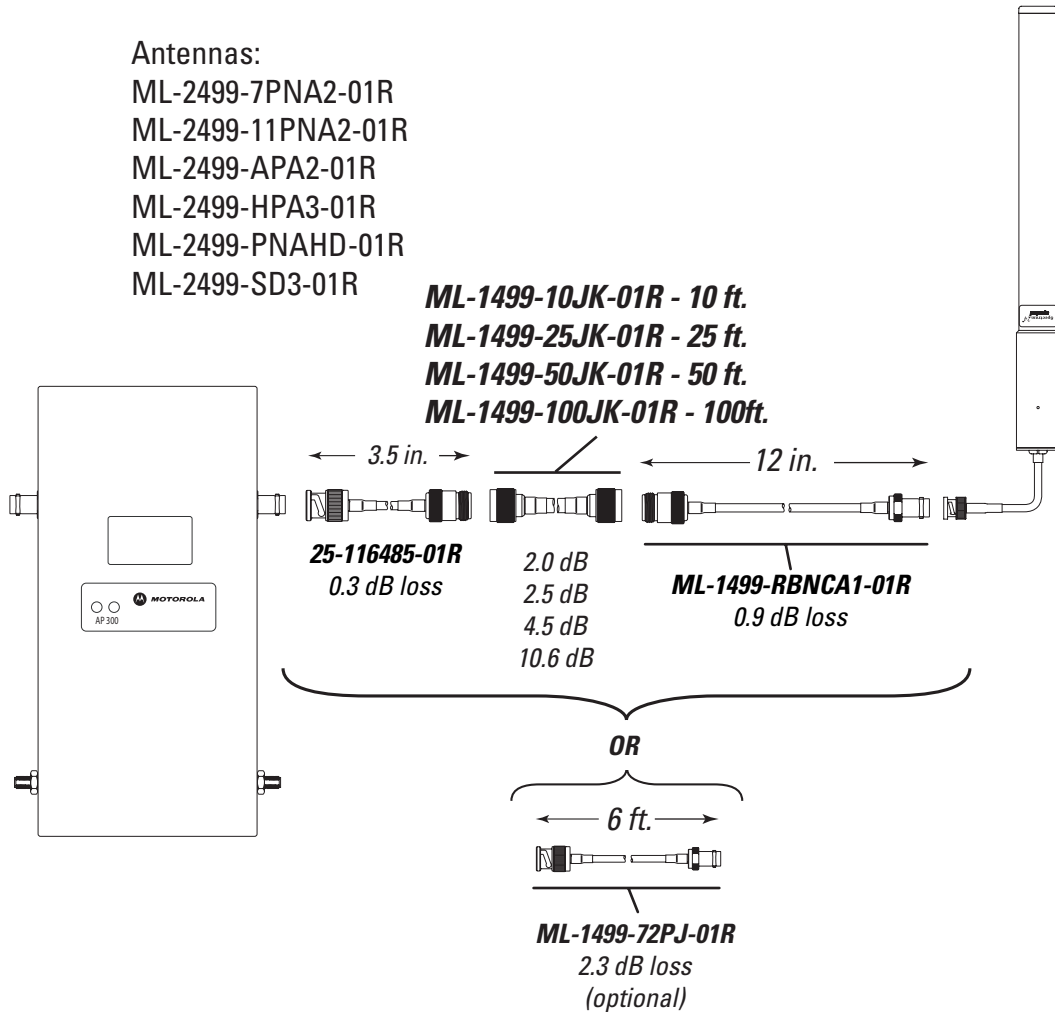
- [*RP-BNC Male Antenna Installation*](#)
- [*Type N Female Connector Installation*](#)
- [*Type N Male Connector Installation*](#)

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:

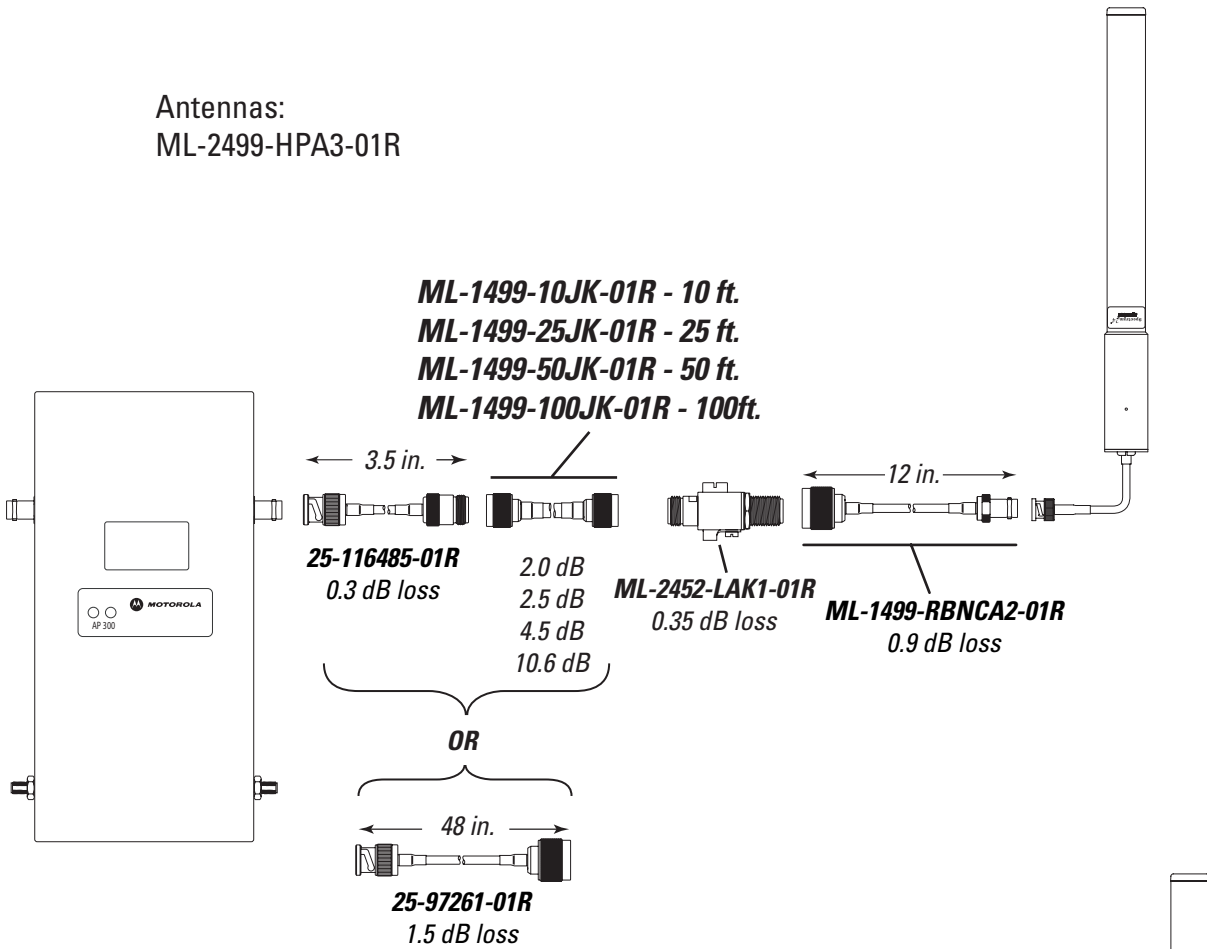
Antennas:

- ML-2499-7PNA2-01R
- ML-2499-11PNA2-01R
- ML-2499-APA2-01R
- ML-2499-HPA3-01R
- ML-2499-PNAHD-01R
- ML-2499-SD3-01R

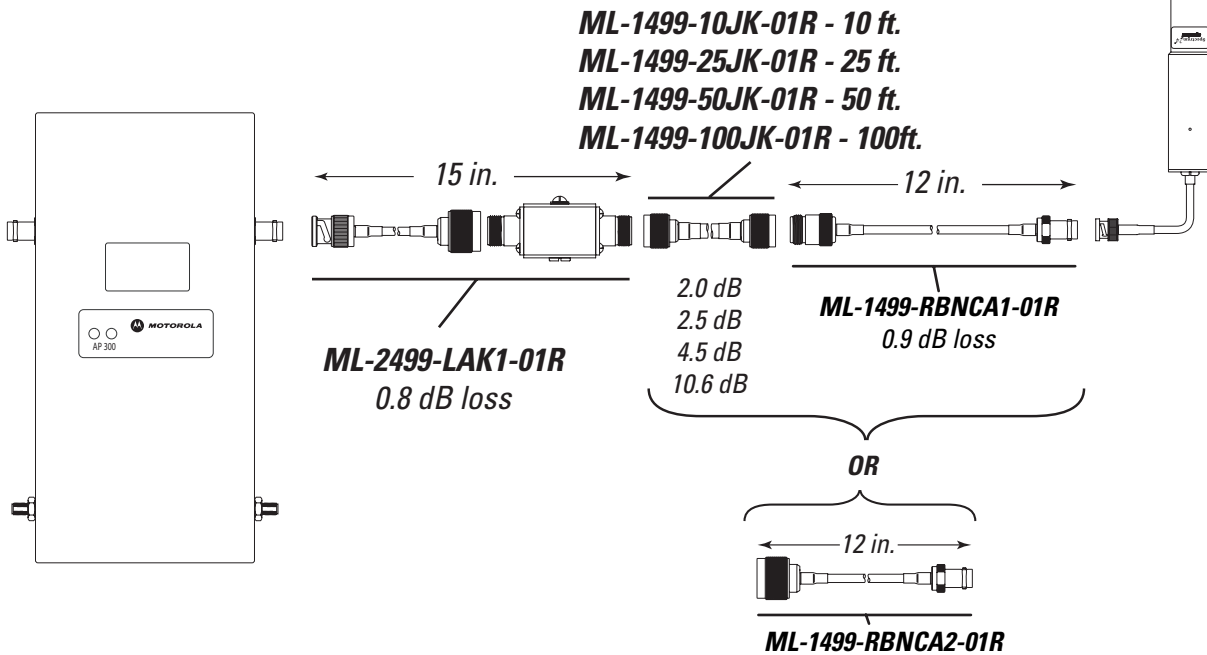


Lightning Arrestor, Antenna side

Antennas:
ML-2499-HPA3-01R

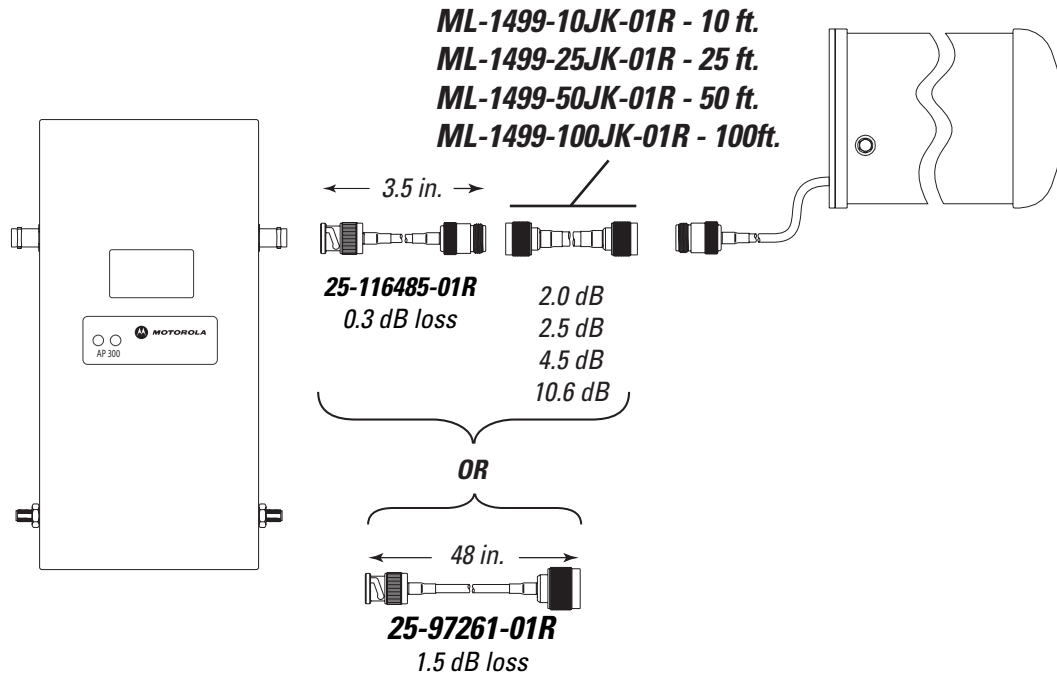


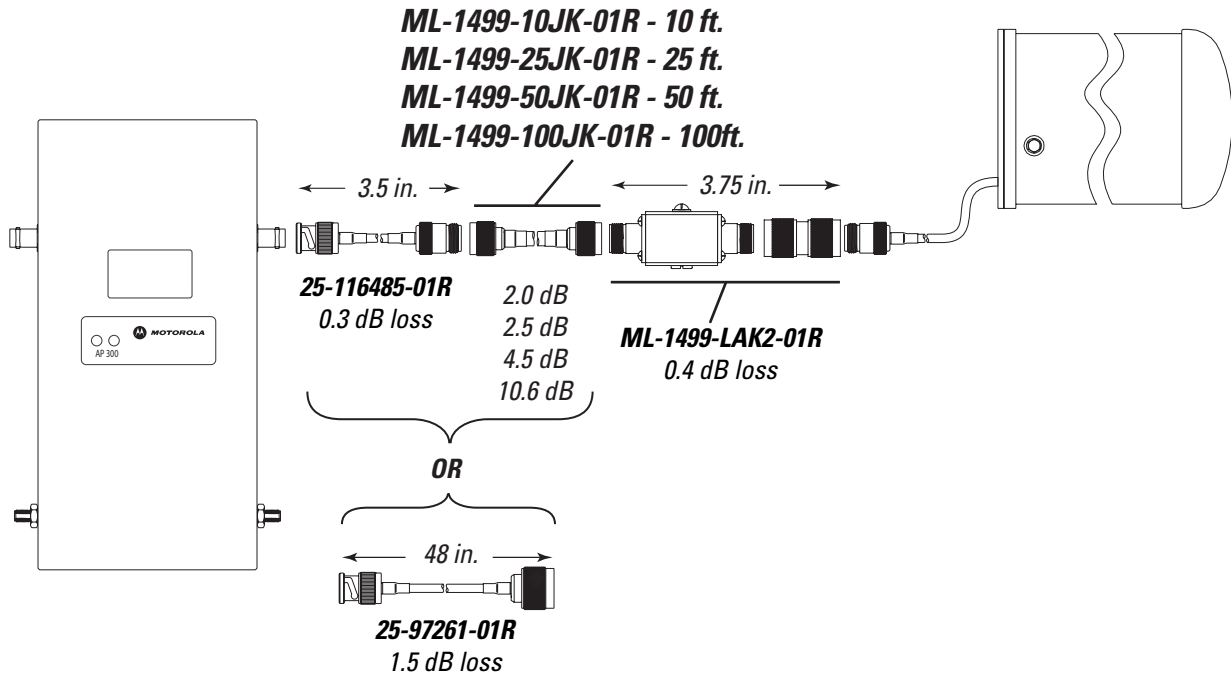
Lightning Arrestor, AP side



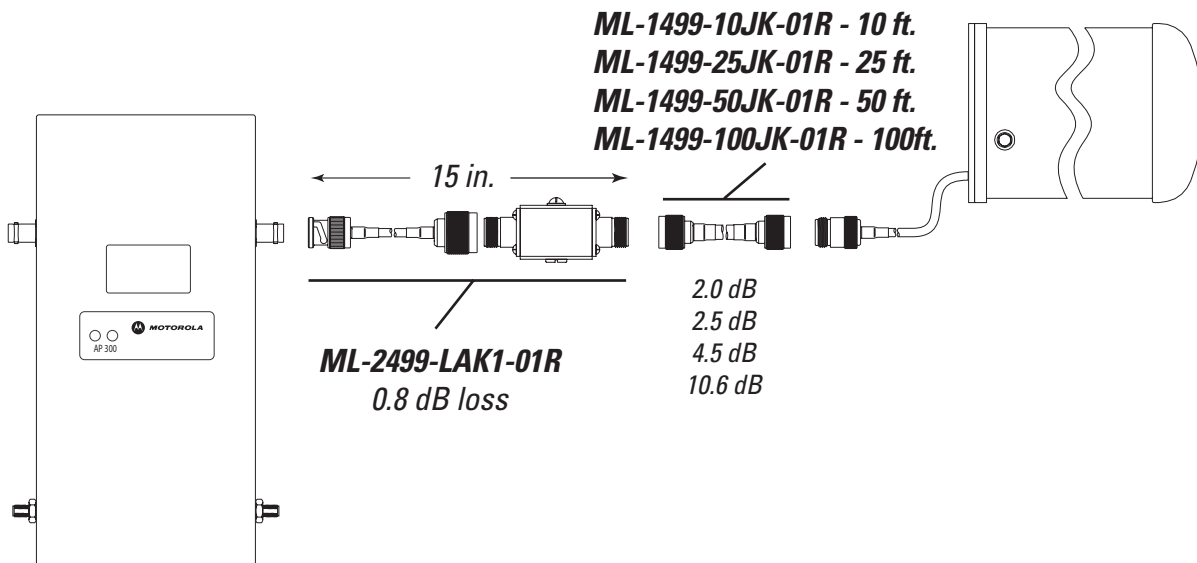
11.1.2 Type N Female Connector Installation

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.



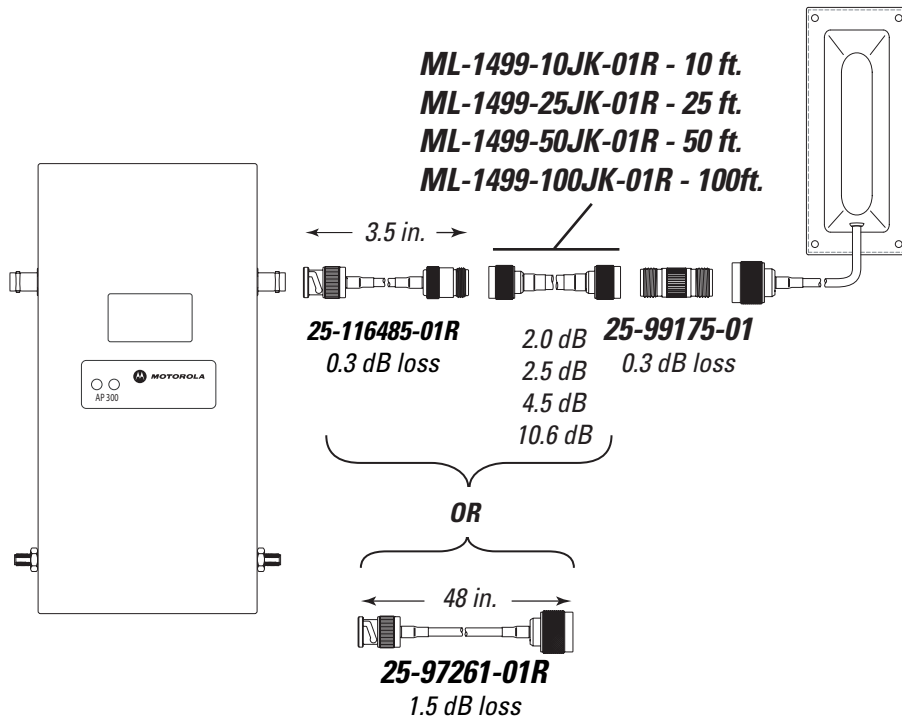


Lightning Aresstor, AP side

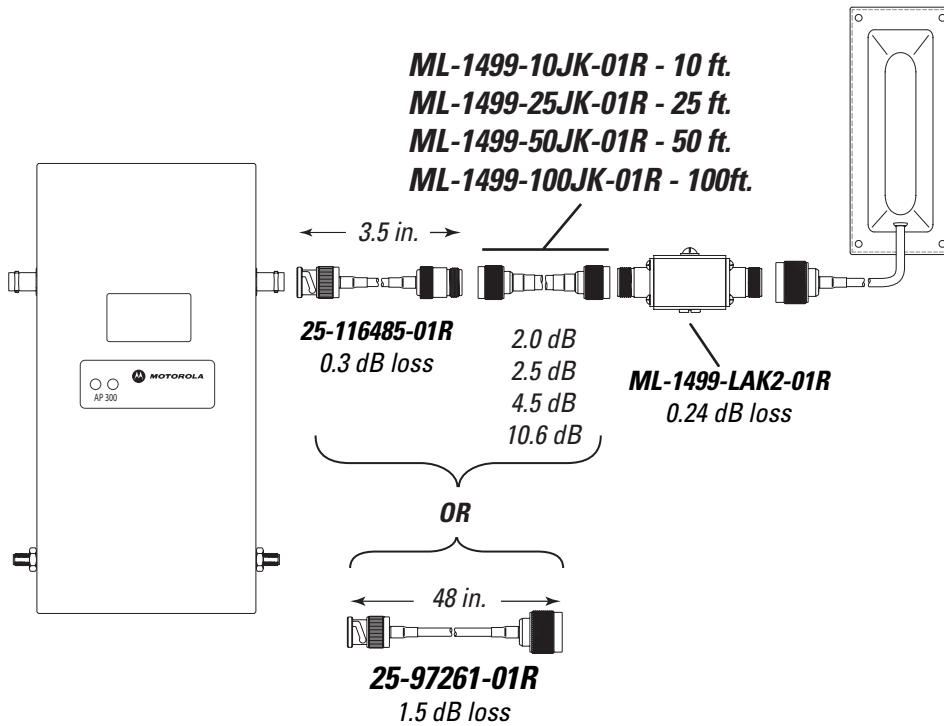


11.1.3 Type N Male Connector Installation

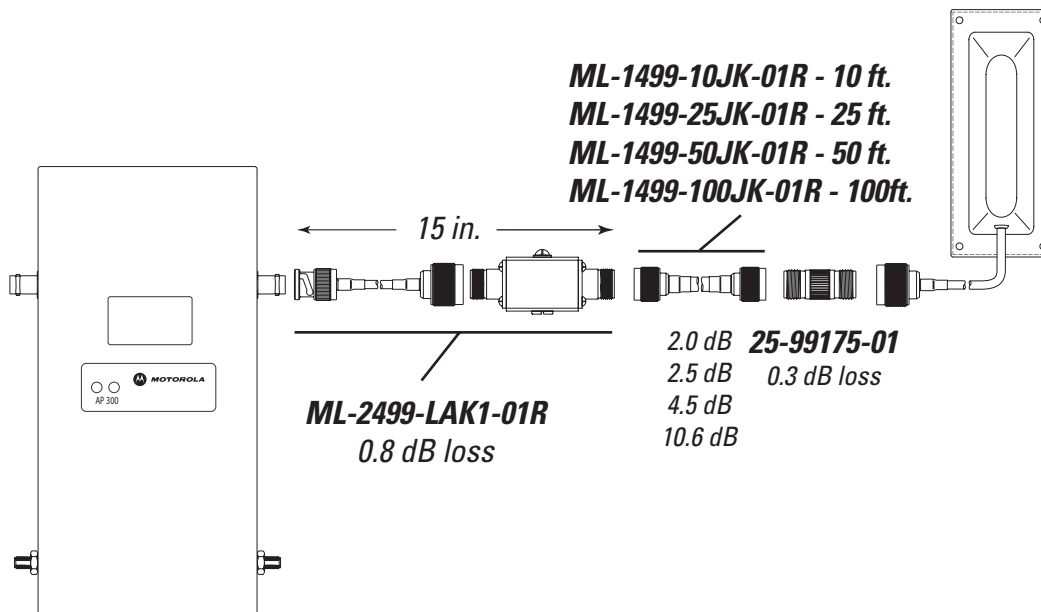
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 2.4 GHz AP300 model access port using Type N male connectors:



Lightning Arrestor, Antenna side



Lightning Arrestor, AP side



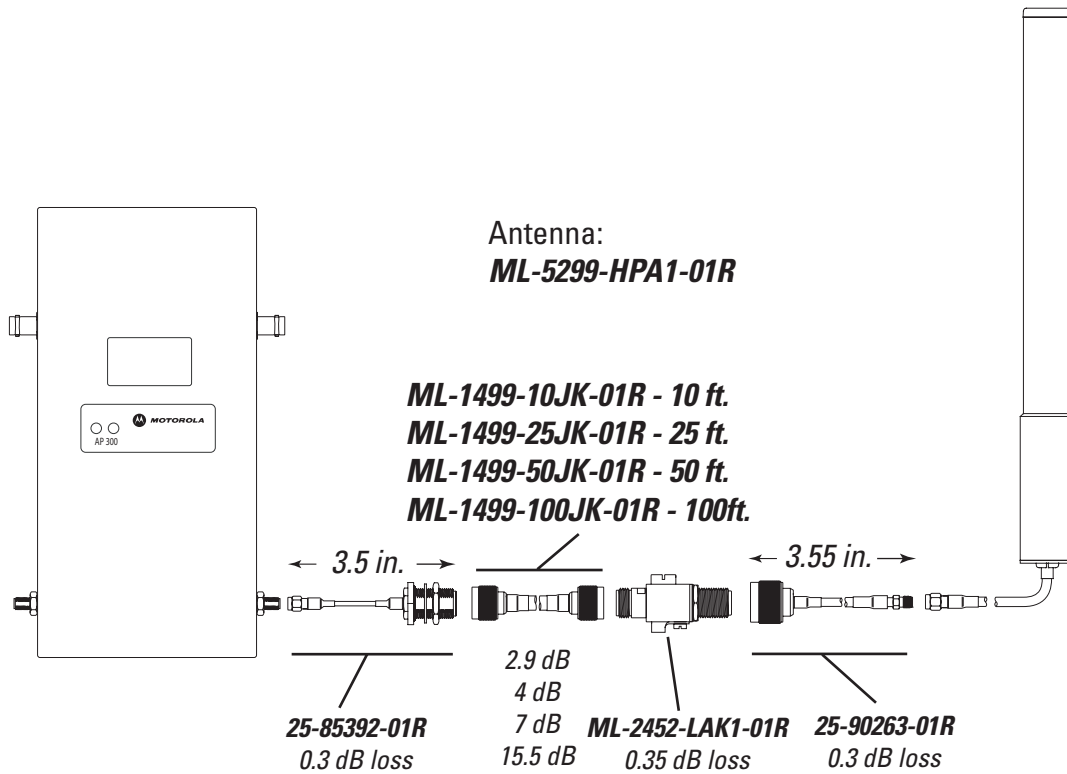
11.2 5 GHz AP300 Antenna Connections

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

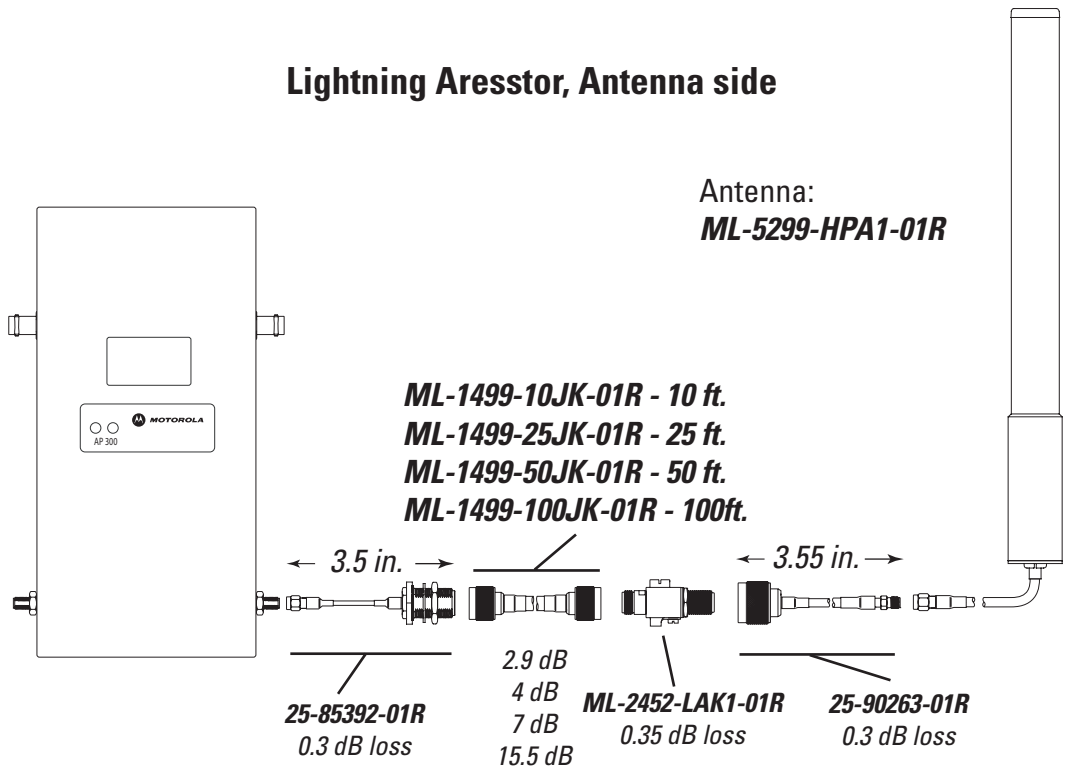
- [RP-SMA Male Antenna Installation](#)
- [Type N Male Connector Installation](#)

11.2.1 RP-SMA Male Antenna Installation

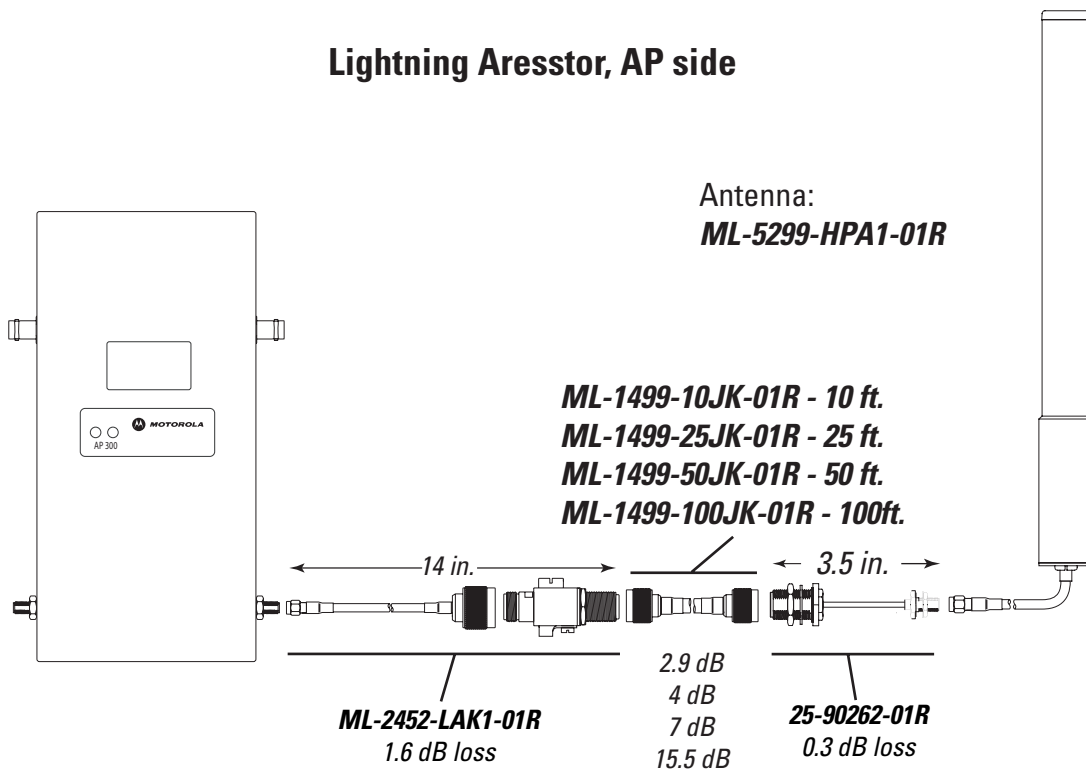
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP300 model access port using a RP-SMA male antenna.



Lightning Aresstor, Antenna side

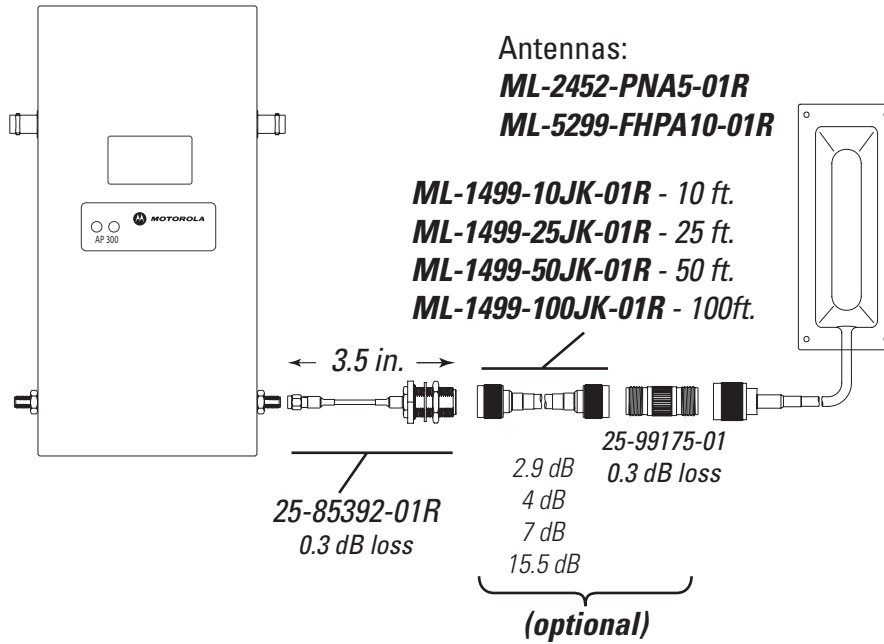


Lightning Aresstor, AP side

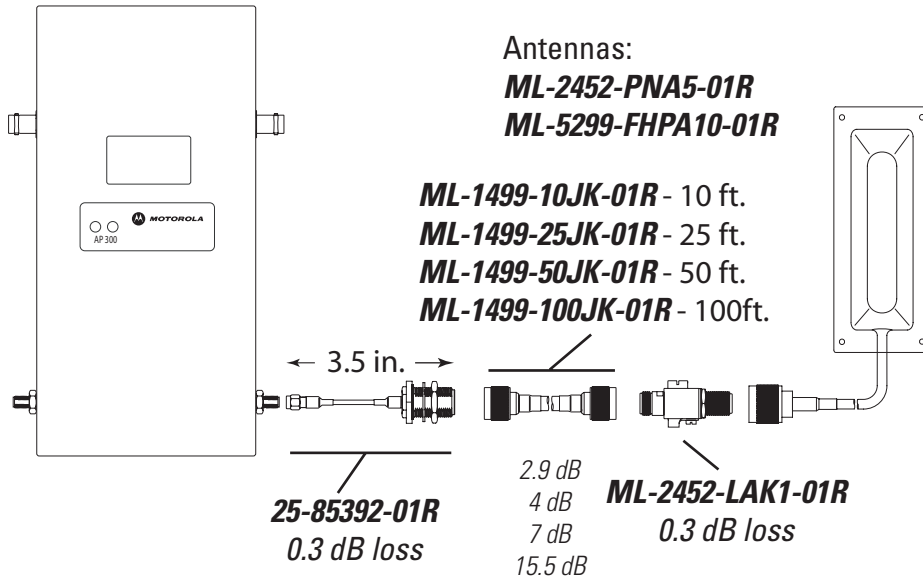


11.2.2 Type N Male Connector Installation

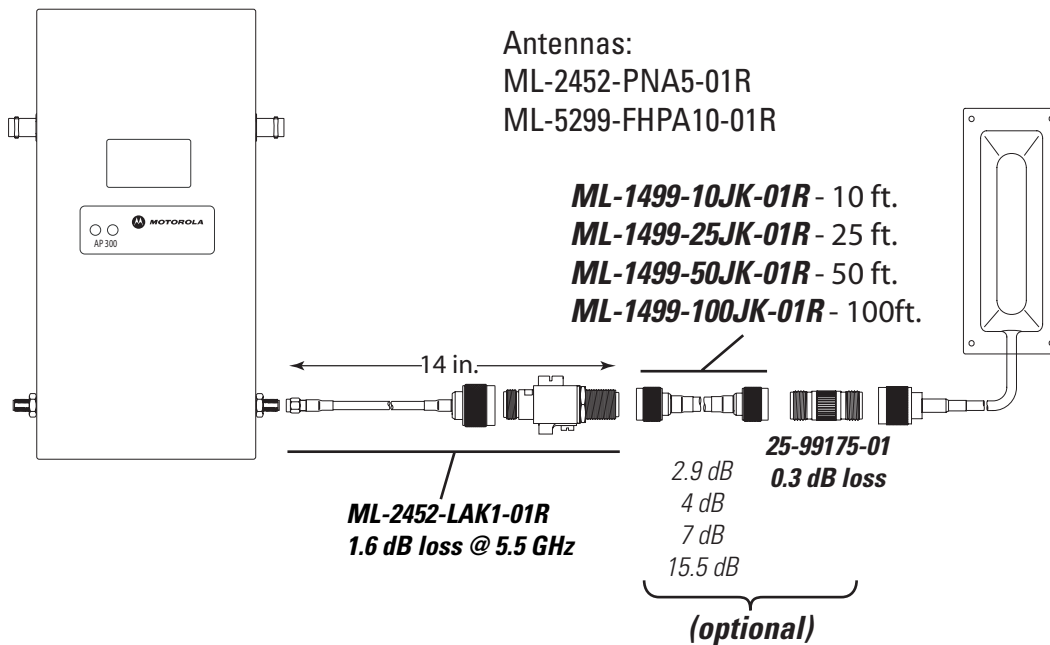
Refer to the following for a graphical depiction of the parts and connection options available for cabling an 5 GHz AP300 model access port using Type N male connectors:



Lightning Aresstor, Antenna side



Lightning Aresstor, AP side



AP-7131 Transmit Power

12.1 Configuring the AP-7131 Series Transmit Power

Professional installers must configure an AP-7131 series access point so it does not violate FCC regulations pertaining to output transmit power.

This chapter describes how to adjust an AP-7131 series access point's radio transmit power.



NOTE: Motorola assumes the AP-7131 series access point radio and power configuration activities described in this chapter are conducted at the location that access point is actually installed and deployed.

To define an AP-7131 series access point's radio transmit power:

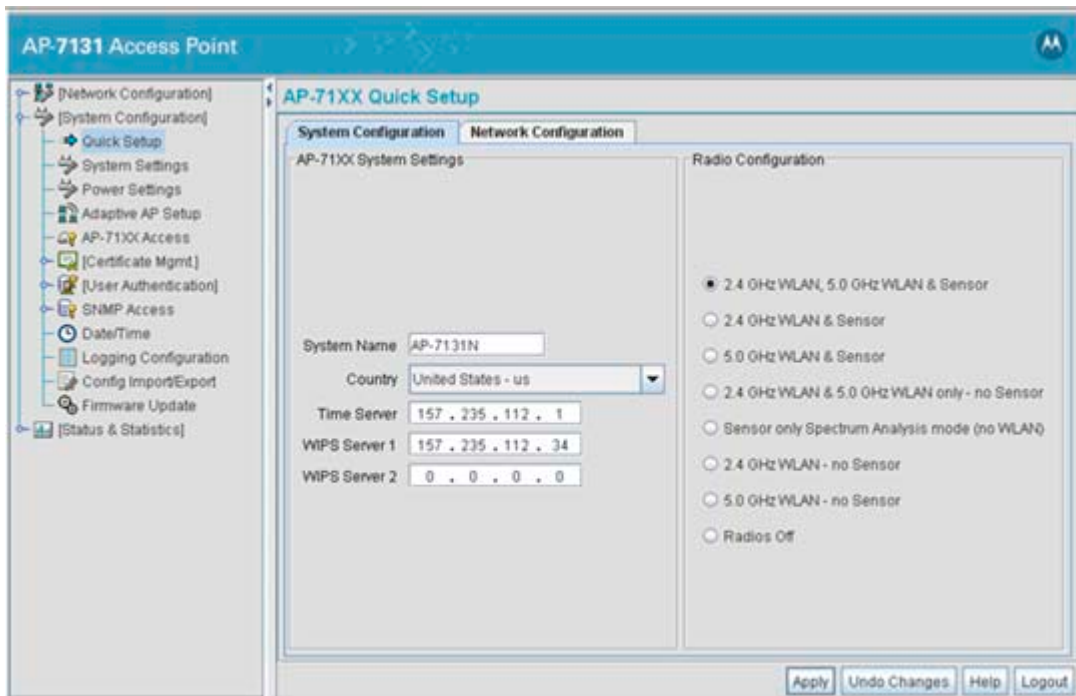
1. Complete the physical installation of the AP-7131 series access point following one of the supported mounting options within either the *AP-7131 Series Installation Guide* or *Product Reference Guide*. Both guides are available at <http://support.symbol.com/support/product/manuals.do>.

An AP-7131 series access point can attach to a wall, mount under a suspended T-Bar or above a ceiling (plenum or attic) following the same installation instructions. Choose a mounting option based on the physical environment of the coverage area. Do not mount the access point in a location that has not been approved in a site survey.

2. Start a browser and enter the access point's default static IP address for the WAN port (10.1.1.1).
3. Initially log in using **admin** as the default Username and **motorola** as the default Password. Use your new password if it has been updated from default.

If the default login is successful, the **Change Admin Password** window displays. Change the password immediately to ensure secure access.

4. Select **System Configuration** -> **Quick Setup** from the menu tree.



5. Select the **System Configuration** tab to define the access point's country code and radio configuration.
6. Select the **Country** for the access point's country of operation.

The access point prompts for the correct country code on the first login. A warning message also displays stating an incorrect country setting may result in illegal radio operation. Selecting the correct country is central to legally operating the access point. Each country has its own regulatory restrictions concerning electromagnetic emissions and the maximum RF signal strength that can be transmitted. To ensure compliance with national and local laws, set the country accurately.

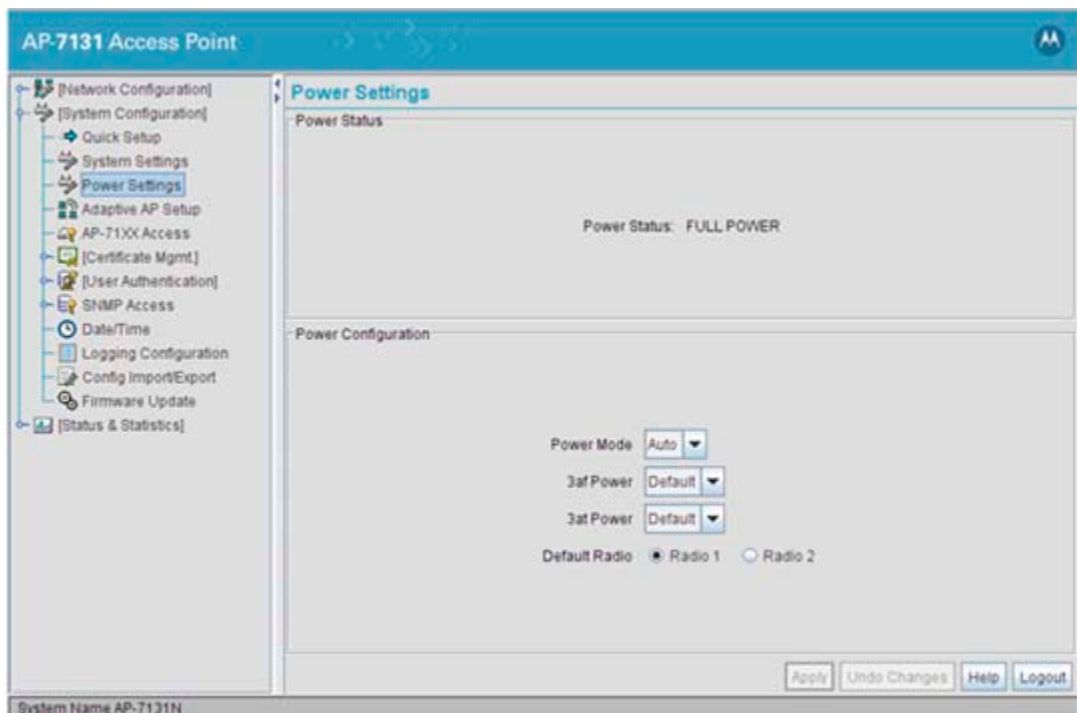


NOTE: If the access point is a US supported model, the country code is automatically set to US.

7. Refer to the **Radio Configuration** field to define how WLAN and WIPS are supported by the access point's radio(s). Remember, the options available depend on the single, dual or three radio model deployed. Apply your settings when finished with the updates.

| Radio Button | Single Radio SKU | Dual Radio SKU | Three Radio SKU |
|--|-------------------------|----------------------------------|--|
| 2.4 GHz WLAN, 5.0 GHz WLAN & Sensor | Not Available | Not Available | Radio 1 WLAN, Radio 2 WLAN, Radio 3 WIPS |
| 2.4 GHz WLAN, & Sensor | Not Available | Radio1 WLAN, Radio 2 WIPS | Radio 1 WLAN, Radio 2 WIPS, Radio 3 WIPS |
| 5.0 GHz WLAN & Sensor | Not Available | Radio 1 WIPS, Radio 2 WLAN | Radio 1 WIPS, Radio 2 WLAN, Radio 3 WIPS |
| 2.4 GHz WLAN & 5.0 GHz WLAN only - no Sensor | Not Available | Radio 1 WLAN, Radio 2 WLAN | Radio 1 WLAN, Radio 2 WLAN, Radio 3 Disabled |
| Sensor only Spectrum Analysis mode (no WLAN) | Radio 1 WIPS | Radio 1 WIPS, Radio 2 WIPS | Radio 1 WIPS, Radio 2 WIPS, Radio 3 Disabled |
| 2.4 GHz WLAN - no Sensor | Radio 1 WLAN (B/G/N) | Radio1 WLAN, Radio 2 Disabled | Radio 1 WLAN, Radio 2 Disabled, Radio 3 Disabled |
| 5.0 GHz WLAN - no Sensor | Radio 1 WLAN (A/N) | Radio1 Disabled, Radio 2 WLAN | Radio 1 Disabled, Radio 2 WLAN, Radio 3 Disabled |
| Radios Off | Radio 1 Disabled | Radios 1 and 2 Disabled | Radios 1, 2 and 3 Disabled |

8. Select **System Configuration** -> **Power Settings** from the menu tree.



Within the **Power Configuration** field, an installation professional selects a power mode based on the different power resources available to that access point's SKU. For 3af and 3at, choose between **Default** and **Option** as best suited to that hardware SKU. For example, if Option is selected for 3af Power, and the access point is a dual radio model, the following configuration is set:

LAN port ON (1000 BASE-T)

WAN port OFF

Radio 1 (2.4) on, 2x3 mode with maximum transmit power 18dBm

Radio 2 (5.0) on, 2x3 mode with maximum transmit power 18dBm

9. For this example, set the Power Mode to **Auto** (if not already defined as Auto by default). Leave the 3af and 3at Power settings as Default.

When the access point is powered on for the first time, the system determines the power budget available to the access point. Using the Auto setting (default setting), the access point automatically determines the best power configuration based on the available power budget. Therefore, the Auto power mode option affords the professional installer a smaller margin of error for legally setting the access point's transmit output power. If changes are made, reboot the access point.

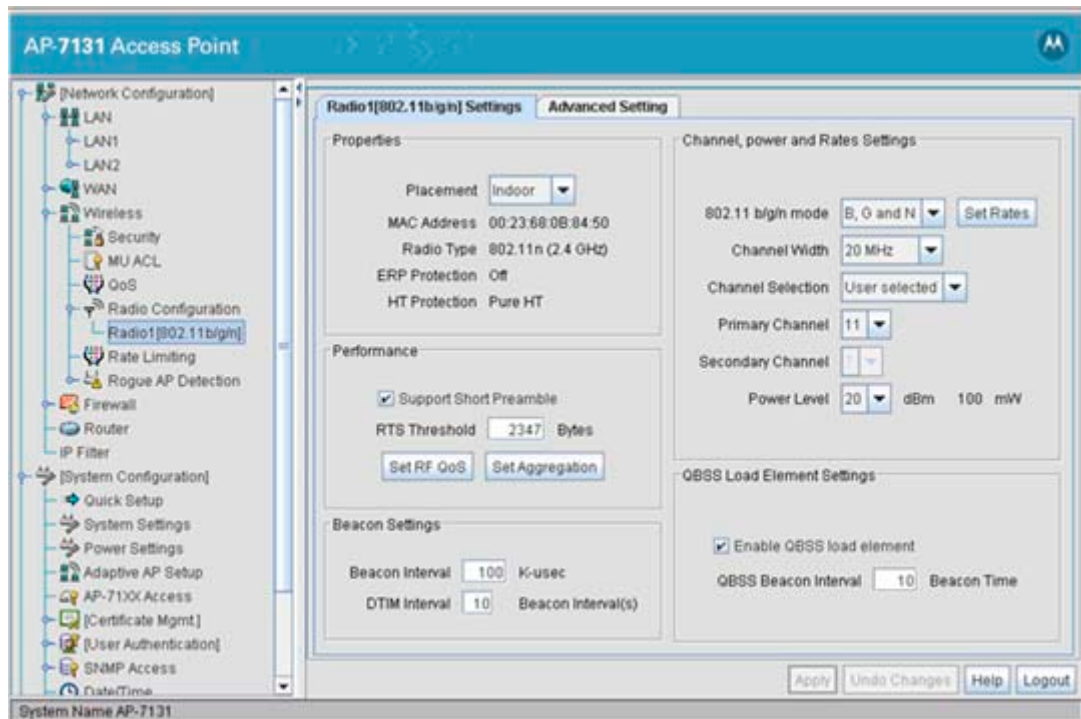


NOTE: Ensure the access point is connected to its expected power supply (3af, 3at or Full Power). Check available access point power by reviewing the Power Status field within the Power Settings screen (this value is cable length dependent). Compare available power to the *Maximum Transmit Power vs POE* table below. If available supply power does not allow the desired transmit power, then increase the supply power.

Maximum Possible Transmit Power

| Power Status | 2.4 GHz | 5.2 GHz |
|---------------------|----------------|----------------|
| 3af | +20 | +19 |
| 3at | +23 | +20 |
| Full Power | +23 | +20 |

10. Select **Network Configuration** -> **Wireless** -> **Radio Configuration** -> **Radio1** or **Radio 2** from the access point menu tree.



11. Refer to the **Channel, power and Rate Settings** field.

12. Set an 802.11 a/n or 802.11 b/g/n radio mode as appropriate.

For radio1, specify **B, G and N**, **B and G**, **G Only**, **B Only** or **N Only** to define whether the 802.11b/g/n radio transmits in the 2.4 GHz band exclusively for 802.11b (legacy) clients or transmits in the 2.4 GHz band for 802.11g/n clients. Selecting **B and G** enables the access point to transmit to both B and G clients if legacy clients (802.11b) partially comprise the network. Select accordingly based on the MU requirements of the network.



NOTE: Select the access point radio's 802.11 a/n or 802.11b/g/n mode carefully in respect to the radio's intended data rate and client support requirements, as the rates available differ depending on the selected mode. For more information on selected mode versus data rate, see [2.4 GHz Mode Versus Data Rate on page 12-8](#) or [5.2 GHz Mode Versus Data Rate on page 12-12](#).

The rates for the access point's 2.4 GHz radio are:

- *B, G and N* - Allows only basic rates (default setting)
- *B and G* - Allows 11b basic rates. Does not allow MCS rates
- *G and N* - Requires basic rates (either 6, 12, 24 or 1, 2, 5.5, 11, 6, 12, 24)
- *G Only* - Requires one 11g basic rate. Does not allow MCS rates
- *B Only* - Allows for 11b rates only. Does not allow G or N rates
- *N Only* - Requires basic MCS rates

If the mode is **B and G**, the Channel Width option is not available, and a Secondary Channel cannot be defined.

For the 5.2 GHz radio, specify **A and N**, **A Only** or **N Only** to define whether the 802.11a/n radio transmits in the 5.2 GHz band exclusively for 802.11a clients, 802.11n clients or transmits in the 5.2 GHz band for both 802.11a/n clients.

The rates for the access point's 5.2 GHz radio are:

- *A Only* - Allows 11a rates
- *N Only* - Requires basic MCS rates
- *A and N* - Allows only 11a basic rates (default setting)

13. For this example, leave the Channel Width at **20/40** and set the Channel to **User selected** for both the 802.11 b/g/n and 802.11 a/n radios.

20/40 MHz operation (the default setting for the 5 GHz radio) allows the access point to receive packets from clients using 20 MHz of bandwidth while transmitting a packet using 40 MHz bandwidth. This mode is supported for 11n users on both the 2.4 and 5 GHz radios. If an 11n user selects two channels (a Primary and Secondary channel), the system is configured for dynamic 20/40 operation. When 20/40 is selected, clients can take advantage of "wider channels." 802.11n clients experience improved throughput using 40 MHz while legacy clients (either 802.11a or 802.11b/g depending on the radio selected) can still be serviced without interruption using 20 MHz.

User selected is the default Channel Selection setting. If 20/40 MHz is selected as the Channel Width (supporting 11n), the Secondary Channel drop-down menu becomes enabled. The user must define the primary channel first. Then, depending on the primary channel defined, the secondary channel list is filled with channels making the combination of primary and secondary channels valid. The actual channels available depend on regulatory domain requirements.

14. Set the **Power Level** in respect to the antennas deployed and the defined channel.



NOTE: If you set the transmit power too high (in relation to FCC transmit requirements), the access point will display an Input Error message stating the maximum power level for the selected channel has been exceeded.

15. Select **Status and Statistics** -> **Radio Stats** -> **Radio1(802.11b/g/n) Statistics or Radio2 (802.11a/n) Statistics** from the access point menu tree.

Refer to the **Current Channel** parameter from within the Information field. This value displays (in red) the two channels utilized as a result of selecting 20/40 as the Channel Width. The first value represents the channel utilized for the 20 MHz bandwidth and the second value (displayed in parenthesis) is the channel supporting 40 MHz.

12.1.1 Supported Antennas by Band, Model, Rate and Transmit Power

Refer to the following Motorola AP-7131 supported antennas for their US Regulatory Domain transmit power (in both the 2.4 and 5.2 GHz bands), rates and supported channels.

US Regulatory Domain - 2.4 GHz Band

- *Yagi Antenna Models*
 - *Yagi Antenna Maximum Conducted Transmit Power Settings*
- *Panel Antenna Models*
 - *Panel Antenna Maximum Conducted Transmit Power Settings*
- *Embedded Antenna Models*
 - *Embedded Antenna Maximum Conducted Transmit Power Settings*
- *Dipole Antenna Models*
 - *Dipole Antenna Maximum Conducted Transmit Power Settings*
- *Patch Antenna Models*
 - *Patch Antenna Maximum Conducted Transmit Power Settings*

US Regulatory Domain - 5.2 GHz Band

- *Yagi Antenna Models*
 - *Yagi Antenna Maximum Conducted Transmit Power Settings*
- *Panel Antenna Models*
 - *Panel Antenna Maximum Conducted Transmit Power Settings*
- *Embedded Antenna Models*
 - *Embedded Antenna Maximum Conducted Transmit Power Settings*
- *Dipole Antenna Models*
 - *Dipole Antenna Maximum Conducted Transmit Power Settings*
- *Patch Antenna Models*
 - *Patch Antenna Maximum Conducted Transmit Power Settings*

12.2 US Regulatory Domain - 2.4 GHz Band

12.2.1 2.4 GHz Mode Versus Data Rate

When setting 2.4 GHz data rates using the access point's GUI applet, use the following chart to cross-reference data rates to the radio's selected operational mode.

| | <i>B, G and N</i> | <i>G and N</i> | <i>N Only</i> | <i>B and G</i> | <i>G Only</i> | <i>B Only</i> |
|---|-------------------|----------------|---------------|----------------|---------------|---------------|
| LEGACY DSSS RATES (1, 2, 5.5, 11 MBPS) | X | | | X | | X |
| LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | X | X | | X | X | |
| 802.11n HT20 RATES (MCS 0 - MCS 15) | X | X | X | | | |
| 802.11n HT40 RATES (MCS 0 - MCS15) | X | X | X | | | |

12.2.2 Yagi Antenna Models

The following is the Yagi antenna model for 2.4 GHz:

| Motorola Part Number |
|-----------------------------|
| ML-2499-BYGA2-01R |

12.2.2.1 Yagi Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per Yagi antenna in the 2.4 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY DSSS RATES (1, 2, 5.5, 11 MBPS) | LEGACY OFDM RATES (6,9,12,18,24,36, 48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS15) |
|-----------------------|-----------------------|---|--|--|---|
| 1 | - | 13 | 7 | 7 | - |
| 2 | - | 13 | 7 | 7 | - |
| 3 | (1, 5) | 13 | 7 | 7 | 2 |
| 4 | (2, 6) | 13 | 7 | 7 | 2 |
| 5 | (3, 7) | 13 | 7 | 7 | 2 |
| 6 | (4, 8) | 13 | 8 | 8 | 5 |
| 7 | (5, 9) | 12 | 7 | 6 | 2 |
| 8 | (6, 10) | 12 | 7 | 6 | 2 |
| 9 | (7, 11) | 12 | 7 | 6 | 2 |
| 10 | - | 12 | 7 | 6 | - |
| 11 | - | 12 | 7 | 6 | - |

With the most recent AP-7131 series software release (4.0.0.0) the Web browser of the command line interface do not allow setting the transmit power to any value less than 4dBm.



NOTE: When a Yagi antenna is used, a 2dB external RF attenuator must be added. Lower power settings will be provided in subsequent software releases.

12.2.3 Panel Antenna Models

The following is the panel antenna model for 2.4 GHz:

| <i>Motorola Part Number</i> |
|-----------------------------|
| ML-2452-PTA3M3-036 |

12.2.3.1 Panel Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per panel antenna in the 2.4 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY DSSS RATES (1, 2, 5.5, 11 MBPS) | LEGACY OFDM RATES (6,9,12,18,24,36, 48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS15) |
|-----------------------|-----------------------|---|--|--|---|
| 1 | - | 16 | 11 | 10 | - |
| 2 | - | 16 | 11 | 10 | - |
| 3 | (1, 5) | 16 | 11 | 10 | 7 |
| 4 | (2, 6) | 16 | 11 | 10 | 7 |
| 5 | (3, 7) | 16 | 11 | 10 | 7 |
| 6 | (4, 8) | 16 | 11 | 11 | 8 |
| 7 | (5, 9) | 16 | 11 | 9 | 5 |
| 8 | (6, 10) | 16 | 11 | 9 | 5 |
| 9 | (7, 11) | 16 | 11 | 9 | 5 |
| 10 | - | 16 | 11 | 9 | - |
| 11 | - | 16 | 11 | 9 | - |

12.2.4 Embedded Antenna Models

The following is the embedded antenna model for 2.4 GHz:

| <i>Motorola Part Number</i> |
|-----------------------------|
| ML-2452-PTA2M3X3-1 |

12.2.4.1 Embedded Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per embedded antenna in the 2.4 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY DSSS RATES (1, 2, 5.5, 11 MBPS) | LEGACY OFDM RATES (6,9,12,18,24,36, 48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS15) |
|-----------------------|-----------------------|---|--|--|---|
| 1 | - | 20 | 16 | 16 | - |
| 2 | - | 20 | 16 | 16 | - |
| 3 | (1, 5) | 20 | 16 | 16 | 11 |
| 4 | (2, 6) | 20 | 16 | 16 | 11 |
| 5 | (3, 7) | 20 | 16 | 16 | 11 |
| 6 | (4, 8) | 18 | 14 | 14 | 12 |
| 7 | (5, 9) | 16 | 15 | 15 | 12 |
| 8 | (6, 10) | 16 | 15 | 15 | 12 |
| 9 | (7, 11) | 16 | 15 | 15 | 12 |
| 10 | - | 16 | 15 | 15 | - |
| 11 | - | 16 | 15 | 15 | - |

12.2.5 Dipole Antenna Models

The following are the dipole antenna models for 2.4 GHz:

| Motorola Part Number | 2.4 GHz Antenna Net Gain |
|------------------------------|---------------------------------|
| ML-2452-APA2-01 | 3 |
| ML-2499-HPA3-01R | 3.3 |
| ML-2452-APA6J-01 (microcell) | -6 |

12.2.5.1 Dipole Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per dipole antenna in the 2.4 GHz band:



NOTE: The access point GUI only allows whole numbers be entered for transmit power. The decimal values are displayed within these tables to help installers accommodate for cable and accessory losses.

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY DSSS RATES (1, 2, 5.5, 11 MBPS) | LEGACY OFDM RATES (6,9,12,18,24,36, 48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS0 - MCS15) |
|-----------------------|-----------------------|---|--|--|--|
| 1 | - | 18.5 | 15.0 | 15.0 | - |
| 2 | - | 18.5 | 15.0 | 15.0 | - |
| 3 | (1, 5) | 18.5 | 16.0 | 16.5 | 10.0 |
| 4 | (2, 6) | 18.5 | 16.0 | 16.5 | 11.0 |

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY DSSS RATES (1, 2, 5.5, 11 MBPS) | LEGACY OFDM RATES (6,9,12,18,24,36, 48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS0 - MCS15) |
|-----------------------|-----------------------|---|--|--|--|
| 5 | (3, 7) | 18.5 | 16.0 | 16.0 | 12.0 |
| 6 | (4, 8) | 23.0 | 16.0 | 16.5 | 13.0 |
| 7 | (5, 9) | 19.0 | 16.0 | 16.5 | 12.0 |
| 8 | (6, 10) | 19.0 | 16.0 | 16.5 | 11.0 |
| 9 | (7, 11) | 19.0 | 15.0 | 16.5 | 9.0 |
| 10 | - | 19.0 | 14.0 | 16.0 | - |
| 11 | - | 19.0 | 13.5 | 13.0 | - |

12.2.6 Patch Antenna Models

The following is the patch antenna model for 2.4 GHz:

| Motorola Part Number | 2.4 GHz Antenna Net Gain |
|-----------------------------|---------------------------------|
| ML-2452-PTA3M3-036 | 3 |

12.2.6.1 Patch Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per patch antenna in the 2.4 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY DSSS RATES (1, 2, 5.5, 11 MBPS) | LEGACY OFDM RATES (6,9,12,18,24,36, 48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS0 - MCS15) |
|-----------------------|-----------------------|---|--|--|--|
| 1 | - | 16 | 15 | 12 | - |
| 2 | - | 16 | 15 | 12 | - |
| 3 | (1, 5) | 16 | 15 | 12 | 9 |
| 4 | (2, 6) | 16 | 15 | 12 | 9 |
| 5 | (3, 7) | 16 | 15 | 12 | 9 |
| 6 | (4, 8) | 20 | 15 | 15 | 12 |
| 7 | (5, 9) | 18 | 13 | 12 | 10 |
| 8 | (6, 10) | 18 | 13 | 12 | 10 |
| 9 | (7, 11) | 18 | 13 | 12 | 10 |
| 10 | - | 18 | 13 | 12 | - |
| 11 | - | 18 | 13 | 12 | - |

12.3 US Regulatory Domain - 5.2 GHz Band

12.3.1 5.2 GHz Mode Versus Data Rate

When setting 5.2 GHz data rates using the access point's GUI applet, use the following chart to cross-reference data rates to the radio's selected operational mode.

| | <i>A and N</i> | <i>N Only</i> | <i>A Only</i> |
|--|----------------|---------------|---------------|
| LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | X | | X |
| 802.11n HT20 RATES (MCS 0 - MCS 15) | X | X | |
| 802.11n HT40 RATES (MCS 0 - MCS 15) | X | X | |

12.3.2 Yagi Antenna Models

The following is the Yagi antenna model for 5.2 GHz:

| <i>Motorola Part Number</i> |
|-----------------------------|
| ML-5299-BYGA15-012 |

12.3.2.1 Yagi Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per Yagi antenna in the 5 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|-----------------------|-----------------------|--|---|---|
| 36 | - | 2 | 2.5 | - |
| 38 | (36, 40) | - | - | 4 |
| 40 | - | 2 | 2.5 | - |
| 42 | - | 2.5 | 2.5 | - |
| 44 | - | 2.5 | 2.5 | - |
| 46 | (44, 48) | - | - | 4 |
| 48 | - | 2.5 | 4 | - |
| 52 | - | 9 | 9 | - |
| 54 | (52, 56) | - | - | 11 |
| 56 | - | 9 | 9 | - |
| 60 | - | 8.5 | 9 | - |
| 62 | (60, 64) | - | - | 10 |
| 64 | - | 8.5 | 9 | - |
| 100 | - | 8 | 8.5 | - |

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|---------------------------|---------------------------|---|--|--|
| 102 | (100, 104) | - | - | 5 |
| 104 | - | 8 | 8.5 | - |
| 108 | - | 8 | 8.5 | - |
| 112 | - | 8 | 8.5 | - |
| 110 | (108, 112) | - | - | 11 |
| 116 | - | 8 | 8.5 | - |
| 118 | (116, 120) | - | - | 10 |
| 120 | - | 8 | 8.5 | - |
| 124 | - | 7.5 | 7.5 | - |
| 126 | (124, 128) | - | - | 10 |
| 128 | - | 7.5 | 7.5 | - |
| 132 | - | 7.5 | 7.5 | - |
| 134 | (132, 136) | - | - | 10 |
| 136 | - | 7.5 | 7.5 | - |
| 140 | - | 7.5 | 7.5 | - |
| 149 | - | 7.0 | 7.5 | - |
| 151 | (149, 153) | - | - | 4.5 |
| 153 | - | 7.0 | 7.5 | - |
| 157 | - | 7.5 | 8.0 | - |
| 159 | (157, 161) | - | - | 5.0 |
| 161 | - | 8.0 | 9.0 | - |
| 165 | - | 8.0 | 9.0 | - |

12.3.3 Panel Antenna Models

The following are the panel antenna models for 5.2 GHz:

| Motorola Part Number |
|-----------------------------|
| ML-5299-WPNA1-01R |
| ML-2452-PNL9M3-036 |

12.3.3.1 Panel Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per panel antenna in the 5 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|-----------------------|-----------------------|---|--|--|
| 36 | - | 4 | 4 | - |
| 38 | (36, 40) | - | - | 6 |
| 40 | - | 4 | 4 | - |
| 42 | - | 4 | 4 | - |
| 44 | - | 4 | 4 | - |
| 46 | (44, 48) | - | - | 6 |
| 48 | - | 4 | 4 | - |
| 52 | - | 10 | 10 | - |
| 54 | (52, 56) | - | - | 13 |
| 56 | - | 10 | 10 | - |
| 60 | - | 10 | 10 | - |
| 62 | (60, 64) | - | - | 11 |
| 64 | - | 10 | 10 | - |
| 100 | - | 10 | 10 | - |
| 102 | (100, 104) | - | - | 5 |
| 104 | - | 10 | 10 | - |
| 108 | - | 10 | 10 | - |
| 112 | - | 10 | 10 | - |
| 110 | (108, 112) | - | - | 13 |
| 116 | - | 10 | 10 | - |
| 118 | (116, 120) | - | - | 13 |
| 120 | - | 10 | 10 | - |
| 124 | - | 10 | 10 | - |
| 126 | (124, 128) | - | - | 12 |
| 128 | - | 10 | 10 | - |
| 132 | - | 10 | 10 | - |
| 134 | (132, 136) | - | - | 12 |
| 136 | - | 10 | 10 | - |
| 140 | - | 8 | 8 | - |
| 149 | - | 8.0 | 9.0 | - |

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|---------------------------|---------------------------|---|--|--|
| 151 | (149, 153) | - | - | 6.0 |
| 153 | - | 8.0 | 9.0 | - |
| 157 | - | 9.0 | 10.0 | - |
| 159 | (157, 161) | - | - | 7.0 |
| 161 | - | 10 | 10 | - |
| 165 | - | 10 | 10 | - |

12.3.4 Embedded Antenna Models

The following is the embedded antenna model for 5.2 GHz:

| Motorola Part Number |
|-----------------------------|
| ML-2452-PTA2M3X3-1 |

12.3.4.1 Embedded Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per embedded antenna in the 5 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|-----------------------|-----------------------|---|--|--|
| 36 | - | 11 | 11 | - |
| 38 | (36, 40) | - | - | 12 |
| 40 | - | 11 | 11 | - |
| 42 | - | 11 | 11 | - |
| 44 | - | 11 | 11 | - |
| 46 | (44, 48) | - | - | 13 |
| 48 | - | 11 | 11 | - |
| 52 | - | 18 | 18 | - |
| 54 | (52, 56) | - | - | 20 |
| 56 | - | 18 | 18 | - |
| 60 | - | 18 | 18 | - |
| 62 | (60, 64) | - | - | 14 |
| 64 | - | 18 | 18 | - |
| 100 | - | 15 | 16 | - |
| 102 | (100, 104) | - | - | 8 |
| 104 | - | 14 | 16 | - |
| 108 | - | 14 | 16 | - |
| 112 | - | 14 | 16 | - |
| 110 | (108, 112) | - | - | 19 |
| 116 | - | 14 | 16 | - |
| 118 | (116, 120) | - | - | 19 |
| 120 | - | 18 | 18 | - |
| 124 | - | 18 | 13 | - |
| 126 | (124, 128) | - | - | 19 |
| 128 | - | 14 | 13 | - |

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|-----------------------|-----------------------|---|--|--|
| 132 | - | 14 | 13 | - |
| 134 | (132, 136) | - | - | 14 |
| 136 | - | 13 | 13 | - |
| 140 | - | 13 | 13 | - |
| 149 | - | 18.0 | 18.0 | - |
| 151 | (149, 153) | - | - | 15.0 |
| 153 | - | 18.0 | 18.0 | - |
| 157 | - | 18.0 | 18.0 | - |
| 159 | (157, 161) | - | - | 16.0 |
| 161 | - | 19.0 | 19.0 | - |
| 165 | - | 19.0 | 19.0 | - |

12.3.5 Dipole Antenna Models

The following are the dipole antenna models for 5.2 GHz:

| Motorola Part Number |
|-----------------------------|
| ML-5299HPA1-01R |
| ML-2452-APA6J-01 |
| ML-2452-APA2-01 |

12.3.5.1 Dipole Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per dipole antenna in the 5 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|-----------------------|-----------------------|---|--|--|
| 36 | - | 11 | 11 | - |
| 38 | (36, 40) | - | - | 12 |
| 40 | - | 11 | 11 | - |
| 42 | - | 11 | 11 | - |
| 44 | - | 11 | 11 | - |
| 46 | (44, 48) | - | - | 13 |
| 48 | - | 11 | 11 | - |
| 52 | - | 18 | 18 | - |

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|-----------------------|-----------------------|---|--|--|
| 54 | (52, 56) | - | - | 20 |
| 56 | - | 18 | 18 | - |
| 60 | - | 18 | 18 | - |
| 62 | (60, 64) | - | - | 14 |
| 64 | - | 18 | 18 | - |
| 100 | - | 15 | 14 | - |
| 102 | (100, 104) | - | - | 7 |
| 104 | - | 15 | 14 | - |
| 108 | - | 15 | 14 | - |
| 112 | - | 15 | 14 | - |
| 110 | (108, 112) | - | - | 19 |
| 116 | - | 15 | 14 | - |
| 118 | (116, 120) | - | - | 19 |
| 120 | - | 18 | 18 | - |
| 124 | - | 15 | 18 | - |
| 126 | (124, 128) | - | - | 19 |
| 128 | - | 15 | 18 | - |
| 132 | - | 15 | 18 | - |
| 134 | (132, 136) | - | - | 14 |
| 136 | - | 13 | 16 | - |
| 140 | - | 13 | 16 | - |
| 149 | - | 18.0 | 18.0 | - |
| 151 | (149, 153) | - | - | 15.0 |
| 153 | - | 18.0 | 19.0 | - |
| 157 | - | 18.0 | 19.0 | - |
| 159 | (157, 161) | - | - | 16.0 |
| 161 | - | 19.0 | 19.0 | - |
| 165 | - | 19.0 | 19.0 | - |

12.3.6 Patch Antenna Models

The following is the patch antenna model for 5.2 GHz:

| Motorola Part Number |
|-----------------------------|
| ML-2452-PTA3M3-036 |

12.3.6.1 Patch Antenna Maximum Conducted Transmit Power Settings

The following is a transmit power table (US domain) per patch antenna in the 5 GHz band:

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|-----------------------|-----------------------|---|--|--|
| 36 | - | 11 | 11 | - |
| 38 | (36, 40) | - | - | 12 |
| 40 | - | 11 | 11 | - |
| 42 | - | 11 | 11 | - |
| 44 | - | 11 | 11 | - |
| 46 | (44, 48) | - | - | 13 |
| 48 | - | 11 | 11 | - |
| 52 | - | 18 | 18 | - |
| 54 | (52, 56) | - | - | 20 |
| 56 | - | 18 | 18 | - |
| 60 | - | 18 | 18 | - |
| 62 | (60, 64) | - | - | 14 |
| 64 | - | 18 | 18 | - |
| 100 | - | 15 | 16 | - |
| 102 | (100, 104) | - | - | 8 |
| 104 | - | 18 | 16 | - |
| 108 | - | 18 | 16 | - |
| 112 | - | 18 | 18 | - |
| 110 | (108, 112) | - | - | 13 |
| 116 | - | 18 | 18 | - |
| 118 | (116, 120) | - | - | 19 |
| 120 | - | 18 | 18 | - |
| 124 | - | 18 | 18 | - |
| 126 | (124, 128) | - | - | 19 |
| 128 | - | 18 | 18 | - |

| 20-MHZ CHANNEL | 40-MHZ CHANNEL | LEGACY OFDM RATES (6,9,12,18,24,36,48,54 MBPS) | 802.11n HT20 RATES (MCS 0 - MCS 15) | 802.11n HT40 RATES (MCS 0 - MCS 15) |
|---------------------------|---------------------------|---|--|--|
| 132 | - | 18 | 18 | - |
| 134 | (132, 136) | - | - | 14 |
| 136 | - | 13 | 13 | - |
| 140 | - | 13 | 13 | - |
| 149 | - | 18.0 | 18.0 | - |
| 151 | (149, 153) | - | - | 15.0 |
| 153 | - | 18.0 | 19.0 | - |
| 157 | - | 18.0 | 19.0 | - |
| 159 | (157, 161) | - | - | 16.0 |
| 161 | - | 19.0 | 19.0 | - |
| 165 | - | 19.0 | 19.0 | - |



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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