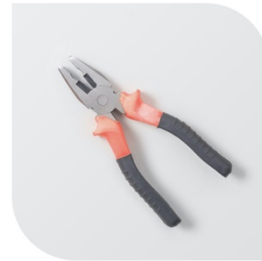


## Nova230i

Outdoor 2x500mW eNB

### Installation Guide



## About This Document

This document is a guidance of Nova230i 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 pBS41010 eNodeB (eNB).

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## Contact Us

|         | Baicells Technologies Co., Ltd.  | Baicells Technologies North America, Inc.  |
|---------|--|--|
|         | China  | North America  |
| Address | 10-11F, Bldg. A1, No.1 Zhongguancun, Yongfeng Industrial Base, Haidian Dist., Beijing, China                                     | 555 Republic Dr., #200, Plano, TX 75074, USA   |
| Phone   | 400-108-0167   | +1-888-502-5585  |
| Email   | <a href="mailto:contact@Baicells.com">contact@Baicells.com</a> or <a href="mailto:support@Baicells.com">support@Baicells.com</a> | <a href="mailto:sales_na@Baicells.com">sales_na@Baicells.com</a> or <a href="mailto:support_na@Baicells.com">support_na@Baicells.com</a> |
| Website | <a href="http://www.Baicells.com">www.Baicells.com</a>   | <a href="https://na.Baicells.com">https://na.Baicells.com</a>  |


## Safety Information


For the safety of installation personnel and for the protection of the equipment from damage, please read all safety warnings. If you have any questions concerning the warnings, before installing or powering on the base station contact the Baicells support team.


 **Warning** IMPORTANT SAFETY INSTRUCTIONS


This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.


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 **Warning** Read the installation instructions before you connect the system to its power source.

 **Warning** Installation of the equipment must comply with local and national electrical codes.

 **Warning** This product relies on the existing building or structure for short-circuit (overcurrent) protection. Ensure that the protective device is rated no greater than 20A.

 **Warning** Do not operate this wireless network device near unshielded blasting caps or in an explosive environment unless the device has been modified and qualified for such use.

 **Warning** In order to comply with the United States Federal Communications Commission (FCC) radio frequency (RF) exposure limits, antennas should be located at a minimum of 20 centimeters (7.9 inches) or more from the body of all persons.

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# 1. Product Overview

## 1.1 Introduction

The Nova230i is a lower power outdoor 2x500mW microcell eNodeB (eNB) specifically for tightly clustered pockets of customers, coverage holes, edges of your network, or simply opportunistic micro targeting, like RV parks, marinas, and high-density dwellings such as townhomes and apartments. As with all Baicells products, the Nova230i supports Long-Term Evolution (LTE) technology, and it operates in Time Division Duplexing (TDD) mode.

When paired with self-install indoor user equipment (UE), such customer sets can be captured quickly and with a near immediate ROI. For private network operators, this microcell is perfect for clusters of cameras, such as those used at traffic intersections, and other devices.

## 1.2 Highlights

Following are some of the key Nova230i highlights.

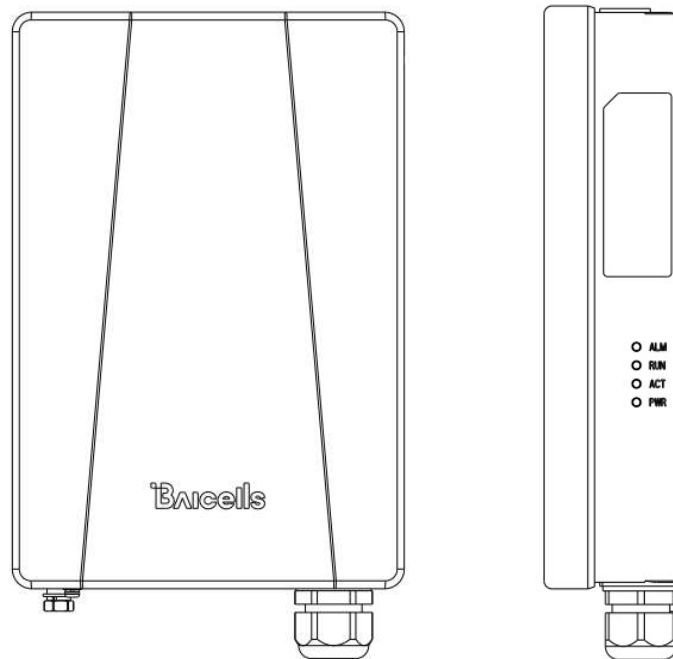
- Standard LTE TDD Band 48
- GUI-based local and remote Web management
- Suitable for private and public deployments; any IP based backhaul can be used, including public transmission protected by Internet Protocol Security (IPsec)
- Excellent Non-Line-of-Sight (NLOS) coverage
- Peak rate: Up to DL 110Mbps and UL 35Mbps with 20MHz bandwidth
- 32 RRC connected users
- PoE++ power supply; only one Ethernet cable required for data transmission and power supply
- Cloud /Local/Embedded EPC (HaloB) is supported for more convenient and economical deployment
- Plug-and-play with Self-Organizing Network (SON) capabilities
- Inter operation with all standard LTE Evolved Packet Core (EPC)
- Supports Citizens Broadband Radio Service (CBRS)
- Supports TR-069 network management interface

- Lower power consumption, which reduces OPEX, can be powered easily by Baicells compact outdoor smart UPS

### 1.3 Appearance

The Nova230i eNB appearance is shown in Figure 1-1.

Figure 1-1 Nova230i Appearance



The Nova230i interfaces are described in Table 1-1.

Table 1-1 Nova230i Interface Description

| Interface Name | Description  |
|----------------|--|
| ETH/POE        | RJ-45 interface (GE), PoE++, complied with IEEE 802.3bt standard<br>Used for power supply and data backhaul/maintenance. |

The Nova230i interface indicators are described in Table 1-2.

Table 1-2 Nova230i LED Indicators

| Identity | Color | Status    | Description                      |
|----------|-------|-----------|----------------------------------|
| PWR      | Green | Steady ON | Power on                         |
|          |       | OFF       | No power supply                  |
| ACT      | Green | Steady ON | The cell has been activated.     |
|          |       | OFF       | The cell has not been activated. |



| Identity | Color | Status                       | Description                        |
|----------|-------|------------------------------|------------------------------------|
| RUN      | Green | Fast flash: 0.1s on,0.1s off | The device is starting up.         |
|          |       | Slow flash: 1s on,1s off     | The device is running normally.    |
|          |       | OFF                          | No power input or device fault.    |
| ALM      | Red   | Steady ON                    | The device exists hardware alarms. |
|          |       | OFF                          | No alarm                           |

## 1.4 Technical Specification

### 1.4.1 Technology

| Item                    | Description  |
|-------------------------|--|
| Standard                | LTE TDD RAN (3GPP R15 compliant)   |
| TDD UL/DL Configuration | 1, 2, 6 (with Special Subframe Configuration 7)                                      |
| Model                   | pBS41010   |
| Frequency Band          | B48 (3550 MHz – 3700 MHz)  |
| Channel Bandwidth       | 10/20 MHz  |
| Multiplexing            | MIMO: 2x2 (DL)   |
| Security                | Radio: SNOW 3G/AES-128<br>Backhaul: IPsec (X.509 AES-128, AES-256, SHA-128, SHA-256) |

### 1.4.2 Interface

| Item               | Description  |
|--------------------|--|
| Ethernet Interface | 1 RJ-45 Ethernet interface (1 FE/GE)   |
| Power Supply       | PoE++ (IEEE 802.3bt compliant)   |
| Protocols Used     | IPv4/IPv6 (Dual Stack), UDP, TCP, ICMP, SNMPv2c, NTP, SSH, IPsec, TR-069, HTTP/HTTPs, 1588v2, DHCP |
| Network Management | IPv4/IPv6, HTTP/HTTPs, SNMPv2c, TR-069, SSH, Embedded EPC  |
| VLAN/VxLAN         | 802.IQ/VxLAN   |
| LED Indicators     | 4 x status LED<br>PWR/ACT/RUN/ALM  |

### 1.4.3 Performance

| Item                     | Description  |           |           |
|--------------------------|--|-----------|-----------|
| Peak Data Rate (DC)      | 2x20 MHz   | DL (Mbps) | UL (Mbps) |
|                          | UL/DL Config 1   | 80        | 28        |
|                          | UL/DL Config 2   | 110       | 14        |
|                          | UL/DL Config 6   | 65        | 35        |
|                          | 2x10 MHz   | DL (Mbps) | UL (Mbps) |
|                          | UL/DL Config 1   | 38        | 14        |
|                          | UL/DL Config 2   | 52        | 7         |
|                          | UL/DL Config 6   | 31        | 17        |
| User Capacity            | Up to 32 RRC connected users per cell (4 users per TTI)                          |           |           |
| Maximum Deployment Range | 7 kilometers   |           |           |
| Latency                  | 30 milliseconds  |           |           |
| Receiving Sensitivity    | -99.5 dBm (per channel)  |           |           |
| Modulation               | MCS0 (QPSK) to MCS27 (64QAM)<br>DL: QPSK, 16QAM, 64QAM<br>UL: QPSK, 16QAM, 64QAM |           |           |
| Transmit Power Range     | 0 to 27 dBm per channel (combined +30dBm, configurable) (1 dB interval)          |           |           |
| Quality of Service       | Nine-level priority indicated by QoS Class Identifiers (QCI)                     |           |           |
| ARQ/HARQ                 | Supported  |           |           |
| Synchronization          | GPS (built-in), 1588v2   |           |           |

**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.

### 1.4.4 Modulation Levels (Adaptive)

| MCS     | Modulation Scheme | RSRP (dBm)                     | Coverage Distance (km) |
|---------|-------------------|--------------------------------|------------------------|
| 0 - 9   | QPSK              | $-120 \leq \text{RSRP} < -100$ | $5 < D \leq 7$         |
| 10 - 16 | 16QAM             | $-100 \leq \text{RSRP} < -90$  | $3 < D \leq 5$         |
| 17 - 28 | 64QAM             | $\text{RSRP} \geq -90$         | $D \leq 3$             |

**NOTE:** The information provided is for reference only as the environment can impact modulation levels. Scenario: Base Station height is 30 meters; Customer User Equipment (CPE) height is two meters.

## 1.4.5 Features

| Item            | Description   |
|-----------------|---|
| Voice           | VoLTE, Circuit Switched Fallback (CSFB) to GSM  |
| NSA             | Supported   |
| SON             | Self-Organizing Network <ul style="list-style-type: none"> <li>Automatic setup</li> <li>Automatic Neighbor Relation (ANR)</li> <li>PCI confliction detection</li> </ul>   |
| EPC             | HaloB (Embedded EPC)  |
| Traffic Offload | Local breakout  |
| Layer 2 Support | Transparent Bridge Mode   |
| Maintenance     | <ul style="list-style-type: none"> <li>Local/Remote Web maintenance</li> <li>Online status management</li> <li>Performance statistics</li> <li>Fault management</li> <li>Local/Remote software upgrade</li> <li>Logging</li> <li>Connectivity diagnosis</li> <li>Automatic start and configuration</li> <li>Alarm reporting</li> <li>User information tracing</li> <li>Signaling trace</li> </ul> |

## 1.4.6 Link Budget

| Item            | Description   |
|-----------------|---|
| Antenna Type    | Built-in high-gain antenna <ul style="list-style-type: none"> <li>Horizontal Beamwidth <math>65^{\circ} \pm 5</math></li> <li>Vertical Beamwidth <math>\geq 21^{\circ}</math></li> <li>Polarization: <math>\pm 45^{\circ}</math></li> </ul> |
| RF Antenna Gain | 13.5dBi   |
| Maximum EIRP    | 43.5 dBm  |
| Power Control   | UL Open-loop/Closed-loop Power Control, DL Power Allocation (3GPP TS 36.213 compliant)  |

## 1.4.7 Physical





| Item                                 | Description  |
|--------------------------------------|--|
| Power Interface Lightning Protection | Differential mode: $\pm 3$ KA<br>Common mode: $\pm 5$ KA |
| MTBF                                 | $\geq 150000$ hours                                      |
| MTTR                                 | $\leq 1$ hour  |
| Ingress Protection Rating            | IP65   |
| Operating Temperature                | -40°F to 131°F / -40°C to 55°C                           |
| Storage Temperature                  | -49°F to 158°F / -45°C to 70°C                           |
| Humidity                             | 5% to 95% RH   |
| Atmospheric Pressure                 | 70 kPa to 106 kPa  |
| Power Consumption                    | Typical 22.5W, maximum 25W                               |
| Weight                               | 3.42 lbs / 1.55kg  |
| Dimensions (HxWxD)                   | 8.7 x 5.9 x 2.05 inches<br>221 x 150 x 52 millimeters    |
| Installation                         | Pole or wall mount                                       |

## 2. Installation Preparation

### 2.1 Support Materials






In addition to industry standard tools, you will need the materials described in Table 2-1 during the installation.



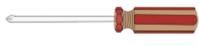








Table 2-1 Support Materials

| Item             | Figure  | Description   |
|------------------|---|---|
| Ethernet cable   |    | Outdoor CAT6e, shorter than 100 meters (~109 yards)<br>It is suggested that the diameter of the cable is greater than 7mm.  |
| Ground cable     |    | If the length of lead is more than 10 meters, 10mm <sup>2</sup> diameter grounding cable should be used.<br>If the length of lead is less than 10 meters, 10mm <sup>2</sup> diameter grounding cable should be used.  |
| Pole             |  | The diameter of the pole is between 40mm and 70mm. It is suggested that the pole is made of hot-galvanized steel.<br>Channel steel and equal angle steel installation are also supported. The width of the channel steel is 50mm to 100mm; the length of side of the angle steel is 63mm to 80mm. |
| Distribution box |  | PoE adaptor, power grounding point, broadband access is all in the distribution box, which must be waterproofed.  |

### 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  | compass  | fixed pulley  |
|  |   |   |  |   |
| multimeter  |   |   |  |   |

## 2.3 Location & Environment

In addition to network planning, when determining where to place the eNB you need to consider factors such as climate, hydrology, geology, the possibility of earthquakes, reliable electric power, and transportation access. Avoid locating the eNB in areas where there may be extreme temperatures, harmful gases, unstable voltages, volatile vibrations, loud noises, flames, explosives, or electromagnetic interference (e.g., large radar stations, transformer substations). Avoid areas prone to impounded water, soaking, leakage, or condensation.

Table 2-2 provides typical environmental specifications for this eNB.

Table 2-2 Environmental Requirements

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

## 2.4 Personnel Requirements

The installation personnel must master the basic safe operation knowledge, through the

training, and having the corresponding qualifications.

## 2.5 Lightning & Grounding Protection

You must protect the eNB against lightning. Following are guidelines concerning grounding.

- The yellow-green ground wire must be at least 10mm<sup>2</sup> in diameter.
- In principle, always place the grounding as near as possible to the equipment.
- Connect to a reliable outdoor grounding point (earth) using one ground screw.
- The connection of the grounding points and ground bar need to be tight and reliable. Rustproofing the terminals, e.g., with anti-oxidant coating or grease, is required.

## 3. Installation

### 3.1 Unpacking

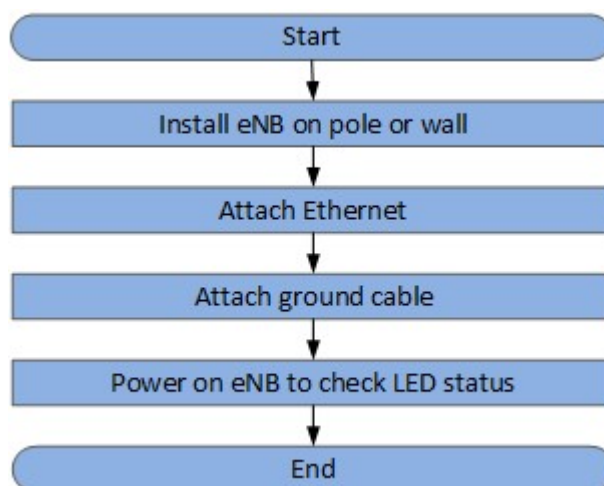
Before opening the box, make sure the package is in good condition, undamaged and not wet. During the unpacking, avoid potential damaging impacts from hits or excessive force.

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

### 3.2 Installation Procedure

Figure 3-1 provides an overview of the installation process.

Figure 3-1 Installation Process



### 3.3 Install on Pole

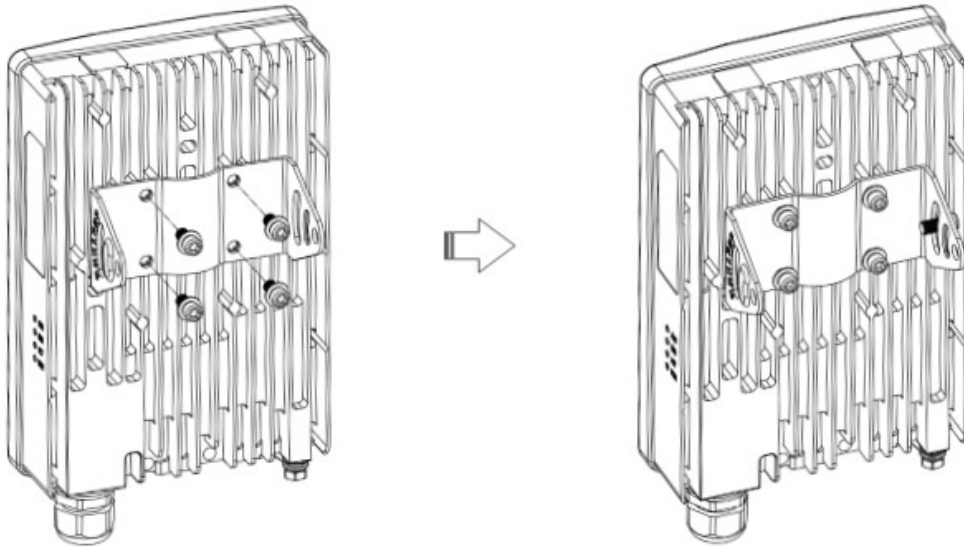
Check to ensure the diameter of the pole is in the range of 1.6inch to 2.8inch (40mm to 70mm). The position of the eNB on the pole should be at least 47 inch (120 cm) in height. Follow the steps below to install the eNB on a pole.

The brackets include two parts. One part is installed on the back of the eNB, the other is for pole mounting or wall mounting.

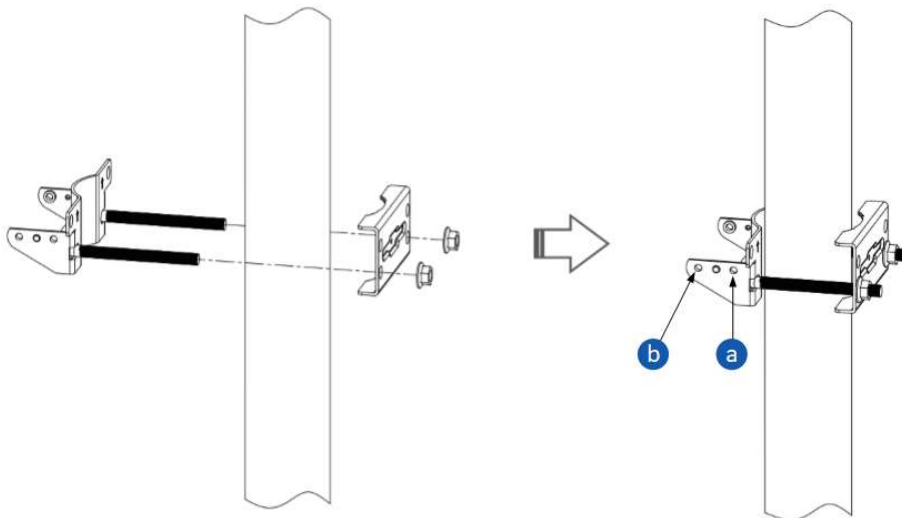
Following will introduce how to fix the eNB on a pole.

1. Assemble the back bracket on the back of the eNB with 4 screws.



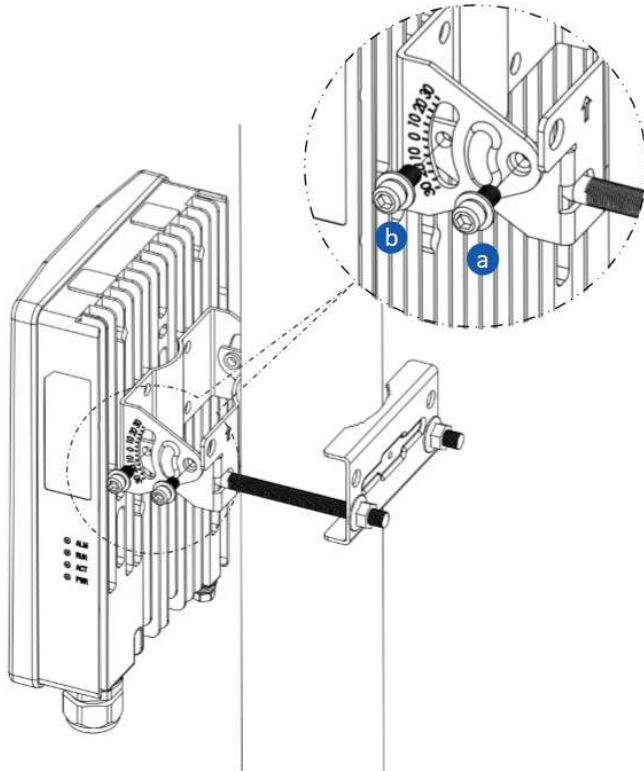


2. Assemble the pole mount part and fix it on the pole. Note that the height must satisfy the requirement described above.



The screw hole **a** is used to assemble and fix the two components of the bracket, and the screw hole **b** is used to adjust the angle of the eNB, which helps the eNB to receive signals better.

3. Align screws holes on the back bracket with corresponding screw holes on the pole mount bracket. **a** corresponds to **a**, and **b** corresponds to **b**. First, screw at position **a** to mount the eNB on the pole mounting bracket. Note that do not fasten the screws. And then adjust the angle of the eNB and fasten screws at position **b**. At last, fasten screws at position **a**.



4. Proceed to “3.5 Connect Cable”.

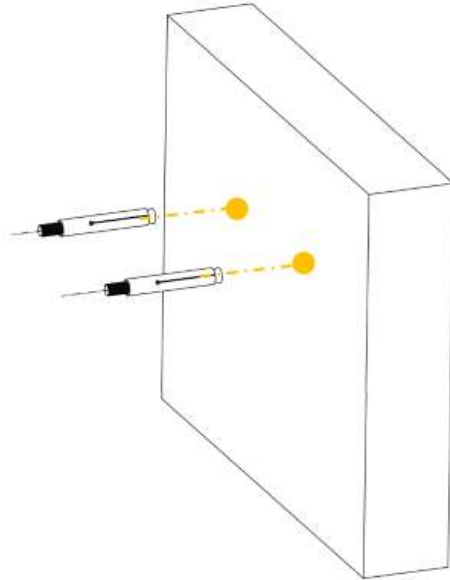
### 3.4 Install on Wall

Ensure that the wall can bear at least 4 times the weight of the eNB. Follow the steps below to install the eNB on the wall.

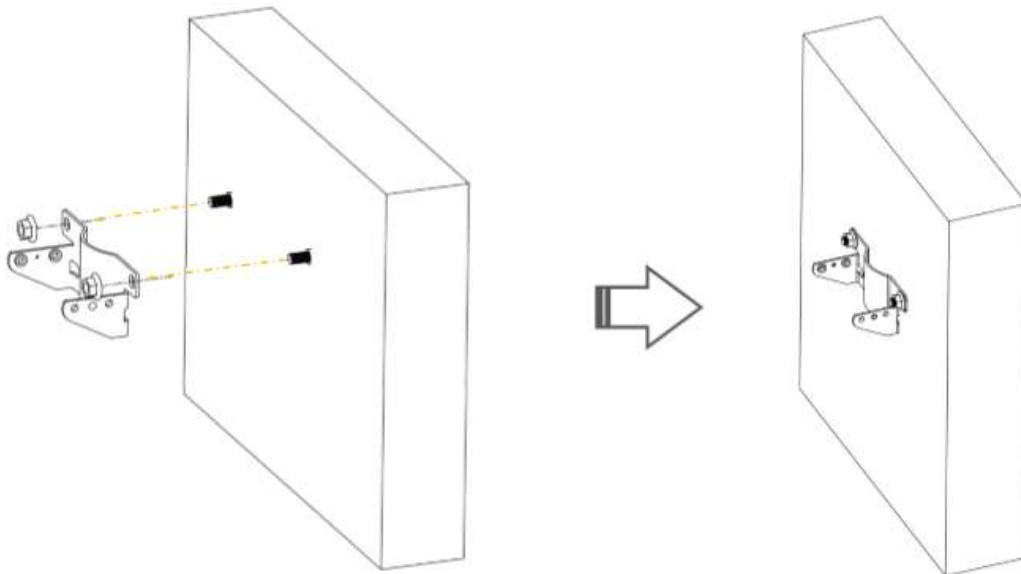
1. Against the wall mounting bracket on the wall, with the arrow pointing up. Mark the drilling locations with a pencil or marker.



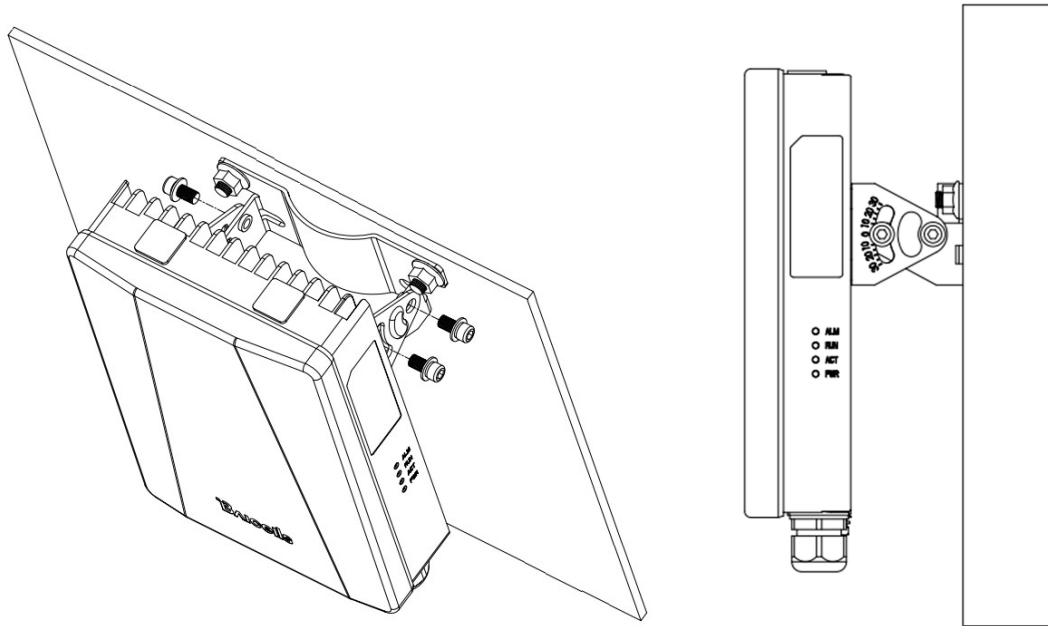
2. Drill two .4in/10mm diameter by 2.8in/70mm deep holes in the wall at the marked locations.
3. Insert expansion bolts into the two drilled holes.



4. Hang the wall mounting bracket on expansion bolts, and fasten with flat washers, spring washers and nuts in sequence.



5. Refer to the step 3 of in “3.3 Install on Pole”. Align screw holes on the back bracket with corresponding screw holes on the wall mounting bracket and fasten screws in sequence.



6. Proceed to “3.5 Connect Cable”.

## 3.5 Connect Cable

### 3.5.1 Cable Laying Requirements

#### General requirements:

- Bending radius of power cable and grounding cable: > tripled of the diameter of the cable.
- Bind the cables according the type of the cable, intertwining and crossing are forbidden.
- An identification label should be attached after the cable is laid.

#### Grounding laying requirements:

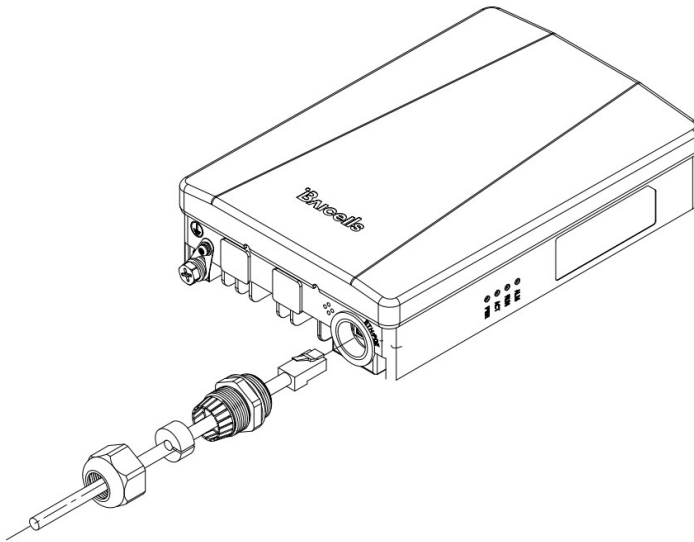
- The grounding cable must connect to the grounding point.
- The grounding cable must be separate with the signal cables, of enough distance to avoid signal interference.

### 3.5.2 Connect Ethernet Cable

The diameter of the Ethernet cable must is not less than 7mm. Recommend to use CAT6e shield Ethernet cable.

**ATTENTION:** If the diameter of the Ethernet cable is less than 7mm, the connector cannot be locked. The eNB will be flooded and damaged.

1. Unscrew the ETH connector in sequence.
2. Pass through the Ethernet cable the unscrewed connector based on original sequence.
3. Insert the RJ-45 connector to the **ETH/POE** port at the right bottom of the eNB.
4. Tighten the connector of the **ETH/POE** port in sequence.



5. Connect the other end of the Ethernet cable to the **POE** port of the PoE adaptor.
6. Connect the **LAN** port of the PoE adaptor to a LAN switch or a router for maintenance and backhaul.



**NOTE:** The PoE adaptor must have lightning protection measures and be placed in a waterproof position.

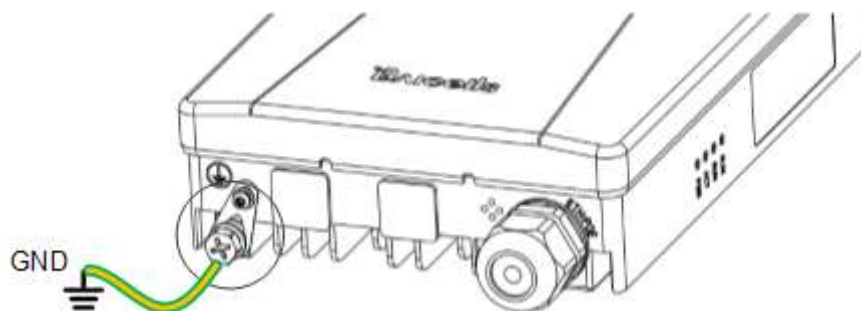
7. Connect the PoE adaptor to an AC power.

### 3.5.3 Connect Ground Cable

#### 3.5.3.1 eNB Grounding

Prepare the grounding cable according to the actual measurements and requirements of the specific installation site. The eNB has two grounding screws located on the bottom of the unit, as shown in Figure 3-2. Follow the steps below the figure to connect the ground cable.

Figure 3-2 eNB Grounding

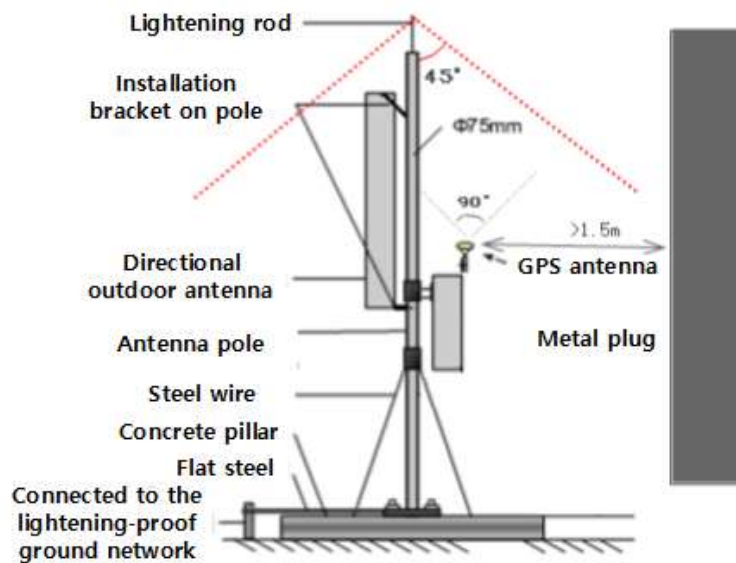


1. Unscrew one grounding screw, connect one end of the ground cable to the grounding screw, and fasten it again.
2. Once the eNB is installed at the outdoor location, the other end of the ground cable needs to connect to a good grounding point.

#### 3.5.3.2 Pole Grounding

The purpose of the pole grounding is to protect the equipment in the station from the damage of lightning overvoltage as far as possible. However, the interfaces between the eNB and the outside world mainly include power system, grounding system, antenna feeder and lightning receiving device, and signal line. Therefore, the damage caused by lightning mainly comes from the voltage difference between the equipment in the eNB and one or more of the four interfaces. The pole grounding is shown in Figure 3-3.

Figure 3-3 Pole Grounding



1. The installation position of the grounding bar shall meet the design requirements. The holding pole and tower body must be connected to the lightning protection network or grounded with a separate lead.
2. The diameter of the grounding wire meets the design requirements. The copper nose must be used for grounding, and the grounding resistance is required to be less than 10 ohms. If the resistance of the public network communication equipment placed in other systems is less than 10 ohms, the grounding network of the system should be overlapped.
3. The grounding wire must be the whole wire material. When laying, it should be bound separately with other cables. All grounding wires should be fixed with wire code or binding tape with a fixed spacing of 0.3m. The appearance should be straight and beautiful.
4. The copper bar must be used for the grounding bar, and the specification of the grounding bar shall meet the design requirements. If there are no specific requirements in the design, 300 × 40 × 4mm and fixed with expansion bolts.
5. The grounding wire must be made of the whole cable material, the intermediate joint is strictly prohibited, and the excess length should be cut. The skin shall be complete, and the insulation resistance of the core wire to the ground (or metal isolation layer) shall meet the technical requirements of the cable.
6. The grounding wire shall be connected to the integrated grounding bar of the building. If it is impossible to connect to the integrated grounding bar of the building, the appropriate grounding point can be selected according to the integrated grounding situation of the indoor building. The selection of grounding point must be higher than the grounding grid, and the feeder grounding shall be towards the

downward direction of the feeder, never upward.

7. The grounding electrode of the self-built grounding grid for the outdoor antenna of the tunnel must meet the design requirements. The buried depth of the grounding electrode and the welding quality of the flat iron meet the specification requirements. In principle, the buried depth of the grounding electrode shall not be less than 0.7m. The non-self-built grounding network shall be connected to the grounding network of the owner.
8. The eNB grounding, power adapter grounding, distribution box grounding and feeder grounding must be connected to the grounding bar independently, and the grounding bar must have a path from the lead to the earth.

### 3.6 Power on to Check LED Status

Power on the eNB, and wait a few minutes while the eNB boots up. Per the previous Figure 1-1 and Table 1-2 in “1.3 Appearance”, check that the LED indicators are lighting as expected.





## 4. Attentions

### 4.1 FAQ

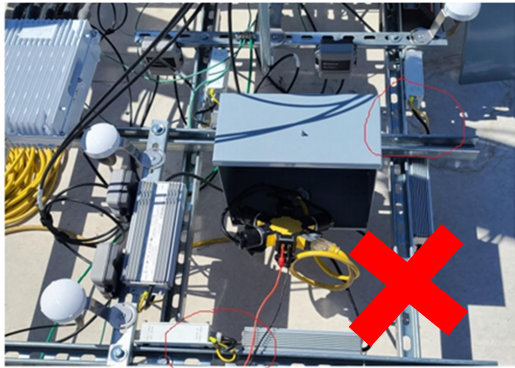
1. How to choose the position of holding pole in the roof
  - 1) Not near the edge.
  - 2) The position of non-bearing beam cannot be selected.
  - 3) Do not choose the side close to the barrier, you need to choose the most open position.
  
2. The coverage of eNB signal is not ideal after opening
  - 1) Check if the power is full in the base station configuration.
  - 2) Check whether the equipment has standing wave alarm. If there is any alarm, please handle it in time.
  - 3) Check whether the RF frequency band of the equipment is consistent with that of the antenna.
  - 4) Check whether the dip angle planning of the base station is reasonable.
  - 5) Whether there is blocking in antenna coverage direct vision.

### 4.2 Common Installation Errors

|   |  |
|---|--|
|  |  |
| <p>The holding pole lightning rod is not led to the ground bar</p>                  | <p>Disordered wiring of distribution box</p>   |



Without the lightning rod



Power line and signal cable are crossed



Multiply the grounding point

## 5. Regulatory Compliance

### 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 A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

#### 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 50cm between the radiator & your body.