



Nova-243 Outdoor
2x10W TDD eNodeB
Installation Guide

December 2019

Version 1.8

About This Document

This document is intended for personnel who will be installing the Baicells Nova-243 Outdoor 2x10W eNodeB (eNB) which is based on Long-term Evolution (LTE) Time Division Duplexing (TDD). The information includes preparation of installation tools and materials and procedures for properly installing the eNB, initially configuring it, and verifying its operational status. Please be advised that only personnel with the appropriate electrical skills and experience should install this device.

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Revision Record

Date	Version	Description	SMEs/Contributors	Writer/Editor
28-Feb-2020	V1.8	New logo & colors	Chris Culver	Sharon Redfoot
17-Dec-2019	V1.7	Sync IGs	Sonny May	Sharon Redfoot
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31-Aug-2018	V1.5	Updated GUIs	See Configuration Guide	Sharon Redfoot

Support Resources

- **Documentation** - Baicells product data sheets, this document, and other technical manuals may be found at Baicells > Resources > [Documentation](#).
- **Support** - How to open a support ticket, process an RMA, and the Support Forum are at Baicells > [Support](#).

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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.

 **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 Overview

1.1 Introduction

The Baicells Nova-243 Outdoor 2x10W eNodeB (eNB) is a high-performing outdoor micro base station that enables wired and wireless broadband access to Long-Term Evolution (LTE) backbone networks using Time Division Duplexing (TDD) technology (Figure 1-1).

Figure 1-1: Nova-243 eNB

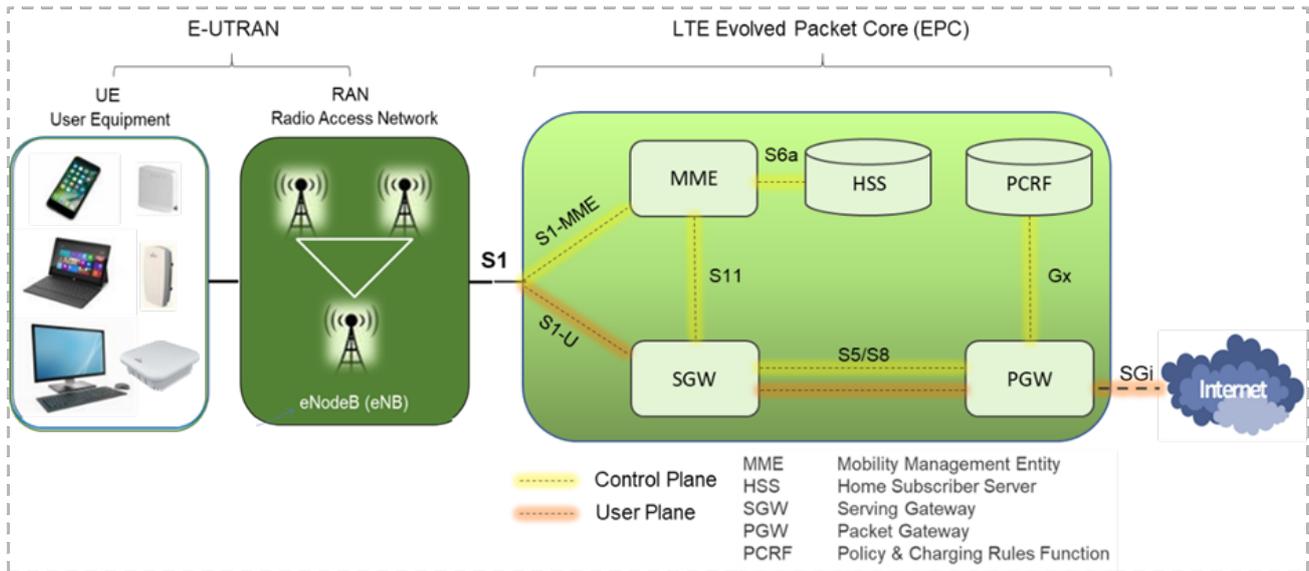


The eNB is a component of the operator's cell site and includes an integrated Global Positioning System (GPS). Optionally, the operator may install external GPS antennas with each eNB. The operator selects and provides one omni or directional Radio Frequency (RF) antenna to install with each eNB. Each eNB comes pre-configured so that installation is simplified and connection to the core network is plug-and-play.

Baicells provides operators with local and Web-based Graphical User Interface (GUI) applications to configure and manage individual eNBs and Customer Premise Equipment (CPE). Additionally, Baicells offers a Software-as-a-Service (SAAS) solution called CloudCore. CloudCore, also referred to as BaiCloud, handles the LTE Evolved Packet Core (EPC) network functions (Figure 1-2) and provides operators an account to use the Operations Management Console (OMC) for managing multiple sites across the network and the Business and Operations Support System (BOSS) for subscriber management.

NOTE: Local, private network versions of EPC and OMC+BOSS are also available. For information on these options, please contact your Baicells sales representative.

Figure 1-2: LTE Network Architecture



1.2 Features

Following is a list of the key features of the Nova-243. All product specifications are kept up to date and referred to as data sheets on the Baicells website.

- Supports standard LTE TDD Bands 41/42/43/48; customization may be requested
- Complies with 3GPP Release 9 standards
- 5/10/15/20 MHz operating bandwidth
- Throughput up to 112 Mbps downlink (DL), 20 Mbps uplink (UL) @ 20 MHz
- Configurable TDD 1:3, 2:2, or 3:1 DL to UL transmission ratio
- 96 concurrent users
- Any IP based backhaul can be used, including public transmission
- Lower power consumption to reduce OPEX
- IoT with all mainstream LTE Evolved Packet Core (EPC) vendors
- Local and remote Web-based GUI management
- Higher transmission power for extended coverage; excellent non-line-of-sight (NLOS) coverage performance

2 Preparing to Install

2.1 Personnel & Network Design

Installation personnel should follow standard, industry safety precautions when installing a Baicells Nova-243 eNB. Installers should refer to the operator's network design plan for information about specific network components, RF coverage goals for the specific cell site, IP addressing, and configuration settings.

Before installing, clearly identify the structure on which the eNB equipment will be installed, the intended height where the antenna and eNB will be located, the degree of antenna down tilt, and other necessary specifications that may impact the success of the installation. Consult regulatory rules concerning output power limits specific to your region.

2.2 Cables

When determining which RF antenna to use, be sure to match the frequency range of the antenna with the supported frequency range of the eNB. In addition to standard tools, refer to Table 2-1 for cables and wire required for eNB installation. The cables are available through [Baicells suppliers](#).

Table 2-1: Materials

Item	Description
Power Cable	Gauge: Less than AWG16 (e.g., AWG14) Length: Shorter than 1150 feet (350.5 meters)
Ethernet Cable	Outdoor CAT6 cable Shorter than 330 feet (100.6 meters)
RF Antenna Feeder Cable	50 ohm
RF Antenna	Omnidirectional or Directional antenna Maximum 1 antenna per Nova-243 eNB
Ground Wire	16mm ² diameter yellow-green wire
GPS Antenna	GPS antenna with N-type cable and GPS mounting bracket

NOTE: Baicells does not manufacture antenna components; please refer to the list of distributors on the Baicells website: <https://na.Baicells.com/where-to-buy/>. Make sure to match the frequency range of the antenna with the eNB, and consult the [regulatory rules](#) for your location concerning output power.

You will need a computer and the Ethernet cable to connect to the local maintenance terminal (LMT) on the Nova-243 unit. Through the LMT you can access the eNB GUI to enter basic configuration parameters so the eNB can connect to the network and to the Baicells CloudCore.

2.3 Form Factor

The 10W eNB has a sleek form factor -- 17.3" (H) x 9.5" (W) x 5.5" (D) / 440mm (H) x 240mm (W) x 140mm (D) -- and it weighs 26 lbs (12 kg). When power is applied to the unit, the LED status indicators should illuminate as shown in Figure 2-1 and are described in Table 2-2.

Figure 2-1: LEDs

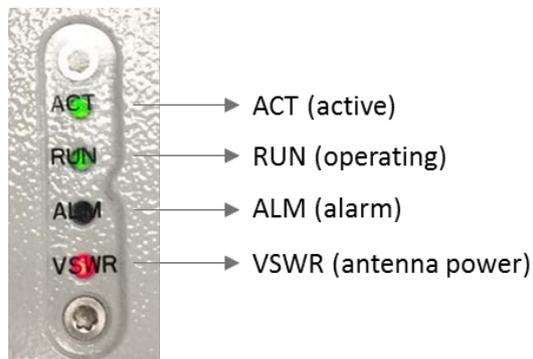


Table 2-2: LEDs

LED	Color	Status	Description
ACT	Green	Steady On	Active cell site, normal transmissions
		OFF	Inactive cell site; the transmitting channel is not working
RUN	Green	Fast flash: 0.125s on, 0.125s off	The eNB is booting up
		Slow flash: 1s on, 1s off	The eNB is booted and operational
		OFF	No power input, or board failure
ALM	Red	Steady On	Hardware alarm, e.g., VSWR alarm
		OFF	No alarms
VSWR	Red	OFF	The standing wave is normal.
		Steady On	The standing wave is larger than normal.

The cable interfaces are shown in Figure 2-2 and described in Table 2-3.

Figure 2-2: Interfaces

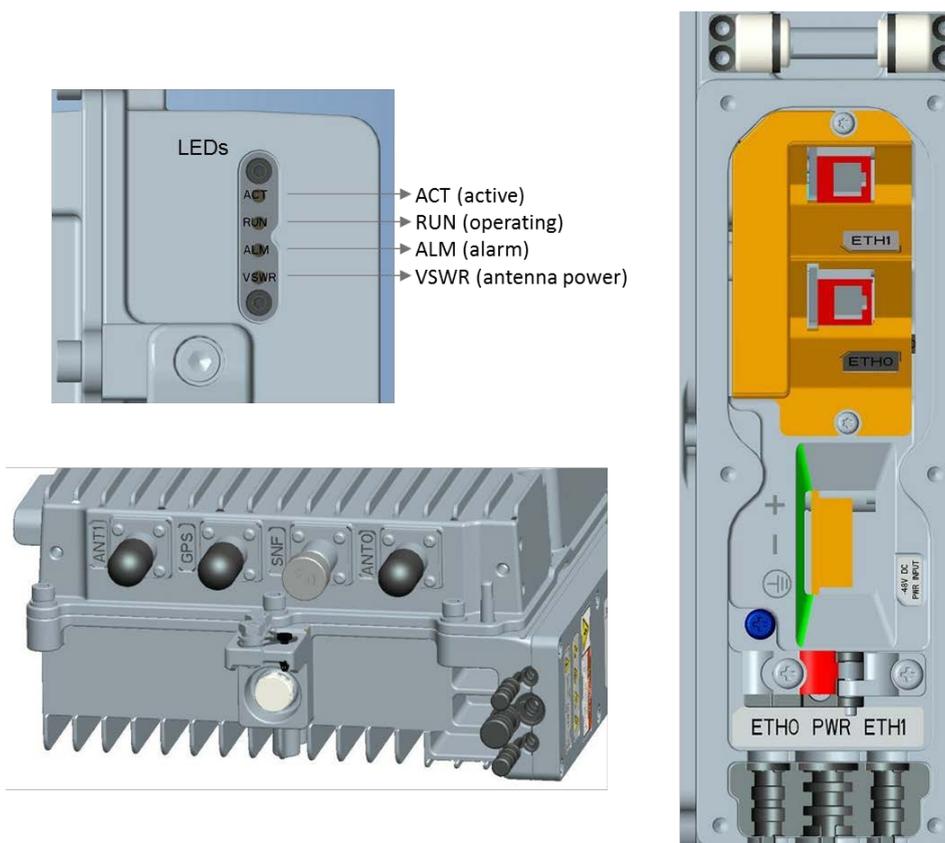


Table 2-3: Interfaces

Interface	Description
ANT1	External RF antenna 1, N-female connector
GPS	External Global Positioning System (GPS) antenna, N-female connection
SNF	(Reserved for future use)
ANT0	External RF antenna 0, N-female connector
ETH0	Ethernet connector 0
PWR	Power connector: +/- 42v to 58V
ETH1	Ethernet connector 1

2.4 Location & Environment

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 that are prone to impounded water, soaking, leakage, or condensation.

2.5 Grounding & Lightning Protection

You must protect the Nova-243 eNB, GPS, external antenna, and RJ-45 port against lightning. The eNB has two ground screws which are located on the bottom of the unit. You must connect the ground screws to a reliable outdoor grounding point (earth) using yellow-green ground wire that is at least 16mm² in diameter. The eNB uses a floating ground on the power line.

In principle, always place the grounding as near as possible to the equipment. Ensure that the connection of the grounding points and the ground bar are tight. Rustproof the terminals using rust preventing paint, anti-oxidation coatings, grease, or similar solution.

2.6 Weatherproofing

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

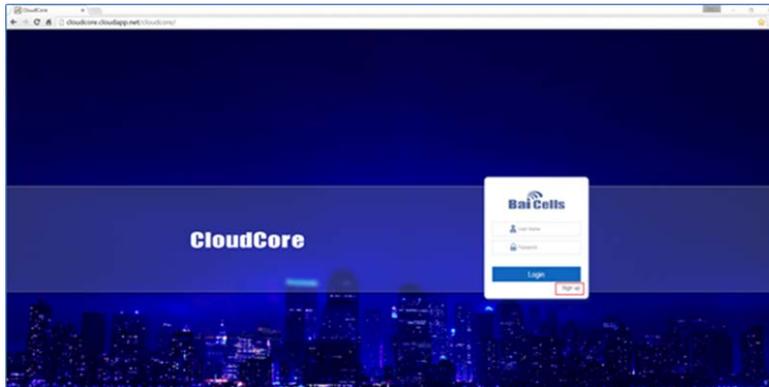


2.7 Open a CloudCore Account

If you have not already set up a Baicells CloudCore account, do the following:

- Step 1: Open a web browser, and enter the CloudCore address (Figure 2–4):
<https://cloudcore.cloudapp.net/cloudcore/>

Figure 2–4: CloudCore Login



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

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

You will receive an email from Baicells. In the email, click on the CloudCore link to go to the login page. Enter your login user name (email address) and password to authenticate. You are all set to start using CloudCore!

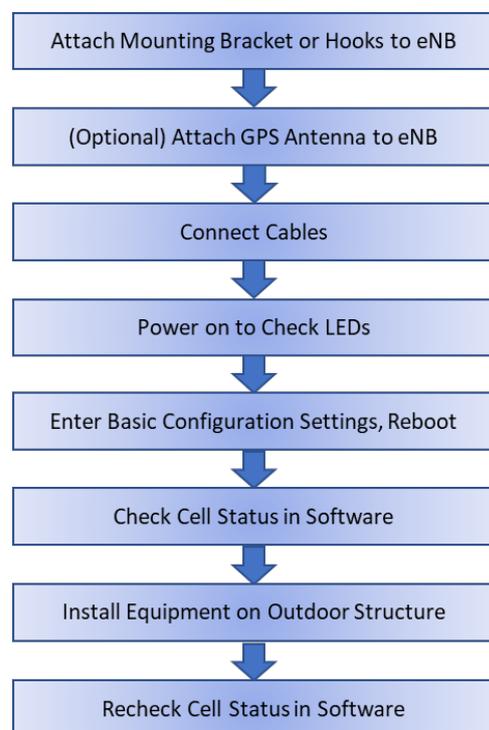
3 Installation

Some cell site structures may have existing frameworks for attaching the eNB and antenna. For purposes of explaining the installation procedure, this section assumes the eNB will be installed on a support pole or on a wall.

3.1 Process Overview

Figure 3-1 provides a high-level overview of the installation process.

Figure 3-1: Installation Process Overview



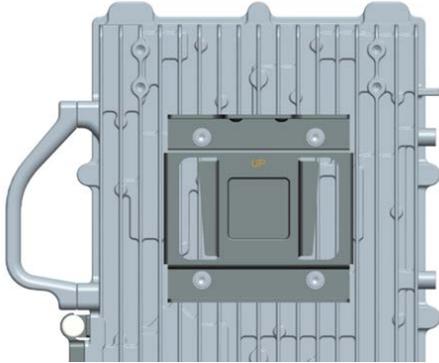
3.2 Attach Mounting Bracket or Hooks to eNB Unit

A pole mount uses a bracket, and a wall mount uses mounting hooks to attach the eNB. Go to the appropriate section below for your type of installation.

3.2.1 Bracket for Pole Mount

1. Fix one of the mounting brackets on the eNB using M6*16 screws (Figure 3-2).

Figure 3-2: Pole Mounting Bracket

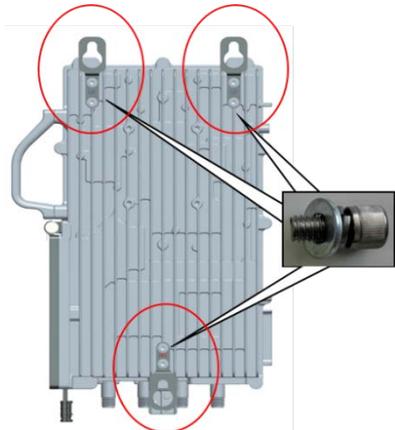


2. Continue to section 3.3 if you will be connecting an optional external GPS antenna. Otherwise, go to section 3.4.

3.2.2 Hooks for Wall Mount

Fix the 3 mounting hooks on the ends of the eNB unit using M6*16 screws (Figure 3-3).

Figure 3-3: Wall Mounting Hooks

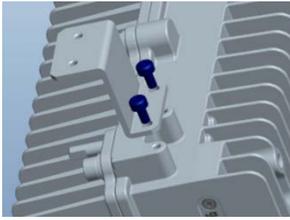


3.3 Optional: Attach GPS Antenna to eNB

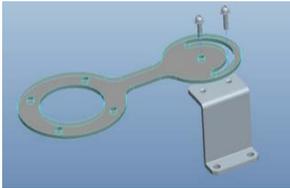
If you are going to install an optional external GPS antenna, you will need to install a GPS antenna lightning arrester before connecting the antenna to the eNB. If more than one antenna will be installed at the same location, separate the antennas by 2.2 yards (2 meters).

Follow the steps below to attach a GPS antenna to the eNB.

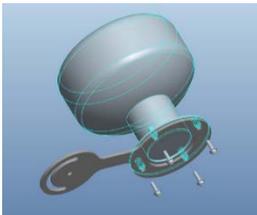
1. Prepare the necessary components: GPS antenna, feed cable, GPS mounting bracket 1, and GPS mounting bracket 2.
2. Fix the GPS mounting bracket 2 on the eNB using M4 screws, as shown in Figure 3-4.

Figure 3-4: GPS Mounting Bracket 2

3. Fix the GPS mounting bracket 1 on the eNB using an M4 screw and according to the required angle (Figure 3-5).

Figure 3-5: GPS Mounting Bracket 1

4. Fix the GPS antenna on the GPS mounting bracket 1 using an M4 screw (Figure 3-6). Vertical installation is required. Figure 3-7 shows the completed installation of the GPS antenna on the top of the eNB.

Figure 3-6: GPS Antenna**Figure 3-7: Completed GPS Antenna Installation**

5. Connect the GPS connector cable to the eNB GPS port, as shown in Figure 3-8.

Figure 3-8: Connect GPS Antenna to eNB Port

3.4 Connect Cables

3.4.1 Cabling Guidelines

Follow all specifications provided by manufacturers of non-Baicells products used. Below are guidelines for cable layout and installation.

General guidelines:

- RF antenna feeder cable bending radius: 7/8" > 250 mm, 4/5" > 380 mm or as specified by the manufacturer
- Jumper cable bending radius: 1/4" > 35 mm, 1/2" (super soft) > 50 mm, 1/2" (normal) > 127 mm or as specified by the manufacturer
- Power cable and grounding cable bending radius: > triple the diameter of the cable or as specified by the manufacturer
- Optical fiber bending radius: 20 times the diameter of the optical fiber or as specified by the manufacturer
- Recommend not binding together the cables
- Attach a label to identify each cable

Optical fiber cable layout guidelines:

- Do not coil or twist the cable
- Do not bind on the turn in the cable
- Do not pull or weigh down the optical fiber

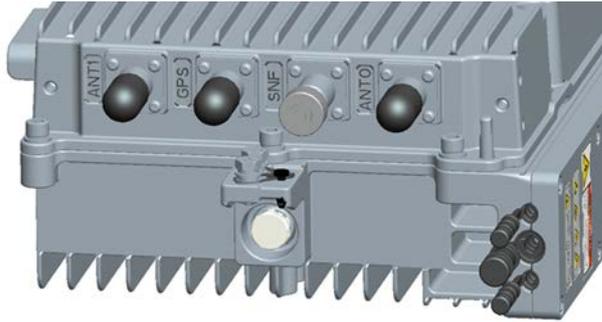
Grounding layout guidelines:

- The grounding cable must connect to the grounding point
- The grounding cable must be kept separate from the signal cables, with enough distance to avoid interference with communications signals

3.4.2 Connect RF Antenna Cables

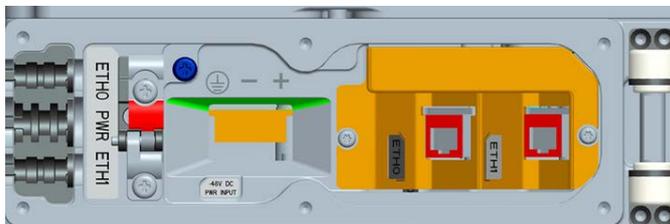
You will need to prepare the RF cables that run between the eNB and the RF antenna specific to the cell site location. Follow the steps below to connect the RF antenna cables to the eNB.

1. Connect an RF antenna cable to ANT0 interface on the eNB (Figure 3-9).
2. Connect an RF antenna cable to ANT1 interface on the eNB.
3. *After* testing eNB operation later in the installation process, waterproof the antenna connectors using waterproof daub and waterproof tape.

Figure 3-9: RF Antenna Connectors

3.4.3 Connect Ethernet Cable

Connect the Ethernet cable to the ETH0 interface on the eNB (Figure 3-10), and fasten the screw. The blue cable in Figure 3-11 in section 3.4.4 shows the Ethernet cable connected.

Figure 3-10: Connect Ethernet Cable

3.4.4 Connect Power Connector

Connect the 48V DC power connector to the PWR interface on the eNB (Figure 3-11, red cable).

Figure 3-11: Connect Power Cable

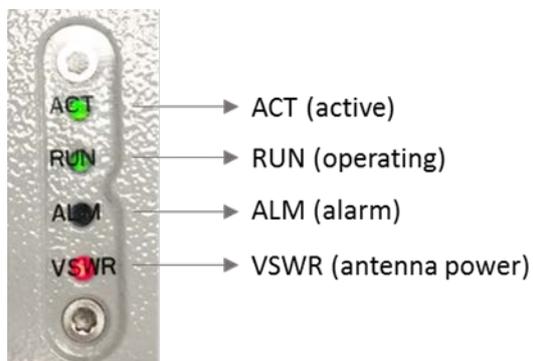
3.4.5 Connect Grounding Cable

The grounding terminals are the 2 screws beside the antenna feeder interface, as shown in Figure 3-12. One end of the ground wire connects to the grounding terminal on the eNB. The other end connects to the outdoor ground point. The connection needs to be tin-soldered. Refer to grounding guidelines in [section 3.9](#).

Figure 3-12: Grounding Protection

3.5 Power on to Check LEDs

With all components connected locally, power on the eNB unit. Wait a few minutes, and then check the LEDs (Figure 3-13). They should illuminate per the descriptions that were provided in [Table 2-2](#).

Figure 3-13: LEDs

After checking to see that all connections are secure and the eNB hardware is operating as intended, go to the next step in section 3.6 to enter the basic configuration settings. If the eNB is not operating properly and you have double-checked that all steps up to this point were completed correctly, please contact [Baicells support](#) before continuing.

3.6 Enter Basic Configuration

Reference: [Baicells Configuration & Network Administration Guide](#), section 2

The initial basic configuration of the eNB covers the minimal parameters required for the eNB to connect to the backhaul and to the Baicells CloudCore. This section does not cover all configuration options available through the eNB GUI. Please refer to the document referenced above for information on all GUI menus and fields.

With the Ethernet cable connected to the eNB ETH port and the other end to a local PC, perform the following steps.

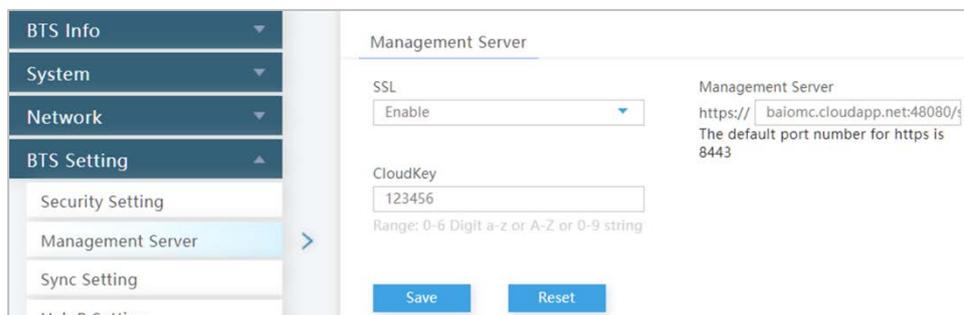
1. Open a Web browser, and enter **http://192.168.150.1**. The eNB GUI login screen will open (Figure 3-14). Use the default user name and password of *admin/admin*.

Figure 3-14: GUI Login



2. Configure the eNB to connect to the Baicells CloudCore:
 - a. Go to the BTS Settings > Management Server menu (Figure 3-15).
 - b. Enter **baiomc.cloudapp.net:48080/smallcell/AcsService** as the management server.
 - c. Enter your unique CloudKey that was provided by Baicells. The CloudKey is operator-specific and enables devices, upon power up, to be added automatically to your OMC account.

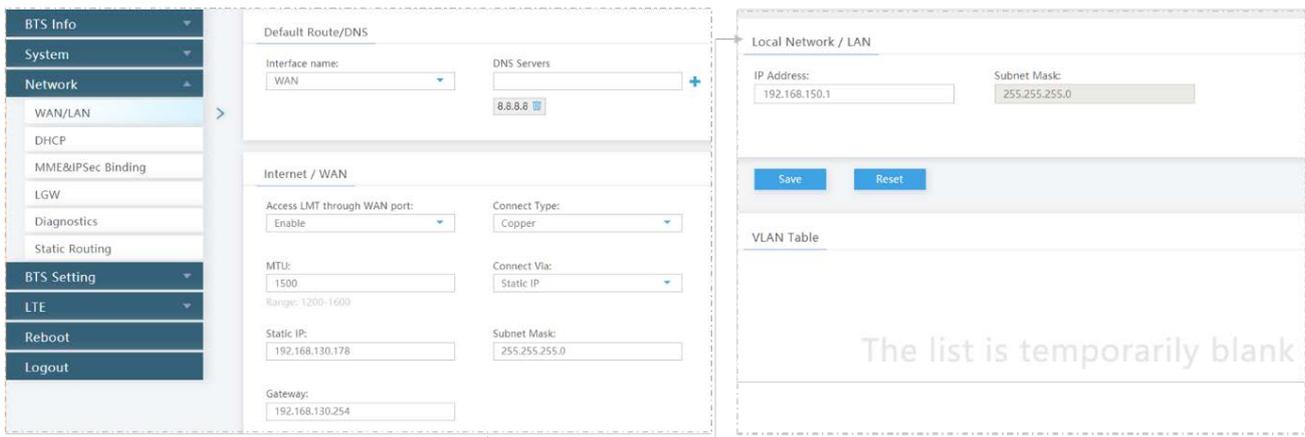
Figure 3-15: Management Server



3. Configure the network interfaces. Go to the Network > WAN/LAN menu (Figure 3-16).
 - a. WAN
 - i. Ensure the *Interface name* is set to WAN.
 - ii. Enter one or more Domain Name Server (DNS) IP addresses.
 - iii. Set the *Connect Type* to either Copper or Fiber, per your backhaul network.

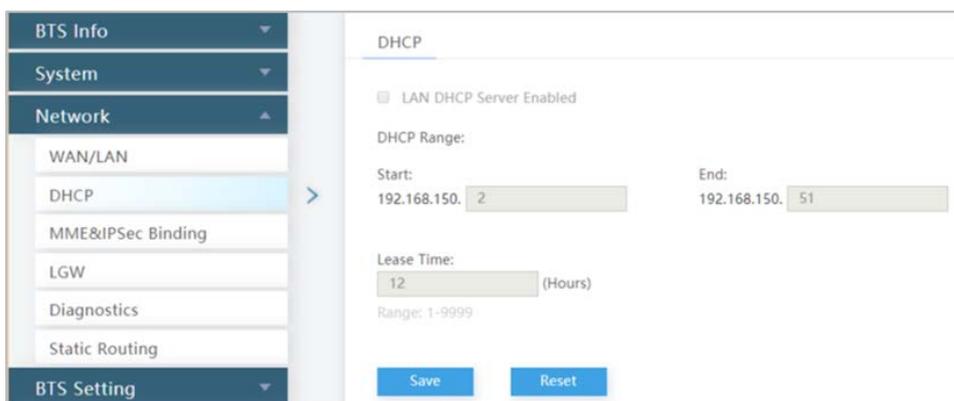
- iv. The eNB can use one of 3 connection services: DHCP, PPPoE, or Static IP, as described below. Choose a *Connect Via* option for this eNB.
 - Dynamic Host Configuration Protocol (DHCP) – The eNB’s IP address will be obtained dynamically from the local DHCP server. The current DHCP server IP address will be displayed, along with the link speed. When DHCP is selected as the connection method, there are no further WAN fields to configure in this window.
 - Point-to-Point Protocol Over Ethernet (PPPoE) – not recommended. If PPPoE is selected, you will be prompted to enter the user name and password. The range of each is 1 to 100 digits. You can also enter an access controller name and service name.
 - Static IP – IPv4 address, netmask, and gateway or IP address of the Domain Name Server (DNS), where multiple addresses are allowed.
- b. LAN - The LAN address is the same one used to access the eNB GUI: 192.168.150.1. The subnet mask is 255.255.255.0.

Figure 3-16: WAN/LAN



- 4. Optional: If a local DHCP server will be used, go to the Network > DHCP menu and click on the check box next to *LAN DHCP Server Enabled* (Figure 3-17). Enter the start (lowest) leased IP address and the end (highest) leased IP address in the range. The lease time field is used to indicate how long a leased IP address remains active before it expires. The range of time may be up to 9,999 hours; the default is 12 hrs.

Figure 3-17: DHCP



5. Verify the core network connection between the eNB and the Mobility Management Entity (MME) in the Baicells CloudCore. Go to Network > MME/IPSec Binding (Figure 3-18). Do not change the *IPSec Setting* fields. They should be left with their default values. In the *IPSec Tunnel List*, verify there are 2 tunnels enabled. The *IPSec Binding* should show the 2 CloudCore MME IP addresses, 10.3.0.9 and 10.5.0.9.

Figure 3-18: MME&IPSec Binding

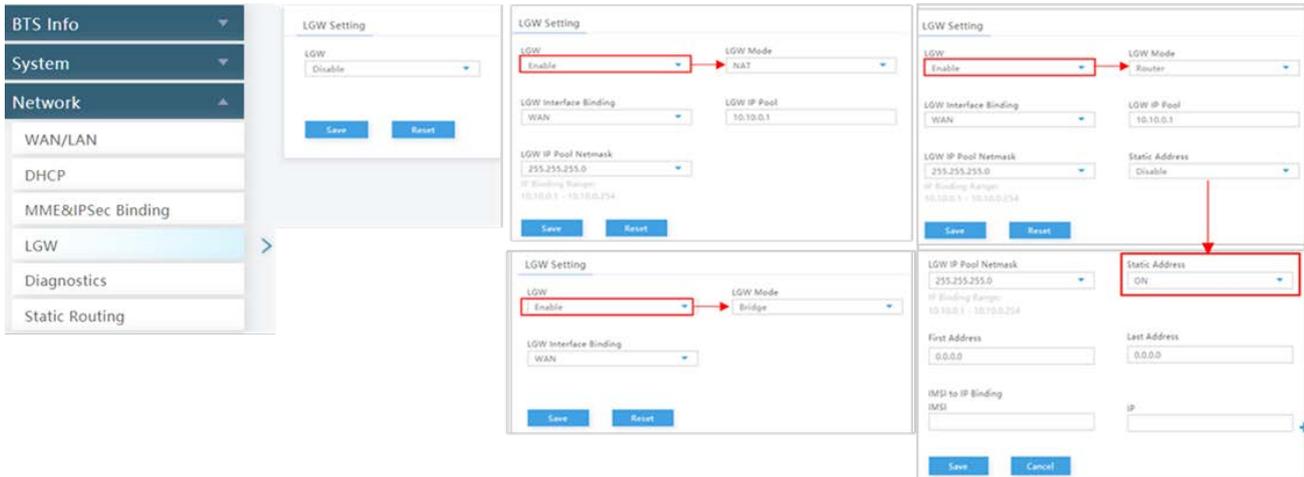


6. Configure the eNB's local gateway (LGW) connection to the backhaul network. The eNB splits the data plane and control plane. The data plane is sent out the LGW path, while the control plane is routed through the IPSec tunnel to the CloudCore EPC.
 - a. Go to the Network > LGW menu (Figure 3-19). LGW should be enabled.
 - b. Select one of 3 LGW modes:
 - i. NAT - Network Address Translation modifies the network address in the IP packet headers. To reach a CPE remotely, enter:

<https://<eNB IP address><5+last 4 digits of CPE IMSI>>

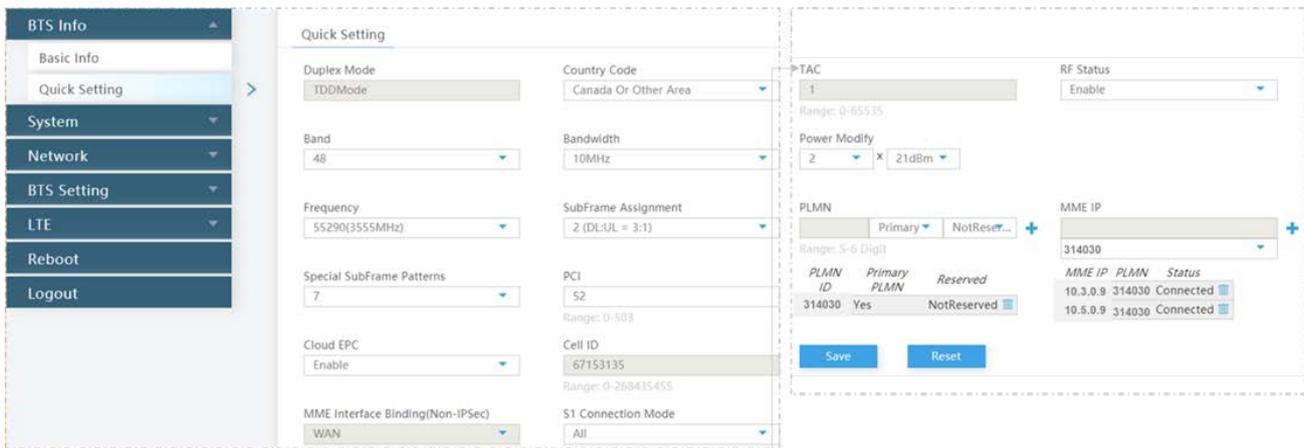
Leave the CPE Web GUI https port as 433; do not change the port number. IP binding uses address range 10.10.0.1 to 10.10.0.254.
 - ii. Router - Enable static IP addressing, and identify the range of addresses. The LGW will assign a local IP address when a CPE attaches. IP binding uses address range 10.10.0.1 to 10.10.0.254.
 - iii. Bridge - Layer 2 will create a virtual interface for each CPE that attaches using a DHCP request to create a 1:1 mapping between the CPE IP address (from the EPC) and the LGW IP address. A CPE's MAC address is generated from its IMSI: Convert the last 12 digits to hex, and then prefix it with "8A". For example, if the IMSI = 11704000002918, the MAC address would be 8A:95:02:F9:B6:6.

Figure 3-19: LGW



7. Verify or configure the Quick Settings (Figure 3-20). These settings are important for LTE transmissions. Go to the BTS Info > Quick Setting menu. Some settings will be auto-configured based on eNB model and will be greyed out. Most of the fields are standard LTE types of settings.

Figure 3-20: Quick Setting



- a. When connecting the eNB to the Baicells CloudCore, you must use PLMN ID = 314030 and MME IP addresses 10.3.0.9 and 10.5.0.9.
- b. Bandwidth setting may be 5, 10, 15, or 20 MHz.
- c. Select the correct frequency within the band for this eNB to use.
- d. Select the SubFrame Assignment (SFA or SA). SFA determines the amount of transmission resources in the downlink and the uplink, and is expressed as a ratio of DL:UL. For example, setting the SFA value to 1 means a 2:2 ratio will be applied to transmissions, where an equal number of RF resources will be available in the downlink and in the uplink.
 - i. 0 = 1:3
 - ii. 1 = 2:2
 - iii. 2 = 3:1

- e. Select the Special SubFrame Pattern (SSF) value, either 5 or 7 (default). This setting determines the length of the guard period for switching between downlink and uplink transmissions. An SSF = 5 provides a longer guard time and is typically used for cells covering more distance. The farther the distance the UE is from the eNB the more likely it is you will need to use a longer guard period of SSF = 5.
- f. Enter a unique Physical Cell Identifier (PCI) for this eNB, between 0 - 503.
- g. Make sure the Cloud EPC field is enabled in order to connect to the Baicells CloudCore.
- h. Enter a Cell ID for a cluster of eNBs on the same tower or other structure. The Cell ID field is equivalent to the LTE E-UTRAN Cell Identity (ECI).
- i. As mentioned in step 5 above, to use the Baicells CloudCore make sure the PLMN = 314030 and the MME IP addresses = 10.3.0.9 and 10.5.0.9.
- j. The Tracking Area Code (TAC) field is used to identify a cluster of cell sites. Enter a value between 0 - 65535 for each unique TAC ID in your network.
- k. The RF Status field is used to enable or disable RF transmissions. In closed environments, such as when "bench testing" the eNB, always disable the RF for personal safety.
- l. The Power Modify field allows you to set the output power on each antenna port. This parameter is typically left with the default values, though you may lower it when testing the eNB on the ground. Every 3 dB doubles the power. The eNB output power must stay within regulatory guidelines.

NOTE: Any changes to Quick Settings requires a reboot of the eNB.

8. **Reboot** the eNB for the settings to take effect. The Reboot function is the last menu in the GUI.

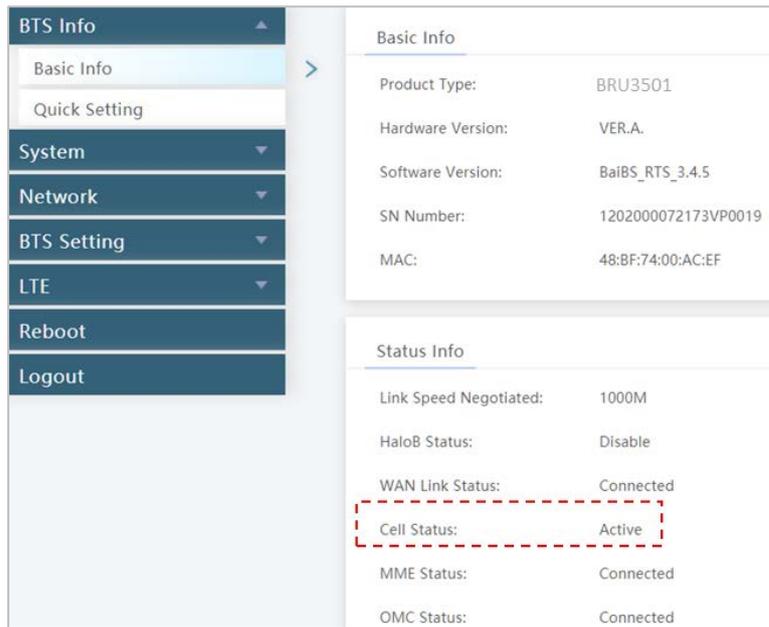
3.7 Check eNB Status in Software

Once the eNB is powered up, check that the eNB cell status is reported as active in software using either the eNB GUI or the OMC. Each method is described below.

3.7.1 eNB GUI

Go to BTS Info > Basic Info and check the *Cell Status* field, as shown in Figure 3–21. If the status is not reported as active, contact [Baicells support](#).

Figure 3–21: Active Status (eNB GUI)

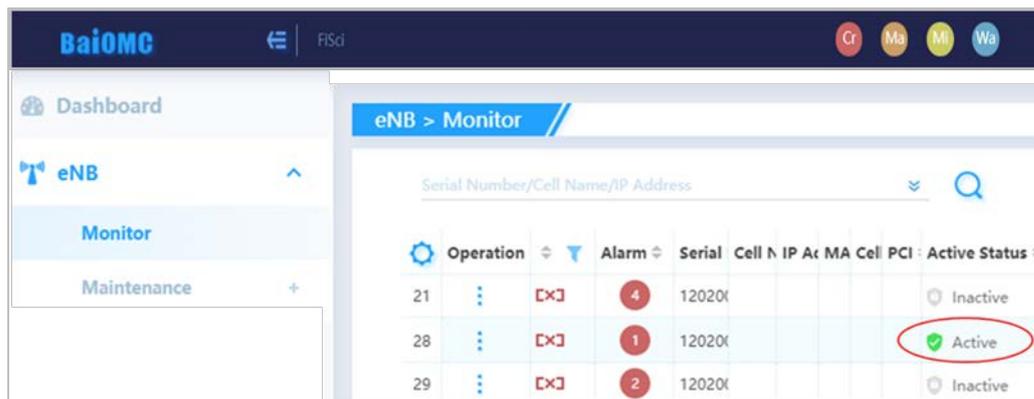


3.7.2 OMC

To check the eNB's status using the OMC, follow the steps below.

1. Open a Web browser, and enter the CloudCore address:
<https://cloudcore.cloudapp.net/cloudcore/>
2. Go to eNB > Monitor, and check the *Active Status* column as shown in Figure 3–22. If the status is not reported as active, contact Baicells support.

Figure 3–22: Active Status (OMC)



3.8 Install Equipment on Outdoor Structure

Installing the eNB should be performed only by qualified installation technicians per the operator's network design plan and according to industry standard safety precautions. Hoisting the RF antenna and eNB onto a tower or other structure may require 2 to 4 people. Follow standard safety precautions for working at the expected height and as required for electrical installations. Always wear proper tower climbing safety gear and follow tower climbing safety certification rules.

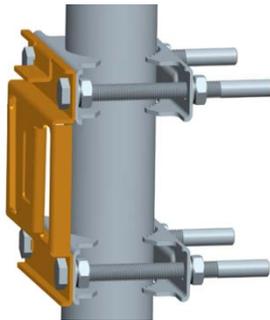
This section provides guidance for pole installations and positioning the equipment on a tower, roof, or other outdoor structure, as well as outside wall installations.

NOTE: It does not matter if the eNB or the antenna is installed first, or together at the same time.

3.8.1 Attach eNB to Support Pole (if Needed)

1. After the mounting bracket has been installed on the eNB, install the other mounting bracket on the pole as shown in Figure 3-23.

Figure 3-23: Install Mounting Bracket on Pole



2. Insert the eNB vertically into the mounting bracket on the pole, and fasten using M6 fixed screws. The completed eNB attachment to the pole is illustrated in Figure 3-24.

Figure 3-24: Completed Pole Mount

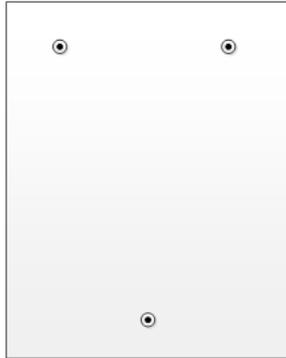


3. After mounting the eNB on the pole, go to section 3.8.3.

3.8.2 Attach eNB to Wall

1. Put the eNB against the wall where you want it to be installed, and mark the 3 drilling hole locations, as shown in Figure 3-25.

Figure 3-25: Wall Mount



2. Drill three ½-inch/12-mm diameter sized holes on the wall where marked. Fix the eNB unit on the wall using the M10*80 expansion screws.
3. Continue on to section 3.8.3.

3.8.3 Recommendations for Installing

In general, it is best to keep the RF cable length between the eNB and antenna as short as possible to minimize signal attenuation. Typically, the eNB will be located within a few feet from the antenna.

This section provides guidance on GPS placement considerations and explains how to install the eNB and an omni or directional antenna on an outdoor tower, building, or other structure.

3.8.3.1 GPS Positioning Considerations

Consider the following concerning GPS positioning when installing the eNB.

- The GPS antenna should be free of any major blocking from buildings in the vicinity. Make sure the space atop within 45 to 90 degrees is not blocked by any buildings.
- Avoid installing the GPS near other transmitting and receiving devices. The GPS should be at least 3 feet (.9 meters) from other transmitting devices.
- The GPS antenna should be installed within 45 degrees to the lightning rod.

3.8.3.2 Install Omnidirectional Antenna

Following are guidelines for installing an omnidirectional antenna at the cell site.

- The mounting pole diameter must be between 1.4 inches to 2 inches (35 to 50 millimeters). Typically, operators use a 2-inch/50-mm round, steel-made pole.
- The top of the pole and the clamp beneath the antenna should be at the same level once the omni is installed on the pole.
- For optimal performance, ensure the omni antenna is precisely vertical.

- The top of the antenna should fall within the 45-degree safety angle towards the lightning rod.
- There should be no metal objects within 3.3 feet (1 meter) of the omni antenna. Use an independent lightning rod that is high enough to keep all antennas under its protection cover.
- Ensure the antenna is high enough to meet the coverage requirements specified in the operator's network design plan.

If it is not possible to install an independent lightning rod due to environmental limitations, ensure that the pole supporting the lightning rod is at least 3.3 feet (1 meter) away from the omni antenna. Follow standard transport procedures to hoist the antenna to the target location.

Once the antenna and eNB unit are installed securely in the proper position, verify grounding and lightning protection. Apply or verify reliable weatherproofing as explained in section 2.6 of this document.

3.8.3.3 Install Directional Antenna on Tower

Following are guidelines for installing a directional antenna at the cell site.

- First, assemble the antenna and the upper and lower racks, as shown in Figure 3-26.
- Follow standard transport procedures to hoist the antenna to the target location.
- Using expansion screws, fix the support pole vertically to the ground (or concrete pillars on a rooftop), and fasten it with steel wires.
- Mount the antenna assembly onto the pole using the installation racks.

Figure 3-26: Assemble Directional Antenna



Once the antenna and eNB unit are installed securely in the proper position, verify grounding and lightning protection. Apply or verify reliable weatherproofing as explained in section 2.6 of this document.

3.8.3.4 Install Directional Antenna on Rooftop

When installing a directional antenna on a rooftop, it is easier to install if the antenna and eNB are first attached to a mounting pole that will then be installed on the roof. Begin by wiring the lightning arrester on the top of the mounting pole. Next, install the directional antenna and eNB on the mounting pole with the provided supports. Ensure the directional antenna is vertically plumb with the proper down tilt for desired antenna propagation, as specified in the operator's network design plan.

In situations where there is a wainscot on the roof and it is taller than 3.9 feet (1.2 meters), attach the fixed mounting pole and antenna on the wall with expansion screws. If the wainscot is less than 3.9 feet (1.2 meters) tall, fix the mounting pole to the wall with expansion screws and attach the base of the mounting pole to an adequate base support frame to stabilize the mounting pole.

If the roof does not have a wainscot, use expansion screws to fix the antenna mount on an adequate base support frame, such as concrete, or properly weight the frame to eliminate wind movement. Use guy wires to further stabilize the mounting pole.

Once the antenna and eNB unit are installed securely in the proper position, verify grounding and lightning protection (section 2.5). Apply or verify reliable weatherproofing (section 2.6).

3.9 Recheck eNB Status in Software

After the eNB has been installed on the outdoor tower or wall, return to the GUI to ensure the eNB cell status is still reported as active and it is connected to the backhaul network. Refer to section 3.7.

Appendix: 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 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 50 cm between the radiator & your body.

IC Compliance

This device complies with Industry Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le present appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le Brouillage est susceptible d'en compromettre le fonctionnement.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 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.