



# Nova-233 G2 (mBS1105) Outdoor LTE TDD Base Station

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## Installation Guide

## About This Document

This document is a guidance of Nova-233 generation2 (G2) hardware installation for installation personnel, including the preparation of installation tools and supporting materials, the demands for installation environment, installation procedure, cable connection and power on.

Accomplish the installation of the device according to this guide, the installation personnel can avoid potential damage to the device during the installation procedure, which makes sure the subsequent good running of the device.

This document suits for the models of mBS11xx series base station.

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## Revision Record

Date	Version	Description
20 Nov, 2017	01	Initial Released.
16 Jan, 2018	02	Optimize descriptions and fix some bugs.
4 Apr, 2018	03	Fix bugs.
31 Mar, 2018	04	Change the installation bracket.

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# 1. Product Overview

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## 1.1 Introduction

Baicells Nova-233 G2 is high performance outdoor micro base station based on LTE TDD technology, which is developed by Baicells. The Nova-233 G2 supports wired backhaul connections to backbone networks, and provides LTE access to user terminals, implemented voice and data service transmissions.

The Nova-233 G2 makes use of the current transmission resources to reduce the operator's investment, implement the low-cost construction of LTE networks and enhance indoor coverage, thereby providing high-speed broadband access for users in assembly occupations.

The Nova-233 G2 can be widely used by telecom operators, broadband operators, enterprises, and so on.

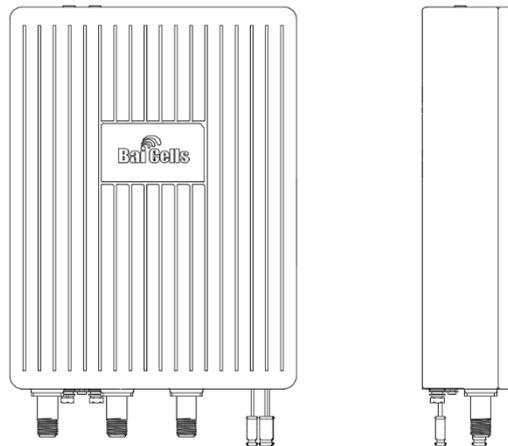
## 1.2 Features

- Adopt the integration design of baseband and RF.
- Based on 3GPP international standard LTE-TDD technology; provide high speed data service; support peak rate of DL: 110Mbit/s, UL: 14Mbit/s with 20MHz spectrum.
- Support flexible uplink and downlink time slot ratio: 1(2:2), 2(1:3), and high speed data transmission.
- Support 10MHz/20MHz operation bandwidth.
- Support copper (RJ-45) and optical port backhaul, flexible to deploy.
- Security services to provide timely protection against potential security risks and illegal intrusion.
- Support simple and convenient local and remote web management.
- Integration as required, easy to installation and deployment, accurate coverage and improved network capacity.
- Support network management functions, which includes the management, monitoring and maintenance.

### 1.3 Appearance

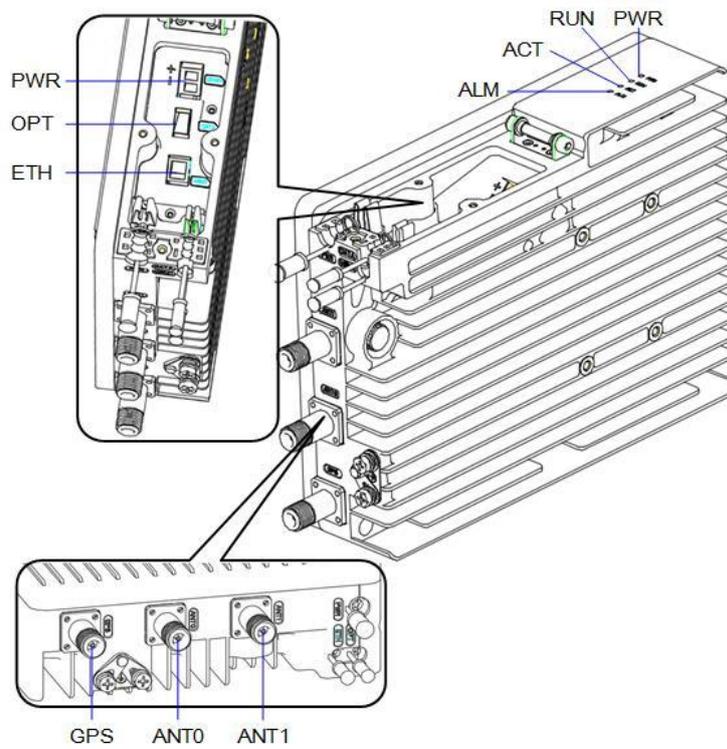
The Nova-233 G2 base station appearance is shown in Figure 1-1.

Figure 1-1 Nova-233 G2 Appearance



The Nova-233 G2 interfaces and indicators are shown in Figure 1-2.

Figure 1-2 Nova-233 G2 Interfaces and Indicators



The Nova-233 G2 interfaces are described in Table 1-1.

Table 1-1 Nova-233 G2 Interface Description

Interface Name	Description
PWR	Power interface: +48V (+42V~+60V) DC
GPS	External GPS antenna, N-female connector.
ANT0	External antenna 0, N-female connector.
OPT	Optical interface, connect to external transmission network, used for data backhaul.
ETH	RJ-45 interface, used for debug or data backhaul.
ANT1	External antenna 1, N-female connector.

The Nova-233 G2 interface indicators are described in Table 1-2.

Table 1-2 Nova-233 G2 Interface Indicators

Identity	Color	Status	Description
PWR	Green	Steady On	Power On
		OFF	No Power Supply
RUN	Green	Fast flash: 0.125s on, 0.125s off	The board is loading.
		Slow flash: 1s on, 1s off	The board is normal.
		OFF	No power input or board fault
ACT	Green	Steady On	The transmitting channel works normally
		OFF	The transmitting channel works abnormally
ALM	Red	Steady On	Hardware alarm, e.g. VSWR alarm
		OFF	No alarm

## 1.4 Technical Specification

### 1.4.1 Hardware Specification

Item	Description
LTE Mode	LTE TDD
LTE Band	band48 (3550 MHz ~ 3700 MHz)
Channel Bandwidth	10/20 MHz
MAX Output Power	30dBm/Ant

Item	Description
Receive Sensitivity	-100 dBm
Synchronization	GPS, 1588 V2
Backhaul	1 Optical (SFP) and 1 RJ-45 Ethernet interface (1 GE)
MIMO	DL 2 x 2
Dimension	227mm (H) x 305mm (W) x 74mm (D)
Installation Type	Pole, wall
Antenna	External 17dBi directional antenna Vertical beamwidth: 35° Horizontal beamwidth:65° Downtilt angle: 8.5° Height: 30m
Overall Power	< 45 W
Power	48V DC, AC adaptor (multi-national standards)
Weight	About 4.4 kg

**Note:** The test method of receiving sensitivity is proposed by the 3GPP TS 36.104, which is based on 5MHz bandwidth, FRC A1-3 in Annex A.1 (QPSK, R=1/3, 25RB) standard.

## 1.4.2 Software Specification

Item	Description
LTE Standard	LTE TDD 3GPP Release 9
Maximum Throughput	<ul style="list-style-type: none"> <li>• 20 MHz: <ul style="list-style-type: none"> <li>SA1: DL 80 Mbps, UL 28 Mbps</li> <li>SA2: DL 110 Mbps, UL 14 Mbps</li> </ul> </li> <li>• 10MHz: <ul style="list-style-type: none"> <li>SA1: DL 40 Mbps, UL 14 Mbps</li> <li>SA2: DL 55 Mbps, UL 7 Mbps</li> </ul> </li> </ul>
Business Capacity	96 concurrent users
Modulation Mode	UL: QPSK, 16QAM, 64QAM DL: QPSK, 16QAM, 64QAM
Voice Solution	CSFB, VoLTE, eSRVCC
Traffic Offload	LIPA (Local IP Access) SIPTO (Selected IP Traffic Offload)
SON	Automatic setup ANR (Automatic Neighbor Relation) PCI confliction detection
Spectrum Scanning	Supported
UL Interference Detection	Supported
RAN Sharing	Supported
Network Management	TR069

Item	Description
Interface	
MTBF	≥ 150000 hours
MTTR	≤ 1 hour
Maintenance	Support remote/local maintenance, based on SSH protocol
	Support remote maintenance
	Support online status management
	Support performance statistics
	Support failure management
	Support configuration management
	Support local or remote software upgrading and loading
	Support log
	Support connectivity diagnosis
	Support automatic start and configuration
	Support alarm reporting
	Support KPI Recording
	Support user information tracing
Support signaling trace	

### 1.4.3 Environment Specification

Item	Description
Operating Temperature	-40°C to 55°C
Storage Temperature	-45°C to 70°C
Humidity	5% to 95%
Atmospheric Pressure	70kPa to 106kPa
Ingress Protection Rating	IP66
Power interface Lightning Protection	Differential mode: ±10 KA Common mode: ±20 KA

### 1.4.4 FCC Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for

compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**Warning:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 61cm between the radiator & your body.

## 2. Installation Preparation

### 2.1 Support Materials

Prepare the following support materials accordingly, as given in Table 2-1.

Table 2-1 Support Materials

Item	Description
Power cable	< AWG16 e.g. AWG14 Shorter than 100m
Power plug	The power plug connecting to the electricity supply.
Antenna RF cable	50 ohm feeder
Optical fiber	Single mode optical fiber
Ethernet cable	Outdoor CAT6 Shorter than 100m
Antenna	Omnidirectional, or directional antenna
Ground cable	16mm <sup>2</sup> yellow-green wire

### 2.2 Installation Tools

The following tools are needed during the installation.

				
Level bar	Marking pen	Knife	Vise	Wrench
				
Percussion drill and some drill heads	hammer	Cross screw driver	Cable vice	Tape measure
				
5mm L-shape allen wrench	T7 screwdriver head	Ladder		

## 2.3 Installation Environment

### 2.3.1 Locational Requirements

Environments with high-temperatures, harmful gases, unstable voltages, volatile vibrations, loud noises, flames, explosives, and electromagnetic interference (large radar stations, transmitting stations, transformer substations) are not suitable for the operation of Nova-233 G2, and thus should be avoided.

Places prone to have impounded water, soaking, leakage, or condensation, should also be avoided.

Factors like climate, hydrology, geology, earthquake, electric power, and transportation should be taken into consideration in the construction process so that a proper location can be chosen to meet the communication engineering environmental requirements, as well as the technical requirements of network planning and communication equipment.

### 2.3.2 Environmental Requirements

Table 2-2 gives the base station's environmental requirements with regards to temperature, humidity, and voltage.

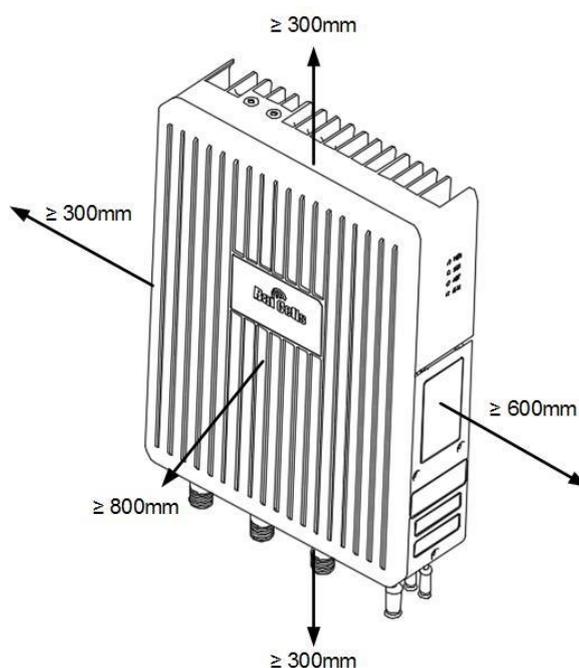
Table 2-2 Environmental Requirements

Item	Range	Typical value
Temperature	-40°C to 55°C	25°C
Relative humidity (no condensation)	0% to 100%	5% to 95%
Safety voltage	42V to 58V	48V

### 2.3.3 Space Requirements

After the base station has installed, the enough space must be provided for operation and maintenance. And for heat dissipation and normal running of the base station, the space must be planed before installation, as shown in Figure 2-1.

Figure 2-1 Installation Space Requirement



## 2.4 Personnel Requirements

The installation personnel must master the basic safe operation knowledge, through the training, and having the corresponding qualifications.

## 2.5 Against Lightning and Grounding Protection



### CAUTION:

It is unlikely to happen but since the LTE base station is very sophisticated equipment so we would recommend you to test it on the ground to make sure everything is functioning before install on the tower.

The operator must prepare external against lightning protector to protect the GPS, external antenna and RJ-45 port.

#### Grounding Notes:

- The ground wire adopts yellow-green wire that is no smaller than 16 mm<sup>2</sup>.
- Grounding principle: as near as possible.
- The base station connects to the reliable outdoor grounding point (earth) through one ground screw.
- The connection of the grounding points and the ground bar need to be tight and

reliable. Rustproofing the terminals is required. This can be done with rust preventing paint, anti-oxidation coatings, grease, and so on.

## 2.6 Weatherproof Protection

The Nova-233 G2 adopts cold shrink tube for weatherproof protection. Before installing the cold shrink tube, clean up the interface first. The weatherproof protection steps are as follows:

1. Insert cable into cold shrink tube.
2. Tighten the connector.
3. Push the cold shrink tube to the top joint and pull out the strip.
4. Check whether the cold shrink tube tight connect with the connection.



## 3. Base Station Installation

### 3.1 Unpacking

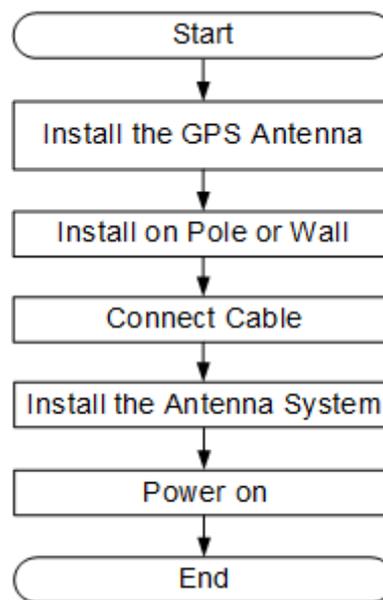
Before opening the box, make sure the package is in good condition, undamaged and not wet. During the unpacking, avoid potential damaging impacts from hits or excessive force.

Once unpacked, check whether the quantity are consistent with the packing list.

### 3.2 Installation Procedure

The installation procedure of Nova-233 G2 is given in Figure 3-1.

Figure 3-1 Installation Procedure of Nova-233 G2



### 3.3 Install GPS Antenna

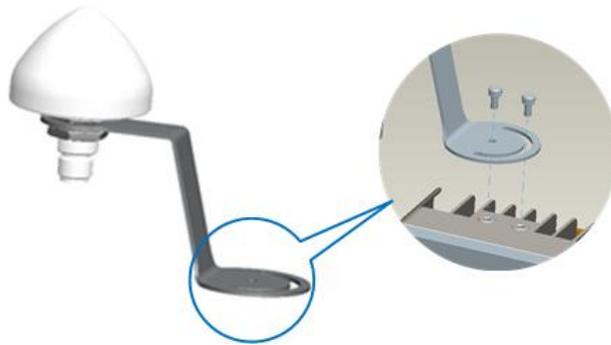
Installation requirements on the GPS antenna:

- No major blocking from buildings in the vicinity. Keep the rooftop buildings a distance away from the GPS. Make sure the space atop within 90 degrees (at least 45 degrees) is not blocked by any buildings.
- Avoid installing the GPS in the vicinity of any other transmitting and receiving

devices. Avoid interference from other transmitting antennas to the GPS antennas.

- Should be installed within 45 degrees to the lightning rod.

The GPS has been assembled before packing, the only installation step is to fix the GPS mounting bracket on the base station using the M4 x 14 screws.



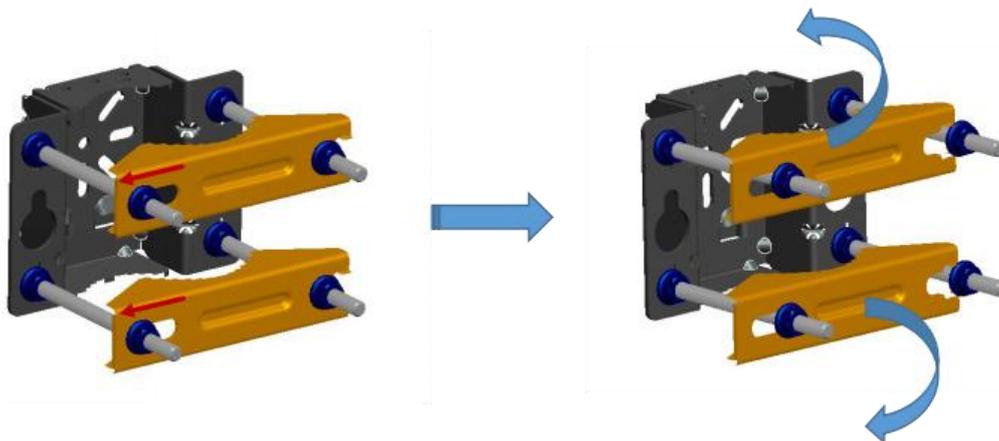
### 3.4 Install on Pole

Required diameter of the pole: 40mm ~ 100mm.

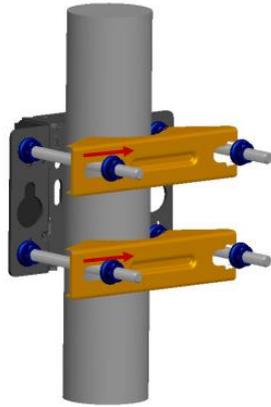
Suggest the installation height higher than 120cm, and the installation space requirements meet the requirements in “2.3.3 Space Requirements”.

The mount bracket has been assembled before packing.

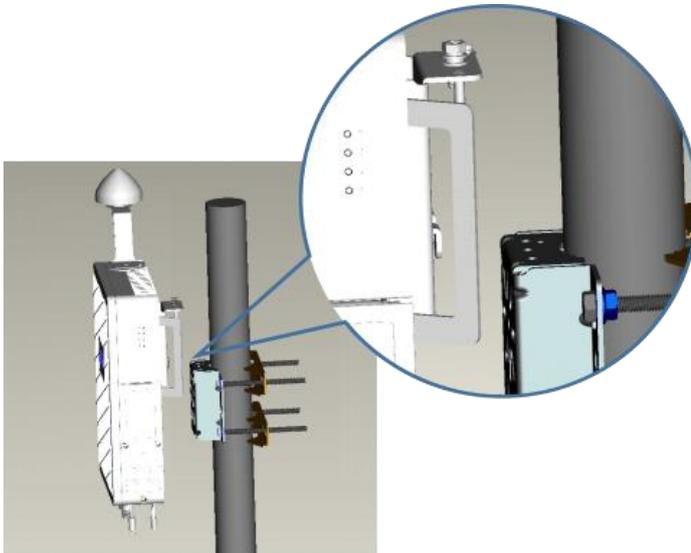
1. Unscrew the four screws of the assembled bracket and slide the two omegas to the left as the following figure, and then turn the two omegas up or down.



2. Make sure the base station's installation height, fit the thread rod of the assembled bracket to the pole, and then turn the two omegas to proper position as the following figure, and slide the two omegas to the right, and then fasten the four screws.



3. As the following figure, hung the two pins on the base station bracket to the installation bracket, push the base station until the hook block to the base station bracket.



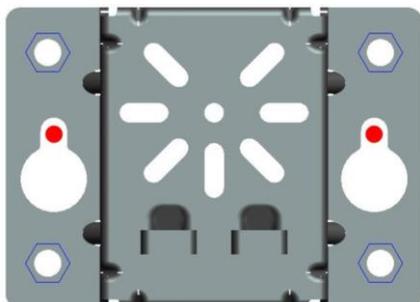
4. Tighten two screws on the top of the bracket using cross screwdriver to complete the installation.



## 3.5 Install on Wall

The wall must bear four times of the base station's weight.

1. Take apart the assembled installation bracket kit to get the installation bracket.
2. Fit the bracket on the wall, and mark the drilling locations.



### Caution:

The arrow of the installation bracket must be upward.

3. Drill two 10mm diameter and 70mm depth holes in the wall on the marked locations, and insert the expansion pipes.
4. Check the up/down direction of the installation rack, and then fix base station to the wall with M8 x 80 expansion bolts.
5. Refer to the installation steps on pole, fix base station on wall.

## 3.6 Connect Cable

### 3.6.1 Requirement for Cable Laying

#### General requirements:

- Bending radius requirement of feeder cable: 7/8" > 250mm, 4/5" > 380mm.
- Bending radius requirement of jumper cable: 1/4" > 35mm, 1/2" (super soft) > 50mm, 1/2" (ordinary) > 127mm.
- Bending radius requirement of power cable and grounding cable: > tripled of the diameter of cable.
- The minimum bend radius of the optical fiber is the 20 times of the diameter of optical fiber.
- Binding the cables according the type of the cable, the intertwining and crossing is forbidden.

- The label should be paste after the cable laying.

**Optical fiber laying requirement:**

- The circling and twisting is forbidden during the laying.
- The binding on the turning is forbidden.
- The pulling and weigh down the optical fiber is forbidden.
- The redundant optical fiber must enwind the dedicated device.

**Grounding laying requirement:**

- The grounding cable must connect to the grounding point.
- The grounding cable must be separate with the signal cables, remaining a certain distance to avoid the interruption of signal.

### 3.6.2 Connect GPS Antenna

1. Insert GPS jumper into cold shrink tube.
2. Connect one end of the GPS jumper to the GPS antenna.
3. Push the cold shrink tube to the top joint and pull out the strip.
4. Connect the other end of the GPS jumper to **GPS** interface of the base station, which also need weatherproof protection.

### 3.6.3 Connect RF Cable

1. Open the dust cap of **ANT0** and **ANT1** interface.
2. Insert RF cables into cold shrink tube.
3. Connect one end of the two RF cables to **ANT0** and **ANT1** interface of the base station and tighten them with wrench.
4. Push the cold shrink tube to the top joint and pull out the strip.
5. Connect the other end of the RF cables to the external antenna, which also need weatherproof protection.

### 3.6.4 Connect Optical Fiber

1. Unscrew three screws on the cover of wiring cavity using M4 cross screwdriver and open the wiring cavity.
2. Connect the optical fiber to **OPT** interface in the wiring cavity.

3. Lay optical fibers along the wire groove, and stretch out the wiring cavity from **OPT** hole.

The redundant fiber should wind neatly.

### 3.6.5 Connect Ethernet Cable

1. Connect the Ethernet cable to **ETH** interface in the wiring cavity.
2. Lay Ethernet cable along the wire groove, and stretch out the wiring cavity from **ETH** hole.

### 3.6.6 Connect Power Connector

Because it is not sure that the distance between the installation site and the power supply device, the two ends of power adapter are bare terminal end. The operators need to make power cable according to the actual conditions on installation site, and assemble power plug and power terminal on two ends of power adapter.

Strip 12mm insulating layer with wire stripper, which is used for connection to connector. It is recommended that the power cord length is kept below 100m (330 feet).

The connection steps of power cable is as follows.

1. Assemble power plug.

The power plug will be installed on the end of input direction. Refer to the identification on power plug, connect live wire, neutral wire, and ground wire to corresponding terminals separately, and tighten screws.

2. Assemble power terminal.

The power terminal will be installed on the end of output direction. Refer to the following figure to connect live wire and neutral wire.



3. Connect the power cable to **PWR** interface in the wiring cavity.
4. The power cable lays along the lint slot, and stretch out the wiring cavity from **PWR** hole.
5. The input of the power adaptor connects to the outlet.
  - If the outlet is indoors, place the power adaptor indoors.

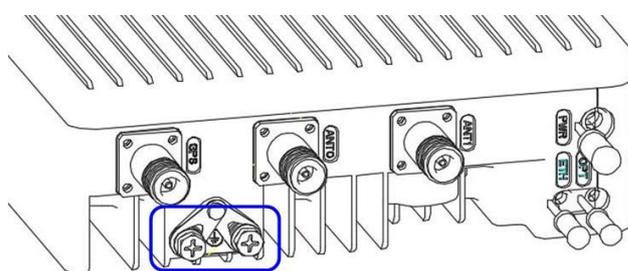
- If the outlet is outdoors, place the power adaptor in a water proof box.
6. After the cable connection is complete in the wiring cavity, tighten the screws on the cover to close the wiring cavity using M4 cross screwdriver.

### 3.6.7 Connect Ground Cable

Make the grounding cable according the actual situation of the installation site.

The Nova-233 G2 provides two grounding screws, which is located on the bottom of the base station, as shown in Figure 3-2.

Figure 3-2 Location of Grounding Screws



1. Unscrew one grounding screw, connect one end of the grounding cable to the grounding screw, and fasten it again.
2. The other end of the ground cable needs to connect to a good grounding point.

## 3.7 Install Antenna Feeder System

There are two kinds of outdoor antennas, omnidirectional outdoor antennas and directional outdoor antennas, whose installation will be introduced in the following, respectively.

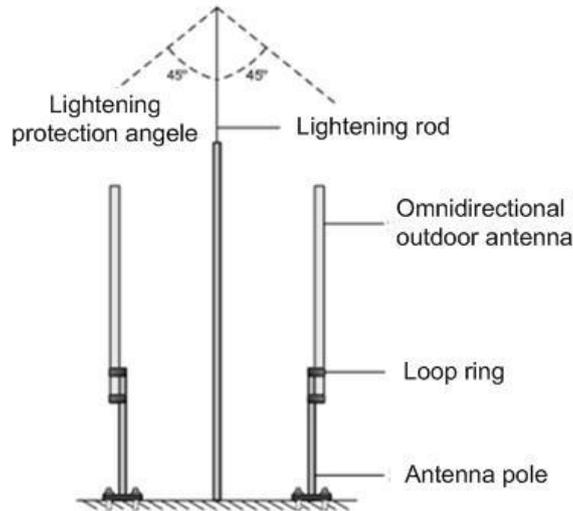
### 3.7.1 Install Omnidirectional Antennas

One should pay attention to the followings while installing the omnidirectional outdoor antenna:

- The diameter of the pole for omnidirectional outdoor antennas is required to be 35mm ~ 50mm. A typical case is to use the 50mm-diameter round-steel-made pole (with details depending on the specific antenna type).
- Make sure that the top of pole and the clamp beneath the antenna are at the same level, after installing the omnidirectional outdoor antenna on the pole.
- Make sure that the antenna is high enough to meet the coverage requirement, and

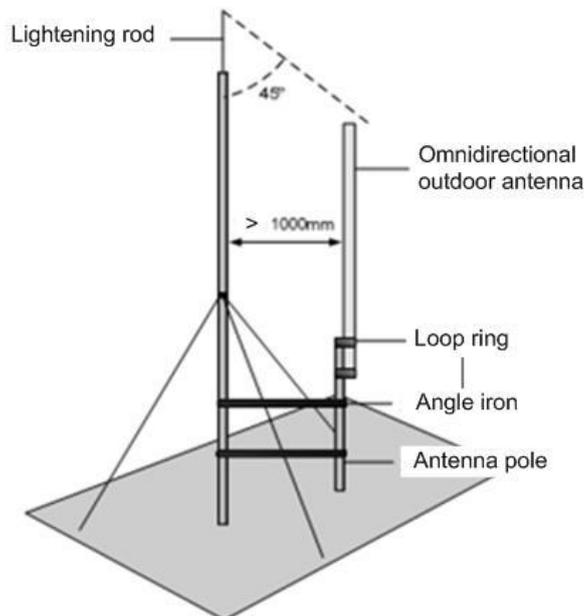
that the antenna top falls within the 45 degrees safety angle towards the lightning rod, as shown in Figure 3-3. In principle, no lightning rod can be welded to pole (no metal object is allowed within 1m of the horizontal direction of the omnidirectional antennas), when installing the omnidirectional antennas. Instead, an independent lightning rod should be settled between the two poles, where the lightning rod must be high enough to keep all antennas under its protection cover.

Figure 3-3 Omnidirectional Antenna Installation (1)



In case is impossible to install an independent lightning rod due to environmental limitations, the installation method shown in Figure 3-4 can be used. Be aware that the pole supporting the lightning rod should be kept at least 1m away from the omnidirectional outdoor antennas.

Figure 3-4 Omnidirectional Antenna Installation (2)



## 3.7.2 Install Directional Antennas

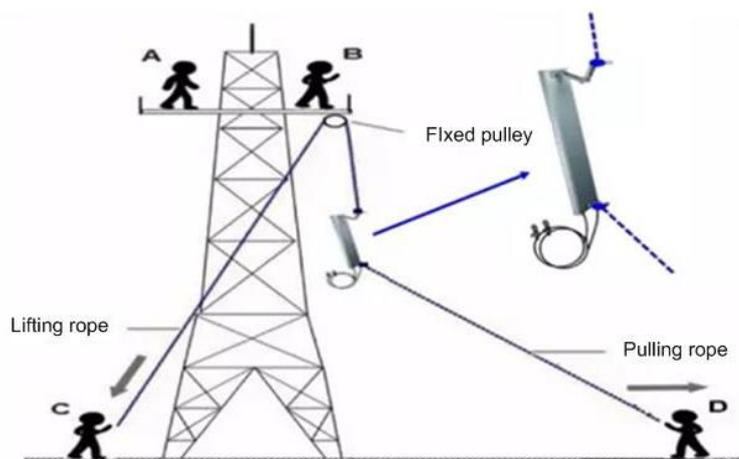
1. First, assemble the antennas, as shown in Figure 3-5.

Figure 3-5 Assembling Procedure of Directional Antennas



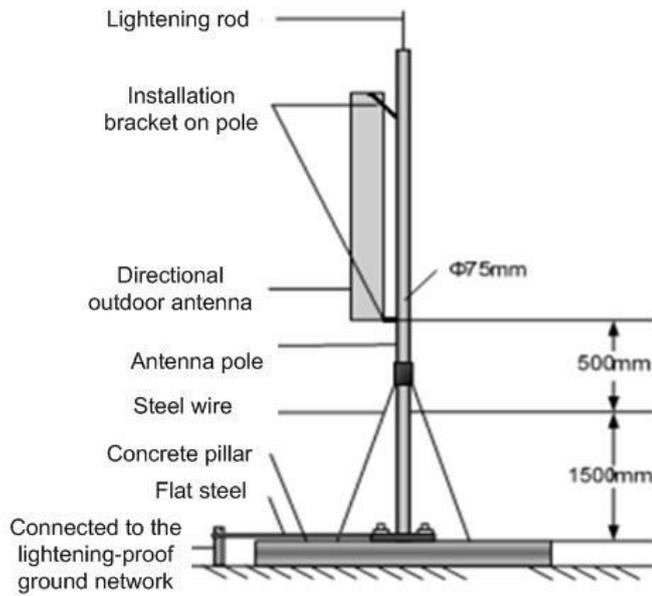
2. To install it on the iron tower, use a pulley to transport the antenna assembled to the platform on the iron tower, as shown in Figure 3-6. Following the safety rules when working at these heights.

Figure 3-6 Transportation the Antennas in the Height



3. Fix the pole vertically to the ground or concrete pillars on the rooftop using expansion screws, and fasten it with steel wires. Then, mount the directional outdoor antenna onto the pole using the installation rack, as shown in Figure 3-7.

Figure 3-7 Directional Antenna Installation

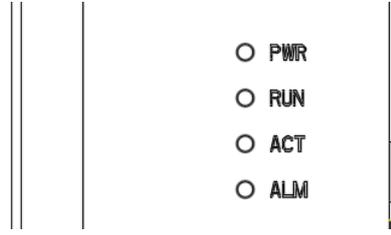


4. When the base station has been installed in a proper position, connect all the cables and wires.
5. Run tests, then seal and weatherproof all the connections after the testing has successfully completed. Refer to 2.6 Weatherproof Protection.

# 4. Power On

Power on the Nova-233 G2, and the indicators will light up, as shown in Figure 4-1.

Figure 4-1 LED Indicators



The explanation of the indicator signal is given in Table 4-1.

Table 4-1 Nova-233 G2 Indicator Description

Type	Color	Status	Meaning
PWR	Green	ON	Have power input
		OFF	No power input
RUN	Green	Fast blink: 0.125s on, 0.125s off	Single board loading
		Slow blink: 1s on, 1s OFF	Single board running well
		OFF	No power input, or single board failure
ALM	Red	ON	Hardware warning status, e.g., cable connection failure warning
		OFF	No warning
ACT	Green	ON	Active cell
		OFF	Inactive cell