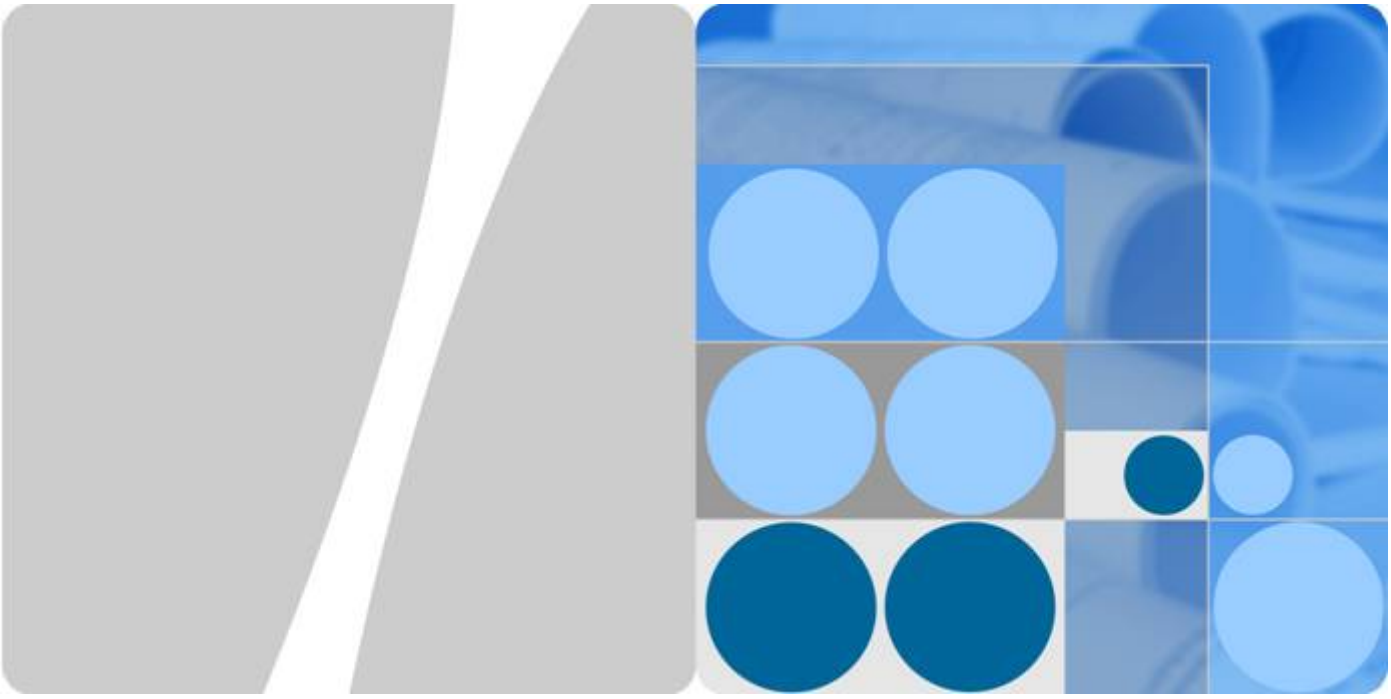


WLAN

Antenna Quick Start

Issue 22

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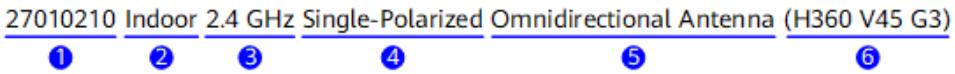
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1 Antenna Description

This document describes key parameters and installation methods of antennas used on Huawei Access Points (APs).

For easy description, the antennas are named according to the following rules.

Figure 1-1 Antenna naming rules



No.	Description	Value
1	Antenna No.	–
2	Installation scenarios	• Indoor: indoor scenarios • Outdoor: outdoor scenarios • Rail transportation: vehicle-ground communication scenarios • Vehicle-mounted: wireless coverage for train compartments scenarios
3	Frequency band Besides the 2.4 GHz and 5 GHz frequency bands, some antennas can also work on other frequency bands. This section lists only the frequency bands used by Huawei APs.	• 2.4 GHz • 5 GHz
4	Polarization mode	• Single-polarized • Dual-polarized
5	Antenna type	• Directional antenna • Omnidirectional antenna

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No.	Description	Value
6	Lobe width and gain (typical values) • H: horizontal lobe width • V: vertical lobe width • G: gain	-

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2 Antenna Fundamentals

About This Chapter

2.1 Antenna Types

2.2 Antenna Angle

2.3 Antenna Gain

2.4 Receiver Sensitivity

2.5 Beamwidth

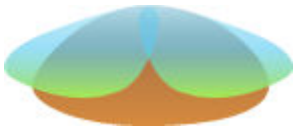
2.1 Antenna Types

Antennas are used to transmit or receive radio waves and play an important role in a WLAN. The following describes how antennas are classified based on different criteria.

Antenna Classification by Horizontal Radiation Pattern

Antennas can be classified into the following types based on the horizontal radiation pattern:

- Omnidirectional antenna



  - The goal of an omnidirectional antenna is to radiate energy equally in all directions in a plane (azimuth plane), with a directional pattern in any orthogonal plane.
  - The radiation pattern of an omnidirectional antenna is similar to that of an incandescent lamp, which radiates visible light in all directions in a plane.

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- Directional antenna



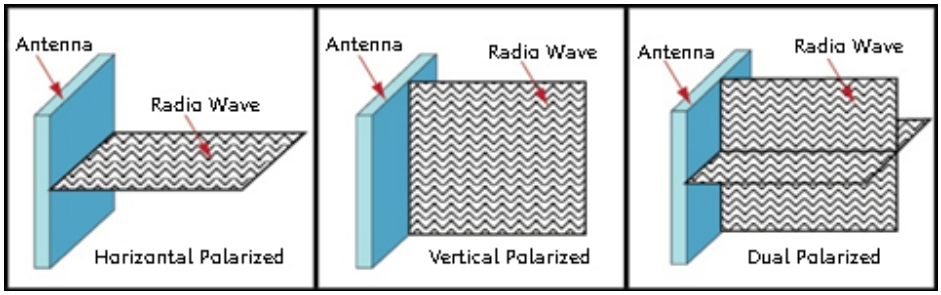
  - A directional antenna radiates its energy more effectively in one (or some) direction than others. Typically, these antennas have one main lobe and several minor lobes.
  - The radiation pattern of a directional antenna is similar to that of a flashlight, which radiates visible light towards a specified direction. With the same radio energy, a directional antenna provides a longer coverage distance than an omnidirectional antenna in a particular direction.
- Smart antenna



  - A smart antenna supports multiple directional radiation patterns and one omnidirectional radiation mode on a horizontal plane.
  - A smart antenna receives signals from transmitters in omnidirectional mode. Based on the received signals, the smart antenna algorithm can determine the location of a transmitter and control the CPU to send control signals to the transmitter in the directional radiation pattern with the direction of the maximum radiation.

Antenna Classification by Polarization Mode

By polarization mode, antennas are classified to single-polarized antennas and dual-polarized antennas. Single polarization and dual polarization are essentially linear polarization, allowing antennas to be horizontally or vertically polarized.



- Single-polarized antenna: supports only one polarization mode. Such an antenna can only receive or transmit signals in either the horizontal or vertical plane at a time. Therefore, more installation space and maintenance workload are required.
- Dual-polarized antenna: supports the horizontal and vertical polarization modes. Such an antenna can both receive and transmit signals.

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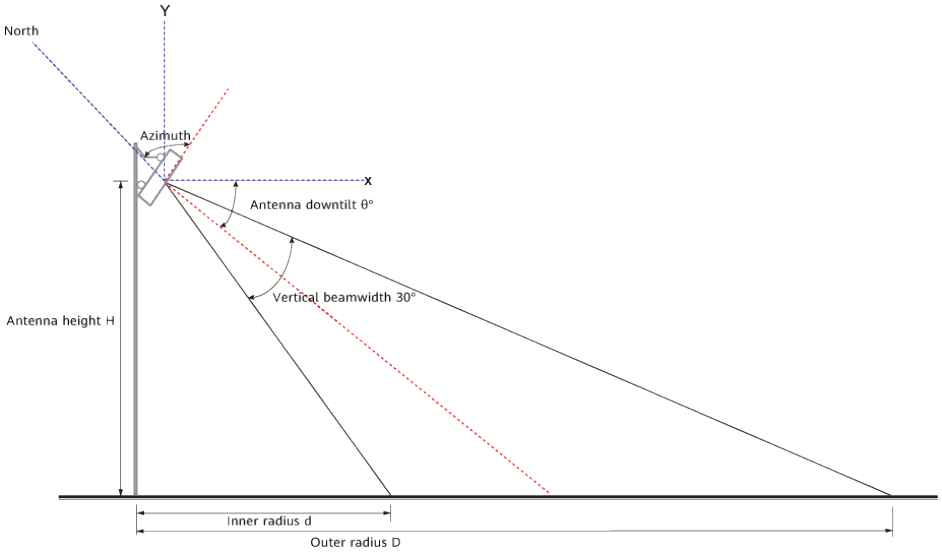
2.2 Antenna Angle

Antenna angles include the azimuth and downtilt angles, which are formed between an antenna and the north and horizontal directions, respectively.

There are two antenna types by directionality: omnidirectional and directional antennas. An omnidirectional antenna receives or transmits signals in all horizontal directions. Therefore, angles of antennas usually refer to azimuth and downtilt angles of directional antennas, as shown in **Figure 2-1**.

A small antenna angle provides a high antenna gain. However, the key to selecting an antenna gain is to meet signal coverage requirements. The signal coverage range of an antenna can be controlled by adjusting the antenna azimuth and downtilt angles.

Figure 2-1 Antenna angles



Related Concepts

- Azimuth angle: defined by a horizontal angle measured clockwise from north.
- Downtilt antenna: formed between an antenna and the horizontal plane.
- Lobe angle: angle between the points in the main lobe that are down from the maximum gain by 3 dB. For details, see **2.5 Beamwidth**.
- Antenna gain: ratio of the power density in a given direction to the power density of a reference antenna (using an ideal radiation source) in the same direction. For details, see **2.3 Antenna Gain**.

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2.3 Antenna Gain

Definition

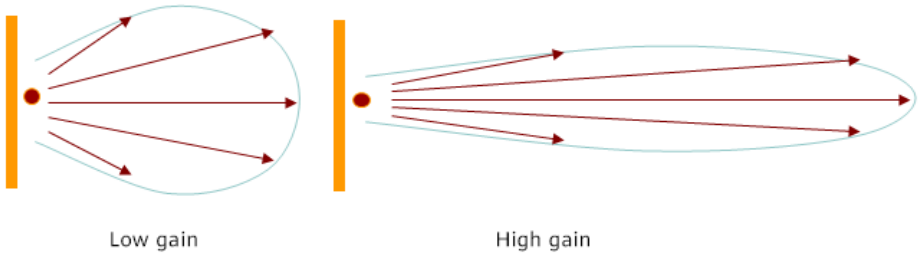
Antenna gain is the ratio of the power density in a given direction to the power density of a reference antenna (using an ideal radiation source) in the same direction. It is expressed in dBd or dBi.

Physically, a gain is the ratio of the signal output of a system to the signal input of the same system. If the transmit antenna is an ideal undirectional source, the input power should be 100 W. If the transmit antenna is a directional antenna with a gain of 13 dB (20 times), only 5 W (100/20) of input power is required. That is, an antenna's gain is the amplifier of input power of the undirectional ideal radiation source.

Antenna gain can be used to measure the capability of an antenna to receive and send signals in a specified direction, which is one of the most important parameters to consider when selecting an antenna. The antenna gain is related to the antenna radiation pattern. If the main lobe is narrow, the side lobe is small and the gain is high. **Figure 2-2** shows the relationship between the main lobe width and antenna gain.

Under the same condition, a higher antenna gain indicates a longer transmission distance. In practice, select a proper antenna gain to ensure that beamwidth matches the target coverage area. If the coverage area is small, select a low-gain antenna with a wide vertical lobe.

Figure 2-2 Relationship between the main lobe width and antenna gain



Related Concepts

- dBd: unit for measuring the balanced dipole's gain.
- dBi: unit for measuring the radiation source antenna's gain, with equal signal radiation in all directions. The relationship between dBi and dBd is as follows: dBi = dBd + 2.15.
- Lobe angle: defined as the angle between the points in the main lobe that are down from the maximum gain by 3 dB. For details, see **2.5 Beamwidth**.
- Ideal radiation source: ideal isotropic antenna, that is, a simple point-shaped radiation source that provides the same radiation performance in all directions.

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Formula

$G=10lg(P_2/P_1)$ Antenna gain = 10lg(Power density of an antenna/Power density of a reference antenna)

2.4 Receiver Sensitivity

Receiver sensitivity refers to the minimum signal received power on an antenna port for receivers to accurately decode a given signal. Receiver sensitivity can be degraded by inter-system interference, affecting the quality of received signals. Therefore, receiver sensitivity is usually used as a criterion to protect the interfered system.

Receiver sensitivity is similar to hearing of human beings. In the daily environment, people with good hearing can capture voice more flexibly. Similarly, higher receiver sensitivity enables a receiver with higher capability to capture weak signals. If the signal strength is lower than receiver sensitivity, the receiver will not receive data.

Factor

- Thermal noise power within the bandwidth range
- Noise factor (NF)
- Minimum signal-to-noise ratio (SNR) required for decoding signals

Formula

S = 10lg(kTB) + NF + SNR

- S: receiver sensitivity, in dBm. A smaller value indicates better performance of the receiver. A larger value indicates lower performance of the receiver.
- k: Boltzmann constant, in J/K.
- T: absolute temperature, in K. As the temperature increases, receiver sensitivity becomes larger, degrading receiver performance. Therefore, lower the ambient temperature as much as possible.
- B: signal bandwidth, in Hz. Higher signal bandwidth represents a larger NF, higher receiver sensitivity, and therefore lower receiver performance.
- kTB: thermal noise power within the bandwidth range, in Watts.
- NF: noise factor, in dB.
- SNR: signal-to-noise ratio required for decoding signals, in dB. A small value of the minimum SNR can enhance receiver performance. The minimum SNR is related to the STA moving speed, wireless environment, and required communication quality. Minimum SNR requirements are different for wireless standards and services of the same wireless standard.

Receiver sensitivity of a common 802.11g product is -85 dBm. Wireless products on the market have -105 dBm receiver sensitivity. Professional receivers provide up to -120 dBm receiver sensitivity. Receiver sensitivity doubles every time the transmit power increases by 3 dB. In most cases, the receiver sensitivity value marked on Wi-Fi devices, such as -83 dBm, is a measurement of receiver sensitivity at a rate of 11 Mbit/s and a bit error rate (BER) of 10E-5 (99.999%).

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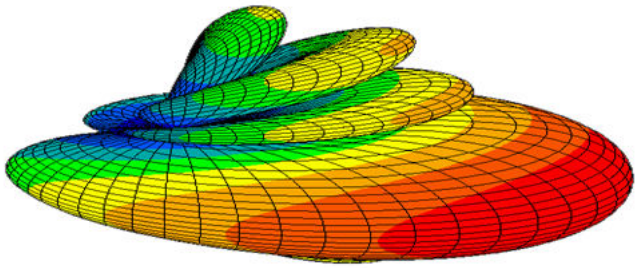
STAs have lower receiver sensitivity than APs. Therefore, the outdoor coverage distance is restricted by the STA uplink. If an AP transmits signals at full power, users may find strong signal strength on STAs but Internet access experience is poor. To prevent such an issue, reduce the transmit power of the AP to slightly higher than the receiver sensitivity of the STAs, so that the uplink and downlink of the STAs have a similar modulation and coding scheme (MCS) level after the link power budget is completed.

2.5 Beamwidth

Beamwidth is the angular separation between the points in the main lobe that are down from the maximum gain by 3 dB. The angle is called the lobe angle. An antenna has horizontal beamwidth and vertical beamwidth, forming a horizontal lobe angle and a vertical lobe angle, respectively. Beamwidth is a key counter for directional antennas.

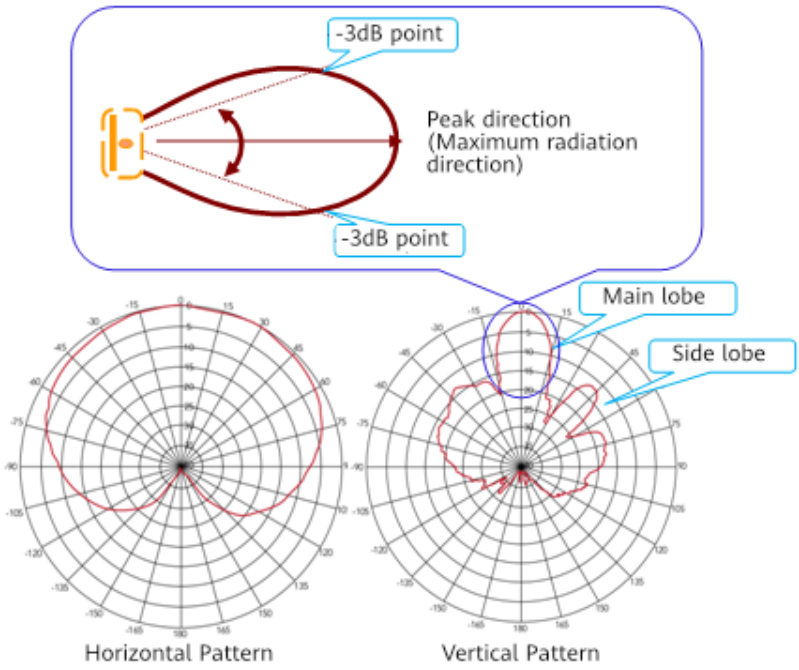
Figure 2-3 shows the radiation pattern of a directional antenna. The signal strength gradually increases from the blue area to the red area. **Figure 2-4** shows the horizontal and vertical patterns, and beamwidth.

Figure 2-3 Antenna radiation pattern



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Figure 2-4 Beamwidth



When the beamwidth is narrow, the radiation distance is long and the anti-interference capability is strong.

- When deploying antennas, note that side lobes interfere with peripheral residential areas. In most cases, main lobe radiation needs to be enhanced, and side lobe radiation needs to be suppressed. However, in the areas near the antennas, side lobes are needed to enlarge the coverage distance.
- H-plane half-power beamwidth determines the beamwidth of an antenna in the horizontal plane. When beamwidth is wide, good signal coverage is available at the sector boundary. However, when the downtilt angle becomes larger, beam distortion is more likely to occur, leading to overshoot coverage. On the contrary, when beamwidth is narrow, signal coverage is poor at the sector boundary. Increasing the downtilt angle can resolve this issue to a certain degree, which can prevent overshoot coverage. Base stations in the downtown are deployed at short intervals and have antennas with large downtilt angles installed. In this case, antennas with small H-plane half-power beamwidth are recommended. In the suburbs, antennas with large H-plane half-power beamwidth are recommended.
- V-plane half-power beamwidth determines the beamwidth of an antenna in the vertical plane. When beamwidth is narrow, signals that deviate from the main beam attenuate fast. In this case, it is easier to control the coverage by adjusting the downtilt angle, therefore improving coverage quality for cells.

Related Concepts

- Main lobe: Antennas have various radiation patterns. Some of them look like petals. The one with the strongest radiation "sticks out". It is the main lobe.
- Side lobe: lobes other than the main lobe on a radiation pattern.

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- 10 dB beamwidth: angle between the points in the main lobe that are down from the maximum gain by 10 dB (power density reduced to one tenth).

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3 Selection Policy

Overview

The following table lists the basic principles for selecting APs and antennas.

Table 3-1 Basic principles

No.	Factors of Consideration	Description
1	Usage scenario and purpose	• Indoor scenarios: use indoor APs and antennas to provide signal coverage. • Outdoor scenarios: use outdoor APs and antennas with a high Ingress Protection (IP) grade and certain surge protection capability to provide signal coverage and bridge backhaul. • Rail transportation scenarios: – Train-ground communications: use outdoor APs and antennas with a high IP rating and certain anti-vibration capability. – Compartment coverage: use indoor APs and antennas with certain anti-vibration capability to provide signal coverage. – Station platform coverage: use the same APs as the common outdoor and indoor scenarios.
2	Local standards and regulations	The transmit power and maximum gain of antennas must strictly comply with local standards and regulations. For the rail transportation scenarios, the performance, environment adaptability, and anti-vibration capability of the antennas must also confirm to requirements of the related railway authorities.

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No.	Factors of Consideration	Description
3	Mapping between APs and antennas	For details, see **Mapping Between APs and Antennas**.
4	Coverage/ Backhaul area and distance	• Coverage: Directional antennas are recommended for long and narrow areas while omnidirectional antennas are recommended for round and square areas. • Backhaul: Directional antennas are usually used. If the backhaul distance is long, high-gain antennas should be used; if the backhaul target is concentrated, small-angle antennas should be used.
5	Transmission frequency for radio signals	• Coverage: To implement 2.4 GHz and 5 GHz signal coverage, use 2.4 GHz and 5 GHz antennas separately in the same area or use dual-band antennas. • Backhaul: The 2.4 GHz antennas are not used for backhaul.
6	Construction cost and simplicity	An external directional antenna usually has a large size and needs to be connected to the AP's radio interface through a feeder cable. Compared to a built-in antenna and whip antenna directly installed on an AP, installing an external directional antenna requires higher construction cost and may affect indoor simplicity. To further simplify cable layout (especially in coverage scenarios) without compromising signal quality, you are advised to use built-in or whip antennas directly installed on APs.

Selection Solution in Typical Scenarios

In common WLAN networking scenarios, if APs with external antennas are selected, you can refer to the following table to learn about antenna selection policies.

NOTE

The antenna selection policies provided here are for reference only. In actual projects, you are advised to select APs and antennas based on the **WLAN planning documents**.

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Table 3-2 Outdoor backhaul (5 GHz only)

WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model
1 km backhaul	• Wi-Fi 6 AP: AirEngine 6760R-51 AirEngine 8760R-X1E AirEngine 6760R-51E • Wi-Fi 5 AP: AP8050DN AP8150DN AP8030DN AP8130DN AP8082DN AP8182DN	• The AirEngine 6760R-51, AP8050DN, AP8030DN, and AP8082DN have built-in 2.4 GHz or 5 GHz directional antennas and require low construction costs. • The AirEngine 8760R-X1E, AirEngine 6760R-51E, AP8150DN, AP8130DN, and AP8182DN require external directional antennas and are applicable to more complex scenarios.	• Wi-Fi 6 AP: **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** **27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)** • Wi-Fi 5 AP: **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** Use antennas with moderate gain and radiation angle to reduce interference to other APs at the same site. For leaf nodes, small-angle high-gain antennas are recommended, which can improve bandwidth.

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WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model
3 km backhaul	• Wi-Fi 6 AP: AirEngine 8760R-X1E AirEngine 6760R-51E AirEngine 5761R-11E AirEngine 5561R-11E • Wi-Fi 5 AP: AP8150DN AP8130DN AP8182DN	The AirEngine 8760R-X1E, AirEngine 6760R-51E, AP8150DN, AP8130DN, and AP8182DN require external directional antennas and are applicable to more complex scenarios.	• Wi-Fi 6 AP: **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • Wi-Fi 5 AP: **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** **27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 & H15 V15 G17)** Use directional cross-polarized antennas that have a small radiation angle and high gain to ensure robust signal strength for long-distance backhaul.

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Table 3-3 Outdoor coverage (2.4 GHz and 5 GHz)

WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model
Rural area, square, dock, customs checkpoint, customs inspection site, transportation hub, or long-distance bus station	• Wi-Fi 6 AP: AirEngine 6760R-51 AirEngine 6760R-51E AirEngine 8760R-X1 AirEngine 8760R-X1E • Wi-Fi 5 AP: AP8050DN AP8150DN AP8030DN AP8130DN AP8082DN AP8182DN	• The AirEngine 6760R-51, AirEngine 8760R-X1, AP8030DN, AP8050DN, and AP8082DN have built-in 2.4 GHz or 5 GHz directional antennas. When the coverage angle is proper, APs with built-in antennas are recommended, which can reduce construction costs and meet aesthetic requirements. • The AirEngine 8760R-X1E, AirEngine 6760R-51E, AP8150DN, AP8130DN, and AP8182DN require external directional antennas and are applicable to more complex scenarios.	• Wi-Fi 6 AP: **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • Wi-Fi 5 AP: **27011668 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 & H360 V22 G7)** • Other types of directional antennas matching the AP (For details, see **Mapping Between APs and Antennas**.) Select directional antennas with proper radiation angles according to the coverage area, landscaping, obstacles, and AP installation height.

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WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model
Common road, pedestrian street, and rolling stock depot	• Wi-Fi 6 AP: AirEngine 6760R-51 AirEngine 6760R-51E AirEngine 8760R-X1 AirEngine 8760R-X1E • Wi-Fi 5 AP: AP8050DN AP8150DN AP8030DN AP8130DN AP8082DN AP8182DN	• The AirEngine 6760R-51, AirEngine 8760R-X1, AP8030DN, AP8050DN, and AP8082DN have built-in 2.4 GHz or 5 GHz directional antennas. When the coverage angle is proper, APs with built-in antennas are recommended, which can reduce construction costs and meet aesthetic requirements. • The AirEngine 8760R-X1E, AirEngine 6760R-51E, AP8150DN, AP8130DN, and AP8182DN require external directional antennas and are applicable to more complex scenarios.	• Wi-Fi 6 AP: **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** • Wi-Fi 5 AP: **27012134 Indoor and Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H33 V33 G13)** Use high-gain antennas with an angle of less than 60 degrees according to the road width.

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WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model
Stand in an outdoor stadium	• Wi-Fi 6 AP: AirEngine 6760R-51E AirEngine 8760R-X1E • Wi-Fi 5 AP: AP8050TN-HD AP8182DN AP8150DN AP8130DN	The AirEngine 6760R-51E, AirEngine 8760R-X1E, AP8150DN, AP8182DN, and AP8130DN support dual 5 GHz radios. **NOTE** The AP8050TN-HD is not recommended in countries that are subject to EU standards for the EIRP limits of 20 dBm on the 2.4 GHz frequency band and 23 dBm on the 5 GHz frequency band.	• AirEngine 6760R-51E and AirEngine 8760R-X1E: **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** • AP8182DN: **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** • AP8150DN and AP8130DN: – 2.4 GHz: **27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)** – 5 GHz: **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)**

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Table 3-4 Indoor coverage (2.4 GHz and 5 GHz)

WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model
Factory and warehouse	• Wi-Fi 6 AP: AirEngine 5761R-11E (outdoor), AirEngine 5561R-11E (outdoor), and AirEngine 6760-X1E (indoor) • Wi-Fi 5 AP: AP4151DN AP6150DN	The AirEngine 5761R-11E, AirEngine 5561R-11E, and AirEngine 6760-X1E are Wi-Fi 6 products, and the AP4151DN and AP6150DN are Wi-Fi 5 products. You are advised to select the product based on actual requirements. When an AirEngine 5761R-11E or AirEngine 5561R-11E works in dual-5G mode and connects to external antennas (part number: 27013720), connect the RF ports on its top and bottom both to two antennas.	• Wi-Fi 6 AP: **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • Wi-Fi 5 AP: **27011668 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 & H360 V22 G7)** Install the APs on the wall, with external directional antennas directing at the aisles. Alternatively, install APs with external omnidirectional antennas connected on the ceiling of aisles for coverage.
Elevator coverage	• Wi-Fi 5 AP: AP9131DN	The AP9131DN and AP9132DN support 3x3 MIMO and can connect to external directional antennas.	**27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)**

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WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model
Elevator backhaul	• Wi-Fi 6 AP: AirEngine 5761R-11E • Wi-Fi 5 AP: AP9131DN AP8150DN AP8130DN	The AirEngine 5761R-11E and AP9131DN are recommended above elevator cars. The AirEngine 5761R-11E, AP8150DN, and AP8130DN are recommended at the top of elevator shafts.	• AP9131DN: **27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)** • AP8130DN and AP8150DN: **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • AP8130DN and AP8150DN: **27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)** • AirEngine 5761R-11E and AirEngine 5561R-11E: **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)**
Stand in an indoor stadium	• Wi-Fi 6 AP: AirEngine 6760-X1E	The AirEngine 6760-X1E is a Wi-Fi 6 product. Select APs as required.	AirEngine 6760-X1E: **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)**

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Table 3-5 Rail transportation (2.4 GHz and 5 GHz)

WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model (Only for APs Using External Antennas)
Train-ground backhaul (5G)	Wi-Fi 6 AP: • Front and rear of a train: AirEngine 6761-51EI • Trackside: AirEngine 8760R-X1E, AirEngine 6760R-51E, AirEngine 5761R-11E, and AirEngine 5561R-11E Wi-Fi 5 AP: • Front and rear of a train: AP9131DN and AP9132DN • Trackside: AP8130DN	• The AirEngine 8760R-X1E, AirEngine 6760R-51E, AirEngine 5761R-11E, AirEngine 5561R-11E, and AP8130DN are applicable to rail transportation scenarios. They comply with railway specifications in terms of performance and environment adaptability, and have a high Ingress Protection (IP) rating. • The AirEngine 6761-51EI has four 2.4 GHz/5 GHz RF ports for train-to-ground backhaul. The AP9131DN has three 2.4G/5G radio interfaces for backhaul or coverage. The AP9132DN has three 2.4G/5G radio interfaces and three 2.4G radio interfaces, which can be simultaneously used for 5G backhaul and 2.4G coverage. The AirEngine 6761-51EI, AP9131DN, and	Wi-Fi 6 AP: • Front and rear of a train: **27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** • Trackside wall mounting: **27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** **27013921 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)** • Trackside pole mounting: **27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** **27013413 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)** Wi-Fi 5 AP: • Front and rear of a train: **27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)** • Trackside wall mounting: Yagi antenna **27012046 Rail Transportation 5 GHz Dual-Polarized**

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WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model (Only for APs Using External Antennas)
		AP9132DN are purpose-built for rail transportation scenarios and comply with anti-vibration requirements of related railway authorities.	**Directional Antenna (H30 V30 G14)** • Trackside pole mounting: **27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)**
Train compartment (2.4 GHz and 5 GHz)	Wi-Fi 5 AP: • AP9131DN • AP9132DN	The two types of APs are purpose-built for rail transportation scenarios and comply with anti-vibration requirements of related railway authorities. • The AP9131DN can transmit 2.4 GHz and 5 GHz signals simultaneously on a radio interface and uses both radios for compartment coverage. • The AP9132DN can transmit only 2.4 GHz or 5 GHz signals on a radio interface, and uses the 5 GHz radio for compartment bridging and 2.4 GHz radio for compartment coverage, or for dual-band compartment coverage.	• Bridging: **27012050 Vehicle-Mounted 5 GHz Dual-Polarized Directional Antenna (H70 V35 G9)** • Compartment coverage: **27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)** • Distributed coverage: **27012075 Vehicle-Mounted 2.4 GHz & 5 GHz Single-Polarized Directional Antenna (H80 V40 G4 & H80 V40 G6)**

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WLAN Networking Scenario	Recommended AP Model	AP Selection Policy	Recommended Antenna Model (Only for APs Using External Antennas)
Outdoor station platform (2.4 GHz and 5 GHz)	• Wi-Fi 6 AP: AirEngine 6760R-51 AirEngine 6760R-51E AirEngine 8760R-X1 AirEngine 8760R-X1E • Wi-Fi 5 AP: AP8050DN AP8150DN AP8030DN AP8130DN AP8082DN AP8182DN	• The AirEngine 6760R-51, AirEngine 8760R-X1, AP8030DN, AP8050DN, and AP8082DN have built-in 2.4 GHz or 5 GHz directional antennas. When the coverage angle is proper, APs with built-in antennas are recommended, which can reduce construction costs and meet aesthetic requirements. • The AirEngine 8760R-X1E, AirEngine 6760R-51E, AP8150DN, AP8130DN, and AP8182DN require external directional antennas and are applicable to more complex scenarios.	• Wi-Fi 6 AP: **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • Wi-Fi 5 AP: **27011668 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 & H360 V22 G7)** • Other types of directional antennas matching the AP (For details, see **Mapping Between APs and Antennas**.) Select directional antennas with proper radiation angles according to the coverage area, landscaping, obstacles, and AP installation height.

Mapping Between APs and Antennas

Table 3-6 lists mapping between APs and antennas involved in this manual.

Table 3-6 Mapping between APs and antennas

AP Model	Matching Antenna Model
AP6150DN	• **27012545 Indoor 2.4 GHz & 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 & H360 V110 G5)** • **27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)**

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AP Model	Matching Antenna Model
AP6310SN	• **27010209 Indoor 2.4 GHz Single-Polarized Directional Antenna (H88 V47 G7)** • **27010210 Indoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V45 G3)**
AP6510DN/ AP6610DN	• **27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)** • **27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)** • **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** • **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • **27010898 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G16.5)** • **27010902 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V6 G14.5)** • **27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)** • **27010912 Outdoor 5 GHz Single-Polarized Directional Antenna (H100 V5.5 G16)** • **27010913 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V11.5 G8)** • **27011016 Outdoor 5 GHz Dual-Polarized Directional Antenna (H9 V9 G23)** • **27011332 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V32 G3)** • **27011333 Outdoor 5 GHz Single-Polarized Omnidirectional Antenna (H360 V20 G5)** • **27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)**
AP7152DN	• **27012545 Indoor 2.4 GHz & 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 & H360 V110 G5)** • **27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)**

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AP Model	Matching Antenna Model
AP8130DN	• **27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)** • **27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)** • **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** • **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • **27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)** • **27011145 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • **27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27011668 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 & H360 V22 G7)** • **27012134 Indoor and Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H33 V33 G13)** • **27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)** • **27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)**
AP8130DN-W	• **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** • **27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)**

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AP Model	Matching Antenna Model
AP8150DN	• **27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)** • **27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)** • **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** • **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • **27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)** • **27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27011668 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 & H360 V22 G7)** • **27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)** • **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • **27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)**
AP8182DN	• **27011668 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 & H360 V22 G7)** • **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** • **27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 & H15 V15 G17)** • **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • **27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)** • **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** • **27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)** • **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)**

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AP Model	Matching Antenna Model
AP9130DN	• **27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)**
AP9131DN	• **27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)** • **27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27012075 Vehicle-Mounted 2.4 GHz & 5 GHz Single-Polarized Directional Antenna (H80 V40 G4 & H80 V40 G6)** • **27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)**

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AP Model	Matching Antenna Model
AP9132DN	• **27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)** • **27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)** • **27012050 Vehicle-Mounted 5 GHz Dual-Polarized Directional Antenna (H70 V35 G9)** • **27012075 Vehicle-Mounted 2.4 GHz & 5 GHz Single-Polarized Directional Antenna (H80 V40 G4 & H80 V40 G6)** • **27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)**
AP9330DN	**27011792 Indoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V55 G4 & H75 V50 G6)**

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AP Model	Matching Antenna Model
AirEngine 8760R-X1E	• **27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)** • **27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)** • **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** • **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** • **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • **27010664 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G18)** • **27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)** • **27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)** • **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** • **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** • **27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 & H15 V15 G17)** • **27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** • **27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)**

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AP Model	Matching Antenna Model
AirEngine 6760R-51E	• **27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)** • **27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)** • **27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)** • **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** • **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** • **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • **27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)** • **27010664 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G18)** • **27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** • **27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** • **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** • **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** • **27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 & H15 V15 G17)** • **27013413 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)** • **27013921 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)**
AirEngine 5761-11EI	• **27014279 Mining 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H30 V30 G11&H15 V15 G15)**

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AP Model	Matching Antenna Model
AirEngine 5761R-11E and AirEngine 5561R-11E	• **27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)** • **27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)** • **27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)** • **27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)** • **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** • **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** • **27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)** • **27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)** • **27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)** • **27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)** • **27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)** • **27013413 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)** • **27013921 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)** • **27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** • **27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)** • **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)**
AirEngine 6760-51EI	• **27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)**

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AP Model	Matching Antenna Model
AirEngine 6760-X1E	• **27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)** • **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** • **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** • **27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)** • **27012545 Indoor 2.4 GHz & 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 & H360 V110 G5)** • **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** **NOTE** When antennas with Type N connectors 27013718, 27013719, 27013720, or 27012565 are used, you need to purchase feeders separately to implement interface conversion. The following types of feeders are available: • RF cable parts - 0.5 m (part number: 04133329) • RF cable parts - 1 m (part number: 04133329-001) • RF cable parts - 3 m (part number: 04133329-002) • RF cable parts - 5 m (part number: 04133329-003)
AirEngine 6761-21E	• **27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)** • **27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)** • **27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)** • **27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)** • **27012545 Indoor 2.4 GHz & 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 & H360 V110 G5)** • **27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 & H26 V26 G11)** **NOTE** When antennas with Type N connectors 27013718, 27013719, 27013720, or 27012565 are used, you need to purchase feeders separately to implement interface conversion. The following types of feeders are available: • RF cable parts - 0.5 m (part number: 04133329) • RF cable parts - 1 m (part number: 04133329-001) • RF cable parts - 3 m (part number: 04133329-002) • RF cable parts - 5 m (part number: 04133329-003)

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AP Model	Matching Antenna Model
AirEngine 5760-11DH	**27014400 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V110 G4 & H360 V110 G5)**

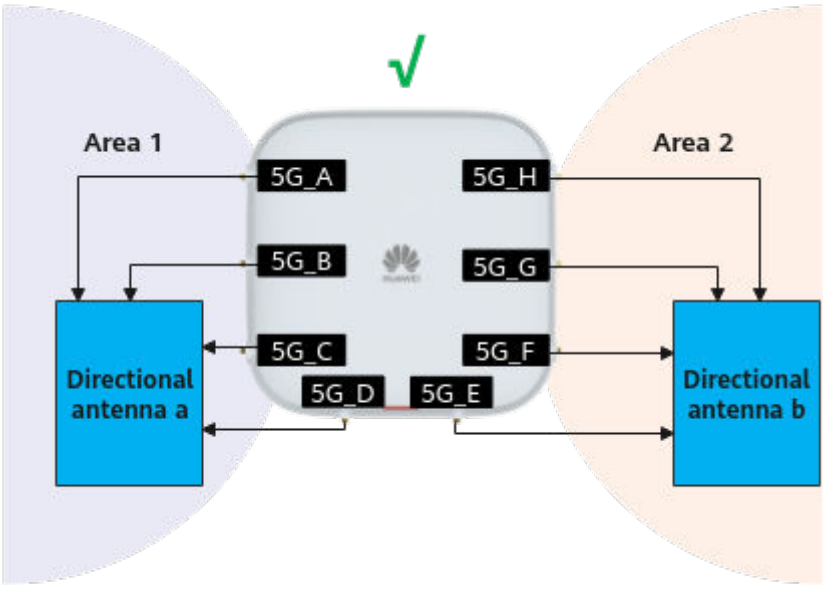
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CAUTION

- The regulatory requirements for the strength of radio signals vary in different countries and regions. Therefore, when APs and external antennas are used together, run the **antenna-gain** command to set the antenna gain based on the actual antenna specifications. Then the device software controls the transmit power based on the configured antenna gain within the range allowed by the country code.
- If directional antennas are connected to an AirEngine X760 series AP requiring external antennas, ensure that the number of antennas used to cover the same area is not less than half of the total number of antennas on a single radio of the AP. Otherwise, issues such as a long service delay will occur. For example, to use 5 GHz directional antennas on an AirEngine 6760-X1E in 4+8 radio mode to cover multiple areas, ensure that at least four 5 GHz antennas are used to cover the same area.

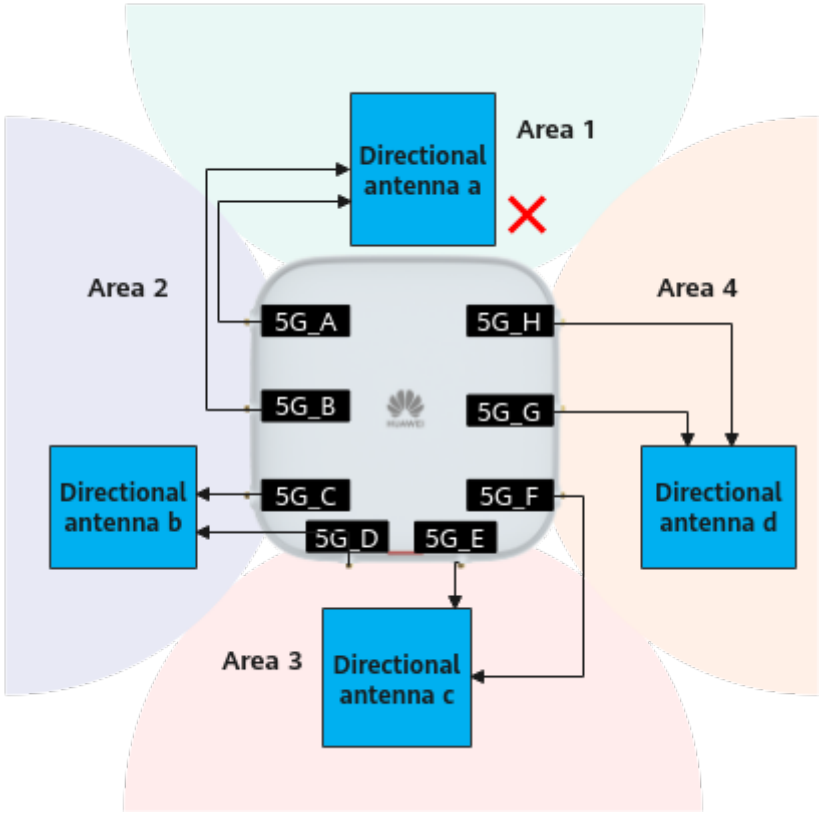
  The following figures show the correct and incorrect connections between antennas and RF ports (eight 5 GHz antennas as an example). In the correct example, every four RF ports are connected to a directional antenna through feeders, and the antennas are used to cover two areas. In the incorrect example, every two RF ports are connected to a directional antenna through feeders, and the antennas are used to cover four areas.

Figure 3-1 Correct example



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Figure 3-2 Incorrect example



- Strictly follow the preceding mapping rules to select antennas. Otherwise, service functions may be affected.

4 Safety Precautions

About This Chapter

4.1 General Safety Precautions

4.2 Electrical Safety Precautions

4.3 Working at Heights

4.1 General Safety Precautions

This section describes safety precautions that instruct you to select measuring and testing instruments when you install, operate, and maintain Huawei equipment.

All Safety Precautions

To ensure human safety and equipment safety, comply with all the safety precautions marked on the equipment and instructed in this document.

WARNING, CAUTION, and DANGER items in this document do not cover all the safety cautions and are only supplementary to the safety cautions.

Local Laws and Regulations

When operating a device, abide by local laws and regulations. The safety precautions instructed in the document are supplementary to the local laws and regulations.

Basic Installation Requirements

Only trained and qualified personnel are allowed to install or maintain Huawei equipment. Familiarize yourself with all safety precautions before performing any operation on the equipment.

- Only the trained and qualified personnel are permitted to install, operate, and maintain Huawei equipment.

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- Only the qualified personnel are permitted to dismantle safety appliances and repair Huawei equipment.
- Only the personnel certified or authorized by Huawei are permitted to replace or change Huawei equipment or parts of Huawei equipment (including software).
- The operating personnel must immediately report the faults or errors that may cause safety problems to the person in charge.

Grounding Requirements

Equipment that needs to be grounded must meet the following requirements:

- When installing the equipment, ground the equipment before any operations and remove the ground cable only after you remove all the other components and cables from the equipment.
- Ensure that the ground conductor is intact.
- Do not operate the equipment in the absence of a suitably installed ground conductor.
- The equipment must be connected to the PGND permanently. Before operating the equipment, check the electrical connections of the equipment and ensure that the equipment is properly grounded.

Personal Safety

- Do not operate the equipment and cables in a thunderstorm.
- To avoid electric shocks, do not connect safety extra-low voltage (SELV) circuits to telecommunication network voltage (TNV) circuits.
- Invisible laser beams will cause eye damage. Do not look into bores of optical modules or connectors of optical fibers without eye protection.
- Before performing any operation on the equipment, wear ESD clothing and ESD gloves or an ESD wrist strap. Remove conductive objects like jewelry and watches to avoid electric shock or burn.
- In case of fire, immediately leave the building or equipment deployment site and press the fire alarm button or call the fire department. Never enter the building on fire again in any situation.

Equipment Safety

- Before any operation, install the equipment firmly on the ground or other rigid objects, such as on a wall or in a rack.
- When the system is working, ensure that the ventilation hole is not blocked.
- When installing panels, use necessary tools to fasten the screws.
- After equipment installation is complete, clean up the packing materials.

4.2 Electrical Safety Precautions

This section describes safety precautions for high voltage, thunderstorms, high leakage current, power cables, and fuses.

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High Voltage

DANGER

- Direct contact with a high-voltage power source or indirect contact through damp objects can be fatal.
- Misoperations on high-voltage facilities may result in fire, electric shock, or other accidents.

High Leakage Current

CAUTION

To protect personal and equipment safety, ground the equipment before powering it on.

If a high leakage current mark is labeled near the power connector of the equipment, you must connect the PGND terminal on the shell to the ground before connecting the equipment to an AC input power supply. This is to prevent the electric shock caused by leakage current of the equipment.

Power Cable

DANGER

Never install or remove the equipment or power cables while the power is on. The electric arc or spark generated between a power cable and conductor may cause fire or eye damage.

- Before installing or removing power cables, you must power off the equipment.
- Before connecting a power cable, verify that the label on the power cable is correct.

Fuses

CAUTION

If the fuse on the equipment is blown, replace the fuse with a fuse of the same type and specifications to ensure safe operation of the equipment.

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4.3 Working at Heights

This section describes safety precautions you need to take when working at heights.

CAUTION

When working at heights, prevent objects from falling down.

The requirements for working at heights are as follows:

- The personnel who work at heights must be trained.
- Carry and handle the operating machines and tools with caution to prevent them from falling down.

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5 27010209 Indoor 2.4 GHz Single-Polarized Directional Antenna (H88 V47 G7)

About This Chapter

5.1 27010209 Technical Specifications

5.2 27010209 Antenna Installation

5.1 27010209 Technical Specifications

Appearance and Structure

Figure 5-1 Appearance of the 27010209 Indoor 2.4 GHz Single-Polarized Directional Antenna (H88 V47 G7)



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Technical Specifications

Table 5-1 Technical specifications of the 27010209 Indoor 2.4 GHz Single-Polarized Directional Antenna (H88 V47 G7)

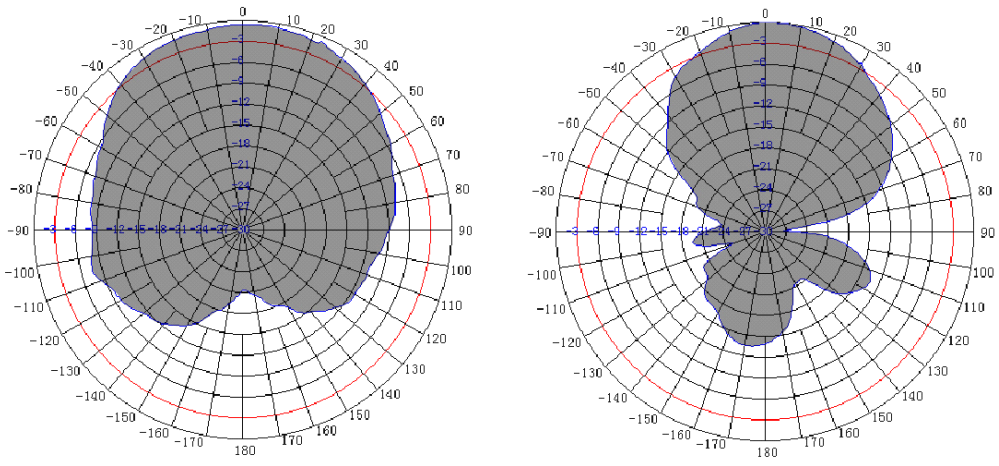
Item	Details
Part Number	27010209
Model	TDJ-SA800/2500-7-90
Description	824~960MHz/1710~2500MHz,7dBi, 90deg,Vertical Polarization,50W,0r,N/female,with support
Frequency [MHz]	824 to 960 1710 to 2500
Antenna gain [dBi]	7 dBi
Coverage distance [m(ft.)]	90 m(ft.)
Horizontal beamwidth [degrees]	88 degrees
Vertical beamwidth [degrees]	47 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Vertical polarization
Attenna connector	N-female
Attenna dimensions [mm(in.)]	H x W x D: 44 x 210 x 180
Weight without packaging [kg(lb)]	0.43 kg(lb)
Installation type	Wall
Grounding requirements	Same as the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 5-2 Antenna Pattern1 of the 27010209 Indoor 2.4 GHz Single-Polarized Directional Antenna (H88 V47 G7)



Horizontal Pattern

Vertical Pattern

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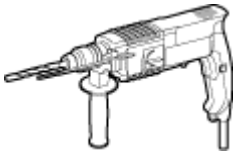
5.2 27010209 Antenna Installation

The 27010209 antenna is an indoor directional antenna. It forms a major lobe in a certain direction with high gains, while other directions have low gains. It applies to scenarios that require small coverage angles but long coverage distances. Typical scenarios include corridors in hospitals or airports.

5.2.1 Accessories and Tools

Tools:

- Hammer drill (ϕ6 mm, for wall mounting)



- Rubber mallet (for wall mounting)



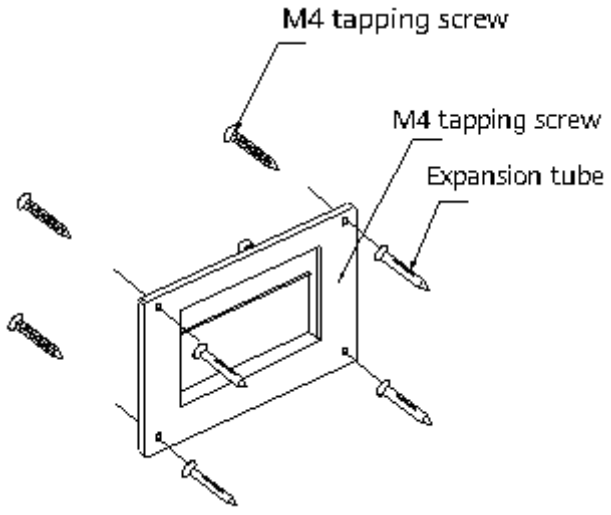
Other accessories:

- Mounting bracket: 1 set
- M4 expansion bolt: 4 sets

5.2.2 Wall Mounting

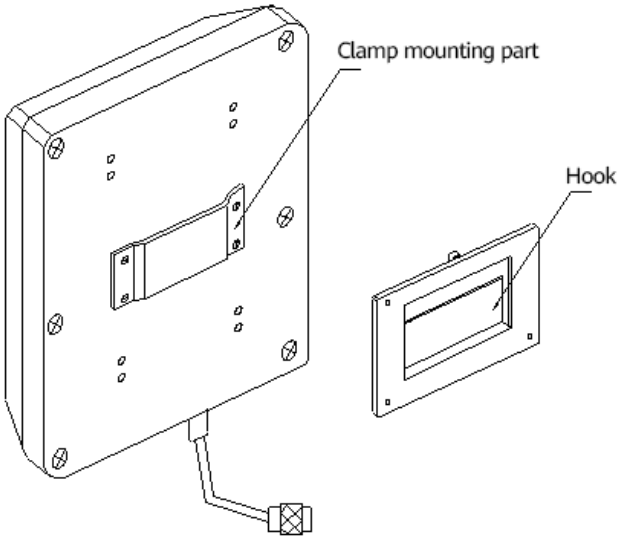
The 27010209 antenna can be mounted on a wall.

1. Drill four ϕ6 mm holes (35 mm deep) on the wall to install plastic expansion tubes that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna mounting bracket.



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2. Fix the antenna support to the wall using expansion bolts.
3. Insert the clamp mounting part on the bottom plate of the antenna to the hook on the mounting bracket.



5.2.3 Connecting RF Cables

RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

Connect the RF cables directly to the antenna interfaces.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

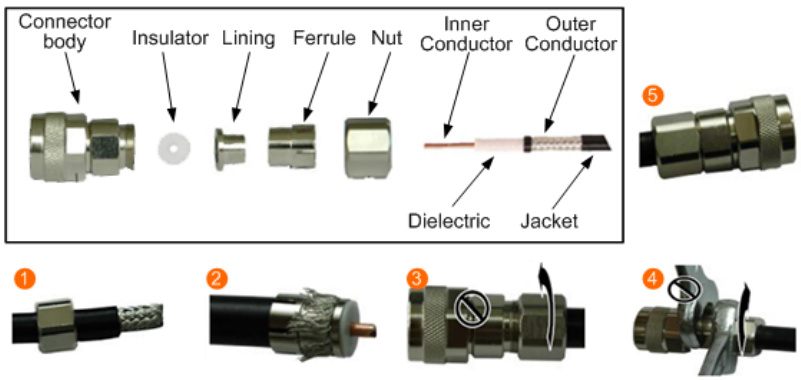
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Table 5-2 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

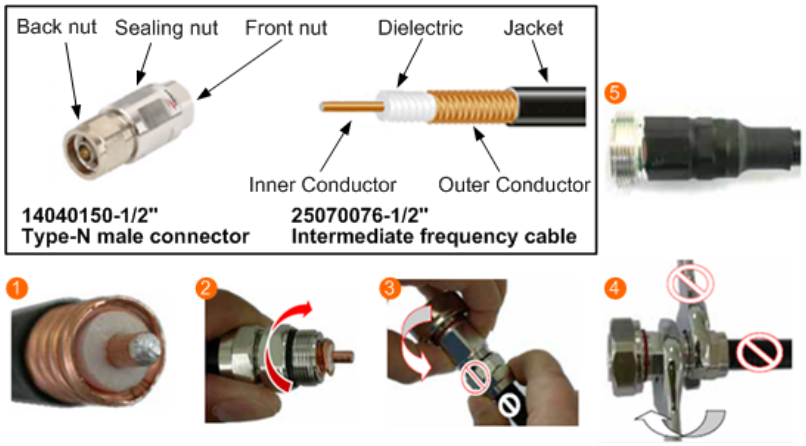
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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6 27010210 Indoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V45 G3)

About This Chapter

6.1 27010210 Technical Specifications

6.2 27010210 Antenna Installation

6.1 27010210 Technical Specifications

Appearance and Structure

Figure 6-1 Appearance of the 27010210 Indoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V45 G3)



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Technical Specifications

Table 6-1 Technical specifications of the 27010210 Indoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V45 G3)

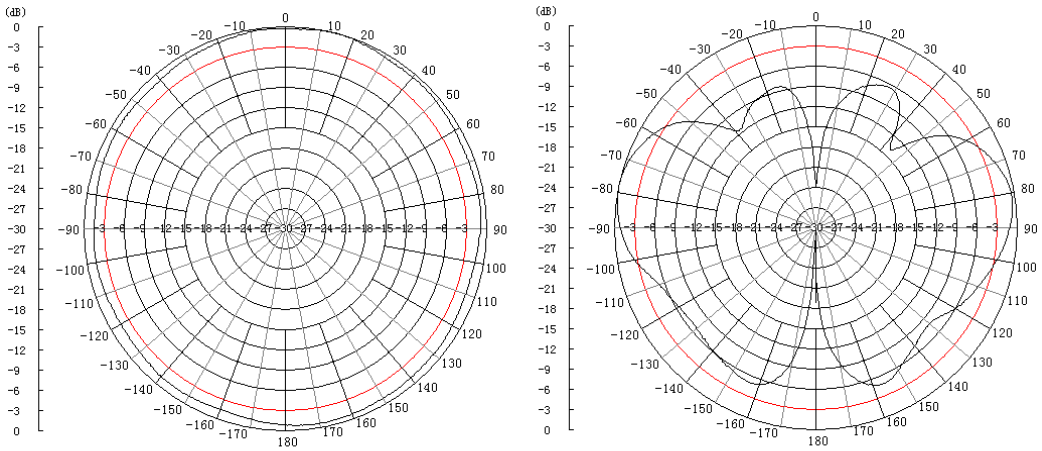
Item	Details
Part Number	27010210
Model	TQJ-SA800/2500-3
Description	Omnidirectional Antenna, 824~960/1710~2500MHz,3dBi,Vertical Polarization,360DEG,50W,0r,N(F),Yes
Frequency [MHz]	824 to 960 1710 to 2500
Antenna gain [dBi]	3 dBi
Coverage distance [m(ft.)]	60 m(ft.)
Horizontal beamwidth [degrees]	360 degrees
Vertical beamwidth [degrees]	45 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Vertical polarization
Attenna connector	N-female
Attenna dimensions [mm(in.)]	ϕ186 x 85
Weight without packaging [kg(lb)]	0.275 kg(lb)
Installation type	Celling
Grounding requirements	Same as the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 6-2 Antenna Pattern1 of the 27010210 Indoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V45 G3)



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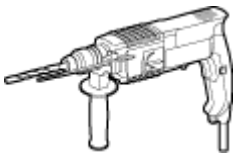
6.2 27010210 Antenna Installation

The 27010210 antenna is an indoor omnidirectional antenna. The antenna is best applied to indoor omnidirectional coverage scenarios, such as open office areas, meeting rooms, and lecture halls.

6.2.1 Accessories and Tools

Tools:

- Open-end wrench
- Hammer drill (used to drill holes in ceilings)



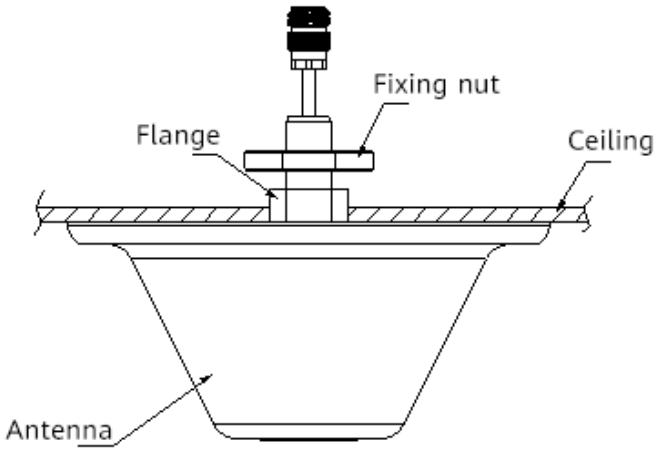
Other accessories:

- Nut: 1 PCS

6.2.2 Ceiling Mounting

The 27010210 antenna can be mounted on a ceiling.

1. Drill one ϕ33 mm - ϕ35 mm hole into the ceiling.
2. Insert the antenna into the hole and secure it using the nut.



NOTE

- The size of the hole in the ceiling must be slightly greater than that of the flange on the antenna connector and the bottom plate of the antenna must be flattened against the ceiling. Otherwise, electrical performance of the antenna will be affected.
- To achieve the optimal coverage effect, it is recommended that you install the omnidirectional antenna six to eight meters above ground.

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6.2.3 Connecting RF Cables

RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

Connect the RF cables directly to the antenna interfaces.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

Table 6-2 Coaxial cables and connectors

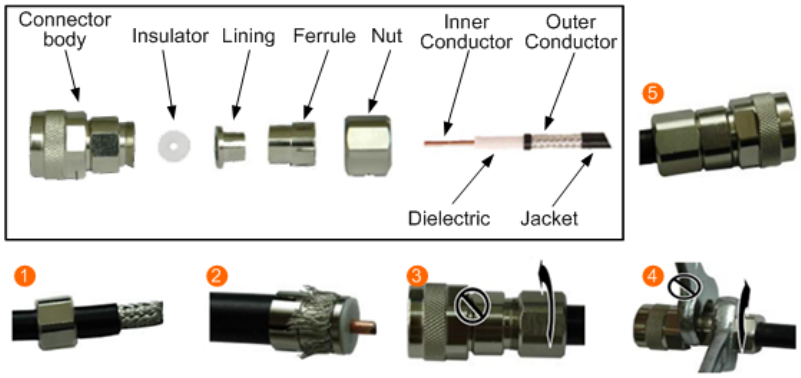
Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	

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Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

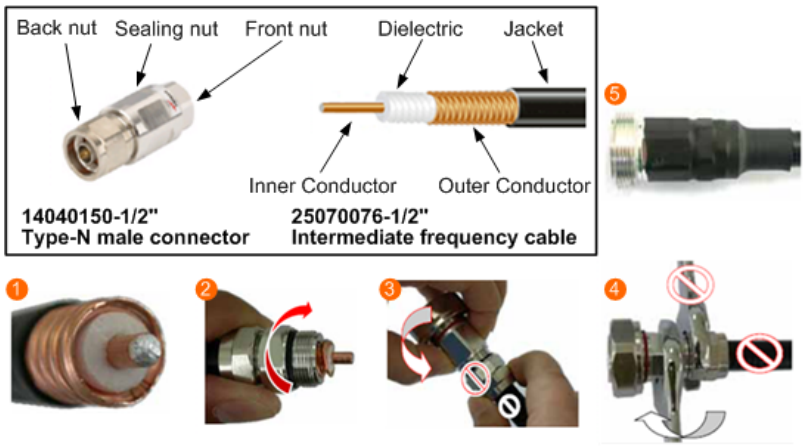
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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7 27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)

About This Chapter

7.1 27010215 Technical Specifications

7.2 27010215 Installation Precautions

7.3 27010215 Antenna Installation

7.1 27010215 Technical Specifications

Appearance and Structure

Figure 7-1 Appearance of the 27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)



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Technical Specifications

Table 7-1 Technical specifications of the 27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)

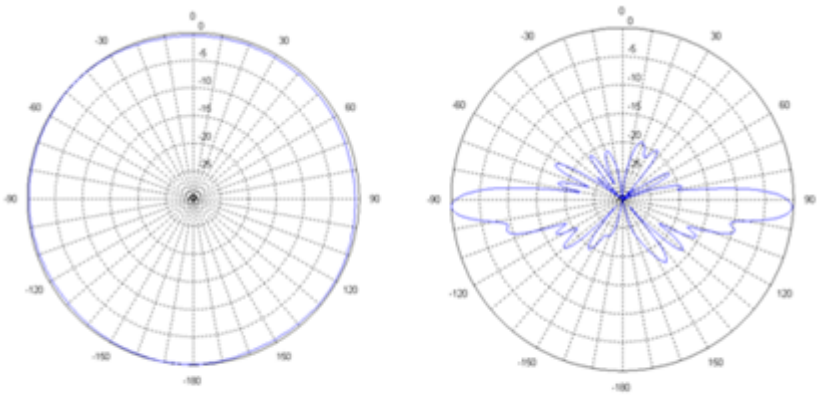
Item	Details
Part Number	27010215
Model	TQJ-2400-11-T2
Description	Omni-directional Antenna, 2400~2500MHz,11dBi,360deg/9deg,N/Female,1port,with mounting parts,pole mounting
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	11 dBi
Coverage distance [m(ft.)]	130 m(ft.)
Horizontal beamwidth [degrees]	360 degrees
Vertical beamwidth [degrees]	9 degrees
Standing wave ratio (SWR)	≤ 1.4
Polarization	Vertical polarization
Attenna connector	N-female
Attenna dimensions [mm(in.)]	Length < 1100
Weight without packaging [kg(lb)]	0.976 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ35 to ϕ50

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 7-2 Antenna Pattern1 of the 27010215 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V9 G11)



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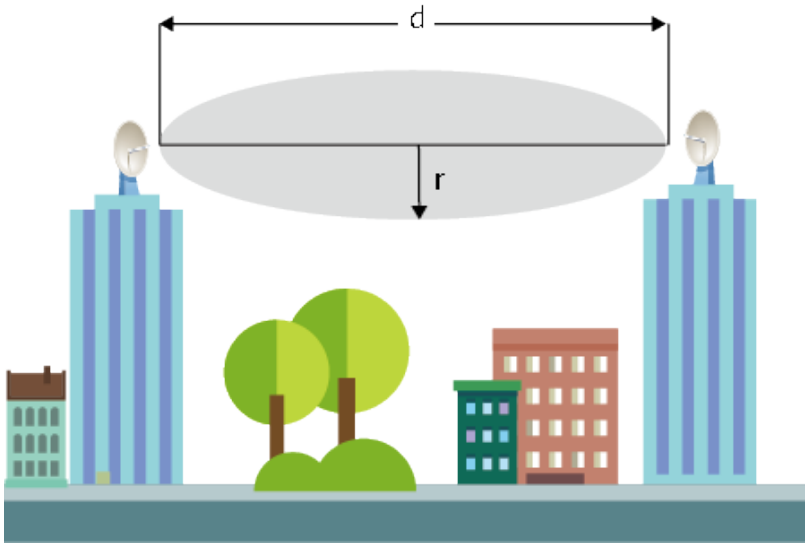
7.2 27010215 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 7-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

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- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 7-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 7-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

7.3 27010215 Antenna Installation

The 27010215 antenna is an outdoor omnidirectional antenna. It is connected to an AP using a power cable and mounted on a pole. The antenna is best applied to outdoor omnidirectional coverage scenarios, such as squares and parks.

7.3.1 Accessories and Tools

Tools:

- 1 x 16 mm combination wrench

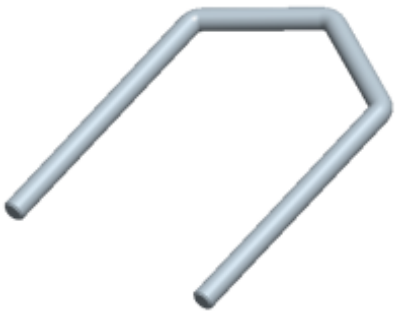


Pole

- 1 x pole with a diameter of ϕ35 mm to ϕ50 mm

Antenna support assembly:

- U-type bolt: 1 PCS



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- M10 nut, M10 spring washer, and M10 flat washer: 2 sets



7.3.2 Pole Mounting

The 27010215 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

NOTICE

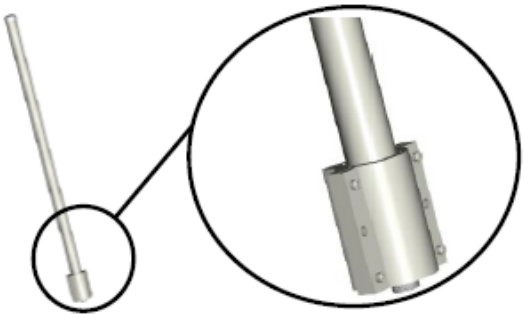
To prevent water in the antenna from degrading the signal quality, keep the antenna vertical and do not allow the condensation drain hole to clog.

Fixing the Antenna to the Pole

Carry out the following steps:

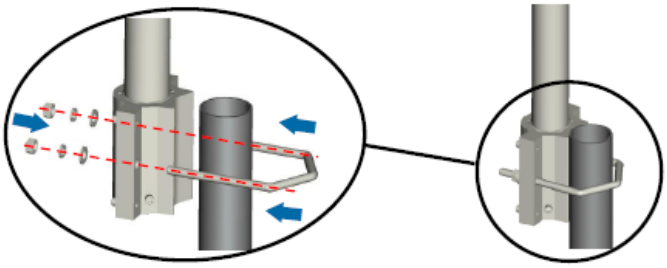
1. Thread the U-type bolt through the bolt holes at the bottom of the antenna and fix the nuts, spring washers, and flat washers on both ends of the U-type bolt (not tightly), as shown in **Figure 7-4** and **Figure 7-5**.

Figure 7-4 Bolt holes at the bottom of the antenna



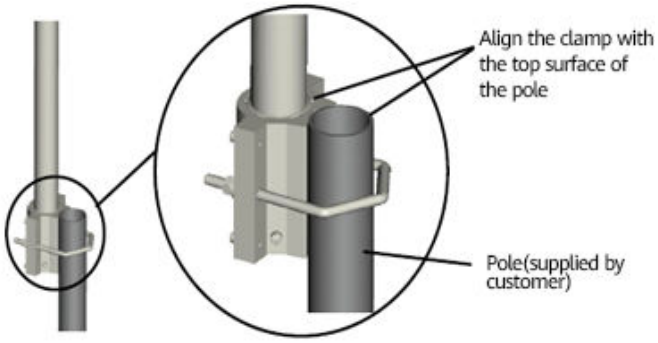
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Figure 7-5 Fixing the antenna to the pole



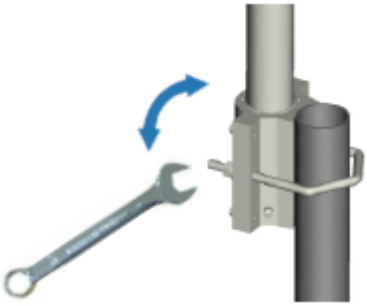
2. Align the clamp with the top surface of the pole, as shown in **Figure 7-6**.

Figure 7-6 Aligning the top surface of the pole



3. Fasten all nuts, as shown in **Figure 7-7**. The recommended torque is 40 N·m for M10 nuts.

Figure 7-7 Fastening nuts



Precautions

Take note of the following points when installing an outdoor omnidirectional antenna:

1. After the installation is complete, the antenna must be high enough to satisfy signal coverage demands, and the top of the antenna must not exceed the 45-degree protection range of the lightning rod.
2. Do not weld a lightning rod directly to the omnidirectional antenna pole, as there should be no metal objects within 1 m of an omnidirectional antenna.

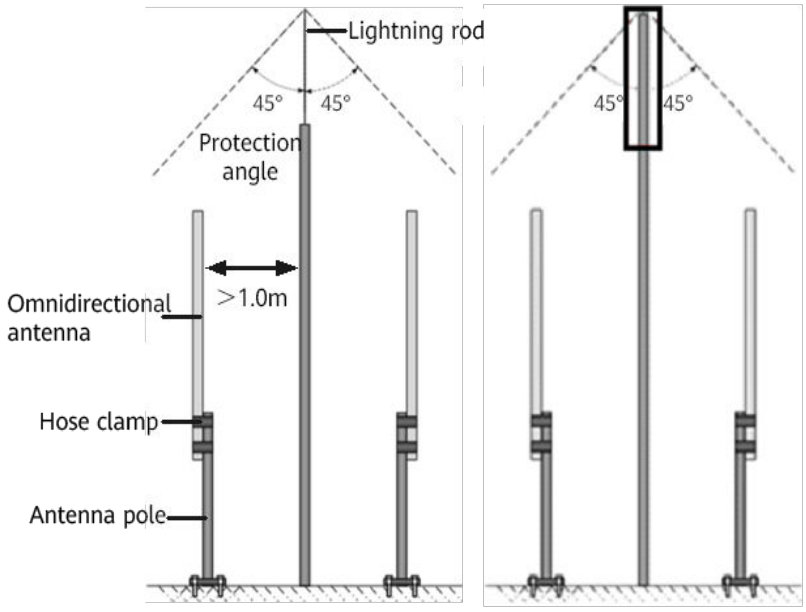
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Instead, install an independent lightning rod between two omnidirectional antenna poles. Adjust the height of the lightning rod to ensure that the antennas are covered in the protection angle.

3. It is recommended that the distance between two omnidirectional antennas be at least 0.5 m.

Figure 7-8 shows installation of an outdoor omnidirectional antenna.

Figure 7-8 Installing an outdoor omnidirectional antenna



NOTE

If antennas are installed on a pole made of metal, such as steel, you do not need to install a lightning rod, as shown on the right in **Figure 7-8**.

7.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface.

RF Cable Deployment Requirements

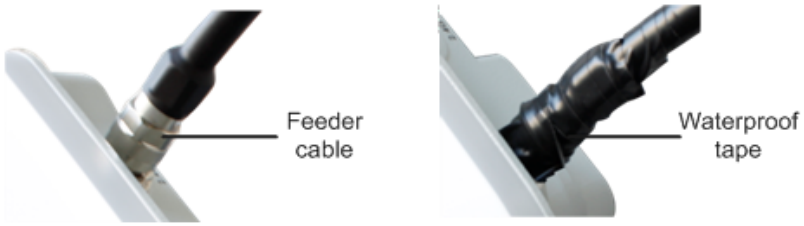
- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.

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- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

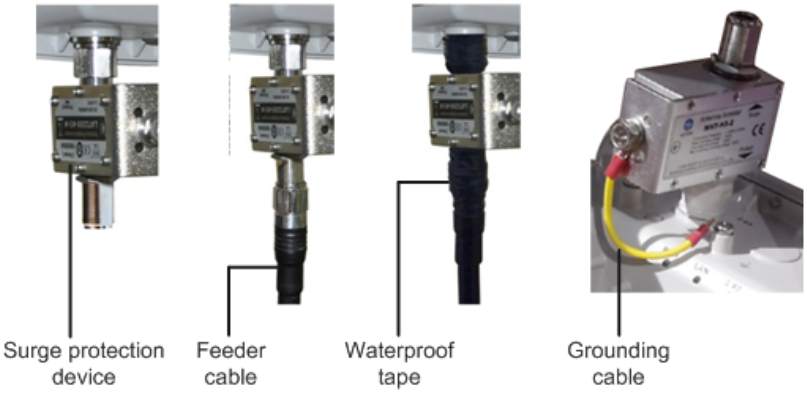
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

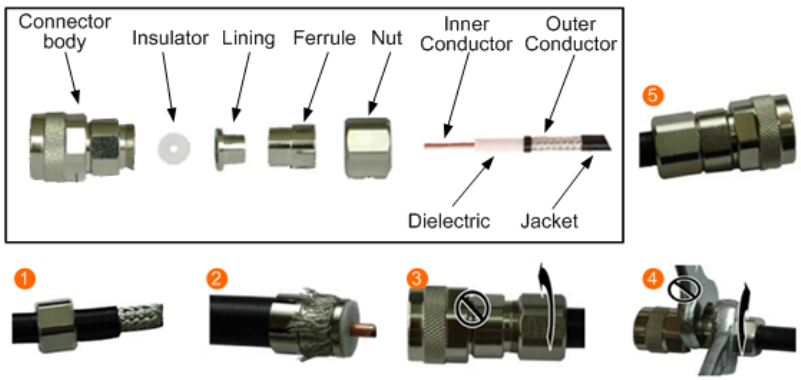
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Table 7-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

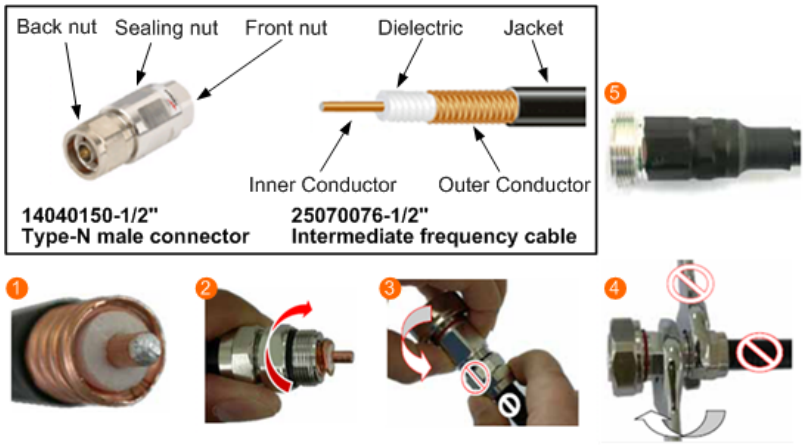
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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8 27010219 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V7 G15.5)

About This Chapter

8.1 27010219 Technical Specifications
8.2 27010219 Installation Precautions
8.3 27010219 Antenna Installation

8.1 27010219 Technical Specifications

Appearance and Structure

Figure 8-1 Appearance of the 27010219 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V7 G15.5)



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Technical Specifications

Table 8-1 Technical specifications of the 27010219 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V7 G15.5)

Item	Details
Part Number	27010219
Model	TDJ-SA2400-16-120
Description	Directional Antenna,2400~2500MHz, 15.5dBi,120deg/7deg,N/Female, 1port,with mounting parts,pole mounting
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	15.5 dBi
Coverage distance [m(ft.)]	200 m(ft.)
Horizontal beamwidth [degrees]	120 degrees
Vertical beamwidth [degrees]	7 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Vertical polarization
Attenna connector	N-female
Attenna dimensions [mm(in.)]	H x W x D: 58 x 970 x 140
Weight without packaging [kg(lb)]	4.5 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ45.5 to ϕ75

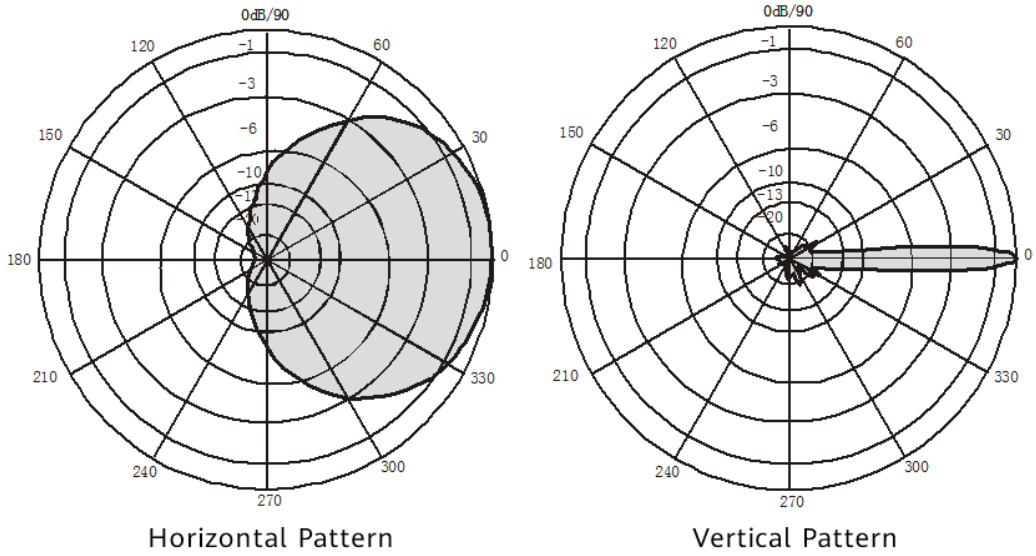
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 8-2 Antenna Pattern1 of the 27010219 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V7 G15.5)



8.2 27010219 Installation Precautions

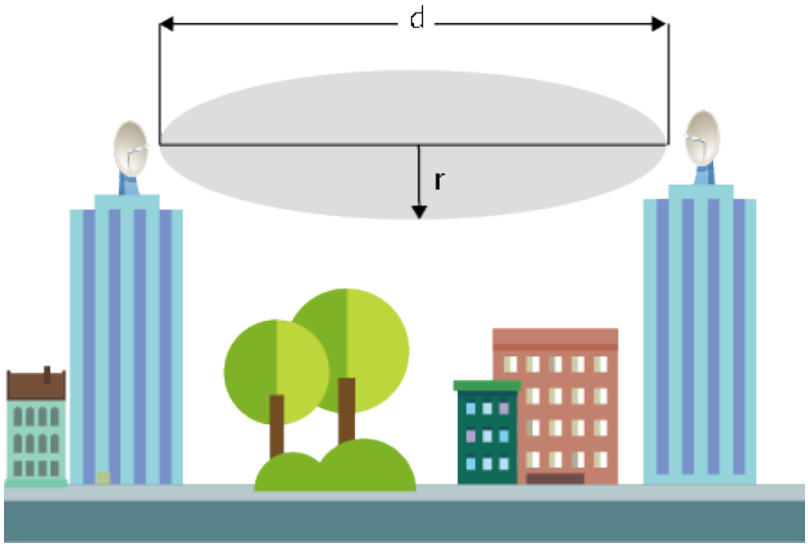
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 8-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 8-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 8-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

8.3 27010219 Antenna Installation

The 27010219 antenna is an outdoor 2.4 GHz directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

8.3.1 Accessories and Tools

Tools:

- 2 x 13 mm open-end wrench

Pole

- 1 x pole with a diameter of ϕ46 mm to ϕ75 mm

Other accessories:

- Connection arm: 1 PCS
- Toothed clamp: 2 PCS
- M8x120 bolt, flat washer, and nut: 4 sets
- M6x16 bolt, flat washer, spring washer and nut: 8 sets

8.3.2 Pole Mounting

The 27010219 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

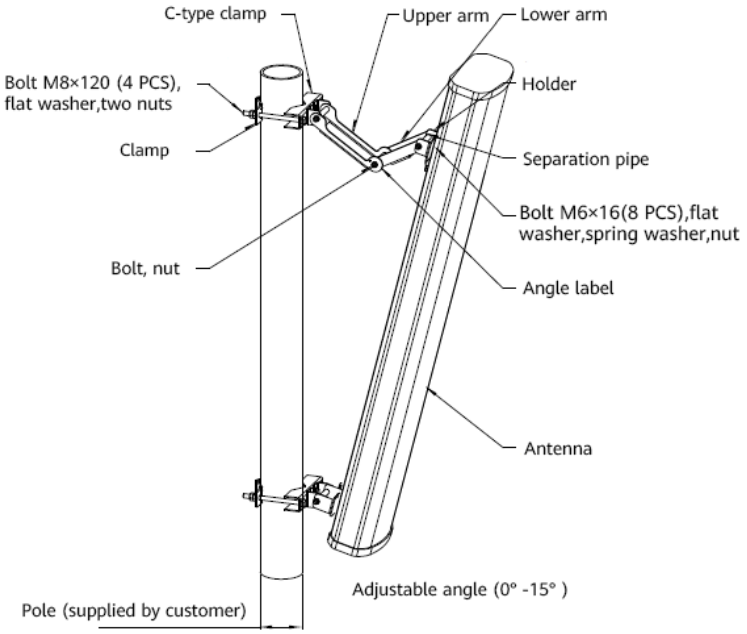
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

Installation of the antenna

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Carry out the following steps:

1. Loosen the nut between the upper and lower arms.
2. Secure the toothed clamps at the top mounting assembly to the pole.
   a. Remove the bolts, nuts, spring washers, and flat washers from the toothed clamps.
   b. Place the toothed clamp connected to the antenna against the pole, thread the bolts through the toothed clamp, put the other toothed clamp on the bolts, and put back the flat washers, spring washers and nuts.
   c. Tighten the nuts to secure the toothed clamps (not tightly).
3. Repeat step 2 to secure the toothed clamps at the bottom mounting assembly to the pole.
4. Adjust the antenna until it is perfectly vertical (the adjustable angle is 0 degrees), adjust the toothed clamps, and then secure all the toothed clamps to the pole. Set the desired antenna tilt angle and then tighten all nuts on the top and bottom assemblies with a tightening torque of 18 N m.
5. Remove the protective cap from the antenna connector, connect the feeder cable to the connector, and tighten the connector. Thoroughly wrap the cable connector with waterproof tape. For details, see the section **Connecting RF Cables**.

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.

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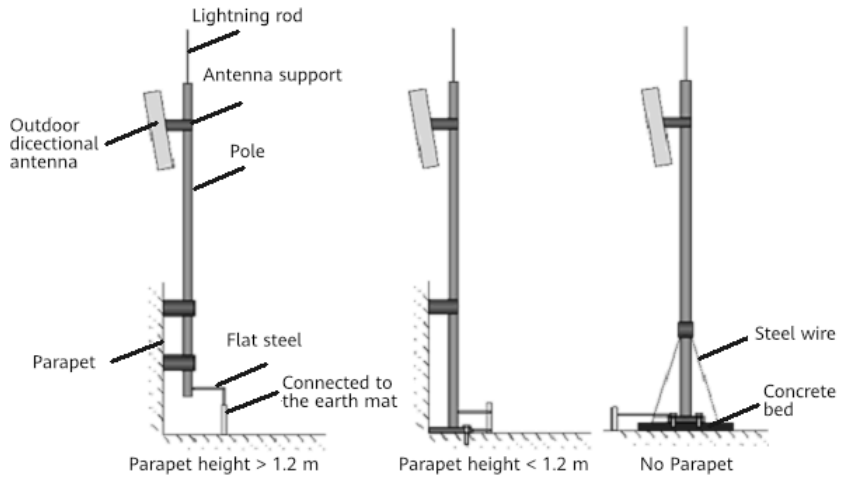
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

Take note of the following points when installing an outdoor directional antenna:

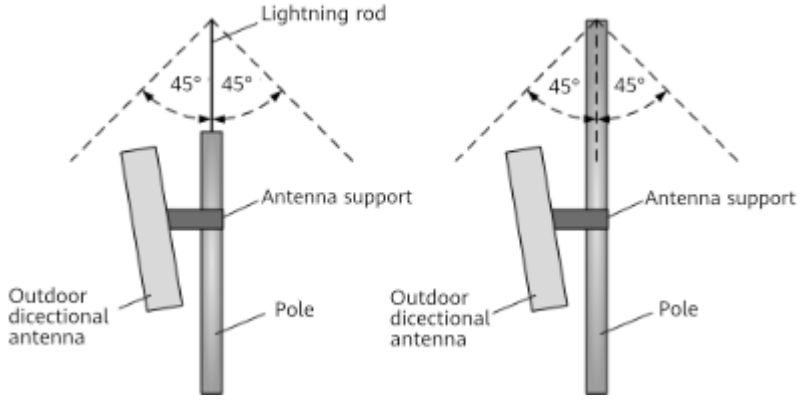
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 8-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 8-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



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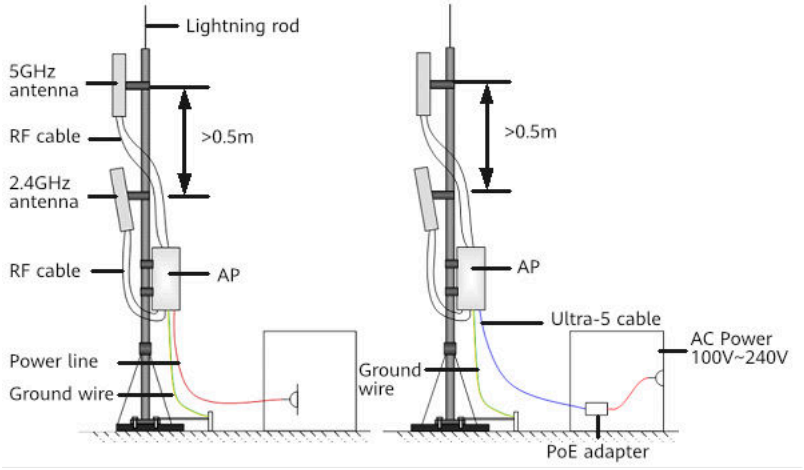
NOTE

If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

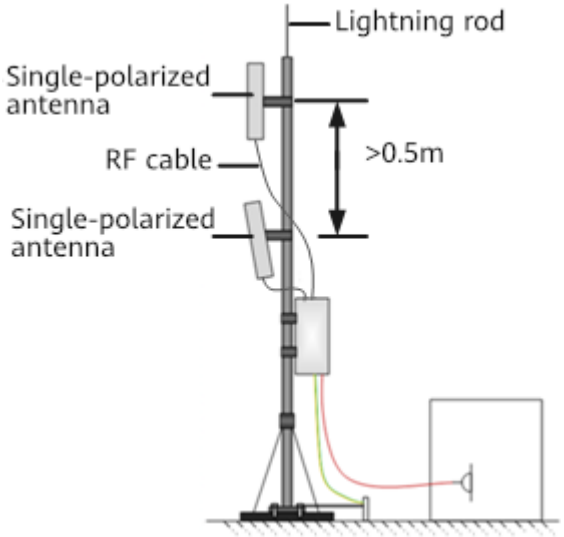
Figure 8-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 8-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in Figure 8-6.

Figure 8-6 Installation of single-polarized antennas



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8.3.3 Connecting RF Cables

RF Cable Connection Requirements

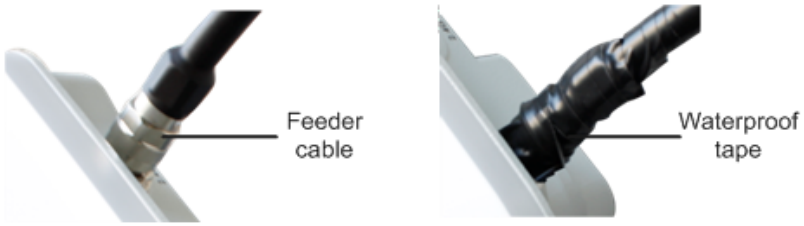
Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface.

RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

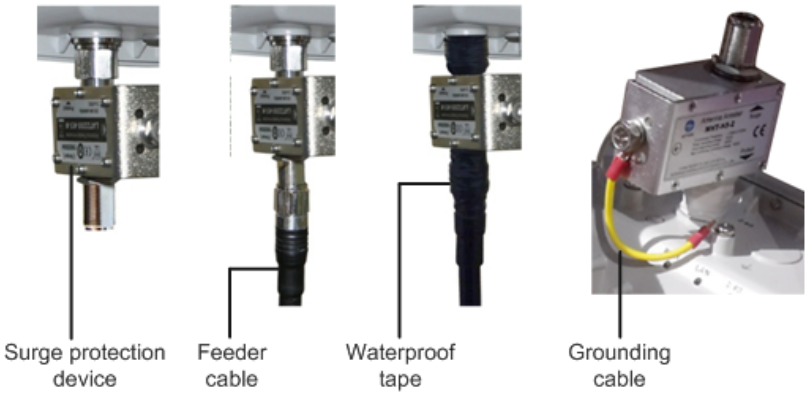


NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.

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Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

Table 8-3 Coaxial cables and connectors

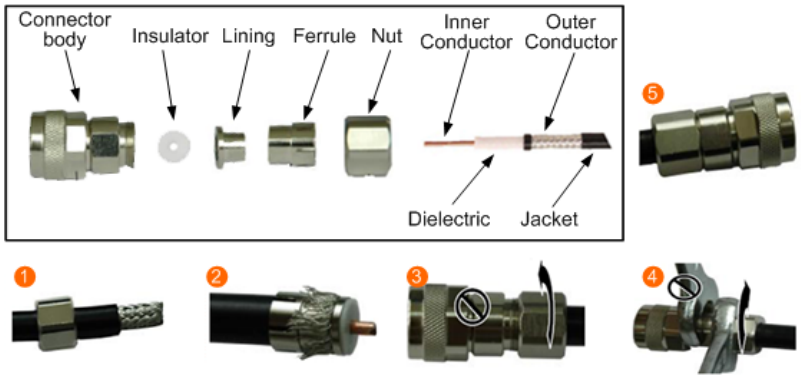
Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.

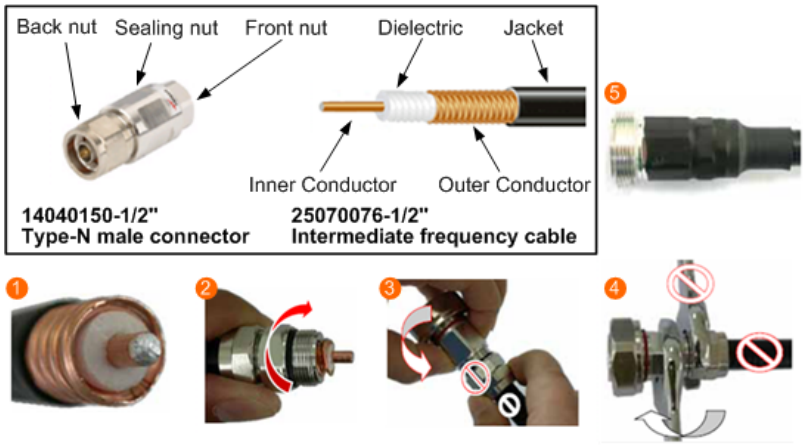
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3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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9 27010223 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H90 V7 G17)

About This Chapter

9.1 27010223 Technical Specifications
9.2 27010223 Installation Precautions
9.3 27010223 Antenna Installation

9.1 27010223 Technical Specifications

Appearance and Structure

Figure 9-1 Appearance of the 27010223 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H90 V7 G17)



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Technical Specifications

Table 9-1 Technical specifications of the 27010223 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H90 V7 G17)

Item	Details
Part Number	27010223
Model	TDJ-SA2400-17-90
Description	Directional Antenna,2400~2500MHz, 17dBi,90deg/7deg,N/Female,1port,with mounting parts,pole mounting
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	17 dBi
Coverage distance [m(ft.)]	230 m(ft.)
Horizontal beamwidth [degrees]	90 degrees
Vertical beamwidth [degrees]	7 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Vertical polarization
Attenna connector	N-female
Attenna dimensions [mm(in.)]	H x W x D: 58 x 970 x 140
Weight without packaging [kg(lb)]	5 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ50 to ϕ115

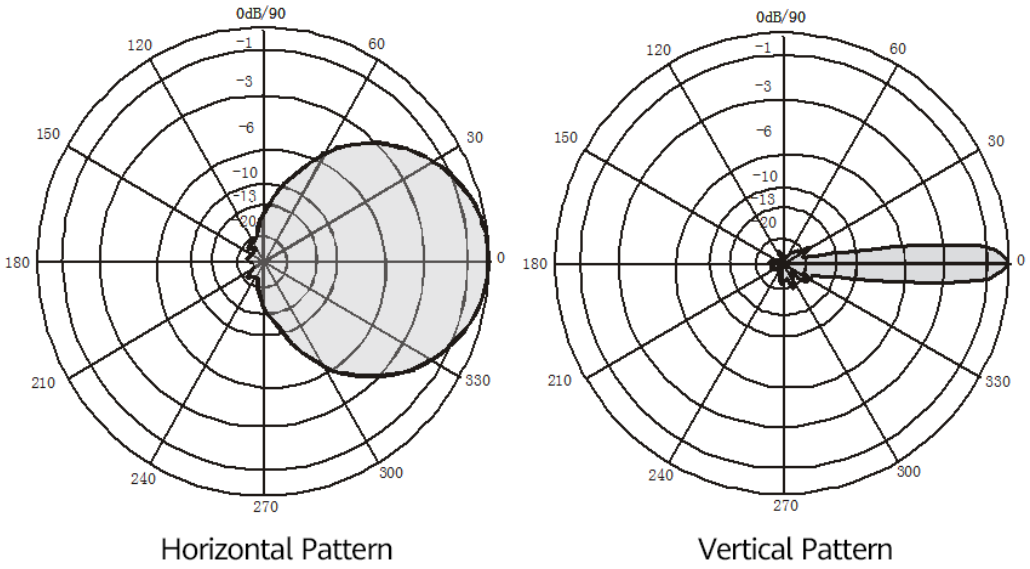
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 9-2 Antenna Pattern1 of the 27010223 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H90 V7 G17)



9.2 27010223 Installation Precautions

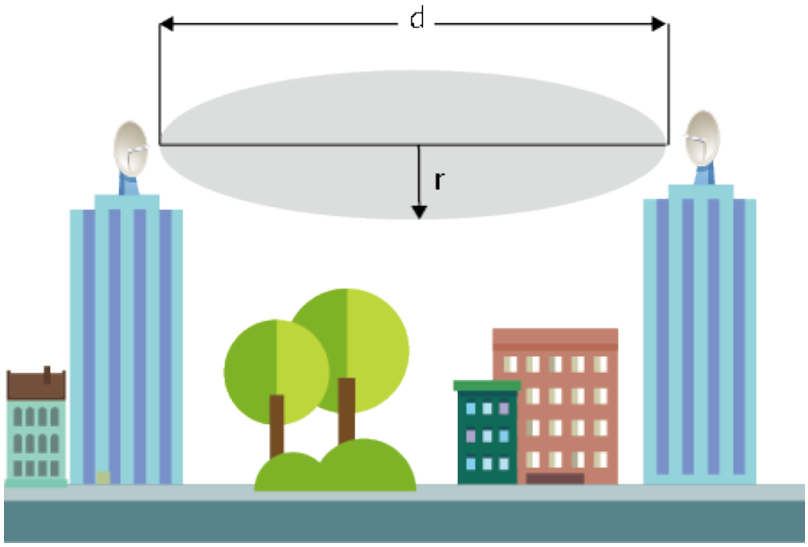
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 9-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 9-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 9-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

9.3 27010223 Antenna Installation

The 27010223 antenna is an outdoor 2.4 GHz directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

9.3.1 Accessories and Tools

Tools:

- 2 x 13 mm open-end wrench

Pole

- 1 x pole with a diameter of ϕ50 mm to ϕ115 mm

Other accessories:

- Connection arm: 1 PCS
- Toothed clamp: 2 PCS
- M8x120 bolt, flat washer, and nut: 4 sets
- M6x16 bolt, flat washer, spring washer and nut: 8 sets

9.3.2 Pole Mounting

The 27010223 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

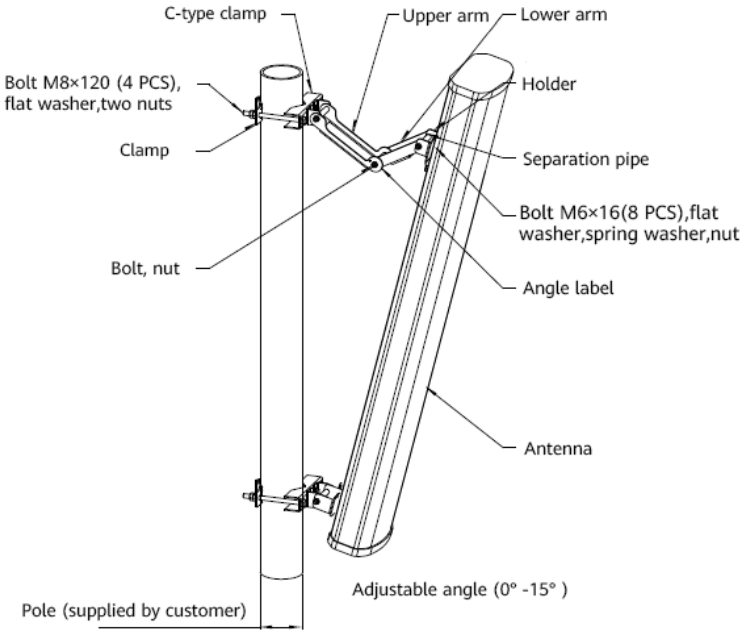
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

Installation of the antenna

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Carry out the following steps:

1. Loosen the nut between the upper and lower arms.
2. Secure the toothed clamps at the top mounting assembly to the pole.
   a. Remove the bolts, nuts, spring washers, and flat washers from the toothed clamps.
   b. Place the toothed clamp connected to the antenna against the pole, thread the bolts through the toothed clamp, put the other toothed clamp on the bolts, and put back the flat washers, spring washers and nuts.
   c. Tighten the nuts to secure the toothed clamps (not tightly).
3. Repeat step 2 to secure the toothed clamps at the bottom mounting assembly to the pole.
4. Adjust the antenna until it is perfectly vertical (the adjustable angle is 0 degrees), adjust the toothed clamps, and then secure all the toothed clamps to the pole. Set the desired antenna tilt angle and then tighten all nuts on the top and bottom assemblies with a tightening torque of 18 N m.
5. Remove the protective cap from the antenna connector, connect the feeder cable to the connector, and tighten the connector. Thoroughly wrap the cable connector with waterproof tape. For details, see the section "Connecting RF Cables."

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.

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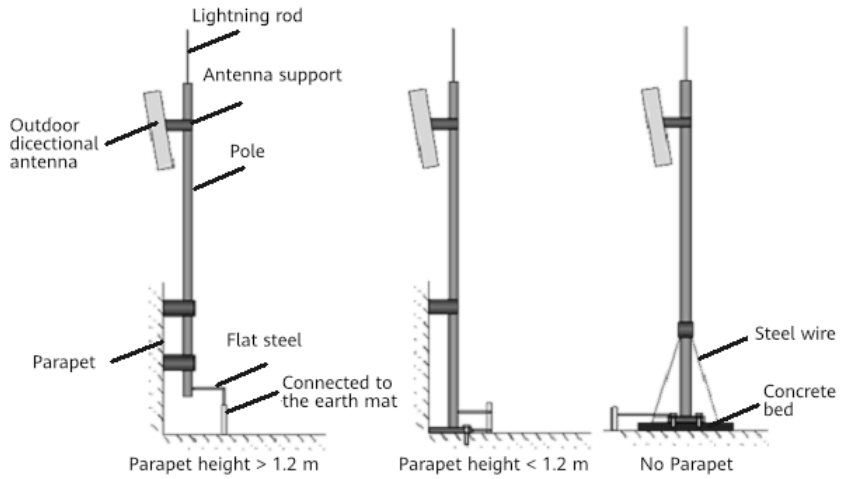
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

Take note of the following points when installing an outdoor directional antenna:

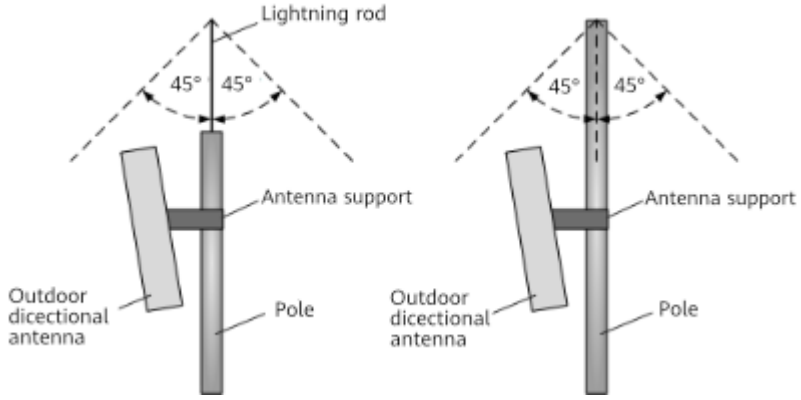
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 9-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 9-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



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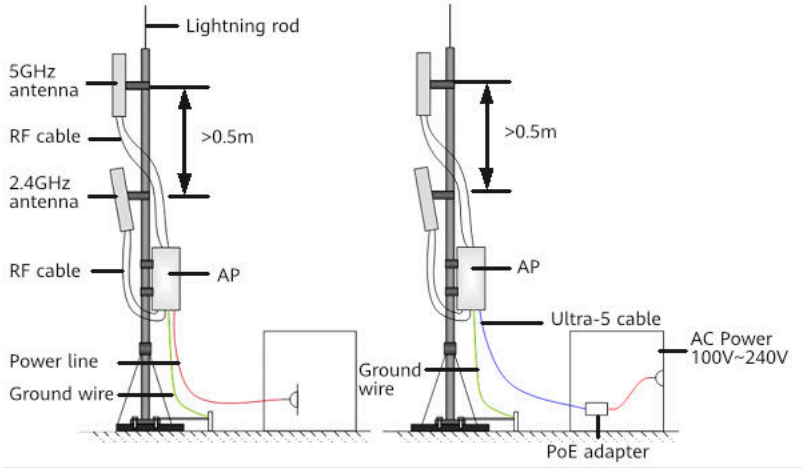
NOTE

If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

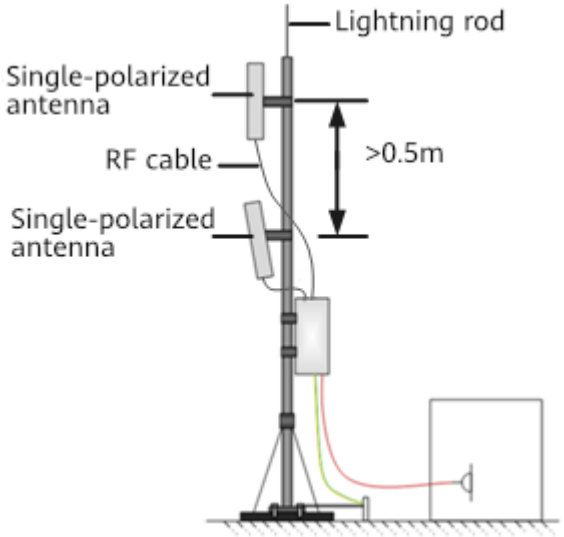
Figure 9-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 9-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in Figure 9-6.

Figure 9-6 Installation of single-polarized antennas



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9.3.3 Connecting RF Cables

RF Cable Connection Requirements

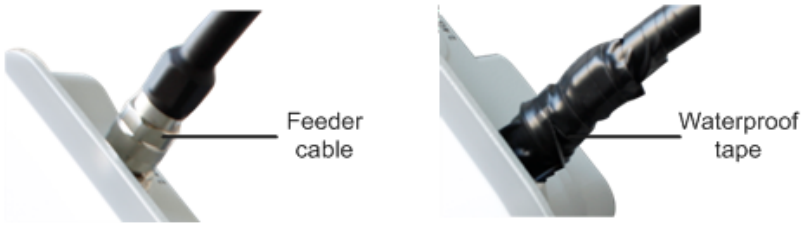
Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface.

RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

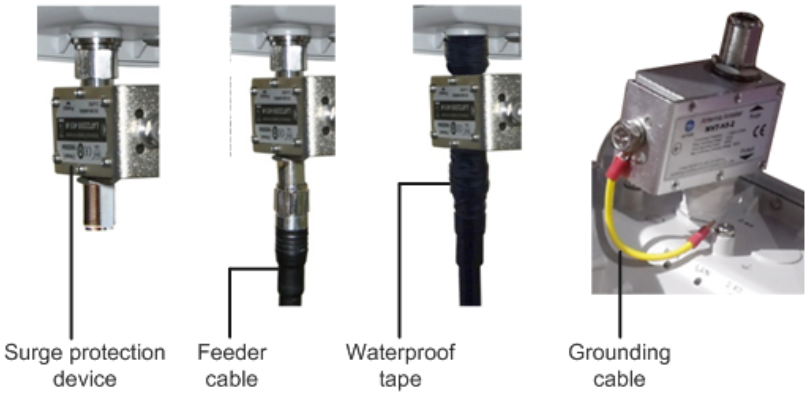


NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.

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Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

Table 9-3 Coaxial cables and connectors

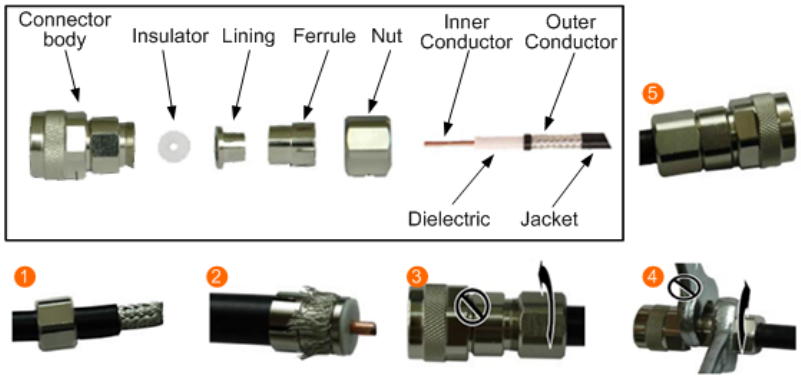
Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.

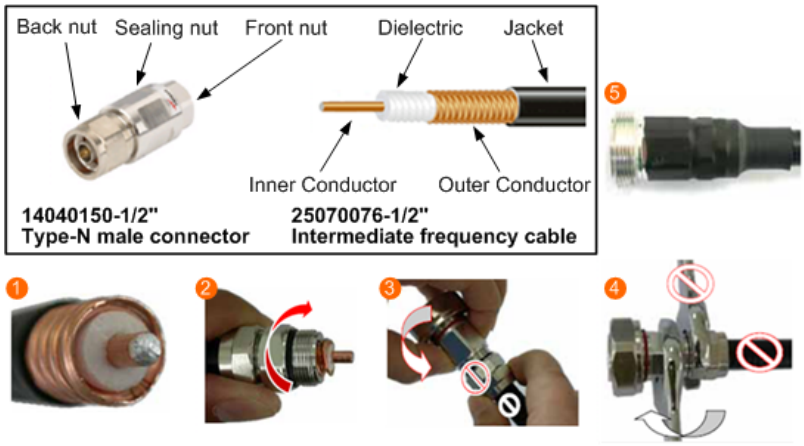
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3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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10 27010664 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G18)

About This Chapter

10.1 27010664 Technical Specifications
10.2 27010664 Installation Precautions
10.3 27010664 Antenna Installation

10.1 27010664 Technical Specifications

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Appearance and Structure

Figure 10-1 Appearance of the 27010664 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G18)



Technical Specifications

Table 10-1 Technical specifications of the 27010664 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G18)

Item	Details
Part Number	27010664
Model	SL12432A
Description	Directional Antenna, 2300-2700/2300-2700MHz,18dBi/18dBi,60deg, +/-45,2deg/2deg,250W/250W,4*N Female,with bracket

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Item	Details
Frequency [MHz]	2300 MHz to 2700 MHz
Antenna gain [dBi]	18 dBi
Coverage distance [m(ft.)]	The coverage distance is 500 m when the antenna is connected to an AirEngine 6760R-51E, the maximum input power of the AP is 30 dBm, and the RSSI is -70 dBm, regardless of the local EIRP limit. The downlink rate of a single STA is 10 Mbit/s. The coverage distance is 700 m when the antenna is connected to an AirEngine 8760R-X1E, two antennas are used for coverage to form 8x8 MIMO, the maximum input power of the AP is 33 dBm, the RSSI is -70 dBm, regardless of the local EIRP limit. The downlink rate of a single STA is 10 Mbit/s. The STA transmit power must be considered in the coverage distance to avoid insufficient uplink power.
Horizontal beamwidth [degrees]	60 degrees
Vertical beamwidth [degrees]	7 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Cross polarization
Attenna connector	N-female x 4
Attenna dimensions [mm(in.)]	86 mm x 1120 mm x 290 mm (3.39 in. x 44.09 in. x 11.42 in.)
Weight without packaging [kg(lb)]	Weight of antenna: 9.9 Weight of mounting bracket: 4.7
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ50 to ϕ80

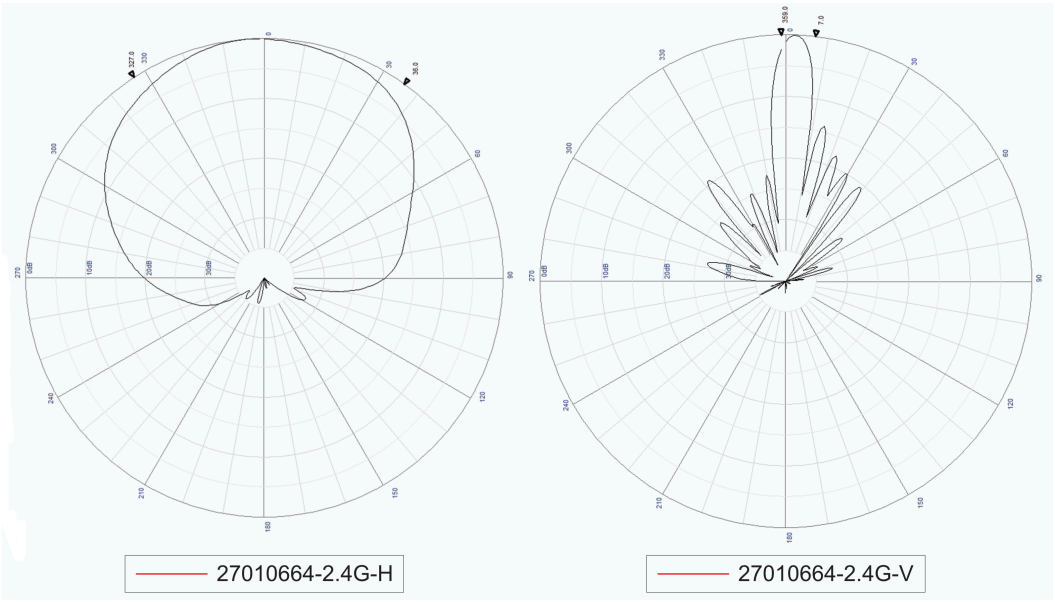
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 10-2 Antenna Pattern1 of the 27010664 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G18)



10.2 27010664 Installation Precautions

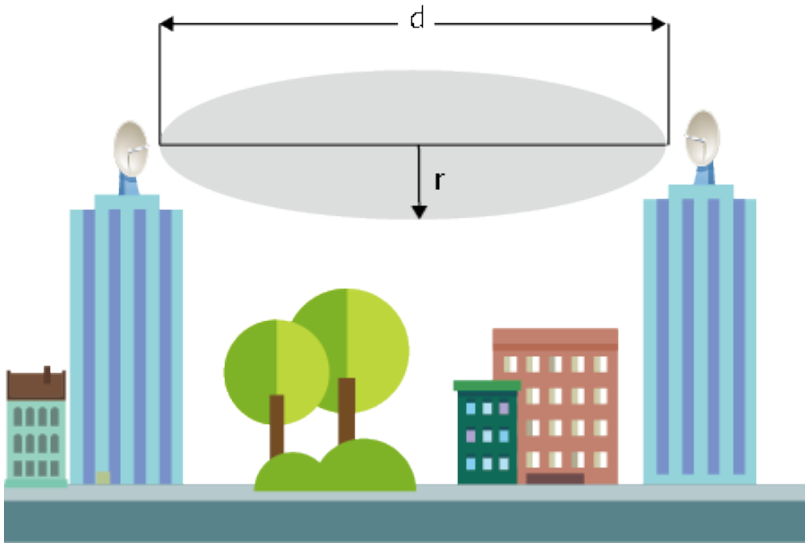
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 10-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 10-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 10-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

10.3 27010664 Antenna Installation

The 27010664 antenna is an outdoor 2.4 GHz directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

10.3.1 Accessories and Tools

Tools:

- 13 mm open-end wrench: 1 PCS
- 16 mm or 18 mm open-end wrench: 1 PCS



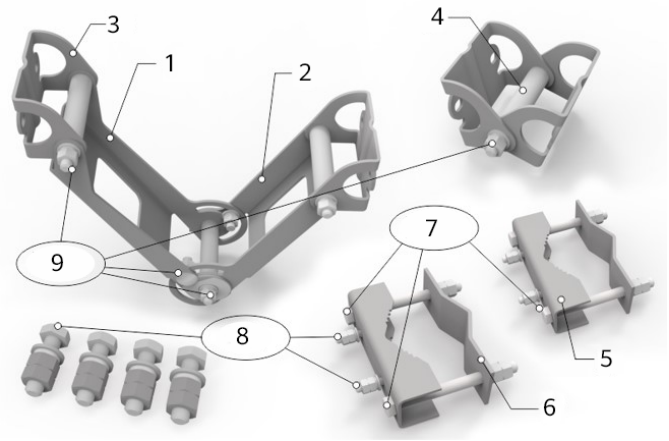
- Inclinometer: 1 PCS



Pole:

- Pole with a diameter of ϕ50 mm to ϕ80 mm: 1 PCS

Accessories (for reference only, and the actual appearances shall prevail.):



NOTE

- The upper arm, lower arm, and holder are assembled into a support before delivery and do not need to be disassembled during installation.
- The C-type clamps and clamps are assembled before delivery and need to be disassembled during installation.

No.	Name	Quantity
1	Lower arm	1
2	Upper arm	1
3	Holder	4

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No.	Name	Quantity
4	Toothed clamp	4
5	C-type clamp	2
6	Clamp	2
7	M12 assembly	• GB/T5783 M12x130 bolt: 4 • GB/T97.1 12 flat washer: 4 • GB/T93 12 spring washer: 4 • GB/T6170 M12 nut: 8
8	M8 assembly	• GB/T5783 M8x30 bolt: 8 • GB/T97.1 8 flat washer: 8 • GB/T93 8 flat washer: 8 • GB/T6170 M8 nut: 16
9	M10 assembly	• GB/T5782 M10x110 bolt: 4 • GB/T97.1 10 flat washer: 6 • GB/T93 10 flat washer: 6 • GB/T6170 M10 nut: 6

10.3.2 Pole Mounting

The 27010664 antenna is mounted on a pole with a diameter of ϕ50 mm to ϕ80 mm.

CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

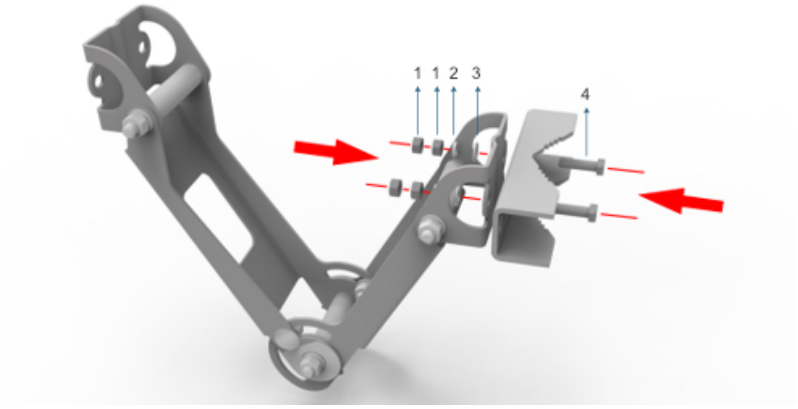
Assembling Mounting Brackets

No.	Name
1	GB/T6170 M8 nut
2	GB/T93 8 flat washer: 8
3	GB/T97.1 8 flat washer: 8
4	GB/T5783 M8x30 bolt: 8

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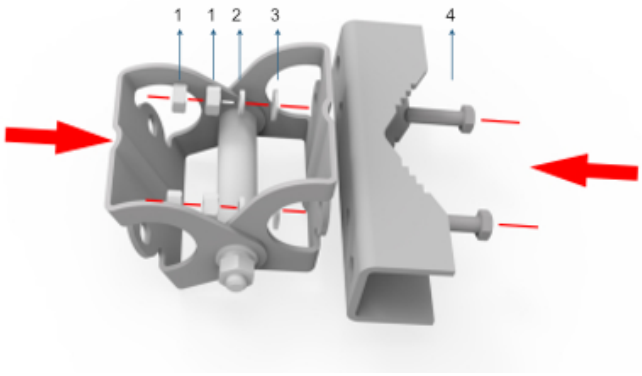
Assembling the Upper Mounting Bracket

1. Remove the bolts, nuts, spring washers, and flat washers from the clamp and C-type clamp.
2. Assemble the upper arm and the C-type clamp using the M8 assembly with a reference torque of 25 N·m.



Assembling the Lower Mounting Bracket

1. Remove the bolts, nuts, spring washers, and flat washers from the clamp and C-type clamp.
2. Assemble the toothed clamp and the C-type clamp using the M8 assembly with a reference torque of 25 N·m.

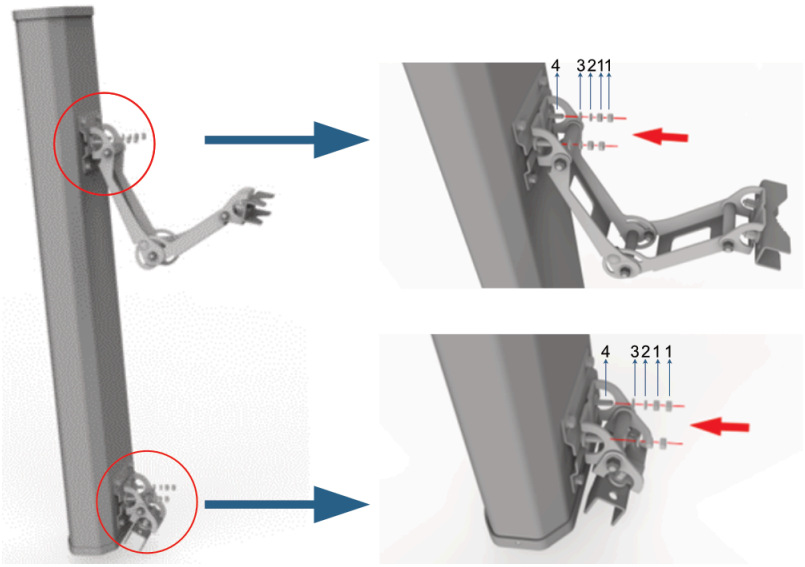


Securing the Upper and Lower Mounting Brackets to an Antenna

No.	Name
1	GB/T6170 M8 nut
2	GB/T93 8 flat washer: 8
3	GB/T97.1 8 flat washer: 8
4	GB/T5783 M8x30 bolt: 8

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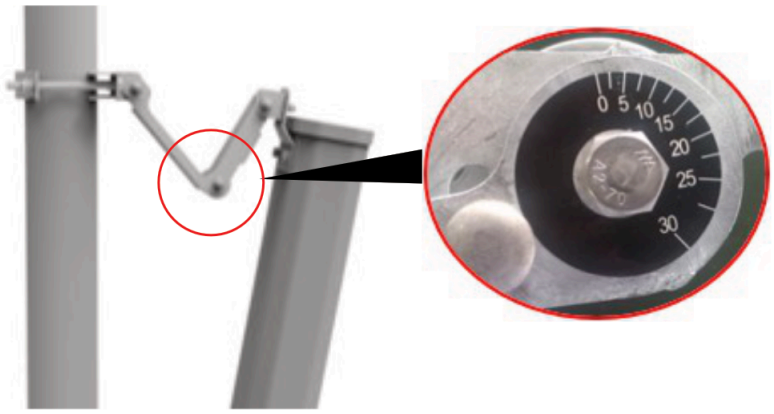
Secure the upper and lower mounting brackets to an antenna using the M8 assembly with a reference torque of 25 N·m, as shown in the following figure.



Fixing the Antenna to a Pole

1. Loosen the nut between the upper and lower arms.
2. Secure the toothed clamps at the top mounting bracket to a pole.
   a. Remove the bolts, nuts, spring washers, and flat washers from the toothed clamp.
   b. Place the C-type clamp connected to the antenna against the pole, thread the bolts through the clamp, and put the other clamp on the bolts, and put back the flat washers, spring washers, and nuts.
   c. Tighten the nuts to secure the toothed clamps (not tightly).
3. Repeat step 2 to secure the toothed clamps at the bottom mounting bracket to the pole.
4. Adjust the antenna until it is perfectly vertical (adjustable angle: 0 degrees), adjust the toothed clamps, and then secure all the toothed clamps to the pole using M12 screws with a reference torque of 62 N·m.
5. Adjust the antenna angle (adjustable angle range: 0 to 32 degrees).
   a. Estimate the angle to be adjusted based on the angle between the upper and lower arms shown on the dial scale.

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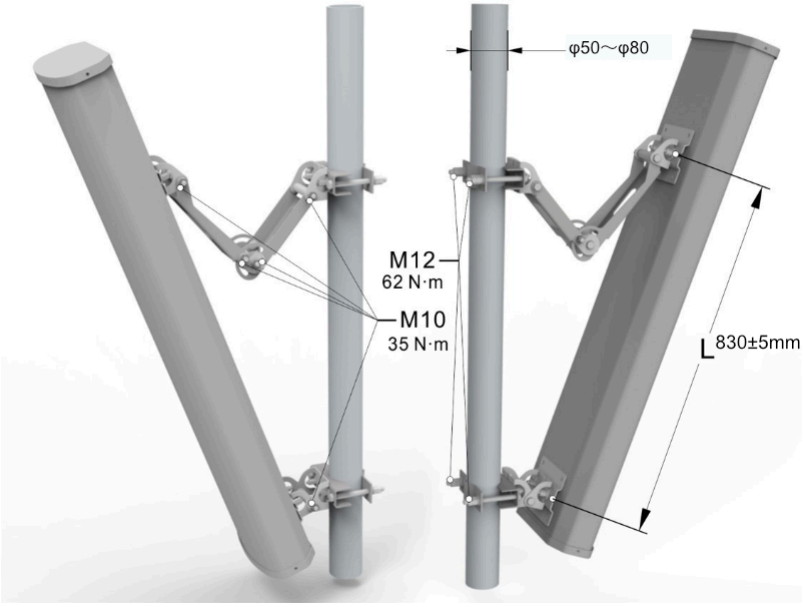
b. Use an inclinometer to precisely measure the angle to be adjusted.



.

c. After adjusting the antenna angle, tighten all the M10 nuts with a reference torque of 35 N·m.

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6. Remove the protective cap from the antenna connector, connect the feeder cable to the connector, and tighten the connector. Thoroughly wrap the cable connector with waterproof tape. For details, see **Connecting RF Cables**.

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

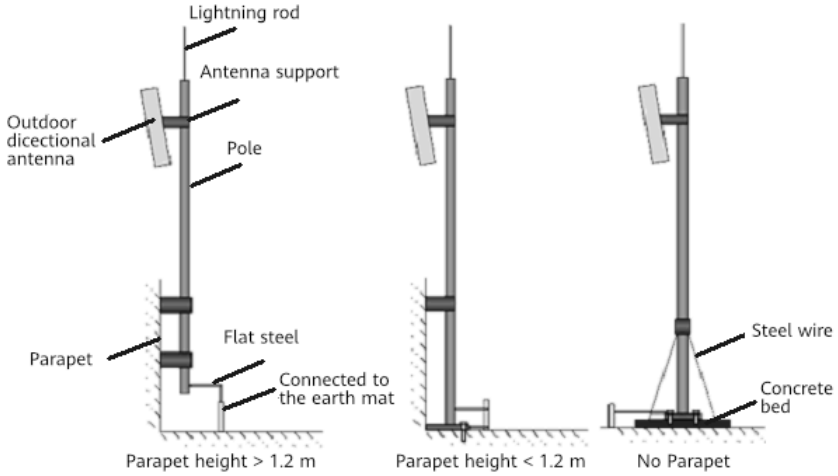
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

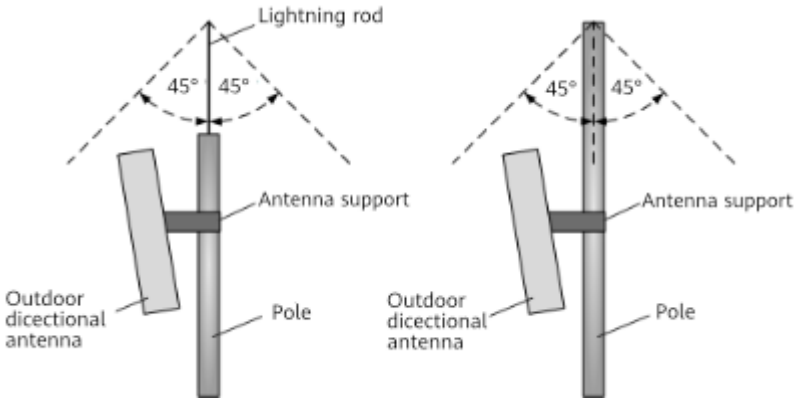
Figure 10-4 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 10-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

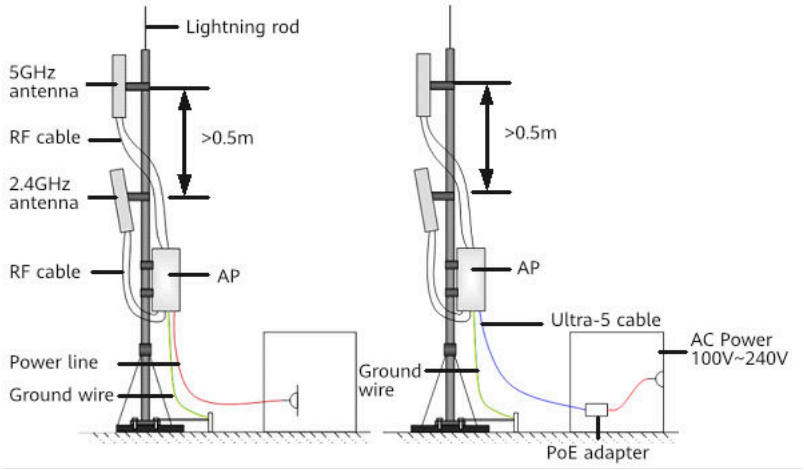
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 10-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

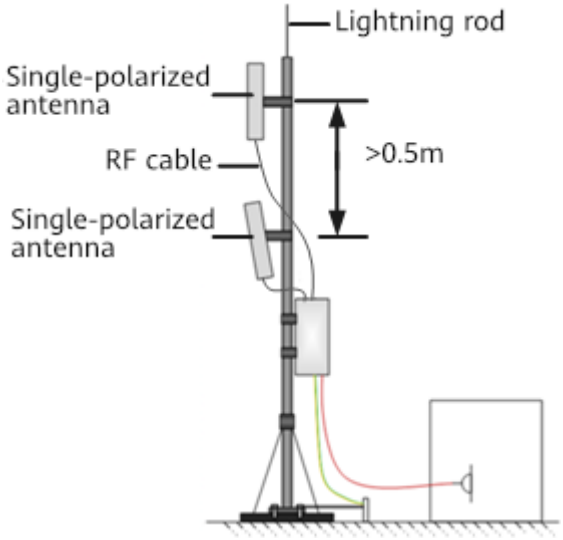
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Figure 10-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 10-6**.

Figure 10-6 Installation of single-polarized antennas



10.3.3 Connecting RF Cables

RF Cable Connection Requirements

- The feeder cables on an antenna must be connected to the AP's RF ports on the corresponding bands. There is no mandatory requirement for the connection mapping between the two ends.
- For the AirEngine 8760R-X1E, the feeder cables on an antenna can be connected only to the RF ports on the same side of the AP but not to RF ports on both sides of the AP.

  The following figure shows the cable connections.

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RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. RF ports of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the RF ports with a tightening torque of 0.8 N·m.

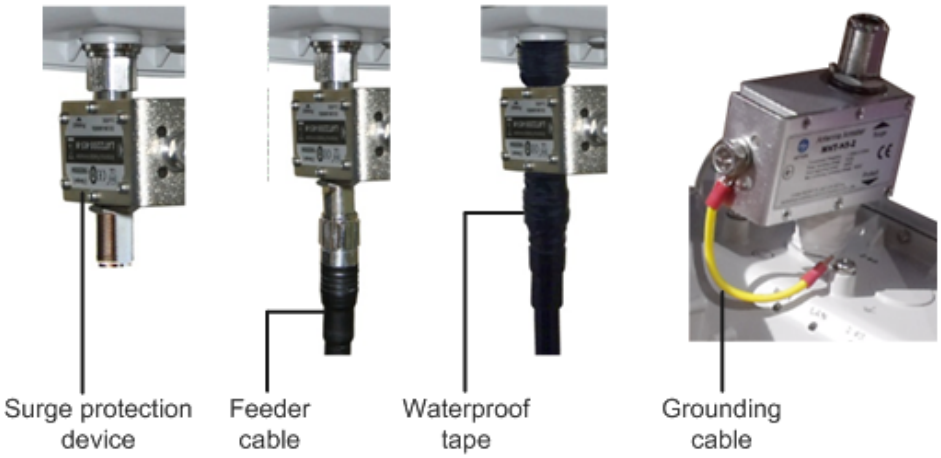
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NOTE

Outdoor APs support built-in surge protection on all RF ports, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

Table 10-3 Coaxial cables and connectors

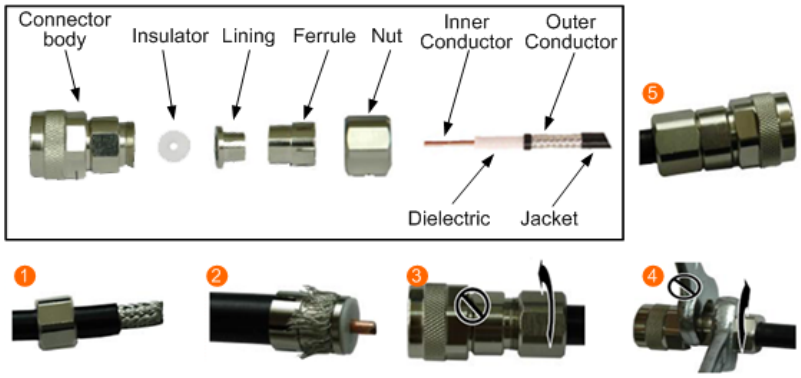
Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	

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Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

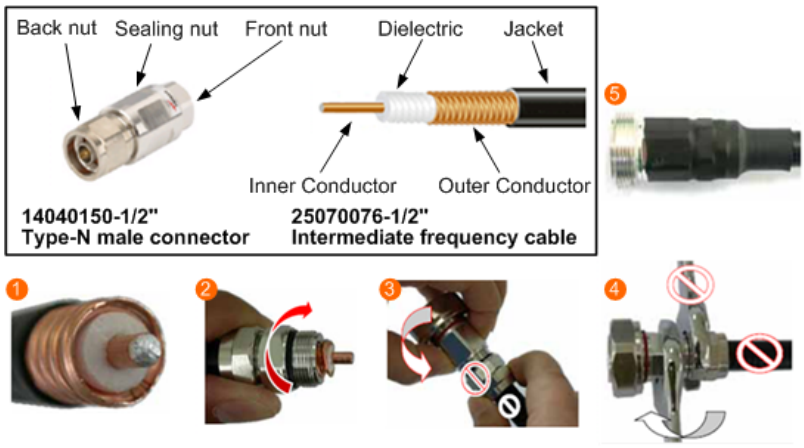
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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11 27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)

About This Chapter

11.1 27010812 Technical Specifications
11.2 27010812 Installation Precautions
11.3 27010812 Antenna Installation

11.1 27010812 Technical Specifications

Appearance and Structure

Figure 11-1 Appearance of the 27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)



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Technical Specifications

Table 11-1 Technical specifications of the 27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)

Item	Details
Part Number	27010812
Model	ADU451100
Description	Directional Antenna,2400~2500MHz, 12dBi,60deg/30deg,N/Female, 2port,with mounting parts,pole mounting
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	12 dBi
Coverage distance [m(ft.)]	150 m(ft.)
Horizontal beamwidth [degrees]	60 degrees
Vertical beamwidth [degrees]	30 degrees
Standing wave ratio (SWR)	≤ 1.45
Polarization	Cross polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 60 x 250 x 155
Weight without packaging [kg(lb)]	<1
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ30 to ϕ114

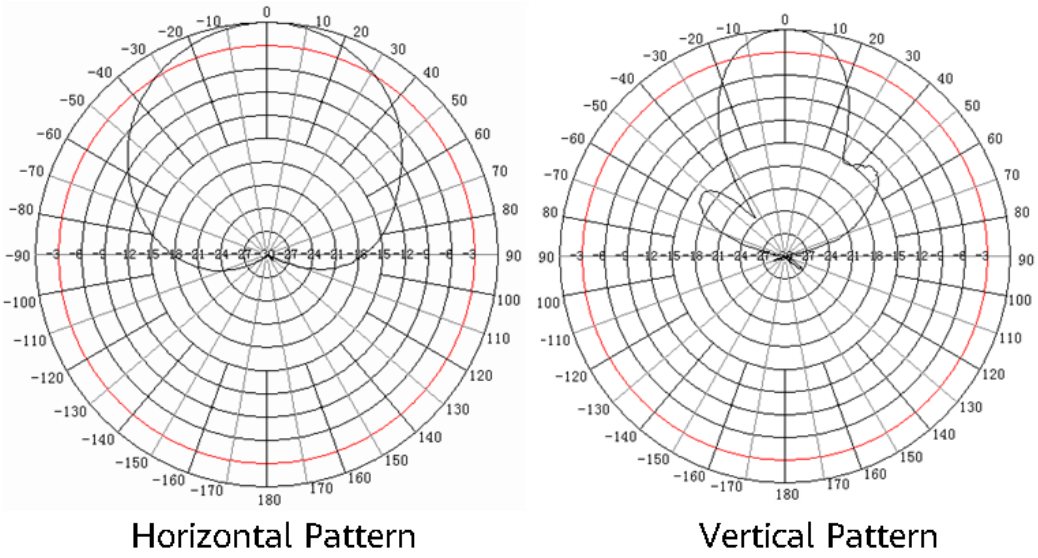
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 11-2 Antenna Pattern1 of the 27010812 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V30 G12)



11.2 27010812 Installation Precautions

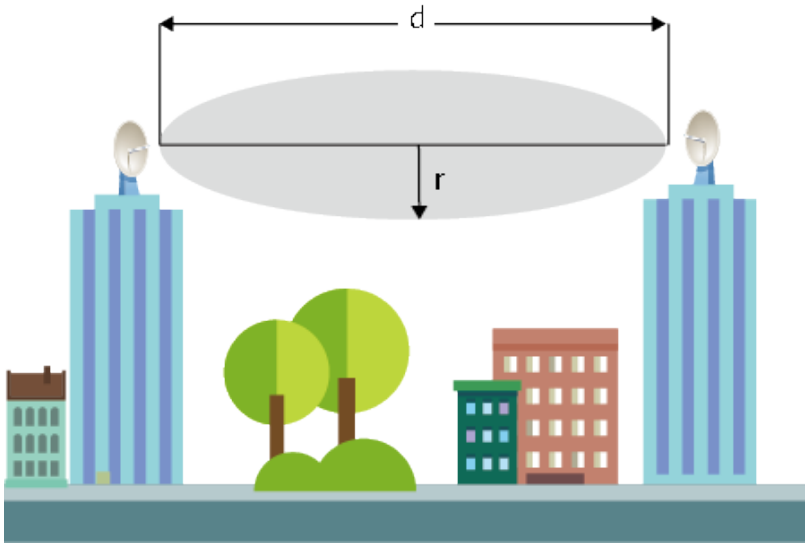
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 11-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 11-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 11-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

11.3 27010812 Antenna Installation

The 27010812 antenna is an outdoor dual-polarized antenna. It is connected to an AP using a feeder cable and mounted on a pole to provide outdoor directional

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coverage. The antenna is best applied to directional coverage scenarios, such as squares, streets, and corridors.

11.3.1 Accessories and Tools

Tools:

- 1 x 10 mm combination wrench



- 1 x inclinometer

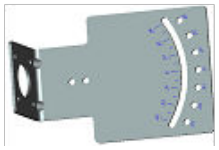


Pole:

- 1 x pole with a diameter of ϕ30 mm to ϕ114 mm

Antenna support assembly:

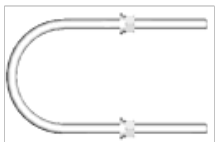
- Installation bracket: 1 PCS



- Toothed clamp: 1 PCS



- U-type bolt: 1 PCS



- Nut



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11.3.2 Pole Mounting

The 27010812 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

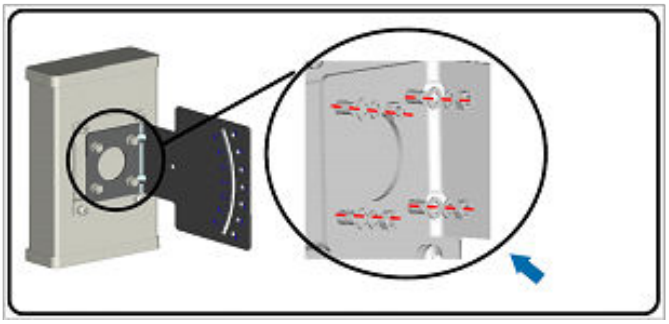
⚠ CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

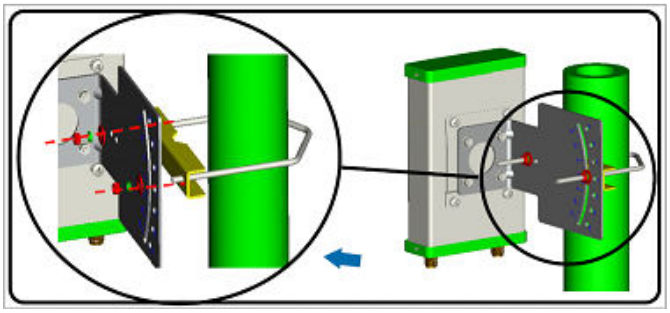
Fixing the Antenna to the Pole

Carry out the following steps:

1. Fix the installation bracket to the antenna using the nut, spring washer, and flat washer.

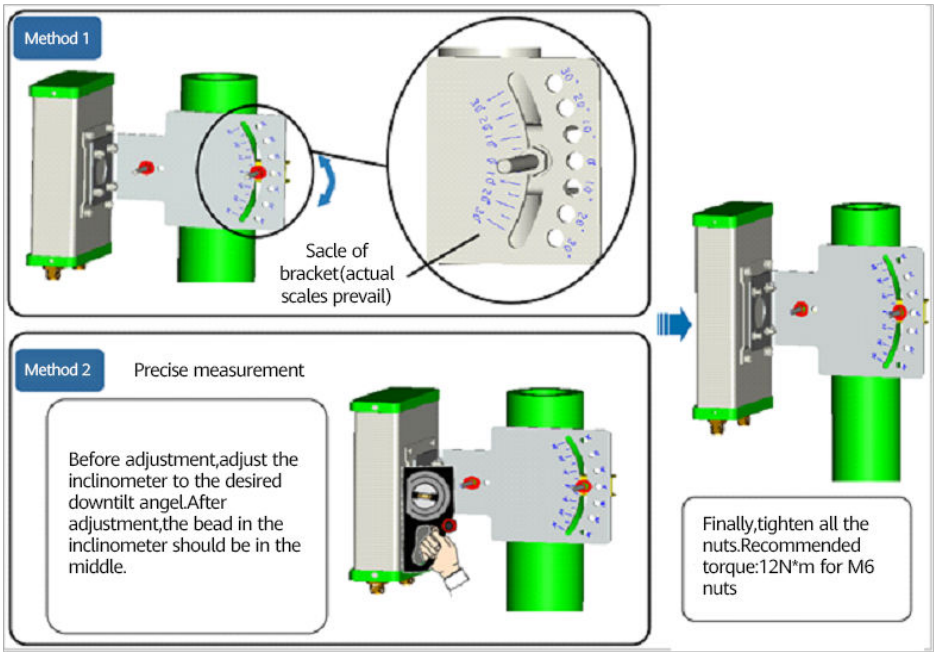


2. Secure the installation bracket, toothed clamp and U-type bolt on the pole. Thread the U-type bolt through the fixing hole and graduated bracket and then tighten screws, nuts, flat washers, and spring washers on both ends of the U-type bolt (not tightly), as shown in the following figure.



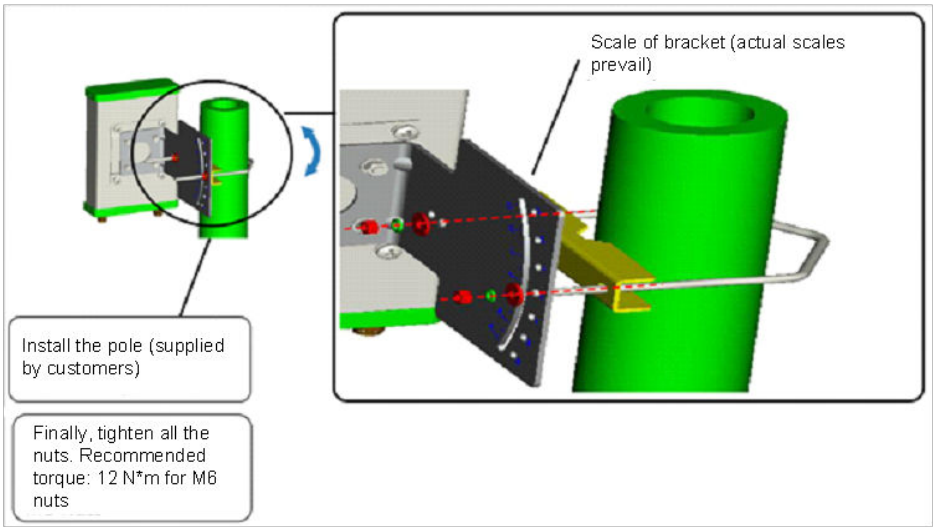
3. Adjust the mechanical downtilt angle using one of the following two methods.
   - Method 1: Adjust the angle by sliding the U-type bolt along the bracket. The pole must be kept vertical.
   - Method 2: Use the inclinometer to determine the antenna angle. Then, move the antenna to adjust its angle until the bead in the inclinometer is at the middle. This method provides precise measurements.

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4. Finally, tighten all nuts. The recommended torque is 12 N m for M6 nuts.

If the required downtilt angle is fixed, you can thread the U-type bolt through the fixing hole and graduated bracket and then tighten the nuts. The pole must be kept vertical.



Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

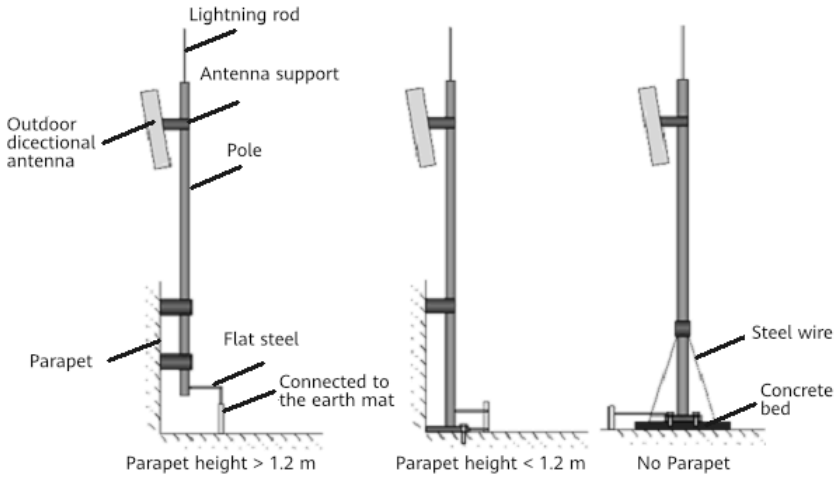
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Take note of the following points when installing an outdoor directional antenna:

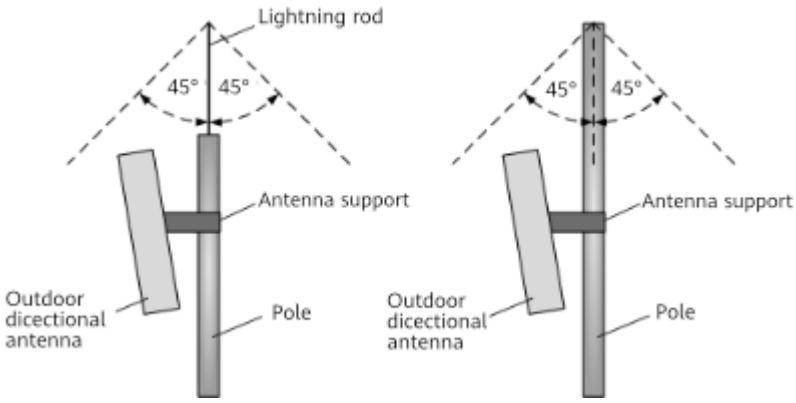
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 11-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 11-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

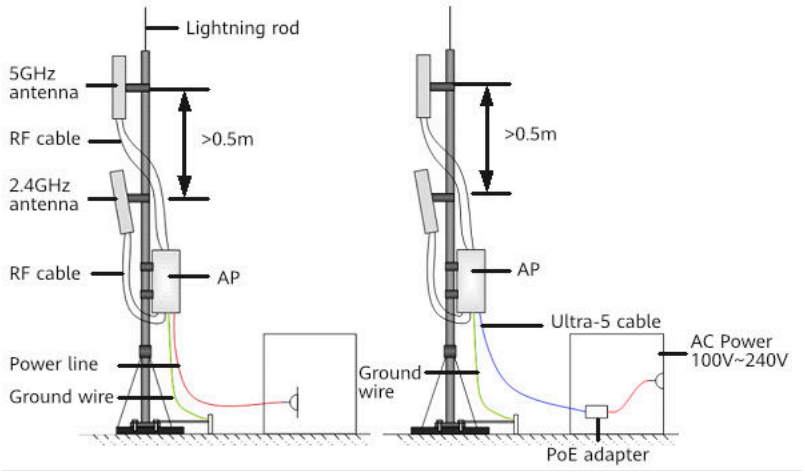
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

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Outdoor AP Installation Scenarios

Figure 11-5 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 11-5 Outdoor AP installation scenarios



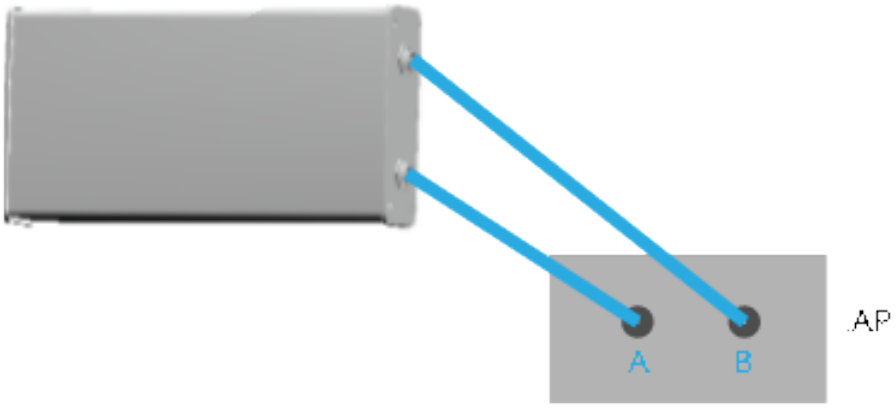
11.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

  The following figure shows the cable connections.



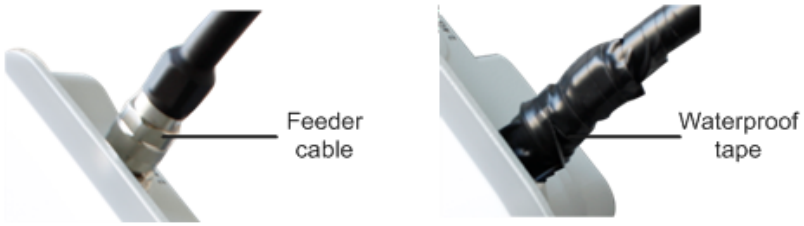
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RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

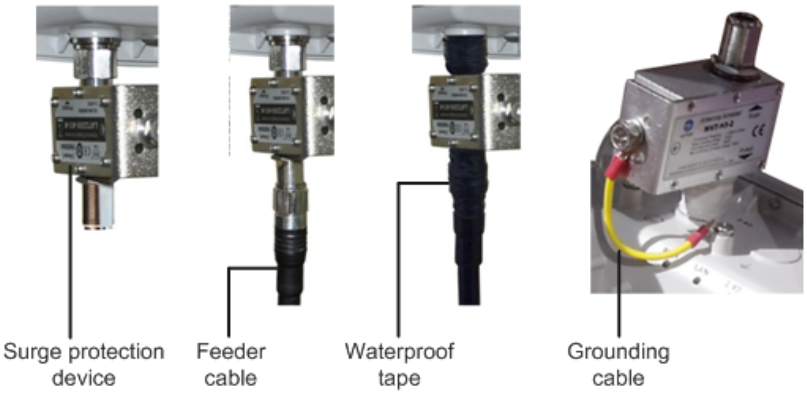
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

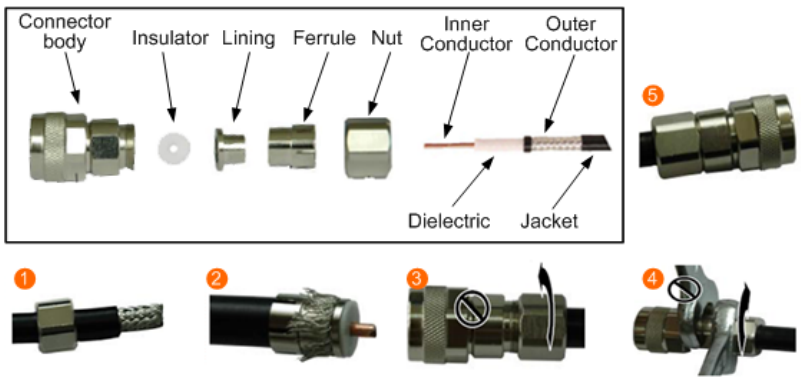
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Table 11-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

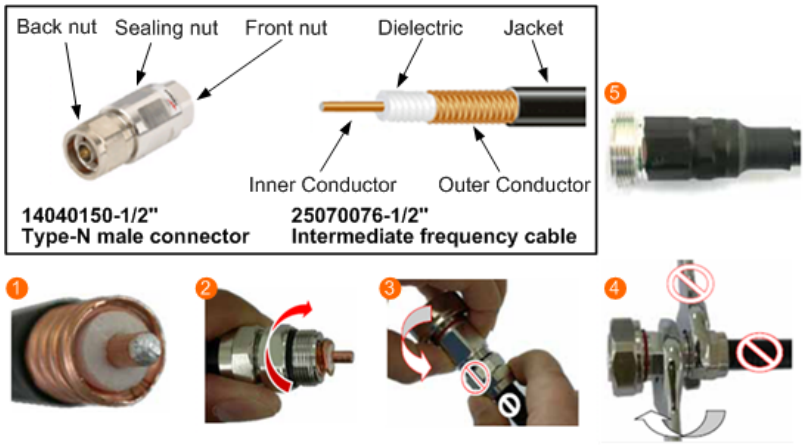
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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12 27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)

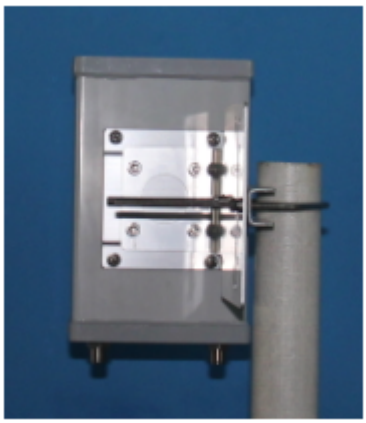
About This Chapter

12.1 27010889 Technical Specifications
12.2 27010889 Installation Precautions
12.3 27010889 Antenna Installation

12.1 27010889 Technical Specifications

Appearance and Structure

Figure 12-1 Appearance of the 27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)



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Technical Specifications

Table 12-1 Technical specifications of the 27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)

Item	Details
Part Number	27010889
Model	ASB115G00
Description	Directional Antenna,4900~5850MHz, 11dBi,60deg/30deg,N/Female, 2port,with mounting parts,pole mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	11.5 dBi
Coverage distance [m(ft.)]	110 m(ft.)
Horizontal beamwidth [degrees]	60 degrees
Vertical beamwidth [degrees]	30 degrees
Standing wave ratio (SWR)	≤ 1.8
Polarization	Cross polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 230 x 145 x 55
Weight without packaging [kg(lb)]	1.3 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ35 to ϕ114

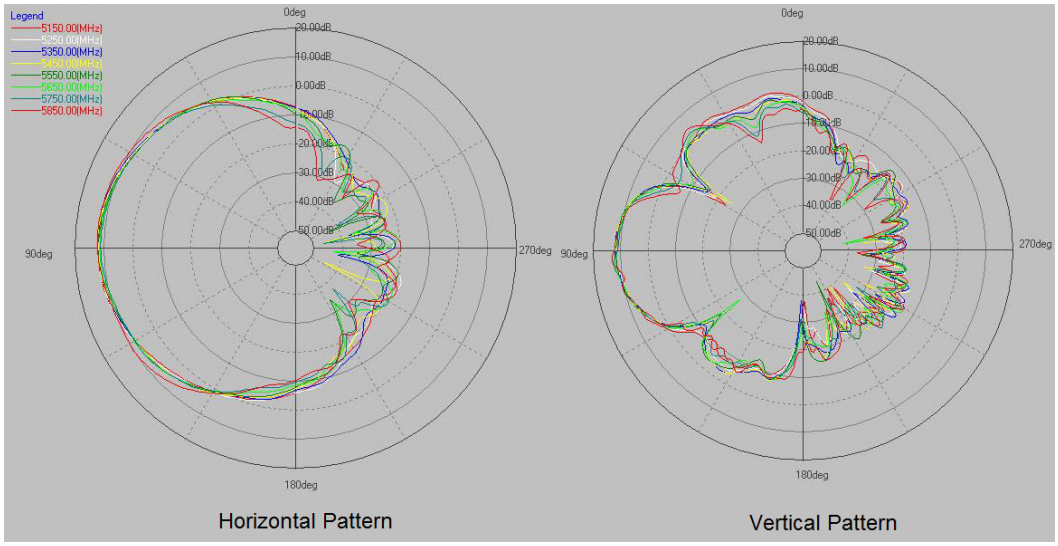
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 12-2 Antenna Pattern1 of the 27010889 Outdoor 5 GHz Dual-Polarized Directional Antenna (H60 V30 G11.5)



12.2 27010889 Installation Precautions

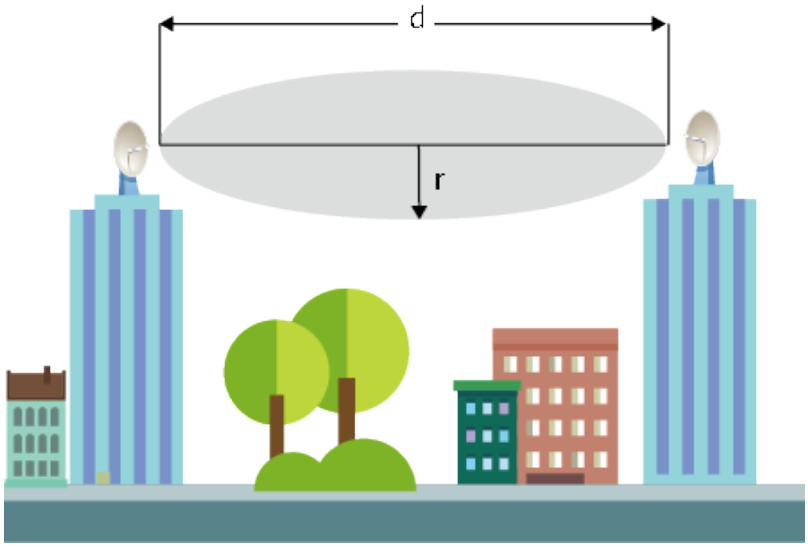
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 12-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 12-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 12-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

12.3 27010889 Antenna Installation

The 27010889 antenna is an outdoor antenna. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from

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metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

12.3.1 Accessories and Tools

Tools:

- 1 x 10 mm combination wrench



- 1 x inclinometer

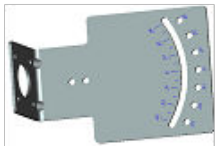


Pole:

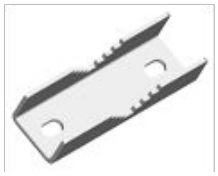
- 1 x pole with a diameter of ϕ35 mm to ϕ114 mm

Antenna support assembly:

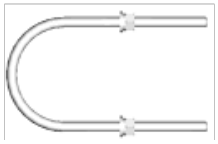
- Installation bracket: 1 PCS



- Toothed clamp: 1 PCS



- U-type bolt: 1 PCS



- Nut



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12.3.2 Pole mounting

The 27010889 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

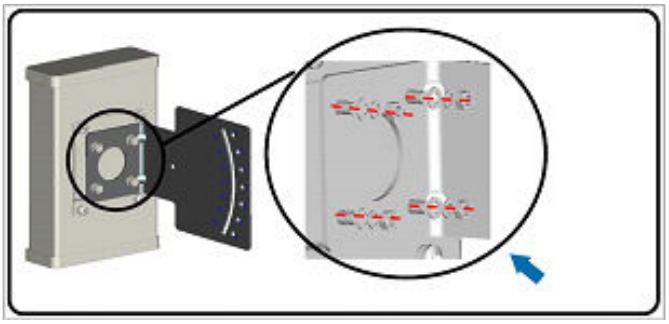
⚠ CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

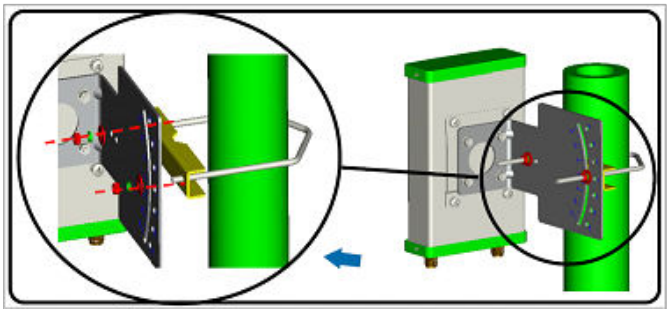
Fixing the Antenna to the Pole

Carry out the following steps:

1. Fix the installation bracket to the antenna using the nut, spring washer, and flat washer.

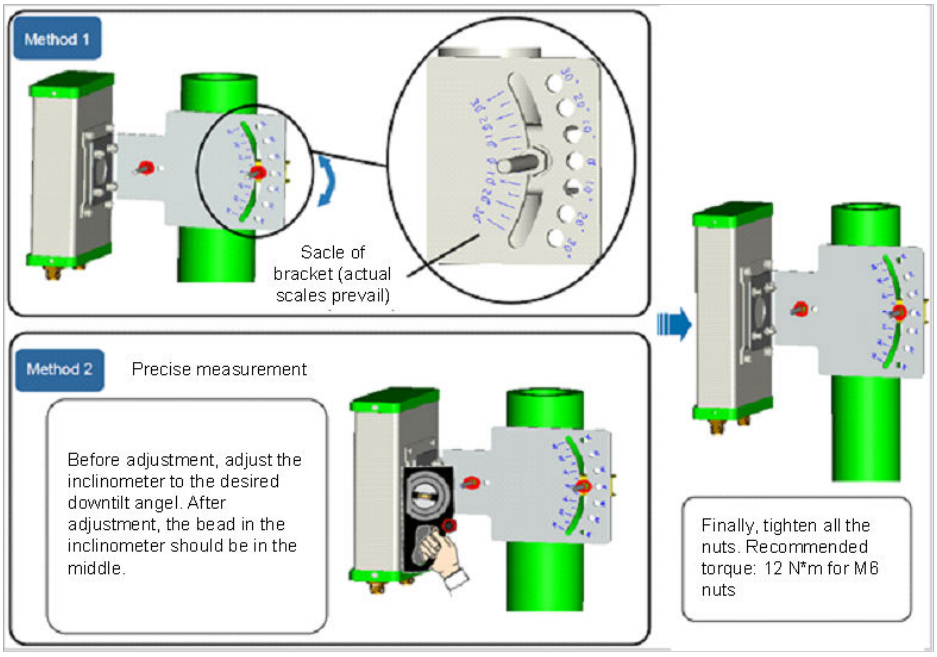


2. Secure the installation bracket, toothed clamp and U-type bolt on the pole. Thread the U-type bolt through the fixing hole and graduated bracket and then tighten screws, nuts, flat washers, and spring washers on both ends of the U-type bolt (not tightly), as shown in the following figure.



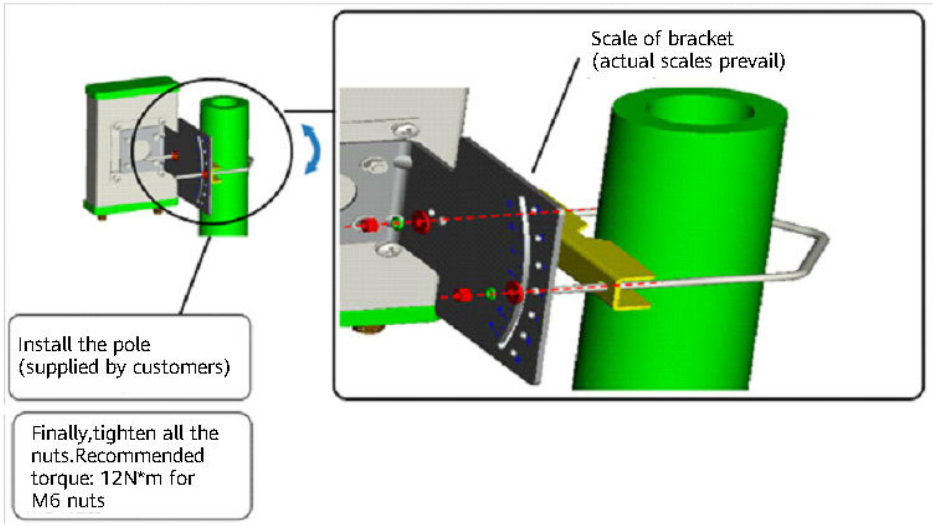
3. Adjust the mechanical downtilt angle using one of the following two methods.
   - Method 1: Adjust the angle by sliding the U-type bolt along the bracket. The pole must be kept vertical.
   - Method 2: Use the inclinometer to determine the antenna angle. Then, move the antenna to adjust its angle until the bead in the inclinometer is at the middle. This method provides precise measurements.

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4. Finally, tighten all nuts. The recommended torque is 12 N m for M6 nuts.

If the required downtilt angle is fixed, you can thread the U-type bolt through the fixing hole and graduated bracket and then tighten the nuts. The pole must be kept vertical.



Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

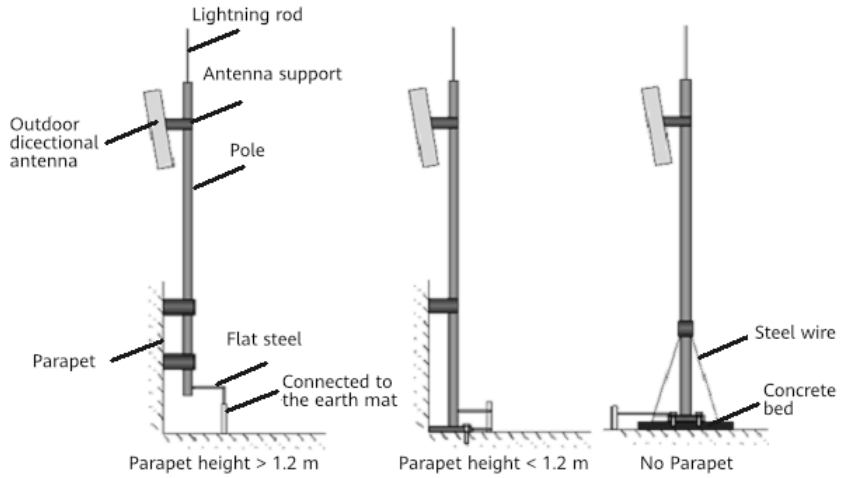
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Take note of the following points when installing an outdoor directional antenna:

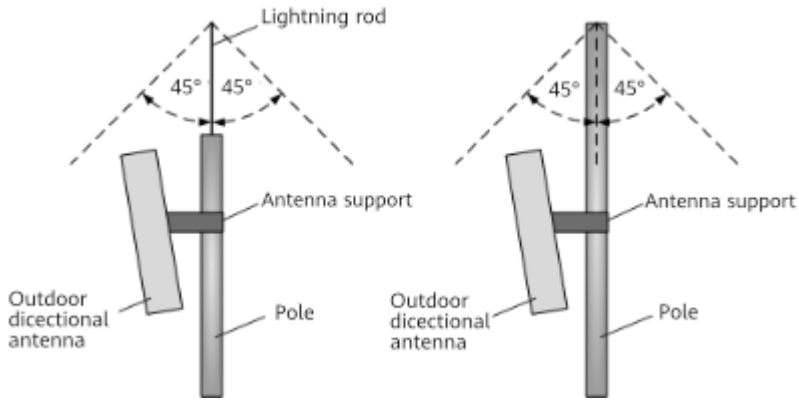
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 12-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 12-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

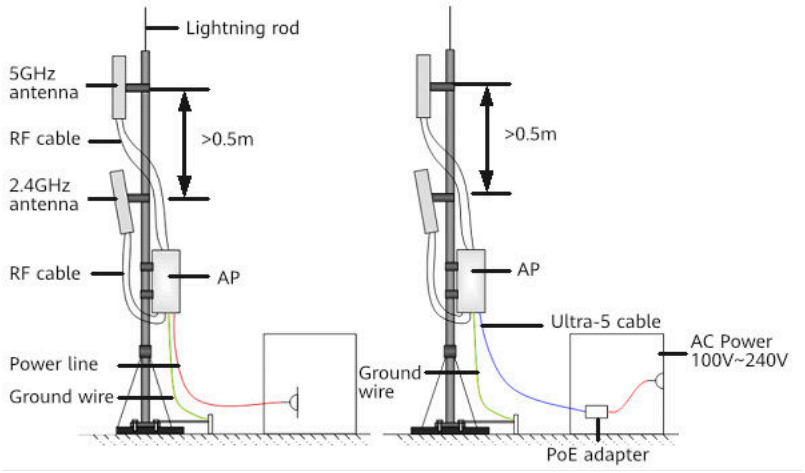
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

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Outdoor AP Installation Scenarios

Figure 12-5 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 12-5 Outdoor AP installation scenarios



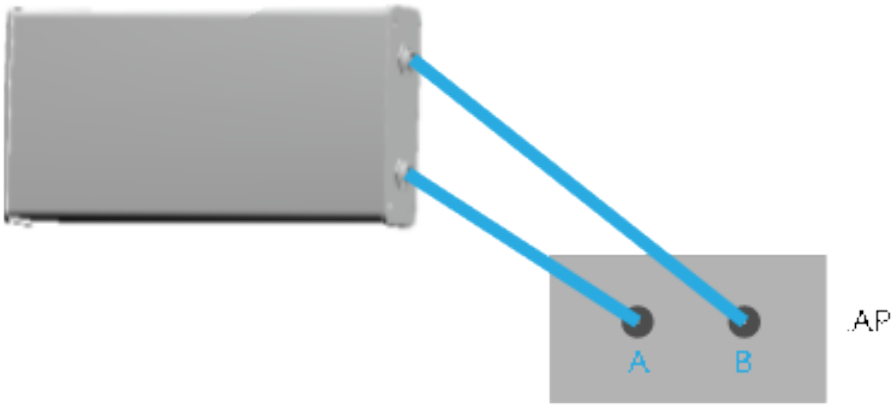
12.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

  The following figure shows the cable connections.



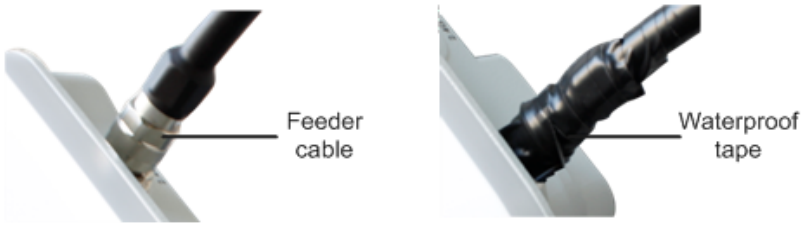
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RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

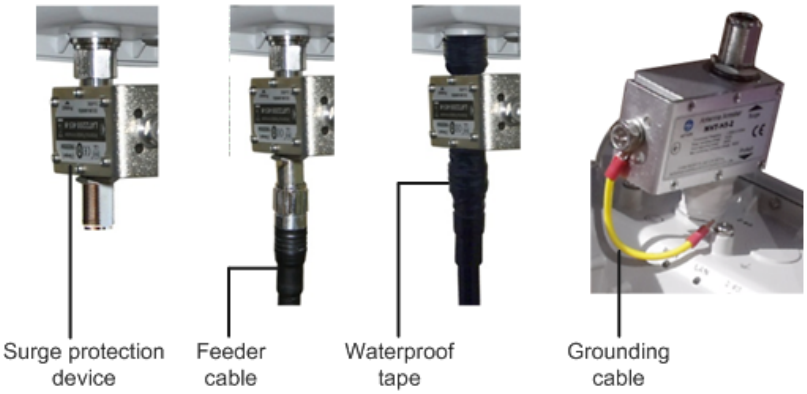
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

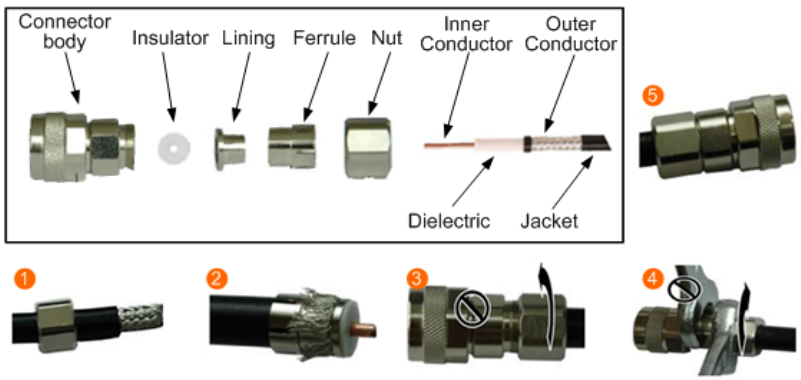
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Table 12-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

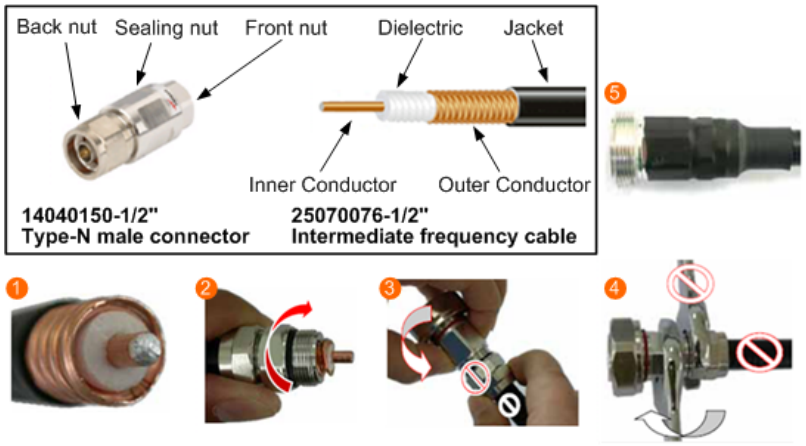
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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13 27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)

About This Chapter

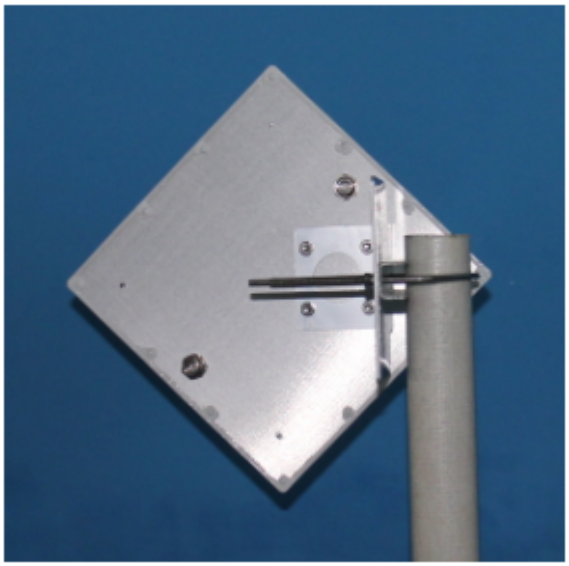
13.1 27010890 Technical Specifications
13.2 27010890 Installation Precautions
13.3 27010890 Antenna Installation

13.1 27010890 Technical Specifications

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Appearance and Structure

Figure 13-1 Appearance of the 27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)



Technical Specifications

Table 13-1 Technical specifications of the 27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)

Item	Details
Part Number	27010890
Model	ASB185G00
Description	Directional Antenna,5150~5850MHz, 19dBi,15deg/15deg,N/Female, 2port,with mounting parts,pole mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	19 dBi
Coverage distance [m(ft.)]	220 m(ft.)
Horizontal beamwidth [degrees]	15 degrees
Vertical beamwidth [degrees]	15 degrees
Standing wave ratio (SWR)	≤ 1.8
Polarization	Cross polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 25 x 250 x 250

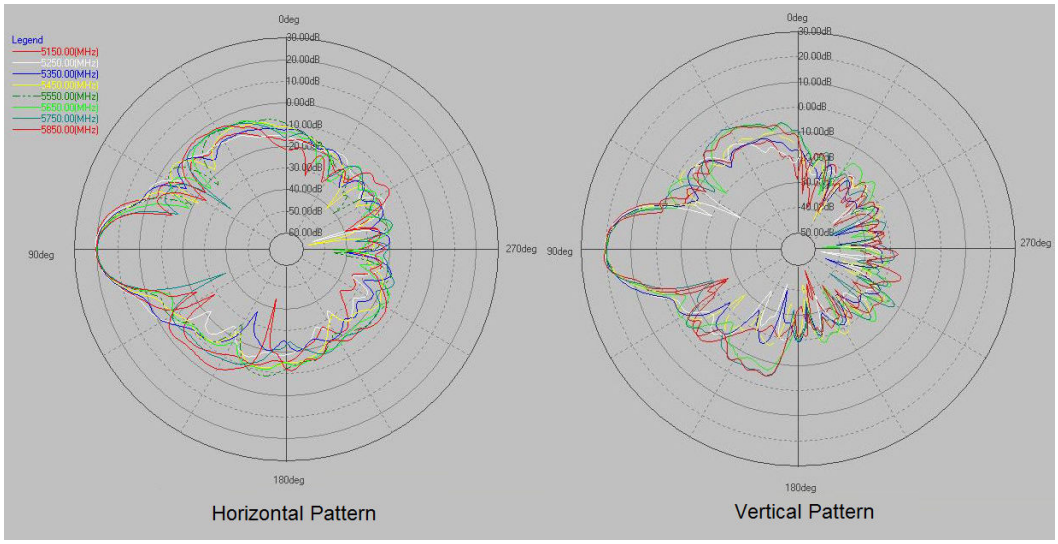
Copyright © Huawei Technologies Co., Ltd.

Item	Details
Weight without packaging [kg(lb)]	1.3 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ35 to ϕ114
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 13-2 Antenna Pattern1 of the 27010890 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)



13.2 27010890 Installation Precautions

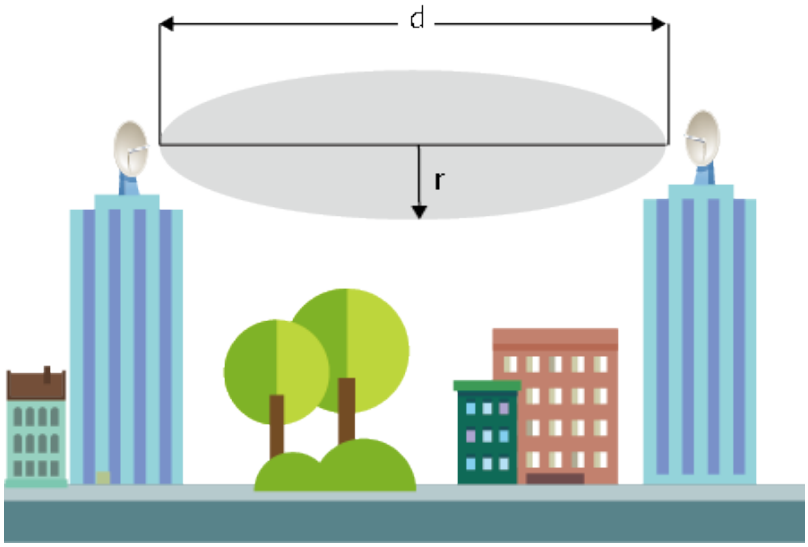
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 13-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 13-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 13-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

13.3 27010890 Antenna Installation

The 27010890 antenna is an outdoor antenna. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from

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metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

13.3.1 Accessories and Tools

Tools:

- 1 x 10 mm combination wrench



- 1 x inclinometer

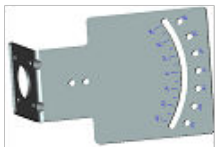


Pole:

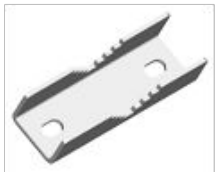
- 1 x pole with a diameter of ϕ35 mm to ϕ114 mm

Antenna support assembly:

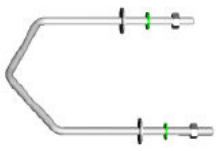
- Installation bracket: 1 PCS



- Toothed clamp: 1 PCS



- U-type bolt: 1 PCS



- Nut



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13.3.2 Pole Mounting

The 27010890 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

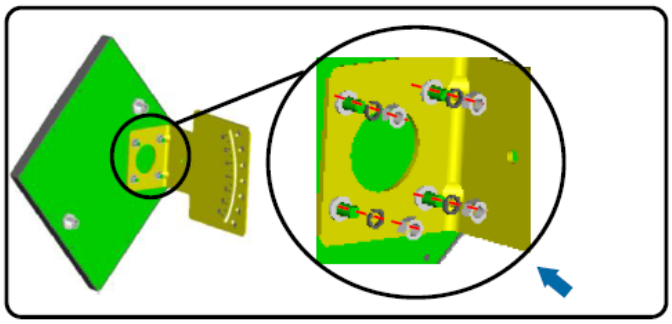
⚠ CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

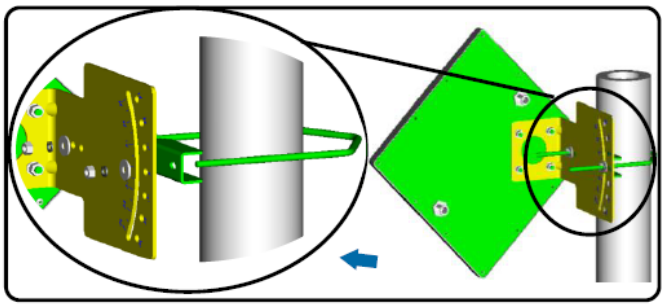
Fixing the Antenna to the Pole

Carry out the following steps:

1. Fix the installation bracket to the antenna using the nut, spring washer, and flat washer.

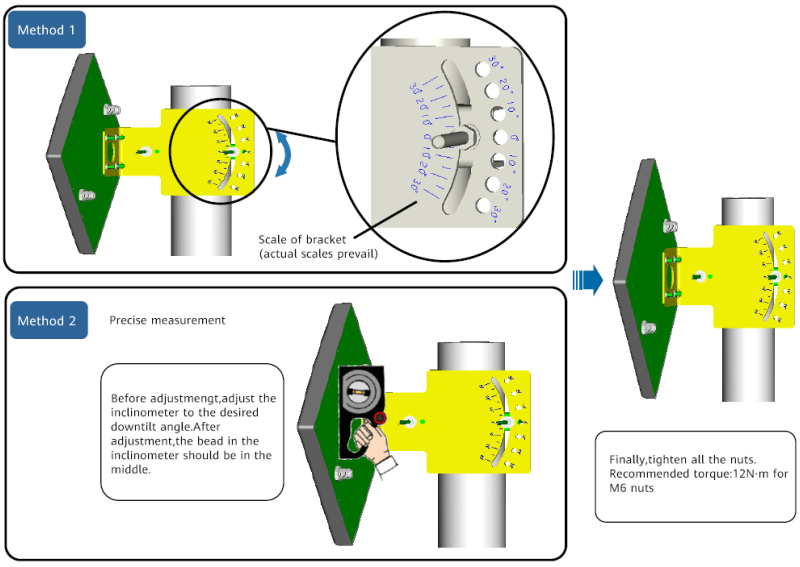


2. Secure the installation bracket, toothed clamp and U-type bolt on the pole. Thread the U-type bolt through the fixing hole and graduated bracket and then tighten screws, nuts, flat washers, and spring washers on both ends of the U-type bolt (not tightly), as shown in the following figure.



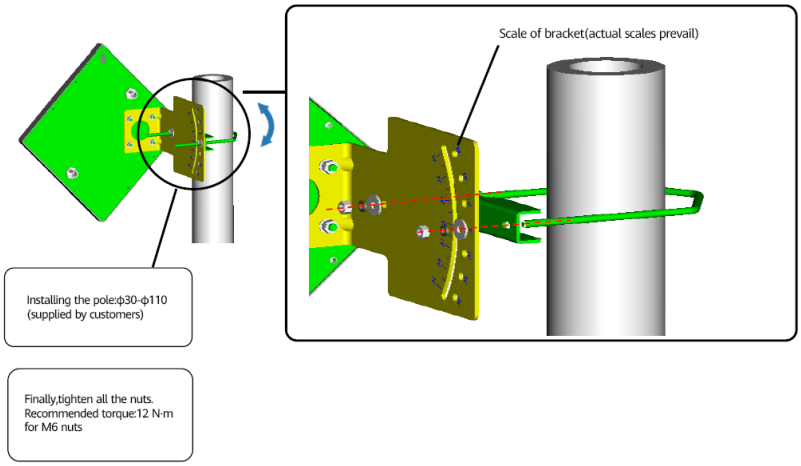
3. Adjust the mechanical downtilt angle using one of the following two methods.
   - Method 1: Adjust the angle by sliding the U-type bolt along the bracket. The pole must be kept vertical.
   - Method 2: Use the inclinometer to determine the antenna angle. Then, move the antenna to adjust its angle until the bead in the inclinometer is at the middle. This method provides precise measurements.

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4. Finally, tighten all nuts. The recommended torque is 12 N m for M6 nuts.

If the required downtilt angle is fixed, you can thread the U-type bolt through the fixing hole and graduated bracket and then tighten the nuts. The pole must be kept vertical.



Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

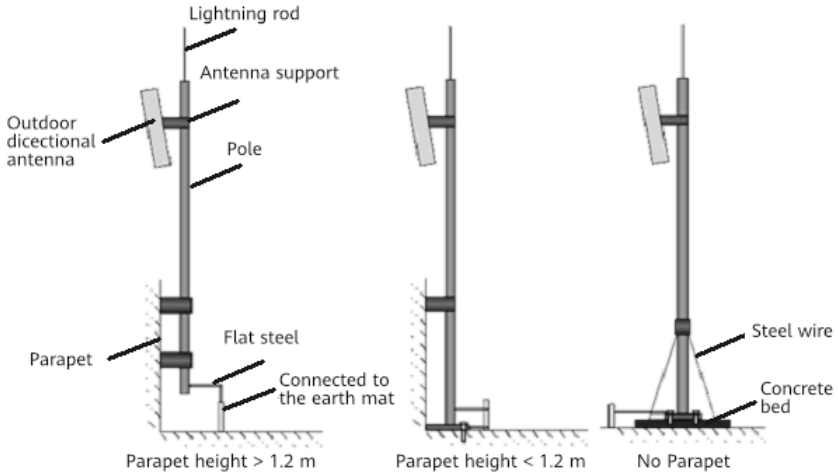
Take note of the following points when installing an outdoor directional antenna:

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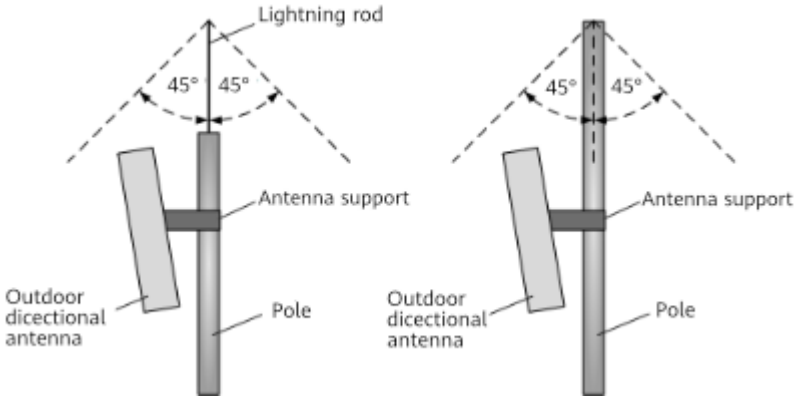
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 13-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 13-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

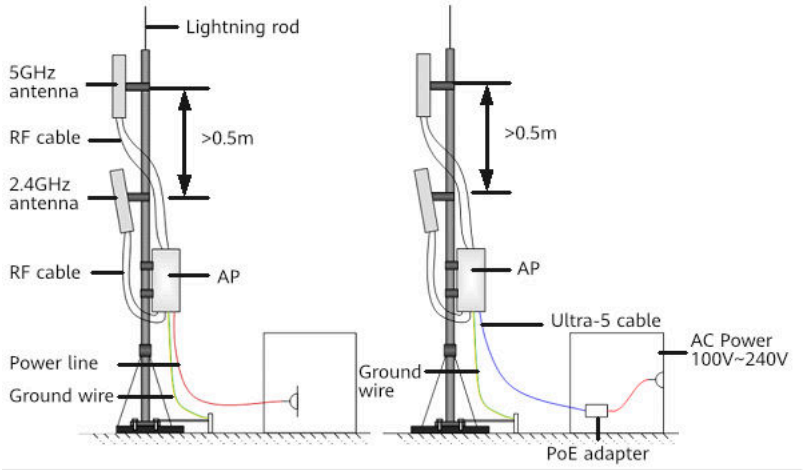
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

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Outdoor AP Installation Scenarios

Figure 13-5 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 13-5 Outdoor AP installation scenarios



13.3.3 Connecting RF Cables

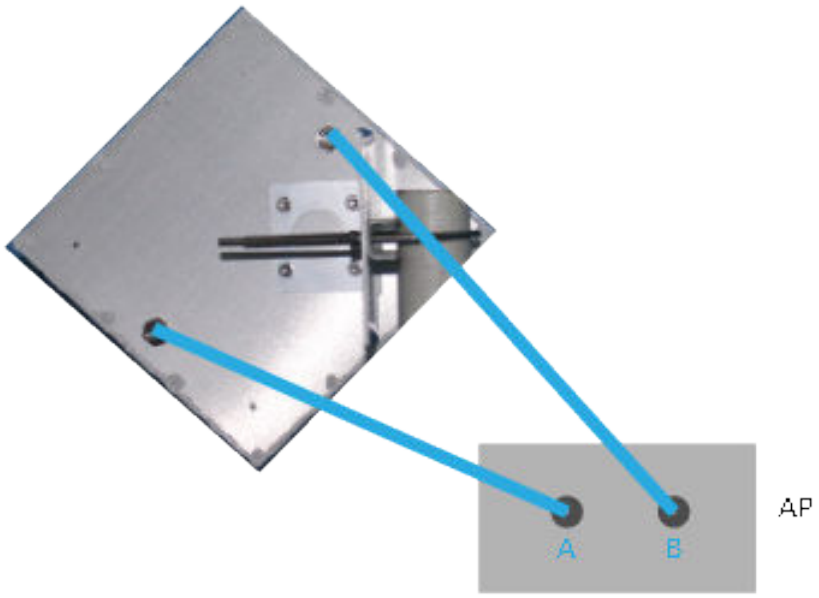
RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

  The following figure shows the cable connections.

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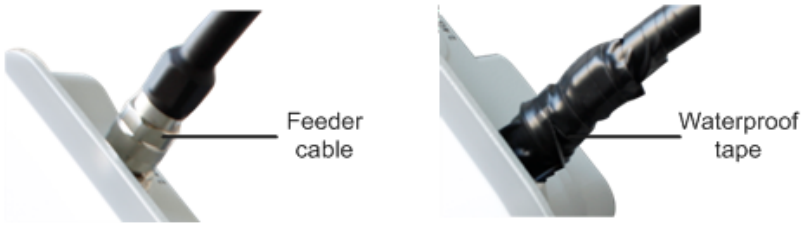


RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

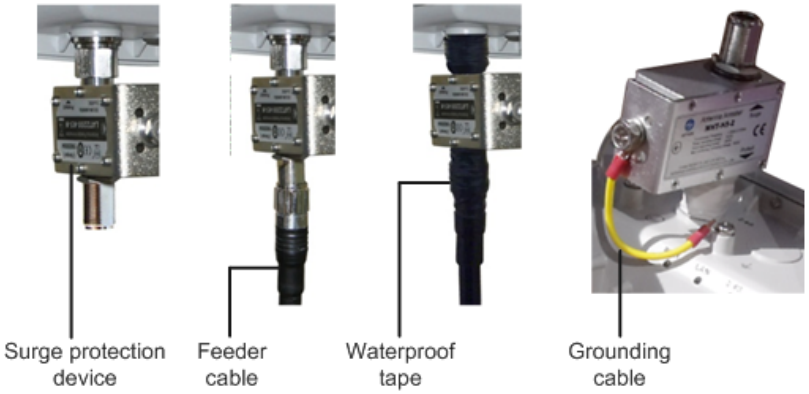


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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

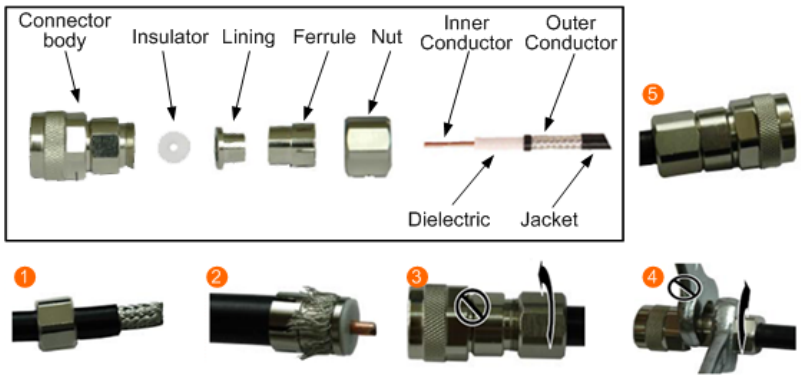
Table 13-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

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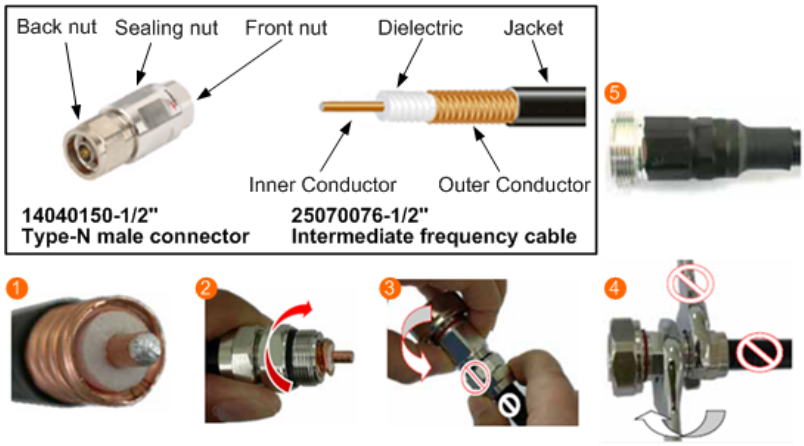
Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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14 27010898 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G16.5)

About This Chapter

14.1 27010898 Technical Specifications
14.2 27010898 Installation Precautions
14.3 27010898 Antenna Installation

14.1 27010898 Technical Specifications

Appearance and Structure

Figure 14-1 Appearance of the 27010898 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G16.5)



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Technical Specifications

Table 14-1 Technical specifications of the 27010898 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G16.5)

Item	Details
Part Number	27010898
Model	AD1760500
Description	Directional Antenna, 2400~2500MHz,>17+/-0.5dBi,60deg, +/-45deg,0r,200W,N-Female*2,with bracket,875*176*63mm
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	16.5 dBi
Coverage distance [m(ft.)]	220 m(ft.)
Horizontal beamwidth [degrees]	60 degrees
Vertical beamwidth [degrees]	7 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Cross polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 63 x 875 x 176
Weight without packaging [kg(lb)]	4.5 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ48 to ϕ135

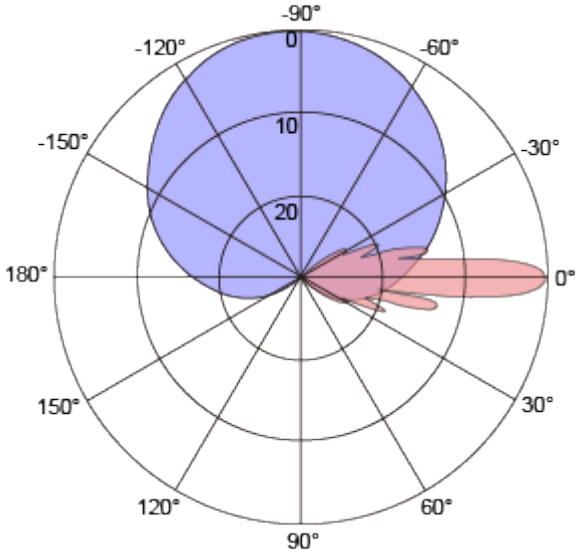
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 14-2 Antenna Pattern1 of the 27010898 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H60 V7 G16.5)



14.2 27010898 Installation Precautions

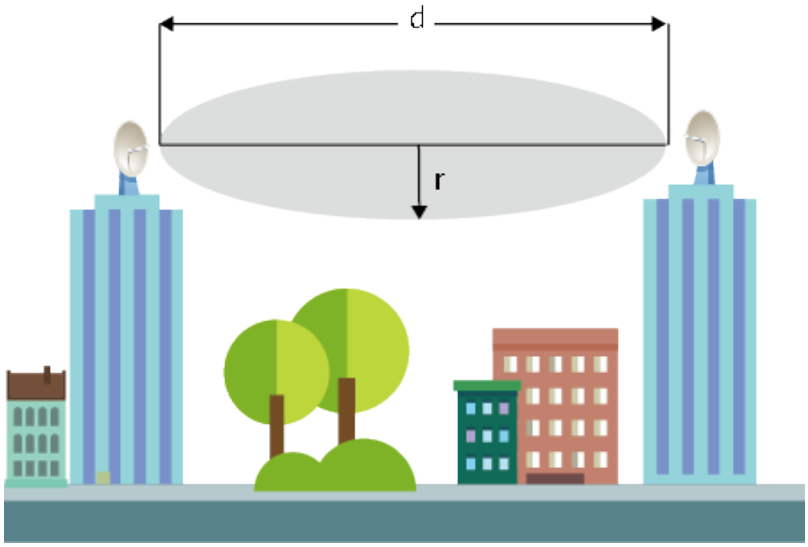
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 14-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 14-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 14-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

14.3 27010898 Antenna Installation

The 27010898 antenna is an outdoor 2.4 GHz directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

14.3.1 Accessories and Tools

Tools:

- 2 x 13 mm open-end wrench
- 2 x 17 mm open-end wrench

Pole:

- 1 x pole with a diameter of ϕ48 mm to ϕ135 mm

Other accessories:

- Connection arm: 1 PCS
- Toothed clamp: 2 PCS
- Nut

14.3.2 Pole Mounting

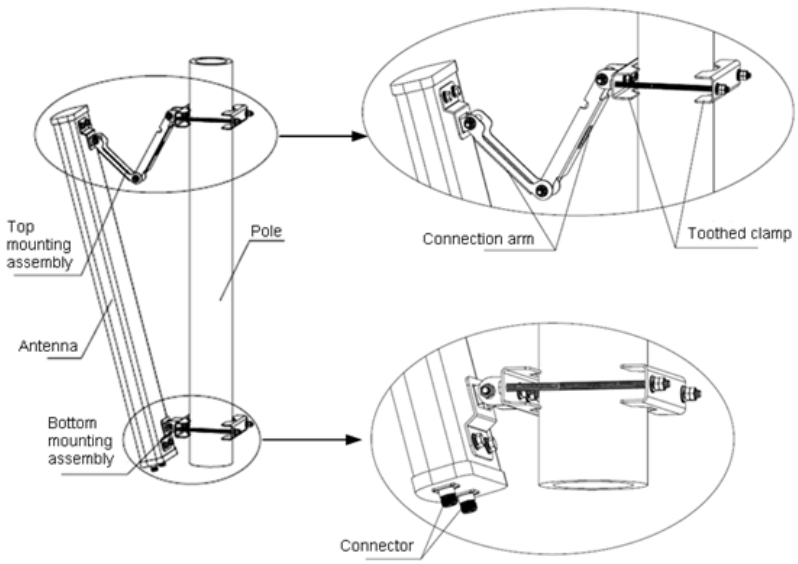
The 27010898 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

⚠ CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

Installation of the antenna



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Carry out the following steps:

1. Loosen the nut between the upper and lower arms.
2. Secure the toothed clamps at the top mounting assembly to the pole.
   a. Remove the bolts, nuts, spring washers, and flat washers from the toothed clamps.
   b. Place the toothed clamp connected to the antenna against the pole, thread the bolts through the toothed clamp, put the other toothed clamp on the bolts, and put back the flat washers, spring washers and nuts.
   c. Tighten the nuts to secure the toothed clamps (not tightly).
3. Repeat step 2 to secure the toothed clamps at the bottom mounting assembly to the pole.
4. Adjust the antenna until it is perfectly vertical (the adjustable angle is 0 degrees), adjust the toothed clamps, and then secure all the toothed clamps to the pole. Set the desired antenna tilt angle and then tighten all nuts on the top and bottom assemblies with a tightening torque of 18 N m.
5. Remove the protective cap from the antenna connector, connect the feeder cable to the connector, and tighten the connector. Thoroughly wrap the cable connector with waterproof tape. For details, see the section **Connecting RF Cables**.

NOTE

The antenna is normally tilted downward. However, you can swap over the top and bottom mounting assemblies to tilt the antenna upward to satisfy project demands.

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

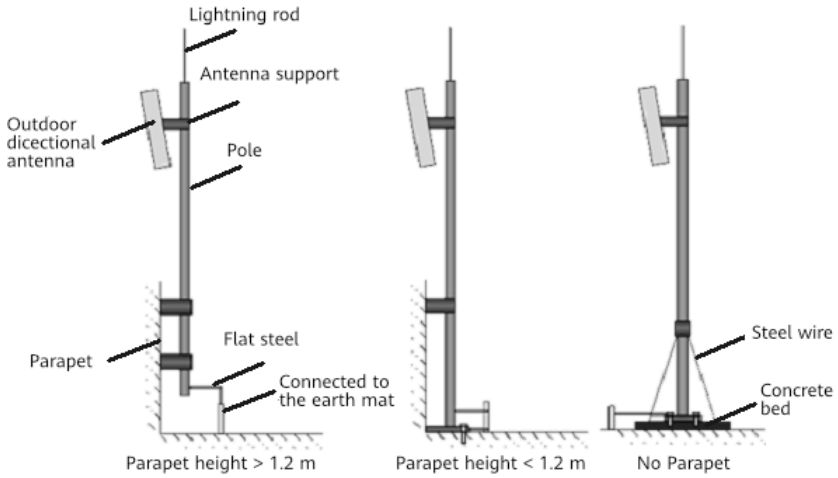
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

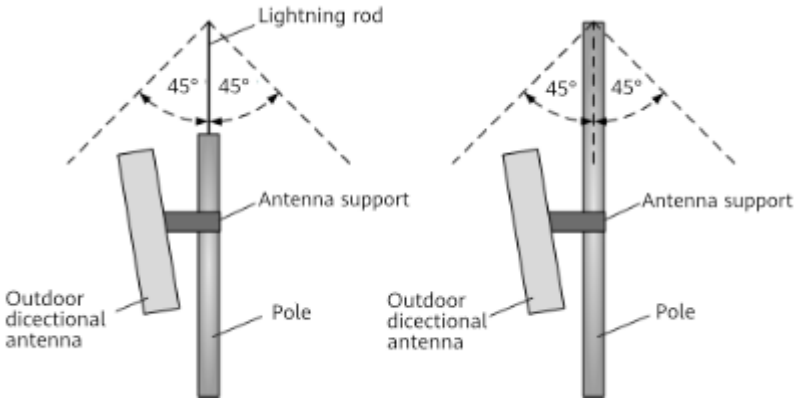
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Figure 14-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 14-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

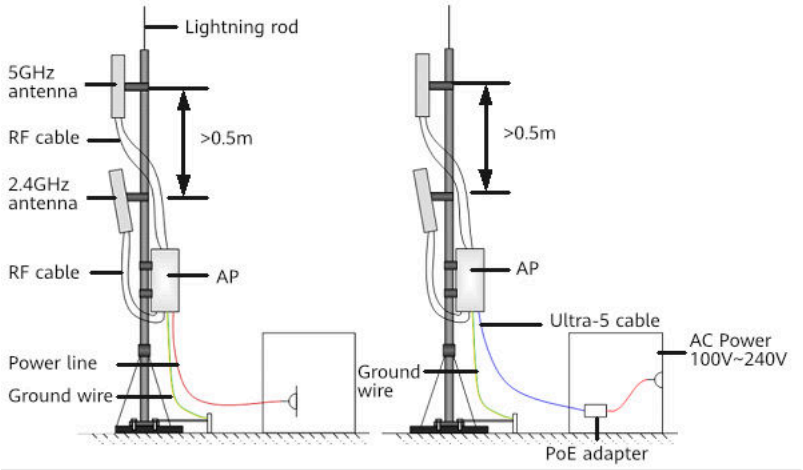
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 14-5 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

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Figure 14-5 Outdoor AP installation scenarios



14.3.3 Connecting RF Cables

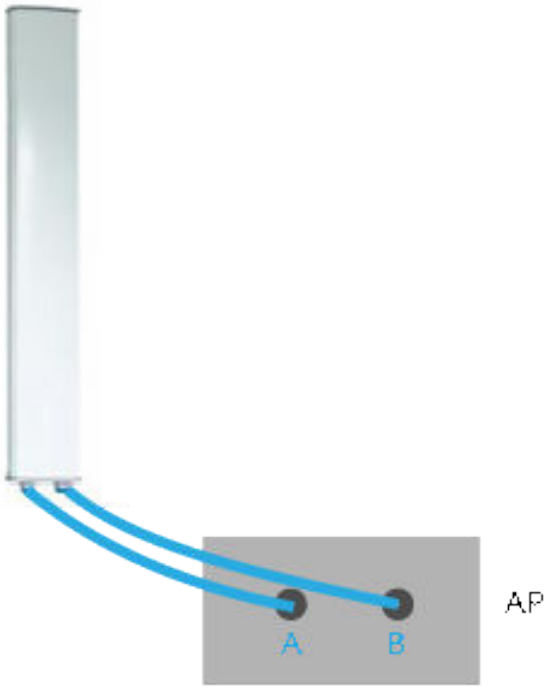
RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

  The following figure shows the cable connections.

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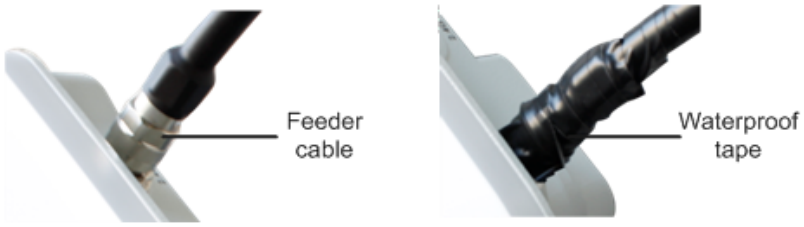


RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

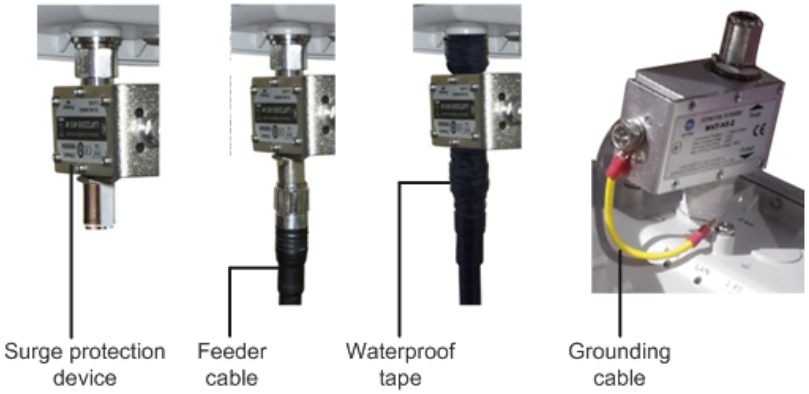


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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

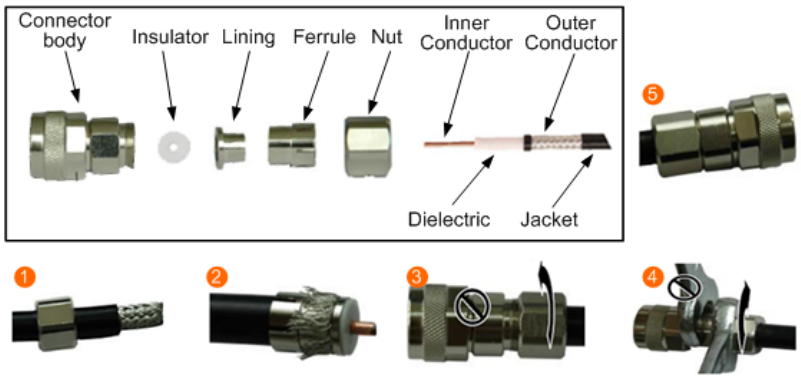
Table 14-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

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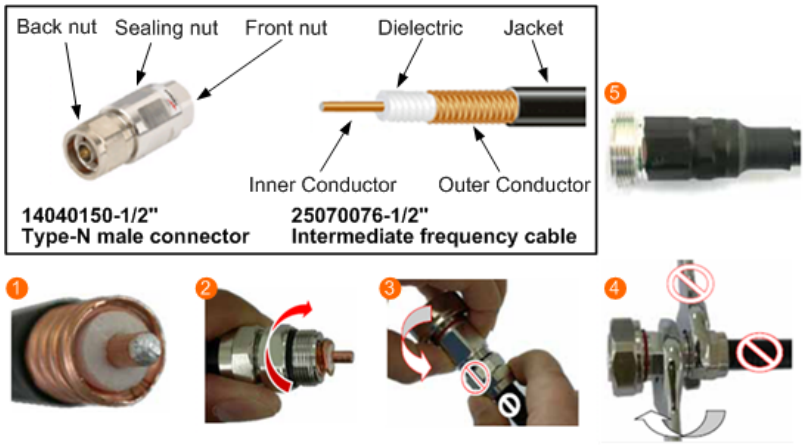
Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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15 27010902 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V6 G14.5)

About This Chapter

15.1 27010902 Technical Specifications
15.2 27010902 Installation Precautions
15.3 27010902 Antenna Installation

15.1 27010902 Technical Specifications

Appearance and Structure

Figure 15-1 Appearance of the 27010902 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V6 G14.5)



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Technical Specifications

Table 15-1 Technical specifications of the 27010902 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V6 G14.5)

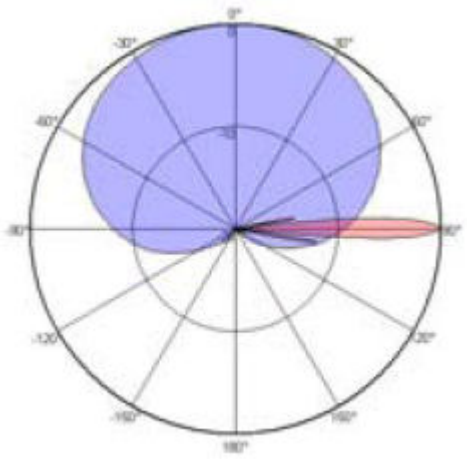
Item	Details
Part Number	27010902
Model	AD1512000
Description	Directional Antenna,2400~2500MHz, 15+/-1dBi,120deg,Vertical polarization, 0r,200W,N-Female,with bracket, 1140*114*54mm
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	14.5 dBi
Coverage distance [m(ft.)]	190 m(ft.)
Horizontal beamwidth [degrees]	120 degrees
Vertical beamwidth [degrees]	6 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Vertical polarization
Attenna connector	N-female
Attenna dimensions [mm(in.)]	H x W x D: 54 x 1140 x 114
Weight without packaging [kg(lb)]	3.4 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ48 to ϕ135

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 15-2 Antenna Pattern1 of the 27010902 Outdoor 2.4 GHz Single-Polarized Directional Antenna (H120 V6 G14.5)



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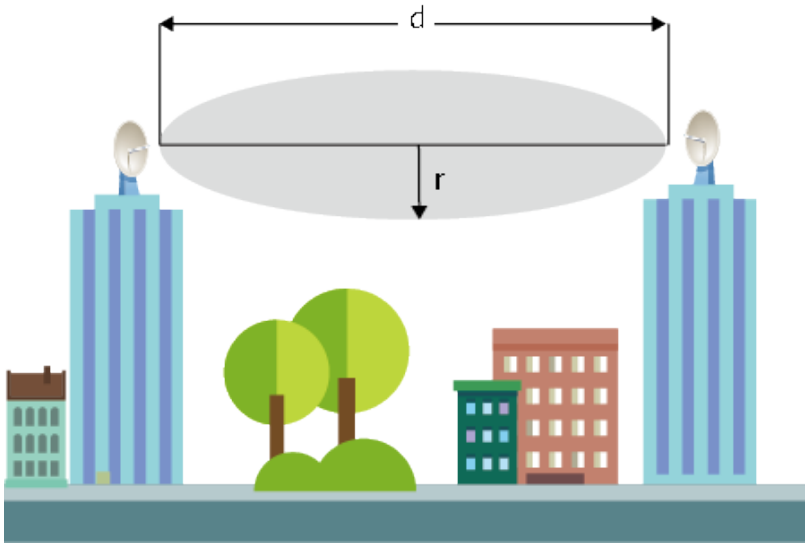
15.2 27010902 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 15-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

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- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 15-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 15-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

15.3 27010902 Antenna Installation

The 27010902 antenna is an outdoor antenna. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

15.3.1 Accessories and Tools

Tools:

- 2 x 13 mm open-end wrench

Pole:

- 1 x pole with a diameter of ϕ48 mm to ϕ135 mm

Other accessories:

- Connection arm: 1 PCS
- Toothed clamp: 2 PCS
- Nut

15.3.2 Pole Mounting

The 27010902 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

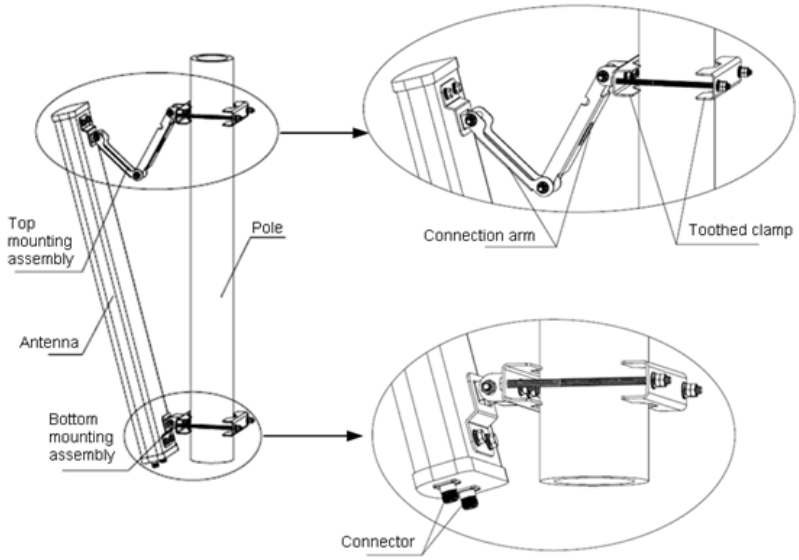
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CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

Installation of the antenna



Carry out the following steps:

1. Loosen the nut between the upper and lower arms.
2. Secure the toothed clamps at the top mounting assembly to the pole.
   a. Remove the bolts, nuts, spring washers, and flat washers from the toothed clamps.
   b. Place the toothed clamp connected to the antenna against the pole, thread the bolts through the toothed clamp, put the other toothed clamp on the bolts, and put back the flat washers, spring washers and nuts.
   c. Tighten the nuts to secure the toothed clamps (not tightly).
3. Repeat step 2 to secure the toothed clamps at the bottom mounting assembly to the pole.
4. Adjust the antenna until it is perfectly vertical (the adjustable angle is 0 degrees), adjust the toothed clamps, and then secure all the toothed clamps to the pole. Set the desired antenna tilt angle and then tighten all nuts on the top and bottom assemblies with a tightening torque of 18 N m.
5. Remove the protective cap from the antenna connector, connect the feeder cable to the connector, and tighten the connector. Thoroughly wrap the cable connector with waterproof tape. For details, see the section **Connecting RF Cables**.

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NOTE

The antenna is normally tilted downward. However, you can swap over the top and bottom mounting assemblies to tilt the antenna upward to satisfy project demands.

Installing the Pole and Lightning Rod

Carry out the following steps:

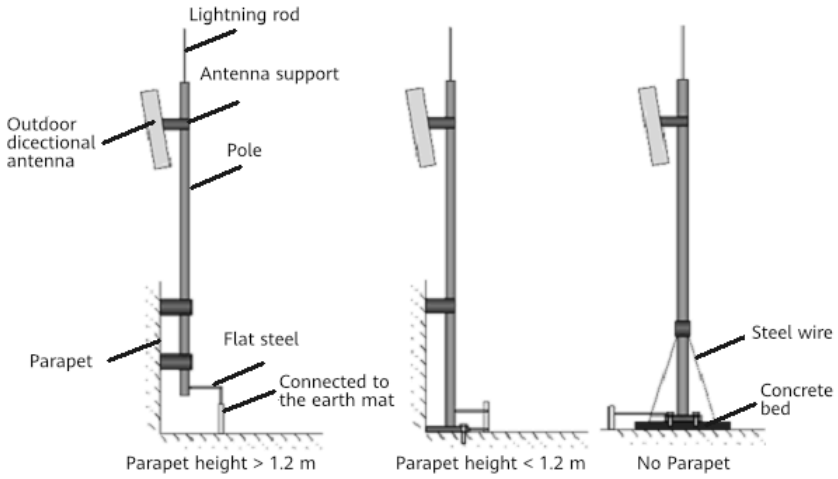
1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

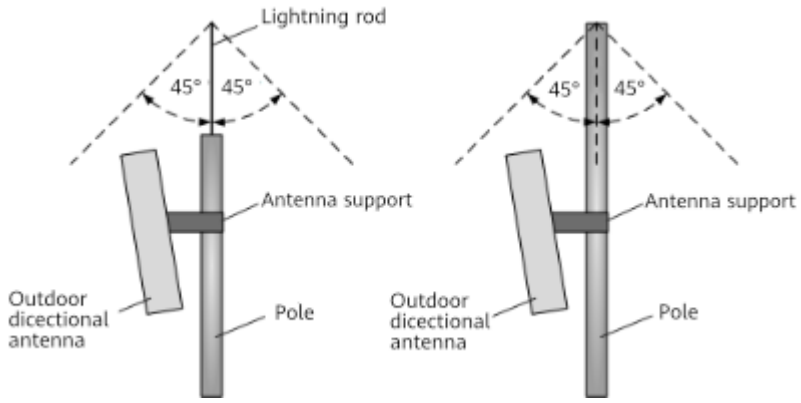
Figure 15-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 15-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.

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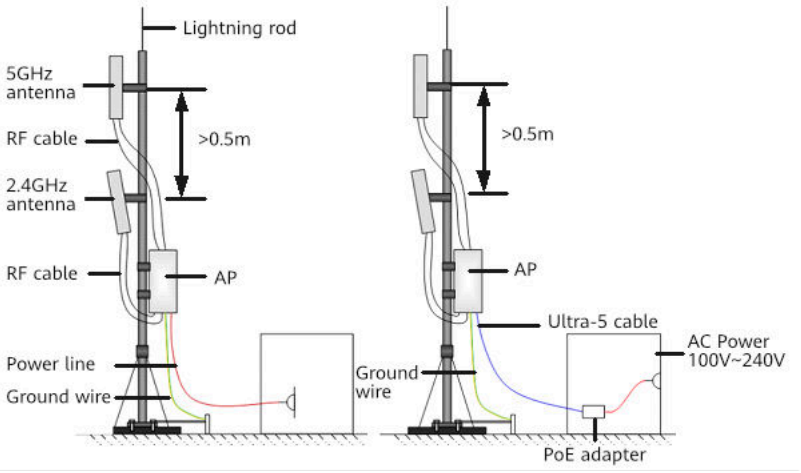
NOTE

If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 15-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

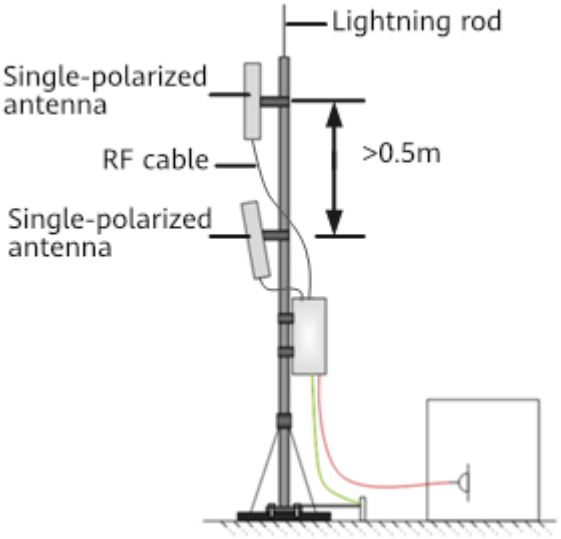
Figure 15-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in Figure 15-6.

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Figure 15-6 Installation of single-polarized antennas



15.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface.

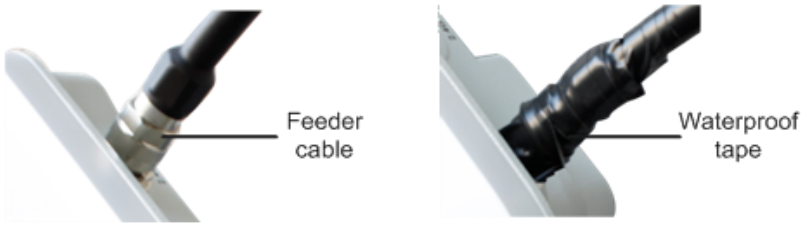
RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

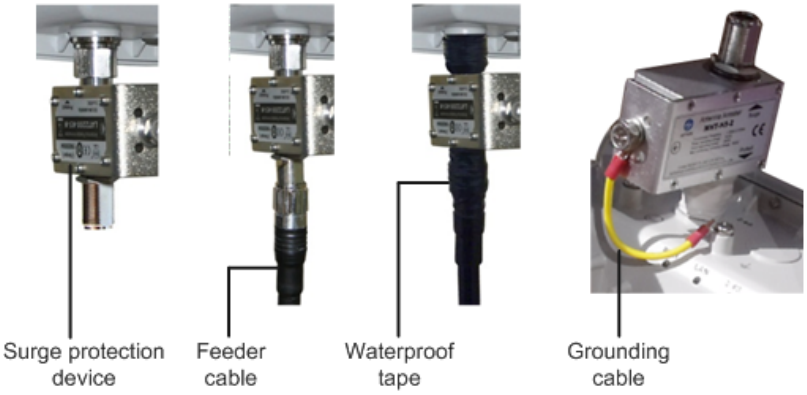
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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

Table 15-3 Coaxial cables and connectors

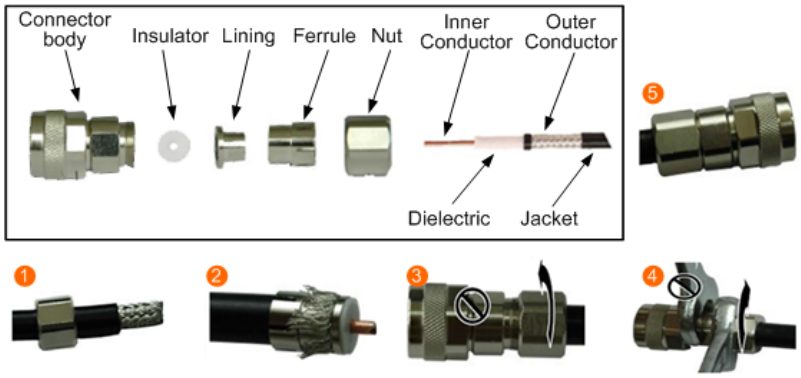
Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	

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Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

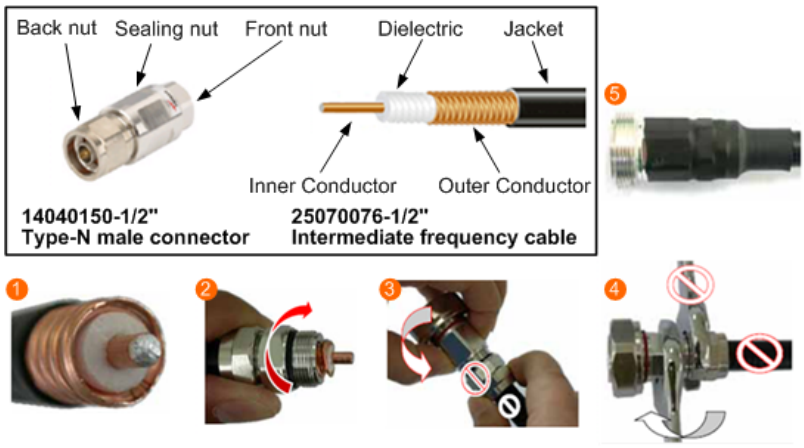
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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16 27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)

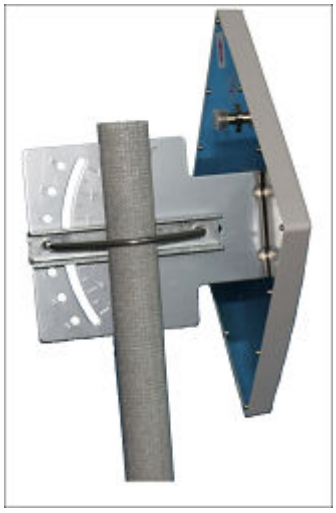
About This Chapter

16.1 27010904 Technical Specifications
16.2 27010904 Installation Precautions
16.3 27010904 Antenna Installation

16.1 27010904 Technical Specifications

Appearance and Structure

Figure 16-1 Appearance of the 27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)



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Technical Specifications

Table 16-1 Technical specifications of the 27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)

Item	Details
Part Number	27010904
Model	AD24145D00
Description	Directional Antenna,2400~2500MHz, 14dBi,30deg,+/-45deg,0r,5W,with bracket,N-Female*2,250*250*25mm
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	14 dBi
Coverage distance [m(ft.)]	180 m(ft.)
Horizontal beamwidth [degrees]	30 degrees
Vertical beamwidth [degrees]	30 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Cross polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 25 x 250 x 250
Weight without packaging [kg(lb)]	0.6 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ30 to ϕ114

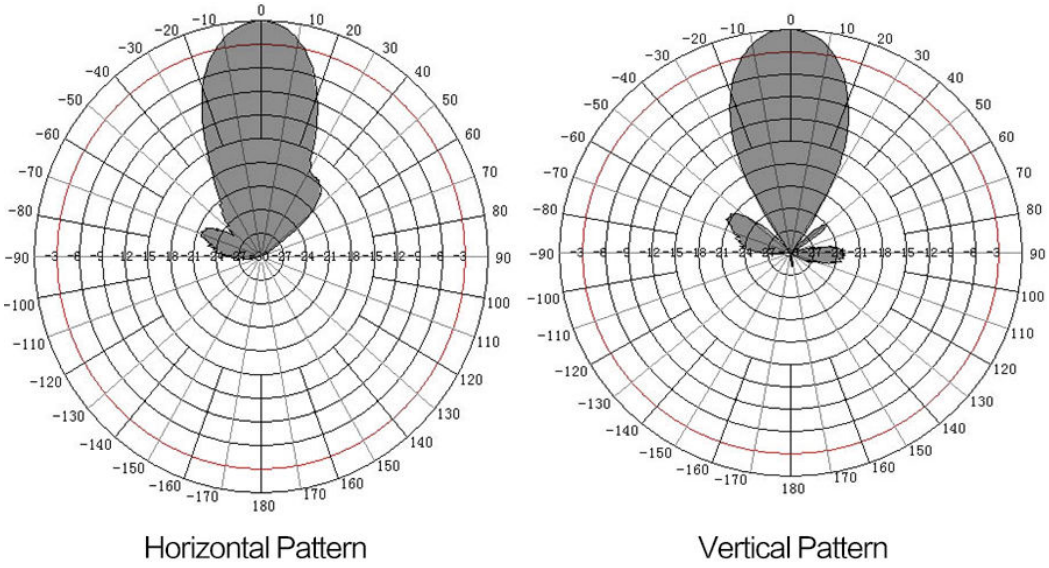
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 16-2 Antenna Pattern1 of the 27010904 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H30 V30 G14)



16.2 27010904 Installation Precautions

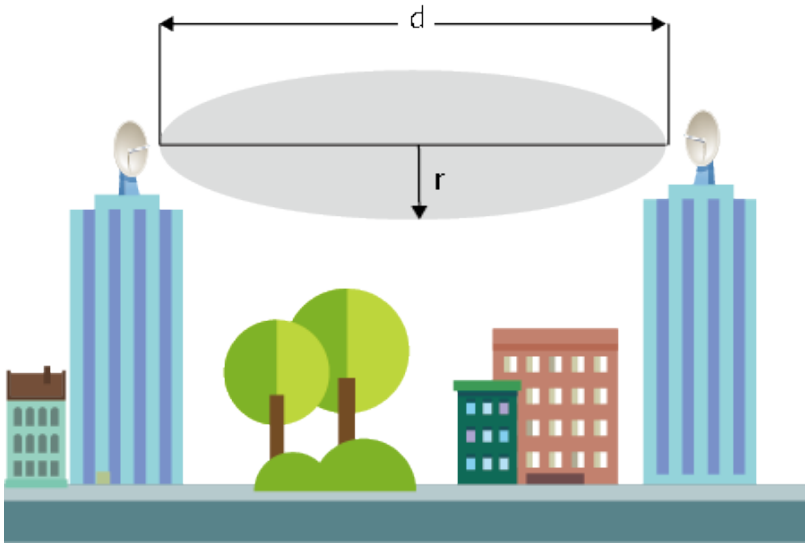
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 16-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 16-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 16-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

16.3 27010904 Antenna Installation

The 27010904 antenna is an outdoor 2.4 GHz directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

16.3.1 Accessories and Tools

Tools:

- 1 x 10 mm combination wrench



- 1 x inclinometer

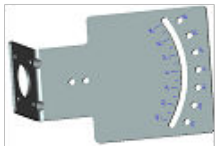


Pole:

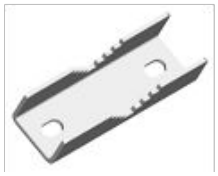
- 1 x pole with a diameter of ϕ30 mm to ϕ114 mm

Antenna support assembly:

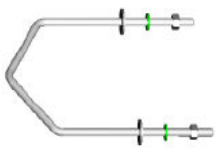
- Installation bracket: 1 PCS



- Toothed clamp: 1 PCS



- U-type bolt: 1 PCS



- Nut



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16.3.2 Pole Mounting

The 27010904 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

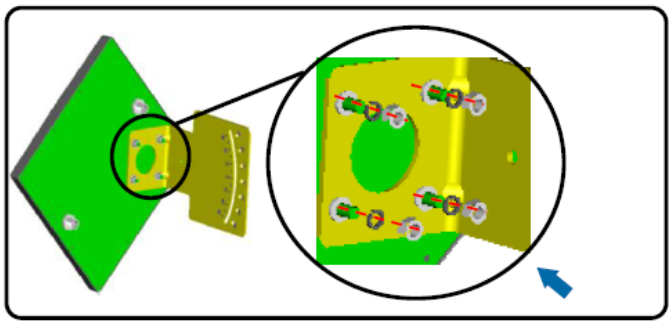
⚠ CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

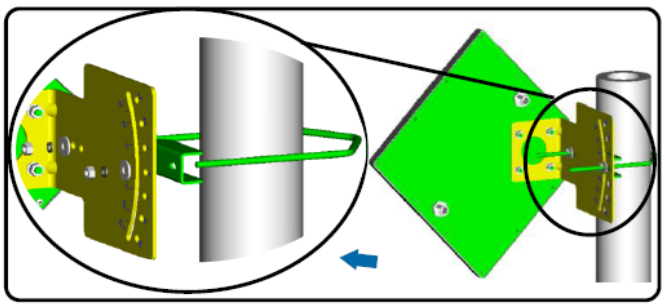
Fixing the Antenna to the Pole

Carry out the following steps:

1. Fix the installation bracket to the antenna using the nut, spring washer, and flat washer.

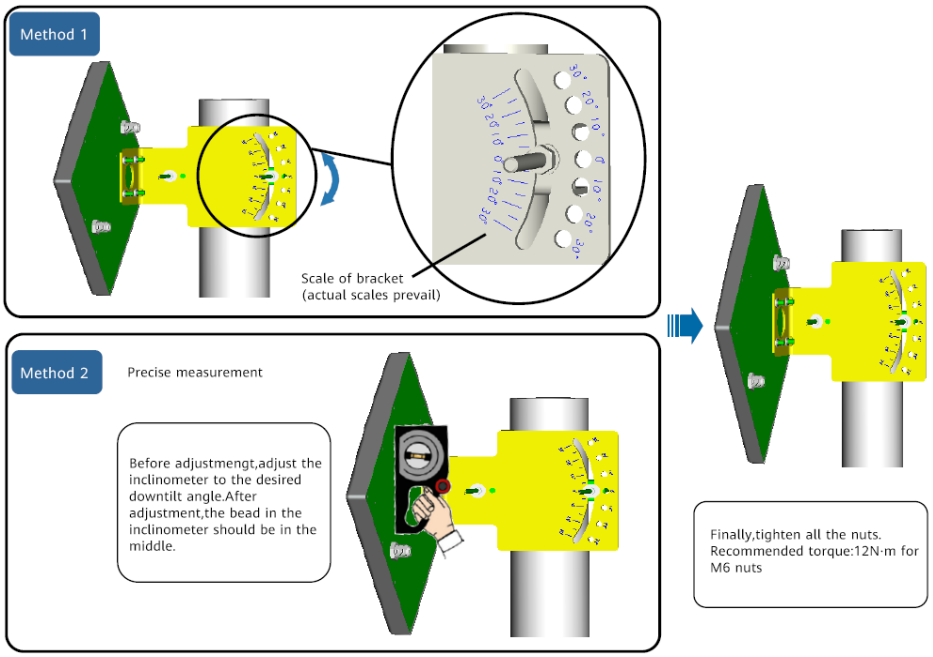


2. Secure the installation bracket, toothed clamp and U-type bolt on the pole. Thread the U-type bolt through the fixing hole and graduated bracket and then tighten screws, nuts, flat washers, and spring washers on both ends of the U-type bolt (not tightly), as shown in the following figure.



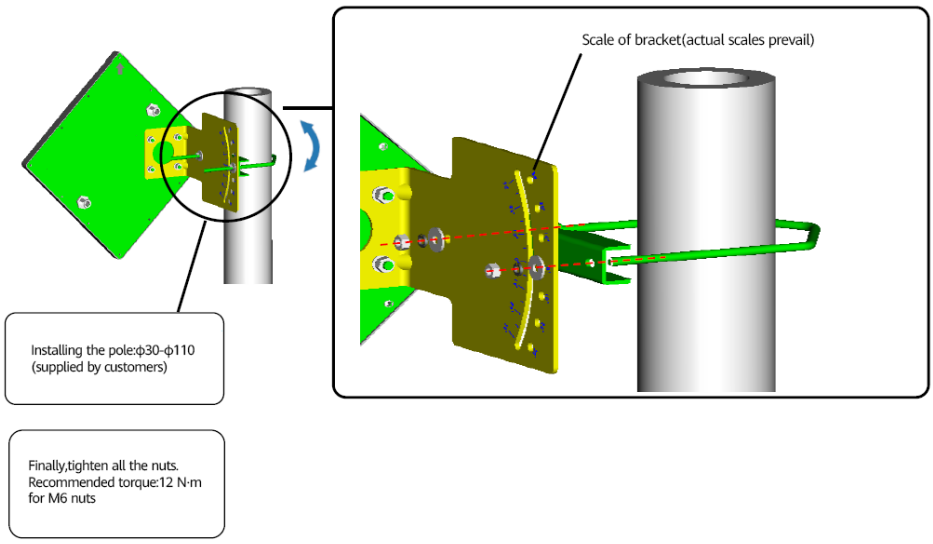
3. Adjust the mechanical downtilt angle using one of the following two methods.
   - Method 1: Adjust the angle by sliding the U-type bolt along the bracket. The pole must be kept vertical.
   - Method 2: Use the inclinometer to determine the antenna angle. Then, move the antenna to adjust its angle until the bead in the inclinometer is at the middle. This method provides precise measurements.

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4. Finally, tighten all nuts. The recommended torque is 12 N m for M6 nuts.

If the required downtilt angle is fixed, you can thread the U-type bolt through the fixing hole and graduated bracket and then tighten the nuts. The pole must be kept vertical.



Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

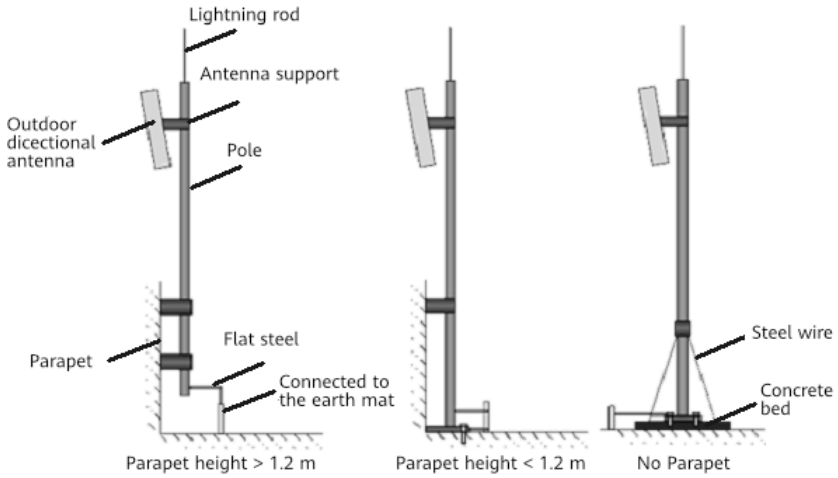
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Take note of the following points when installing an outdoor directional antenna:

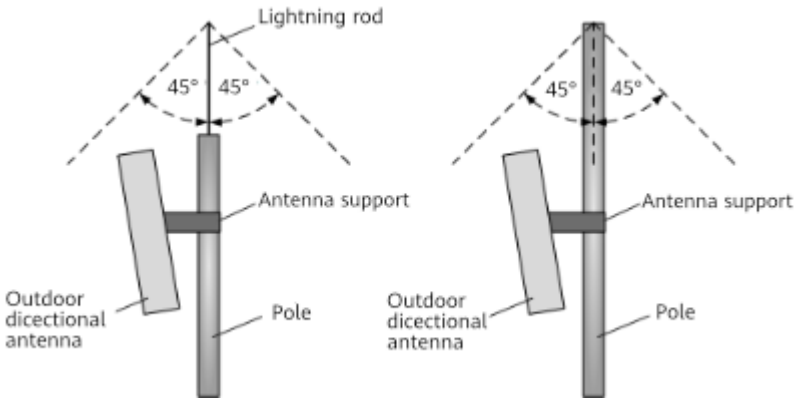
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 16-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 16-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

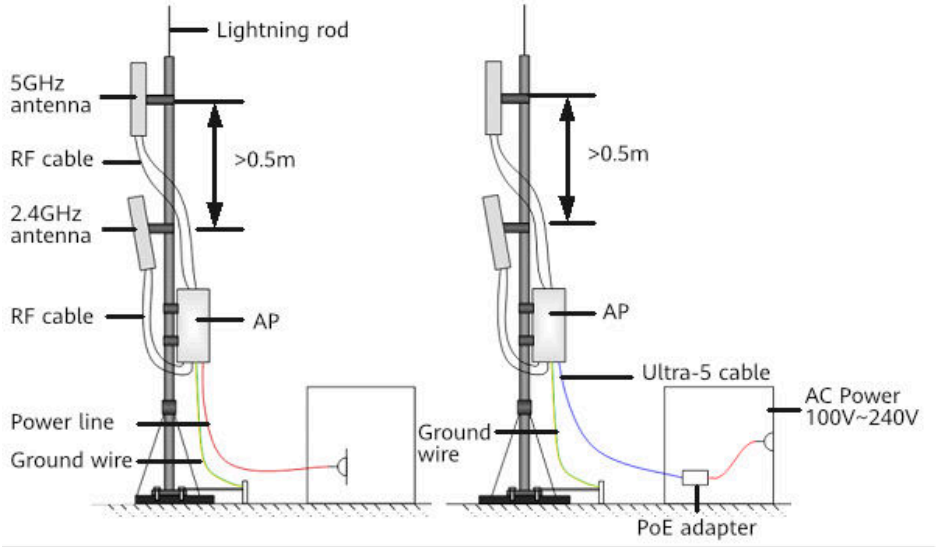
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

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Outdoor AP Installation Scenarios

Figure 16-5 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 16-5 Outdoor AP installation scenarios



16.3.3 Connecting RF Cables

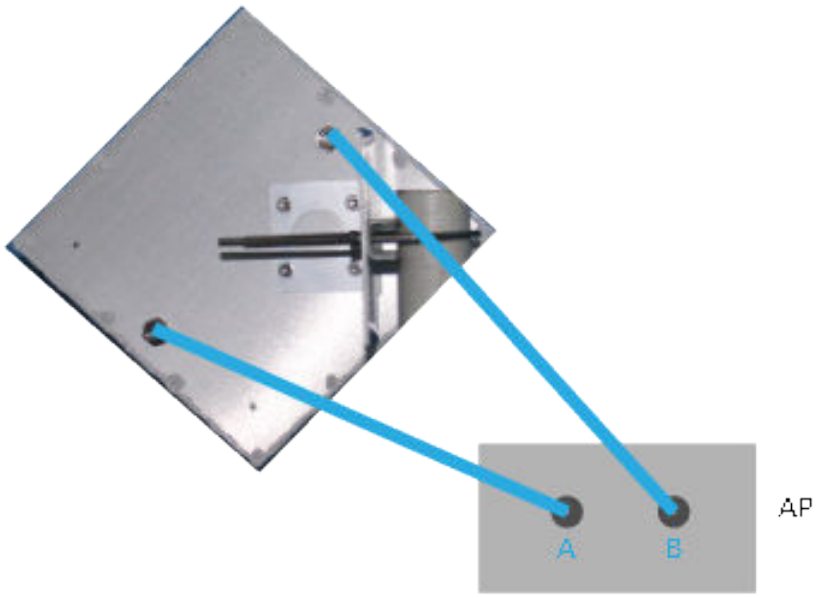
RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

  The following figure shows the cable connections.

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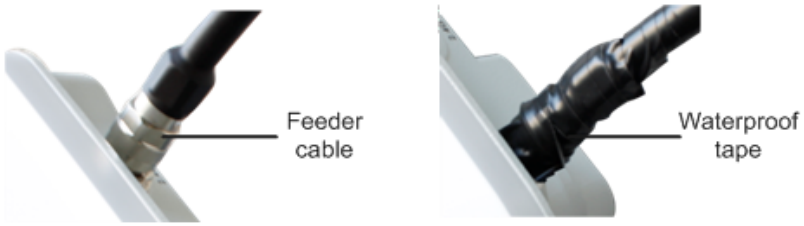


RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

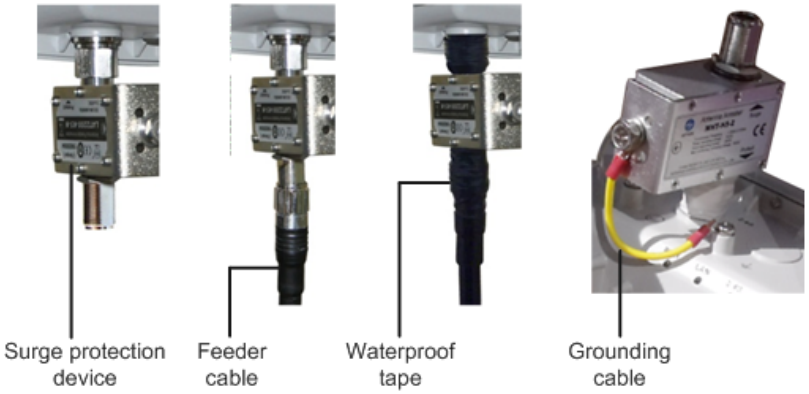


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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

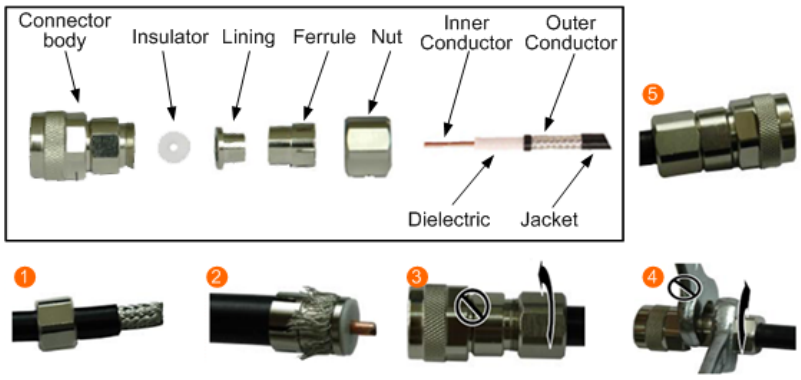
Table 16-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

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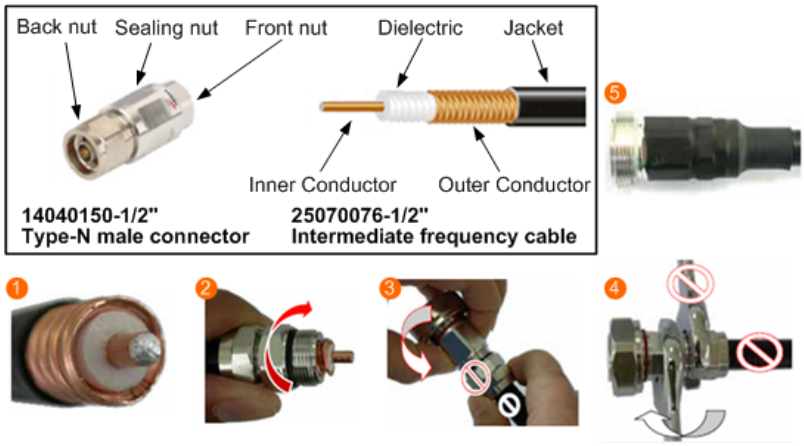
Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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17 27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)

About This Chapter

17.1 27010906 Technical Specifications
17.2 27010906 Installation Precautions
17.3 27010906 Antenna Installation

17.1 27010906 Technical Specifications

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Appearance and Structure

Figure 17-1 Appearance of the 27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)



Technical Specifications

Table 17-1 Technical specifications of the 27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)

Item	Details
Part Number	27010906
Model	AD515145D00
Description	Directional Antenna,5150~5850MHz, 14dBi,30deg,+/-45deg,0r,5W,with bracket,N-Female*2
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	14 dBi
Coverage distance [m(ft.)]	140 m(ft.)
Horizontal beamwidth [degrees]	32 degrees
Vertical beamwidth [degrees]	32 degrees
Standing wave ratio (SWR)	≤ 1.8
Polarization	Cross polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 25 x 220 x 120

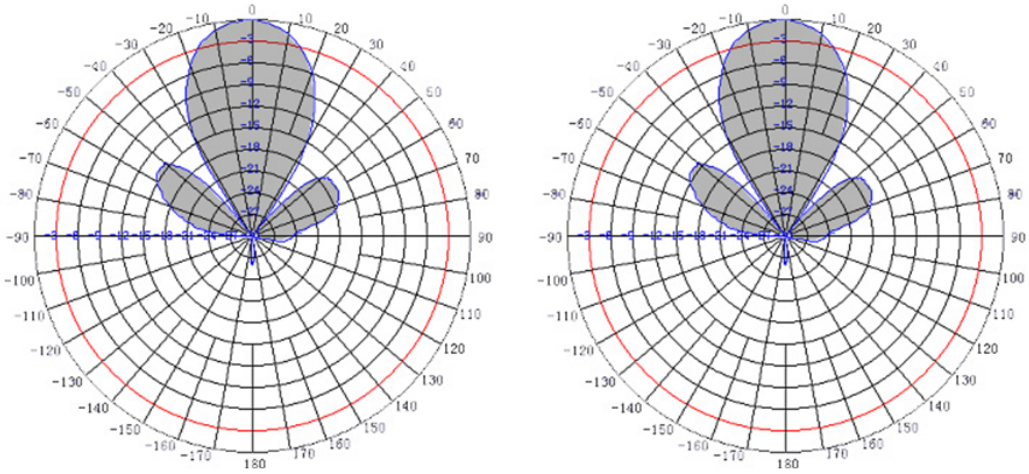
Copyright © Huawei Technologies Co., Ltd.

Item	Details
Weight without packaging [kg(lb)]	0.8 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ30 to ϕ114
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 17-2 Antenna Pattern1 of the 27010906 Outdoor 5 GHz Dual-Polarized Directional Antenna (H32 V32 G14)



17.2 27010906 Installation Precautions

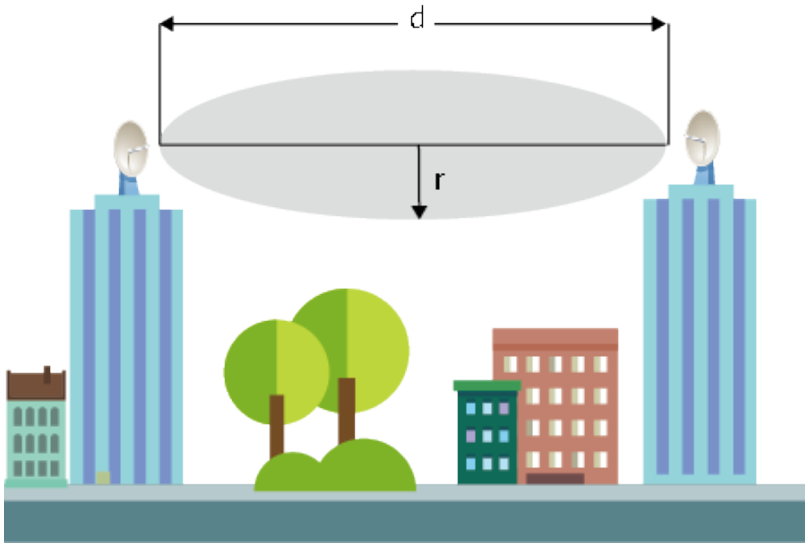
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 17-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 17-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 17-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

17.3 27010906 Antenna Installation

The 27010906 antenna is an outdoor 5 GHz directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

17.3.1 Accessories and Tools

Tools:

- 1 x 10 mm combination wrench



- 1 x inclinometer

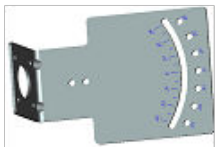


Pole:

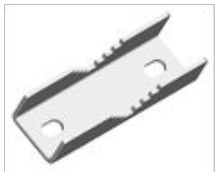
- 1 x pole with a diameter of ϕ30 mm to ϕ114 mm

Antenna support assembly:

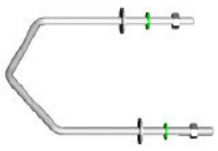
- Installation bracket: 1 PCS



- Toothed clamp: 1 PCS



- U-type bolt: 1 PCS



- Nut



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17.3.2 Pole Mounting

The 27010906 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

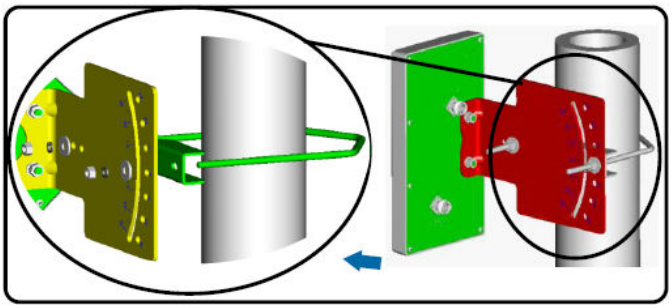
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

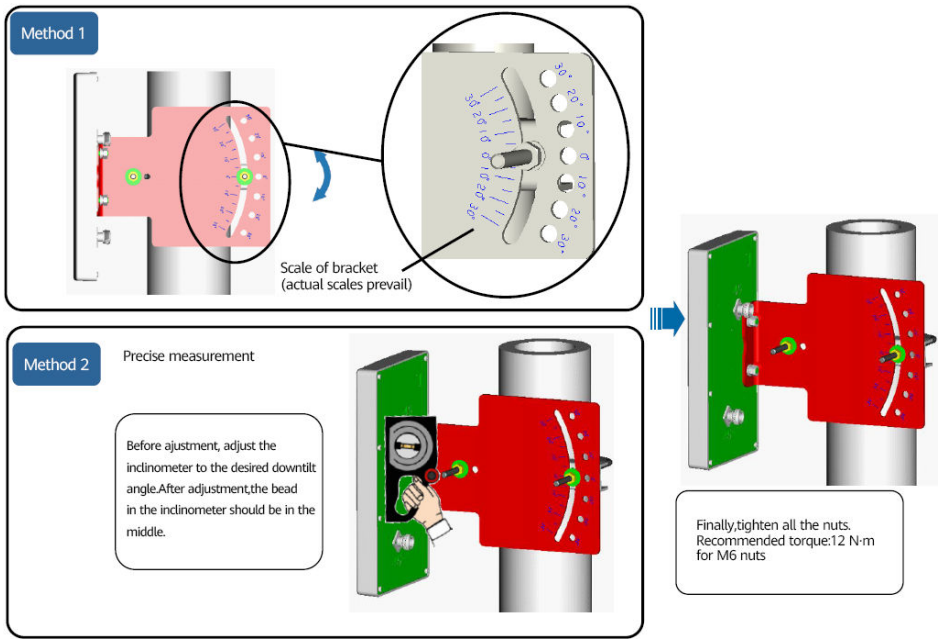
Carry out the following steps:

1. Fix the installation bracket to the antenna using the nut, spring washer, and flat washer.
2. Secure the installation bracket, toothed clamp and U-type bolt on the pole. Thread the U-type bolt through the fixing hole and graduated bracket and then tighten screws, nuts, flat washers, and spring washers on both ends of the U-type bolt (not tightly), as shown in the following figure.



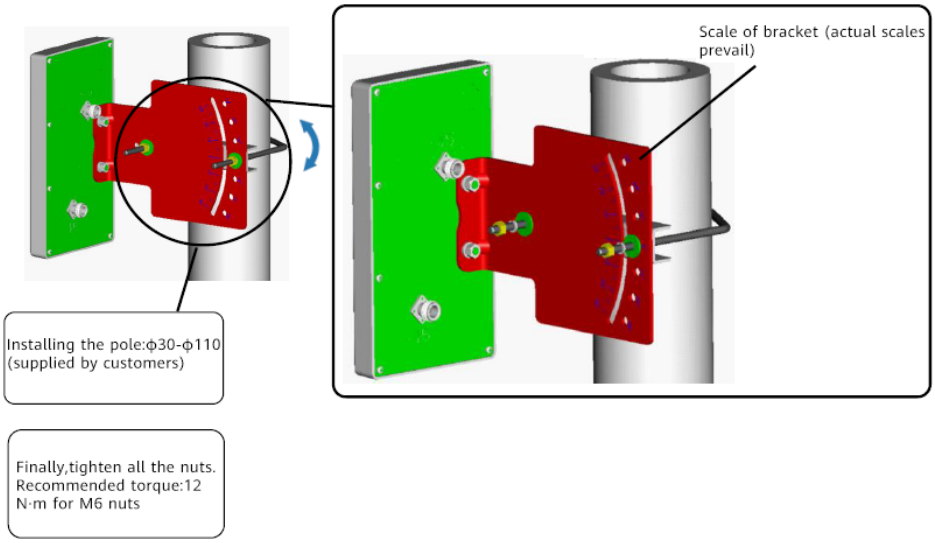
3. Adjust the mechanical downtilt angle using one of the following two methods.
   - Method 1: Adjust the angle by sliding the U-type bolt along the bracket. The pole must be kept vertical.
   - Method 2: Use the inclinometer to determine the antenna angle. Then, move the antenna to adjust its angle until the bead in the inclinometer is at the middle. This method provides precise measurements.

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4. Finally, tighten all nuts. The recommended torque is 12 N m for M6 nuts.

If the required downtilt angle is fixed, you can thread the U-type bolt through the fixing hole and graduated bracket and then tighten the nuts. The pole must be kept vertical.



Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

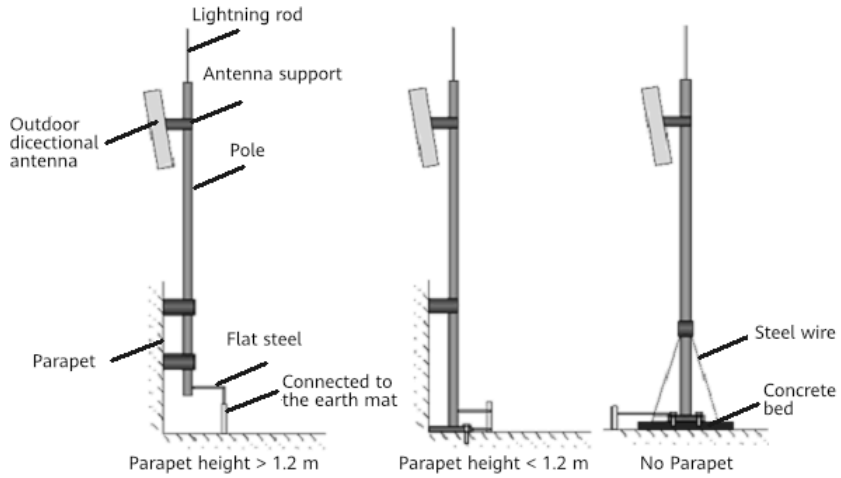
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Take note of the following points when installing an outdoor directional antenna:

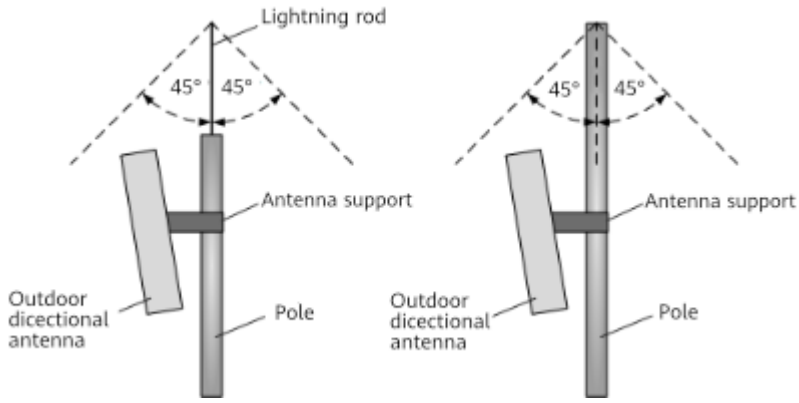
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 17-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 17-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

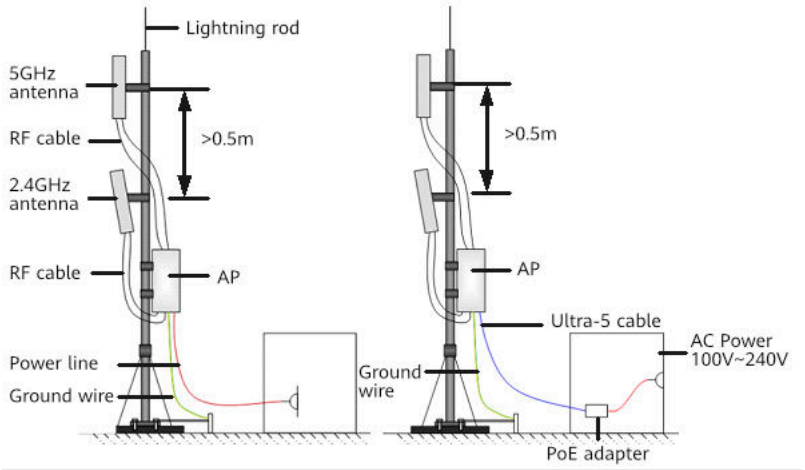
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

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Outdoor AP Installation Scenarios

Figure 17-5 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 17-5 Outdoor AP installation scenarios



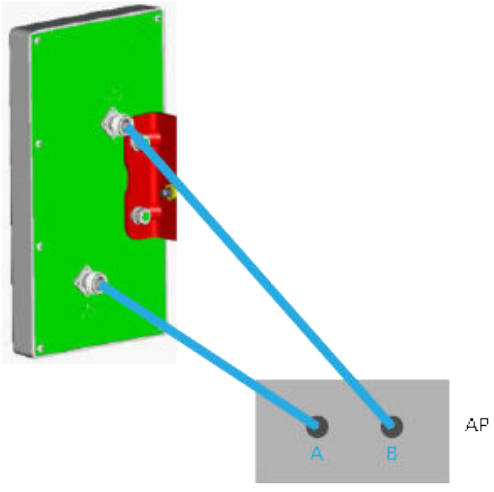
17.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

  The following figure shows the cable connections.



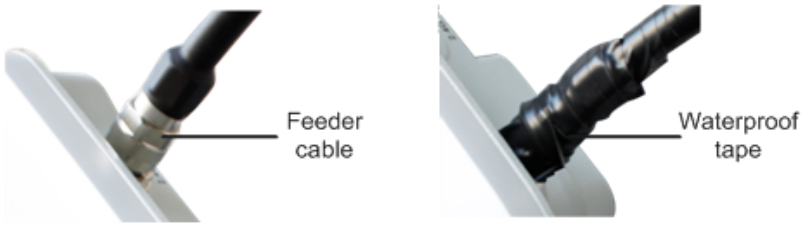
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RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

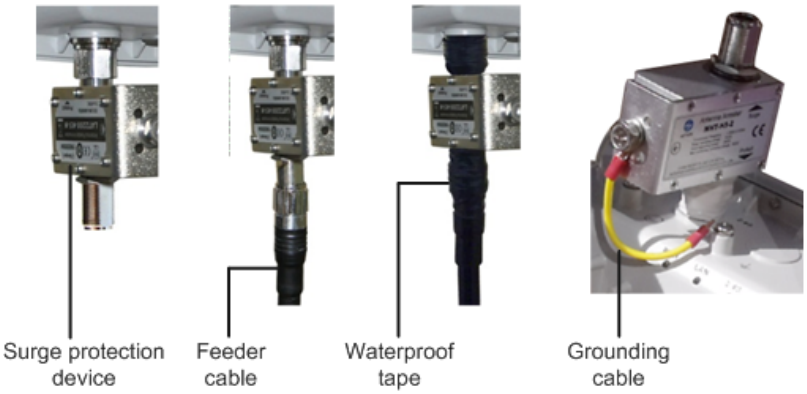
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

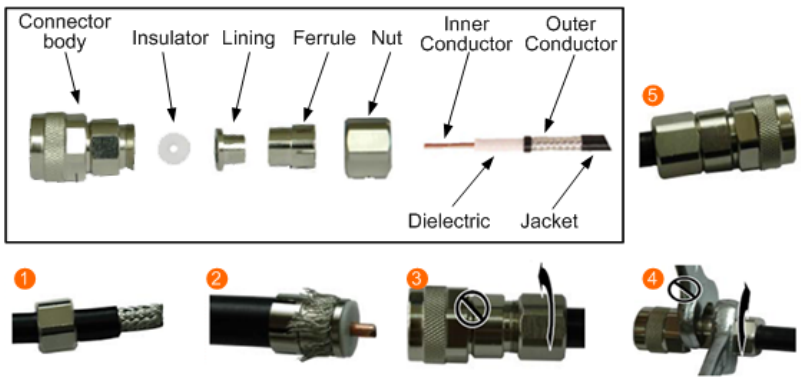
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Table 17-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

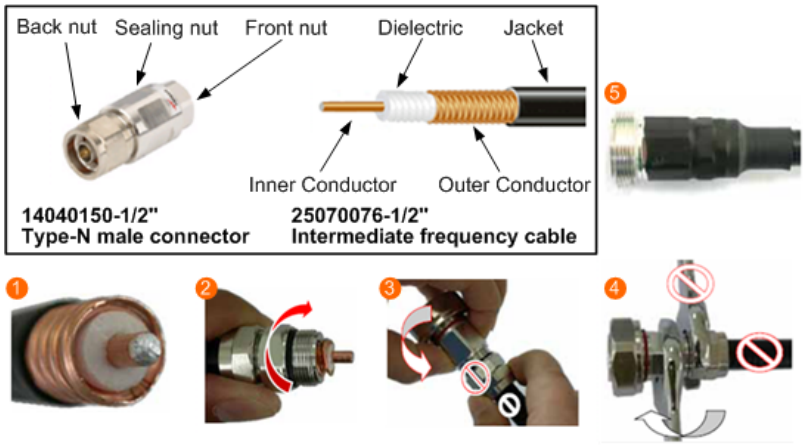
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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18 27010912 Outdoor 5 GHz Single-Polarized Directional Antenna (H100 V5.5 G16)

About This Chapter

18.1 27010912 Technical Specifications
18.2 27010912 Installation Precautions
18.3 27010912 Antenna Installation

18.1 27010912 Technical Specifications

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Appearance and Structure

Figure 18-1 Appearance of the 27010912 Outdoor 5 GHz Single-Polarized Directional Antenna (H100 V5.5 G16)



Technical Specifications

Table 18-1 Technical specifications of the 27010912 Outdoor 5 GHz Single-Polarized Directional Antenna (H100 V5.5 G16)

Item	Details
Part Number	27010912
Model	AD5151200
Description	Directional Antenna,5150~5850MHz, 15+/-1dBi,110deg,Vertical polarization, 0r,200W,N-Female,with bracket, 547*250*18mm
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	16 dBi
Coverage distance [m(ft.)]	170 m(ft.)
Horizontal beamwidth [degrees]	100 degrees
Vertical beamwidth [degrees]	5.5 degrees
Standing wave ratio (SWR)	≤ 1.7
Polarization	Vertical polarization

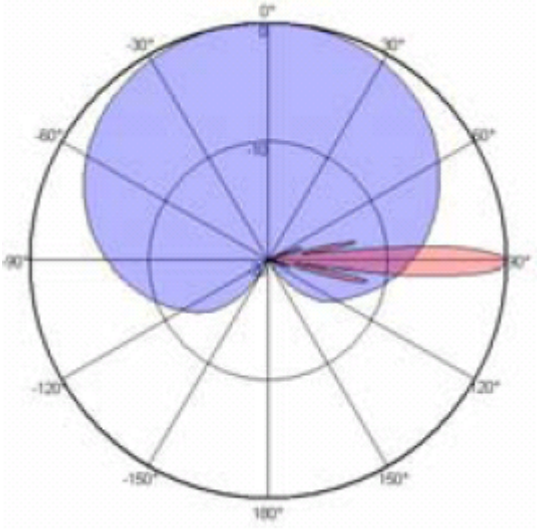
Copyright © Huawei Technologies Co., Ltd.

Item	Details
Attenna connector	N-female
Attenna dimensions [mm(in.)]	H x W x D: 18 x 547 x 250
Weight without packaging [kg(lb)]	1.8 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ48 to ϕ135
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 18-2 Antenna Pattern1 of the 27010912 Outdoor 5 GHz Single-Polarized Directional Antenna (H100 V5.5 G16)



18.2 27010912 Installation Precautions

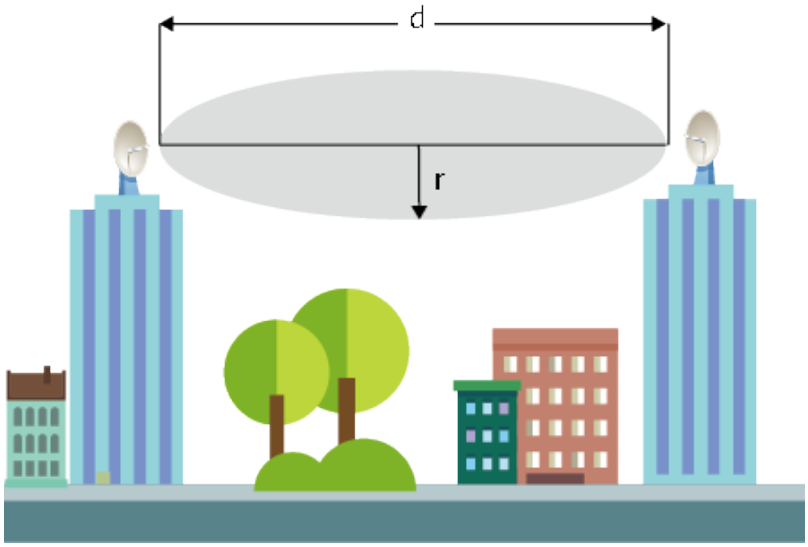
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 18-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 18-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 18-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

18.3 27010912 Antenna Installation

The 27010912 antenna is an outdoor 5 GHz directional antenna that provides high gains. To obtain a better performance and wider coverage, the antenna should be

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installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

18.3.1 Accessories and Tools

Tools:

- 2 x 13 mm open-end wrench
- 1 x 10 mm open-end wrench

Pole:

- 1 x pole with a diameter of ϕ48 mm to ϕ135 mm

Other accessories:

- Installation bracket: 1 PCS
- Antenna support: 1 PCS
- Toothed clamp: 1 PCS

18.3.2 Pole Mounting

The 27010912 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

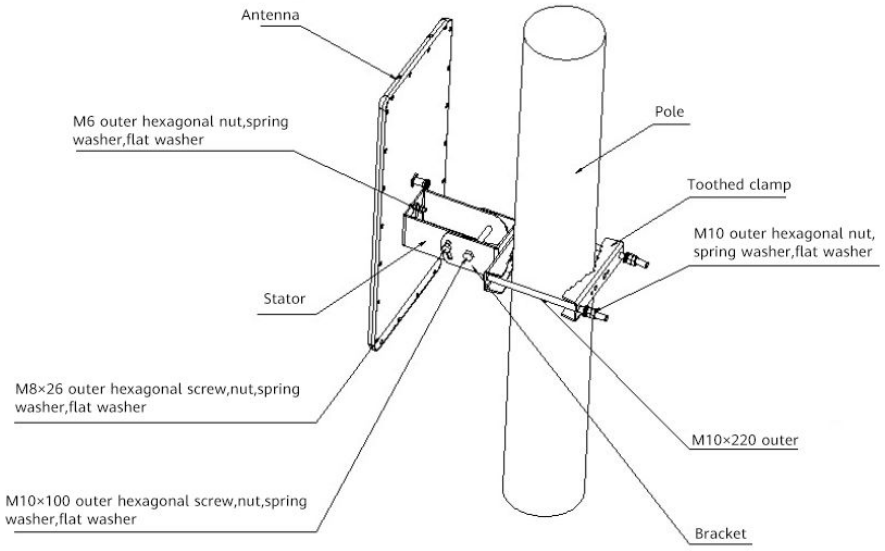
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

Installation of the antenna

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Carry out the following steps:

1. Fix the installation bracket to the antenna using the M6 nut, spring washer, and flat washer with a tightening torque of 9 N m.
2. Fix the antenna support to a toothed clamp using the M8 bolt, nut, spring washer, and flat washer (not tightly).
3. Place the installation bracket of the antenna on the antenna support, thread the M10x100 bolt through the fixing hole, and tighten the nut, spring washer, and flat washer to secure the installation bracket.
4. Thread the M8x25 bolt through the graduated bracket to adjust the downtilt angle of the antenna. After the angle is fixed, tighten all nuts with a tightening torque of 18 N m.
5. Remove the protective cap from the antenna connector, connect the feeder cable to the connector, and tighten the connector. Thoroughly wrap the cable connector with waterproof tape. For details, see the section **Connecting RF Cables**.

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

Take note of the following points when installing an outdoor directional antenna:

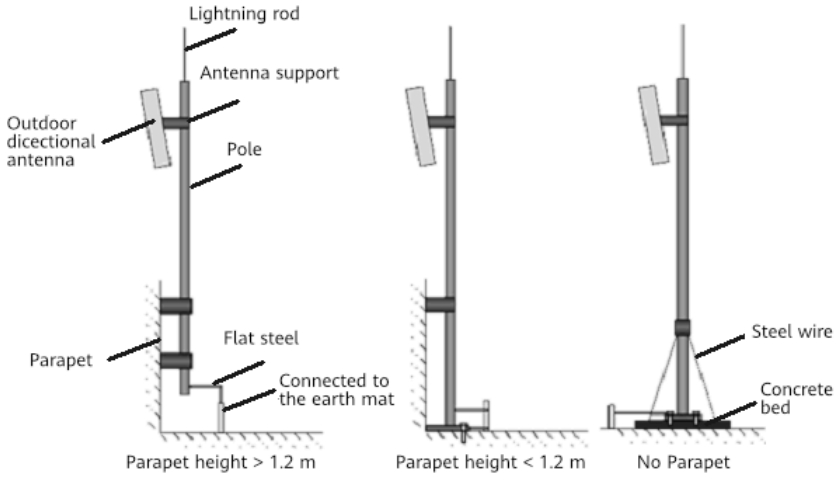
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.

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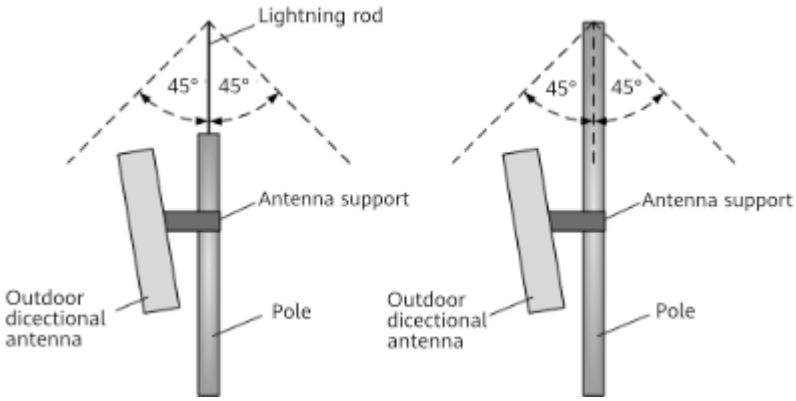
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 18-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 18-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

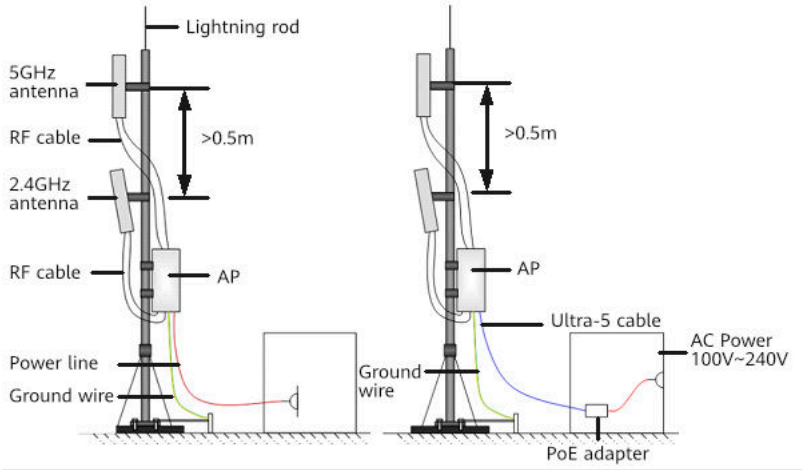
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 18-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

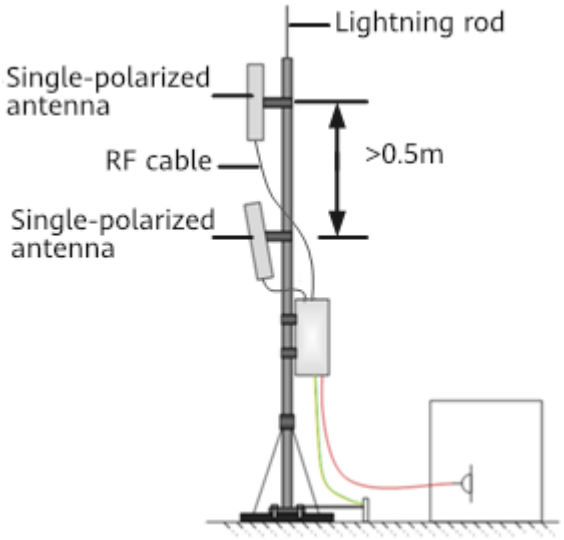
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Figure 18-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 18-6**.

Figure 18-6 Installation of single-polarized antennas



18.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface.

RF Cable Deployment Requirements

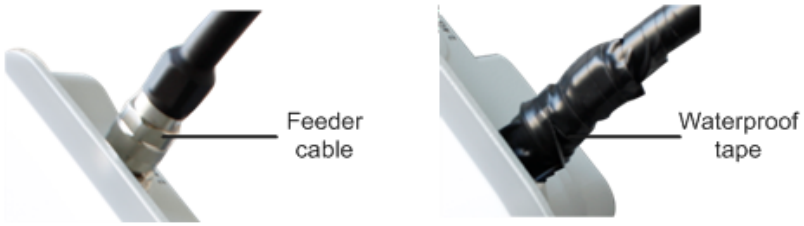
- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.

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- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

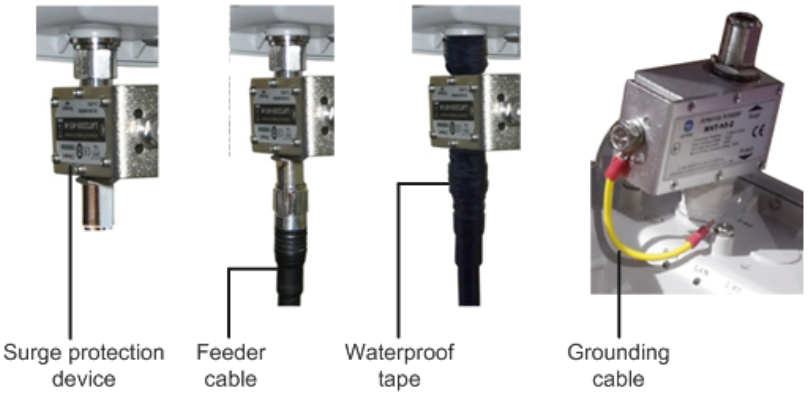
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

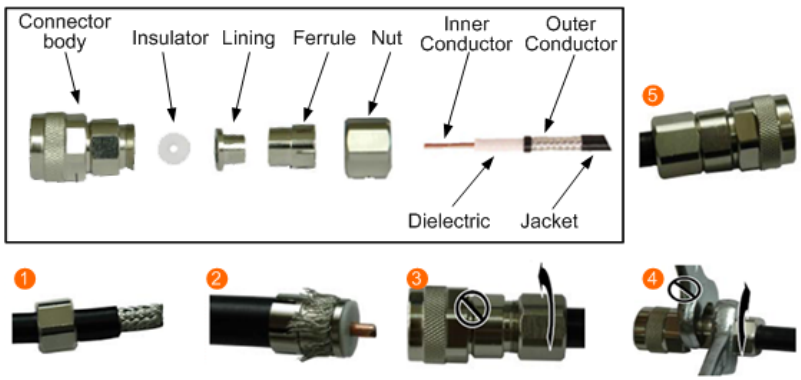
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Table 18-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

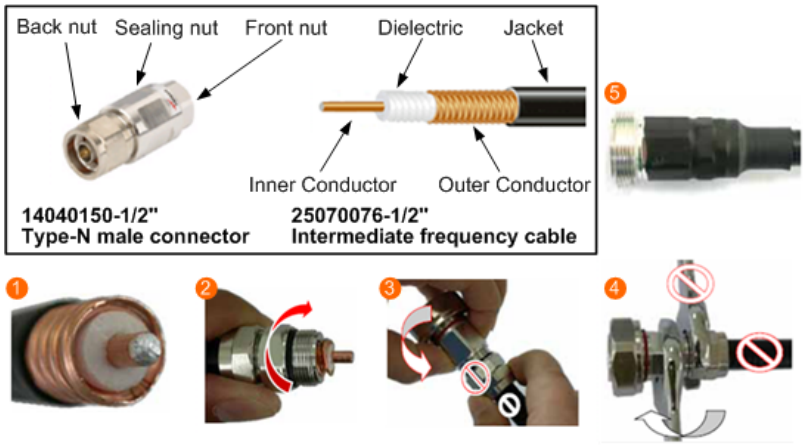
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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19 27010913 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V11.5 G8)

About This Chapter

19.1 27010913 Technical Specifications
19.2 27010913 Installation Precautions
19.3 27010913 Antenna Installation

19.1 27010913 Technical Specifications

Appearance and Structure

Figure 19-1 Appearance of the 27010913 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V11.5 G8)



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Technical Specifications

Table 19-1 Technical specifications of the 27010913 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V11.5 G8)

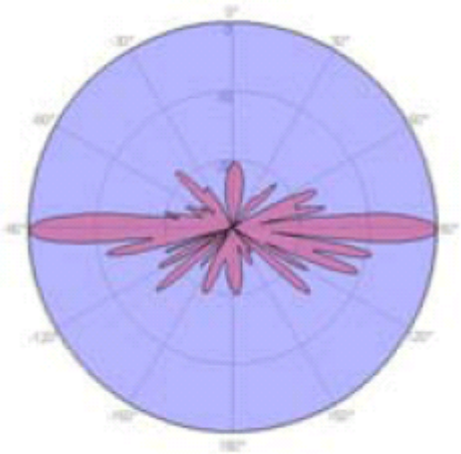
Item	Details
Part Number	27010913
Model	AL0800500
Description	Isotropic Antenna, 2400~2500MHz,>8dBi,Vertical polarization,Isotropic,200W,0r,N-Female,with bracket
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	8 dBi
Coverage distance [m(ft.)]	100 m(ft.)
Horizontal beamwidth [degrees]	360 degrees
Vertical beamwidth [degrees]	11.5 degrees
Standing wave ratio (SWR)	≤ 1.5
Polarization	Vertical polarization
Attenna connector	N-female
Attenna dimensions [mm(in.)]	Diameter x Length: Φ29 x 720
Weight without packaging [kg(lb)]	0.5 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ48 to ϕ135

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 19-2 Antenna Pattern1 of the 27010913 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V11.5 G8)



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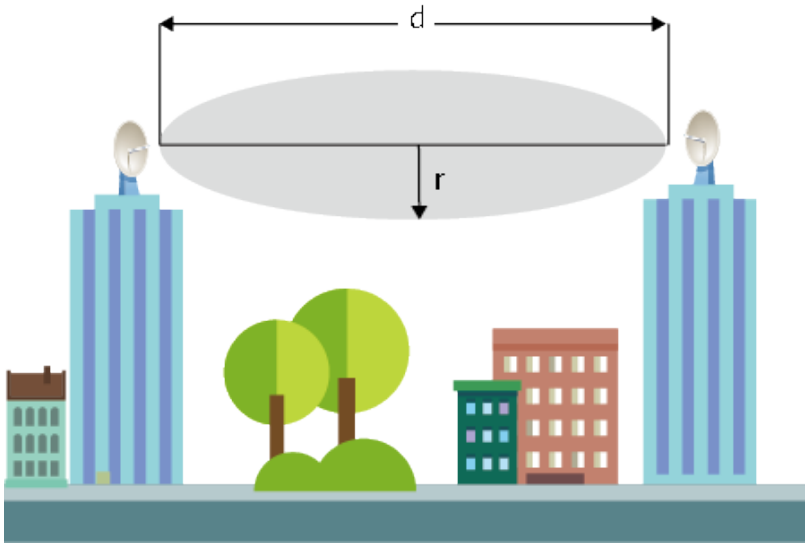
19.2 27010913 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 19-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

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- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 19-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 19-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

19.3 27010913 Antenna Installation

The 27010913 antenna is an outdoor 2.4 GHz directional antenna that provides high gains. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

19.3.1 Accessories and Tools

Tools:

- 1 x combination wrench

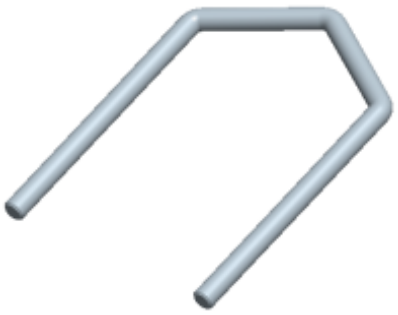


Pole

- 1 x pole with a diameter of ϕ48 mm to ϕ135 mm

Antenna support assembly:

- U-type bolt: 2 PCS



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- Nut, spring washer, and flat washer



19.3.2 Pole Mounting

The 27010913 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

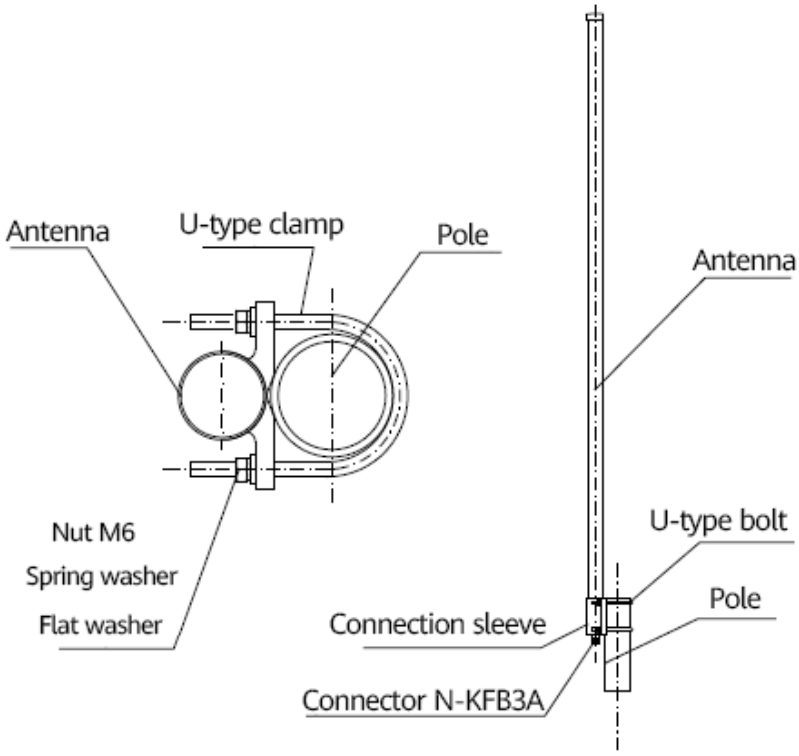
NOTICE

- To prevent water in the antenna from degrading the signal quality, keep the antenna vertical and do not allow the condensation drain hole to clog.
- To achieve the optimal coverage effect, it is recommended that you install the omnidirectional antenna four to six meters above ground.

Fixing the Antenna to the Pole

Installation of the antenna

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Carry out the following steps:

1. Place the antenna vertically based on the direction marked on the antenna. Ensure that the pole does not overtop the connection sleeve.
2. Use U-type bolts, nuts, and washers to secure the antenna to the pole, as shown in the preceding figures.

Precautions

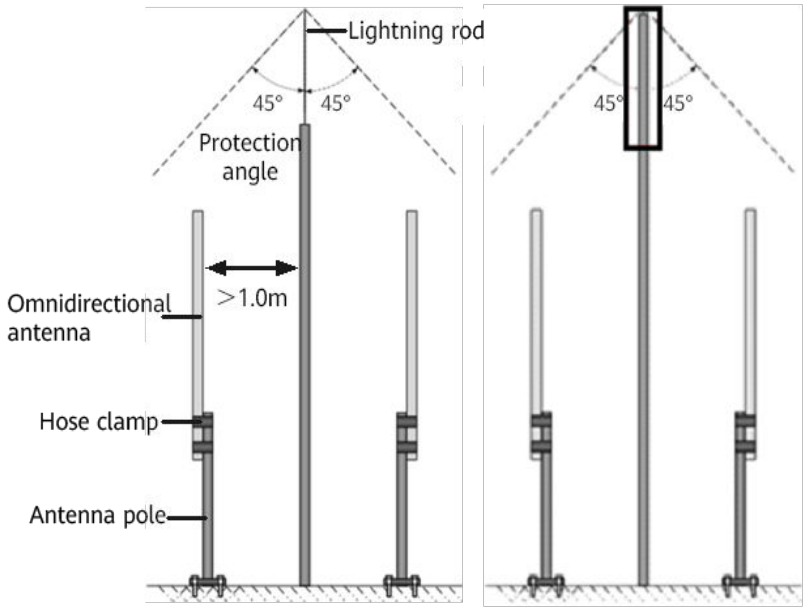
Take note of the following points when installing an outdoor omnidirectional antenna:

1. After the installation is complete, the antenna must be high enough to satisfy signal coverage demands, and the top of the antenna must not exceed the 45-degree protection range of the lightning rod.
2. Do not weld a lightning rod directly to the omnidirectional antenna pole, as there should be no metal objects within 1 m of an omnidirectional antenna. Instead, install an independent lightning rod between two omnidirectional antenna poles. Adjust the height of the lightning rod to ensure that the antennas are covered in the protection angle.
3. It is recommended that the distance between two omnidirectional antennas be at least 0.5 m.

Figure 19-4 shows installation of an outdoor omnidirectional antenna.

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Figure 19-4 Installing an outdoor omnidirectional antenna



NOTE

If antennas are installed on a pole made of metal, such as steel, you do not need to install a lightning rod, as shown on the right in **Figure 19-4**.

19.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface.

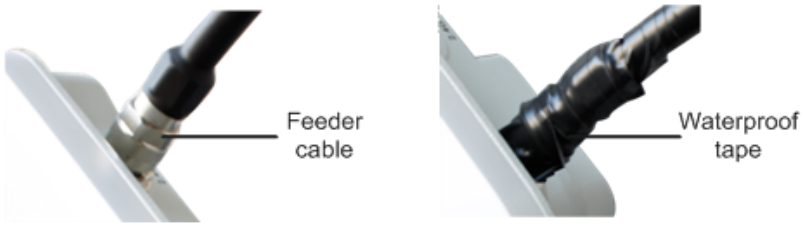
RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

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RF Cable Connections

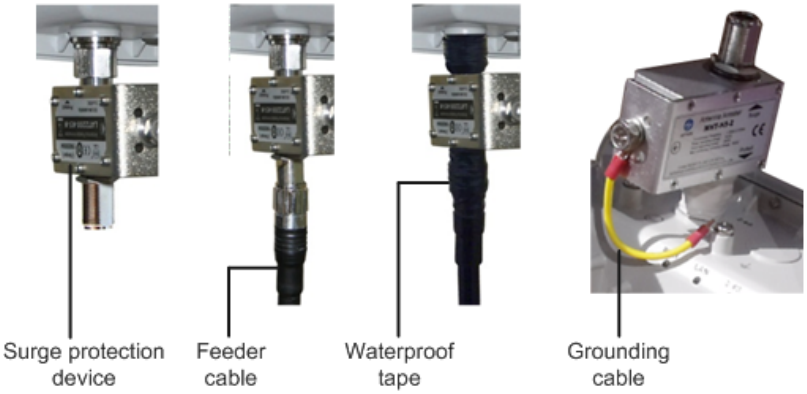
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

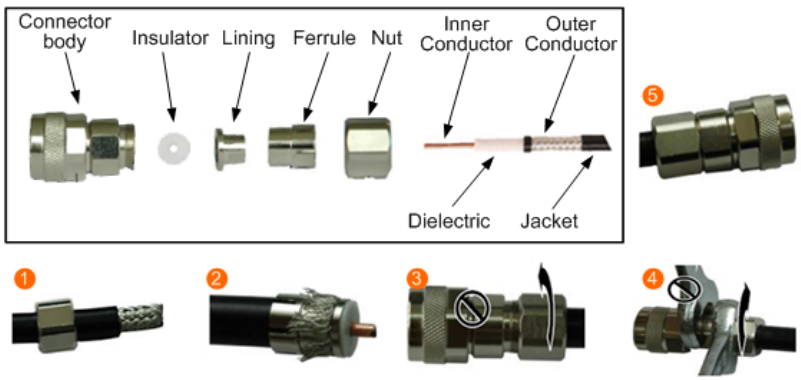
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Table 19-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

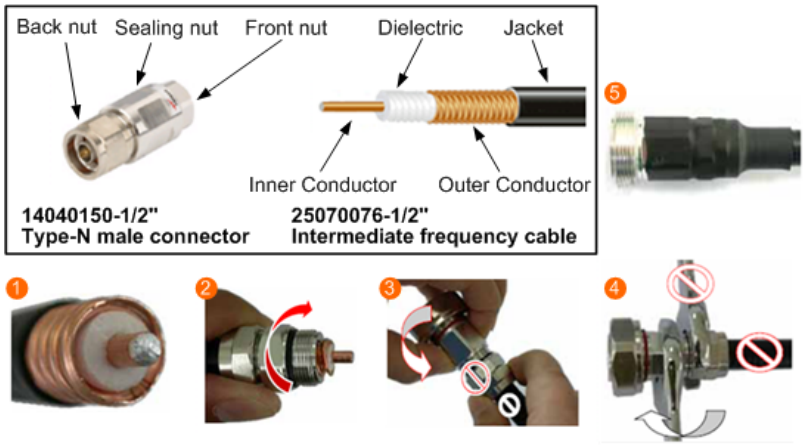
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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20 27011016 Outdoor 5 GHz Dual-Polarized Directional Antenna (H9 V9 G23)

About This Chapter

20.1 27011016 Technical Specifications
20.2 27011016 Installation Precautions
20.3 27011016 Antenna Installation

20.1 27011016 Technical Specifications

Appearance and Structure

Figure 20-1 Appearance of the 27011016 Outdoor 5 GHz Dual-Polarized Directional Antenna (H9 V9 G23)



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Technical Specifications

Table 20-1 Technical specifications of the 27011016 Outdoor 5 GHz Dual-Polarized Directional Antenna (H9 V9 G23)

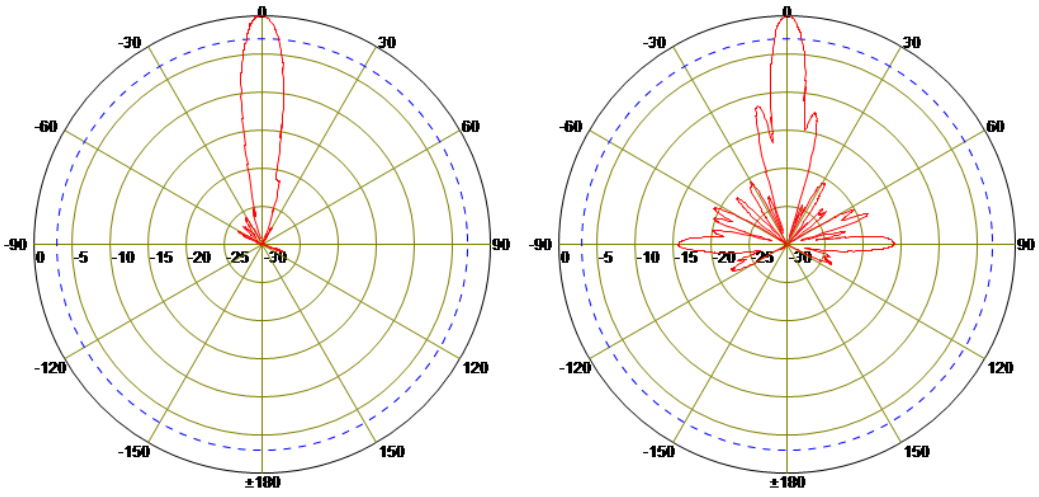
Item	Details
Part Number	27011016
Model	ASB235G00
Description	Directional Antenna,5150~5850MHz, 23dBi,9deg/9deg,N/Female,2port,with mounting parts,pole mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	23 dBi
Coverage distance [m(ft.)]	310 m(ft.)
Horizontal beamwidth [degrees]	9 degrees
Vertical beamwidth [degrees]	9 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Cross polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	Diameter: ϕ400
Weight without packaging [kg(lb)]	3 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ40 to ϕ114

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

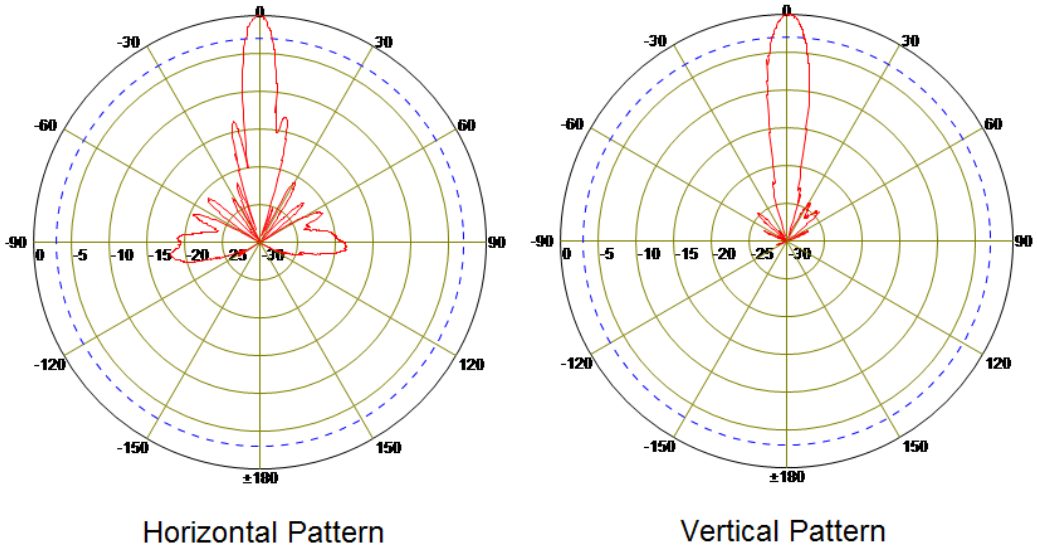
Antenna's Radiation Pattern

Figure 20-2 Antenna Pattern1 of the 27011016 Outdoor 5 GHz Dual-Polarized Directional Antenna (H9 V9 G23)



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Figure 20-3 Antenna Pattern2 of the 27011016 Outdoor 5 GHz Dual-Polarized Directional Antenna (H9 V9 G23)



20.2 27011016 Installation Precautions

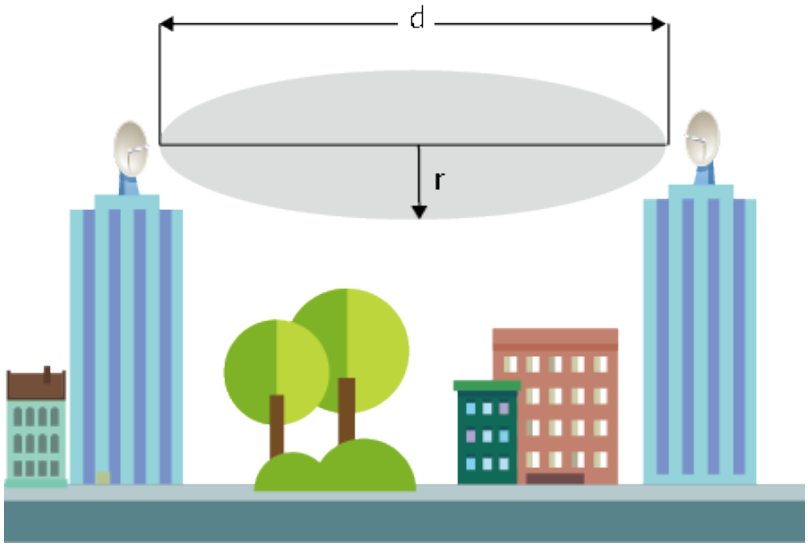
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 20-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 20-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 20-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

20.3 27011016 Antenna Installation

The 27011016 antenna is an outdoor 5 GHz directional antenna that provides high gains. To obtain a better performance and wider coverage, the antenna should be

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installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

20.3.1 Accessories and Tools

Tools:

- Hex key
- Phillips screwdriver
- M6 bolt

Pole

- 1 x pole with a diameter of ϕ40 mm to ϕ114 mm

Other accessories:

- 1 x antenna support assembly
  - ϕ40 mm to ϕ65 mm pole: U-type clamp
  - ϕ65 mm to ϕ92 mm pole: small hose clamp
  - ϕ92 mm to ϕ114 mm pole: large hose clamp

20.3.2 Pole Mounting

The 27011016 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

1. Select mounting kits based on pole diameters.
   - **When the diameter of a pole is 40-65 mm, use U-type bolts.**

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– **When the diameter of a pole is 65-92 mm, use small hose clamps.**

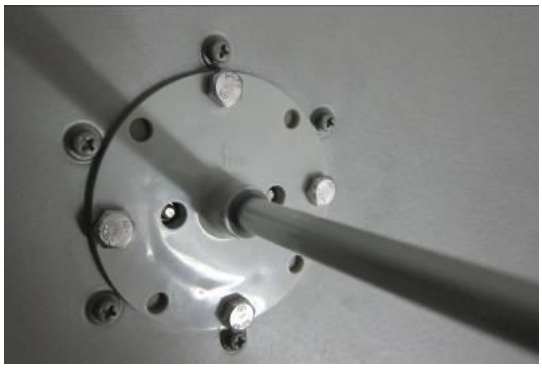


– **When the diameter of a pole is 92–114 mm, use large hose clamps.**



2. Keep the polarization arrows pointing upwards during installation. In the following figures, A indicates horizontal polarization and B indicates vertical polarization.

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3. Finally, tighten all nuts. The recommended torque is 7.6 N·m for M6 nuts.

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

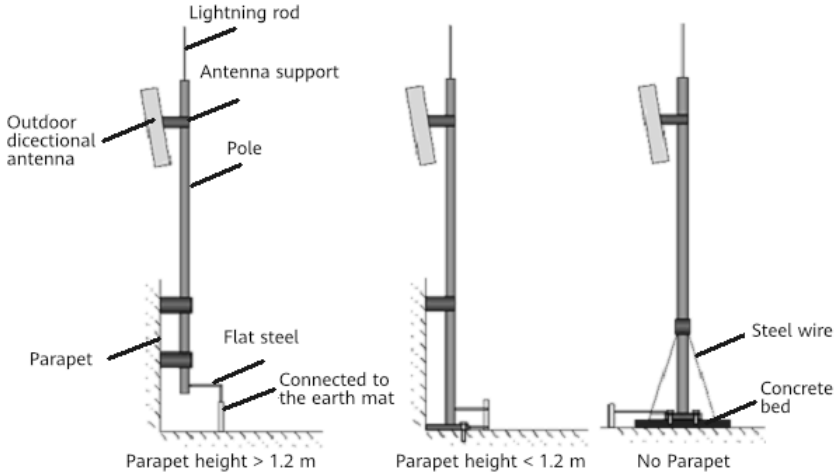
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

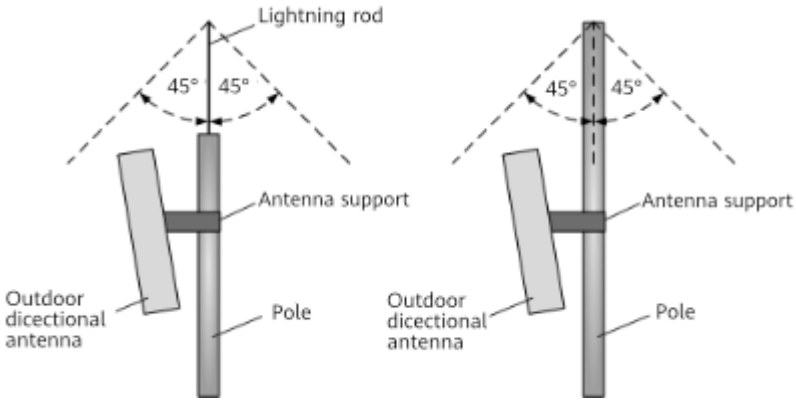
Figure 20-5 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 20-5 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

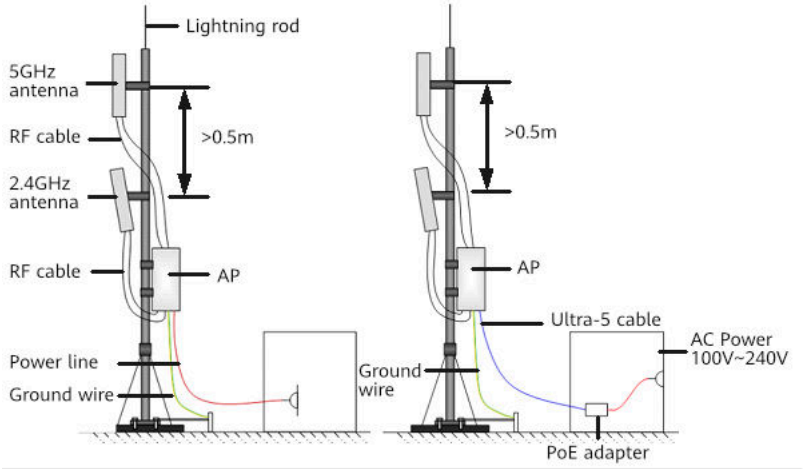
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 20-6 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

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Figure 20-6 Outdoor AP installation scenarios



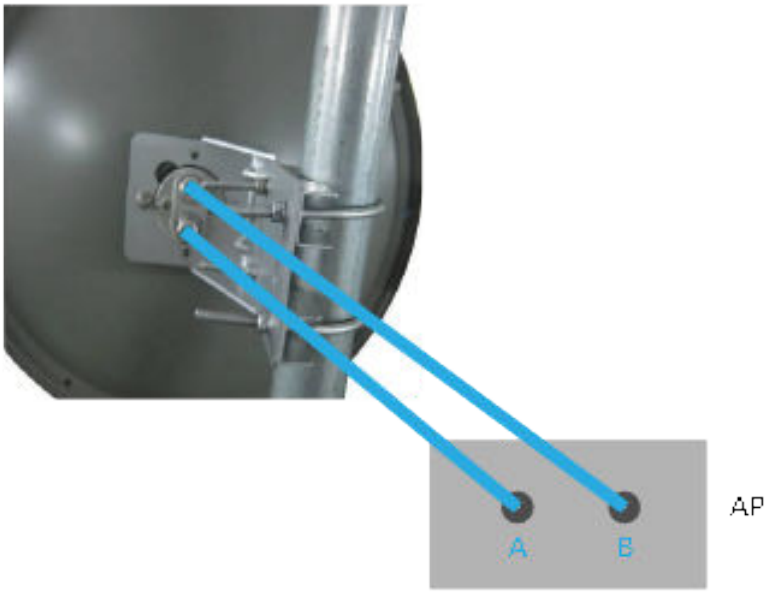
20.3.3 Connecting RF Cables

RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

  The following figure shows the cable connections.



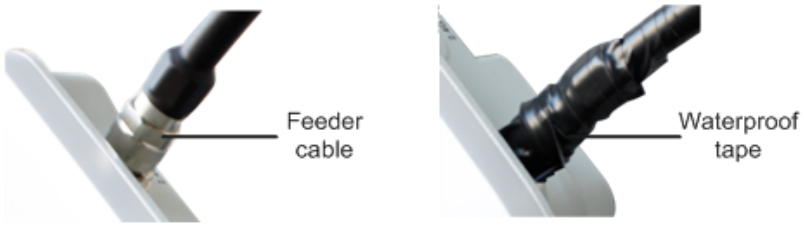
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RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

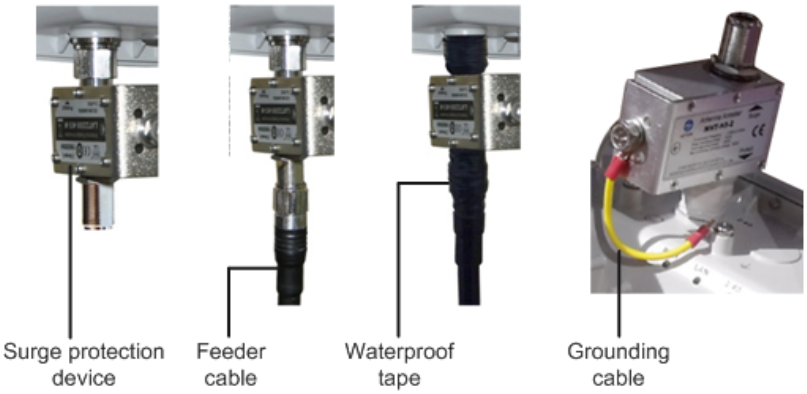
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

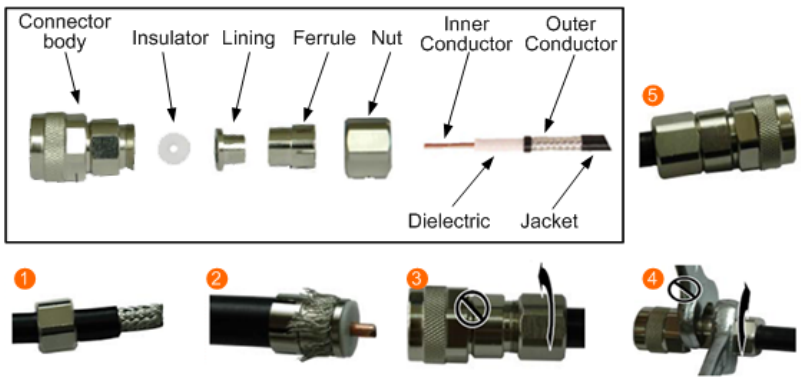
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Table 20-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

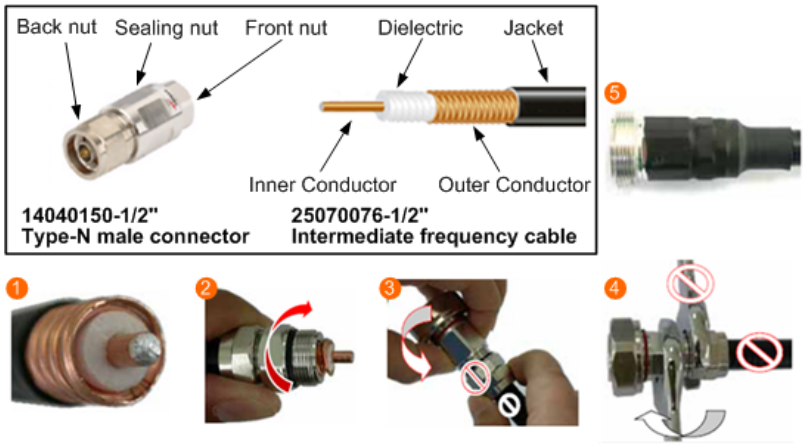
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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21 27011145 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)

About This Chapter

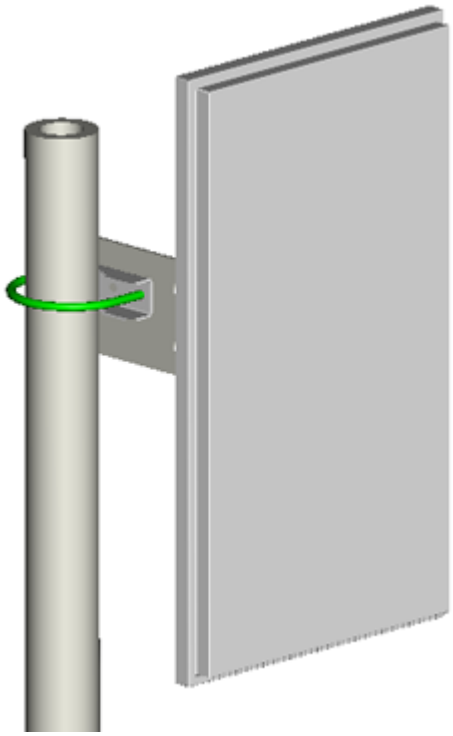
21.1 27011145 Technical Specifications
21.2 27011145 Installation Precautions
21.3 27011145 Antenna Installation

21.1 27011145 Technical Specifications

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Appearance and Structure

Figure 21-1 Appearance of the 27011145 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)



Technical Specifications

Table 21-1 Technical specifications of the 27011145 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)

Item	Details
Part Number	27011145
Model	AD5G1915
Description	Directional Antenna,5150~5850MHz, 19dBi,15deg,+1 polarization, 0,50W,with bracket,N-Female *3
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	19 dBi
Coverage distance [m(ft.)]	220 m(ft.)
Horizontal beamwidth [degrees]	15 degrees
Vertical beamwidth [degrees]	15 degrees
Standing wave ratio (SWR)	≤ 2

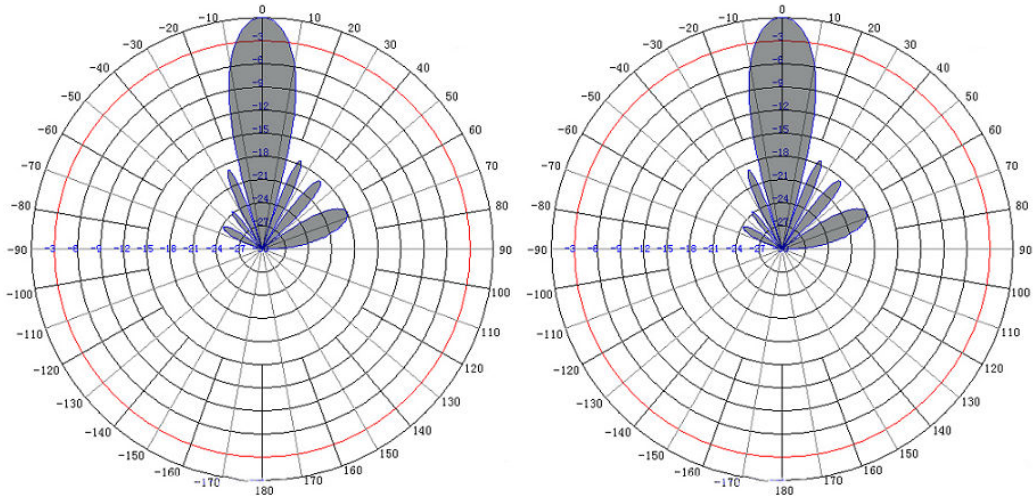
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Item	Details
Polarization	Vertical,horizontal,vertical polarization
Attenna connector	N-female x 3
Attenna dimensions [mm(in.)]	H x W x D: 30 x 450 x 245
Weight without packaging [kg(lb)]	1.4 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ30 to ϕ114
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 21-2 Antenna Pattern1 of the 27011145 Outdoor 5 GHz Dual-Polarized Directional Antenna (H15 V15 G19)



21.2 27011145 Installation Precautions

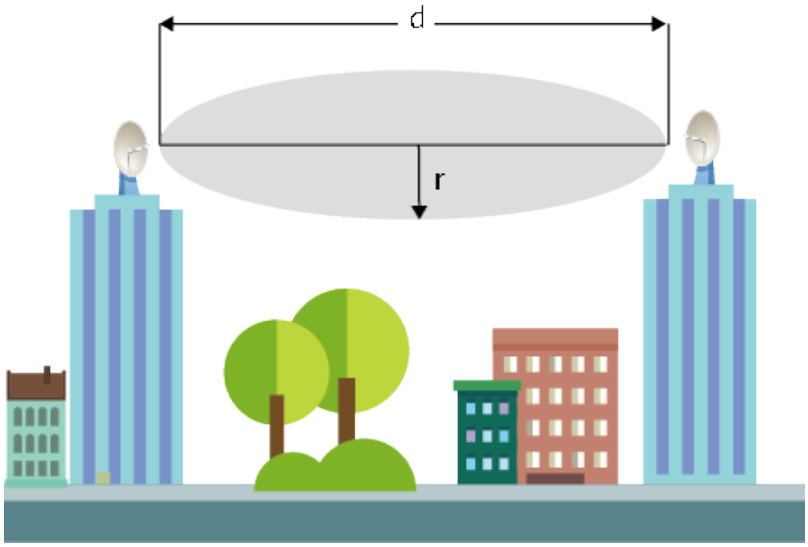
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 21-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 21-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 21-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

21.3 27011145 Antenna Installation

The 27011145 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

21.3.1 Accessories and Tools

Tools:

- 1 x 10 mm combination wrench



- 1 x 13 mm combination wrench



- 1 x inclinometer



Pole

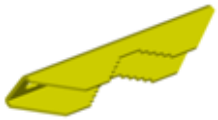
- 1 x pole with a diameter of ϕ30 mm to ϕ114 mm

Antenna support assembly:

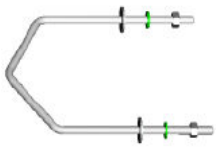
- Installation bracket: 1 PCS



- Toothed clamp: 1 PCS



- U-type bolt: 1 PCS



- Nut



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21.3.2 Pole Mounting

The 27011145 antenna is mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

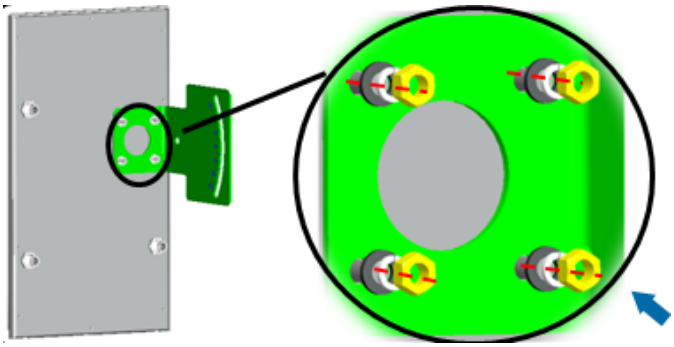
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

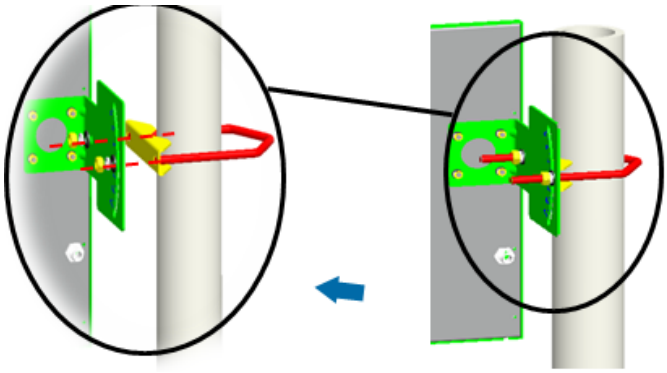
Fixing the Antenna to the Pole

Carry out the following steps:

1. Fix the installation bracket to the antenna using the nut, spring washer, and flat washer.



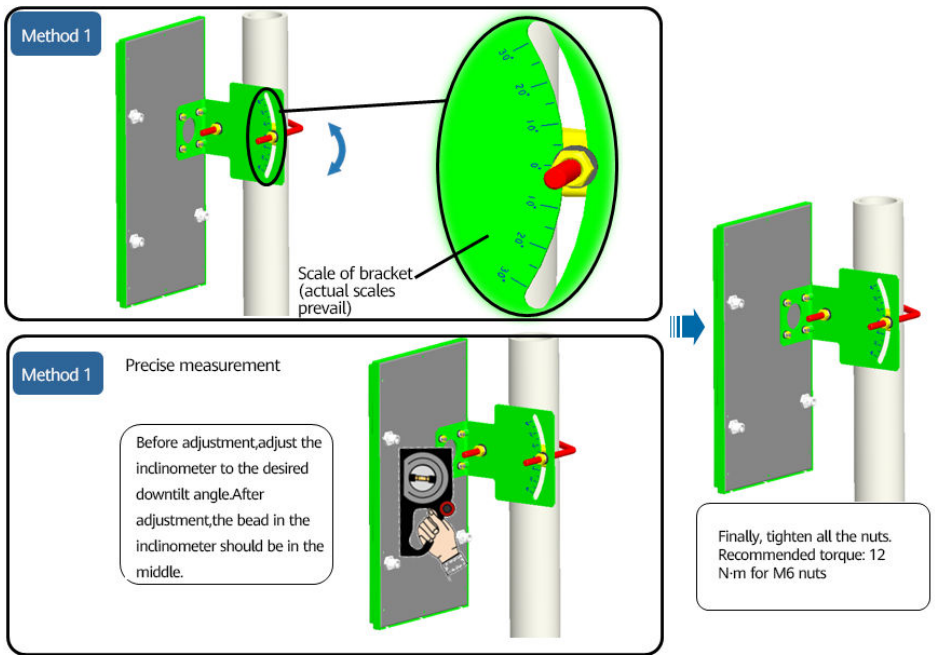
2. Secure the installation bracket, toothed clamp and U-type bolt on the pole. Thread the U-type bolt through the fixing hole and graduated bracket and then tighten screws, nuts, spring washers, and flat washers on both ends of the U-type bolt (not tightly), as shown in the following figure.



3. Adjust the mechanical downtilt angle using one of the following two methods.
   - Method 1: Adjust the angle by sliding the U-type bolt along the bracket. The pole must be kept vertical.

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– Method 2: Use the inclinometer to determine the antenna angle. Then, move the antenna to adjust its angle until the bead in the inclinometer is at the middle. This method provides precise measurements.



4. Finally, tighten all nuts. The recommended torque is 12 N·m for M6 nuts and 25 N·m for M8 nuts.

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

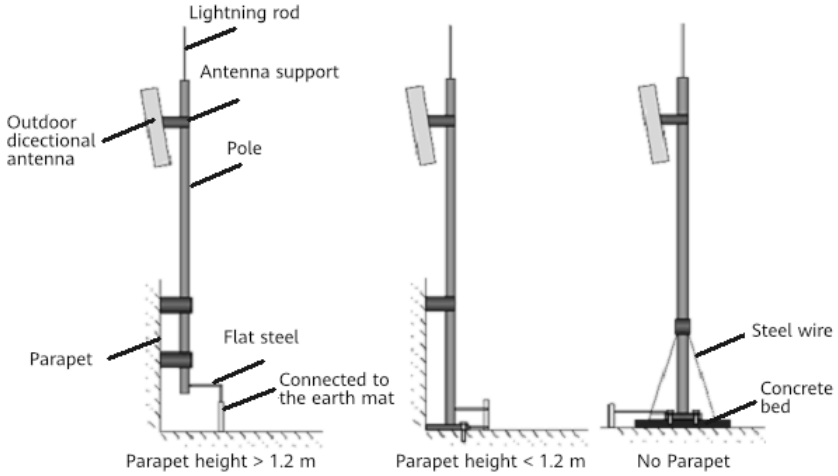
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

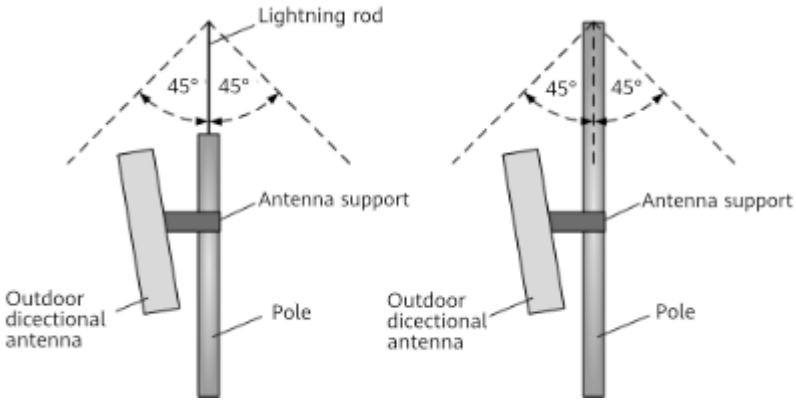
Figure 21-4 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 21-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

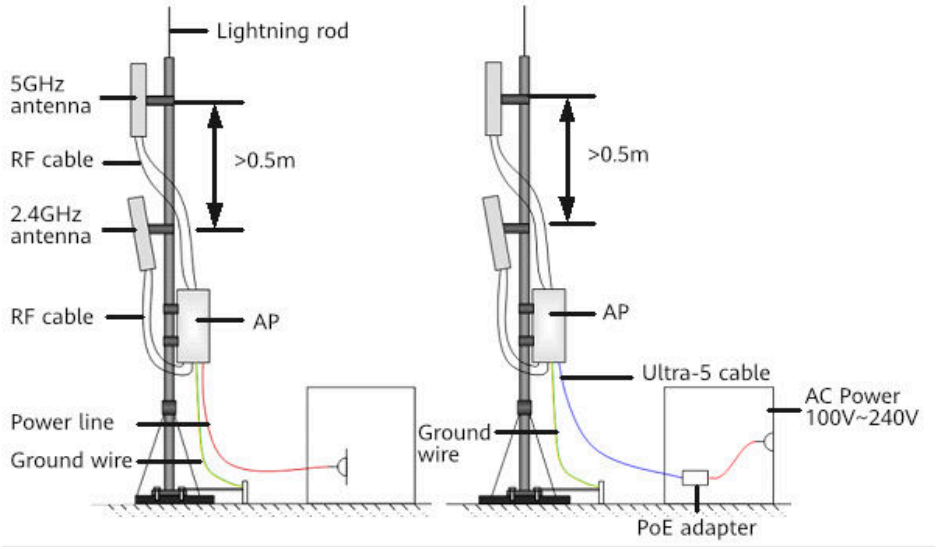
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 21-5 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

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Figure 21-5 Outdoor AP installation scenarios



21.3.3 Connecting RF Cables

RF Cable Connection Requirements

The radio interfaces of the same frequency band on an AP have silkscreens A, B, and C, as shown in the following figure.



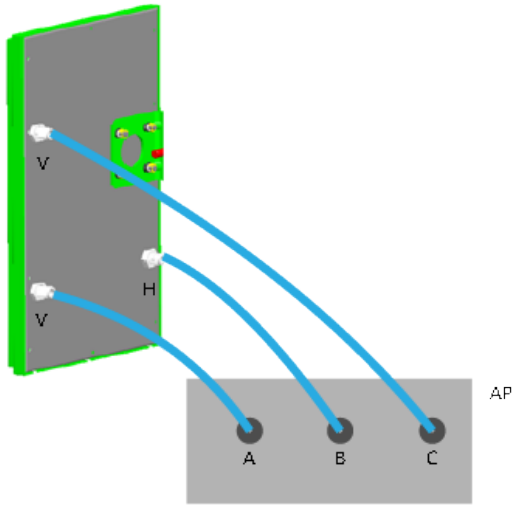
Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A, B, and C of the same frequency band on an AP.
- On the rear of the 27011145 antenna, the letters V and H are used to differentiate feeder interfaces of different polarization directions. Among the

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radio interfaces of the same frequency band on an AP, interface A and interface B are connected to feeder interfaces of different polarization directions on an antenna, and interface C is connected to the remaining feeder interface of the antenna.

The following figure shows the cable connections.

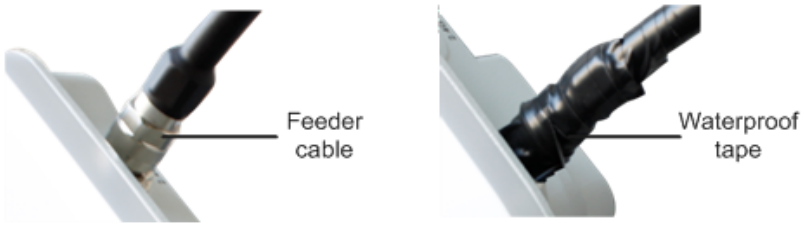


RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

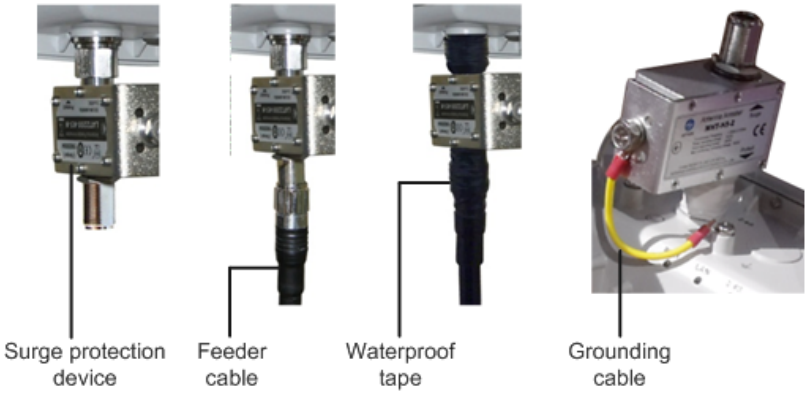


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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

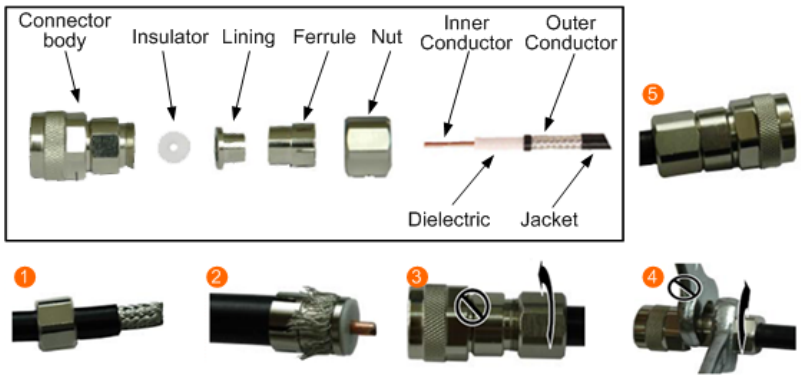
Table 21-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

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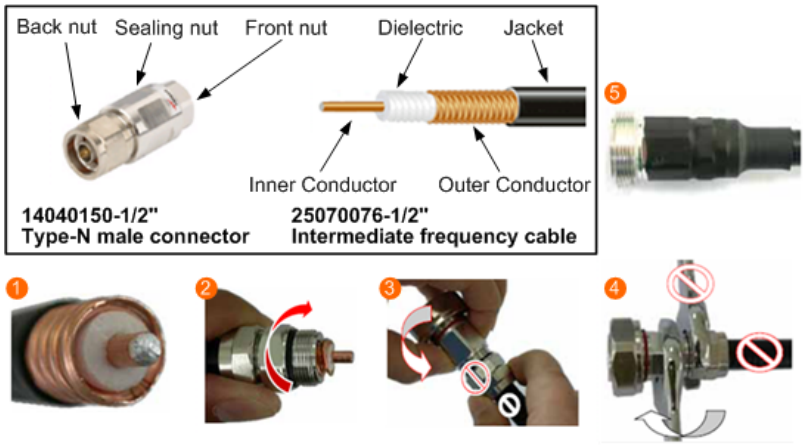
Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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22 27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)

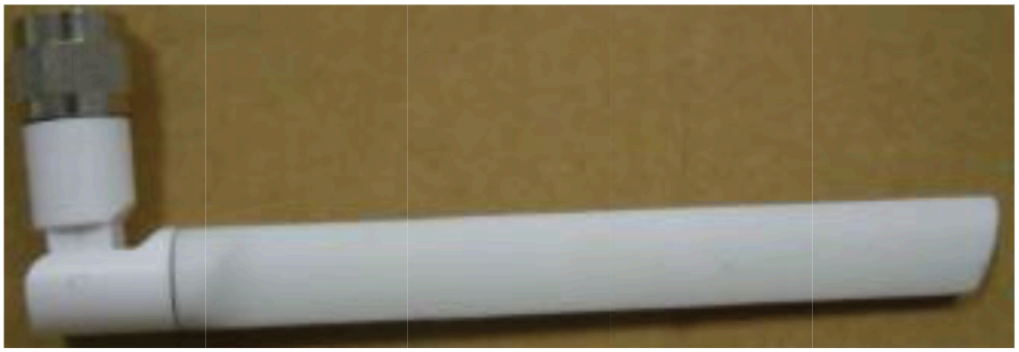
About This Chapter

22.1 27011172 Technical Specifications
22.2 27011172 Installation Precautions
22.3 27011172 Antenna Installation

22.1 27011172 Technical Specifications

Appearance and Structure

Figure 22-1 Appearance of the 27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)



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Technical Specifications

Table 22-1 Technical specifications of the 27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)

Item	Details
Part Number	27011172
Model	ANTDG0304A1SR
Description	Omni-directional Antenna, 2400~2500MHz/5150~5850MHz, 3dBi(2.4G)/4dBi(5G),1W,0r,RP-SMA-J
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 3 5G: 4
Coverage distance [m(ft.)]	2.4G: 18 5G: 12
Horizontal beamwidth [degrees]	360 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization
Attenna connector	RP-SMA-J
Attenna dimensions [mm(in.)]	Diameter x length: ϕ14 x 149
Weight without packaging [kg(lb)]	0.012 kg(lb)
Installation type	Directly installed on the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 22-2 Antenna Pattern1 of the 27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)

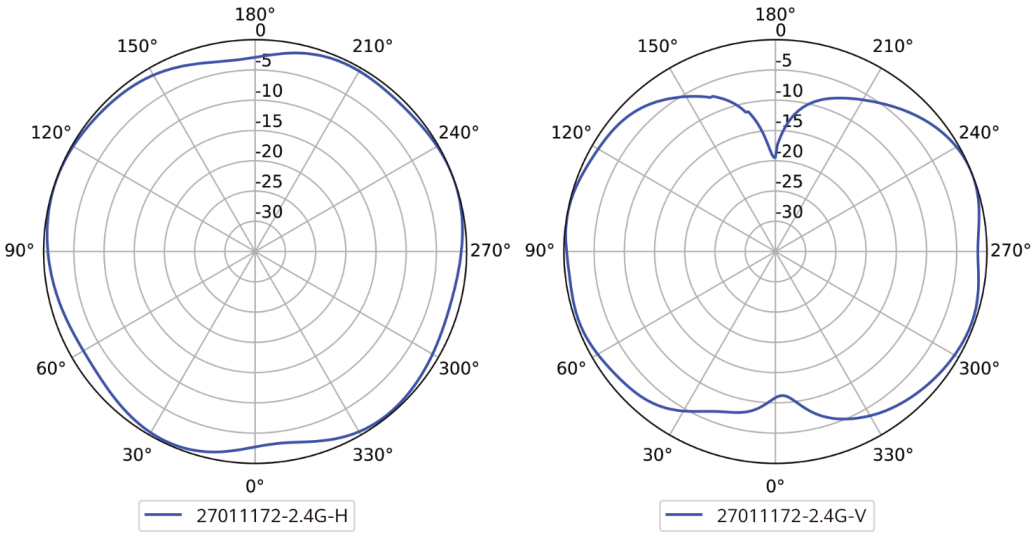
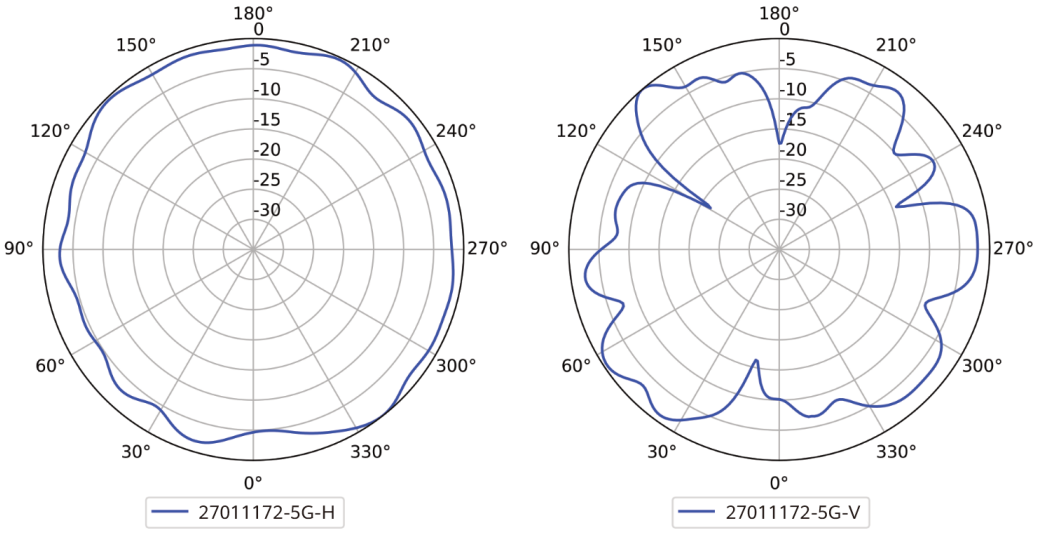


Figure 22-3 Antenna Pattern2 of the 27011172 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 G3 & H360 G4)



22.2 27011172 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

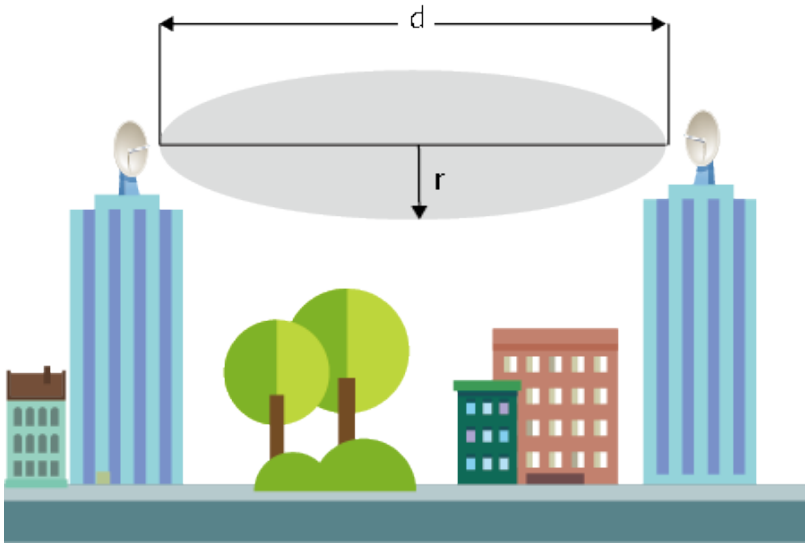
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.

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- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 22-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 22-2** lists the radius of the first Fresnel zone in different backhaul distances.

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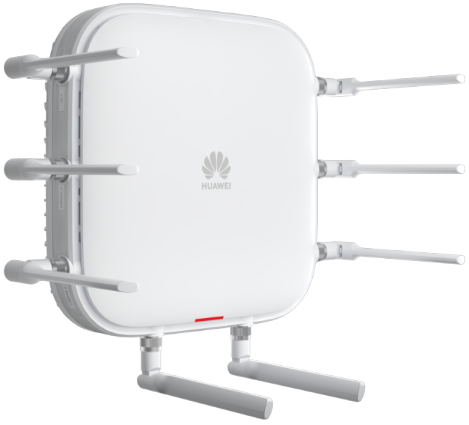
Table 22-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

22.3 27011172 Antenna Installation

27011172 antennas are directly installed on APs. You only need to tighten nuts.

The following figure shows the antenna installation.



- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the connectors in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.

NOTE

- To achieve the optimal coverage effect, it is recommended that you install the omnidirectional antenna four to six meters above ground.
- When installing an antenna, tightly hold the antenna connector and tighten it using a torque wrench. The recommended tightening torque is 0.8 N·m to 1.0 N·m.
- Tighten the nut of the AP's RF connector with a torque of no more than 1.2 N·m.

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23 27011332 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V32 G3)

About This Chapter

23.1 27011332 Technical Specifications
23.2 27011332 Installation Precautions
23.3 27011332 Installing Antennas

23.1 27011332 Technical Specifications

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Appearance and Structure

Figure 23-1 Appearance of the 27011332 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V32 G3)



Technical Specifications

Table 23-1 Technical specifications of the 27011332 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V32 G3)

Item	Details
Part Number	27011332
Model	ANT2G03A1NR
Description	Omni-directional Antenna, 2400~2500MHz,3dBi,360deg/32deg,N/Male,1port,without mounting parts,install directly on AP
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	3 dBi
Coverage distance [m(ft.)]	60 m(ft.)
Horizontal beamwidth [degrees]	360 degrees

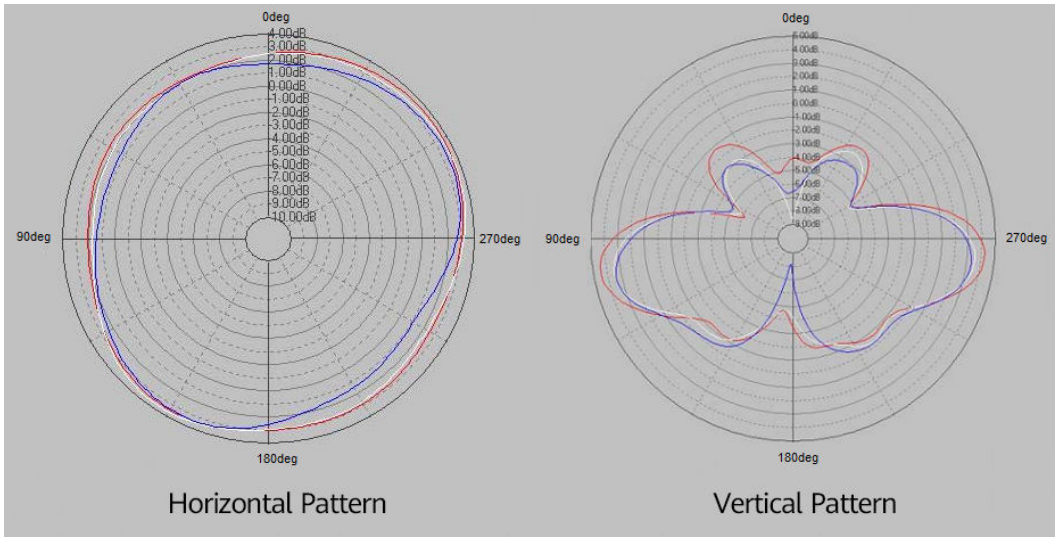
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Item	Details
Vertical beamwidth [degrees]	32 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization
Attenna connector	N-male
Attenna dimensions [mm(in.)]	Length: 280±3
Weight without packaging [kg(lb)]	0.218±0.01
Installation type	Directly installed on the AP
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 23-2 Antenna Pattern1 of the 27011332 Outdoor 2.4 GHz Single-Polarized Omnidirectional Antenna (H360 V32 G3)



23.2 27011332 Installation Precautions

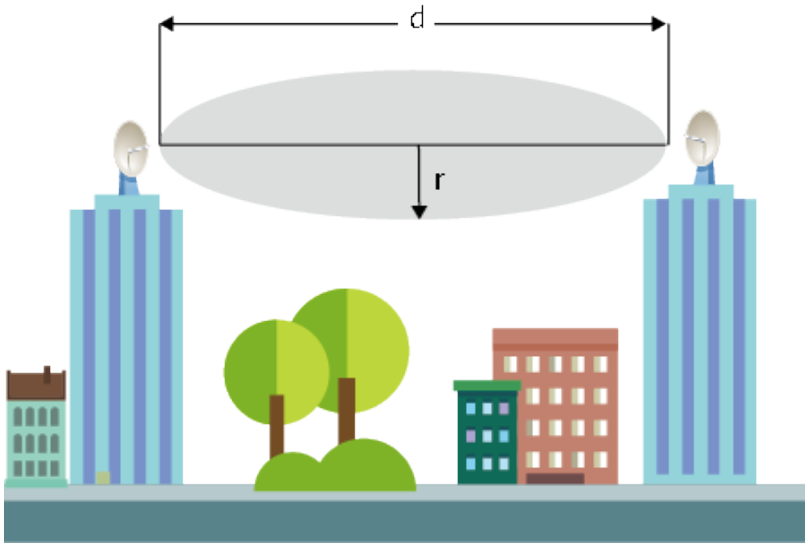
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 23-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 23-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 23-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

23.3 27011332 Installing Antennas

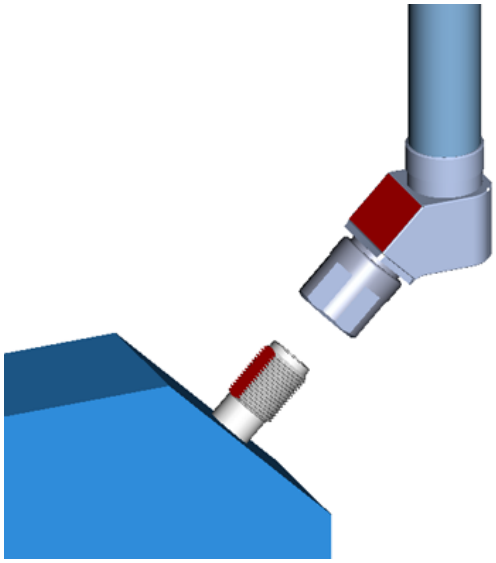
27011332 antennas are directly installed on APs.

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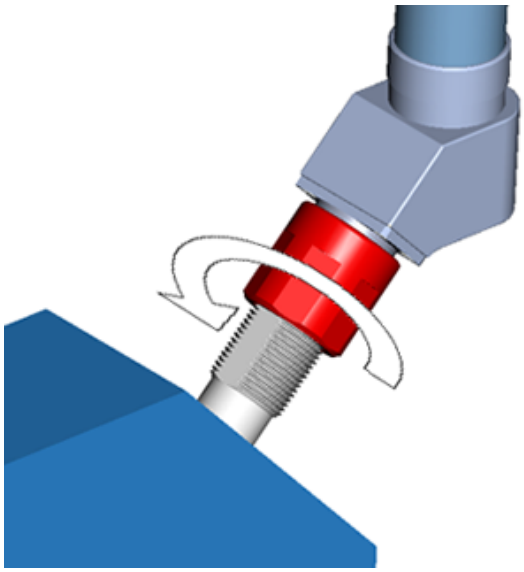
NOTICE

- Connectors of 27011332 antennas must be installed in the right direction. You should comply with the following installation instructions.
- To achieve the optimal coverage effect, it is recommended that you install the omnidirectional antenna 6 m to 8 m above ground.
- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.

1. Install the wire thread insert to the antenna port on the AP. Ensure that the two red surfaces in the following figure are on the same horizontal plane.



2. Manually tighten the wire thread insert in the direction of the arrow shown in the following figure. Then use a torque wrench to tighten it with a tightening torque of 10 N m to 15 N m.



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NOTE

If the two surfaces are not on the same horizontal plane when you tighten them, the antenna cannot be tightened securely and signal transmission will be affected. In this case, loosen the antenna and adjust its position and then tighten it again.

The following figure shows the antenna installation.



- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.
- Wrap the connectors in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.

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24 27011333 Outdoor 5 GHz Single-Polarized Omnidirectional Antenna (H360 V20 G5)

About This Chapter

24.1 27011333 Technical Specifications
24.2 27011333 Installation Precautions
24.3 27011333 Installing Antennas

24.1 27011333 Technical Specifications

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Appearance and Structure

Figure 24-1 Appearance of the 27011333 Outdoor 5 GHz Single-Polarized Omnidirectional Antenna (H360 V20 G5)



Technical Specifications

Table 24-1 Technical specifications of the 27011333 Outdoor 5 GHz Single-Polarized Omnidirectional Antenna (H360 V20 G5)

Item	Details
Part Number	27011333
Model	ANT5G05A1NR
Description	Omni-directional Antenna, 5150~5850MHz,5dBi,360deg/20deg,N/Male,1port,without mounting parts,install directly on AP
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	5 dBi
Coverage distance [m(ft.)]	60 m(ft.)
Horizontal beamwidth [degrees]	360 degrees

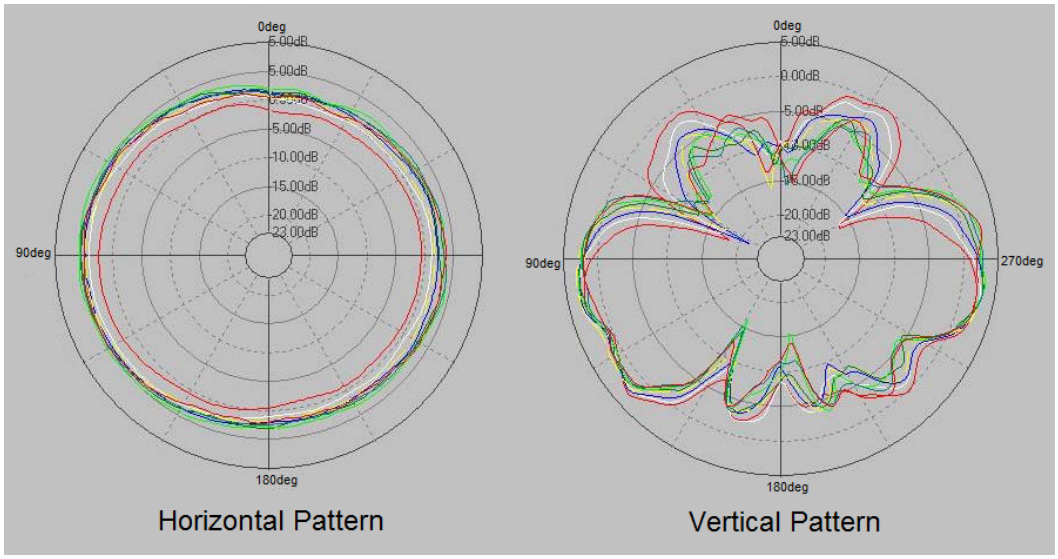
Copyright © Huawei Technologies Co., Ltd.

Item	Details
Vertical beamwidth [degrees]	20 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization
Attenna connector	N-male
Attenna dimensions [mm(in.)]	Length: 280±3
Weight without packaging [kg(lb)]	0.218±0.01
Installation type	Directly installed on the AP
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 24-2 Antenna Pattern1 of the 27011333 Outdoor 5 GHz Single-Polarized Omnidirectional Antenna (H360 V20 G5)



24.2 27011333 Installation Precautions

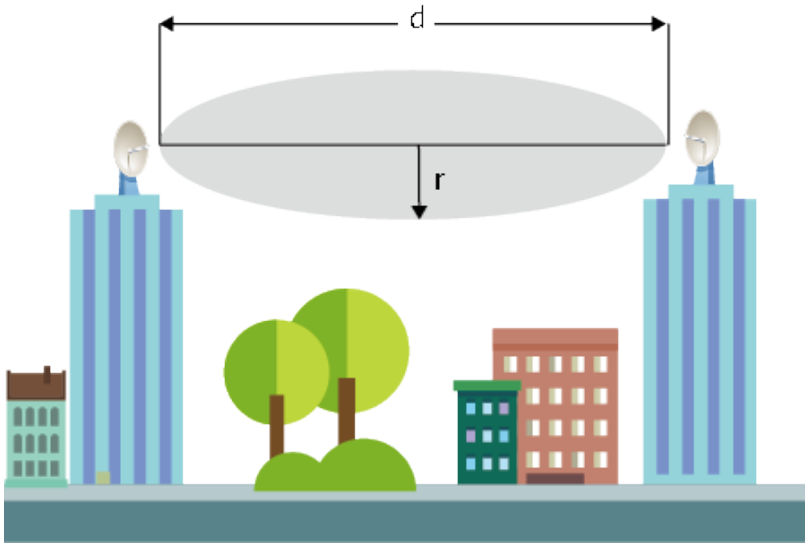
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 24-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 24-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 24-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

24.3 27011333 Installing Antennas

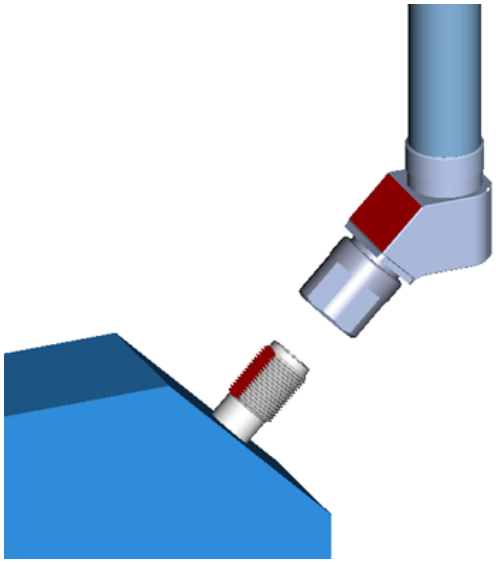
27011333 antennas are directly installed on APs.

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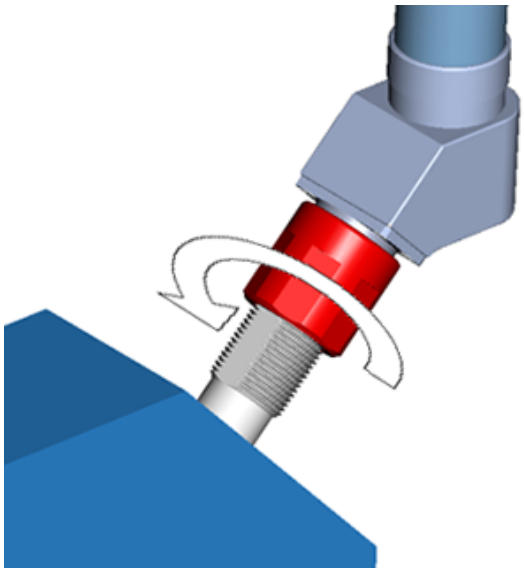
NOTICE

- Connectors of 27011333 antennas must be installed in the right direction. You should comply with the following installation instructions.
- To achieve the optimal coverage effect, it is recommended that you install the omnidirectional antenna four to six meters above ground.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.

1. Install the wire thread insert to the antenna port on the AP. Ensure that the two red surfaces in the following figure are on the same horizontal plane.



2. Manually tighten the wire thread insert in the direction of the arrow shown in the following figure. Then use a torque wrench to tighten it with a tightening torque of 10 N m to 15 N m.



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NOTE

If the two surfaces are not on the same horizontal plane when you tighten them, the antenna cannot be tightened securely and signal transmission will be affected. In this case, loosen the antenna and adjust its position and then tighten it again.

The following figure shows the antenna installation.



- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the connectors in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.

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25 27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)

About This Chapter

25.1 27011618 Technical Specifications
25.2 27011618 Installation Precautions
25.3 27011618 Antenna Installation

25.1 27011618 Technical Specifications

Appearance and Structure

Figure 25-1 Appearance of the 27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)



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Technical Specifications

Table 25-1 Technical specifications of the 27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)

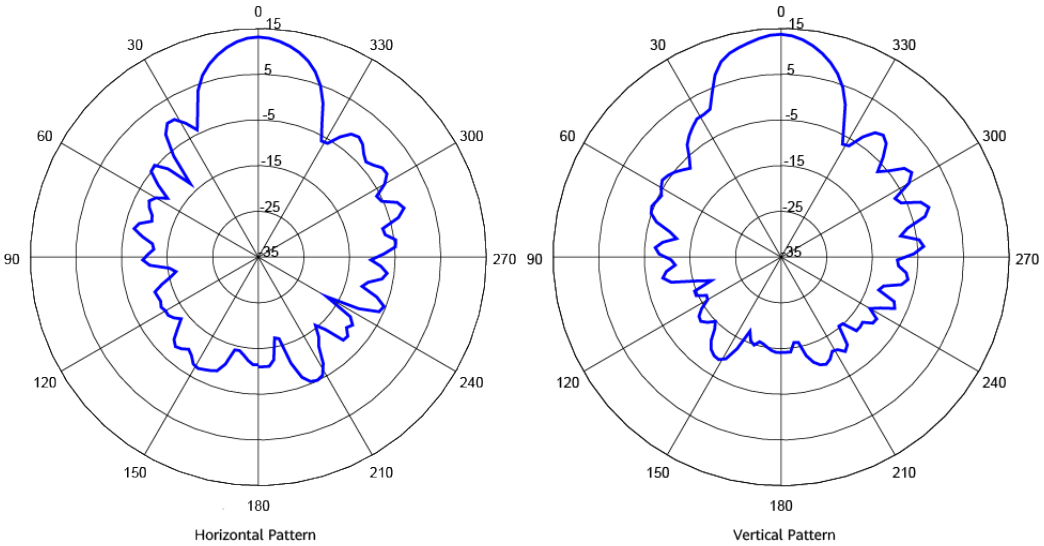
Item	Details
Part Number	27011618
Model	ANT5G14D3NY
Description	Directional Antenna,5150~5850MHz, 14dBi,30deg/30deg,N/Female, 3port,with mounting parts,pole mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	14 dBi
Coverage distance [m(ft.)]	140 m(ft.)
Horizontal beamwidth [degrees]	30 degrees
Vertical beamwidth [degrees]	30 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization,± 45-degree polarization
Attenna connector	N-female x 3
Attenna dimensions [mm(in.)]	Diameter x Length: ϕ84 x 257
Weight without packaging [kg(lb)]	1.22 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ25 to ϕ50

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 25-2 Antenna Pattern1 of the 27011618 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)



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25.2 27011618 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna horizontally and ensure that the RF cable connector points towards the ground.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.

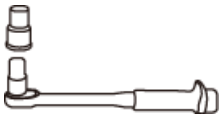
25.3 27011618 Antenna Installation

The 27011618 antenna is a directional antenna applicable to outdoor and rail transportation scenarios.

25.3.1 Accessories and Tools

Tools:

- Torque socket (M8)



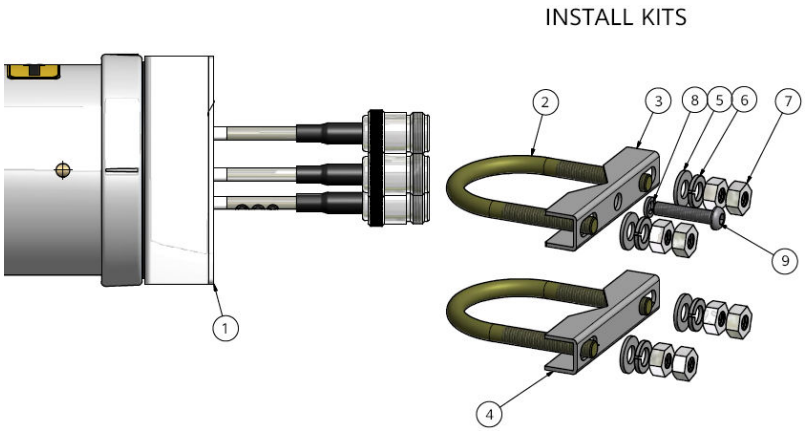
- Hex key (M6)



- Level



Other accessories:



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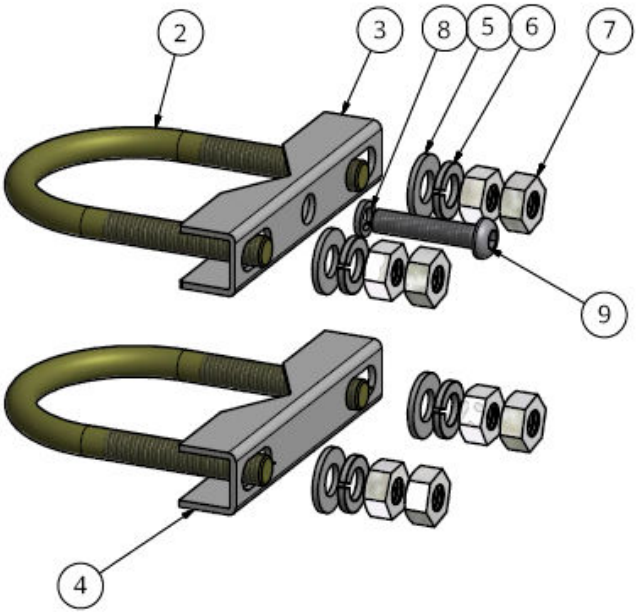
No.	1	2	3	4	5	6	7	8	9
Name	Antenna assembly (including the mounting bracket)	Stainless steel U-type bolt (M8)	V-type pole mount socket (with holes)	V-type pole mount socket	Stainless steel flat washer (M8)	Stainless steel spring washer (M8)	Stainless steel hex nut (M8)	Spring washer	Hex socket screw (M6)
Quantity	1	2	1	1	4	4	8	1	1

25.3.2 Pole Mounting

The 27011618 antenna is mounted on a pole.

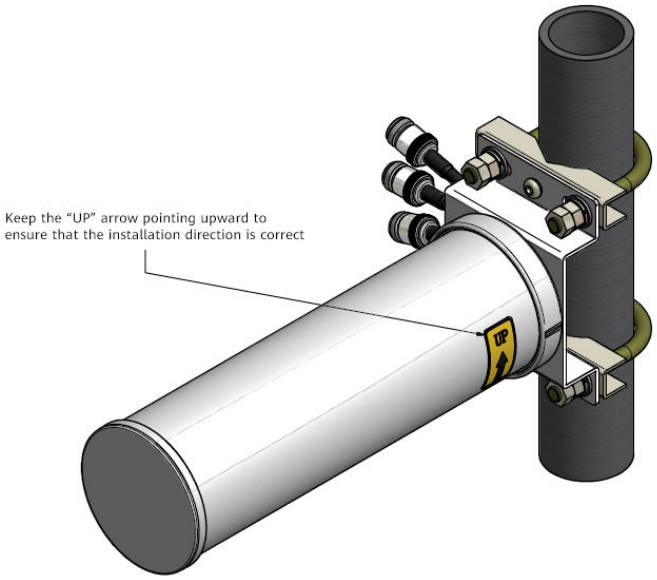
Procedure

1. Secure the V-type pole mount socket on the pole using stainless steel U-type bolts. Thread the U-type bolt through fixing holes and tighten screws, nuts, flat washers, and spring washers.



2. Ensure that the installation direction complies with the "UP" mark.

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25.3.3 Connecting RF Cables

RF Cable Connection

Connect the feeder connector to the radio interface of an AP using an RF transit cable (sold separately) and tighten the connector to the interface. A 1 N m tightening torque is recommended for the type-N connector.

The following table lists the RF transit cables and connectors used.

AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP8130DN	RG-8U cable (25070009)	Type-N male connector (14040184)	• 2400 MHz to 2483.5 MHz: 26.8 dB / 100 m • 4920 Mhz to 5825 Mhz: 41.8 dB / 100 m	

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
	1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400 MHz to 2483.5 MHz: 18.1 dB / 100 m • 4920 Mhz to 5825 Mhz: 30 dB / 100 m	
AP9131DN/ AP9132DN	RF transit cable (04130714, 0.5 m) connecting a QMA-J connector to an N-J connector.	- (No cable needs to be made onsite.)	• 2.4 GHz to 2.5 GHz: < 0.9 dB • 4.9 GHz to 6 GHz:< 1.3 dB	

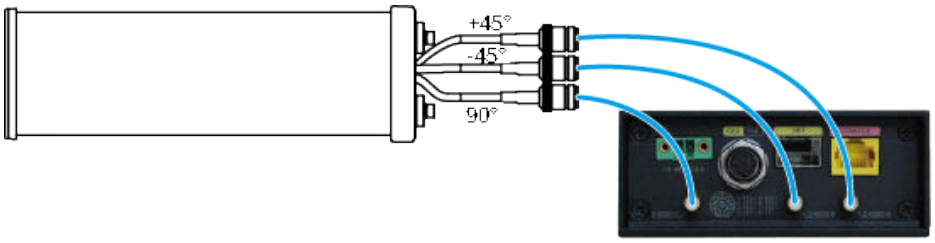
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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
	RF transit cable (04130714-001, 3 m) connecting a QMA-J connector to an N-J connector.		• 2.4 GHz to 2.5 GHz: < 2.3 dB • 4.9 GHz to 6 GHz: < 3.2 dB	

The requirements on connections between the antenna and the AP's radio interfaces are as follows:

- Feeders of the same antenna must be connected to radio interfaces of the corresponding frequency bands on the same AP.
- Feeder ports whose polarization directions are +45° and -45° on an antenna are connected to radio interfaces A and B of an AP respectively, and the feeder port whose polarization direction is 90°is connected to radio interface C of the AP.

Take the AP9132DN as an example. The following figure shows the RF cable connection on the AP9132DN.



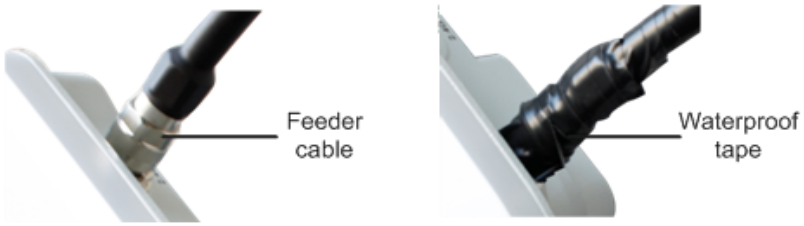
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RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

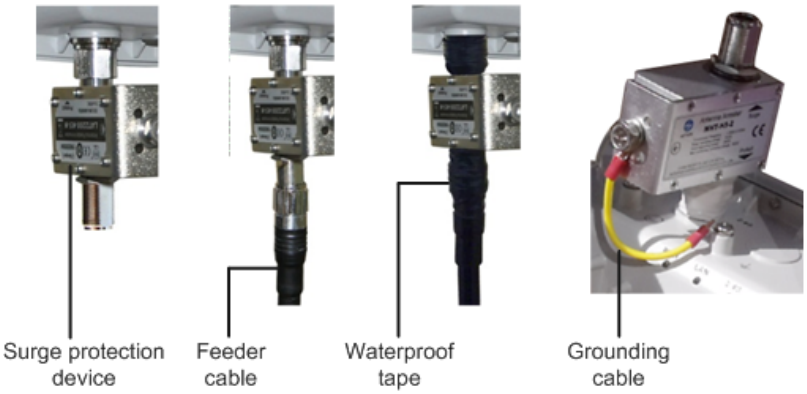
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



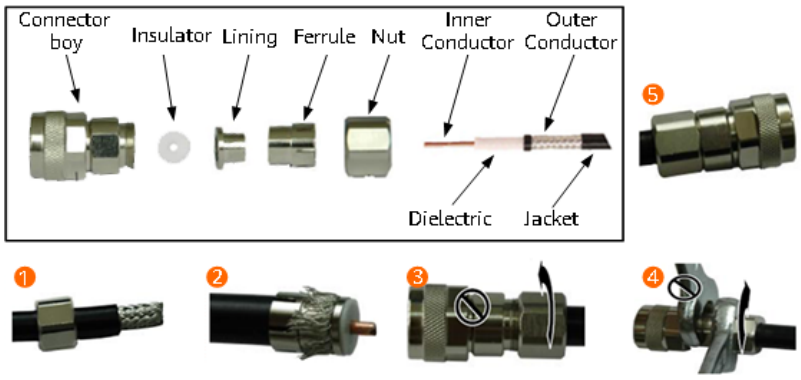
Instructions on Making RF Cables

When connecting the AP8130DN, you need to assemble the type-N male connector and 1/2" (inch) super-flexible feeder cable onsite in the following way:

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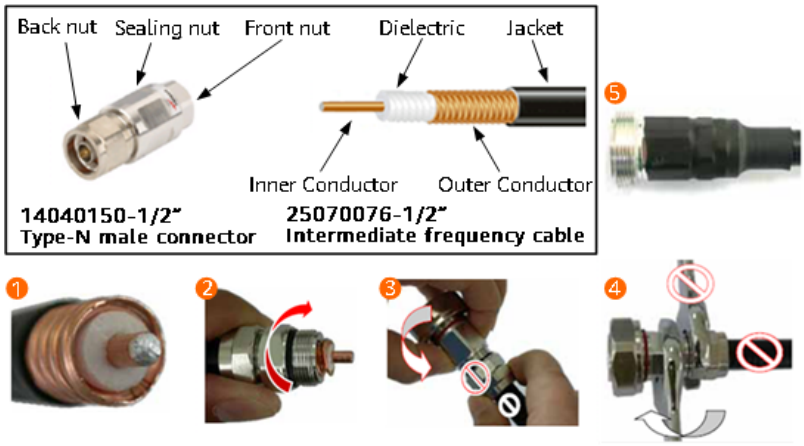
Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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26 27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)

About This Chapter

26.1 27011619 Technical Specifications
26.2 27011619 Installation Precautions
26.3 27011619 Antenna Installation

26.1 27011619 Technical Specifications

Appearance and Structure

Figure 26-1 Appearance of the 27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)



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Technical Specifications

Table 26-1 Technical specifications of the 27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)

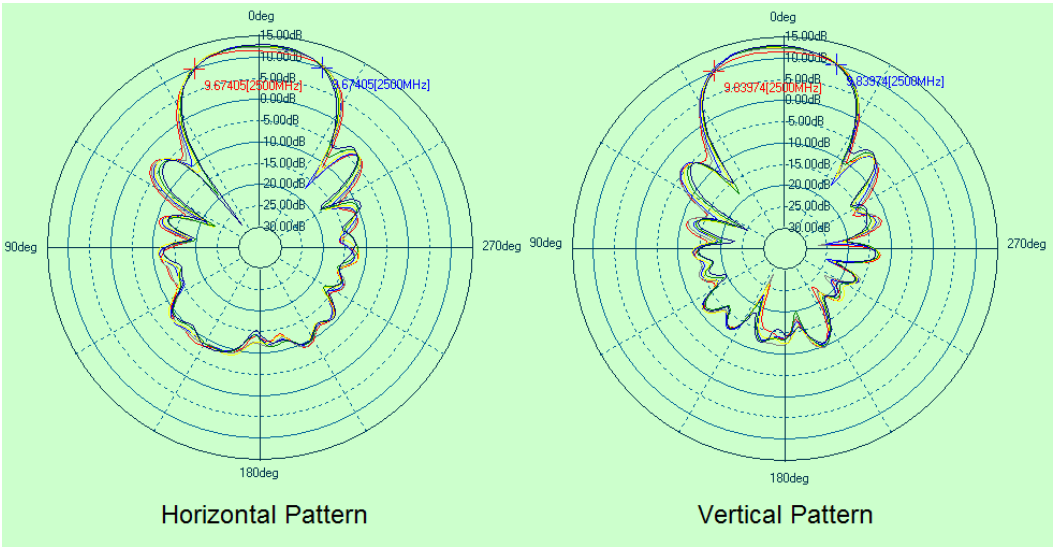
Item	Details
Part Number	27011619
Model	ANT2G12D2NY
Description	Directional Antenna,2400~2500MHz, 12dBi,35deg/35deg,N/Female, 2port,with mounting parts,pole mounting
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	12 dBi
Coverage distance [m(ft.)]	150 m(ft.)
Horizontal beamwidth [degrees]	35 degrees
Vertical beamwidth [degrees]	35 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Horizontal polarization,vertical polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	Diameter x Length: ϕ84 x 385
Weight without packaging [kg(lb)]	1.22 kg(lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ25 to ϕ50

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

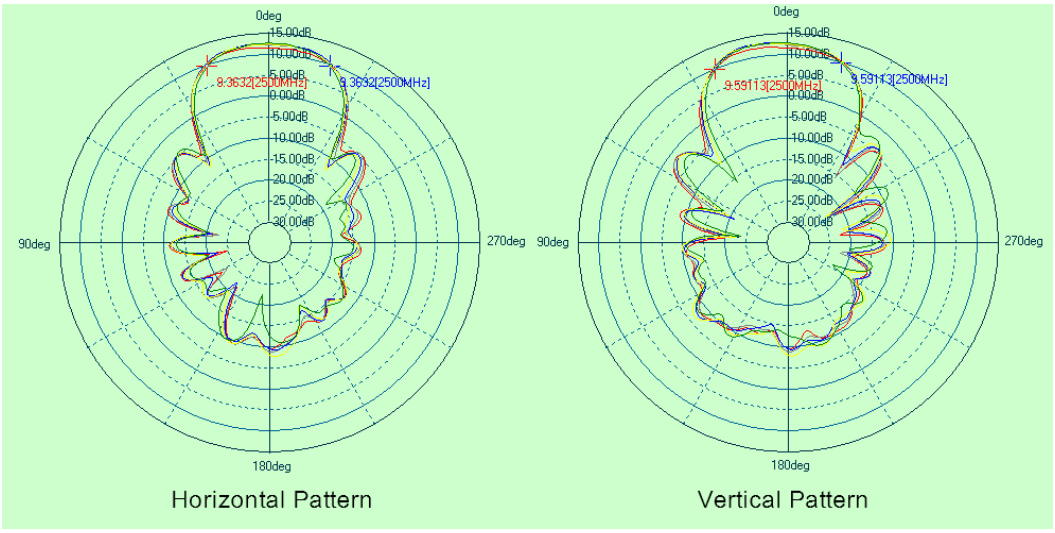
Antenna's Radiation Pattern

Figure 26-2 Antenna Pattern1 of the 27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)



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Figure 26-3 Antenna Pattern2 of the 27011619 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)



26.2 27011619 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna horizontally and ensure that the RF cable connector points towards the ground.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.

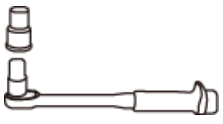
26.3 27011619 Antenna Installation

The 27011619 antenna is a directional antenna applicable to outdoor and rail transportation scenarios.

26.3.1 Accessories and Tools

Tools:

- Torque socket (M8)



- Hex key (M6)

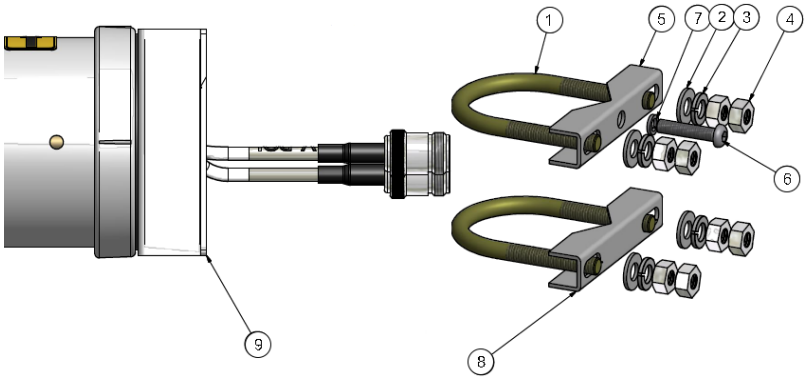


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- Level



Other accessories:



No.	1	2	3	4	5	6	7	8	9
Name	Stainless steel U-type bolt (M8)	V-type pole mount socket (with holes)	V-type pole mount socket	Stainless steel flat washer (M8)	Stainless steel spring washer (M8)	Stainless steel hex nut (M8)	Spring washer	Hex socket screw (M6)	Antenna assembly (including the mounting bracket)
Quantity	2	1	1	4	4	8	1	1	1

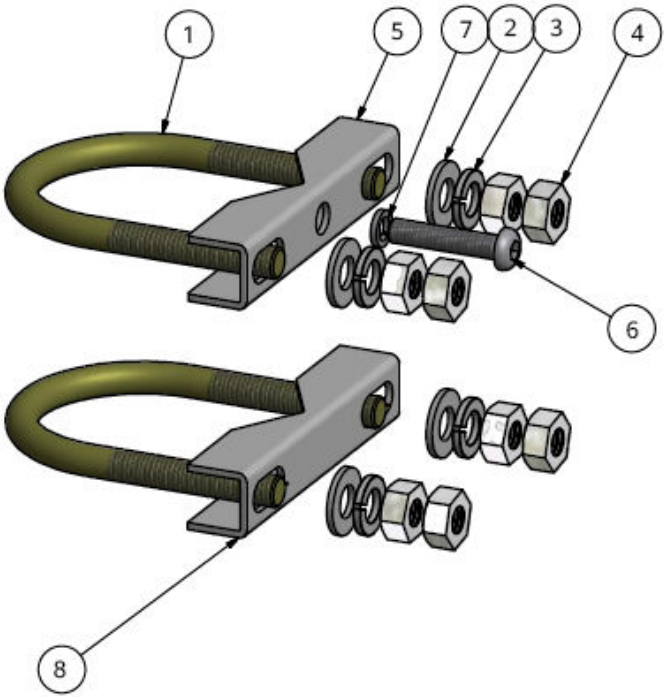
26.3.2 Pole Mounting

The 27011619 antenna can be mounted on a pole.

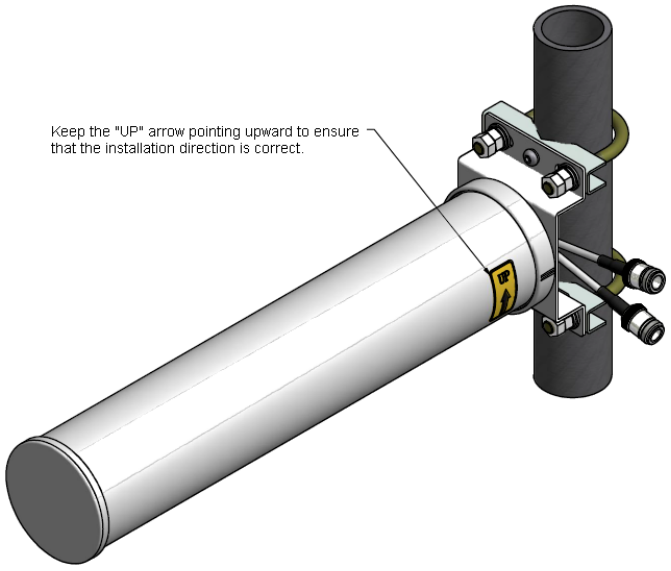
Procedure

1. Secure the V-type pole mount socket on the pole using stainless steel U-type bolts. Tighten nuts, flat washers, and spring washers.

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2. Ensure that the installation direction complies with the "UP" mark.



26.3.3 Connecting RF Cables

RF Cable Connection

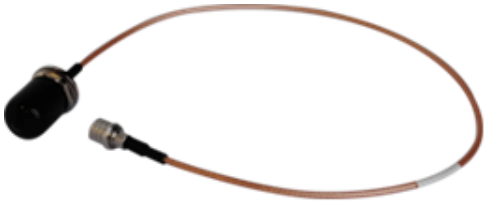
Connect the feeder connector to the radio interface of an AP using an RF transit cable (sold separately) and tighten the connector to the interface. A 1 N m tightening torque is recommended for the type-N connector.

The following table lists the RF transit cables and connectors used.

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP8130DN	RG-8U cable (25070009)	Type-N male connector (14040184)	• 2400 MHz to 2483.5 MHz: 26.8 dB / 100 m • 4920 Mhz to 5825 Mhz: 41.8 dB / 100 m	
	1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400 MHz to 2483.5 MHz: 18.1 dB / 100 m • 4920 Mhz to 5825 Mhz: 30 dB / 100 m	

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP9131DN/AP9132DN	RF transit cable (04130714, 0.5 m) connecting a QMA-J connector to an N-J connector.	- (No cable needs to be made onsite.)	• 2.4 GHz to 2.5 GHz: < 0.9 dB • 4.9 GHz to 6 GHz:< 1.3 dB	

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
	RF transit cable (04130714-001, 3 m) connecting a QMA-J connector to an N-J connector.		• 2.4 GHz to 2.5 GHz: < 2.3 dB • 4.9 GHz to 6 GHz: < 3.2 dB	

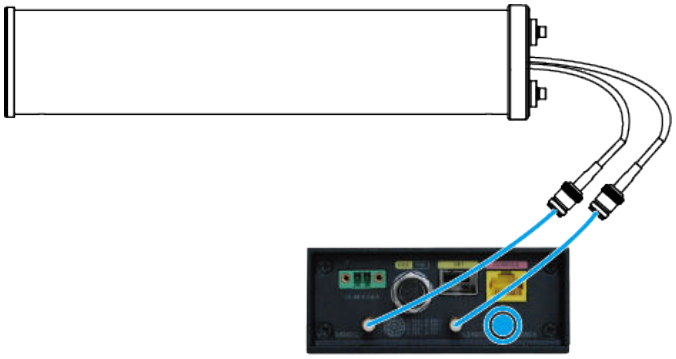
The requirements on connections between the antenna and the AP's radio interfaces are as follows:

AP Model	Principle for RF Cable Connection
AP8130DN	• Feeders of the same antenna must be connected to radio interfaces of the corresponding frequency bands on the same AP. • Two ports on the antenna are connected to radio interfaces A and B of the AP, and an RF load should be connected to radio interface C of the AP.
AP9131DN	Two ports on the antenna are connected to radio interfaces 2.4G/5G-B and 2.4G/5G-C of the AP, and an RF load should be connected to radio interface 2.4G/5G-A of the AP.

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AP Model	Principle for RF Cable Connection
AP9132DN	• When the antenna transmits 2.4 GHz and 5 GHz signals simultaneously on a radio interface, two ports on the antenna are connected to radio interfaces 2.4G/5G-B and 2.4G/5G-C of the AP respectively, and an RF load should be connected to radio interface 2.4G/5G-A of the AP. • When the antenna transmits only 2.4 GHz or 5 GHz signals on a radio interface, two ports on the antenna are connected to radio interfaces 2.4G-A and 2.4G-B of the AP, and an RF load should be connected to radio interface 2.4G-C of the AP to transmit 2.4 GHz signals.

Take the AP9131DN as an example. The following figure shows the RF cable connection on the AP9131DN.



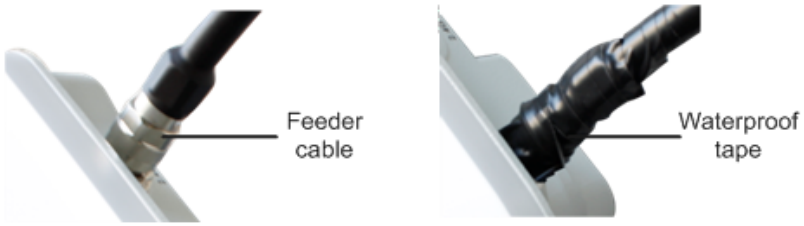
RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

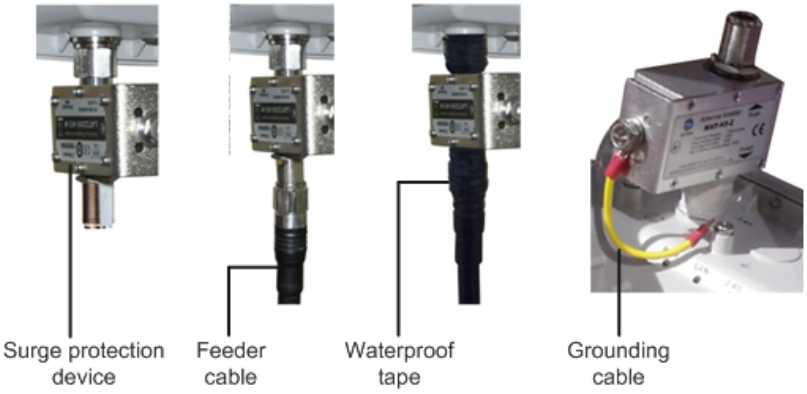
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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.

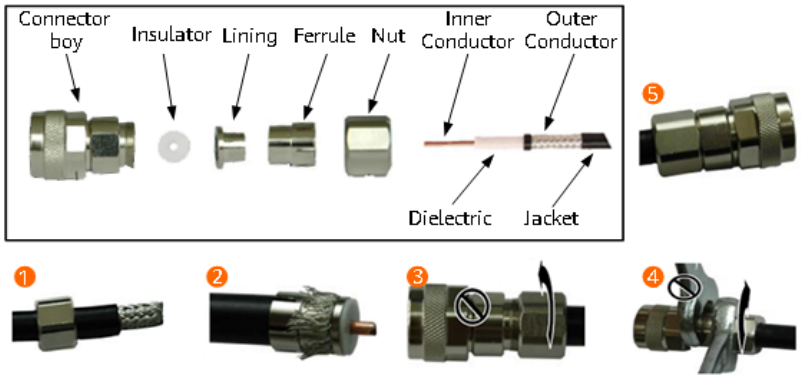


Instructions on Making RF Cables

When connecting the AP8130DN, you need to assemble the type-N male connector and 1/2" (inch) super-flexible feeder cable onsite in the following way:

Connecting the type-N male coaxial connector to the RG-8U feeder cable

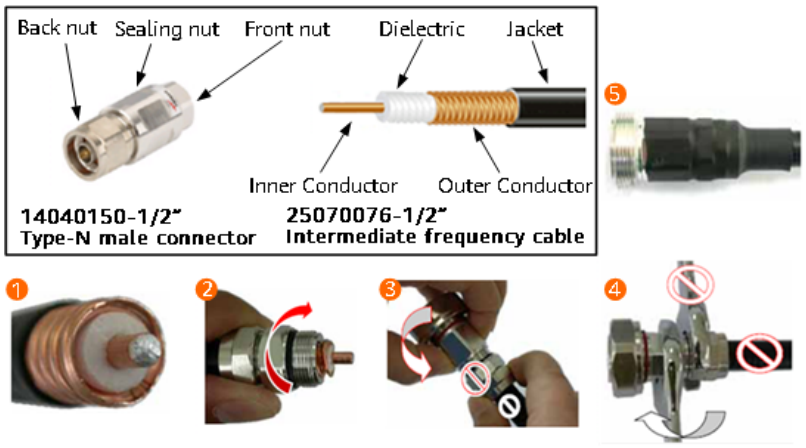
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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27 27011668 Outdoor 2.4 GHz and 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 and H360 V22 G7)

About This Chapter

27.1 27011668 Technical Specifications

27.2 27011668 Installation Precautions

27.3 27011668 Installing Antennas

27.1 27011668 Technical Specifications

Appearance and Structure

Figure 27-1 Appearance of the 27011668 Outdoor 2.4 GHz and 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 and H360 V22 G7)



Technical Specifications

Table 27-1 Technical specifications of the 27011668 Outdoor 2.4 GHz and 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 and H360 V22 G7)

Item	Details
Part Number	27011668

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Item	Details
Model	ANTDG0407A1NR
Description	Omni-directional Antenna, 2400~2500&5150~5850MHz,4&7dBi, 360deg/33deg&360deg/22deg,N/Male, 1port,without mounting parts,install directly on AP
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 4 5G: 7
Coverage distance [m(ft.)]	70 m(ft.)
Horizontal beamwidth [degrees]	360 degrees
Vertical beamwidth [degrees]	2.4G:33 5G:22
Standing wave ratio (SWR)	≤ 2
Polarization	Single polarization
Attenna connector	N-male
Attenna dimensions [mm(in.)]	Diameter x Length: ϕ23.8 x 275
Weight without packaging [kg(lb)]	0.106 kg(lb)
Installation type	Directly installed on the AP

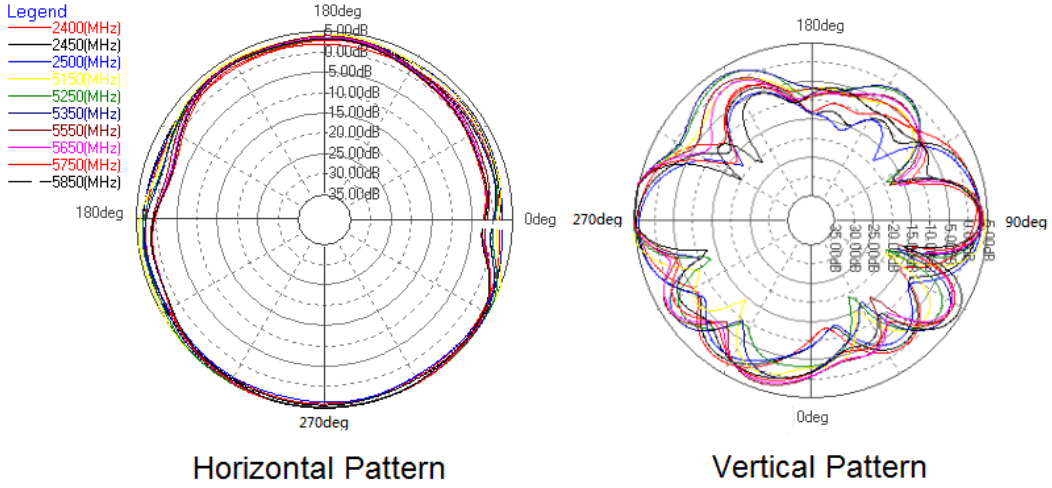
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 27-2 Antenna Pattern1 of the 27011668 Outdoor 2.4 GHz and 5 GHz Single-Polarized Omnidirectional Antenna (H360 V33 G4 and H360 V22 G7)



27.2 27011668 Installation Precautions

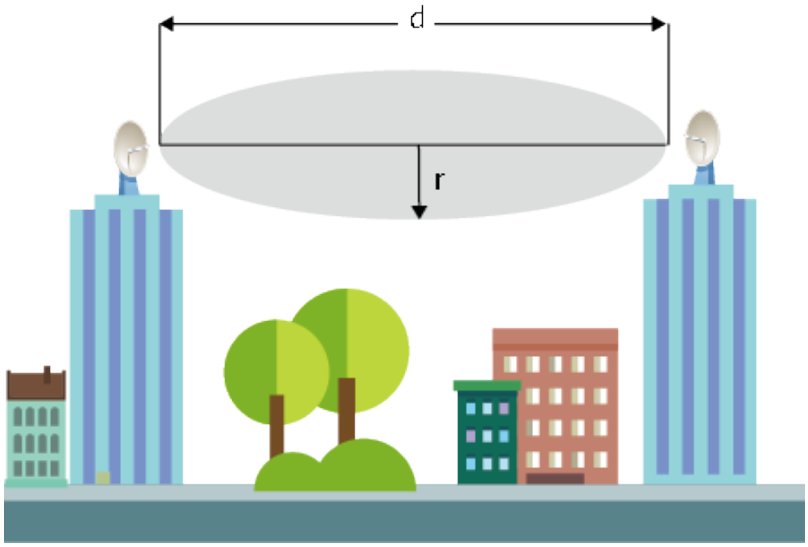
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 27-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 27-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 27-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

27.3 27011668 Installing Antennas

27011668 antennas are directly installed on APs. You only need to tighten nuts.

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The following figure shows the antenna installation.



- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the connectors in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.

NOTE

To achieve the optimal coverage effect, it is recommended that you install the omnidirectional antenna four to six meters above ground.

When installing an antenna, tightly hold the antenna connector and tighten it using a torque wrench. The recommended tightening torque is 0.8 N m to 1.0 N m.

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28 27011792 Indoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H75 V55 G4 and H75 V50 G6)

About This Chapter

28.1 27011792 Technical Specifications

28.2 27011792 Antenna Installation

28.1 27011792 Technical Specifications

Appearance and Structure

Figure 28-1 Appearance of the 27011792 Indoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H75 V55 G4 and H75 V50 G6)



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Figure 28-2 Structure of the 27011792 Indoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H75 V55 G4 and H75 V50 G6)



Technical Specifications

Table 28-1 Technical specifications of the 27011792 Indoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H75 V55 G4 and H75 V50 G6)

Item	Details
Part Number	27011792
Model	ANTDG0406D2SS
Description	Directional Antenna, 2400~2500&5150~5850MHz,4&6dBi, 75deg/55deg&75deg/50deg,SMA/ Female,2port,with mounting parts,pole mounting
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 4 5G: 6
Coverage distance [m(ft.)]	70 m(ft.)
Horizontal beamwidth [degrees]	75 degrees
Vertical beamwidth [degrees]	2.4G:55 5G:50
Standing wave ratio (SWR)	≤ 2
Polarization	Horizontal polarization,vertical polarization
Attenna connector	SMA-K x 2
Attenna dimensions [mm(in.)]	H x W x D: 25 x 86 x 86

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Item	Details
Weight without packaging [kg(lb)]	0.07±0.01
Installation type	Wall
Grounding requirements	Same as the AP
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 28-3 Antenna Pattern1 of the 27011792 Indoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H75 V55 G4 and H75 V50 G6)

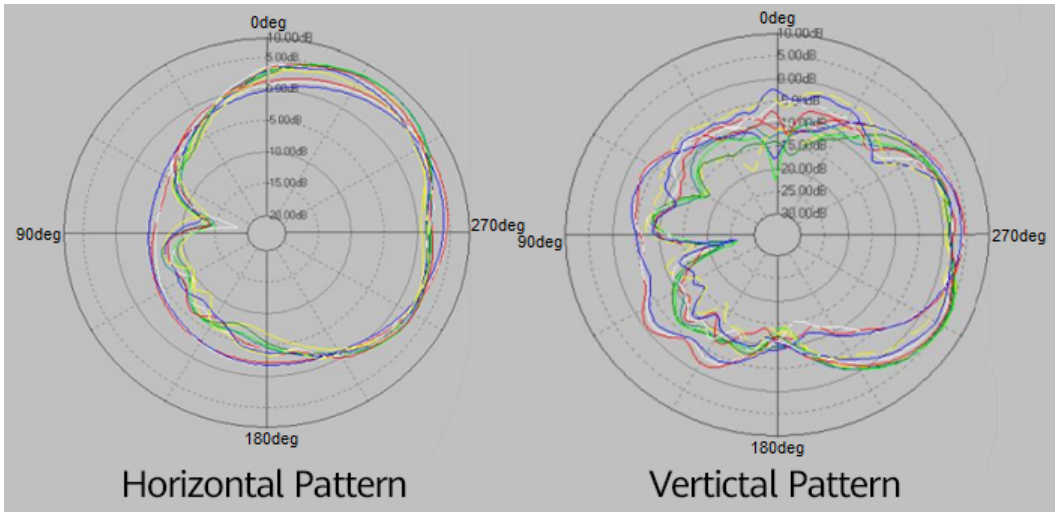
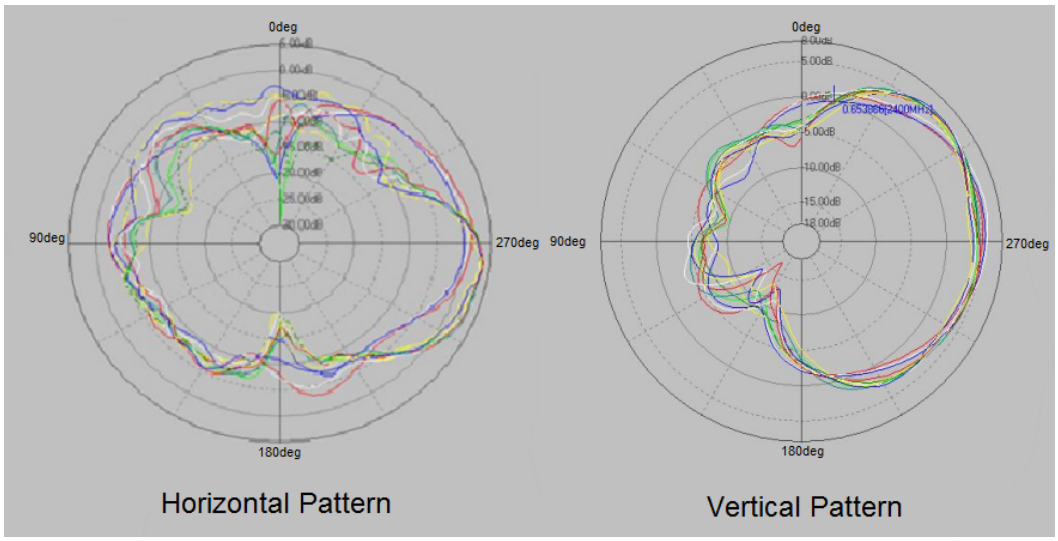


Figure 28-4 Antenna Pattern2 of the 27011792 Indoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H75 V55 G4 and H75 V50 G6)



28.2 27011792 Antenna Installation

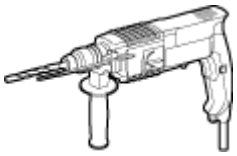
The 27011792 antenna is an indoor directional antenna. It applies to scenarios that require small coverage angles but long coverage distances. Typical scenarios include corridors in hospitals or airports.

28.2.1 Accessories and Tools

Tools:

- Hammer drill (ϕ6 and ϕ23)

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- Phillips screwdriver



- Rubber mallet



Other accessories:

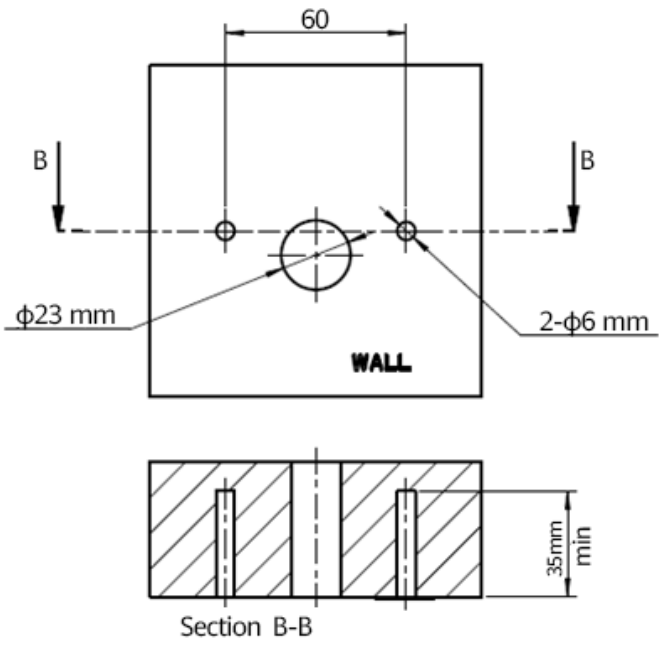
- Screw components: 2 screws and 2 expansion bolts

28.2.2 Wall Mounting

The 27011792 antenna is mounted on a wall. Different directions of outgoing RF cables result in two installation methods: outgoing direction parallel with the wall and outgoing direction vertical to the wall.

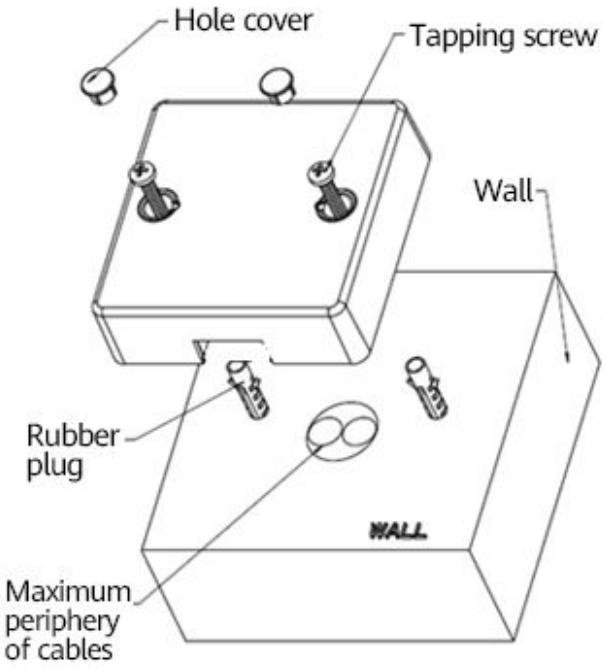
Outgoing Direction Vertical to the Wall

1. Drill holes on the wall in compliance with the sizes shown in the following figure.



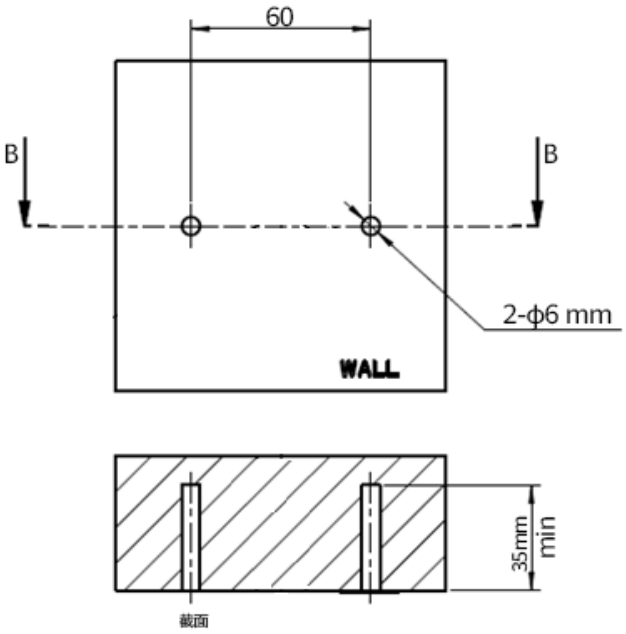
2. Place expansion bolts into the ø6 mm holes and thread screws through mounting holes of the antenna.
3. Thread the RF cable through the ø23 mm hole. After connecting cables, use screws to fix the antenna on the wall.

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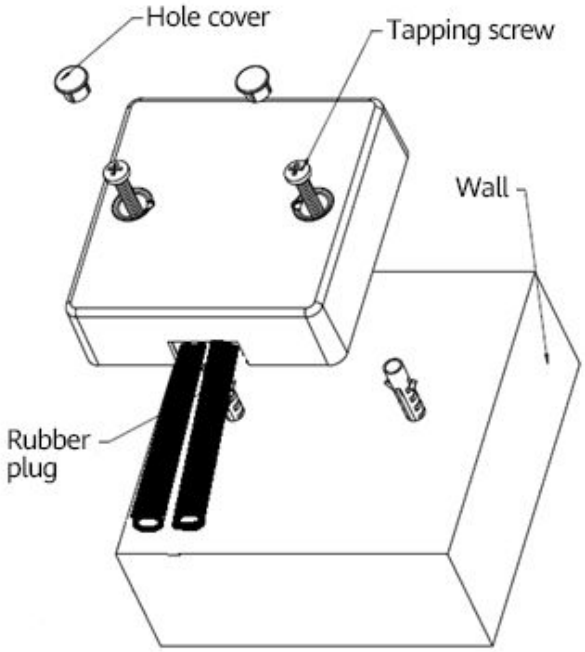
Outgoing Direction Parallel with the Wall

1. Drill holes on the wall in compliance with the sizes shown in the following figure.



2. Place expansion bolts into the ø6 mm holes and thread screws through mounting holes of the antenna.
3. Connect the RF cable to the plastic plug. After connecting cables, use screws to fix the antenna on the wall.

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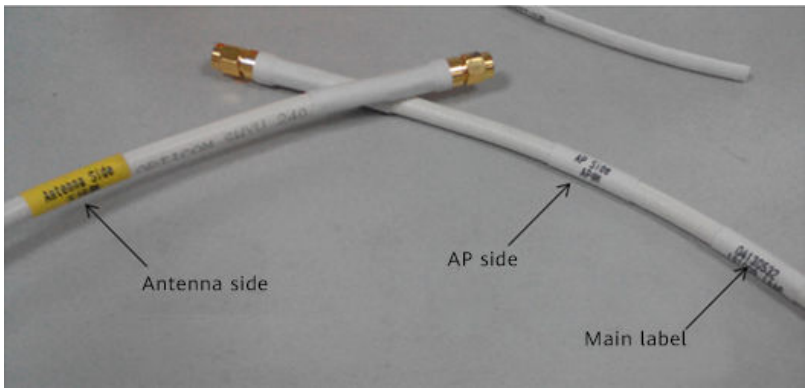
28.2.3 Connecting RF Cables

Procedure

1. Remove covers on external antenna ports of APs to expose RP-SMA female connectors.
2. Connect SMA male connectors of feeder cables to ANT ports on APs.

RF Cable Photos

Figure 28-5 RF cables



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Figure 28-6 Labels



You can use the following RF transit cables.

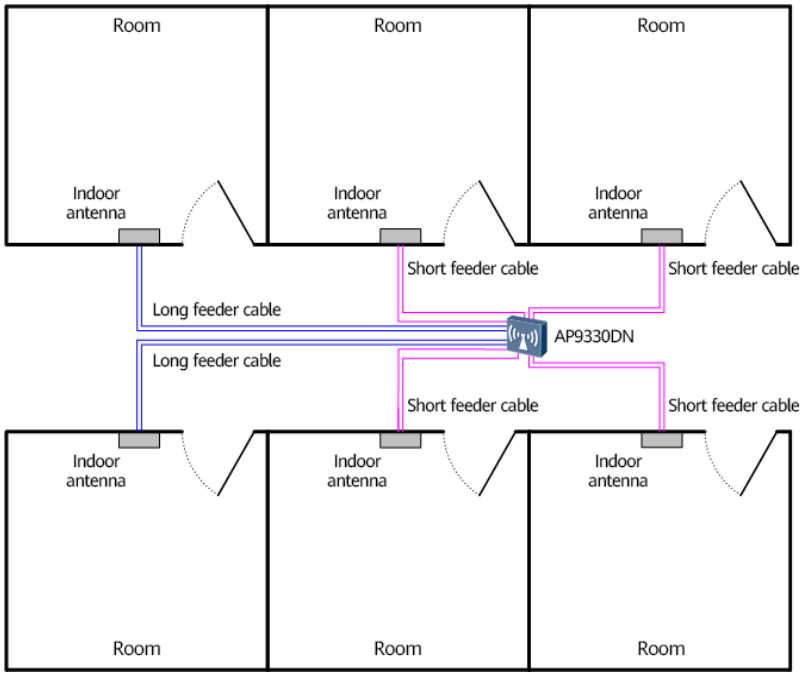
Part Number	Cable Length	Interface Description
04130532	5 m	SMA-J/RP-SMA-J
04130532-001	10 m	
04130532-002	15 m	

NOTE

- Connectors on the two ends of an RF cable are different. You should connect the AP side connector to the AP and the antenna side connector to the antenna.
- The longer the feeder cable, the weaker the signal strength within the antenna coverage range. The cabling method in **Figure 28-7** is recommended. The feeder cable should be as short as possible. The 15-meter feeder cable is not recommended.

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Figure 28-7 Cabling of feeder cables



NOTE

In dual-band and double-stream scenarios, ensure that the two antenna ports with the same number on the AP9330DN are connected to the same antenna.

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29 27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)

About This Chapter

29.1 27012045 Technical Specifications

29.2 27012045 Antenna Installation

29.1 27012045 Technical Specifications

Appearance and Structure

Figure 29-1 Appearance of the 27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)



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Technical Specifications

Table 29-1 Technical specifications of the 27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)

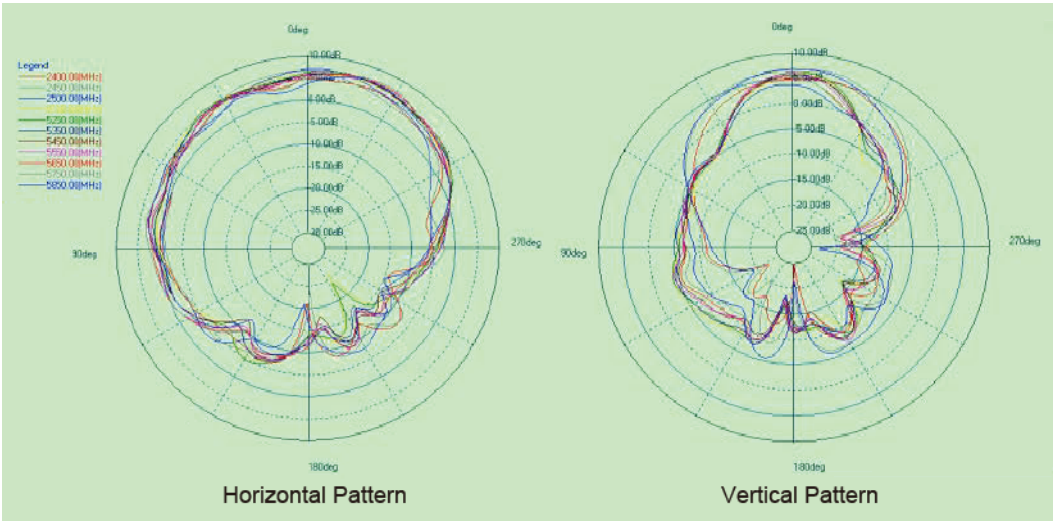
Item	Details
Part Number	27012045
Model	ANTDG0606D3NR
Description	Directional Antenna, 2400~2500&5150~5850MHz,5.5&6dBi, 75deg/65deg&80deg/40deg,QMA/Male,3port,without mounting parts,used in carriage
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 5.5 5G: 6
Coverage distance [m(ft.)]	2.4G: 80 5G: 70
Horizontal beamwidth [degrees]	2.4G:75 5G:80
Vertical beamwidth [degrees]	2.4G:65 5G:40
Standing wave ratio (SWR)	≤ 2
Polarization	Horizontal,Vertical,Cross polarization
Attenna connector	QMA-male x 3
Attenna dimensions [mm(in.)]	H x W x D: 35 x 140 x 100
Weight without packaging [kg(lb)]	0.26 kg(lb)
Installation type	Wall
Grounding requirements	Same as the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 29-2 Antenna Pattern1 of the 27012045 Vehicle-Mounted 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H75 V65 G5.5 & H80 V40 G6)



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29.2 27012045 Antenna Installation

The 27012045 antenna is a vehicle-mounted directional antenna and applicable to wireless coverage on vehicles.

29.2.1 Accessories and Tools

The following accessories and tools are required for installing the 27012045 antenna.

- One screwdriver

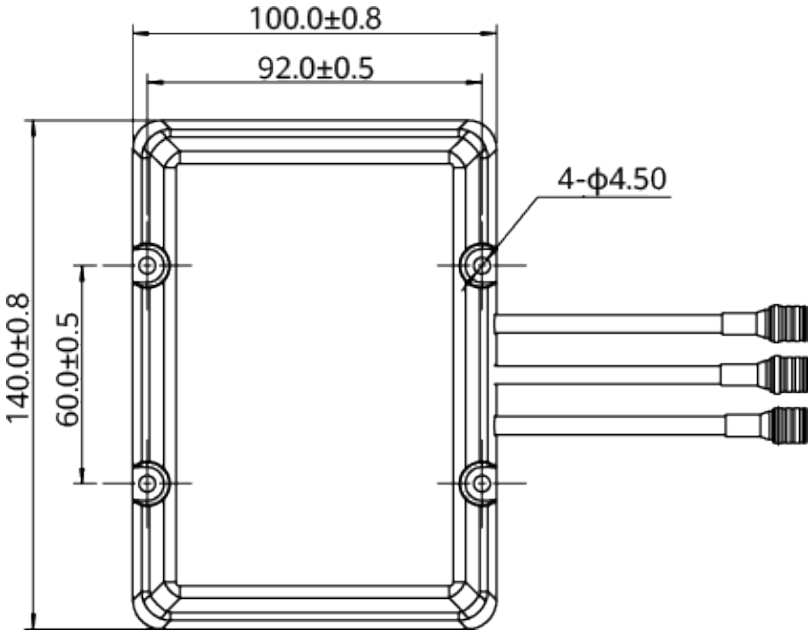
29.2.2 Wall Mounting

The 27012045 antenna can be mounted on a wall in a vehicle.

NOTE

- Determine the antenna mounting method according to onsite situations.
- Select the proper outlet direction for the feeder, preventing small-angle bending of the feeder.

1. Select a suitable mounting position on the inner wall of a vehicle based on the positions and dimensions of mounting holes of the antenna, as shown in the following figure (unit: mm).



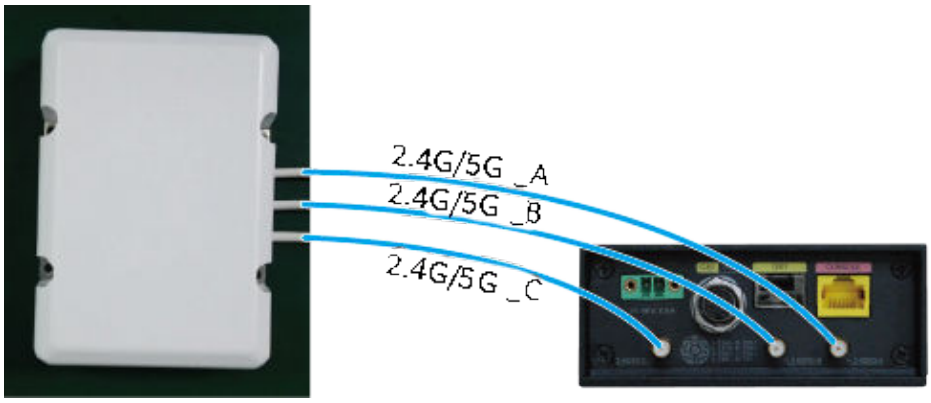
2. Fix the antenna on the inner wall of the vehicle using four screws.

29.2.3 Connecting RF Cables

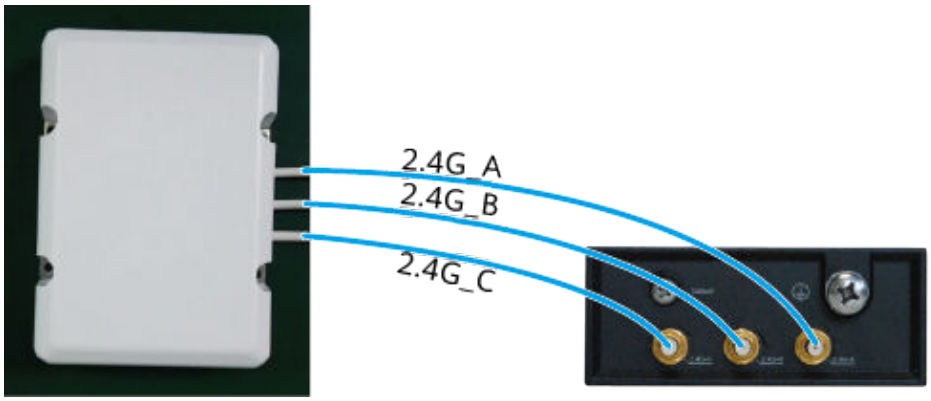
RF Cable Connections

Connect three feeder ports A, B, and C of the antenna to radio interfaces A, B, and C of the corresponding frequency bands on the AP.

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If the AP9132DN is used to transmit only 2.4 GHz or 5 GHz signals on a radio interface, connect the 2.4 GHz antenna following the instructions in the figure below.



RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

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30 27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)

About This Chapter

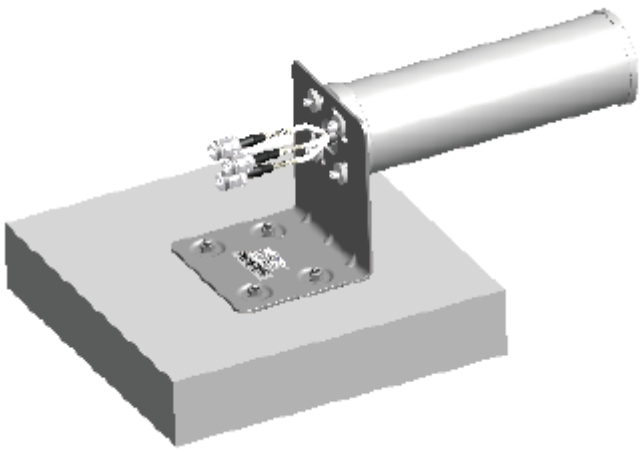
30.1 27012046 Technical Specifications

30.2 27012046 Antenna Installation

30.1 27012046 Technical Specifications

Appearance and Structure

Figure 30-1 Appearance of the 27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)



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Technical Specifications

Table 30-1 Technical specifications of the 27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)

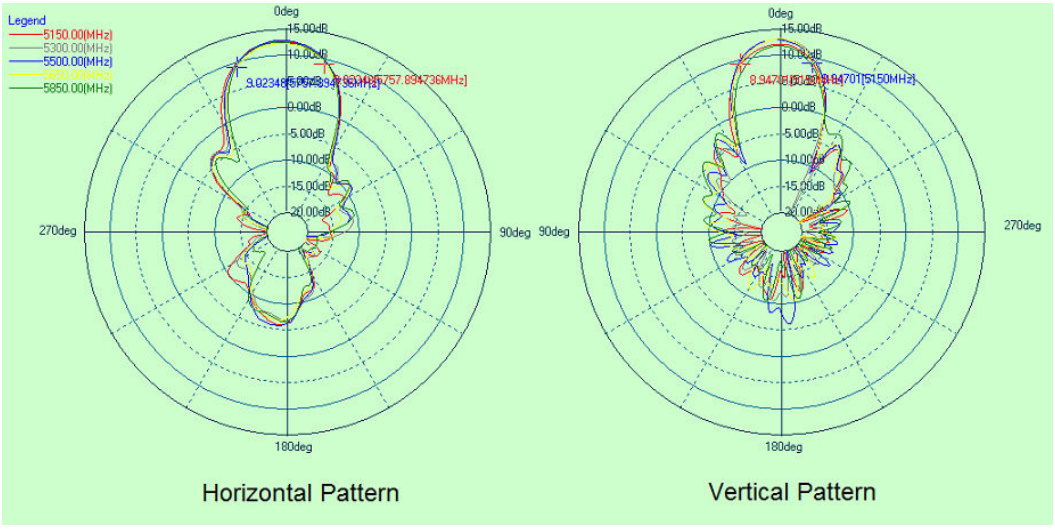
Item	Details
Part Number	27012046
Model	ANT5G14D3NW
Description	Directional Antenna,5150~5850MHz, 14dBi,30deg/30deg,N/Female, 3port,with mounting parts,wall mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	14 dBi
Coverage distance [m(ft.)]	140 m(ft.)
Horizontal beamwidth [degrees]	30 degrees
Vertical beamwidth [degrees]	30 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization&Cross polarization
Attenna connector	N-female x 3
Attenna dimensions [mm(in.)]	Diameter x Length: ϕ84 x 257
Weight without packaging [kg(lb)]	1.22 kg(lb)
Installation type	Wall
Grounding requirements	Same as the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 30-2 Antenna Pattern1 of the 27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)



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Figure 30-3 Antenna Pattern2 of the 27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)

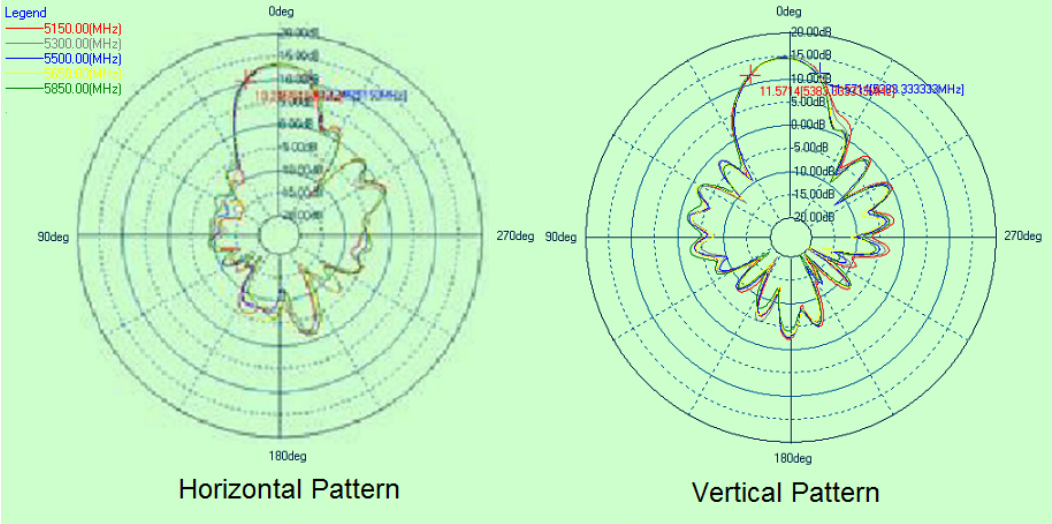
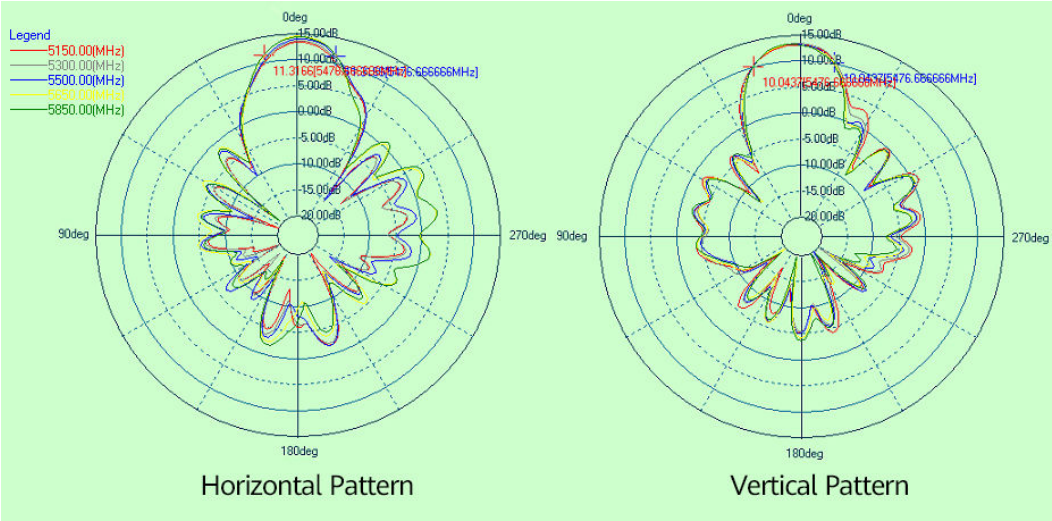


Figure 30-4 Antenna Pattern3 of the 27012046 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H30 V30 G14)



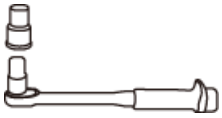
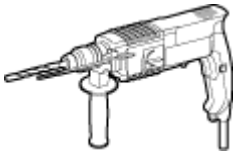
30.2 27012046 Antenna Installation

The 27012046 antenna is a directional antenna. It can be installed on an inner wall of a tunnel and in vehicle-ground backhaul scenarios.

30.2.1 Accessories and Tools

The following accessories and tools are required for installing the 27012046 antenna.

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Accessory/Tool	Quantity	Picture
Torque socket (M6)	1 PCS	
Level	1 PCS	
Rubber mallet	1 PCS	
Hammer drill (the drill bit diameter is 8 mm)	1 PCS	
Sheet metal mounting bracket	1 PCS	
Expansion bolts (M6 x 60)	4 sets	

30.2.2 Wall Mounting

Precautions

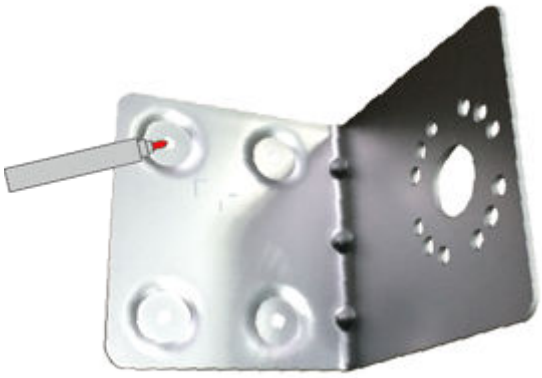
Take note of the following points when installing this antenna:

- The distance between the installation height and the height of antennas of vehicle-mounted APs is within 30 cm. It is recommended that it is 20 cm higher than the height of antennas of vehicle-mounted APs.
- The tubular center axis of the antenna is paralleled with the rail and the angle between the antenna and wall is less than 1°. Do not incline the antenna towards the wall.
- If you customize mounting brackets, ensure that the distance between the center axis of the antenna and the installation wall is at least 15 cm.

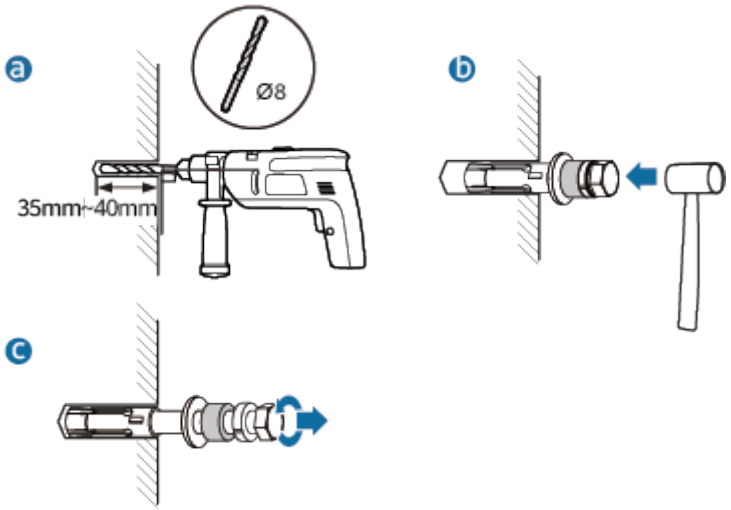
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Wall Mounting

1. Fix the mounting bracket to the wall, adjust the installation position using a level, and mark positions of four mounting holes.

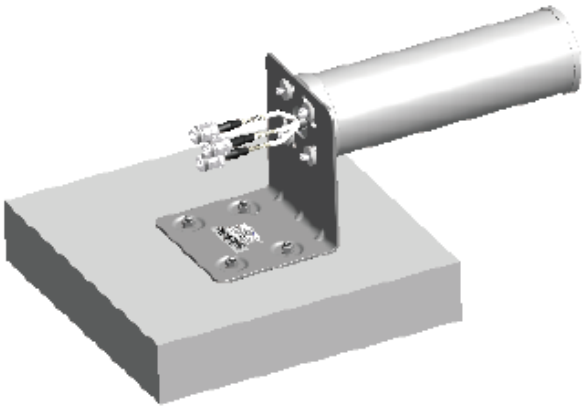


2. Use a hammer drill to drill holes at the four marked positions. Screw the nut into the expansion bolt, hammer the expansion bolt into a hole until the flat washer is closely attached to the wall. Remove the nut, spring washer, and flat washer in order.



3. Fix the antenna onto the mounting bracket, fit flat washers, spring washers, and nuts in order, and tighten the nuts (the tightening torque is 5 N m). Stretch the feeder port out of the hole of the mounting bracket.
4. Pinch the mounting bracket on the expansion bolts, fit flat washers, spring washers, and nuts in order, and tighten the nuts (the tightening torque is 5 N m).

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30.2.3 Connecting RF Cables

RF Cable Connection

Connect the feeder connector to the radio interface of an AP using an RF transit cable (sold separately) and tighten the connector to the interface. A 1 N m tightening torque is recommended for the type-N connector.

The following table lists the RF transit cables and connectors used.

AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP8130DN	RG-8U cable (25070009)	Type-N male connector (14040184)	• 2400 MHz to 2483.5 MHz: 26.8 dB / 100 m • 4920 Mhz to 5825 Mhz: 41.8 dB / 100 m	

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
	1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400 MHz to 2483.5 MHz: 18.1 dB / 100 m • 4920 Mhz to 5825 Mhz: 30 dB / 100 m	
AP9131DN/ AP9132DN	RF transit cable (04130714, 0.5 m) connecting a QMA-J connector to an N-J connector.	- (No cable needs to be made onsite.)	• 2.4 GHz to 2.5 GHz: < 0.9 dB • 4.9 GHz to 6 GHz:< 1.3 dB	

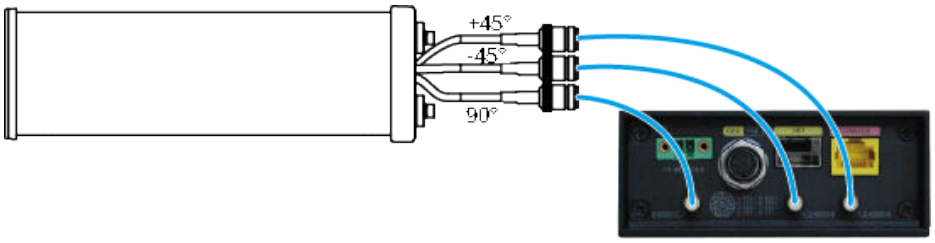
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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
	RF transit cable (04130714-001, 3 m) connecting a QMA-J connector to an N-J connector.		• 2.4 GHz to 2.5 GHz: < 2.3 dB • 4.9 GHz to 6 GHz: < 3.2 dB	

The requirements on connections between the antenna and the AP's radio interfaces are as follows:

- Feeders of the same antenna must be connected to radio interfaces of the corresponding frequency bands on the same AP.
- Feeder ports whose polarization directions are +45° and -45° on an antenna are connected to radio interfaces A and B of an AP respectively, and the feeder port whose polarization direction is 90°is connected to radio interface C of the AP.

Take the AP9132DN as an example. The following figure shows the RF cable connection on the AP9132DN.



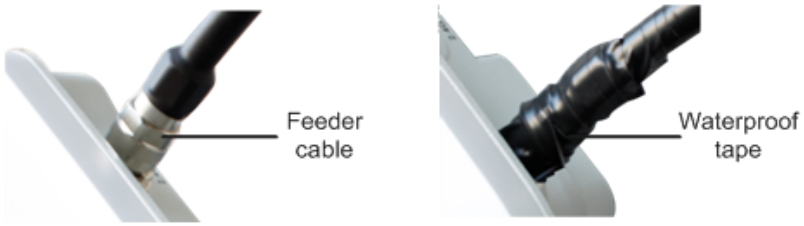
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RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

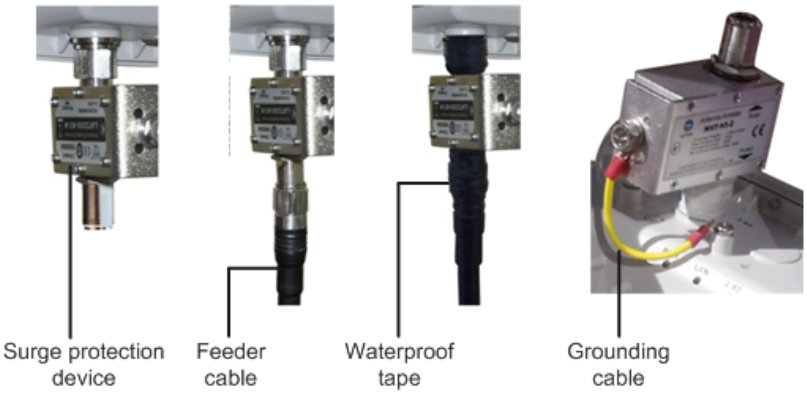
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



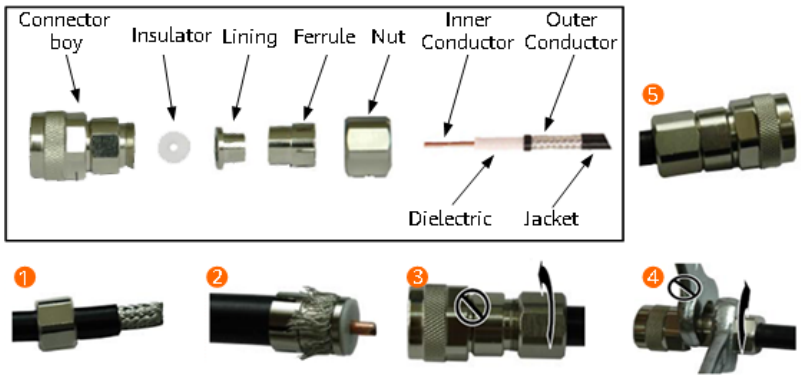
Instructions on Making RF Cables

When connecting the AP8130DN, you need to assemble the type-N male connector and 1/2" (inch) super-flexible feeder cable onsite in the following way:

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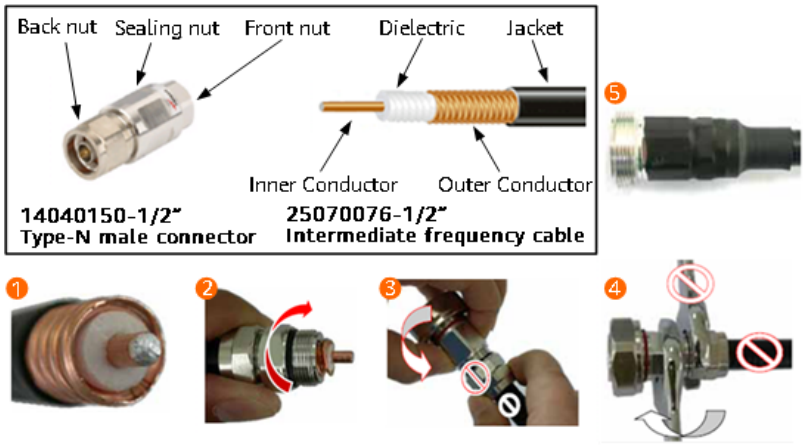
Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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31 27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)

About This Chapter

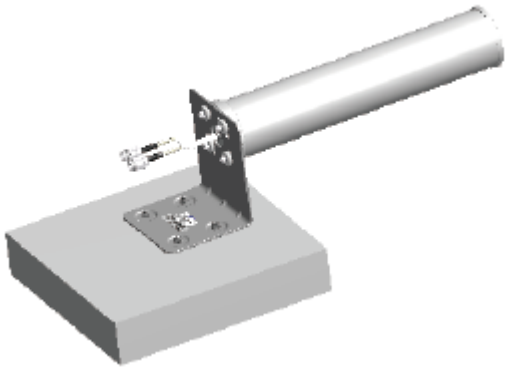
31.1 27012048 Technical Specifications

31.2 27012048 Antenna Installation

31.1 27012048 Technical Specifications

Appearance and Structure

Figure 31-1 Appearance of the 27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)



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Technical Specifications

Table 31-1 Technical specifications of the 27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)

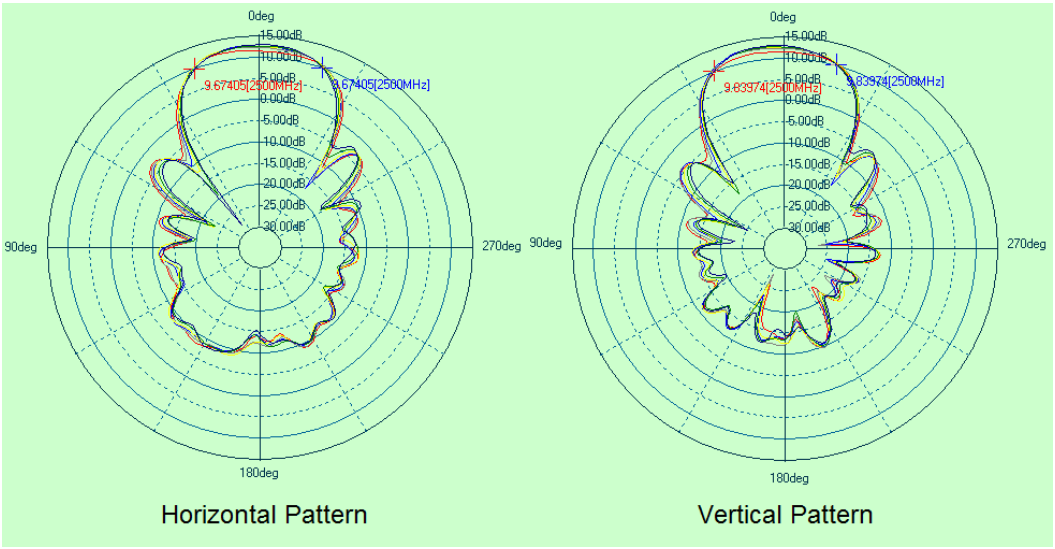
Item	Details
Part Number	27012048
Model	ANT2G12D2NW
Description	Directional Antenna,2400~2500MHz, 12dBi,35deg/35deg,N/Female, 2port,with mounting parts,wall mounting
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	12 dBi
Coverage distance [m(ft.)]	150 m(ft.)
Horizontal beamwidth [degrees]	35 degrees
Vertical beamwidth [degrees]	35 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Horizontal and vertical polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	Diameter x Length: ϕ84 x 385
Weight without packaging [kg(lb)]	1220 kg(lb)
Installation type	Wall
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ25 to ϕ50

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

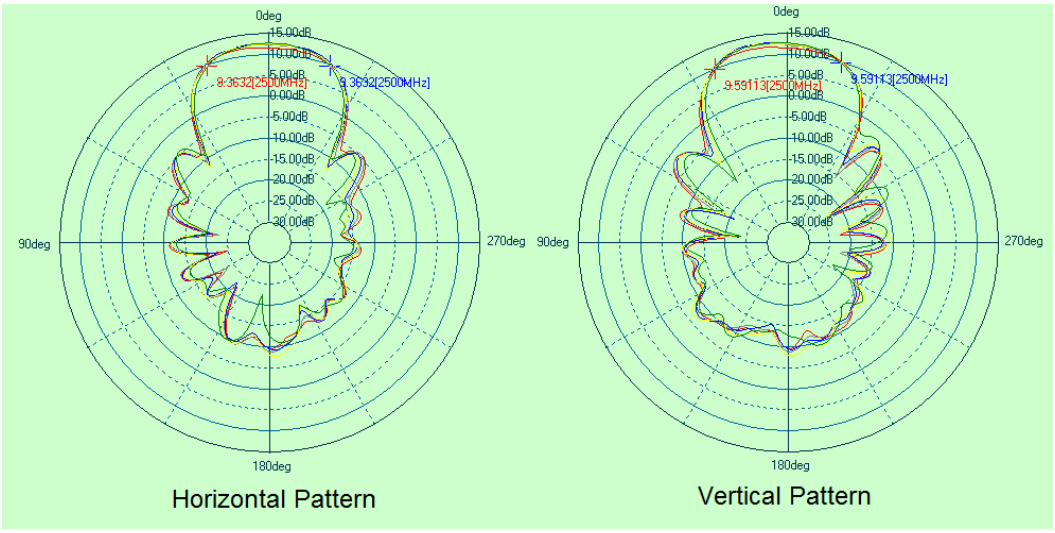
Antenna's Radiation Pattern

Figure 31-2 Antenna Pattern1 of the 27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)



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Figure 31-3 Antenna Pattern2 of the 27012048 Rail Transportation 2.4 GHz Dual-Polarized Directional Antenna (H35 V35 G12)

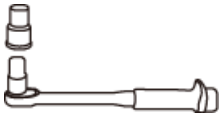
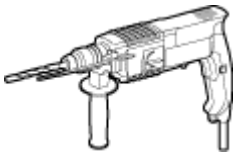


31.2 27012048 Antenna Installation

The 27012048 antenna is a directional antenna. It can be installed on an inner wall of a tunnel and in vehicle-ground backhaul scenarios.

31.2.1 Accessories and Tools

The following accessories and tools are required for installing the 27012048 antenna.

Accessory/Tool	Quantity	Picture
Torque socket (M6)	1 PCS	
Level	1 PCS	
Rubber mallet	1 PCS	
Hammer drill (the drill bit diameter is 8 mm)	1 PCS	

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Accessory/Tool	Quantity	Picture
Sheet metal mounting bracket	1 PCS	
Expansion bolts (M6 x 60)	4 sets	

31.2.2 Wall Mounting

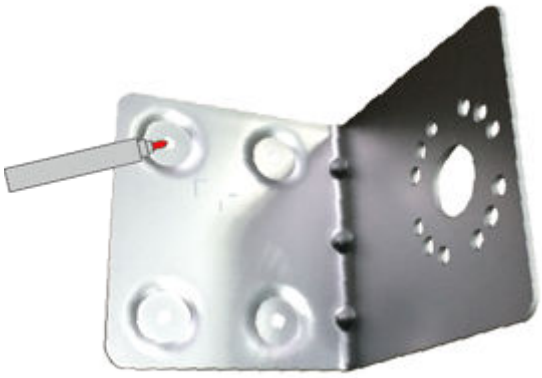
Precautions

Pay attention to the following points when installing this antenna:

- The distance between the installation height and the height of antennas of vehicle-mounted APs is less than 30 cm. It is recommended that it be installed at a position 20 cm higher than the antennas of vehicle-mounted APs.
- The tubular central axis of the antenna is horizontally paralleled with the rails and the angle between the antenna and wall is less than 1°. Do not incline the antenna towards the wall.
- If you customize mounting brackets, ensure that the distance between the central axis of the antenna and the installation wall is no less than 15 cm.

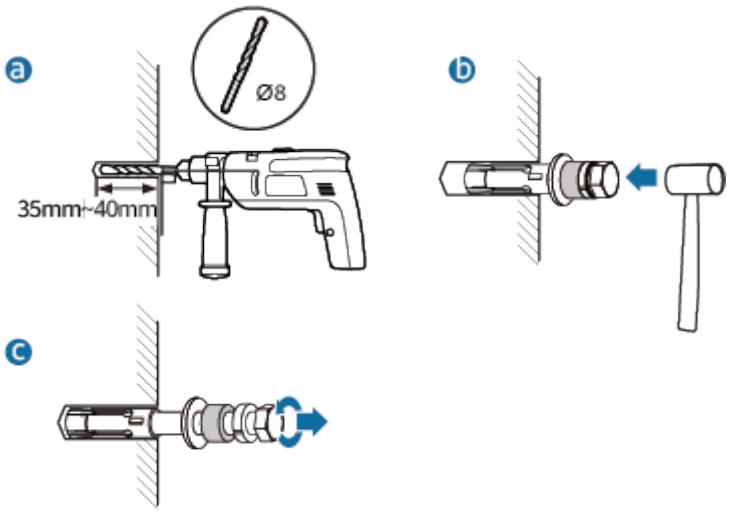
Wall Mounting

1. Fix the mounting bracket to the wall, adjust the installation position using a level, and mark positions of four mounting holes.

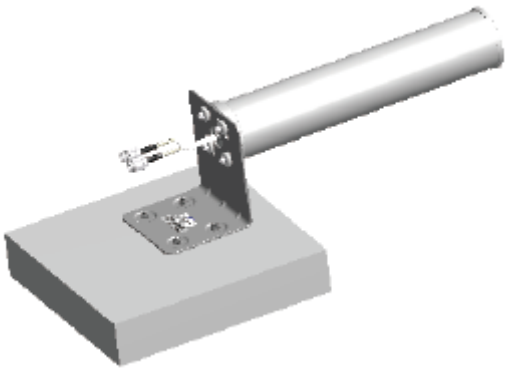


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2. Use a hammer drill to drill holes at the four marked positions. Screw the nut into the expansion bolt, hammer the expansion bolt into a hole until the flat washer is closely attached to the wall. Remove the nut, spring washer, and flat washer in order.



3. Fix the antenna onto the mounting bracket, fit flat washers, spring washers, and nuts in order, and tighten the nuts (the tightening torque is 5 N m). Stretch the feeder port out of the hole of the mounting bracket.
4. Pinch the mounting bracket on the expansion bolts, fit flat washers, spring washers, and nuts in order, and tighten the nuts (the tightening torque is 5 N m).



31.2.3 Connecting RF Cables

RF Cable Connection

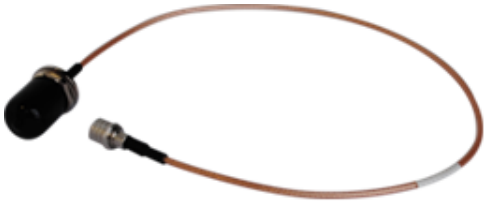
Connect the feeder connector to the radio interface of an AP using an RF transit cable (sold separately) and tighten the connector to the interface. A 1 N m tightening torque is recommended for the type-N connector.

The following table lists the RF transit cables and connectors used.

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP8130DN	RG-8U cable (25070009)	Type-N male connector (14040184)	• 2400 MHz to 2483.5 MHz: 26.8 dB / 100 m • 4920 Mhz to 5825 Mhz: 41.8 dB / 100 m	
	1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400 MHz to 2483.5 MHz: 18.1 dB / 100 m • 4920 Mhz to 5825 Mhz: 30 dB / 100 m	

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP9131DN/AP9132DN	RF transit cable (04130714, 0.5 m) connecting a QMA-J connector to an N-J connector.	- (No cable needs to be made onsite.)	• 2.4 GHz to 2.5 GHz: < 0.9 dB • 4.9 GHz to 6 GHz:< 1.3 dB	

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
	RF transit cable (04130714-001, 3 m) connecting a QMA-J connector to an N-J connector.		• 2.4 GHz to 2.5 GHz: < 2.3 dB • 4.9 GHz to 6 GHz: < 3.2 dB	

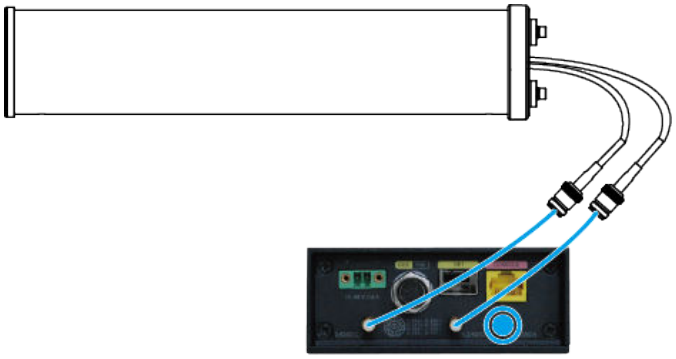
The requirements on connections between the antenna and the AP's radio interfaces are as follows:

AP Model	Principle for RF Cable Connection
AP8130DN	• Feeders of the same antenna must be connected to radio interfaces of the corresponding frequency bands on the same AP. • Two ports on the antenna are connected to radio interfaces A and B of the AP, and an RF load should be connected to radio interface C of the AP.
AP9131DN	Two ports on the antenna are connected to radio interfaces 2.4G/5G-B and 2.4G/5G-C of the AP, and an RF load should be connected to radio interface 2.4G/5G-A of the AP.

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AP Model	Principle for RF Cable Connection
AP9132DN	• When the antenna transmits 2.4 GHz and 5 GHz signals simultaneously on a radio interface, two ports on the antenna are connected to radio interfaces 2.4G/5G-B and 2.4G/5G-C of the AP respectively, and an RF load should be connected to radio interface 2.4G/5G-A of the AP. • When the antenna transmits only 2.4 GHz or 5 GHz signals on a radio interface, two ports on the antenna are connected to radio interfaces 2.4G-A and 2.4G-B of the AP, and an RF load should be connected to radio interface 2.4G-C of the AP to transmit 2.4 GHz signals.

Take the AP9131DN as an example. The following figure shows the RF cable connection on the AP9131DN.



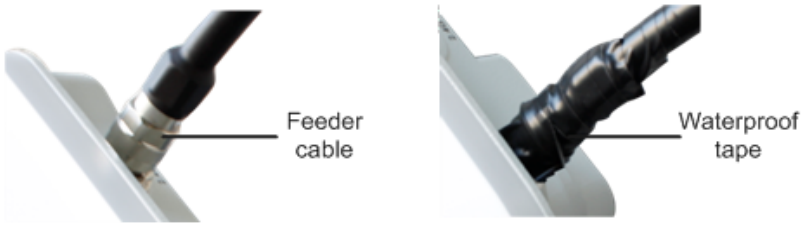
RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

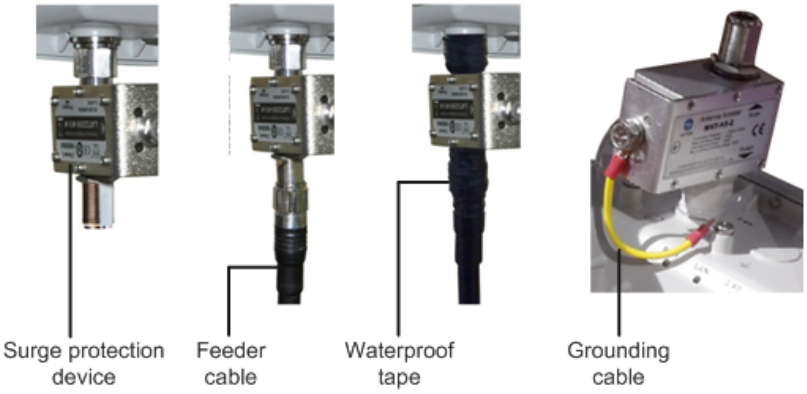
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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.

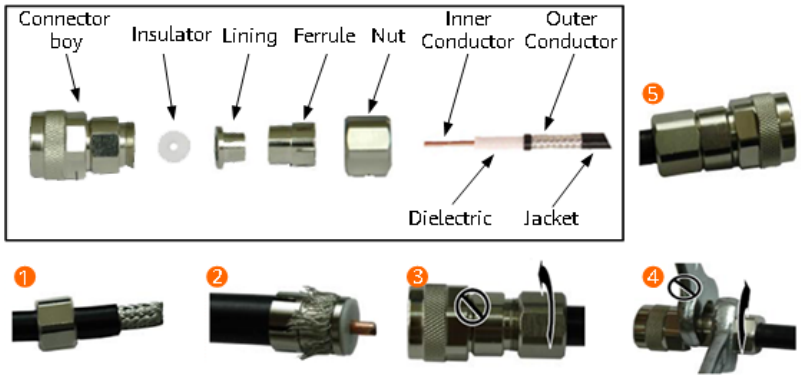


Instructions on Making RF Cables

When connecting the AP8130DN, you need to assemble the type-N male connector and 1/2" (inch) super-flexible feeder cable onsite in the following way:

Connecting the type-N male coaxial connector to the RG-8U feeder cable

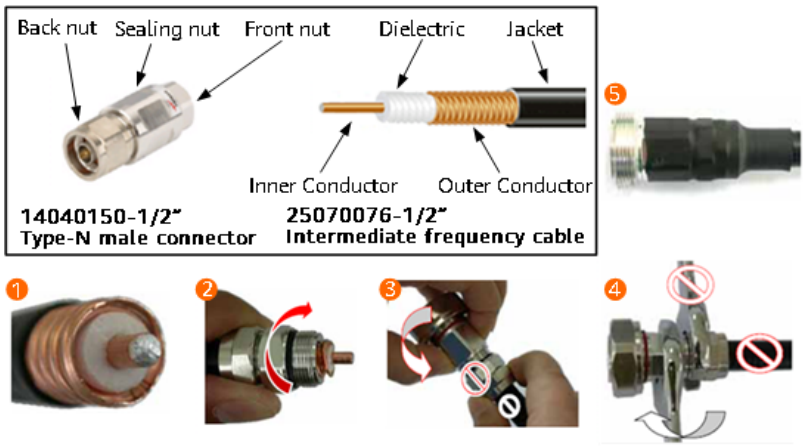
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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32 27012050 Vehicle-Mounted 5 GHz Dual-Polarized Directional Antenna (H70 V35 G9)

About This Chapter

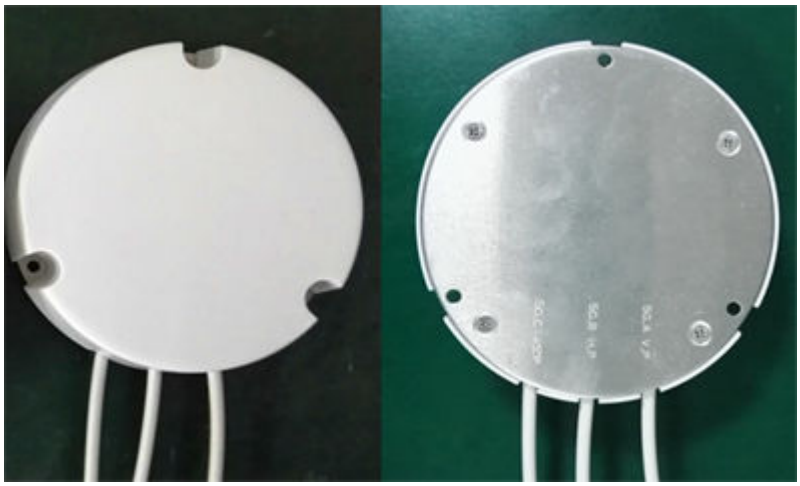
32.1 27012050 Technical Specifications

32.2 27012050 Antenna Installation

32.1 27012050 Technical Specifications

Appearance and Structure

Figure 32-1 Appearance of the 27012050 Vehicle-Mounted 5 GHz Dual-Polarized Directional Antenna (H70 V35 G9)



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Technical Specifications

Table 32-1 Technical specifications of the 27012050 Vehicle-Mounted 5 GHz Dual-Polarized Directional Antenna (H70 V35 G9)

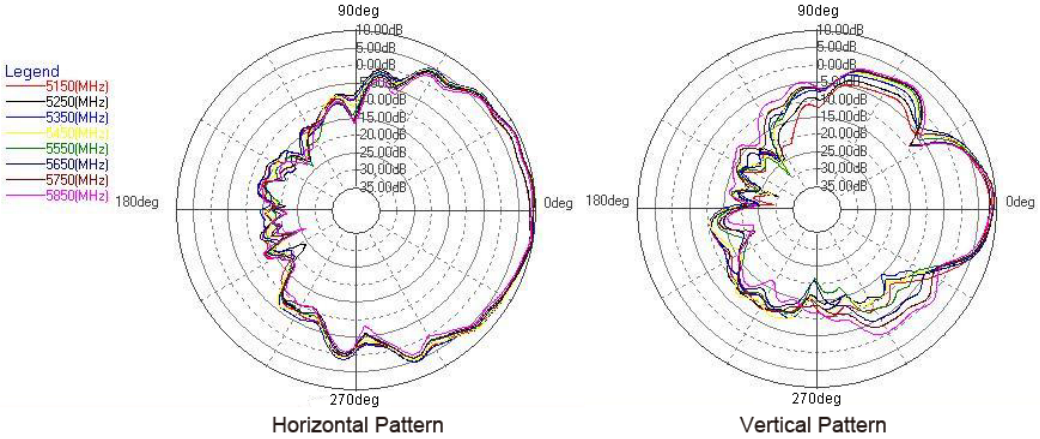
Item	Details
Part Number	27012050
Model	ANT5G09D3QR
Description	Directional Antenna,5150~5850MHz, 9dBi,70deg/35deg,QMA/Male, 3port,without mounting parts,used in carriage
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	9 dBi
Coverage distance [m(ft.)]	90 m(ft.)
Horizontal beamwidth [degrees]	70 degrees
Vertical beamwidth [degrees]	35 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Horizontal,Vertical,Cross polarization
Attenna connector	QMA-male x 3
Attenna dimensions [mm(in.)]	Diameter x Length: ϕ110 x 33
Weight without packaging [kg(lb)]	0.24 kg(lb)
Installation type	Wall
Grounding requirements	Same as the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 32-2 Antenna Pattern1 of the 27012050 Vehicle-Mounted 5 GHz Dual-Polarized Directional Antenna (H70 V35 G9)



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32.2 27012050 Antenna Installation

The 27012050 antenna is a vehicle-mounted directional antenna and applicable to wireless coverage on vehicles.

32.2.1 Accessories and Tools

The following accessories and tools are required for installing the 27012050 antenna.

- One screwdriver

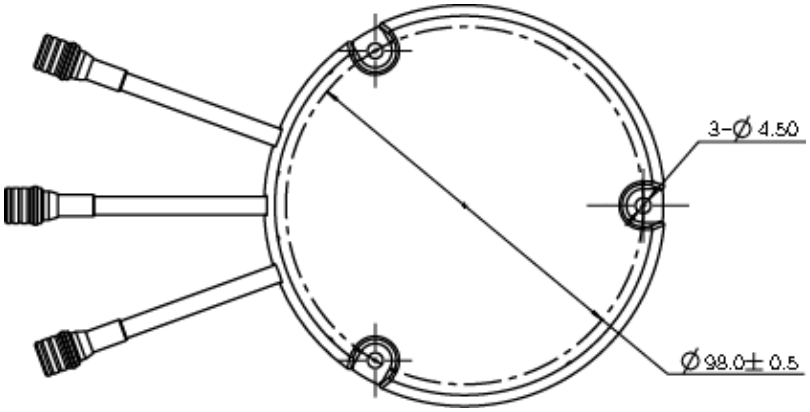
32.2.2 Wall Mounting

The 27012050 antenna can be mounted on a wall in a vehicle.

NOTE

- Determine the antenna mounting method according to onsite situations.
- Select the proper outlet direction for the feeder, preventing small-angle bending of the feeder.

1. Select a suitable mounting position on the inner wall of a vehicle based on the positions and dimensions of mounting holes of the antenna, as shown in the following figure (unit: mm).

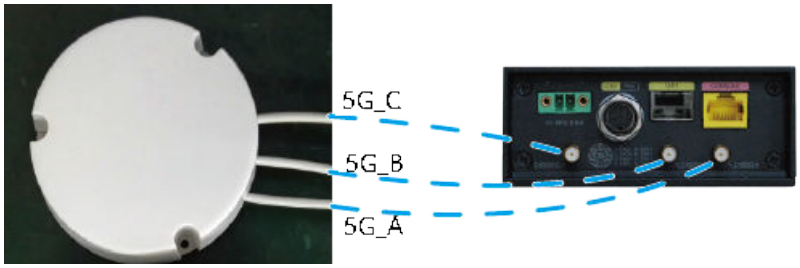


2. Fix the antenna on the inner wall of the vehicle using three screws.

32.2.3 Connecting RF Cables

RF Cable Connections

Connect three feeder ports A, B, and C of the antenna to radio interfaces A, B, and C of the corresponding frequency bands on the AP.



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RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

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33 27012075 Vehicle-Mounted 2.4 GHz & 5 GHz Single-Polarized Directional Antenna (H80 V40 G4 & H80 V40 G6)

About This Chapter

33.1 27012075 Technical Specifications

33.2 27012075 Antenna Installation

33.1 27012075 Technical Specifications

Appearance and Structure

Figure 33-1 Appearance of the 27012075 Vehicle-Mounted 2.4 GHz & 5 GHz Single-Polarized Directional Antenna (H80 V40 G4 & H80 V40 G6)



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Technical Specifications

Table 33-1 Technical specifications of the 27012075 Vehicle-Mounted 2.4 GHz & 5 GHz Single-Polarized Directional Antenna (H80 V40 G4 & H80 V40 G6)

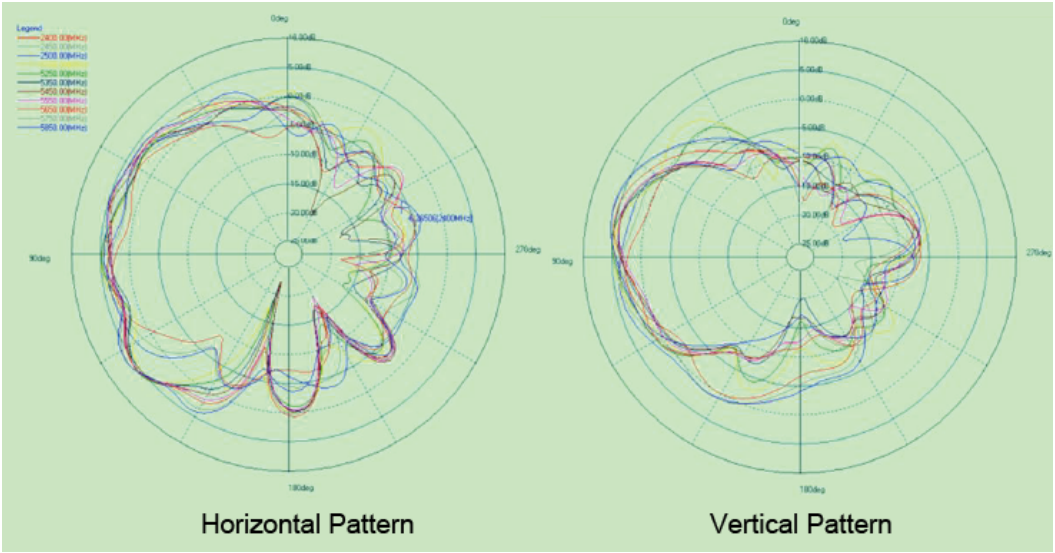
Item	Details
Part Number	27012075
Model	C15N15Z100DK
Description	Directional Antenna, 2400~2500&5150~5850MHz,4&6dBi, 80deg/40deg&80deg/40deg,SMA/Female,1port,without mounting parts,used in carriage
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 4 5G: 6
Coverage distance [m(ft.)]	70 m(ft.)
Horizontal beamwidth [degrees]	80 degrees
Vertical beamwidth [degrees]	40 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization
Attenna connector	SMA-K
Attenna dimensions [mm(in.)]	H x W x D: 23 x 86 x 86
Weight without packaging [kg(lb)]	0.065 kg(lb)
Installation type	Wall
Grounding requirements	Same as the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 33-2 Antenna Pattern1 of the 27012075 Vehicle-Mounted 2.4 GHz & 5 GHz Single-Polarized Directional Antenna (H80 V40 G4 & H80 V40 G6)



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33.2 27012075 Antenna Installation

The 27012075 antenna is a vehicle-mounted directional antenna and applicable to wireless coverage on vehicles.

33.2.1 Accessories and Tools

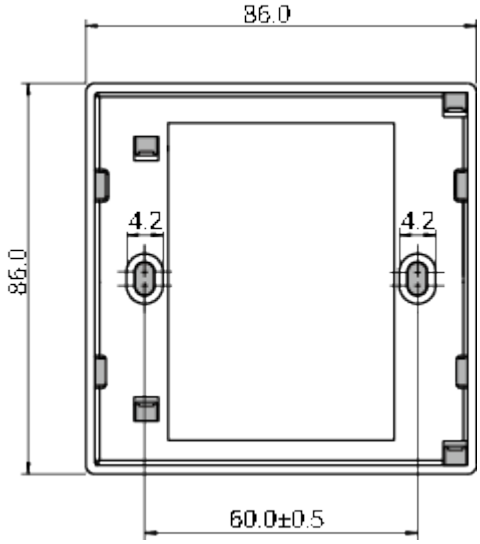
The following accessories and tools are required for installing the 27012075 antenna.

- One screwdriver

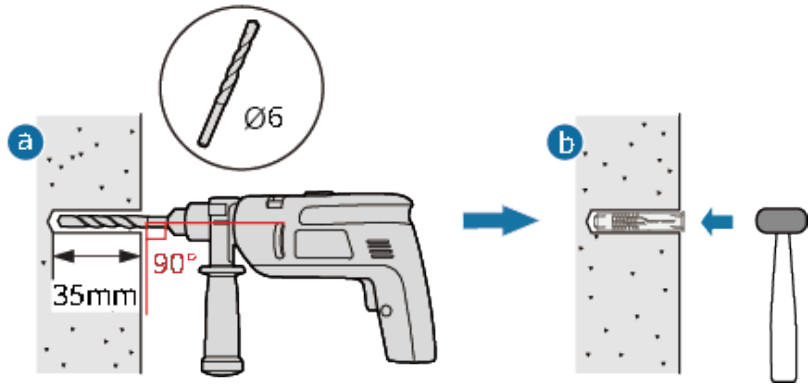
33.2.2 Wall Mounting

The 27012075 antenna can be mounted on a wall indoors or in a vehicle. The following describes how to mount the antenna to a wall indoors. The method of mounting the antenna in a vehicle is determined according to onsite situations.

1. Select a suitable mounting position on the wall based on the positions and dimensions of mounting holes of the antenna, as shown in the following figure (unit: mm).



2. Drill holes at the marked positions and install the plastic expansion tubes.

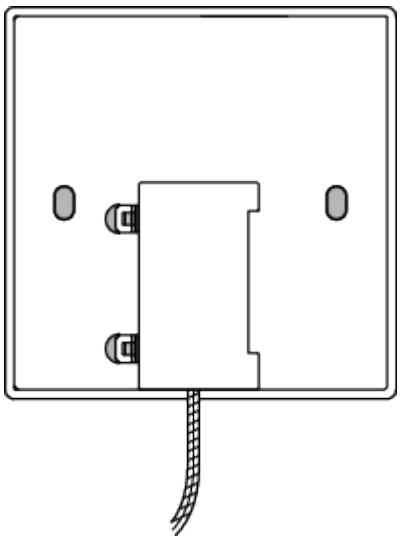


a. Use a 6 mm drill bit to drill holes at the marked positions.

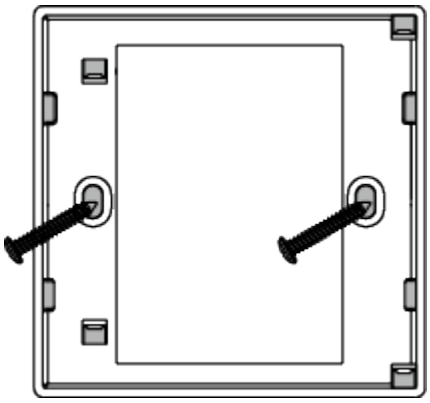
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b. Hammer the plastic expansion tubes into the holes.

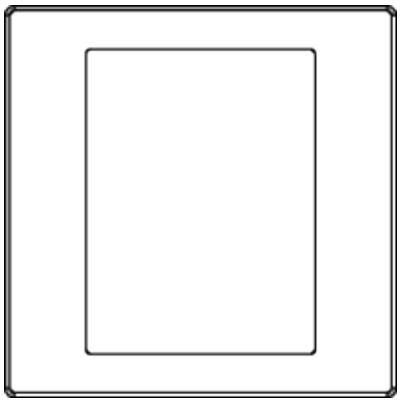
3. Connect the RF cable and close the rear cover of the antenna. For details, see **33.2.3 Connecting RF Cables**.



4. Use screws to fix the antenna to plastic expansion tubes on the wall (with a torque of 0.3 N m).



5. Close the front cover.



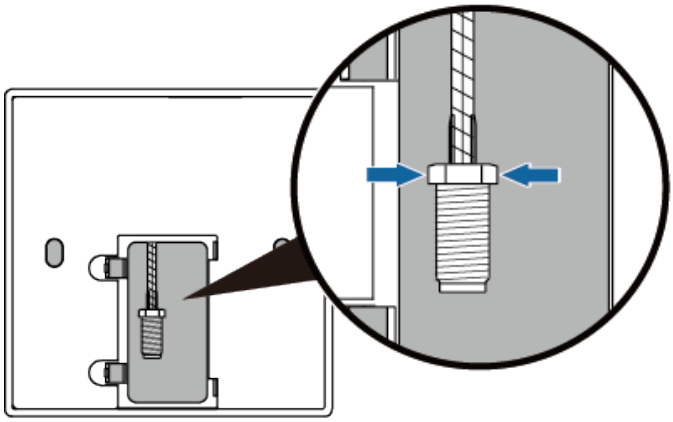
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33.2.3 Connecting RF Cables

RF Cable Connections

Connect the feeder connector to the radio interface of an AP using an RF transit cable (sold separately) and tighten the connector to the interface. The recommended tightening torque is 1 N·m.

Tighten the connector according to the following figure. Avoid rotating the cable with the connector; otherwise, the core wires of the cable may be damaged.



The following table lists RF transit cables.

Transit Cable	Cable Length	Interface Description
04130713	5 m	SMA-J / QMA-J
04130713-001	10 m	
04130713-002	15 m	

NOTE

The longer the feeder, the weaker the signal strength within the antenna coverage range. You are advised to use short feeders based on the actual situation. The 15-meter feeder cable is not recommended.

RF Cable Deployment Requirements

- A 50-ohm RF load must be connected to an idle RF port on an AP.
- The bending radius of RF cables must be no smaller than 30 mm.
- The grounding requirements of antennas are the same as those of APs.

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34 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)

About This Chapter

34.1 27012134 Technical Specifications
34.2 27012134 Installation Precautions
34.3 27012134 Antenna Installation

34.1 27012134 Technical Specifications

Appearance and Structure

Figure 34-1 Appearance of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)



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Technical Specifications

Table 34-1 Technical specifications of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)

Item	Details
Part Number	27012134
Model	ANTDG1313D6NR
Description	Directional Antenna, 2400~2500&5150~5850MHz, 13&13dBi,33deg/33deg&33deg/33deg,N/Female,6port,with mounting parts,pole/wall mounting
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	13 dBi
Coverage distance [m(ft.)]	2.4G: 160 5G: 130
Horizontal beamwidth [degrees]	33 degrees
Vertical beamwidth [degrees]	33 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization,± 45-degree polarization
Attenna connector	N-female x 6
Attenna dimensions [mm(in.)]	H x W x D: 39.878 x 368.3 x 368.3
Weight without packaging [kg(lb)]	1.6 kg(lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ35 to ϕ114

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 34-2 Antenna Pattern1 of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)

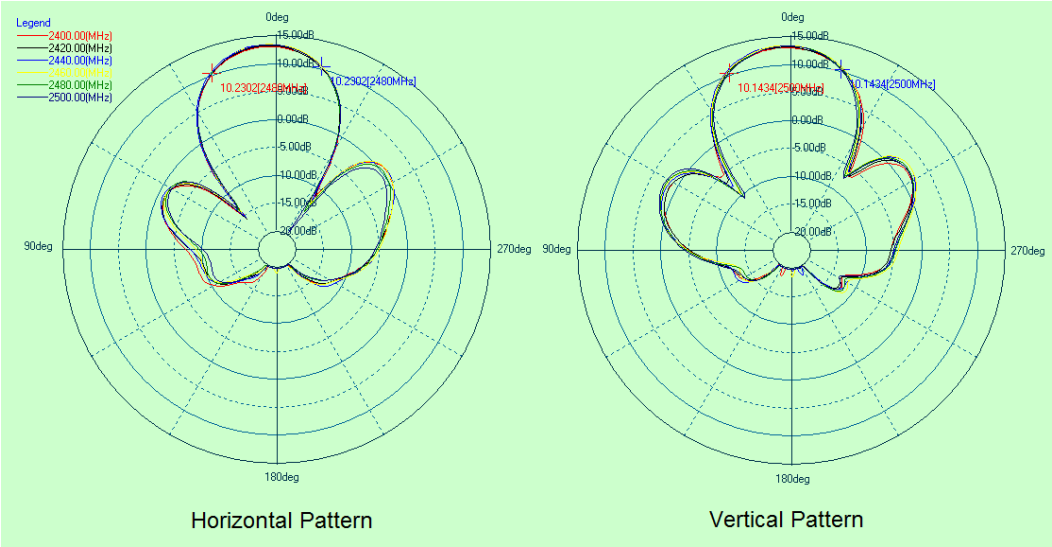
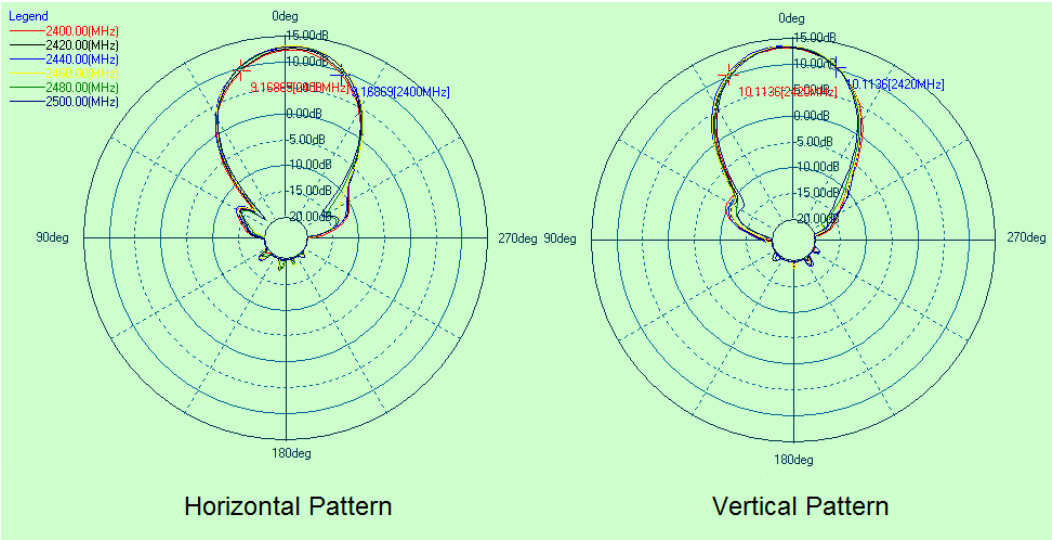


Figure 34-3 Antenna Pattern2 of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)



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Figure 34-4 Antenna Pattern3 of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)

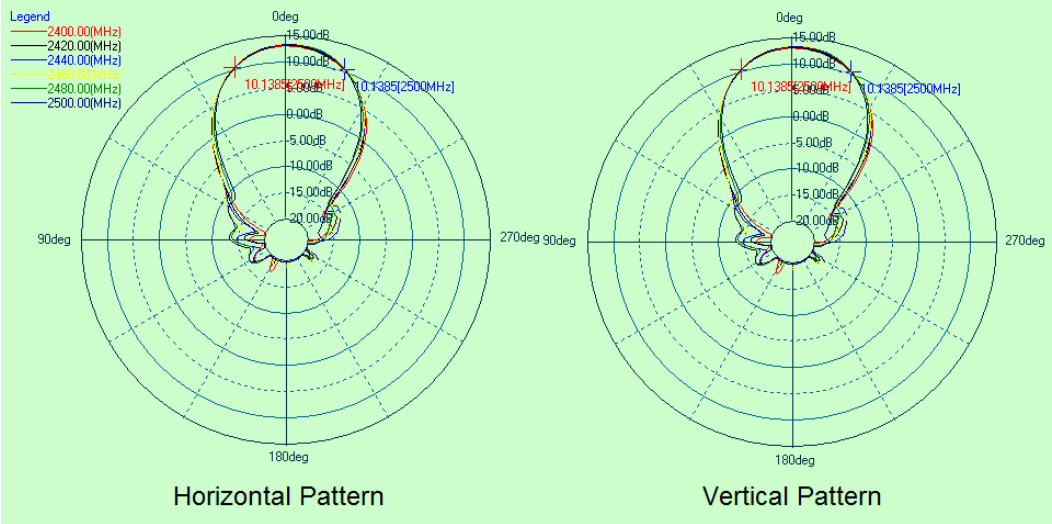
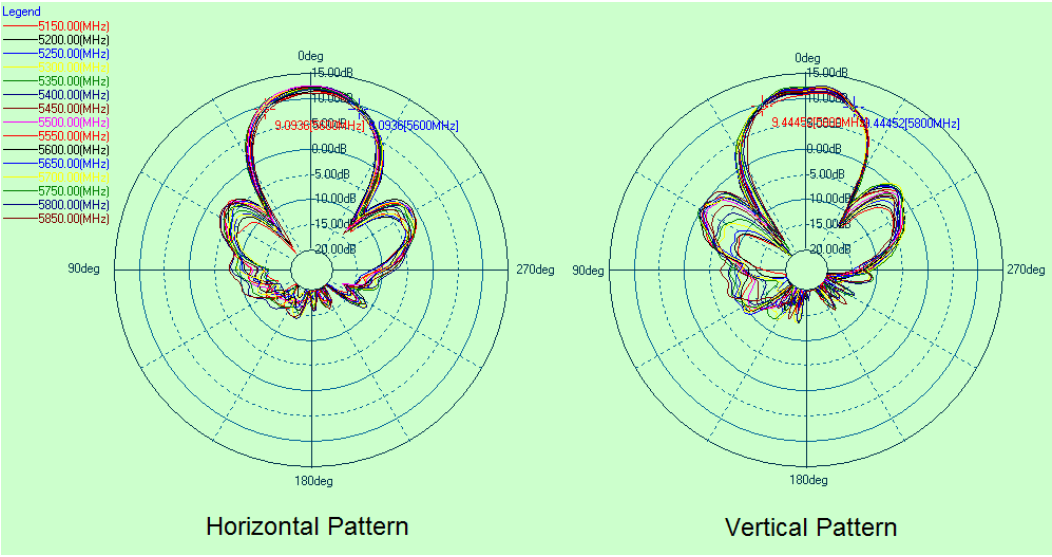


Figure 34-5 Antenna Pattern4 of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)



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Figure 34-6 Antenna Pattern5 of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)

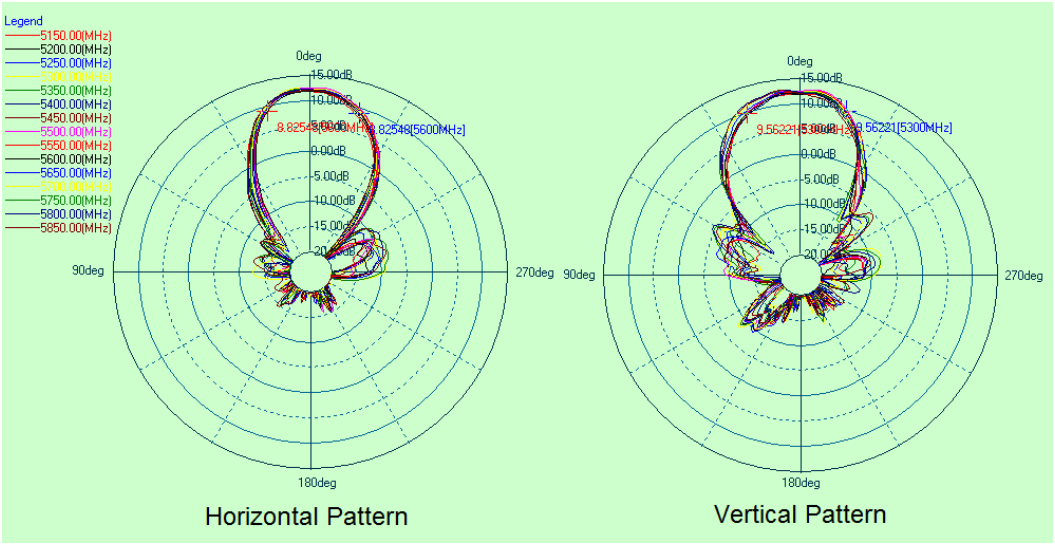
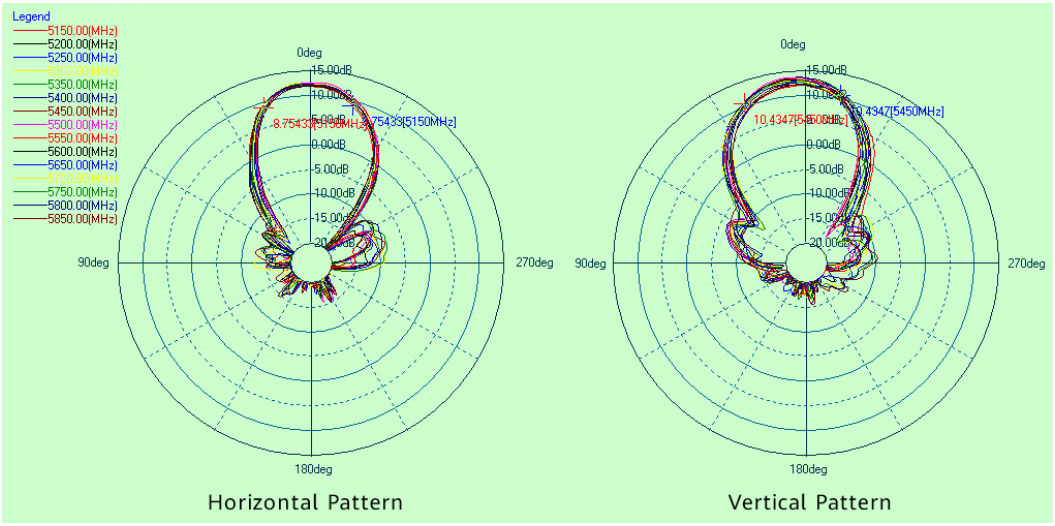


Figure 34-7 Antenna Pattern6 of the 27012134 Indoor and Outdoor 2.4 GHz and 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 and H33 V33 G13)



34.2 27012134 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

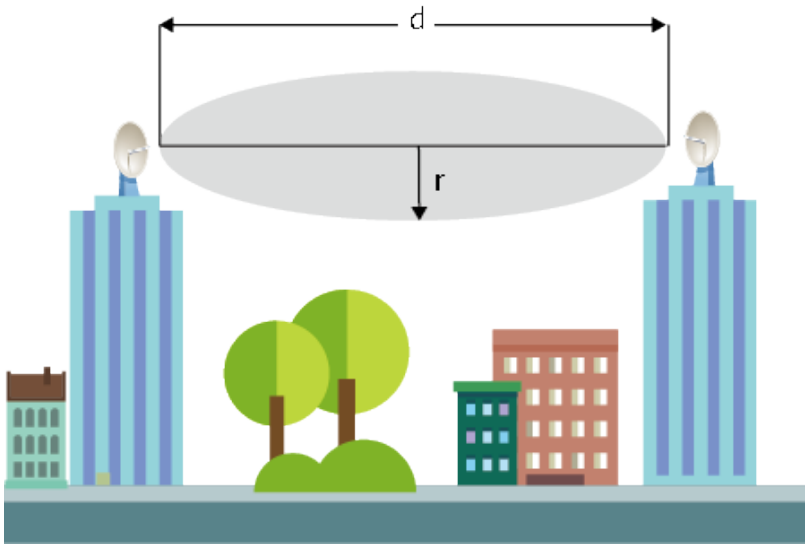
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.

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- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 34-8 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 34-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 34-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48

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Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
3	6.71
5	8.66
10	12.25

34.3 27012134 Antenna Installation

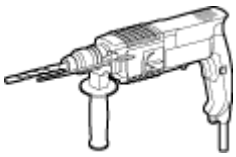
The 27012134 antenna is a directional antenna applicable to outdoor and indoor scenarios. When it is installed indoors, it is best applied to scenarios that require small coverage angles but long coverage distances. Typical scenarios include corridors in hospitals or airports. When it is installed outdoors, it should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops, to obtain better performance. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

34.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Hammer drill (ϕ8 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- 1 x pole with a diameter of ϕ35 mm to ϕ114 mm

Other accessories:

- M10 bolt: 4 sets
- Hex nut: 6 sets
- Spring washer: 6 sets
- Flat washer: 6 sets
- Hose clamp: 2 sets
- Expansion bolt: 4 sets

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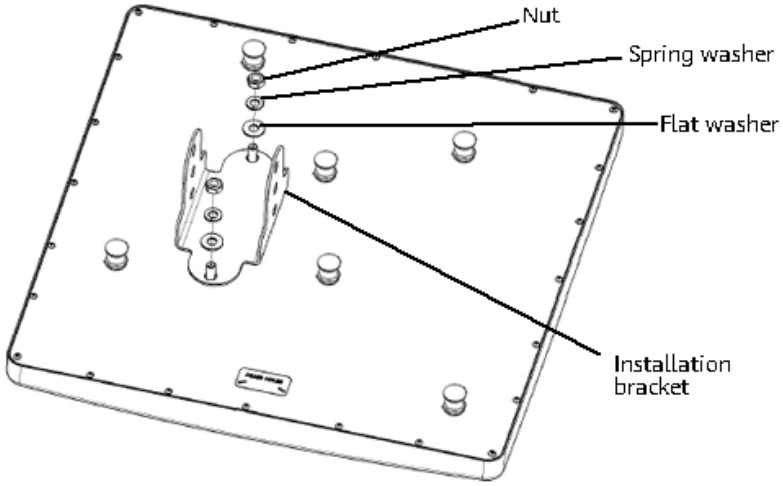
34.3.2 Wall Mounting

The 27012134 antenna can be mounted on a wall.

CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

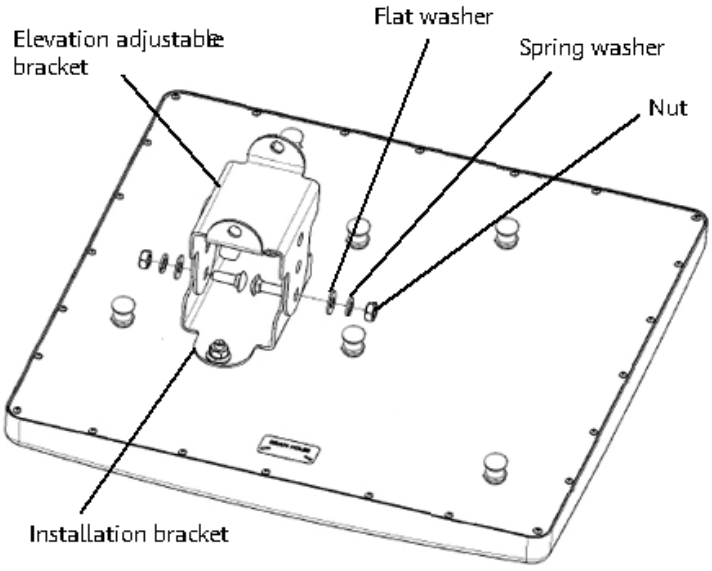
1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.



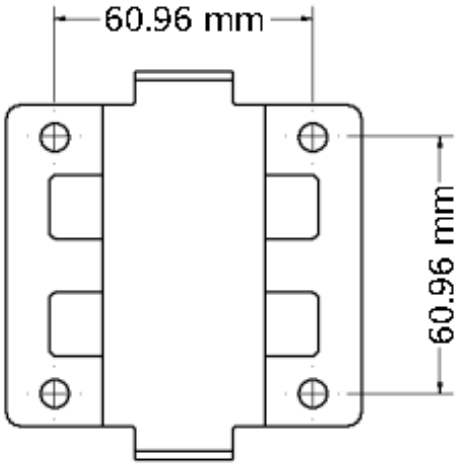
2. Fix the elevation adjustable bracket to the installation bracket.

   Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

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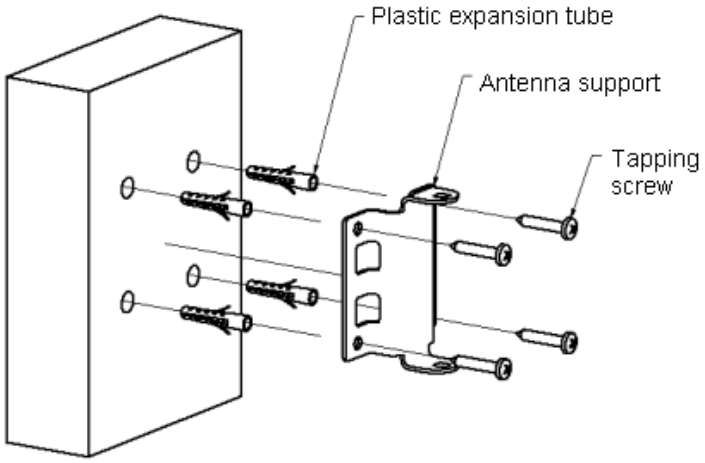


3. Drill four ϕ8 mm holes (42 mm depth) on the wall to install plastic expansion tubes that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.

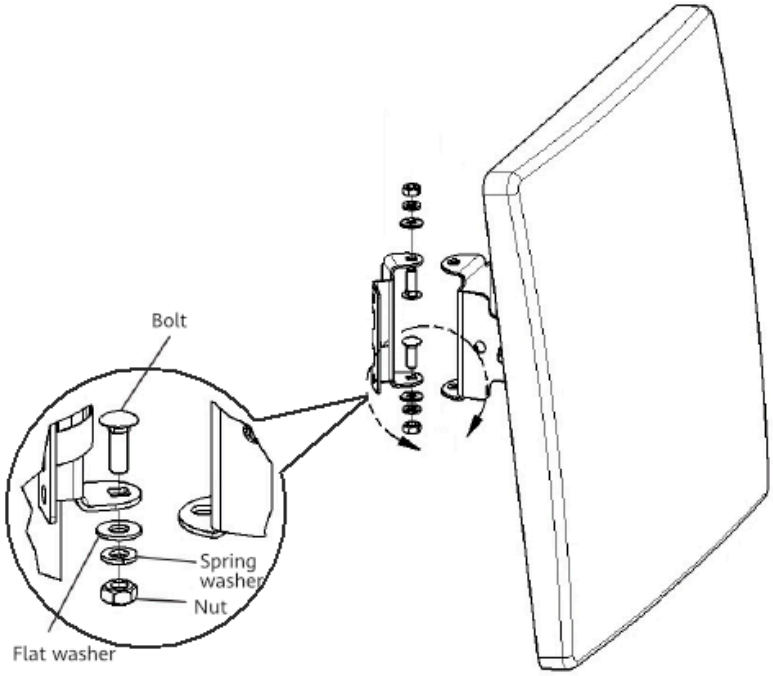


4. Fix the antenna support to the wall using expansion bolts.

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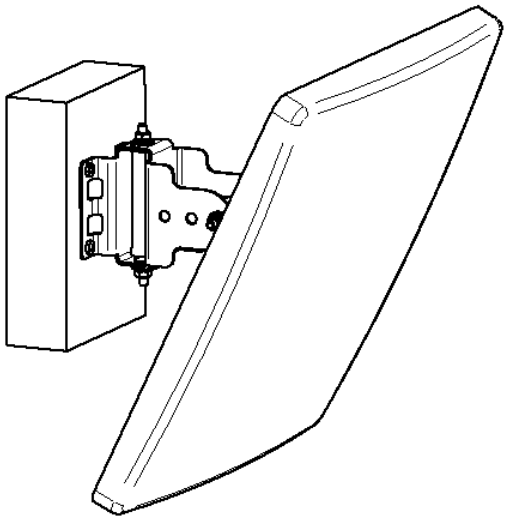


5. Fix the elevation adjustable bracket to the antenna support. Thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).



6. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

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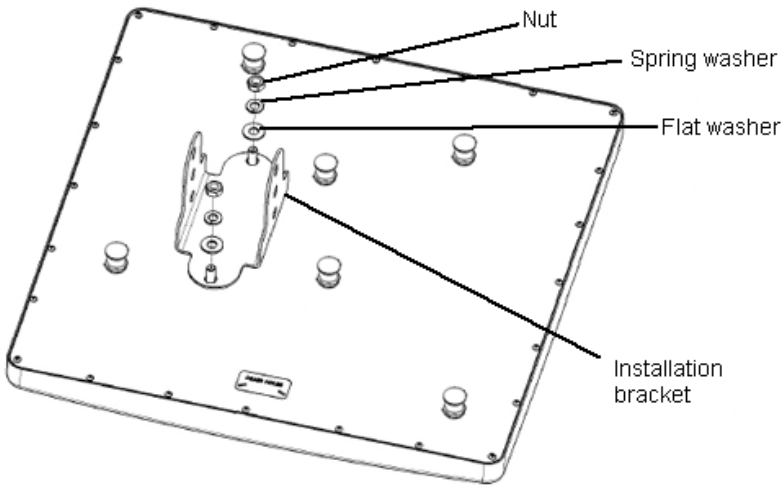
34.3.3 Pole Mounting

The 27012134 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

⚠ CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

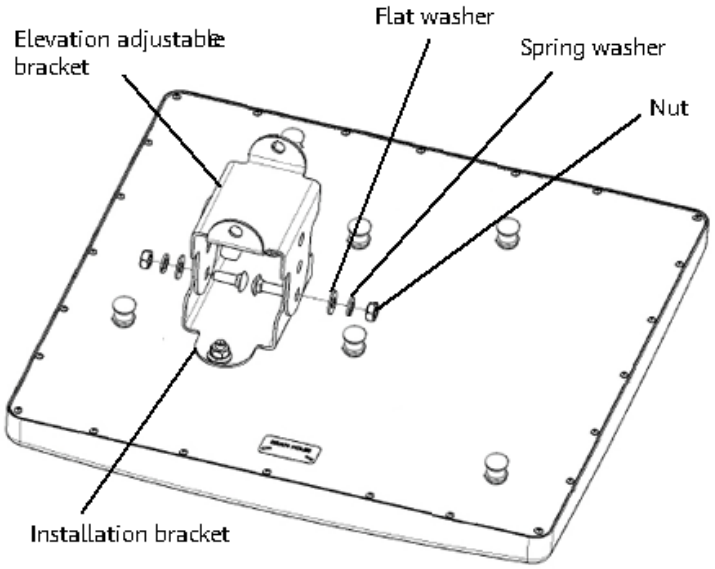
1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.



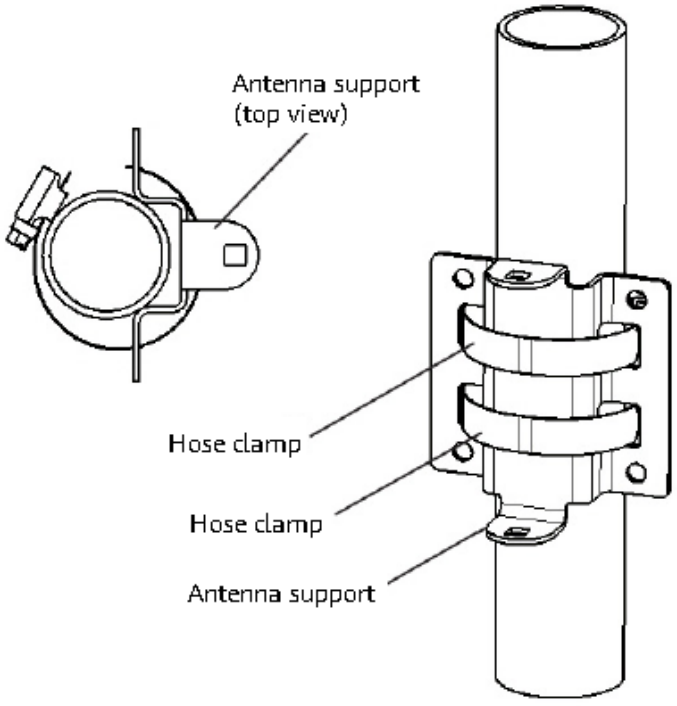
2. Fix the elevation adjustable bracket to the installation bracket.

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Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

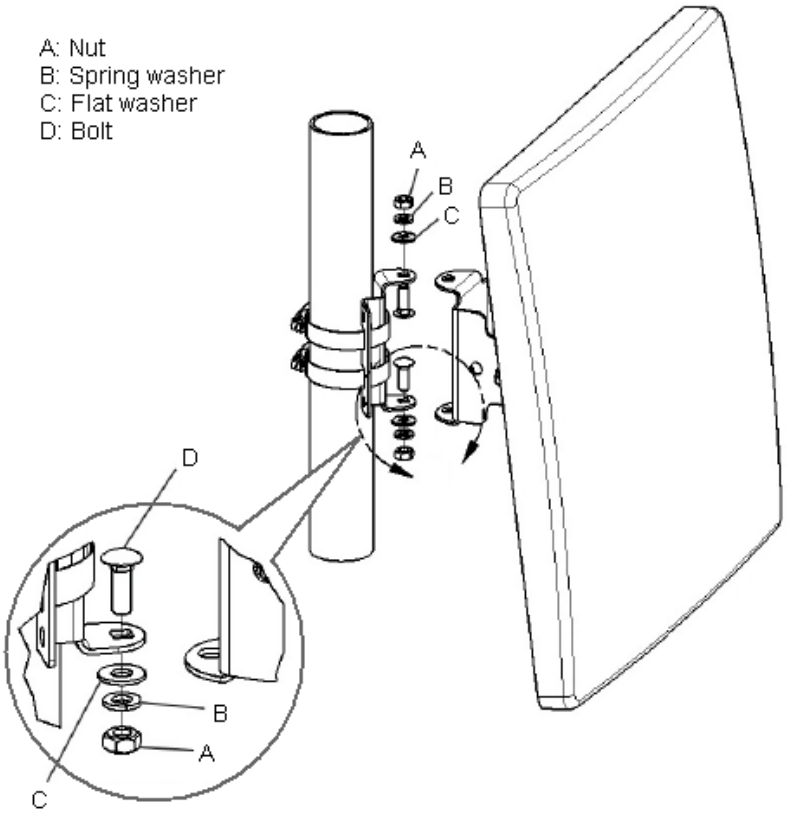


3. Fix the antenna support to the pole.



4. Fix the antenna to the antenna support. Thread bolts through the antenna support and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

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5. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

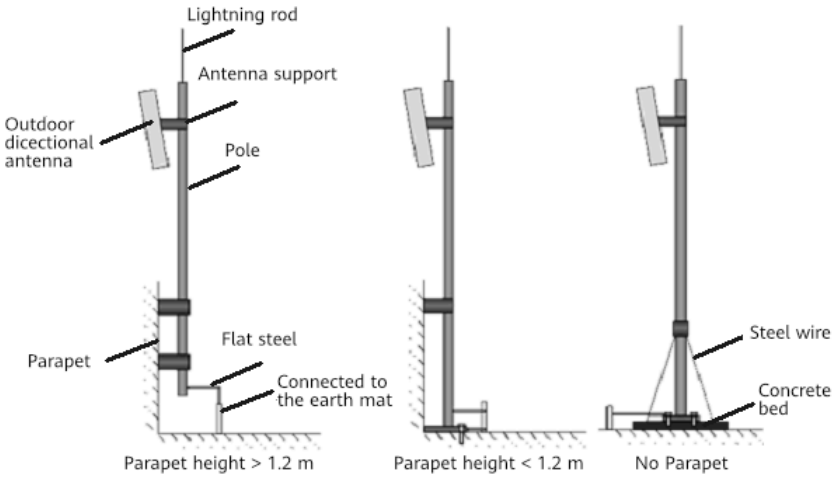
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

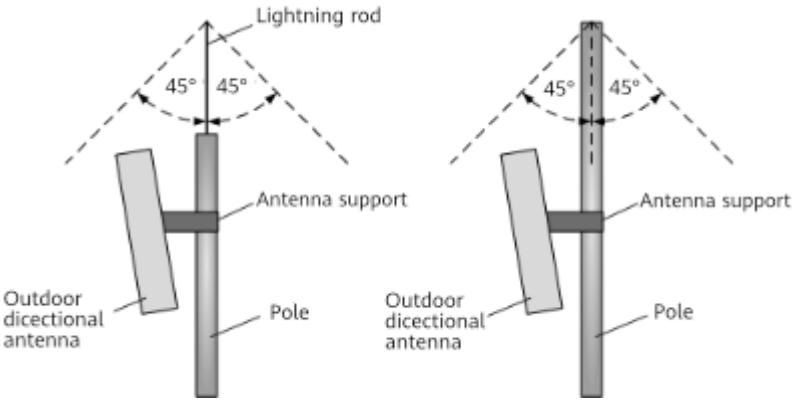
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Figure 34-9 illustrates how an outdoor directional antenna and a pole are installed.

Figure 34-9 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

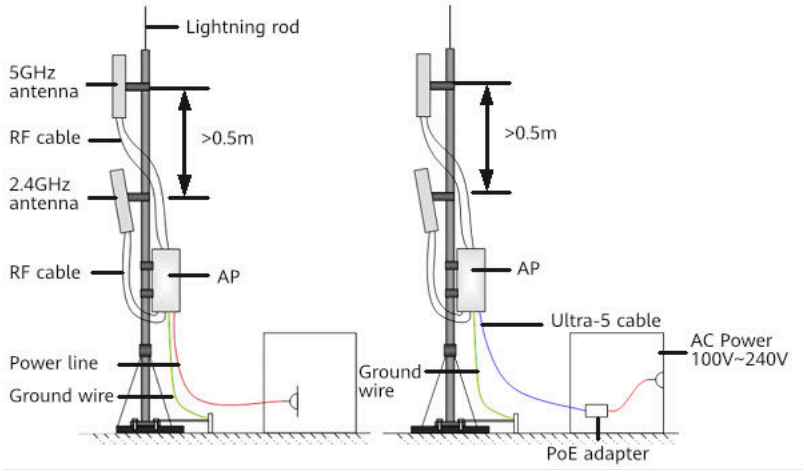
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 34-10 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

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Figure 34-10 Outdoor AP installation scenarios



34.3.4 Connecting RF Cables

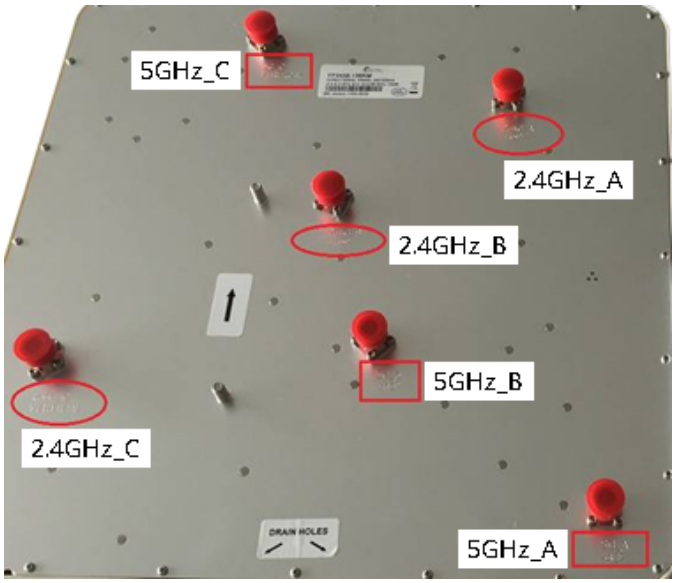
RF Cable Connection Requirements

The radio interfaces of the same frequency band on an AP have silkscreens A, B, and C, as shown in the following figure.



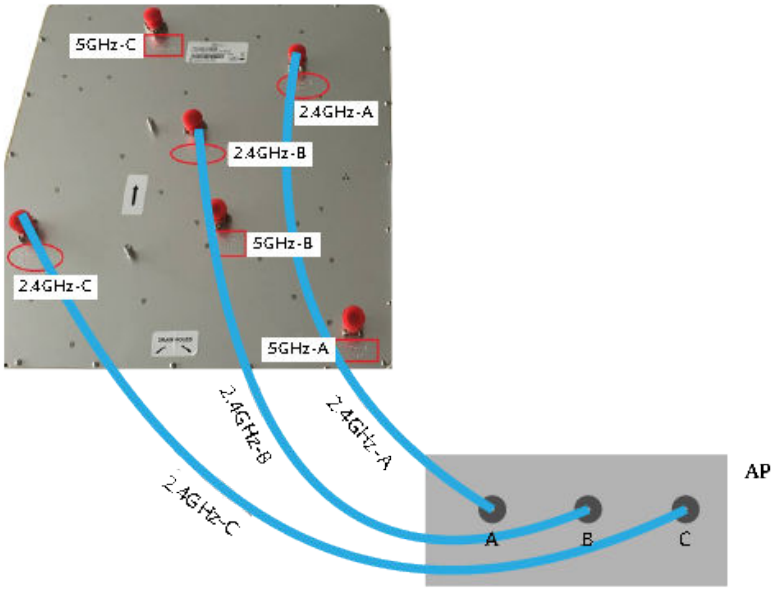
The following figure shows the feeder interfaces on the 27012134 antenna.

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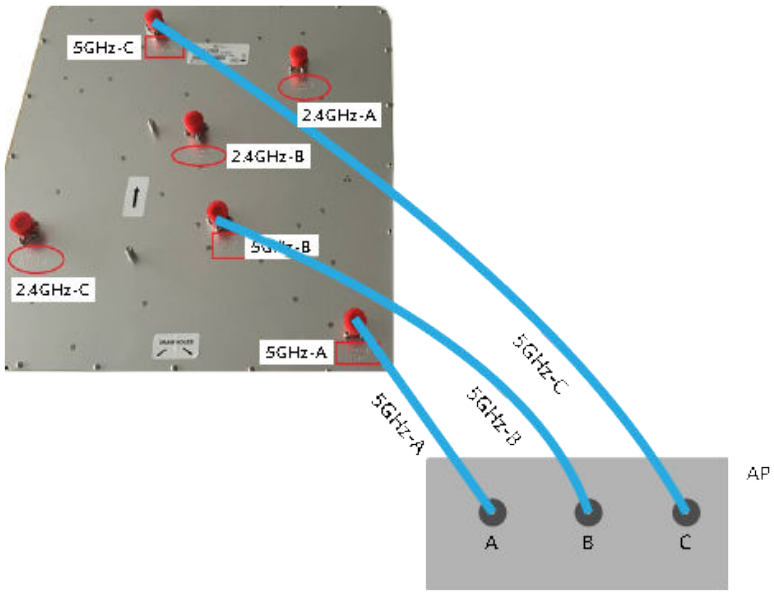
Use the feeder cable to connect the radio interfaces of the AP and antenna. The feeder interfaces A, B, and C of an antenna must be connected to radio interfaces A, B, and C of the same frequency band on an AP.

The following figure shows cable connections on 2.4G radio ports of antennas.



The following figure shows cable connections on 5G radio ports of antennas.

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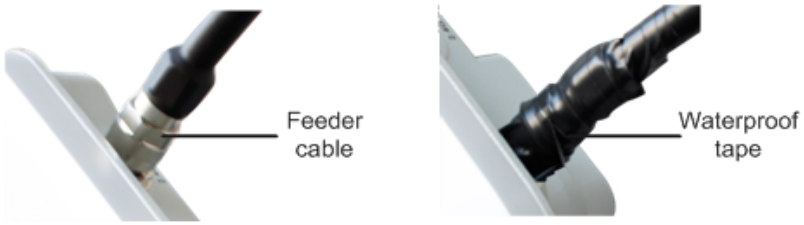


RF Cable Deployment Requirements

- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

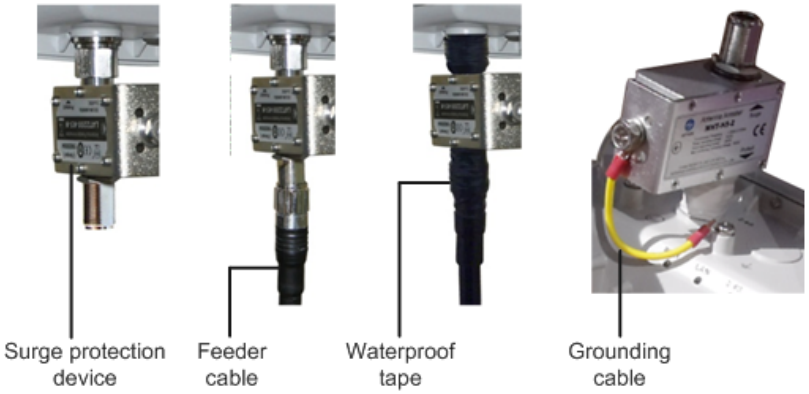


NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

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2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

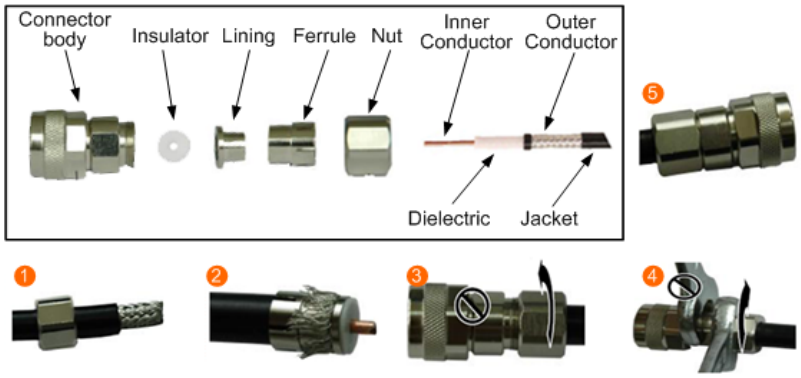
Table 34-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

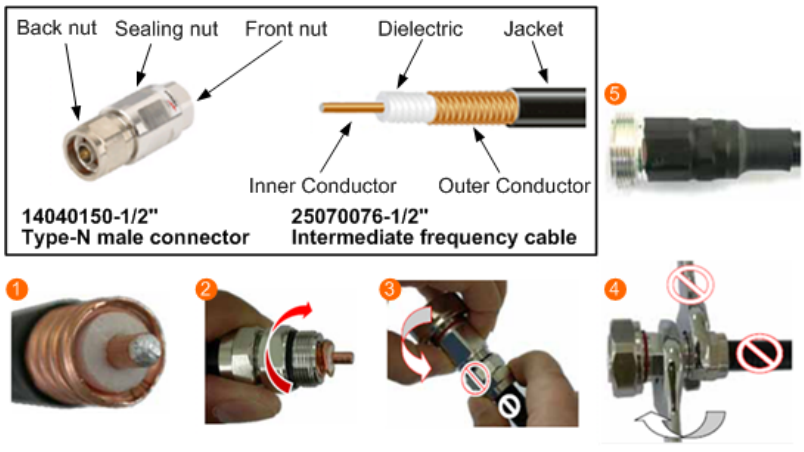
Copyright © Huawei Technologies Co., Ltd.

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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35 27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)

About This Chapter

35.1 27012140 Technical Specifications
35.2 27012140 Installation Precautions
35.3 27012140 Antenna Installation

35.1 27012140 Technical Specifications

Appearance and Structure

Figure 35-1 Appearance of the 27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)



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Technical Specifications

Table 35-1 Technical specifications of the 27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)

Item	Details
Part Number	27012140
Model	ANT5G13D3NR
Description	Directional Antenna,5150~5850MHz, 13dBi,33deg/33deg,N/Female, 3port,with mounting parts,pole/wall mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	13 dBi
Coverage distance [m(ft.)]	130 m(ft.)
Horizontal beamwidth [degrees]	33 degrees
Vertical beamwidth [degrees]	33 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization,± 45-degree polarization
Attenna connector	N-female x 3
Attenna dimensions [mm(in.)]	H x W x D: 34.5 x 197.5 x 197.5
Weight without packaging [kg(lb)]	1.2 kg(lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ35 to ϕ114

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 35-2 Antenna Pattern1 of the 27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)

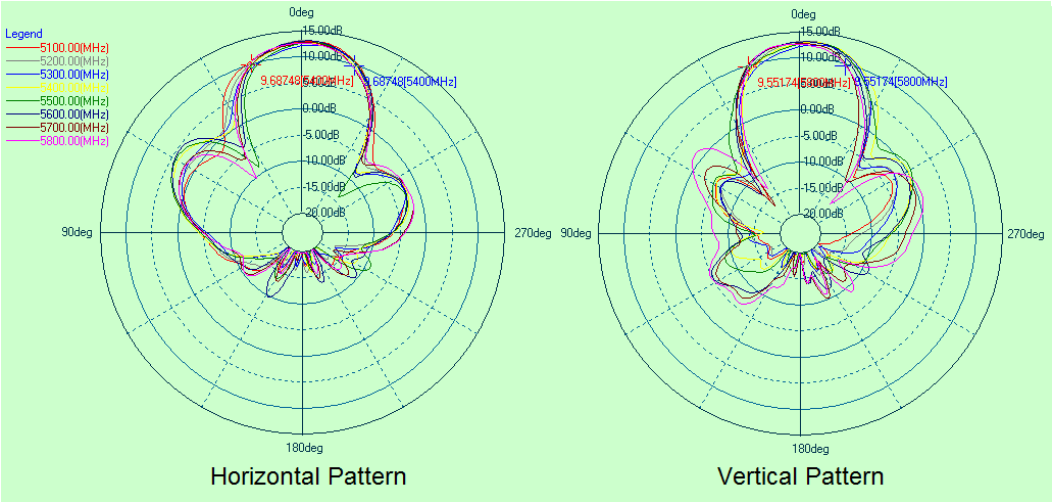
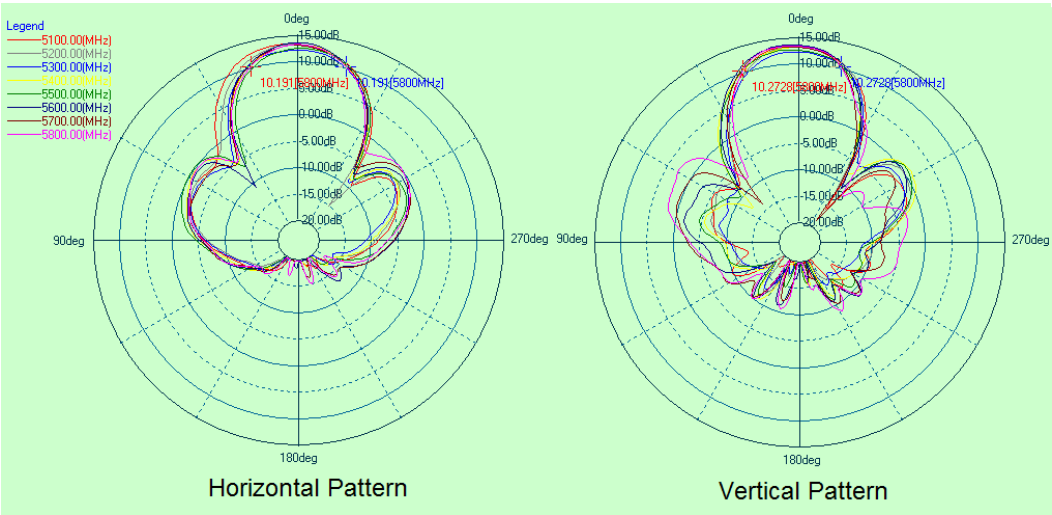
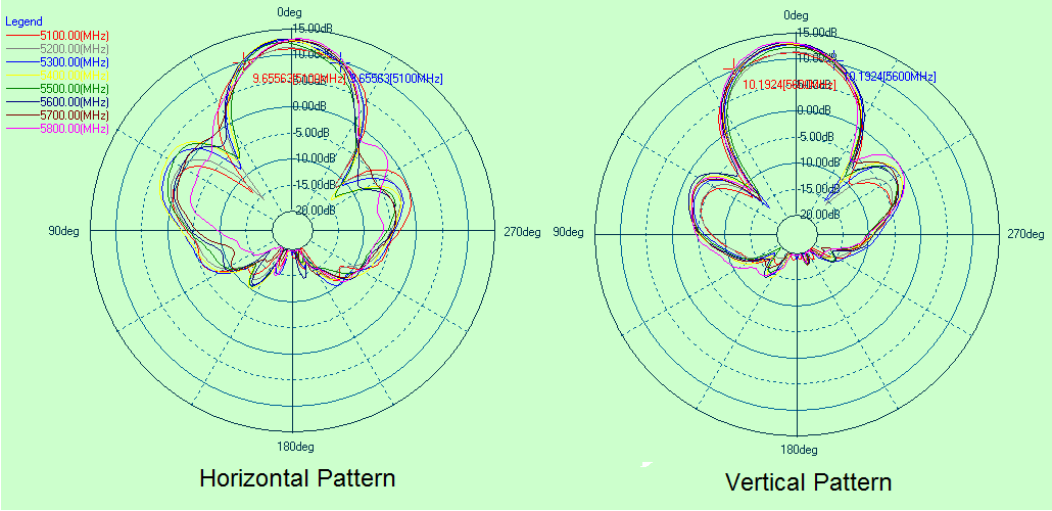


Figure 35-3 Antenna Pattern2 of the 27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)



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Figure 35-4 Antenna Pattern3 of the 27012140 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13)



35.2 27012140 Installation Precautions

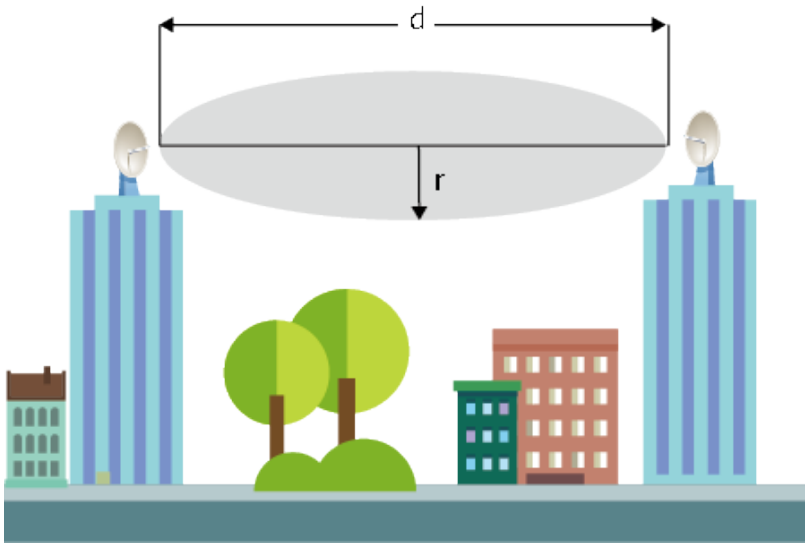
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation".
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be large than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 35-5 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 35-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 35-2 Radius of the first Fresnel zone

Backhaul Distance (km)	1	2	3	5	10
Radius of the First Fresnel Zone (m)	3.87	5.48	6.71	8.66	12.25

35.3 27012140 Antenna Installation

The 27012140 antenna can be installed on a vehicle for vehicle-ground backhaul.

The 27012140 directional antenna is applicable to outdoor and indoor scenarios. When it is installed indoors, it applies to scenarios that require small coverage

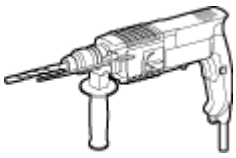
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angles but long coverage distances. Typical scenarios include corridors in hospitals or airports. When it is installed outdoors, it should be installed at high positions away from metal obstacles, for example, building top, mountaintop, and tower top, to obtain better performance. Its transmit end should not be blocked by obstacles.

35.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Hammer drill (ϕ8 drill bit for vehicle mounting and wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- 1 x Pole with a diameter of ϕ35 mm to ϕ114 mm

Other accessories:

Installation Scenario	Accessory
Vehicle mounting	Installation brackets customized for different scenarios
Wall mounting or pole mounting	• M10 bolt: 4 sets • Hex nut: 6 sets • Spring washer: 6 sets • Flat washer: 6 sets • Hose clamp: 2 sets • Expansion bolt: 4 sets

35.3.2 Wall Mounting

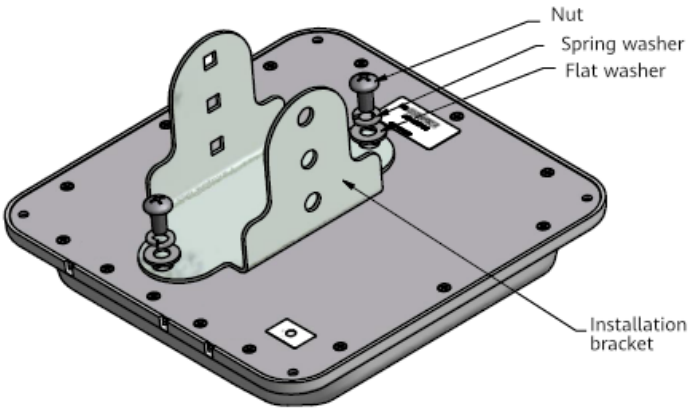
The 27012140 antenna can be mounted on a wall.

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CAUTION

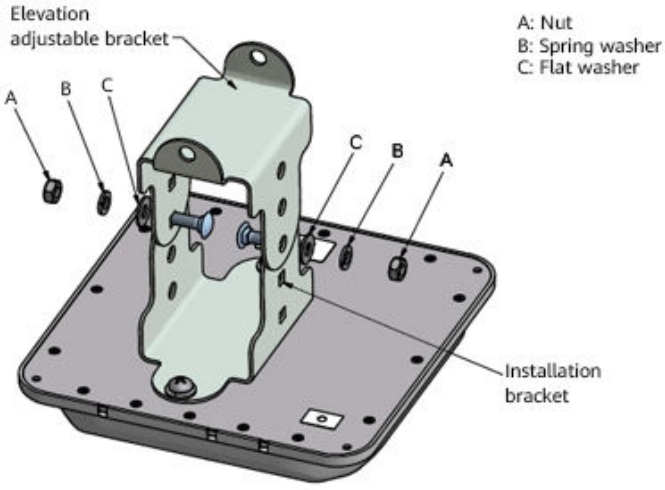
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Fix the installation bracket to the back of the antenna with the nut, spring washer, and flat washer.



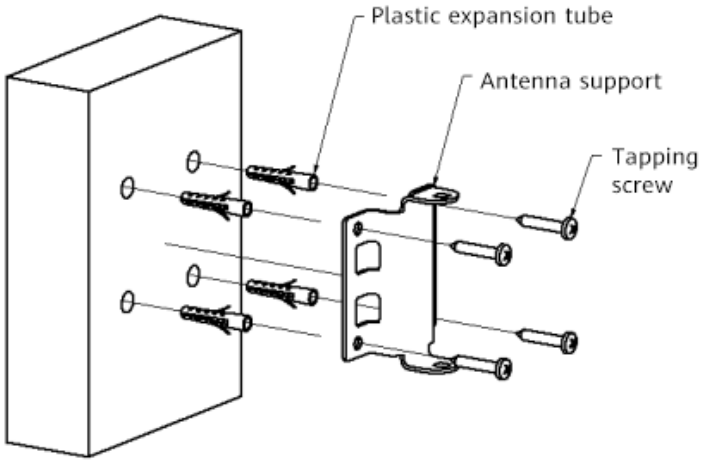
2. Fix the adjustable support to the installation bracket.

   Select appropriate holes and thread bolts through the space between the antenna and adjustable support. Place flat washers, spring washers, and nuts to fix them (not tightly).

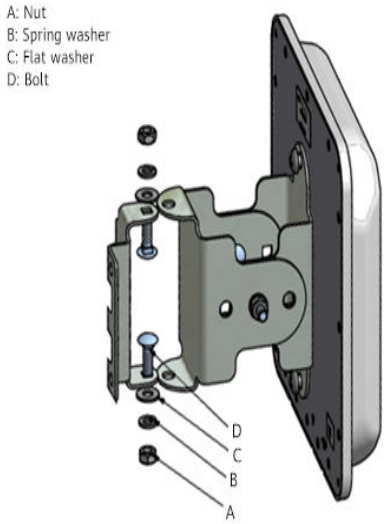


3. Drill four holes (ϕ8 * 42 mm) on the wall to install plastic expansion tubes that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.
4. Fix the antenna support to the wall using expansion bolts.

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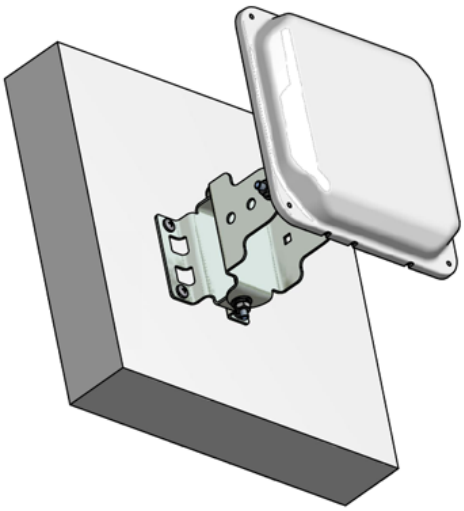


5. Fix the adjustable support to the antenna support. Thread bolts through the space between the antenna and adjustable support. Place flat washers, spring washers, and nuts to fix them (not tightly).



6. Adjust the antenna angle and tighten all of the four nuts.

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35.3.3 Pole Mounting

The 27012140 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

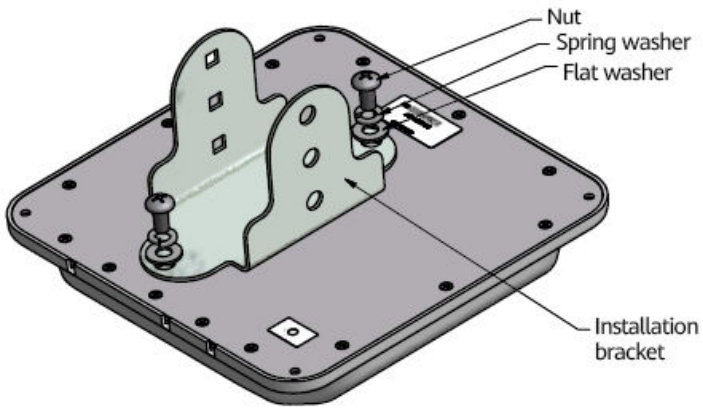
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Fixing the Antenna to the Pole

Carry out the following steps:

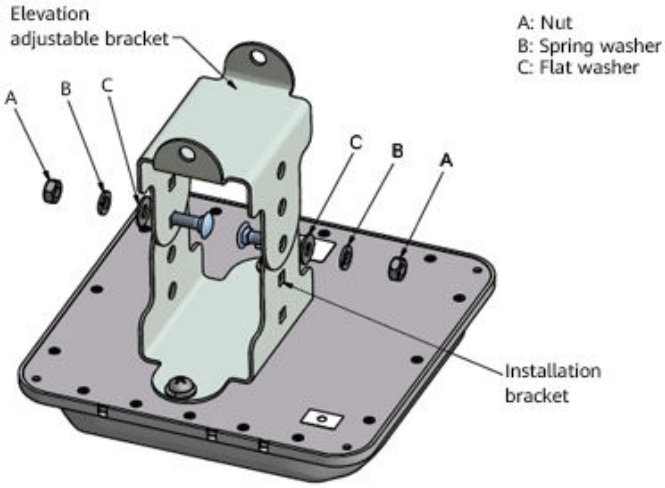
1. Fix the installation bracket to the back of the antenna with the nut, spring washer, and flat washer.



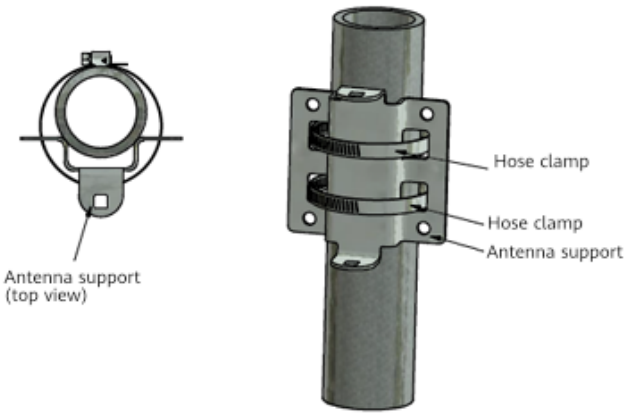
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2. Fix the adjustable support to the installation bracket.

   Select appropriate holes and thread bolts through the space between the antenna and adjustable support. Place flat washers, spring washers, and nuts to fix them (not tightly).

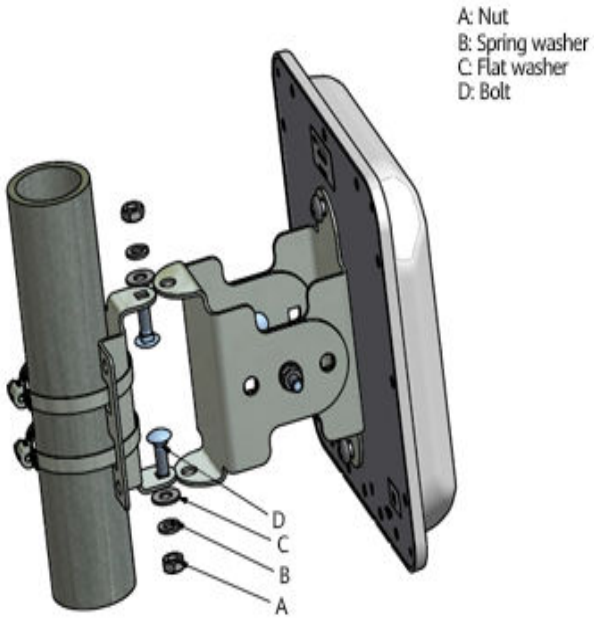


3. Fix the antenna support to the pole with the hose clamp.

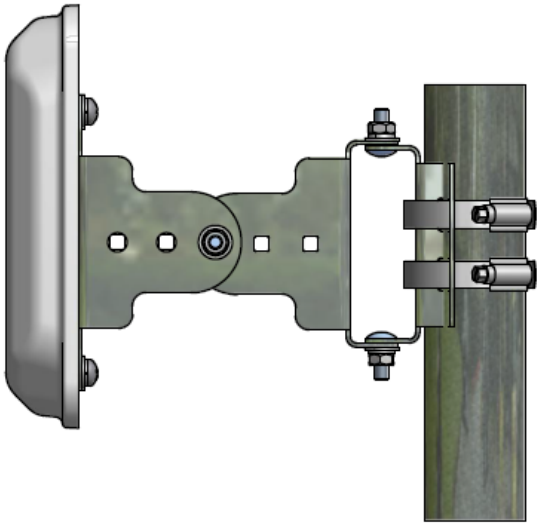


4. Fix the antenna to the antenna support. Thread bolts through the space between the antenna and adjustable support. Place flat washers, spring washers, and nuts to fix them (not tightly).

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5. Adjust the antenna angle and tighten all of the four nuts.



Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

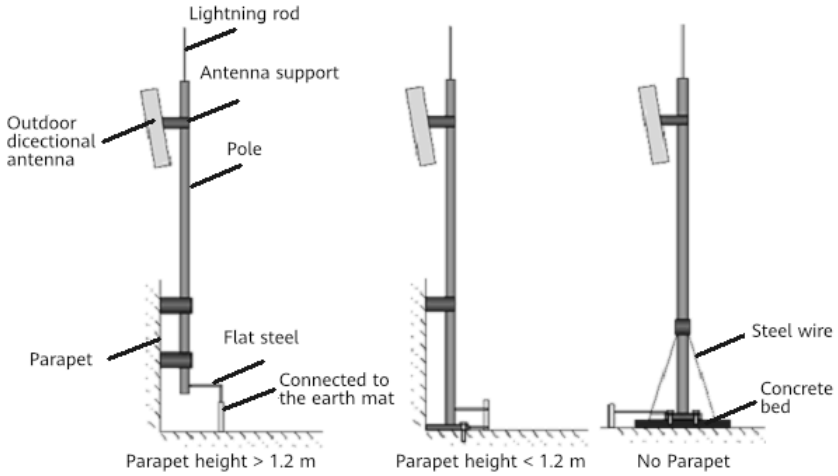
Take note of the following points when installing an outdoor directional antenna:

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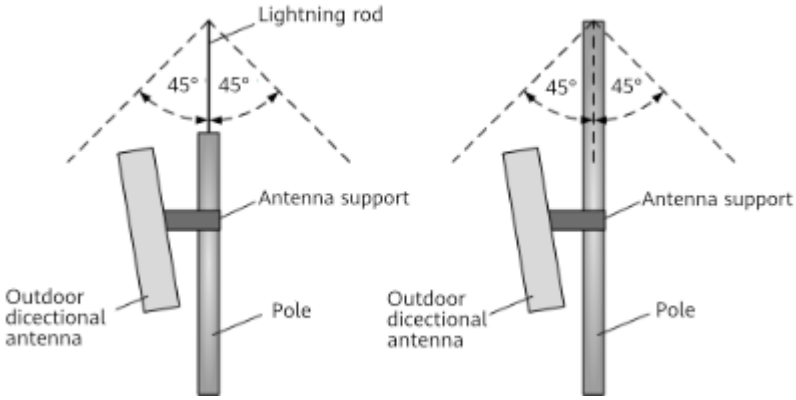
- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 35-6 illustrates how an outdoor directional antenna and a pole are installed.

Figure 35-6 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

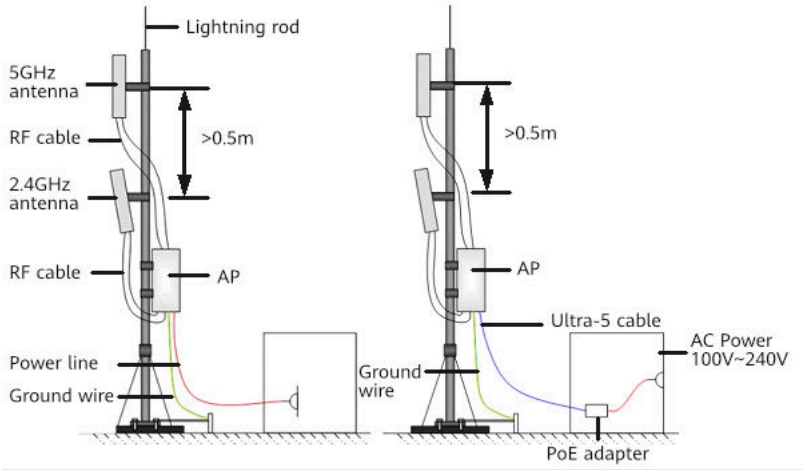
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

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Outdoor AP Installation Scenarios

Figure 35-7 shows outdoor AP installation scenarios. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

Figure 35-7 Outdoor AP installation scenarios



35.3.4 Connecting RF Cables

RF Cable Connection Requirements

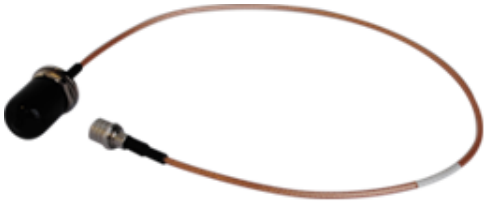
Connect the feeder connector to the radio interface of an AP using an RF transit cable (sold separately) and tighten the connector to the interface. A 1 N m tightening torque is recommended for the type-N connector.

The following table lists the RF transit cables and connectors used.

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP8130DN	RG-8U cable (25070009)	Type-N male connector (14040184)	• 2400 MHz to 2483.5 MHz: 26.8 dB / 100 m • 4920 Mhz to 5825 Mhz: 41.8 dB / 100 m	
	1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400 MHz to 2483.5 MHz: 18.1 dB / 100 m • 4920 Mhz to 5825 Mhz: 30 dB / 100 m	

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AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
AP9131DN/AP9132DN	RF transit cable (04130714, 0.5 m) connecting a QMA-J connector to an N-J connector.	- (No cable needs to be made onsite.)	• 2.4 GHz to 2.5 GHz: < 0.9 dB • 4.9 GHz to 6 GHz:< 1.3 dB	

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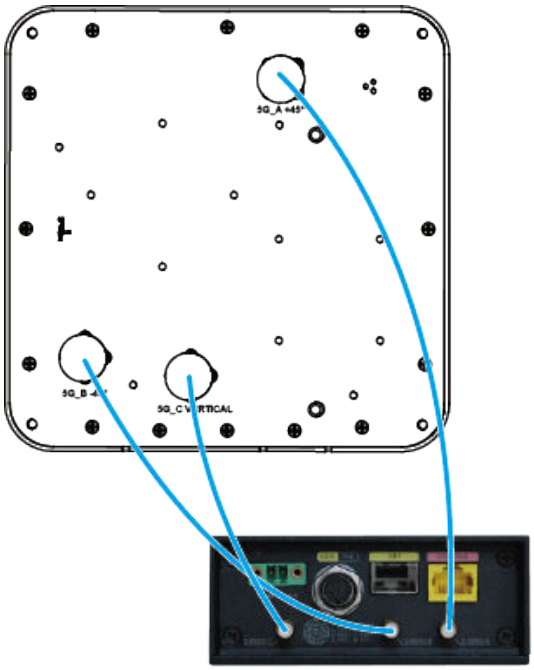
AP Type	Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
	RF transit cable (04130714-001, 3 m) connecting a QMA-J connector to an N-J connector.		• 2.4 GHz to 2.5 GHz: < 2.3 dB • 4.9 GHz to 6 GHz: < 3.2 dB	

The requirements on connections between the antenna and the AP's radio interfaces are as follows:

- Feeders of the same antenna must be connected to radio interfaces of the corresponding frequency bands on the same AP.
- Feeder ports whose polarization directions are +45° and -45° on an antenna are connected to radio interfaces A and B of an AP respectively, and the feeder port whose polarization direction is 90° is connected to radio interface C of the AP.

Take the AP9132DN as an example. The following figure shows the RF cable connection on the AP9132DN.

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RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

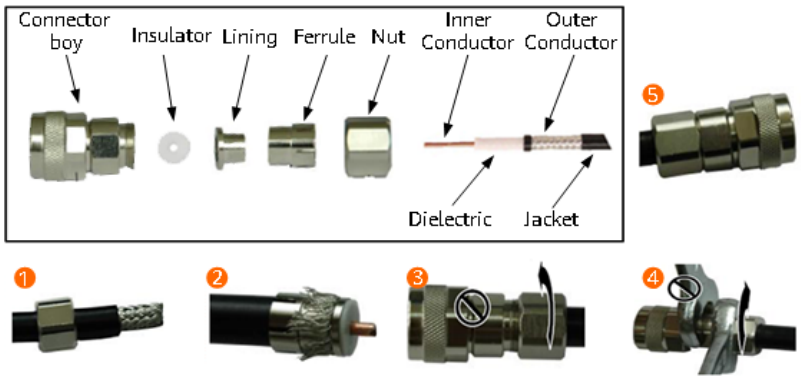
Instructions on Making RF Cables

When connecting the AP8130DN, you need to assemble the type-N male connector and 1/2" (inch) super-flexible feeder cable onsite in the following way:

Connecting the type-N male coaxial connector to the RG-8U feeder cable

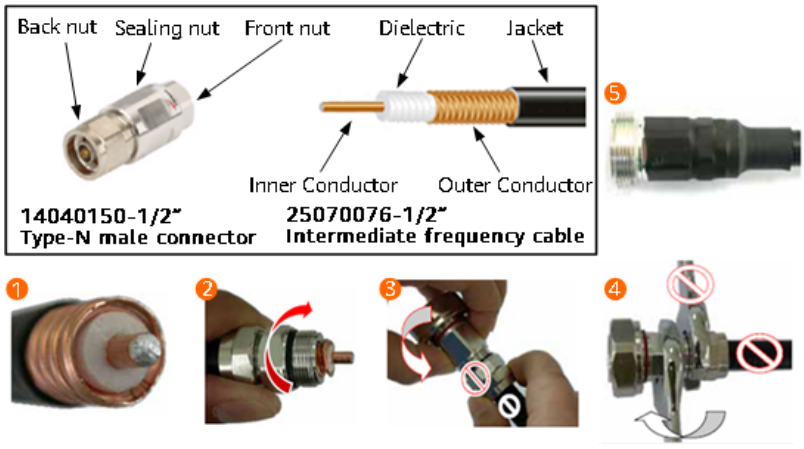
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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36 27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)

About This Chapter

36.1 27012544 Technical Specifications
36.2 27012544 Installation Precautions
36.3 27012544 Antenna Installation

36.1 27012544 Technical Specifications

Appearance and Structure

Figure 36-1 Appearance of the 27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)



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Technical Specifications

Table 36-1 Technical specifications of the 27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)

Item	Details
Part Number	27012544
Model	ANT2G18D2NR
Description	Directional antenna-2400~2500MHz-18dBi-linear polarized-5W-N-female*2
Frequency [MHz]	2300 MHz to 2700 MHz
Antenna gain [dBi]	18 dBi
Coverage distance [m(ft.)]	260 m(ft.)
Horizontal beamwidth [degrees]	18 degrees
Vertical beamwidth [degrees]	18 degrees
Standing wave ratio (SWR)	typical:1.7 maximum:2
Polarization	Horizontal polarization,vertical polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 40 x 368 x 368
Weight without packaging [kg(lb)]	1.6 kg(lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ41 to ϕ58

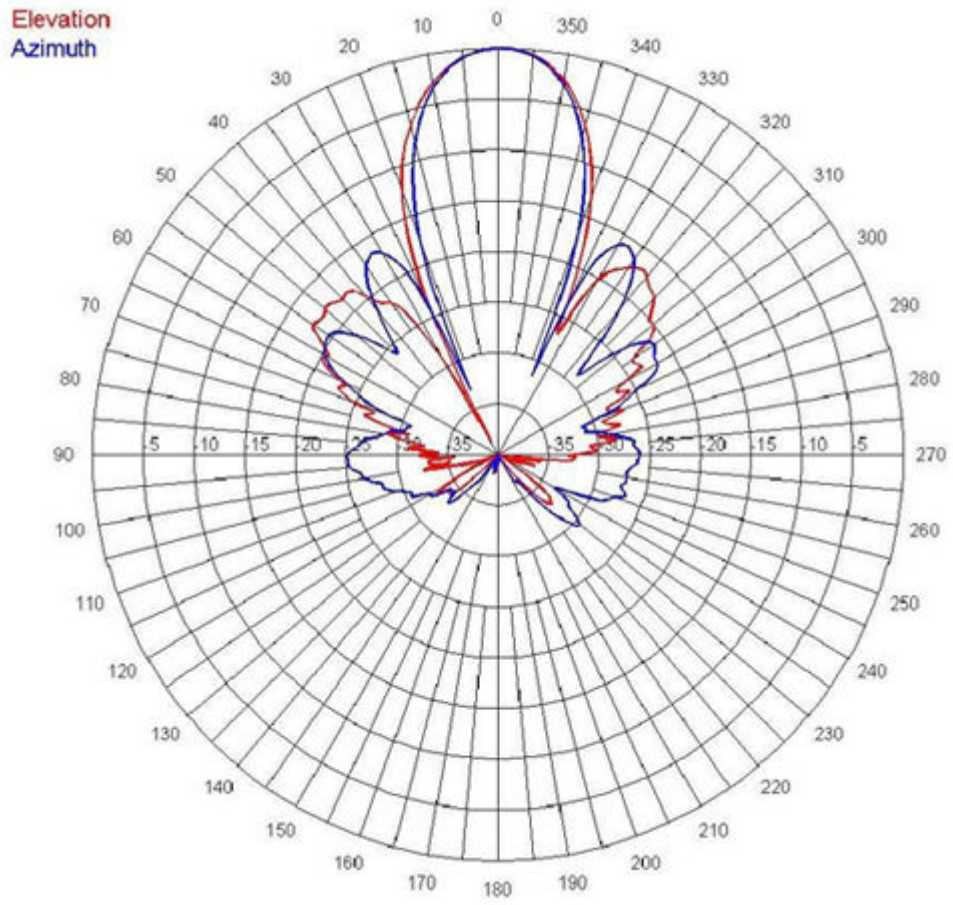
Copyright © Huawei Technologies Co., Ltd.

Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 36-2 Antenna Pattern1 of the 27012544 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)



36.2 27012544 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

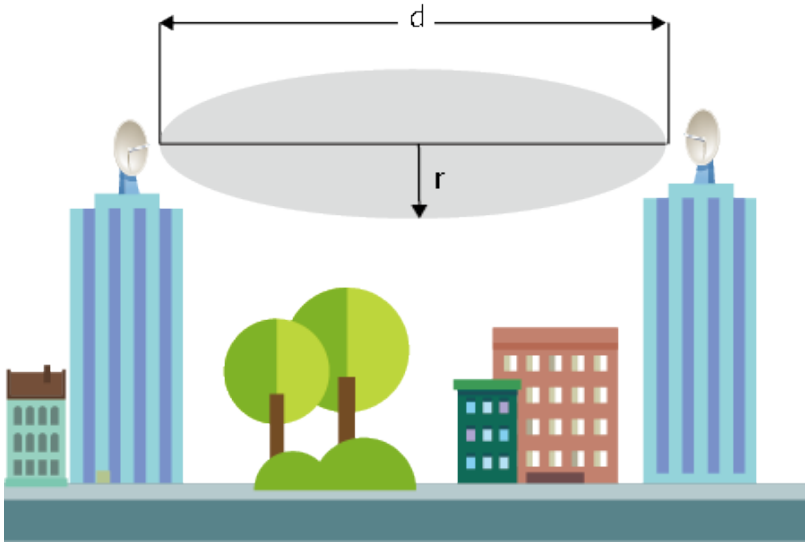
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."

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- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 36-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 36-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 36-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66

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Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
10	12.25

36.3 27012544 Antenna Installation

The 27012544 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

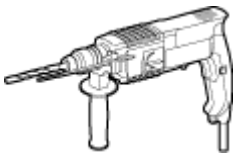
36.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- 1 x inclinometer



- Hammer drill (ϕ8 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- 1 x pole with a diameter of ϕ41 mm to ϕ58 mm

Other accessories:

- M10 bolt: 4 sets
- Hex nut: 6 sets
- Spring washer: 6 sets
- Flat washer: 6 sets
- Hose clamp: 2 sets
- Expansion bolt: 4 sets

36.3.2 Wall Mounting

The 27012544 antenna can be mounted on a wall.

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If an extension bracket is used, install the antenna according to **Antenna Installation with an Extension Bracket**; otherwise, install the antenna according to **Antenna Installation Without an Extension Bracket**.

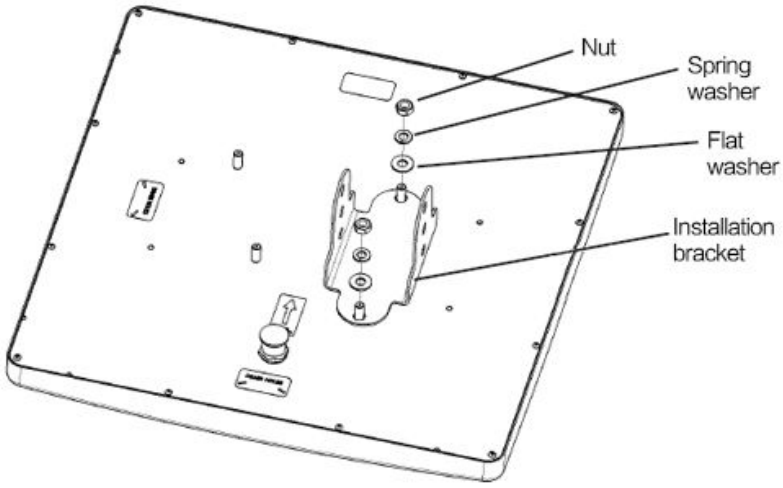
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Antenna Installation Without an Extension Bracket

The installation procedure is as follows:

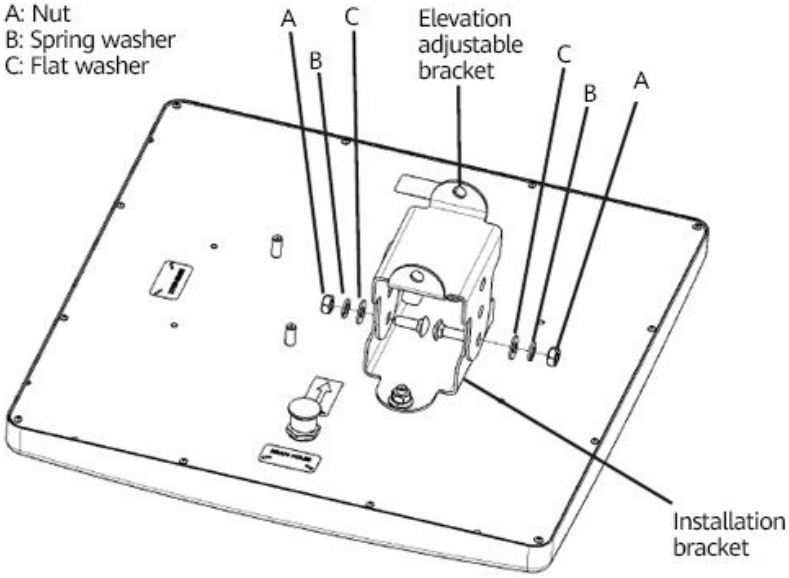
1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.



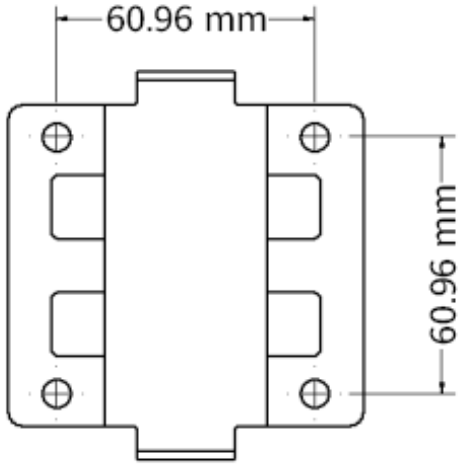
2. Fix the elevation adjustable bracket to the installation bracket.

   Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

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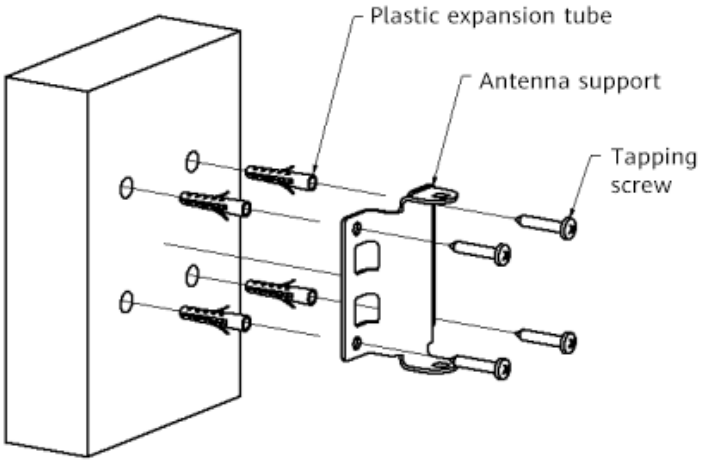


3. Drill four ϕ8 mm holes (42 mm depth) on the wall to install plastic expansion tubes that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.

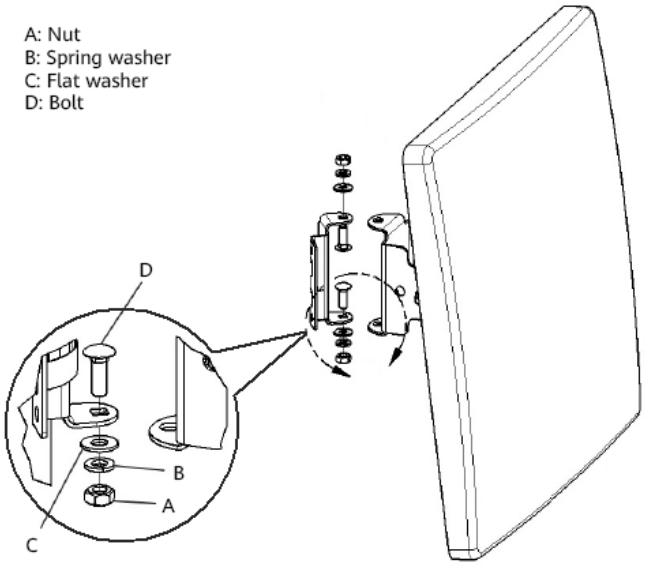


4. Fix the antenna support to the wall using expansion bolts.

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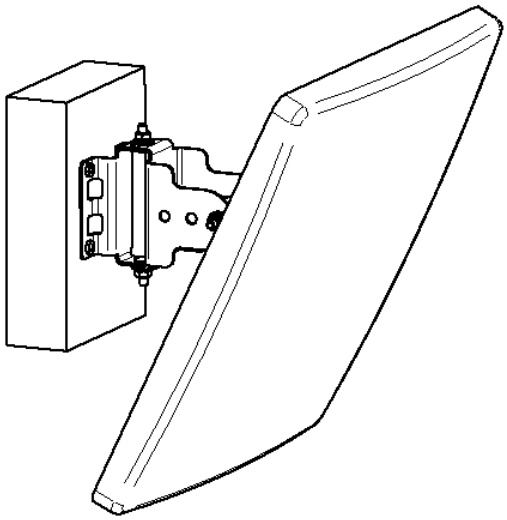


5. Fix the elevation adjustable bracket to the antenna support. Thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).



6. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

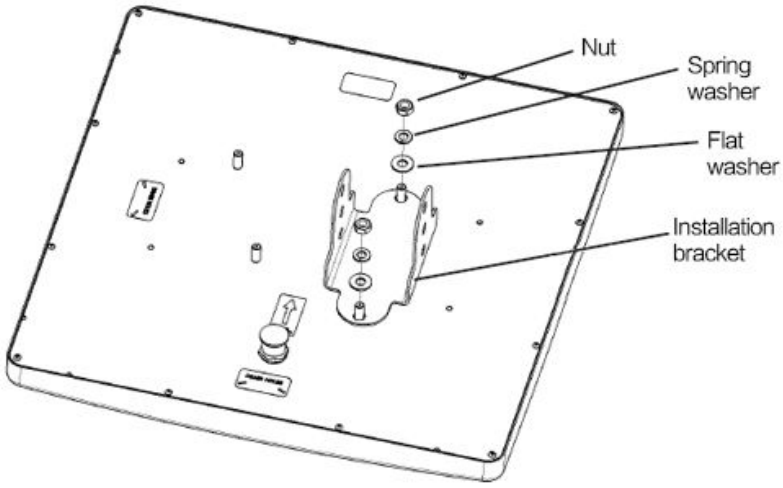
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Antenna Installation with an Extension Bracket

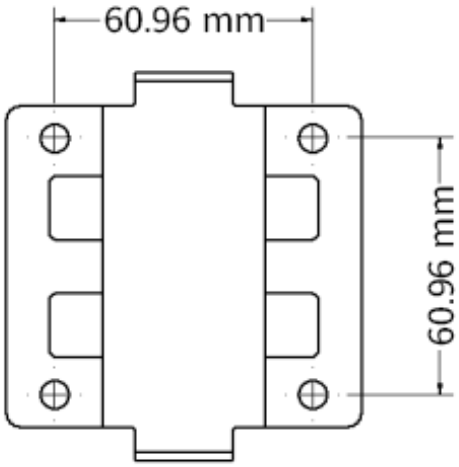
The installation procedure is as follows:

1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.

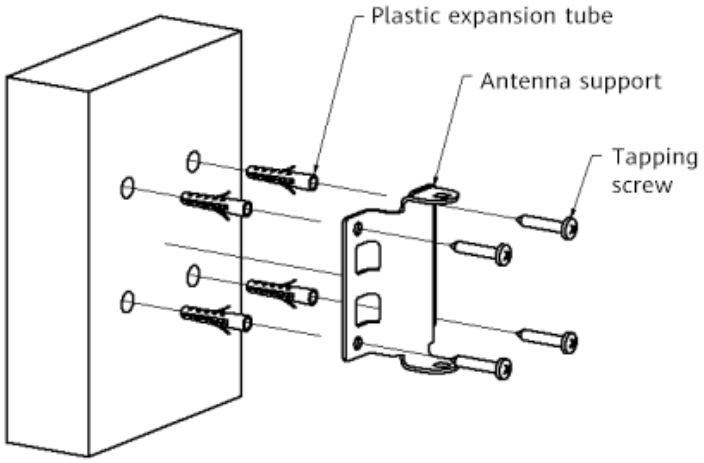


2. Drill four ϕ8 mm holes (42 mm depth) on the wall to install plastic expansion tubes that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.

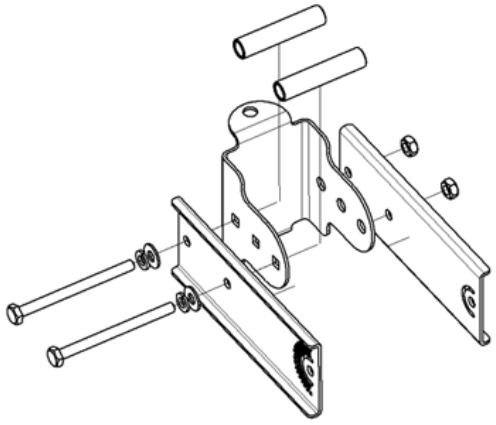
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3. Fix the antenna support to the wall using expansion bolts.

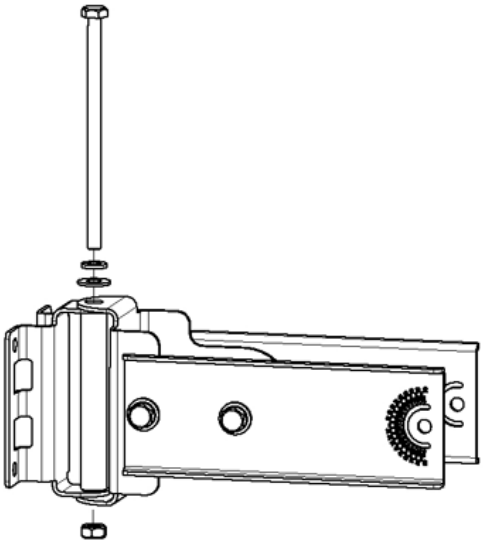


4. Assemble the extension bracket. Tighten it with the flat washers, spring washers and nuts.

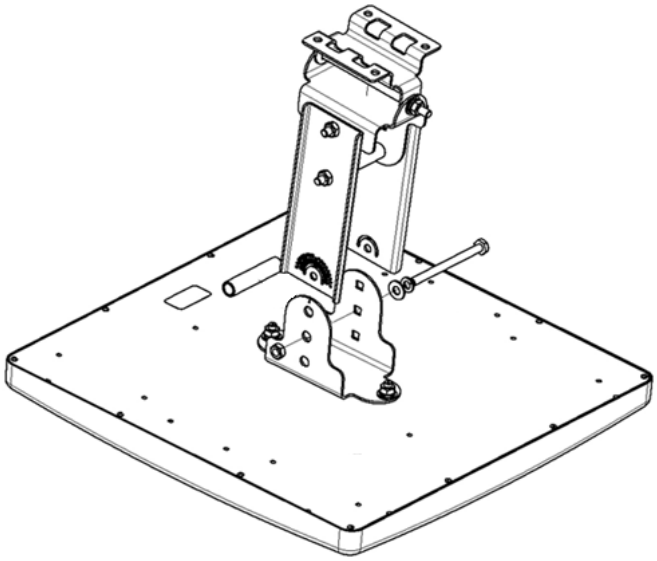


5. Connect the antenna support and extension bracket.

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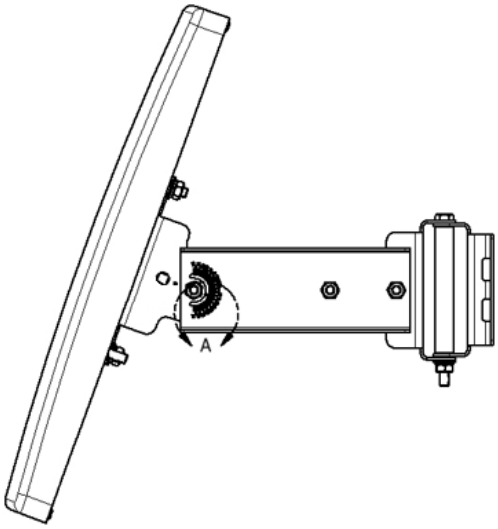


6. Fix the antenna to the extension bracket.



7. Adjust the antenna angle.

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36.3.3 Pole Mounting

The 27012544 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

If an extension bracket is used, install the antenna according to **Antenna Installation with an Extension Bracket**; otherwise, install the antenna according to **Antenna Installation Without an Extension Bracket**.

CAUTION

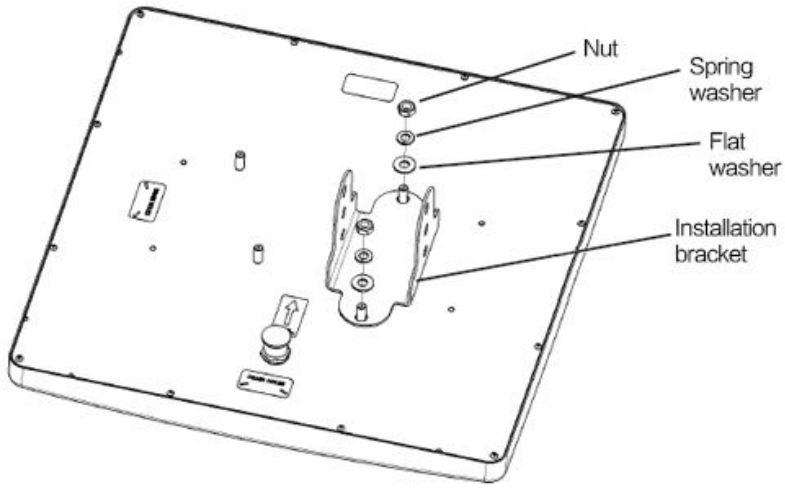
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

Antenna Installation Without an Extension Bracket

The installation procedure is as follows:

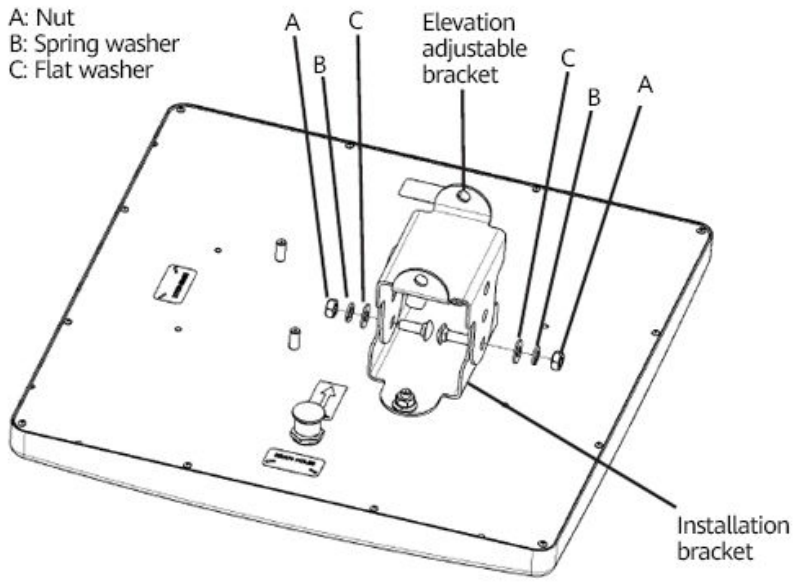
1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.

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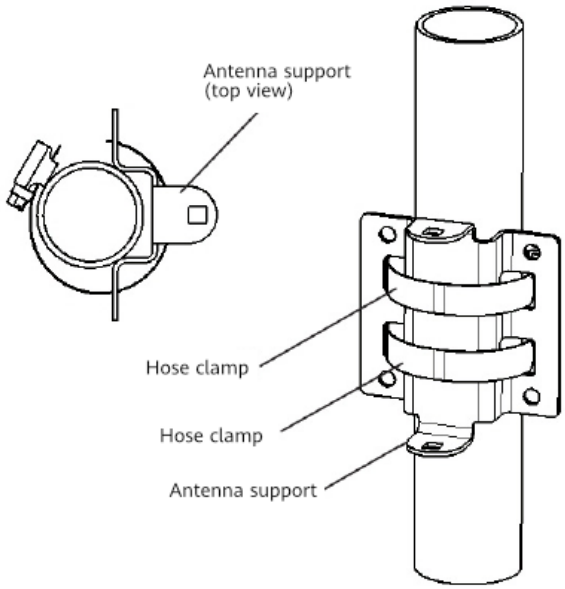
2. Fix the elevation adjustable bracket to the installation bracket.

   Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

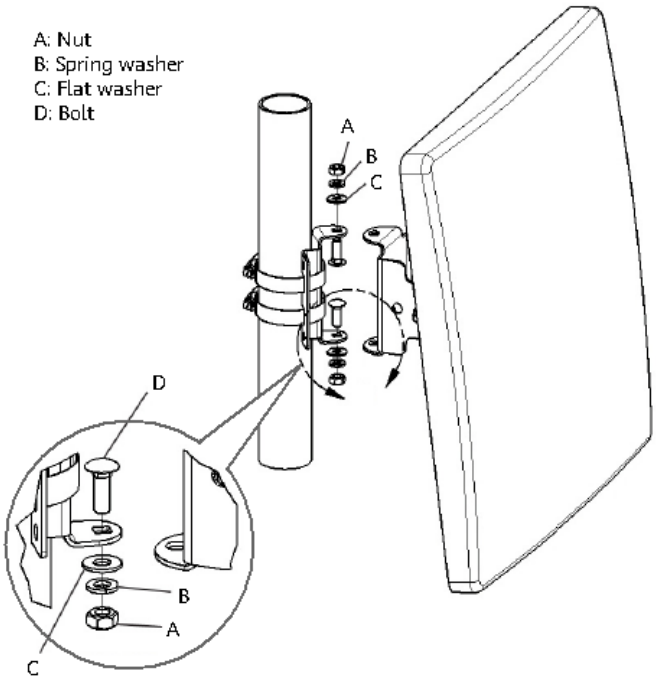


3. Fix the antenna support to the pole.

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4. Fix the antenna to the antenna support. Thread bolts through the antenna support and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).



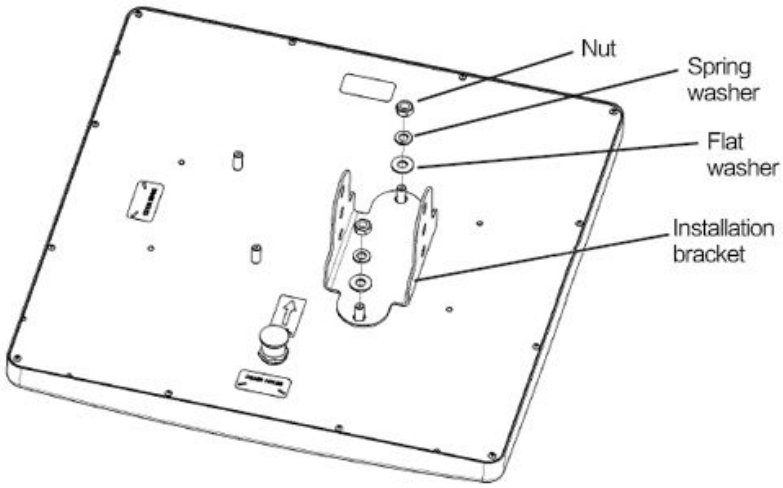
5. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

Antenna Installation with an Extension Bracket

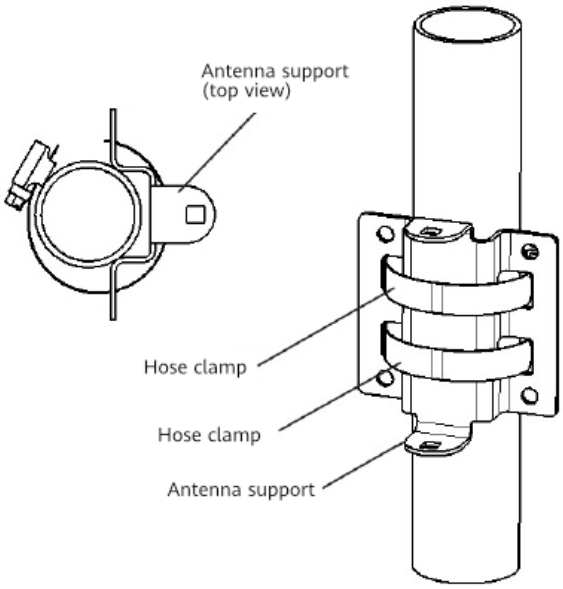
The installation procedure is as follows:

1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.

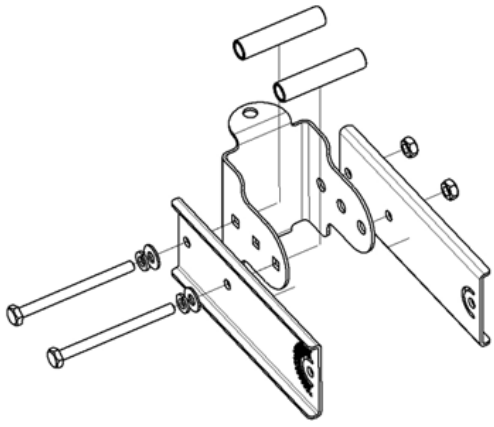
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2. Fix the antenna support to the pole with hose clamps.

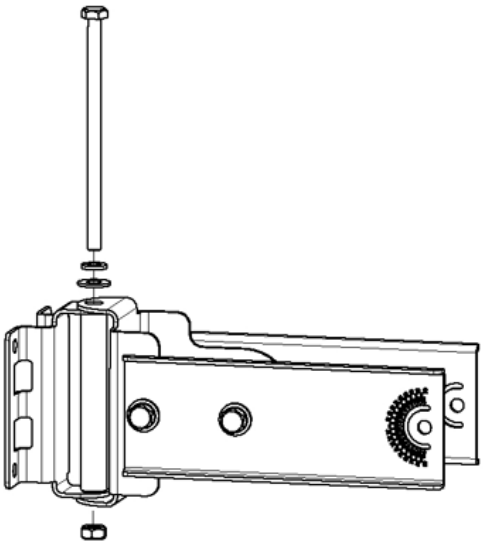


3. Assemble the extension bracket. Tighten it with the flat washers, spring washers and nuts.

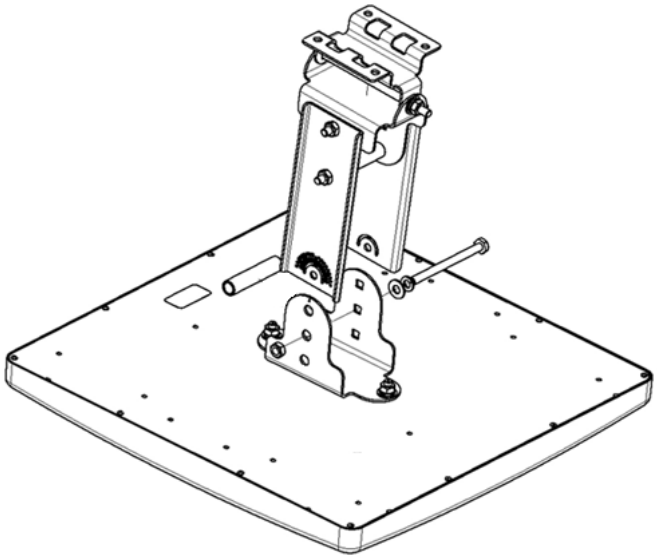


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4. Connect the antenna support and extension bracket.

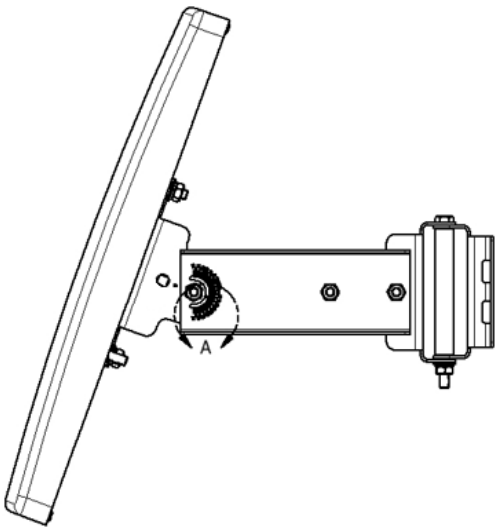


5. Fix the antenna to the extension bracket.



6. Adjust the antenna angle.

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Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

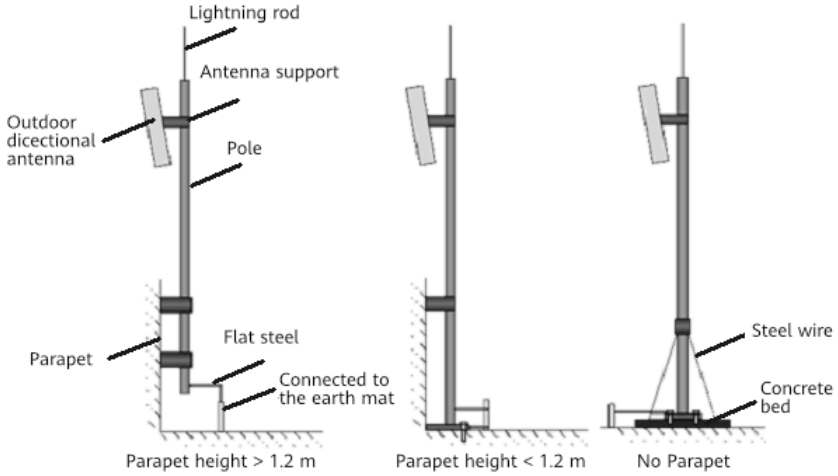
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

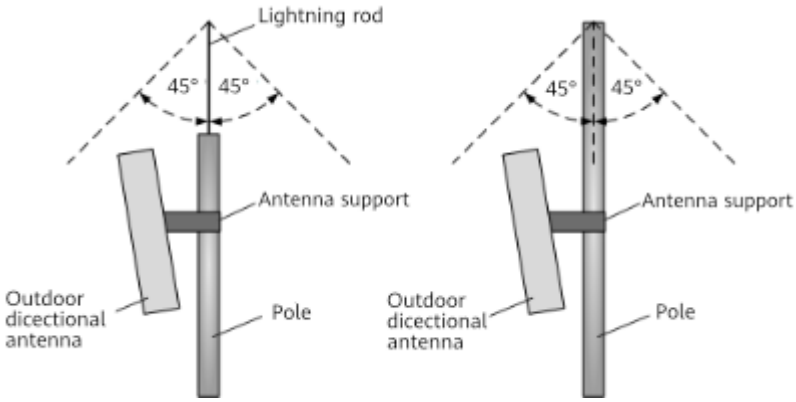
Figure 36-4 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 36-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

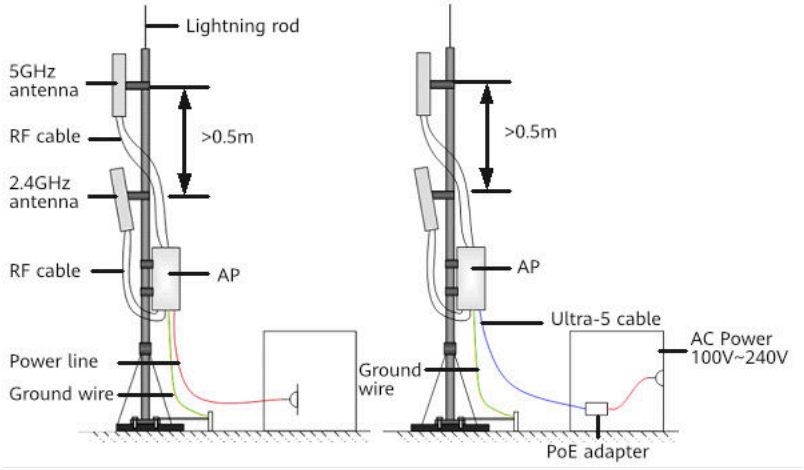
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 36-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

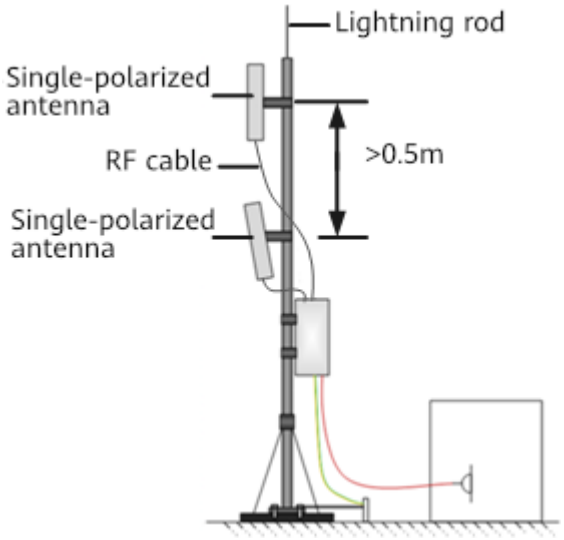
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Figure 36-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 36-6**.

Figure 36-6 Installation of single-polarized antennas



36.3.4 Connecting RF Cables

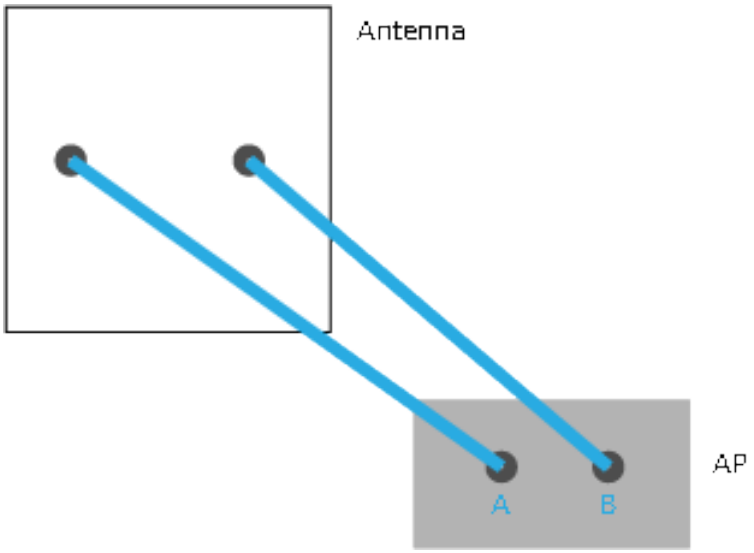
RF Cable Connection Requirements

Connect the feeder connector to the radio interface of an AP and tighten the connector to the interface. The requirements on connections between the AP's radio interfaces and antenna feeder cables are as follows:

- The feeder interfaces of an antenna must be connected to radio interfaces A and B of the same frequency band on an AP.
- The AP's radio interfaces working on the same frequency band (interface A and interface B) must be connected to feeder interfaces of different polarization directions.

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The following figure shows the cable connections.

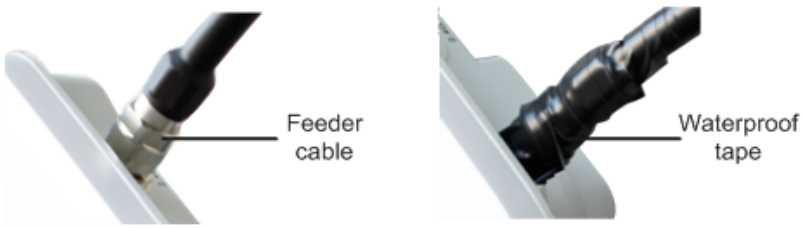


RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.

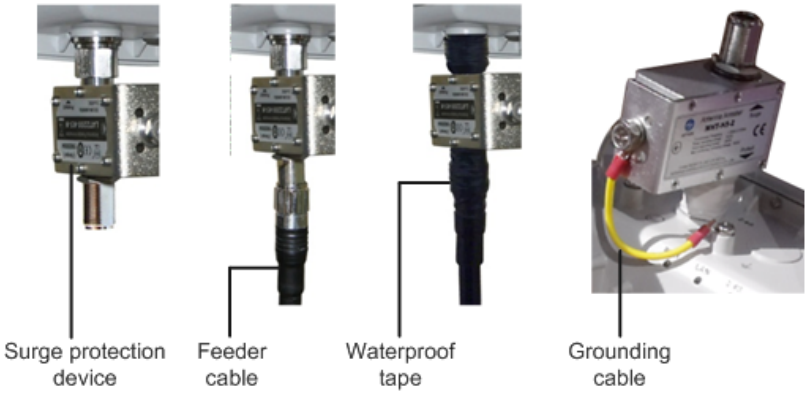


NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

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2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

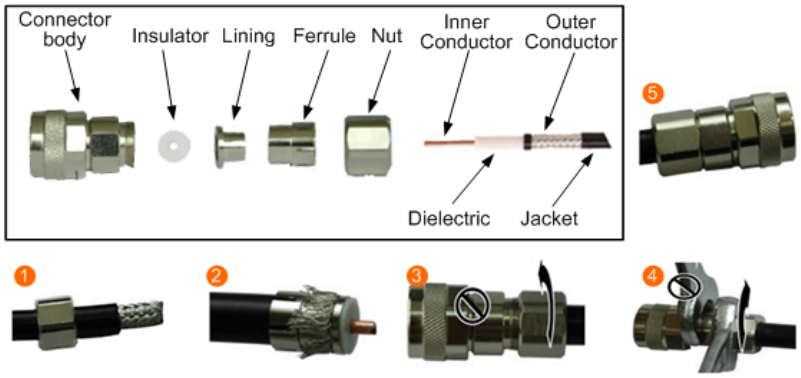
Table 36-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

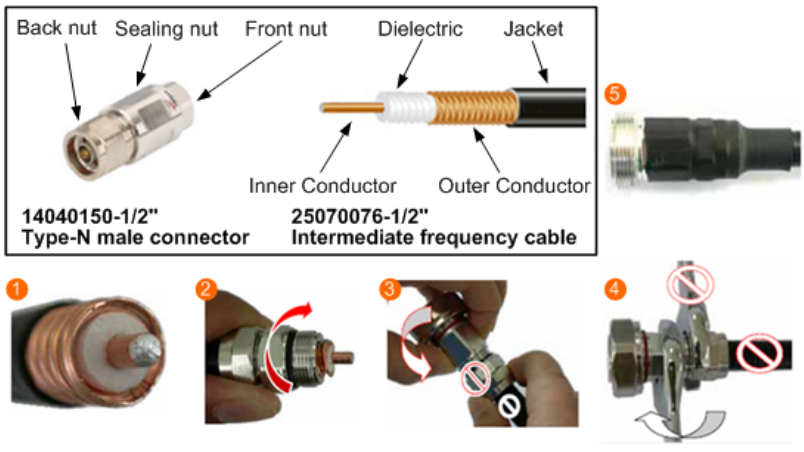
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1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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37 27012545 Indoor 2.4 GHz and 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 and H360 V110 G5)

About This Chapter

37.1 27012545 Technical Specifications

37.2 27012545 Antenna Installation

37.1 27012545 Technical Specifications

Appearance and Structure

Figure 37-1 Appearance of the 27012545 Indoor 2.4 GHz and 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 and H360 V110 G5)



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Technical Specifications

Table 37-1 Technical specifications of the 27012545 Indoor 2.4 GHz and 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 and H360 V110 G5)

Item	Details
Part Number	27012545
Model	ANTDG0404D4SR
Description	Omni Directional Antenna, 2400~2500&5150~5850MHz,4&5dBi, 360deg/110deg&360deg/110deg,RP-SMA-J,4port,with 1M cable, with mounting parts,ceil mounting
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 4 5G: 5
Coverage distance [m(ft.)]	2.4G: 70 5G: 60
Horizontal beamwidth [degrees]	360 degrees
Vertical beamwidth [degrees]	110 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Linear polarization
Attenna connector	RP-SMA-J x 4
Attenna dimensions [mm(in.)]	H x W x D: 20 x 150 x 150
Weight without packaging [kg(lb)]	0.45 kg(lb)
Installation type	Celling
Grounding requirements	Same as the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 37-2 Antenna Pattern1 of the 27012545 Indoor 2.4 GHz and 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 and H360 V110 G5)

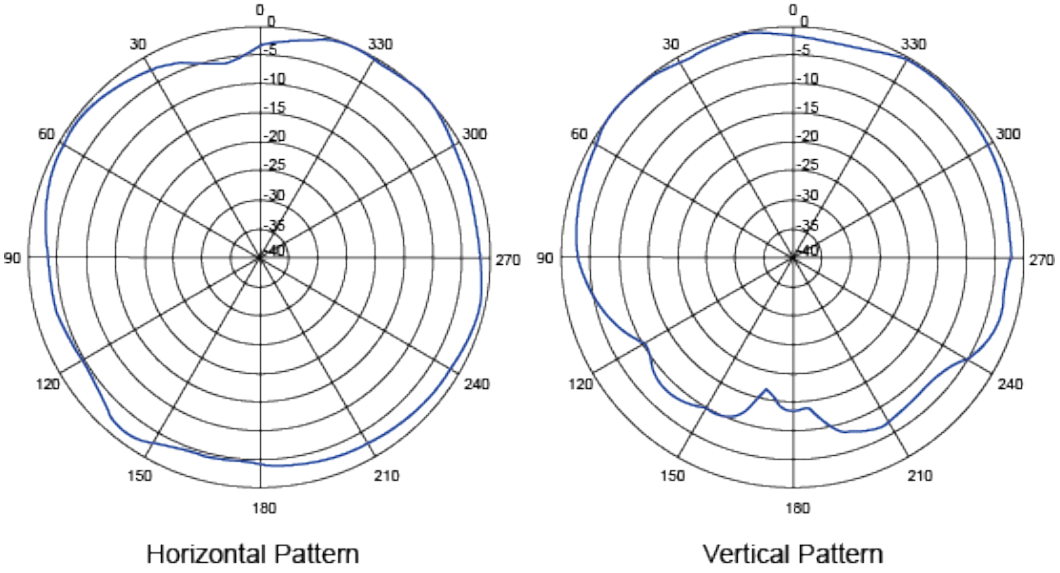
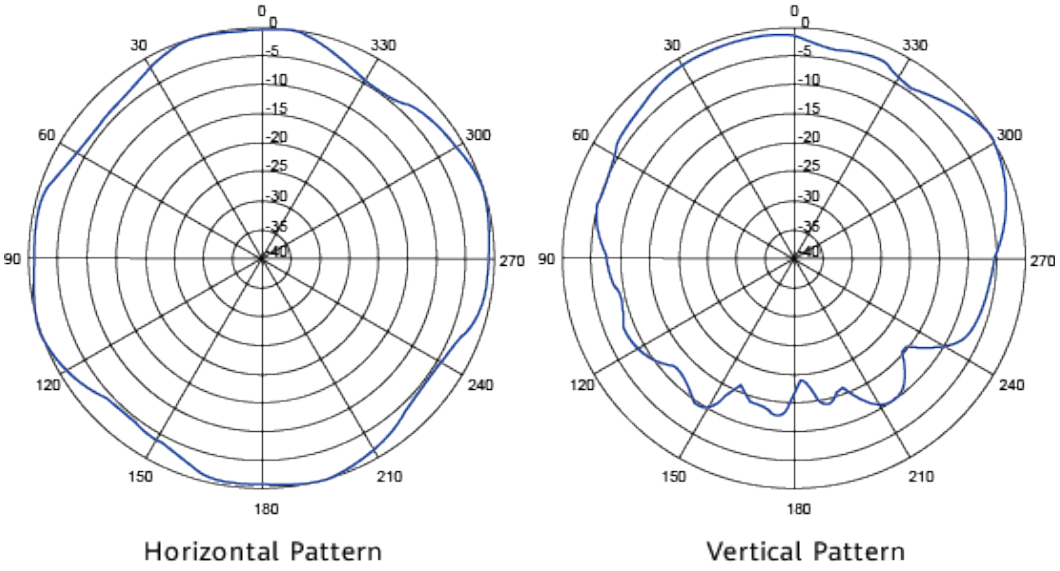


Figure 37-3 Antenna Pattern2 of the 27012545 Indoor 2.4 GHz and 5 GHz Linear-Polarized Omnidirectional Antenna (H360 V110 G4 and H360 V110 G5)



37.2 27012545 Antenna Installation

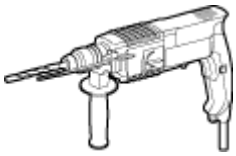
The 27012545 antenna is an indoor omnidirectional antenna. The antenna is best applied to indoor omnidirectional coverage scenarios, such as open office areas, meeting rooms, and lecture halls.

37.2.1 Accessories and Tools

Tools:

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- Open-end wrench
- Hammer drill (used to drill holes in ceilings)



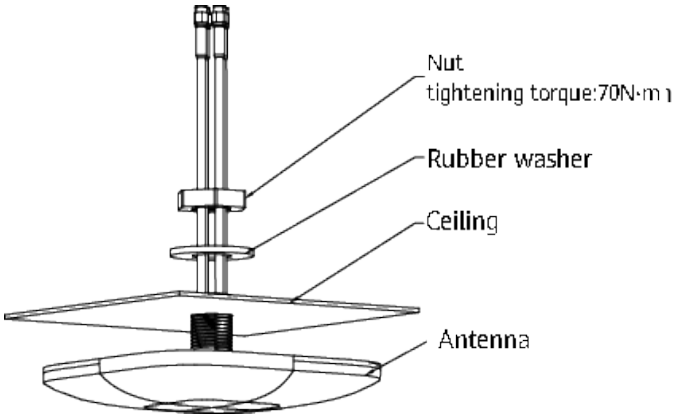
Other accessories:

- Nut: 1 PCS
- Rubber washer: 1 PCS

37.2.2 Ceiling Mounting

The 27012545 antenna can be mounted on a removable ceiling.

1. Drill one ϕ23 ± 0.5 mm hole into the ceiling.
2. Insert the antenna into the hole and secure it using the nut.



NOTE

- The size of the hole in the ceiling must be slightly greater than that of the flange on the antenna connector and the bottom plate of the antenna must be flattened against the ceiling. Otherwise, electrical performance of the antenna will be affected.
- The ceiling must be no greater than 20 mm thick and can bear the weight of four times the weight of the antenna without damage.

37.2.3 Connecting RF Cables

RF Cable Deployment Requirements

- The 27012545 antenna has four 1 m RF cables delivered. For longer RF cables, purchase them separately.
- It is recommended that you connect a 50 ohm RF load to an idle RF port.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

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RF Cable Connections

1. Remove covers on external antenna ports of APs to expose RP-SMA female connectors.
2. Connect the RP-SMA male connector on the feeder to the RP-SMA female connector on the AP.

NOTE

Feeder cables on an antenna must be connected to the local AP's radio ports on the correct frequency band. There are no other requirements regarding the connection between the feeder cables and radio ports.

RF Cable Appearance

Figure 37-4 Rear view of the antenna (27012545)

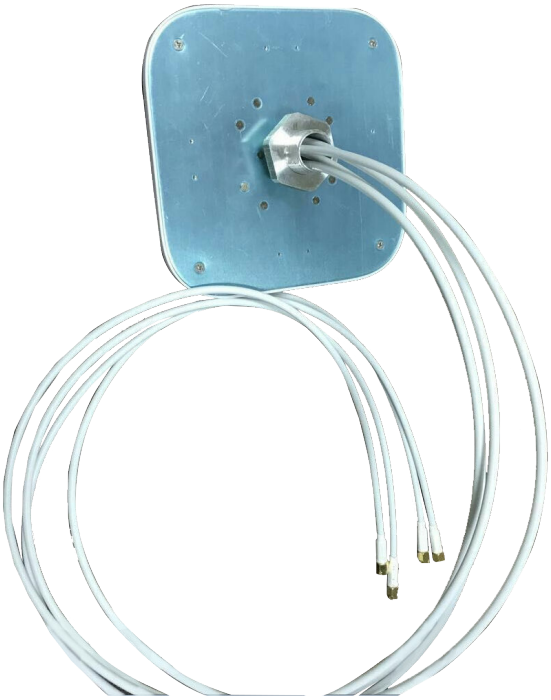


Table 37-2 lists the SMA connector types.

Table 37-2 SMA connector types

Connector Type	Polarity	Male or Female	Shape
SMA-J	Positive polarity	Male	Internal thread, inner pin
SMA-K	Positive polarity	Female	External thread, inner hole
RP-SMA-J	Reverse polarity	Male	Internal thread, inner hole

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Connector Type	Polarity	Male or Female	Shape
RP-SMA-k	Reverse polarity	Female	External thread, inner pin

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38 27012565 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H35 V35 G12 and H26 V26 G11)

About This Chapter

38.1 27012565 Technical Specifications
38.2 27012565 Installation Precautions
38.3 27012565 Antenna Installation

38.1 27012565 Technical Specifications

The 27012565 directional antenna is named ANTDG1211D4NR and applicable to outdoor scenarios.

Antenna Appearance

Figure 38-1 shows the appearance of the 27012565 antenna.

Figure 38-1 Appearance of the 27012565 antenna



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Technical Specifications

Table 38-1 lists technical specifications of the 27012565 antenna.

Table 38-1 Technical specifications of the 27012565 antenna

Item	Value (2.4G)	Value (5G)
Frequency (MHz)	2400–2500	5150–5850
Gain (dBi)	12	11
Coverage radius (m)	150	110
Horizontal lobe width (degrees)	35	26
Vertical lobe width (degrees)	35	26
Standing wave ratio (SWR)	≤ 2	≤ 2.2
Polarization	Cross polarization	
Connector	N-female*4	
Dimensions (mm)	H x W x D: 40 x 450 x 420	
Weight (kg)	3	
Support pole diameter (mm)	ϕ35–ϕ114	
Mounting mode	Wall mounting or pole mounting	
Grounding requirements	Same as the AP	

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NOTE

- The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet.
- The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments.
- There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information.
- The coverage distance is subject to the following constraints:
  - The default AP transmit power is 15 dBm.
  - The default STA type is mobile phone, and no obstacle exists.
  - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm.
  - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm.

  For any questions about the parameters above, contact Huawei technical support.

Antenna Pattern

Figure 38-2 and Figure 38-3 show radiation patterns of the 27012565 antenna (2.4 GHz and 5 GHz) in the horizontal and vertical directions.

Figure 38-2 Radiation pattern of the 27012565 antenna (2.4 GHz)

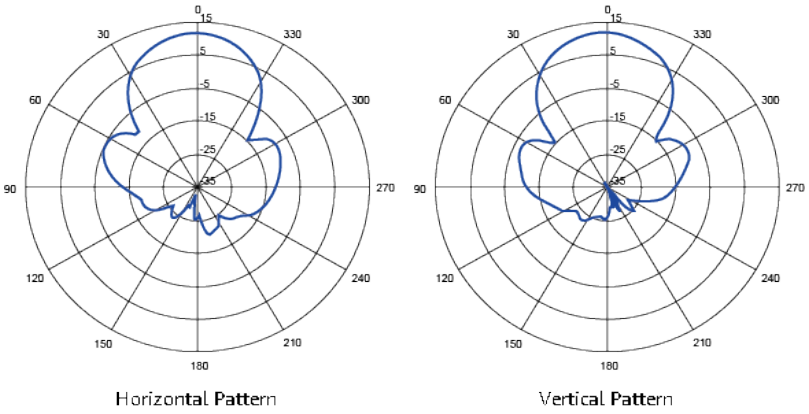
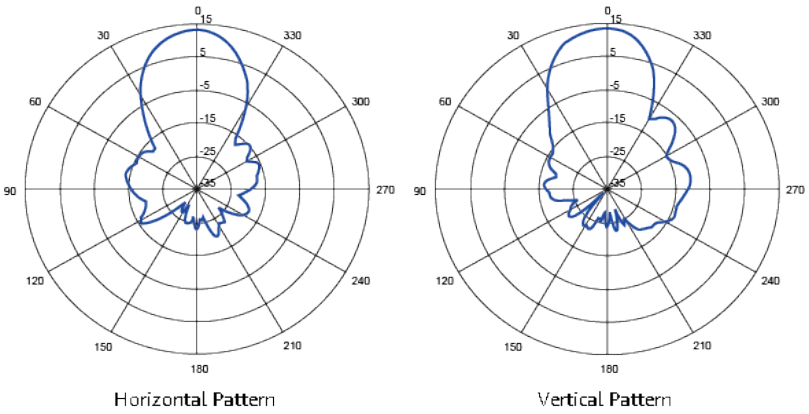


Figure 38-3 Radiation pattern of the 27012565 antenna (5 GHz)



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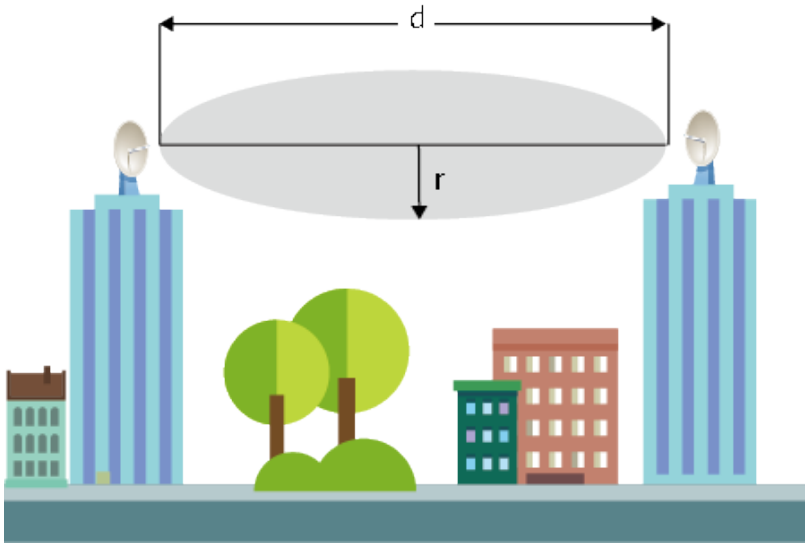
38.2 27012565 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 38-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

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- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 38-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 38-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

38.3 27012565 Antenna Installation

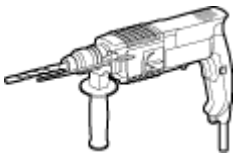
The 27012565 antenna is a directional antenna applicable to outdoor scenarios. It should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops, to obtain better performance. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

38.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Hammer drill (ϕ10 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- 1 x pole with a diameter of ϕ35 mm to ϕ114 mm

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Other accessories:

- M8x70 Expansion bolt: 4 sets

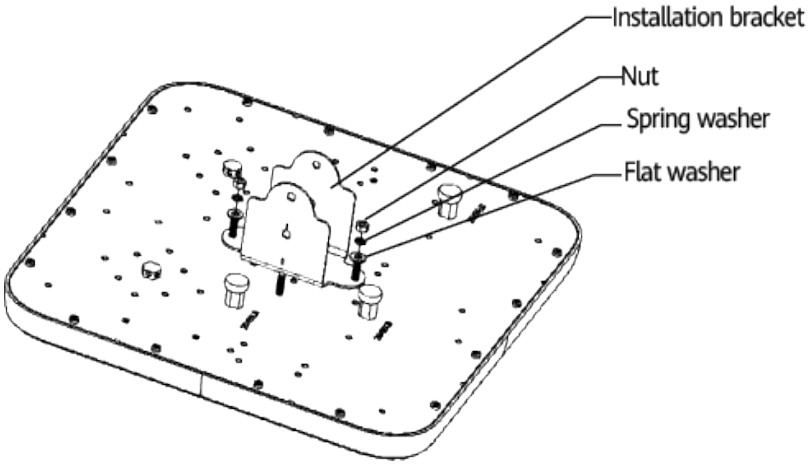
38.3.2 Wall Mounting

The 27012565 antenna can be mounted on a wall.

CAUTION

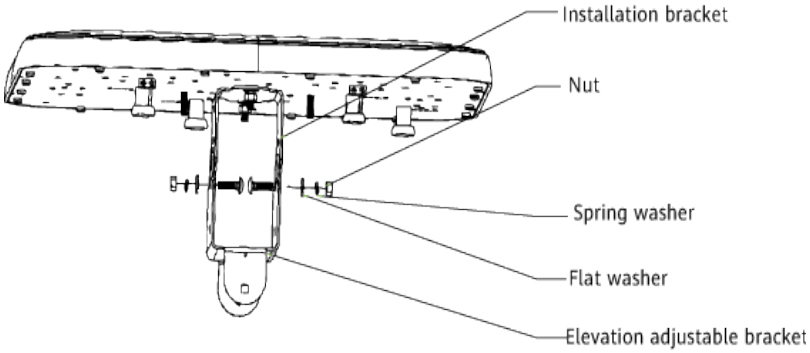
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.



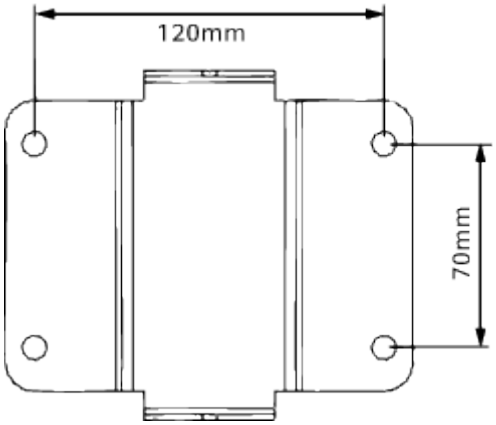
2. Fix the elevation adjustable bracket to the installation bracket.

   Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

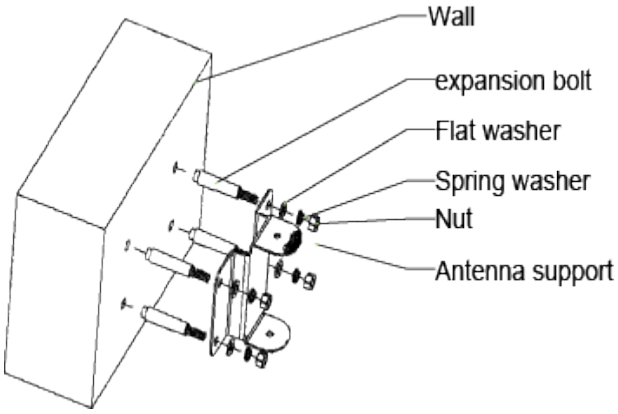


3. Drill four ϕ10 mm holes (72 mm depth) on the wall to install plastic expansion tubes that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.

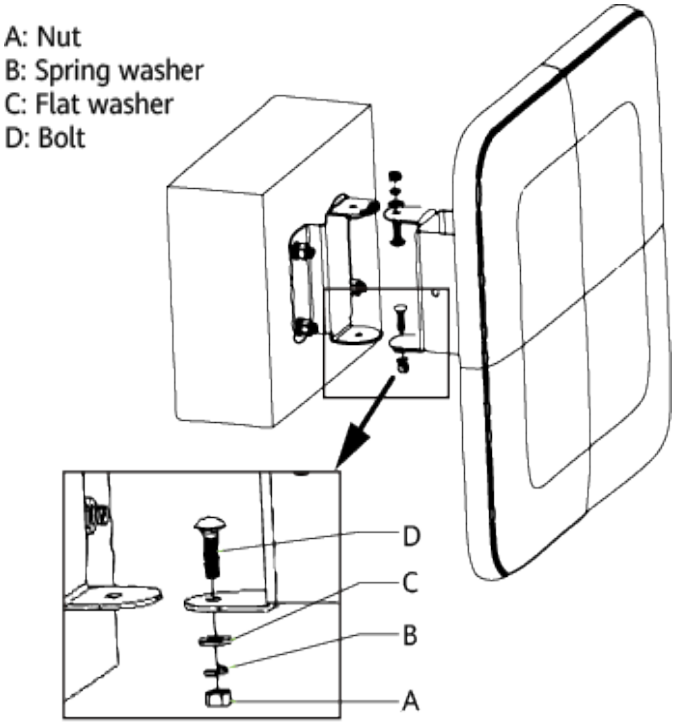
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4. Fix the antenna support to the wall using expansion bolts.



5. Fix the elevation adjustable bracket to the antenna support. Thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).



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6. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

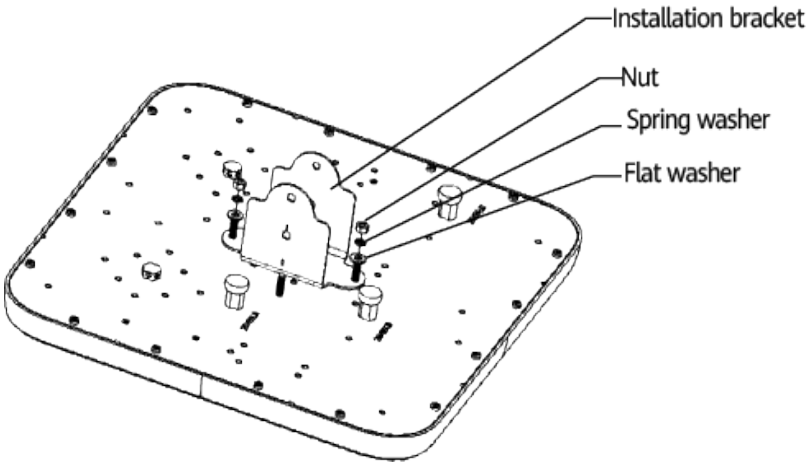
38.3.3 Pole Mounting

The 27012565 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

CAUTION

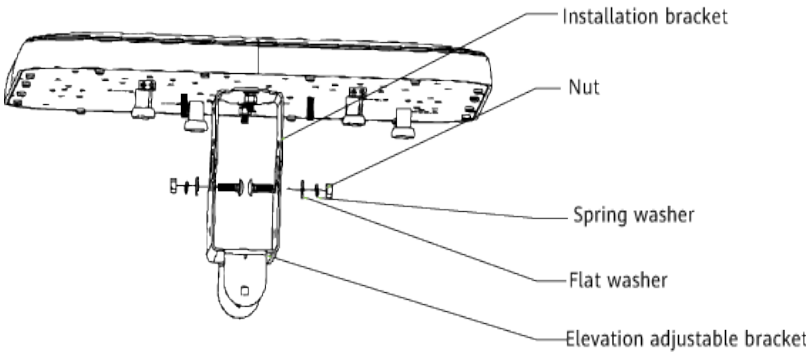
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.



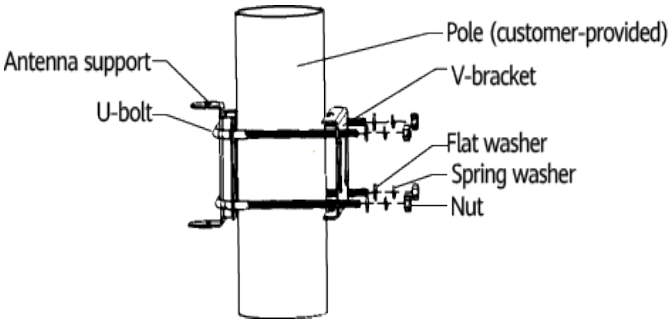
2. Fix the elevation adjustable bracket to the installation bracket.

   Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

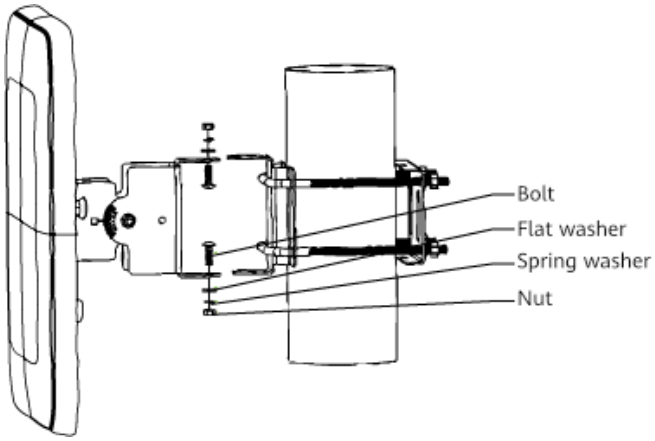


3. Fix the antenna support to the pole.

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4. Fix the antenna to the antenna support. Thread bolts through the antenna support and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).



5. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

38.3.4 Connecting RF Cables

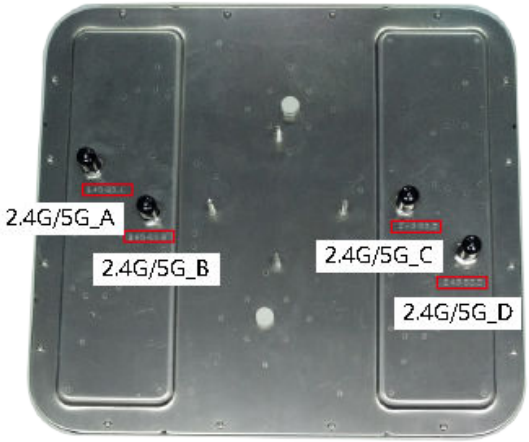
RF Cable Connection Requirements

The radio interfaces of the same frequency band on an AP have silkscreens A, B, C, and D, as shown in the following figure.

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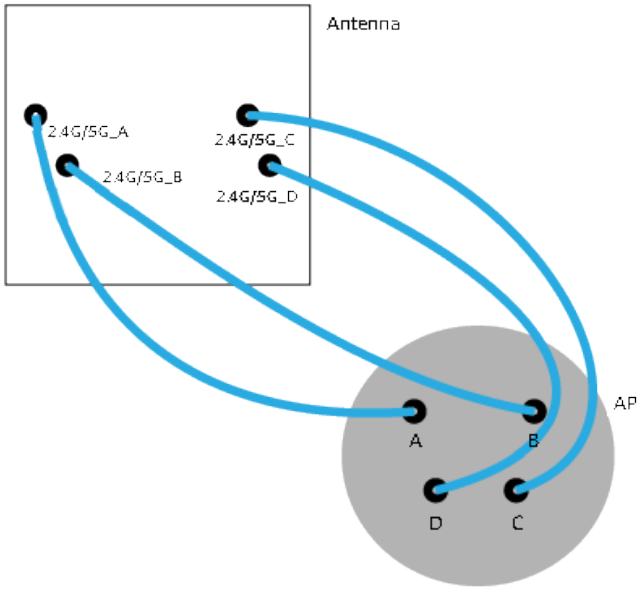
The following figure shows the feeder interfaces on the 27012565 antenna.



Use the feeder cable to connect the radio interfaces of the AP and antenna. The feeder interfaces A, B, C, and D of an antenna must be connected to radio interfaces A, B, C, and D of the same frequency band on an AP.

The following figure shows the cable connections.

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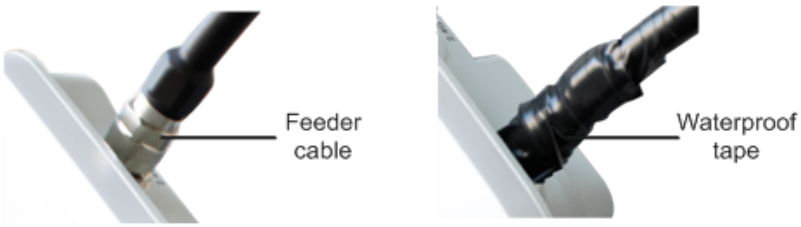


RF Cable Deployment Requirements

- Feeders connecting antennas and APs must be as short as possible.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

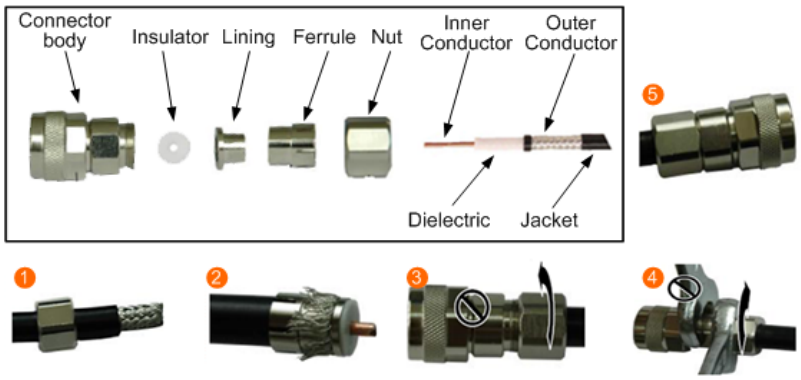
Table 38-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

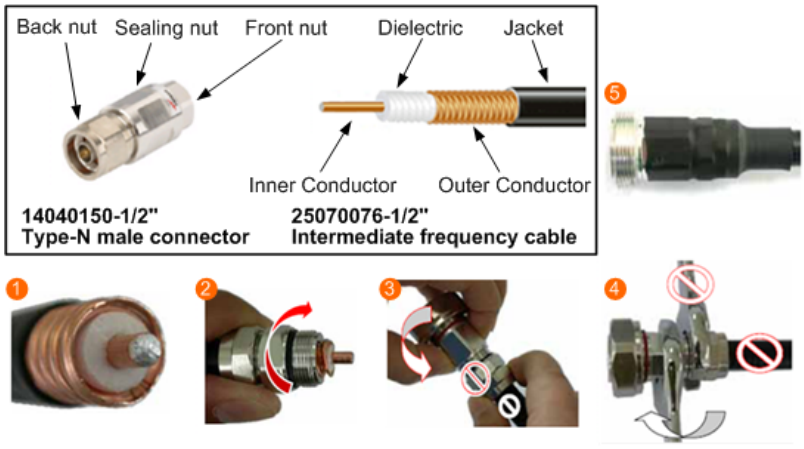
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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39 27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 and H15 V15 G17)

About This Chapter

39.1 27012566 Technical Specifications
39.2 27012566 Installation Precautions
39.3 27012566 Antenna Installation

39.1 27012566 Technical Specifications

Appearance and Structure

Figure 39-1 Appearance of the 27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 and H15 V15 G17)



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Technical Specifications

Table 39-1 Technical specifications of the 27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 and H15 V15 G17)

Item	Details
Part Number	27012566
Model	ANTDG13184NR
Description	Directional Antenna, 2400~2500&5150~5850MHz, 13&17dBi,32deg/32deg&15deg/15deg,N/Female,4port,with mounting parts,pole/wall mounting
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 13 5G: 17
Coverage distance [m(ft.)]	2.4G: 160 5G: 180
Horizontal beamwidth [degrees]	2.4G:32 5G:15
Vertical beamwidth [degrees]	2.4G:32 5G:15
Standing wave ratio (SWR)	≤ 2
Polarization	Cross polarization
Attenna connector	N-female x 4
Attenna dimensions [mm(in.)]	H x W x D: 35 x 450 x 420
Weight without packaging [kg(lb)]	3 kg(lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ35 to ϕ114

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 39-2 Antenna Pattern1 of the 27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 and H15 V15 G17)

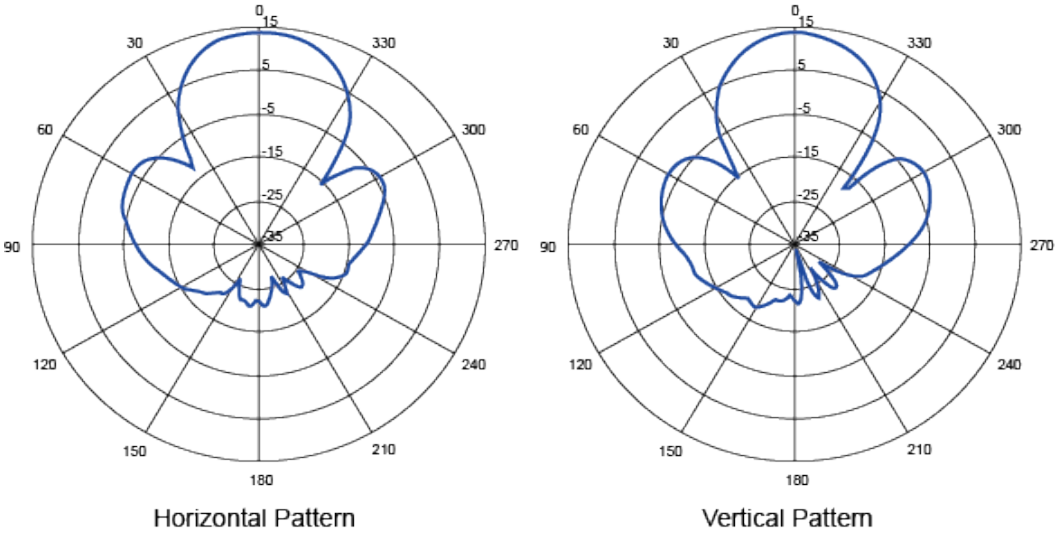
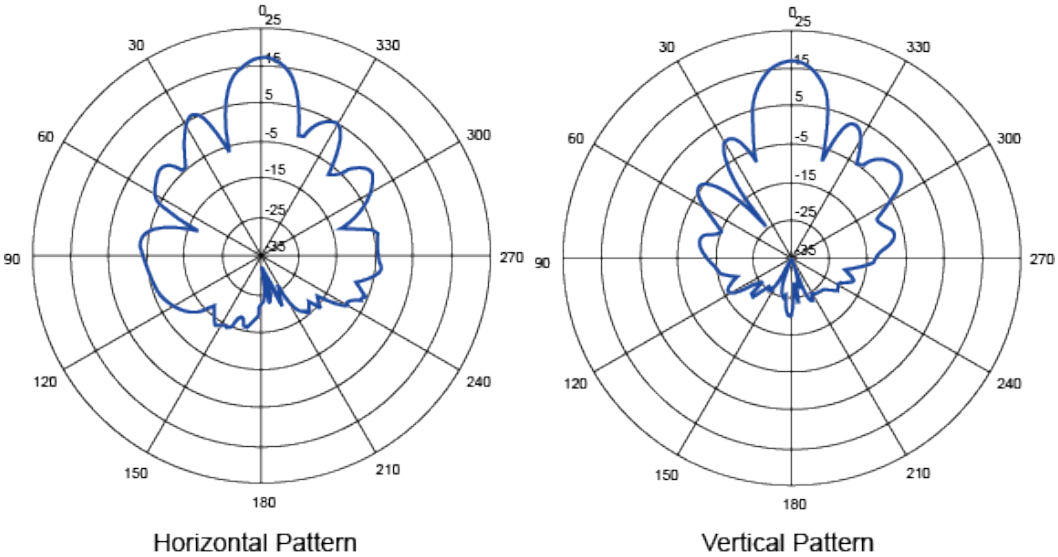


Figure 39-3 Antenna Pattern2 of the 27012566 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H32 V32 G13 and H15 V15 G17)



39.2 27012566 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

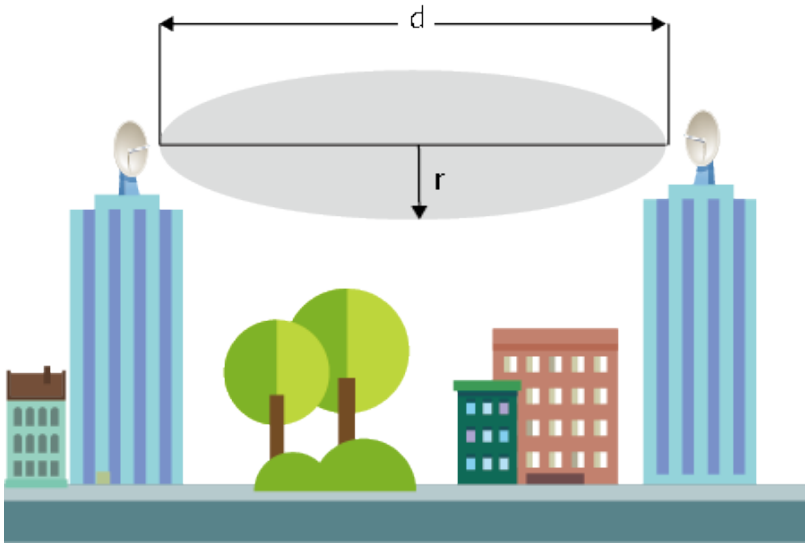
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.

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- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 39-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 39-2** lists the radius of the first Fresnel zone in different backhaul distances.

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Table 39-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

39.3 27012566 Antenna Installation

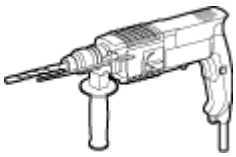
The 27012566 antenna is a directional antenna applicable to outdoor scenarios. It should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops, to obtain better performance. Its transmit end should not be blocked by obstacles.

In bridging scenarios, installation positions should not exceed wireless bridge transmission distances.

39.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Hammer drill (ϕ10 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- 1 x pole with a diameter of ϕ35 mm to ϕ114 mm

Other accessories:

- M8x70 Expansion bolt: 4 sets

39.3.2 Wall Mounting

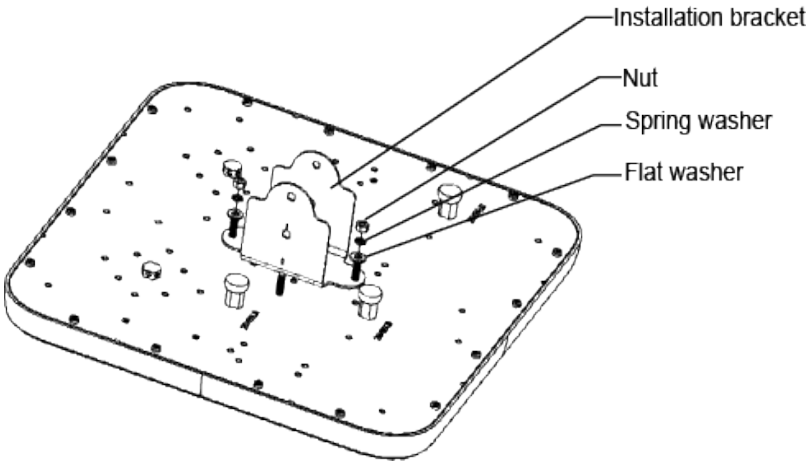
The 27012566 antenna can be mounted on a wall.

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CAUTION

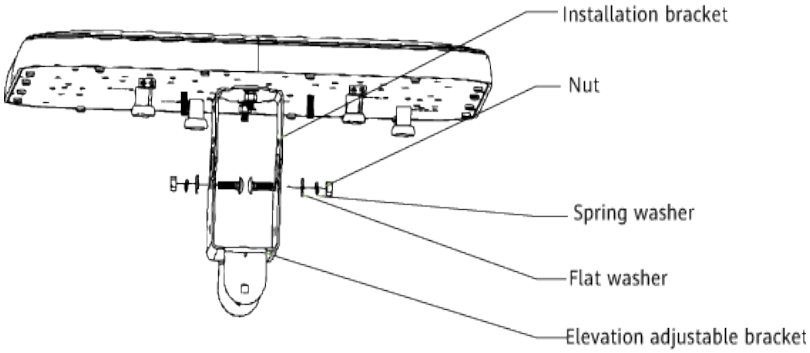
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.



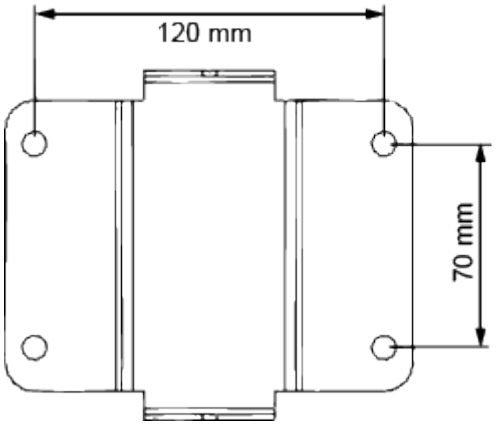
2. Fix the elevation adjustable bracket to the installation bracket.

   Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

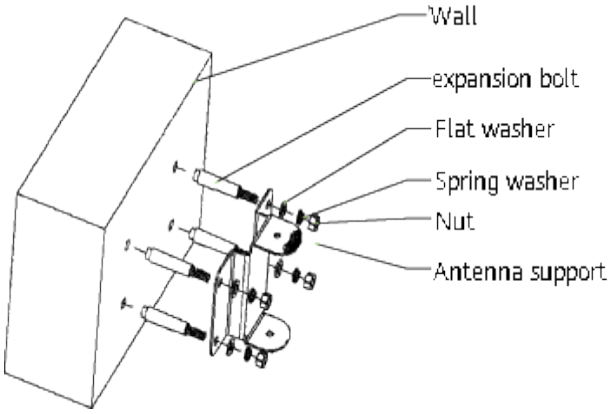


3. Drill four ϕ10 mm holes (72 mm depth) on the wall to install plastic expansion tubes that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.

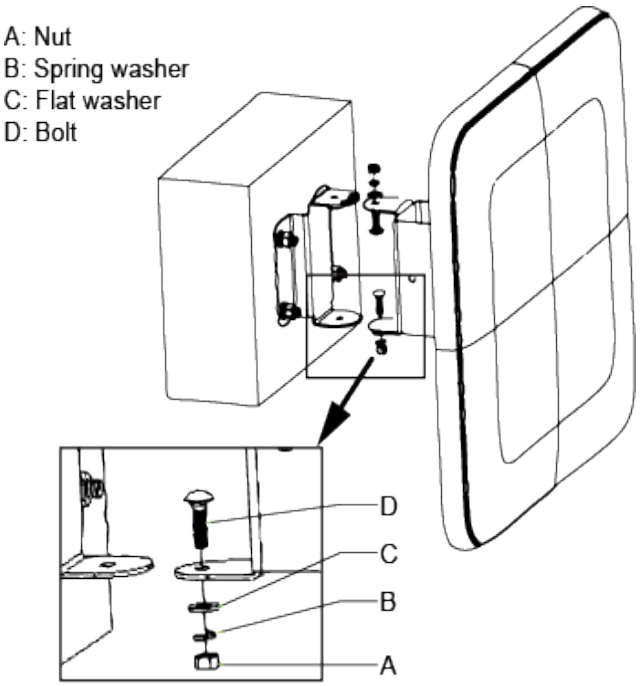
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4. Fix the antenna support to the wall using expansion bolts.



5. Fix the elevation adjustable bracket to the antenna support. Thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).



6. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

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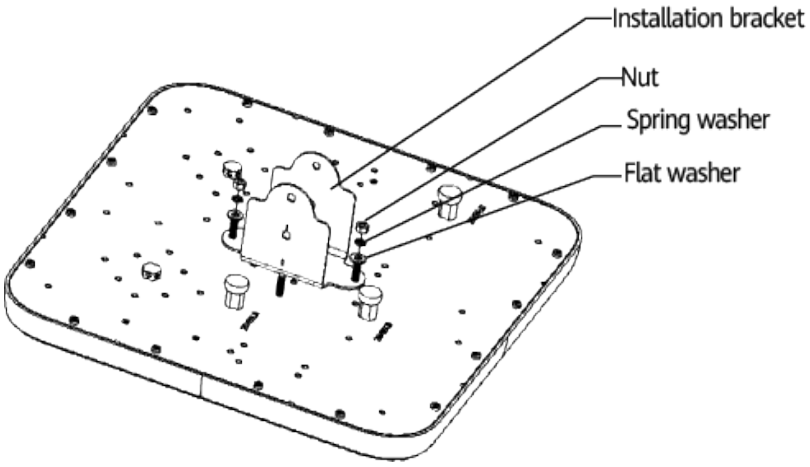
39.3.3 Pole Mounting

The 27012566 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

⚠ CAUTION

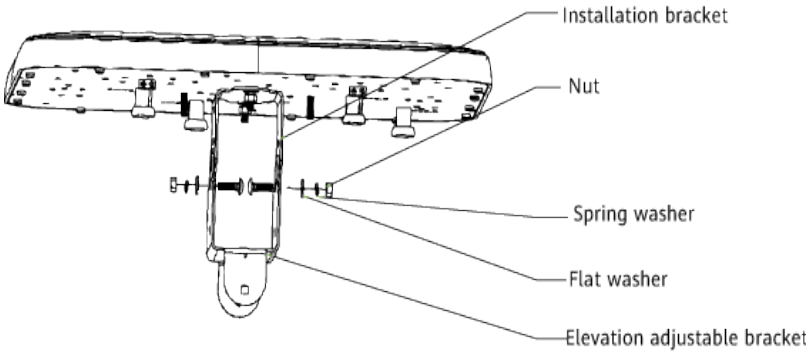
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Fix the installation bracket to the back of the antenna with the nuts, spring washers, and flat washers. The maximum torque is 6.2 N m.



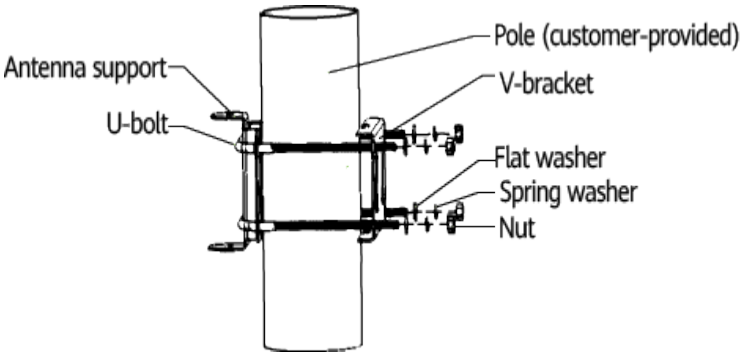
2. Fix the elevation adjustable bracket to the installation bracket.

   Select appropriate holes and thread bolts through the installation bracket and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).

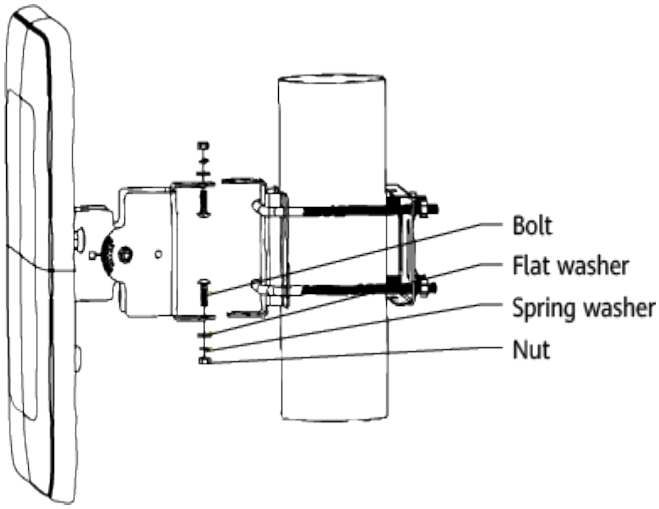


3. Fix the antenna support to the pole.

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4. Fix the antenna to the antenna support. Thread bolts through the antenna support and elevation adjustable bracket. Put on flat washers, spring washers, and nuts to fix the bolts (not tightly).



5. Adjust the antenna angle and tighten all of the four nuts. The maximum torque is 6.2 N m.

39.3.4 Connecting RF Cables

RF Cable Connection Requirements

The radio interfaces of the same frequency band on an AP have silkscreens A, B, C, and D, as shown in the following figure.

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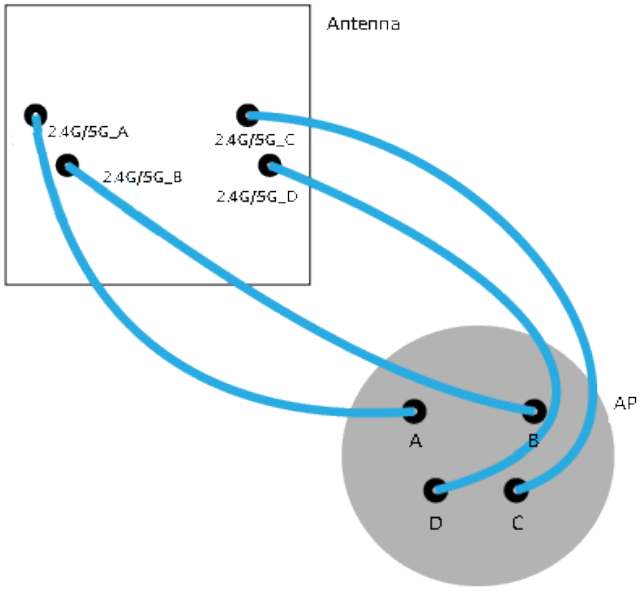
The following figure shows the feeder interfaces on the 27012566 antenna.



Use the feeder cable to connect the radio interfaces of the AP and antenna. The feeder interfaces A, B, C, and D of an antenna must be connected to radio interfaces A, B, C, and D of the same frequency band on an AP.

The following figure shows the cable connections.

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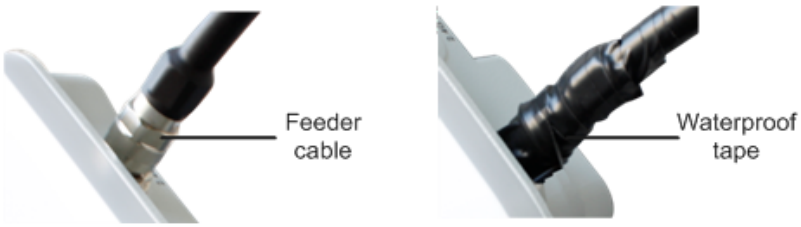


RF Cable Deployment Requirements

- Feeders connecting antennas and APs must be as short as possible.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until the tape length is twice its original length. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces.



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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

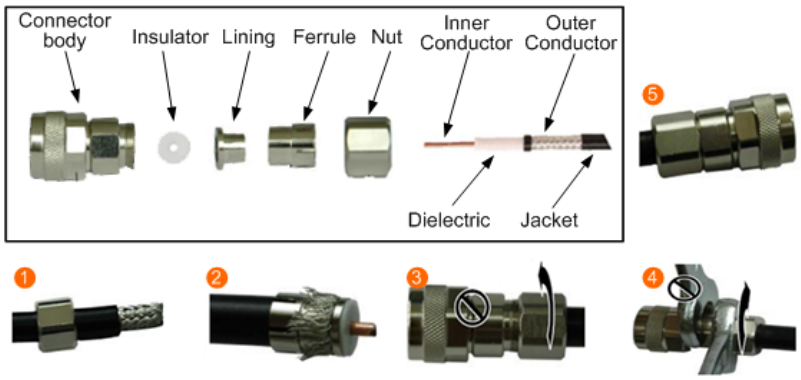
Table 39-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

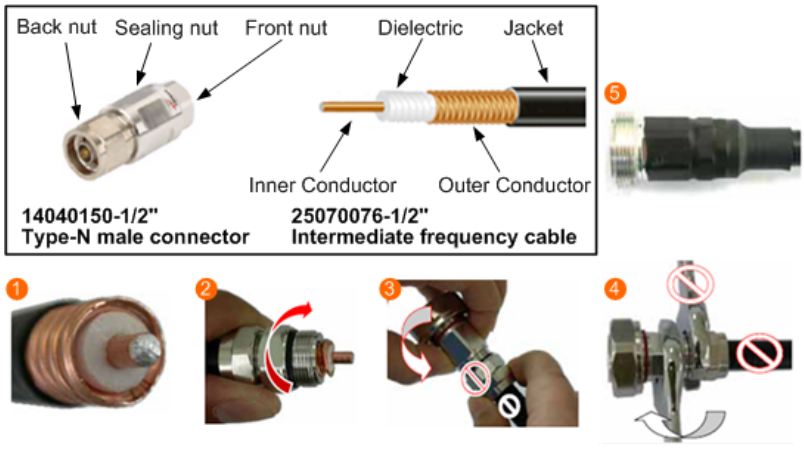
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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40 27013413 Outdoor 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)

About This Chapter

40.1 27013413 Technical Specifications

40.2 27013413 Installation Precautions

40.3 27013413 Antenna Installation

40.1 27013413 Technical Specifications

Appearance and Structure

Figure 40-1 Appearance of the 27013413 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)



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Technical Specifications

Table 40-1 Technical specifications of the 27013413 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)

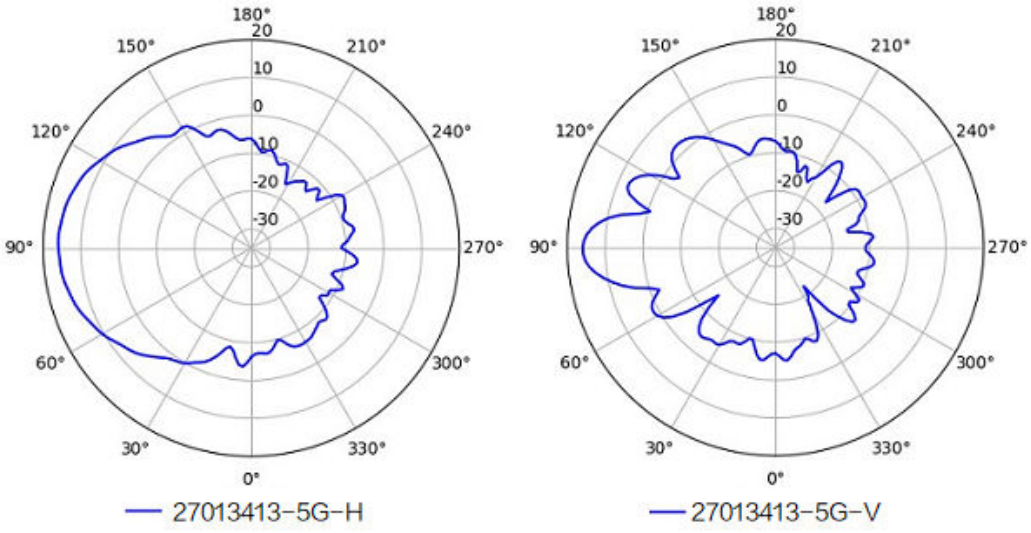
Item	Details
Part Number	27013413
Model	ANT5G15D2NR
Description	Directional Antenna-5150~5850MHz-15dBi-45deg /15deg-Nfemale-2ports -with bracket-pole mounting-only used in metro project
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	15.5±1.5
Coverage distance [m(ft.)]	The coverage distance is 150 m when the transmit power and field strength of STAs are 15 dBm and -75 dBm, respectively, regardless of the local EIRP limit.
Horizontal beamwidth [degrees]	45 degrees
Vertical beamwidth [degrees]	15 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	± 45°
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	60 mm x 240 mm x 133 mm (2.36 in. x 9.45 in. x 5.24 in.)
Weight without packaging [kg(lb)]	Antenna body: 0.6 kg (1.32 lb) Mounting bracket: 0.5 kg (1.1 lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ35 to ϕ75

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Item	Details
Attenna note	The gains and lobe widths are typical values, and the actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default terminal type is mobile phone and no obstacle exists. - The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

Antenna's Radiation Pattern

Figure 40-2 Antenna Pattern1 of the 27013413 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)



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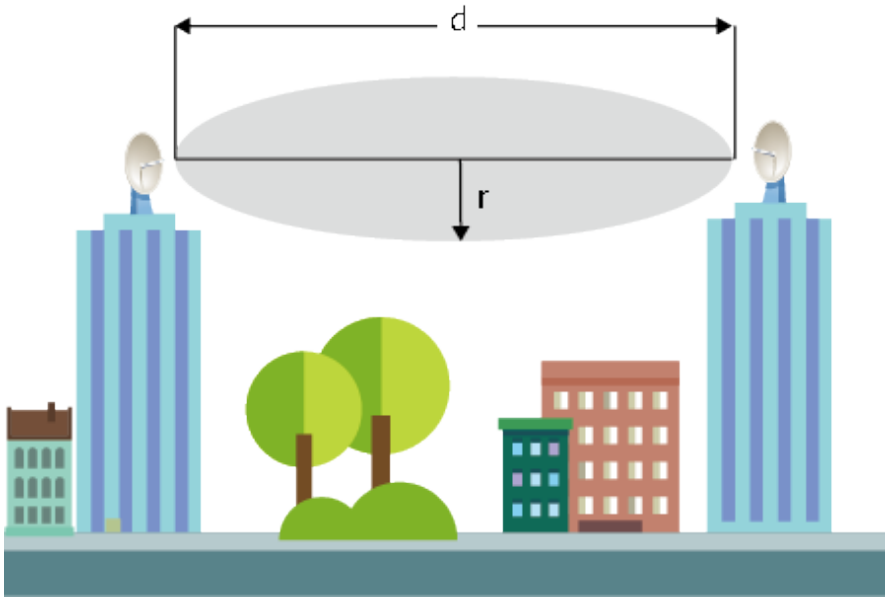
40.2 27013413 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see the subsequent antenna installation section.
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 40-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

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$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in kilometers.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 40-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 40-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
4	8.66
5	12.25

40.3 27013413 Antenna Installation

The 27013413 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, install the antenna at high positions away from metal obstacles, such as building tops, mountaintops, and tower tops. Keep the antenna's transmit end away from obstacles.

40.3.1 Accessories and Tools

Tools:

- 13 mm combination wrench (applicable to M8 assemblies) x 2

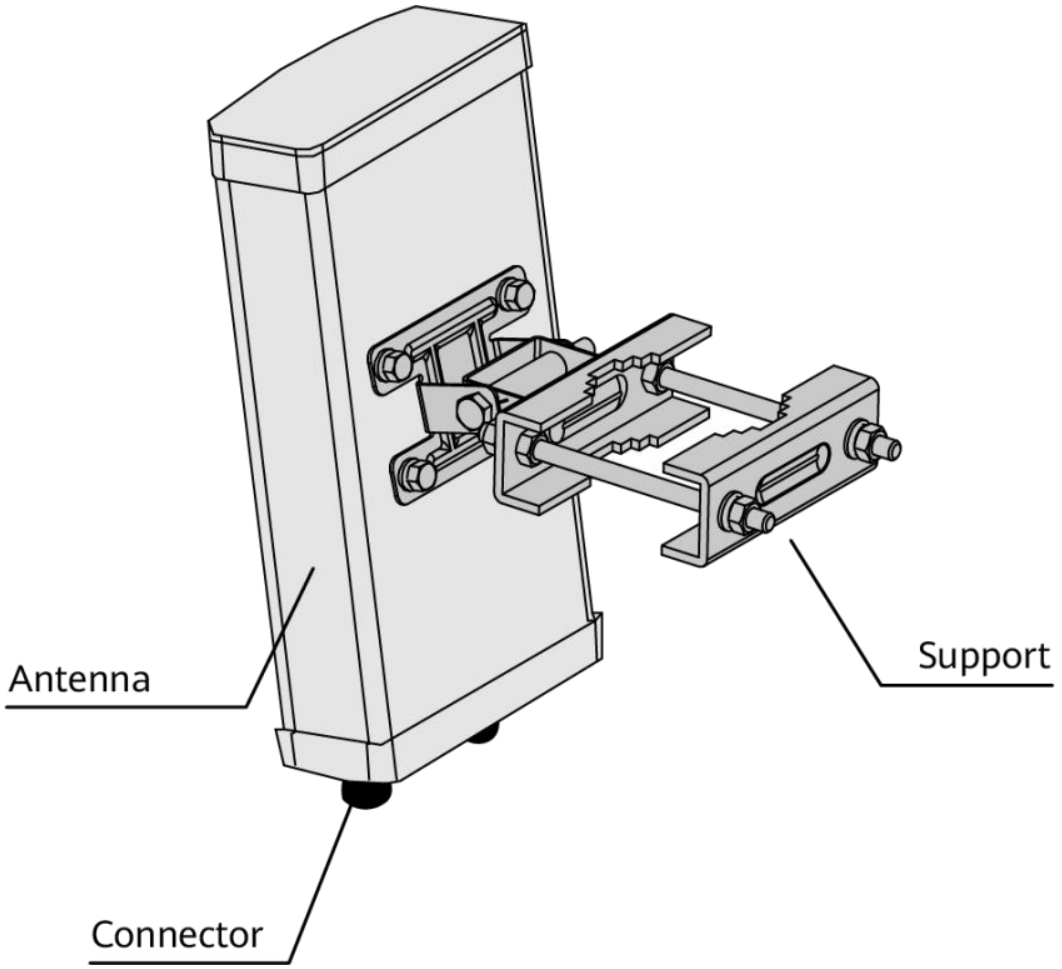


- Inclinometer



By default, the support and screws are preinstalled on an antenna.

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40.3.2 Pole Mounting

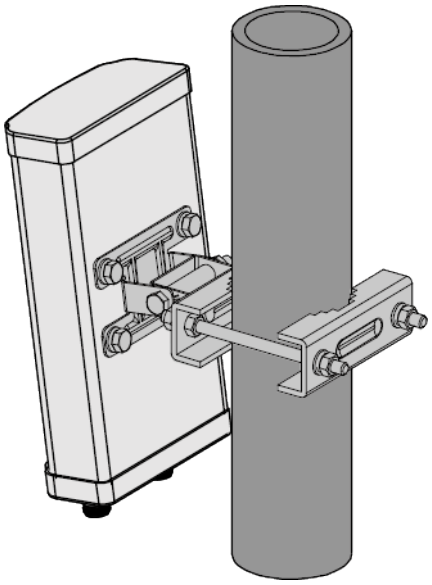
The 27013413 antenna can be mounted on a pole. The thickness of the pole should be no less than 2.5 mm. U-bolts are recommended for rail transportation scenarios and are applicable to poles with a diameter in the range of 34 mm to 70 mm. Hose clamps are recommended in common outdoor coverage scenarios and are applicable to poles with a diameter in the range of 34 mm to 114 mm.

⚠ CAUTION

- Keep antennas away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.
- Ensure that the drainage hole faces downwards, and do not install the antenna upside down.

1. Loosen the nuts. Secure the antenna to the pole with a torque of 8 N·m (M6). (The pole needs to be prepared by the customer.)

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2. Adjust the angle of the mounting support as required and tighten all screws with a reference torque of 8 N·m (M6).

Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to a lightning protection ground grid.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical to the ground during the installation.

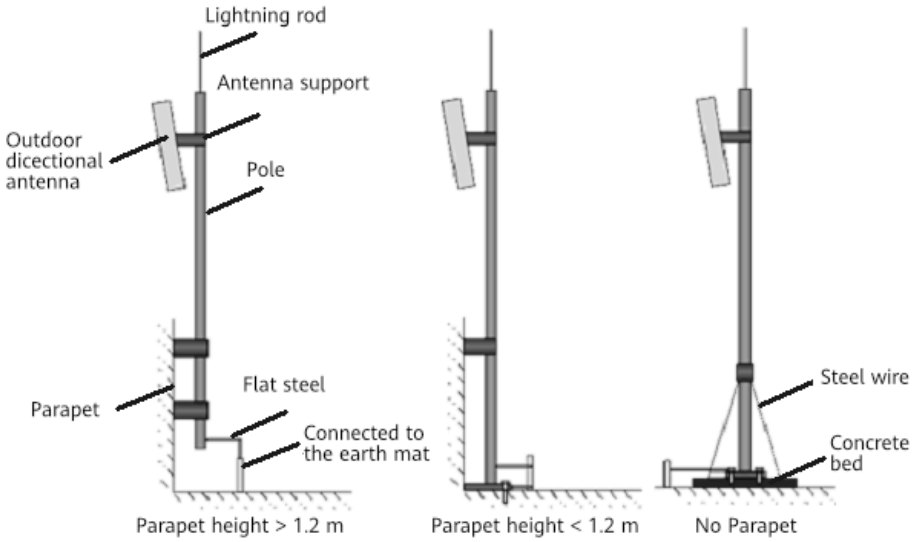
Pay attention to the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

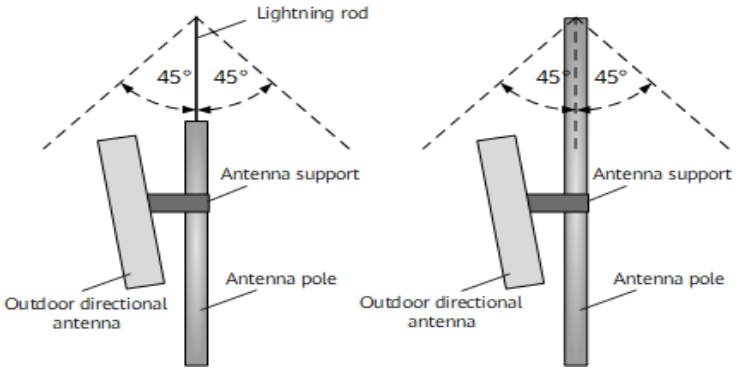
Figure 40-4 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 40-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

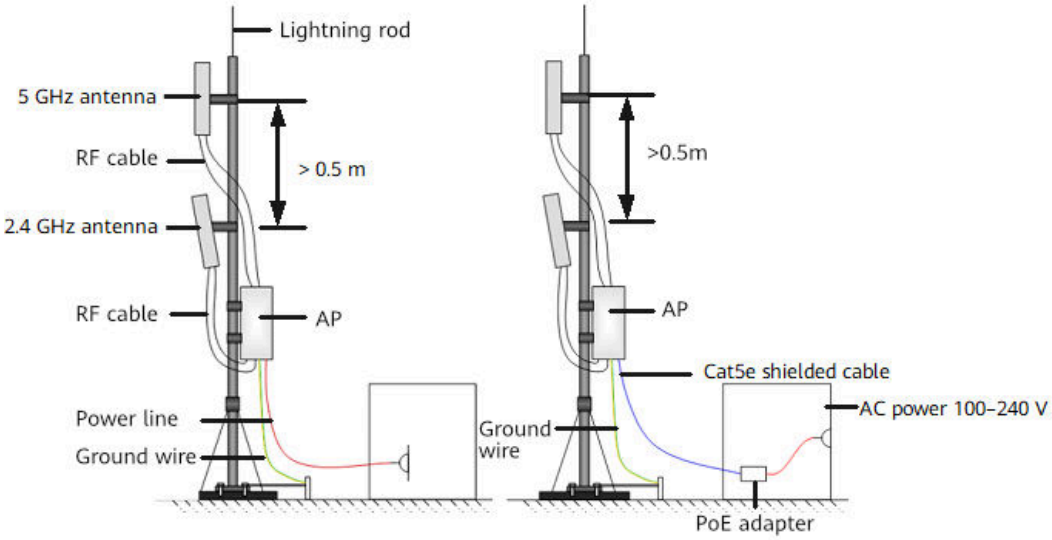
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 40-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

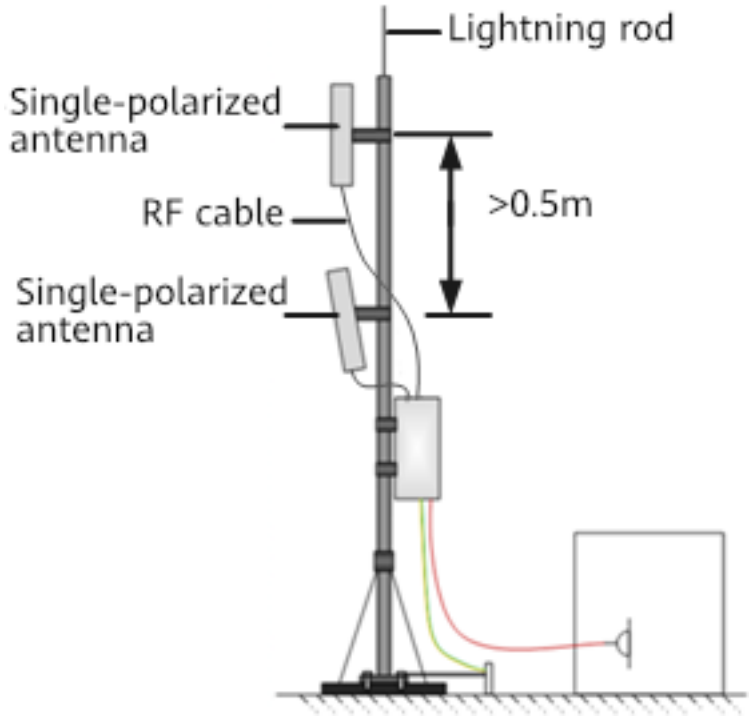
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Figure 40-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 40-6**.

Figure 40-6 Installing single-polarized antennas



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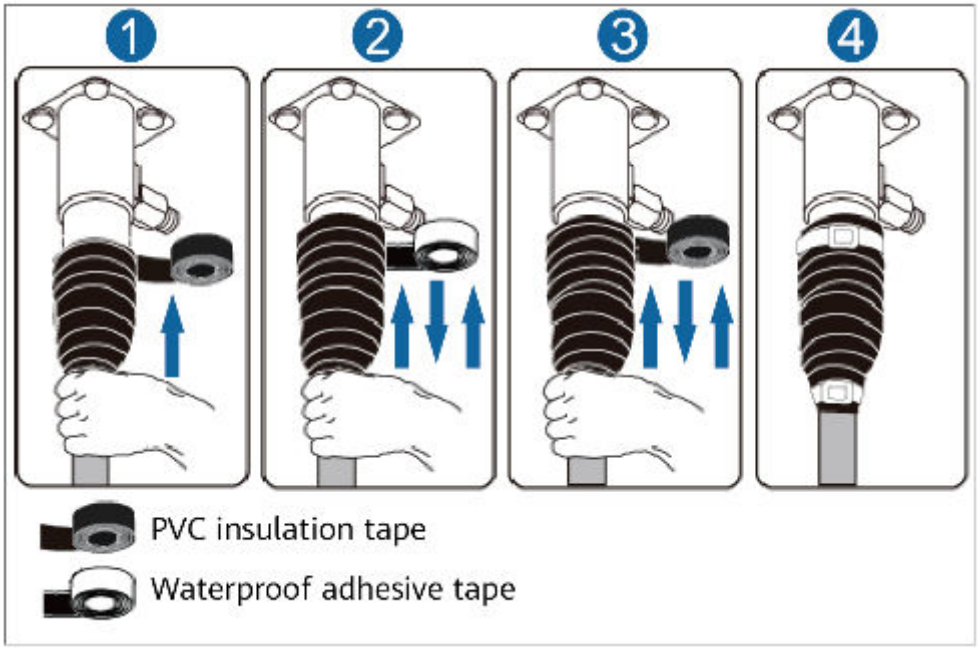
40.3.3 Connecting RF Cables

RF Cable Connection Requirements

The feeders of the same antenna must be connected to the 5 GHz RF ports on the same AP. The connection rules for antennas are the same as those for RF cables on the AP.

RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.



- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. RF ports of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the RF ports with a tightening torque of 0.8 N·m.

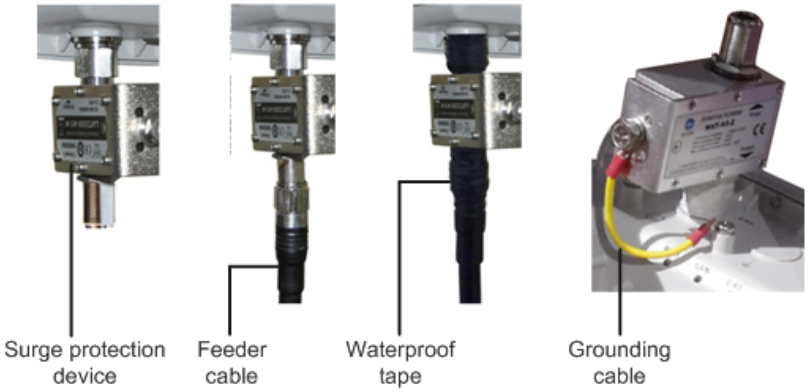
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NOTE

Outdoor APs support built-in surge protection on all RF ports, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

Table 40-3 Coaxial cables and connectors

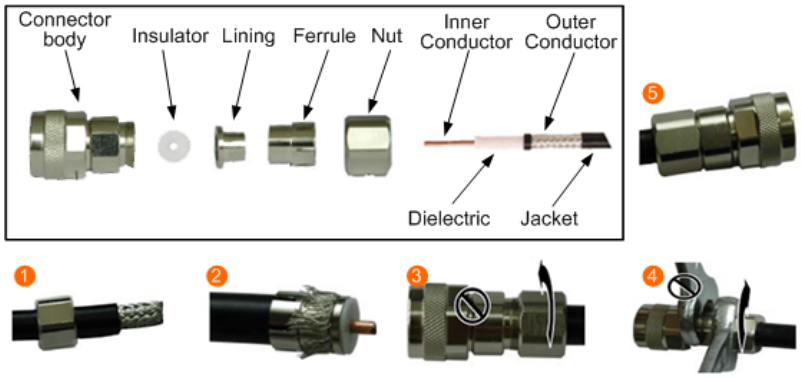
Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	

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Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

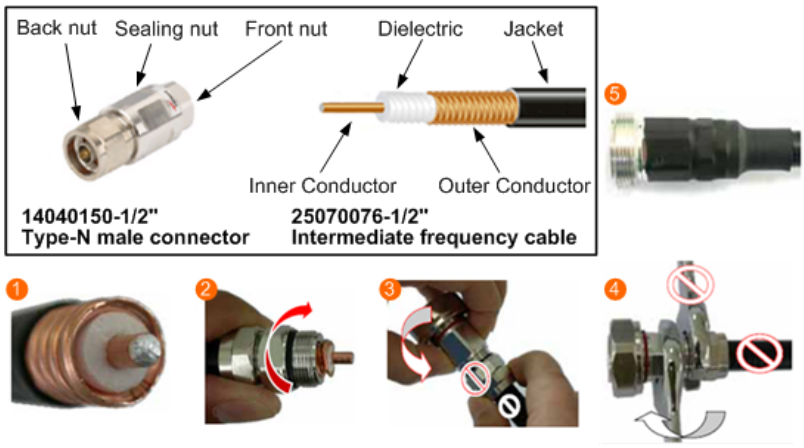
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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41 27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)

About This Chapter

41.1 27013571 Technical Specifications
41.2 27013571 Installation Precautions
41.3 27013571 Antenna Installation

41.1 27013571 Technical Specifications

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Appearance and Structure

Figure 41-1 Appearance of the 27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)



Technical Specifications

Table 41-1 Technical specifications of the 27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)

Item	Details
Part Number	27013571
Model	ANT2G18D2NS

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Item	Details
Description	Directional Antenna, 2400~2500MHz-18dBi-18deg/18deg,N/Female-2port,with mounting part,pole/wall mounting
Frequency [MHz]	2400 MHz to 2500 MHz
Antenna gain [dBi]	18 dBi
Coverage distance [m(ft.)]	260 m(ft.)
Horizontal beamwidth [degrees]	18 degrees
Vertical beamwidth [degrees]	18 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization,Horizontal polarization
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	H x W x D: 33 x 380 x 380
Weight without packaging [kg(lb)]	Antenna body: 2.2 kg (4.85 lb) Mounting bracket: 0.80 kg (1.76 lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ34 to ϕ114

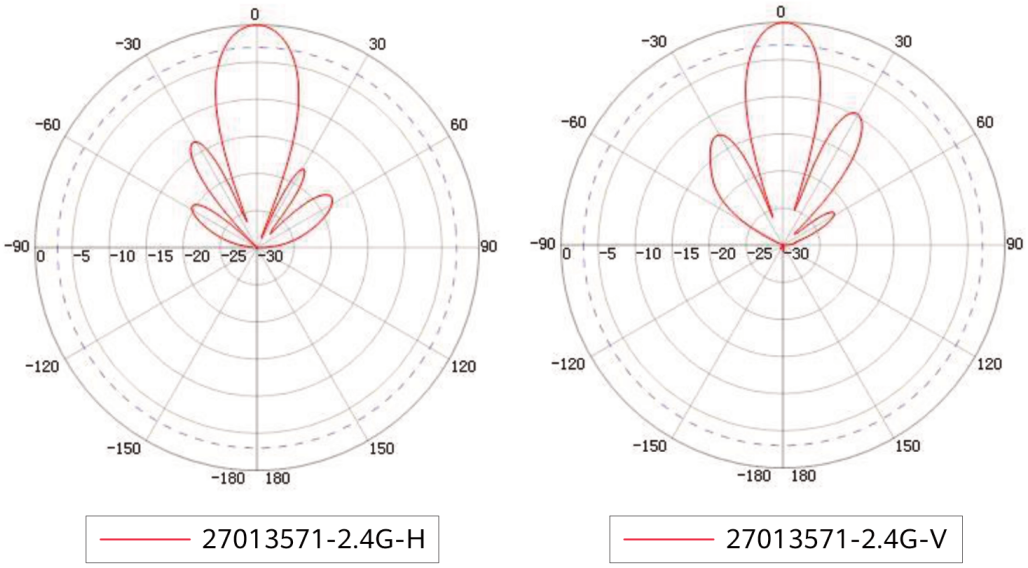
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Item	Details
Attenna note	The gains and lobe widths are typical values, and the actual values are within a range. For specifications, see the corresponding data sheet. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to Huawei planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 41-2 Antenna Pattern1 of the 27013571 Outdoor 2.4 GHz Dual-Polarized Directional Antenna (H18 V18 G18)



41.2 27013571 Installation Precautions

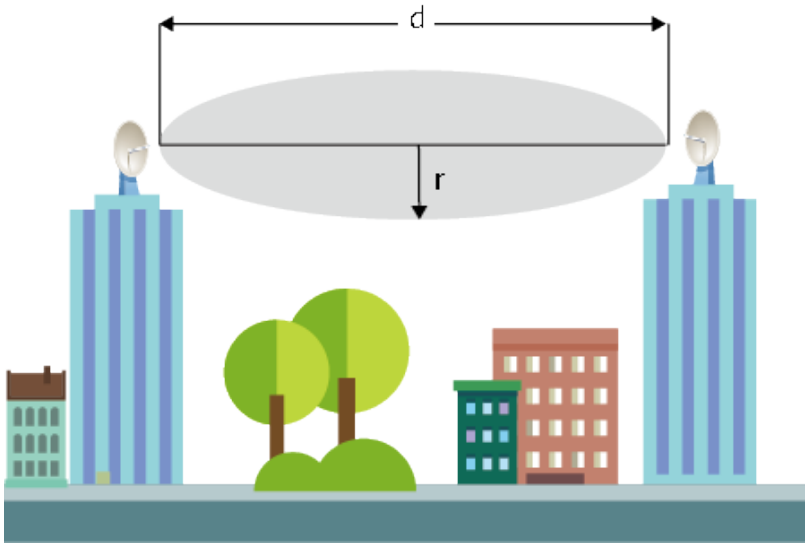
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 41-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 41-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 41-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

41.3 27013571 Antenna Installation

The 27013571 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high

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positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

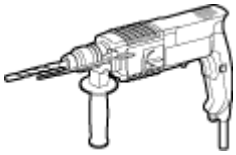
41.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Inclinometer



- Hammer drill (ϕ8 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- Pole with a diameter of ϕ34 mm to ϕ114 mm

Other accessories:

- Mounting flange x 2
- Fastener x 1
- U-bracket x 2
- M8x20 carriage bolt x 4
- M8 spring washer x 4
- M8 flat washer x 4
- M8 hexagon nut x 4
- M6 spring washer x 4
- M6 flash washer x 4
- M6 hexagon nut x 4
- Hose clamp x 2
- M6x80 expansion bolt x 4

41.3.2 Wall Mounting

The 27013571 antenna can be mounted on a wall.

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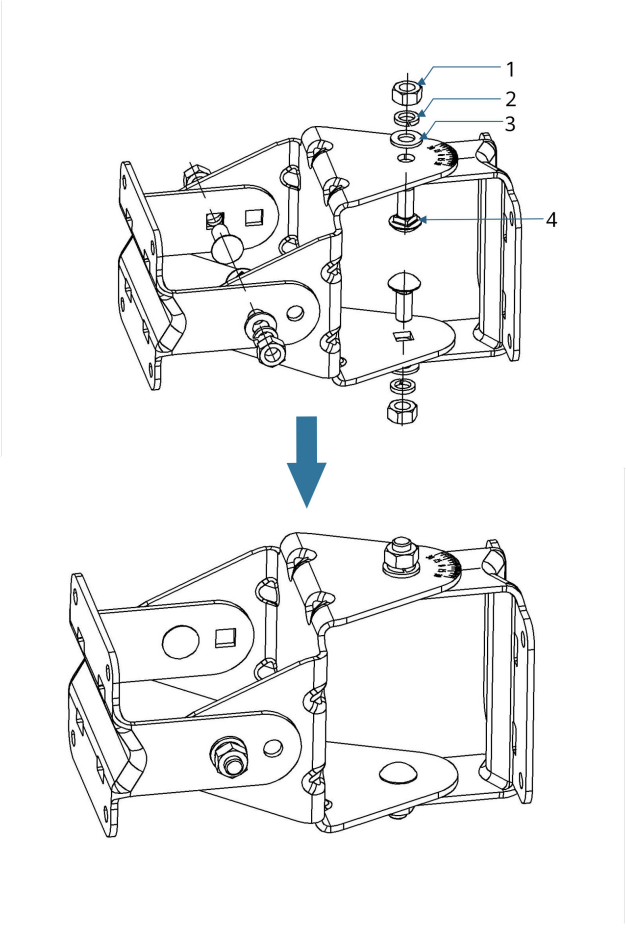
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the clamp components.

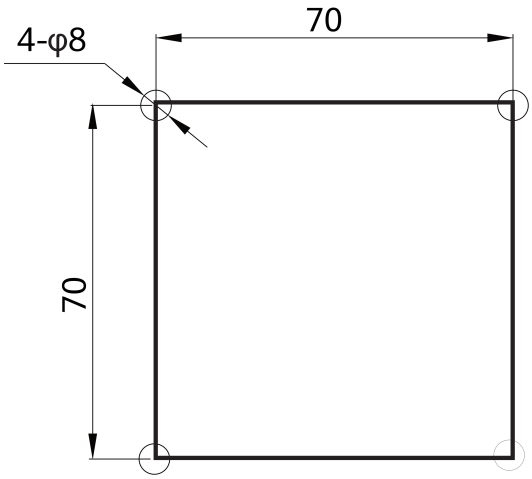
No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.



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2. Drill four ϕ8 mm holes (70 mm depth) on the wall to install plastic expansion sleeves that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.

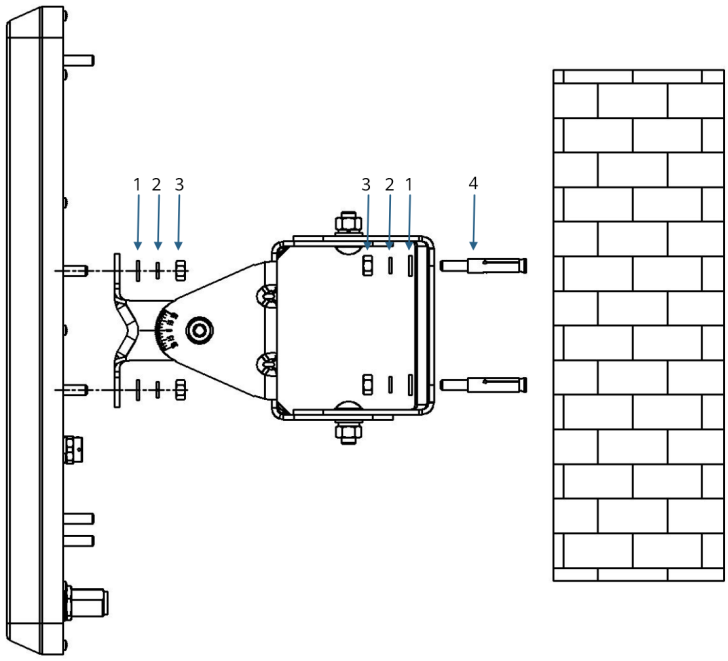


3. Install the antenna on the wall using the antenna mounting bracket.

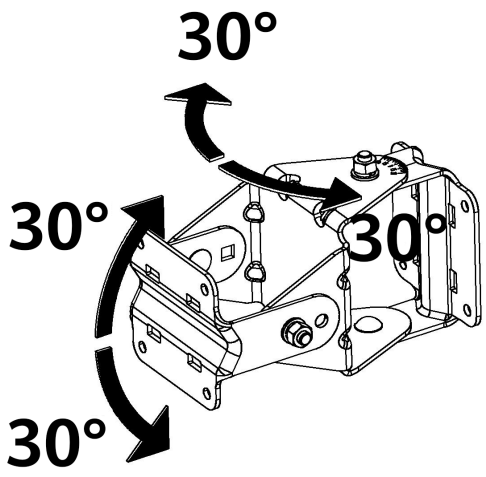
No.	Name
1	M6 flat washer
2	M6 spring washer
3	M6 hexagon nut
4	M6x80 expansion bolt

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.

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4. Adjust the angle of the antenna mounting bracket.



41.3.3 Pole Mounting

The 27013571 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

CAUTION

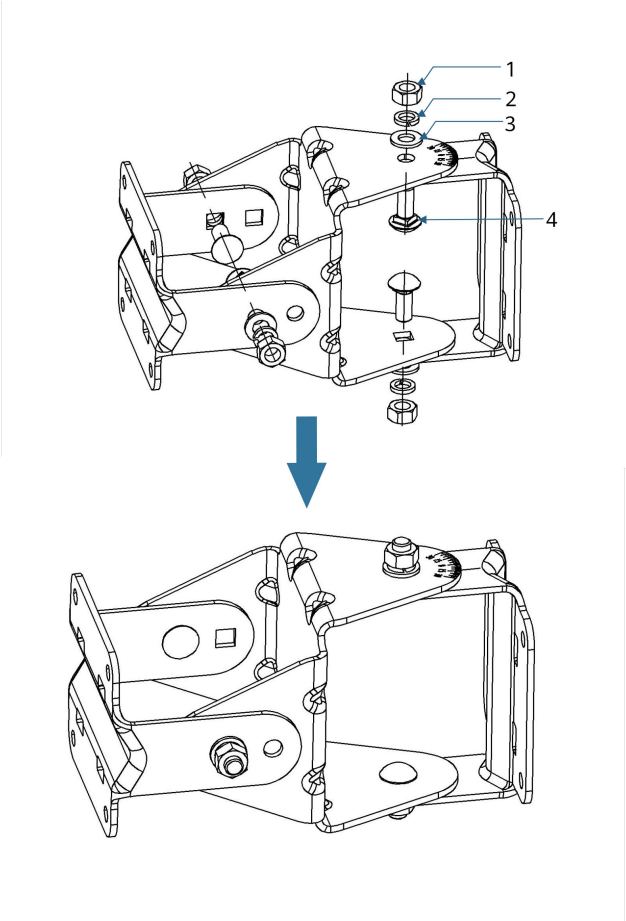
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

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1. Install the clamp components.

No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.



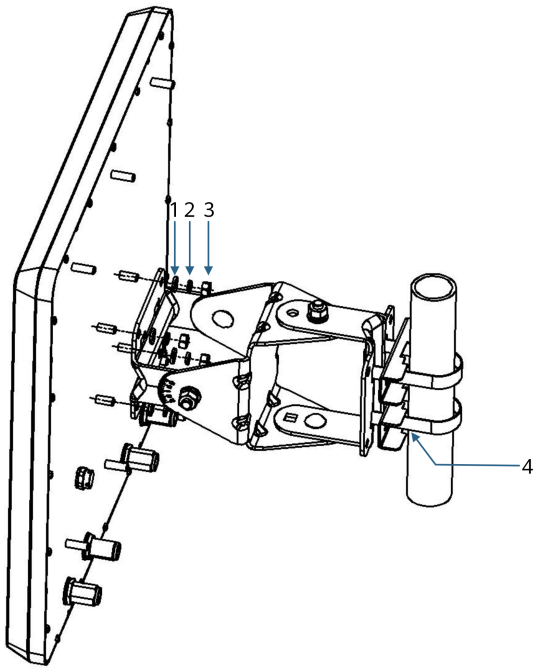
2. Install the antenna on the pole using the antenna mounting bracket. (with a diameter of ϕ34 mm to ϕ114 mm, prepared by customers)

No.	Name
1	M6 flat washer

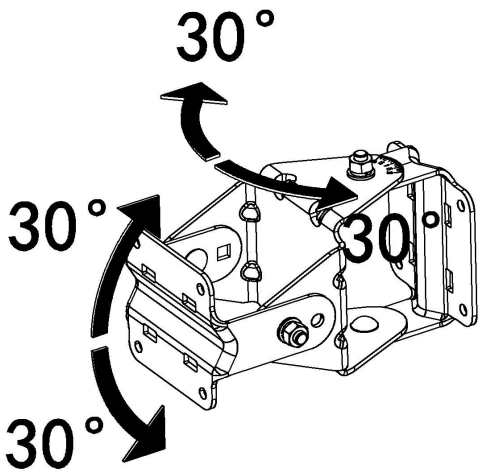
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2	M6 spring washer
3	M6 hexagon nut
4	U-bracket and hose clamp

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.



3. Adjust the angle of the antenna mounting bracket.



Installing the Pole and Lightning Rod

Carry out the following steps:

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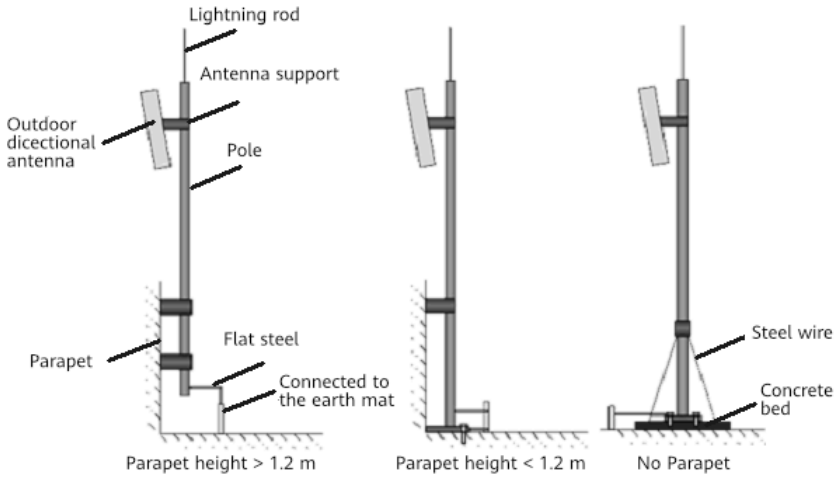
1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

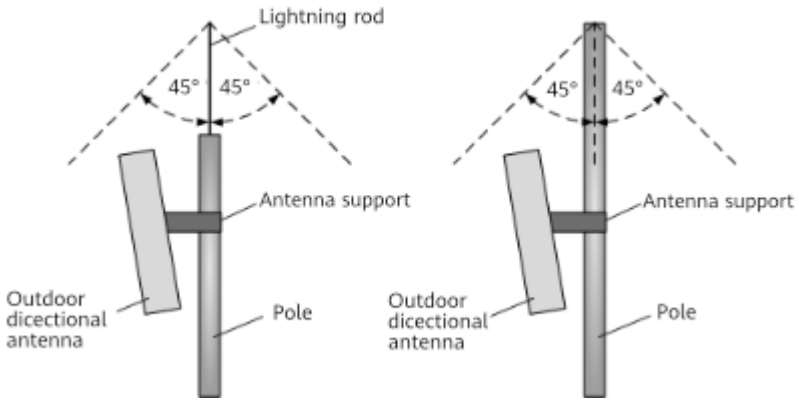
Figure 41-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 41-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.

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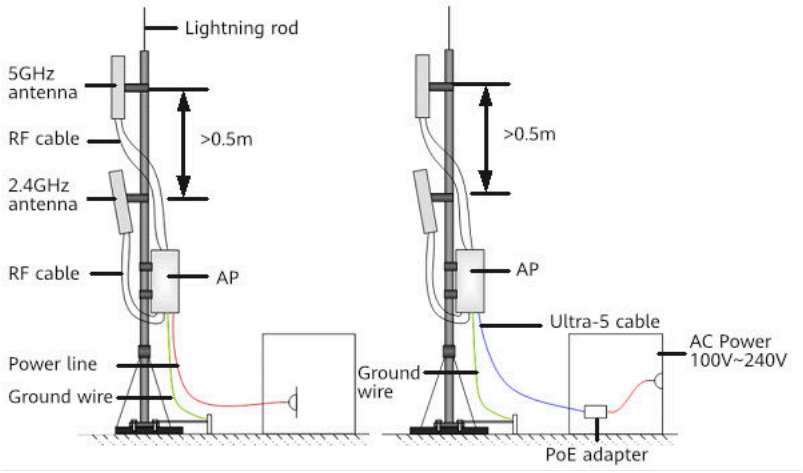
NOTE

If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 41-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

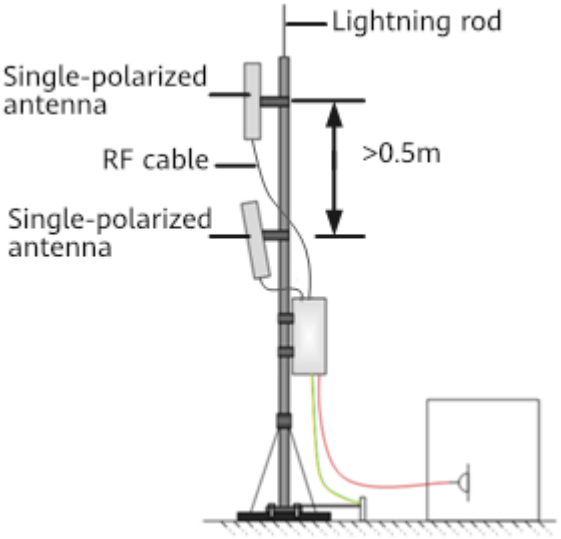
Figure 41-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in Figure 41-6.

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Figure 41-6 Installation of single-polarized antennas



41.3.4 Connecting RF Cables

RF Cable Connection Requirements

- The feeder cables on an antenna must be connected to the AP's RF ports on the corresponding bands. There is no mandatory requirement for the connection mapping between the two ends.
- For the AirEngine 8760R-X1E, the feeder cables on an antenna can be connected only to the RF ports on the same side of the AP but not to RF ports on both sides of the AP.

RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

1. RF ports of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the

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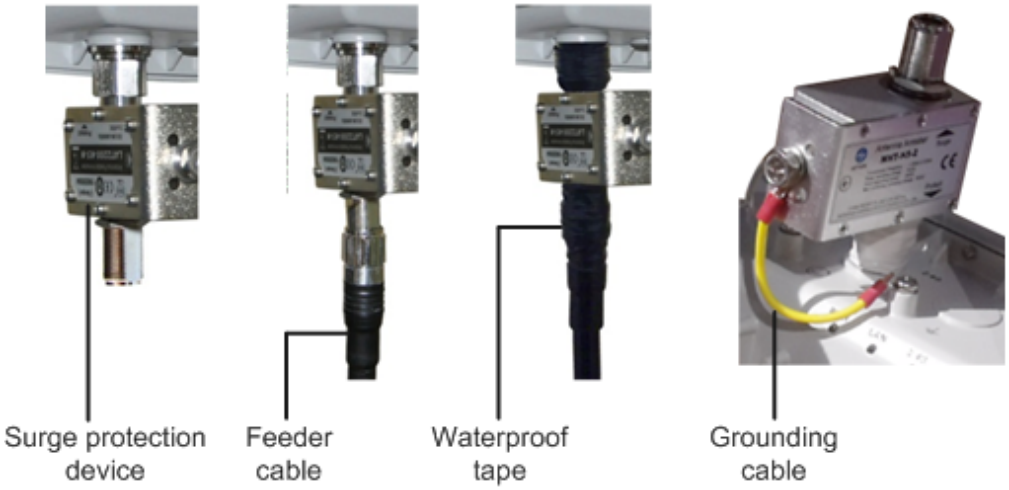
RF cables are directly connected to the RF ports with a tightening torque of 0.8 N·m.



NOTE

Outdoor APs support built-in surge protection on all RF ports, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

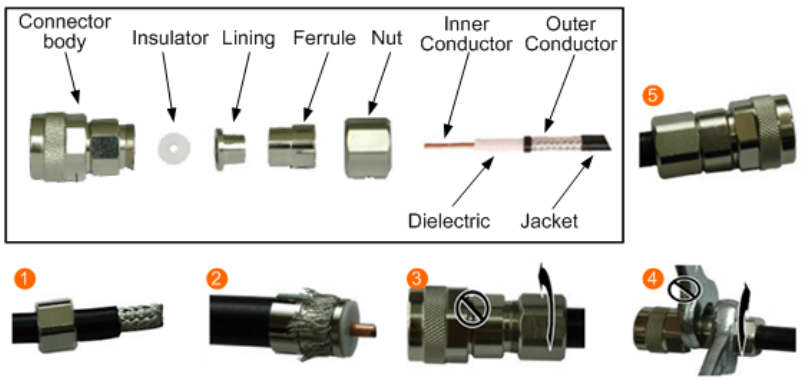
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Table 41-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

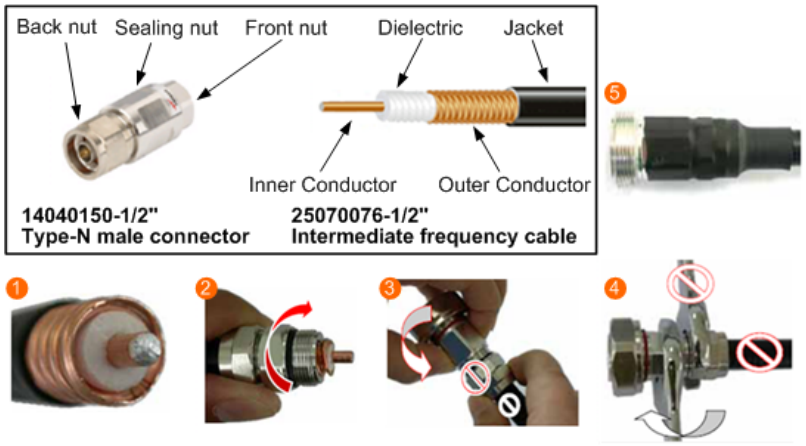
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

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1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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42 27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)

About This Chapter

42.1 27013718 Technical Specifications
42.2 27013718 Installation Precautions
42.3 27013718 Antenna Installation

42.1 27013718 Technical Specifications

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Appearance and Structure

Figure 42-1 Appearance of the 27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)



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Technical Specifications

Table 42-1 Technical specifications of the 27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)

Item	Details
Part Number	27013718
Model	ANTDG1316D4NR
Description	Directional Antenna,N-female,with bracket,13dBi@2.4GHz&16dBi@5GHz
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 13 5G: 16
Coverage distance [m(ft.)]	2.4G: 160 5G: 170
Horizontal beamwidth [degrees]	2.4G:33 5G:18
Vertical beamwidth [degrees]	2.4G:33 5G:18
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization,Horizontal polarization
Attenna connector	N-female x 4
Attenna dimensions [mm(in.)]	H x W x D: 33 x 380 x 380
Weight without packaging [kg(lb)]	2.18 kg(lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ34 to ϕ114

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 42-2 Antenna Pattern1 of the 27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)

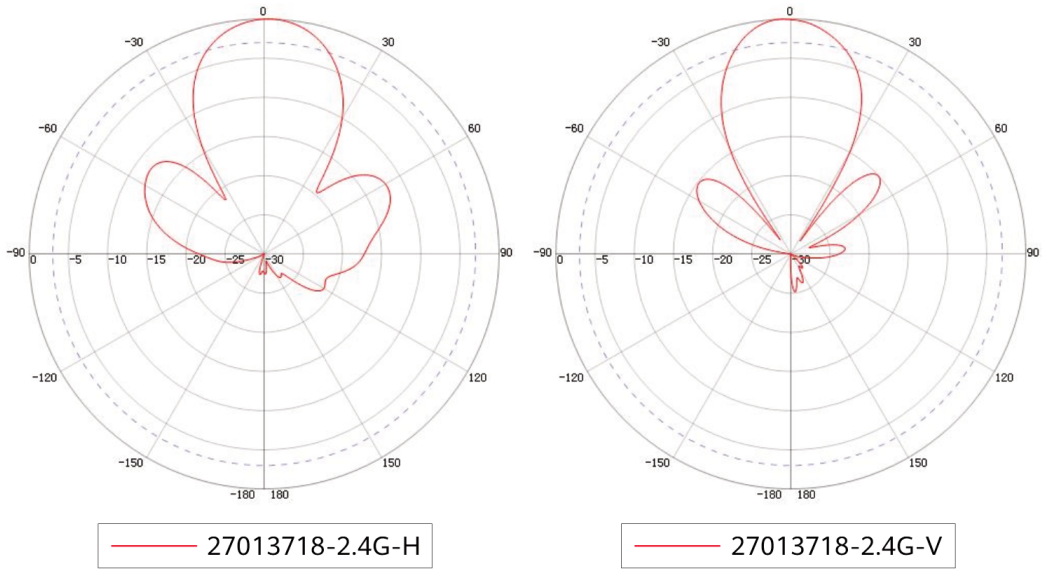
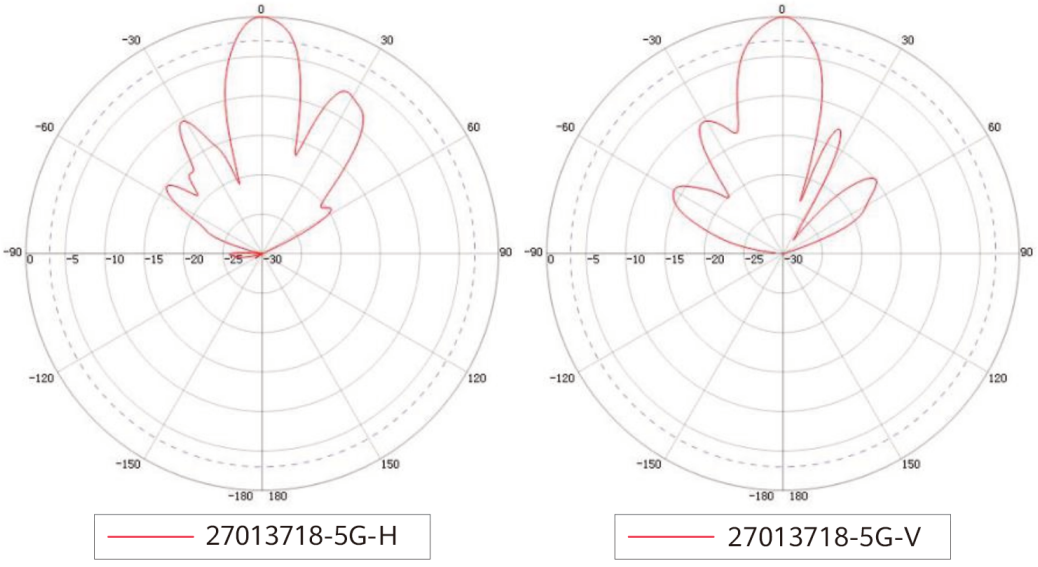


Figure 42-3 Antenna Pattern2 of the 27013718 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H18 V18 G16)



42.2 27013718 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

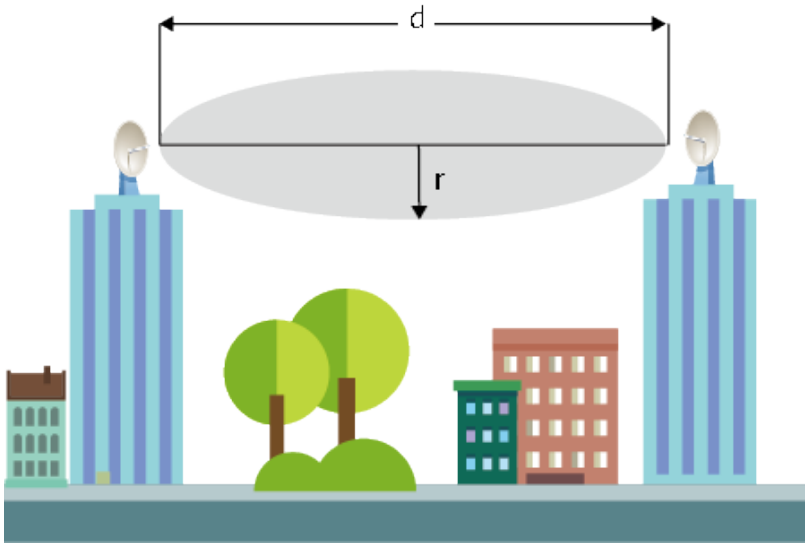
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.

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- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 42-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 42-2** lists the radius of the first Fresnel zone in different backhaul distances.

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Table 42-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

42.3 27013718 Antenna Installation

The 27013718 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

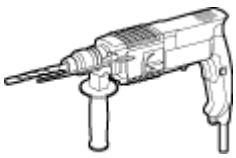
42.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Inclinometer



- Hammer drill (ϕ8 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- Pole with a diameter of ϕ34 mm to ϕ114 mm

Other accessories:

- Mounting flange x 2
- Fastener x 1

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- U-bracket x 2
- M8x20 carriage bolt x 4
- M8 spring washer x 4
- M8 flat washer x 4
- M8 hexagon nut x 4
- M6 spring washer x 4
- M6 flash washer x 4
- M6 hexagon nut x 4
- Hose clamp x 2
- M6x80 expansion bolt x 4

42.3.2 Wall Mounting

The 27013718 antenna can be mounted on a wall.

CAUTION

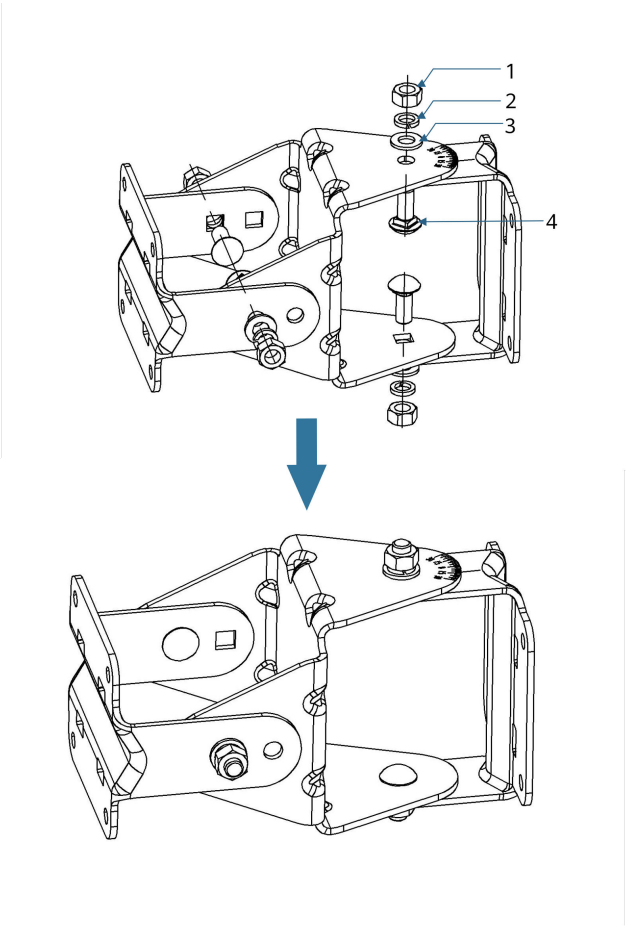
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the clamp components.

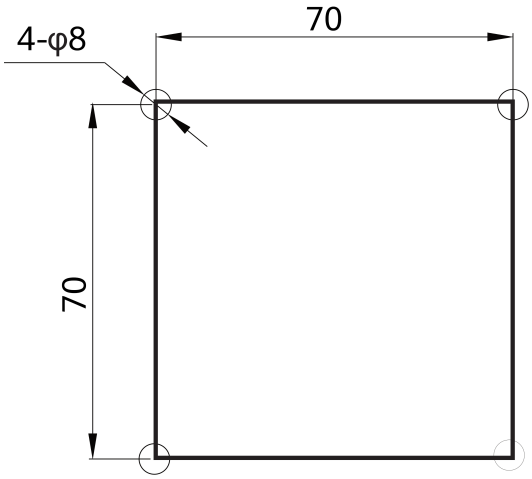
No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.

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2. Drill four ϕ8 mm holes (70 mm depth) on the wall to install plastic expansion sleeves that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.



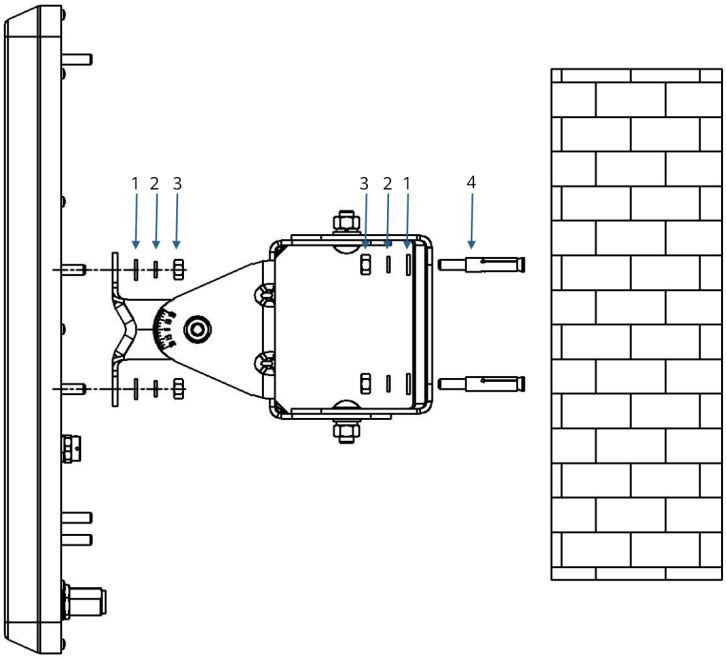
3. Install the antenna on the wall using the antenna mounting bracket.

No.	Name
1	M6 flat washer

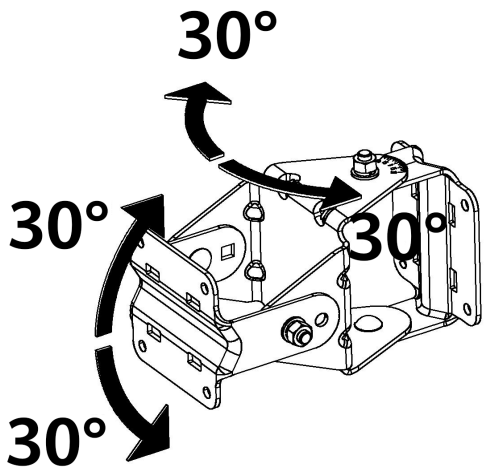
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2	M6 spring washer
3	M6 hexagon nut
4	M6x80 expansion bolt

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.



4. Adjust the angle of the antenna mounting bracket.



42.3.3 Pole Mounting

The 27013718 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

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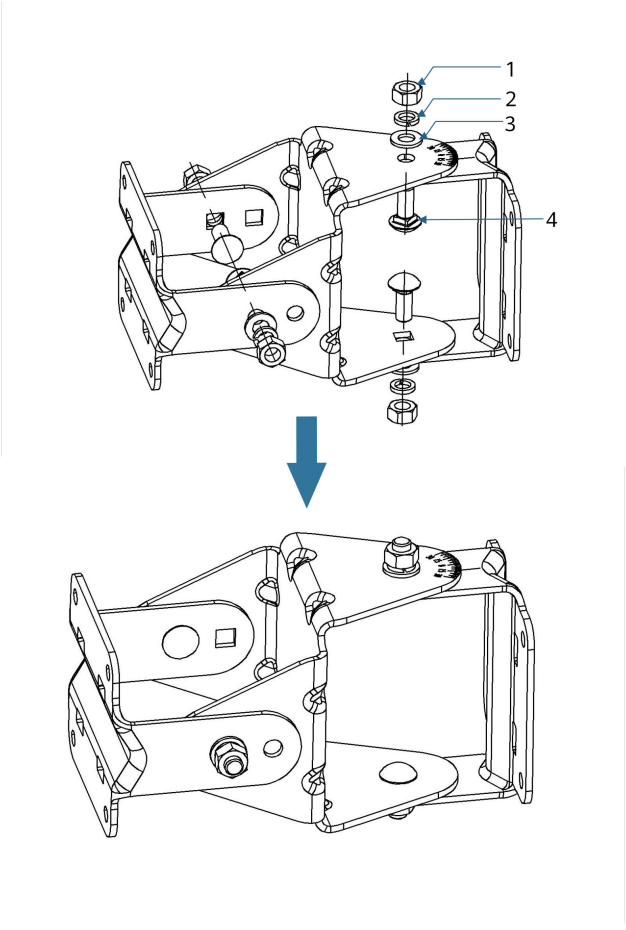
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the clamp components.

No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.

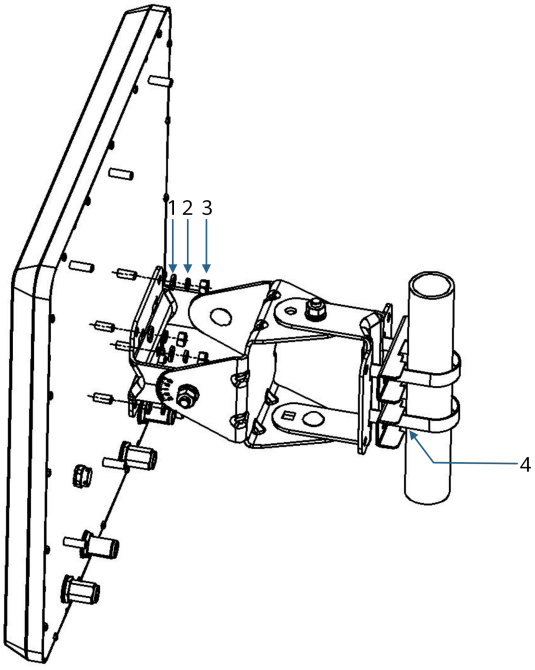


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2. Install the antenna on the pole using the antenna mounting bracket. (with a diameter of ϕ34 mm to ϕ114 mm, prepared by customers)

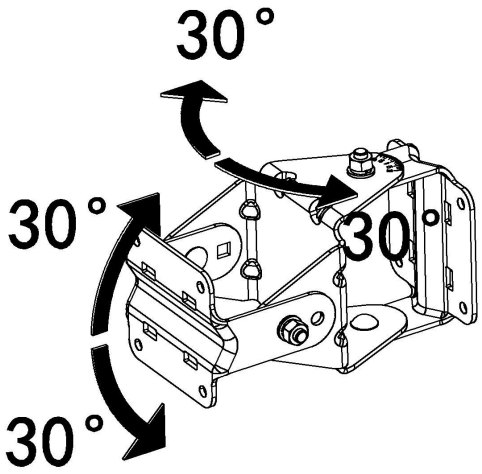
No.	Name
1	M6 flat washer
2	M6 spring washer
3	M6 hexagon nut
4	U-bracket and hose clamp

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.



3. Adjust the angle of the antenna mounting bracket.

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Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

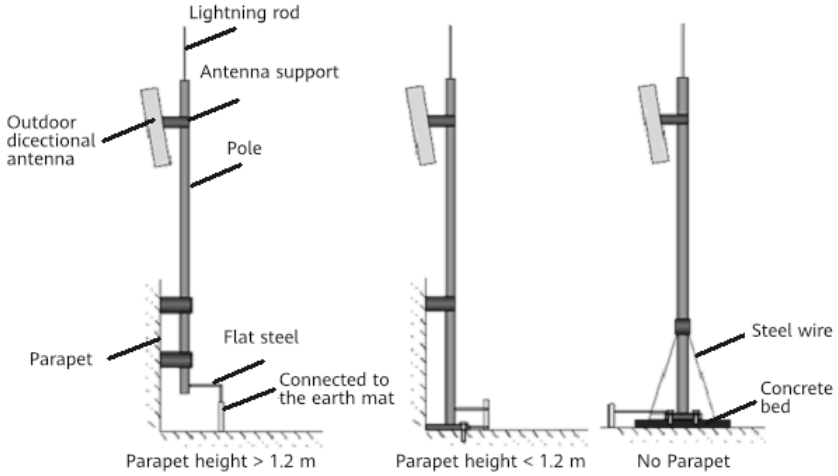
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

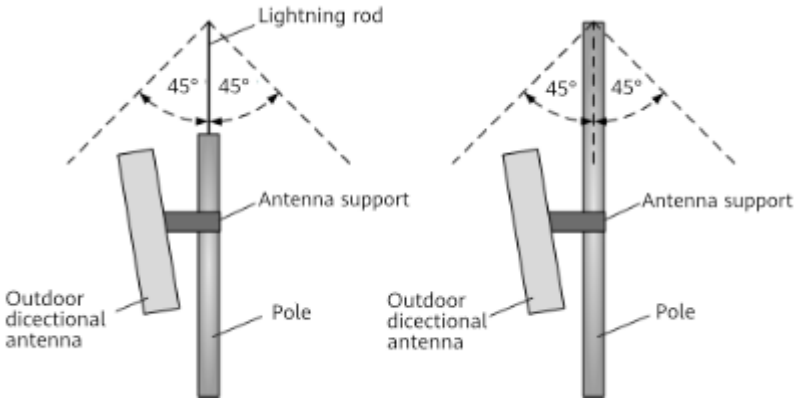
Figure 42-5 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 42-5 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

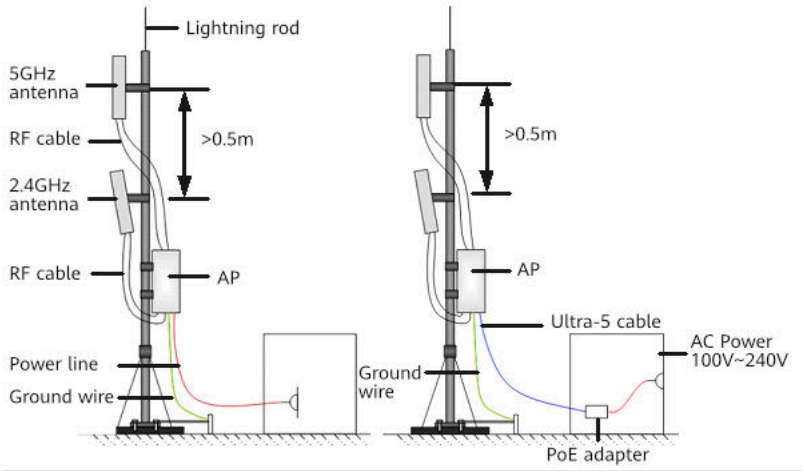
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 42-6 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

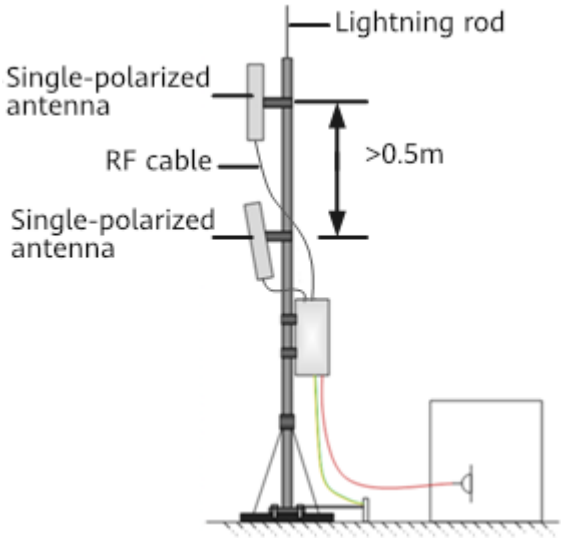
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Figure 42-6 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 42-7**.

Figure 42-7 Installation of single-polarized antennas



42.3.4 Connecting RF Cables

RF Cable Connection Requirements

- The feeder cables on an antenna must be connected to the AP's RF ports on the corresponding bands. There is no mandatory requirement for the connection mapping between the two ends.
- For the AirEngine 8760R-X1E, the feeder cables on an antenna can be connected only to the RF ports on the same side of the AP but not to RF ports on both sides of the AP.

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RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

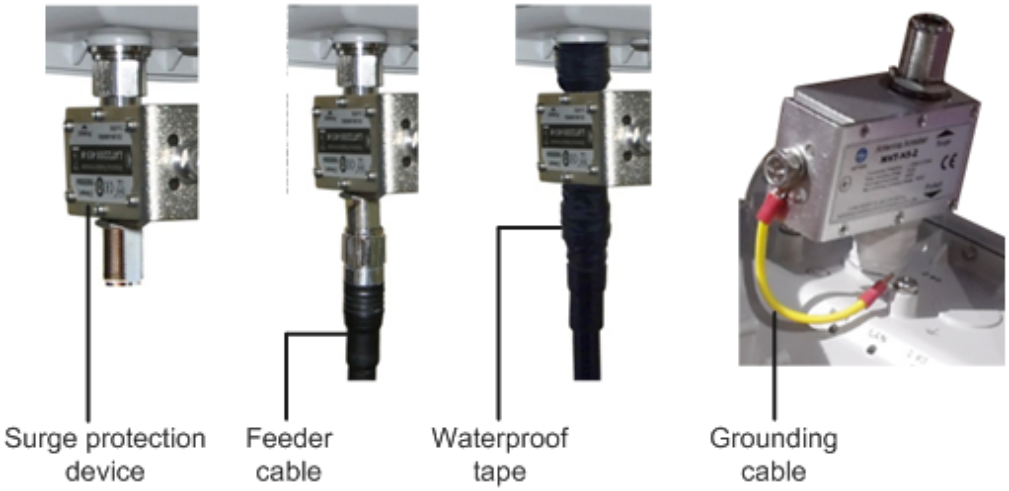
1. RF ports of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the RF ports with a tightening torque of 0.8 N·m.



NOTE

Outdoor APs support built-in surge protection on all RF ports, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



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Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

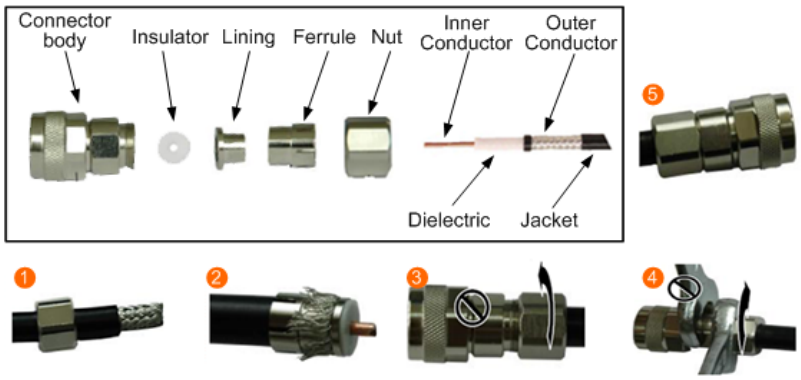
Table 42-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

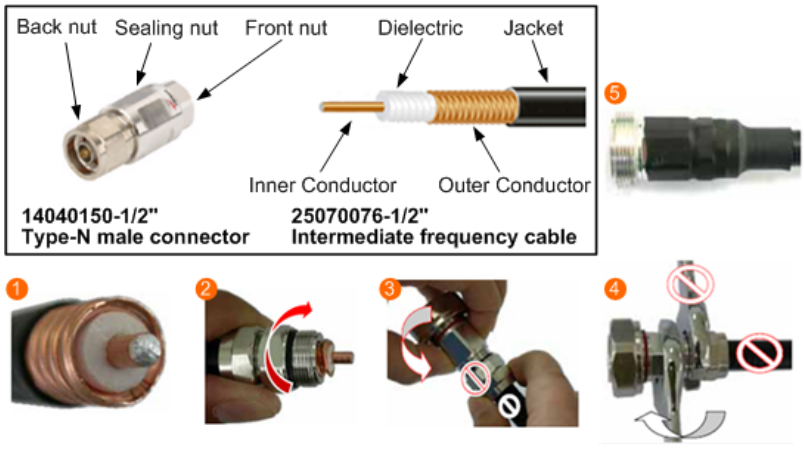
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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43 27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)

About This Chapter

43.1 27013719 Technical Specifications
43.2 27013719 Installation Precautions
43.3 27013719 Antenna Installation

43.1 27013719 Technical Specifications

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Appearance and Structure

Figure 43-1 Appearance of the 27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)



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Technical Specifications

Table 43-1 Technical specifications of the 27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)

Item	Details
Part Number	27013719
Model	ANTDG1313D4NR
Description	Directional Antenna,N-female,with bracket,13dBi@2.4GHz&13dBi@5GHz
Frequency [MHz]	2.4G: 2400-2500 5G: 5150-5850
Antenna gain [dBi]	13 dBi
Coverage distance [m(ft.)]	2.4 GHz: 160 m (525 ft.) 5 GHz: 130 m (427 ft.)
Horizontal beamwidth [degrees]	2.4 GHz: 33 5 GHz: 30
Vertical beamwidth [degrees]	2.4 GHz: 33 5 GHz: 30
Standing wave ratio (SWR)	≤ 2
Polarization	2.4 GHz: vertical polarization and horizontal polarization 5 GHz: ±45° polarization
Attenna connector	N-female x 4
Attenna dimensions [mm(in.)]	33 mm x 380 mm x 380 mm (1.30 in. x 14.96 in. x 14.96 in.)
Weight without packaging [kg(lb)]	Antenna body: 2.15 kg (4.74 lb) Mounting bracket: 0.80 kg (1.76 lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ34 to ϕ114

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Item	Details
Attenna note	The gains and lobe widths are typical values, and the actual values are within a range. For specifications, see the corresponding data sheet. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to Huawei planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 43-2 Antenna Pattern1 of the 27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)

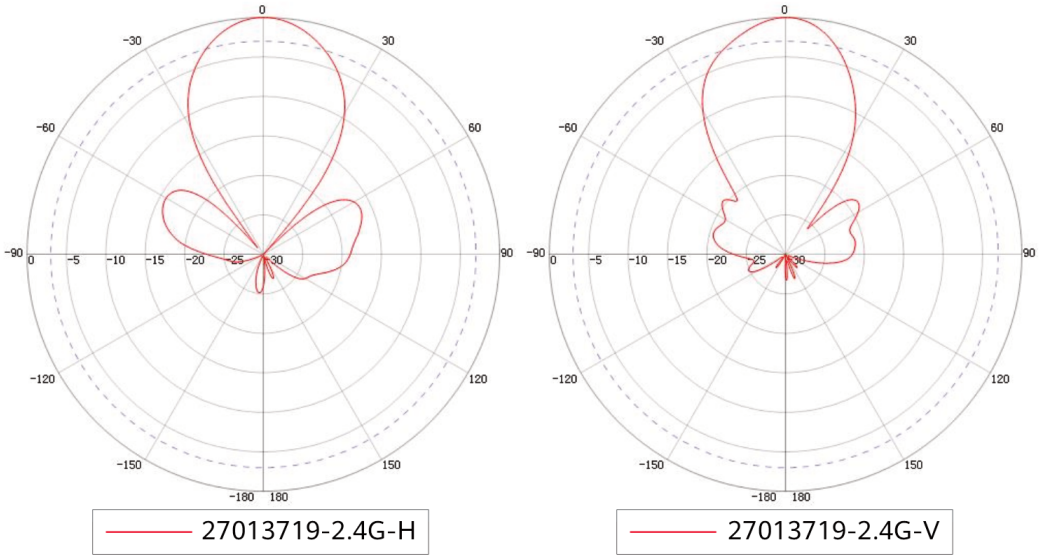
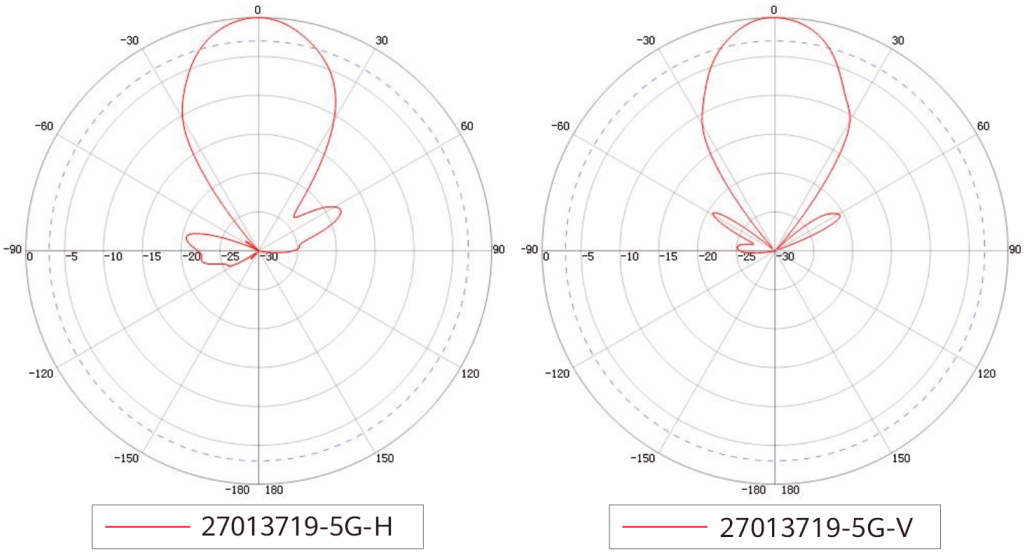


Figure 43-3 Antenna Pattern2 of the 27013719 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H33 V33 G13 & H30 V30 G13)



43.2 27013719 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

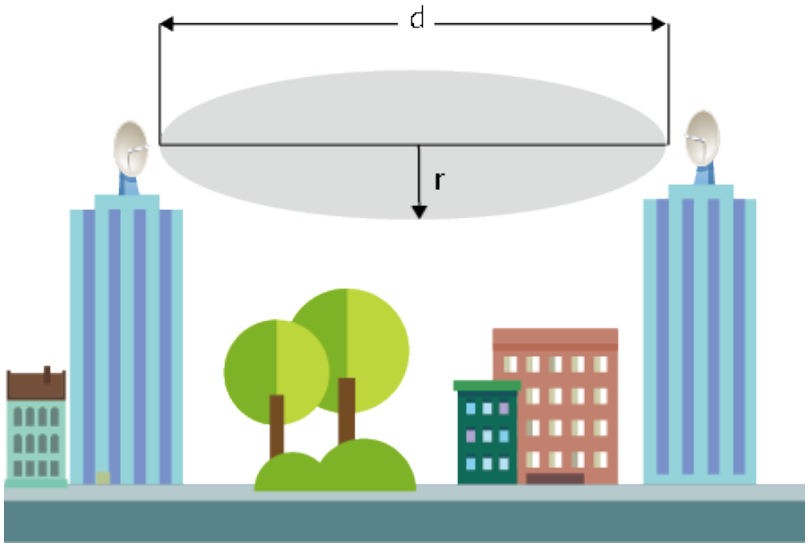
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.

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- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 43-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 43-2** lists the radius of the first Fresnel zone in different backhaul distances.

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Table 43-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

43.3 27013719 Antenna Installation

The 27013719 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

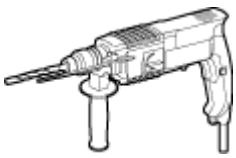
43.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Inclinometer



- Hammer drill (ϕ8 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- Pole with a diameter of ϕ34 mm to ϕ114 mm

Other accessories:

- Mounting flange x 2
- Fastener x 1

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- U-bracket x 2
- M8x20 carriage bolt x 4
- M8 spring washer x 4
- M8 flat washer x 4
- M8 hexagon nut x 4
- M6 spring washer x 4
- M6 flash washer x 4
- M6 hexagon nut x 4
- Hose clamp x 2
- M6x80 expansion bolt x 4

43.3.2 Wall Mounting

The 27013719 antenna can be mounted on a wall.

CAUTION

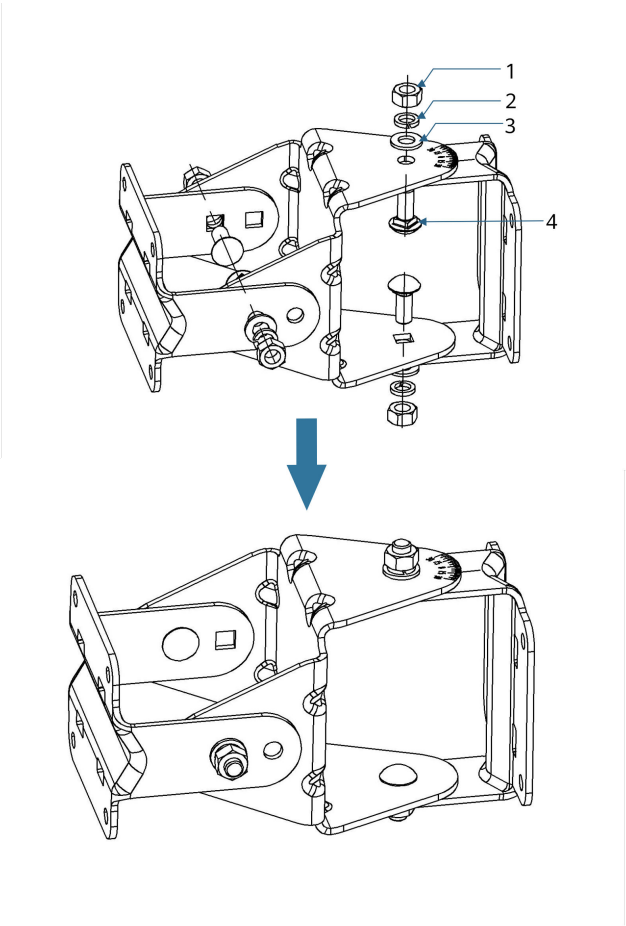
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the clamp components.

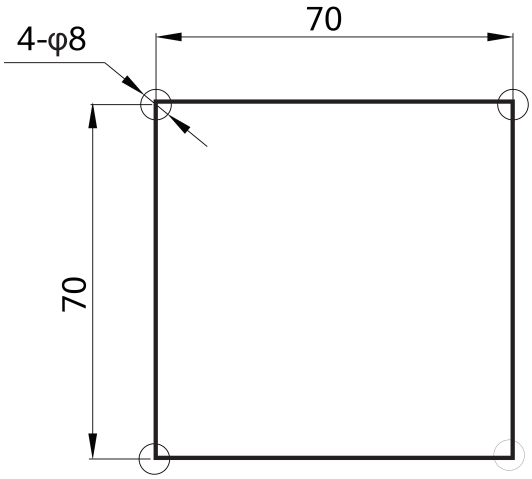
No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.

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2. Drill four ϕ8 mm holes (70 mm depth) on the wall to install plastic expansion sleeves that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.



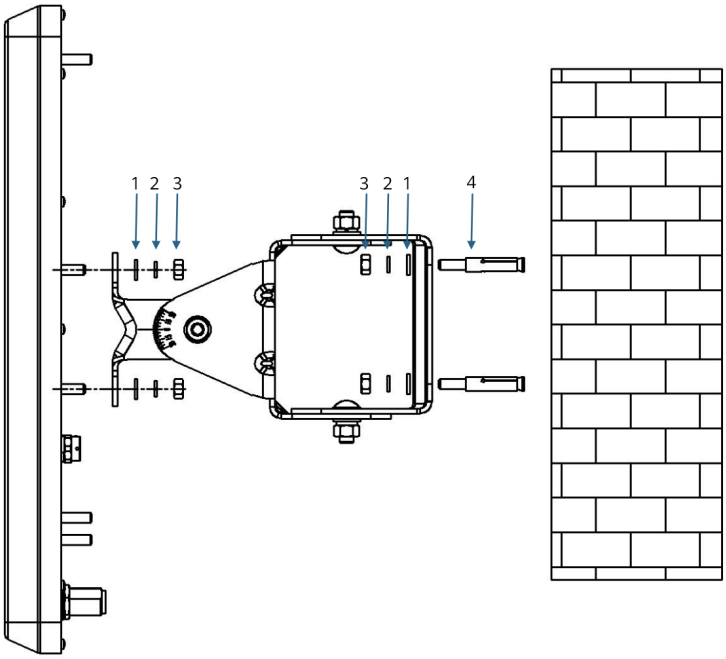
3. Install the antenna on the wall using the antenna mounting bracket.

No.	Name
1	M6 flat washer

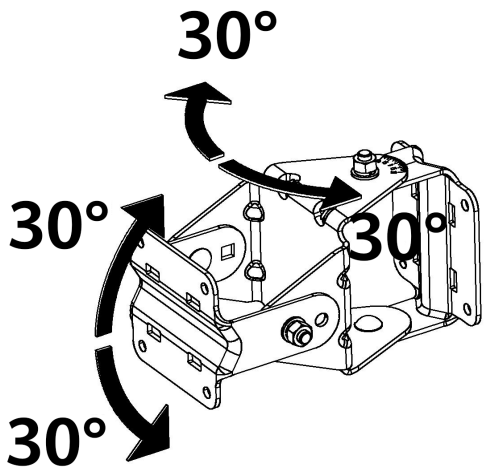
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2	M6 spring washer
3	M6 hexagon nut
4	M6x80 expansion bolt

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.



4. Adjust the angle of the antenna mounting bracket.



43.3.3 Pole Mounting

The 27013719 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

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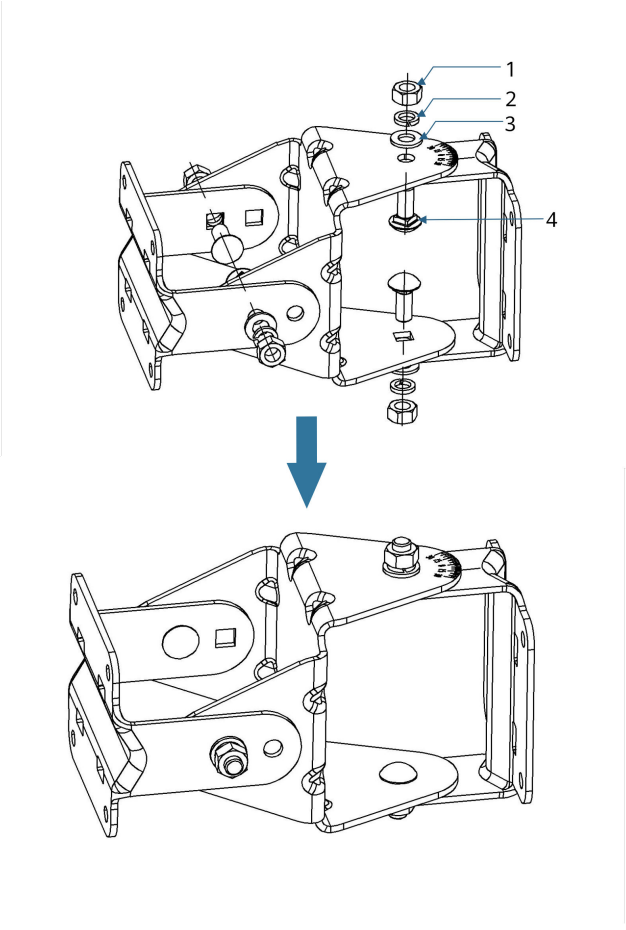
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the clamp components.

No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.

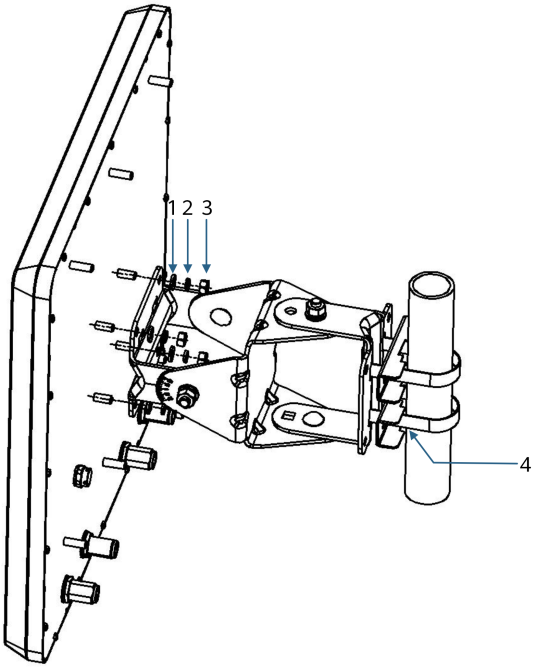


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2. Install the antenna on the pole using the antenna mounting bracket. (with a diameter of ϕ34 mm to ϕ114 mm, prepared by customers)

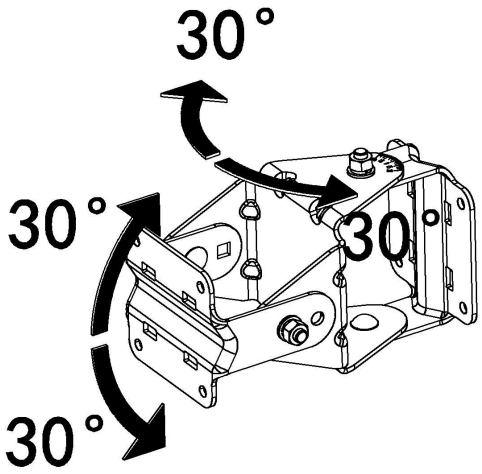
No.	Name
1	M6 flat washer
2	M6 spring washer
3	M6 hexagon nut
4	U-bracket and hose clamp

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.



3. Adjust the angle of the antenna mounting bracket.

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Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

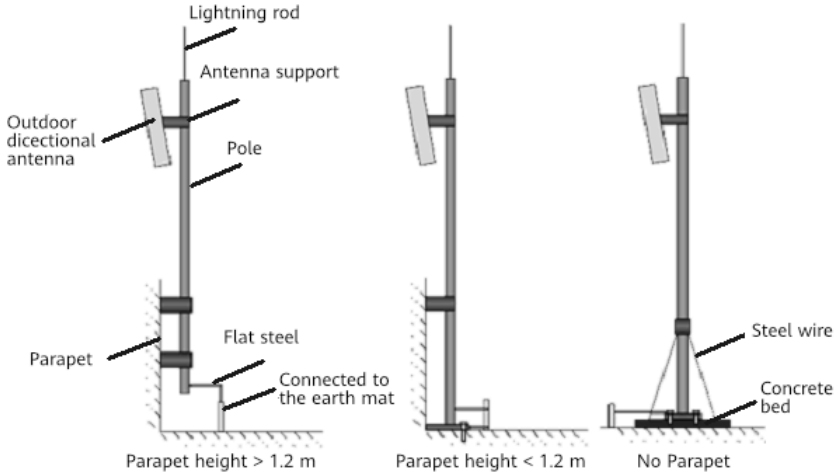
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

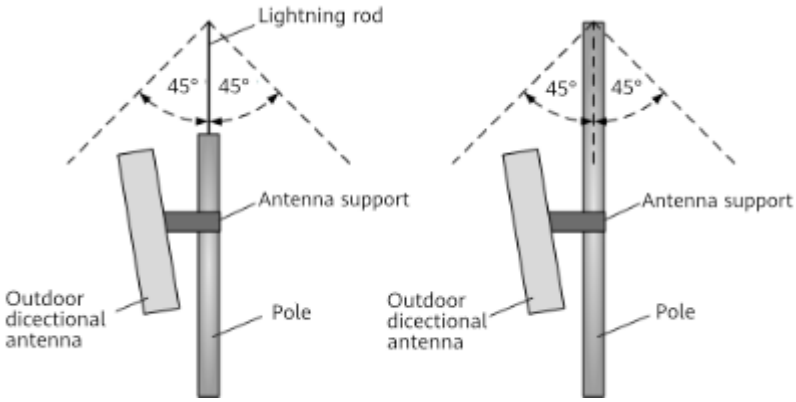
Figure 43-5 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 43-5 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

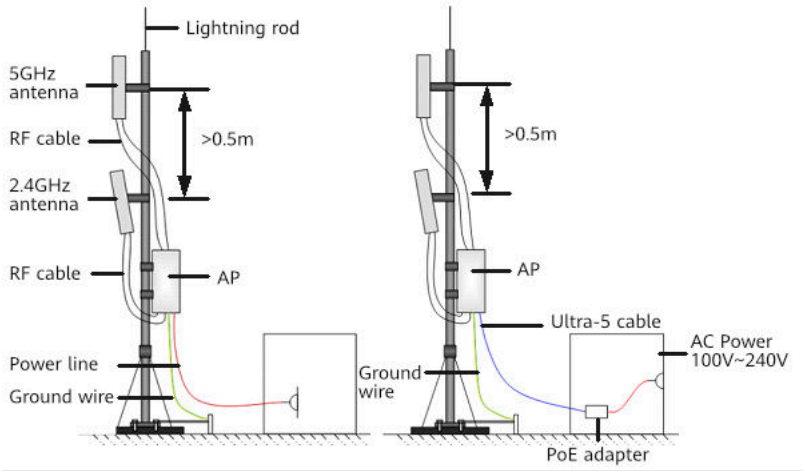
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 43-6 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

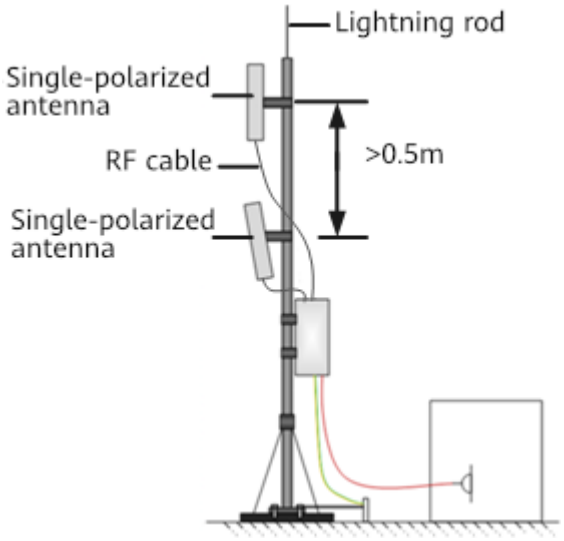
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Figure 43-6 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 43-7**.

Figure 43-7 Installation of single-polarized antennas



43.3.4 Connecting RF Cables

RF Cable Connection Requirements

- The feeder cables on an antenna must be connected to the AP's RF ports on the corresponding bands. There is no mandatory requirement for the connection mapping between the two ends.
- For the AirEngine 8760R-X1E, the feeder cables on an antenna can be connected only to the RF ports on the same side of the AP but not to RF ports on both sides of the AP.

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RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

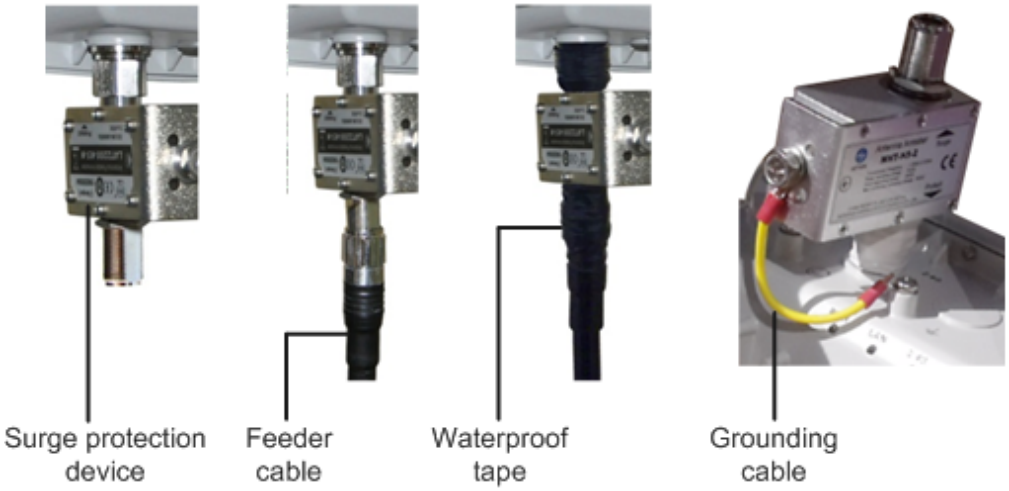
1. RF ports of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the RF ports with a tightening torque of 0.8 N·m.



NOTE

Outdoor APs support built-in surge protection on all RF ports, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



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Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

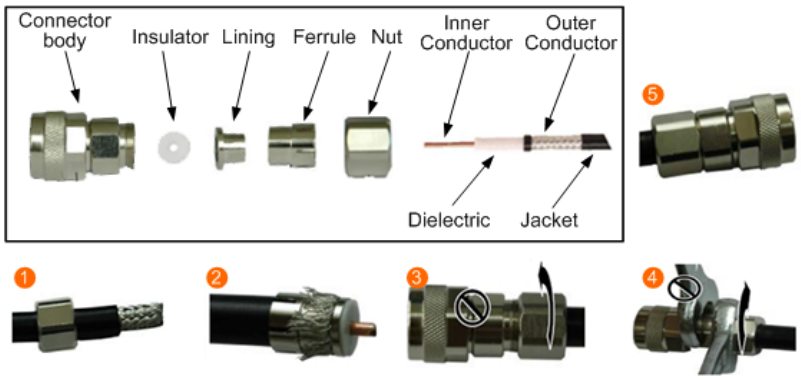
Table 43-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

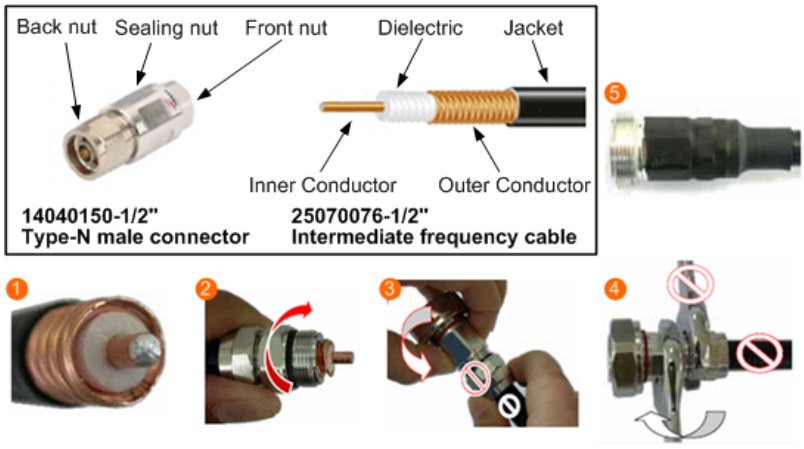
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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44 27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)

About This Chapter

44.1 27013720 Technical Specifications
44.2 27013720 Installation Precautions
44.3 27013720 Antenna Installation

44.1 27013720 Technical Specifications

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Appearance and Structure

Figure 44-1 Appearance of the 27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)



Technical Specifications

Table 44-1 Technical specifications of the 27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)

Item	Details
Part Number	27013720

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Item	Details
Model	ANTDG0808D4NR
Description	Directional Antenna,N-female,with bracket,8dBi@2.4GHz&8dBi@5GHz
Frequency [MHz]	2.4G: 2400-2500 5G: 5150-5850
Antenna gain [dBi]	8 dBi
Coverage distance [m(ft.)]	2.4 GHz: 100 m (328 ft.) 5 GHz: 80 m (262 ft.)
Horizontal beamwidth [degrees]	70 degrees
Vertical beamwidth [degrees]	70 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Vertical polarization, horizontal polarization, ±45° polarization
Attenna connector	N-female x 4
Attenna dimensions [mm(in.)]	40 mm x 220 mm x 220 mm (1.57 in. x 8.66 in. x 8.66 in.)
Weight without packaging [kg(lb)]	Antenna body: 0.75 kg (1.65 lb) Mounting bracket: 0.80 kg (1.76 lb)
Installation type	• Wall • Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ34 to ϕ114

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Item	Details
Attenna note	The gains and lobe widths are typical values, and the actual values are within a range. For specifications, see the corresponding data sheet. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to Huawei planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 44-2 Antenna Pattern1 of the 27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)

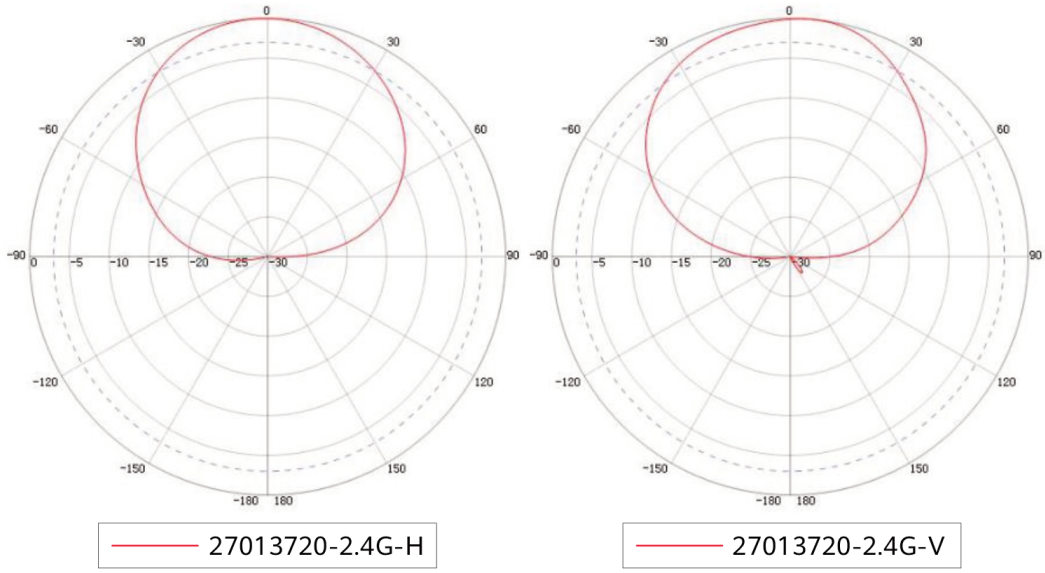
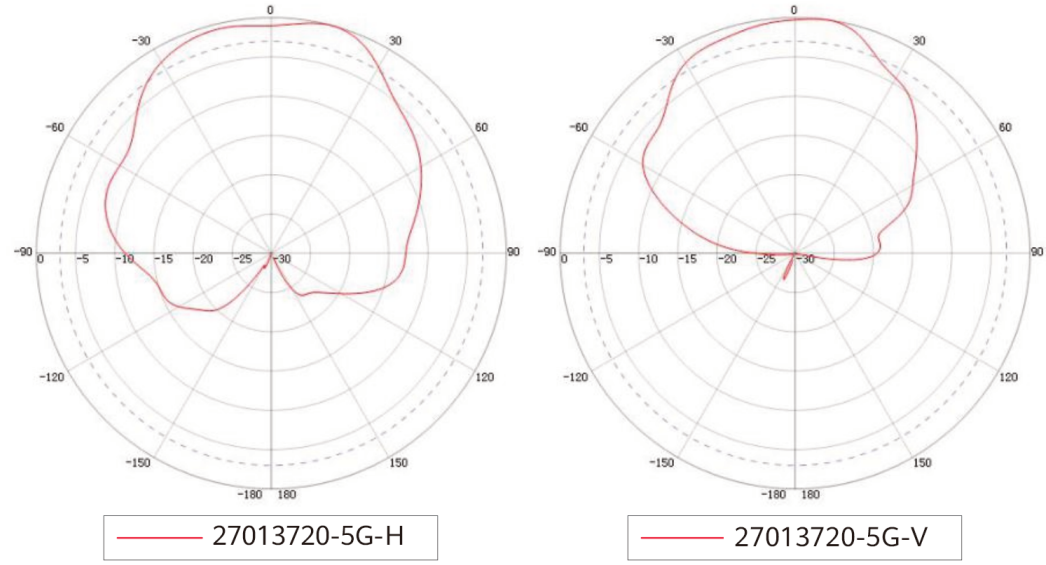


Figure 44-3 Antenna Pattern2 of the 27013720 Outdoor 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H70 V70 G8 & H70 V70 G8)



44.2 27013720 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

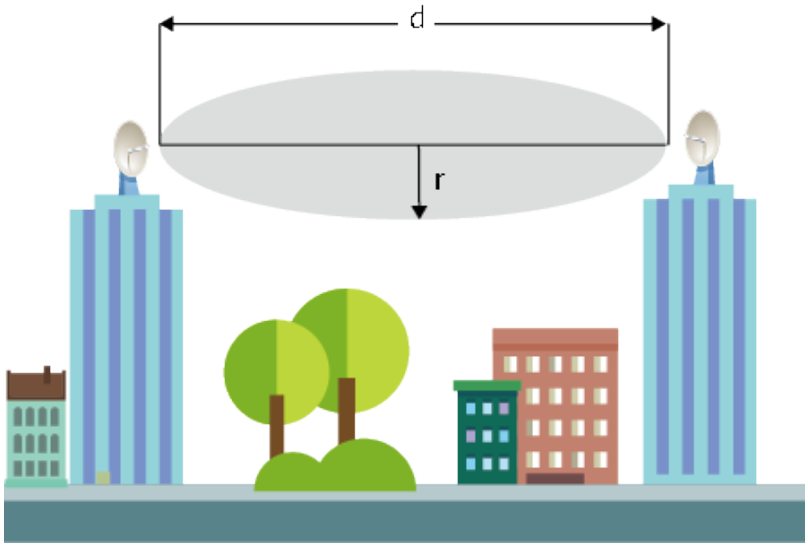
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.

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- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 44-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 44-2** lists the radius of the first Fresnel zone in different backhaul distances.

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Table 44-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

44.3 27013720 Antenna Installation

The 27013720 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, the antenna should be installed at high positions away from metal obstacles, for example, building tops, mountaintops, and tower tops. Its transmit end should not be blocked by obstacles.

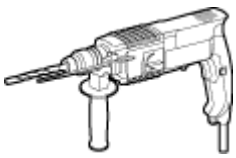
44.3.1 Accessories and Tools

Tools:

- Open-end wrench
- 8 mm socket wrench or torque screwdriver
- Inclinometer



- Hammer drill (ϕ8 mm, for wall mounting)



- Rubber mallet (for wall mounting)



Pole:

- Pole with a diameter of ϕ34 mm to ϕ114 mm

Other accessories:

- Mounting flange x 2
- Fastener x 1

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- U-bracket x 2
- M8x20 carriage bolt x 4
- M8 spring washer x 4
- M8 flat washer x 4
- M8 hexagon nut x 4
- M6 spring washer x 4
- M6 flash washer x 4
- M6 hexagon nut x 4
- Hose clamp x 2
- M6x80 expansion bolt x 4

44.3.2 Wall Mounting

The 27013720 antenna can be mounted on a wall.

CAUTION

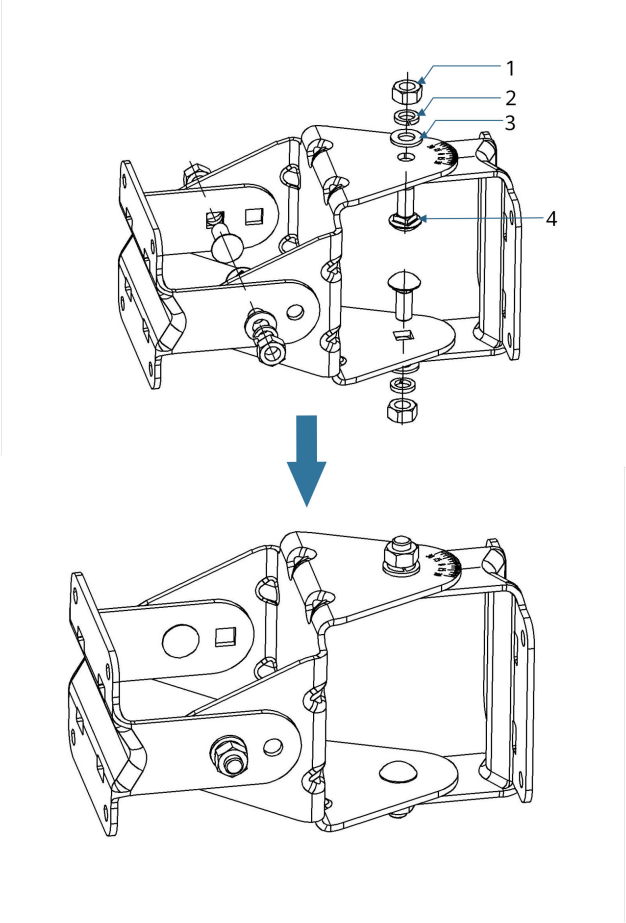
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the clamp components.

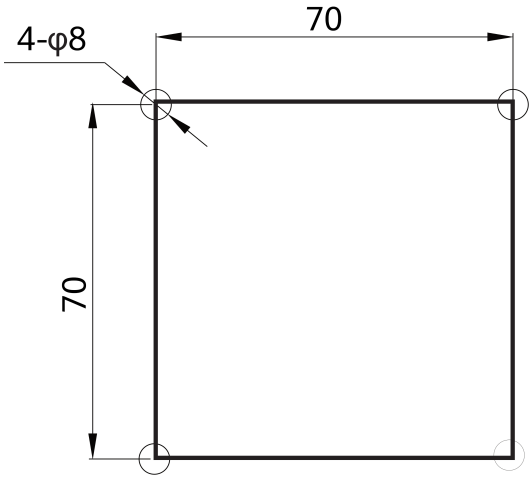
No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.

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2. Drill four ϕ8 mm holes (70 mm depth) on the wall to install plastic expansion sleeves that will support expansion bolts. The relative position of the four holes must exactly match with that of the four holes on the antenna support.



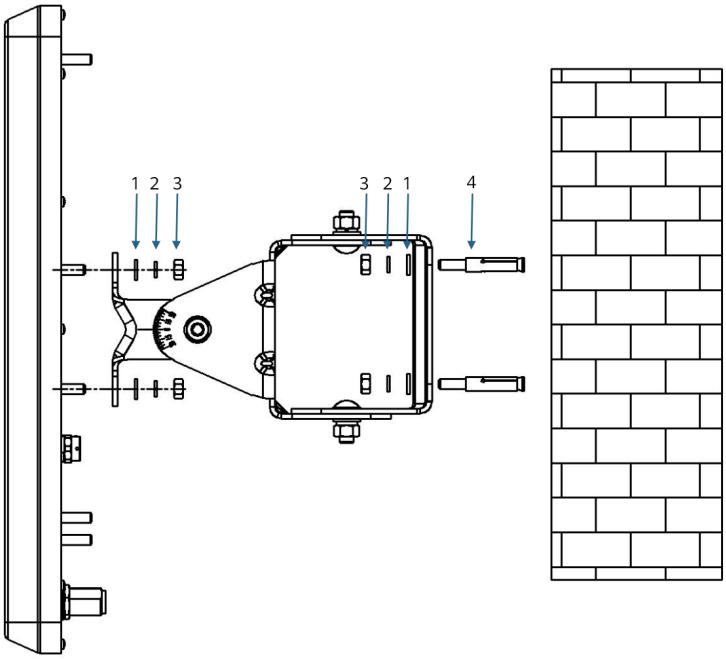
3. Install the antenna on the wall using the antenna mounting bracket.

No.	Name
1	M6 flat washer

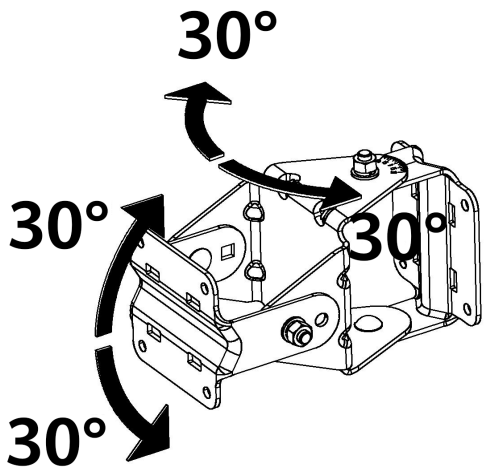
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2	M6 spring washer
3	M6 hexagon nut
4	M6x80 expansion bolt

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.



4. Adjust the angle of the antenna mounting bracket.



44.3.3 Pole Mounting

The 27013720 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

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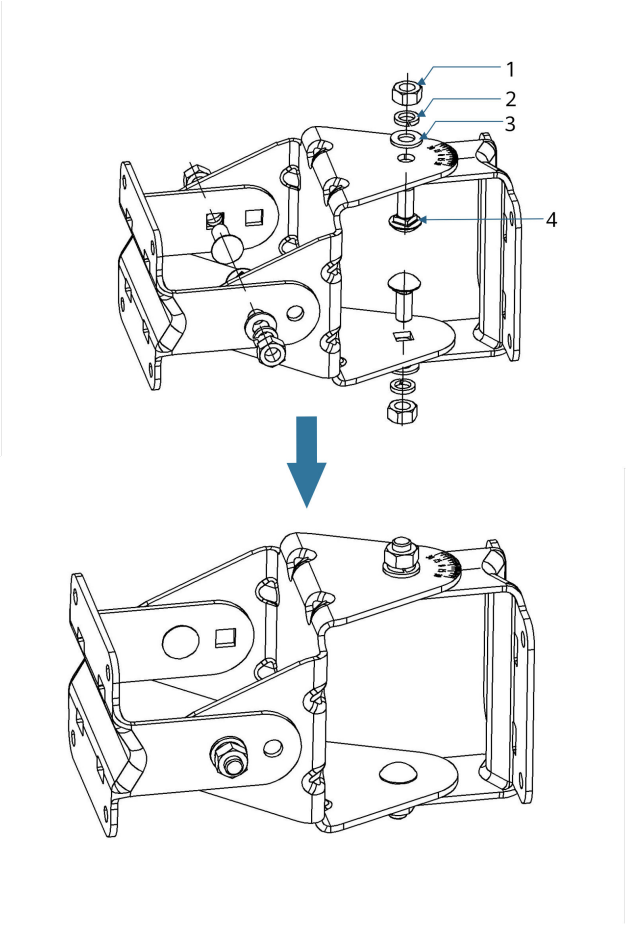
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the clamp components.

No.	Name
1	M8 hexagon nut
2	M8 spring washer
3	M8 flat washer
4	M8x20 carriage bolt

Use an S=13 mm wrench to assemble the mounting flange and fastener into an antenna mounting bracket with a reference torque of 188 kgf.cm.

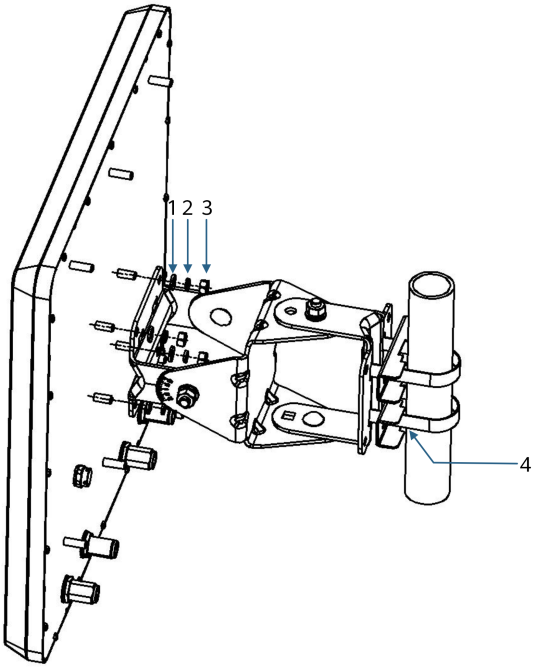


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2. Install the antenna on the pole using the antenna mounting bracket. (with a diameter of ϕ34 mm to ϕ114 mm, prepared by customers)

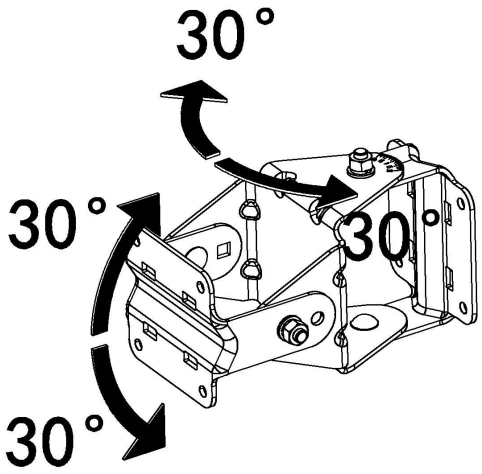
No.	Name
1	M6 flat washer
2	M6 spring washer
3	M6 hexagon nut
4	U-bracket and hose clamp

Use a wrench (S = 10 mm) with a reference torque of 76 kgf.cm.



3. Adjust the angle of the antenna mounting bracket.

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Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to an earth mat.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical during the installation.

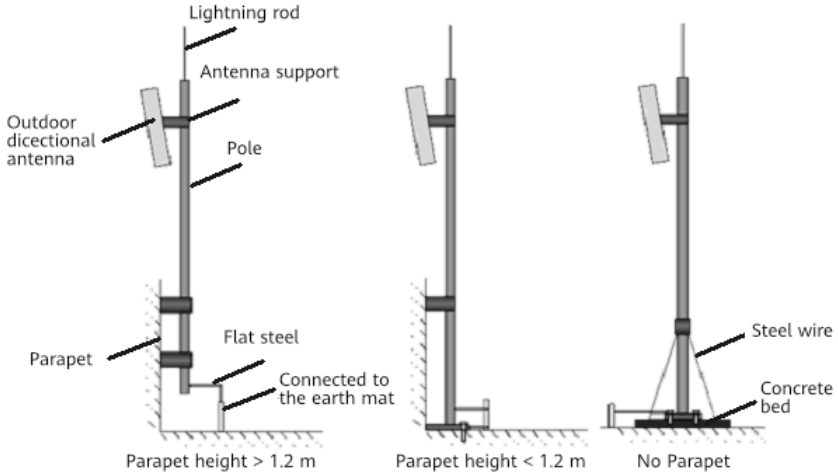
Take note of the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

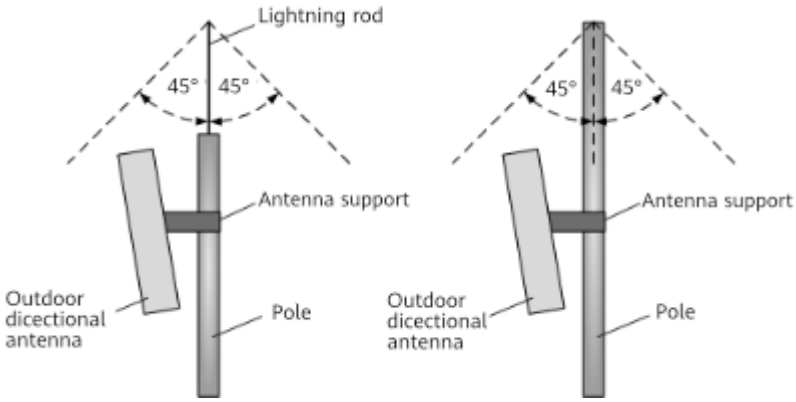
Figure 44-5 illustrates how an outdoor directional antenna and a pole are installed.

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Figure 44-5 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

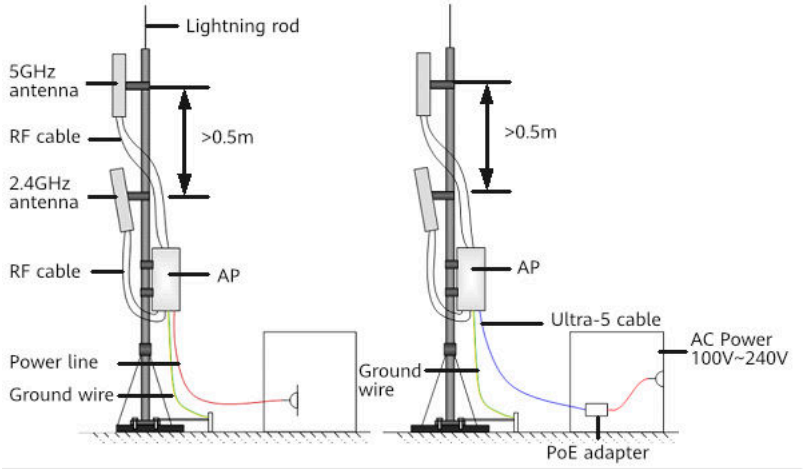
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 44-6 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

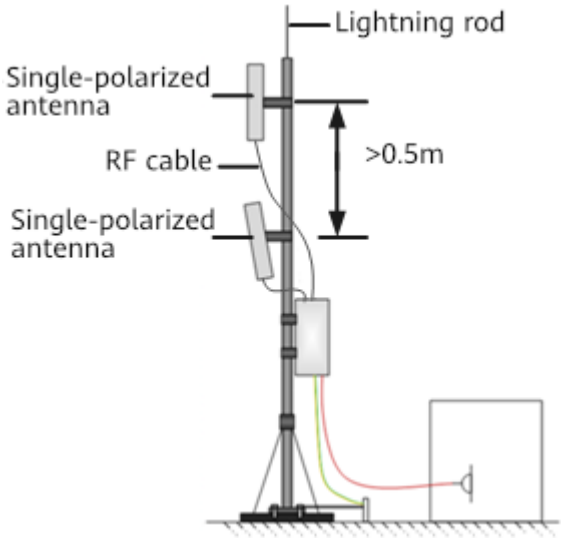
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Figure 44-6 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 44-7**.

Figure 44-7 Installation of single-polarized antennas



44.3.4 Connecting RF Cables

RF Cable Connection Requirements

- The feeder cables on an antenna must be connected to the AP's RF ports on the corresponding bands. There is no mandatory requirement for the connection mapping between the two ends.
- For the AirEngine 8760R-X1E, the feeder cables on an antenna can be connected only to the RF ports on the same side of the AP but not to RF ports on both sides of the AP.

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RF Cable Deployment Requirements

- Use a short RF cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle RF port and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.
- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.
- The grounding requirements of antennas are the same as those of APs.

RF Cable Connections

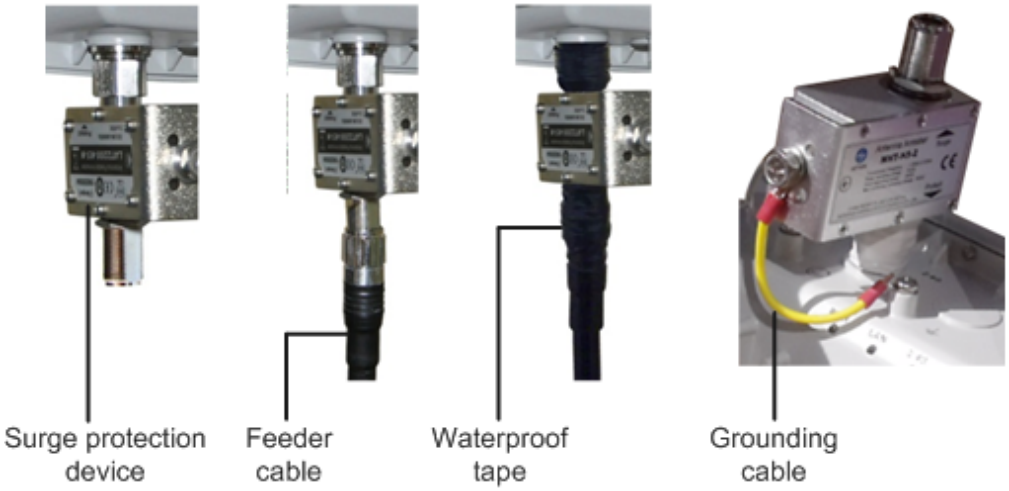
1. RF ports of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the RF ports with a tightening torque of 0.8 N·m.



NOTE

Outdoor APs support built-in surge protection on all RF ports, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



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Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

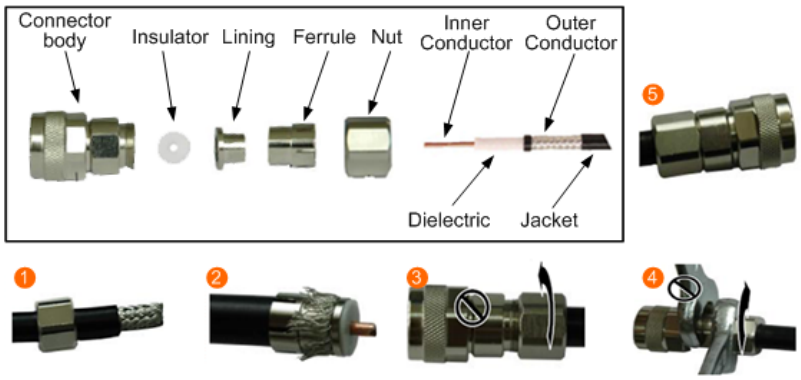
Table 44-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

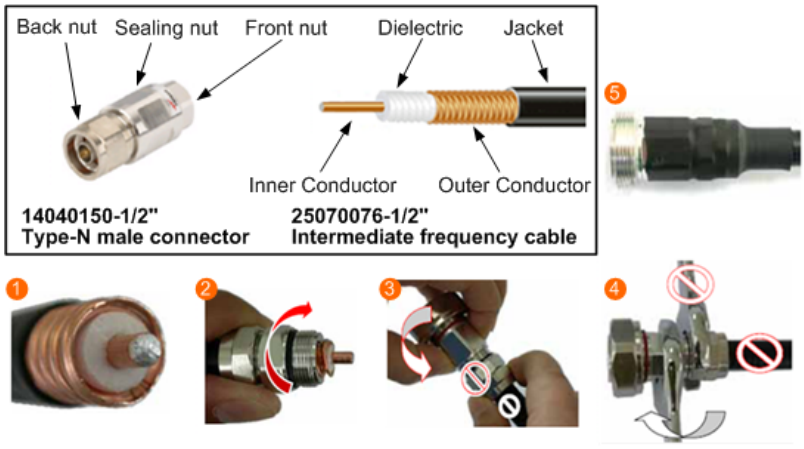
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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45 27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)

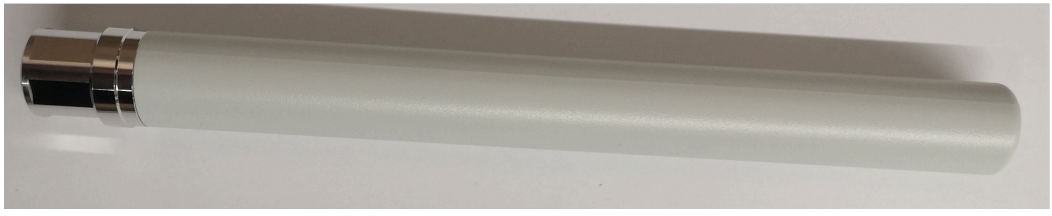
About This Chapter

45.1 27013721 Technical Specifications
45.2 27013721 Installation Precautions
45.3 27013721 Antenna Installation

45.1 27013721 Technical Specifications

Appearance and Structure

Figure 45-1 Appearance of the 27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)



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Technical Specifications

Table 45-1 Technical specifications of the 27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)

Item	Details
Part Number	27013721
Model	ANTDG0407A1NS
Description	Omni-directional Antenna, 2400~2500MHz&5150~5850MHz, 4/7dBi,linear polarized,5W,N-male,without mounting parts
Frequency [MHz]	2.4G: 2400 to 2500 5G: 5150 to 5850
Antenna gain [dBi]	2.4G: 4 5G: 7
Coverage distance [m(ft.)]	70 m(ft.)
Horizontal beamwidth [degrees]	360 degrees
Vertical beamwidth [degrees]	2.4G:30 5G:15
Standing wave ratio (SWR)	<2
Polarization	Vertical polarization
Attenna connector	N-male
Attenna dimensions [mm(in.)]	Diameter x Length: ϕ23.8 x 235
Weight without packaging [kg(lb)]	0.09 kg(lb)
Installation type	Directly installed on the AP

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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheet. The previous specifications list the coverage distance for reference only, which may vary depending on specific conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -70 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 45-2 Antenna Pattern1 of the 27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)

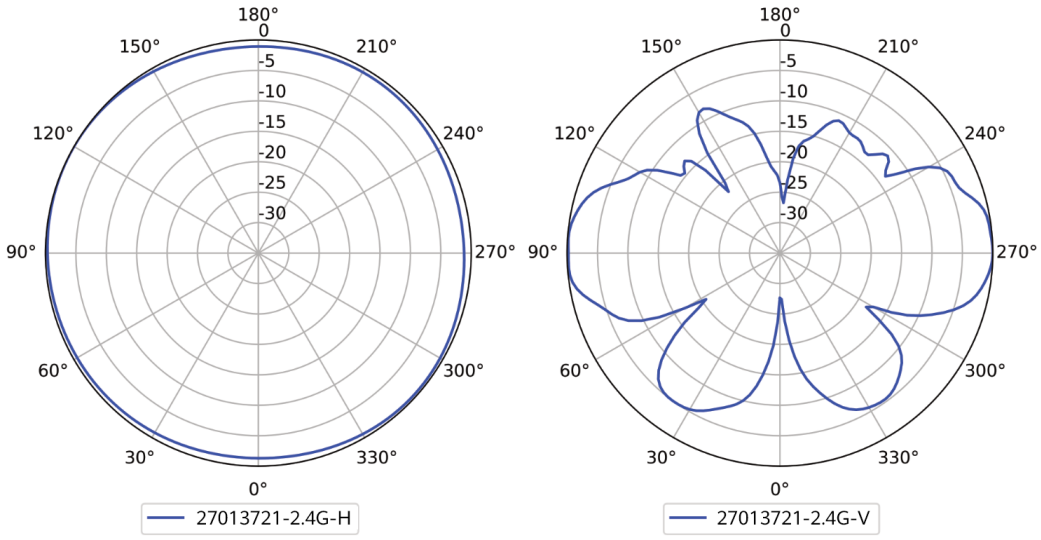
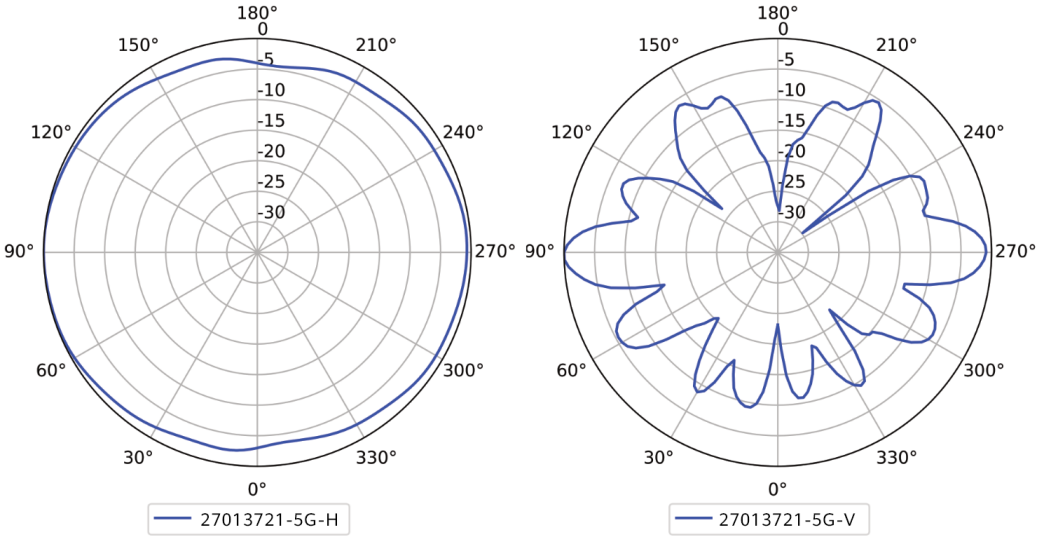


Figure 45-3 Antenna Pattern2 of the 27013721 Outdoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V30 G4 & H360 V15 G7)



45.2 27013721 Installation Precautions

To ensure that the antenna works at the optimal performance level, take the following installation precautions:

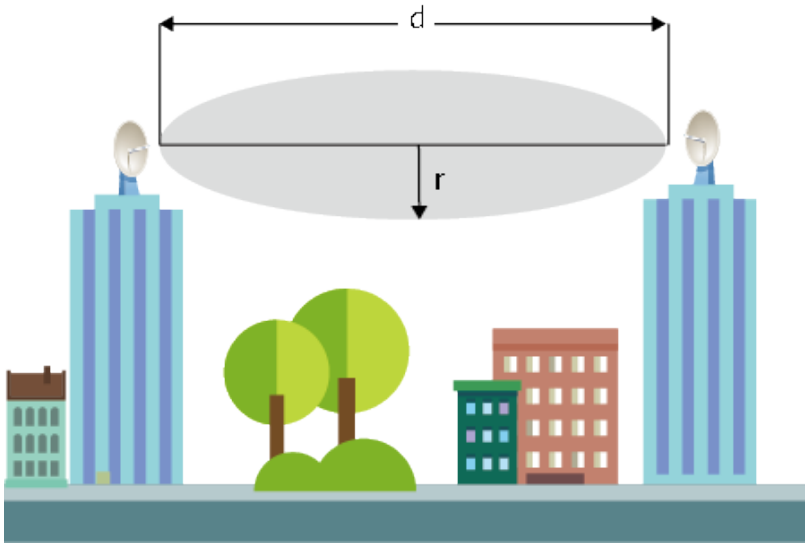
- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas to within 30 cm to 50 cm.

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- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see section "Antenna Installation."
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

Figure 45-4 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 45-2** lists the radius of the first Fresnel zone in different backhaul distances.

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Table 45-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

45.3 27013721 Antenna Installation

27013721 antennas are directly installed on APs. You only need to tighten nuts.

The following figure shows the antenna installation.



- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the connectors in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.

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NOTE

- To achieve the optimal coverage effect, it is recommended that you install the omnidirectional antenna four to six meters above ground.
- When installing an antenna, tightly hold the antenna connector and tighten it using a torque wrench. The recommended tightening torque is 0.8 N·m to 1.0 N·m.
- Tighten the nut of the AP's RF connector with a torque of no more than 1.2 N·m.

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46 27013921 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15)

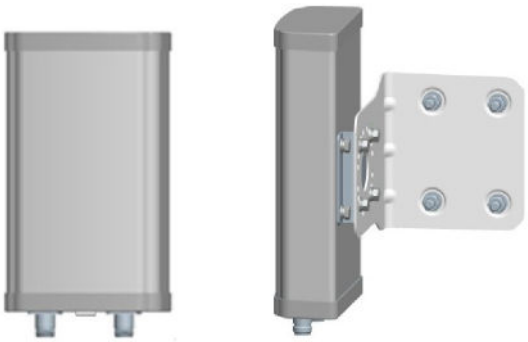
About This Chapter

46.1 27013921 Technical Specifications
46.2 27013921 Installation Precautions
46.3 27013921 Antenna Installation

46.1 27013921 Technical Specifications

Appearance and Structure

Figure 46-1 Appearance of the 27013921 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15.5)



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Technical Specifications

Table 46-1 Technical specifications of the 27013921 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15.5)

Item	Details
Part Number	27013921
Model	ANT5G15D2NW
Description	Directional Antenna-5150~5850MHz-15dBi-45deg/15deg-Nfemale-2ports -with bracket-wall mounting-only used in metro project
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	15 dBi
Coverage distance [m(ft.)]	The coverage distance is 150 m when the transmit power and field strength of STAs are 15 dBm and -75 dBm, respectively, regardless of the local EIRP limit.
Horizontal beamwidth [degrees]	45 degrees
Vertical beamwidth [degrees]	15 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	± 45°
Attenna connector	N-female x 2
Attenna dimensions [mm(in.)]	60 mm x 240 mm x 133 mm (2.36 in. x 9.45 in. x 5.24 in.)
Weight without packaging [kg(lb)]	Weight of antenna: 0.8 Weight of mounting bracket: 0.6
Installation type	Wall
Grounding requirements	Same as the AP

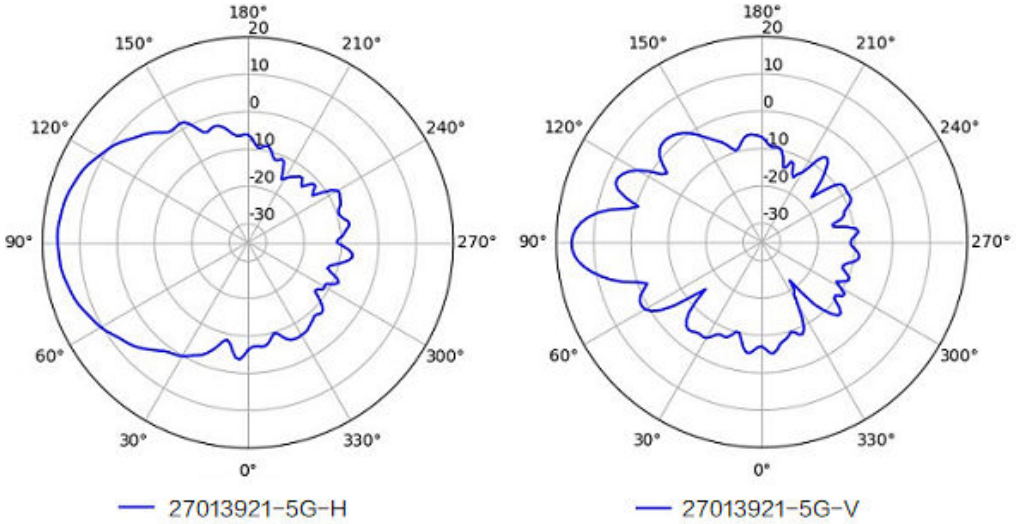
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 46-2 Antenna Pattern1 of the 27013921 Rail Transportation 5 GHz Dual-Polarized Directional Antenna (H45 V15 G15.5)



46.2 27013921 Installation Precautions

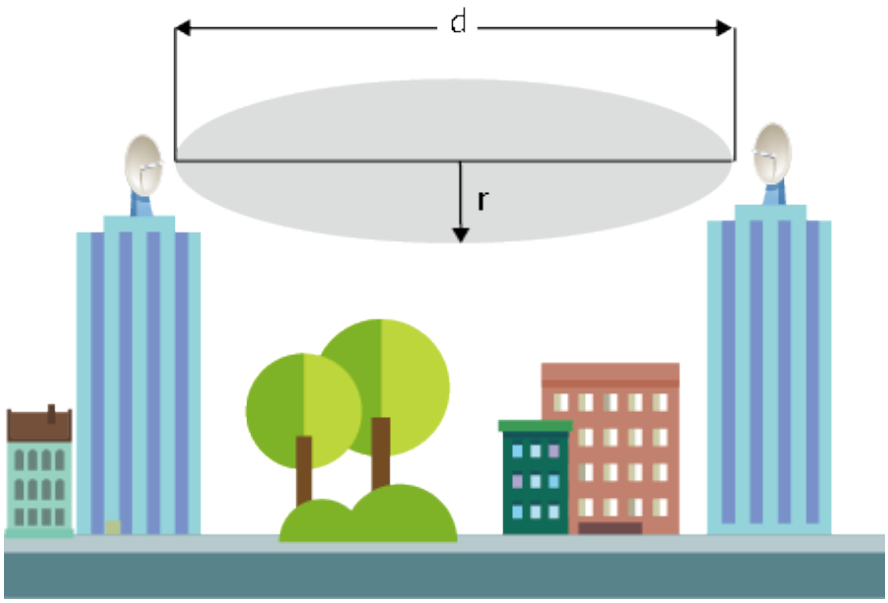
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see the subsequent antenna installation section.
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 46-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

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$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 46-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 46-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

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46.3 27013921 Antenna Installation

The 27013921 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, install the antenna at high positions away from metal obstacles, such as building tops, mountaintops, and tower tops. Keep the antenna's transmit end away from obstacles.

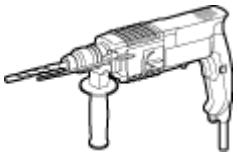
46.3.1 Accessories and Tools

Tools:

- 10 mm and 13 mm combination wrenches



- Hammer drill



- Inclinometer

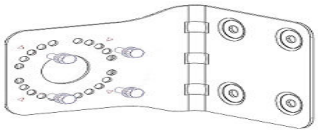


- Rubber mallet



Other accessories:

- M8 expansion bolt x 4
- M6 hexagon nut assembly x 4
- Mounting bracket x 1



46.3.2 Wall Mounting

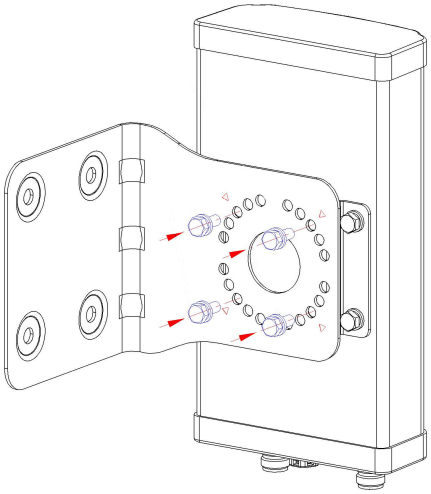
The 27013921 antenna can be mounted on a wall.

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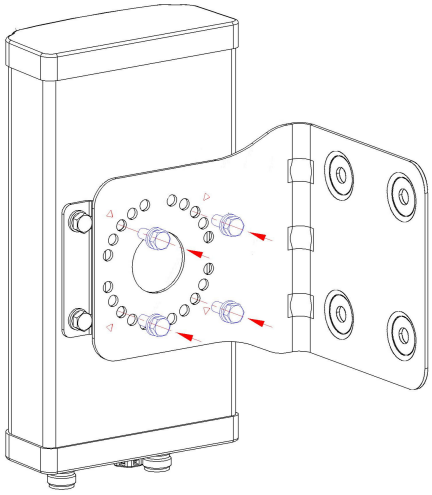
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Use flat washers, spring washers, and nuts to secure the mounting bracket to the antenna with a reference torque of 10 N·m (M6).

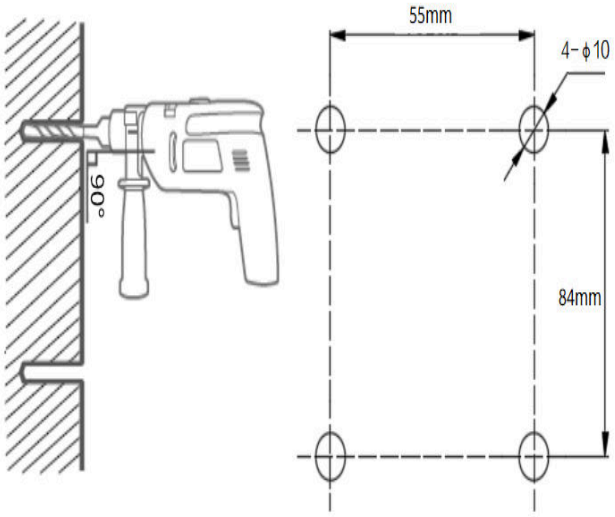


Mounting the antenna with the wall on its left side



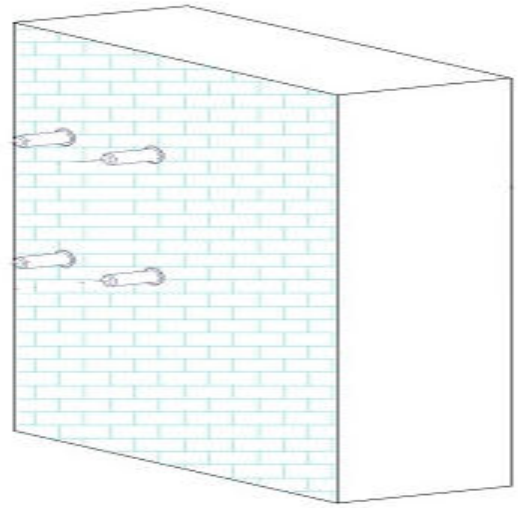
Mounting the antenna with the wall on its right side

2. Drill four holes (diameter: ϕ10; depth: 65 mm) on the wall according to the hole spacing, as shown in the following figure.

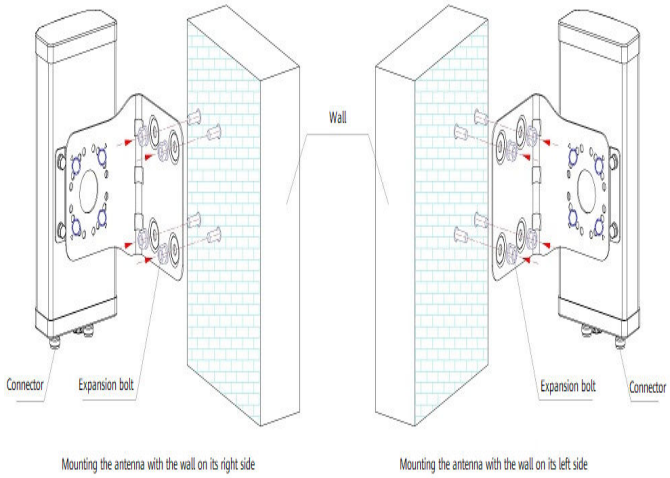


3. Screw the nuts into the expansion bolts. Hammer the expansion bolts into the holes until the flat washers are closely attached to the wall. Remove the nuts, spring washers, and flat washers in sequence.

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4. Fix the antenna mounting support to the expansion bolts on the wall, fit flat washers, spring washers, and nuts in order, and tighten the nuts with a reference torque of 23.5 N·m (M8).



46.3.3 Connecting RF Cables

RF Cable Connection Requirements

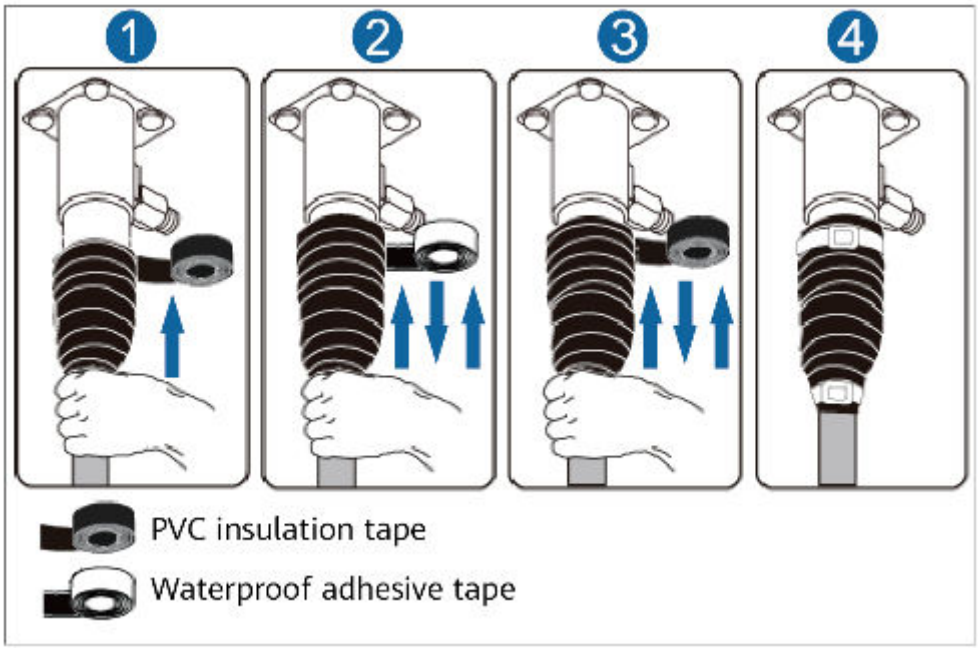
The feeders of the same antenna must be connected to the 5 GHz RF ports on the same AP. The connection rules for antennas are the same as those for RF cables on the AP.

RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.

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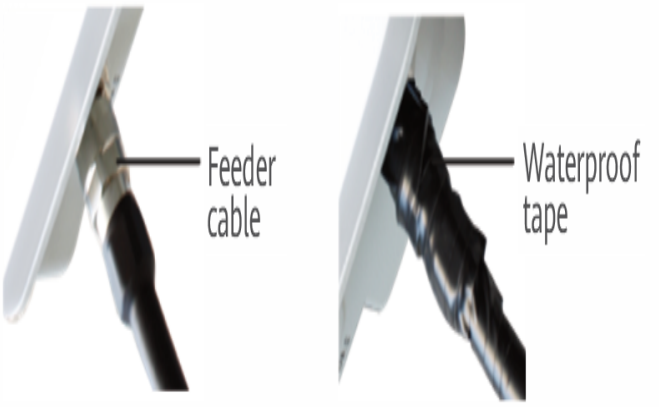
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.



- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces with a tightening torque of 0.8 N·m.

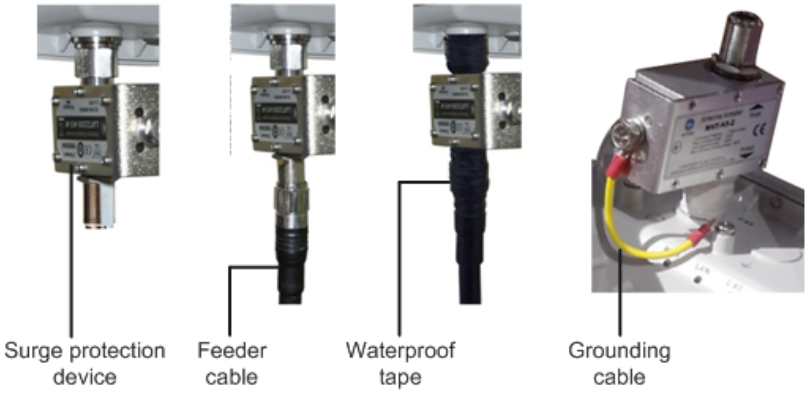


NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

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2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

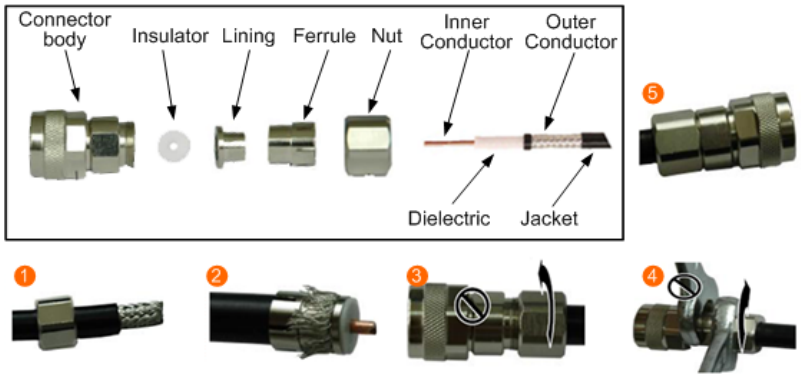
Table 46-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

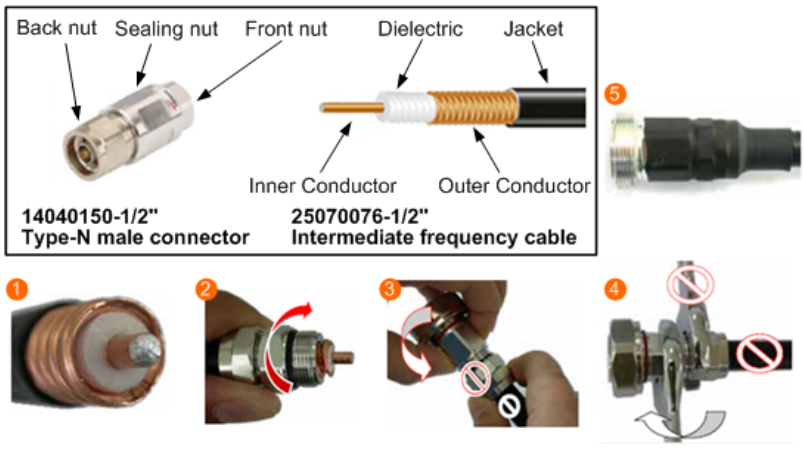
Copyright © Huawei Technologies Co., Ltd.

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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47 27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)

About This Chapter

47.1 27013955 Technical Specifications

47.2 27013955 Installation Precautions

47.3 27013955 Antenna Installation

47.1 27013955 Technical Specifications

Appearance and Structure

Figure 47-1 Appearance of the 27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)



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Technical Specifications

Table 47-1 Technical specifications of the 27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)

Item	Details
Part Number	27013955
Model	ANT5G16D4NW
Description	Directional Antenna-5150~5850MHz-16dBi-25deg/25deg-Nfemale-4ports -with bracket-wall mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	16 dBi
Coverage distance [m(ft.)]	The coverage distance is 260 m when the transmit power and field strength of STAs are 15 dBm and -75 dBm, respectively, regardless of the local EIRP limit.
Horizontal beamwidth [degrees]	25 degrees
Vertical beamwidth [degrees]	25 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	± 45°
Attenna connector	N-female x 4
Attenna dimensions [mm(in.)]	64 mm x 265 mm x 134 mm (2.52 in. x 10.43 in. x 5.28 in.)
Weight without packaging [kg(lb)]	Weight of antenna: 1.26 ± 0.05 Weight of mounting bracket: 0.61 ± 0.05
Installation type	Wall
Grounding requirements	Same as the AP

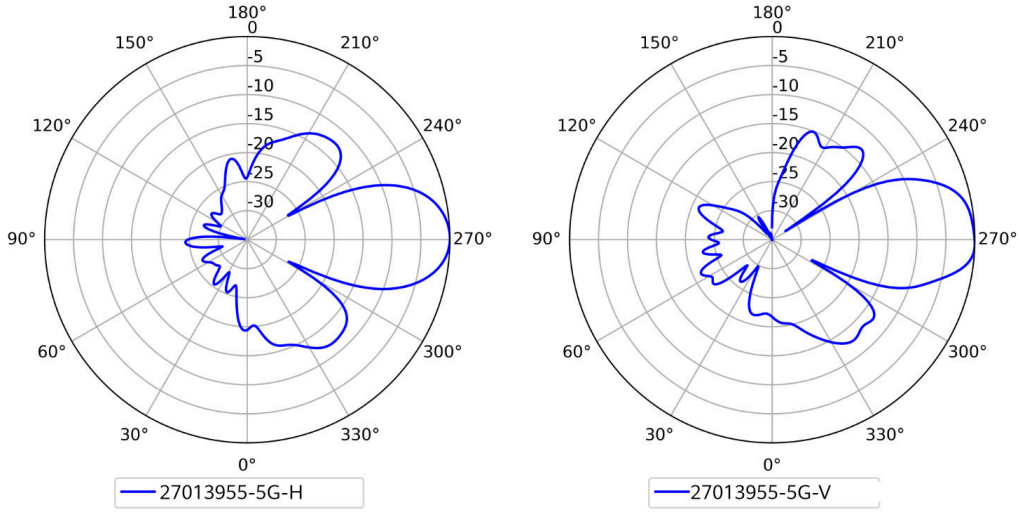
Copyright © Huawei Technologies Co., Ltd.

Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 47-2 Antenna Pattern1 of the 27013955 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)



47.2 27013955 Installation Precautions

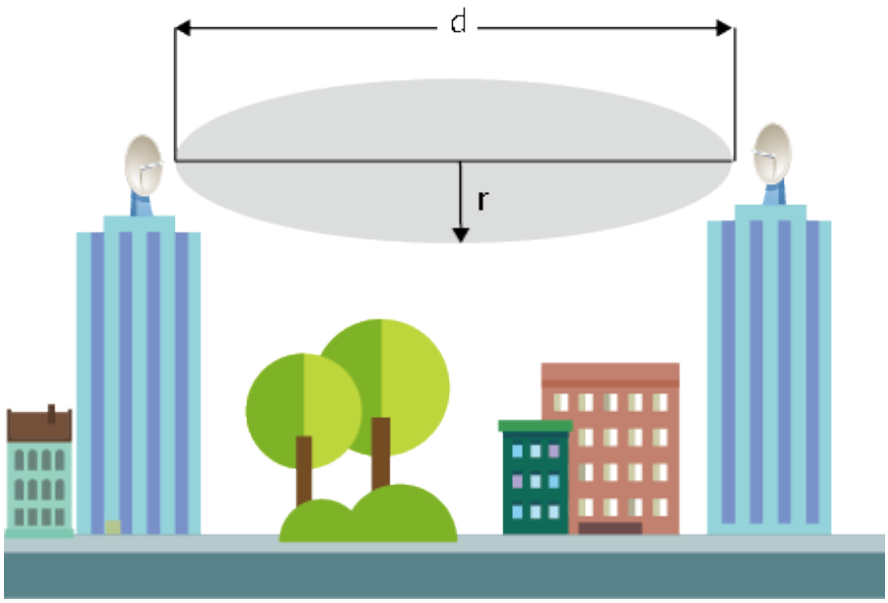
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see the subsequent antenna installation section.
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 47-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in km.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 47-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 47-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

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47.3 27013955 Antenna Installation

The 27013955 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, install the antenna at high positions away from metal obstacles, such as building tops, mountaintops, and tower tops. Keep the antenna's transmit end away from obstacles.

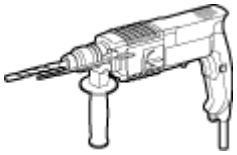
47.3.1 Accessories and Tools

Tools:

- 10 mm and 13 mm combination wrenches



- Hammer drill



- Inclinometer

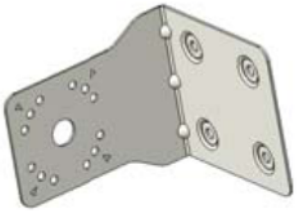


- Rubber mallet



Other accessories:

- Spring washer x 4
- Flat washer x 4
- M8x80 expansion bolt x 4
- M6 nut x 4
- Mounting bracket x 1



47.3.2 Wall Mounting

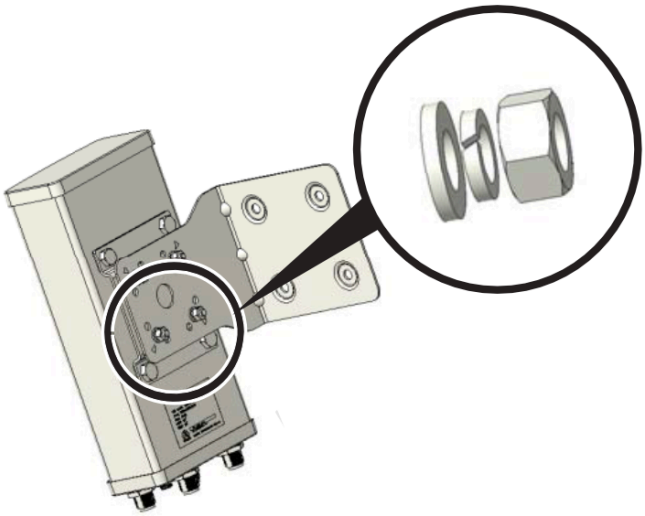
The 27013955 antenna can be mounted on a wall.

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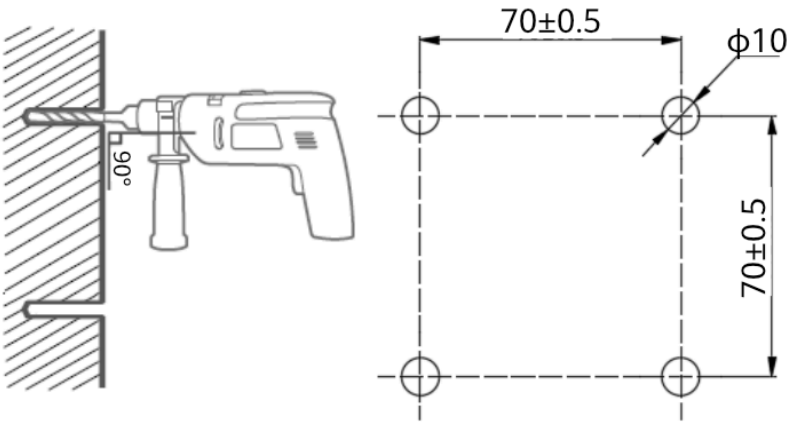
CAUTION

- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Use flat washers, spring washers, and nuts to secure the mounting bracket to the antenna with a reference torque of 8 N·m (70.81 lbf·in.).

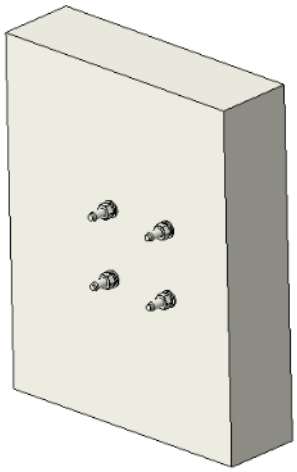


2. Drill four holes (diameter: 10 mm; depth: 60 mm) on the wall according to the hole spacing, as shown in the following figure.

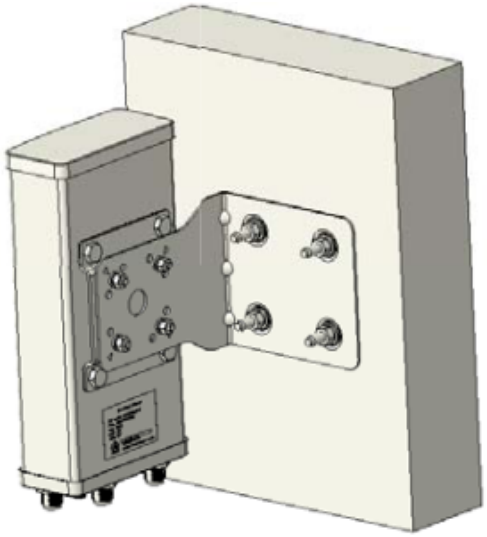


3. Screw the nuts into the expansion bolts. Hammer the expansion bolts into the holes until the flat washers are closely attached to the wall. Remove the nuts, spring washers, and flat washers in sequence.

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4. Align the holes on the mounting bracket with the expansion bolts on the wall, put the flat washers, spring washers, and nuts on the mounting bracket in sequence to ensure that the mounting bracket is closely attached to the wall, and then use a wrench to tighten the nuts with a reference torque of 20 N·m (177.01 lbf·in.).



47.3.3 Connecting RF Cables

RF Cable Connection Requirements

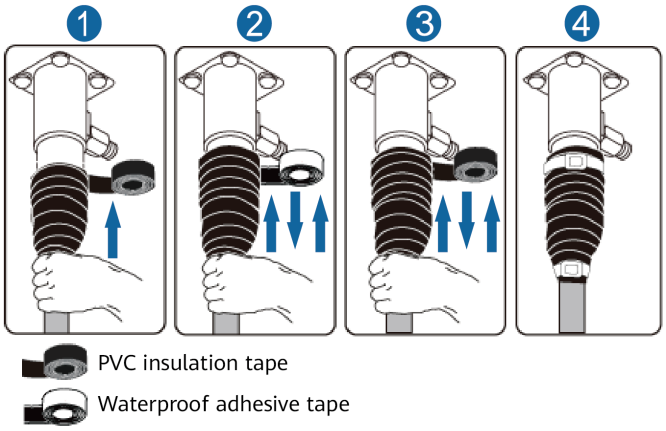
The feeders of the same antenna must be connected to the 5 GHz RF ports on the same AP. The connection rules for antennas are the same as those for RF cables on the AP.

RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.

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- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.



- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.

RF Cable Connections

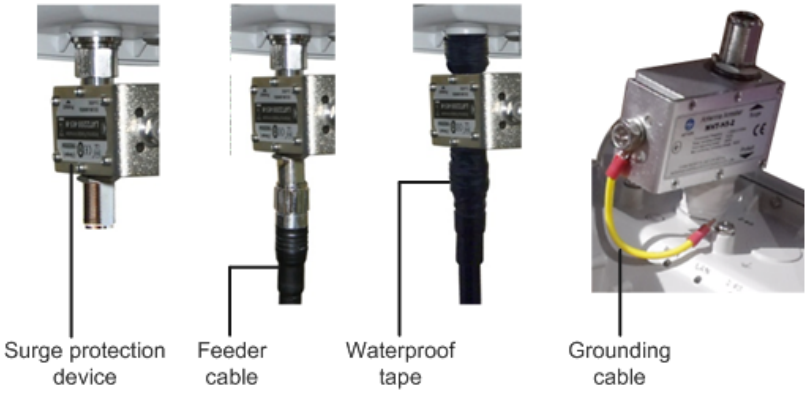
1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces with a tightening torque of 0.8 N·m.



NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



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Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

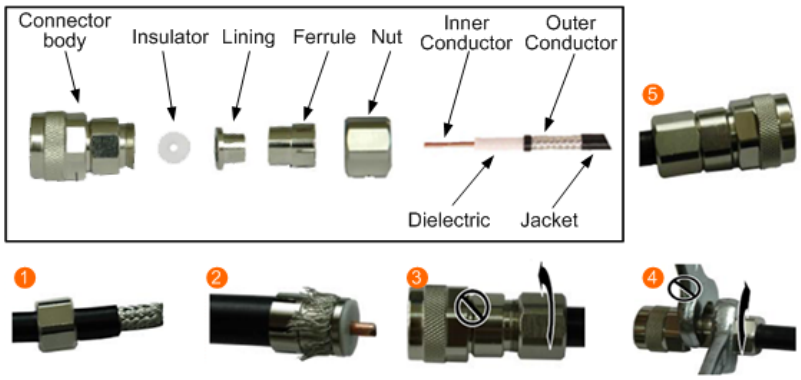
Table 47-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz ~2483.5 MHz: 26.8dB/100m • 4920Mhz ~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz ~2483.5 MHz: 18.1dB/100m • 4920Mhz ~5825Mhz: 30dB/100m	

Connecting the type-N male coaxial connector to the RG-8U feeder cable

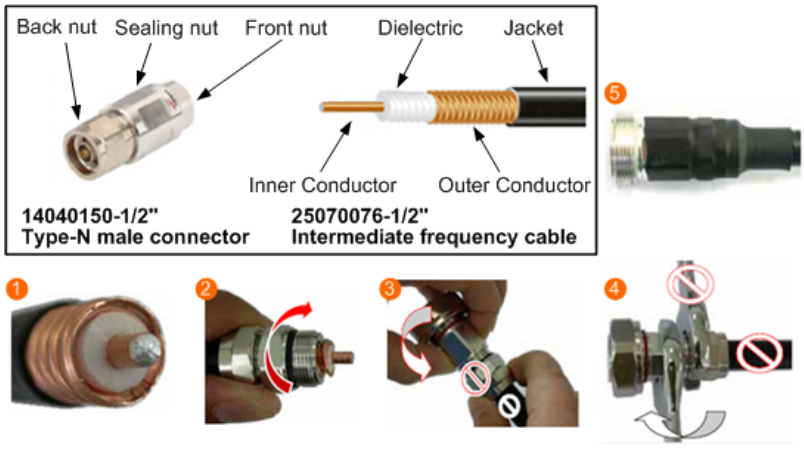
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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48 27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)

About This Chapter

48.1 27013956 Technical Specifications

48.2 27013956 Installation Precautions

48.3 27013956 Antenna Installation

48.1 27013956 Technical Specifications

Appearance and Structure

Figure 48-1 Appearance of the 27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)



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Technical Specifications

Table 48-1 Technical specifications of the 27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)

Item	Details
Part Number	27013956
Model	ANT5G16D4NP
Description	Directional Antenna-5150~5850MHz-16dBi-25deg/25deg-Nfemale-4ports -with bracket-pole mounting
Frequency [MHz]	5150 MHz to 5850 MHz
Antenna gain [dBi]	16 dBi
Coverage distance [m(ft.)]	The coverage distance is 260 m when the transmit power and field strength of STAs are 15 dBm and -75 dBm, respectively, regardless of the local EIRP limit.
Horizontal beamwidth [degrees]	25 degrees
Vertical beamwidth [degrees]	25 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	± 45°
Attenna connector	N-female x 4
Attenna dimensions [mm(in.)]	64 mm x 265 mm x 134 mm (2.52 in. x 10.43 in. x 5.28 in.)
Weight without packaging [kg(lb)]	Weight of antenna: 1.26 ± 0.05 Weight of mounting bracket: 0.86 ± 0.05
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ34 to ϕ70 (U-bolts are recommended for rail transportation scenarios.)ϕ34 to ϕ114 (Hose clamps are recommended for common outdoor coverage scenarios.)

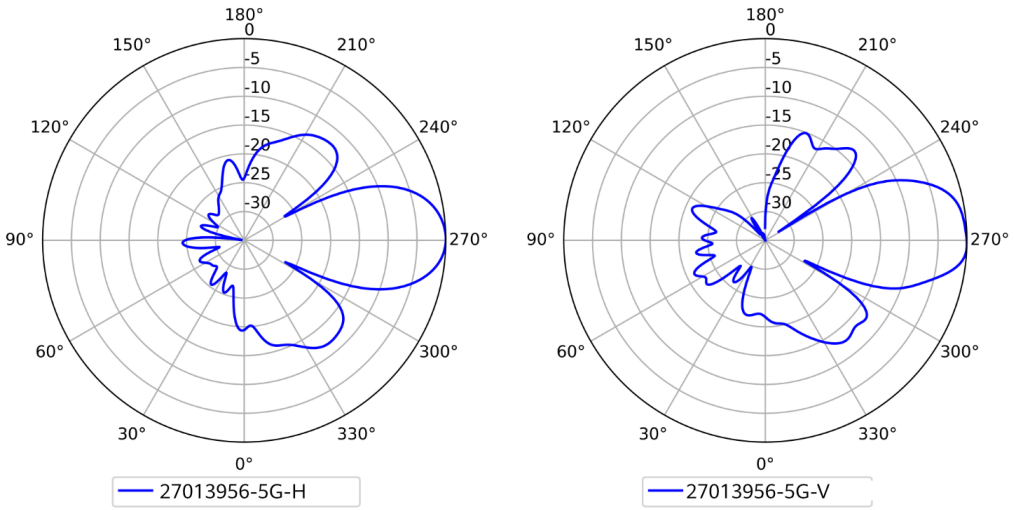
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Item	Details
Attenna note	The gains and lobe widths in this document are typical values. The actual values are within a range. For specifications, see the corresponding data sheets. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default AP transmit power is 15 dBm. - The default STA type is mobile phone, and no obstacle exists. - The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.

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Antenna's Radiation Pattern

Figure 48-2 Antenna Pattern1 of the 27013956 Outdoor 5 GHz Dual-Polarized Directional Antenna (H25 V25 G16)



48.2 27013956 Installation Precautions

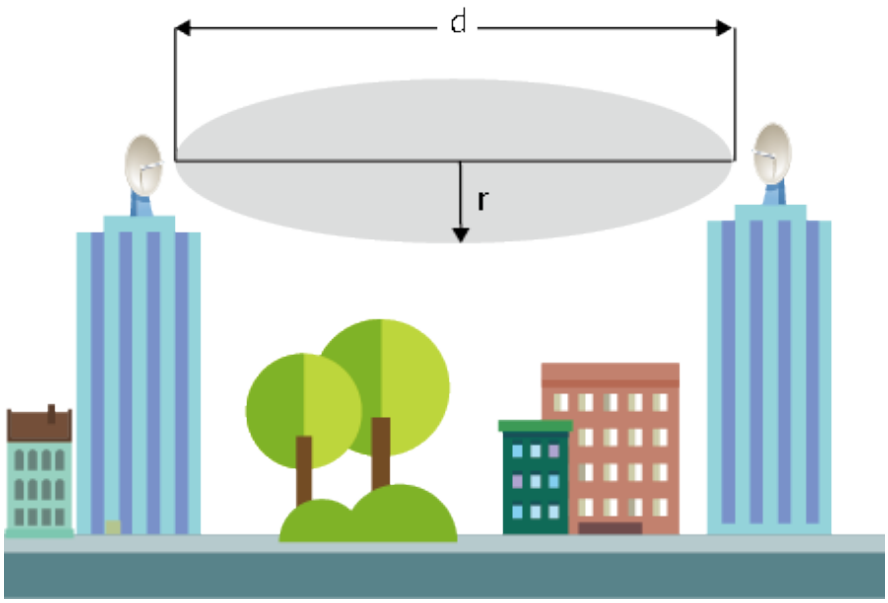
To ensure that the antenna works at the optimal performance level, take the following installation precautions:

- Install the antenna upright and place one side of the RF cable connector towards the ground.
- When installing single-polarized antennas, keep the distance between two antennas within 30 cm to 50 cm.
- Install the antenna away from metal obstructions, such as air conditioners or heating pipes. Do not install the antenna on a wire mesh.
- Wall materials and thickness determine the number of walls that radio signals can pass through. Factor that into antenna selection.
- Install lightning rods for outdoor antennas to prevent lightning strikes. For details on how to install a lightning rod, see the subsequent antenna installation section.
- Ensure that no obstacle exists in the Fresnel zone in bridging scenarios. That is, the antenna height must be larger than the sum of the radius of the first Fresnel zone and obstacle height.

  As shown in the figure, the Fresnel zone refers to the ellipsoid. Obstacles in the zone will adversely affect signal transmissions. If not blocked, radio signals can travel in an approximate free space.

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Figure 48-3 Fresnel zone



Fresnel zones differ depending on the Fresnel zone radius. In a free space, radio signals are mainly transmitted between antennas in the first Fresnel zone. In normal cases, the Fresnel zone refers to the first Fresnel zone.

The radius of the first Fresnel zone is calculated and related parameters are described as follows:

$$r = 17.32\sqrt{d/4f}$$

- r: indicates the radius of the first Fresnel zone, in meters.
- d: indicates the distance between two antennas, in kilometers.
- f: indicates the signal frequency, in GHz.

With 5 GHz signals as an example, **Table 48-2** lists the radius of the first Fresnel zone in different backhaul distances.

Table 48-2 Radius of the first Fresnel zone

Backhaul Distance (km)	Radius of the First Fresnel Zone (m)
1	3.87
2	5.48
3	6.71
5	8.66
10	12.25

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48.3 27013956 Antenna Installation

The 27013956 antenna is an outdoor directional antenna. To obtain a better performance and wider coverage, install the antenna at high positions away from metal obstacles, such as building tops, mountaintops, and tower tops. Keep the antenna's transmit end away from obstacles.

48.3.1 Accessories and Tools

Tools:

- 10 mm combination wrench



- Slotted point screwdriver



- Inclinometer

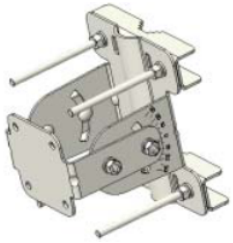


Pole:

- For antenna mounting with U-bolts: Pole with a diameter of ϕ34 mm to ϕ70 mm
- For antenna mounting with hose clamps: Pole with a diameter of ϕ34 mm to ϕ114 mm

Other accessories:

- Spring washer x 12
- Flat washer x 12
- U-bolt x 2
- Hose clamp x 2
- Square neck screw x 4
- M6 nut x 12
- Mounting bracket x 1



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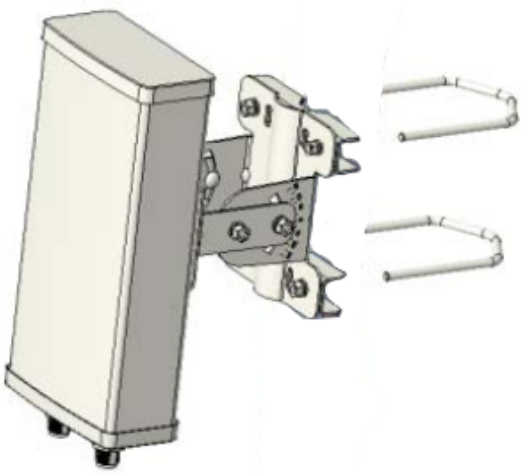
48.3.2 Pole Mounting

The 27013956 antenna can be mounted on a pole. The thickness of the pole should be no less than 2.5 mm. U-bolts are recommended for rail transportation scenarios and are applicable to poles with a diameter in the range of 34 mm to 70 mm. Hose clamps are recommended in common outdoor coverage scenarios and are applicable to poles with a diameter in the range of 34 mm to 114 mm.

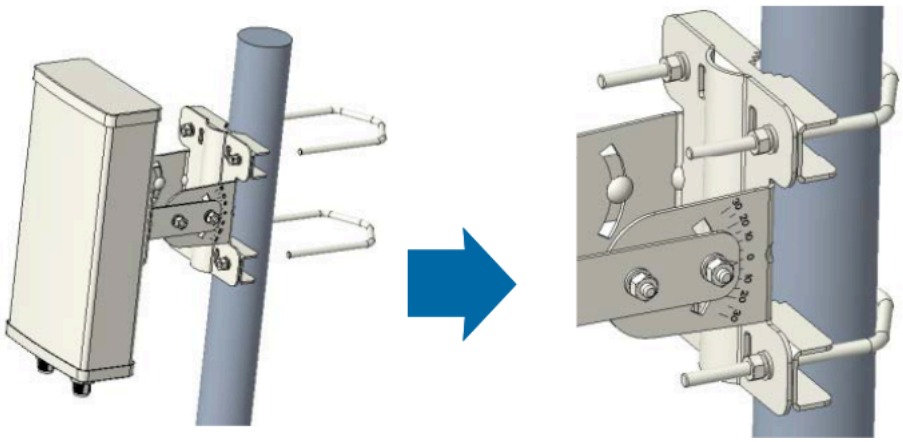
⚠ CAUTION

- Keep antennas away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Remove the spring washers, flat washers, and nuts from U-bolts.



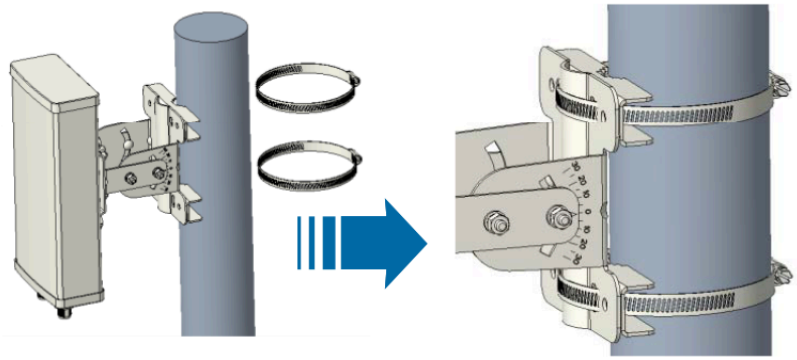
2. Secure the antenna to the pole with a torque of 8 N·m (70.81 lbf·in.). (The pole needs to be prepared by the customer.)



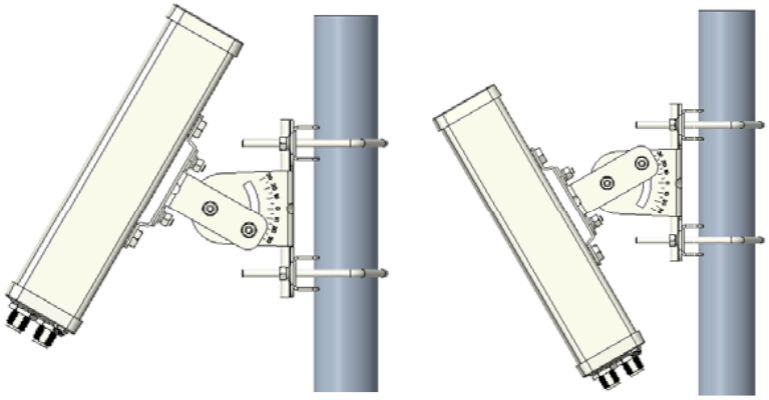
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NOTE

The following figure shows the installation using hose clamps. (The pole needs to be prepared by the customer.)



3. Adjust the angle of the mounting bracket as required (within the range of ±30° in the vertical direction), and tighten all screws. The reference torque is 8 N·m (70.81 lbf·in.).



Installing the Pole and Lightning Rod

Carry out the following steps:

1. Weld the lightning rod to the top of the antenna pole.
2. Install the antenna pole on a parapet or concrete bed on the roof of the building.
3. Use a 40 mm x 4 mm flat piece of steel to connect the antenna pole to a lightning protection ground grid.
4. Secure the outdoor directional antenna to the pole using an antenna support. Keep the pole vertical to the ground during the installation.

Pay attention to the following points when installing an outdoor directional antenna:

- If the roof of the building is surrounded by parapets of no less than 1.2 m high, fix the pole on a parapet with expansion screws, and then fix the outdoor directional antenna on the pole with an antenna support.
- If the roof of the building is surrounded by parapets of less than 1.2 m high, fix one of the installation points of the pole on a parapet and the other

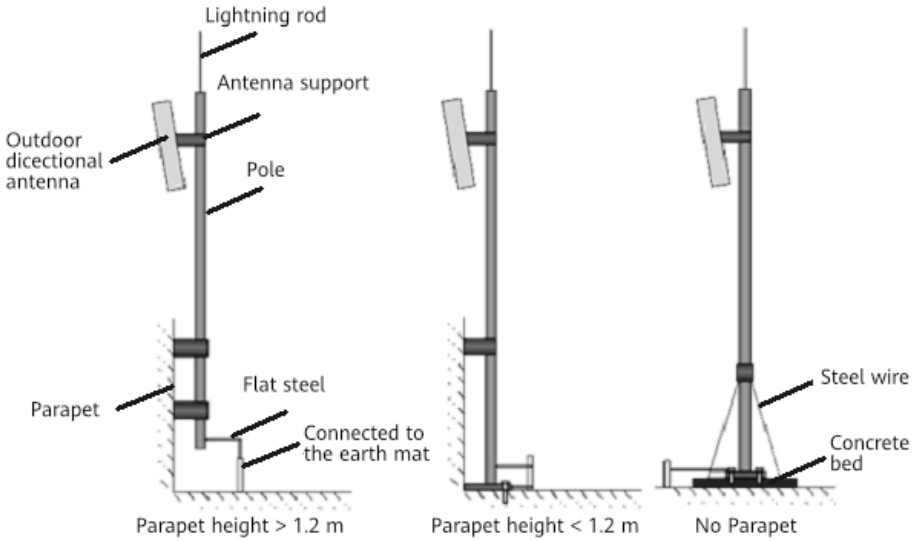
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installation point to the roof with expansion screws, and then fix the outdoor directional antenna to the pole with an antenna support.

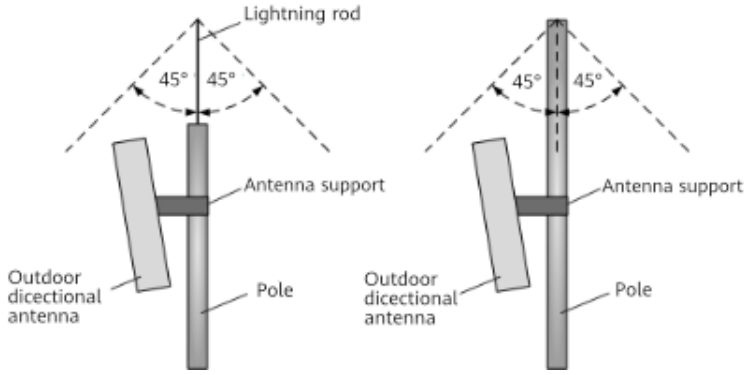
- If there are no parapets around the roof, fix the pole to the ground or a concrete bed with expansion screws and steel wires, and then fix the outdoor directional antenna on the pole with an antenna support.

Figure 48-4 illustrates how an outdoor directional antenna and a pole are installed.

Figure 48-4 Installing an outdoor directional antenna and a pole



The following figure shows the protection area of a lightning rod. The entire antenna must be within the 45-degree protection area of the lightning rod.



NOTE

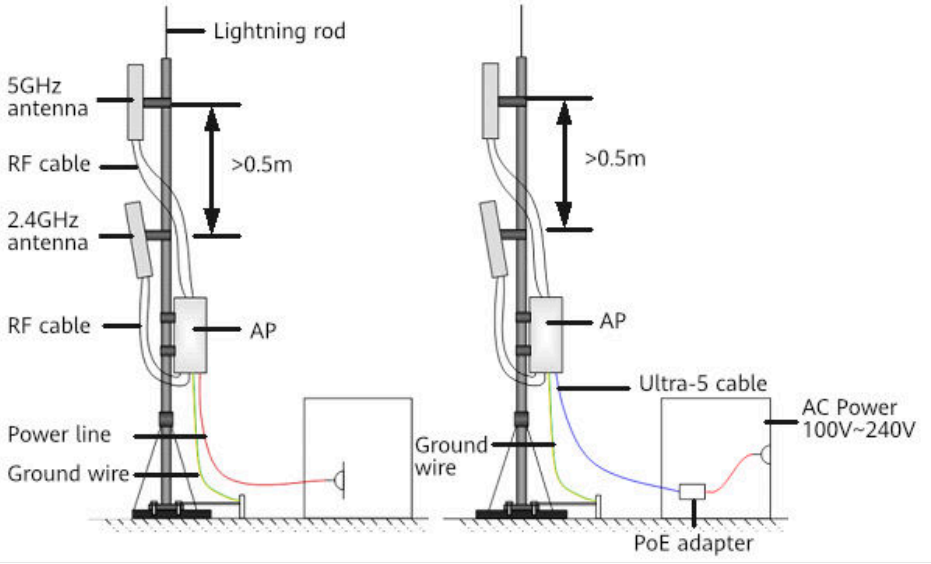
If an antenna is installed on a metal pole such as a steel pole, you do not need to install a lightning rod, as shown on the right in the preceding figure.

Outdoor AP Installation Scenarios

Figure 48-5 shows an outdoor AP installation scenario. The distance between a 2.4 GHz antenna and a 5 GHz antenna must be more than 0.5 m.

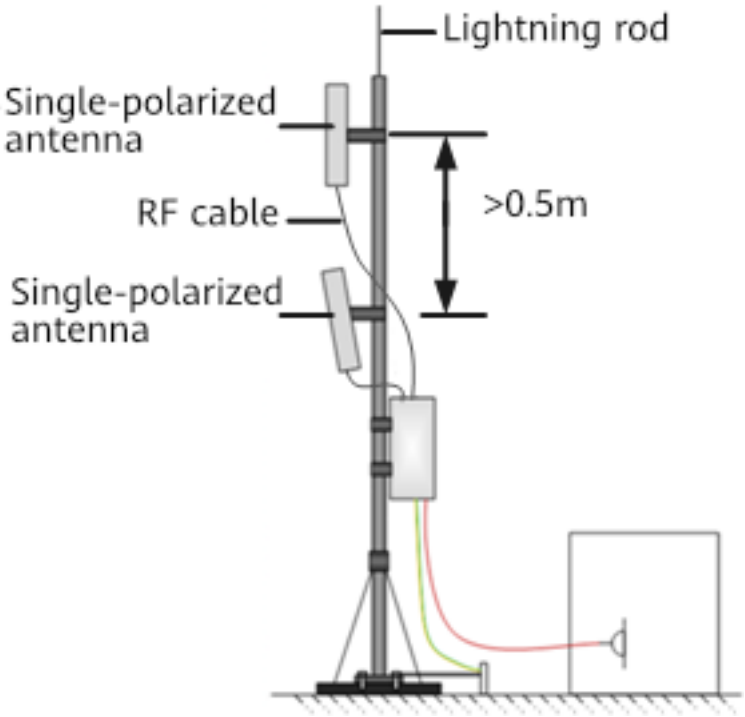
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Figure 48-5 Outdoor AP installation scenarios



The distance between two single-polarized antennas of the same AP should be more than 0.5 m, and the two antennas should cover the same area, as shown in **Figure 48-6**.

Figure 48-6 Installing single-polarized antennas



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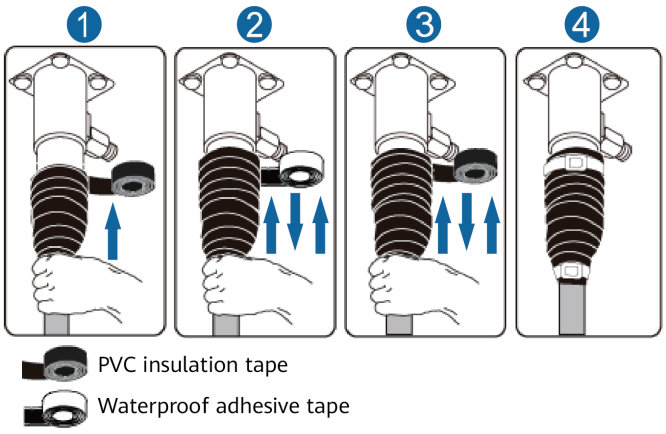
48.3.3 Connecting RF Cables

RF Cable Connection Requirements

The feeders of the same antenna must be connected to the 5 GHz RF ports on the same AP. The connection rules for antennas are the same as those for RF cables on the AP.

RF Cable Deployment Requirements

- Use a short feeder cable to connect the antenna to an AP.
- It is recommended that you connect a 50 ohm RF load to an idle antenna interface and wrap the RF load with both the insulation and waterproof tape.
- Wrap the RF cable in single-layer PVC insulation tape, triple-layer waterproof tape, and then triple-layer PVC insulation tape.
- Before wrapping the waterproof tape, stretch the tape evenly until it is 1/2 the width as before. With each layer of tape wrap the cable tightly and ensure that each layer covers more than 50% of the layer beneath it.
- Wrap the triple-layer tape from bottom to top, from top to bottom, and then from bottom to top again.



- Bend radius requirements: RG-8U RF cable: > 150 mm; 1/2" RF cable: > 50 mm; 7/8" RF cable: > 250 mm. One inch (1") equals 25.4 mm.

RF Cable Connections

1. Antenna interfaces of Huawei outdoor APs provide a 5 kA surge protection capability. In general, no additional surge protective device needs to be installed, and the RF cables are directly connected to the antenna interfaces with a tightening torque of 0.8 N·m.

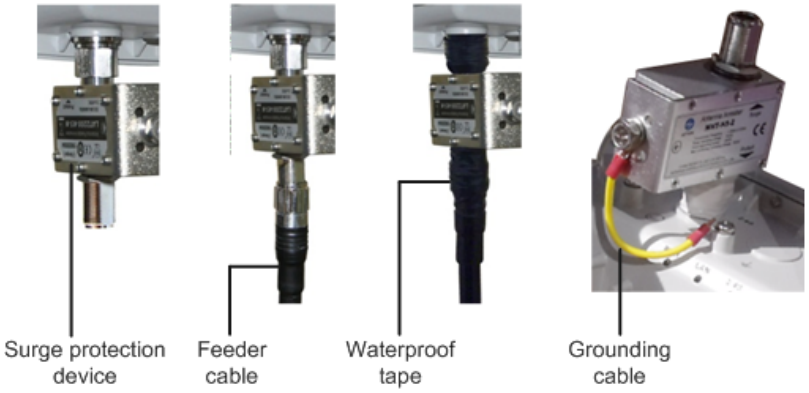


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NOTE

Outdoor APs support built-in surge protection on all interfaces, but the surge protection works only when the outdoor APs are grounded.

2. If a higher surge protection capability is required, you need to purchase a surge protective device separately. When installing the surge protective device, ensure that it is connected to a ground cable.



Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in Table **Coaxial cables and connectors**.

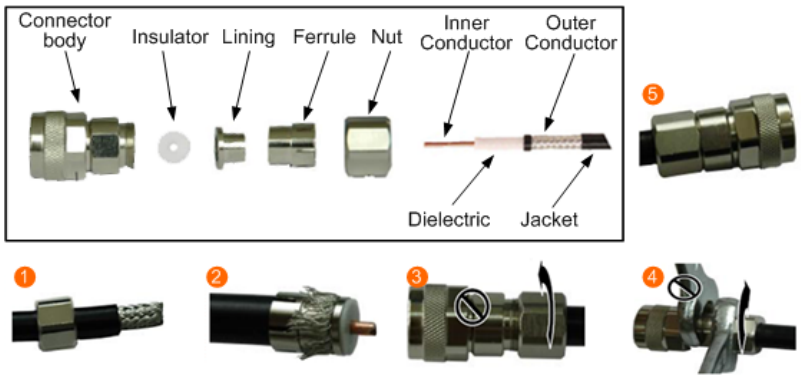
Table 48-3 Coaxial cables and connectors

Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U(25070009)	Type-N male connector (14040184)	• 2400MHz~2483.5MHz: 26.8dB/100m • 4920Mhz~5825Mhz: 41.8dB/100m	
1/2" (inch) super-flexible cable (25070076)	Type-N male connector (14040150)	• 2400MHz~2483.5MHz: 18.1dB/100m • 4920Mhz~5825Mhz: 30dB/100m	

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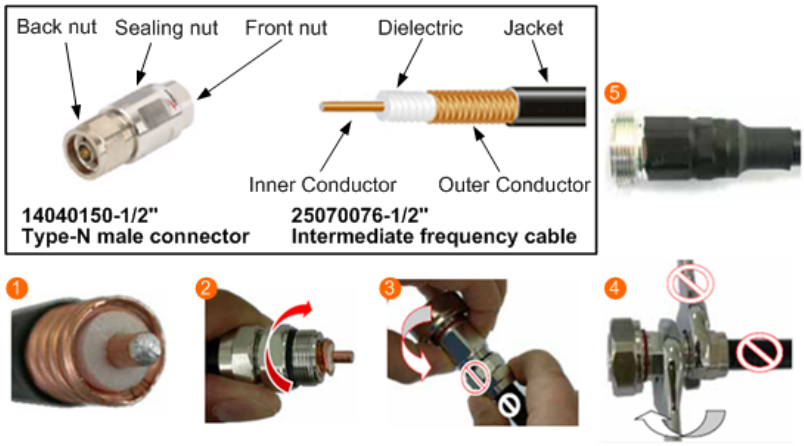
Connecting the type-N male coaxial connector to the RG-8U feeder cable

1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting the type-N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



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49 27014279 Mining 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H30 V30 G11&H15 V15 G15)

About This Chapter

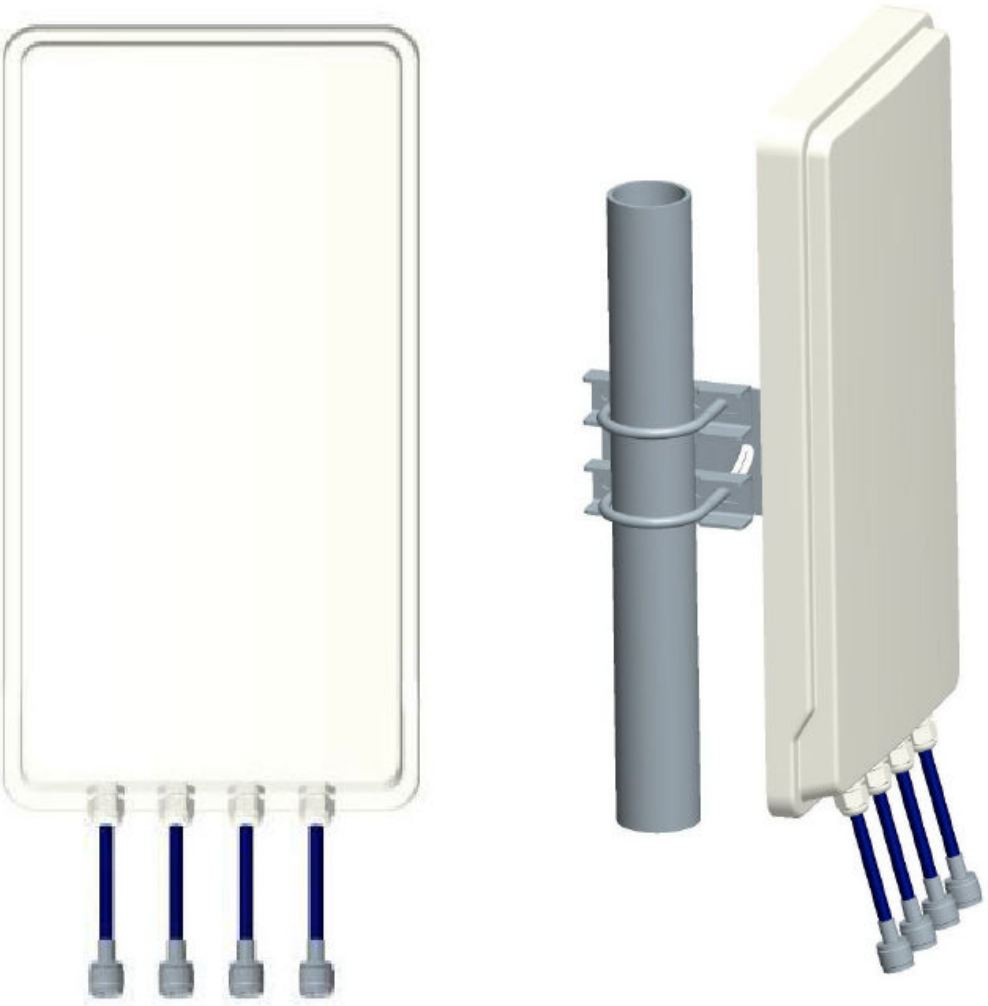
49.1 27014279 Technical Specifications
49.2 27014279 Antenna Installation

49.1 27014279 Technical Specifications

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Appearance and Structure

Figure 49-1 Appearance of the 27014279 Mining 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H30 V30 G11&H15 V15 G15)



Technical Specifications

Table 49-1 Technical specifications of the 27014279 Mining 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H30 V30 G11&H15 V15 G15)

Item	Details
Part Number	27014279
Model	ANTDG1115D4NM
Description	Directional Antenna,N -male,with bracket, 2400~2500MHz&5150~5850MHz, 4port, mining use

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Item	Details
Frequency [MHz]	2.4G: 2400-2500 5G: 5150-5850
Antenna gain [dBi]	2.4G: 11 5G: 15
Horizontal beamwidth [degrees]	2.4G: 30 5G: 15
Vertical beamwidth [degrees]	2.4G: 30 5G: 15
Standing wave ratio (SWR)	≤ 2.0
Polarization	Horizontal and vertical polarization
Attenna connector	N-male x 4 (two 2.4 GHz RF ports + two 5 GHz RF ports)
Attenna dimensions [mm(in.)]	45 mm x 450 mm x 240 mm (1.77 in. x 17.72 in. x 9.45 in.)
Weight without packaging [kg(lb)]	Antenna body (excluding cables): 2.7 kg (5.95 lb) Mounting bracket: 0.65 kg (1.43 lb)
Installation type	Pole
Grounding requirements	Same as the AP
Pole diameter [mm(in.)]	ϕ34 to ϕ50

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Item	Details
Attenna note	The gains and lobe widths are typical values, and the actual values are within a range. For specifications, see the corresponding data sheet. The coverage distance is a reference value in certain conditions. Plan an appropriate distance value according to Huawei planning experience, local standards, and onsite environments. There may be differences in the standards of different countries, so the mapping between antennas and APs shall comply with local standards. For details, refer to device access authentication information. The coverage distance is subject to the following constraints: - The default STA type is mobile phone, and no obstacle exists. - 2.4 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. - 5 GHz: The uplink and downlink RSSIs are greater than or equal to -75 dBm. For any questions about the parameters above, contact Huawei technical support.
Wind resistance	36 m/s

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Antenna's Radiation Pattern

Figure 49-2 Antenna Pattern1 of the 27014279 Mining 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H30 V30 G11&H15 V15 G15)

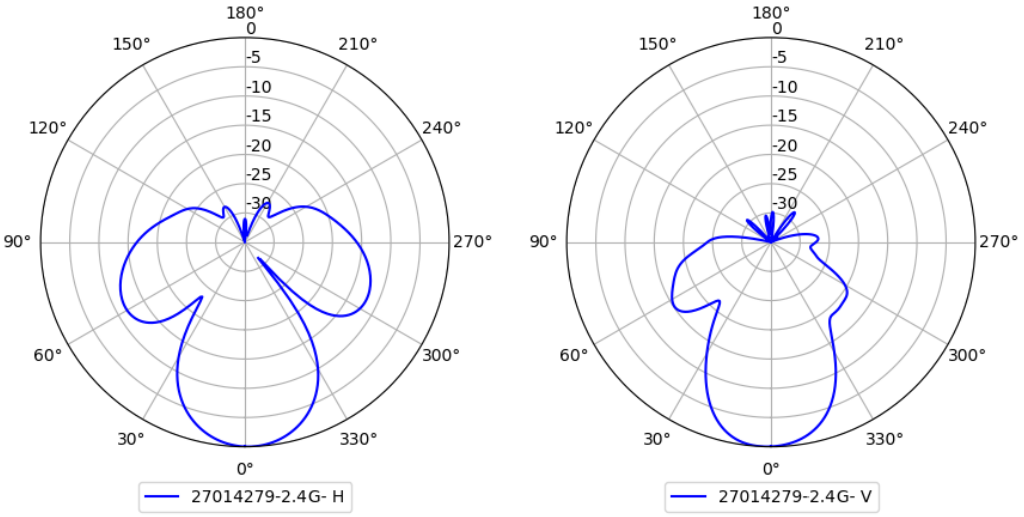
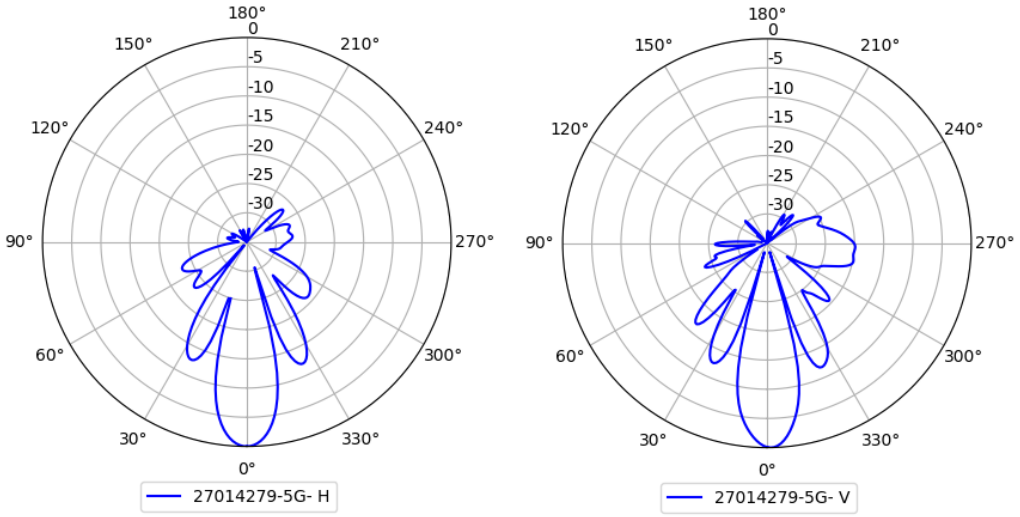


Figure 49-3 Antenna Pattern2 of the 27014279 Mining 2.4 GHz & 5 GHz Dual-Polarized Directional Antenna (H30 V30 G11&H15 V15 G15)



49.2 27014279 Antenna Installation

The 27014279 antenna is a mining-dedicated directional antenna and applies only to mining scenarios.

49.2.1 Accessories and Tools

Tools:

- Open-end wrench

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- 8 mm socket wrench or torque screwdriver
- Inclinometer



Pole:

- Pole with a diameter of ϕ34 mm to ϕ50 mm

Other accessories:

- L-shaped bracket x 1
- U-bracket x 2
- U-bolt x 2
- M8 spring washer x 4
- M8 flat washer x 4
- M8 hexagon nut x 4

49.2.2 Pole Mounting

The 27014279 antenna can be mounted on a pole. The wall thickness of the pole should be no less than 2.5 mm. A 50 mm diameter pole made of round steel is usually used.

⚠ CAUTION

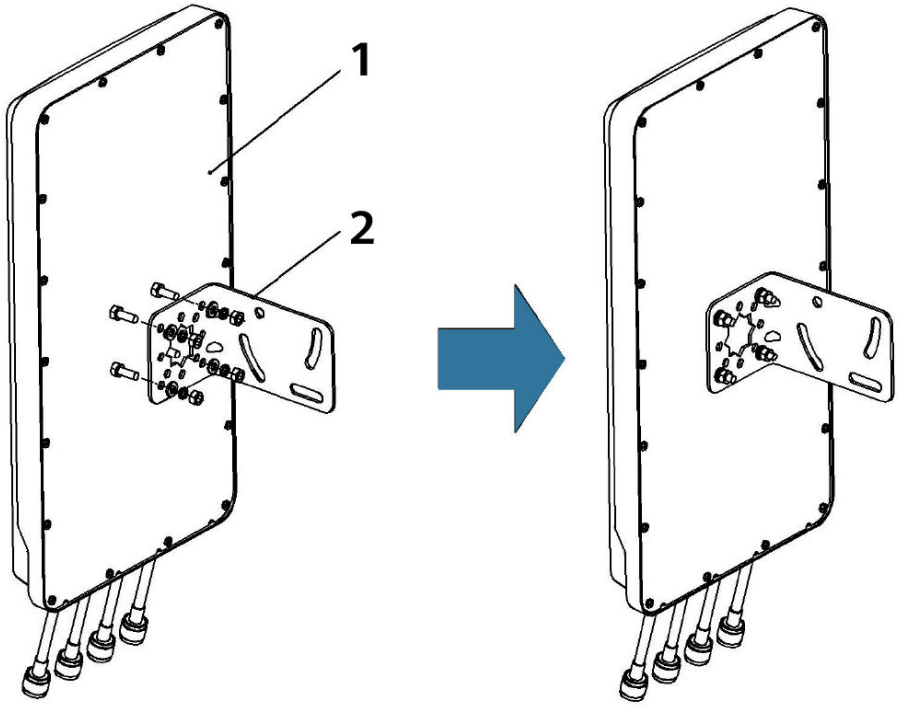
- The antenna must be installed in a place far away from high-voltage power supplies or radio signal interference sources (such as other APs or antennas).
- Do not install antennas in bad weather conditions, for example, during rain, snow, or strong winds.

1. Install the L-shaped bracket on the antenna.

No.	Name
1	Antenna
2	L-shaped bracket
3	U-bracket
4	U-bolt
5	M8 hexagon nut

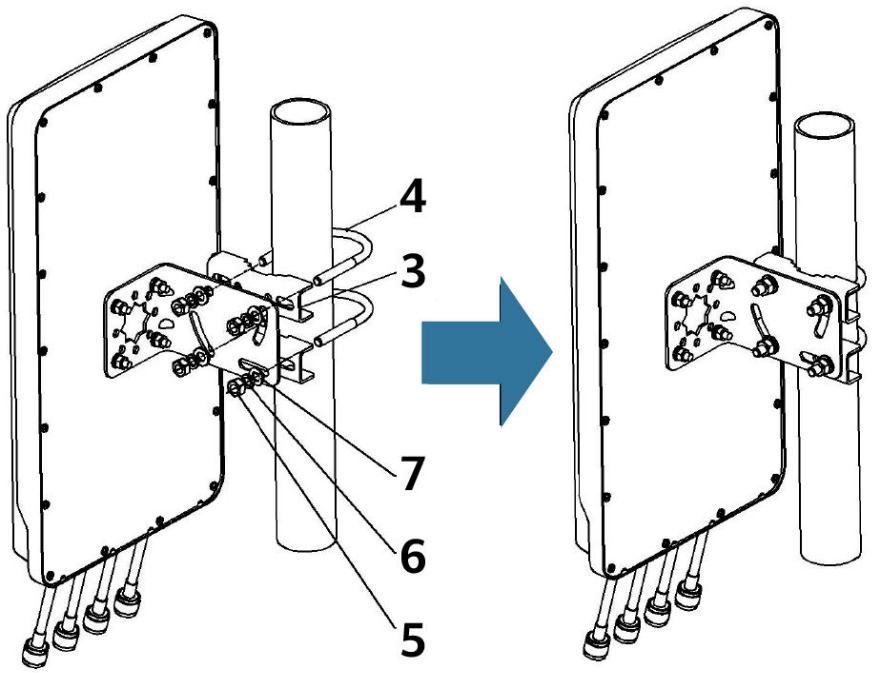
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6	M8 spring washer
7	M8 flat washer



2. Secure the antenna on the pole with an antenna support. Keep the pole vertical to the ground during the installation.

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NOTE

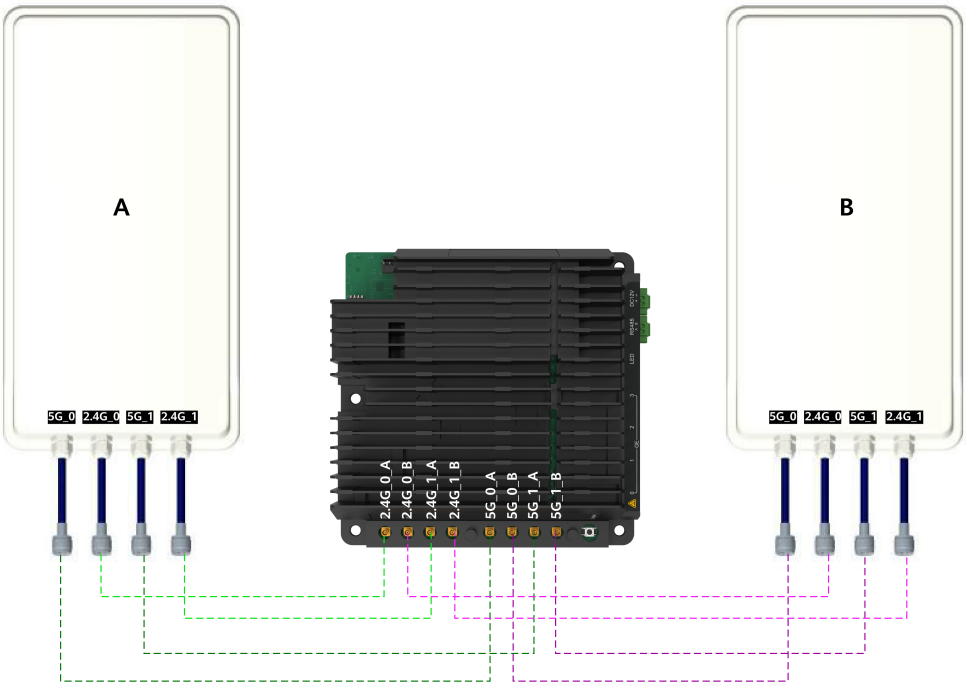
The mine wall may have protrusions that may block signals, and antennas need to be installed along drifts. The pole mounting mode is recommended so that APs are installed at a certain distance away from the wall. Keep antennas away from metal obstacles, and ensure that the transmit ends are not blocked by obstacles.

49.2.3 Connecting RF Cables

RF Cable Connections

One AirEngine 5761-11EI is configured with two mining 2.4 GHz and 5 GHz dual-polarized directional antennas (part number: 27014279), as shown in the following figure.

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RF cables are directly connected to RF ports with a tightening torque of 0.8 N·m.

RF Cable Deployment Requirements

- Generally, all the RF ports must be equipped with antennas. For idle RF ports, install 50-ohm RF loads and wrap the RF loads with insulation tapes and waterproof tapes. Huawei offers 50-ohm RF loads (part number: 27110001 or 27110231) for you to purchase.

Figure 49-4 27110001



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Figure 49-5 27110231



- When connecting to RF cables, the requirements of the bend radius are (1 inch = 25.4 mm):
  - RG-8U RF cable: > 150 mm
  - 1/2" RF cable: > 50 mm
  - 7/8" RF cable: > 250 mm

NOTICE

- Tighten the nut of the AP's RF connector with a torque of no more than 1.2 N·m.
- The grounding requirements of antennas are the same as those of APs.

Instructions on Making RF Cables

When making RF cables onsite, ensure that the coaxial cables and connectors in use comply with the mappings described in **Table 49-2**.

Table 49-2 Coaxial cables and connectors

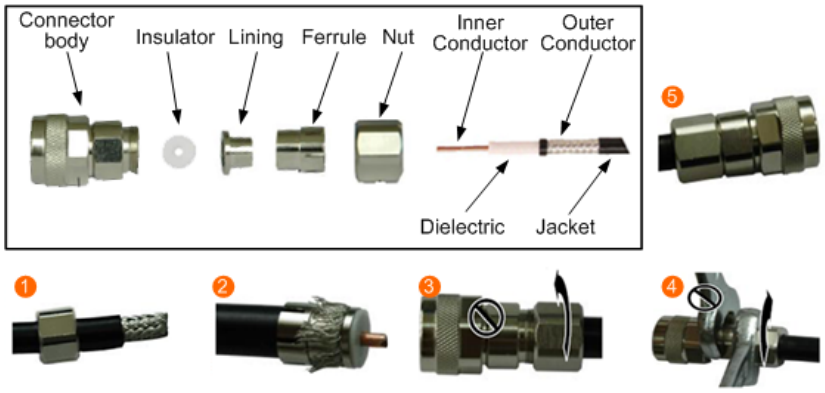
Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
RG-8U (25070009)	Type N male connector (14040184)	• 2400–2483.5 MHz: 26.8 dB/100 m • 4920–5825 MHz: 41.8 dB/100 m	

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Coaxial Cable	Coaxial Connector	Cable Loss	Appearance
1/2" (inch) super-flexible cable (25070076)	Type N male connector (14040150)	• 2400–2483.5 MHz: 18.1 dB/100 m • 4920–5825 MHz: 30 dB/100 m	

Connecting a Type N male coaxial connector to the RG-8U feeder cable

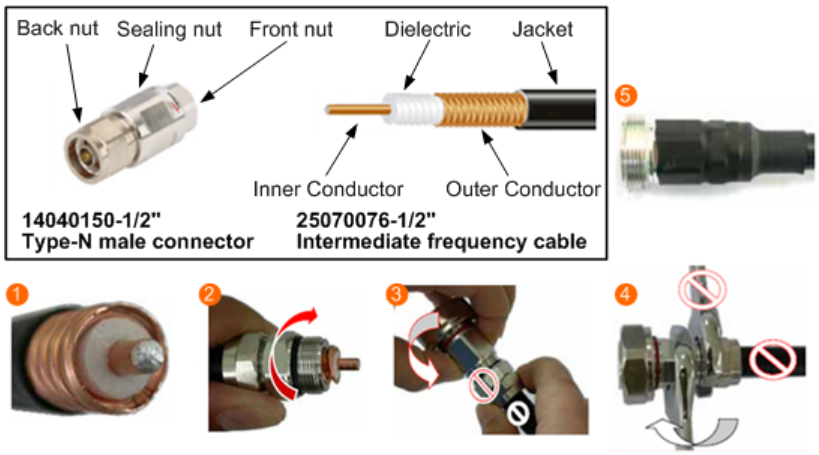
1. Peel the cable.
2. Install accessories, such as the nut.
3. Install the connector body.
4. Tighten the connector on the cable.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.



Connecting a Type N male coaxial connector to the 1/2" feeder cable

1. Peel the cable.
2. Install the back nut.
3. Install the front nut.
4. Put the cable through the heat-shrink tubing.
5. After assembly is complete, verify that cable attenuation is within the proper range. Take waterproof measures during the operation.

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50 27014400 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V110 G3&H360 V110 G5)

About This Chapter

50.1 27014400 Technical Specifications
50.2 27014400 Antenna Installation

50.1 27014400 Technical Specifications

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Appearance and Structure

Figure 50-1 Appearance of the 27014400 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V110 G3 & H360 V110 G5)

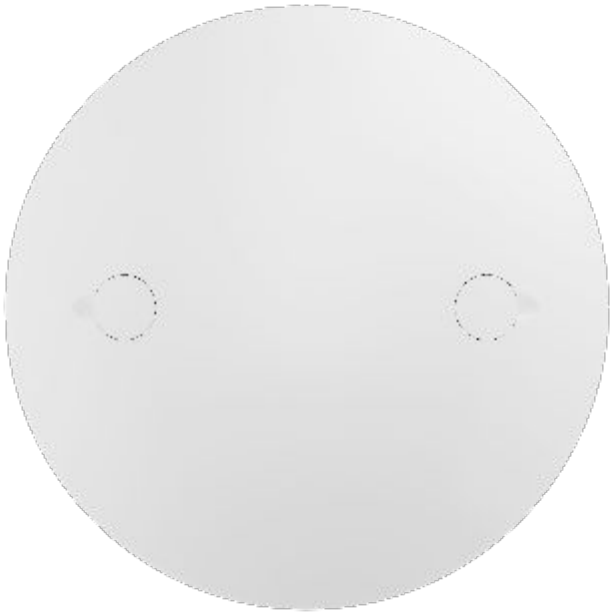


Figure 50-2 Structure of the 27014400 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V110 G3 & H360 V110 G5)



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Technical Specifications

Table 50-1 Technical specifications of the 27014400 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V110 G3 & H360 V110 G5)

Item	Details
Part Number	27014400
Model	ANTDG0405A1SR
Description	Omni-directional Antenna, 2400-2500MHz&5150MHz-5850MHz, 3dBi&5dBi,linear,omni,5W,SMA-K,with bracket,with bracket
Frequency [MHz]	2.4G: 2400-2500 5G: 5150-5850
Antenna gain [dBi]	2.4G: 3 5G: 5
Horizontal beamwidth [degrees]	360 degrees
Vertical beamwidth [degrees]	110 degrees
Standing wave ratio (SWR)	≤ 2
Polarization	Linear polarization
Attenna connector	SMA-K
Attenna dimensions [mm(in.)]	Diameter x Height: 104 mm x 19 mm (4.09 in. x 0.75 in.)
Weight without packaging [kg(lb)]	0.07 kg (0.15 lb)
Installation type	• Celling • Wall
Attenna note	The gain and lobe width are typical values. The actual values are within a range. For details about the specifications, see the data sheet.

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Antenna's Radiation Pattern

Figure 50-3 Antenna Pattern1 of the 27014400 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V110 G3 & H360 V110 G5)

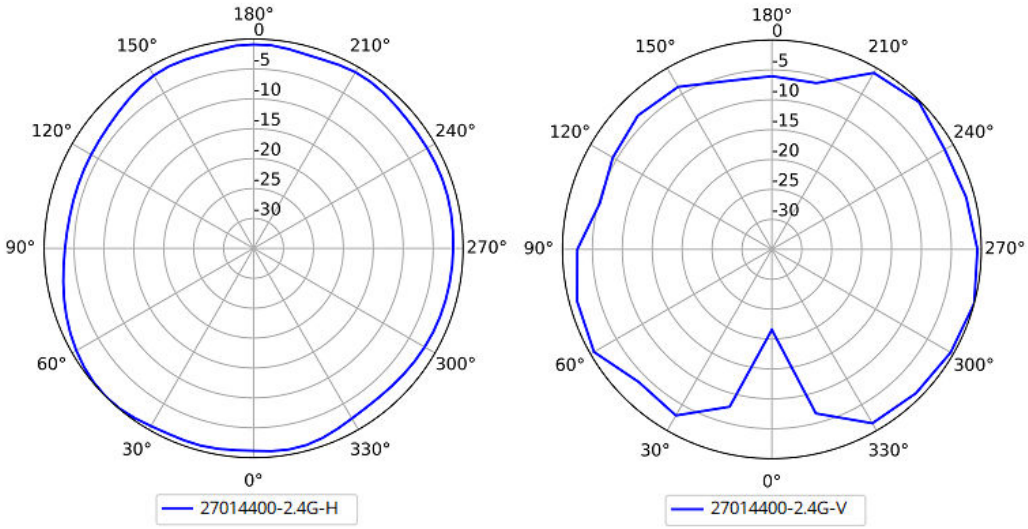
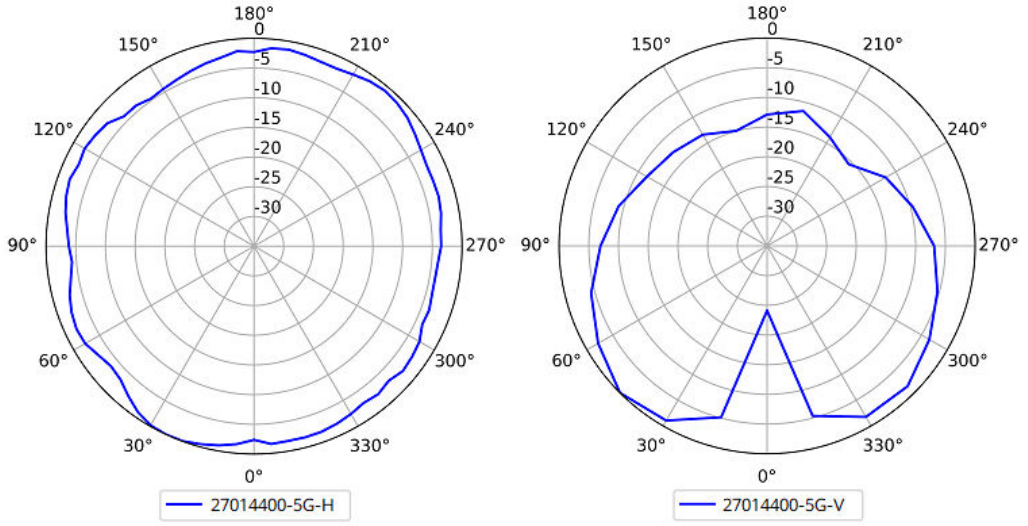


Figure 50-4 Antenna Pattern2 of the 27014400 Indoor 2.4 GHz & 5 GHz Single-Polarized Omnidirectional Antenna (H360 V110 G3 & H360 V110 G5)



50.2 27014400 Antenna Installation

The 27014400 antenna is a distributed antenna and applies to zero-roaming distributed scenarios.

50.2.1 (Recommended) Ceiling Mounting

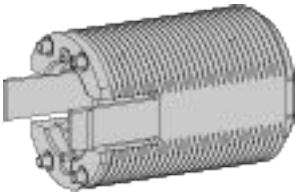
Background

It is recommended that you install an AU on the ceiling by using a nut plate and a stud. If the RF feeder is long enough and the construction conditions permit,

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ceiling mount the AU in the center of the room to achieve better coverage. Keep the excess of feeders on the AU side.

The following table lists the required auxiliary materials.

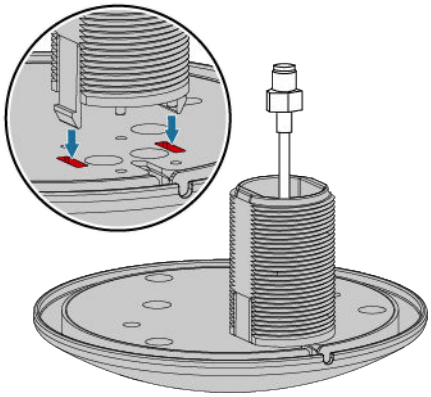
Name	Quantity	Description
Stud (diameter: 28 mm) 	1	Clamped to the rear of the AU and put through the ceiling.
Nut plate 	1	Used to clamp the AU to the ceiling.

If it is inconvenient to tighten the nut plate on the ceiling, prepare two sets of hollow wall anchors or toggle bolts and install the AU on the ceiling. For details, see **50.2.3 Description of Mounting an AU on a Plasterboard Ceiling**.



Procedure

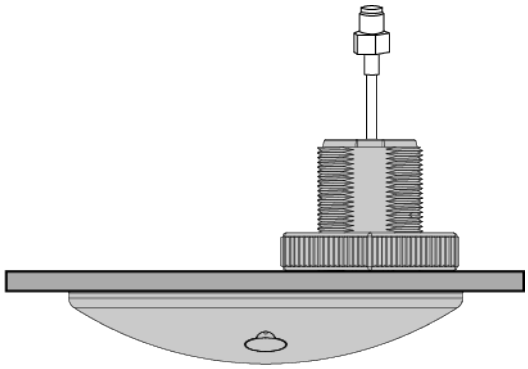
Step 1 Lead the RF feeder at the rear of the AU through the stud, and then fasten the stud to the AU.



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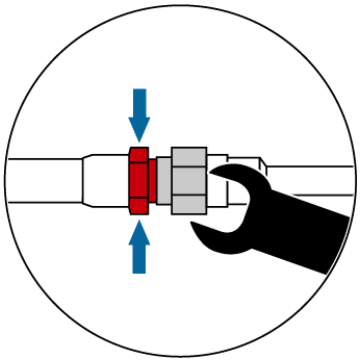
Step 2 In the selected installation position, use a hole driller to drill a hole with a diameter of 30 mm on the ceiling.

Step 3 Lead the stud fastened to the AU through the hole in the ceiling, and then use a nut plate to tighten the stud on the back of the ceiling.



Step 4 Connect the RF feeder of the AU to the pre-routed RF feeder connected to an ORU.

Use a torque wrench to tighten the feeder connector with a torque of 1 N·m. Before tightening the torque wrench, secure the connector by referring to the following figure.



If the ORU is powered on, the white indicator for the RF port on the ORU is on after the AU is connected to the ORU, as shown in the following figure.



----End

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50.2.2 Wall Mounting

Background

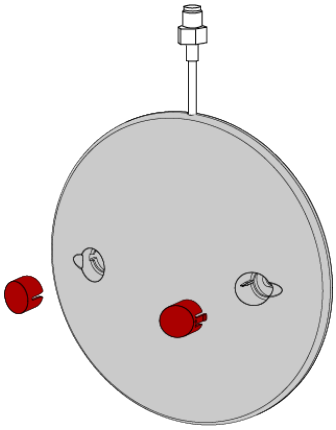
If the RF feeder is long enough and the construction conditions permit, deploy the AU in the center of the room to achieve better coverage. Keep the excess of feeders on the AU side.

The following table lists the required auxiliary materials.

Name	Quantity	Description
ST3.5 expansion screw + expansion tube	2	Used to secure an AU to the wall.

Procedure

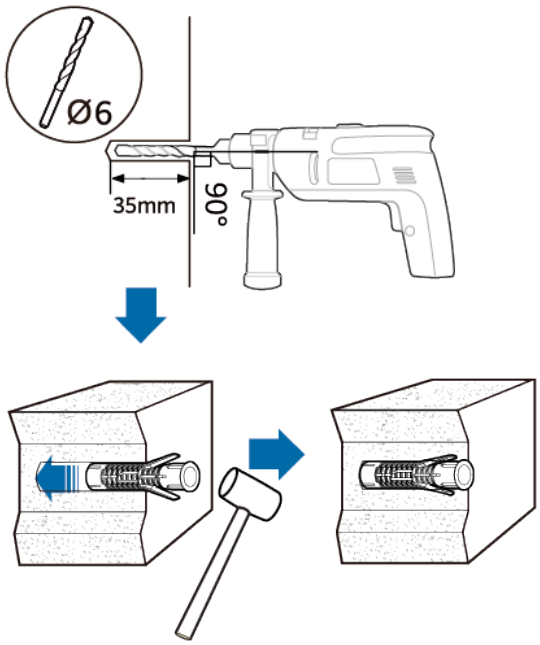
Step 1 Use a tool, such as tweezers, to remove the caps from the two screw holes on an AU.



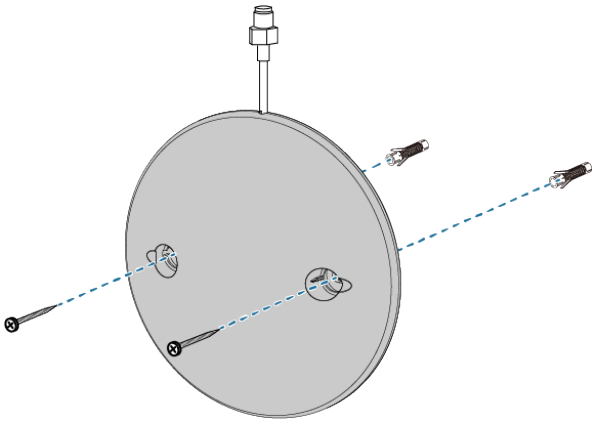
Step 2 Place the AU against the wall according to the direction of the feeder, and then use a marker to mark the positions for drilling holes (with a horizontal spacing of 60 mm).

Step 3 Drill holes at the marked positions. Hammer the expansion tubes into the holes until the expansion tubes are flush with the wall.

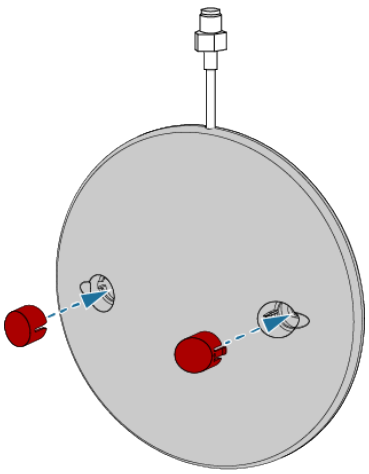
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Step 4 Secure the AU to the wall using self-tapping screws.



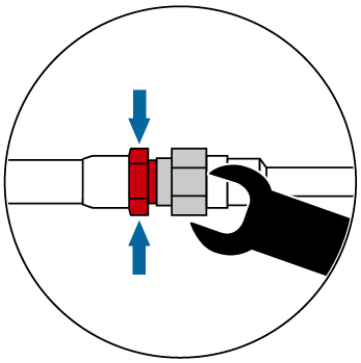
Step 5 Place caps on the screw holes.



Step 6 Connect the RF feeder of the AU to the pre-routed RF feeder connected to an ORU.

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Use a torque wrench to tighten the feeder connector with a torque of 1 N·m. Before tightening the torque wrench, secure the connector by referring to the following figure.



If the ORU is powered on, the white indicator for the RF port on the ORU is on after the AU is connected to the ORU, as shown in the following figure.



----End

50.2.3 Description of Mounting an AU on a Plasterboard Ceiling

Background

For a plasterboard ceiling with a thickness of 10 mm to 25 mm, if it is inconvenient to tighten the nut plate on the plasterboard ceiling, prepare two sets of hollow wall anchors or toggle bolts and matching tapping screws for installing the AU. The method of securing an AU is similar to that of installing an AU on the wall.

Figure 50-5 Hollow wall anchors and toggle bolts + tapping screws

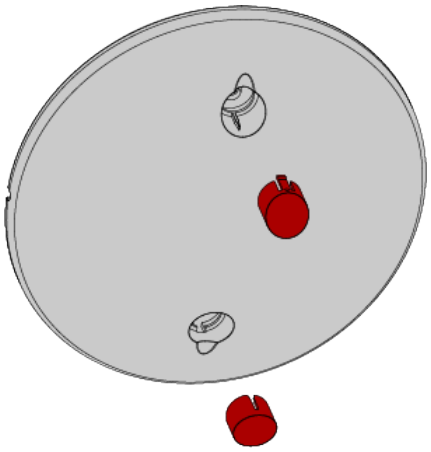


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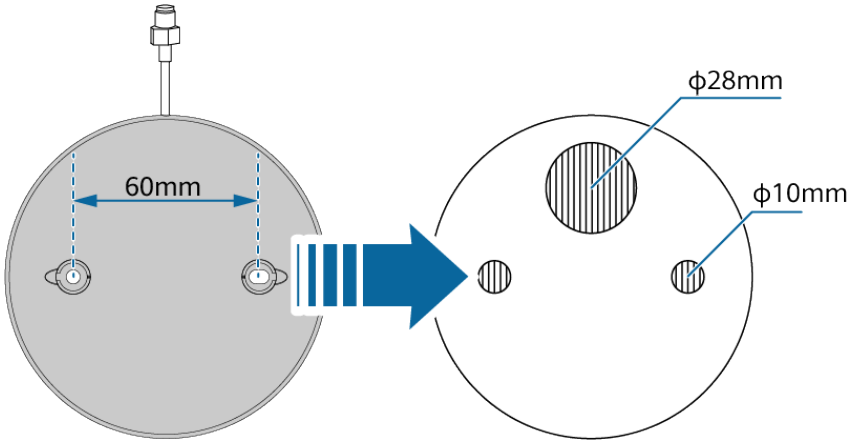
Procedure

This section uses a toggle bolt as an example to describe the installation procedure.

Step 1 Use a tool, such as tweezers, to remove the caps from the two screw holes on an AU.



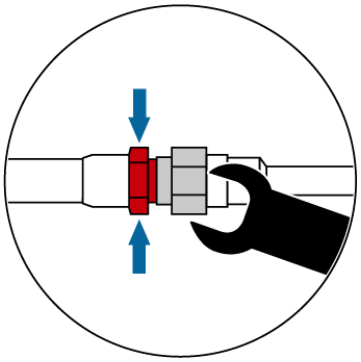
Step 2 Drill two small holes and one large hole on the plasterboard ceiling by referring to the outline and holes of the AU.



Step 3 Lead the pre-routed feeder out of the big hole and connect it to the RF feeder of the AU.

Use a torque wrench to tighten the feeder connector with a torque of 1 N·m. Before tightening the torque wrench, secure the connector by referring to the following figure.

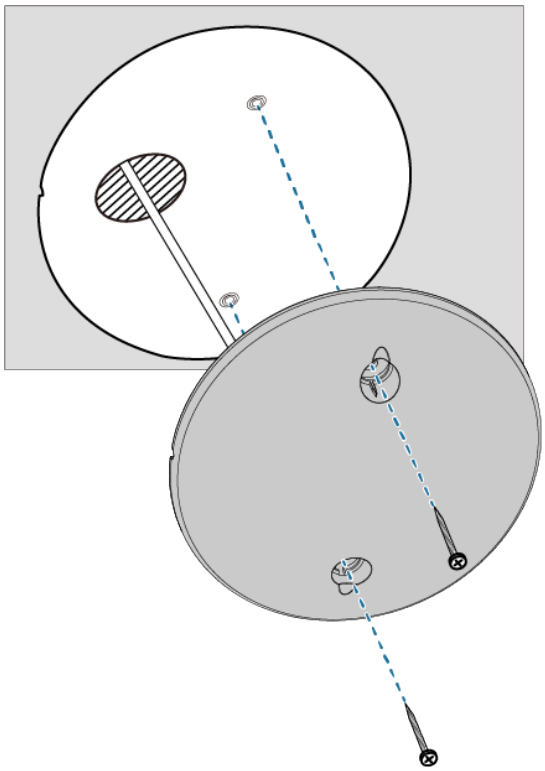
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If the ORU is powered on, the white indicator for the RF port on the ORU is on after the AU is connected to the ORU, as shown in the following figure.

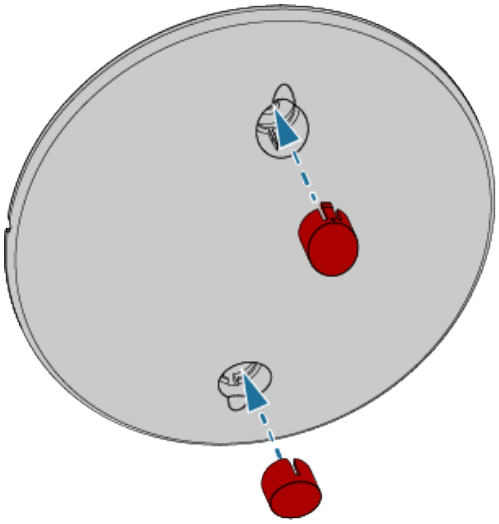


Step 4 Insert the expansion tubes into the two small holes and hammer two self-tapping screws into the tubes to fix the AU.



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Step 5 Place caps on the screw holes.



----End

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