Baicells

Atom OD040615 Outdoor

Low-Gain & High-Gain CPE

User Manual

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BaiCE_BG_1.6.20

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Version 1.12

About This Document

This document is intended for installers and subscribers setting up and operating the Baicells Atom OD040615* Outdoor Low-Gain and High-Gain Customer Premise Equipment (CPE), *aka* User Equipment (UE). The Atom unit provides a way for users to connect to the Internet through broadband wireless access to Long-Term Evolution (LTE) backhaul networks. The information covers how to install, configure basic settings, monitor, and perform basic troubleshooting for the outdoor CPE. If you are using a Baicells *in*door CPE, please refer to the *Atom ID0406-6.5 Indoor CPE User Manual*.

> *NOTE: "OD" stands for outdoor. The "04" designation stands for CAT4, "06" stands for CAT6, and "15" stands for CAT15. These categories are related to the LTE standards requirements for user equipment. Model numbers are shown in the product datasheets, which can be found at Baicells.com > Resources > *Documents*.

This document is applicable to the following Atom Outdoor CPEs:

- Atom OD04L – Outdoor CAT4 Low-Gain CPE, model EG7035L
- Atom OD04H – Outdoor CAT4 High-Gain CPE, model EG7035E
- Atom OD06L – Outdoor CAT6/7 Low-Gain CPE, model EG7010C
- Atom OD06H – Outdoor CAT6/7 High-Gain CPE, model EG7010A
- Atom OD06-LX – Outdoor CAT6 Low-Gain CPE, model EG8013L
- Atom OD15/OD15 EUD – Outdoor CAT15 High Gain CPE, model EG8015G

Terms used in this document or related to LTE are listed in alphabetical order and described in *Acronyms and Abbreviations*, which can be found at Baicells.com > Resources > *Documents*.

New in This Release

The following updates have been provided in this release:

- Updates reflect changes to new software BG 1.6.20
- Updated to include applicable models
- Updated to include CAT6-LX Outdoor CPE
- Updated to include CAT15 Outdoor High-Gain CPE
- Updated MTU setting in *section 7.7.2, step 4*
- Updated the Spectrum Access System (SAS) information in *section 7.8*

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Revision Record

Date	Version	Description	SMEs/Contributors	Writer/Editor
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18-Sep-2019 13-Sep-2019	V1.6 V1.5	SME comments Updated for naming convention change, BaiCE_AP_2.2.1_NA (CAT4) and BCE_MD-1.0.1-B036SP28-NA (CAT6/7/15) and general info; added more detail for key GUI windows as well as basic user maintenance and troubleshooting section	From Configuration & Network Admin Guide published Sept 3, 2019; TangHoucheng, Xuanjianxi, Nitisha Potti	Sharon Redfoot

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1 Introduction

The Baicells Atom OD040615 Outdoor Low-Gain and High-Gain Customer Premise Equipment (CPE), *aka* User Equipment (UE), is part of a broadband wireless access system that integrates with Long-Term Evolution (LTE) backhaul networks to provide subscribers with Internet access. The CPE communicates through a wireless connection to the operator's eNodeBs (eNBs) at cell sites located in the region. The eNBs communicate with the backhaul network (Figure 1).

Figure 1: LTE Network Architecture
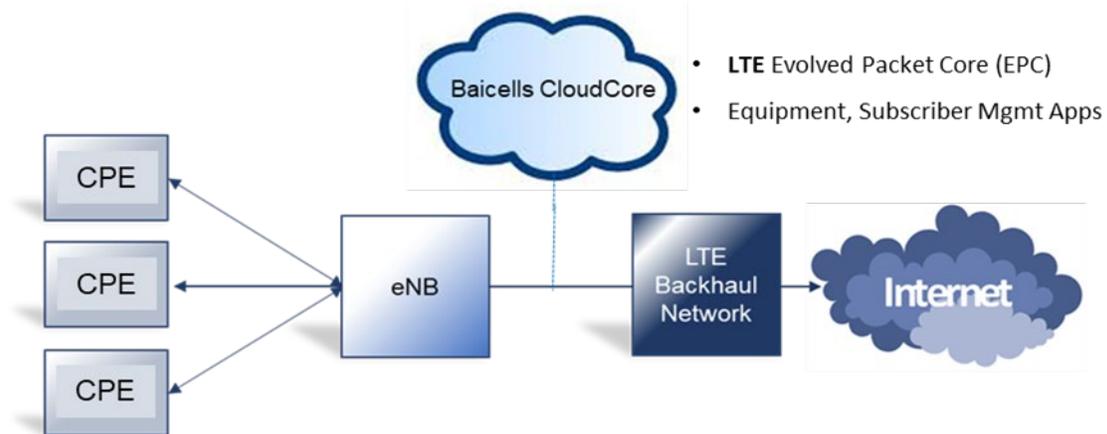
The LTE standards organization that defines certain characteristics of user equipment across manufacturers describes each progression of the standards as releases, such as Release 9, Release 10, etc., and categories, such as Category 4 (CAT4) and Category 6/7/15 (CAT6/7/15).

The Outdoor Unit (ODU) CPE comes preloaded with a Graphical User Interface (GUI) application to configure the device. The GUI menus and screens for CAT4 and CAT6/7/15 look different, though both contain many of the same types of settings. This document covers both GUIs and points out where there are differences.

2 Features

Some of the key features and attributes of the Atom outdoor CPEs are listed below. Exact specifications vary by model; please refer to the datasheets found at Baicells.com > Resources > *Documents*.

- Standardized LTE TDD bands 38, 40, 41, 42, 43, 48. Customization can be requested.
- Complies with 3GPP Release 9 (CAT4), Release 10 (CAT6/7), and Release 12 (CAT15)
- Wi-Fi assisted alignment, IEEE 802.11b/g/n Wi-Fi (WLAN) connections @ 2.4 GHz
- 1000 Mbps Ethernet interface (CAT6/7/15); 100 Mbps Ethernet interface (CAT4)
- Built-in bipolar directional LTE antenna
- Power supply using Power over Ethernet (PoE)
- Cell lock, SIM lock, and Pin lock
- Pole or wall mount options
- TR-069 management protocol support
- Local and remote GUI management

3 Parts & Materials

Table 1 lists the primary components that you should receive with the Baicells outdoor CPEs.

Table 1: Parts

Item	Qty	Picture
Atom OD0406 Low-Gain or High-Gain unit	1	Low-Gain High-Gain
Atom OD15 unit	1	
Power Cable	1	
PoE Power Adaptor	1	
Atom OD040615 Mounting Bracket	1 each	

You will need standard tools, Ethernet cable, ground wire, and RJ-45 connectors for installing and connecting the outdoor unit (Table 2).

Table 2: Materials

Item	Description
Ethernet Cable	Outdoor shield CAT5E, shorter than 330 ft. (100 m)
Ground Wire	6 AGW (16 mm^2) yellow-green wire

4 Description

The Baicells Atom outdoor low-gain and high-gain CPE models are powerful, standards-based devices designed to connect seamlessly to any standard LTE eNB operating on the same frequency band. The devices have a small, sleek form-factor (Figure 2) yet are ruggedized for the most challenging outdoor environments.

Figure 2: Dimensions

All models of the low-gain (Figure 3) and high-gain (Figure 4 and Figure 5) CPEs have external LED status indicator lights and interface connectors. These external features make it easier to determine the CPE's operational status and to check cables.

On the low-gain CPE the LEDs are on the side of the unit, and the connection interfaces are on the bottom of the unit. On the high-gain CPE both the LEDs and the interfaces are on the side of the unit. Refer to Table 3 for a description of the LEDs and Table 4 for a description of the interfaces.

Figure 3: Atom OD0406 Low-Gain LEDs & Interfaces
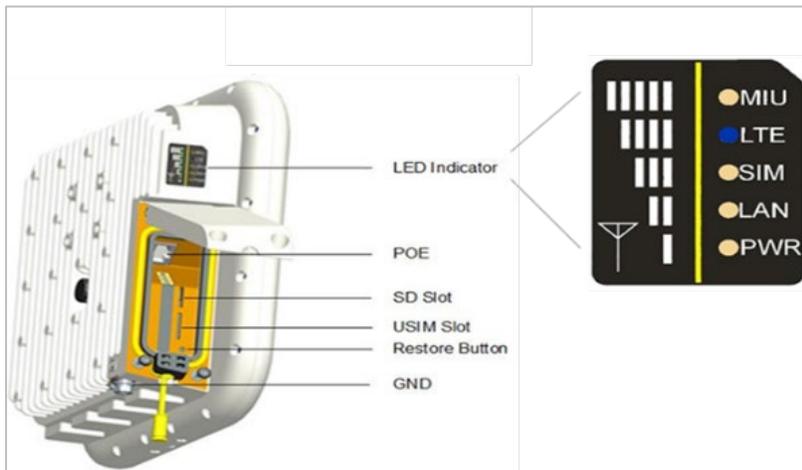

Figure 4: Atom OD0406 High-Gain LEDs & Interfaces
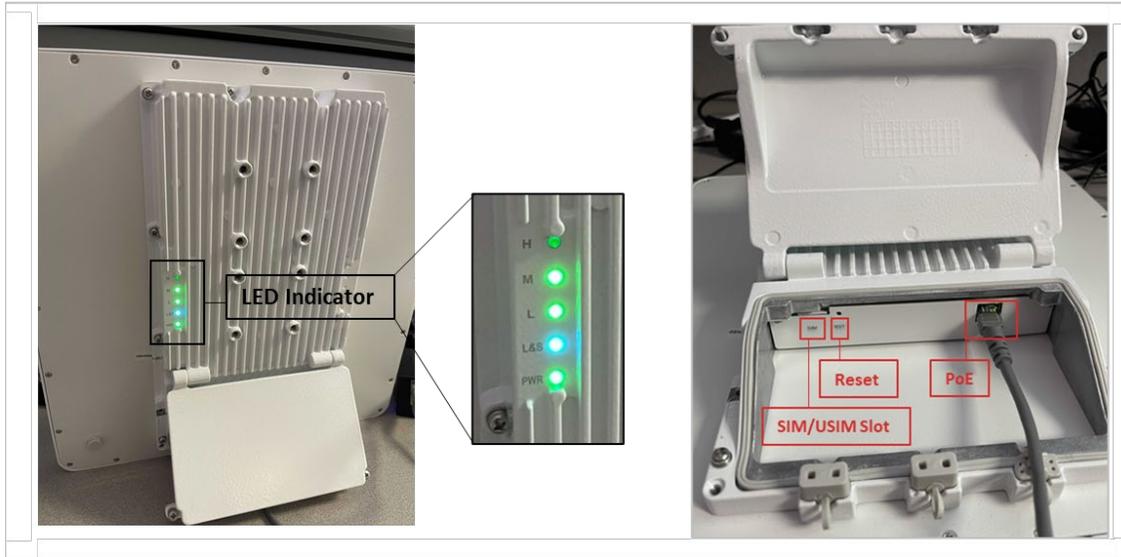
Figure 5: Atom OD15 High-Gain LEDs & Interfaces

Table 3: LED Descriptions

LEDs vary by model – not all models will have all of the LEDs listed below.

Identity	Description	Color	Status	Description
MIU	-	Yellow	Off	Reserved for future use
			Steady On	Reserved for future use
			Blinking	Reserved. for future use
LTE	LTE network status	Blue	Off	The CPE is not connected to the network
			Steady On	The CPE is connected to the LTE network
SIM/USIM	SIM/USIM card status	Yellow	Steady On	The USIM card is functioning normally
			Blinking	The USIM card is not inserted or is not functioning normally
LAN	100 or 1000 Mbps Local Area Network Ethernet status	Yellow	Off	No Ethernet connection established
			Steady On	Ethernet connection is normal
			Blinking	Data is transmitting
PWR	Power status	Yellow	Off	No power supply to the CPE
			Steady On	Power to the CPE is on
LTE Signal	1, 2, 3, 4, or 5 bars to indicate wireless connection status. The more bars, the stronger the signal between the CPE and a network cell (eNB).	Green	All Off	The signal is too weak for the CPE to connect to the network
			Steady On	Bars will light steadily according to signal strength
			Blinking	The CPE is scanning the network
				The CPE is authenticating with the network
				The CPE is getting an IP address from the network

Table 4: Interfaces

Interfaces vary by model – not all models will have all of the interfaces listed below.

Interfaces	Description
PoE	Power over Ethernet (PoE) power adaptor
TF or SD Slot	Card slot for a secure digital (SD) card
SIM/USIM Slot	Universal Subscriber Identity Module card slot, 1.8 V/3.0 V USIM 2FF
RESET	Reset/restore button
GND	Ground lug. The unit is connected to Earth by conductor.

5 Preparing to Install

To help ensure a smooth and successful installation, check that you have all of the parts, materials, and tools you will need, per *section 3*. When selecting the best outdoor location for the installation, plan on placing the CPE so that it faces the nearest eNB. You may need to adjust the tilt and angle for optimum signal reception.

If you are installing the outdoor CPE with a Baicells SNAP PoE Router, please refer to the *SNAP PoE Router Installation Guide*. There will be some installation differences.

At the time of this publication, the SNAP PoE Router is supported on the following ODU CPE models:

• Atom OD04H - Outdoor CAT4 high-gain CPE, model EG7035E

• Atom OD04L - Outdoor CAT4 low-gain CPE, model EG7035L

• Atom OD06H - Outdoor CAT6/7 high-gain CPE, model EG7010A

• Atom OD06L - Outdoor CAT6/7 low-gain CPE, model EG7010C

• Atom OD06-LX – Outdoor CAT6/7 low-gain CPE, model EG8013L

• Atom OD15 - Outdoor CAT15 high gain CPE, model EG8015G

6 Installation

Follow the steps below to install the outdoor unit.

1. Loosen the screws on the CPE's waterproof cover, and open the cover.

2. Insert the service provider's SIM/USIM card into the card slot (Figure 6 and Figure 7).

> ⚠ **ATTENTION**: Never power on the unit while installing or uninstalling the USIM card. Doing so could damage the card and the unit.

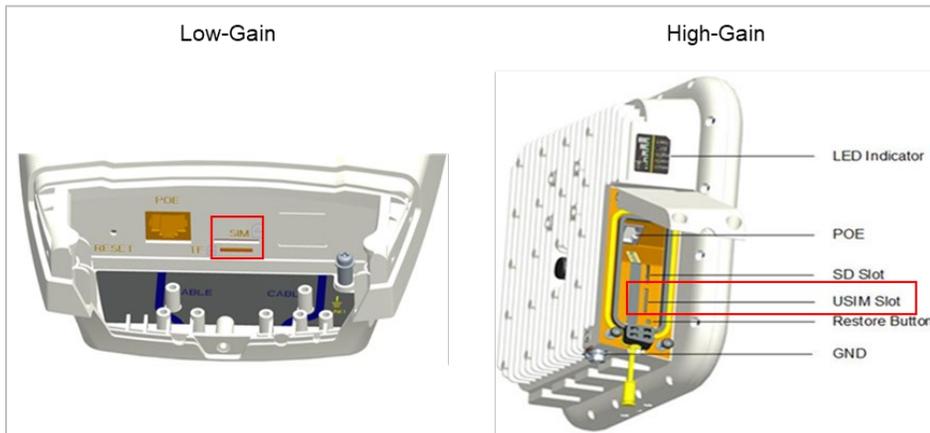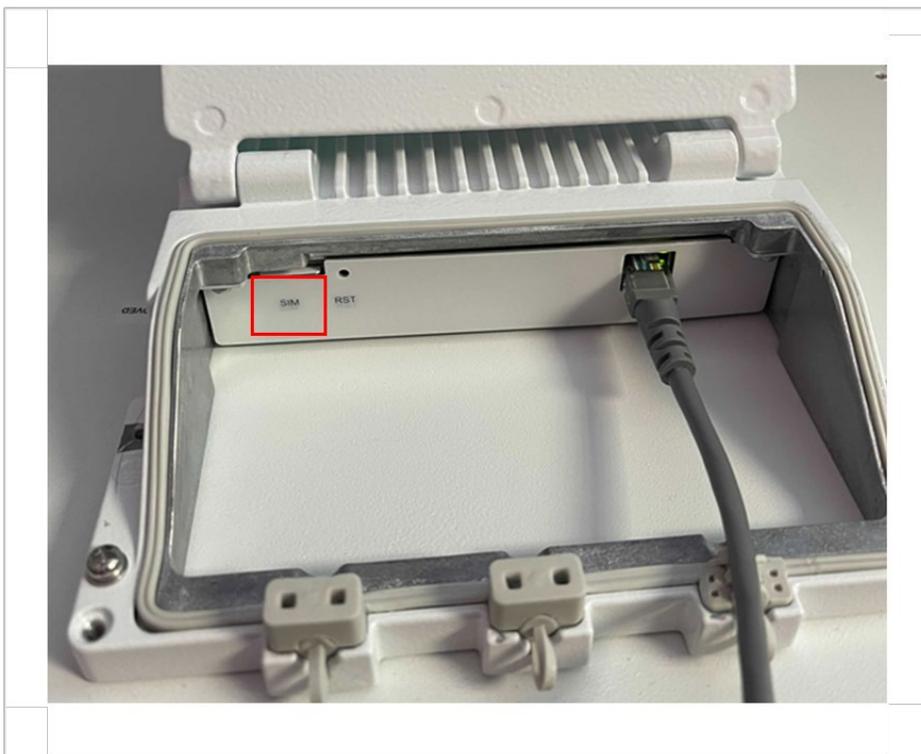**Figure 6: SIM/USIM Card Atom OD0406**

Figure 7: SIM/USIM Card Atom OD15

3. Prepare the outdoor shielded CAT5E Ethernet cable. The Ethernet cable will run between the outdoor CPE and the inside of the facility, where it will connect to the PoE adaptor and LAN. Cable length will vary by location.

4. Connect one end of the Ethernet cable to the PoE port on the unit. Connect the other end to the power adaptor (Figure 8 and Figure 9).
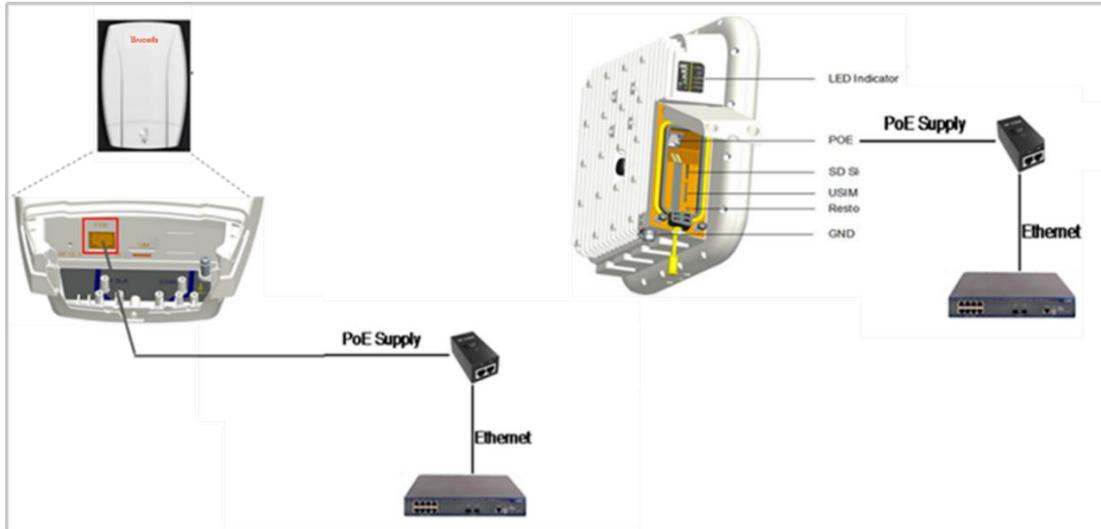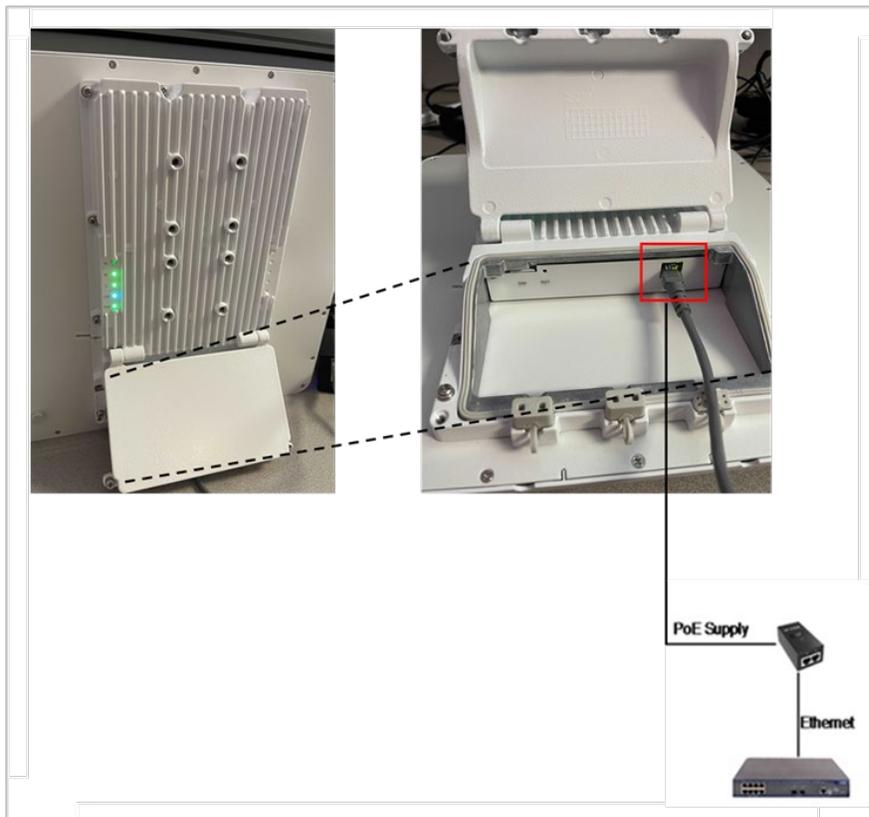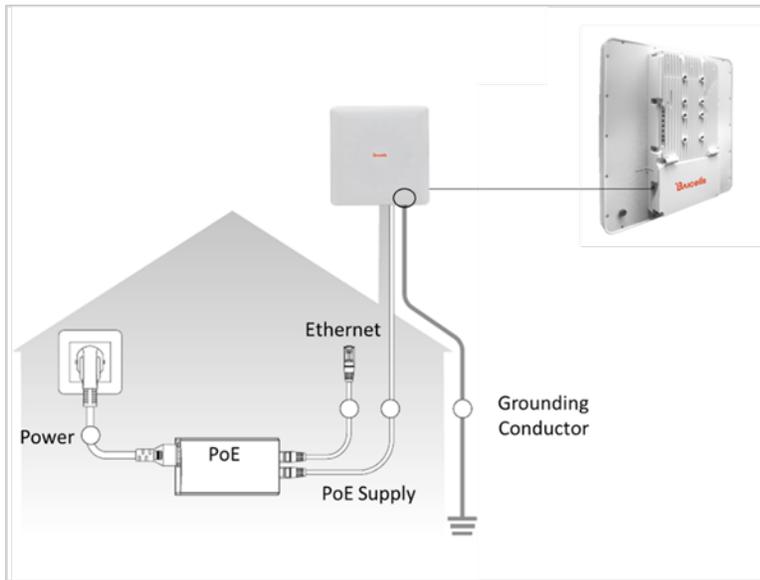
Figure 8: PoE Adaptor Atom OD0406

Figure 9: PoE Adaptor Atom OD15

5. Close the waterproof cover and tighten the screws.

6. Prepare the 6 AWG (16 mm^2) yellow-green ground wire and follow the ground steps below. Once the unit is fully installed, make sure the ground cable is connected to a solid ground point (earth) (Figure 10).
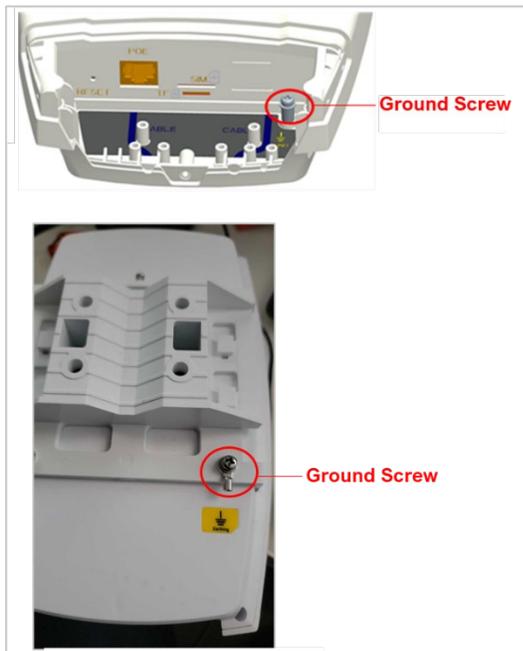
Figure 10: Completed Grounding

a. Atom Low-Gain CPE: Connect the ground cable to the ground screw (Figure 11).

NOTE: The location of the ground screw varies by model.

Figure 11: Low-Gain CPE Ground Screw

b. Atom High-Gain CPE: Connect the ground cable to the ground screw (Figure 12).

Figure 12: High-Gain CPE Ground Screw and Ground Row

7. Plug the power adaptor into an electrical outlet (Figure 13). Pay attention to the power adaptor interface directions noted on the adaptor itself. The LED indicators should light up when the unit is powered on.
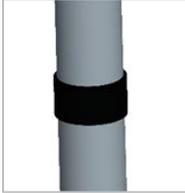
Figure 13: Power Adaptor
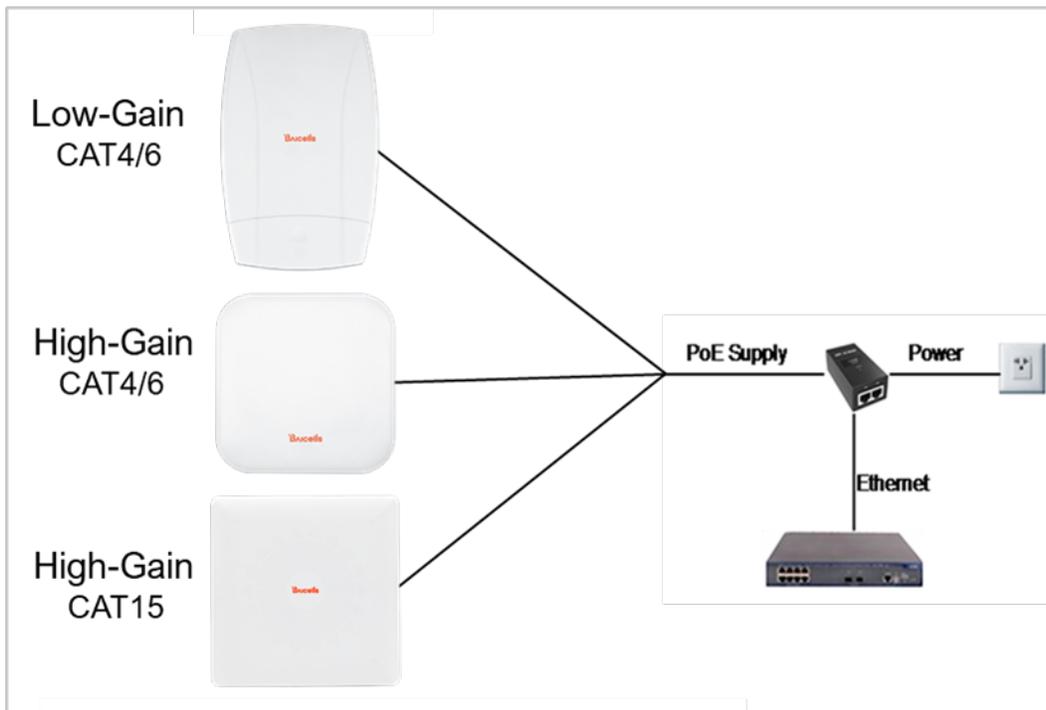
8. Mount the CPE: If you are installing the unit on a pole, e.g., to attach to a roof, go to *step 9*. If you are installing it on an outside wall, go to *step 10*.

9. Pole installation:
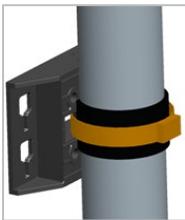
    a. Low-Gain CPE:

        a1) Attach a heavy-duty anti-slip rubber band on the pole (Figure 14).

Figure 14: Rubber Band

        a2) Fix the CPE bracket over the band using the hoop (Figure 15).

Figure 15: Bracket

        a3) Attach the CPE to the bracket and tighten the screw (Figure 16).

Figure 16: Attach CPE
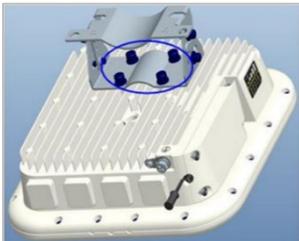

        a4) The CPE is now ready for installation at its final outside location. Proceed to *section 7*.

    b. High-Gain CPE:

        b1) Tighten the four M6 screws on the bottom of the bracket (Figure 17).

Figure 17: Tighten Screws

b2)   Install the threaded rod onto the bracket (Figure 18).

Figure 18: Threaded Rod

b3)   Hold the assembly up to the pole. Attach the two omega clamps to the threaded rods with M8 nuts and tighten them (Figure 19).

Figure 19: Omega Clamps

b4)   The CPE is now ready for installation at its final outside location. Proceed to *section 7*.

10. Wall installation:

a.   Low-Gain CPE:

a1) Slip the bracket off of the Atom unit, and fit it on the wall to mark the drilling locations (Figure 20).
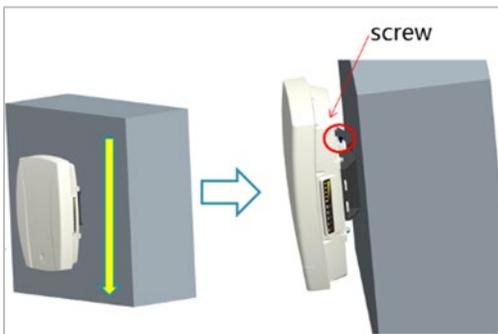
Figure 20: Mark Holes for Drilling

a2) At the marked locations, drill four 0.4 in. (10 mm) diameter and 2.8 in. (70 mm) depth holes.

a3) Check the up/down direction of the bracket, and then fix it on the wall using the M5 tapping screws (Figure 21).

Figure 21: Fix Bracket to Wall
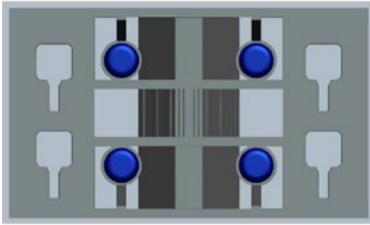
a4)   Attach the CPE to the bracket and tighten the screw (Figure 22).

Figure 22: Attach CPE

a5)   Proceed to *section 7*.

b.   High-Gain CPE:

b1)   Put the bracket up to the wall and mark the drilling locations (Figure 23).

Figure 23: Mark Holes for Drilling
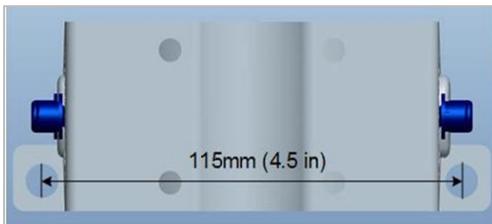
b2)   Drill two 0.5 in. (12 mm) diameter and 3.1 in. (80 mm) depth holes at the marked locations on the wall.

b3)   Tap the expansion bolts into the holes with a hammer.

b4)   Install the bracket on the expansion and tighten the screws.

b5)   Attached the CPE to the bracket and tighten the screws (Figure 24).

Figure 24: Attach CPE

> b6) Proceed to *section 7*.

11. Power on the CPE and wait a few minutes while the CPE boots up. Per Table 3, check that the LED indicators are lighting as expected.

7 Basic Configuration

Reference: *CPE Configuration Guide*

The CPE comes preloaded with a Graphical User Interface (GUI) to configure the device. The GUI screens for CAT4 and CAT6/7/15 CPEs look different, though both contain many of the same types of settings. This manual covers both GUIs and points out where there are differences.

The basic configuration settings allow you to get the CPE up and running, i.e., connected to the Internet, to verify operation. Other features as well as more in-depth information about the CPE GUIs are covered in the document referenced above.
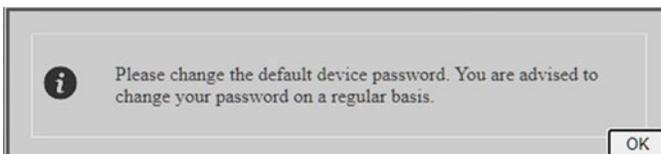
7.1 Log in

With your computer connected through Ethernet to the CPE:

1. Open a Web browser and enter *http://192.168.150.1*.

   NOTE: If the address does not open the GUI, try *http://192.168.254.1* or *http://192.168.1.1*. These were used for older generation CPEs.

2. Upon first login, you may be prompted to change your password (Figure 25).
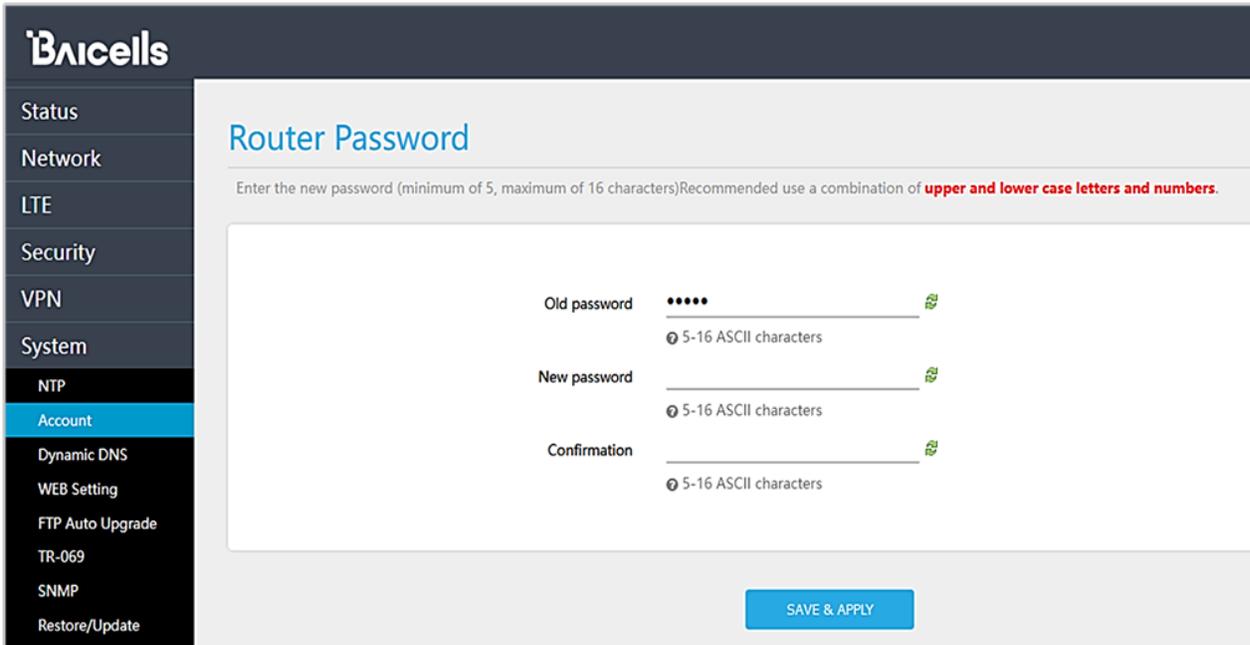
Figure 25: First Login

When you click on *OK*, you will be taken to the *System > Account* window (Figure 26). Enter a password using 5 to 16 characters (upper/lower case letters, numbers, and special characters). For CAT4, click on *SAVE & APPLY*. For CAT6/7/15, click *Apply.*

> For CAT6/7/15, in the *System > Account* window you can change the lockout time, i.e., if there is no activity on the CPE for this amount of time, users will be logged off. The default is 300 seconds (five minutes), and the maximum is 65535 seconds (~18 hrs). Click on *Apply* to save.

Figure 26: Change Password

CAT4

CAT6/7/15

3. At the *4G Router login* window (Figure 27), enter the default user name (*admin*) and your password. If you were not prompted to change the password upon initial login, enter the default password (also *admin*). Click on *LOGIN*. This will take you to the GUI home page, which is the *Status > Overview* window.

Figure 27: Login
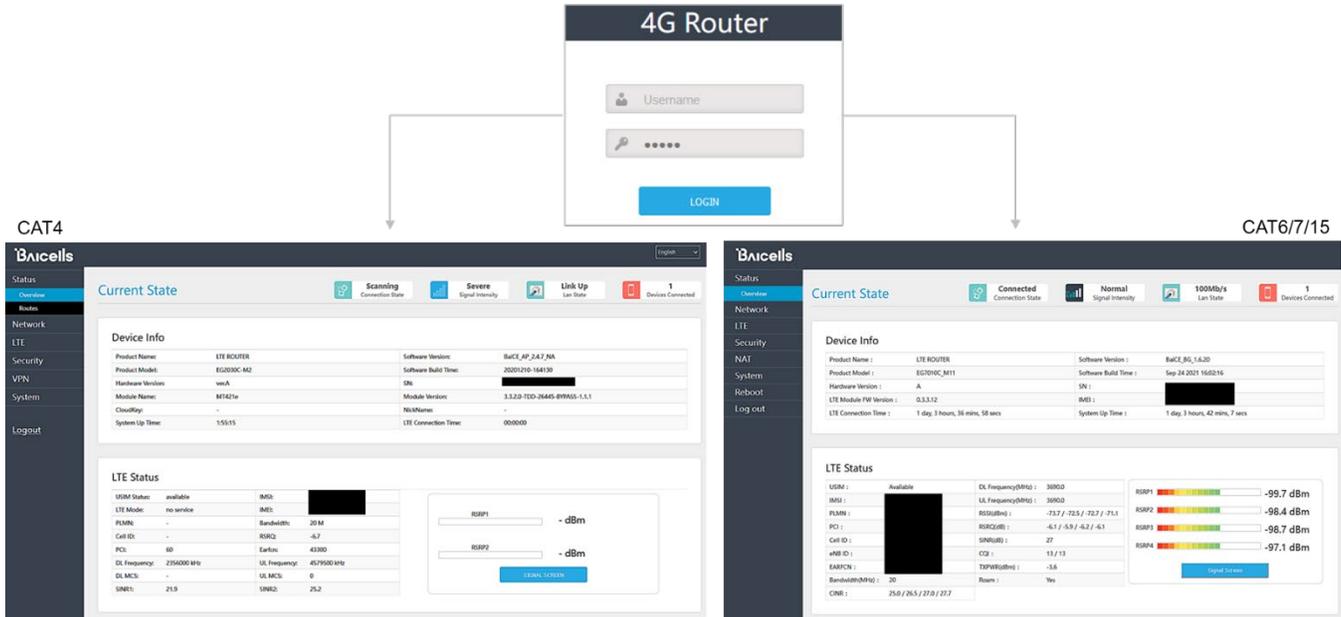
7.2 Check Current Status Icons

As shown in Figure 27 above, the GUI home page is the *Status > Overview* window. This page displays the at-a-glance CPE *Current State* icons at the top of the window, as shown in Figure 28. These fields give a quick indication if anything is wrong with basic CPE operation.

Figure 28: Status Icons

- Connection State - The possible connection states are *Checking SIM, Scanning, Registering, Acquiring IP, Connected*, or *Disconnected*. If the CPE is *checking SIM, scanning, registering,* or *acquiring an IP address*, it means the CPE is in the process of establishing a connection. Give it a few moments to finish its connection process, and then check if the status is *Connected*. Otherwise, make sure the CPE is installed properly and powered on.
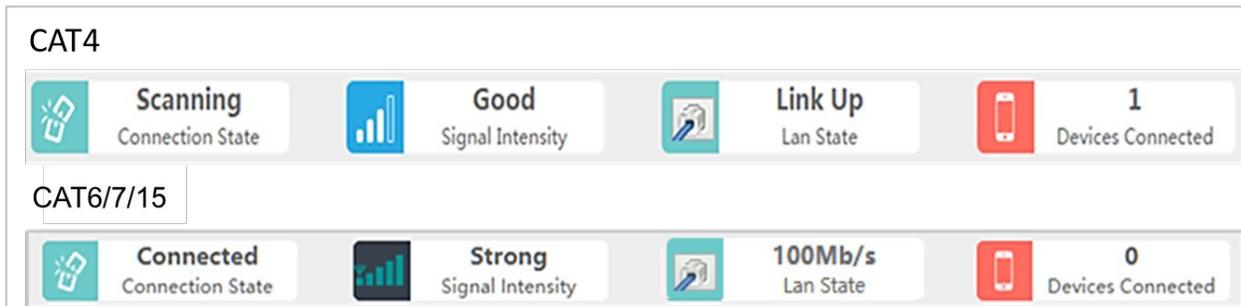
- Signal Intensity - The possible states are *No Signal, Severe, Bad, Good*, or *Excellent* (CAT4)/ *Strong* (CAT6/7/15). Check that the signal is indicated as either *Good or Excellent/Strong*. If the Atom unit cannot detect a wireless signal, or if the signal is very weak, try moving the unit closer to a window, higher up, and away from any other devices using radio frequency, or away from objects that may be blocking the signal between the CPE and the eNB. Otherwise, contact your service provider for assistance.

- Lan State - The CPE connection to the Local Area Network will be either *Link Up* or *Link Down*. If the link is down, recheck the installation steps, make sure the CPE is powered on, and check the router or other LAN device operation.

- Devices Connected - A count of the number of different smart devices using the CPE

7.3 Configure WAN Settings

The *Network > WAN* Settings pertain to:

- How the CPE interfaces with the Wide Area Network (WAN) - typically the Internet.

- The network or operation mode, which determines how IP addressing is handled; and

- The Domain Name System (DNS) to be used.

Because the GUI screens for the WAN Settings are laid out differently between CAT4 and CAT6/7/15, each is described separately in the sections below. Refer to Table 5 for a description of all fields in both GUIs.

7.3.1 CAT4

To configure the *WAN Settings* on a CAT4 CPE (Figure 29, Table 5):

1. Check that the *WAN Interface* is set to *LTE*, the default and only selection for this field.

2. For *Network Mode*, configure the CAT4 CPE in either Network Address Translation (NAT) or Bridge mode, depending on your network topology.

   NAT allows multiple hosts on a private network to access the Internet using a single public IP address. Bridge mode disables NAT and allows the CPE to create a Layer 2 (L2) link and function as a Dynamic Host Configuration Protocol (DHCP) server without IP address confliction.

   NOTE 1: If L2 has been enabled in the *VPN > L2* menu, the system will prompt you to disable those L2 settings first before changing the network mode to Bridge. When you get this prompt, click *OK*, go to the *VPN > L2* menu, and select *Destroy*.
   NOTE 2: Changing the Network Mode requires rebooting the CPE for the change to take effect.

3. Configure one or more DNS servers. The DNS translates domain names such as *www.na.baicells.com* into their underlying IP addresses. The service provider may use DNS servers to cache domain names frequented by its users, so the sites load more quickly in a browser.

   If you leave the *Manually DNS* checkbox unchecked, the CPE will check the first available DNS in the network to resolve the domain name to IP address translation. If you select this checkbox, you can specify a Primary DNS IP address and a Secondary DNS IP address.

Figure 29: WAN Settings (CAT4)
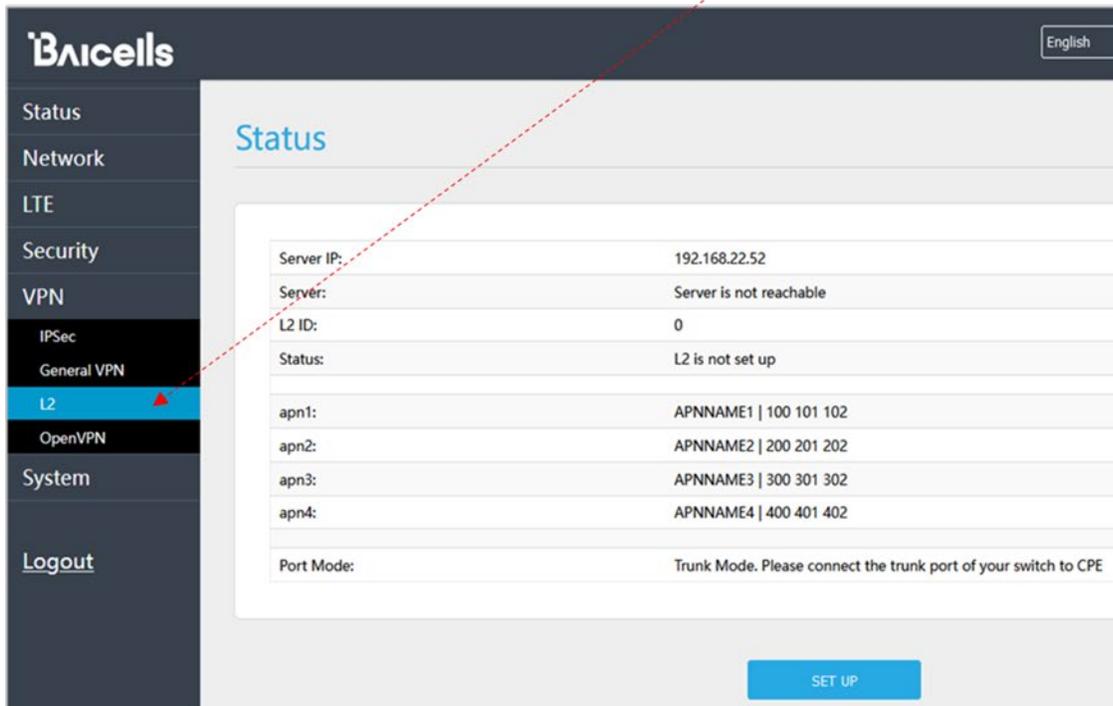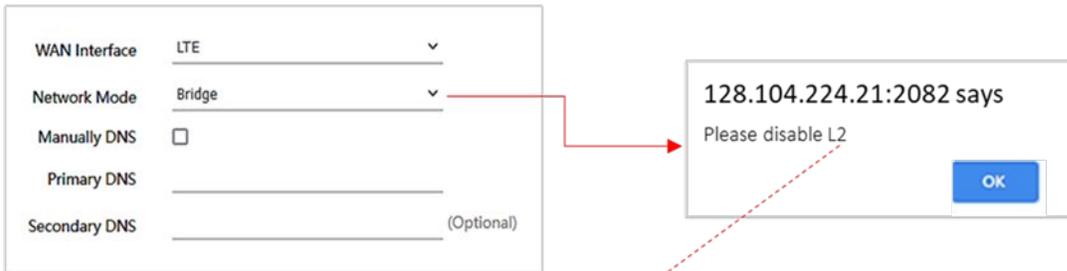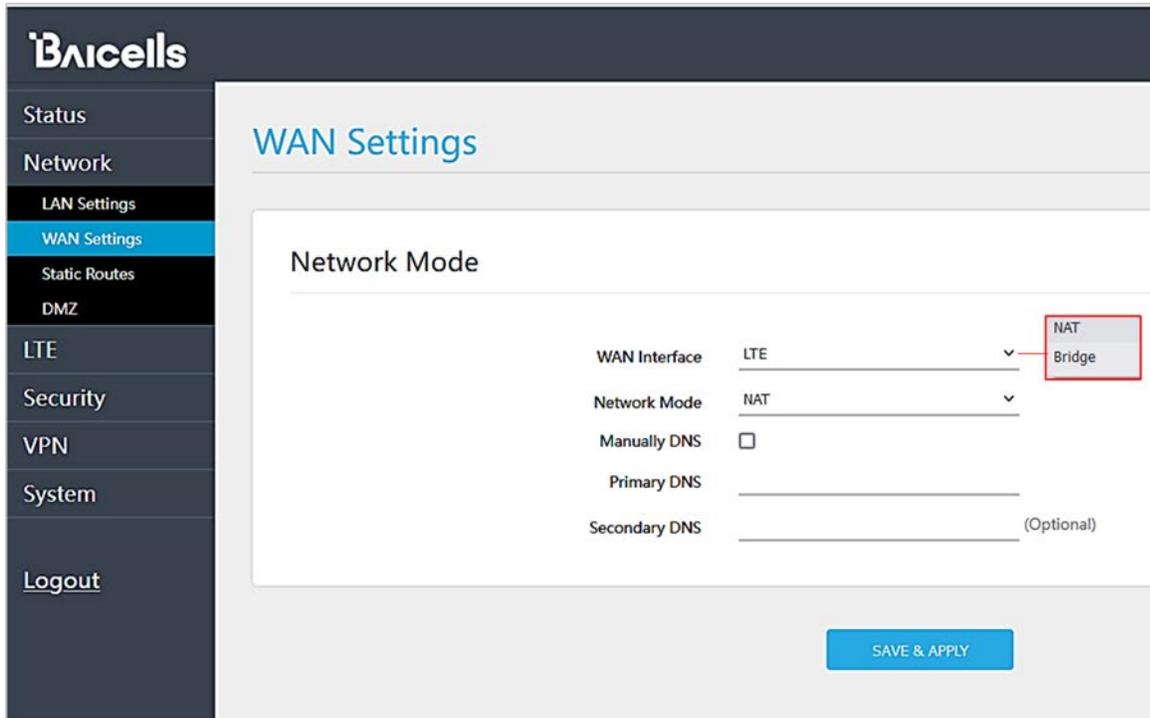
7.3.2 CAT6/7/15

To configure the *WAN Settings* on a CAT6/7/15 CPE (Figure 30, Figure 31, and Table 5):

1. Select one of the following for the *Operation Mode*:

    *   NAT - Allows multiple hosts on a private network to access the Internet using a single public IP address. When *NAT* is selected, all eight Access Point Name (APN) gateways can be configured for either *Default Router, Data, Mgmt*, *Voip,* or *Reserve*.

    *   Router - The CPE will dynamically update the router tables.

    *   Tunnel - The CPE will support Layer 2 Tunneling Protocol (L2TP) or Generic Routing Encapsulation (GRE) VPN mode. You can set the *Default Route* to *VPN* or *WAN*.

    *   Bridge - The WAN port addresses will bridge to the LAN port; the LAN port will work in trunking mode.

    *   Mixed Mode - Each Access Point Name, or external gateway, can be configured with a different mode, either *NAT* or *Bridge*, and a different bearer type.

    Figure 31 shows how the settings will appear for each operation mode.

2. In the *Profile List* you will see up to eight APNs. You must have at least one APN configured for the CPE TR-069 connection to the Baicells CloudCore, Local OMC (Operations Management Console), or other Network Management System (NMS). Therefore, *APN1* is the default router *Bear Type*. When using more than one APN, for example if you have a different route and Quality of Service (QoS) or other treatment for voice traffic than for data, you can edit the *Bear Type* by selecting the radio button under *Edit* and in *Profile Setting* choose the *Bear Type*.

3. For *DNS Mode*, you can select either *Automatic* or *Manually*. The DNS server translates domain names such as *www.na.baicells.com* into their underlying IP addresses. The service provider may use DNS servers to cache domain names frequented by its users, so the sites load more quickly in a browser.

    If you select *Automatic*, the CPE will check the first available DNS in the network to resolve the domain name to IP address translation. If you select *Manually*, specify a *Primary DNS* IP address and a *Secondary DNS* IP address.

Figure 30: WAN Settings (CAT6/7/15) (1 of 2)

Figure 31: WAN Settings (CAT6/7/15) (2 of 2)
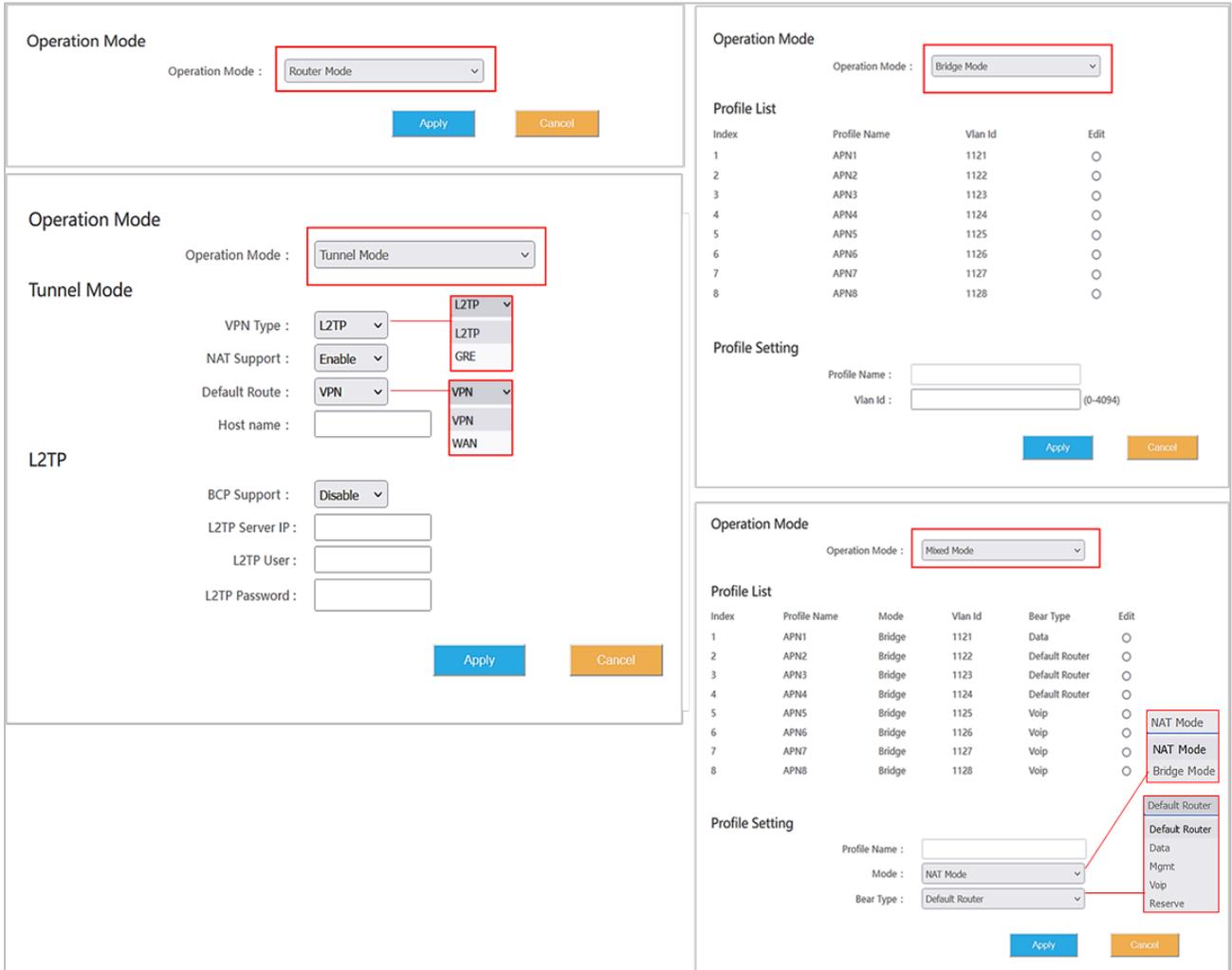
Table 5: WAN Settings

Field Name	Description
Network or Operation Mode	
WAN Interface	CAT4 only. LTE is the only option.
Network Mode or Operation Mode	CAT4: • NAT - Network Address Translation. Allows multiple hosts on a private network to access the Internet using a single public IP address. • Bridge - The WAN port addresses will bridge to the LAN port, and the LAN port will work in trunking mode. If you select *Bridge mode*, the system will prompt you to disable L2 in the *VPN > L2* menu. CAT6/7/15: • NAT - Allows multiple hosts on a private network to access the Internet using a single public IP address. • Router - The CPE will dynamically update the router tables.

Field Name	Description
	• Tunnel - The CPE will support Layer 2 Tunneling Protocol (L2TP) or Generic Routing Encapsulation (GRE) VPN mode. See field descriptions below*. • Bridge - The WAN port addresses will bridge to the LAN port, and the LAN port will work in trunking mode. If you select *Bridge mode*, the system will prompt you to disable L2 in the *VPN > L2* menu. • Mixed Mode - Each APN gateway can be configured with a different mode, either NAT or Bridge, and a different bearer type.
Manually DNS	CAT4 only. If left unchecked, the CPE will automatically search the domain name on the first available DNS server. If checked, enter the primary and secondary DNS server IP addresses.
Primary DNS	CAT4 only. If *Manually DNS* checkbox was checked, enter the primary DNS server's IP address for the CPE to check first for domain name resolution.
Secondary DNS	CAT4 only. If *Manually DNS* checkbox was checked, enter the secondary DNS server's IP address.
*Tunnel Mode (CAT6/7/15 Only)	
VPN Type	L2TP or GRE
NAT Support	Enable/Disable NAT on the VPN
Default Route	VPN or WAN
Host name	Optional - enter the default route name
*L2TP (CAT6/7/15 Only)	
BCP Support	Enable/Disable Bridge Control Protocol for L2TP tunneling. If enabled, must be set up on both ends, the CPE/router acting as Point-to-Point Protocol (PPP) client and the PPP server.
L2TP Server IP	IP address of the L2TP server
L2TP User	L2TP server user name
L2TP Password	L2TP server password
DNS Mode (CAT6/7/15 Only)	
DNS Mode	Automatic or Manually. If you select *Automatic*, the CPE will automatically search the domain name on the first available DNS server. If you select *Manually*, enter the primary and secondary DNS server IP addresses.
Primary DNS	If DNS Mode was set to *Manually*, enter the primary DNS server's IP address for the CPE to check first for domain name resolution.
Secondary DNS	If DNS Mode was set to *Manually*, enter the secondary DNS server's IP address for the CPE to check after the primary DNS if the domain name was not resolved.

7.4 Wifidog

The feature, Wifidog, is available on outdoor Atom CAT6/7/15 CPEs and is used to build wireless hotspots. The feature works in cooperation with a remote authentication server. When Wifidog is enabled, Wi-Fi devices such as guest users will have to be authenticated through the remote authentication server.

NOTE 1: The feature requires a connection to an authentication server to function.
NOTE 2: Wifidog is not recommended for Baicells CPEs using Power over Ethernet (PoE).

You can create a whitelist to identify which website addresses or URLs users are allowed to reach. You can also limit the number of times that a user attempts to log in within a configured time period before failure to authenticate times out. These settings help to avoid unauthorized use of the network.

In the GUI, go to *Network > Wifidog* (Figure 32). Notice the three panes in the *Wifidog Settings* window - *Basic Settings*, *Whitelist*, and *Advanced Settings*. In the *Basic Settings* pane, click on the checkbox next to *Enable* to initiate Wifidog, and enter the *AP code* and the *Authentication Server Address*. If you don't want to create a whitelist or configure advanced settings, then click on *Apply*. Otherwise, continue to the additional procedures for these settings before clicking on *Apply*.

In the *Whitelist* pane you can add URL addresses to be whitelisted – that is, allowed – without the user having to authenticate. Separate each URL with a comma (,). For the *Free certification equipment* field, enter the hotspot users' device MAC addresses. Use a comma (,) to separate each one. If you don't want to configure advanced settings, then click on *Apply*. Otherwise, continue to the additional procedures for these settings before clicking on *Apply*.

In the *Advanced Settings* pane, if you want all hotspot users to use the same authentication server and login requirements, enter the server path information and set the *Check interval* field (maximum time, in seconds), for logging in and the *Client timed out* field (maximum amount of time before failure to authenticate times out, in minutes). Click on *Apply*.

Figure 32: Wifidog Settings

7.5 Configure Connection Mode / Connection Settings

You can set the CPE to connect to the default network automatically or you can connect manually, where you have to select the network you want to connect to each time.
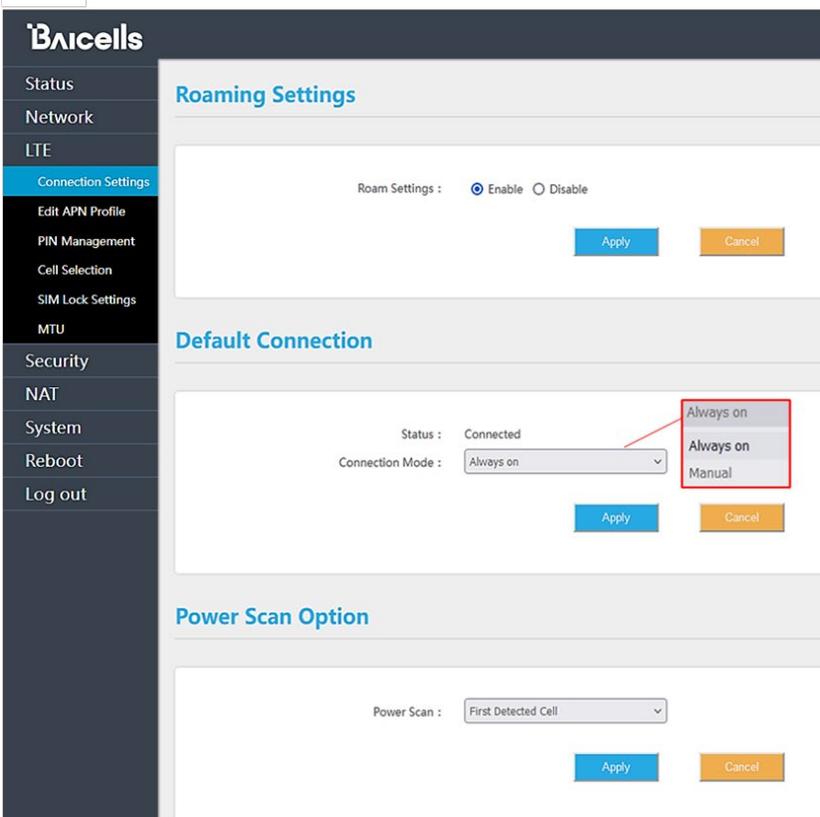
1. In the CAT4 GUI, go to *LTE > Connection Mode*, and in the CAT6/7/15 GUI, go to *LTE > Connection Settings* to choose *Automatic* (CAT4)/*Always On* (CAT6/7/15) or *Manual* (Figure 33). If you choose *Automatic* (CAT4) or *Always On* (CAT6/7/15), click on *SAVE/APPLY* (CAT4) or *Apply* (CAT6/7/15) to save your selection. If you choose *Manual*, go to step 2.

Figure 33: Connection Mode
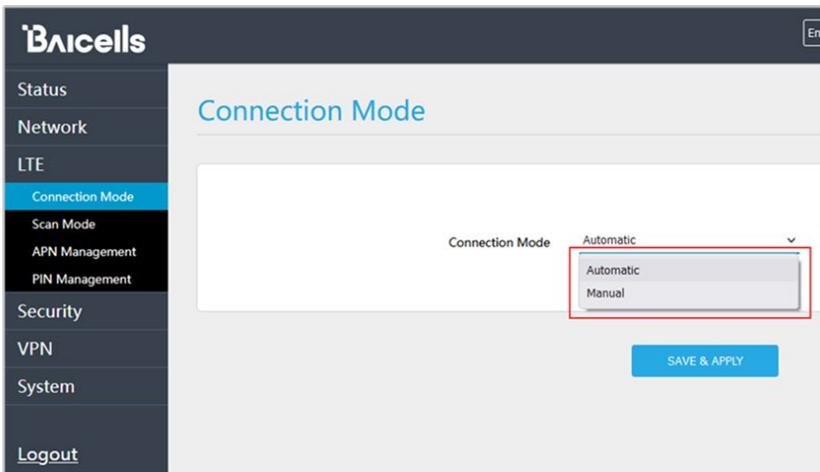
2. Manual: Click on *PLMN* for Public Land Mobile Network to scan all available networks and to select a specific LTE network with which to connect. Select *Connect* to connect to the network. Use the *Disconnect* button to disconnect from the selected network.

NOTE: The other configuration options shown are covered in the *CPE Configuration Guide*.

7.6 Configure Scan Mode / Cell Selection

7.5.1 Overview

The *Scan Mode / Cell Selection* setting has to do with how the CPE selects the best wireless signal between it and an eNB for its connection to the LTE network. The setting determines which frequencies the CPE's routine scan of available frequencies will cover.

Scanning is a process of tuning to specific frequencies and using a simple measure of signal quality to select the best cell (eNB) with which to communicate. It is a routine background function that occurs regularly to ensure the CPE is using the best available signal. There are four different scanning options, as shown in Figure 34 and described below.

Figure 34: Scan Mode/Cell Selection
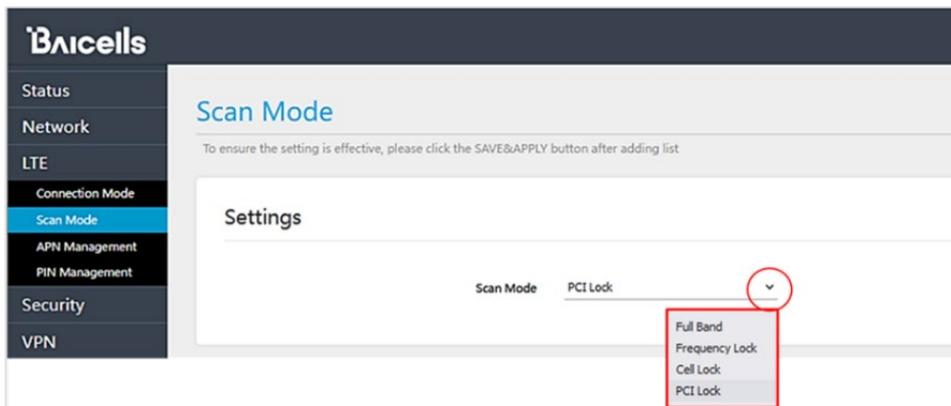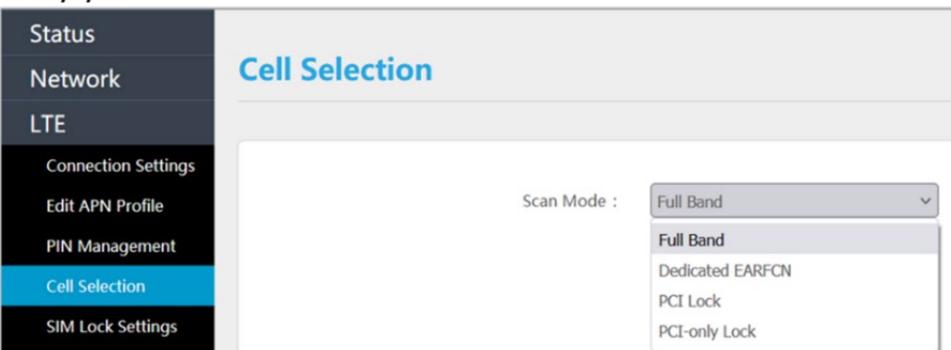
- **Full Band** – Default setting. The CPE will routinely scan all channels in the band, which can make the time it takes to connect to the network longer than the other modes. The band is dependent on the CPE model.

- **Frequency Lock / Dedicated EARFCN** – You can specify up to 9 frequencies or E-UTRA Absolute Radio Frequency Channel Numbers (EARFCNs) the CPE will scan during its routine signal scan. The frequency/EARFCN information will come from the service provider.

- **Cell Lock / PCI Lock** - A combination of Physical Cell Identifier (PCI) + EARFCN or frequency. The CPE will scan only the list of eNBs with the PCI and EARFCN combination, which accelerates network access time.

- **PCI-only Lock** – You can lock the CPE to a designated PCI or PCI range.

If you wish to leave the scan mode as *Full Band*, you do not need to make any configuration changes for the mode The procedures for configuring the other three modes are described for CAT4 and for CAT6/7/15 in the sections that follow.

7.5.2 CAT4

Following are the procedures for configuring *Frequency Lock, Cell Lock*, and *PCI Lock* on a CAT4 CPE.

- Frequency Lock (Figure 35)

    1. For *Scan Mode*, select *Frequency Lock* from the pull-down menu.

    2. Click on *ADD LIST* to open the *Frequency Lock Setting* pane.

    3. Select the *Band* number, and enter the *Earfcn*.

    4. Click on *ADD*. Then click *SAVE & APPLY*.

Figure 35: Frequency Lock (CAT4)
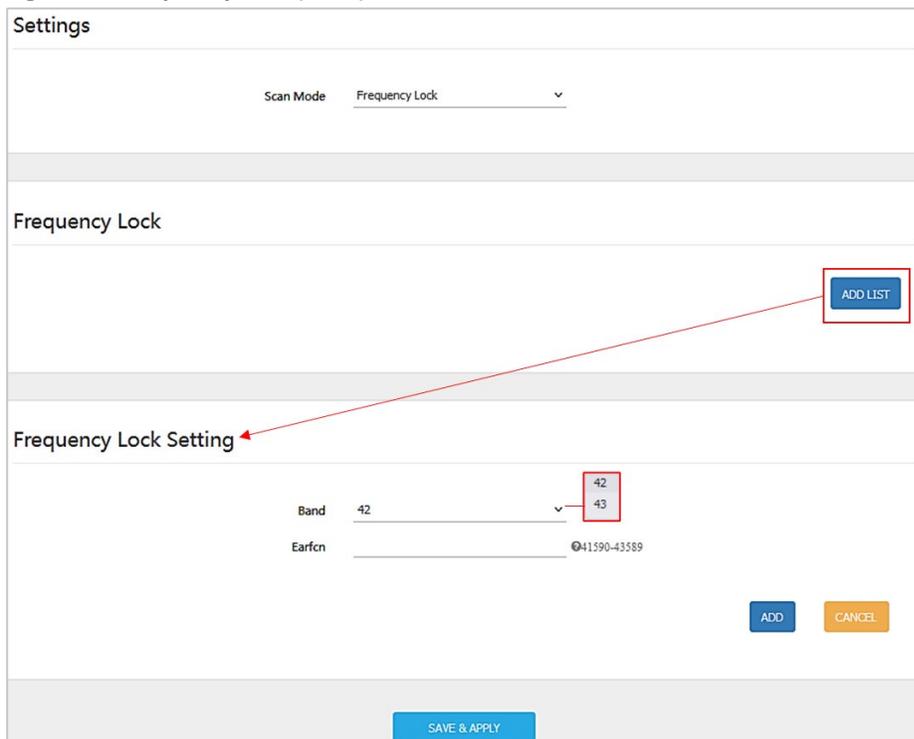
- Cell Lock (Figure 36)

    1. For *Scan Mode*, select *Cell Lock* from the pull-down menu.

    2. Click on *ADD LIST* to open the *Cell Lock Setting* pane.

    3. Select the *Band* number, and enter the *Earfcn* and *PCI* number combination.

    4. Click on *ADD*. Then click *SAVE & APPLY*.

Figure 36: Cell Lock (CAT4)
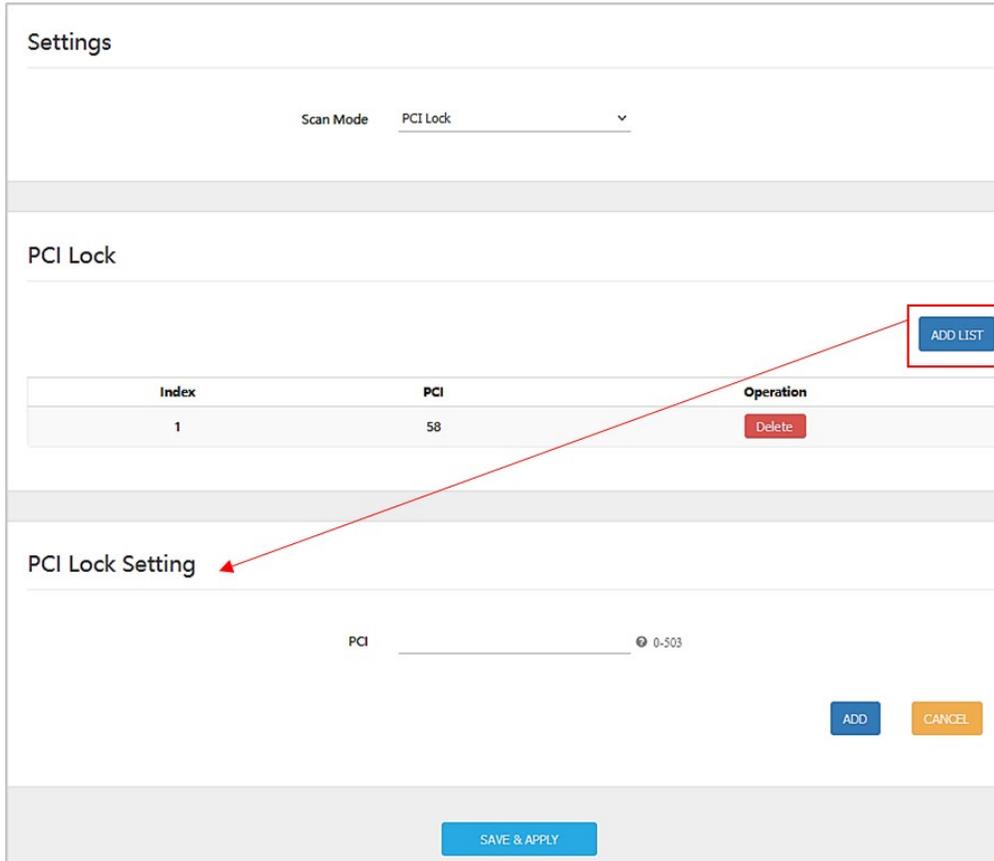
- PCI Lock (Figure 37)

    1. For *Scan Mode*, select *PCI Lock* from the pull-down menu.

    2. Click on *ADD LIST* to open the *PCI Lock Setting* pane.

    3. Enter the *PCI* number.

    4. Click on *ADD*. Then click *SAVE & APPLY*.

Figure 37: PCI Lock (CAT4)

7.5.3 CAT6/7/15

Following are the procedures for configuring *Dedicated EARFCN, PCI Lock*, and *PCI-only* Lock on a CAT6/7/15 CPE.

- Dedicated EARFCN (Figure 38)

    1. For *Scan Mode*, select *Dedicated EARFCN* from the pull-down menu.

    2. Identify the CPE LTE duplexing mode, *TDD* or *FDD*, and then select *Apply*.

    3. In the *EARFCN Settings* pane, choose the *Band* number.

    4. Select either *EARFCN* or *Frequency*, and enter the associated number to identify the EARFCN or frequency.

    5. Click on *Apply*.

Figure 38: Dedicated EARFCN (CAT6/7/15)

- PCI Lock (Figure 39)

  1. For *Scan Mode*, select *PCI Lock* from the pull-down menu, and click on *Apply*.

  2. In the *PCI Setting* pane, select the *Band* number.

  3. For *Type*, choose either *EARFCN* or *Frequency,* and enter the associated number.

  4. Enter a *PCI ID* number, (0-503) and click on *Apply*. The configuration will appear in the *PCI List* in the bottom pane.

Figure 39: PCI Lock (CAT6/7/15)

- PCI-only Lock (Figure 40)

    1. For *Scan Mode*, select *PCI-only Lock* from the pull-down menu, and click on *Apply*.

    2. In the *PCI Setting* pane, enter the *PCI Start* and *PCI End* numbers.

    3. Click on *Apply*. The configuration will appear in the *PCI List* in the bottom pane.

Figure 40: PCI-only Lock (CAT6/7/15)

7.7 Configure APN Management / Edit APN Profile

7.7.1 Overview

An Access Point Name (APN) is the name of a gateway between a device and another computer network, frequently the public Internet. In a Baicells system where the operator uses the Baicells CloudCore to connect to the backhaul, the APN establishes one connection between the CPE and the EPC (Evolved Packet Core) via the eNB. The Baicells CloudCore EPC, as well as eNBs operating in HaloB mode, support only one APN, which is configured by default. Therefore, when the service provider is using the Baicells CloudCore, there is no need to change this setting.

When using a Local EPC (private network EPC), more than one APN can be established for connections to multiple gateways. In this case, the CAT4 CPEs support up to four APN gateway configuration profiles, and the CAT6/7/15 CPEs support up to eight.

7.7.2 Configure Local EPC APN

In a Local EPC network setup, follow the steps below to configure an APN on a CAT4 or CAT6/7/15 CPE.

1. In the CAT4 GUI go to *LTE > APN Management*, and in the CAT6/7/15 GUI go to *LTE > Edit APN Profile* (Figure 41).

Figure 41: APN Management / Edit APN Profile
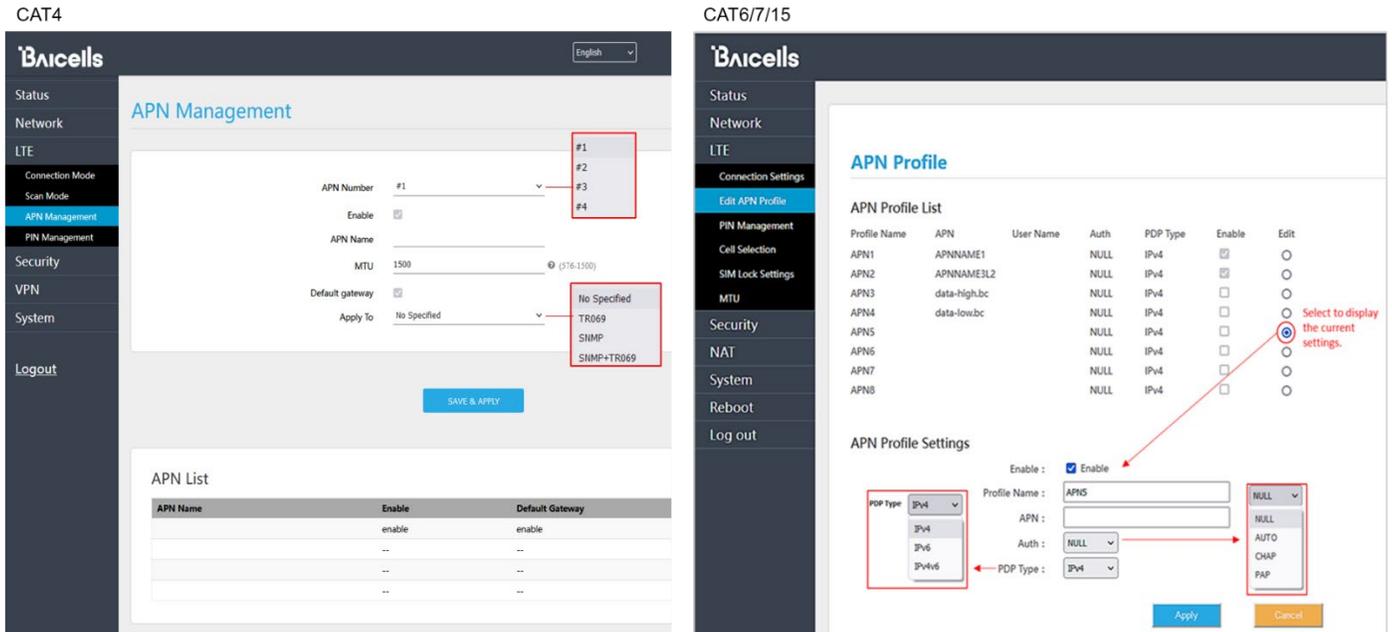
2. Select an APN number, which is just an index to separate the different APN profiles.

3. *Enable* the APN profile, and give it a name.

4. In CAT4, enter the Maximum Transmission Unit (MTU) packet size that can be sent on this APN. The range is 576-1500 bytes.

   NOTE: For CAT6/7/15, the MTU setting is in the *LTE > MTU* menu and the range is 1280-1500 bytes.

5. In CAT4, if you want this APN profile to be the default gateway, select the *Default* checkbox.

6. In CAT4, you can select a protocol to use: *No Specified, TR069, SNMP, SNMP+TR069*.*

7. In CAT6/7/15, for security you can enter a username and password, and set the *Auth Type.* The choices for the authorization/encryption protocol are *NULL, AUTO, CHAP*, or *PAP*.

8. Click *SAVE & APPLY* (CAT4) or *Apply* (CAT6/7/15) to save the settings.

7.8 Configure SAS

References: *CPE Configuration Guide* and *SAS Deployment Guide.*

The Citizens Broadband Radio Service (CBRS) covers the once-regulated 3.55-3.7 GHz band. What makes CBRS especially different is the way the 3.55-3.7 GHz band may be accessed as a "shared" spectrum, where spectrum resources are dynamically assigned and released on an as-needed basis. Shared spectrum assignment is handled by approved Spectrum Access System (SAS) vendors. The CBRS equipment is configured to connect to a SAS vendor for band assignment. When the assigned band is no longer needed, SAS can free it up so that other users can operate in that band.

The SAS feature is available to operators who have acquired the appropriate software license to operate certified network elements in SAS mode. The CBRS Service Devices (CBSDs), such as the Baicells eNBs and CPEs, must also go through certification, and must be installed by a Certified Professional Installer (CPI) in order to lawfully operate within the designated spectrum of CBRS. The CBSDs are identified by categories based on output power, Effective Isotropic Radiated Power (EIRP), and Power Spectral Density (PSD). Under these guidelines, the Baicells outdoor CPEs are classified as Category B.

The *CPE Configuration Guide* describes basic configuration procedures for CPE SAS setup. The *SAS Deployment Guide* provides a full overview and procedures for implementing SAS operation across all of the Baicells components. Refer to these documents when you are ready to implement SAS.

> NOTE 1: The first generation (Gen 1) Baicells CPEs do not support SAS.
> NOTE 2: If you are not sure if the CPE you are working with is certified, please check with your Baicells sales representative.
> NOTE 3: Before implementing SAS, verify basic CPE operation, i.e., it can connect to the network (see *section 7.9)*.

7.9 Verify Network Connection

Reference: *CPE Configuration Guide*

Now, the minimal (basic) configuration settings for the CPE are complete. With the CPE powered on, you should be able to connect to the Internet. If you have trouble connecting, go through this sequence of actions:

1. Retrace and verify the installation and basic configuration steps.

2. Refer to *section 8* below.

3. Contact your support team for assistance.

For configuration of additional features as well as more in-depth information about the CPE GUI, refer to the document referenced above.

8 Basic Troubleshooting

References: *CPE Configuration Guide*

Some of the common GUI menus and fields used for monitoring and troubleshooting the CPE are covered in this section. Features and GUI navigation may vary by CPE model and software version.

8.1 Device Information

To find basic information about the CPE you are using, in the GUI go to *Status > Overview* (Figure 42). At the top of the window, you can easily observe the network *connection state, signal intensity*, *LAN state*, and number of *devices connected*. The *Device Info* section gives the "look up" type of information such as *model number, hardware version, software version*, etc.

Figure 42: Device Info

8.2 LTE Status

The *LTE Status* section of the *Status > Overview* window offers USIM card status, IMSI, and IMEI numbers, as well as real-time LTE signal information (Figure 43). The data provides a more granular level of detail that pertains to signal strength, signal quality, the eNB connection, which frequencies are being used, and other wireless metrics.

This information typically is used by the service provider when troubleshooting an issue such as not being able to connect or stay connected to the network, dropped sessions, reboots, etc. Resolving such problems requires isolating whether the problem is caused by the device setup, the LAN/WAN network connection, or a wireless signal problem.

Figure 43: LTE Status
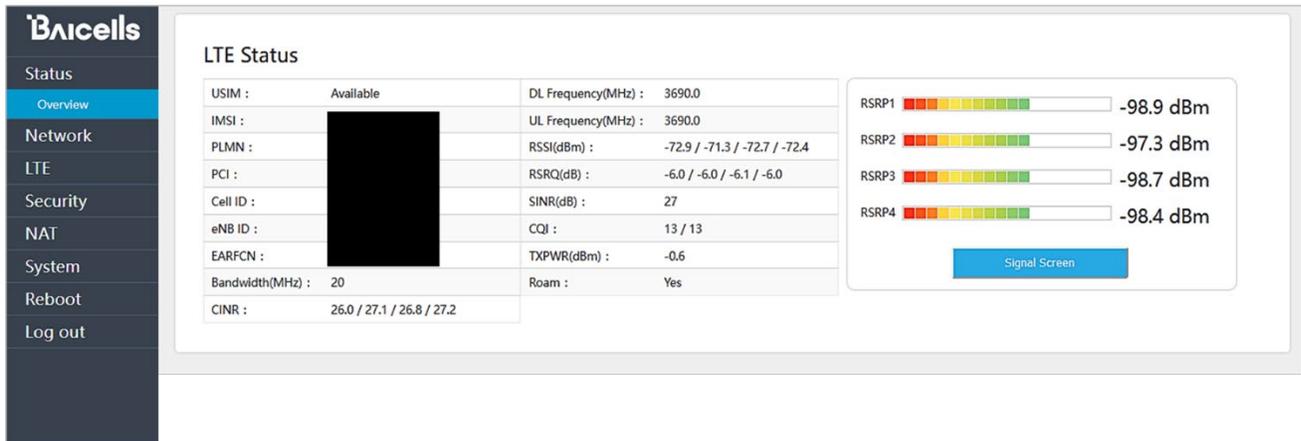
8.3 Throughput Statistics

To see how much data is flowing through the CPE, and to see how fast the traffic is moving uplink (to the eNB) and downlink (from the eNB), scroll down the *Status > Overview* window to the *Throughput Statistics* (Figure 44). The uplink/downlink data is in Kbps, showing the average, the peak, and the Sum (total) CPE throughput for all connected devices.

Figure 44: Throughput Statistics
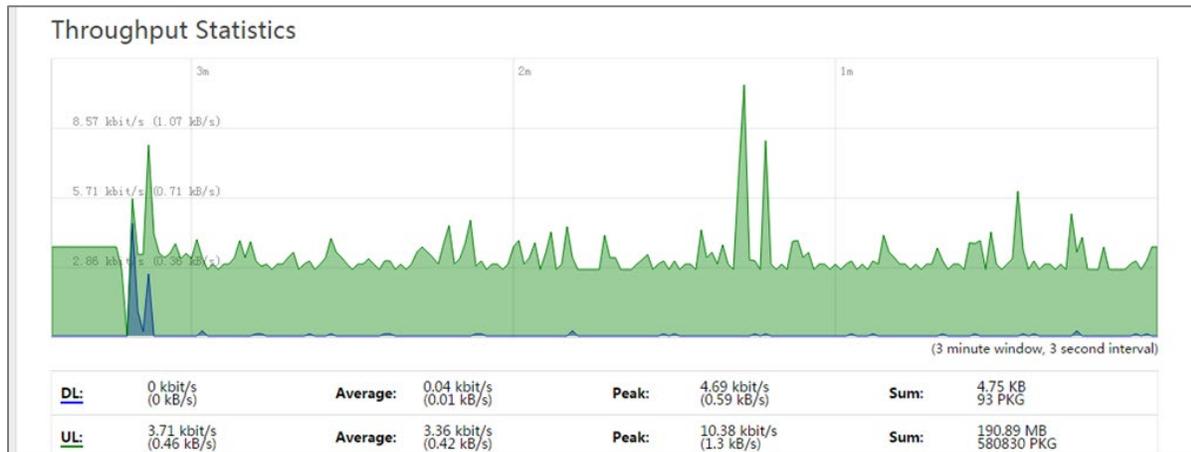
8.4 APN Status / Internet Status

For background, refer to *section 7.6*.

As you scroll down the *Status > Overview* window, the *APN Status* section (it is called *Internet Status* in CAT6/7/15) displays each configured APN gateway (Figure 45). At least one APN (APN1) is by default configured for the TR-069 connection to the Baicells CloudCore. If the service provider's network uses a Local EPC (private network EPC), there may be up to four (CAT4) or eight (CAT6/7/15) APNs. It shows

Mainly you want to check that any gateways you are using show as *enabled*. On a CAT4 CPE, you can see the gateway's *MAC address, IP address, connection type*, and *DNS server* being used. On a CAT6/7/15 CPE, you will see the *APN Profile Name*, *IPv4/v6 Address*, and the *primary* and *secondary DNS*.

Figure 45: APN Status

8.5 LAN Status

The *LAN Status* part of the *Overview* window displays the Local Area Network *MAC address, IP address,* and *Netmask* (Figure 46). If you are having issues connecting to the LAN/WAN, check this window for the basic IP networking status information.

Figure 46: LAN Status

8.6 Devices List

To check how many devices are connected to the CPE, scroll down the *Status > Overview* window to the *Devices List* (Figure 47). If too many users are accessing the Internet through the CPE at the same time, on a CAT6/7/15 CPE you may consider limiting the IP address range and number of devices connected in the *Security > Connect Limit* menu.

Figure 47: Devices List