Cisco Multi-element, 9-in-1, LTE/Wi-Fi/GNSS antenna (5G-ANTM-O-4-B)

This chapter contains the following:

Overview

This section describes the technical specifications and installation instructions for the Cisco Multi-element, 9-in-1, LTE/Wi-Fi/GNSS antenna (5G-ANTM-O-4-B), hereafter referred to as the antenna. The antenna meets or exceeds a variety of environmental ruggedization specifications for transportation applications.

Antenna Features

The antenna features:

- Wideband coverage: 4G LTE, 5G - FR1 and dual-band 802.11ac (Wi-Fi 5) coverage in a single, low-profile housing
- Superior out-of-band rejection: Proprietary filtering design allows wideband coverage for all GNSS frequencies
- Metal 1-inch stud mount with slotted jam nut provides single cable exit for easier installation and/or antenna replacement.
- IP67 compliant design provides maximum protection against water or dust ingress under severe environmental conditions (when installed on sealed surface)

- Proprietary high rejection filtering allows wide-band coverage while achieving superior out-of-band rejection for all GNSS frequencies
- Meets EN 50155:2007 and AAR certification requirements for rail applications

Note Loss of the 17 foot GNSS cable is compensated by the gain of the active GNSS antenna, and has little impact on GNSS performance.

Antenna Assembly

The following figure shows the antenna.

Figure 1: Cisco 5G-ANTM-O-4-B Antenna

The following figure shows the top of the antenna.

Figure 2: Antenna Mechanical View (Top)

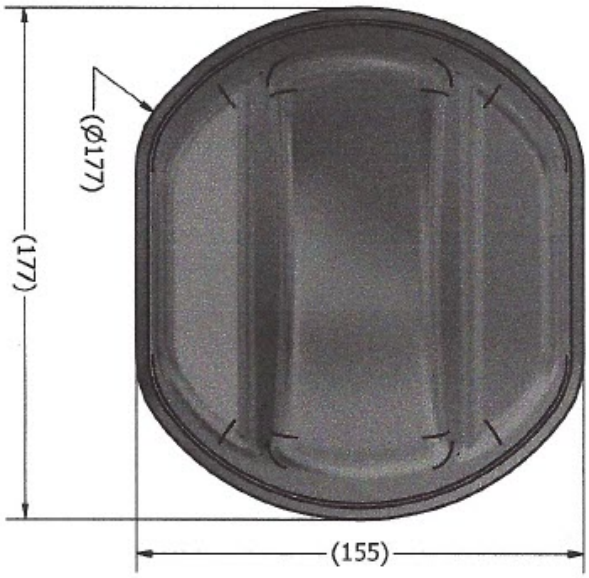


Figure 3: Antenna Mechanical View (Side)

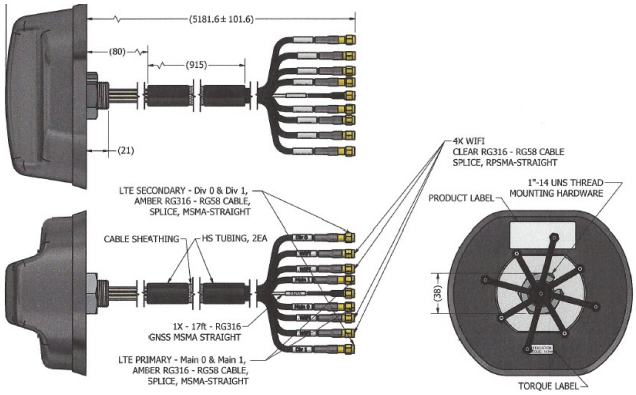
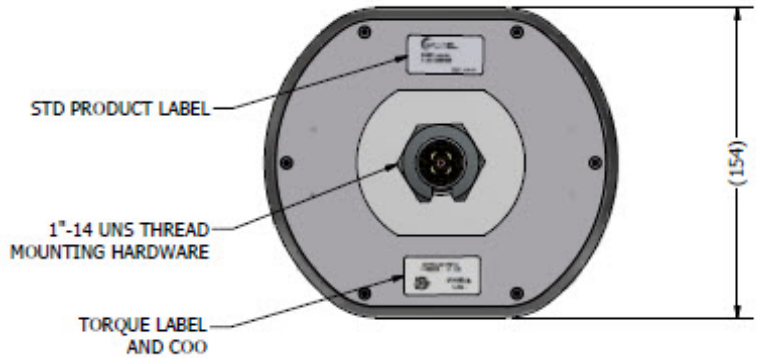


Figure 4: Antenna Mechanical View (Bottom)

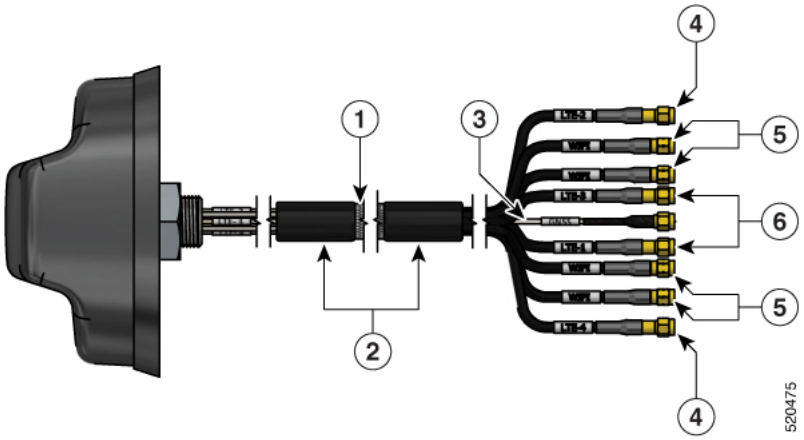


Note All dimensions are in millimeters [inches] unless explicitly stated otherwise in the drawing.

Antenna Cable Details

The following figure shows the details and labels of the antenna cables.

Figure 5: Cable Details



1	Cable sheathing
2	HS TUBING, 2EA LTE-ID LABEL 2EA
3	RG316 GNSS MSMA STRAIGHT
4	LTE SECONDARY (DIVERSITY) – LTE2 (DIV0) and LTE4 (DIV1) AMBER RG316 - RG58 CABLE, SPLICE, MSMA-STRAIGHT
5	4X WIFI CLEAR RG316 - RG58 CABLE SPLICE, RPSMA-STRAIGHT
6	LTE PRIMARY (MAIN) – LTE1 (MAIN0) and LTE3 (MAIN1) AMBER RG316 - RG58 CABLE, SPLICE, MSMA-STRAIGHT

Technical Specifications

This section contains mechanical, electrical, environmental, and operational specifications.

Mechanical Specifications

The following table shows the details for the antenna cables.

Table 1: Antenna Cable Details

Elements	Cable	Connectors	Mounting Method
LTE (All Ports)	Four-17 feet (2-ft RG-316/15-ft Pro-Flex™ Plus 195)	SMA Plug (Male)	1-inch OD, 3/4-inch long (.75”) zinc stud mount with jam nut
Wi-Fi (All Ports)	Four-17 feet (2-ft RG-316/15-ft Pro-Flex™ Plus 195)	Reverse Polarity SMA Plug (Male)	
GNSS	One-17 feet RG-316	SMA Plug (Male)	

The following table shows the details for the antenna body.

Table 2: Antenna Body Details

Dimensions (L x W x H)	Weight (9 ports)	Housing Material	Gasket Design & Construction
6.93 x 6.09 x 3.01 in (176.0 x 154.8 x 76.5 mm)	4.8 lbs (2.2 kg)	UV-Stable Rugged Thermoplastics. UV-94 HB Flammability rated. UL 746C F1 rated for UV and water exposure.	Contour matching, conformable, thermoplastic-elastomer gasket designed to seal between radome and baseplate. Gasket flexes and conforms to contoured surfaces. Baseplate has a 3M™ VHB mounting pad for anti-rotation.

Electrical Specifications

The following tables provide Radio Frequency specifications:

Table 3: LTE Primary (1 and 3)

F1 (MHz)	F2 (MHz)	VSWR	Gain (dB)			Efficiency	
			Max	Typical	Range +/-	Avg	Range +/-
617	698	2.5	-0.2	0.9	0.7	33%	3%
698	802	1.9	1.1	-0.3	1.4	34%	6%
824	960	2.0	2.1	0.6	1.6	36%	4%
1710	2200	1.6	4.4	2.6	1.9	31%	3%
2300	2690	1.4	4.8	2.7	2.1	29%	2%
3400	3800	1.4	4.7	2.5	2.2	26%	1%
5150	5950	1.3	5.8	1.9	3.9	16%	3%

Table 4: LTE Secondary (Diversity) (2 and 4)

F1 (MHz)	F2 (MHz)	VSWR	Gain (dB)			Efficiency	
			Max	Typical	Range +/-	Avg	Range +/-
617	698	3.4	-1.4	-3.0	1.6	16%	8%
733	802	2.0	0.0	-1.0	0.9	31%	4%
824	960	2.7	0.0	-1.6	1.5	28%	8%
1805	2200	1.6	1.7	0.9	0.8	29%	4%
2300	2690	2.0	1.5	-0.5	2.0	20%	6%
3400	3800	1.9	2.2	0.4	1.8	20%	3%
5150	5950	1.4	2.6	1.3	1.4	16%	1%

Table 5: Wi-Fi

F1 (MHz)	F2 (MHz)	VSWR	Gain (dB)			Efficiency	
			Max	Typical	Range +/-	Avg	Range +/-
2400	2500	1.3	9.1	7.2	1.9	74%	74%
4900	5900	1.5	11.4	9.1	2.3	59%	14%

The following notes apply to the tables provided:

Note Gain and efficiency measured with no cable and no ground plane.

Note VSWR measured with 17-ft cables and no ground plane.

Note For all items listed in the above tables, the following applies:

- Polarization is Linear
- Nominal Impedance is 50 ohms
- Maximum Power is 25 watts

The following table provides GNSS Specifications:

Table 6: GNSS Specifications

Specification	Measurement
Frequency Band	1565-1608 MHz
Amplifier Gain	@ 3.0 VDC: 26 dB (typical)
Output VSWR	2.0:1 (maximum)
DC Current	25 mA (typical)
DC Voltage	2.8-6.0 V (operating) ≤ 12.0 V (survivability)
Noise Figure	< 2.0 dB (typical)
Out-of-Band Rejection	f0 = 1586 MHz f0 ± 50 MHz: ≥ 60 dBc f0 ± 60 MHz: ≥ 70 dBc
Nominal Gain	3 dBic @ 90° -2 dBic @ 20°
Polarization	Right hand circular
Nominal Impedance	50 ohms

Environmental and Operational Specifications

Table 7: Environmental and Operational Specifications for the Antenna

Specification	Description
Operating temperature range	-40°C to +85°C
Vibration, Shock, Thermal, Corrosion, Seismic	Outdoor IP67. Tested to a variety of appropriate industrial, vehicular, transportation, and mil-spec standards.

Antenna Radiation Patterns

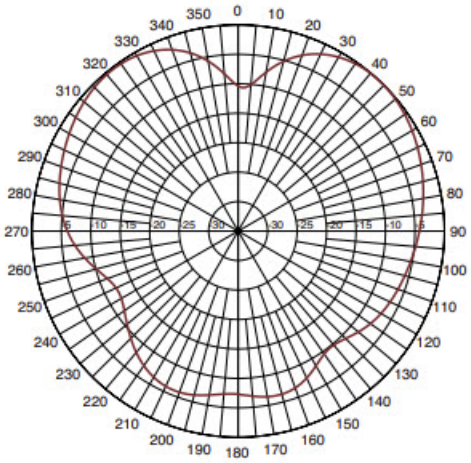
The following sections illustrate the radiation patterns for the antenna.

Primary LTE/5G Antenna Radiation Patterns (LTE1 and LTE3)

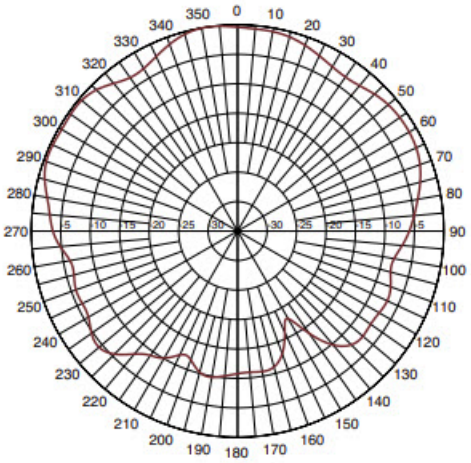
Note LTE1 and LTE3 are also referred to as Main0 and Main1, respectively.

Refer to the following graphics.

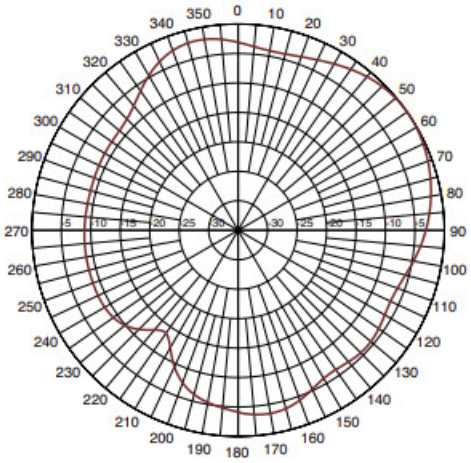
Elevation Pattern at 750 MHz



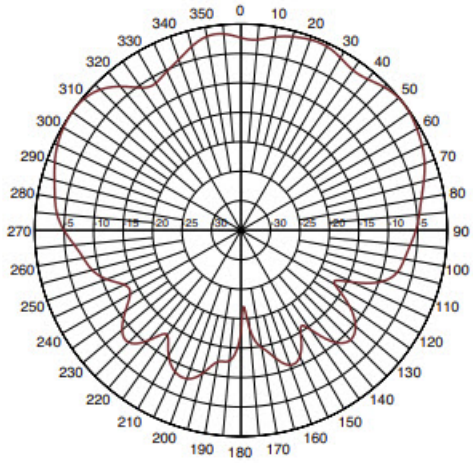
Elevation Pattern at 960 MHz



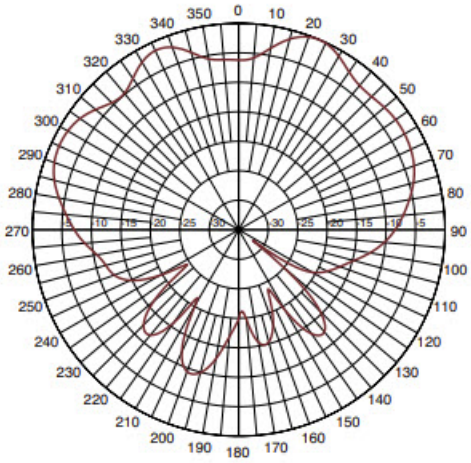
Elevation Pattern at 850 MHz



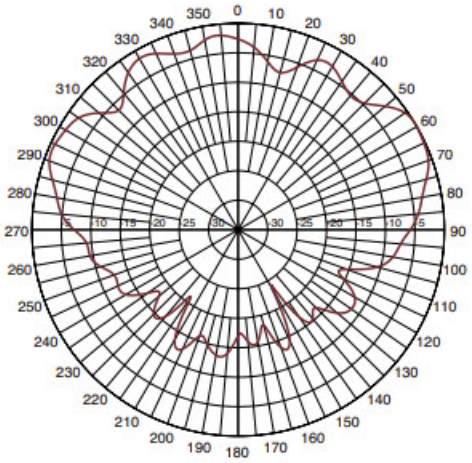
Elevation Pattern at 1.75 GHz



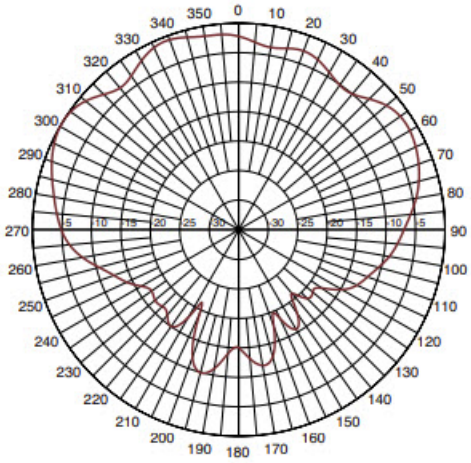
Elevation Pattern at 1.9 GHz



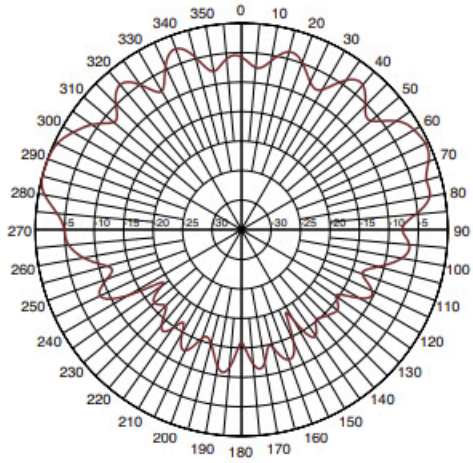
Elevation Pattern at 2.6 GHz



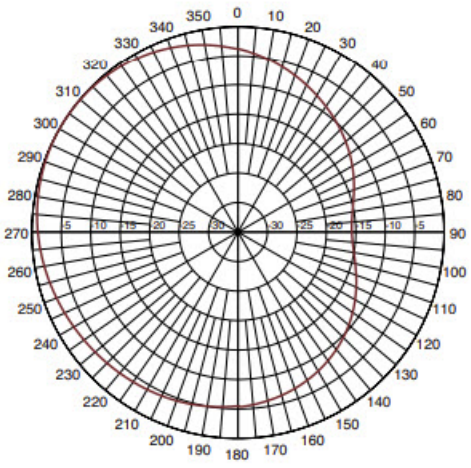
Elevation Pattern at 2.2 GHz



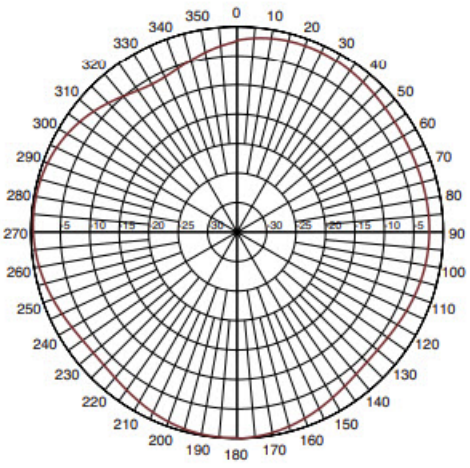
Elevation Pattern at 3.6 GHz



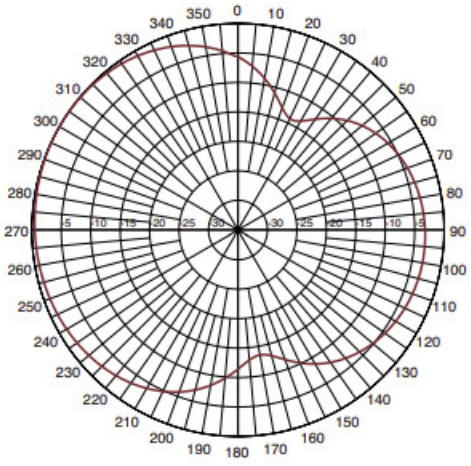
Azimuth Pattern at 750 MHz



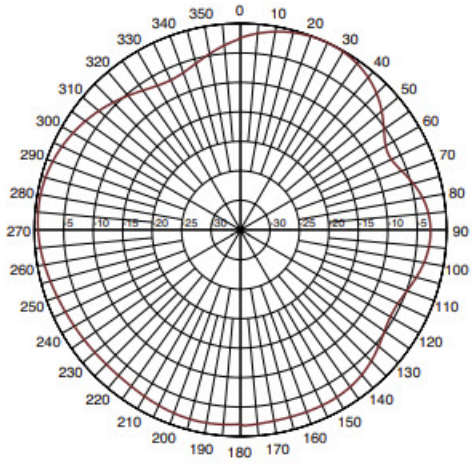
Azimuth Pattern at 960 MHz



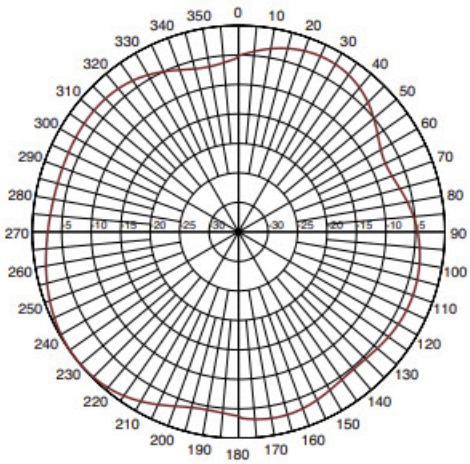
Azimuth Pattern at 850 MHz



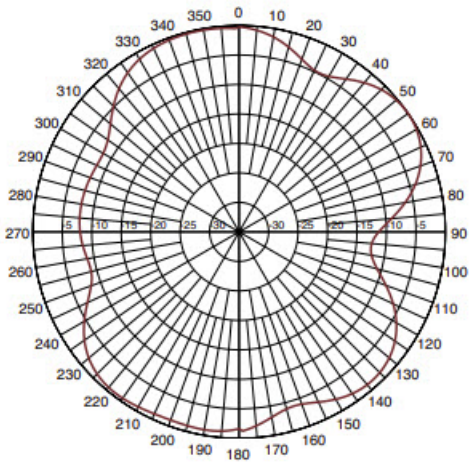
Azimuth Pattern at 1.75 GHz



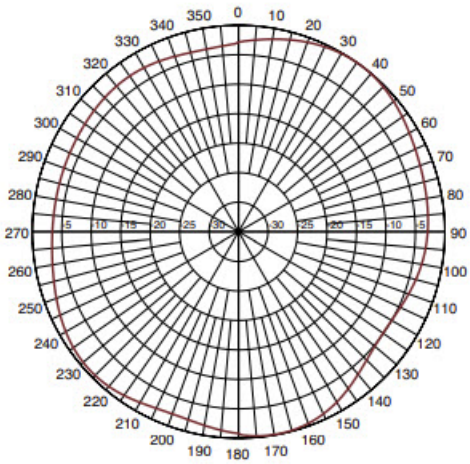
Azimuth Pattern at 1.9 GHz



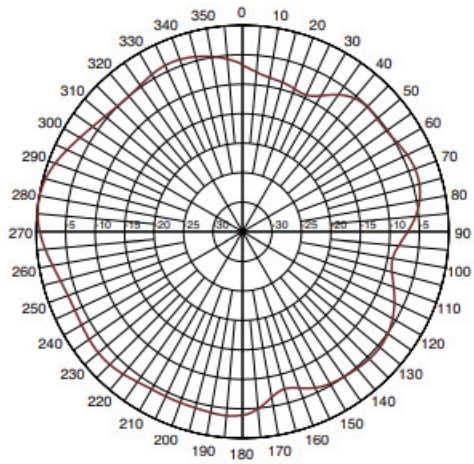
Azimuth Pattern at 2.6 GHz



Azimuth Pattern at 2.2 GHz



Azimuth Pattern at 3.6 GHz

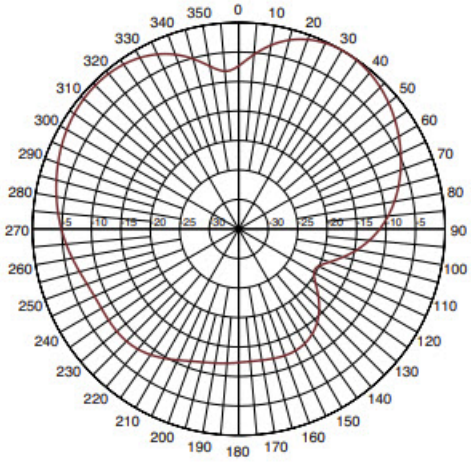


Secondary LTE/5G Antenna Radiation Patterns (LTE2 and LTE4)

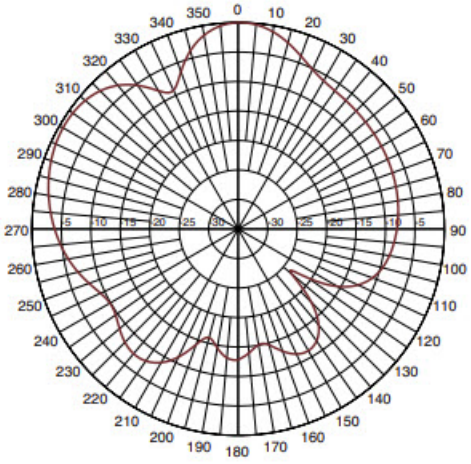
Note LTE2 and LTE4 are also referred to as Div0 and Div1, respectively.

Refer to the following graphics.

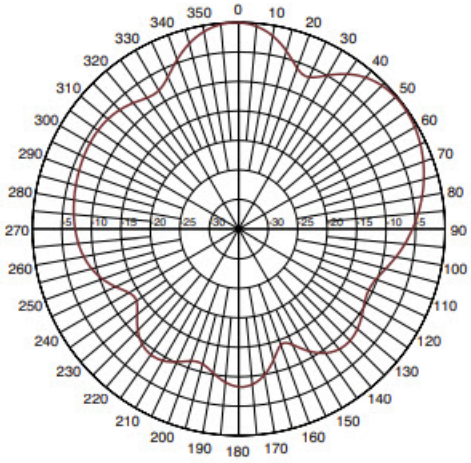
Elevation Pattern at 750 MHz



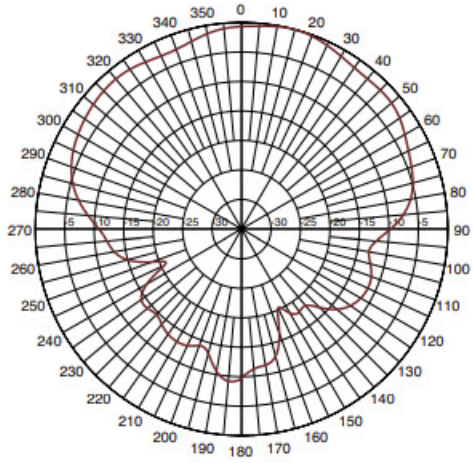
Elevation Pattern at 960 MHz



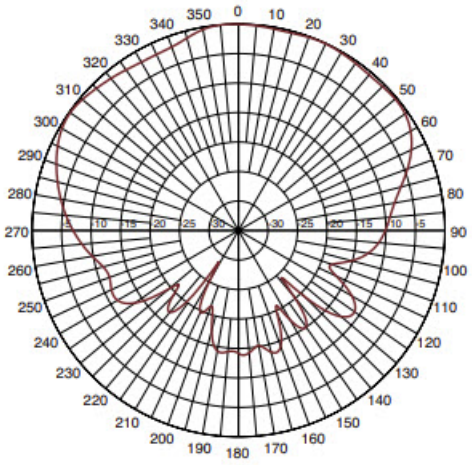
Elevation Pattern at 850 MHz



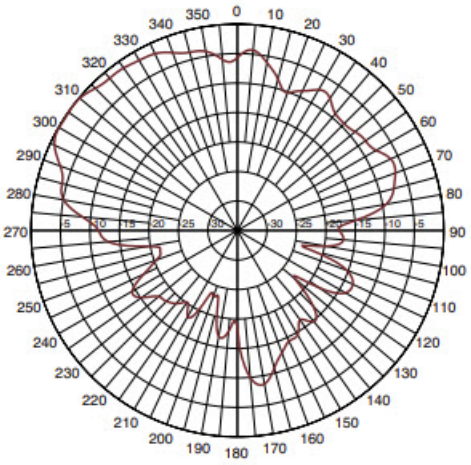
Elevation Pattern at 1.9 GHz



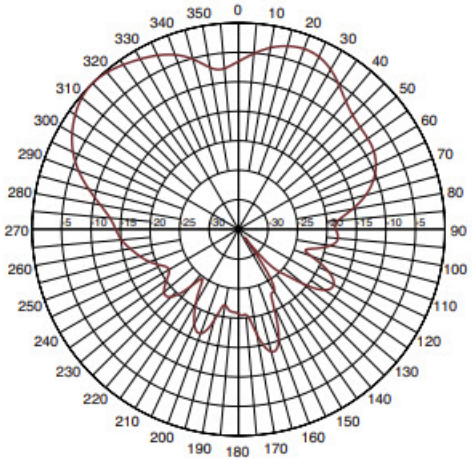
Elevation Pattern at 2.2 GHz



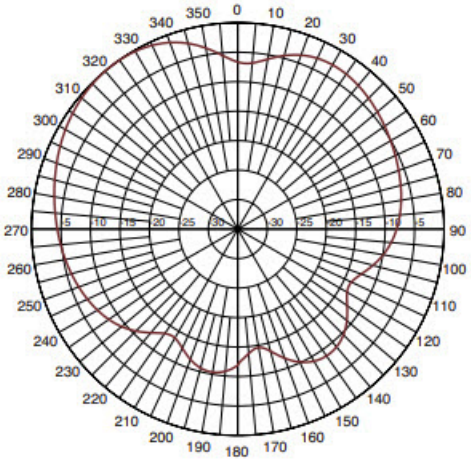
Elevation Pattern at 3.6 GHz



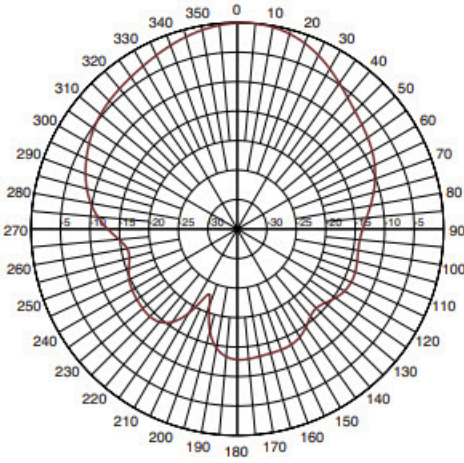
Elevation Pattern at 2.6 GHz



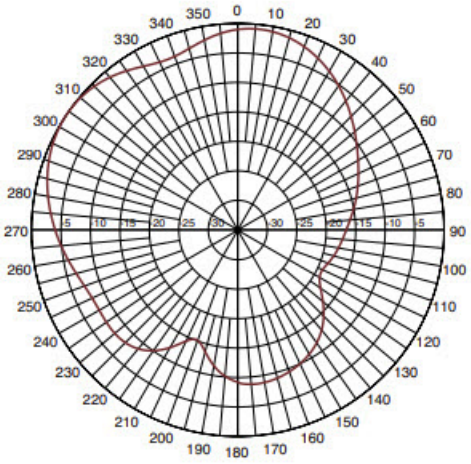
Phi-90 Azimuth Pattern at 750 MHz



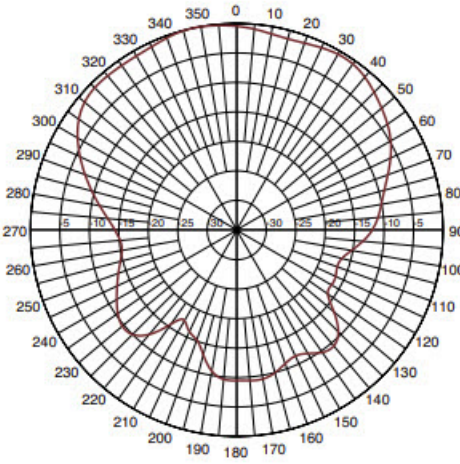
Phi-90 Azimuth Pattern at 960 MHz



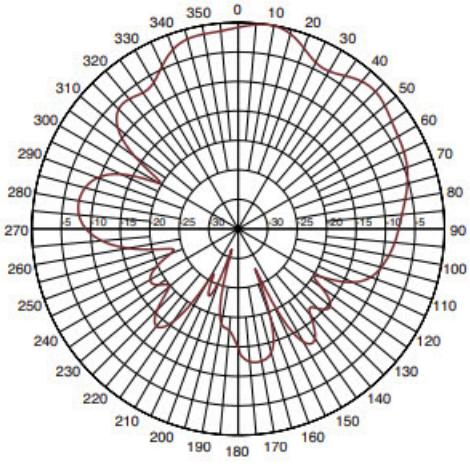
Phi-90 Azimuth Pattern at 850 MHz



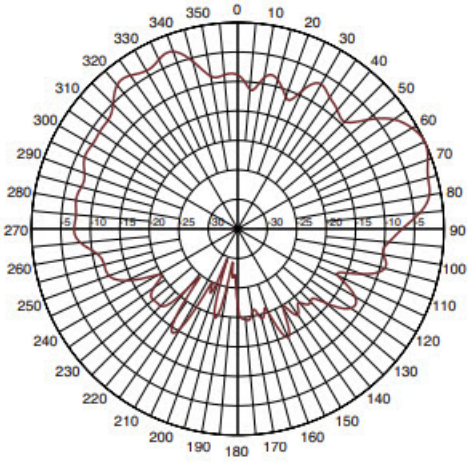
Phi-90 Azimuth Pattern at 1.9 GHz



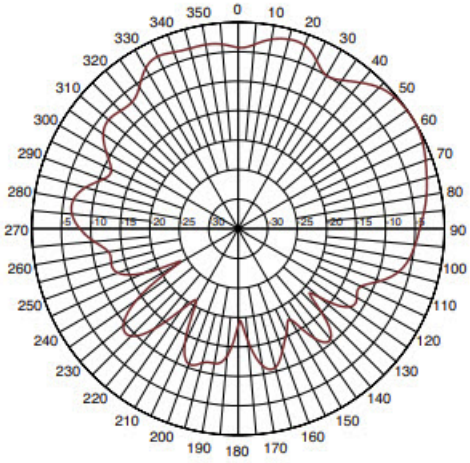
Phi-90 Azimuth Pattern at 2.2 GHz



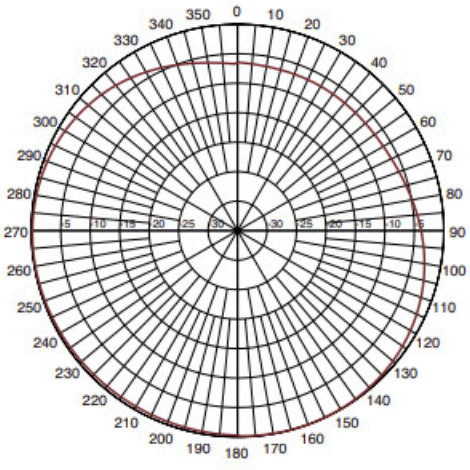
Phi-90 Azimuth Pattern at 3.6 GHz



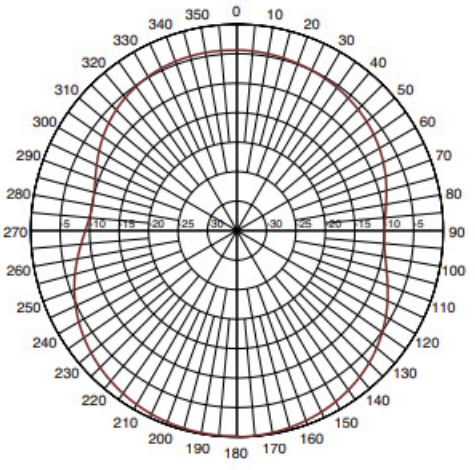
Phi-90 Azimuth Pattern at 2.6 GHz



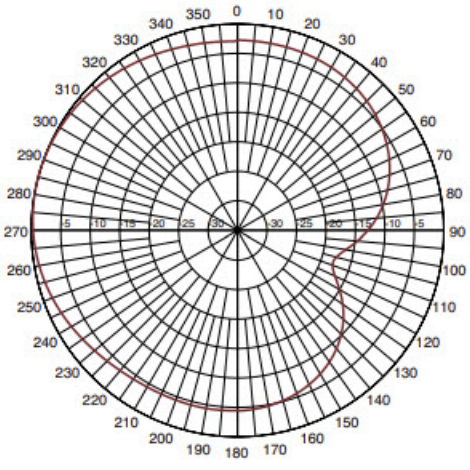
THETA-90 Azimuth Pattern at 750 MHz



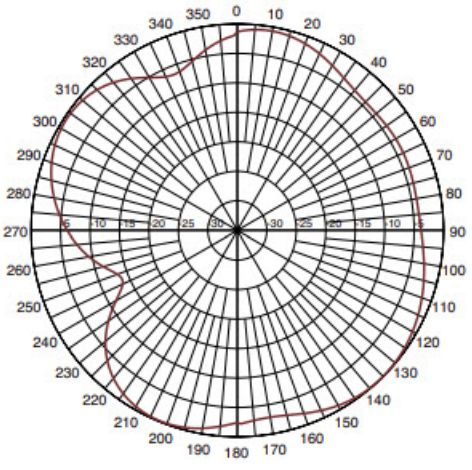
THETA-90 Azimuth Pattern at 960 MHz



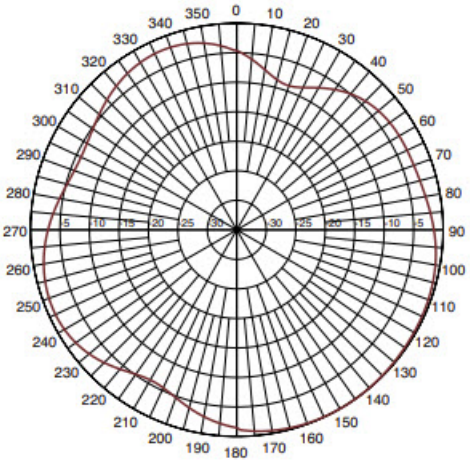
THETA-90 Azimuth Pattern at 850 MHz



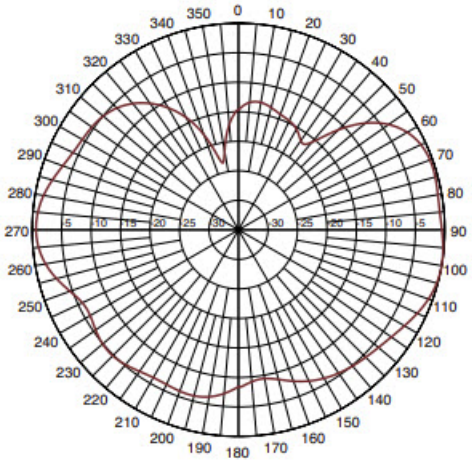
THETA-90 Azimuth Pattern at 1.9 GHz



THETA-90 Azimuth Pattern at 2.2 GHz



THETA-90 Azimuth Pattern at 3.6 GHz



General Safety Precautions

Warning This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. **Statement 1071**

Warning Do not work on the system or connect or disconnect cables during periods of lightning activity. **Statement 1001**

Warning Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). **Statement 1052**

Warning In order to comply with FCC radio frequency (RF) exposure limits, antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons. **Statement 332**

Note For your safety, and to help you achieve a good installation, please read and follow these safety precautions.

Mast Mounted or Building Mounted Installations

The following instructions are common to most mast mounted or building mounted installations. For specific installation instructions for each antenna, see the antenna data-sheet and the router hardware installation guide.

- Find someone to help you—installing an antenna is often a two-person job.
- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.
- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.
- Do not use a metal ladder.
- Do not work on a wet or windy day.
- Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.
- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.
- If an accident should occur with the power lines, call for qualified emergency help immediately.
- Assemble your new antenna on the ground or a level surface at the installation site.
- Connect its coaxial cable while you are on the ground and attach the antenna to the mast.
- Ensure that the mast does not fall as you raise or remove it. Use a durable non-conductive rope secured at each two foot level as the mast is raised. Have an assistant tend the rope, ready to pull the mast clear of any hazards (such as power lines) should it begin to fall.
- Use the mounting bracket provided with the antenna.
- If the installation will use guy wires:
  - Install guy anchor bolts.
  - Estimate the length of guy wire and cut it before raising the mast.
  - Attach guy wires to a mast using guy rings.
  - In the case of a guyed (tall, thin mast) installation, you must have at least one assistant to hold the mast upright while the guy wires are attached and tightened to the anchor bolts.
- Attach a “DANGER” label at eye level on the mast.
- Install ground rods to remove any static electricity buildup and connect a ground wire to the mast and ground rod. Use ground rods designed for that purpose, not a spare piece of pipe.

Unused Antenna Ports

Port plugs must be installed in any unused antenna ports.

The weatherproof caps on the connectors protect the router interior from environmental elements including water, heat, cold, and dust. They are installed on unused ports before the router is shipped.

When you install a new antenna in a port with an N-connector:

- Chassis-mounted antennas—Remove the weather proof cap before installing a chassis-mounted antenna.
- External antennas—Remove weatherproof cap, then connect the supported Cisco cable to the connector.

Guidelines to Achieving Optimal RF and Antenna Performance

Antennas are a critical component of a wireless communication system. Selecting a suitable antenna, an optimal antenna location, or antenna site is essential for optimum performance of a wireless links.

This section covers general tips for optimizing RF performance of indoor and outdoor terrestrial radio systems in the 400-7125 MHz frequency range. Examples of terrestrial radio systems include 4G LTE, 5G NR, Wi-Fi, LoRa, LR-WPAN and similar. In this context GPS SPS would not be considered a terrestrial system as the signal is received from space, not from another terrestrial site.

Because the antenna transmits and receives radio signals over the air, overall RF performance of the link is susceptible to RF obstructions and common sources of RF interference that can reduce throughput and range of the system.

Follow these guidelines to optimize performance. When in doubt, consult a qualified RF professional, and check with your solution partner for specific recommendations.

Antenna Model Selection and Performance

Consider the following when planning your installation:

- When selecting the antenna, ensure that it covers the frequency ranges or frequency bands of interest, and that it has good RF parameters such as antenna efficiency, VSWR and suitable radiation pattern for every frequency range that your application will use with this antenna.
- Antenna pattern is important. Omni-directional antennas have lower gain, but allow communicating to devices in all azimuth directions. Directional antennas concentrate the beam in a specific direction, making them ideal for point to point communication.
- When a system has multiple RF ports for receive and / or transmit, as is the case for 4G LTE , 5G NR or Wi-Fi, it is highly recommended to populate all the RF ports with suitable antennas to take advantage of MIMO, rather than rely on a single port or single antenna to save on cost. Please see the MIMO section for a detailed description of MIMO benefits.
- For RF systems that support multiple RF ports and multiple RF standards such as LTE, Wi-Fi, and GPS: consider using a multi-element antenna that integrates multiple antennas under the same radome (cover). Doing so may reduce cost compared to deploying and mounting a discrete single port antenna for every RF port.
- For communication between fixed infrastructure devices, such as mesh nodes or a point-to-point backhaul link, each device should have an antenna with the same polarization. If communicating with mobile

devices that might be randomly oriented, consider dual-polarized antennas, such as those with both vertical and horizontal or slant +45° and -45° polarized elements.

Antenna Environmental Specifications

The selected antenna must have suitable mechanical and environmental specifications for the environment where it will be deployed. For example, shock and vibration specifications for transportation, corrosion resistant construction for marine and oil and gas industries, or IP (ingress protection) rating for outdoor deployment. Indoor antennas are typically not suitable for harsh industrial environments. Please check with your system integrator for environmental requirements for your application.

Antenna Accessories and Mounting

Consider the following when planning your installation:

- Carefully consider what type of other RF accessories, besides antenna, such as RF cables, lightning arrestors or RF adapters may be required in your installations. It is best to minimize long RF cable runs due to RF signal losses in the cable. Thinner RF cables have more RF loss , thicker cables are less flexible and more expensive.
- Carefully consider how the antenna will be physically mounted, as this may affect antenna selection. For example, a stud mount mechanical mounting design is a better fit for mounting on top of an electrical cabinet than a mast mount antenna.
- For outdoor deployments, follow installation instructions for the antenna. It is good practice to keep protective covers on the radio's RF ports and any antenna or accessory RF ports until the moment the interfaces are mated. This reduces chances of contamination, trapping water or condensation inside the connector, or accidental damage to RF interfaces.

MIMO Performance and Arrays

MIMO systems deliver benefits of higher SNR, higher reliability and higher throughput compared to single antenna systems. In more technical terms, MIMO delivers array gain, diversity gain and multiplexing gain compared to single antenna.

- Array gain — Improvement in SNR (signal to noise ratio) by coherently combining signals from multiple antennas. For example, increasing SNR through beamforming techniques.
- Diversity gain — Improvement in reliability by mitigating deep fading or strong destructive EM wave interference. For example, in a two-antenna system, if one antenna is experiencing deep fading due to an EM destructive null at its location at a given instant, the other antenna is unlikely to have a null at the same instant, and the combined SNR stays at a reliable level. In contrast, a single antenna would see SNR oscillating between good SNR and very poor SNR and reliability would degrade.
- Multiplexing gain — Increase in system capacity or throughput by sending independent data over multiple spatial streams simultaneously. The number of streams cannot be more than the number of antennas. For example, to support three spatial streams, a minimum of three antennas is required. Often there may be additional antennas for diversity or redundancy, such as in the case of 4x4:3, or 4x4 MIMO with 3 spatial streams.

If deploying multiple single-element antennas for a MIMO system in an array, ensure sufficient spacing between the antennas. Omnidirectional elements should generally be at least one wavelength apart at the lowest operating frequency.

Consider the following:

- For Wi-Fi systems operating in the 2.4, 5, and/or 6 GHz bands, space elements at least 5 inches (12.5 cm) apart.
- For 4G LTE and 5G systems with the lowest operating frequency of 617 MHz , space elements at least 20 inches (50 cm) apart.
- Note that spacing between elements inside multi-element MIMO antennas is often less than one wavelength. However multi-element antennas are engineered with MIMO performance in mind, by providing antenna diversity through pattern, polarization, and isolation between MIMO elements.

Antenna siting and location

Consider the following when planning your installation:

- Plan antenna location ahead of time. Ideal location for an antenna is in LOS (line of sight) of the counterpart that it is trying to communicate with. Under LOS conditions the signals propagate directly between the two communication nodes, without relying on signal bouncing off a wall or other structure to reach the counterpart. This is sometimes not possible to achieve in practice, but it is a useful goal to keep in mind when optimizing antenna location.
- While it is good to keep RF cables short, it is most desirable for an antenna to be in the best location it can be to provide the desired coverage.
- For large deployments involving multiple units communicating with each other across a complex urban or industrial landscape, consider running an RF propagation modeling study to predict approximate simulated coverage maps and determine initial placement of the units. A propagation study may help reduce overall deployment cost by discovering and mitigating issues with RF coverage before the infrastructure is physically installed.
- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. One exception is if the antenna is designed to be mounted on a ground plane. If mounting on a ground plane, mount the antenna on a flat metal surface away from adjacent obstructions.
- It is strongly recommended not to install antennas directly on the router or access point (AP), unless the router or AP is specifically engineered to directly mount the antennas. Products that are engineered for direct mounting of antennas specifically address each of the below issues.
- Reasons to mount antennas away from the router include:
  - Router location may not be optimal location for antenna to communicate with the counterpart wirelessly, so router and antenna may need to be in different locations.
  - Router may have a clutter of Ethernet cable and power cables around it, which will obstruct antenna signal.
  - A number of routers, such as the IR1835, are modular. They have plug-in RF modules for Wi-Fi , 4G LTE or 5G NR such as WP-WIFI6, P-LTEAP18-GL, P-5GS6-GL. These modules have RF connectors spaced close together, and while it is mechanically possible to install four or five antennas directly attached, this will result in significant degradation to RF performance of antennas due to mutual de-tuning between closely spaced antennas. It is strongly recommended to install antennas away from the chassis in modular cases.

- If installing an antenna indoors, consider that the density and electromagnetic properties of the materials used in the building construction determines the number of walls the signal can pass through and still maintain adequate coverage.
  - Paper and vinyl walls have very little effect on signal penetration.
  - Solid and pre-cast concrete walls limit signal penetration to one or two walls without degrading coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall causes signals to reflect off, causing poor penetration.
  - A chain link fence or wire mesh spaced between 1 and 1 1/2 in. (2.5 and 3.8 cm) acts as a harmonic reflector that blocks a 2.4-GHz radio signal.
  - Install the antenna away from microwave ovens and 2-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device your antenna is connected to.

Installing the Antenna

The antenna can be installed in the following deployments:

Deployment Type	Description	Antenna Accessories Required
Transportation	The antenna is installed on a vehicle such as automobile, train, or other moving platform. The antenna is connected to a mobile router in the vehicle. **Note** This is the most common IoT installation scenario.	5G-ANTM-O-4-B antenna, accessories depend on the installation scenario.
Indoor ceiling mount	The antenna is installed on a grounded metal surface on a ceiling, and attached directly to a router.	5G-ANTM-GD
Indoor wall mount	The antenna is installed on a grounded metal bracket, on a drywall or wooden wall, and attached directly to a router.	5G-ANTM-BRACKET (mounting hardware included)
Outdoor wall mount	The antenna is installed outdoors on a metal bracket, on a brick or concrete wall, and attached directly to a router mounted indoors.	5G-ANTM-BRACKET (mounting hardware not included)

Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco 5G-ANTM-O-4-B antenna
- SMA Plug (4x LTE/5G, GNSS)
- Reverse Polarity SMA Plug (4x Wi-Fi)

Optional items that are not included, but may be needed for installation:

- Ground Disc (5G-ANTM-GD): Required for ceiling mount only
- L-shape mounting bracket and accessories (5G-ANTM-BRACKET): Required for indoor/outdoor wall-mount

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the previous section, you must provide the following tools to install the antenna:

- Open-ended wrench
- Electric drill

Note This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

Mounting on a Ceiling

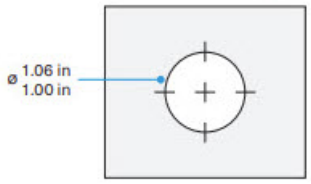
When choosing a location to mount the antenna, keep the following in mind:

- Attempt to center the antenna on a flat plane.
- Attempt to position the antenna so that it has 8 inches of flat plane in any given direction.
- Attempt to space at least 16 inches from an adjacent antenna or metallic structure and choose a location with gentle surface curves to ensure proper sealing.
- Ensure there is a space that is 2 inches deep and 2 inches in diameter below the mounting surface to allow sufficient clearance for the mounting stud, hardware, and cables.
- Ensure that the diameter of the hole is 1.00-1.06 inch.

Step 1 Select a mounting location with gentle surface curves to ensure a proper seal with 203.2 mm (8 inches) of ground plane in any given direction around the antenna. Position the antenna at least 406.4 mm (16 inches) from any adjacent antennas or metallic structures. Allow for 50.8 mm (2 inches) of clearance below the mounting surface for the mounting stud and cable routing. Ensure that there is 50.8 mm (2 inches) in diameter around the mounting hole for the mounting nut and tightening procedure.

Step 2 Drill a hole through the mounting surface where the center of the antenna is located, as shown in the following figure.

Figure 6: Mounting Hole Dimensions

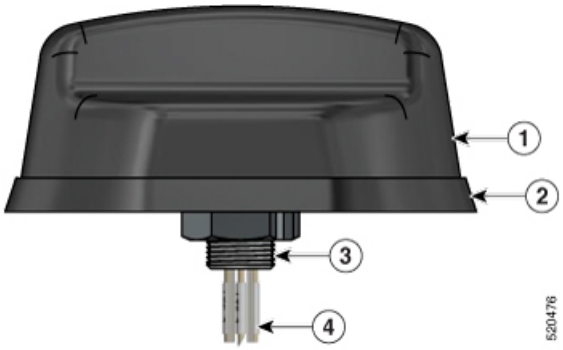


Step 3 Ensure that the hole is free of any burrs and sharp edges to prevent cable damage and VHB adhesive contamination during installation.

Step 4 Clean the mounting surface around the hole. The surface must be free of any debris that would otherwise prevent the inner VHB foam gasket from adhering, or the outer rubber gasket from forming a seal.

Step 5 Feed the cables and stud through the mounting surface hole and ground disc. Take care not to damage the jacket, and route them to the desired location. The following figure shows the cables and stud.

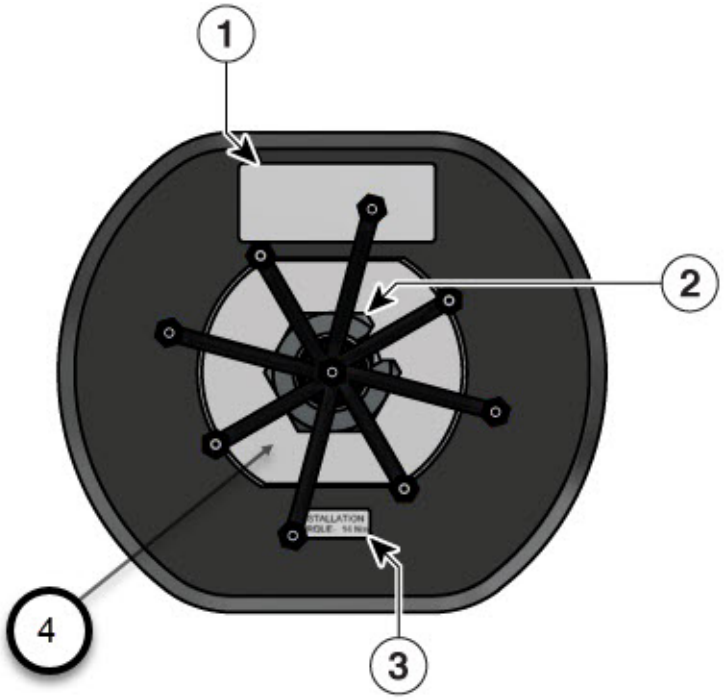
Figure 7: Side View



1	4 LTE/5G, 4 Wi-Fi, and GPS antennas inside black radome
2	VHB Compressed Foam Gasket
3	Mounting stud
4	Cables

Step 6 Remove the liner from the inner VHB foam gasket, insert the mounting stud through the hole, and position the antenna onto the mounting surface as shown in the following figure.

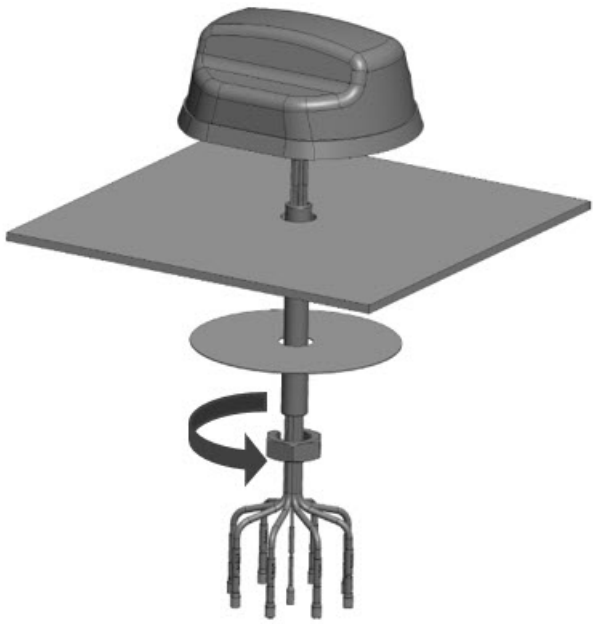
Figure 8: Bottom View



1	Product ID and Serialization Label
2	UNS Thread slotted lock-nut
3	Torque label
4	VHB Foam Gasket/Liner

Step 7 Beneath the mounting surface and ground disc, install the slotted lock nut onto the mounting stud. Hand tighten as shown in the following figure. Then tighten with a wrench until the antenna is fully seated, or with a torque wrench, tighten the nut to 14Nm (10.5 lbft) minimum.

Figure 9: Hand Tighten



Step 8 Visually inspect the outer rubber gasket to ensure it has made a proper seal against the mounting surface and radome. If the locking nut includes a set screw locking feature, torque down the locking nut as directed above, then torque the set screw to 3.5 Nm (2.2 lbft).

Step 9 The completed antenna installation is shown in the following figure.

Figure 10: Completed Installation

What to do next

Connect the antenna to the device according to specific installation instructions for each product.

Mounting on an Indoor Wall (Drywall)

When choosing a location to mount the antenna, keep the following in mind:

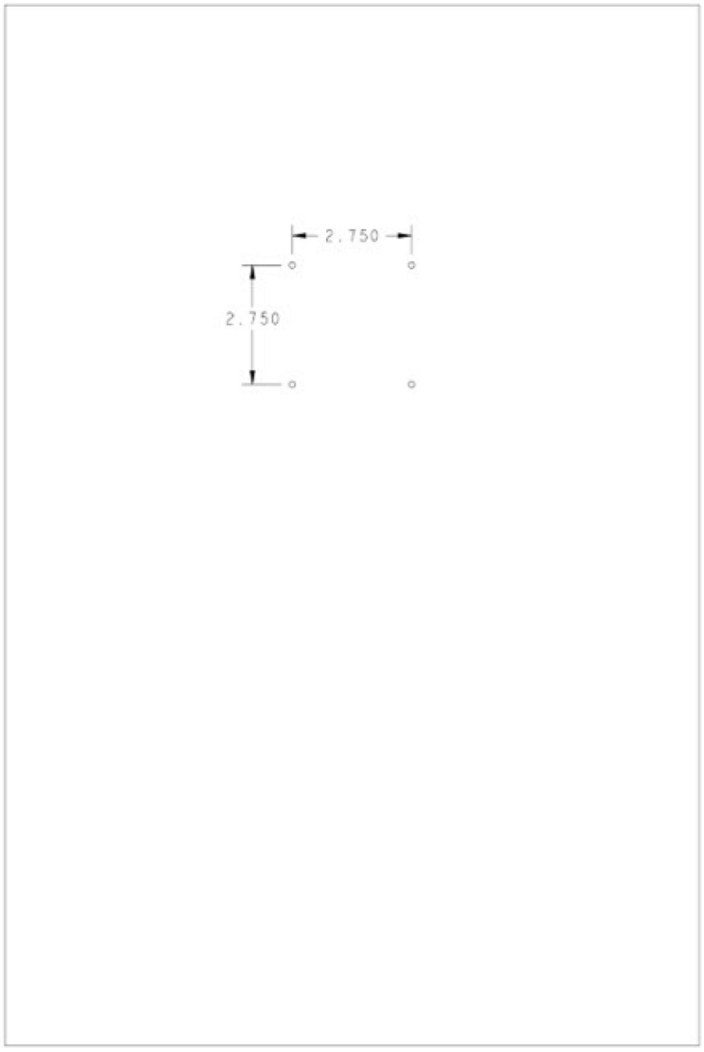
- Attempt to center the antenna on a flat plane.
- Attempt to position the antenna so that it has 8 inches of flat plane in any given direction.
- Attempt to space at least 16 inches from an adjacent antenna or metallic structure and choose a location with gentle surface curves to ensure proper sealing.

For indoor drywall mounting, the following items are required:

- Plastic wall plugs (4x)
- 30mm long pan-head ST3.5 screws (4x)
- 12mm OD/1mm thick washers (4x)

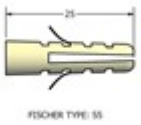
Step 1 Drill the four 5mm diameter holes at 2.75in spacing, at a minimum depth of 35mm.

Figure 11: Mounting Hole Template



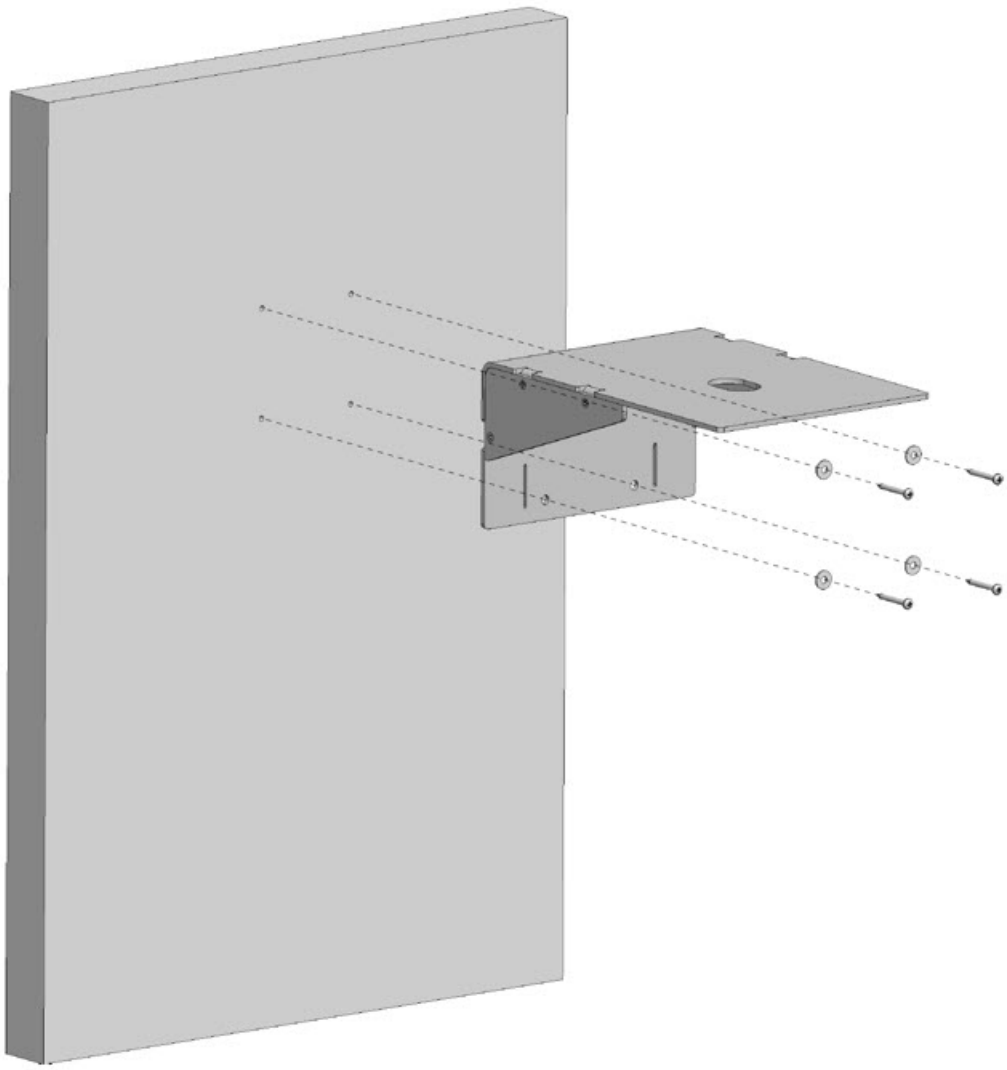
Step 2 Insert the plastic wall plugs into the holes until flushed with wall surface. The following figure shows an example of a plastic wall plug.

Figure 12: Plastic Wall Plug



Step 3 Align the four holes on the L-shape mounting bracket with the four holes on the wall.

Figure 13: Attach Brackets



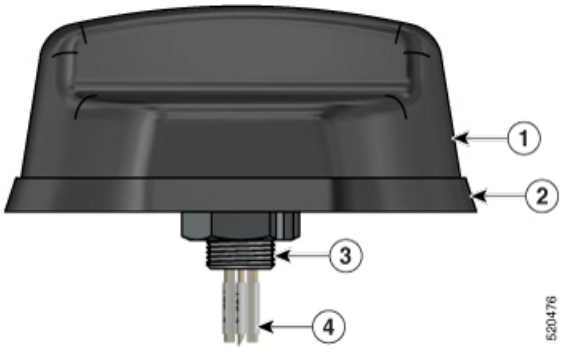
Step 4 Secure and tighten with provided screws and washers.

Step 5 Ensure that the hole is free of any burrs and sharp edges to prevent cable damage and VHB adhesive contamination during installation.

Step 6 Clean the mounting surface around the hole. The surface must be free of any debris that would otherwise prevent the inner VHB foam gasket from adhering, or the outer rubber gasket from forming a seal.

Step 7 Feed the cables and stud through the mounting surface hole taking care not to damage the jacket, and route them to desired location as shown in the following figure.

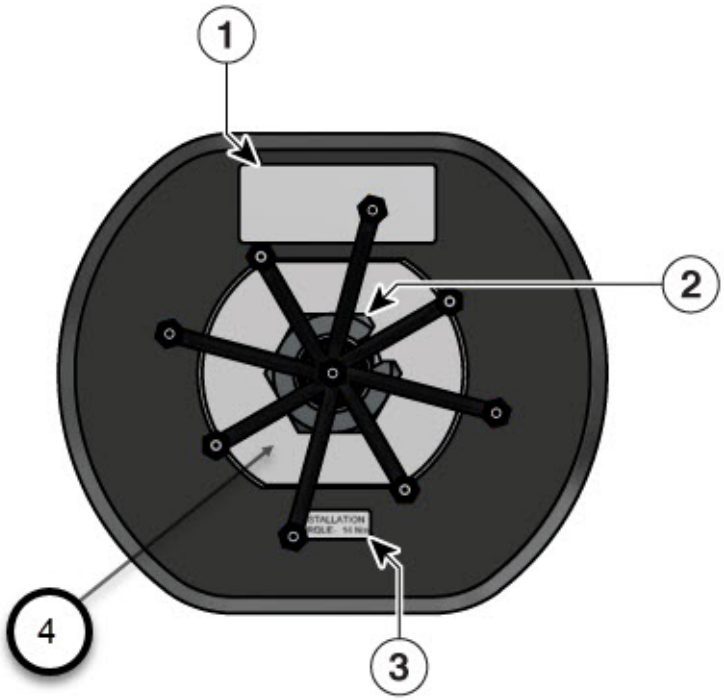
Figure 14: Side View



1	4 LTE/5G, 4 Wi-Fi, and GPS antennas inside black radome
2	VHB Compressed Foam Gasket
3	Mounting stud
4	Cables

Step 8 Remove the liner from the inner VHB foam gasket, insert the mounting stud through the hole, and position the antenna onto the mounting surface as shown in the following figure.

Figure 15: Bottom View

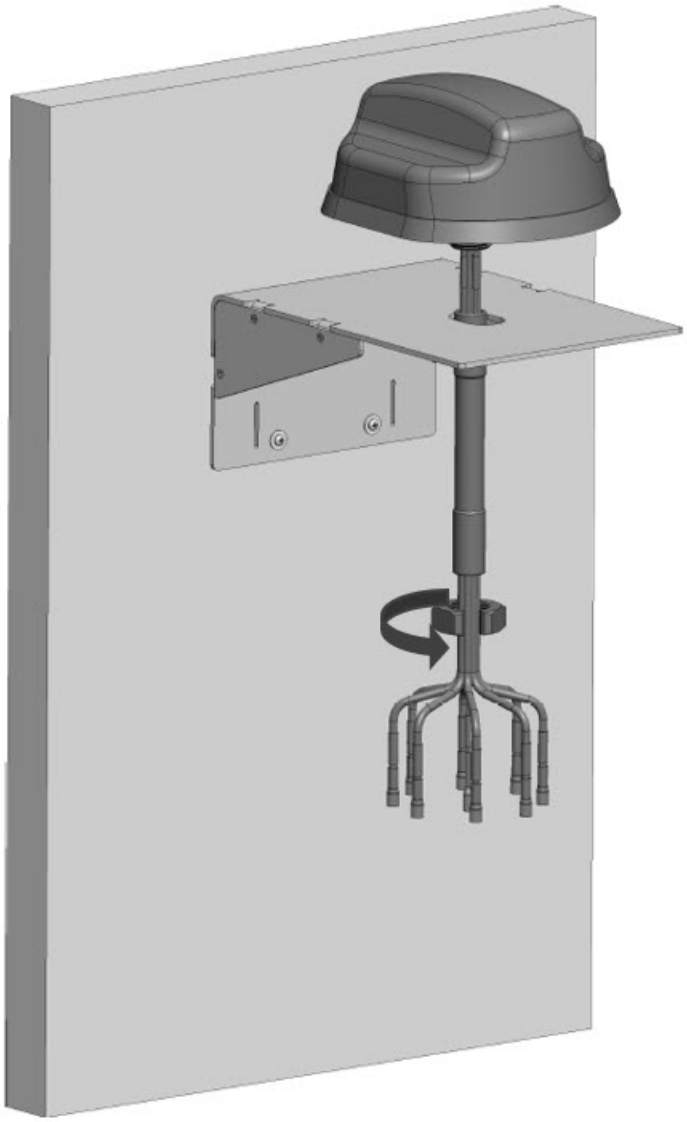


1	Product ID and Serialization Label

2	UNS Thread slotted lock-nut
3	Torque label
4	VHB Foam Gasket/Liner

Step 9 Beneath the mounting surface, install the slotted lock nut onto the mounting stud and hand tighten as shown in the following figure. Then wrench tighten until antenna is fully seated, or with a torque wrench, tighten the nut to 14Nm (10.5 lbft) minimum.

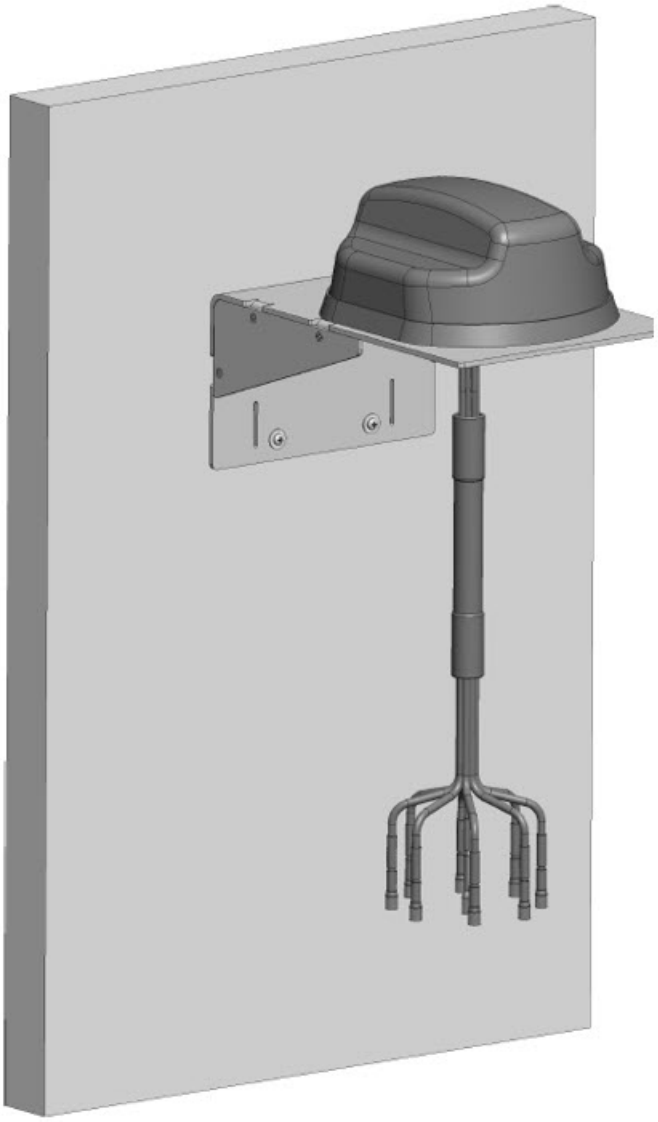
Figure 16: Hand Tighten



Step 10 Visually inspect the outer rubber gasket. Ensure it has made a proper seal against the mounting surface and radome. If the locking nut includes a set screw locking feature, torque down the locking nut as directed above, then torque the set screw to 3.5 Nm (2.2 lbft).

Step 11 The completed antenna installation is shown in the following figure.

Figure 17: Completed Installation



Mounting on an Indoor Wall (Wood Surface or Stud)

When choosing a location to mount the antenna, keep the following in mind:

- Attempt to center the antenna on a flat plane.

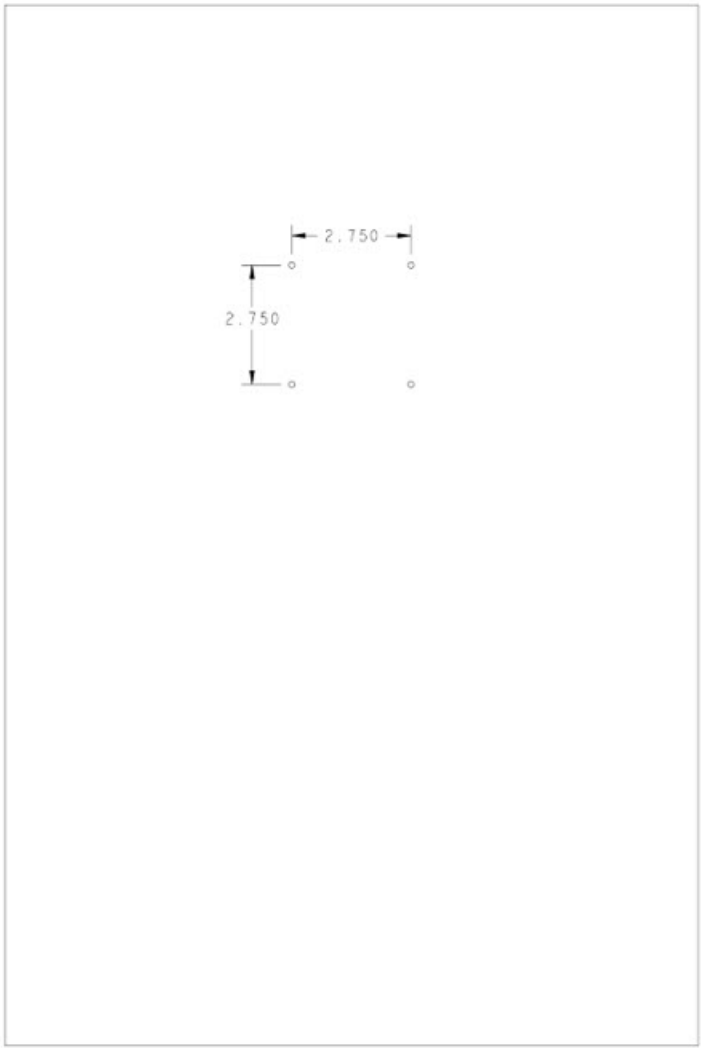
- Attempt to position the antenna so that it has 8 inches of flat plane in any given direction.
- Attempt to space at least 16 inches from an adjacent antenna or metallic structure and choose a location with gentle surface curves to ensure proper sealing.

For indoor wood surface or stud mounting, the following items are required:

- 30mm long pan-head ST3.5 screws (4x)
- 12mm OD/1mm thick washers (4x)

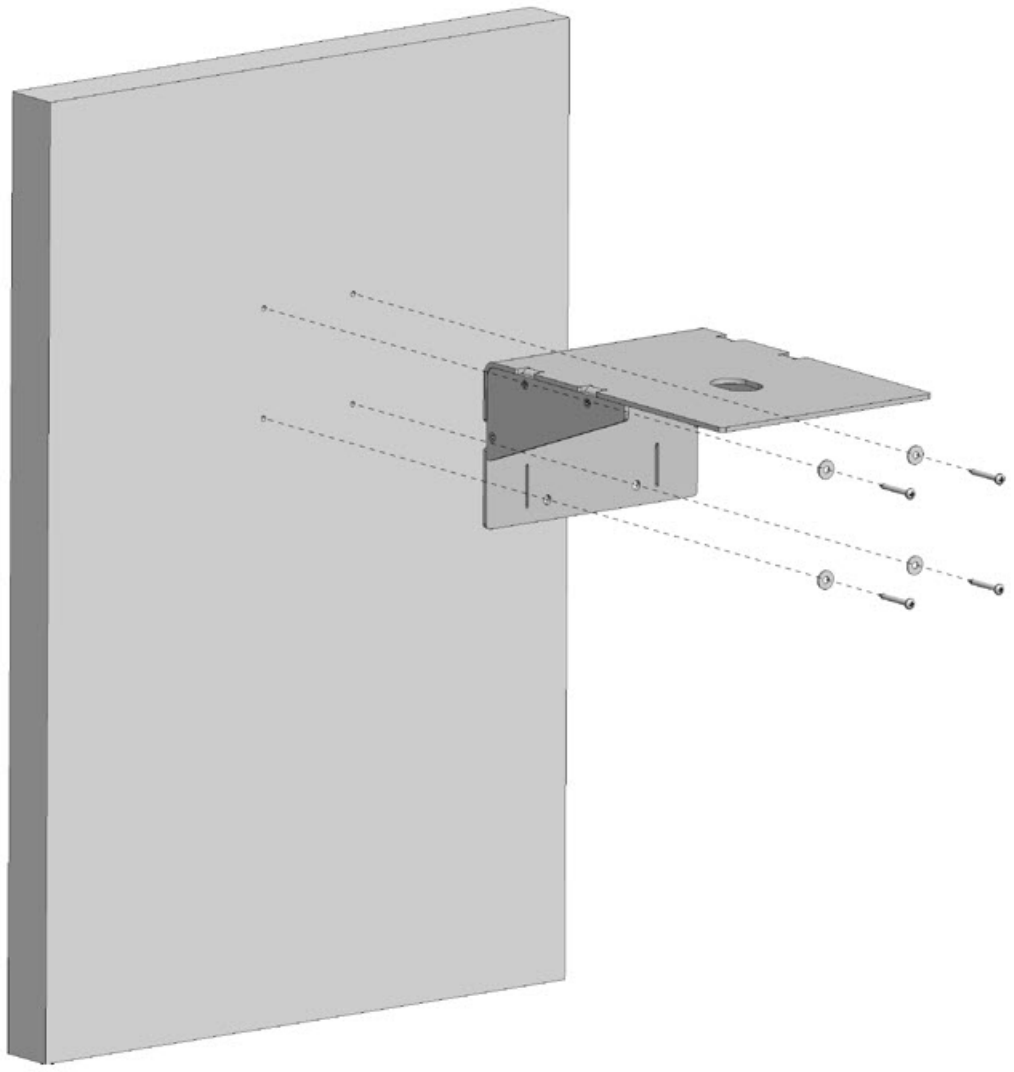
Step 1 Mark the location of four holes at 2.75in spacing on the wall.

Figure 18: Mounting Hole Template



Step 2 Align the four holes on the L-shape mounting bracket with the four holes on the wall.

Figure 19: Attach Brackets



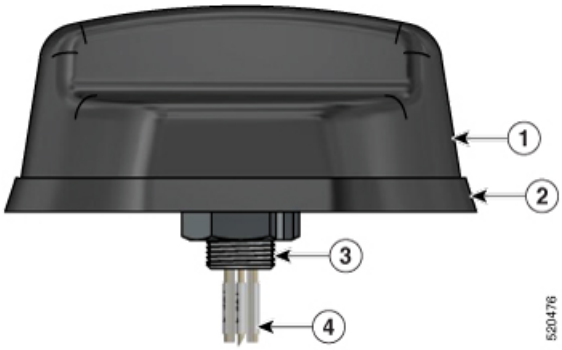
Step 3 Secure and tighten with provided screws and washers.

Step 4 Ensure that the hole is free of any burrs and sharp edges to prevent cable damage and VHB adhesive contamination during installation.

Step 5 Clean the mounting surface around the hole. The surface must be free of any debris that would otherwise prevent the inner VHB foam gasket from adhering, or the outer rubber gasket from forming a seal.

Step 6 Feed the cables and stud through the mounting surface hole, taking care not to damage the jacket, and route them to desired location as shown in the following figure.

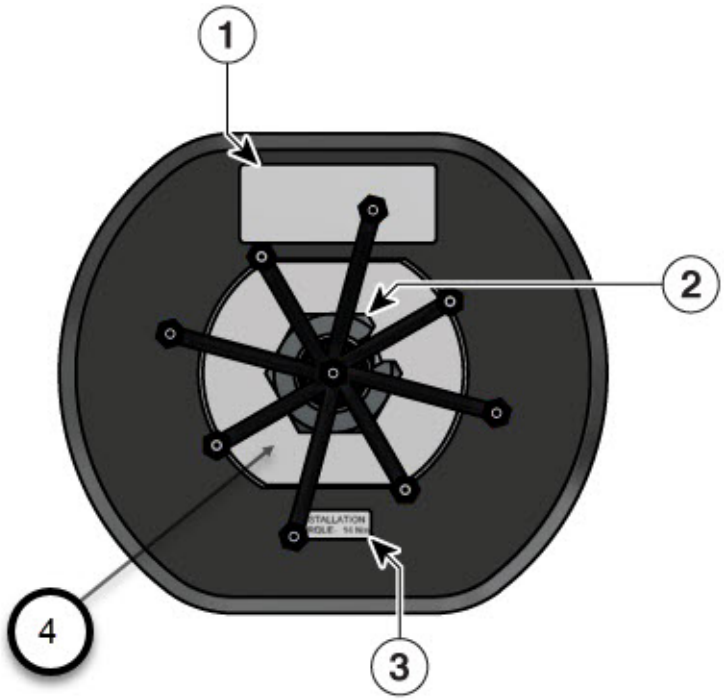
Figure 20: Side View



1	4 LTE/5G, 4 Wi-Fi, and GPS antennas inside black radome
2	VHB Compressed Foam Gasket
3	Mounting stud
4	Cables

Step 7 Remove the liner from the inner VHB foam gasket, insert the mounting stud through the hole, and position the antenna onto the mounting surface as shown in the following figure.

Figure 21: Bottom View

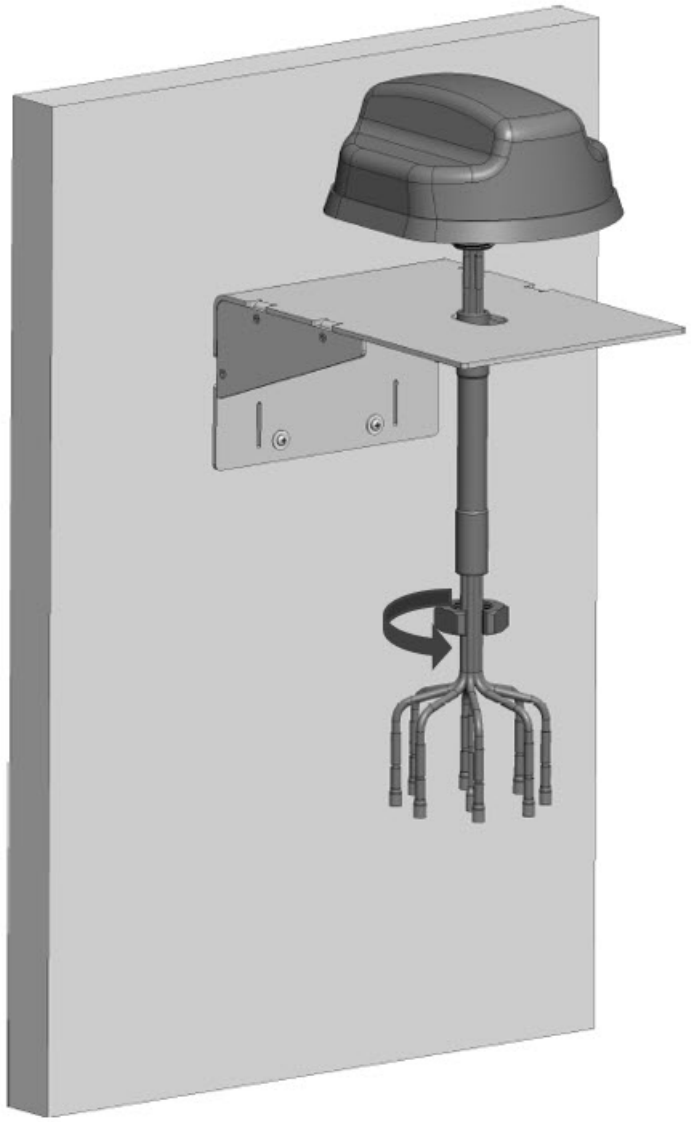


1	Product ID and Serialization Label

2	UNS Thread slotted lock-nut
3	Torque label
4	VHB Foam Gasket/Liner

Step 8 Beneath the mounting surface, install the slotted lock nut onto the mounting stud and hand tighten as shown in the following figure. Then wrench tighten until antenna is fully seated, or with a torque wrench, tighten the nut to 14Nm (10.5 lbft) minimum.

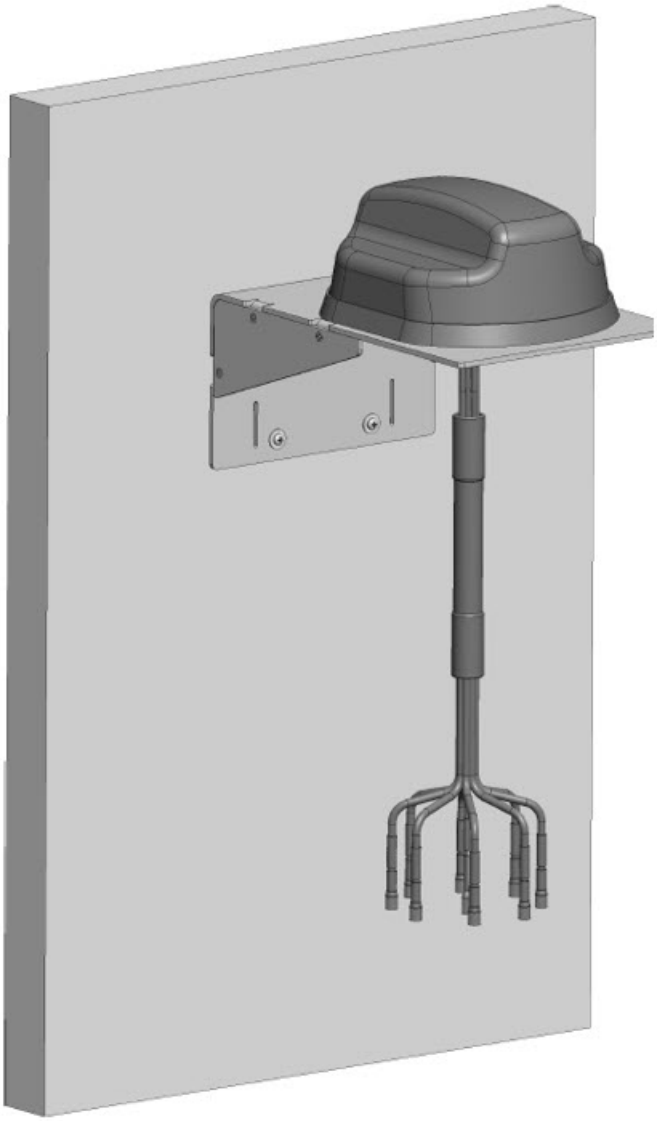
Figure 22: Hand Tighten



Step 9 Visually inspect the outer rubber gasket. Ensure it has made a proper seal against the mounting surface and radome. If the locking nut includes a set screw locking feature, torque down the locking nut as directed above, then torque the set screw to 3.5 Nm (2.2 lbft).

Step 10 The completed antenna installation is shown in the following figure.

Figure 23: Completed Installation



Mounting on an Outdoor Wall

When choosing a location to mount the antenna, keep the following in mind:

- Attempt to center the antenna on a flat plane.

- Attempt to position the antenna so that it has 8 inches of flat plane in any given direction.
- Attempt to space at least 16 inches from an adjacent antenna or metallic structure and choose a location with gentle surface curves to ensure proper sealing.

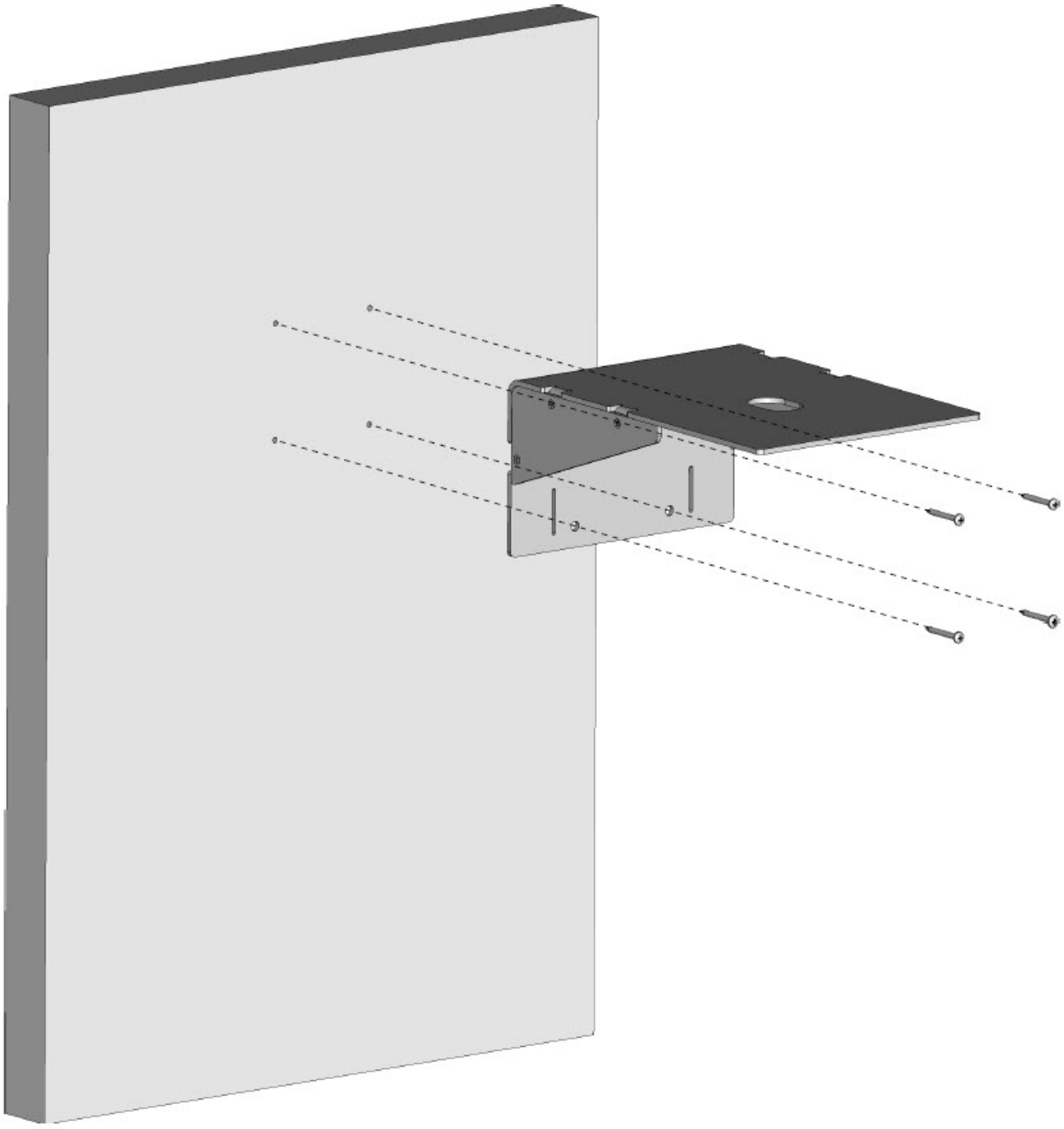
For outdoor brick or cement mounting, the following items are required:

- 3/16in hex washer head concrete screws, 1 1/4in in length or longer. (not provided)

Step 1 Drill four pilot holes at 2.75in spacing appropriate for your mounting surface and environment.

Step 2 Align the four holes on the L-shape mounting bracket with the four holes on the wall.

Figure 24: Attach Brackets



Step 3 Using the four concrete screws, secure and tighten with a 3/16in hex head driver.

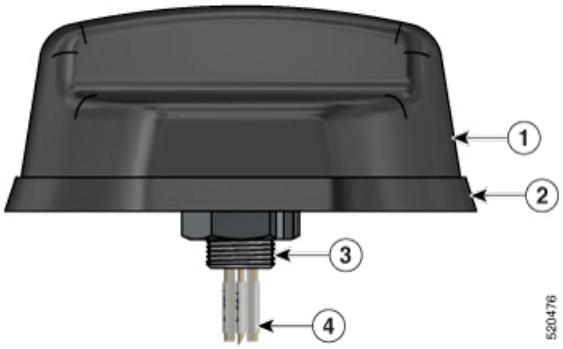
Note An access hole through the wall must be created to connect the outdoor antenna to an indoor router

Step 4 Ensure that the hole is free of any burrs and sharp edges to prevent cable damage and VHB adhesive contamination during installation.

Step 5 Clean the mounting surface around the hole. The surface must be free of any debris that would otherwise prevent the inner VHB foam gasket from adhering, or the outer rubber gasket from forming a seal.

Step 6 Feed the cables and stud through the mounting surface hole, taking care not to damage the jacket, and route them to desired location as shown in the following figure.

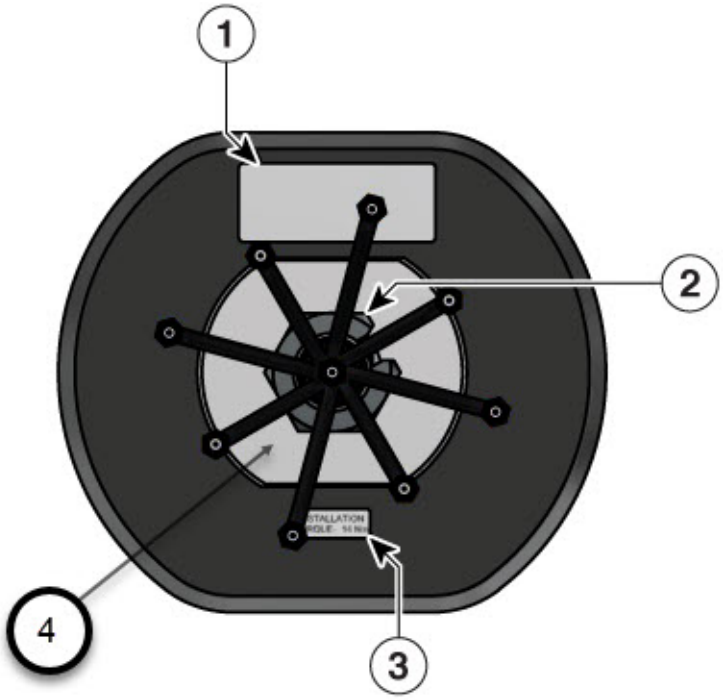
Figure 25: Side View



1	4 LTE/5G, 4 Wi-Fi, and GPS antennas inside black radome
2	VHB Compressed Foam Gasket
3	Mounting stud
4	Cables

Step 7 Remove the liner from the inner VHB foam gasket, insert the mounting stud through the hole, and position the antenna onto the mounting surface as shown in the following figure.

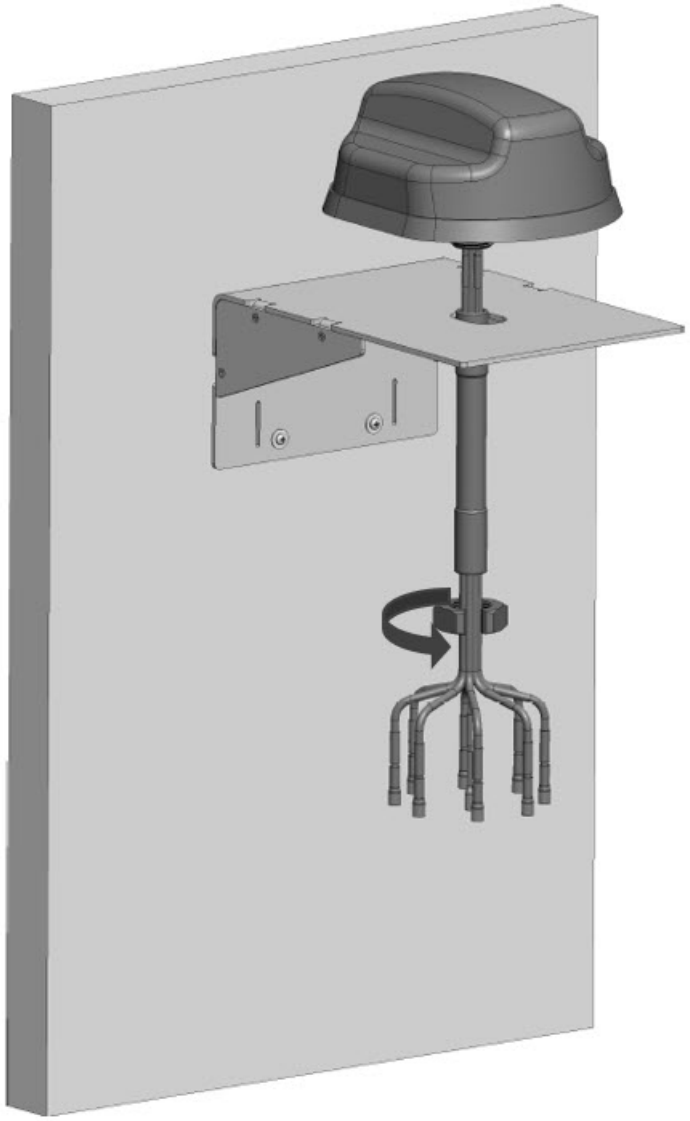
Figure 26: Bottom View



1	Product ID and Serialization Label
2	UNS Thread slotted lock-nut
3	Torque label
4	VHB Foam Gasket/Liner

Step 8 Beneath the mounting surface, install the slotted lock nut onto the mounting stud and hand tighten as shown in the following figure. Then wrench tighten until antenna is fully seated, or with a torque wrench, tighten the nut to 14Nm (10.5 lbft) minimum.

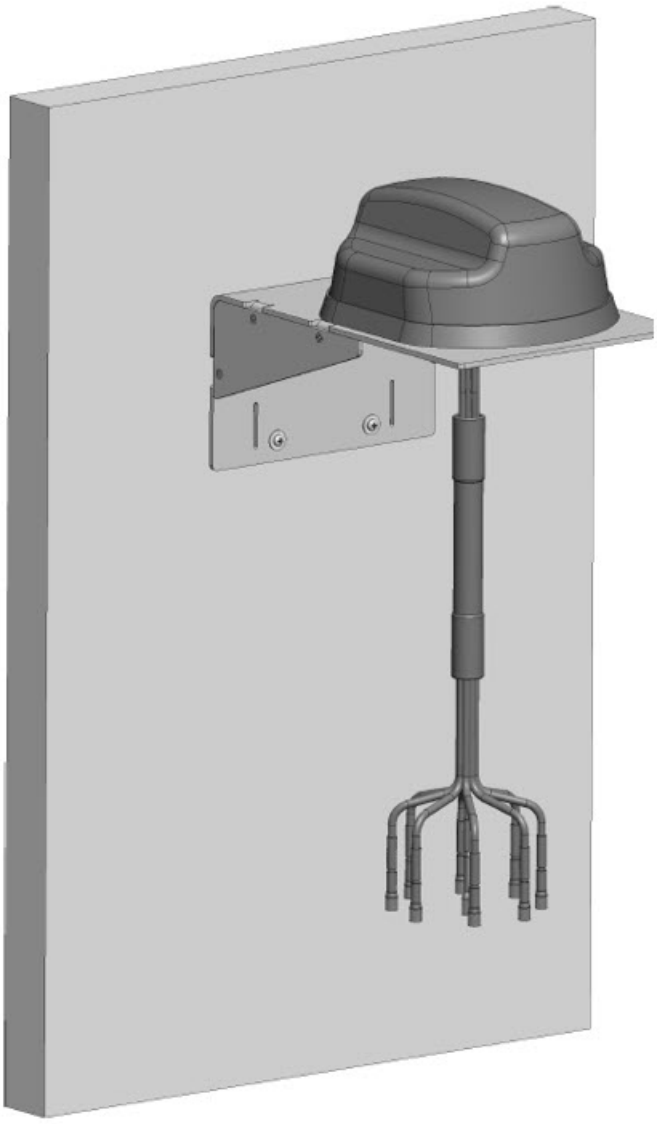
Figure 27: Hand Tighten



Step 9 Visually inspect the outer rubber gasket. Ensure it has made a proper seal against the mounting surface and radome. If the locking nut includes a set screw locking feature, torque down the locking nut as directed above, then torque the set screw to 3.5 Nm (2.2 lbft).

Step 10 The completed antenna installation is shown in the following figure.

Figure 28: Completed Installation



Connecting the Antenna to the Router

To attach the router-end of the cable to your router, please see your platforms Hardware Installation Guide.

Note Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss).

Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
- To get the business impact you're looking for with the technologies that matter, visit Cisco Services.
- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions, and services, visit Cisco DevNet.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

Cisco Bug Search Tool

Cisco Bug Search Tool (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.

Documentation Feedback

To provide feedback about Cisco technical documentation, use the feedback form available in the right pane of every online document.

Cisco Support Community

Cisco Support Community is a forum for you to ask and answer questions, share suggestions, and collaborate with your peers. Join the forum at https://supportforums.cisco.com/index.jspa.