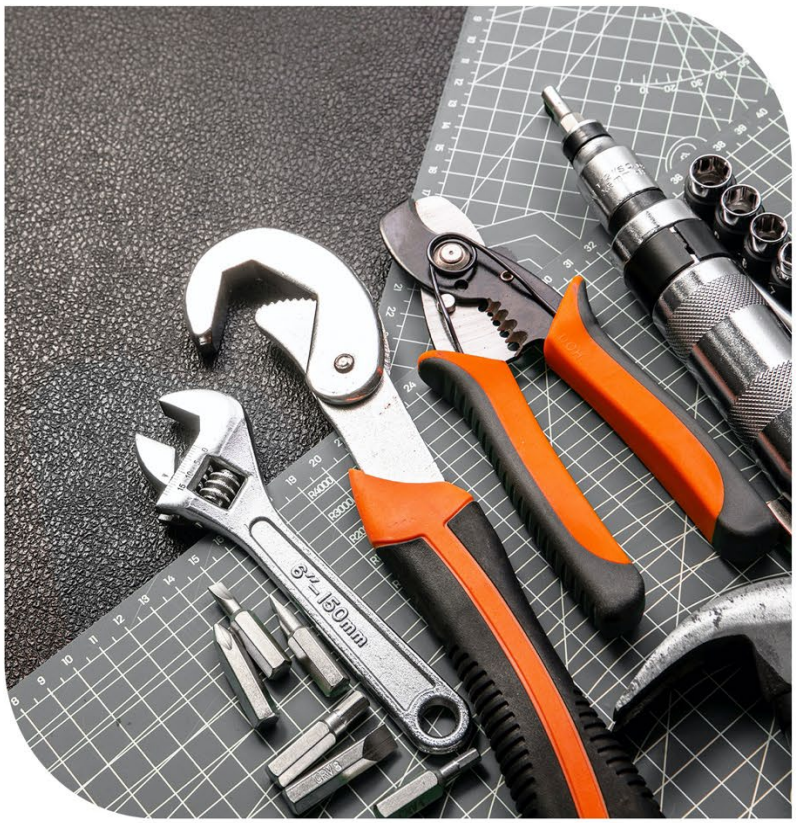
Nova430e

Outdoor 4x250mW Two-Carrier TDD eNodeB

Installation Guide

BaiBLQ_3.0



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Version 1.04

About This Document

This document is intended for personnel installing the Baicells Nova430e Outdoor 4x250mW eNodeB (eNB) product. The product overview is followed by the procedures for properly installing, performing basic configuration, and verifying the eNB is operational. Please be advised that only personnel with the appropriate electrical skills and experience should install this device. This document is based on software version BaiBLQ_3.0. The Nova430e model number is pBS3101SE.

New in This Release

The following updates have been provided in this release:

- The software BaiBS_QRTB migrated to BaiBLQ_3.0 at this release, and all Graphical User Interfaces (GUIs) depicted in this document reflect the BaiBLQ_3.0 software.

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Disposal of Electronic and Electrical Waste

Pursuant to the WEEE EU Directive, electronic and electrical waste must not be disposed of with unsorted waste. Please contact your local recycling authority for disposal of this product.

Revision Record

Date	Version	Description	SMEs/Contributors
04-Aug-2023	1.04	Updated for BaiBLQ 3.0	Blake Volk
21-Feb-2023	1.03	Updated for QRTB 2.12	Blake Volk, Anna Ch
21-Oct-2022	1.02	Updated for QRTB 2.10.6	Blake Volk, Anna Ch
04-Mar-2022	1.01	Initial release for QRTB 2.9.4	Warren Lai, Sonny May, Abel Lamas

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Safety Information

For the safety of installation personnel and 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.

WARNING: Read the installation instructions before you connect the system to its power source.

WARNING: Equipment installation 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: To comply with the United States Federal Communications Commission (FCC) radio frequency (RF) exposure limits, antennas should be located at a minimum of 7.9 in (20 cm) or more from the body of all persons.

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1 Overview

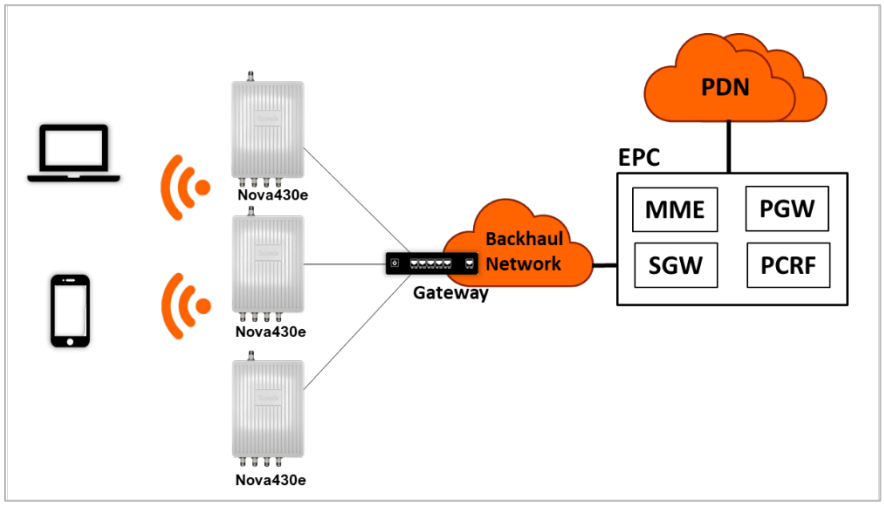
1.1 Introduction

The Baicells Nova430e (Figure 1-1) is an advanced two-carrier outdoor eNB that is compliant with Third-Generation Partnership Project (3GPP) on LTE TDD technology. This 4x250mW eNodeB can operate in Carrier Aggregation (CA) mode or Dual Carrier (DC)/split mode. The Nova430e supports broadband data access, providing various data service transformation and transmission capabilities to enable outdoor wireless coverage. This eNodeB can be used by operators to improve capacity and throughput while eliminating existing dead zones.

Figure 1-1: Nova430e eNB

The network structure of the Nova430e is shown in Figure 1-2.

Figure 1-2: Network Structure



As a two-carrier eNB, the Nova430e hardware unit contains two separate eNBs inside one shell. Having two carriers provides versatile options in how you operate the eNB. The available operating modes are described in the next section, *Features*.

The Nova430e primary cell (Pcell) is called Cell 1, and the secondary cell (Scell) is called Cell 2. Each eNB is pre-configured to simplify the installation. Baicells provides operators with local and Web-based Graphical User Interface (GUI) software applications to configure and manage individual eNBs and Customer Premise Equipment (CPE).

Additionally, Baicells offers a centralized Software-as-a-Service (SaaS) solution called CloudCore. CloudCore includes all of the essential LTE Evolved Packet Core (EPC) network functions, an Operations Management Console (OMC) for managing multiple sites across the Network, and a Business and Operation Support System (BOSS) for subscriber management.

This document provides a general description, guidelines, and procedures for installing, entering basic configuration information, and verifying the operational status of the Nova430e eNB.

1.2 Features

The two-carrier Nova430e eNB can operate in one of several modes:

- Single Carrier (SC)
- CA mode (based on software license)
- DC/split mode (based on software license)
- HaloB mode (embedded in the base software)
- Citizens Broadband Radio System (CBRS) Spectrum Access System (SAS)

SC describes a scenario where the operator wishes to use only one of the two available cells in the eNB. This may be necessary for operators who have limited licensed spectrum or who are planning to use the second carrier later as their Network grows. In SC mode, only the primary cell (Pcell), *aka* Cell 1, is used.

CA provides the ability to aggregate channels from across the full CBRS range, even channels that are not adjacent. Using CA essentially doubles the downlink capacity when all users have CAT6 or later CPE.

DC (split sector) mode enables the operator to run the Nova430e as two independent carriers for split sector coverage.

HaloB allows the eNB to function with embedded Mobility Management Entity (MME) capabilities on board so that the eNB operates independently from the usual cloud connection. HaloB is standard in the Nova430e as part of the basic software. This enables the user to migrate core network functions to the eNB.

CBRS SAS is a multi-vendor SAS database where CBRS spectrum use is managed dynamically across operators. The CBRS band covers 3.55–3.70 GHz. Operators must sign up with a SAS provider, which handles the dynamic frequency assignment and release process. Baicells provides FCC Part 96 certified eNBs, including the Nova430e, and CPEs that operate within the Part 96 rules for CBRS. The Baicells eNBs and CPEs use a Domain Proxy (DP) to connect to the SAS server by leveraging the existing connection with the OMC.

NOTE 1: Legacy Gen 1 CPEs do not support SAS.

NOTE 2: This installation guide only covers the basic configuration of a single cell for verifying that the eNB unit is operational during the process of installation. More detailed configuration guides are available on the Baicells website: Baicells.com > Resources > *Documents*:

- CloudCore Configuration and Network Administration Guide
- Atom CAT4 CPE Configuration Guide
- Atom CAT6/CAT15 CPE Configuration Guide
- 4G LTE eNodeB Configuration Guide – BaiBLQ (formerly QRTB)
- Carrier Aggregation and Dual Carrier/Split Mode Configuration Guide
- HaloB Solution User Guide
- SAS Deployment Guide

In addition to the Nova430e eNB two carriers and multiple operating modes, the following is a list of other key features. The Nova430e datasheet providing technical specifications is kept up-to-date on the *Baicells website*.

- Supports standard LTE TDD Band 48 (3550 MHz – 3700 MHz)
- Complies with 3GPP Release 15 standards
- Supports 5/10/15/20 MHz bandwidth per carrier
- Provides excellent Non-Line-of-Sight (NLOS) coverage
- Peak rate is a configurable parameter using special Subframe Assignment (SA):
    - 2x20 MHz, per carrier:
        - SA1: DL 105 Mbps, UL 28 Mbps
        - SA2: DL 145 Mbps, UL 14 Mbps
        - SA6: DL 85 Mbps, UL 35 Mbps
    - 2x10 MHz, per carrier:
        - SA1: DL 51 Mbps, UL 14 Mbps
        - SA2: DL 70 Mbps, UL 7 Mbps
        - SA6: DL 42 Mbps, UL 17 Mbps
- Supports 96 concurrent users per carrier [x2 carriers (96+96) if operating in DC mode]; upgradeable to higher capacity in future software releases
- Supports TR-069 network management interface
- GUI-based remote Web management using Baicells OMC
- Connects to any IP-based backhaul, including public transmission
- Is lightweight and uses low power consumption to reduce OPEX
- Compact, plug-and-play device with Self-Organizing Network (SON) capabilities
- Can be used for Internet of Things (IoT) with all Standard EPC vendors
- Ensures secure protection against illegal intrusion
- Optional external Global Positioning System (GPS) antenna
- Integrated small cell form-factor for quick and easy installation
- Configured out-of-the-box to work with Baicells CloudCore
- Supports both CA and DC modes

- Embedded HaloB ("lite" EPC) solution
- Supports CBRS with dual carrier
- GPS synchronization (built-in)
- Built-in Dynamic Host Configuration Protocol (DHCP) Server, Domain Name System (DNS) Client, and Network Access Translation (NAT) functionality, providing strong high-speed routing
- Supports Transparent Bridge Mode

2 Installation Preparation

2.1 Materials

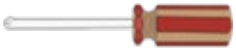
Check the Nova430e package to ensure it contains the primary components in the pack out (Figure 2-1). In addition to industry-standard tools, you need the materials described in Table 2-1 and the tools shown in Table 2-2 during the installation.

Figure 2-1: Pack Out

Table 2-1: Materials

Item	Description
RF antenna cable	50-ohm feeder, ½ jumper
RF antenna	Omni or directional dual polarized
Ethernet cable	Outdoor CAT6, shorter than 330 feet (100 meters) It is suggested that the diameter of the cable is 0.3 in ± 0.04 in (7 mm ± 1 mm).
Ground cable	If the length of lead is more than 33 feet (10 meters), 6 AWG (10 mm²) grounding cable should be used.

Table 2-2: Installation Tools

			
Level bar	Marker	Knife	Pliers
			
Wrench	Percussion drill and drill heads	Hammer	Phillips-head screwdriver
			
Cable vice (crimper)	Tape measure	5 mm L-shape Allen wrench	T7 screwdriver head

2.2 LEDs and Interfaces

Figure 2-2, Table 2-3, and Table 2-4 explain the eNB status indicators and interfaces.

Figure 2-2: LEDs and Interfaces

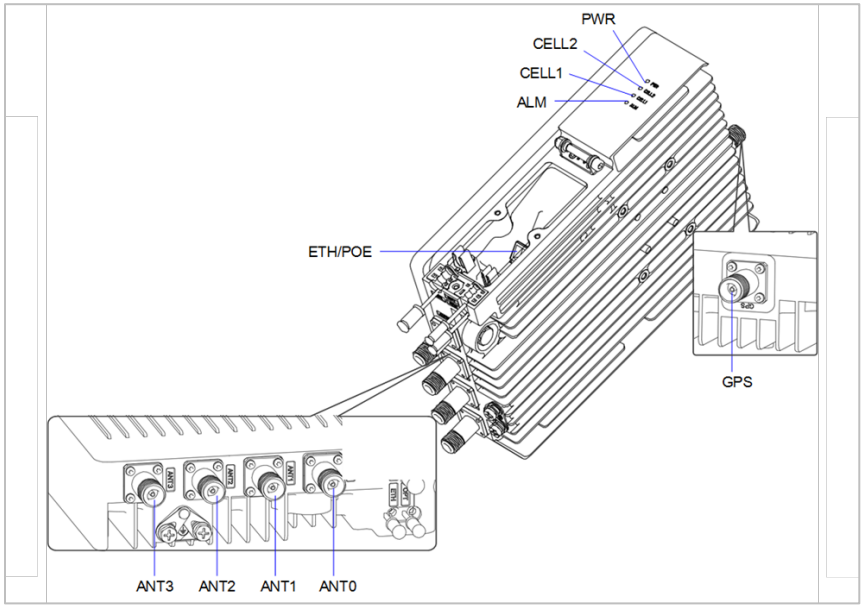


Table 2-3: LEDs

LED	Color	Status	Description
PWR	Green	Steady on	Power is on
		OFF	No power supply
CELL2	Green	OFF	CELL1 is inactive
		Fast flash: 0.1 s on, 0.1 s off	CELL1 is deactivated
		Slow flash: 1 s on, 1 s off	CELL1 is activated
CELL1	Green	OFF	CELL2 is inactive
		Fast flash: 0.1 s on, 0.1 s off	CELL2 is deactivated
		Slow flash: 1 s on, 1 s off	CELL2 is activated
ALM	Red	Steady on	Hardware alarm
		OFF	No alarm

Table 2-4: Interfaces

Interface	Description
ETH/PoE+	RJ-45 interface (FE/GE). Used for power supply, debug or data backhaul. PoE++, complies with IEEE 802.3bt standard
GPS	GPS antenna interface, N-type connector
ANT0	External antenna interface 1, N-type connector
ANT1	External antenna interface 2, N-type connector
ANT2	External antenna interface 3, N-type connector
ANT3	External antenna interface 4, N-type connector

2.3 Location and Environment

The Nova430e can be installed on a pole or a wall. For the best signal coverage, place the eNB in an unobstructed location. In addition to network planning, when determining where to place the eNB, consider the best location for signal coverage. Avoid locating the eNB in areas with 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. Environmental specifications are shown in Table 2-5.

Table 2-5: Environment Specifications

Item	Description
Operating Temperature	-40°F to 131°F / -40°C to 55°C
Storage Temperature	-58°F to 149°F / -50°C to 65°C
Relative Humidity	5 % to 95 % RH
Atmospheric Pressure	70 kPa to 106 kPa
Safety Voltage	42 V to 58 V

2.4 Grounding and Lightning Protection

You must protect the eNB against lightning. All Nova eNBs have a floating ground on the power system. The following are grounding guidelines.

- The yellow-green ground wire must be at least 6 AWG (10 mm^2) diameter.
- 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 needs to be tight and reliable. Rustproofing the terminals, e.g., with antioxidant coating or grease, is required.

2.5 Weatherproofing

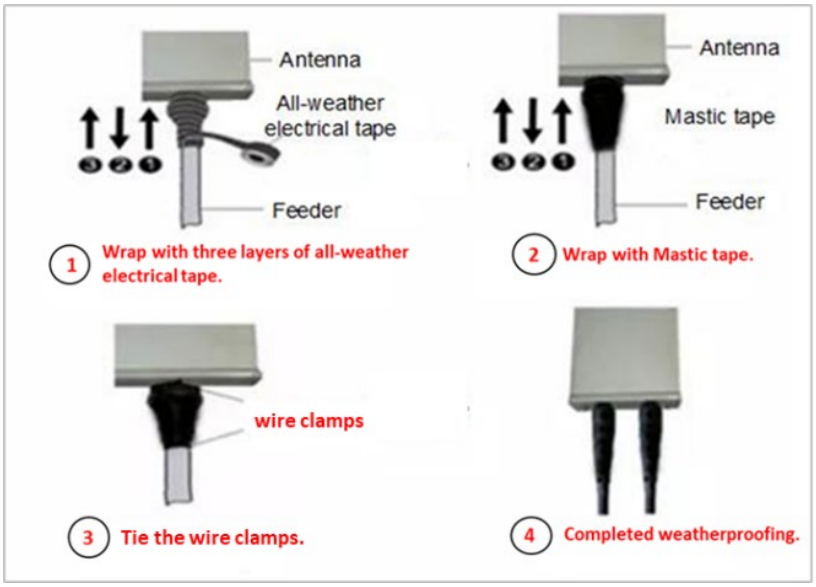
For Radio Frequency (RF) antenna weatherproofing, use cold shrink tubes. To protect the connection points from weather and climate, clean each connection point before installing cold shrink tubes, per the following (Figure 2-3).

1. Insert the cable into the cold shrink tube.
2. Tighten the connector.
3. Push the cold shrink tube to the top joint and pull out the strip.
4. Ensure the cold shrink tube is tightly fitted with the connection.

Figure 2-3: Weatherproofing

For GPS antenna weatherproofing, use all-weather electrical tape and mastic tape, per Figure 2-4.

Figure 2-4: Weatherproofing GPS Antenna



NOTE: Make sure that the wrapping direction of the last layer is from the bottom up. The last layer should be tight enough to keep it from cracking.

2.6 CloudCore Account

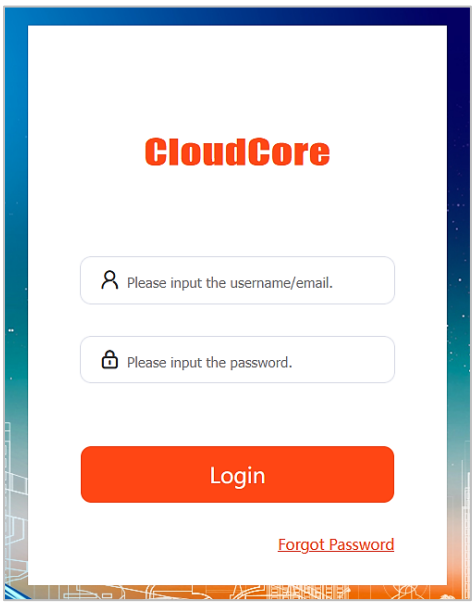
The Baicells CloudCore includes the EPC, managed by Baicells, and two operator applications, OMC to manage network elements, and BOSS to manage subscribers. If you have not already set up a Baicells CloudCore account, follow the steps below.

Step 1: Open a web browser, and enter the CloudCore address (Figure 2-5): *https://cloudcore.cloudapp.net/cloudcore/*

Step 2: Click on the *Sign up* button.

Step 3: Complete the mandatory fields, and again click on *Sign up*.

Figure 2-5: CloudCore Login Page



You will receive an email from Baicells. Click on the CloudCore link to go to the login page.

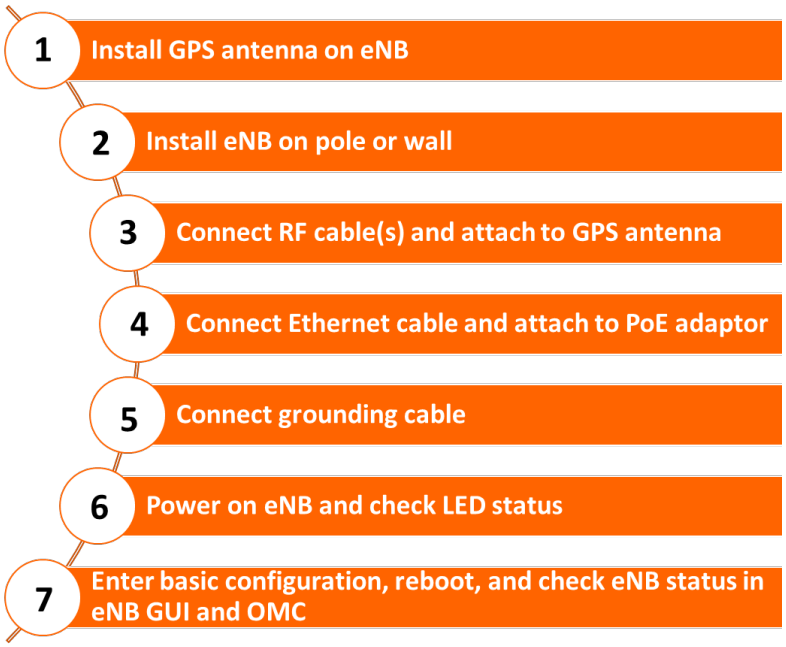
Enter your login user name (email address) and password to authenticate.

3 Installation

3.1 Process Overview

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

Figure 3-1: Installation Process Overview



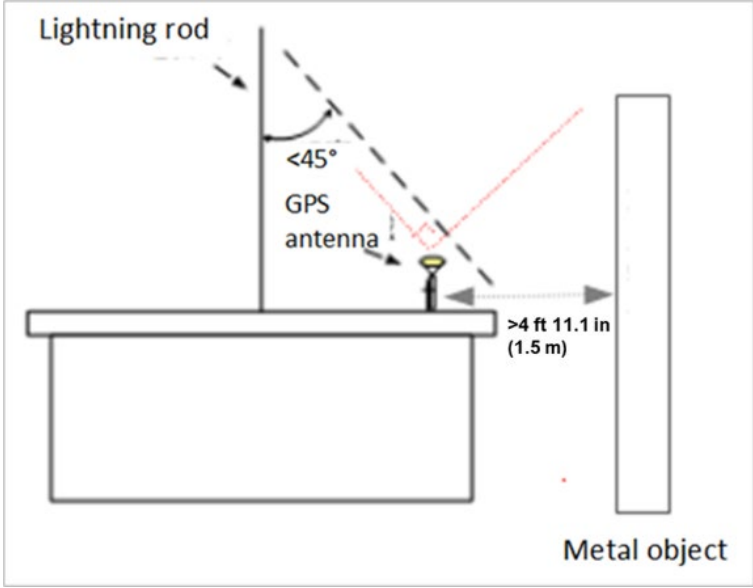
3.2 Install GPS Antenna

WARNING: Ensure the antenna is connected before powering up the eNB. The wireless signal transmission power can cause bodily injury and damage to the eNB and RF power amplifier devices.

Read the following GPS antenna installation requirements before installing it on the eNB and refer to Figure 3-2.

- No major blocking from buildings in the vicinity. Make sure the space atop is within at least 45 degrees unblocked by any buildings.
- The GPS antenna should be installed within 45 degrees to the lightning rod.
- Do not install the GPS antenna near other transmitting and receiving equipment, to avoid interference. Do not install it under a microwave antenna or high voltage cable. Avoid the direction of radiation from other transmitting antennas to the GPS antenna.
- When two or more GPS antennas are installed, it is recommended to keep the spacing of more than 6.74 feet (2 meters), and install multiple GPS antennas in different locations to prevent simultaneous interference.
- GPS antenna feeders cannot be grounded together with ground conductors of interfering equipment such as air conditioners, motors, and pump motors, etc. to prevent external interference from being introduced into the antenna system.

Figure 3-2: GPS Installation Requirements



The GPS antenna system includes an antenna and a connector. The two parts should be assembled according to Figure 3-3.

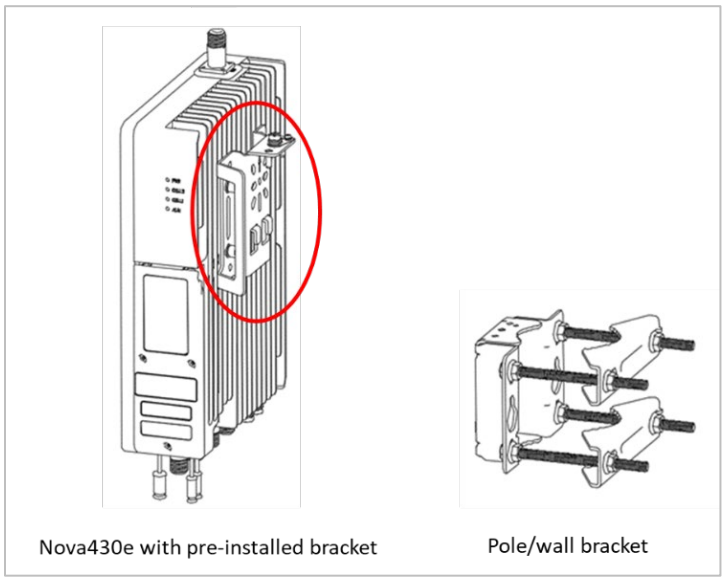
Figure 3-3: GPS Antenna Installation

After assembling the GPS antenna, the connector must be waterproofed with all-weather electrical tape and mastic tape. Refer to *section 2.5*.

3.3 Install eNB on Pole or Wall

The eNB mounting brackets are pre-assembled in manufacturing before packing. One bracket is pre-installed on the back of the eNB, and the other is for pole or wall mounting, as shown in Figure 3-4.

Figure 3-4: Pre-assembled Brackets



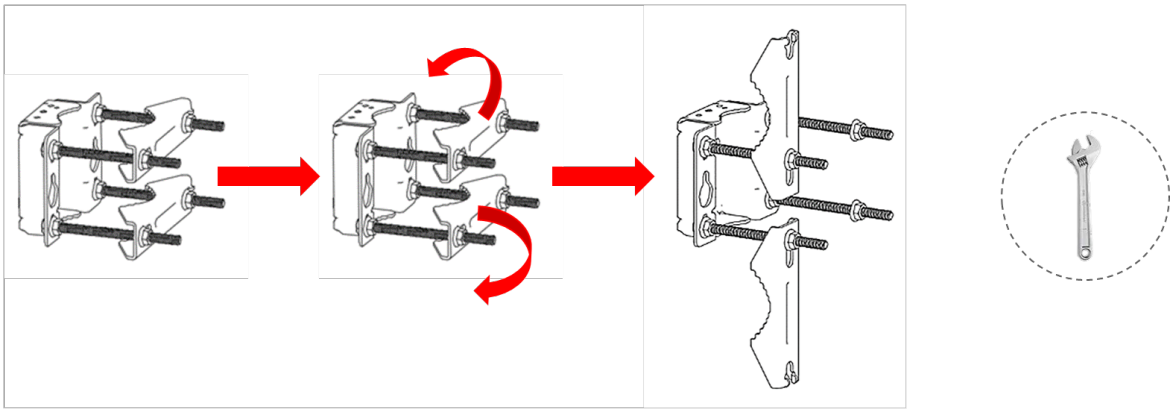
3.3.1 Install on Pole

The following explains how to install the eNB on a pole.

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

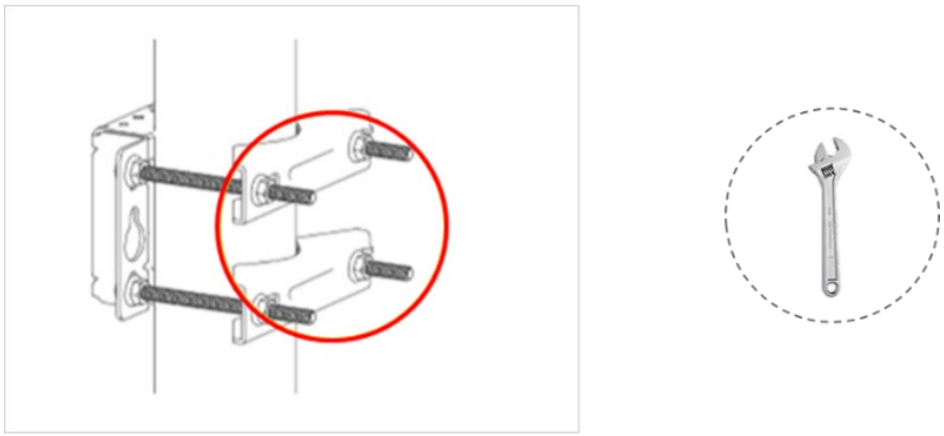
1. Unscrew the four nuts on the pole bracket. Slide the two omega clamps to the left, and then turn them up or down (Figure 3-5).

Figure 3-5: Omega Clamps



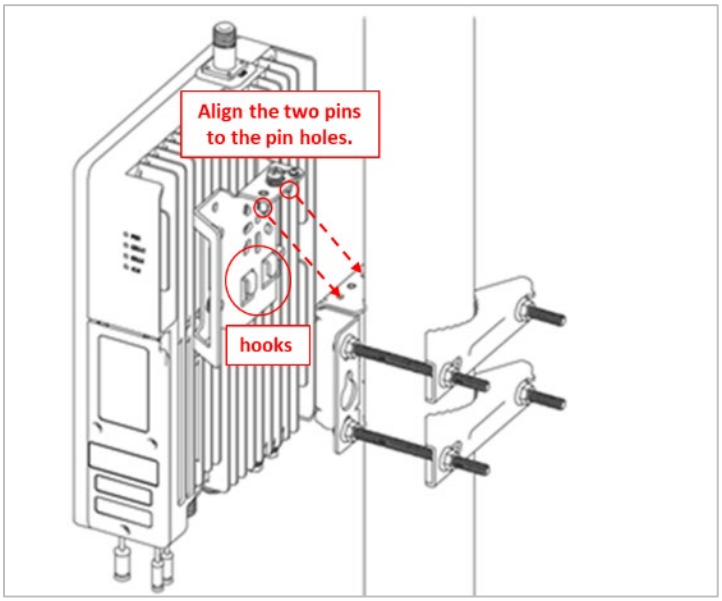
2. Place the pole bracket on the pole and turn the two clamps to the proper position as shown in Figure 3-6. Fasten the four nuts with a wrench.

Figure 3-6: Attach Bracket to Pole



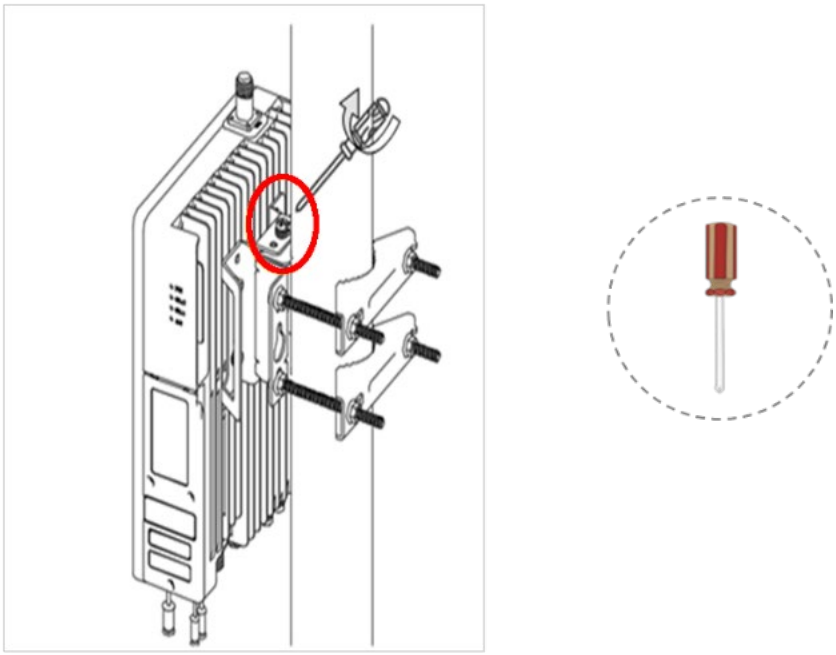
3. Align the two pins on the eNB bracket to the pin holes on the pole bracket, and lower the pins vertically into the pin holes, ensuring the hooks on the eNB are firmly attached in the slots on the pole bracket (Figure 3-7).

Figure 3-7: Attach eNB to Bracket



4. Tighten the screw on the top of the bracket using a Phillips-head screwdriver to complete the installation (Figure 3-8).

Figure 3-8: Completed Attachment



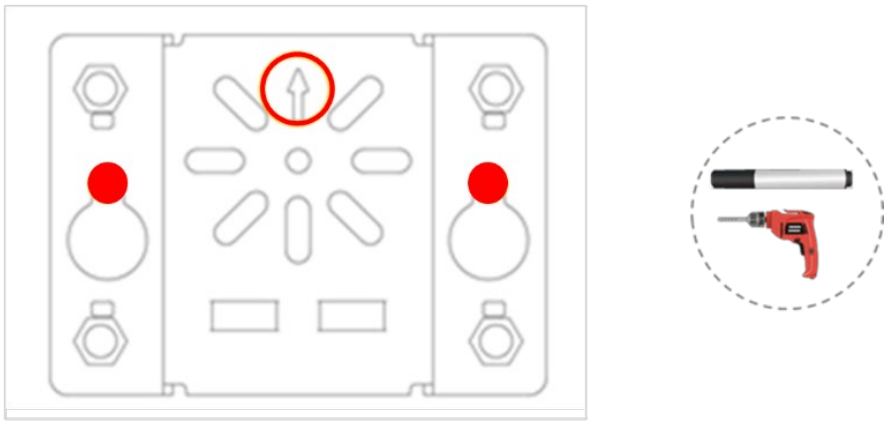
5. Proceed to *section 3.4*.

3.3.2 Install on Wall

Ensure that the wall can bear at least four times the weight of the eNB. Follow the steps below to install the Nova430e eNB on a wall.

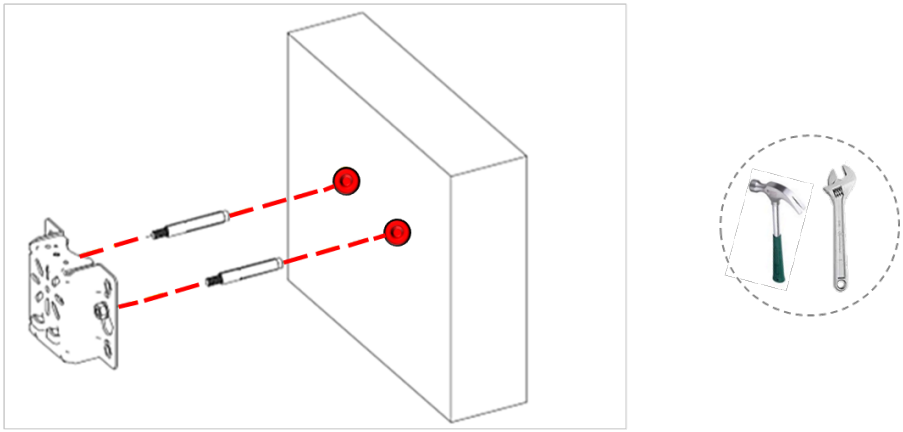
1. Take apart the assembled pole/wall bracket so that only the wall bracket remains.
2. Place the wall bracket on the wall with the arrow facing up, as shown in Figure 3-9. Mark the drilling locations using a pencil or marker.
3. Drill two holes in the wall to match the size of the wall bracket holes.

Figure 3-9: Mark and Drill Holes



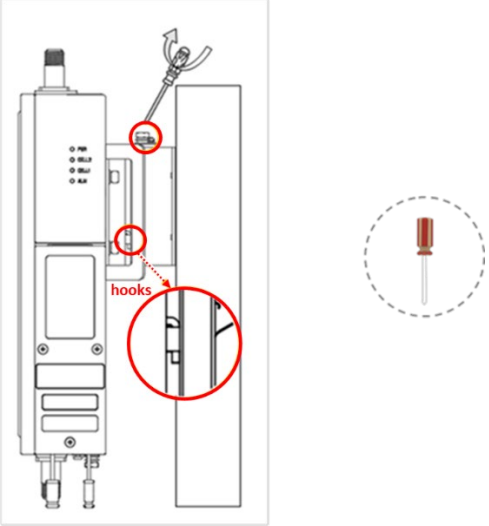
4. Insert the expansion bolts in the marked location. Check the up/down direction of the installation bracket, and then hang the wall bracket on the expansion bolts. Fasten with flat washers, spring washers, and nuts (Figure 3-10).

Figure 3-10: Attach With Expansion Bolts



5. Align the two pins on the eNB bracket to the pin holes on the wall bracket (refer to Figure 3-7), and lower the pins vertically into the pin holes, ensuring the hooks on the eNB are firmly attached in the slots on the wall bracket. Tighten the screw on the top of the bracket using a Phillips-head screwdriver to complete the installation (Figure 3-11).

Figure 3-11: Attach eNB to Bracket



3.4 Connect Cables

3.4.1 Cable Laying Requirements

General requirements:

- Bending radius of antenna feeder cable:
  - 7/8 in > 9.84 in (22.2 mm > 250 mm)
  - 4/5 in > 14.96 in (20.3 mm > 380 mm)
- Bending radius of jumper cable:
  - 1/4 in > 1.38 in (6.3 mm > 35 mm)
  - super soft 1/2 in > 1.97 in (13 mm > 50 mm)
  - ordinary 1/2 in > 5 in (13 mm > 127 mm)
- Bending radius of power cable and grounding cable: > triple the diameter of the cable.
- Bind the cables according to the type of cable; intertwining and crossing are forbidden.
- An identification label should be attached after the cable is laid.

Grounding cable requirements:

- The grounding cable must connect to the grounding point.
- The grounding cable must be separated from the signal cables, and of enough distance to avoid signal interference.

3.4.2 Connect RF Cables

WARNING: Ensure the antenna is connected before powering up the eNB. The wireless signal transmission power can cause bodily injury and damage to the eNB and RF power amplifier devices.

1. Open the dust caps of the ANT0, ANT1, ANT2, and ANT3 interfaces.
2. Insert the RF cables into cold shrink tubes.
3. Connect RF cables to the ANT0, ANT1, ANT2, and ANT3 interfaces on the eNB, and tighten them with a wrench to 12–15 in-lb or 1.4–1.7 NM torque.

   NOTE: Antenna ports ANT0 and ANT1 connect to the primary cell (Pcell), or Cell 1. Antenna ports ANT2 and ANT3 connect to the secondary cell (Scell), or Cell 2.

4. Push the cold shrink tube to the top joint, and pull out the strip.
5. Take another shrink tube and pass the RF cable through.
6. Connect the other end of the RF cables to the external antenna.
7. Push the cold shrink tube to the antenna connector, and pull out the strip.

3.4.3 Connect Ethernet Cable

1. Connect the Ethernet cable to the Ethernet (ETH) interface in the wiring cavity.
2. Lay the Ethernet cable along the wire groove and stretch out the wiring cavity from Ethernet (ETH) hole.
3. The Ethernet cable connects to the PoE interface of the PoE adapter.
4. The LAN interface of the PoE adaptor connects to a LAN switch or a router for maintenance and backhaul.

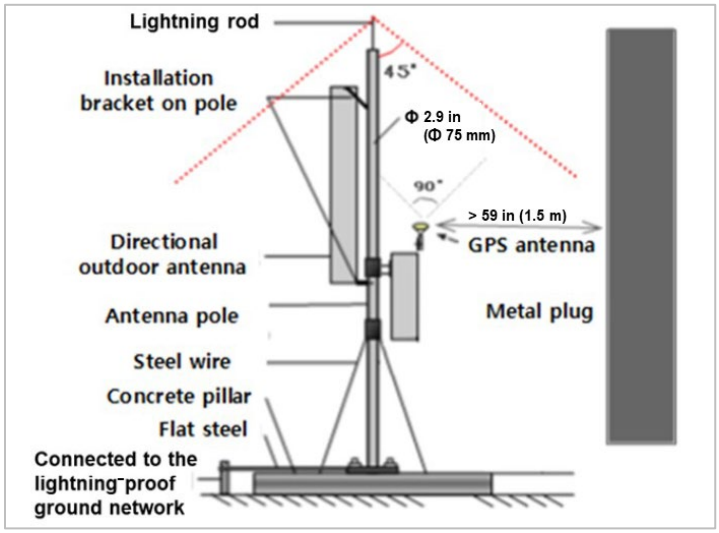
   NOTE: The PoE adaptor must be placed in the distribution box for waterproofing.

3.4.4 Grounding

3.4.4.1 Pole Grounding

The purpose of pole grounding is to protect the equipment as much as possible from potential damage of lightning overvoltage. 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, any damage caused by lightning primarily 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 3-12.

Figure 3-12: Pole Grounding



1. The installation position of the grounding bar should 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 should meet 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 core or binding tape with a fixed spacing of 12 in (0.3 m).
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, 12 x 1.5 x 0.16 in (300 × 40 × 4 mm) 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.

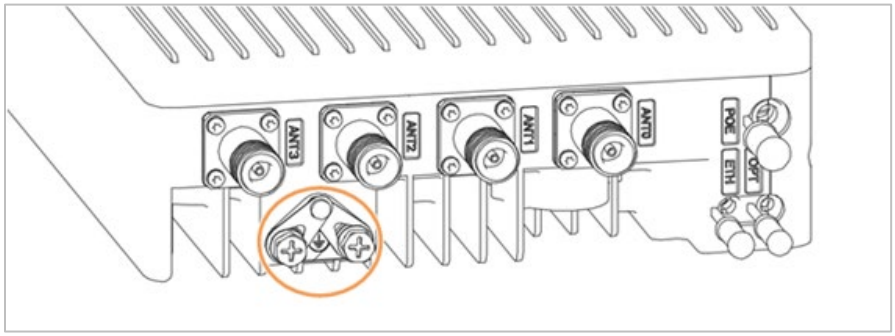
7. The grounding electrode of the self-built grounding grid for the outdoor antenna of the tunnel must meet the design requirements. The buried depth of the grounding electrode and the welding quality of the flat iron meet the specification requirements. In principle, the buried depth of the grounding electrode shall not be less than 27.5 in (0.7 m). 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.

3.4.4.2 eNB Grounding

Prepare the grounding cable according to the actual measurements and requirements of the specific installation site. The Nova430e eNB has two grounding screws located on the bottom of the unit, as shown in Figure 3-13. Follow the steps below the figure to connect the ground cable.

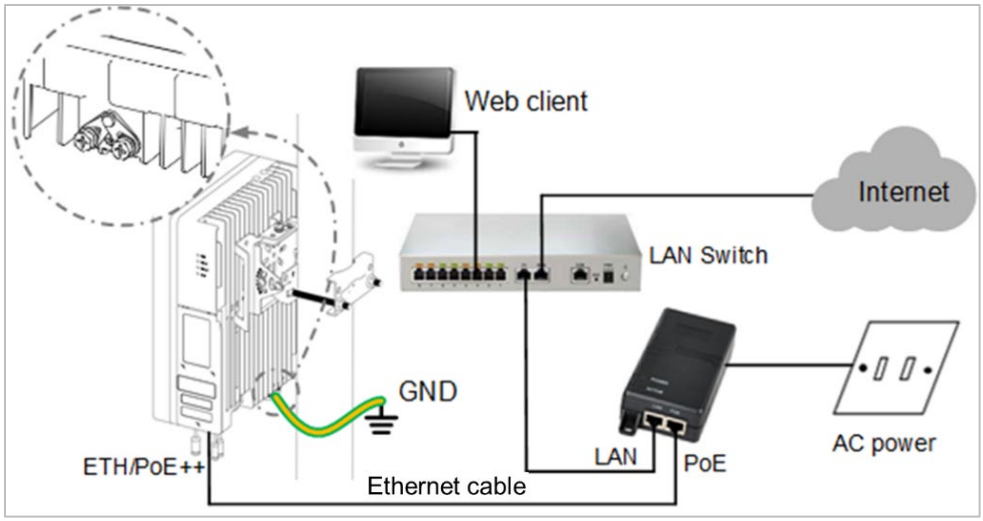
NOTE: All Nova eNBs have a floating ground on the power system.

Figure 3-13: Grounding Screws



1. Unscrew one grounding screw, connect one end of the ground cable to the grounding screw, and retighten the screw.
2. Repeat step 1 for the second grounding screw.
3. Once the eNB is installed at the outdoor location, the other end of the ground cable needs to connect to a good grounding point (earth), as shown in Figure 3-14.

Figure 3-14: Connecting Cables and Grounding Screws



3.5 Maintenance Chamber Waterproofing

Once the installation is complete, you must close the maintenance chamber of the equipment and waterproof the chamber.

Put the Ethernet cable on the wire, and seal the wire diameter 0.3 in ± 0.04 in (7 mm ± 1 mm).

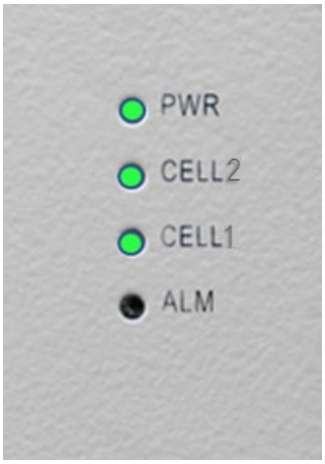
Before installing the eNB at its final destination, perform the steps in *section 3.6* and *section 3.7*. Upon successful testing, the eNB will be ready for installation at the cell site. Seal and weatherproof all the connection points, and rustproof where needed.

3.6 Power on to Check LED Status

WARNING: Ensure the antenna is connected before powering up the eNB. The wireless signal transmission power can cause bodily injury and damage to the eNB and RF power amplifier devices.

After the Nova430e is powered on, check that the LED indicators are lighting as expected: Power is steady green, cell activated is slow flash green, and there are no alarms (Figure 3-15) per Table 2-3.

Figure 3-15: Check LEDs



3.7 Configure Basic Parameters

Reference: *4G LTE eNodeB Configuration Guide – BaiBLQ*

The Nova430e eNB can be configured in SC, CA, or DC/split mode, depending on which licenses you have purchased, and/or in HaloB mode, which is embedded in the base software. The Nova430e also supports CBRS SAS operation.

When first installing and testing the Nova430e, Baicells recommends configuring the primary cell (Pcell)/Cell 1 carrier settings (without enabling CA, DC, HaloB, or SAS) for simple verification that the new eNB unit is operational. Once it is confirmed to be operational, you can then refer to the appropriate configuration guide(s) for the operating mode you plan to use.

NOTE: For all GUI menus and fields, refer to the following documents on the Baicells website: Baicells.com > Resources > *Documents.*

- CloudCore Configuration and Network Administration Guide
- Atom CAT4 CPE Configuration Guide
- Atom CAT6/CAT15 CPE Configuration Guide
- 4G LTE eNodeB Configuration Guide – BaiBLQ
- Carrier Aggregation and Dual Carrier/Split Mode Configuration Guide
- HaloB Solution User Guide
- SAS Deployment Guide

3.7.1 Launch the eNB GUI

Follow the steps below to connect to the Nova430e GUI.

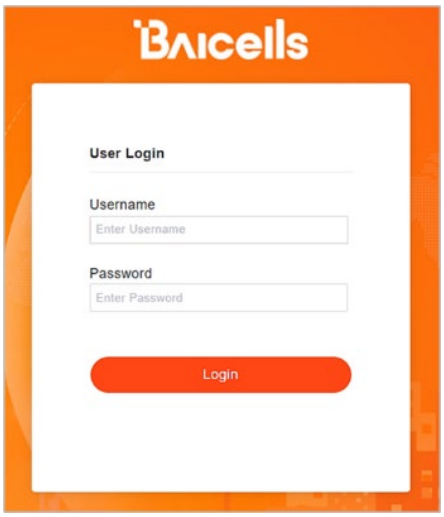
Step 1: Use an Ethernet cable to connect the eNB WAN/PoE+ port to the local Network routed to the Internet. The DATA interface is set to Dynamic Host Configuration Protocol (DHCP) client by default.

Optionally, you can plug a Personal Computer (PC) directly into the eNB MGMT port. On your PC you will need to assign a static IP address within the Management (MGMT) subnet. The default IP address for the MGMT interface is *http://192.168.150.1/24*.

Step 2: Open a Web browser and enter the following IP address: *http://192.168.150.1*.

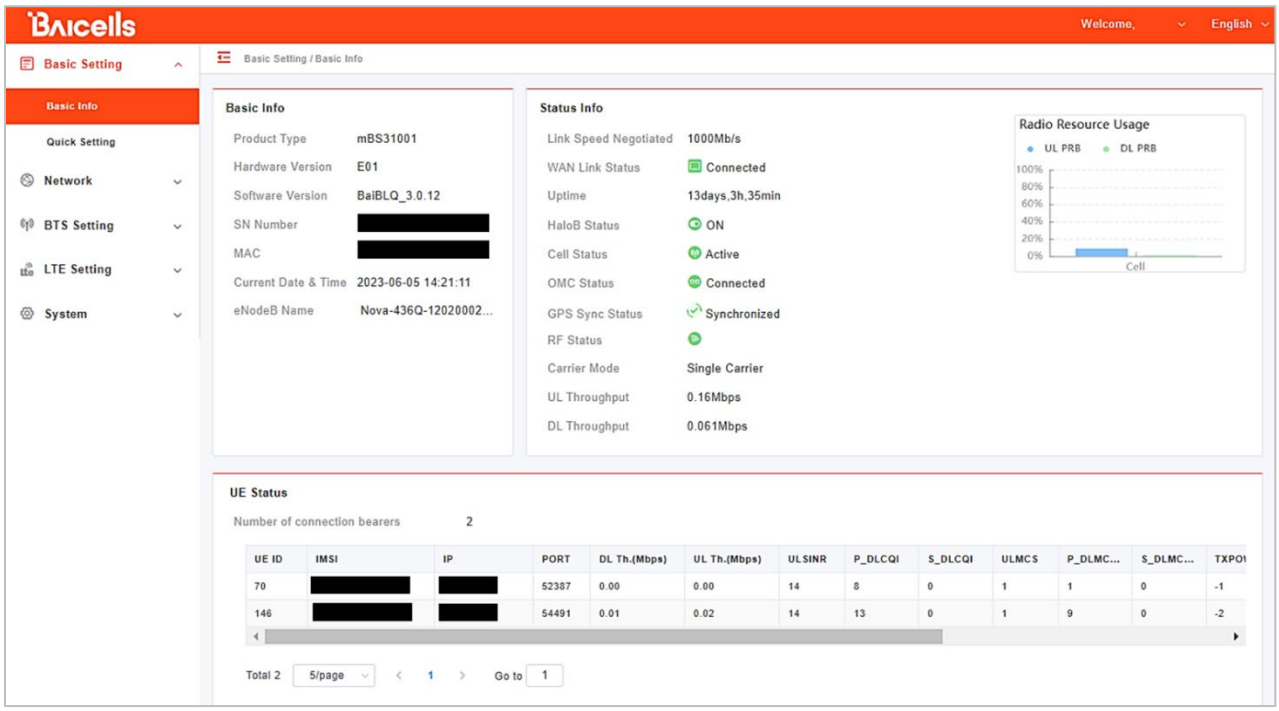
Step 3: At the login screen (Figure 3-16), enter the default username (*admin*) and password (*admin*) and click on *Login* to open the home page.

Figure 3-16: GUI Login



The home page is the *Basic Setting* > *Basic Info* menu, which reports the current eNB status (Figure 3-17). In *section 3.7.9*, you will use this page to confirm that the eNB is active.

Figure 3-17: Home Page



Optionally, you may want to:

1. Change the login password.
2. Confirm the firmware version is the latest available from Baicells website; upgrade if needed. Firmware upgrades can be found at Baicells.com > Support > *Firmware*. See *Section 3.7.2* for detailed instructions regarding firmware upgrades.
3. Set the Network Timing Protocol (NTP).

For help, refer to the *CloudCore Configuration and Network Administration Guide*.

3.7.2 Upgrade Firmware

Follow the steps below to ensure you are using the most recent software version before configuring the eNB.

3.7.2.1 Upgrade Firmware from eNB GUI

1. Download the most recent firmware file from Baicells.com > Support > *Firmware*, and save on local computer.
2. Go to *System* > *Upgrade* and select whether to preserve the current settings.
3. Choose *Select File* in the *Upgrade Firmware* pane, and navigate to the firmware file saved to the local computer.

   NOTE: The file type is *.IMG.

4. Select *Upgrade* in the *Upgrade Firmware* pane.

5. When prompted, click *Proceed*.
6. After the upgrade is completed (about 5 minutes), the eNB performs a reboot.
7. On the *Basic Setting > Basic Info* page, the upgraded version is displayed in *Software Version.*

3.7.2.2 Upgrade Firmware from the OMC

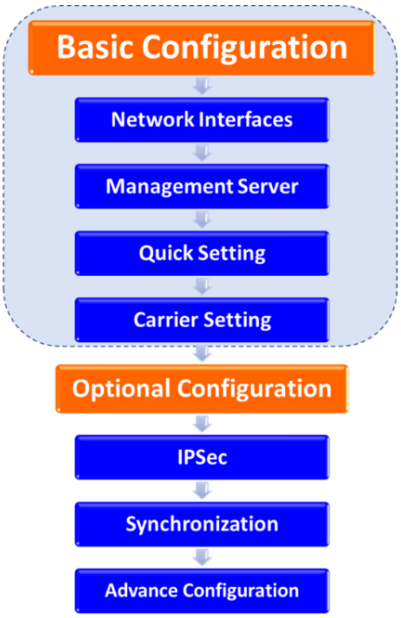
1. Go to *Upgrade > eNB > Upgrade&Rollback*.
2. In the upper right corner of the window, select the *Upgrade* icon, and the *New Task* window opens.
3. In the *Basic Info* pane, accept the *Task Name* or enter a new name.
4. In the *Select Device* pane, for *Upgrade Type*, choose *Software Upgrade*.
5. Use the drop-down menu to select the *Product Type*.
6. Select *All, online*, or *offline* from the *Online Status* drop-down menu to filter the devices in the device list.
7. Next to *Equipment Specified*, choose *All* or *Select*.
8. Next to *File list*, select the checkbox next to *Preserve Settings* if you want to keep the eNB's current configuration.
9. Choose the *Execute Mode* (*Immediately, Awaiting Start, Go Live Execution*, or *Schedule Time*).
10. To apply the upgrade to multiple eNBs, set the *Device Concurrent Number*.
11. Select *OK* to complete the action.

For help, refer to the *CloudCore Configuration and Network Administration Guide*.

3.7.3 Basic Configuration Overview

Figure 3-18 indicates four main steps for basic configuration: network interfaces, management server address, quick settings pertaining to key LTE parameters, and the carrier setting.

Figure 3-18: Configuration Flow



3.7.4 Configure Network Interfaces

The network interfaces defined as part of the initial, basic setup include the WAN/LAN/VLAN interfaces, DHCP, and the Local Gateway (LGW) mode.

3.7.4.1 WAN/LAN/VLAN

Go to the *Network > WAN/LAN/VLAN* sub-menu (Figure 3-19). The Wide Area Network (WAN) interface is an external communication portal (Internet connection) between the eNB's Network Management System (NMS) – in most cases, the CloudCore OMC – and the MME. If not using CloudCore, the eNB's NMS can be a Local OMC or the LTE NMS. The *WAN/LAN/VLAN* fields are described in Table 3-1.

If the *IP Access Mode* field is set to *DHCP* (Figure 3-19) and the *LGW* function is *ON* as shown in (*section 3.7.4.2*), the *Connect Type* field must be modified, based on the requirement. The IP address of the eNB is changed due to the Message Authentication Code (MAC) address being changed. Therefore, modify the router server at the same time.

The *LAN* interface is used only for local maintenance port during initial eNB setup and basic configuration, and is not used during normal eNB operation. In the *LAN Config* tab (Figure 3-20), enter the IP address and subnet mask address for the local network connection. The default LAN IP address is **192.168.150.1** and the default subnet mask address is **255.255.255.0**.

NOTE: If the LAN IP address is changed, the eNB will reboot and you will have to log in to the GUI again.

Figure 3-19: WAN/LAN/VLAN

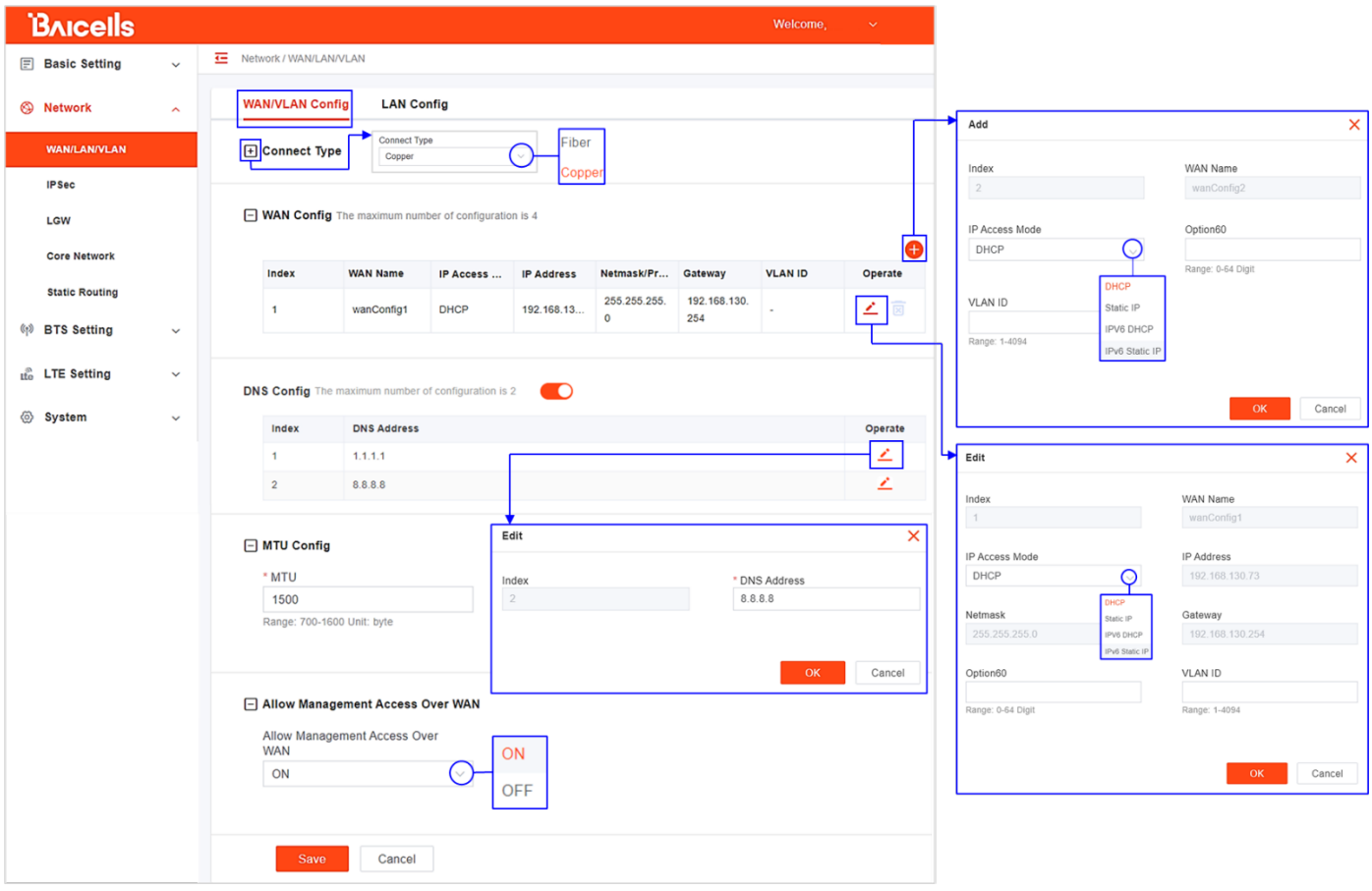


Figure 3-20: LAN Config Tab

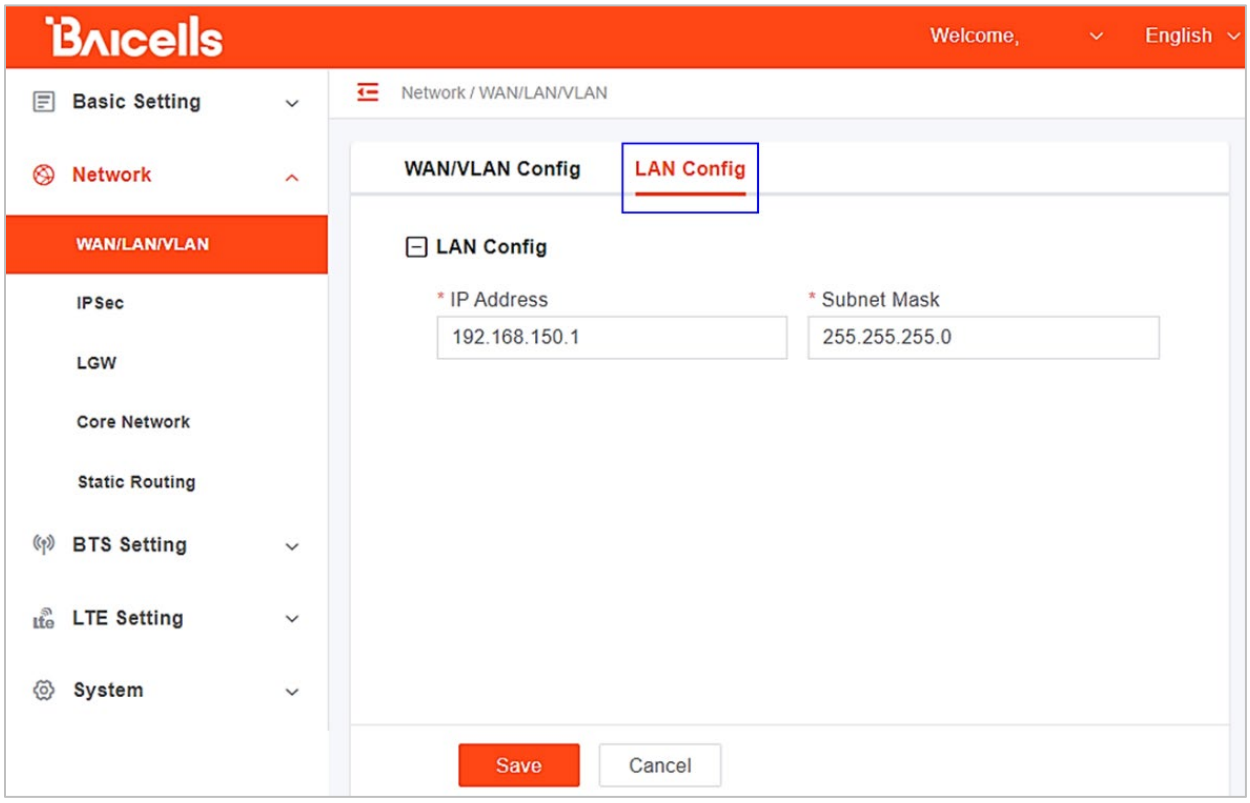


Table 3-1: WAN/LAN/VLAN

Field Name	Description
WAN/LAN Config Tab	
Connect Type Pane	
Connect Type	Used to select the type of connection for the eNB: • Copper: RJ-45 electrical interface • Fiber: optical fiber interface The connection type is based on the eNB model. If the eNB doesn't support optical ports, the value must be set to *Copper*.
WAN Config Pane	
Index	The WAN index number, which is automatically generated. The eNB supports up to four WAN interfaces.
WAN Name	The WAN Name is automatically generated.
IP Access Mode	Used to select the desired interface protocol to be used by the WAN interface: • DHCP: only the Option60 parameter needs to be configured if DHCP is the interface protocol selected. • Static IP • IPv6 DHCP • IPv6 Static IP
Option60	Used to differentiate between different terminals when *IP Access Mode* is set to *DHCP*. Range is 0–64 digits.

Field Name	Description
Netmask	The IP address' subnet mask address. This parameter displays when *IP Access Mode* is set to *Static IP*.
Gateway	The default gateway's IP address. This parameter displays when *IP Access Mode* is set to *Static IP*.
Prefix	The IPv6 address' prefix for the WAN interface. This parameter displays when *IP Access Mode* is set to *IPv6 Static IP*. Range is 0–128.
IPv6 Gateway	The IPv6 address' gateway for the WAN interface. This parameter displays when *IP Access Mode* is set to *IPv6 Static IP*.
IP Address	The WAN interface's IP address. This parameter displays when *IP Access Mode* is set to *Static IP* or *IPv6 Static IP*.
VLAN ID	Used to configure more IP addresses for the WAN interface through the VLAN when there is a need to transmit multi-types of data through a separate channel. Range is 1–4094.
DNS Config Pane	
Index	The DNS index number, which is generated automatically.
DNS Address	The IP address assigned to the DNS. The maximum number of configurations is two.
MTU Config Pane	
MTU	Used to specify the size of the largest network layer protocol data unit that can be communicated in a single network transaction. Specifying the correct MTU for the network can help to improve data transmission efficiency. Range is 700 to 1600 bytes. The default value is 1500 bytes.
Allow Management Access Over WAN Pane	
Allow Management Access Over WAN	Used to enable/disable the Local Maintenance Terminal connection through the WAN port (*ON* or *OFF*) for management purposes. If set to *ON*, the administrator can maintain the eNB through the WAN interface.
LAN Config Tab	
LAN Config Pane	
IP Address	The LAN interface IP address. The default value is **192.168.150.1**.
Subnet Mask	Used to define the subnet mask address for the LAN interface. The default value is **255.255.255.0**.

3.7.4.2 LGW

The Local Gateway (LGW) must be configured when the Baicells CloudCore Evolved Packet Core (EPC) is used. The Baicells eNodeB (eNB) splits the data and control planes, so there are two IP addresses per Customer Premise Equipment (CPE). The data plane is sent out to the LGW, while the control plane is routed through an IPSec tunnel to the Baicells CloudCore EPC.

Refer to Figure 3-21 and Table 3-2 to configure LGW. You must reboot the eNB when you make changes to these settings.

Figure 3-21: LGW

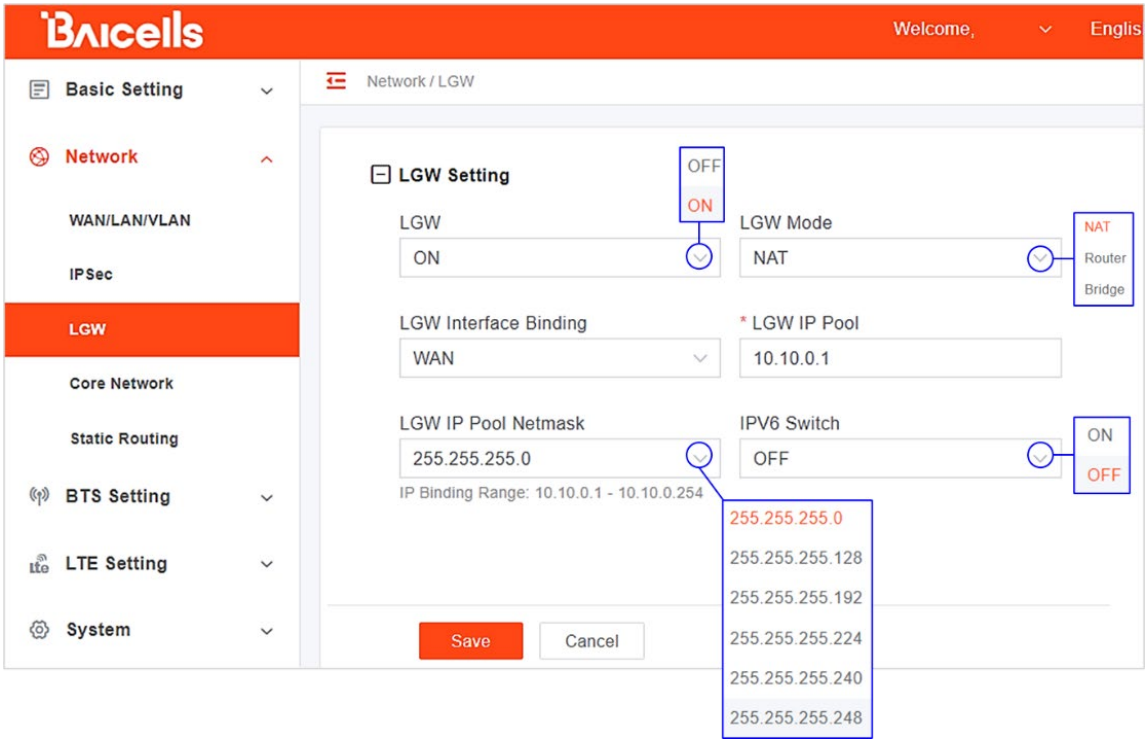
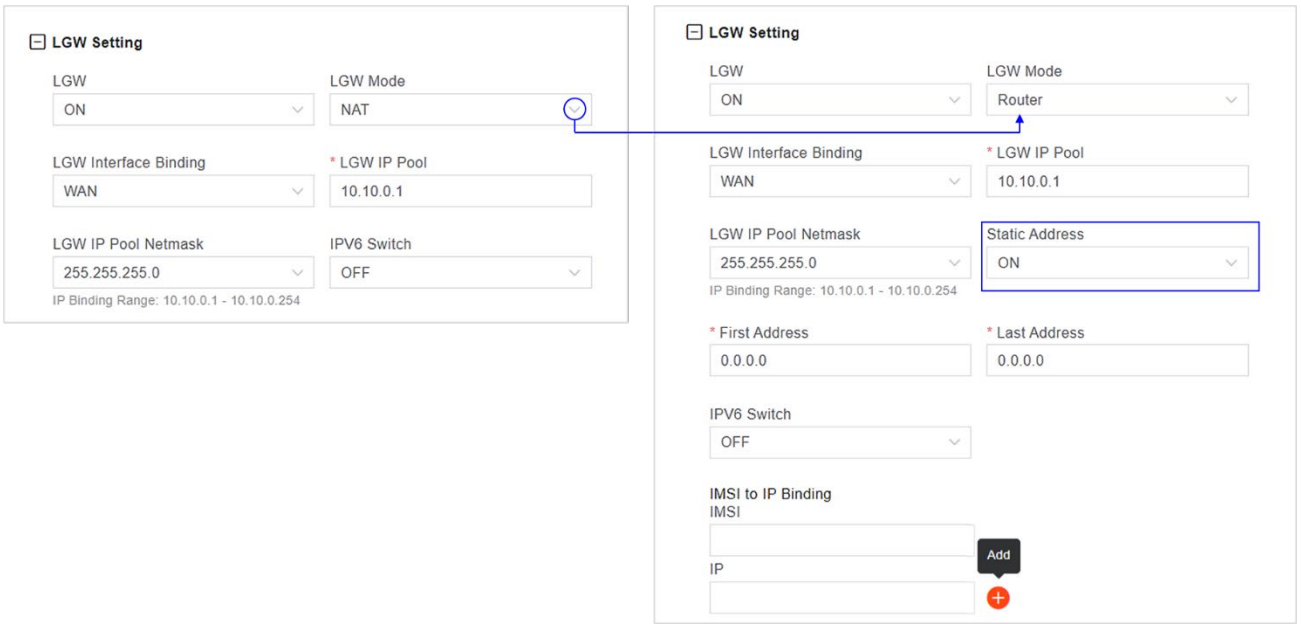


Table 3-2: LGW

Field Name	Description
LGW	LGW (*ON* or *OFF*). Default is *ON*.
LGW Mode	Select an option: NAT: Packages from the internal network to the external network need Network Address Translation Router: Select optimized route from the routing table (Figure 3-22). Bridge: Transfer in the data link layer.
LGW Interface Binding	The IP address LGW used for data unloading. Select from configured interfaces. Default is WAN interface. The VLAN interface can also be used to separate different links.
LGW IP Pool	Enter the starting IP address of the dynamic IP address pool. The LGW assigns a local IP address for the accessed CPE to manage the CPEs.
LGW IP Pool Netmask	For example, if the first IP address is 10.10.10.1 and the netmask is 255.255.255.0, the IP address pool includes 254 IP addresses. The options are shown in the drop-down menu: 

Field Name	Description
IPV6 Switch	The IPV6 network interface is used for in-band connectivity with the switch, as *ON* and *OFF*.
Static Address	If *LGW Mode = Router* (Figure 3-22), set it to *ON* if you want to use a static IP address.
First Address	If *LGW Mode = Router* and *Static Address = ON* (Figure 3-22), enter the first static IP address in the range.
Last Address	If *LGW Mode = Router* and *Static Address = ON* (Figure 3-22), enter the last static IP address in the range.
IMSI to IP Binding - IMSI	If *LGW Mode = Router* and *Static Address = ON* (Figure 3-22), if you want to bind an IMSI number to the IP address, enter the IMSI number.
IMSI to IP Binding - IP	If *LGW Mode = Router* and *Static Address = ON* (Figure 3-22), enter the IP address to bind to the IMSI. You can add more than one IP address.

Figure 3-22: LGW = Router

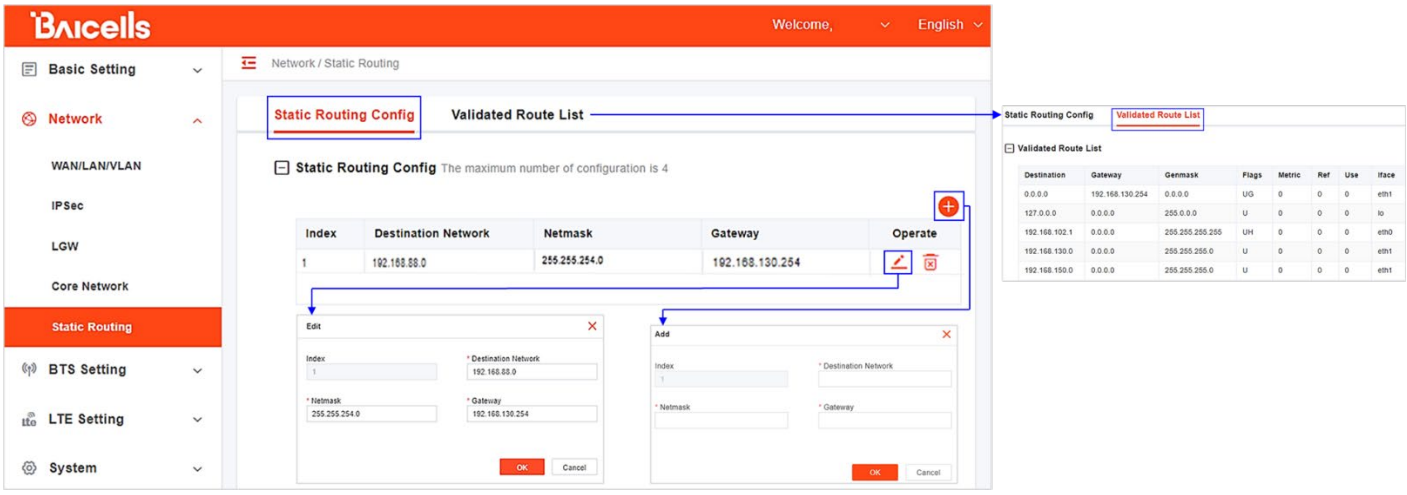


3.7.4.3 Static Routing

When using static routing, go to *Network > Static Routing*. The *Network > Static Routing* landing page has two main sections, *Static Routing Config* tab and *Validated Route List* tab (Figure 3-23). The configured static route information is displayed under *Static Routing Config* tab.

To add a new static routing address to the list, click on the *Add* icon , enter the information, and select *OK*. Once created, you can enable/disable the address. To edit an existing static routing setting, click on the *Edit* icon , modify the information, and then save. Use the *Delete* icon to remove an existing static route setting. Field descriptions are in Table 3-3.

Figure 3-23: Static Routing



NOTE: For each field description, refer to the *Atom CAT4 CPE Configuration Guide* and *Atom CAT6/CAT15 CPE Configuration Guide*.

Table 3-3: Static Routing

Field Name	Description
Index	Auto-generated static route index number.
Enable	Enable/Disable the static route.
Destination Network	The destination IP address.
Netmask	The subnet mask of the destination IP address.
Gateway	The target IP address' gateway IP address.

3.7.5 Configure the Management Server

In the *BTS Setting > Management Server* window, enter the NMS information (Figure 3-24). When using the Baicells CloudCore to manage the network, in the *http://* field, enter the following URL address and port number: **http://baiomc.cloudapp.net:8443/smallcell/AcsService**.

If you are using Local OMC or another NMS, enter its server address and port number. Refer to the field descriptions in Table 3-4.

Figure 3-24: Management Server

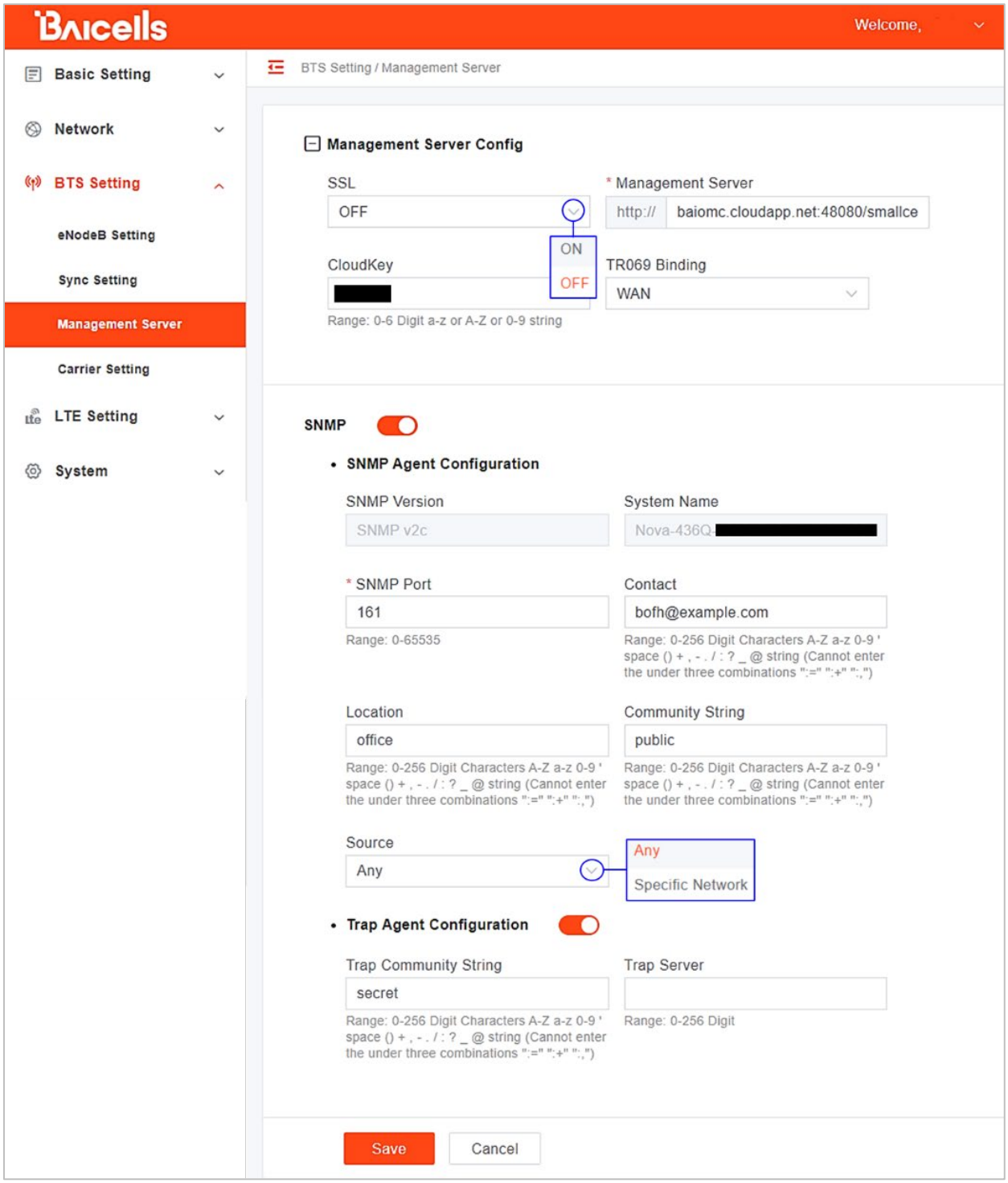


Table 3-4: Management Server

Field Name	Description
Management Server Config	
Override Cloud OMC URL	Select *ON* or *OFF*. Selecting *ON* allows you to configure the URL and port number in the *Management Server* field in the *Management Server Config* pane of the *BTS Setting > Management Server* sub-menu. NOTE: This field only displays when the eNB operating mode is set to *Cloud EPC* in the *Network > Core Network* menu.
SSL	Optional: The SSL connection adds enhanced security when it is turned on.
Management Server	The management server's IP address.
CloudKey	The NMS assigns this unique identifier for each operator. Range is 0–6 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9).
TR069 Binding	The interface binding with TR069 protocol. Default is *WAN*.
SNMP Agent Configuration	
SNMP Version	The current supported SNMP version, which is generated automatically and is SNMP v2c.
System Name	The community name, which is automatically generated.
SNMP Port	The SNMP protocol port used. Range is 0–65535.
Contact	The contact email. Range is 0–256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9).‘ space ( ) + , - . / : ? _ @ string Cannot enter the following three combinations ":=" ":+" and ":,"
Location	The system's location. Range is 0–256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9). ‘ space ( ) + , - . / : ? _ @ string Cannot enter the following three combinations ":=" ":+" and ":,".
Community String	Used to define a community. Default is *public*. Range is 0–256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9). ‘ space ( ) + , - . / : ? _ @ string Cannot enter the following three combinations ":=" ":+" and ":,".
Source	The source address of acquiring information. Default is *Any*.
Trap Agent Configuration	
Trap Community String	Used to define a community. Default is *secret*. Range is 0–256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9). ‘ space ( ) + , - . / : ? _ @ string Cannot enter the following three combinations ":=" ":+" and ":,".
Trap Server	The IP address for the host. Range is 0–256 characters.

3.7.6 Configure Quick Settings

The *Basic Setting* > *Quick Setting* sub-menu (Figure 3-25) is used to configure important RF parameters and connectivity to the Baicells CloudCore Evolved Packet Core (EPC). There are several important fields you must configure and/or verify. First, if the operator is using the Baicells CloudCore EPC, you must enter a fixed Public Land Mobile Network (PLMN) and MME IP address:

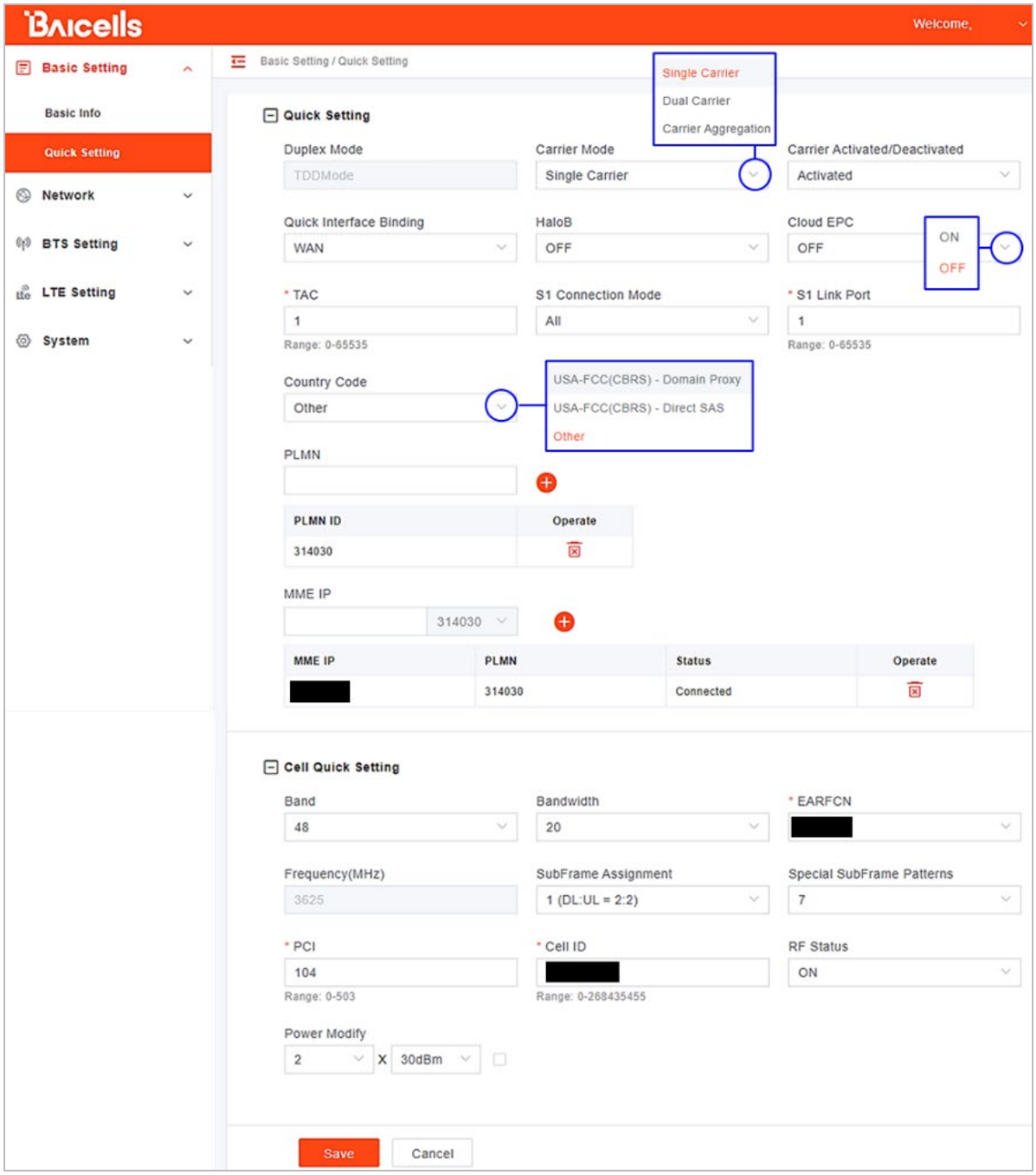
- PLMN = **314030**
- MME IP = **10.3.0.9 and 10.5.0.9**

Do not change these settings except when connecting to a Local (private network) EPC or different vendor's EPC. Second, you must enter the operator's planned settings for *Band*, *Bandwidth*, *EARFCN*, *Cell ID*, *PCI*, *TAC*, etc. Some *Quick Setting* fields such as *Duplex Mode* and *Frequency* will auto-fill based on the eNB hardware model. Make sure the *Cloud EPC* field is set to *ON* when using the Baicells CloudCore. If you are testing the eNB in a lab environment, turn the power down as low as it will go under the *Power Modify* field.

NOTE 1: If planning to use CBRS SAS, the SAS vendor will determine some of these parameters. Refer to the *SAS Deployment Guide* for more information.
NOTE 2: Nova430e does not support SFA = 0.
NOTE 3: Cloud EPC mode is enabled using the *Network* > *Core Network* menu.

For a description of all the eNB *Quick Setting* fields, refer to the *4G LTE eNodeB Configuration Guide – BaiBLQ*.

Figure 3-25: Quick Setting



3.7.7 Configure Carrier Setting

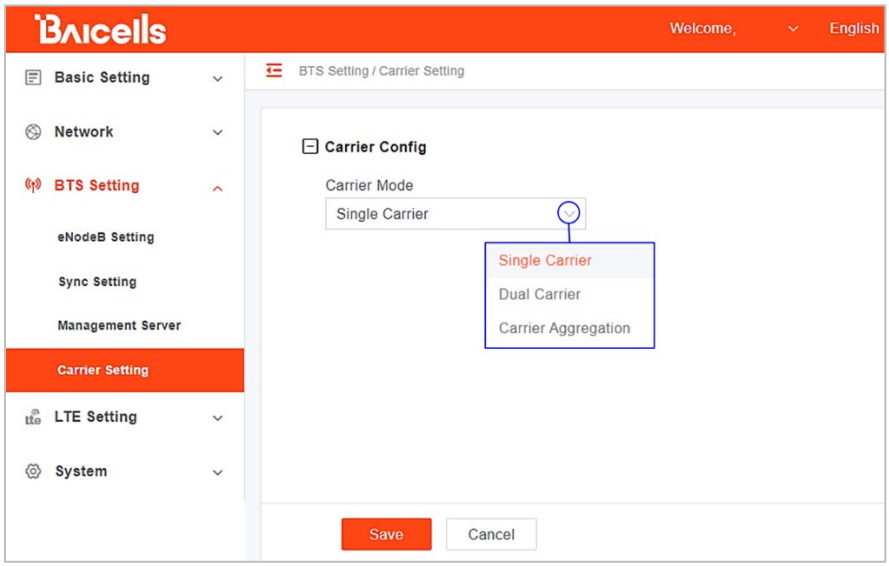
Reference: *Carrier Aggregation and Dual Carrier/Split Mode Configuration Guide*

The *BTS Setting* > *Carrier Setting* sub-menu (Figure 3-26) is used in eNBs running BaiBLQ software to enable a desired carrier mode setting. You can set the eNB to run as a single carrier, as two combined carriers using carrier aggregation, or as two independent carriers using dual carrier, depending on which licenses you have purchased. Single carrier (no CA) means only Cell 1 will operate and use only two RF ports instead of four. Operators may need to use this mode if they have limited spectrum or are planning to change to CA or DC mode at a later time when more capacity is needed for the coverage area.

Go to *BTS Setting* > *Carrier Setting* to configure *Carrier Mode*. Click the arrow to view the drop-down menu.

NOTE: Whenever you change the carrier setting, you must reboot the eNB for the change to take effect.

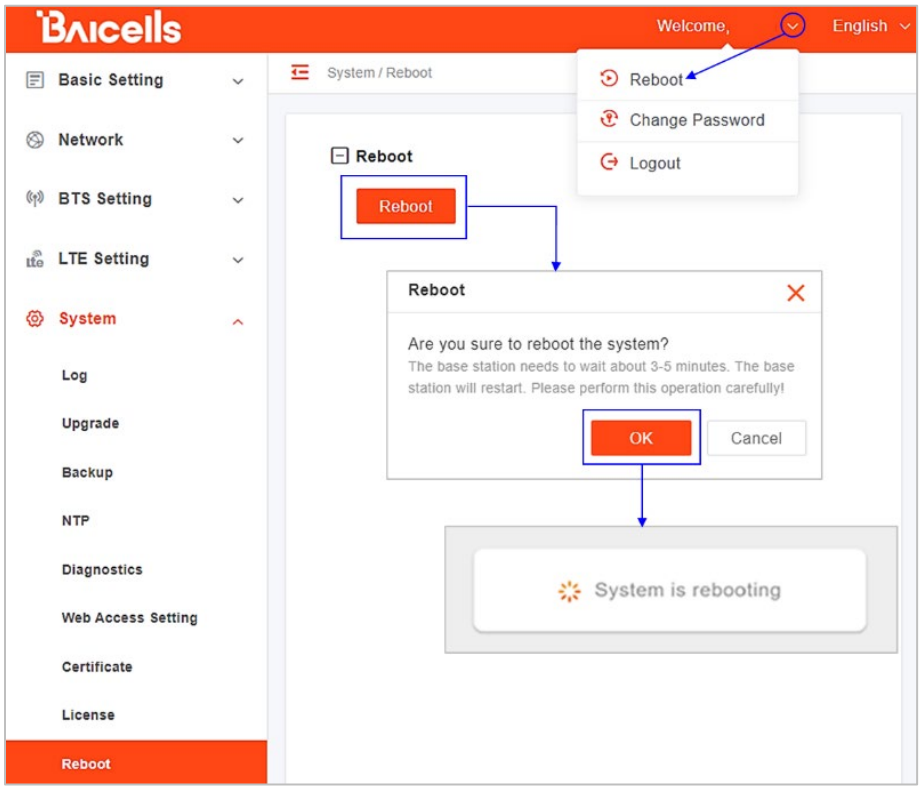
Figure 3-26: Carrier Setting



3.7.8 Reboot

Once the basic configuration settings are saved, reboot the eNB. There are two options for rebooting in the eNB GUI. From the landing page of the eNB GUI, navigate to *System* > *Reboot*, or select *Reboot* under the *Welcome* banner (Figure 3-27).

Figure 3-27: Reboot



3.7.9 Verify eNB Operational Status

When the eNB is finished rebooting, check the eNB status using the eNB GUI and the OMC. Once the eNB is mounted at its intended destination and powered on, recheck the status settings.

- **eNB GUI**: Go to *Basic Setting > Basic Info* and check the *Cell Status* field. It should show *Active*. Also, check that *GPS Sync Status* is reported as *Synchronized* (Figure 3-28).
- **OMC:** Go to *Monitor > eNB* to see if the *Cell Status* shows *Active* and the *Sync Status* shows *GPS Synchronized* (Figure 3-29).

NOTE: To manage which columns of information are displayed on the *Monitor > eNB* page, select the *Settings* icon in the upper left of the window. You can customize the order in which the columns display. Select a category, then drag and drop it in the preferred order (Figure 3-30).

Figure 3-28: Cell Status (eNB GUI)

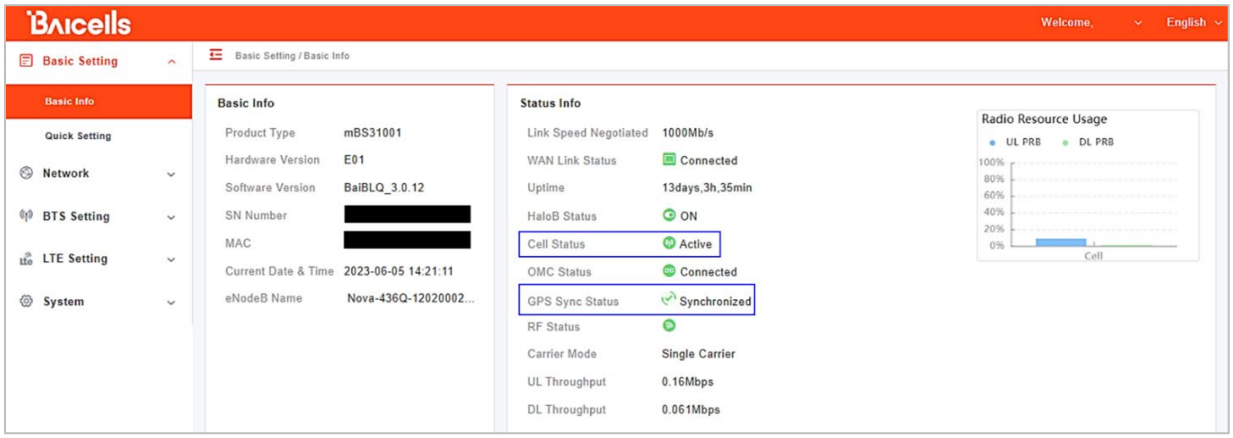
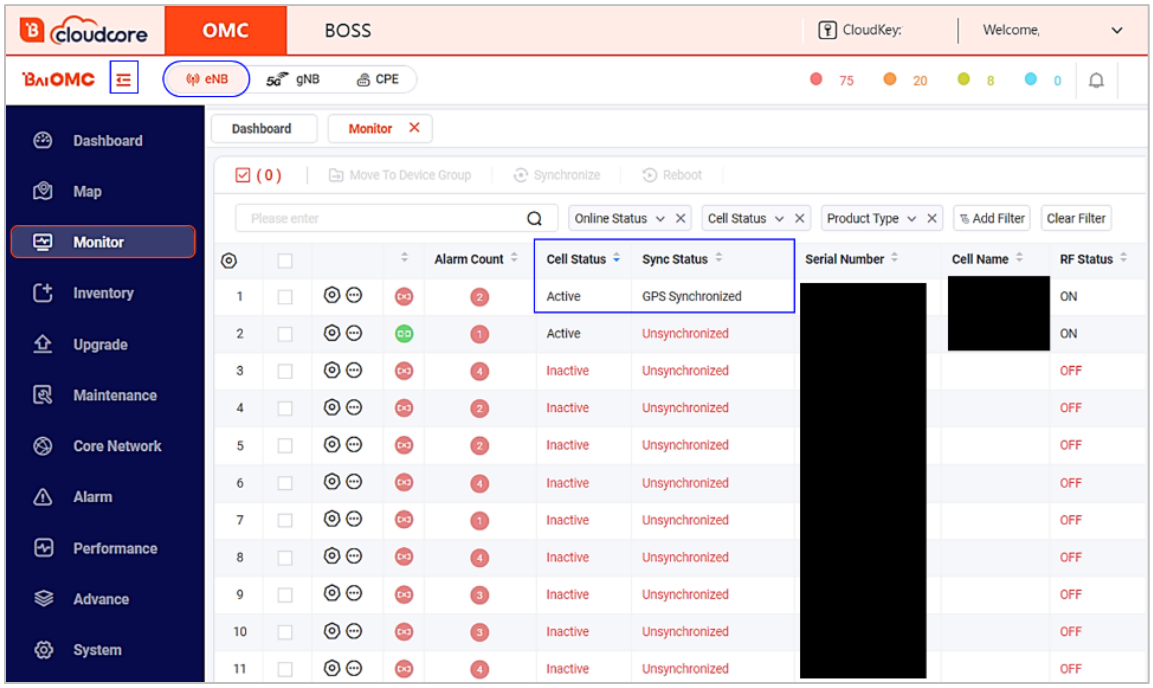
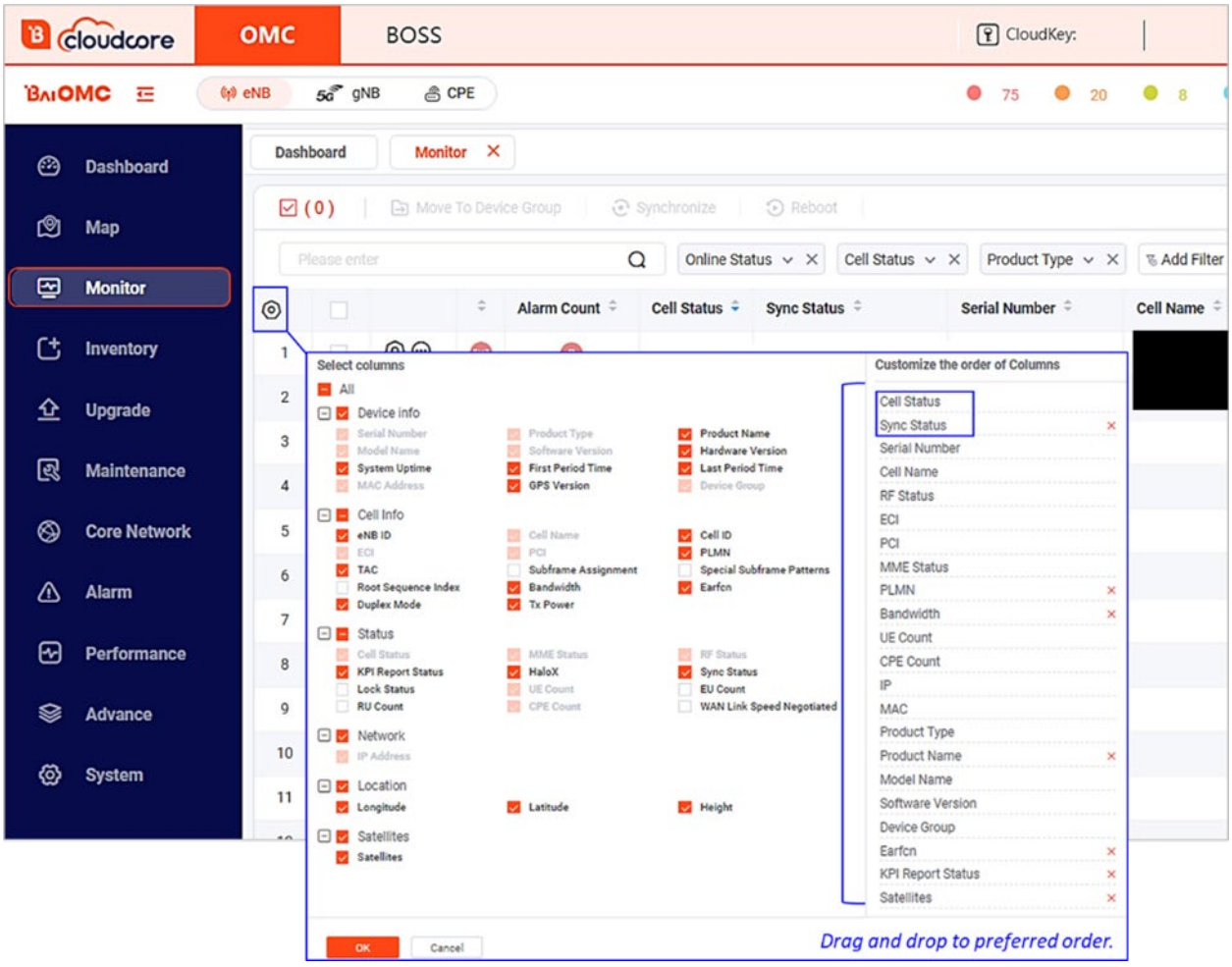


Figure 3-29: Cell Status (OMC)



NOTE: This image is captured with customized filters for Cell Status and Sync Status applied.

Figure 3-30: OMC Display Settings



Before the commercial operation, Baicells recommends implementing cell site acceptance testing of a new site to ensure the service meets expectations, to document network speeds at various locations in the cell, and to verify RF coverage.

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. 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 a minimum distance of 20 inches (50 cm) between the radiator and your body.

ISEDC Compliance

This device complies with Innovation, Science, and Economic Development Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 inches (50 cm) from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter, End-Users must be provided with transmitter operation conditions for satisfying RF exposure compliance.