eNodeB Configuration Guide

BaiBS_RTS_3.7.5
BaiBS_RTD_3.7.5
BaiBS_QRTB_2.6.2

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Version 1.05

About This Document

This document describes the mainstream applications used for configuring and administering the Baicells eNodeBs (eNBs). The scope of information includes the standard single carrier eNB GUI, as well as the two-carrier eNB capable of operating in Carrier Aggregation (CA) mode or Dual Carrier (DC)/split mode. The target audience is network administrators who are responsible for configuring, monitoring, troubleshooting, and upgrading Baicells eNBs; configuring network interfaces; adding subscribers, and creating service plans.

Separate *documents* are available for specific use cases or to focus on particular deployment scenarios:

- HaloB User Guide
- Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide
- SAS Deployment Guide
- Spectra LTE-U
- Local OMC+BOSS
- Local Evolved Packet Core (EPC)

This publication of the guide is written to the following Baicells eNB software versions:

- Nova227/233/243: BaiBS_RTS_3.7.5 (focus)
- Nova246 BaiBS_RTD_3.7.5
- Nova436Q/Neutrino430: BaiBS_QRTB_2.6.2 (differences from RTS only)

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

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Revision Record

Date	Version	Description	SMEs/Contributors	Author/Editor
5-Aug-2021	V1.05	• Updated for BaiBS_QTRB_2.6.2 (differences from RTS only) • Updated SAS deployment processes for applicable software (BaiBS_RTS_3.7.5 and BaiBS_QRTB_2.6.2) • Updated product naming conventions to align with marketing strategy	Pengyu Chen, Bergh Diebel, Warren Lai, Jesse Raasch, Seng Tang, Blake Volk	Kathy Clark
8-Apr-2021	V1.04	Updated for BaiBS_RTS_3.7.5, BaiBS_RTD_3.7.5, and BaiBS_QRTB_2.5.4 (differences from RTS only). In addition, the list of terms was deleted, and a cross-reference to the Acronyms & Abbreviations document was added.	Yang Yanan, Warren Lai	Kathy Clark
29-Oct-2020	V1.03	Editorial updates (non-technical impact)	-	Kathy Clark
13-Oct-2020	V1.02	Updated for BaiBS_QRTB_2.4.2 (differences from RTS only) **NOTE:** The original format for the Baicells Configuration and Network Administration Guide has been changed and is no longer available on the website. That document has been replaced with: • eNB Configuration Guide • CPE Configuration Guide • CloudCore Configuration and Network Administration Guide	Nitisha Potti, Liu Guidong	Kathy Clark
10-Sep-2020	V1.01	This is a new document for Baicells eNodeB and CloudCore release: • Nova-227/233/243 eNBs: BaiBS_RTS_3.6.6 (focus) • Nova-246 eNB: BaiBS_RTD_3.6.6 • Nova-436Q/Neutrino-430 eNBs: BaiBS_QRTB_2.3.6 (differences from RTS only) • CloudCore OMC version: 6.0.5.1 • CloudCore BOSS version: 6.1. **NOTE:** Refer to the Baicells Configuration and Network Administration Guide for previous eNodeB software releases.	Chris Culver, Nitisha Potti, Yang Yanan	Kathy Clark

Support Resources

- **Documentation** - Baicells product data sheets and technical manuals may be found at Baicells > Support > *Documents*.
- **Support** - Open a support ticket, process an RMA, and the Support Forum are at Baicells > *Support*.

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1. Introduction

The Baicells products give network operators the ability to offer internet service to subscribers using LTE-based broadband wireless access. In a standard configuration, the key components include user equipment (UE), eNodeB (eNB) radio access network equipment, and cloud-based core functions and network/subscriber management applications (Figure 1-1). A subscriber connects a laptop, tablet, or other smart device through the UE – also called Customer Premise Equipment (CPE) – which connects wirelessly to an eNB. The eNB communicates with the LTE backhaul network.

NOTE: The terms UE and CPE have the same meaning and are used interchangeably in this document.

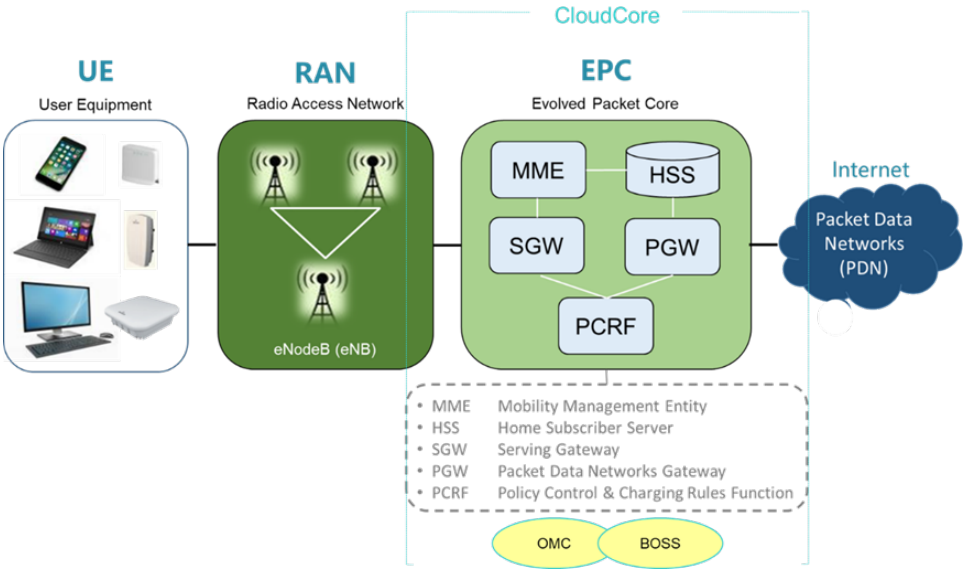
The available operations, administration, and management (OAM) applications include an eNB GUI, a UE GUI, the Baicells CloudCore Operations Management Console (OMC), and the Baicells CloudCore Business Operations and Support System (BOSS). The eNB GUI is documented in this guide, and the other apps are documented in:

- CPE Configuration Guide
- CloudCore Configuration & Network Administration Guide

The eNB GUI and the UE GUI are used to configure and manage individual devices. The CloudCore apps may be used to configure and manage all of the operator's network devices across multiple sites through the OMC and all of the subscribers and services plans through BOSS. Baicells charges a monthly CloudCore usage fee based on the number of active users.

CloudCore includes not only management apps but also provides the core LTE network functions that are shown in the figure. Private network solutions such as Local EPC and Local OMC+BOSS are available.

Figure 1-1: Standard Baicells LTE Network



Many of the equipment and network interface parameters are preconfigured with recommended default settings from the factory. However, every field and operation is explained and illustrated in this guide to allow each operator the flexibility to use the Baicells CloudCore-based solution to meet their unique requirements.

2. eNB GUI

This section describes the eNB GUI for three different software versions:

- BaiBS_RTS_3.7.5 Nova227/233/243
- BaiBS_RTD_3.7.5 Nova246
- BaiBS_QRTB_2.6.2 Nova436Q/Neutrino430

The BaiBS_RTS_3.7.5 software version is used to explain how to configure a single-carrier eNB running in standard mode. The BaiBS_QRTB_2.6.2 software version is used to explain how to configure a two-carrier eNB capable of operating in Carrier Aggregation (CA) mode or Dual Carrier (DC)/split mode. Any major differences for non-standard or two-carrier configurations are noted. Not all menus and fields are applicable to every eNB model or deployment scenario. Specific documents that are available for such exceptions, for specific use cases, or to focus on particular deployment scenarios are cited.

NOTE 1: The Nova246, Nova436Q and Neutrino430 can be configured for Dual Carrier (DC)/split mode capabilities. Currently, only the Nova436Q and Neutrino430 can also be configured to operate in Carrier Aggregation (CA) mode.
NOTE 2: The Nova436Q and Neutrino430 GUIs vary slightly from each other when they are configured for Dual Carrier (DC)/split mode. Certain fields that are used to differentiate Cell 1 and Cell 2 may be labeled “Cell1” and “Cell2” or Primary Cell (PCELL) and Secondary Cell (SCELL). The terms Cell1 and Cell2 are used throughout this document.
NOTE 3: For more information about the Neutrino430, see *Neutrino430 Indoor 4x250mW Two-Carrier TDD eNodeB Installation Guide*.

2.1 Computer Requirements

Refer to Table 2-1 for the minimum requirements of the computer that you use to launch the eNB GUI.

Table 2-1: Computer Requirements

Item	Description	
CPU	Higher than Intel Core 1GHz	
Memory	Greater than 2G RAM	
Hard Disk	No less than 100 MB space available	
Ethernet port	10/100/1000 adaptive Ethernet interface	
Operating System	Microsoft: Windows XP, Windows Vista, Windows 7, or higher	Mac: MacOSX 10.5 or higher
Screen Resolution	Higher than 1024 x 768 pixels	
Browser	Google Chrome 9+, Internet Explorer 7.0+, Mozilla Firefox 3.6+	

You can launch the eNB GUI through a Web address (discussed in section 2.2). If you are on-site you can connect a computer directly to the eNB unit’s Local Maintenance Terminal (LMT), which is the MGMT/LAN port Before launching the GUI, you will need to set up the computer’s IP address to connect the client to the server, e.g.:

1. In Windows 7, select Start > Control Panel, and in the pop-up dialogue window click on *Network and Internet*.
2. Click on *View network status and tasks*, and then click on *Local Connectivity*.
3. In the dialogue window labeled *Status of Local Connectivity*, click on *Properties*. This will open the *Properties of Local Connectivity* dialogue window.
4. Select *Internet Protocol Version (TCP/IPV4)*, and click on *Properties* (Figure 2-1).

Figure 2-1: Internet Protocol Version (TCP/IPV4)

Either *Obtain an IP address automatically* and proceed to step 6, or *Use the following IP address* and follow steps 5 and 6. If the option for obtaining the IP address automatically fails, you will need to set up the IP address manually.

5. Use the following IP address option: Input the IP address, subnet mask, and default gateway, where:

   - IP address is **192.168.150.xxx** (xxx is a number from 100 to 254).
   - Subnet mask is **255.255.255.0**.
   - Default gateway is **192.168.150.1**.

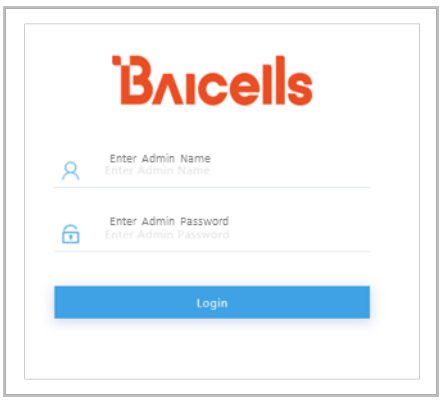
6. Execute ping 192.168.150.1 in the command dialogue window and check whether the connection between the local (client) computer and the server is working.

2.2 Launching the GUI

To launch the GUI, open a Web browser and go to *http://192.168.150.1*. At the *Login* dialogue window (Figure 2-2), enter **admin** for both the default name and password.

NOTE For security reasons, you should change the password after you first log in rather than leaving the default admin name and password. Refer to section 2.5.4 of this document.

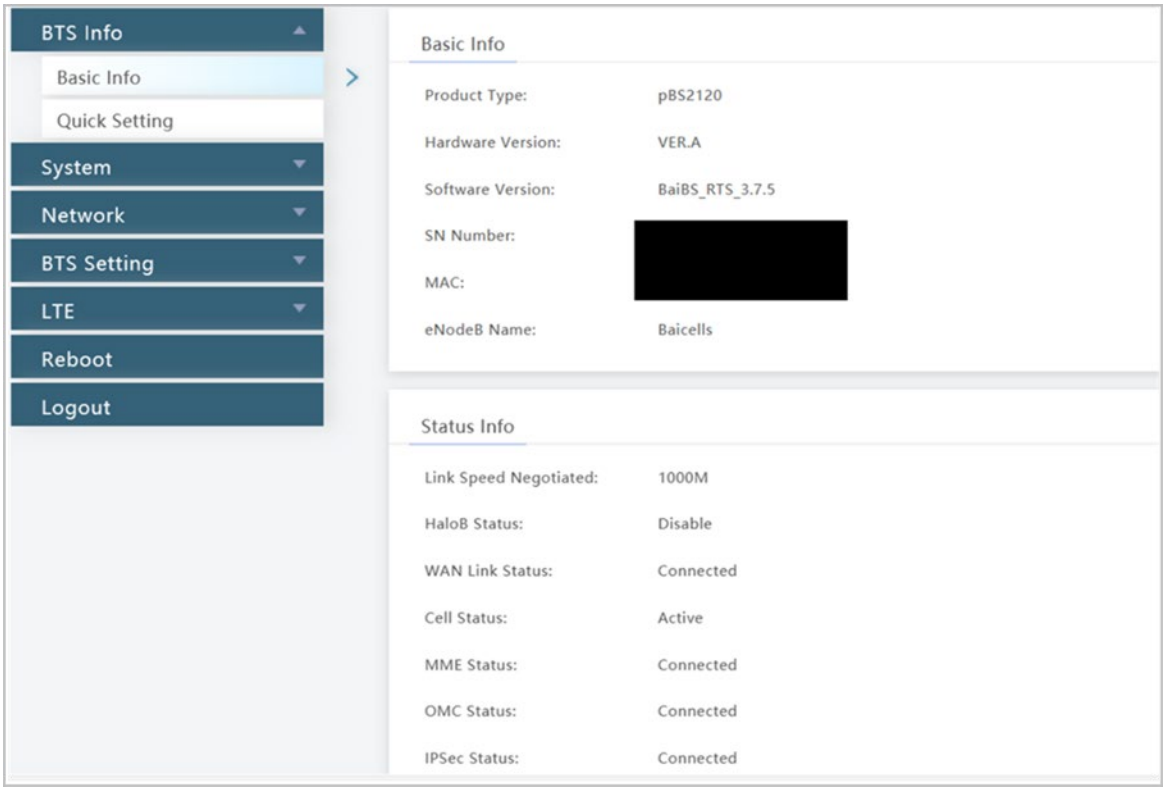
Figure 2-2: Login



The GUI home page will display, showing the navigation pane on the left (example in Figure 2-3). The menus may vary by hardware model, software version, and eNB operating mode.

Use the vertical/horizontal scroll bars to see all of a displayed menu's fields. Vertical scroll bars are usually on the right side of the display. Horizontal scroll bars are usually at the bottom of the display.

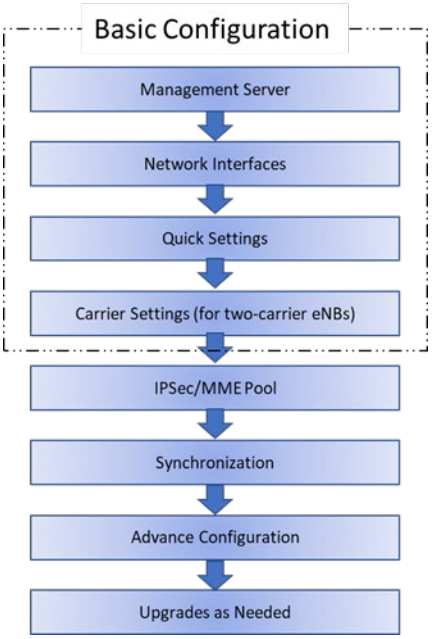
Figure 2-3: Home Page



2.3 Configuration Flow

This document is organized around the visual flow of the GUI menus and fields. However, during initial eNB installation and configuration, perform the basic configuration steps in the order shown in Figure 2-4.

Figure 2-4: Initial eNB Configuration Flow



2.4 BTS Info

2.4.1 Basic Info

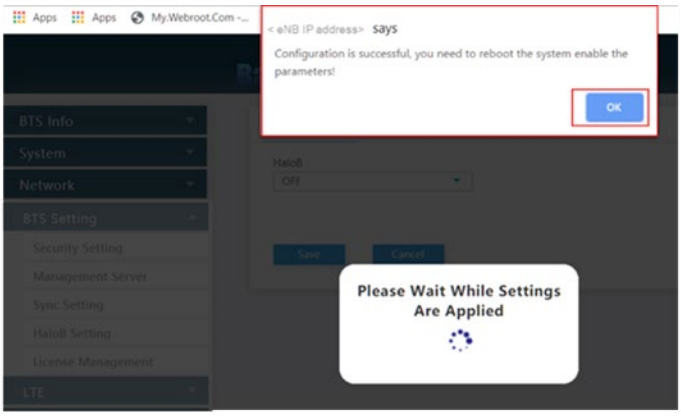
Under BTS Info > Basic Info are several fields providing essential eNB operational information. The fields that are displayed depend on the hardware model, software version, and eNB operating mode. For example, if you were running the eNB in HaloB mode, the field *HaloB Status Enable* (or *HaloB Status ON* for BaiBS_QRTB_2.6.2) would display in the *Status Info* list. If the eNB is a two-carrier system configured for Dual Carrier (DC)/split mode, you will see fields that differentiate Cell 1 and Cell 2, e.g., *RF Status(Cell1)* and *RF Status(Cell2)*.

NOTE: The only eNB currently running software version BaiBS_RTD_3.7.5 to enable Dual Carrier (DC)/split mode capabilities is the Nova246.

Switching to a different operating mode requires a warm reboot of the eNB. You will see a message display to please wait while settings are applied. When you get this message, click on OK to initiate the reboot (Figure 2-5). Refer to the following documents that are specific to non-standard operating modes:

- HaloB User Guide
- Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide
- SAS Deployment Guide

Figure 2-5: Message



The eNB GUI refreshes the basic information every 15 seconds. For eNBs running BaiBS_RTS_3.7.5 software, the basic info window is shown in Figure 2-6, and the fields are described in Table 2-2. For eNBs running BaiBS_RTD_3.7.5 software, the basic info window is shown in Figure 2-7, and the fields are described in Table 2-3. For eNBs running BaiBS_QRTB_2.6.2 software, the basic info window is shown in Figure 2-8, and the fields are described in Table 2-4.

Figure 2-6: Basic Info (RTS)

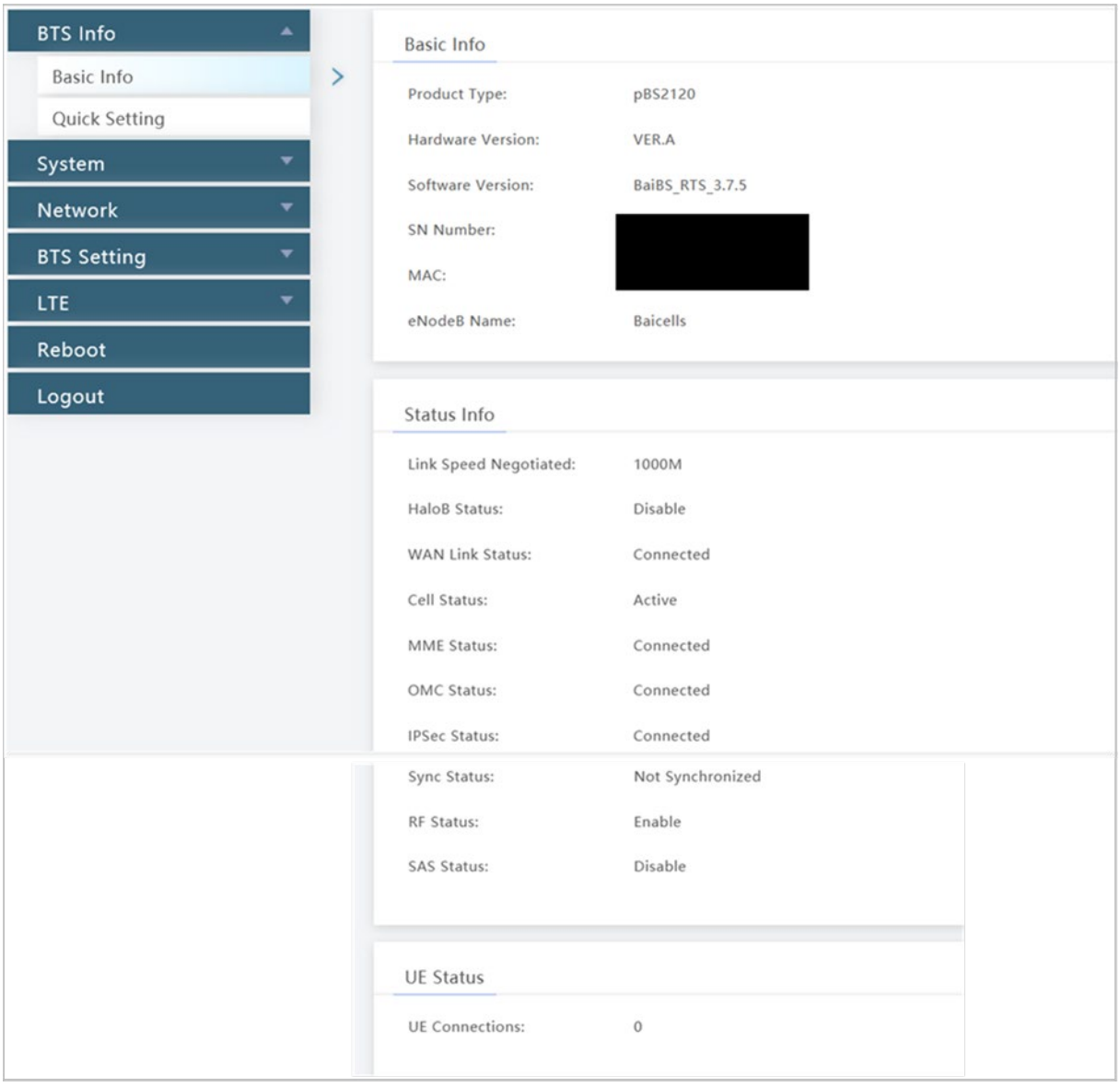


Table 2-2: Basic Info Fields (RTS)

Field Name	Description
Basic Info	
Product Type	The eNB model
Hardware Version	The version number of the eNB hardware
Software Version	The version number of the operating software running on the eNB
SN Number	Serial Number identifier for the eNB
MAC	Data Link layer Media Access Control address for the eNB
eNodeB Name	Name you assign to the eNB
Status Info	
Link Speed Negotiated	Data rate negotiated between the eNB and the WAN interface

Field Name	Description
HaloB Status	Indicates HaloB mode status (disable or enable) when the HaloB licensed feature is applied to the eNB
WAN Link Status	Status of link between eNB and WAN (external) interface: Connected/Not connected
Cell Status	Active or Inactive. When the eNB is operating (transmitting and receiving signals), the status will be active. If not, the status will be reported as inactive.
MME Status	Mobility Management Entity status is connected or not connected to the eNB. The LTE MME is responsible for initiating paging and authentication of mobile devices. The operator may have more than one MME in the network. NOTE: This field will not appear in HaloB mode.
OMC Status	Status of the link between the eNB and the Baicells Operations Management Console is either connected or not connected
IPSec Status	The Internet Protocol Security gateway is connected or not connected to the eNB. The operator may have more than one IPSec gateway. The system will enable the IPSec by default. In the presence of a security gateway, the security protocols are provided in the network layer to ensure the safety of the message transmission. NOTE: This field will not appear in HaloB mode.
Sync Status	The eNB is either synchronized or not synchronized with other eNBs in the area. Refer to section 2.7.3 for more information.
Sync Source	The source providing synchronization of transmissions, typically the GPS. NOTE: This field will not appear when Sync Mode is shut off.
RF Status	Indicates if the RF is on (transmitting and receiving) or off.
SAS Status	Field that displays whether CBRS Spectrum Access System (SAS) is enabled or disabled. Refer to section 2.9.7.
UE Status	
UE Connections	Number of UEs currently connected to the eNB; if at least 1, additional fields display
UE ID	The UE identification number assigned by the system
IMSI	The International Mobile Subscriber Identity (IMSI) number. An IMSI is used to identify the user of a cellular network and is a unique identification associated with all cellular networks.
LGW MAC	The MAC address of the local area network gateway.
IP	Internet Protocol address for the eNB
PORT	Port number assigned to the UE to allow remote logins. For example, type in the eNB <IP address>:5<last 4 digits of IMSI>
UL Throughput (Mbps)	The data throughput rate, in megabits per second (Mbps), of data transmitted uplink by the UE to the eNB

Field Name	Description
DL Throughput (Mbps)	The data throughput rate, in megabits per second (Mbps), of data transmitted downlink by the eNB to the UE
ULSINR	Uplink Signal-to-Interference-Plus-Noise Ratio (ULSINR) describes the signal strength of the UE's signals to the eNB in comparison with other interfering signals or background noise, expressed in dB. Range is 0-30 dB.
DLCQI	Downlink Channel Quality Indicator indicates how good or bad the communication channel quality is for data being transmitted from the eNB to the UE. CQI is a combination of SNR, SINR, and SNDR. Value range is 1-15.
ULMCS	Uplink Modulation and Coding Scheme is a numerical index based on Orthogonal Frequency Division Multiplexing (OFDM) that represents the maximum data rate the UE can achieve when transmitting data over-the-air to the eNB. The MCS index value comprises several variables, including channel width, modulation type, coding rate, and spatial streams.
DLMCS	Downlink Modulation and Coding Scheme – see description for "ulmcs" above, which in this case pertains to the downlink
TxPower (dBm)	Transmit (Tx) power is the amount of radio frequency (RF) power (in Watts) that the UE produces. Unit of measurement is dBm. Range is -8 to +23 dBm.
Uplink BLER	Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Uplink BLER represents a ratio of the number of erroneous data blocks received to the total number of blocks sent from UE to eNB.
DownLink BLER	Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Downlink BLER is a ratio of the number of erroneous data blocks received to the total number of blocks sent from the eNB to the UE.
Pathloss&Interference(dB)	Reports the reduction in power density (attenuation) as the wireless signal propagates through space. The pathloss value impacts the overall RF link budget. An RF link budget is an accounting of all the gains and losses from the transmitter, through the medium to the receiver.

Figure 2-7: Basic Info (RTD)

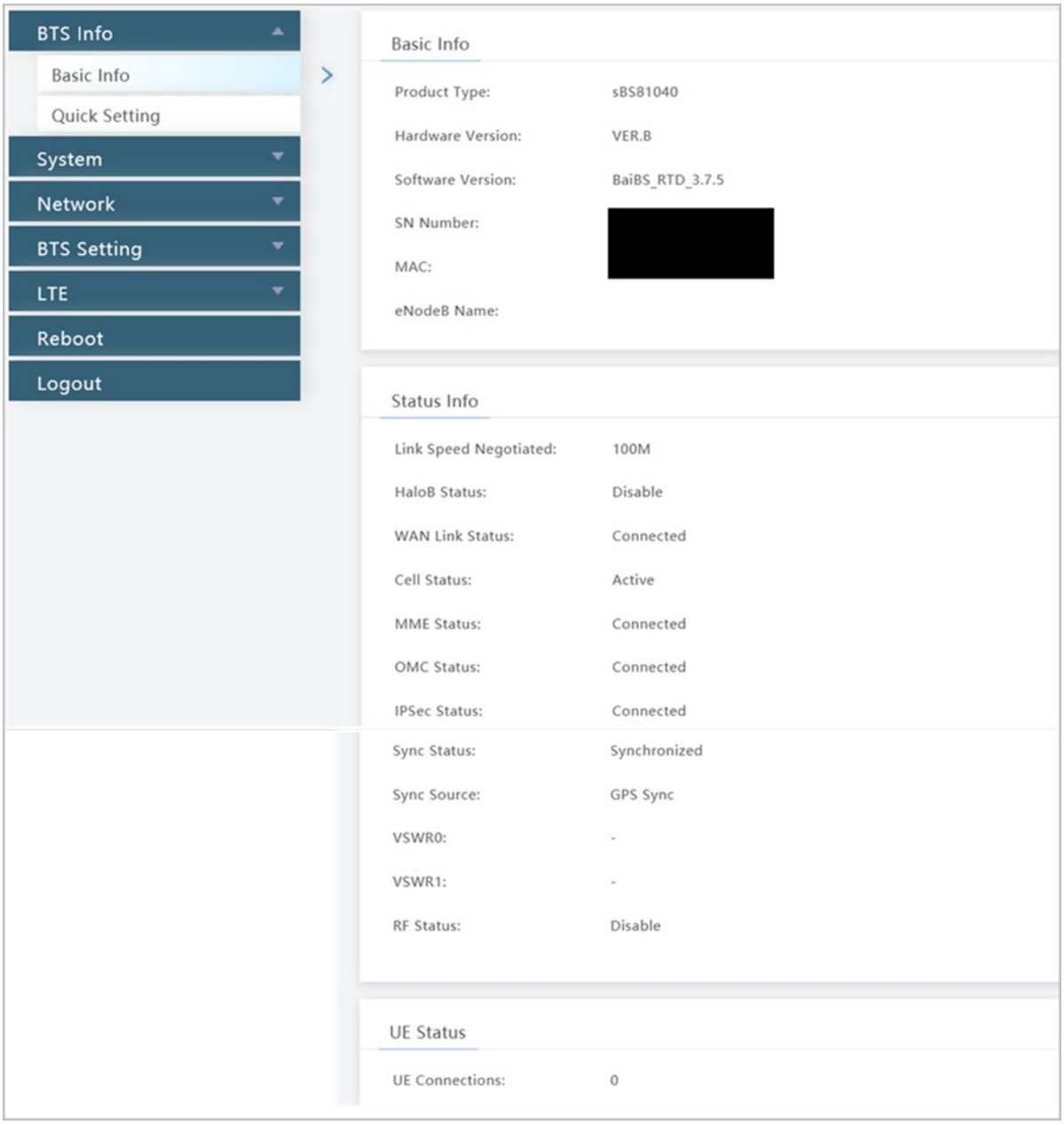


Table 2-3: Basic Info Fields (RTD)

Field Name	Description
Basic Info	
Product Type	The eNB model
Hardware Version	The version number of the eNB hardware
Software Version	The version number of the operating software running on the eNB
SN Number	Serial Number identifier for the eNB
MAC	Data Link layer Media Access Control address for the eNB
eNodeB Name	Name you assign to the eNB

Field Name	Description
Status Info	
Link Speed Negotiated	Data rate negotiated between the eNB and the WAN interface
HaloB Status	Indicates HaloB mode status (disable or enable) when the HaloB licensed feature is applied to the eNB
WAN Link Status	Status of link between eNB and WAN (external) interface: Connected/Not connected
Cell Status	Active or Inactive. When the eNB is operating (transmitting and receiving signals), the status will be active. If not, the status will be reported as inactive.
MME Status	Mobility Management Entity status is connected or not connected to the eNB. The LTE MME is responsible for initiating paging and authentication of mobile devices. The operator may have more than one MME in the network. NOTE: This field will not appear in HaloB mode.
OMC Status	Status of the link between the eNB and the Baicells Operations Management Console is either connected or not connected
IPSec Status	The Internet Protocol Security gateway is connected or not connected to the eNB. The operator may have more than one IPSec gateway. The system will enable the IPSec by default. In the presence of a security gateway, the security protocols are provided in the network layer to ensure the safety of the message transmission. NOTE: This field will not appear in HaloB mode.
Sync Status	The eNB is either synchronized or not synchronized with other eNBs in the area. Refer to section 2.7.3 for more information.
Sync Source	The source providing synchronization of transmissions, typically the GPS
VSWR0	Voltage Standing Wave Ratio (VSWR) that is set up on transmission device 0
VSWR1	Voltage Standing Wave Ratio (VSWR) that is set up on transmission device 1
RF Status (CELL1) and (CELL2)	Indicates if the RF is on (transmitting and receiving) or off. For two-carrier eNBs, each cell is reported.
Radio Resource Usage	
UL Total Throughput (Mbps)	The total aggregate data throughput rate, in megabits per second (Mbps), of data transmitted uplink by all the UEs currently connected to the eNB
DL Total Throughput (Mbps)	The total aggregate data throughput rate, in megabits per second (Mbps), of data transmitted downlink by all the UEs currently connected to the eNB
UL PRB Usage	Shows the percentage of available Physical Resource Blocks being used in the uplink. NOTE 1: A two-carrier eNB operating in Dual Carrier (DC)/split mode will display Cell 1 and Cell 2 data. Refer to the *Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide*. NOTE 2: The only eNB currently running software version BaiBS_RTD_3.7.5 to enable Dual Carrier (DC)/split mode capabilities is the Nova246.

Field Name	Description
DL PRB Usage	Shows the percentage of available Physical Resource Blocks being used in the downlink. NOTE 1: A two-carrier eNB operating in Dual Carrier (DC)/split mode will display Cell 1 and Cell 2 data. Refer to the *Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide*. NOTE 2: The only eNB currently running software version BaiBS_RTD_3.7.5 to enable Dual Carrier (DC)/split mode capabilities is the Nova246.
Uplink BLER	Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer. Uplink BLER represents a ratio of the number of erroneous data blocks received to the total number of blocks sent from UE to eNB.
DownLink BLER	Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Downlink BLER is a ratio of the number of erroneous data blocks received to the total number of blocks sent from the eNB to the UE.
UE Status	
UE Connections	Number of UEs currently connected to the eNB; if at least 1, additional fields display
UE ID	The UE identification number assigned by the system
IMSI	The International Mobile Subscriber Identity (IMSI) number. An IMSI is used to identify the user of a cellular network and is a unique identification associated with all cellular networks.
LGW MAC	The MAC address of the local area network gateway.
IP	Internet Protocol address for the eNB
PORT	Port number assigned to the UE to allow remote logins. For example, type in the eNB <IP address>:5<last 4 digits of IMSI>
UL Throughput (Mbps)	The data throughput rate, in megabits per second (Mbps), of data transmitted uplink by the UE to the eNB
DL Throughput (Mbps)	The data throughput rate, in megabits per second (Mbps), of data transmitted downlink by the eNB to the UE
ULSINR	Uplink Signal-to-Interference-Plus-Noise Ratio (ULSINR) describes the signal strength of the UE's signals to the eNB in comparison with other interfering signals or background noise, expressed in dB. Range is 0-30 dB.
DLCQI	Downlink Channel Quality Indicator indicates how good or bad the communication channel quality is for data being transmitted from the eNB to the UE. CQI is a combination of SNR, SINR, and SNDR. Value range is 1-15.
ULMCS	Uplink Modulation and Coding Scheme is a numerical index based on Orthogonal Frequency Division Multiplexing (OFDM) that represents the maximum data rate the UE can achieve when transmitting data over-the-air to the eNB. The MCS index value comprises several variables, including channel width, modulation type, coding rate, and spatial streams.

Field Name	Description
DLMCS	Downlink Modulation and Coding Scheme – see description for “ulmcs” above, which in this case pertains to the downlink
TxPower (dBm)	Transmit (Tx) power is the amount of radio frequency (RF) power (in Watts) that the UE produces. Unit of measurement is dBm. Range is -8 to +23 dBm.
Uplink BLER	Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Uplink BLER represents a ratio of the number of erroneous data blocks received to the total number of blocks sent from UE to eNB.
DownLink BLER	Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Downlink BLER is a ratio of the number of erroneous data blocks received to the total number of blocks sent from the eNB to the UE.
Pathloss&Interference(dB)	Reports the reduction in power density (attenuation) as the wireless signal propagates through space. The pathloss value impacts the overall RF link budget. An RF link budget is an accounting of all the gains and losses from the transmitter, through the medium to the receiver.

Figure 2-8: Basic Info (QRTB)

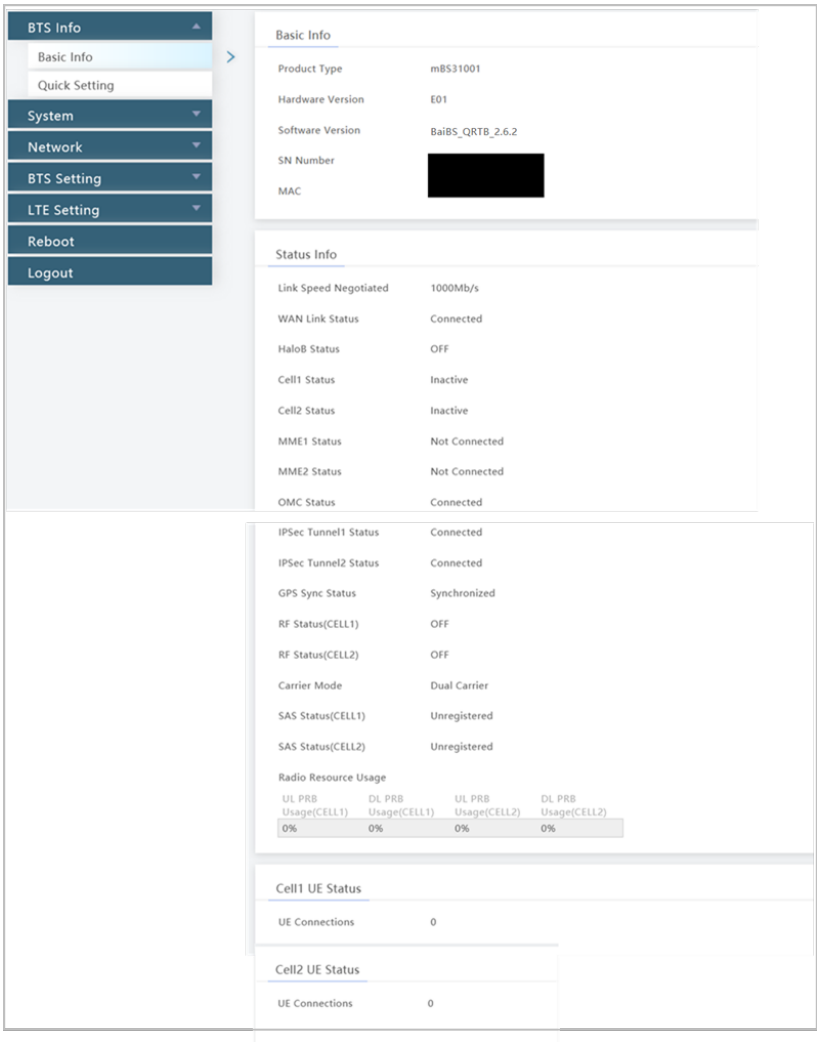


Table 2-4: Basic Info Fields (QRTB)

Field Name	Description
Basic Info	
Product Type	The eNB model
Hardware Version	The version number of the eNB hardware
Software Version	The version number of the operating software running on the eNB
SN Number	Serial Number identifier for the eNB
MAC	Data Link layer Media Access Control address for the eNB
Status Info	
Link Speed Negotiated	Data rate negotiated between the eNB and the WAN interface
WAN Link Status	Status of link between eNB and WAN (external) interface: Connected/Not connected
HaloB Status	Indicates HaloB mode status (OFF or ON) when the HaloB licensed feature is applied to the eNB

Field Name	Description
Cell Status*	Active or Inactive. When the eNB is operating (transmitting and receiving signals), the status will be active. If not, the status will be reported as inactive.
MME1 Status and MME2 Status	Mobility Management Entity status is connected or not connected to the eNB. The LTE MME is responsible for initiating paging and authentication of mobile devices. The operator may have more than one MME in the network. NOTE: This field will not appear in HaloB mode.
OMC Status	Status of the link between the eNB and the Baicells Operations Management Console is either connected or not connected
IPSec Tunnel1 Status and IPSec Tunnel2 Status	The Internet Protocol Security gateway is connected or not connected to the eNB. The operator may have more than one IPSec gateway. The system will enable the IPSec by default. In the presence of a security gateway, the security protocols are provided in the network layer to ensure the safety of the message transmission. NOTE: This field will not appear in HaloB mode.
GPS Sync Status	The eNB is either synchronized or not synchronized with other eNBs in the area. Refer to section 2.7.3 for more information.
RF Status (CELL)*	Indicates if the RF is on (transmitting and receiving) or off. For two-carrier eNBs, each cell is reported.
Carrier Mode	Used to configure the carrier setting. Options are Dual Carrier (with Carrier Aggregation enabled or disabled) and Single Carrier. Refer to section 2.8.6 for more information.
SAS Status*	Field that displays whether CBRS Spectrum Access System (SAS) is enabled or disabled. Refer to section 2.10.5.
Radio Resource Usage	
UL PRB Usage*	Shows the percentage of available Physical Resource Blocks being used in the uplink. NOTE: A two-carrier eNB operating in Dual Carrier (DC)/split mode will display Cell 1 and Cell 2 data. Refer to the *Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide*.
DL PRB Usage*	Shows the percentage of available Physical Resource Blocks being used in the downlink. NOTE: A two-carrier eNB operating in Dual Carrier (DC)/split mode will display Cell 1 and Cell 2 data. Refer to the *Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide*.
UE Status*	
UE Connections	Number of UEs currently connected to the eNB; if at least 1, additional fields display
UE ID	The UE identification number assigned by the system
IMSI	The International Mobile Subscriber Identity (IMSI) number. An IMSI is used to identify the user of a cellular network and is a unique identification associated

Field Name	Description
	with all cellular networks.
IP	Internet Protocol address for the eNB
PORT	Port number assigned to the UE to allow remote logins. For example, type in the eNB <IP address>:5<last 4 digits of IMSI>
Downlink Rate (Mbps)	The data throughput rate, in megabits per second (Mbps), of data transmitted downlink by the eNB to the UE
Uplink Rate (Mbps)	The data throughput rate, in megabits per second (Mbps), of data transmitted uplink by the UE to the eNB
ULSINR	Uplink Signal-to-Interference-Plus-Noise Ratio (ULSINR) describes the signal strength of the UE's signals to the eNB in comparison with other interfering signals or background noise, expressed in dB. Range is 0-30 dB.
P-DLCQI	(Primary Cell) Downlink Channel Quality Indicator indicates how good or bad the communication channel quality is for data being transmitted from the eNB to the UE. CQI is a combination of SNR, SINR, and SNDR. Value range is 1-15.
S-DLCQI	(Secondary Cell) Downlink Channel Quality Indicator indicates how good or bad the communication channel quality is for data being transmitted from the eNB to the UE. CQI is a combination of SNR, SINR, and SNDR. Value range is 1-15.
ULMCS	Uplink Modulation and Coding Scheme is a numerical index based on Orthogonal Frequency Division Multiplexing (OFDM) that represents the maximum data rate the UE can achieve when transmitting data over-the-air to the eNB. The MCS index value comprises several variables, including channel width, modulation type, coding rate, and spatial streams.
P-DLMCS	(Primary Cell) Downlink Modulation and Coding Scheme – see description for "ulmcs" above, which in this case pertains to the downlink
S-DLMCS	(Secondary Cell) Downlink Modulation and Coding Scheme – see description for "ulmcs" above, which in this case pertains to the downlink
TXPOWER (dBm)	Transmit (Tx) power is the amount of radio frequency (RF) power (in Watts) that the UE produces. Unit of measurement is dBm. Range is -8 to +23 dBm.
UBLER	Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Uplink BLER represents a ratio of the number of erroneous data blocks received to the total number of blocks sent from UE to eNB.
P_TB1_DLBLR	(Primary Cell) Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Downlink BLER is a ratio of the number of erroneous data blocks received to the total number of blocks sent from the eNB to the UE.
P_TB2_DLBLR	(Primary Cell) Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Downlink BLER is a ratio of the number of erroneous data blocks received to the total number of blocks sent from the eNB to the UE.

Field Name	Description
S_TB1_DLBLR	(Secondary Cell) Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Downlink BLER is a ratio of the number of erroneous data blocks received to the total number of blocks sent from the eNB to the UE.
S_TB2_DLBLR	(Secondary Cell) Block Error Ratio (BLER) is a measure of how successful a data transmission is over-the-air at the Physical/MAC layer level. Downlink BLER is a ratio of the number of erroneous data blocks received to the total number of blocks sent from the eNB to the UE.
PATHLOSS (dBm)	Reports the reduction in power density (attenuation) as the wireless signal propagates through space. The pathloss value impacts the overall RF link budget. An RF link budget is an accounting of all the gains and losses from the transmitter, through the medium to the receiver.

NOTE: The field names annotated by (*) vary depending on how the carrier mode setting is configured. When the eNB is configured in Dual Carrier mode, the status for CELL1 and CELL2 are shown separately.

2.4.2 Quick Setting

The *Quick Setting* fields must be configured for cell parameters and transmission information. When an eNB is attaching to the core network through the Baicells CloudCore, the *PLMN* field must be set to **314030.** When the eNB connects to CloudCore, the *MME IP* address fields will be set to 10.3.0.9 and 10.5.0.9. Check to make sure the eNB has obtained the 2 MME addresses. For eNBs running BaiBS_RTS_3.7.5 software, the *Quick Setting* menu is shown in Figure 2-9 and the fields are described in Table 2-5. For eNBs running BaiBS_RTD_3.7.5 software, the *Quick Setting* menu is shown in Figure 2-10 and the fields are described in Table 2-6. For eNBs running BaiBS_QRTB_2.6.2 software, the *Quick Setting* menu is shown in Figure 2-11 and the fields are described in Table 2-7.

NOTE 1: The eNBs that currently support the Citizens Broadband Radio Service (CBRS) and the shared Spectrum Access System (SAS) are Nova227/Nova233 (RTS software) and Nova436Q/Neutrino430 (QRTB software). When SAS is enabled on any of these eNBs, the standard BTS Info > Quick Setting for Band, Bandwidth, Frequency, and Power Modify will become greyed out. In that case, the eNB uses the settings determined by the SAS vendor. However, you can assign preferences to these settings for the SAS vendor using the *Quick Setting* menu. Refer to the *SAS Deployment Guide* for more detailed information about SAS requirements and configurations.
NOTE 2: With the software update from QRTB 2.5.4 to QRTB 2.6.2, the “Channel Reuse” check box moved from the *SAS Settings* menu to the *Quick Setting* menu.
NOTE 3: If the Nova246, Nova436Q and Neutrino430 eNBs are set to single carrier mode, one cell will be configured. If these eNBs are set to Dual Carrier (DC)/split mode, two cells will be configured. In those cases, Quick Settings for BaiBS_QRTB_2.6.2 software version will display fields for Cell1 and for Cell2. Refer to the *Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide* and *Neutrino430 Indoor 4x250mW Two-Carrier TDD eNodeB Installation Guide*.

For most *Quick Setting* parameter changes, you must perform a warm **reboot** the eNB for the changes to take effect. Use the *Reset* button if you want to reset the configuration to the original default settings.

Figure 2-9: Quick Setting (RTS)

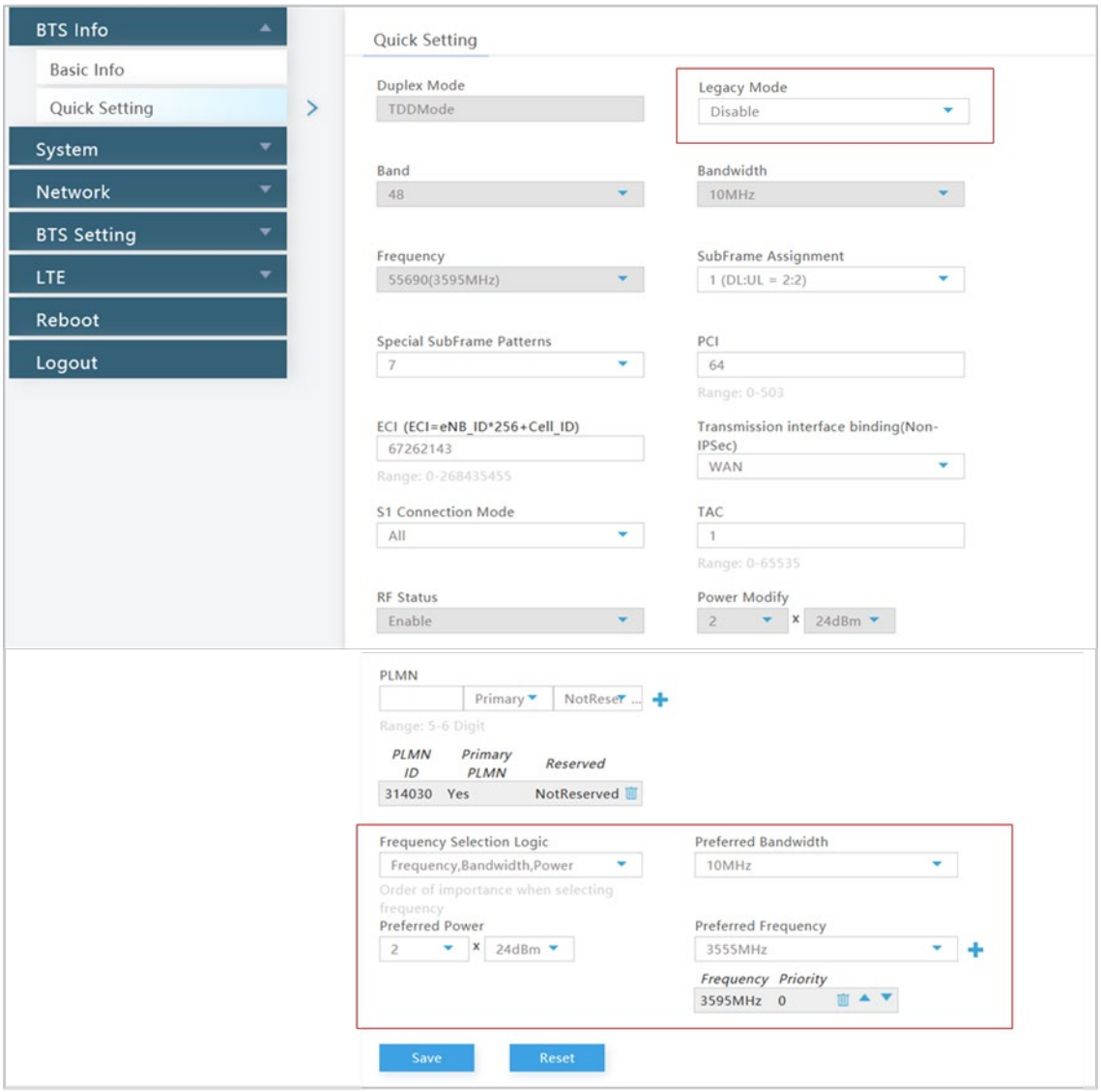


Table 2-5: Quick Setting Fields (RTS)

Field Name	Description
Duplex Mode	Preset field - cannot be configured at this time. Either Time Division Duplexing (TDD) or Frequency Division Duplexing (FDD) depending on model and country.
Legacy Mode	Used to enable CPEs only supporting Bands 42 or 43 to connect to a Band 48 eNB. Default is disable. NOTE: This field will not appear unless SAS is enabled.
Band	The eNB's operating frequency band, which is auto-selected based on the hardware model or assigned by the Spectrum Access System (SAS) vendor if SAS is enabled.
Bandwidth	For TDD mode, the channel bandwidth the eNB may use: 5, 10, 15, or 20 MHz. Applies

Field Name	Description
	to both uplink and downlink. The default is 20 MHz. Example for B43: 44190 (3660 MHz) to 44490 (3690 MHz). If SAS is enabled, the bandwidth will be assigned by the SAS vendor.
Frequency	The eNB's operating frequency (MHz). Range depends on the eNB hardware model, country code, and whether or not SAS is enabled. Example for B43: 44190 (3660MHz) to 44490 (3690MHz). If SAS is enabled, the frequency will be assigned by the SAS vendor.
SubFrame Assignment	Downlink (DL) and uplink (UL) subframe configuration, either 0, 1, or 2, where: 0 = DL:UL is 1:3 transmission ratio 1 = DL:UL is 2:2 transmission ratio 2 = DL:UL is 3:1 transmission ratio (default) Refer to the BaiTip on this setting: *https://community.na.baicells.com/t/baitip-of-the-day-december-14th-2016-subframes-and-special-subframes/163*
Special SubFrame Patterns	Either 5 or 7. This is a standard LTE setting that pertains to synchronization of downlink and uplink timing. The guard period between switching from DL to UL or UL to DL determines the maximum supportable cell size. The guard period has to be large enough to cover the propagation delay of DL interferers. The default setting is 7.
PCI	Physical Cell Identification (PCI) allocated by the operator. Range is 0-503. PCI is an essential Layer 1 cell identity for each cell site in the network. Planning PCIs is crucial for QoS. NOTE: Baicells does not use and does not work with PCI 0.
Cloud EPC	The Baicells CloudCore Evolved Packet Core (EPC) is either enabled/ON or disabled/OFF. When you enable it, the fields for ECI, MME Interface Binding, TAC, and MME IP are automatically assigned. When you disable the Cloud EPC setting, it unlocks the greyed-out fields below it, e.g., ECI, PLMN, and TAC. When you change the Cloud EPC setting, it will perform a warm **reboot** of the eNB. NOTE: This field will not appear in HaloB mode.
ECI	Unique identification number for the Cell ID. Range from 0 to 268435455. The Cell ID + the eNB ID x 256 comprises the E-UTRAN Cell Identity (ECI), which identifies a cell site in the network. Example of how Cell ID is used in calculating the ECI using ENB ID*256+cell ID: ECI = 256055 if ENB ID=1000 and Cell ID=55.
MME Interface Binding (Non-IPSec)	When IPSec is set to enabled, this field is not displayed. Assign the interface connected to the MME or other external transmission interface if the eNB is operating in HaloB mode. The interface should be selected among the network interfaces already

Field Name	Description
	configured. The interface is configured under the GUI menu Network > WAN/LAN/VLAN. The WAN interface is used by default, but the VLAN interface or PPPoE can also be used. NOTE: This field will not appear in HaloB mode.
S1 Connection Mode	The connection mode of the S1 interface between the eNB and the core network. One - The eNB will connect only to the first MME All - The eNB will connect to all MMEs configured NOTE: This field will not appear in HaloB mode.
TAC	Tracking Area Code (TAC) for where the eNB is located. The TAC is used to determine the range of the paging information. Use a number between 1 - 65,535. The default is 1.
RF Status	Enable/ON or disable/OFF the eNB's RF antenna to allow it to transmit and receive or to keep it from transmitting and receiving. The default is Enable/ON.
Power Modify	Output power on each port, typically left with the default values. 30 dBm x2 = 33 dBm. Every 3 dB doubles the power. This field may be used in situations where you need to reduce the output power, such as testing the eNB before installing it on a tower; restricting the eNB output to reduce interference with other eNBs in the same geographical area; or staying within Effective Isotropic Radiated Power (EIRP) rules. If SAS is enabled, the bandwidth will be assigned by the SAS vendor.
PLMN	The numerical identifier for the operator's Public Land Mobile Network (PLMN) for this cell. Must be a 5- or 6-digit number. If you are using the Baicells CloudCore, you must enter **PLMN = 314030.**
MME IP	This field appears for eNBs operating in standard mode. Enter the IP address of the Mobility Management Entity (MME). If you are using the Baicells CloudCore, the MME IP addresses will be **10.3.0.9** and **10.5.0.9.** NOTE: This field will not appear in HaloB mode.
Frequency Selection Logic	Used to configure preferred frequencies, channel bandwidth, and power when SAS is enabled. After receiving channel availability from SAS, the DP uses the frequency selection logic setting to calculate CBRS channel selection based on the order of importance identified. NOTE: This field will not appear unless SAS is enabled.
Preferred Bandwidth	Used to set the preferred bandwidth for the eNB. NOTE: This field will not appear unless SAS is enabled.
Preferred Power	Used to set the preferred power for the eNB. The preferred power is the total TX power (in dBm) being transmitted per carrier. NOTE: This field will not appear unless SAS is enabled.
Preferred Frequency	Used to set the preferred frequency for the eNB. More than one preferred frequency

Field Name	Description
	can be added, and each frequency's priority can be set. NOTE: This field will not appear unless SAS is enabled.

Figure 2-10: Quick Setting (RTD)

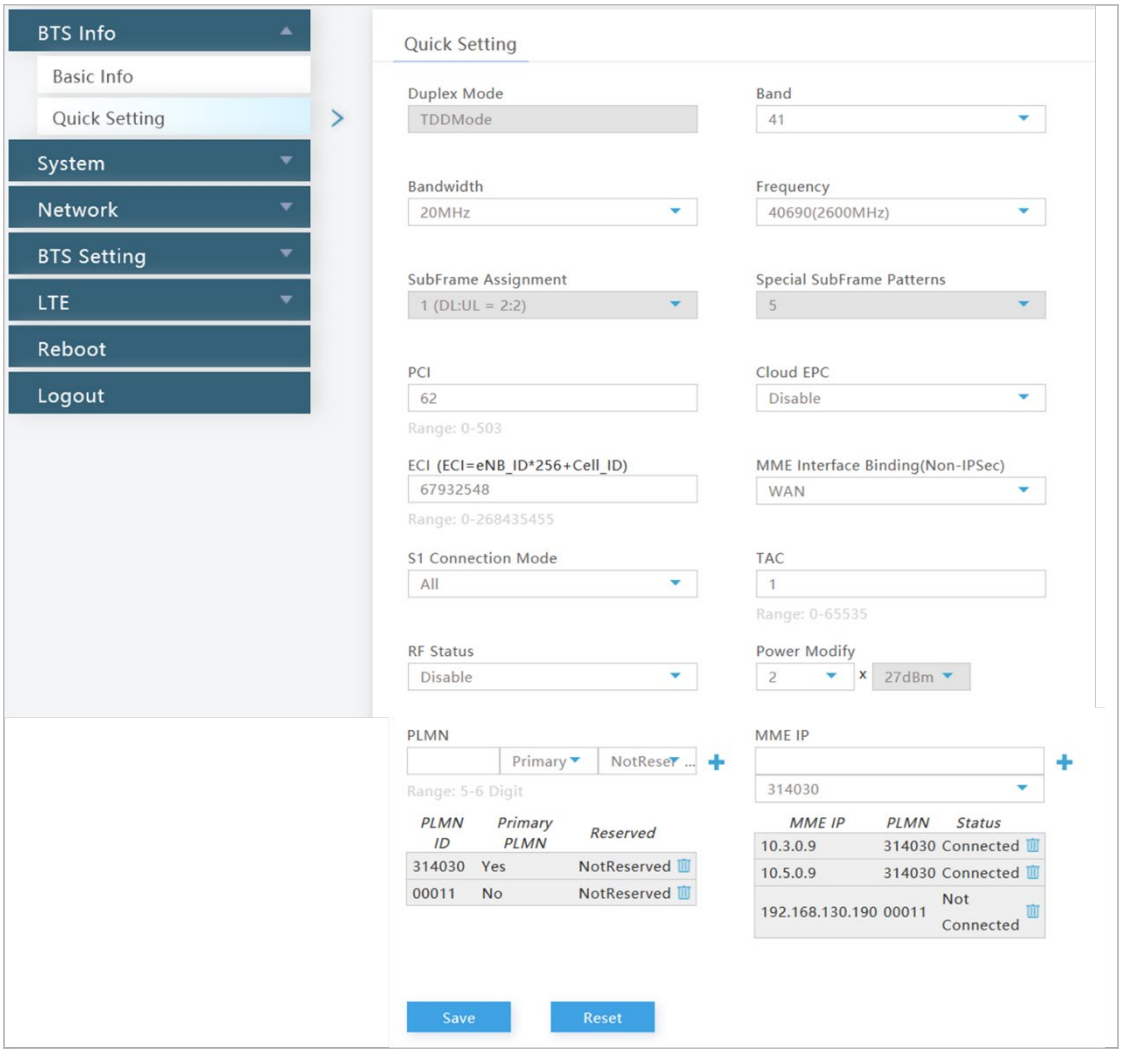


Table 2-6: Quick Setting Fields (RTD)

Field Name	Description
Duplex Mode	Preset field - cannot be configured at this time. Either Time Division Duplexing (TDD) or Frequency Division Duplexing (FDD) depending on model and country.
Band	The eNB's operating frequency band, which is auto-selected based on the hardware model
Bandwidth	For TDD mode, the channel bandwidth the eNB may use: 5, 10, 15, or 20 MHz. Applies to both uplink and downlink. The default is 20 MHz. Example for B43: 44190 (3660 MHz)

Field Name	Description
	to 44490 (3690 MHz).
Frequency	The eNB's operating frequency (MHz). Range depends on the eNB hardware model, country code. Example for B43: 44190 (3660MHz) to 44490 (3690MHz).
SubFrame Assignment	Downlink (DL) and uplink (UL) subframe configuration, either 0, 1, or 2, where: 0 = DL:UL is 1:3 transmission ratio 1 = DL:UL is 2:2 transmission ratio 2 = DL:UL is 3:1 transmission ratio (default) Refer to the BaiTip on this setting: *https://community.na.baicells.com/t/baitip-of-the-day-december-14th-2016-subframes-and-special-subframes/163*
Special SubFrame Patterns	Either 5 or 7. This is a standard LTE setting that pertains to synchronization of downlink and uplink timing. The guard period between switching from DL to UL or UL to DL determines the maximum supportable cell size. The guard period has to be large enough to cover the propagation delay of DL interferers. The default setting is 7.
PCI	Physical Cell Identification (PCI) allocated by the operator. Range is 0-503. PCI is an essential Layer 1 cell identity for each cell site in the network. Planning PCIs is crucial for QoS. NOTE: Baicells does not use and does not work with PCI 0.
Cloud EPC	The Baicells CloudCore Evolved Packet Core (EPC) is either enabled/ON or disabled/OFF. When you enable it, the fields for ECI, MME Interface Binding, TAC, and MME IP are automatically assigned. When you disable the Cloud EPC setting, it unlocks the greyed-out fields below it, e.g., ECI, PLMN, and TAC. When you change the Cloud EPC setting, it will perform a warm **reboot** of the eNB. NOTE: This field will not appear in HaloB mode.
ECI	Unique identification number for the Cell ID. Range from 0 to 268435455. The Cell ID + the eNB ID x 256 comprises the E-UTRAN Cell Identity (ECI), which identifies a cell site in the network. Example of how Cell ID is used in calculating the ECI using ENB ID*256+cell ID: ECI = 256055 if ENB ID=1000 and Cell ID=55.
MME Interface Binding (Non-IPSec)	When IPSec is set to enabled, this field is not displayed. Assign the interface connected to the MME or other external transmission interface if the eNB is operating in HaloB mode. The interface should be selected among the network interfaces already configured. The interface is configured under the GUI menu Network > WAN/LAN/VLAN. The WAN interface is used by default, but the VLAN interface or PPPoE can also be used. NOTE: This field will not appear in HaloB mode.

Field Name	Description
S1 Connection Mode	The connection mode of the S1 interface between the eNB and the core network. One - The eNB will connect only to the first MME All - The eNB will connect to all MMEs configured NOTE: This field will not appear in HaloB mode.
TAC	Tracking Area Code (TAC) for where the eNB is located. The TAC is used to determine the range of the paging information. Use a number between 1 - 65,535. The default is 1.
RF Status	Enable/ON or disable/OFF the eNB's RF antenna to allow it to transmit and receive or to keep it from transmitting and receiving. The default is Enable/ON.
Power Modify	Output power on each port, typically left with the default values. 30 dBm x2 = 33 dBm. Every 3 dB doubles the power. This field may be used in situations where you need to reduce the output power, such as testing the eNB before installing it on a tower; restricting the eNB output to reduce interference with other eNBs in the same geographical area; or staying within Effective Isotropic Radiated Power (EIRP) rules.
PLMN	The numerical identifier for the operator's Public Land Mobile Network (PLMN) for this cell. Must be a 5- or 6-digit number. If you are using the Baicells CloudCore, you must enter **PLMN = 314030.**
MME IP	This field appears for eNBs operating in standard mode. Enter the IP address of the Mobility Management Entity (MME). If you are using the Baicells CloudCore, the MME IP addresses will be **10.3.0.9** and **10.5.0.9.** NOTE: This field will not appear in HaloB mode.

Figure 2-11: Quick Setting (QRTB)

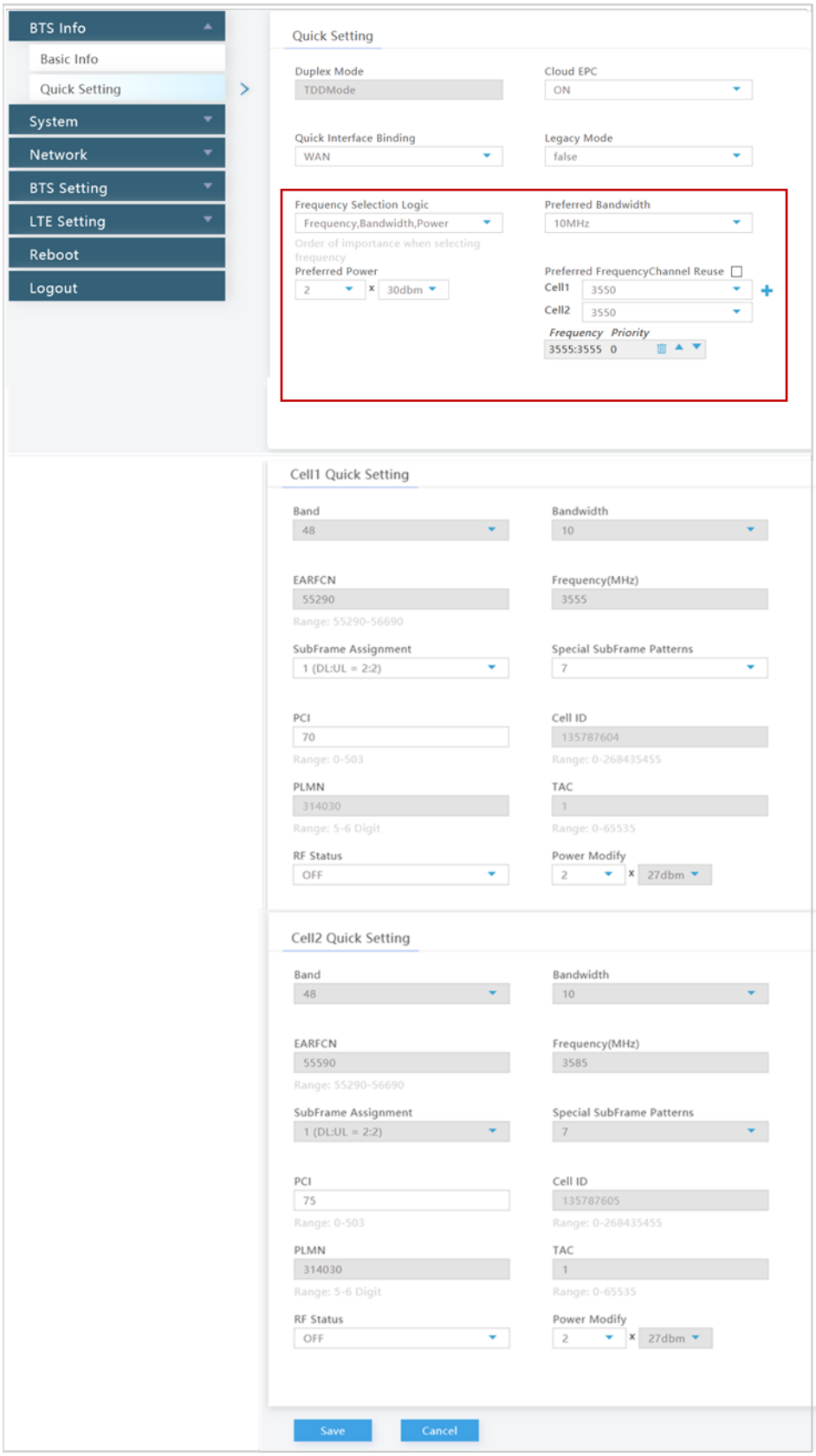


Table 2-7: Quick Setting Fields (QRTB)

Field Name	Description
Quick Setting	
Duplex Mode	Preset field - cannot be configured at this time. Either Time Division Duplexing (TDD) or Frequency Division Duplexing (FDD) depending on model and country.
Cloud EPC	The Baicells CloudCore Evolved Packet Core (EPC) is either enabled/ON or disabled/OFF. When you enable it, the fields for Cell ID, PLMN, and TAC are automatically assigned. When you disable the Cloud EPC setting, it unlocks the greyed-out fields below it, e.g., Cell ID, PLMN, and TAC. When you change the Cloud EPC setting, it will perform a warm **reboot** of the eNB. NOTE: This field will not appear in HaloB mode.
MME IP	The IP address of the associated MME, which is identical to the IP address of the MME at the core network side. NOTE: The field will not appear in HaloB mode or when IP MME Pool is enabled.
Quick Interface Binding	Used to assign the interface connected to the MME. The interface should be selected from among the network interfaces already configured in section 2.7.1. Default is the WAN interface, but the VLAN interface can also be used.
Legacy Mode	Used to enable (true) CPEs only supporting Bands 42 or 43 to connect to a Band 48 eNB. Default is disable (false). NOTE: This field will not appear unless SAS is enabled.
Frequency Selection Logic	Used to configure preferred frequencies, channel bandwidth, and power when SAS is enabled. After receiving channel availability from SAS, the DP uses the frequency selection logic setting to calculate CBRS channel selection based on the order of importance identified. NOTE: This field will not appear unless SAS is enabled.
Preferred Bandwidth	Used to set the preferred bandwidth for the eNB. NOTE: This field will not appear unless SAS is enabled.
Preferred Power	Used to set the preferred power for the eNB. The preferred power is the total TX power (in dBm) being transmitted per carrier. NOTE: This field will not appear unless SAS is enabled.
Preferred Frequency	Used to set the preferred frequency for the eNB. More than one preferred frequency can be added, and each frequency's priority can be set. If the eNB is set to Dual Carrier (DC)/split mode, the preferred frequency is set for the Primary Cell (Cell1) and Secondary Cell (Cell2). NOTE: This field will not appear unless SAS is enabled.

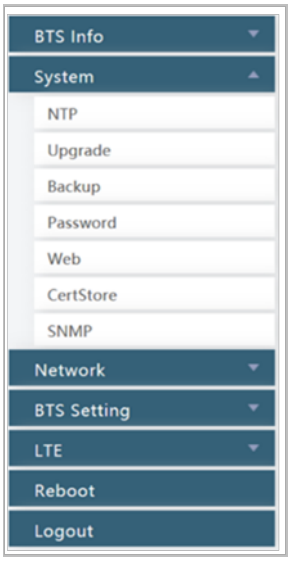
Field Name	Description
ChannelReuse (used for DC mode only)	True/false to designate channel reuse for Dual Carrier (DC) mode, so that both Cell1 and Cell2 are forced to use the same frequency, which is the frequency configured for Cell1. If the ChannelReuse check box is selected, then only the Preferred Frequency field for Cell1 should display in BTS Info > Quick Setting.
Cell1 and Cell2 Quick Setting	
Band	The eNB's operating frequency band, which is auto-selected based on the hardware model or assigned by the Spectrum Access System (SAS) vendor if SAS is enabled.
Bandwidth	For TDD mode, the channel bandwidth the eNB may use: 5, 10, 15, or 20 MHz. Applies to both uplink and downlink. The default is 20 MHz. Example for B43: 44190 (3660 MHz) to 44490 (3690 MHz). If SAS is enabled, the bandwidth will be assigned by the SAS vendor.
EARFCN	Used to set the absolute radio frequency channel number.
Frequency (MHz)	The eNB's operating frequency (MHz). Range depends on the eNB hardware model, country code, and whether or not SAS is enabled. Example for B41: 44190 (3660MHz) to 44490 (3690MHz). If SAS is enabled, the frequency will be assigned by the SAS vendor.
SubFrame Assignment	Downlink (DL) and uplink (UL) subframe configuration, either 1 or 2, where: 1 = DL:UL is 2:2 transmission ratio 2 = DL:UL is 3:1 transmission ratio (default) Refer to the BaiTip on this setting: *https://community.na.baicells.com/t/baitip-of-the-day-december-14th-2016-subframes-and-special-subframes/163*
Special SubFrame Patterns	Either 5 or 7. This is a standard LTE setting that pertains to synchronization of downlink and uplink timing. The guard period between switching from DL to UL or UL to DL determines the maximum supportable cell size. The guard period has to be large enough to cover the propagation delay of DL interferers. The default setting is 7.
PCI	Physical Cell Identification (PCI) allocated by the operator. Range is 0-503. PCI is an essential Layer 1 cell identity for each cell site in the network. Planning PCIs is crucial for QoS. NOTE: Baicells does not use and does not work with PCI 0.
Cell ID	Unique identification number for the Cell ID. Range from 0 to 268435455.
PLMN	The numerical identifier for the operator's Public Land Mobile Network (PLMN) for this cell. Must be a 5- or 6-digit number. If you are using the Baicells CloudCore, you must enter **PLMN = 314030.**
TAC	Tracking Area Code (TAC) for where the eNB is located. The TAC is used to determine the range of the paging information. Use a number between 1 - 65,535. The default is 1.
RF Status	Enable/ON or disable/OFF the eNB's RF antenna to allow it to transmit and receive or to keep it from transmitting and receiving. The default is Enable/ON.

Field Name	Description
Power Modify	Output power on each port, typically left with the default values. 30 dBm x2 = 33 dBm. Every 3 dB doubles the power. This field may be used in situations where you need to reduce the output power, such as testing the eNB before installing it on a tower; restricting the eNB output to reduce interference with other eNBs in the same geographical area; or staying within Effective Isotropic Radiated Power (EIRP) rules. If SAS is enabled, the bandwidth will be assigned by the SAS vendor.

2.5 System

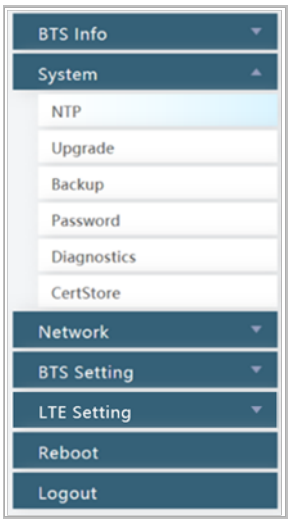
The *System* menu for BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 includes Network Time Protocol (NTP), software upgrade/rollback, configuration backup, password reset (for the eNB GUI), Web enablement for remote access to the eNB, the CertStore for uploading eNB certificates, e.g., licensing files, and the SNMP function used to enable KPI reporting. See Figure 2-12.

Figure 2-12: System Menu (RTS/RTD)



The *System* menu for BaiBS_QRTB_2.6.2 includes Network Time Protocol (NTP), software upgrade/rollback, configuration backup, password reset (for the eNB GUI), diagnostics, and the CertStore for uploading eNB certificates, e.g., licensing files. See Figure 2-13.

Figure 2-13: System Menu (QRTB)



2.5.1 NTP

The operator may configure more than one NTP server to provide synchronized time-of-day to the eNB. The fields are shown in Figure 2-14 and described in Table 2-8 for eNBs running BaiBS_RTS_3.7.5 and BaiBS_RTD_3.7.5 software. The fields are shown in Figure 2-15 and described in Table 2-9 for eNBs running BaiBS_QRTB_2.6.2 software.

Figure 2-14: NTP (RTS/RTD)

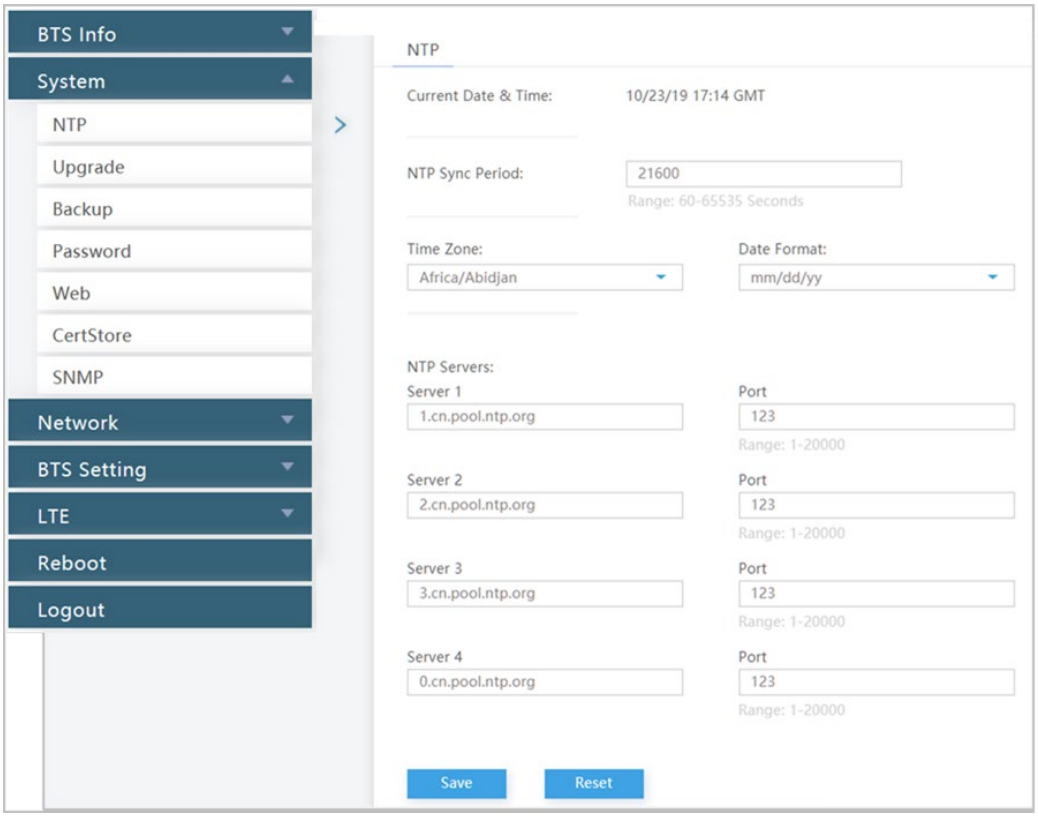


Table 2-8: NTP (RTS/RTD)

Field Name	Description
Current Date & Time	Displays the current date and time that the eNB is using
NTP Sync Period	Network Time Protocol interval for synchronizing between the eNB and the primary NTP server. The range is 10-65,535 seconds. The default is 60 seconds.
Time Zone	The time zone for where the eNB is located
Date Format	The format of the date display, e.g., mm/dd/yy
Enabled	Enable/Disable NTP sync
NTP Servers – Server 1	Primary NTP server IP address
Port	Primary NTP server port number
Server 2	Optional: Slave NTP server IP address
Port	Optional: Slave NTP server port number
Server 3	Optional: Slave NTP server IP address
Port	Optional: Slave NTP server port number
Server 4	Optional: Slave NTP server IP address
Port	Optional: Slave NTP server port number

Figure 2-15: NTP (QRTB)

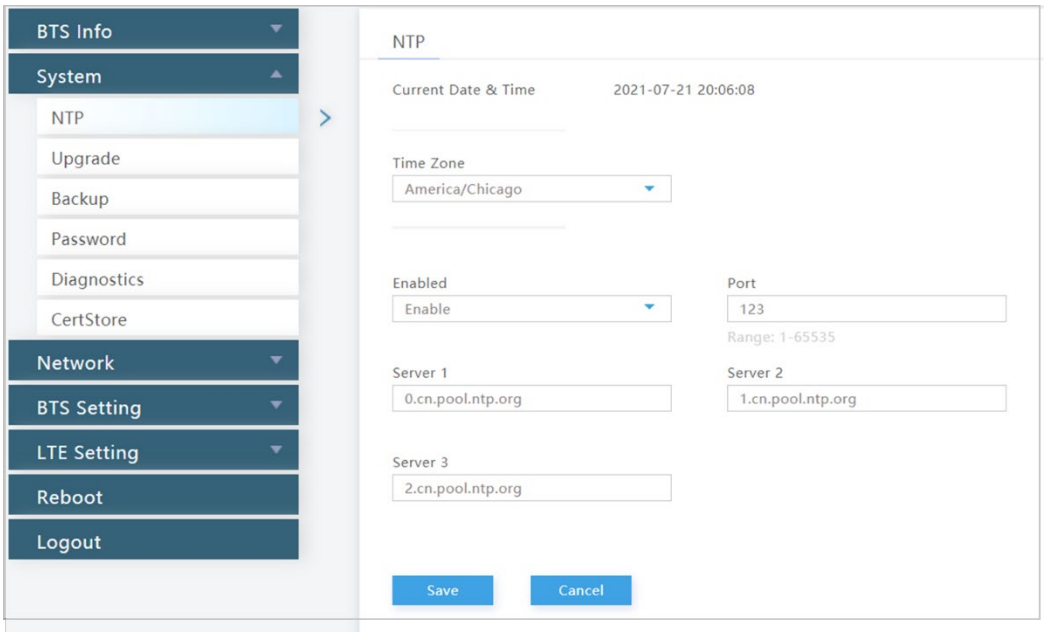


Table 2-9: NTP (QRTB)

Field Name	Description
Current Date & Time	Displays the current date and time that the eNB is using, with the date format as yyyy/mm/dd.
Time Zone	The time zone for where the eNB is located. Default is US NTP servers using Central Standard Time (CST).

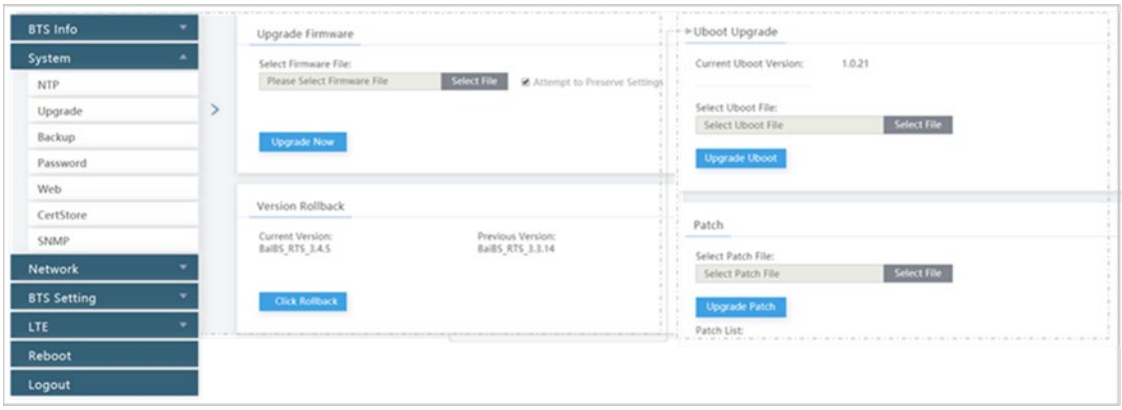
Field Name	Description
Enabled	Enable/Disable NTP sync
Port	Primary NTP server port number
NTP Servers – Server 1	Primary NTP server IP address, which must be configured identically on both ends of the connection
Server 2	Optional: Slave NTP server IP address, which must be configured identically on both ends of the connection
Server 3	Optional: Slave NTP server IP address, which must be configured identically on both ends of the connection

2.5.2 Upgrade

Use the *Upgrade* menu to upgrade or downgrade (rollback) the eNB software (Figure 2-16).

NOTE 1: All eNBs running BaiBS_RTD_3.7.5 software also allow you to perform an FPGA Upgrade, which is not shown in Figure 2-16 and currently only applies to the Nova246.
NOTE 2: For eNBs running BaiBS_RTD_3.7.5 software, the *Upgrade* menu option does not display for Cell2.
NOTE 3: All eNBs running BaiBS_RTS_3.7.5 and BaiBS_RTD_3.7.5 software also allow you to perform a Uboot Upgrade or Patch Upgrade.

Figure 2-16: Upgrade



Perform the following steps:

1. Go to System > Upgrade.
2. Click on *Choose File* or *Select File* in the dialogue window that opens.
3. Find and highlight the target file, click on *Open*, and then click on the appropriate GUI action button -- *Upgrade Now, Rollback, Upgrade Uboot, Upgrade FPGA,* or *Upgrade Patch* -- depending on hardware model and software version. You may get a pop-up window to click *Proceed*.
4. After the upgrade is completed (about 5 minutes), the eNB will perform a warm reboot.

Caution: The reboot action will disrupt eNB service.

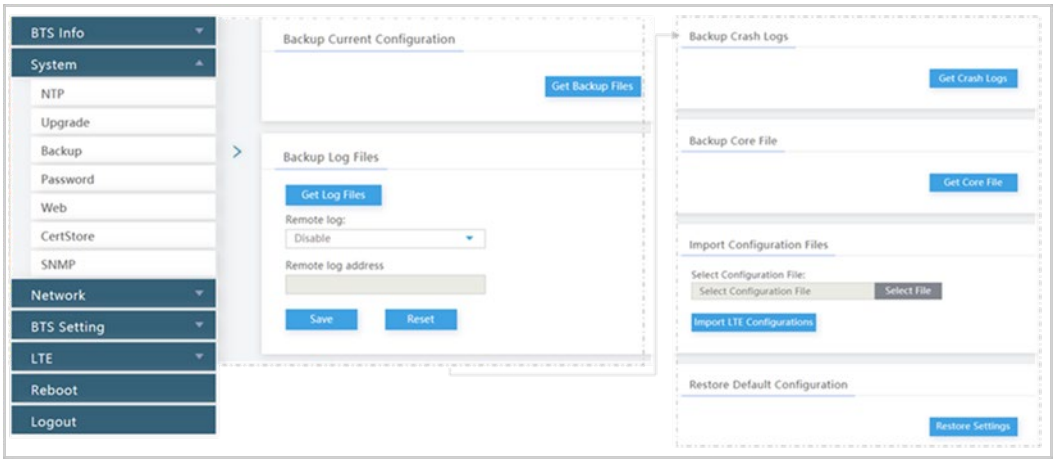
NOTE 1: Older versions of the eNB GUI may look different. When upgrading from an older version to the latest, the GUI home page and other menus will automatically switch over to the new GUI. However, when rolling back from the latest software to a former software version, the home page and other GUI menus will not switch back to the older GUI. In this case you must verify the configuration (e.g., IP address).
NOTE 2: Additional upgrade capabilities, such as upgrading multiple eNBs simultaneously, are available using the OMC. Refer to *CloudCore Configuration & Network Administration Guide*.

2.5.3 Backup

The *Backup* function is used to back up the current configuration, log files, crash logs, and the core file*; to import configuration files (e.g., to create a new eNB using the configuration from an existing eNB); or to restore all of the default configuration settings for the eNB. The System > Backup window is shown in Figure 2-17.

*NOTE: The core backup file may be requested by Baicells support to assist in troubleshooting.

Figure 2-17: Backup



To initiate a backup:

1. Click on the appropriate GUI action button, e.g., *Get Backup Files*.
2. The system will display “Preparing backup file” and then present a dialogue window for you to select where you want to save the file.

To import a configuration file:

1. Select *Choose File,* and navigate to the file you want to import.
2. Highlight the file, click on *Open*, and then select *Import LTE Configurations.*

To restore the default configuration:

1. Under *Restore Default Configuration*, select *Restore Settings*.
2. The eNB will perform a warm reboot when you restore the default configuration.

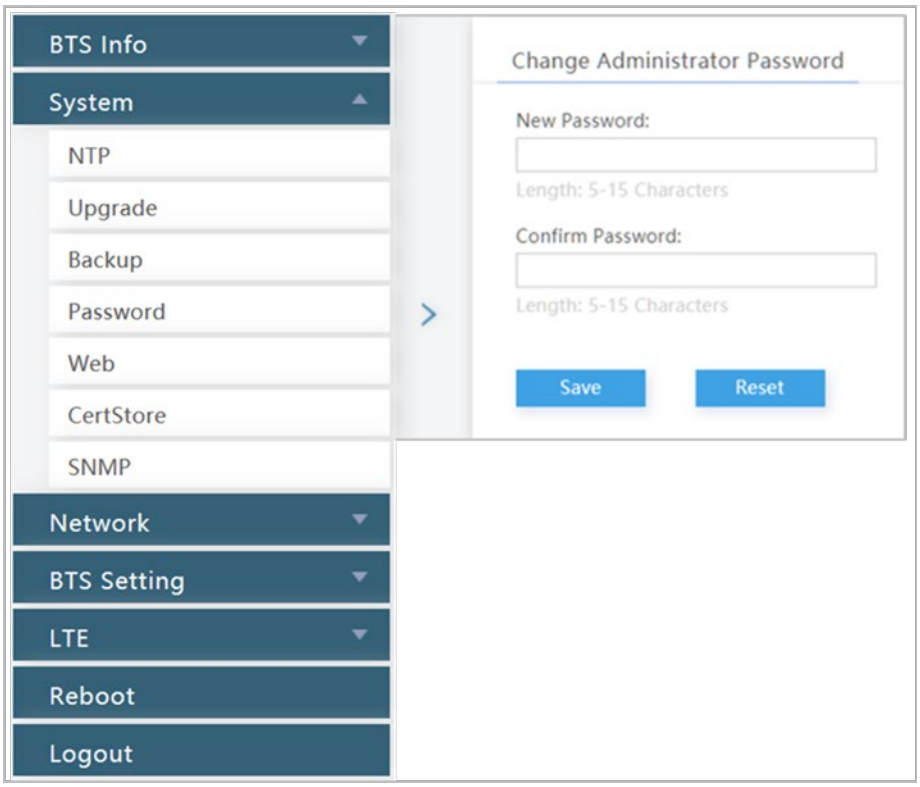
Caution: The *Restore Settings* action will disrupt eNB service.

2.5.4 Password

The System > Password menu is where you change the eNB administrator's (GUI) password. Enter the new password, from 5 to 15 characters, and then enter it again to confirm it (Figure 2-18). Use the *Reset* button if you want to reset the password to the original default setting of *admin*.

NOTE: For eNBs running BaiBS_QRTB_2.6.2 software, you will be required to enter your old password (from 5 to 15 characters) before entering a new password and confirming it.

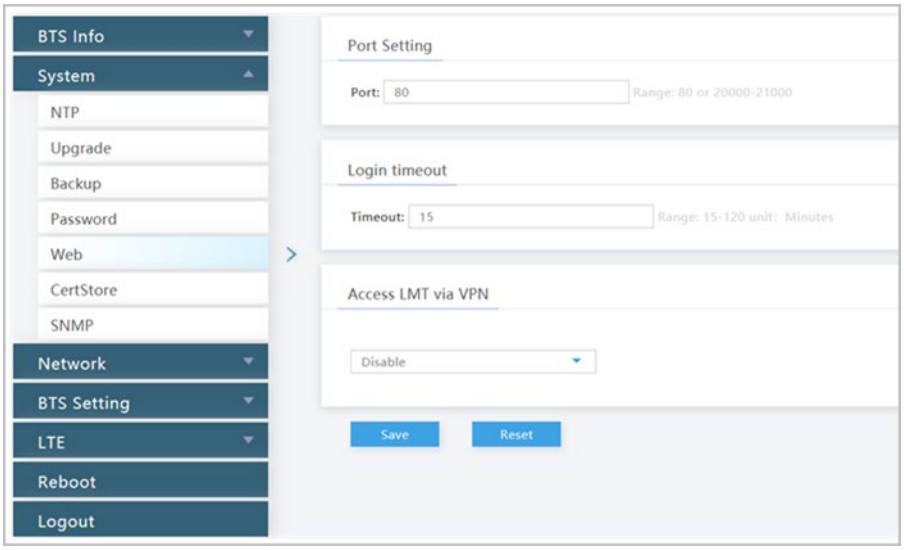
Figure 2-18: Password



2.5.5 Web (BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5)

The *Web* menu is used to change the port number for the eNB and/or to change the login timeout period. Accessing a Local Maintenance Terminal (LMT) via a Virtual Private Network (VPN) is also enabled or disabled using this menu. The default HTTP (Web) port for the eNB is port 80, and the default for the login timeout period is 15 minutes (Figure 2-19). After changing the port number or login timeout period by entering new preferences and saving, the eNB will perform a warm reboot. It usually takes about 5 minutes to restart successfully. To access the GUI using the new port number, open a Web browser and enter the IP address with the new port number, e.g., 192.168.100.101:80.

Figure 2-19: Web (RTS/RTD)



2.5.6 Diagnostics (BaiBS_QRTB_2.6.2)

Use the System > Diagnostics menu to perform a ping test or traceroute from the eNB (Figure 2-20 and Figure 2-21). Each field is described in Table 2-10. After entering the settings, click on *Implement* to run the test.

NOTE: The *Diagnostics* menu is under the *Network* menu in BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software version and is documented in section 2.6.5.

Figure 2-20: Diagnostics (Ping) (QRTB)

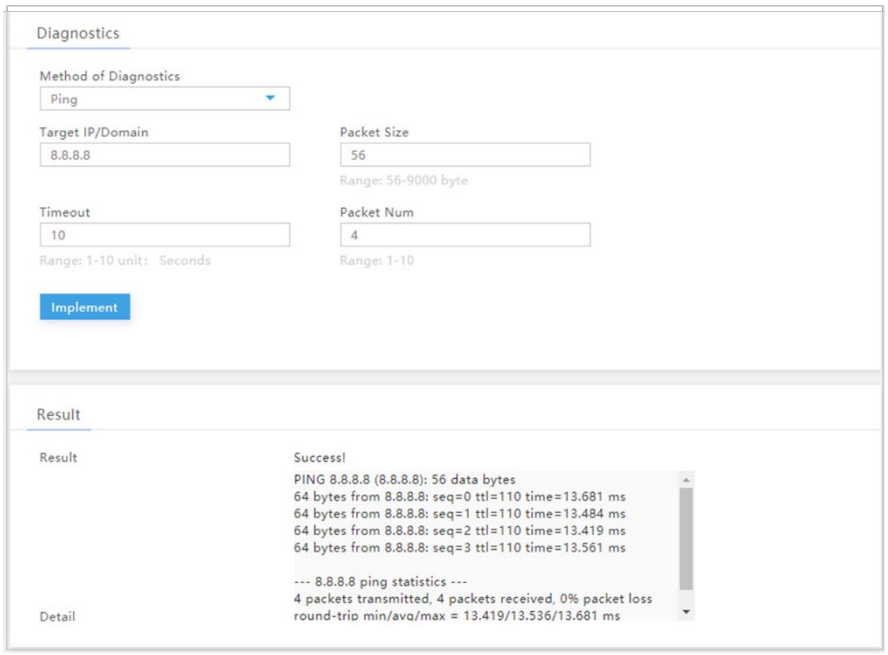


Figure 2-21: Diagnostics (TraceRoute) (QRTB)

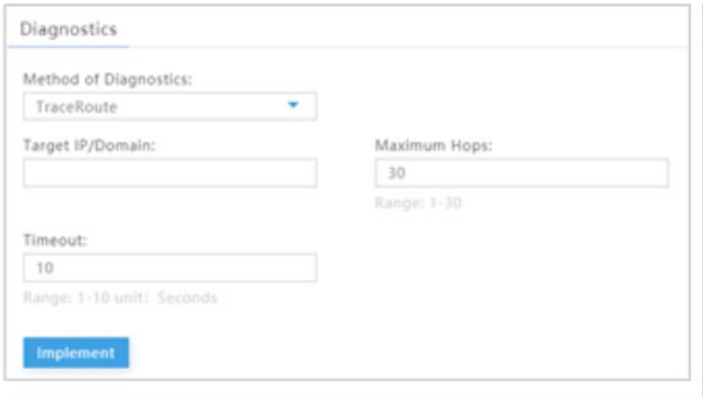


Table 2-10: Diagnostics (QRTB)

Field Name	Description
Method of Diagnostics	Ping or TraceRoute
Ping	
Target IP/Domain	The IP address or domain name of the destination device
Packet Size	The size of the data packet to be sent. Range is 56-9000 bytes. Default is 56 bytes.
Timeout	The timeout period when the test ends. Range is 1-10 seconds. Default is 10 seconds.
Packet Num	The number of packets to be sent. Range is 1-10.
TraceRoute	
Target IP/Domain	The IP address or domain name of the destination device
Maximum Hops	The maximum number of hops (network nodes/routers) the packet will have to pass before arriving at its destination. Range is 1-30. Default is 30.
Timeout	The timeout period when the test ends. Range is 1-10 seconds. Default is 10 seconds.

You can also perform an iperf3 diagnostic test by using Secure Shell Protocol (SSH) to log in to the eNB and execute the command “iperf”. The iperf3 tests that can be performed are:

- CPE test (server mode)
- CPE test (client mode using Transmission Control Protocol (TCP))
- CPE test (client mode using User Datagram Protocol (UDP))

The default protocol for Iperf3 to use is TCP. If you select UDP as the protocol to be used, both the client and the server must be in UDP mode to successfully perform the tests.

NOTE: See section 2.10.4.8 for more information about how to enable SSH using the *SSH Setting* parameter.

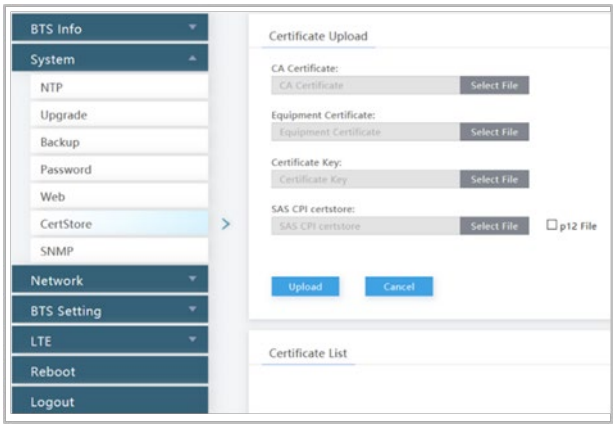
2.5.7 CertStore

The *CertStore* menu provides a way to store important files unique to the eNB, such as regulatory authorization files and HaloB or other licensed feature key files (Figure 2-22).

To upload any of the files, simply click on the *Select File* button and navigate to the file to be uploaded. Once you highlight the file, click on *Open*. When you return to the *Certificate Upload* window, click on *Upload.* When the file finishes uploading, the file name appears in the *Certificate List* portion of the window.

NOTE 1: The *CertStore* menu varies slightly between BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 and BaiBS_QRTB_2.6.2 software versions.
NOTE 2: For eNBs that support CBRS and SAS, you must upload the SAS CPI certstore file before you can register the CBSD with the SAS vendor. For more information, including the two types of upload files that are supported, see the *SAS Deployment Guide*.

Figure 2-22: CertStore



2.5.8 SNMP (BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5)

Use the *SNMP* menu to enable the eNB to report KPI information to the third-party Network Management System (NMS). When the SNMP Switch option “enable” is selected, the fields shown in Figure 2-23 display. The fields are described in Table 2-11.

NOTE: In BaiBS_QRTB_2.6.2, the SNMP function is located in the BTS Setting > Management Server menu. See section 2.8.2.

Figure 2-23: SNMP (RTS/RTD)

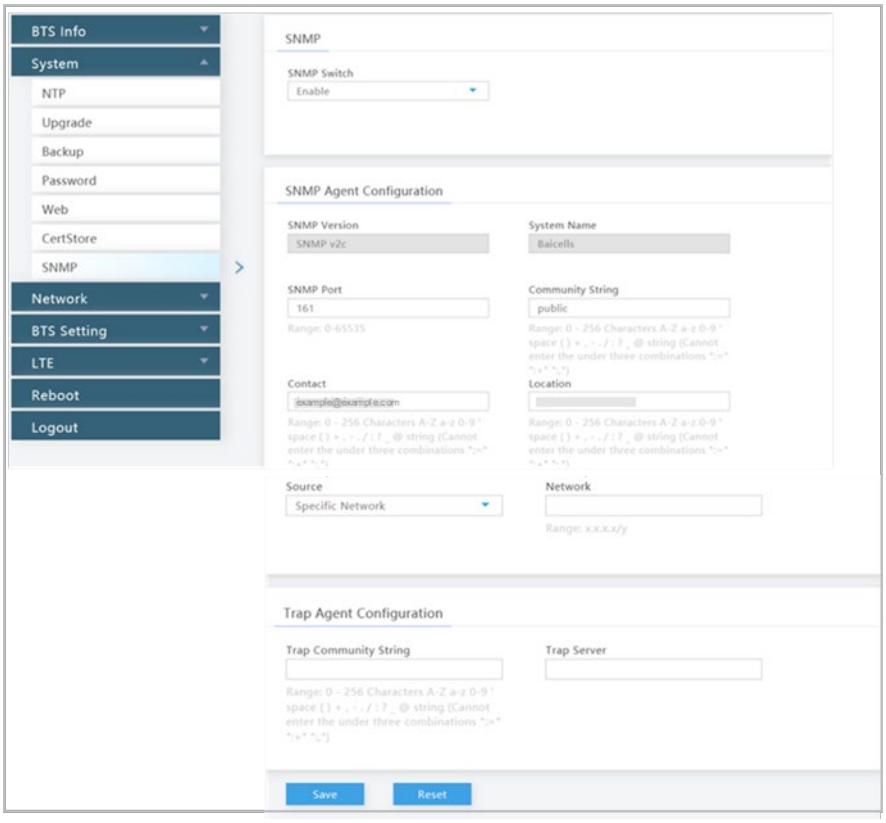


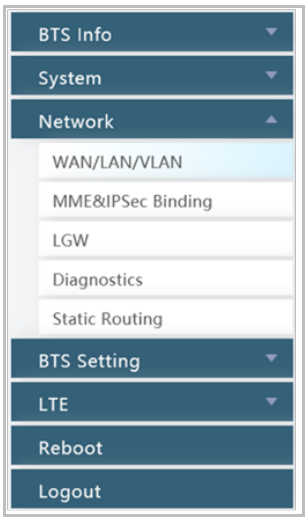
Table 2-11: SNMP (RTS/RTD)

Field Name	Description
SNMP Agent Configuration	
SNMP Version	The SNMP version being executed. The data in this field is auto-filled.
System Name	The name of the managing system. The data in this field is auto-filled.
SNMP Port	The port upon which SNMP messages are transported. The range is 0-65535.
Community String	Used to define a community. The 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 ":,"). The default is public.
Contact	The SNMP agent’s contact information. The 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 SNMP agent’s physical location. The 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 for transmitting SNMP messages. Options are “Any” or “Specific Network”.
Network	If you choose “Specific Network” as the source for transmitting SNMP messages, you must provide the network IP address. Format is x.x.x.x/y.
Trap Agent Configuration	
Trap Community String	Used to define a trap community. The 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 ":,"). The default is secret.
Trap Server	The trap server IP address or name.

2.6 Network (BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5)

The *Network* menu settings are where you configure the network interfaces for the eNB (Figure 2-24). This section describes the menu options for BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software version. See section 2.7 for *Network* menu setting descriptions for BaiBS_QRTB_2.6.2 software version.

Figure 2-24: Network Menu (RTS/RTD)



2.6.1 WAN/LAN/VLAN

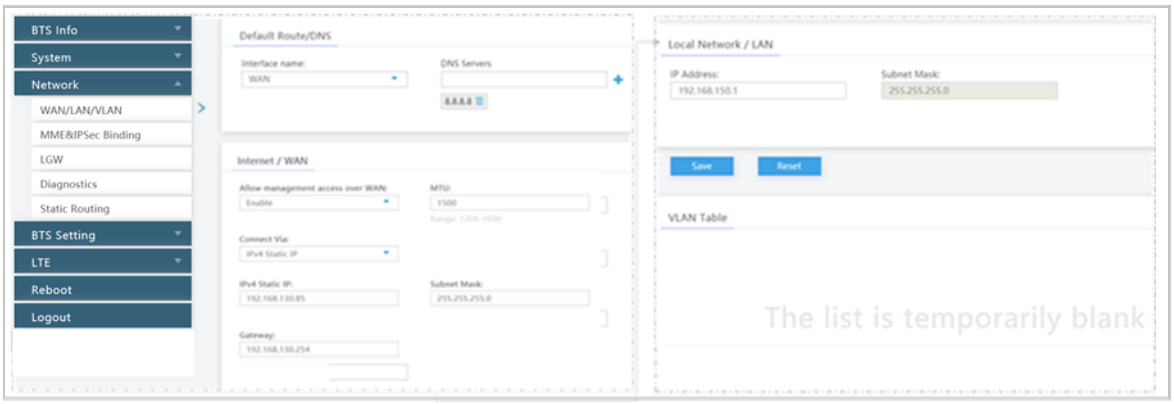
The WAN interface is an external communication portal (Internet connection) between the eNB's Network Management System (NMS) and the MME. The eNB's NMS may be the Baicells Operations Management Console (OMC) or the LTE NMS. The only option for the Interface name field is WAN.

The *WAN/LAN/VLAN* menu (Figure 2-25) is for configuring the default router/Domain Name Services (DNS), the type of physical connection that the eNB uses to the external network, the local LAN information, and one or more VLANs (single-carrier eNBs only). The physical *Connect Type* may be copper or fiber and may connect via DHCP, PPPoE, or a Static IP:

- Dynamic Host Configuration Protocol (DHCP) – the eNB's IP address will be obtained dynamically from the local DHCP server. When the *Connect Via* option "DHCP" is selected, the current DHCP server IP address displays, along with Subnet Mask, Gateway, and DNS Servers information. 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.
- IPv4 Static IP – IPv4 static address, subnet mask, and gateway or IP address of the Domain Name Server (DNS), where multiple addresses are allowed.

The *Local Network/LAN* fields are used to configure the Local Maintenance Terminal (LMT) port on the eNB. The port may be used during initial eNB setup and configuration. Enter the IP address and subnet mask address for the local network connection. The default LAN IP address is **192.168.150.1**.

Figure 2-25: WAN/LAN/VLAN



NOTE: The *WAN/LAN/VLAN* menu varies slightly between software versions BaiBS_RTS_3.7.5 and BaiBS_RTD_3.7.5. For eNBs running BaiBS_RTD_3.7.5 software, there is also a pulldown menu to allow you to select the physical *Connect Type*. Options are copper or fiber.

In the *VLAN Table* section, to add a VLAN click on the **+** Add icon to open the *VLAN Setting* window (Figure 2-26). Enter a 1- to 15-digit VLAN name and a VLAN ID within the range of 2-4094. The VLAN ID must be a unique number from any other VLAN. Avoid entering "12", which is commonly used by the LAN interface. All of the Network > WAN/LAN fields are described in Table 2-12.

Figure 2-26: VLAN

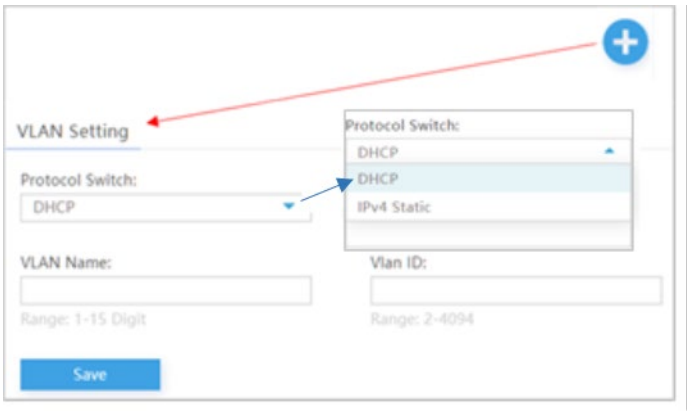


Table 2-12: WAN/LAN/VLAN

Field Name	Description
Default Route/DNS	
Interface Name	Wide Area Network (WAN) is the eNB connection route to the Internet
DNS Servers	Domain Name Server (DNS) IP address. More than one DNS server may be added.
Internet / WAN	
Allow management access over WAN	Enable or disable the Local Maintenance Terminal connection through the WAN port.
Connect Type	Select Copper or Fiber type of connection to the WAN Copper: RJ-45 port Fiber: optical port

Field Name	Description
MTU	Maximum Transmission Unit - maximum network packet size. Default is 1500 bytes. Range: 1200-1600 bytes.
Connect Via	Options for the connection type are: • DHCP • Point-to-Point Protocol Over Ethernet (PPPoE) – not recommended • IPv4 Static IP NOTE: See detailed descriptions of each connection type in the section introduction above. The DHCP and IPv4 Static IP are recommended. The displayed fields depend on which protocol is selected.
Local Network / LAN	
IP Address	IP address for the local area network connection. The default LAN IP address is **192.168.150.1**.
Subnet Mask	Subnet mask for the local area network connection. Default is 255.255.255.0.
VLAN Setting	
Protocol Switch	Choose the VLAN interface protocol (DHCP or IPv4 Static)
VLAN Name	VLAN interface name
VLAN ID	VLAN interface's ID, which should be a unique number not identical to any other VLAN. Range is 2 to 4095. Avoid using "12", which is commonly used by the LAN interface.
IPv4 Static IP	This field displays when the value of "Protocol Switch" is "IPv4 Static" and is the VLAN interface's IP address.
Netmask	This field displays when the value of "Protocol Switch" is "IPv4 Static" and is the VLAN interface's subnet mask.
Gateway	This field displays when the value of "Protocol Switch" is "IPv4 Static" and is the VLAN interface's gateway IP address.

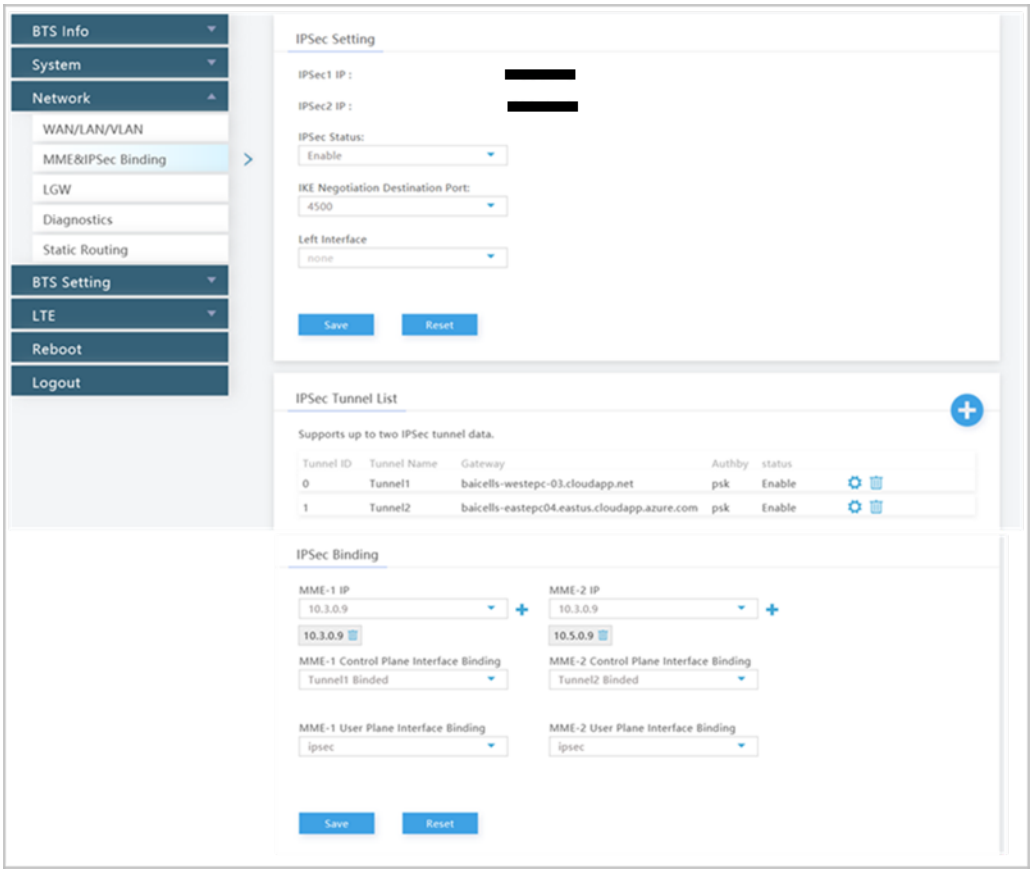
2.6.2 MME&IPSec Binding

NOTE 1: This menu is not included in the GUI of an eNB operating in HaloB mode.
NOTE 2: The MME IP addresses will be 10.3.0.9 and 10.5.0.9 when using PLMN 314030 connecting to the Baicells CloudCore.

2.6.2.1 IPSec Setting

The IP Security (IPSec) interface is used to route the control plane information between the eNB and the EPC (Figure 2-27). By default, in standard mode the system will enable the IPSec gateway. You can select the Internet Key Exchange (IKE) Negotiation Destination Port of either 4500 or none, and either WAN(eth2), PPPOE(pppoe-wan), or none for the *Left Interface*.

Figure 2-27: MME&IPSec Binding



2.6.2.2 IPSec Tunnel List

Under the *IPSec Tunnel List*, you can define up to two sets of data per IPSec tunnel. Tunnel 0 and Tunnel 1 display information about the tunnel name, gateway, authorization method, and status. If you click on the *Settings* icon, a new window called *Tunnel Configure* opens (Figure 2-28), where you can configure the tunnel fields. Notice the two tabs, *Basic Setting* and *Advance Setting*. In RTS 3.4.8 or higher and RTD 3.6.6 or higher, you can also add another IPSec tunnel by clicking on the **+** Add icon.

2.6.2.2.1 Tunnel Configure - Basic Setting

The *Basic Setting* fields are shown in Figure 2-28 and described in Table 2-13.

Figure 2-28: Tunnel Setting - Basic Setting Tab

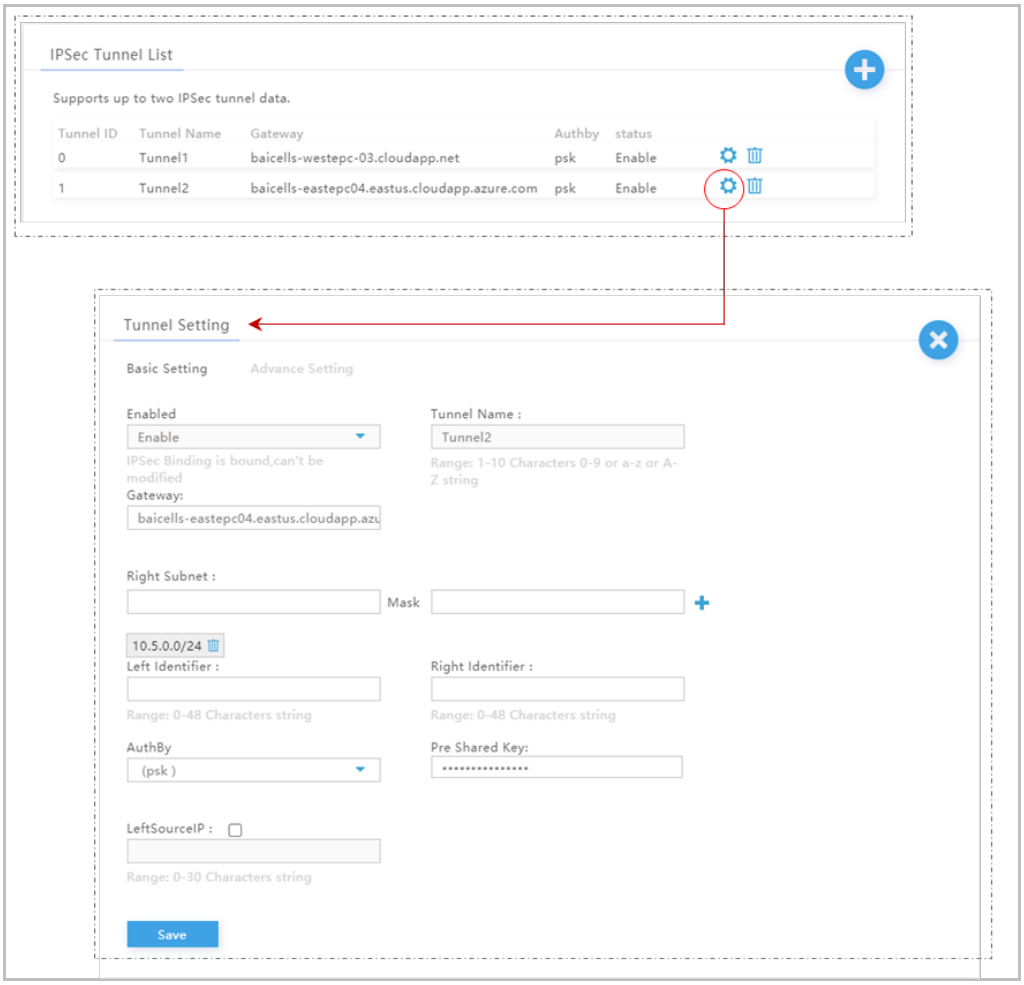


Table 2-13: Tunnel Configure > Basic Setting Tab

Field Name	Description
Enabled	Check to enable/ON or uncheck to disable/OFF IP security gateway
Tunnel Name	The existing tunnel name will be shown in a light grey color. The field may be configured only if fewer than the maximum 2 data tunnels are currently defined. The tunnel name may be 10 characters, either digits 0-9 or lower-case letters a-z or upper case letters A-Z.
Gateway	Enter the IPSec security gateway IP address. Make sure the IP address entered here matches the actual IP address on the security gateway side. When using the Baicells CloudCore, enter **baicells-westepc-03.cloudapp.net** (tunnel1) and **baicells-eastepc04.eastus.cloudapp.azure.com** (tunnel2)
Right Subnet and Mask	IP address and subnet mask of the remote subnet, which must be consistent with the security gateway side. Messages within this address range will be packed as a tunnel.
Left Identifier	Identification of this client end (0-48 digit string). It must be consistent with the security gateway side. If there is no security gateway left identifier, leave this field empty.

Field Name	Description
Right Identifier	Identification of the server end (0-48 digit string). It must be consistent with the security gateway side. If there is no security gateway right identifier, leave this field empty.
AuthBy	**Caution: Change not recommended!** Authentication method of the IPSec server. Must be consistent with the security gateway side. Options are: • (psk) (default) • (cert) • (aka_psk) • (aka_cert)
Pre Shared Key	**Caution: Change not recommended!** The Pre Shared Key (PSK) must be consistent with the security gateway.
LeftSourceIP	Virtual address allocation: 0-30 digit string for BaiBS_RTS_3.4.8 or higher and BaiBS_RTD_3.6.6 or higher. If absent, use the local IP address.

2.6.2.2.2 Tunnel Configure - Advance Setting

Caution: It is highly recommended that for the *Advance Setting* fields you use the default values. Improper changes may lead to system exceptions.

The *Advance Setting* fields become particularly important to network operations as areas become denser with users. Please refer to Figure 2-29 and Table 2-14.

Figure 2-29: Tunnel Setting - Advance Setting Tab

[Recommend leaving at default values]

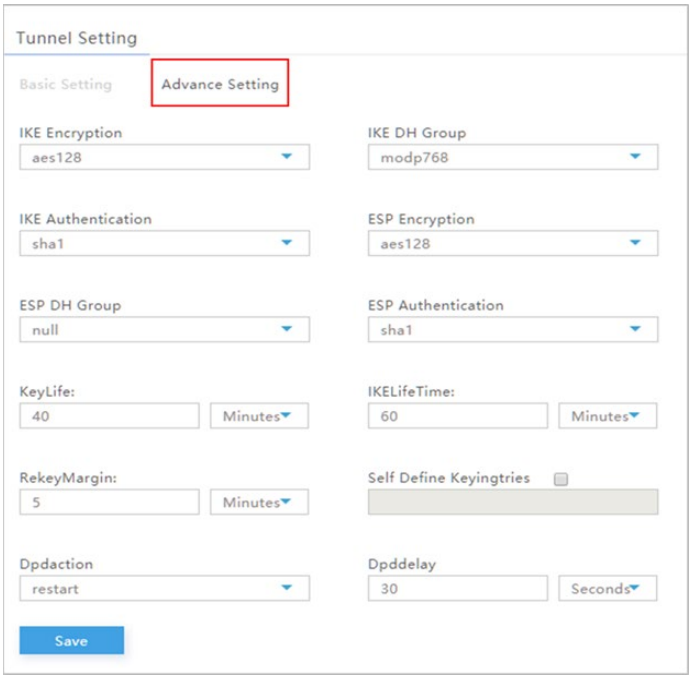


Table 2-14: Tunnel Configure > Advance Setting Fields

[Recommend leaving at default values]

Field Name	Description
IKE Encryption	Internet Key Exchange (IKE) encryption method. IKE is a protocol used to ensure security for Virtual Private Network (VPN) negotiation and remote host or network access. Options are: • aes128 (default) • aes256 • 3des
IKE DH Group	IKE Diffie-Hellman (DF) key computation, or exponential key agreement, to be used between two entities. Options are: • modp768 (default) • modp1024 • modp1536 • modp2048 • modp4096
IKE Authentication	IKE authentication algorithm to be used: • sha1 (default) • sha512
ESP Encryption	Encapsulating Security Payload (ESP) – a member of the IPsec protocol suite that provides origin authenticity, integrity, and confidentiality protection of packets. Options: • aes128 (default) • aes256 • 3des
ESP DH Group	ESP Diffie-Hellman (DF) key computation, or exponential key agreement, to be used between two entities. Options are: • null • modp768 • modp1024 (default) • modp1536 • modp2048 • modp4096
ESP Authentication	ESP authentication algorithm to be used: sha1
KeyLife	IPsec security association (SA) renegotiation time. Format: Minutes, Hours, or Days. The default setting is 40 minutes.
IKELifeTime	IKE security association renegotiation time. Format: Minutes, Hours, or Days. The default setting is 60 minutes.
RekeyMargin	Renegotiation time before the expiry of IKELifeTime (negotiate the IKE security association time before the expiry of IKELifeTime). Format: Minutes, Hours, or Days. The default setting is 5 minutes.
Self Define Keyingtries	Number of renegotiation attempts after an IKE negotiation fails. Default is 3.
Dpdaction	DPD stands for dead peer detection (DPD) protocol. Determines what action to take when a gateway exception occurs: • None

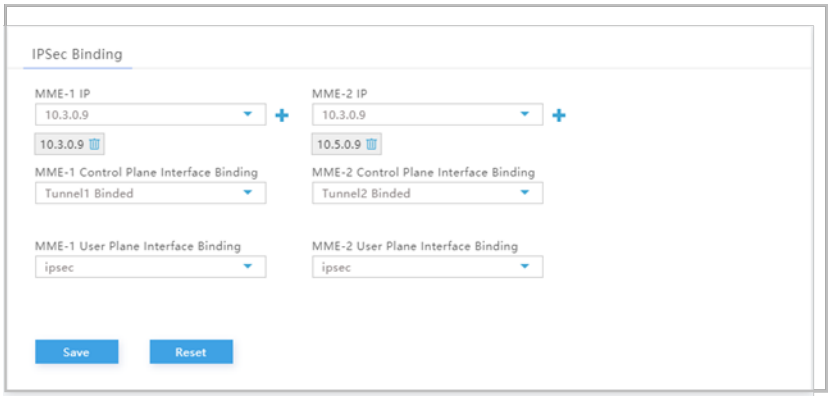
Field Name	Description
	• Clear • Hold • Restart (default)
Dpddelay	Time interval for sending the DPD detection message. Format: Seconds, Minutes, or Days. The default setting is 30 seconds.

2.6.2.3 IPSec Binding

In a typical network setup using the Baicells CloudCore, the security tunnel is between the eNB and the MME in the core network. This menu is used to bind an IPSec tunnel with an MME IP address.

The Baicells CloudCore uses two MMEs, MME-1 and MME-2. MME-1 uses IP address 10.3.0.9, and MME-2 uses IP address 10.5.0.9. Use the configuration fields for MME-1/tunnel 1 and MME-2/tunnel 2 to bind the interfaces (Figure 2-30).

Figure 2-30: IPSec Binding



2.6.3 LGW

Reference: *Set LGW Mode on eNB*

The Baicells eNodeB (eNB) splits the data plane and the control plane, so there are two IP addresses per user equipment (UE). The data plane is sent out the local gateway (LGW), while the control plane is routed through an IPSec tunnel to the Cloud Evolved Packet Core (EPC).

Most manufacturers do not split the two planes and all traffic is sent through a hardware EPC. You have that option with Baicells as well, but anyone using the Baicells CloudCore EPC uses LGW.

Using the eNB GUI, follow the steps below to configure LGW.

1. Go to Network > LGW.
2. Verify that LGW is enabled.
3. Select one of three LGW modes (Figure 2-31, Figure 2-32, and Figure 2-33):
    - **NAT** - Network Address Translation - The IP address is kept local between the eNB and CPE. The eNB modifies the network address in the IP packet headers. To reach user equipment 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.

- **Router** - Enable static IP addressing, and identify the range of addresses. The LGW (external router) will assign an IP address when a CPE attaches. IP binding uses address range 10.10.0.1 to 10.10.0.254.
- **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 = 117040000002918, the MAC address would be 8A:95:02:F9:B6:6.

4. Enter the required fields. For the LGW Interface Binding field, you can select either WAN or PPPoE. You can then enter the LGW IP Pool address and netmask. The IP binding range is 10.10.0.1 to 10.10.0.254. For router mode, if you enable Static Address, configure the static address range by entering the first and last IP addresses; then, configure the IMSI to IP Binding IMSI.
5. If you change the LGW mode, you must perform a warm reboot the eNB for the changes to take effect. Rebooting will interrupt service temporarily.

Figure 2-31: LGW Setting (NAT Mode)

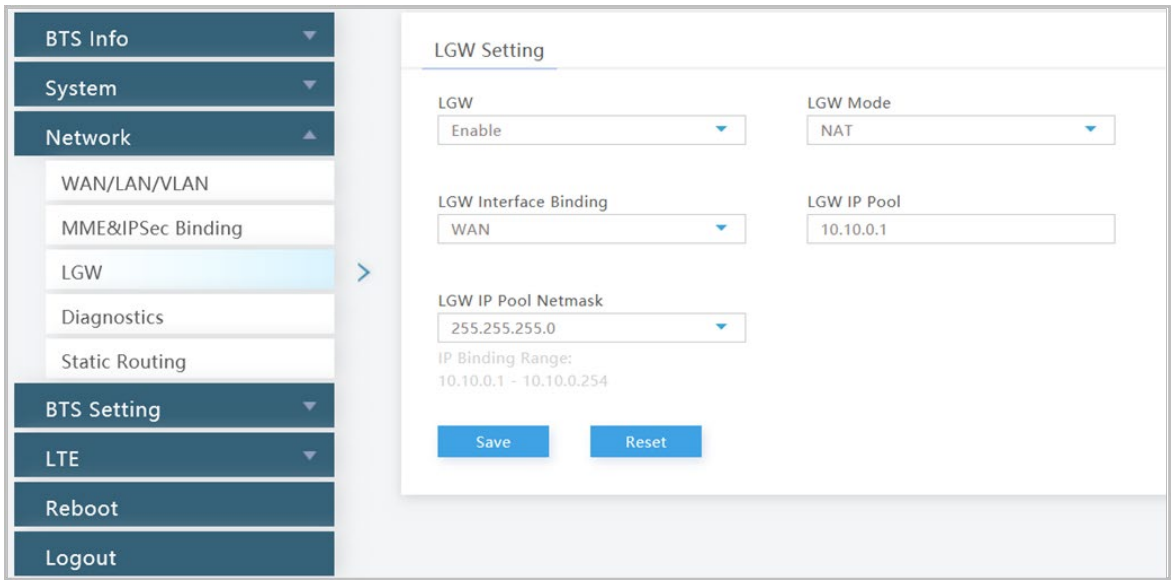


Figure 2-32: LGW Setting (Router Mode)

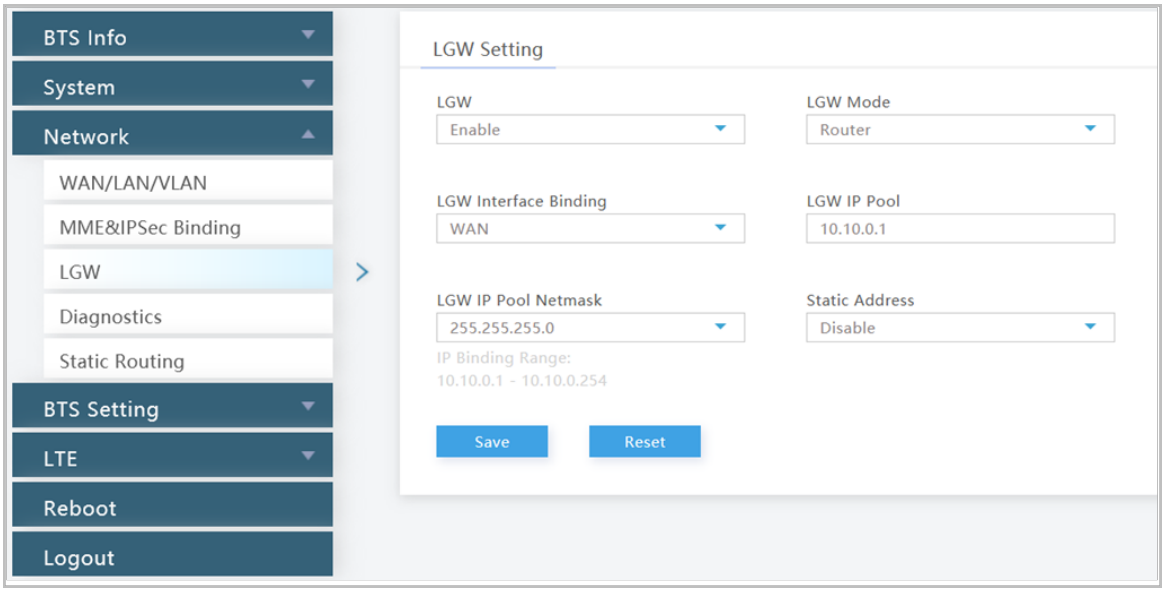
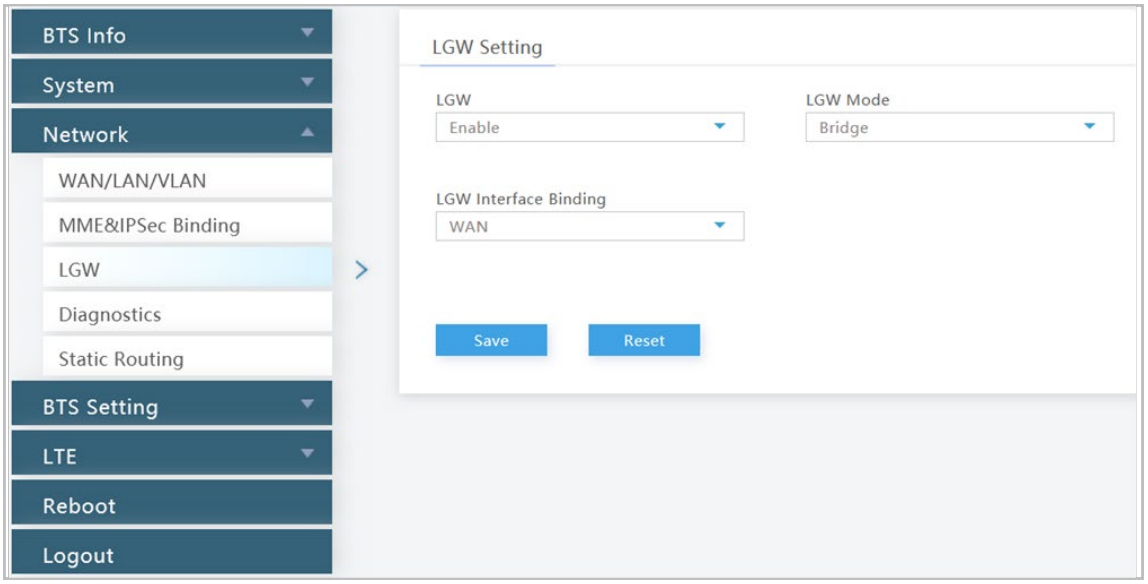


Figure 2-33: LGW Setting (Bridge Mode)



2.6.4 Diagnostics

Use the Network > Diagnostics menu to perform a ping test, traceroute, or Iperf3 from the eNB. Figure 2-34, Figure 2-35, and Figure 2-36 provide examples of the fields. Each field is described in Table 2-15. After entering the settings, click on *Implement* to run the test.

NOTE: For the BaiBS_QRTB_2.6.2 software version, the *Diagnostics* menu is under the *System* menu. See section 2.5.6.

Figure 2-34: Diagnostics (Ping)

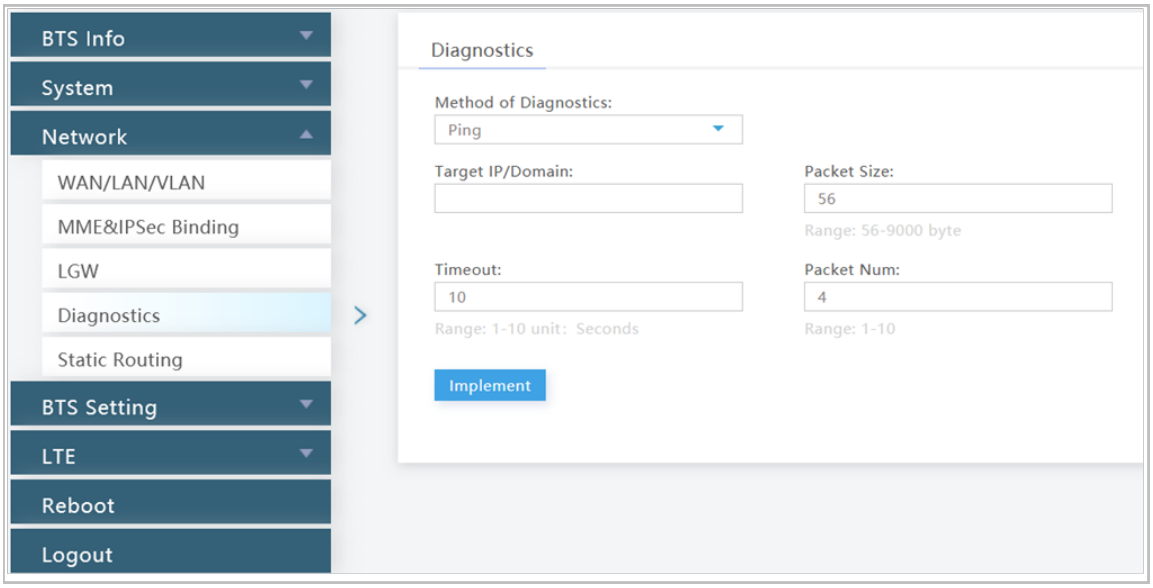


Figure 2-35: Diagnostics (TraceRoute)

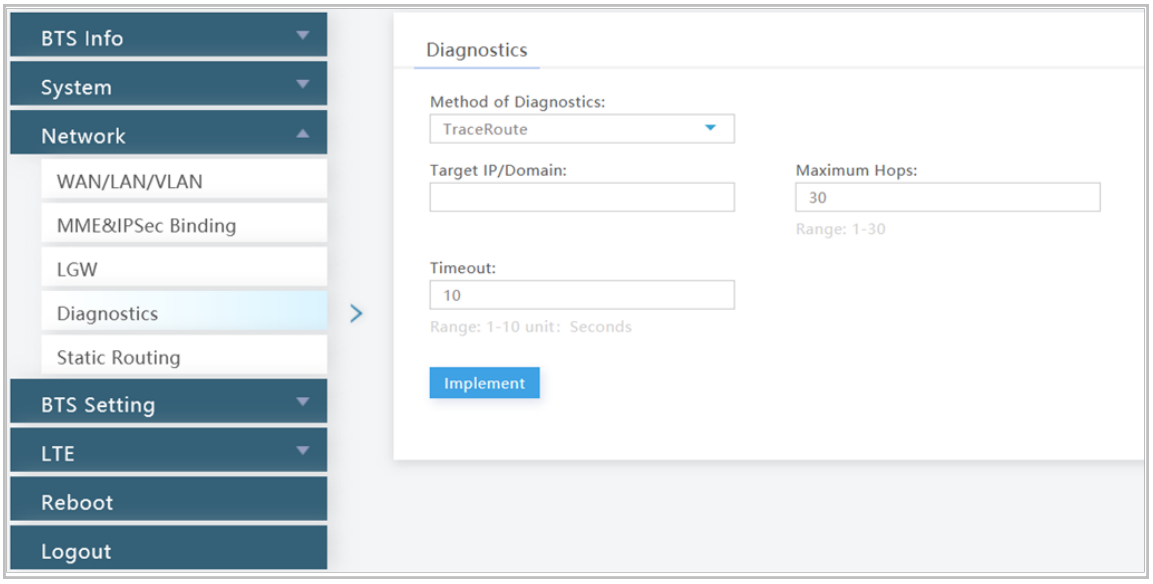


Figure 2-36: Diagnostics (Iperf3)

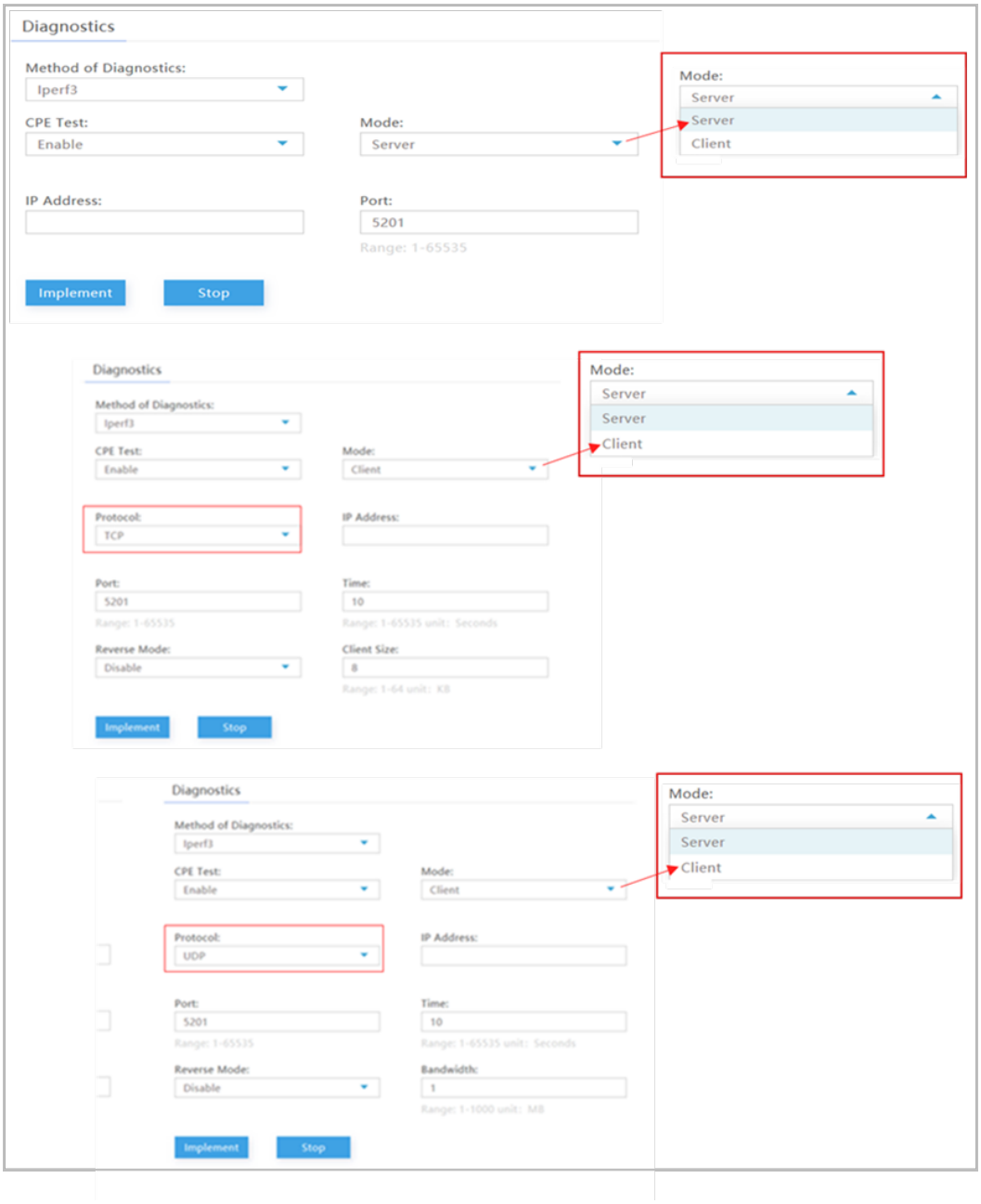


Table 2-15: Diagnostics

Field Name	Description
Method of Diagnostics	Ping, TraceRoute, or Iperf3
Ping	
Target IP/Domain	The IP address or domain name of the destination device
Packet Size	The size of the data packet to be sent. Range is 56-9000 bytes. Default is 56 bytes.
Timeout	The timeout period when the test ends. Range is 1-10 seconds. Default is 10 seconds.
Packet Num	The number of packets to be sent. Range is 1-10.

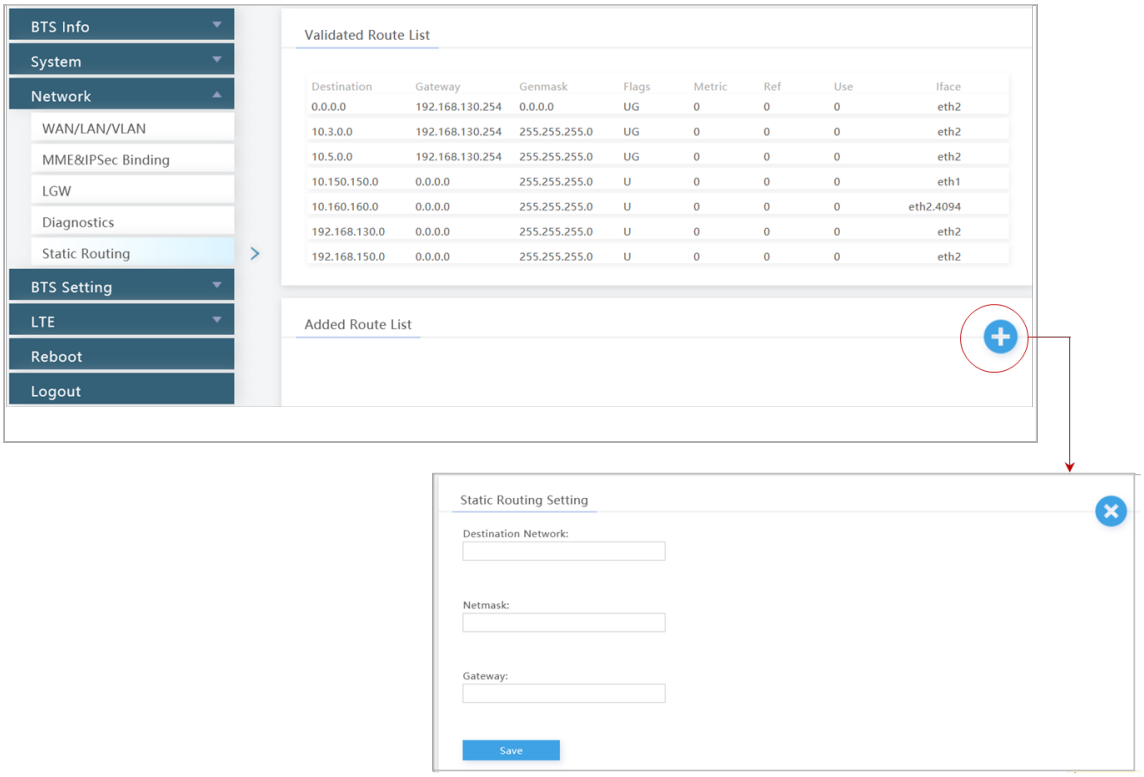
Field Name	Description
TraceRoute	
Target IP/Domain	The IP address or domain name of the destination device
Maximum Hops	The maximum number of hops (network nodes/routers) the packet will have to pass before arriving at its destination. Range is 1-30. Default is 30.
Timeout	The timeout period when the test ends. Range is 1-10 seconds. Default is 10 seconds.
Iperf3	
CPE Test (Server Mode)	
Enable/Disable	Used to enable or disable a CPE rate test in server mode. The server runs on the remote host and listens for connections from the client.
IP Address	IP address of the eNB
Port	Identifies which port number is used for the test. You must use the same port number on both the client and the server for them to be able to communicate with each other. Range is 1-65535.
CPE Test (Client Mode, Protocol TCP*)	
Enable/Disable	Used to enable or disable a CPE rate test in client mode. The client is where all the test fields are defined and connection to the remote server is made.
Protocol	Used to select data packet protocol type. When TCP protocol is selected, the following fields display.
IP Address	Identifies the target client's IP address
Port	Identifies which port number is used for the test. You must use the same port number on both the client and the server for them to be able to communicate with each other. Range is 1-65535.
Time	Used to set the test duration time in which the Iperf tool measures the data throughput. Range is 1-65535 seconds.
Reverse Mode	Enable or Disable the reverse mode capability. Enabling reverse mode allows the option to upload/download test data from/to the client without any restrictions.
Client Size	Used to specify the largest amount of data that the client can receive in a single TCP segment. Range is 1-64 KB.
CPE Test (Client Mode, Protocol UDP*)	
Enable/Disable	Used to enable or disable a CPE rate test in client mode. The client is where all the test fields are defined and connection to the remote server is made.
Protocol	Used to select data packet protocol type. When UDP protocol is selected, the following fields display.
IP Address	Identifies the target client's IP address
Port	Identifies which port number is used for the test. You must use the same port number on both the client and the server for them to be able to communicate with each other. Range is 1-65535.

Field Name	Description
Time	Used to set the test duration time in which the Iperf tool measures the data throughput. Range is 1-65535 seconds.
Reverse Mode	Enable or Disable the reverse mode capability. Enabling reverse mode allows the option to upload/download test data from/to the client without any restrictions.
Bandwidth	Used to set the bandwidth target. Range is 1-1000 MB
*The default protocol for Iperf3 to use is TCP. If you select User Datagram Protocol (UDP) as the protocol to be used, both the client and the server must be in UDP mode to successfully perform the tests.	

2.6.5 Static Routing

Use this menu to add Static IP routing addresses and monitor their status (Figure 2-37). Existing routes will display in the *Added Route List* section of the window, showing the destination IP address, netmask or genmask (for general destination netmask), and other data. To add a new static routing address to the list, click on the **+** (Add) icon, enter the information, and click on *Save*. Once created, you can enable/disable the address. To edit an existing static routing setting, click on the display icon, modify the information, and then save.

Figure 2-37: Static Routing

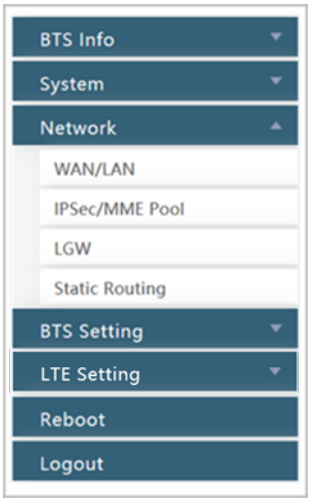


2.7 Network (BaiBS_QRTB_2.6.2)

The *Network* menu settings are where you configure the network interfaces for the eNB (Figure 2-38). This section describes the menu options for BaiBS_QRTB_2.6.2 software version.

NOTE: The *Diagnostics* menu is under the *Network* menu in BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software version. See section 2.6 for more information.

Figure 2-38: Network Menu (QRTB)



2.7.1 WAN/LAN

The WAN interface is an external communication portal (internet connection) between the eNB's Network Management System (NMS) and the MME. The eNB's NMS may be the Baicells Operations and Maintenance Console (OMC) or the LTE NMS.

The *WAN/LAN* menu (Figure 2-39) is for configuring the default router/Domain Name Services (DNS), the type of physical connection that the eNB uses to the external network, the local LAN information, and one or more VLANs (single-carrier eNBs only). The physical *Connect Type* may be copper or fiber and may connect via DHCP, Static IP, IPv6 DHCP, or IPv6 Static IP. All of the Network > WAN/LAN fields are described in Table 2-16.

NOTE: If DHCP is selected for the interface protocol, only option 60 field needs to be configured.

The Local Network/LAN fields are used to configure the Local Maintenance Terminal (LMT) port on the eNB. The port may be used during initial eNB setup and configuration. Enter the IP address and subnet mask address for the local network connection. The default LAN IP address is **192.168.150.1**.

Figure 2-39: WAN/LAN

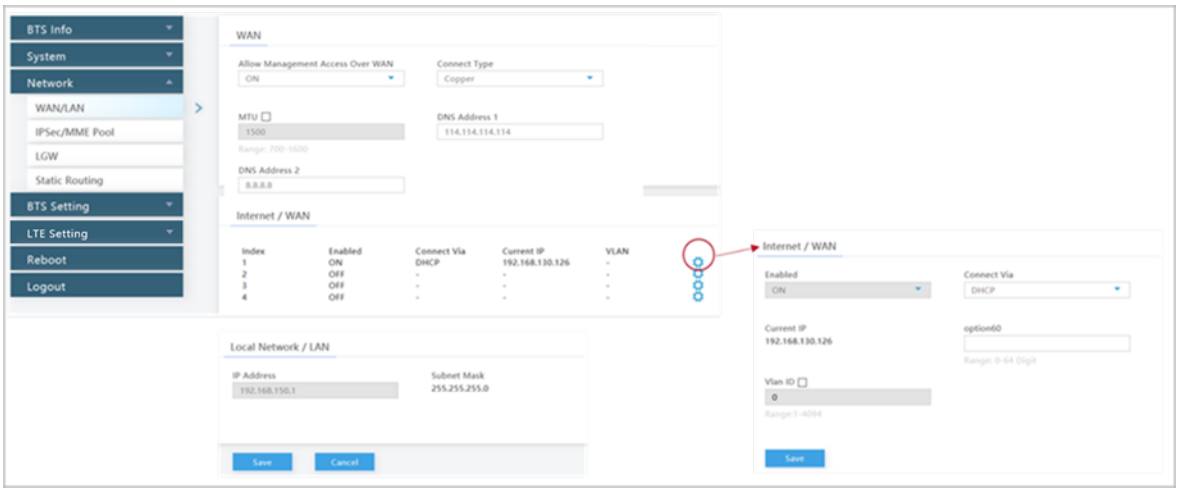


Table 2-16: WAN/LAN

Field Name	Description
WAN	
Allow management access over WAN	Enable or disable the Local Maintenance Terminal connection through the WAN port.
Connect Type	Used to select the type of connection for the eNB (Copper or Fiber)
MTU	Used to specify the size of the largest network layer protocol data unit that can be communicated in a single network transaction. Range is 500 to 1600.
DNS Address 1	Used to define the DNS 1 IP address
DNS Address 2	Used to define the DNS 2 IP address
Internet / WAN	
Enabled	Used to enable the interface. Four IP addresses are the maximum number the eNB supports.
Connect Via	Used to select the desired interface protocol: DHCP, Static IP, IPv6 DHCP, or IPv6 Static IP
Current IP	The WAN interface IP address
Option60	Used to differentiate between different terminal when “Connect Via” is set to “DHCP”
Subnet Mask	Used to define subnet mask address if “Connect Via” is set to “Static IP”
Prefix	Prefix of IPv6 address for WAN interface if “Connect Via” is set to “IPv6 Static IP”
Gateway	Used to define gateway address if “Connect Via” is set to “Static IP”
Vlan ID	Used to configure more IP addresses for the WAN interface through the VLN when there is a need to transmit multi-types of data.

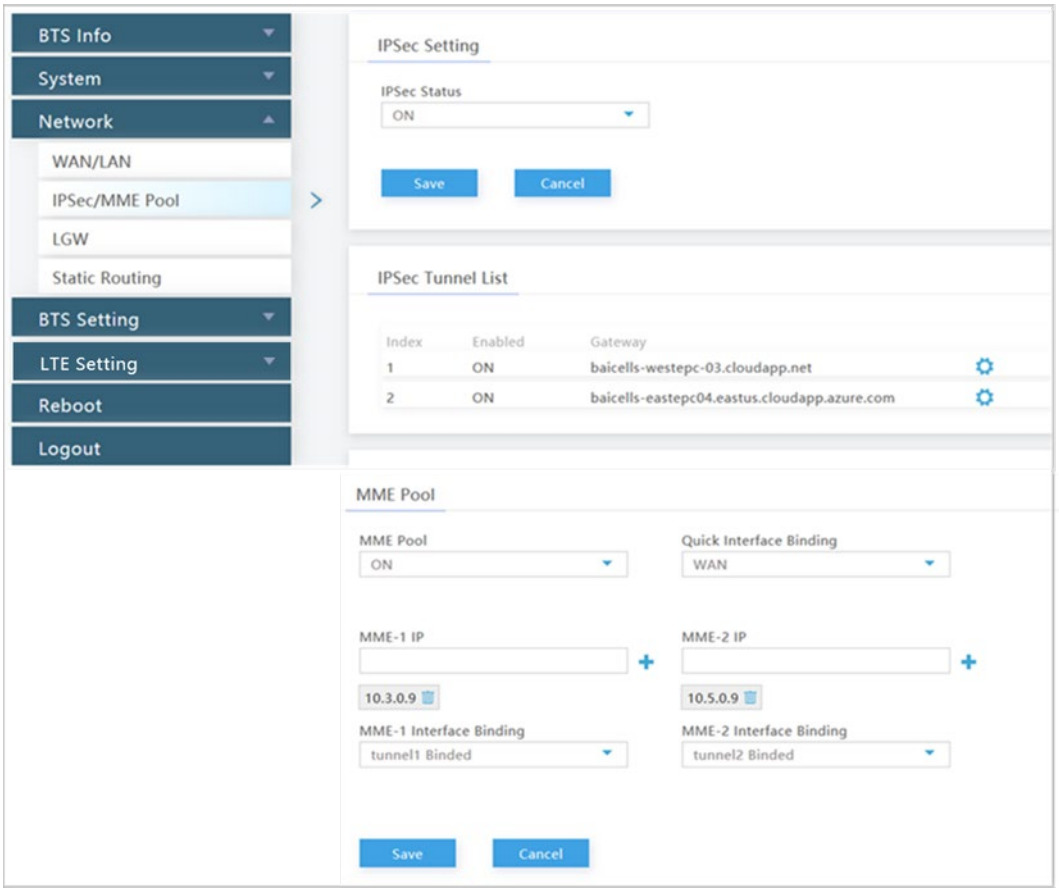
2.7.2 IPSec/MME Pool

NOTE 1: This menu is not included in the GUI of an eNB operating in HaloB mode.
NOTE 2: The MME IP addresses will be 10.3.0.9 ad 10.5.0.9 when using PLMN 314030 connecting to the Baicells CloudCore.

2.7.2.1 IPSec Setting

The IP Security (IPSec) interface is used to route the control plane information between the eNB and the EPC (Figure 2-40). By default, in standard mode the system will enable the IPSec gateway.

Figure 2-40: IPSec/MME Pool



2.7.2.2 IPSec Tunnel List

Under the *IPSec Tunnel List*, you can define up to two sets of data per IPSec tunnel. Tunnel 1 and Tunnel 2 display information about the tunnel status and gateway. If you click on the *Settings* icon, a new window called *Tunnel Configure* opens (Figure 2-41), where you can configure the tunnel fields. Notice the two tabs, *Basic Setting* and *Advance Setting*.

2.7.2.2.1 Tunnel Configure – Basic Setting

The *Basic Setting* fields are shown in Figure 2-41 and described in Table 2-17.

Figure 2-41: Tunnel Setting – Basic Setting Tab

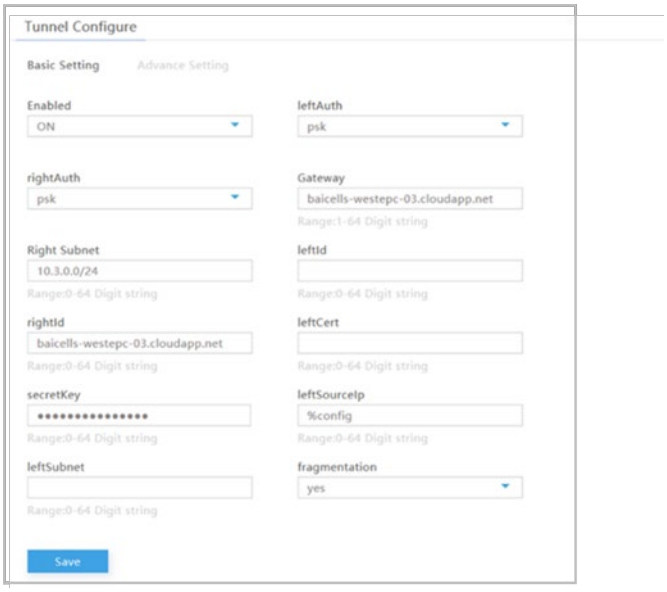


Table 2-17: Tunnel Configure > Basic Setting Tab

Field Name	Description
Enabled	Used to enable the IPSec tunnel. Select ON or OFF. The default value is ON.
leftAuth	**Caution: Change not recommended!** Local authentication method of the IPSec server. Must be consistent with the security gateway side. Options are: • (psk) (default) • (pubkey)
rightAuth	**Caution: Change not recommended!** Peer authentication method of the IPSec server. Must be consistent with the security gateway side. Options are: • (psk) (default) (pubkey)
Gateway	IP address of the IPSec server (security gateway)
Right Subnet	IP address of the remote subnet (message within this address range will be packed as tunnel). Must be consistent with the security gateway side.
leftId	Local ID (client). Must be consistent with the security gateway. If absent from the security gateway, leave this field empty as well.
rightId	Peer ID (server). Must be consistent with the security gateway. If absent from the security gateway, leave this field empty as well.
leftCert	Certificate name. This field needs to be set if “leftAuth” is set to “pubkey”.
secretKey	File name of private key. Default is “clientKey.bin”. When Auth is “psk”, the value is the password of authentication.
leftSourceIP	Virtual address allocation assigned by the system. If absent, use the local IP address.

Field Name	Description
leftSubnet	IP address of the local subnet.
Fragmentation	Fragmentation type • yes • accept • force • no

2.7.2.2.2 Tunnel Configure – Advance Setting

Caution: It is highly recommended that for the *Advance Setting* fields you use the default values. Improper changes may lead to system exceptions.

The *Advance Setting* fields become particularly important to network operations as areas become denser with users. Please refer to Figure 2-42 and Table 2-18.

Figure 2-42: Tunnel Setting – Advance Setting Tab

[Recommend leaving at default values]

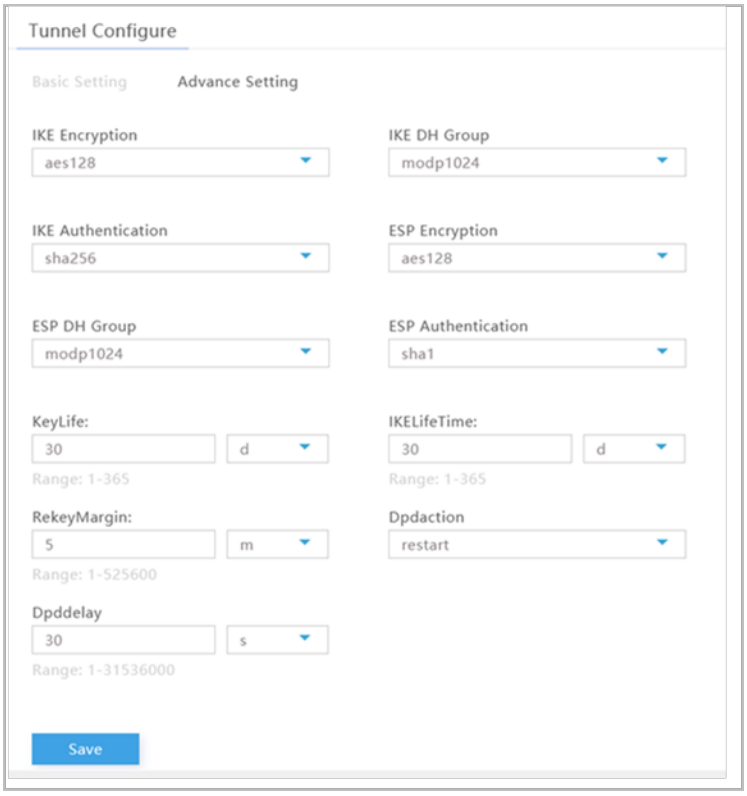


Table 2-18: Tunnel Configure > Advance Setting Fields

[Recommend leaving at default values]

Field Name	Description
IKE Encryption	Internet Key Exchange (IKE) encryption method. IKE is a protocol used to ensure security for Virtual Private Network (VPN) negotiation and remote host or network access. Options are:

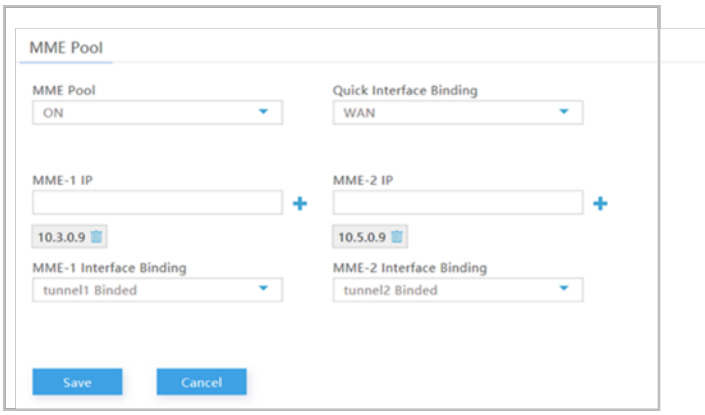
Field Name	Description
	• aes128 (default) • aes256 • 3des
IKE DH Group	IKE Diffie-Hellman (DF) key computation, or exponential key agreement, to be used between two entities. Options are: • modp768 (default) • modp1024 • modp1536 • modp2048 • modp4096
IKE Authentication	IKE authentication algorithm to be used: • sha1 (default) • sha512
ESP Encryption	Encapsulating Security Payload (ESP) – a member of the IPsec protocol suite that provides origin authenticity, integrity, and confidentiality protection of packets. Options: • aes128 (default) • aes256 • 3des
ESP DH Group	ESP Diffie-Hellman (DF) key computation, or exponential key agreement, to be used between two entities. Options are: • null • modp768 • modp1024 (default) • modp1536 • modp2048 • modp4096
ESP Authentication	ESP authentication algorithm to be used: sha1
KeyLife	IPsec security association (SA) renegotiation time. Format: Minutes, Hours, or Days. The default setting is 40 minutes.
IKELifeTime	IKE security association renegotiation time. Format: Minutes, Hours, or Days. The default setting is 60 minutes.
RekeyMargin	Renegotiation time before the expiry of IKELifeTime (negotiate the IKE security association time before the expiry of IKELifeTime). Format: Minutes, Hours, or Days. The default setting is 5 minutes.
Dpdaction	DPD stands for dead peer detection (DPD) protocol. Determines what action to take when a gateway exception occurs: • None • Clear • Hold • Restart (default)
Dpddelay	Time interval for sending the DPD detection message. Format: Seconds, Minutes, or Days. The default setting is 30 seconds.

2.7.2.3 MME Pool

In a typical network setup using the Baicells CloudCore, the security tunnel is between the eNB and the MME in the core network. This menu is used to bind an IPSec tunnel with an MME IP address.

The Baicells CloudCore uses two MMEs, MME-1 and MME-2. MME-1 uses IP address 10.3.0.9, and MME-2 uses IP address 10.5.0.9. Use the configuration fields for MME-1/tunnel 1 and MME-2/tunnel 2 to bind the interfaces (Figure 2-43).

Figure 2-43: MME Pool



2.7.3 LGW

Reference: *Set LGW Mode on eNB*

The Baicells eNodeB (eNB) splits the data plane and the control plane, so there are two IP addresses per user equipment (UE). The data plane is sent out the local gateway (LGW), while the control plane is routed through an IPSec tunnel to the Cloud Evolved Packet Core (EPC).

Most manufacturers do not split the two planes and all traffic is sent through a hardware EPC. You have that option with Baicells as well, but anyone using the Baicells CloudCore EPC uses LGW.

Using the eNB GUI, follow the steps below to configure LGW.

1. Go to Network > LGW.
2. Verify that LGW is enabled (ON).
3. Select one of three LGW modes (Figure 2-44, Figure 2-45, and Figure 2-46):
   - **NAT** - Network Address Translation - The IP address is kept local between the eNB and CPE. The eNB modifies the network address in the IP packet headers. To reach user equipment 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.
   - **Router** - Enable static IP addressing, and identify the range of addresses. The LGW (external router) will assign an IP address when a CPE attaches. IP binding uses address range 10.10.0.1 to 10.10.0.254.

- **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 = 117040000002918, the MAC address would be 8A:95:02:F9:B6:6.

4. Enter the required fields. For the LGW Interface Binding field, you can select either WAN or PPPoE. You can then enter the LGW IP Pool address and netmask. The IP binding range is 10.10.0.1 to 10.10.0.254. For router mode, if you enable Static Address, configure the static address range by entering the first and last IP addresses; then, configure the IMSI to IP Binding IMSI.
5. If you change the LGW mode, you must perform a warm reboot the eNB for the changes to take effect. Rebooting will interrupt service temporarily.

Figure 2-44: LGW Setting (NAT Mode)

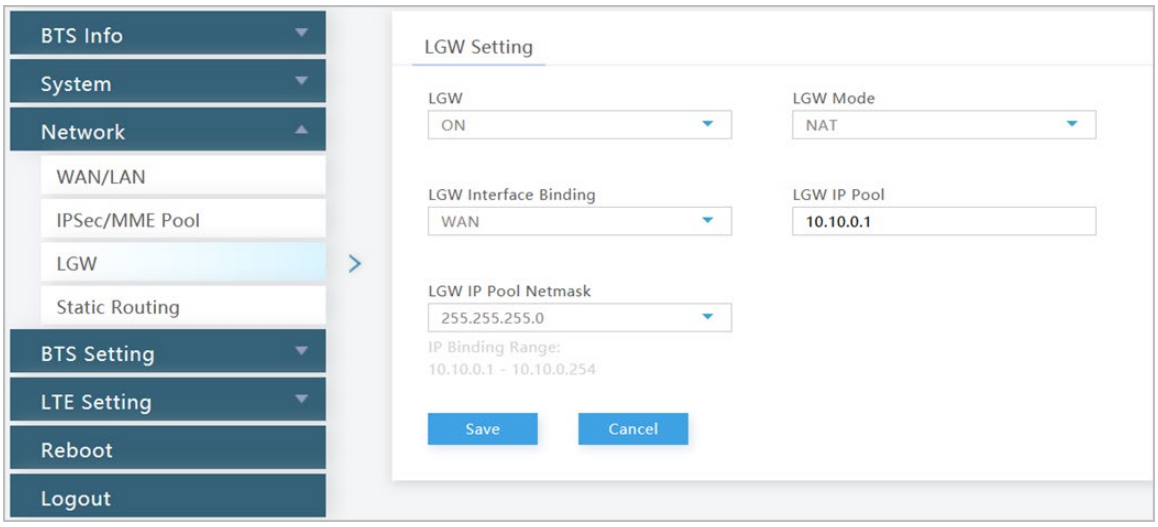


Figure 2-45: LGW Setting (Router Mode)

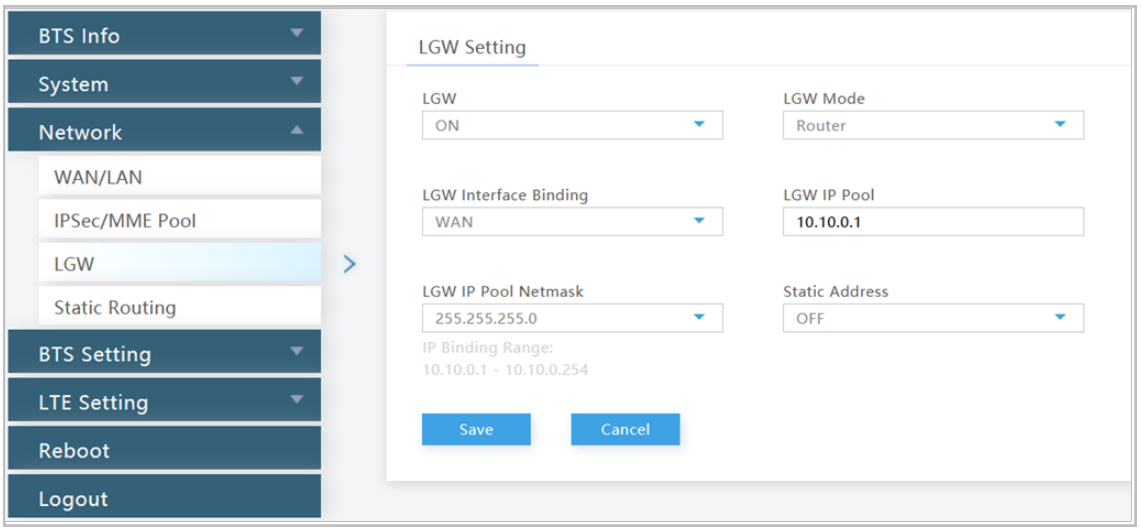
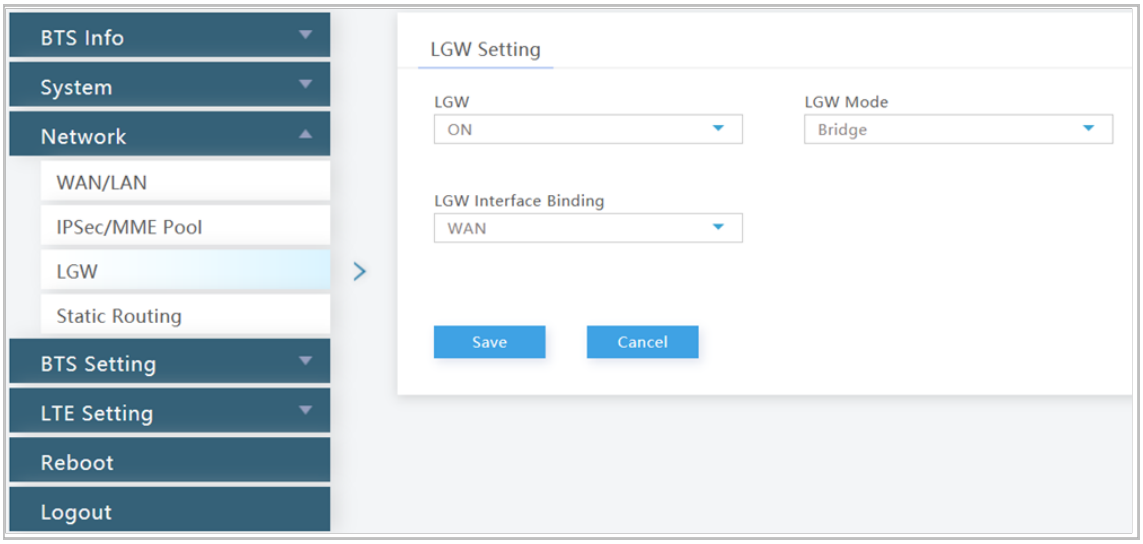


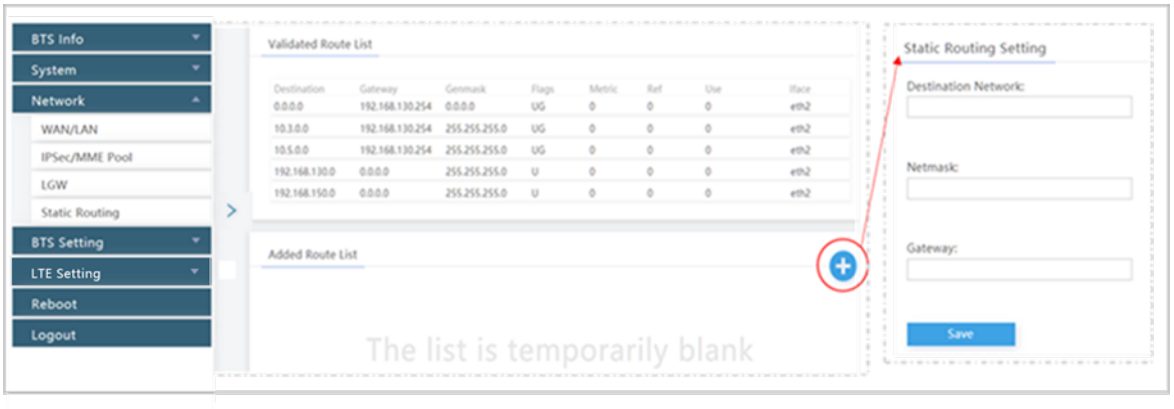
Figure 2-46: LGW Setting (Bridge Mode)



2.7.4 Static Routing

Use this menu to add Static IP routing addresses and monitor their status (Figure 2-47). Existing routes will display in the *Added Route List* section of the window, showing the destination IP address, netmask or genmask (for general destination netmask), and other data. To add a new static routing address to the list, click on the **+** (Add) icon, enter the information, and click on *Save*. Once created, you can enable/disable the address. To edit an existing static routing setting, click on the display icon, modify the information, and then save.

Figure 2-47: Static Routing



2.8 BTS Setting

The base transceiver station (BTS) settings relate to eNB security, management, and synchronization with other network elements (Figure 2-48).

NOTE 1: For eNBs running BaiBS_QRTB_2.6.2 software, the BTS Setting menu also includes the Carrier Setting menu. See section 2.8.6 for more information.
NOTE 2: For eNBs running BaiBS_RTD_3.7.5, the BTS Setting menu also includes the AId Setting menu. See section 2.8.7 for more information.

Figure 2-48: BTS Setting Menu

2.8.1 Security Setting

Caution: Do not modify these security settings; keep the default values.

The *Security Setting* fields pertain to the LTE encryption algorithms that are used (Figure 2-49). The selections will depend on the LTE core network setup. In a two-carrier eNB, these settings apply to both the primary and secondary cell. Table 2-19 identifies the security setting fields.

NOTE 1: The only eNB currently running software version BaiBS_RTD_3.6.6 or higher to enable Dual Carrier (DC)/split mode capabilities is the Nova246.
NOTE 2: On a two-carrier eNB running BaiBS_QRTB_2.6.2, the Security Setting is configured on the primary cell (Cell1) for both Cell1 and the secondary cell (Cell2).

Figure 2-49: Security Setting

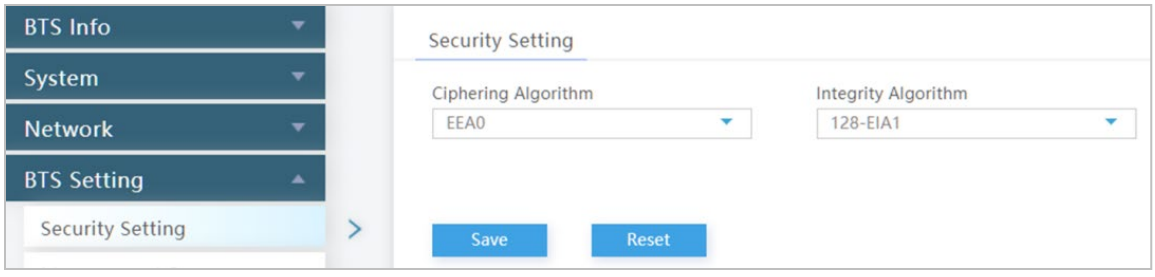


Table 2-19: Security Settings - For Information Only

Field Name	Description
Ciphering Algorithm	Encryption algorithm options: • EEA0 (default) • 128-EEA1: 128-EEA1, EEA0 • 128-EEA2: 128-EEA2, EEA0 • 128-EEA3: 128-EEA3, 128-EEA1, EEA0 (RTS/RTD software)
Integrity Algorithm	Integrity protection algorithm options: • 128-EIA1: 128-EIA1, EIA0 (default) • 128-EIA2: 128-EIA2, EIA0 • 128-EIA3: 128-EIA3, 128-EIA1, EIA0 (RTS/RTD software)

2.8.2 Management Server

For the Network Management Service (NMS), an operator has the option to use the Baicells CloudCore OMC, a Local OMC, or their own management server. Follow the steps below to configure the management server. See Figure 2-50 for eNBs running BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software, and see Figure 2-51 and Table 2-20 for eNBs running BaiBS_QRTB_2.6.2 software.

1. For NBs running BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software only: enable or disable the initial (originating) management server. *Enable* is the default.
2. For NBs running BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software only: this field is pre-configured when the initial management server function is enabled.
3. Optional: Enable a Secure Socket Layer (SSL) connection for enhanced security. When you set to *Enable*, a message will display telling you the default port number for HTTPS is 8443.
4. Enter the http:// address for your management server. If it is the Baicells CloudCore OMC, enter **baiomc.cloudapp.net:48080/smallcell/AcsService**. If you are using Local OMC or other EMS/NMS server, enter the URL for that device.
5. If you are using the Baicells CloudCore OMC for your NMS, enter your unique operator CloudKey ID that you received from Baicells. The CloudKey is used as part of the plug-and-play aspect of the Baicells network elements. When you configure your CloudKey number in the device GUI (eNB and UE), the first time the device is powered on it will automatically be associated to your OMC account.
6. For eNBs running BaiBS_QRTB_2.6.2 software only: the TR069 field is pre-configured and *WAN* is the default.

7. If you want to enable eNBs running BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software to report KPI information to the third-party Network Management System (NMS) using the SNMP function, see section 2.5.8. If you want to enable eNBs running BaiBS_QRTB_2.6.2 software to report KPI information to the third-party Network Management System (NMS) using the SNMP function, configure the SNMP according to parameters shown in Figure 2-51 and Table 2-20.

NOTE: When you enable SNMP on eNBs running BaiBS_QRTB_2.6.2 software, the fields required to configure the security and trap communities display (Figure 2-51).

Figure 2-50: Management Server (RTS/RTD)

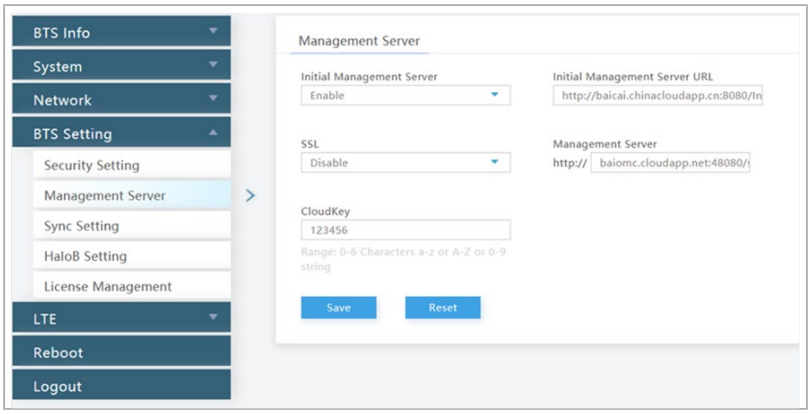


Figure 2-51: Management Server (SNMP) (QRTB)

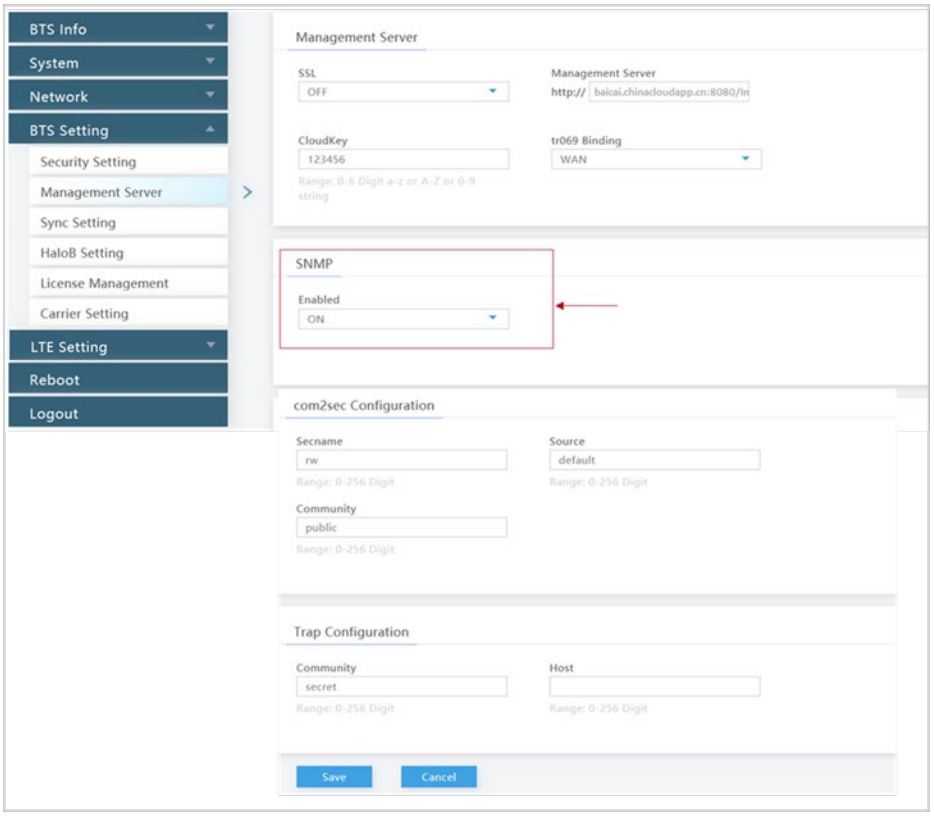


Table 2-20: Management Server (SNMP) (QRTB)

Field Name	Description
Com2sec Configuration	
Secname	The name of the security community. Range is 0-256 characters.
Source	The source address of acquiring information. Range is 0-256 characters.
Community	Used to define a community. Default is public.
Trap Configuration	
Community	Used to define a community. Default is secret.
Host	The IP address for the host. Range is 0-256 characters.

2.8.3 Sync Setting

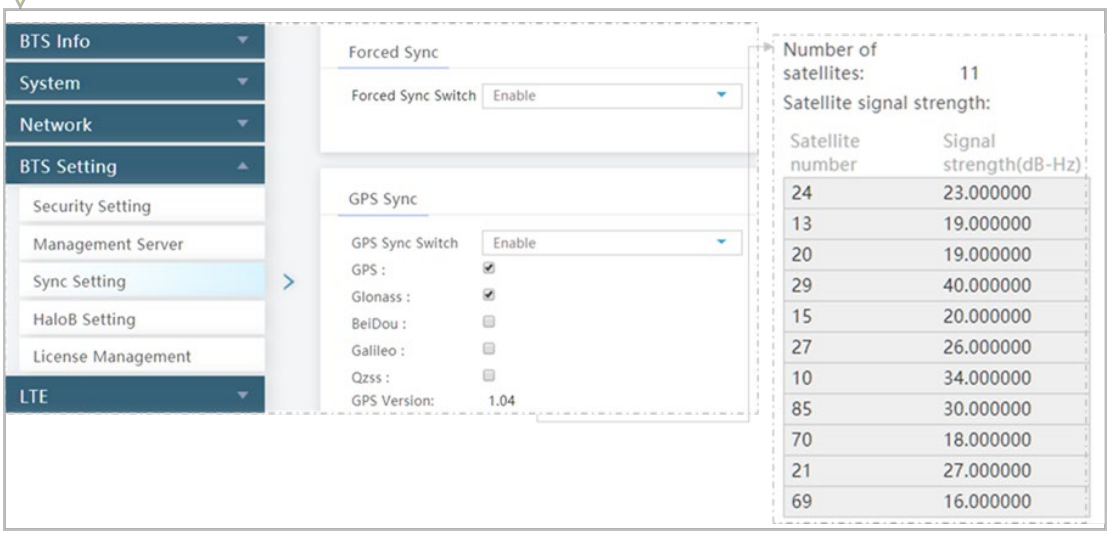
The LTE technology standards specify timing and synchronization requirements between adjacent eNBs. Synchronized transmissions help eNBs avoid interfering with one another, optimize bandwidth usage, and enhance network capacity. There are two synchronized transmission options available: GPS and 1588v2. Synchronized transmissions can be enabled for sync modes to operate simultaneously or independently. Section 2.8.3.1 and section 2.8.3.2 describe sync settings for eNBs running BaiBS_RTS_3.7.5 and BaiBS_RTD_3.7.5 software. Section 2.8.3.3 describes sync settings for eNBs running BaiBS_QRTB_2.6.2 software.

2.8.3.1 GPS Sync Setting (RTS/RTD)

In the *Sync Setting* menu (Figure 2-52), enable the *Forced Sync Switch* and enable the *GPS Sync Switch*. Select the timing technology - either Glonass, BeiDou, Galileo, or Qzss. When you click on *Save* to retain the settings, a pop-up message will tell you to reboot (warm reboot) the eNB for the new settings to be applied. Click on *OK*.

After the reboot, the window will display the GPS software version, the current number of satellites the GPS is tracking, and the satellite signal strength. Use the *Reset* button if you want to restore the configuration settings to their original default values.

Figure 2-52: GPS Sync Setting (RTS/RTD)



2.8.3.2 1588v2 Sync Setting (RTS/RTD)

Using 1588v2 synchronization requires a highly reliable network environment. The network delay jitter must be less than 20 µs, and the link delay must be less than 1 ms. The Baicells eNBs meet the time variation requirements within +/- 1 µs and frequency deviation within 50 ppb. The 1588v2 sync method will not support soft routing, soft switching, or other similar devices. Refer to Figure 2-53 and Table 2-21.

NOTE: The operator will need to get a separate 1588v2 license for the eNB to support this sync mode.

Figure 2-53: 1588 Sync Setting (RTS/RTD)

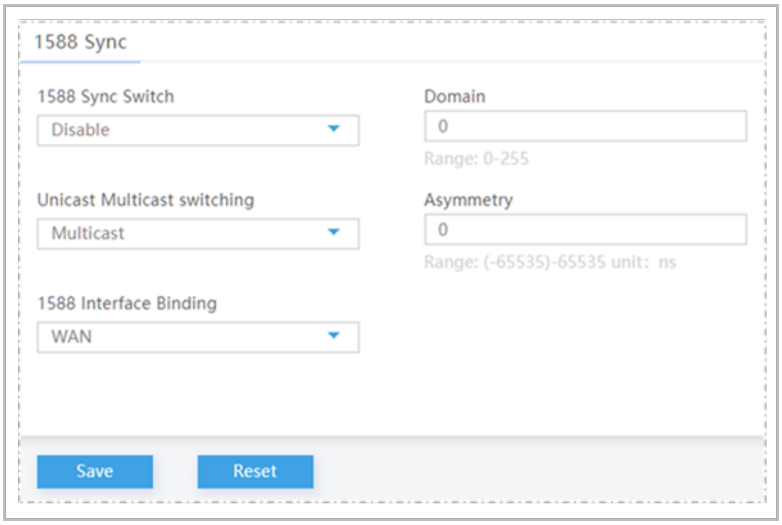


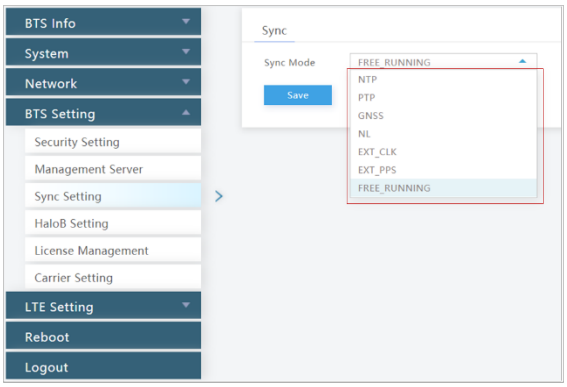
Table 2-21: 1588 Sync Setting (RTS/RTD)

Field Name	Description
1588 Sync Switch	Enable or disable the 1588v2 server sync method
Domain	Enter a domain identifier in the range of 0-255
Unicast Multicast Switching	Select either unicast or multicast transmission
Asymmetry	Enter the asymmetry (offset) value, in nanoseconds, between the server and the eNB. The range is -65535 to 65535.
1588 Interface Binding	WAN is the only available interface binding

2.8.3.3 Sync Setting (QRTB)

The BaiBS_QRTB_2.6.2 software version sync setting (Figure 2-55) offers several sync mode options: NTP, PTP, GNSS, NL, EXT_CLK, EXT_PPS, and FREE_RUNNING.

Figure 2-54: Sync Setting (QRTB)



When Network Listening (NL) sync mode is selected, you are intending to use two neighboring adjacent eNBs to sync with in order to establish the tower's GPS location, which ensures your eNB won't cause interference by being out of timing. You'll notice upon choosing NL sync mode that an NL Sync List is autogenerated. Once you identify which two neighboring eNBs you want to use for syncing, you will come back to the NL sync list, click on the *Settings* icon, and configure key parameters about those two eNBs (Figure 2-55). The NL sync list parameters are described in Table 2-22.

Figure 2-55: NL Sync Config Settings (QRTB)

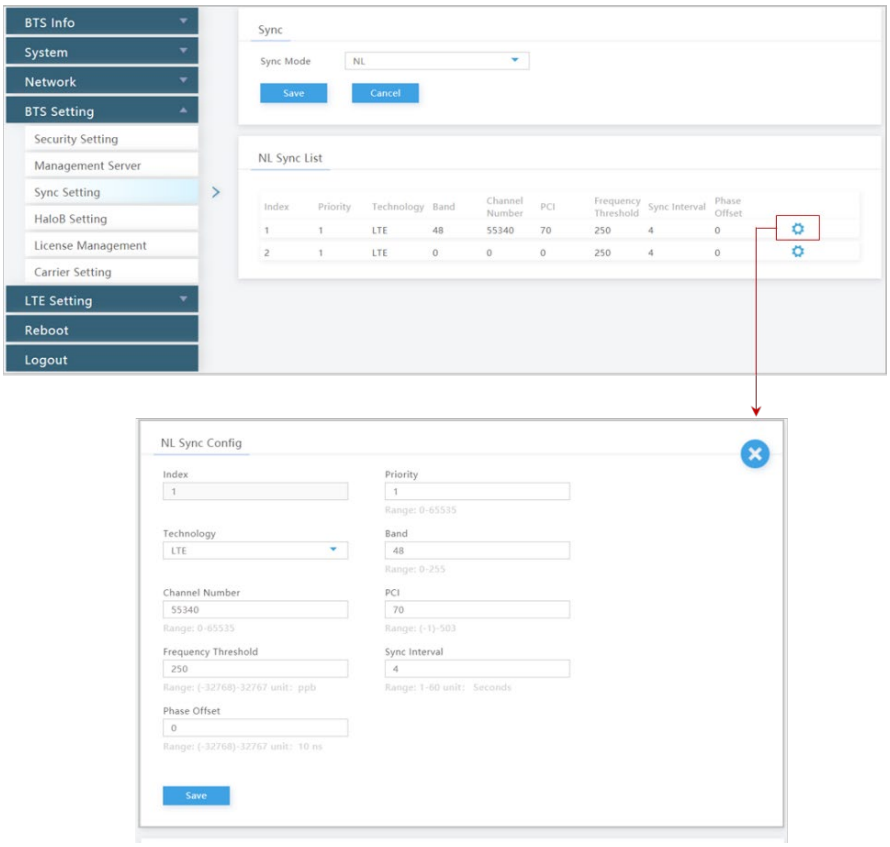


Table 2-22: NL Sync Config Settings (QRTB)

Field Name	Description
Index	
Priority	Range is 0 to 65535.
Technology	Only LTE may be selected at this time.
Band	Frequency band. Range is 0 to 255.
Channel Number	Range is 0 to 65535.
PCI	Range is -1 to 503.
Frequency Threshold	Range is -32768 to 32767 (unit = ppb).
Sync Interval	Range is 1 to 60 seconds
Phase Offset	Range is -32768 to 32767 (unit = 10 ns).

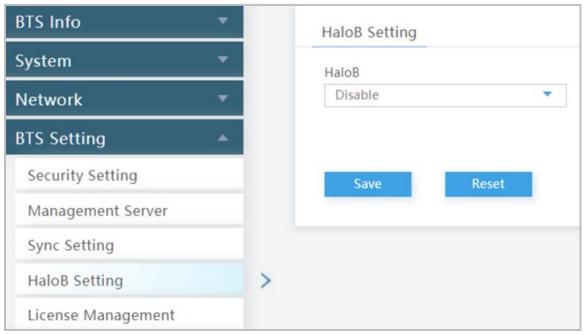
2.8.4 HaloB Setting

Reference: *HaloB User Guide*

The *HaloB Setting* menu is used by operators who have a HaloB license for the eNB. This menu (Figure 2-56) is used to enable/disable the eNB to operate in HaloB mode.

NOTE 1: In eNBs running the BaiBS_QRTB_2.6.2 software version, the HaloB Setting options are "ON" and "OFF", not "Enable" and "Disable".
NOTE 2: When HaloB is set to "ON" or "Enable", the pulldown menu displays two modes. Currently, the "Centralized" mode is the default setting and only mode supported. "Standalone" mode is anticipated in a future software release.

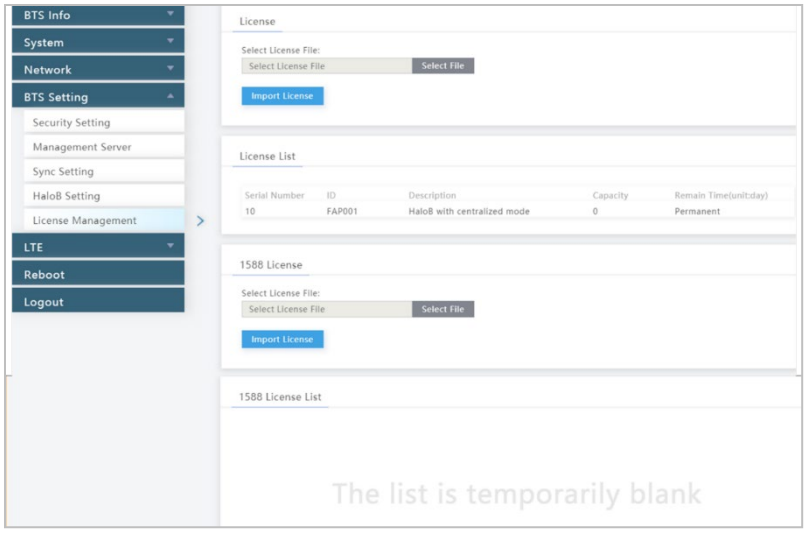
Figure 2-56: HaloB Setting



2.8.5 License Management

The *License Management* menu may be used to import license files for optional features such as HaloB or regulatory certificates of authorization to operate (Figure 2-57). When imported, the files are stored in the eNB memory and shown in the *License List* area of this window. The bottom half of the window pertains to licenses for using one or more 1588v2 servers for transmission timing synchronization (refer to section 2.8.3 Sync Setting).

Figure 2-57: License Management



2.8.6 Carrier Setting (Nova436Q and Neutrino430 only)

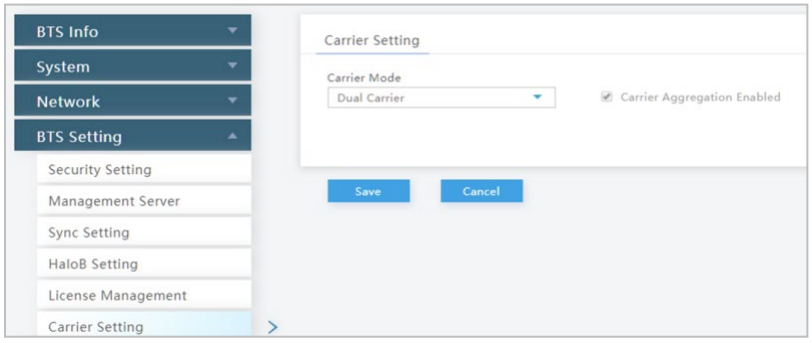
Reference: *Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide* and *Neutrino430 Indoor 4x250mW Two-Carrier TDD eNodeB Installation Guide*

The *Carrier Setting* menu is used for two-carrier eNBs running BaiBS_QRTB_2.6.2 software version, which currently includes the Nova436Q and the Neutrino430 (Figure 2-58). You can set the eNB to run as either a single carrier, two combined carriers using Carrier Aggregation (CA), or two separate carriers using Dual Carrier (DC)/split mode. In single carrier mode only Cell 1 will operate, and it will use only 2 RF ports instead of 4. 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, for example when more capacity is needed for the coverage area.

If you set the *Carrier Mode* to *Dual Carrier*, the *Carrier Aggregation Enabled* check box is automatically checked. Leave as is and save if you want to run the eNB in CA mode. If you want to use DC mode, uncheck the check box and save. Whenever you change the carrier setting, you must perform a warm **reboot** the eNB for the change to take effect.

NOTE: The Nova436Q and Neutrino430 CA mode supports contiguous or non-contiguous channels in the North American bands defined by 3GPP.

Figure 2-58: Carrier Setting (Nova436Q and Neutrino430 only)



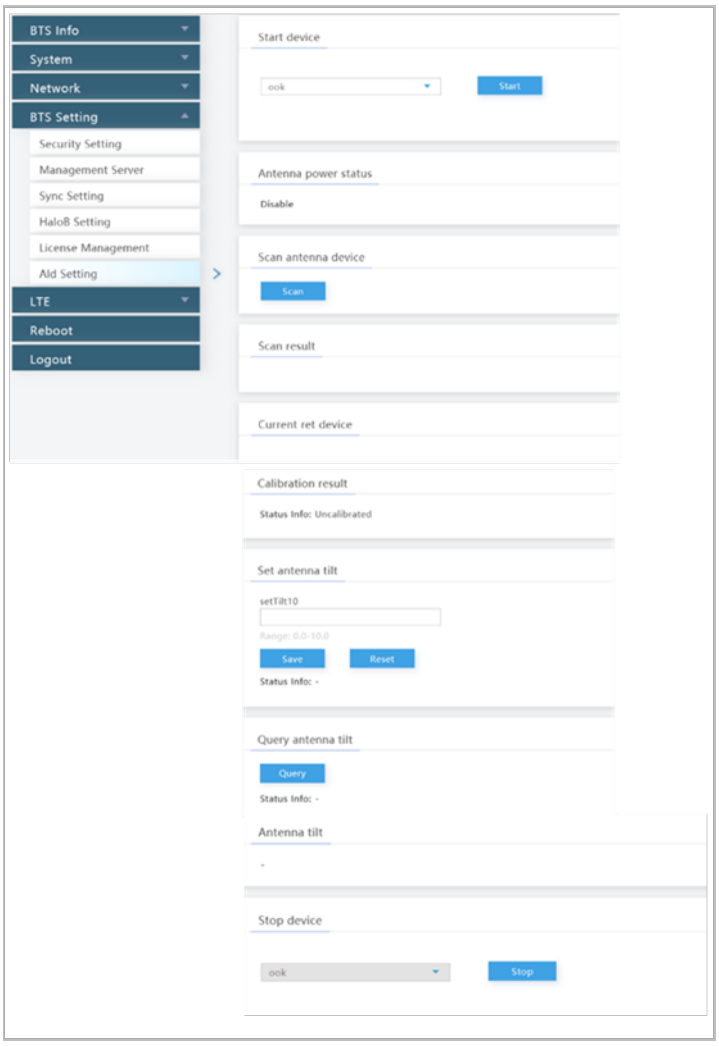
2.8.7 Ald Setting to Configure RET (Nova246 only)

The *Ald Setting* menu is used to configure the smart antenna on the local maintenance terminal, which adjusts the downtilt of antennas remotely (Figure 2-59). The eNB supports two types of communication methods between the eNB and the antenna (OOK and RS485).

- OOK: the eNB outputs an on-off keying (OOK) signal that transmits the antenna's alignment port to the Antenna Information Management Module (AIMM) through bundled cable. When received at the AIMM, the signal is demodulated to an RS485 signal to control AIMM settings.
- RS485: The Remote Electrical Tilt (RET) port on the eNB outputs an RS485 signal that transmits the antenna's alignment port to the AIMM through an Antenna Interface Standards Group (AISG) cable to control AIMM settings.

NOTE: The Ald setting to configure RET is not intended for use with mechanical antennas.

Figure 2-59: Ald Setting to Configure RET (Nova246 only)



Perform the following steps:

1. Go to BTS Setting > Ald Setting.
2. In the *Start Device* portion of the window, select “Start ook” or “Start rs485”. Then, click on the *Start* button.
3. In the *Antenna power status* portion of the window, ensure the antenna power status is displaying “enable”.

   NOTE: The system updates the status of the antenna automatically when the device is started.

4. In the *Scan antenna device* portion of the window, click on the *Scan* button.
5. After the scanning operation is complete, the results display in the *Scan result* portion of the window, and you will be able to view information such as the device’s serial number and protocol version. If the scanning operation failed, check the configuration for errors and re-scan until the results display correctly.
6. Select RET device from the *Scan result* portion of the window. Then, click “Add” to add the device so it displays in the *Current ret device* portion of the window.

   NOTE: As soon as you click “Add” in previous step, the antenna starts to automatically calibrate.

7. Check the *Status info* in the *Calibration result* portion of the window to confirm the calibration is successful.
8. In the *Set antenna tilt* portion of the window, input downtilt angle (setTilt10) and click on the *Save* button. Range of downtilt angle is 0.0-10.0.
9. Check the *Status info* in the *Set antenna tilt* portion of the window to confirm downtilt setting you configured in previous step.
10. In the *Query antenna tilt* portion of the window, click on the *Query* button.
11. Check the *Status info* in the *Query antenna tilt* portion of the window to check the current downtilt status.
12. In the *Stop device* portion of the window, select “Stop ook” or “Stop rs485”. Then, click on the *Stop* button to complete the RET setting.

    NOTE: The system updates the status of the antenna automatically when the device is stopped.

2.9 LTE (BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5)

The *LTE* menu contains several sub-menus related to mobility as well as other radio-related settings (Figure 2-60). Many LTE parameters are important for efficient wireless network operation. When setting up mobility, you have to establish the neighboring eNBs operating in the same geographical area as is the eNB that you are configuring. This information is completed for each eNB so that the eNBs collectively work well with one another to handle mobile users and to balance the traffic load.

NOTE 1: HaloB-enabled eNBs operate as standalone entities and do not support mobility. Therefore, the LTE menu options change depending on the HaloB functionality setting.
NOTE 2: The terms handoff and handover are used interchangeably in LTE.
NOTE 3: The SAS Settings menu item shown in Figure 2-60 does not apply to eNBs running BaiBS_RTD_3.7.5 software.

Figure 2-60: LTE Menu (RTS/RTD)

Use the first 5 sub-menus under LTE to (a) configure the neighboring eNBs' frequencies and identify each eNB running on that frequency (section 2.9.1); (b) configure the current eNB's mobility parameters (beginning with section 2.9.2); and (c) examine the current eNB's advanced settings (section 2.9.6).

It is a good idea to review all of the information in this section to understand how the configuration settings relate.

Important: Make sure the current and neighboring eNBs are synchronized to help the eNBs avoid interfering with one another (see section 2.8.3).

If you change these parameters, perform a warm **reboot** of the eNB for the new configuration to take effect. A case study for LTE to LTE handoffs is provided in section 2.11 Real-World LTE to LTE Handoff Configuration Example.

2.9.1 Identify Neighbor Frequencies & Cell Information

Depending on geographic region, there are 3 types of neighboring eNBs: other LTE eNBs; eNBs running another type of wireless technology called Time Division Synchronous Code Division Multiple Access (TD-SCMDA); and those operating with the Global System for Mobile (GSM) communications technology. For each type of neighboring eNB, you will first add the neighbor frequency settings via the *Neigh Freq Table*, and then you will add the cell information associated to the frequencies via the *Neigh Cell Table*.

You can configure the *Neigh Cell Table* for both inter-frequency (between different frequencies) and intra-frequency (within the same frequency) neighboring eNBs. For inter-frequency cells, you must add the neighbor inter-frequency settings in the *Neigh Frequency Table* before you try to add the neighbor inter-frequency cell (eNB) information. Conversely, if you need to delete a neighbor inter-frequency record, you must first delete the neighbor inter-frequency cells (eNBs) associated to it. For an intra-frequency neighbor

cell, meaning a neighbor eNB operates on the same frequency as the eNB you are configuring, you do not need to configure the *Neigh Freq Table* but you do need to configure the *Neigh Cell Table*.

2.9.2 LTE Freq/Cell

Using the *LTE Freq/Cell* sub-menu (Figure 2-61), you can configure parameters related to how adjacent eNBs operating with LTE technology work with the Baicells LTE eNB that you are configuring. You will define for the Baicells eNB how to deal with any neighboring LTE eNBs.

Figure 2-61: LTE Freq/Cell (RTS/RTD)

2.9.2.1 LTE Neigh Freq Table

Under *Neigh Freq Table*, select the **+** (Add) icon. This will open the *Neigh Freq Settings* window, as shown in Figure 2-62 and described in Table 2-23. You can configure up to 8 LTE frequency tables. The parameters shown in the figure reflect the recommended settings for this operator example.

Figure 2-62: LTE Freq/Cell > Neigh Freq Settings (RTS/RTD)

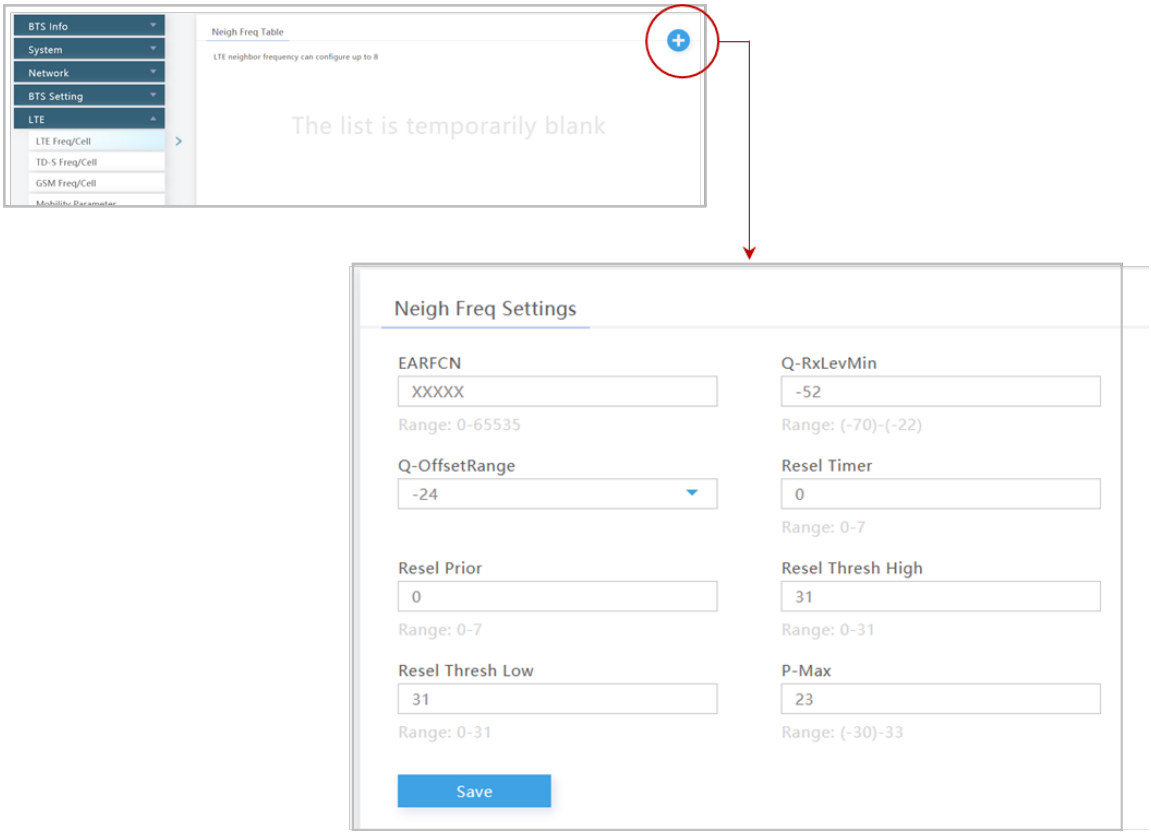


Table 2-23: LTE Freq/Cell > Neigh Freq Settings (RTS/RTD)

Field Name	Description
EARFCN	In short, this is the frequency point of the neighboring eNB's frequency. Range is 0-65,535. EARFCN stands for Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access (E-UTRA) Absolute Radio Frequency Channel Number.
Q-RxLevMin	The minimum received signal level at which user equipment (UE) will detect a neighboring eNB's signal. The range is -70 to -22 dBm. A typical value is -62, which equals -124 dBm.
Q-OffsetRange	Indicates the difference in signal level between the serving and neighboring eNBs, as determined by the received signal level at the UE. If the received signal level is better from a neighboring eNB by at least this amount of difference in dB, the UE will reselect the other cell. The range is +24 to -24 dB. A typical value is 0 dB.
Resel Timer	Determines when the cell reselection timer expires. Range is 0-7 seconds. A typical value is 0 seconds.
Resel Prior	Priority of cell reselection to cells at this frequency. Range is 0-7 (integer). A typical value is 4.
Resel Thresh High	The cell reselection threshold for higher priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has a higher cell reselection

Field Name	Description
	priority than the serving cell). Range is 0-31 dB. A typical value is 18 dB.
Resel Thresh Low	The cell reselection threshold for lower priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has an absolute priority lower than the serving cell). Range is 0-31 dB. A typical value is 13 dB.
P-Max	The maximum transmit power that UEs in this cell are allowed to use in the uplink. The range is -30 to 33 dBm. A typical value is 23 dBm.

2.9.2.2 LTE Neigh Cell Table

You can configure up to 16 LTE Neigh Cell Tables. Click on the **+** (Add) icon to open the *Neigh Cell Settings* window, as shown in Figure 2-63 and described in Table 2-24. The parameters shown in the figure reflect the recommended settings for this operator example.

Figure 2-63: LTE Freq/Cell > Neigh Cell Settings (RTS/RTD)

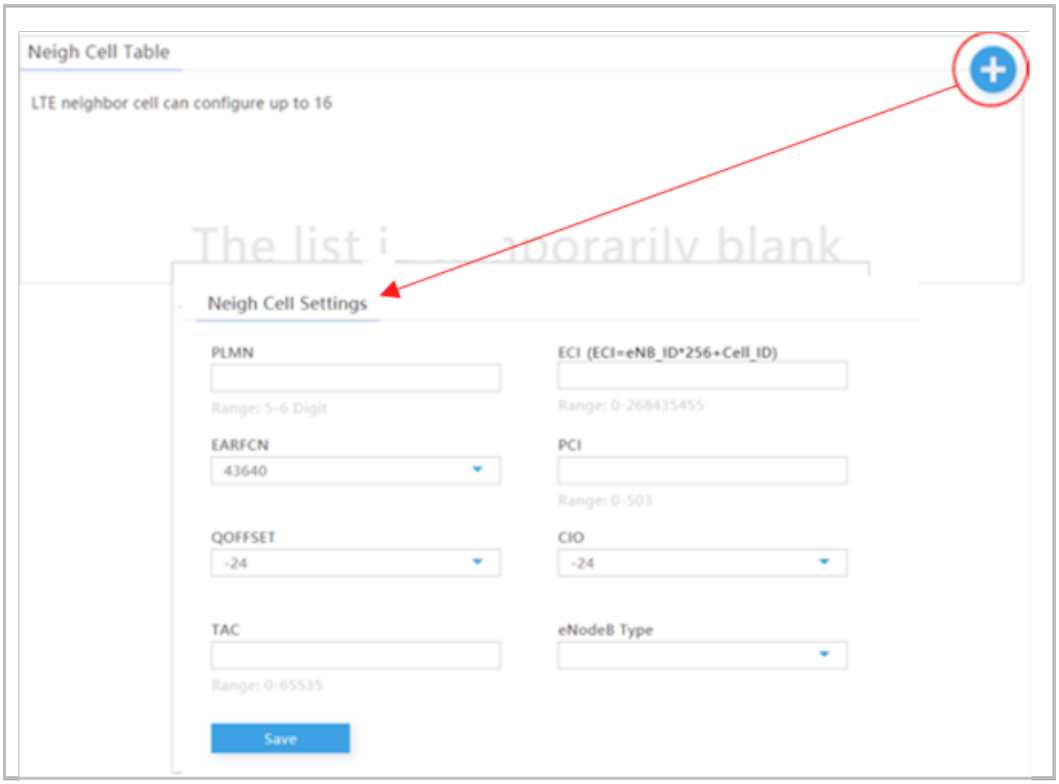


Table 2-24: LTE Freq/Cell > Neigh Cell Settings (RTS/RTD)

Field Name	Description
PLMN	The 5- or 6-digit Public Land Mobile Network (PLMN) that the neighbor cell belongs to.
ECI	The cell ID of the neighbor cell. Range is 0-268,435,455. The cell ID + the eNB ID x 256 comprises the E-UTRAN Cell Identity (ECI), which identifies a cell site in the network.

Field Name	Description
EARFCN	Frequency point of the neighbor cell. EARFCN stands for Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access (E-UTRA) Absolute Radio Frequency Channel Number.
PCI	Physical Cell Identifier (PCI) of the neighbor cell. Range is 0-503.
QOFFSET	Frequency offset of this neighbor cell. Indicates the difference in signal level between the serving and this neighboring eNB, as determined by the received signal level at the UE. If the received signal level is better from this neighbor eNB by at least this amount of difference in dB, the UE will reselect this cell. Range is +24 to -24 dB. A typical value is 0 dB.
CIO	Cell Individual Offset (CIO) is this neighbor eNB's cell offset, which is one of the variables used to determine which eNB will best serve a given UE. Range is -24 to 24 dB. A typical value is 0 dB.
TAC	Tracking Area Code (TAC) of this neighbor cell. Range is 0-65535.
eNodeB Type	Macro or Home

2.9.3 TD-S Freq/Cell

Using the *TD-S Freq/Cell* sub-menu (Figure 2-64), you can configure parameters related to how adjacent eNBs operating with TD-SCDMA technology work with the Baicells LTE eNB that you are configuring. You will define for the Baicells eNB how to deal with any neighboring TD-SCDMA eNBs. The maximum is 5.

Figure 2-64: TD-S Freq/Cell (RTS/RTD)

2.9.3.1 TD-S Neigh Freq Table

Under *TD-S Neigh Freq Table*, click on the **+** (Add) icon to open *Neigh Freq Settings*, as shown in Figure 2-65 and described in Table 2-25. Even though some of the field names are the same as in the LTE Neigh Freq Table, in some cases the ranges are different for TD-SCDMA. Configure up to 5 frequency tables for TD-S eNBs.

Figure 2-65:TD-S Freq/Cell > Neigh Freq Settings (RTS/RTD)

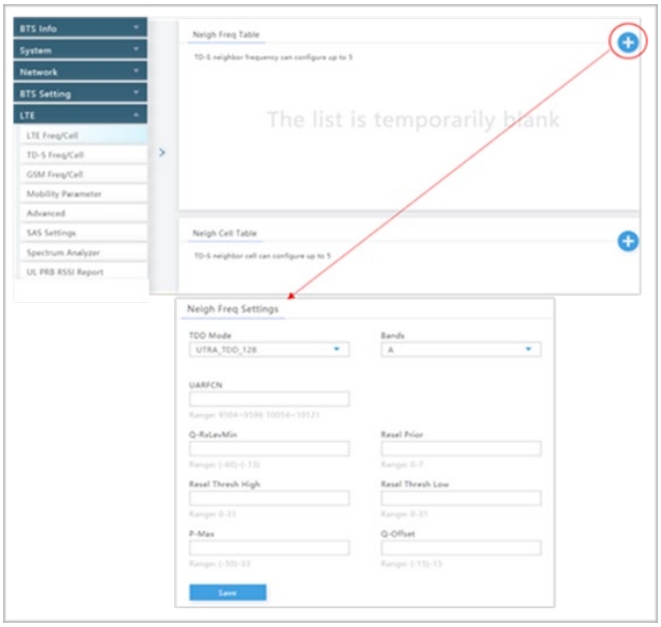


Table 2-25: TD-S Freq/Cell > Neigh Freq Settings (RTS/RTD)

Field Name	Description
TDD Mode	Select a chip rates (bps) to spread the signal: UTRA_TDD_128, UTRA_TDD_384, or UTRA_TDD_768.
Bands	Channels in which the TD-S neighbor eNB operates. Options are A, B, C, D, E, or F.
UARFCN	In short, this is the frequency point of the neighboring eNB's frequency. Range is 9504 to 9596 Mhz, or 10054 to 10121MHz. The acronym stands for Universal Mobile Telecommunications System (UMTS) Absolute Radio Frequency Channel Number.
Q-RxLevMin	Minimum received signal level at which a UE will detect a neighboring eNB's signal. The range is -60 to -13 dBm.
Resel Prior	Priority of cell reselection to cells at this frequency. Range is 0-7.
Resel Thresh High	The cell reselection threshold for a higher priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has a higher cell reselection priority than the serving cell). Range is 0-31.
Resel Thresh Low	The cell reselection threshold for a lower priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has an absolute priority lower than the serving cell). Range is 0-31.
P-Max	The maximum transmit power UEs in this cell are allowed to use uplink. Range: -50 to -33 dB.
Q-Offset	Indicates the difference in signal level between the serving and neighboring eNBs, as determined by the received signal level at the UE. If the received signal level is better from a neighboring eNB by at least this amount of difference in dB, the UE will reselect the

Field Name	Description
	other cell. The range is -15 to 15 dB.

2.9.3.2 TD-S Neigh Cell Table

Under *Neigh Cell Table*, click on the **+** (Add) icon. This will open the *Neigh Cell Settings* window, as shown in Figure 2-66 and described in Table 2-26. You can configure up to 5 cell tables.

Figure 2-66: TD-S Freq/Cell > Neigh Cell Settings (RTS/RTD)

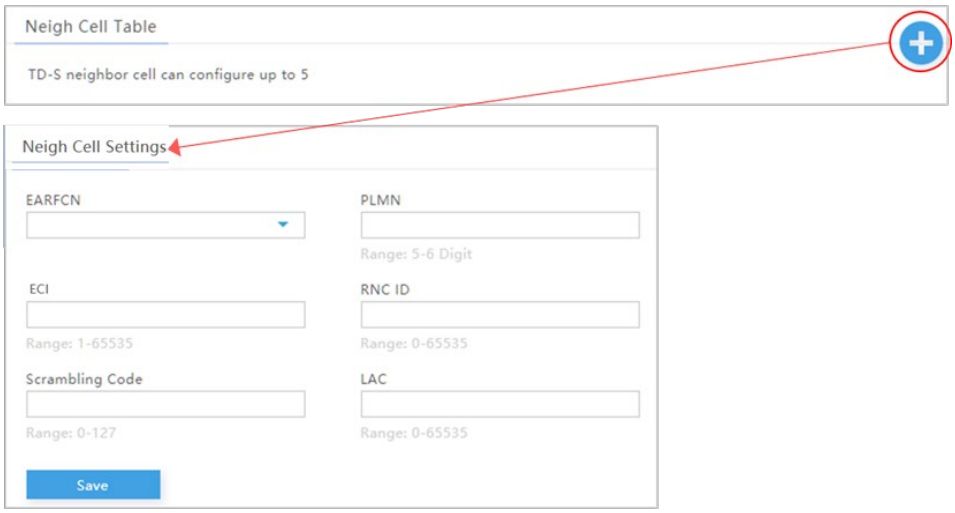


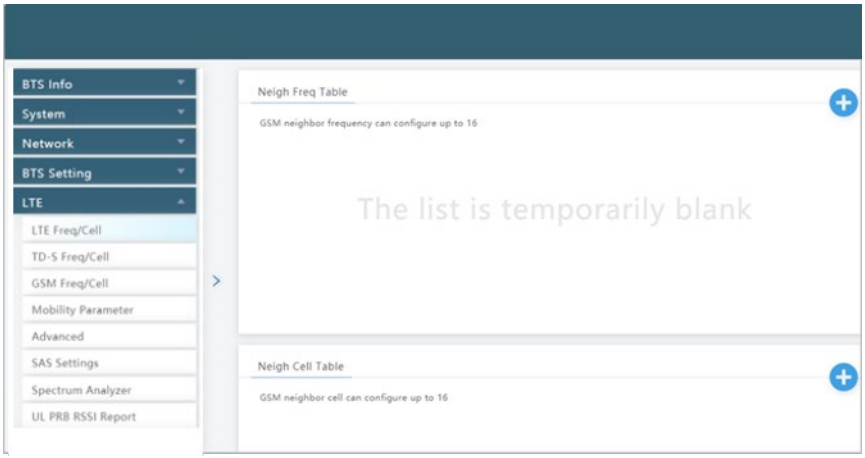
Table 2-26: TD-S Freq/Cell > Neigh Cell Settings (RTS/RTD)

Field Name	Description
EARFCN	Display of the frequency point of the neighboring eNB's cell.
PLMN	The Public Land Mobile Network (PLMN) the neighbor cell belongs to. Range is 5-6 digits.
ECI	The cell ID of the neighbor cell. Range is 0-268,435,455. The cell ID + the eNB ID x 256 comprises the E-UTRAN Cell Identity (ECI), which identifies a cell site in the network.
RNC ID	The neighbor cell's Radio Network Controller (RNC) ID. Range is 0-65,535.
Scrambling Code	The scrambling code assigned to this neighbor cell. Range is 0-127. The scrambling code is unique to each eNB and is used to distinguish one eNB's data from another eNB's data.
LAC	Location Area Code (LAC) of the neighbor cell. Range is 0-65,535.

2.9.4 GSM Freq/Cell

Using the *GSM Freq/Cell* sub-menu (Figure 2-67), you can configure parameters related to how adjacent eNBs operating with GSM technology work with the Baicells LTE eNB that you are configuring. You will define for the Baicells eNB how to deal with any neighboring GSM eNBs. You can configure up to 16 adjacent GSM eNB frequency tables and 16 cell tables.

Figure 2-67: GSM Freq/Cell (RTS/RTD)



2.9.4.1 GSM Neigh Freq Table

Under *GSM Neigh Freq Settings*, click on the **+** (Add) icon. This will open the *Neigh Freq Settings* window, as shown in Figure 2-68 and described in Table 2-27. Please note that even though some of the field names are the same as in the LTE Neigh Freq Table, in some cases the ranges for GSM are different.

Figure 2-68: GSM Freq/Cell > Neigh Freq Settings (RTS/RTD)

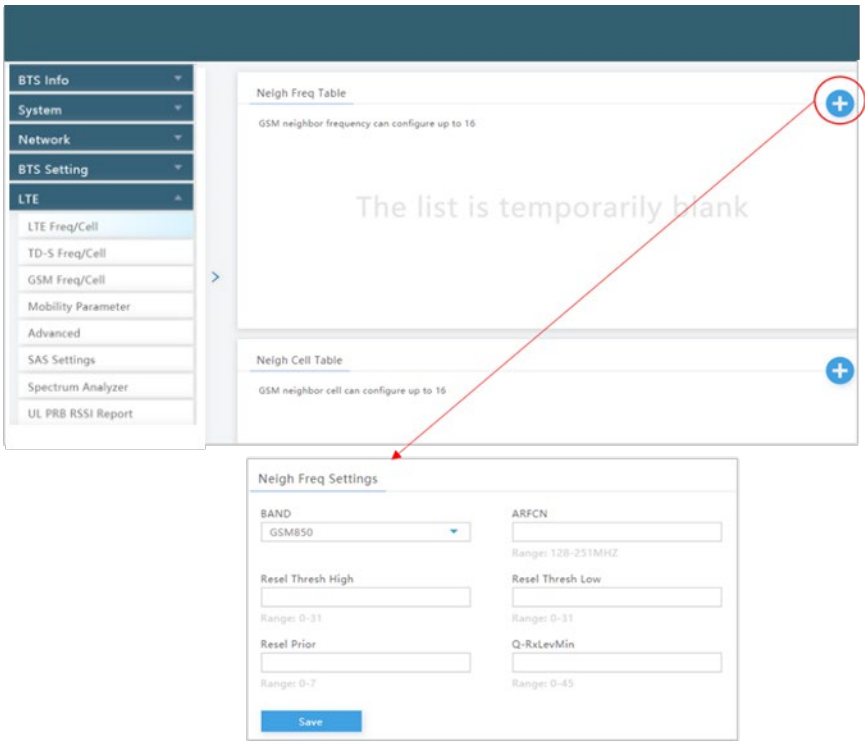


Table 2-27: GSM Freq/Cell > Neigh Freq Settings (RTS/RTD)

Field Name	Description
BAND	Channel in which the GSM neighbor eNB operates: GSM850, GSM900, DCS1800, or PCS1900.
ARFCN	In short, this is the frequency point of the neighbor eNB's frequency. Range is 128-251MHz. The acronym stands for Absolute Radio Frequency Channel Number.
Resel Thresh High	The cell reselection threshold for a higher priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has a higher cell reselection priority than the serving cell). The range is 0-31.
Resel Thresh Low	The cell reselection threshold for a lower priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has an absolute priority lower than the serving cell). The range is 0-31.
Resel Prior	Priority of cell reselection to cells at this frequency. The range is 0-7.
Q-RxLevMin	The minimum received signal level at which a UE will detect a neighboring eNB's signal. The range is 0-45 dBm.

2.9.4.2 GSM Neigh Cell Table

Under *Neigh Cell Table*, click on the **+** (Add) icon. This will open *Neigh Cell Settings* window, as shown in Figure 2-69 and described in Table 2-28.

Figure 2-69: GSM Freq/Cell > Neigh Cell Settings (RTS/RTD)

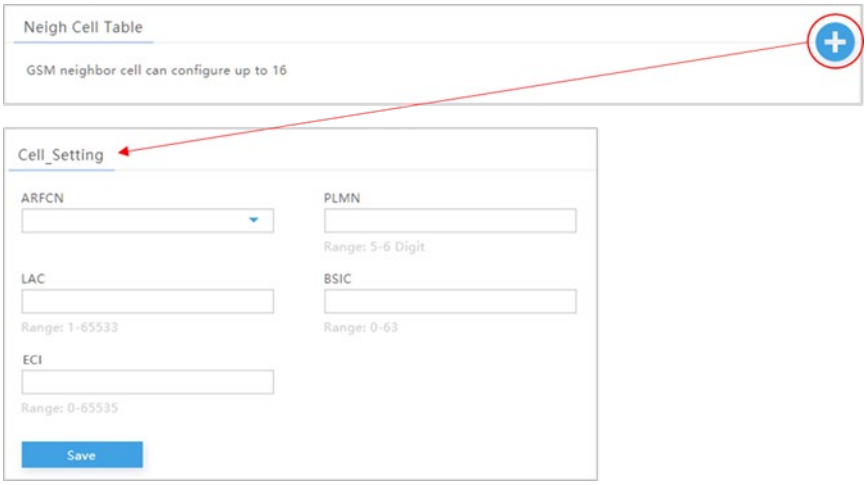


Table 2-28: GSM Freq/Cell > Neigh Cell Settings (RTS/RTD)

Field Name	Description
ARFCN	Display of the frequency point of the neighbor eNB's frequency.
PLMN	The Public Land Mobile Network (PLMN) the neighbor cell belongs to. Range is 5-6 digits.

Field Name	Description
LAC	Location Area Code (LAC) of the neighbor cell
BSIC	Base station identification code (BSIC) of the neighbor cell
ECI	The cell ID of the neighbor cell. Range is 0-268,435,455. The cell ID + the eNB ID x 256 comprises the E-UTRAN Cell Identity (ECI), which identifies a cell site in the network.

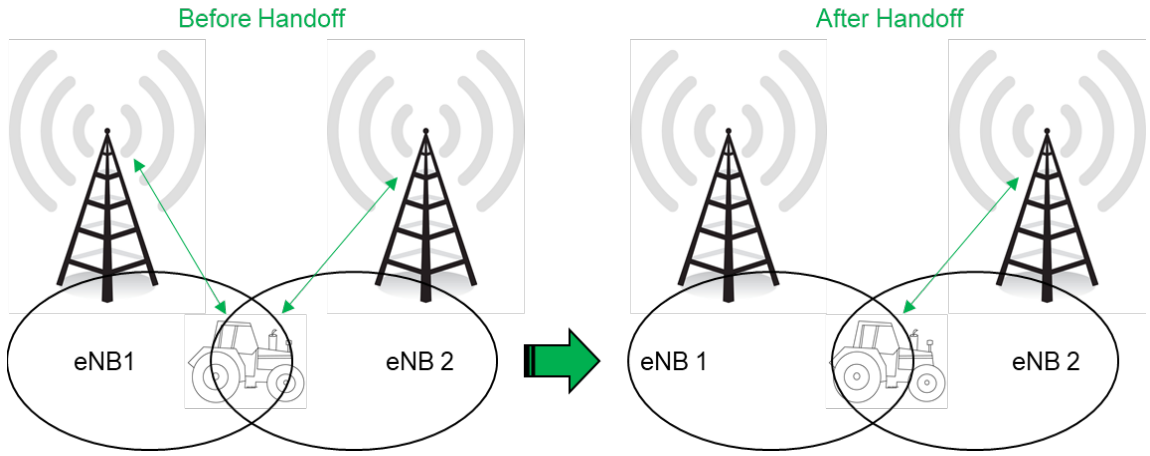
2.9.5 Mobility Parameter

The *Mobility Parameter* menu pertains to how roaming UE sessions are handled between different eNBs in the same service area. When a UE is actively connected to an eNB, the current eNB is referred to as the serving eNB or cell. The other eNBs in the area are referred to as either neighbor or target eNBs or cells.

The process of a device moving from cell to cell and changing over from its serving eNB to a neighbor (target) eNB is called handoff or handover. The UE exchanges information with its serving eNB to perform cell selection and reselection based on parameters which you will set for each eNB. Refer to Figure 2-70.

NOTE 1: The terms handoff and handover are used interchangeably in LTE.
NOTE 2: Handoff is not supported at this time on an eNB operating in HaloB mode.
NOTE 3: Cloud EPC cannot perform handoffs currently.

Figure 2-70: Handoff (RTS/RTD)



What the UE measures that determines cell selection and reselection is the Reference Signal Received Power (RSRP) of the serving as well as neighboring eNBs. The measurements are sent periodically to the serving eNB, which then determines if the UE would be better served by an adjacent eNB. Refer to the case study in section 2.11 Real-World LTE to LTE Handoff Configuration Example.

The default settings in the *Mobility Parameter* sub-menus represent standard LTE deployments. Many of the mobility settings should be left with their default values. Any modification should be determined only by experienced wireless professionals.

Figure 2-71 shows the sub-menus for the mobility parameters. In terms of LTE to LTE handoff, only the *A1*, *A2, A3*, *A5*, *Measurement Control*, *Cell Selection Parameter*, and *Cell ReSelection Parameter* fields are used. The *B2 Event Thresholds* pertain only to TD-SCDMA and GSM adjacent cells, not to adjacent LTE cells.

You will configure these mobility parameters for every adjacent eNB. If the serving eNB determines that more than one adjacent eNB meets the RSRP event thresholds, the *Cell Reselection* settings will determine to which adjacent eNB the serving eNB would hand off.

To begin the configuration, next to *A1 Event Threshold* and the other event thresholds, select the **+** icon. The resulting window presents the fields for each sub-menu: *A1, A2, A3,* and *A5 Event Threshold* (Figure 2-72). The configuration values in the figure are the recommended settings for the eNB in this operator example. Table 2-29 describes each of the event threshold fields.

Figure 2-71: Mobility Parameters (RTS/RTD)

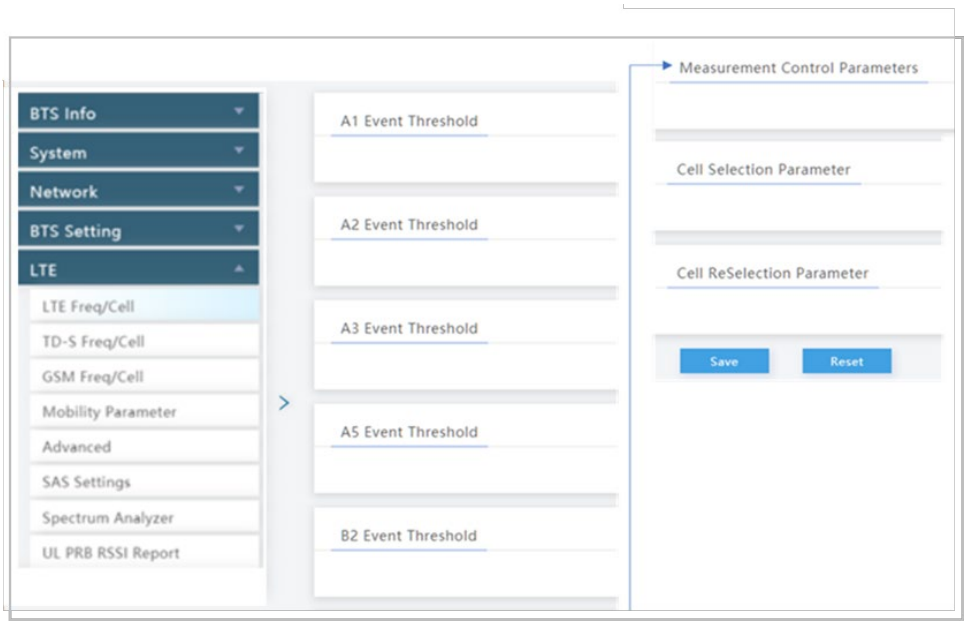


Figure 2-72: A1, A2, A3, and A5 Event Thresholds (RTS/RTD)

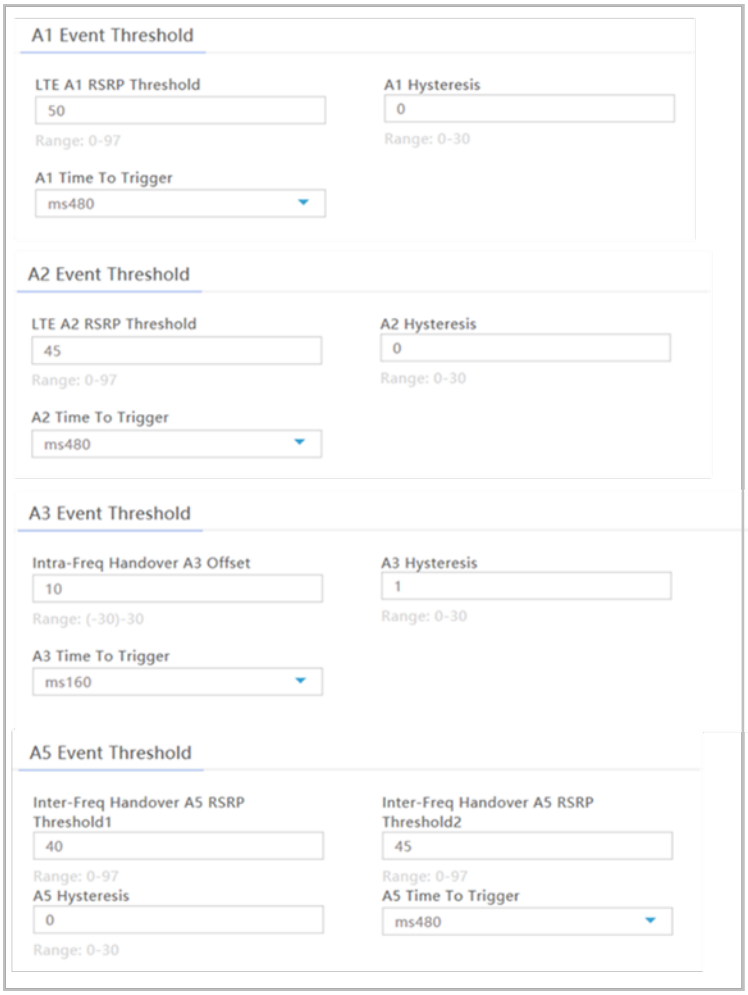


Table 2-29: A1, A2, A3, and A5 Event Threshold Fields (RTS/RTD)

Field Name	Description
A1 Event Threshold	
LTE A1 RSRP Threshold	The LTE A1 event is triggered when the serving cell's Reference Signal Received Power (RSRP) becomes better than the A1 threshold. The A1 event can be used to turn off certain inter-cell measurements. Range is 0-97 (integer). Default value is 90. In this example, the recommended value is 45 (integer), which means -140 dBm + 45 = -95 dBm.
A1 Hysteresis	Specifies the entering (A1-1) and leaving (A1-2) conditions for A1 events. Default is 1 dBm. Range: 0 - 30 dBm
A1 Time To Trigger	The period of time that specific criteria for the A1 event are met in order to trigger a measurement report. Default is ms160.
A2 Event Threshold	
LTE A2 RSRP Threshold	The LTE A2 event is triggered when the serving cell's Reference Signal Received Power

Field Name	Description
	(RSRP) becomes worse than the A2 threshold. Range is 0-97 dB. The default is 65. In this example, the recommended value is 40 (integer), which means -140 dBm + 40 = -100 dBm. Refer to the Baicells Tip concerning A2 settings: *https://www.facebook.com/groups/baicellsoperatorsupportgroup/permalink/1760449424249426/*
A2 Hysteresis	Specifies the entering (A2-1) and leaving (A2-2) conditions for A2 events. Default is 1 dBm. Range: 0 - 30 dBm
A2 Time To Trigger	The period of time that specific criteria for the A2 event are met in order to trigger a measurement report. Default is ms160.
A3 Event Threshold	
Intra-Freq Handover A3 Offset	The LTE A3 event is triggered when a neighbor cell becomes better than the serving cell by as much as the offset value. The offset can be either positive or negative. Range is -30 dB to 30 dB. The default is 10. In this example, the recommended value also is 10 (integer), which means 10*0.5 = 5 dB.
A3 Hysteresis	Specifies the entering (A3-1) and leaving (A3-2) conditions for A3 events. Default is 1 dBm. Range: 0 - 30 dBm
A3 Time To Trigger	The period of time that specific criteria for the A3 event are met in order to trigger a measurement report. Default is ms160.
A5 Event Threshold	
Inter-Freq Handover A5 RSRP Threshold 1	The LTE A5 event is triggered when the serving cell becomes worse than Threshold 1 while a neighbor cell becomes better than Threshold 2. Range is 0-97 (integer). The default is 70. In the example, the recommended value is 40 (integer): equals -140 dBm + 40 = -100 dBm.
Inter-Freq Handover A5 RSRP Threshold 2	Range is 0-97 (integer). The default is 65. In this example, the recommended value is 45 (integer), which equals -140 dBm + 45 = -95 dBm.
A5 Hysteresis	Specifies the entering (A5-1) and leaving (A5-2) conditions for A5 events. Default is 1 dBm. Range: 0 - 30 dBm
A5 Time To Trigger	The period of time that specific criteria for the A5 event are met in order to trigger a measurement report. Default is ms480. Range: ms0 - ms5120

The *B2 Event Threshold* pertains only to TD-SCDMA and GSM adjacent cells, not to adjacent LTE cells. The *B2 Event Threshold* fields are shown in Figure 2-73 and described in Table 2-30.

Figure 2-73: B2 Event Threshold (RTS/RTD)

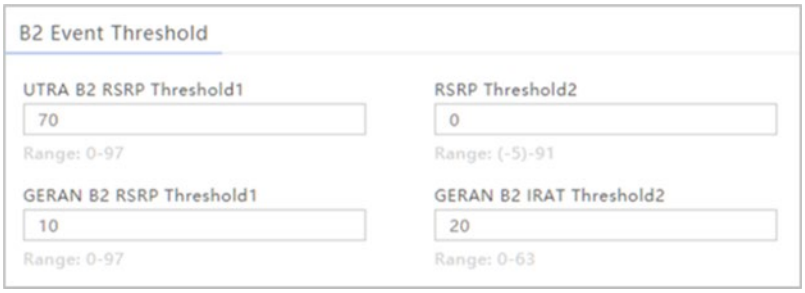


Table 2-30: B2 Event Threshold Fields (RTS/RTD)

Field Name	Description
UTRA B2 RSRP Threshold 1	Threshold 1 field of the UTRA Time Domain Scheduling (TDS) based B2 event. Range is 0-97 dB. Default is 70 dB.
RSRP Threshold 2	Threshold 2 field of the Reference Signal Received Power (RSRP) based B2 event. Range is -5 dB to 91 dB. The default is 0.
GERAN B2 RSRP Threshold 1	Threshold 1 field of the GSM Edge Radio Access Network (GERAN) B2 event based on Reference Signal Received Power (RSRP). Range is 0-97 dB. Default is 10 dB.
GERAN B2 IRAT Threshold 2	Threshold 2 field of the GSM Edge Radio Access Network (GERAN) B2 event, based on Inter-Radio Access Technology (IRAT). Range is 0-63 dB. The default is 20.

The Measurement Control parameters determine how frequently the UE measures the serving and neighboring eNBs' RSRP values and at what level of hysteresis-based RSRP triggers a handoff (Figure 2-74 and Table 2-31). The UE evaluates the RF conditions around it and reports the information to the serving eNB. The eNB's radio resource management function evaluates the measurements and determines whether or not to hand off the session to a neighbor eNB. The parameters shown in the figure reflect the recommended settings for this operator example.

Figure 2-74: Measurement Control Parameters (RTS/RTD)

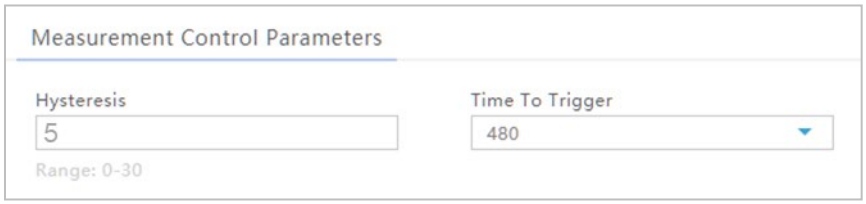


Table 2-31: Measurement Control Fields (RTS/RTD)

Field Name	Description
Hysteresis	Refers to the hysteresis (historical records) of the handover measurement events. The value is used to avoid the frequent triggering of cell handover evaluation due to the fluctuation in wireless signals. This setting tells the UE, if you hear another eNB with at least this amount of dB better, initiate a handover. The lower the number the sooner the handover is initiated. If set too low, it may cause the UE to ping-pong between eNBs. Such events are tracked by the

Field Name	Description
	EPC, but not by the eNB. Range is 0-30 dB. The default is 0. In this example, the recommended value is 5 dB.
Time To Trigger	Length of time the target cell RSRP value is better than the serving cell before the UE initiates a handover request. The range is 0-5120 ms. The default is ms480 (recommended). Range: ms0 - ms5120.

The *Cell Selection Parameter* and *Cell ReSelection Parameter* sub-menus are shown in Figure 2-75 and described in Table 2-32. The parameters shown in the figure reflect the settings recommended in this example.

Figure 2-75: Cell Selection and Cell ReSelection Parameters (RTS/RTD)

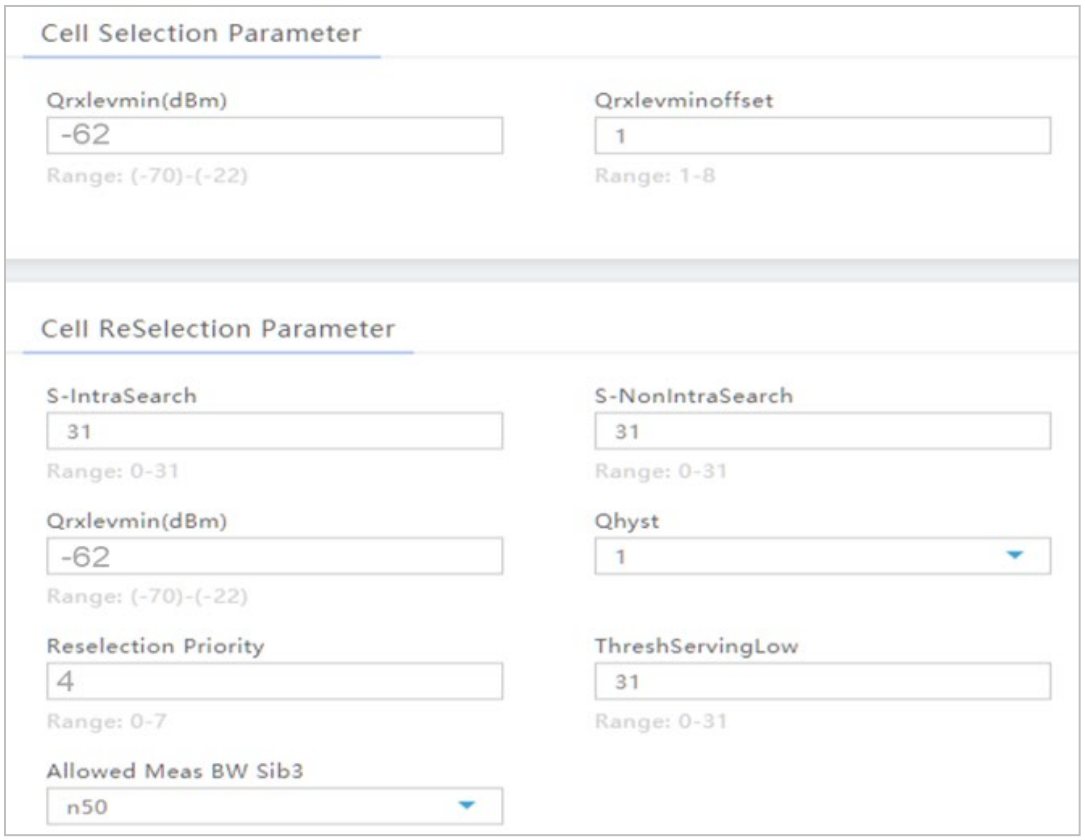


Table 2-32: Cell Selection and Cell ReSelection Fields (RTS/RTD)

Field Name	Description
Cell Selection Parameter	
Qrxlevmin(dBm)	Minimum acceptable signal level at the UE before cell selection. Range is -70 dBm to -22 dBm. The default is -60. In this example, the recommended value is -62 dBm. The value will be this number x 2, e.g., if set to -60 the value will actually be -120 dBm, minus the offset.

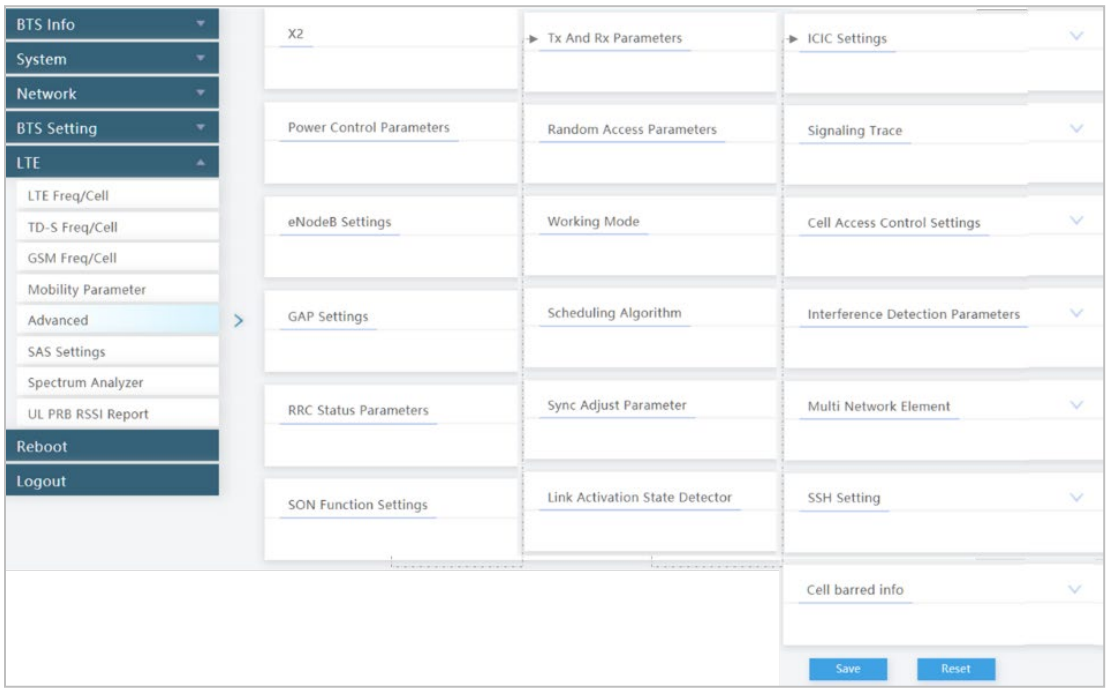
Field Name	Description
Qrxdevminoffset	Minimum level offset (difference) in RSRP at the UE needed for cell selection. Range is 1-8 dB. The default is 1. In this example, the recommended value is 1 dB.
Cell ReSelection Parameter	
S-IntraSearch	Intra-band measurement threshold that must be met before the UE will reselect a neighbor eNB. Range is 0-31 (integer). In this example, the recommended value is 31 (integer), which means 31*2 = 62 dB.
S-NonIntraSearch	Inter-band measurement threshold that must be met before the UE will reselect a neighbor eNB. Range is 0-31 (integer). In this example, the recommended value is 31 (integer), which means 31*2 = -62 dB.
Qrxlevmin(dBm)	Minimum level for reselection. Range is -70 to -22 (integer). In this example, the recommended value is -62 (integer), which means -62*2 = -124 dBm.
Qhyst	Delay time for reselection. Range is 0-24 dB. In this example, the recommended value is 1 dB.
Reselection Priority	Priority for reselection. Range is 0-7 (integer). In this example, the recommended value is 4.
ThreshServingLow	Threshold for selection to cells of lower priority. Range is 0-31 dB. In this example, the recommended value is 31 dB.
Allowed Meas BW Sib3	Measurement bandwidth allowed. Choices are n15, n25, n50, n75, or n100. The default value is n50.

2.9.6 Advanced

Caution: Many, if not all, of the *Advanced* settings should be left with their default values. Any modifications should be determined only by experienced wireless professionals.

The Advanced settings are primarily used to fine-tune the RF settings and to configure special features. Figure 2-76 shows the LTE > Advanced sub-menus which are explained in this section.

Figure 2-76: Advanced (RTS/RTD)



2.9.6.1 X2

An X2 interface is a logical interface which may be enabled for intra-LTE eNB handovers when the Mobility Management Entity (MME) being used for the UE is the same for both the serving and the target eNB. If enabled, the two eNBs can communicate directly with one another without communicating through a radio network controller (RNC). The X2 starts buffering on the target eNB in advance of a handover.

By default, the *X2* interface parameter is disabled. The recommended setting is *Enable*. To enable X2, select *Enable* from the pulldown menu (Figure 2-77).

Figure 2-77: X2 (RTS/RTD)

2.9.6.2 Power Control Parameters

The *Power Control Parameters* help to limit UE transmit power to the eNB being configured, including the power of the transmitted reference signals. The parameters factor into the overall RF link budget. The power control parameters are shown in Figure 2-78 and described in Table 2-33.

Figure 2-78: Power Control Parameters (RTS/RTD)

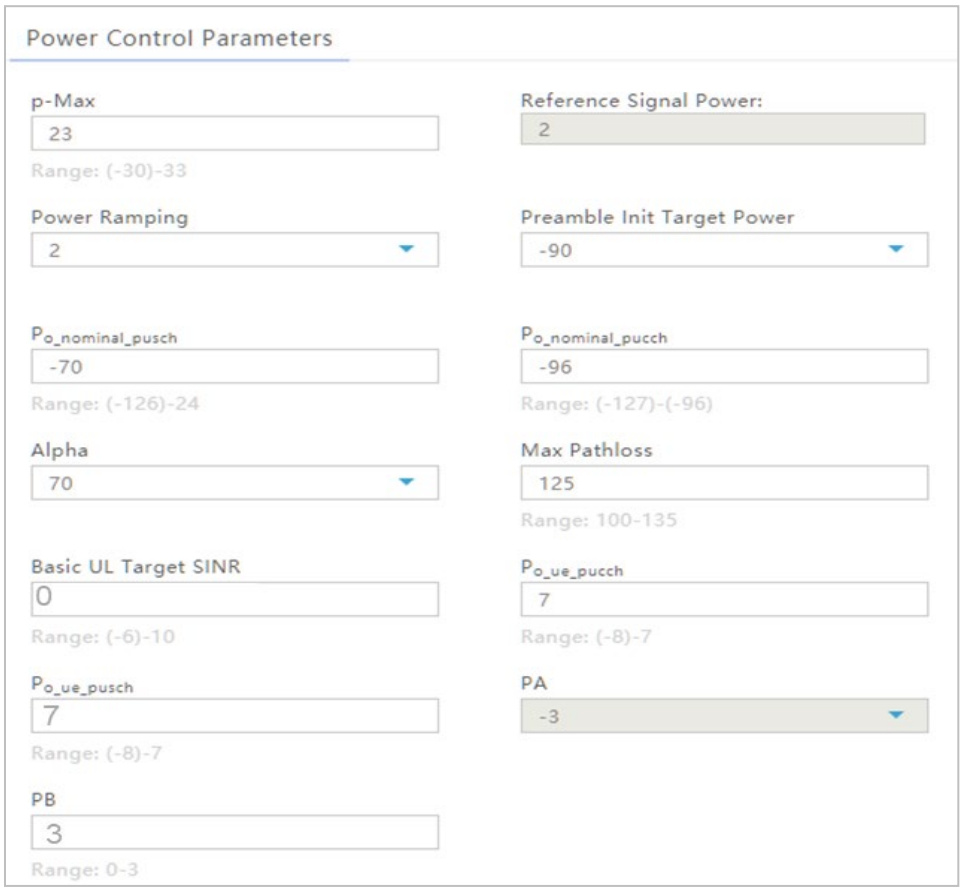


Table 2-33: Power Control Parameters (RTS/RTD)

Field Name	Description
p-Max	The maximum power that a UE can transmit in this cell. Range is -30 dB to 33 dB.
Reference Signal Power	Transmit power of the reference signals. Auto-set to 2.
Power Ramping	Step size of the Physical Random-Access Channel's (PRACH's) power index broadcast to the UEs via a Layer 1 channel used by UEs to access the mobile network for call setup and bursty data transmission. Options are 0, 2, 4, or 6.
Preamble Init Target Power	Initial power of the Physical Random-Access Channel (PRACH). Range is -90 to -120.
Po_nominal_pusch	Physical Uplink Shared Channel (PUSCH) carries user data. It supports Quadrature Phase Shift Keying (QPSK) and 16 Quadrature Amplitude Modulation (QAM), with 64QAM being optional. Range is -126 to 24 dB.
Po_nominal_pucch	Physical Uplink Control Channel (PUCCH) is used to carry Uplink Control Information (UCI). LTE UEs can never transmit both PUCCH and Physical Uplink Shared Channel (PUSCH) during the same subframe. Range is -127 to -96 dB.
Alpha	Power control loss compensation factor, which controls the UE power. Range is 0 to 100.

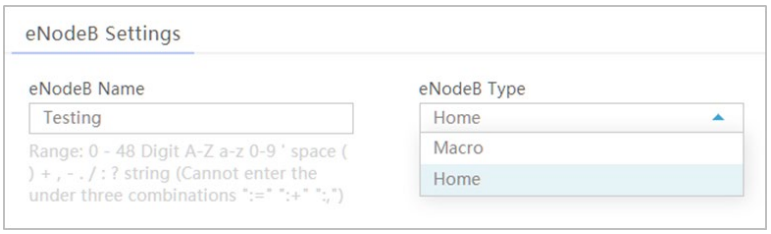
Field Name	Description
Max Pathloss	Maximum threshold at which the UE determines not to transmit to the eNB based on pathloss. Pathloss is the difference between the transmitted reference signal information and the actual received signal power. Range is 100 to 135.
Basic UL Target SINR or Target ul sinr	Desired Signal-to-Interference-Plus-Noise Ratio (SINR) level to ensure an acceptable level of communication between the UE and eNB, while also controlling interference that might be caused to neighboring cells. Range is -6 dB to 10 dB.
Po_ue_pucch	Initial UE transmit power when using Physical Uplink Control Channel (PUCCH). Range is -8 dB to 7 dB.
Po_ue_pusch	Initial UE transmit power when using Physical Uplink Shared Channel (PUSCH). Range is -8 dB to 7 dB.
PA	Physical Downlink Shared Channel (PDSCH) is the main data bearing channel. Power boosting the reference signal is allocated to UEs on a dynamic and opportunistic basis. The relative PDSCH power is determined by two computed parameters: P_A and P_B. Traffic loading must be balanced with controlling interference to neighboring cells. Auto-set to -3.
PB	See description for field “PA”. Range is 0-3.

To optimize channel conditions on the eNB, please refer to the BaiTip posted on the Baicells website: *https://community.na.baicells.com/t/recommened-advanced-settings-on-the-enb-to-optimise-channel-conditions/531*

2.9.6.3 eNodeB Settings

The *eNodeB Settings* sub-menu is used to name the eNB you are configuring and to select the eNB type, as shown in Figure 2-79. For the name, the types of characters and length of the name that may be used are provided in the figure. For type, choose either *Macro* or *Home*. "Macro" means the eNB is covering a large cell area and the transmission power is on the higher end of the power range. "Home" means the eNB's transmission power is much lower than Macro and covers a much smaller area.

Figure 2-79: eNodeB Settings (RTS/RTD)



2.9.6.4 GAP Settings

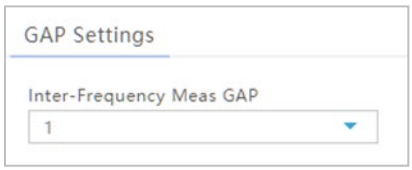
The Inter-Frequency Measurement Gap (*Inter-Frequency Meas GAP*) field pertains to how a UE measures the signal quality of a neighbor cell that is operating at a different frequency from the serving cell. The gap

settings parameter (Figure 2-80) creates a time gap during which the UE will not receive or transmit with the serving cell. It will switch its frequency to the target cell and perform a measurement of signal quality before coming back to the serving cell.

The Baicells eNB radio resource control (RRC) gap may be set to 1 or 2, where:

- 1 is a GAP measurement period of 40 ms (default)
- 2 is a GAP measurement period of 80 ms

Figure 2-80: GAP Settings (RTS/RTD)



2.9.6.5 RRC Status Parameters

Under Radio Resource Control Status (*RRC Status Parameters*), you will configure parameters related to how the RRC protocol in the air interface control plane establishes, maintains, and releases an RRC connection between UEs and the eNB. If the *Ue Inactivity Timer* is set to 0, the timer does not take effect. The UE inactive status duration is equal to the RRC inactivity timer times the maximum expiry count. Refer to Figure 2-81 and Table 2-34.

Figure 2-81: RRC Status Parameters (RTS/RTD)

Table 2-34: RRC Status Parameters (RTS/RTD)

Field Name	Description
Ue Inactivity Timer	Expire time of the UE inactive status timer(s). Range is 0-4294967 seconds. If set to 0, the timer does not take effect.
Max Expiry Count	Maximum number of times the UE's inactive status timer expires. The range is 1-65,535 times.

2.9.6.6 SON Function Settings

The Self-Organizing Network (SON) Function Settings refer to standards-based automation technology designed to make the planning, configuration, management, optimization, and recovery of mobile radio access networks (RANs) simpler and faster. When enabled, the eNB will auto-configure these mobility related values. Refer to Figure 2-82 and Table 2-35.

Figure 2-82: SON Function Settings (RTS/RTD)

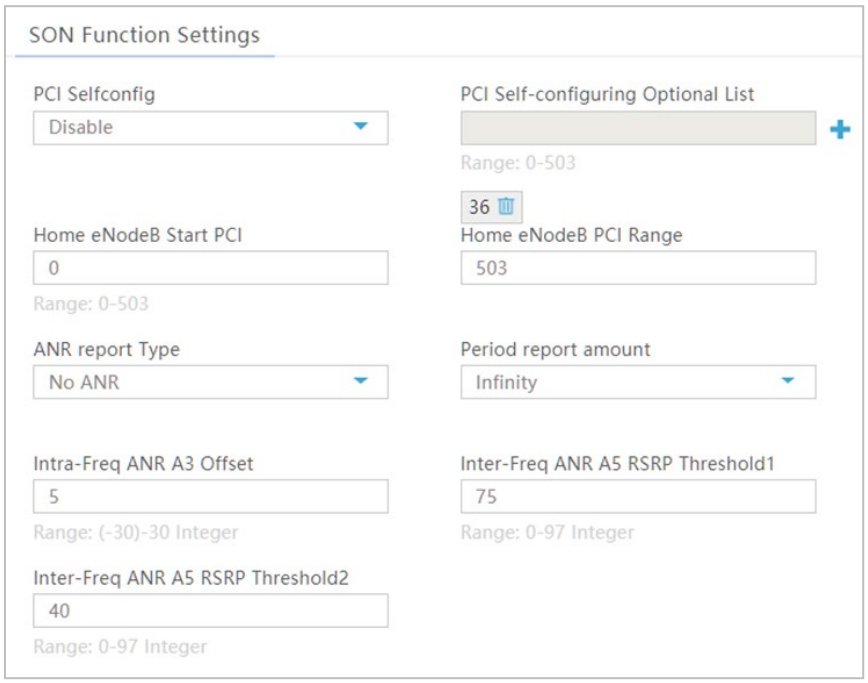


Table 2-35: SON Function Settings (RTS/RTD)

Field Name	Description
PCI Selfconfig	Enable or disable self-configuration of the eNB Physical Cell Identifier (PCI) and other RF settings. Default: Disable
PCI Self-configuring Optional List	The Physical Cell Identifier (PCI) numbers to use. Enter each PCI number, and click the **+** (Add) icon. The range is 0-503. To remove a PCI number, select the Remove button.
Home eNodeB Start PCI	Starting PCI number. Range is 0-503. Default is 0.
Home eNodeB PCI Range	The last PCI number that may be used. Range is 0-503. Default is 503.
ANR report Type	Automatic Neighbor Relation trigger: No ANR (default), STRONG CELL, or INTRA&INTER
Period report amount	Specifies the number of measurement reports applicable for the event threshold period. Options are r1, r2, r4, r8, r16, r32, r64, and Infinity (default)
Intra-Freq ANR A3 Offset	The offset of Automatic Neighbor Relation (ANR) A3 event for intra-frequency handover. The offset can be either positive or negative. Range is -30 dB to 30 dB.
Inter-Freq ANR A5 RSRP Threshold 1	The threshold 1 of Automatic Neighbor Relation (ANR) A5 event for inter-frequency handover. Range is 0-97 (integer).
Inter-Freq ANR A5 RSRP Threshold 2	The threshold 2 of Automatic Neighbor Relation (ANR) A5 event for inter-frequency handover. Range is 0-97 (integer).

2.9.6.7 Tx And Rx Parameters

The Transmit (Tx) and Receive (Rx) Parameters *PHY RXGAIN* field controls how much RF signal gain UEs will have in the uplink. **Do not modify this field.** The range is -48 to 48 dB. Refer to Figure 2-83.

Figure 2-83: Tx and Rx Parameters (RTS/RTD)

2.9.6.8 Random Access Parameters

The preamble format to be used in a specific cell is messaged from the eNB to the UEs using a Physical Random-Access Channel (PRACH) configuration index. The UE uses the preamble to access the network when it is first powered on. The settings for *Random Access Parameters* are shown in Figure 2-84 and explained in Table 2-36.

Figure 2-84: Random Access Parameters (RTS/RTD)

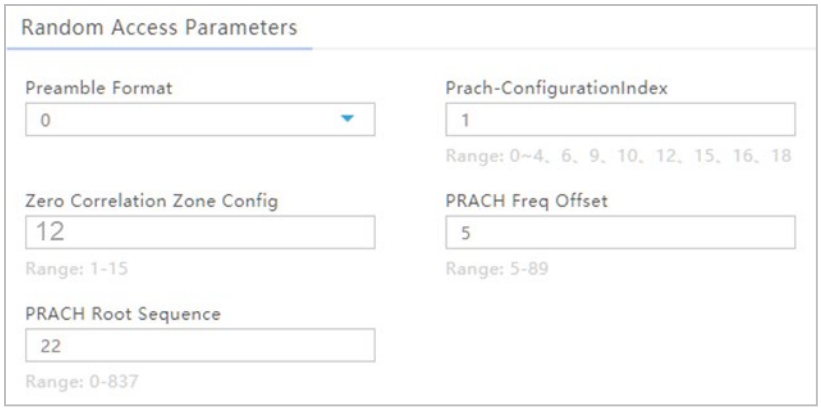


Table 2-36: Random Access Parameters (RTS/RTD)

Field Name	Description
Preamble Format	Packet preamble format [based on the Physical Random-Access Channel (PRACH) index] to be used for this cell and communicated to UEs. Options are 0, 2, or 4.
Prach-Configuration Index	The PRACH configuration index number that will be broadcast to the UEs via SIB2. Options are: 0, - 4, 6, 9, 10, 12, 15, 16, or 18.
Zero Correlation Zone Config	Specifies the cyclic shift intervals to generate the preamble sequence. Range is 0-15 in the standard eNB GUI. The range is 0-63. Default is 10. Refer to the BaiTip on this setting: *https://community.na.baicells.com/t/baitip-of-the-day-december-14th-2016-subframes-and-special-subframes/163*
PRACH Freq Offset	Determines the location of the PRACH preamble in the frequency domain. Range: 5 - 89

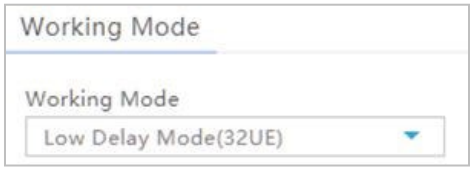
Field Name	Description
PRACH Root Sequence	Index broadcast by the eNB and used by UEs to calculate the preamble they should use to attach to the eNB. The default value is 12. Range: 0 - 837.

2.9.6.9 Working Mode

The *Working Mode* allows you to configure the maximum* number of simultaneous, connected users or limit it to service a maximum of 32 users, called Low Delay Mode (Figure 2-85). When this value is set to *Low Delay Mode(32UE)*, fewer users will be served but will have more capacity than when the value is set to handle the maximum of 96 users. Otherwise, select *Multi-user Mode(96UE)* to support the highest possible number of users.

*NOTE: The maximum number of users depends on eNB model, software version, and operating mode.

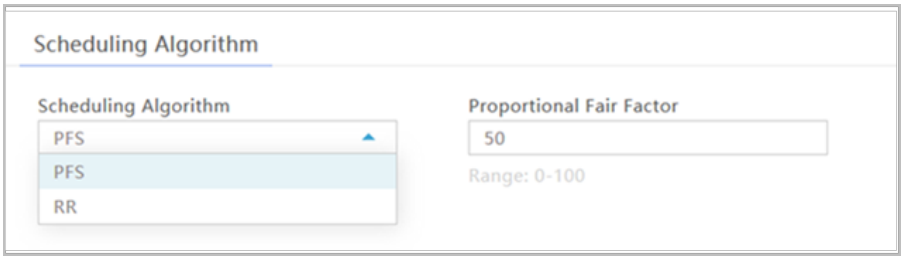
Figure 2-85: Working Mode (RTS/RTD)



2.9.6.10 Scheduling Algorithm

The *Scheduling Algorithm* fields are important for smooth RF operation and can impact key performance indicators such as cell throughput, cell edge users, Voice Over IP (VoIP) capacity, and data Quality of Service (QoS). Two scheduling strategies are available: Round Robin (RR) and Proportionally Fair Scheduling (PFS). The most common scheduling strategy is Round Robin, which is the default type for both UL and DL. Round Robin scheduling allocates resources to all UEs equally, and neither QoS nor memory is considered. Proportionally Fair Scheduling balances between user channel quality and fairness, where both cell throughput and user fairness are considered and will give higher priority to UEs with good channel quality and low average data rate. When scheduling algorithm PFS is selected, the "Proportional Fair Factor" must be set. The range is 0 to 100 and can be adjusted to fine-tune this priority balance. A higher fairness factor value will result in greater eNB aggregate throughput as UEs with better modulation will have higher priority, whereas a lower value will provide less weight/priority to the high SINR users. A value of 0 would be similar to the RR scheduler, providing equal fairness to all UE. Refer to Figure 2-86.

Figure 2-86: Scheduling Algorithm (RTS/RTD)



2.9.6.11 Sync Adjust Parameter

The *Sync Adjust Parameter* helps the system to compensate for packet delay in the uplink and downlink. **Do not modify these fields**. Refer to Figure 2-87 and Table 2-37 concerning these settings.

Figure 2-87: Sync Adjust Parameter (RTS/RTD)

Table 2-37: Sync Adjust Parameter (RTS/RTD)

Field Name		Description
GPS or 1588 Sync Adjust Value		Default is 0 µs. Range: -2000 to 2000 µs
ICTA Adjust Value		Industry Council for Tangible Assets (ICTA) Adjust Value Default is 0 µs. Range: -2000 to 2000 µs

2.9.6.12 Link Activation State Detector

The *Link Activation State Detector* is used to enable or disable a link watchdog. If you select *Enable*, a watchdog action will check the UE every "x" minutes to see if it is connected or disconnected from the EPC, LAN, or both, and if disconnected after "x" number of minutes the watchdog will perform a warm reboot the UE. If you select *Disable*, the watchdog will not reboot the UE. Refer to Figure 2-88 and Table 2-38.

Figure 2-88: Link Activation State Detector (RTS/RTD)

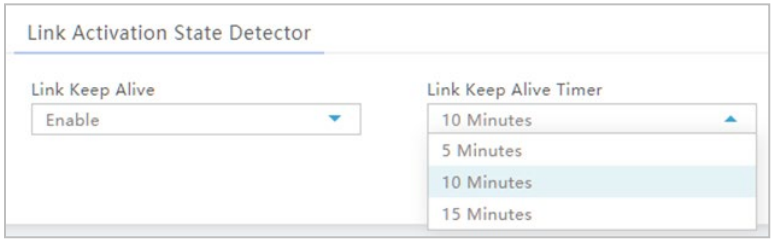


Table 2-38: Link Activation State Detector (RTS/RTD)

Field Name	Description
Link Keep Alive	Enable/disable the link activation state detector between the UE and EPC, LAN, or both
Link Keep Alive Timer	Select 5, 10, or 15 minutes for the link keep alive timer. 5 minutes is the default.

2.9.6.13 ICIC Settings

In LTE, Inter-Cell Interference Coordination (ICIC) reduces inter-cell interference by having UEs that are at the same cell edge but attached to different cells use different frequency resources. This is typical for roaming scenarios and sometimes PCI conflicts.

To enable ICIC among adjacent eNBs, go to Advanced > ICIC Settings and enable *Single Frequency Reuse* (Figure 2-89). In most cases you will accept the default values of the other fields, which are described in Table 2-39.

Figure 2-89: ICIC Settings (RTS/RTD)

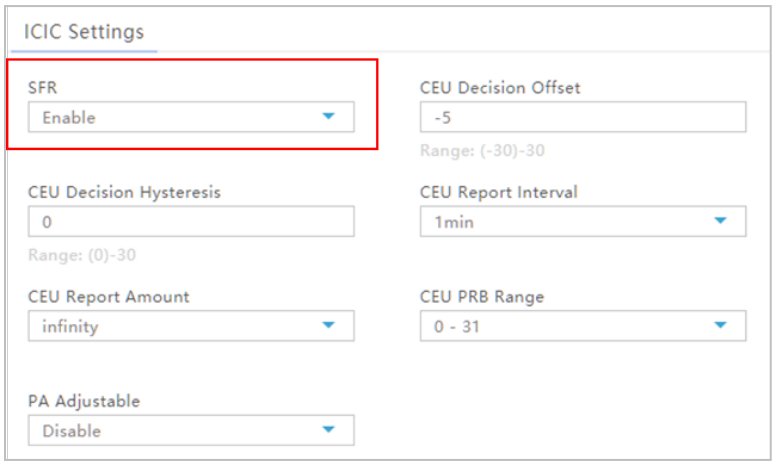


Table 2-39: ICIC Settings (RTS/RTD)

Field Name	Description
SFR	Enable/Disable Single Frequency Reuse
CEU Decision Offset	Common Equipment Unit (CEU) frequency offset. Range is -30 to 30 dB.
CEU Decision Hysteresis	CEU hysteresis threshold. Range is 0-30.
CEU Report Interval	CEU reporting interval, in milliseconds or minutes. Default is 1 min. Options: 120ms, 240ms, 480ms, 640ms, 1024ms, 2048ms, 5120ms, 10240ms, 1min, 6min, 12min, 30min, 60min
CEU Report Amount	Limit number of CEU reports per reporting period (integer). Default is Infinity. Options: r1, r2, r4, r8, r16, r32, r64, Infinity.
CEU PRB Range	CEU Physical Resource Block (PRB) range. Default is 0-31. Options: 0-31, 32-63, 64-99, 0-23, 24-47, 48-71, 72-99
PA Adjustable	Enable or disable Power Amplifier (PA) adjustment

2.9.6.14 Signaling Trace

2.9.6.14.1 Description

The *Signaling Trace* function is typically used for troubleshooting UE attachment and handover issues. During a signaling trace, Radio Resource Control (RRC) and Stream Control Transmission Protocol (SCTP) packets are captured in real-time. The packets are sent to a remote computer running Wireshark* or to a Local OMC** and displayed so the data can be analyzed. The Baicells CloudCore OMC does not support the Signaling Trace feature.

*NOTE 1: For more information about the Wireshark app, refer to *https://www.wireshark.org/*.
**NOTE 2: Local OMC is covered in the Local OMC Administrator Guide, available upon request.

The RRC protocol controls the UE and eNB over-the-air communications, and is especially important during mobility scenarios as a mobile user is handed off from one eNB to another. SCTP is a transport layer for the S1-MME signaling bearer and is responsible for the Evolved Packet System (EPS) bearer setup/modification/release, handover procedures, Non-Access Stratum (NAS) signaling transport, and paging procedures.

2.9.6.14.2 Configuration

In the eNB GUI, go to LTE > Advanced > Signaling Trace to enable the RRC and SCTP functions (Figure 2-90). Each field is described in Table 2-40. You do not need to reboot the eNB to initiate the trace.

Figure 2-90: Signaling Trace (RTS/RTD)

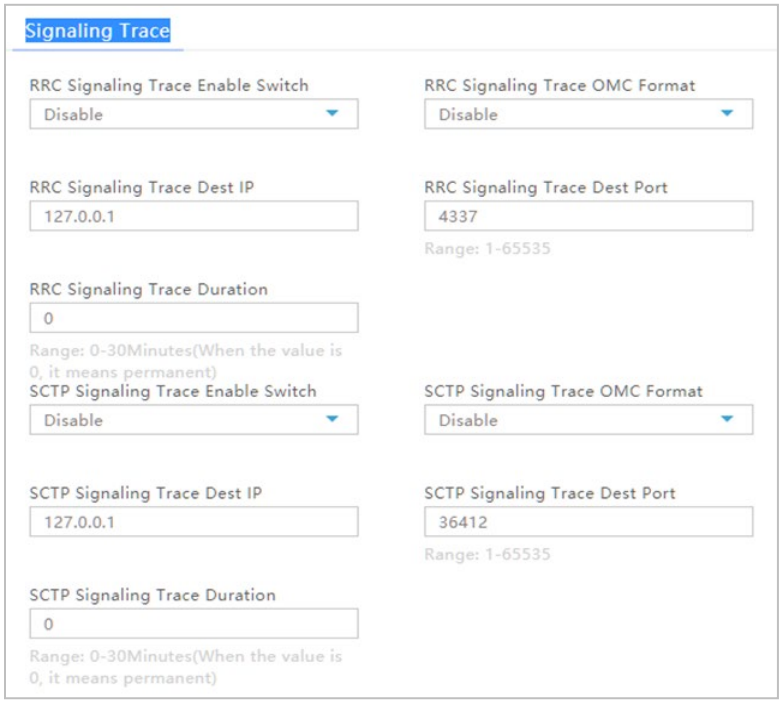


Table 2-40: Signaling Trace (RTS/RTD)

Field Name	Description
RRC Signaling Trace Enable Switch	Enable or disable the RRC signaling trace function.
RRC Signaling Trace OMC Format	Enable or disable sending the RRC signaling trace to the Local OMC.
RRC Signaling Trace Dest IP	The IP address of the computer where RRC signaling trace data will be sent. The default value is 127.0.0.1, which should be changed.
RRC Signaling Trace Dest Port	The port number of the computer where the RRC signaling trace data will be sent. Range: 0-65535. Default value is 4337. NOTE: For MAC computers, if there is an existing MAC package (directory) make sure you use a different port number for the RRC package.
RRC Signaling Trace Duration	The duration of the RRC signaling trace. Range: 0~30 minutes. A value of zero (0) means continuous.
SCTP Signaling Trace Enable Switch	Enable or disable the SCTP signaling trace function.
SCTP Signaling Trace OMC Format	Enable or disable sending the SCTP signaling trace to the Local OMC.
SCTP Signaling Trace Dest IP	The IP address of the computer where the SCTP signaling trace data will be sent. The default value is 127.0.0.1.
SCTP Signaling Trace Dest Port	The port number of the computer where the SCTP signaling trace data will be sent. Range: 0-65535. Default value is 36412.
SCTP Signaling Trace Duration	The duration of the SCTP signaling trace. Range: 0-30 minutes. A value of zero (0) means continuous.

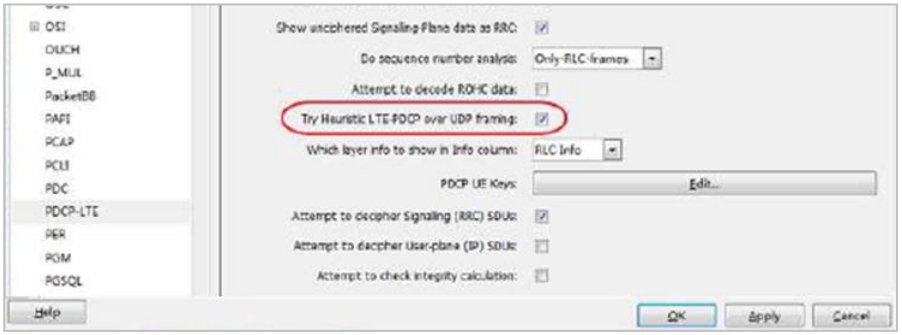
2.9.6.14.3 Wireshark Settings

Go to section 2.9.6.14.3.1 if you are using Wireshark 1.x, or go to section 2.9.6.14.3.2 if you are using Wireshark 2.x to use the app for signaling trace. A few troubleshooting tips are described in section 2.9.6.14.3.3.

2.9.6.14.3.1 Wireshark 1.x

1. Protocol:
    a. Go to Edit > Preferences > Protocols > PDCP-LTE (Figure 2-91).
    b. Select the check box for *Try Heuristic LTE-PDCP over UDP framing*.

Figure 2-91: Protocol Setting (RTS/RTD)



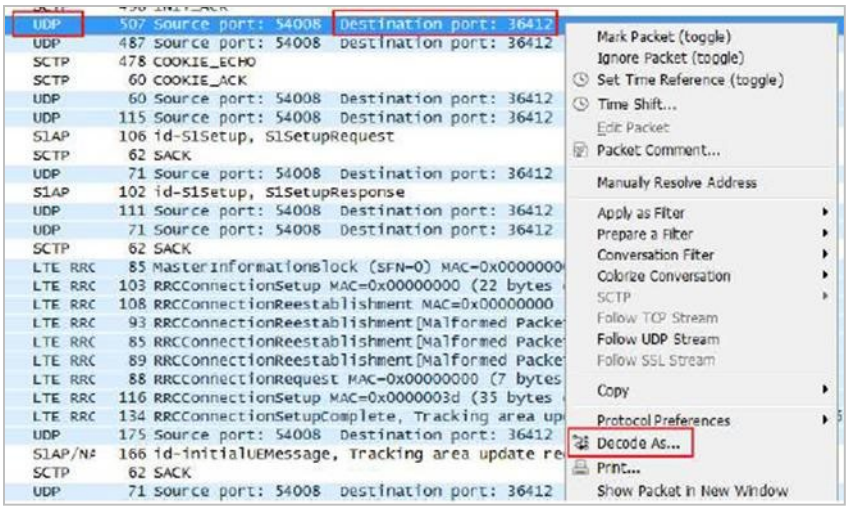
2. SCTP message:

    a. Find the related UDP package, and start a capture.

    b. Locate and select a packet with protocol UDP and destination port 36412. Or, you can use filter *udp.port=36412*.

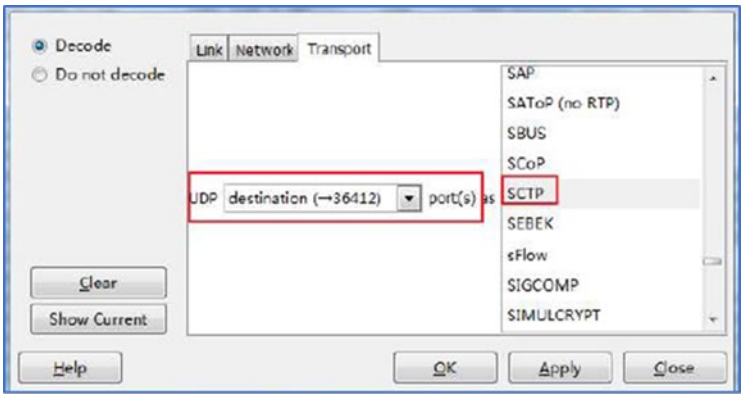
    c. Right-click on the packet, and choose *Decode As…* (Figure 2-92).

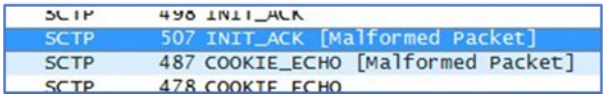
Figure 2-92: Decode As (RTS/RTD)



3. Go to the *Transport* tab, and set the destination as 36412 and the decoding type as SCTP (Figure 2-93). Get the SCTP message as shown in the figure.

Figure 2-93: Get SCTP Message (RTS/RTD)





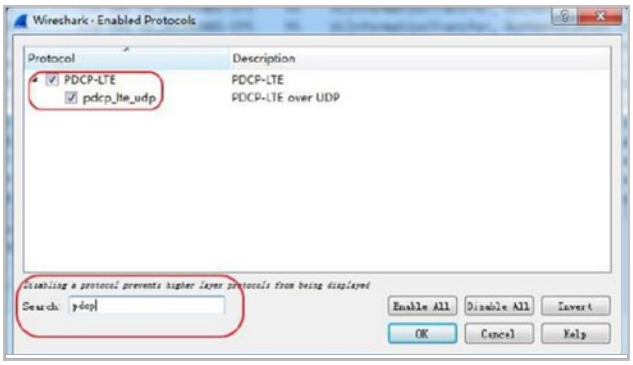
2.9.6.14.3.2 Wireshark 2.x

1. Protocol:

    a. Go to Analyze > Enabled Protocols.

    b. Select the check boxes for PDCP-LTE and pdcp_lte_udp (Figure 2-94).

Figure 2-94: Protocol Setting (RTS/RTD)



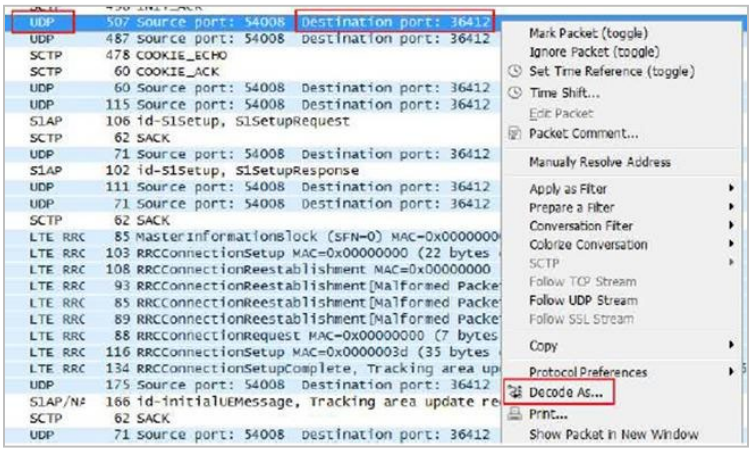
2. SCTP message:

    a. Find the related UDP package, and start a capture.

    b. Locate and select a packet with protocol UDP and destination port 36412. Or, you can use filter *udp.port=36412*.

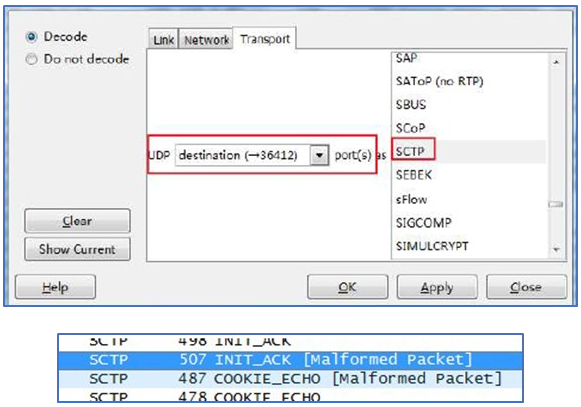
    c. Right-click on the packet, and choose *Decode As…* (Figure 2-95).

Figure 2-95: Decode As (RTS/RTD)



    d. Go to the *Transport* tab, and set the destination as 36412 and the decoding type as SCTP (Figure 2-96). Get the SCTP message as shown in the figure.

Figure 2-96: Get SCTP Message (RTS/RTD)

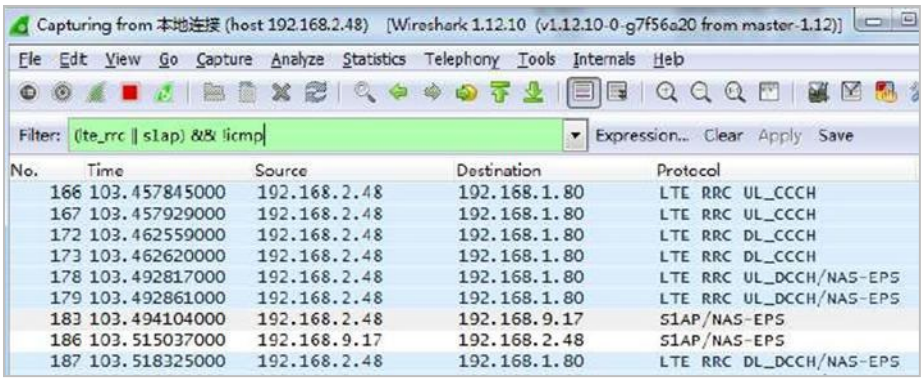


3. Filter:

   a. In the filter window, enter *lte_rrc*, and display the RRC message.

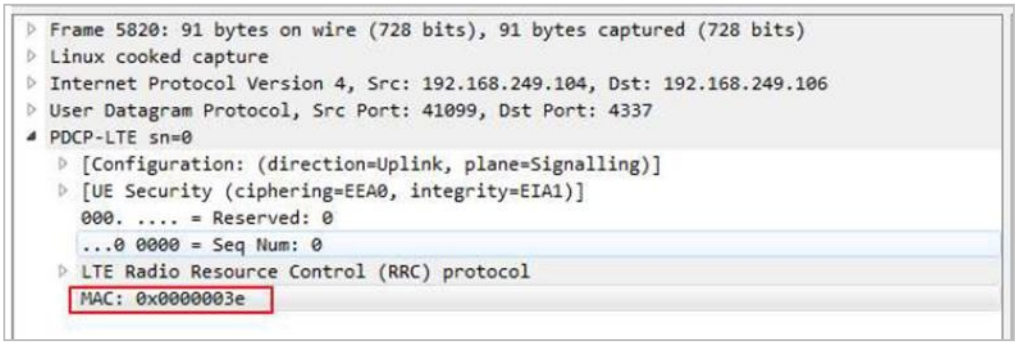
   b. Optionally, enter the RRC and S1AP command as shown in Figure 2-97.

Figure 2-97: Filter (RTS/RTD)



NOTE: In order to distinguish multiple user packets in RRC messages, we use the MAC-I field, which changes it to show UE RNTI (Figure 2-98).

Figure 2-98: UE RNTI (RTS/RTD)



2.9.6.14.3.3 Troubleshooting

Following are some common issues when running a signaling trace, and how to address them.

- IP address: Make sure the IP you use for the computer you are sending trace messages to is reachable. First try to ping it from the eNB (Network > Diagnostics). If a ping does not go through, check for and temporarily disable any firewall or antivirus software apps.
- No RRC messages: If a trace yields no results, try changing the filter condition (refer back to Figure 2-97).
- Local OMC not displaying results: Make sure you have registered the eNB in the Local OMC.

2.9.6.15 RF Status and Parameter (Nova246 only)

You can view the current status of antennas by selecting this menu item, including Received Signal Strength Indicator (RSSI) values, antenna transmit power, and voltage standing wave ratios.

2.9.6.16 Cell Access Control Settings

The *Cell Access Control Settings* menu under LTE > Advanced is for operators who have deployed a Local EPC in their private network. This function is not available for operators using the Baicells CloudCore EPC. The feature allows an operator with a Local EPC to enable or disable the Allocation and Retention Priority (ARP) function for this eNB (Figure 2-99). ARP prioritizes traffic services assigned a Guaranteed Bit Rate (GBR). Typically, ARP is considered only when a new bearer (subscriber) attempts to attach. If the eNB is out of resources, the attachment request will be denied until resources are available.

The goal of this feature is to ensure proper QoS for in-progress sessions by rejecting radio bearer requests when they cannot be accommodated, e.g., when the total uplink GBR bandwidth exceeds the *UL GBR Acceptance Threshold* or the total number of GBR bearers exceeds the *Maximum Number of GBR Bearers*. The thresholds defined in this sub-menu determine how much of the eNB's resources can be allocated in the uplink and in the downlink. Refer to Table 2-41 for a description of the fields.

Figure 2-99: Cell Access Control Settings (RTS/RTD)

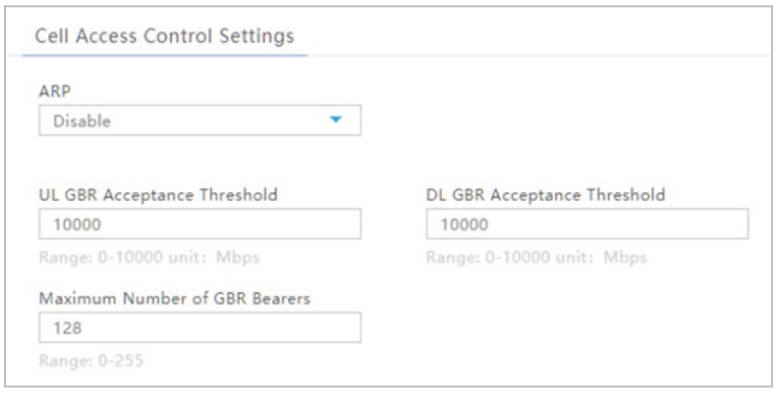


Table 2-41: Cell Access Control Settings (RTS/RTD)

Field Name	Description
ARP	Enable or disable the ARP function

Field Name	Description
UL GBR Acceptance Threshold	Uplink GBR acceptance threshold. Range: 0-10000 Mbps. Default is 10000 Mbps.
DL GBR Acceptance Threshold	Downlink GBR acceptance threshold. Range: 0-10000 Mbps. Default is 10000 Mbps.
Maximum Number of GBR Bearers	Set the maximum number of GBR bearers. Range is 0-255. Default is 128.

2.9.6.17 Interference Detection Parameters

Using this menu you can enable/disable the Interference Detection feature to trigger an alarm notification when the eNB reaches a set of configured thresholds. The eNB will calculate UL and DL path loss based on Reference Signal (RS) power, Signal-to-Noise Ratio (SNR), and other measurements. It compares the path loss data between UL and DL, and if there is a significant difference (in dB) for a specified period of time, it is likely due to UL interference. If the thresholds are met, the eNB reports the interference alarm (ID 11224) to the OMC.

To configure the Interference Detection feature, in the eNB GUI go to LTE > Advanced > Interference Detection Parameters (Figure 2-100). The fields are described in Table 2-42.

Figure 2-100: Interference Detection Parameters (RTS/RTD)

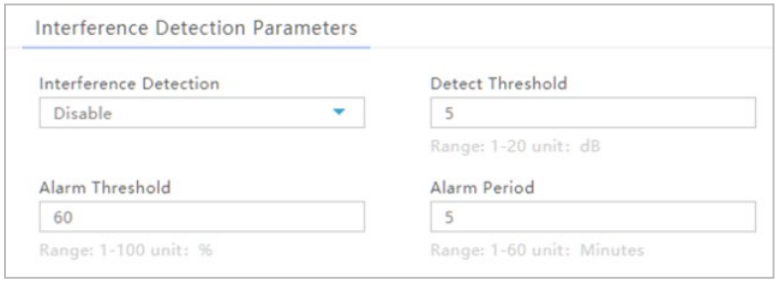


Table 2-42: Interference Detection Parameters (RTS/RTD)

Field Name	Description
Interference Detection	Enable or disable the interference detection function.
Detect Threshold	Interference detection threshold, based on the amount of difference, in dB, between UL and DL path loss. Range is 1-20 dB. Default is 5 dB.
Alarm Threshold	Alarm trigger threshold, based on the percentage of all UEs passing traffic that are meeting the detection threshold for the amount of time specified in the Alarm Period field. Range is 1-100%. Default is 60%.
Alarm Period	Set the minimum period of time that the interference detection threshold is sustained before the alarm is triggered. Range is 1-60 minutes. Default is 5 minutes.

2.9.6.18 Multi Network Element

If you have multiple network elements providing the same service, use this sub-menu to bind the eNB to:

- A specific S1-User path (e.g., operator has Local EPC as well as CloudCore EPC);
- An X2 interface (eNB to eNB handoff scenarios); or
- A TR-069 interface (multiple ACS servers).

Refer to Figure 2-101 and Table 2-43.

Figure 2-101: Multi Network Element (RTS/RTD)

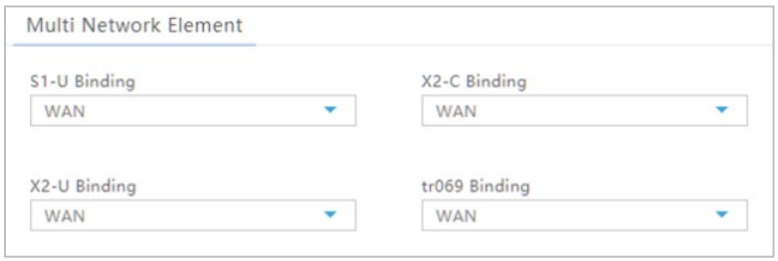


Table 2-43: Multi Network Element (RTS/RTD)

Field Name	Description
S1-U Binding	Select the binding interface for S1-U - either WAN (default) or VLAN
X2-C and X2-U Binding	Select the control plane and user traffic binding interface for X2 - either WAN (default) or VLAN
tr069 Binding	Select the binding interface for TR-069 - either WAN (default) or VLAN

2.9.6.19 SSH Setting

Enable the Secure Shell (SSH) setting for a secure, encrypted connection to the eNB from a remote location (Figure 2-102). If SSH is disabled, you will not be able to SSH into the eNB remotely.

Figure 2-102: SSH Setting (RTS/RTD)

2.9.6.20 Cell barred info

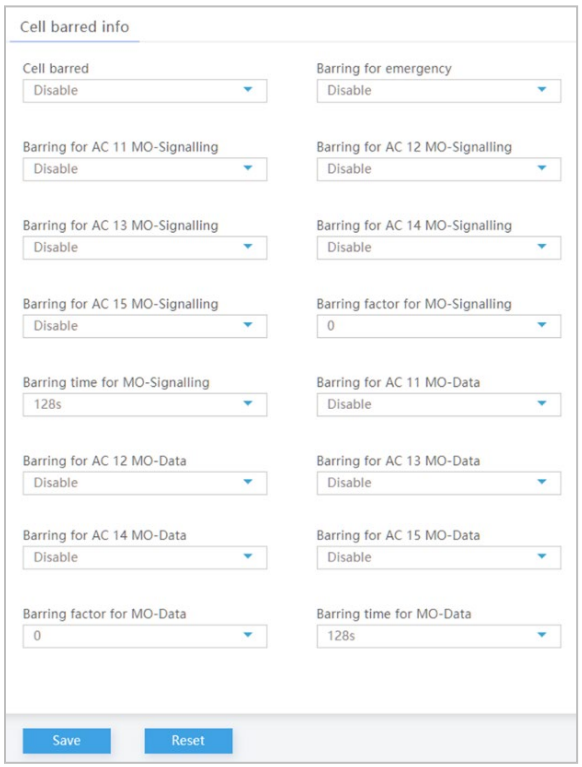
A barred cell is a type of access control, where UEs of a certain priority level may not be allowed to attach to the eNB due to congestion. An Access Class between 0-15 is embedded in the user SIM card as a way to prioritize user traffic for a period of time. The restricted access to the eNB is not a permanent blockage.

Use the LTE > Advanced > Cell barred info menu to enable/disable barring of the 0-15 classes, and to enter the time periods for each (Figure 2-103). The time period determines how long the eNB is barred from being accessed by any UEs with a SIM access class that has been enabled for barring.

"MO-Signaling" refers to Mobile Originated Signaling, i.e., when a UE requests access to the eNB. "MO-Data" refers to Mobile Originated Data, meaning actual user traffic.

The cell barring factor for MO-Signaling and MO-Data determines if a UE needs to treat a cell as barred or not. The barring factor can be a value between 0 - 0.95 in increments of 0.05. The barring time determines for how long the cell is barred from access, and can be configured as 4, 8, 16, 32, 64, 128, 256, or 512 seconds.

Figure 2-103: Cell barred info (RTS/RTD)



2.9.6.21 Carrier Control (Nova246 only)

Reference: *Carrier Aggregation & Dual Carrier (Split Mode) Configuration Guide*

The *Carrier Control* menu is used for two-carrier eNBs running BaiBS_RTD_3.6.6 or higher software. You can set the eNB to run as either a single carrier or two separate carriers using Dual Carrier (DC)/split mode. In single carrier mode only Cell 1 will operate. Operators may need to use this mode if they have limited spectrum or are planning to change to DC mode at a later time, for example when more capacity is needed for the coverage area. Whenever you change the carrier control setting, you must perform a warm reboot the eNB for the change to take effect.

1. Click “Carrier Control” to display the configuration parameters.
2. Select “single carrier” or “dual carrier”.
3. Click “Save” to complete the carrier control setting.

NOTE 1: The *Carrier Control* menu displays only when the dual carrier function license file is imported
NOTE 2: The only eNB currently running software version BaiBS_RTD_3.6.6 or higher to enable Dual Carrier (DC)/split mode capabilities is the Nova246.

2.9.6.22 Load Balance (LB) Settings (Nova246 only)

The *LB Settings* menu displays when the dual carrier function license file is imported.

1. Click “LB Settings” to display the load balance configuration parameters.
2. Select “Enable” from the pulldown menu in the *LB Switch* field to enable the load balance function. “Disable” is the default.
3. Select “UE Count” from the pulldown menu in the *LB Type* field to select how to trigger the load balance function. Currently, the only option available is “UE Count”.
4. Click “Save” to complete the load balance configuration.

2.9.6.23 SCTP Port

1. Click “SCTP Port” to display the SCTP port configuration parameter.
2. Set the SCTP number. Range is 1 to 65535.
3. Click “Save” to complete the SCTP port setting.

2.9.6.24 MME Port

1. Click “MME Port” to display the MMP port configuration parameter.
2. Set the port number(s) of the MME(s). Range is 1024 to 65535.
3. Click “Save” to complete the MME port setting.

2.9.6.25 Periodic Upload Log Setting

1. Click “Periodic Upload Log Setting” to display the log upload configuration parameter.
2. Enable or disable the function.
3. If enabled, enter the “Upload URL” configuration parameter. Range is 1 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
4. If enabled, enter the “Upload Period” configuration parameter. Range is 300 to 3600 seconds.
5. Click “Save” to complete the log upload setting.

2.9.6.26 64QAM Setting

1. Click “64QAM Setting” to display the configuration parameter.
2. Enable or disable the “64QAM” function.
3. Enable or disable the “64QAM v1270” function.
4. Click “Save” to complete the 64QAM setting.

2.9.7 SAS Settings

Reference: *SAS Deployment Guide*

The Citizens Broadband Radio Service (CBRS) band covers 3.55-3.65 GHz and was officially launched in January 2020. Operators must sign up with a Spectrum Access System (SAS) provider for services to handle the dynamic frequency assignment and release process. Baicells provides FCC Part 96 certified eNBs and CPEs as CBRS Service Devices (CBSDs) that can operate within the FCC rules for CBRS, and certification will be an ongoing process as new products are introduced. The SAS vendors currently available to manage spectrum usage are Amdocs, CommScope, Federated Wireless, and Google.

The Baicells eNBs use domain proxy (DP) to connect to the SAS server by leveraging the existing connection with the OMC. All eNBs will need to be connected to the OMC in order to connect to the SAS.

The following are the current software levels for SAS to work:

- Nova227/233: BaiBS_RTS_3.7.5
- Nova436Q/Neutrino430: BaiBS_QRTB_2.6.2
- OMC: BaiOMC 7.0.4

NOTE 1: This section covers eNBs running RTS software. See section 2.10.5 to configure eNBs running QRTB software.
NOTE 2: The Nova246 TDD Band 40/41 in N.A. isn't in the CBRS spectrum and doesn't support SAS capabilities, and neither does the Nova243. Therefore, the information in this section only applies to the eNBs listed above.
NOTE 3: Legacy Gen 1 CPEs do not support SAS.

*****This section covers only the eNB LTE > SAS Settings. Please refer to the *SAS Deployment Guide* for the full instructions to implement CBRS SAS operation.*****

In the eNB GUI, the LTE > SAS Settings menu opens by default as disabled. When you enable SAS, you will enter the installation information and the Certified Professional Installer (CPI) credentials. The SAS vendor will control the eNB's power and frequency point, as required by CBRS regulations. Refer to Figure 2-104, Figure 2-105, and Table 2-44.

NOTE 1: When SAS is enabled, the standard BTS Info > Quick Setting for *Band, Bandwidth, Frequency,* and *Power Modify* will become greyed out; the eNB will use the configuration based on the SAS settings response. However, you can configure your preferences for these settings by selecting a *Frequency Selection Logic*. Refer to the *SAS Deployment Guide*.
NOTE 2: There are two SAS setting registration types: Single-step and Multi-step. The difference in these types is that in Single-step registration, all configuration is accomplished on the eNB GUI itself and there is no need to use a SAS portal. The Multi-step registration type has fewer fields for configuring the eNB, but the rest of the configuration must be accomplished using the SAS portal.
NOTE 3: Each SAS vendor provides their own GUI to assist you in using their SAS portal.
NOTE 4: If you choose to use the Single-step registration type, have your CPI info and all antenna requirements ready to input before you start the configuration procedures.

Figure 2-104: SAS Settings (Registration Type Multi-step) (RTS)

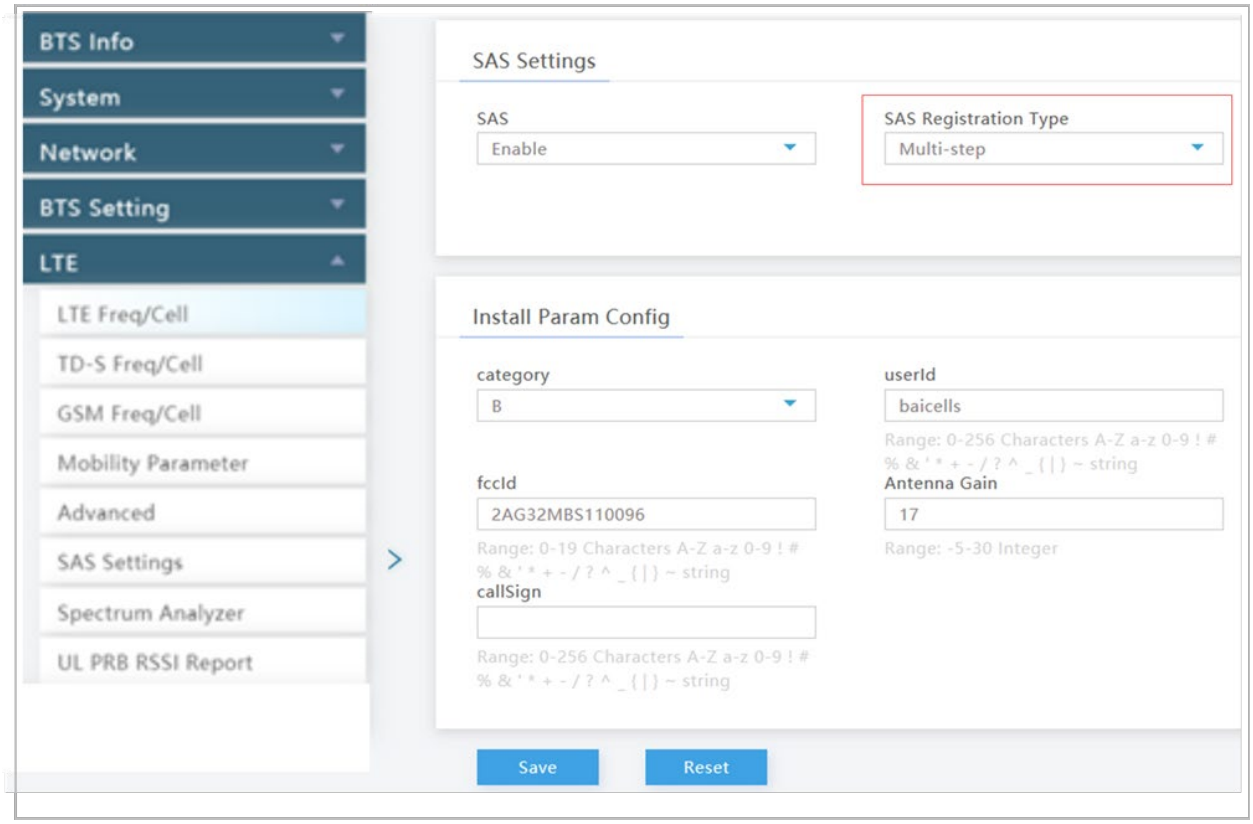


Figure 2-105: SAS Settings (Registration Type Single-step) (RTS)

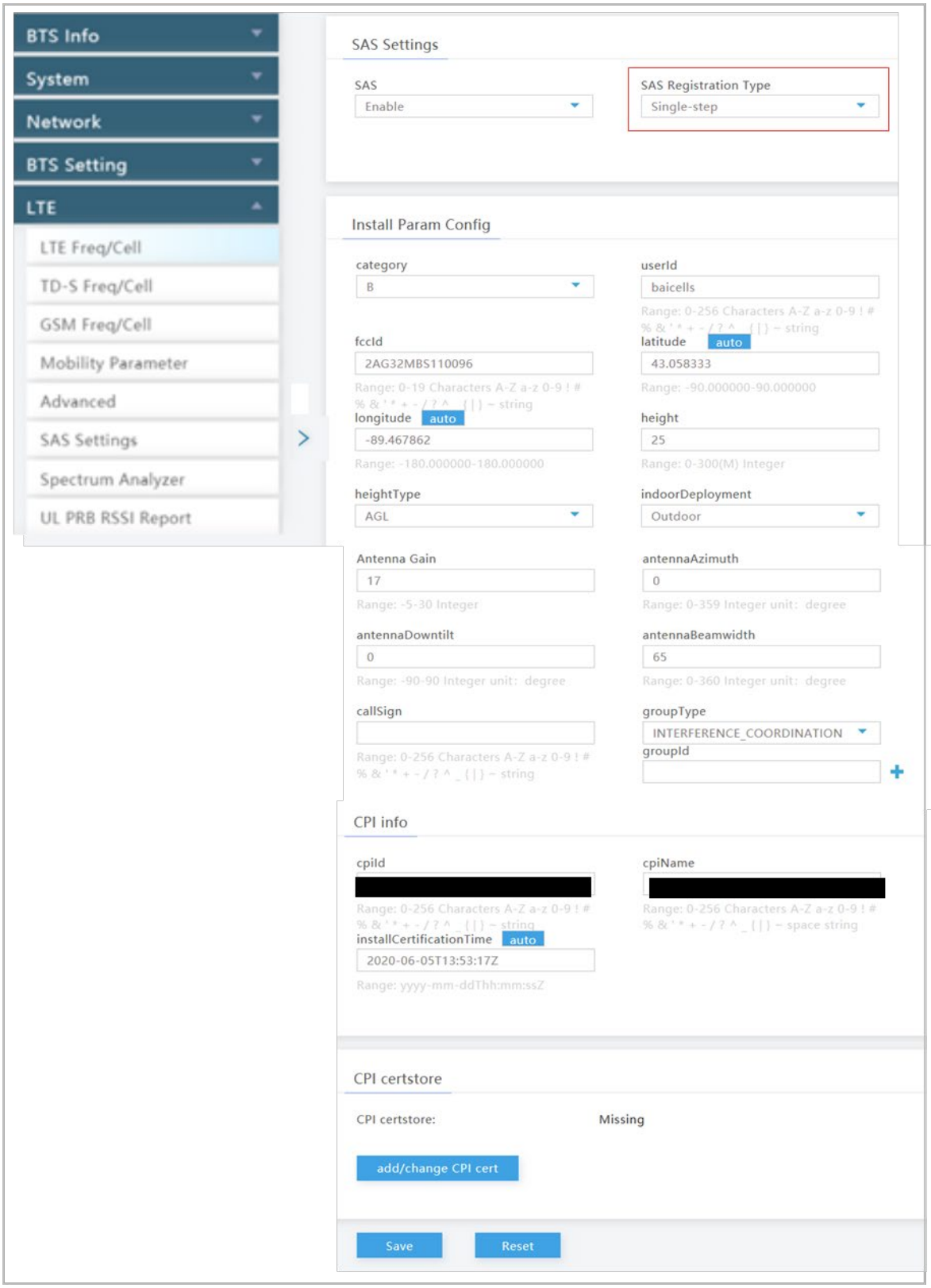
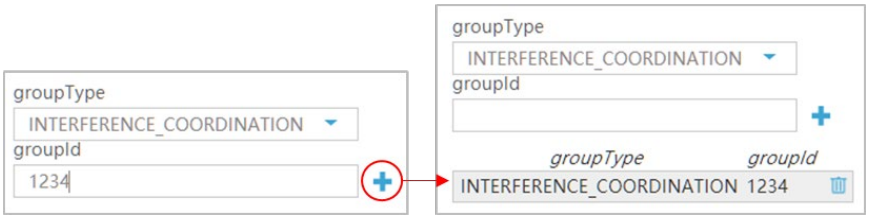


Table 2-44: SAS Settings (RTS)

Field Name	Description
SAS Settings	
SAS	Enable/Disable the SAS function
SAS Registration Type	Select Multi-step or Single-step method to register the eNB with the SAS vendor.
Multi-step method	
Install Param Config (Multi-step method)	
category	Either A or B according to the CBRS device designation. The main difference between these categories is the power limit (see *SAS Deployment Guide*). The eNB is typically Category B.
userid	Enter a user ID, which is provided by your SAS vendor and is associated with this SAS-enabled eNB. Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
fccid	The eNB's FCC certification number. Range is 0 to 19 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
Antenna Gain	Set the eNB antenna gain. Range: -5 to 30 dBi.
callSign	Optional: Parameter that is useful to identify the PAL license under which the operator is deploying a CBSD. The parameter is not necessary to configure for the GAA spectrum (3550 – 3700 MHz). Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
Single-step method	
Install Param Config (Single-step method)	
category	Either A or B according to the CBRS device designation. The main difference between these categories is the power limit (see *SAS Deployment Guide*). The eNB is typically Category B.
userid	Enter a user ID, which is provided by your SAS vendor and is associated with this SAS-enabled eNB. Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
fccid	The eNB's FCC certification number. Range is 0 to 19 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
latitude	Latitude of the eNB's location. Select auto to autofill the latitude based on GPS data; otherwise, enter the latitude. Range is -90.000000 to 90.000000.
longitude	Longitude of the eNB's location. Select auto to autofill the longitude based on GPS data; otherwise, enter the longitude. Range is 180.000000 to 180.000000.
height	Enter the antenna height, in meters. Range: 0-300 meters.
heightType	Only Above Ground Level (AGL) may be selected
indoorDeployment	Indicate whether the eNB is an Indoor or Outdoor (default) unit

Field Name	Description
Antenna Gain	Set the eNB antenna gain. Range: -5 to 30 dBi.
antennaAzimuth	Enter the antenna azimuth, in degrees. Default is 180°. Range: 0 - 359°
antennaDowntilt	Enter the degrees of antenna downtilt. Default is 5°. Range: -90° to 90°.
antennaBeamwidth	Enter the degrees of antenna beamwidth. Default is 65°. Range: 0 - 360°.
callSign	Optional: Parameter that is useful to identify the PAL license under which the operator is deploying a CBSD. The parameter is not necessary to configure for the GAA spectrum (3550 – 3700 MHz). Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
groupType	Optional: Only INTERFERENCE_COORDINATION may be selected at this time. Adding a Group is also optional at this time. CBSD grouping is currently not being used by SAS vendors, but will be used in the future when General Authorized Access (GAA) coexistence is introduced.
groupID	Optional: You must enter a group ID if using a group type. You cannot leave the groupID field blank when using a group type. Specify the group ID using letters, numbers, or special characters. When you add the ID, it will be displayed beneath this field. 
CPI info	
cpiId	Enter the Certified Professional Installer's identification number.
cpiName	Enter the Certified Professional Installer's name. Use an underscore to separate first name and last name; you cannot use a space in this field. Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
installCertificationTime	Select “auto” to automatically enter the date and time of installation: yyyy-mm-ddThh:mm:ssZ
CPI certstore	
CPI certstore	Used to view the status of CPI certifications that have already been uploaded in the system when using the System > CertStore menu.
Loaded	Indicates if the CPI Certificate is loaded
Missing	Indicates if the CPI Certificate is missing
add/change CPI cert	Select to upload or change the CPI certificate. You can also use the System > CertStore menu to upload the certificate.

2.9.8 Spectrum Analyzer (BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5)

Reference: *Spectrum Analysis User Guide*

2.9.8.1 Description

The eNB Spectrum Scanning Mode feature helps you to see what is happening in the RF spectrum. It may be used to analyze signal amplitude (strength) as it varies by signal frequency on the uplink. You can use this information to determine the best frequency to use and to identify where there may be interference. Frequency scanning encompasses both frequency and time information. The scan looks at the uplink data within a configured frequency range for up to 20 MHz at a time.

IMPORTANT: As indicated by the feature name, when you put the eNB into spectrum scanning mode it is no longer working like it normally does and UEs will not be able to attach to the eNB. Therefore, it is important to remember to return the configuration back to normal mode when you are finished with the scan.

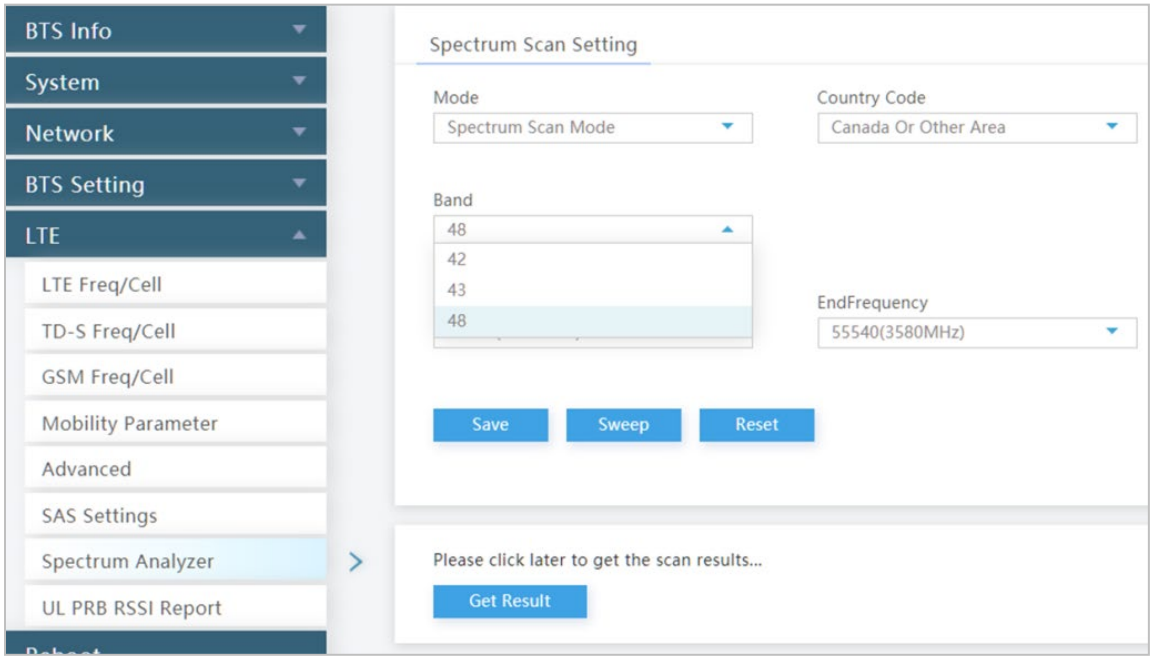
NOTE: When the eNB is operating in spectrum scanning mode, it uses the TDD subframe assignment of "1" and the special subframe pattern of "7". These settings are restored to their previous values in BTS Info > Quick Setting when the eNB is set back to normal operating mode.

2.9.8.2 Configuration

To initiate spectrum scanning, follow the steps below.

1. In the eNB GUI, go to LTE > Spectrum Analyzer to set spectrum scanning parameters (Figure 2-106).
2. Set the *Mode* field to *Spectrum Scan Mode*, and select the country code, band, and frequency range you wish to analyze. The start and end frequencies must be within the same band, and there must be a 20 MHz gap between *StartFrequency* and *EndFrequency.*
3. Save the settings.

Figure 2-106: Spectrum Analyzer (RTS/RTD)



4. Perform a warm reboot of the eNB.
5. Once the eNB finishes rebooting, in the GUI go back to LTE > Spectrum scanning mode and select *Sweep* to start the scan. The sweep usually takes about one minute.
6. To see the scan results, click on *Get Result.* The results will appear at the bottom of the window. Examples of results are shown below in section 2.9.8.3.
7. When you are finished, remember to set the *Mode* field back to *Normal* and perform a warm reboot to exit the spectrum scanning mode and return to normal operating mode.

When initiating a scan, possible error messages you may see include:

- Frequency Lock error - Start and end frequencies entered in the GUI are out of range or not supported
- Gain error - Indicates an offset error in converting the baseband signal to RF signal strength
- Sync error - Indicates an issue with the I/Q data where the uplink subframe starting point cannot be identified. Performing a warm reboot of the eNB may clear this error.
- PCI error - The Physical Cell Identifier (PCI) cannot be read from the GUI setting or is out of range.

2.9.8.3 Interpreting the Results

There are two types of scan results: frequency domain and time domain. For 20 MHz* spectrum, when you run the scan you will get 2 uplink frequency domain results and 2 time domain results, where:

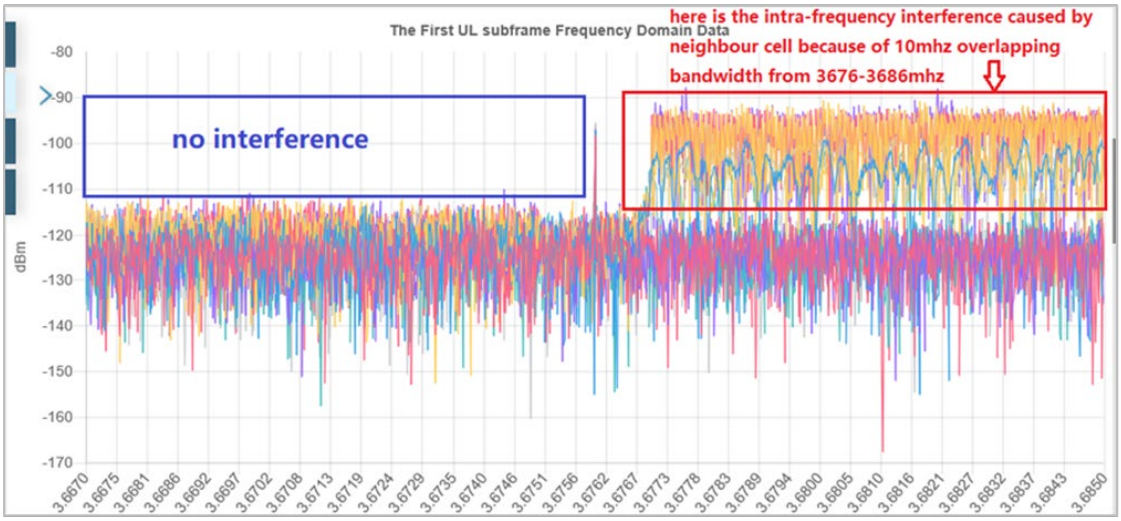
- First UL subframe = Combined UL subframes from the first half-frame (subframes 2 or 7)
- Second UL subframe = Combined UL subframes from the second half-frame (subframes 3 or 8)

*NOTE: The actual usable bandwidth is 18 MHz (20 MHz minus 2 MHz), because 1 MHz for the start frequency and 1 MHz for the end frequency are omitted.

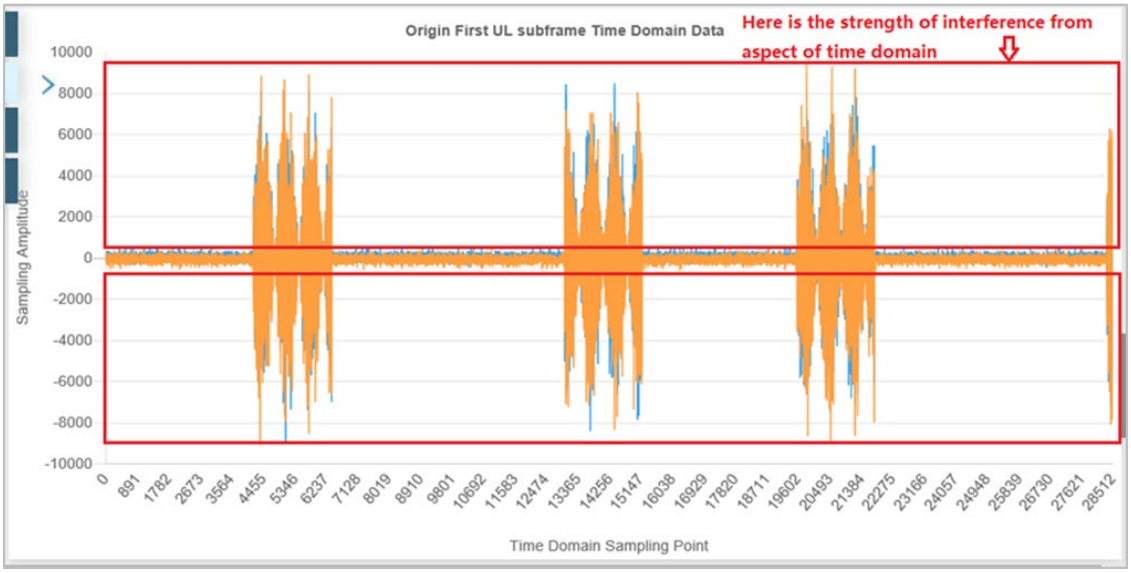
Figure 2-107 is an example of the spectrum scanning results for the frequency domain and the time domain. Please refer to the *Spectrum Analysis User Guide* for additional information and examples.

Figure 2-107: Examples of Spectrum Scanning Results (RTS/RTD)

Frequency Domain



Time Domain



2.9.9 UL PRB RSSI Report (BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5)

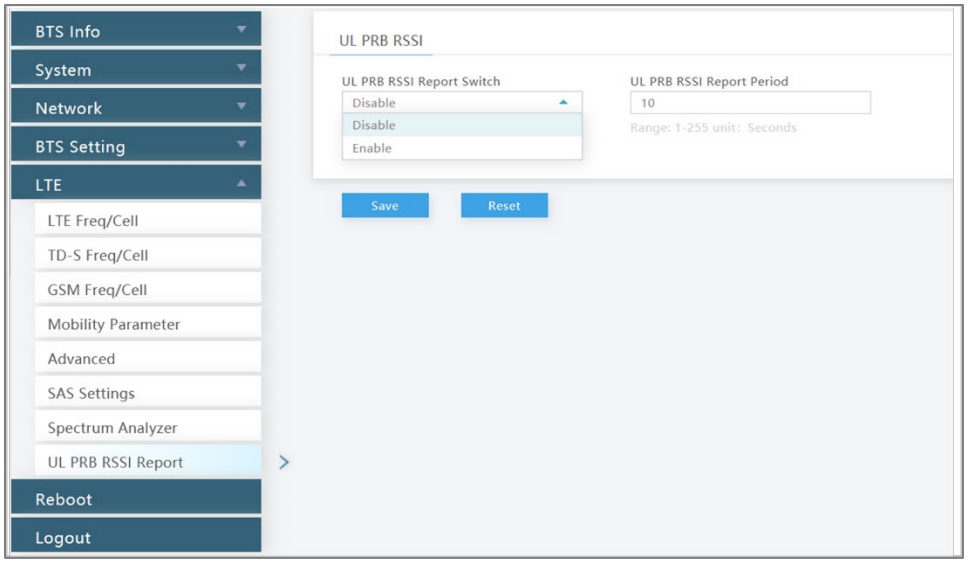
Reference: *Spectrum Analysis User Guide*

The UpLink (UL) Physical Resource Block (PRB) Received Signal Strength Indicator (RSSI) Report feature may be used when you think you have an interference issue. RSSI measures the total received wideband power, including noise. When you run this report, the eNB looks for UE subframes not being used (no PRBs assigned, no traffic) then takes the RSSI measurement.

NOTE: Some older eNB hardware versions (for example, the Nova233 Gen 1), do not have the Physical layer to support this feature; therefore, the UL PRB RSSI Report option will not be displayed in the *LTE* menu.

By default this feature is disabled. In the eNB GUI, go to LTE > UL PRB RSSI Report to enable it (Figure 2-108). Next, set the report period. This time period determines how often the report will run, and may be set from 1 to 255 seconds. The feature will remain enabled and continue to run until you reset it to *Disable*; it will not automatically shut off.

Figure 2-108: LTE > UL PRB RSSI Report (RTS/RTD)



The report will display a graph in real-time at the bottom of the window, showing the total UL RSSI (in dBm) along the y-axis for each PRB along the x-axis. Since there are multiple antenna elements, the Baicells eNB reports each RF chain - ANT1 and ANT2. Only 20 MHz of bandwidth can be detected at one time. The report shown in Figure 2-109 indicates a clean (no interference) environment. Figure 2-110 is a report where there is interference.

Figure 2-109: LTE > UL PRB RSSI Report (No Interference) (RTS/RTD)

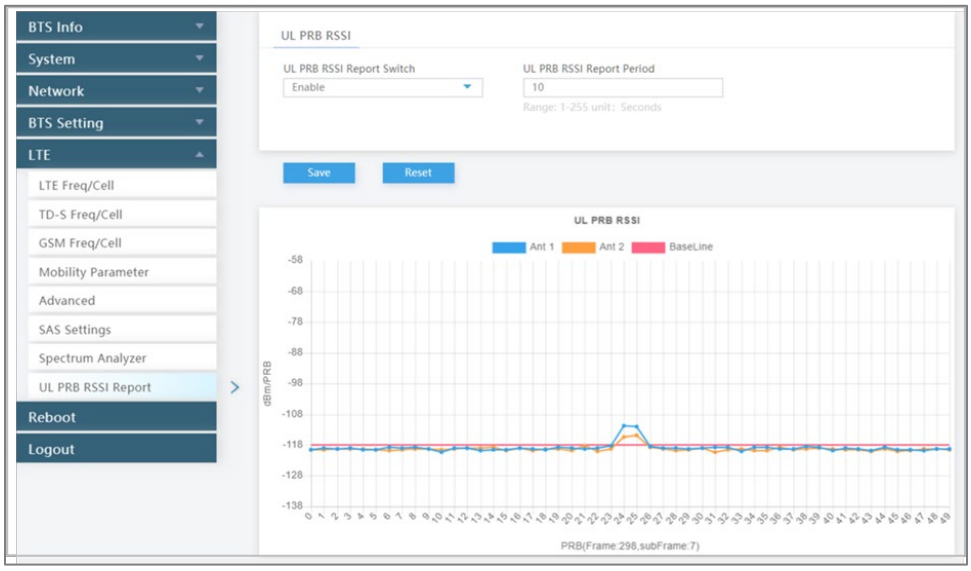
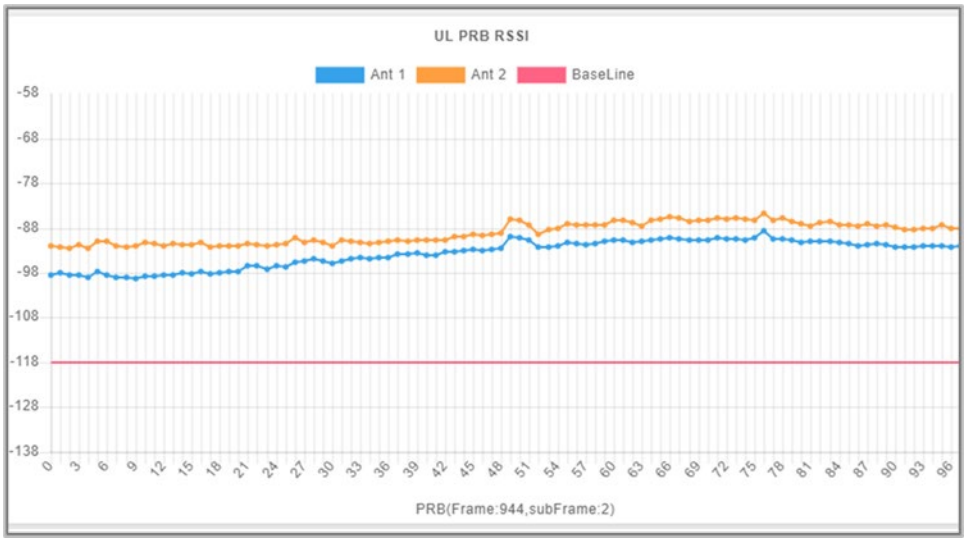


Figure 2-110: LTE > UL PRB RSSI Report (With Interference) (RTS/RTD)



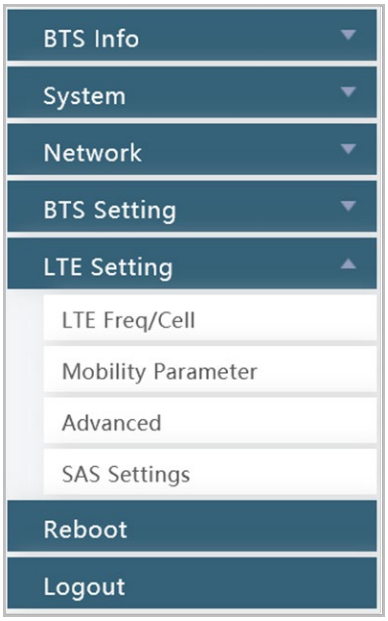
2.10 LTE Setting (BaiBS_QRTB_2.6.2)

The *LTE Setting* menu contains several sub-menus related to mobility as well as other radio-related settings (Figure 2-111). Many LTE parameters are important for efficient wireless network operation.

NOTE 1: The *LTE Setting* menu displays the *LTE Freq/Cell* and *Mobility Parameter* sub-menus only when MME pool, LGW, and HaloB functions are disabled.
NOTE 2: HaloB-enabled eNBs operate as standalone entities and do not support mobility.
NOTE 3: On a two-carrier eNB running BaiBS_QRTB_2.6.2, the *Advanced* menu settings are configured on the primary cell (Cell1) for both the primary cell and the secondary cell (Cell2).
NOTE 4: The terms *handoff* and *handover* are used interchangeably in LTE.

When setting up mobility, you have to establish the neighboring eNBs operating in the same geographical area as is the eNB that you are configuring. This information is completed for each eNB so that the eNBs collectively work well with one another to handle mobile users and to balance the traffic load.

Figure 2-111: LTE Setting Menu (QRTB)



Use the first 3 sub-menus under the *LTE Setting* menu to (a) configure the neighboring eNBs' frequencies and identify each eNB running on that frequency (section 2.10.1); (b) configure the current eNB's mobility parameters (beginning with section 2.10.2); and (c) examine the current eNB's advanced settings (section 2.10.4).

It is a good idea to review all of the information in this section to understand how the configuration settings relate.

Important: Make sure the current and neighboring eNBs are synchronized to help the eNBs avoid interfering with one another.

If you change these parameters, perform a warm **reboot** of the eNB for the new configuration to take effect. A case study for LTE to LTE handoffs is provided in section 2.11 Real-World LTE to LTE Handoff Configuration Example.

2.10.1 Identify Neighbor Frequencies & Cell Information

Depending on geographic region, there are 3 types of neighboring eNBs: other LTE eNBs; eNBs running another type of wireless technology called Time Division Synchronous Code Division Multiple Access (TD-SCMDA); and those operating with the Global System for Mobile (GSM) communications technology. TD-SCMDA and GSM settings for handover are not available with BaiBS_QRTB_2.6.2 software; therefore, section 2.10.1, section 2.10.2, and section 2.10.3 describe only how to configure adjacent eNBs operating with LTE technology. See section 2.9 for more information on the TD-SCMDA and GSM settings, which are supported by BaiBS_RTS_3.7.5/BaiBS_RTD_3.7.5 software.

For each type of neighboring eNB, you will first add the neighbor frequency settings via the *Neigh Freq Table*, and then you will add the cell information associated to the frequencies via the *Neigh Cell Table*.

You can configure the *Neigh Cell Table* for both inter-frequency (between different frequencies) and intra-frequency (within the same frequency) neighboring eNBs. For inter-frequency cells, you must add the neighbor inter-frequency settings in the *Neigh Frequency Table* before you try to add the neighbor inter-frequency cell (eNB) information. Conversely, if you need to delete a neighbor inter-frequency record, you must first delete the neighbor inter-frequency cells (eNBs) associated to it. For an intra-frequency neighbor cell, meaning a neighbor eNB operates on the same frequency as the eNB you are configuring, you do not need to configure the *Neigh Freq Table* but you do need to configure the *Neigh Cell Table*.

2.10.2 LTE Freq/Cell

Using the *LTE Freq/Cell* sub-menu (Figure 2-112), you can configure parameters related to how adjacent eNBs operating with LTE technology work with the Baicells LTE eNB that you are configuring. You will define for the Baicells eNB how to deal with any neighboring LTE eNBs.

Figure 2-112: LTE Freq/Cell (QRTB)

2.10.2.1 LTE Neigh Freq Table

Under *Neigh Freq Table*, select the **+** (Add) icon. This will open the *Neigh Freq Settings* window, as shown in Figure 2-113 and described in Table 2-45. You can configure up to 8 LTE frequency tables. The parameters shown in the figure reflect the recommended settings for this operator example.

Figure 2-113: LTE Freq/Cell > Neigh Freq Settings (QRTB)

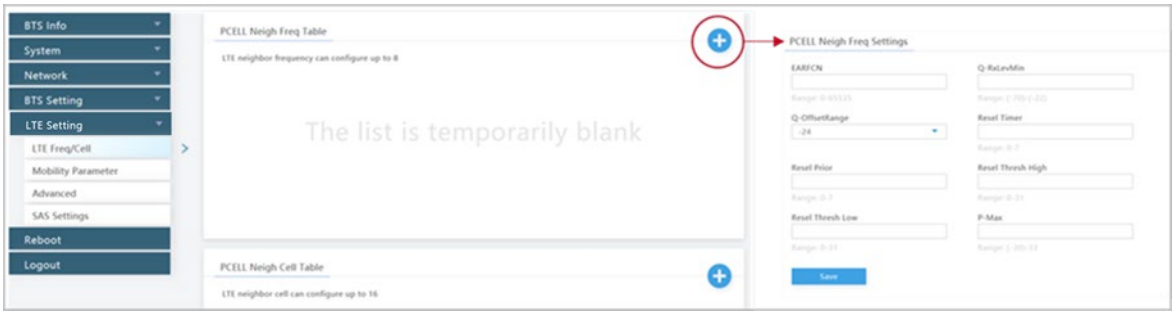


Table 2-45: LTE Freq/Cell > Neigh Freq Settings (QRTB)

Field Name	Description
EARFCN	In short, this is the frequency point of the neighboring eNB's frequency. Range is 0-65,535. EARFCN stands for Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access (E-UTRA) Absolute Radio Frequency Channel Number.
Q-RxLevMin	The minimum received signal level at which user equipment (UE) will detect a neighboring eNB's signal. The range is -70 to -22 dBm. A typical value is -62, which equals -124 dBm.

Field Name	Description
Q-OffsetRange	Indicates the difference in signal level between the serving and neighboring eNBs, as determined by the received signal level at the UE. If the received signal level is better from a neighboring eNB by at least this amount of difference in dB, the UE will reselect the other cell. The range is +24 to -24 dB. A typical value is 0 dB.
Resel Timer	Determines when the cell reselection timer expires. Range is 0-7 seconds. A typical value is 0 seconds.
Resel Prior	Priority of cell reselection to cells at this frequency. Range is 0-7 (integer). A typical value is 4.
Resel Thresh High	The cell reselection threshold for higher priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has a higher cell reselection priority than the serving cell). Range is 0-31 dB. A typical value is 18 dB.
Resel Thresh Low	The cell reselection threshold for lower priority inter-band frequency. Represents the access threshold level at which the UE will leave the serving cell and reselect another cell at the target frequency (assuming the target frequency cell has an absolute priority lower than the serving cell). Range is 0-31 dB. A typical value is 13 dB.
P-Max	The maximum transmit power that UEs in this cell are allowed to use in the uplink. The range is -30 to 33 dBm. A typical value is 23 dBm.

2.10.2.2 LTE Neigh Cell Table

You can configure up to 16 LTE Neigh Cell Tables. Click on the **+** (Add) icon to open the *Neigh Cell Settings* window, as shown in Figure 2-114 and described in Table 2-46. The parameters shown in the figure reflect the recommended settings for this operator example.

Figure 2-114: LTE Freq/Cell > Neigh Cell Settings (QRTB)

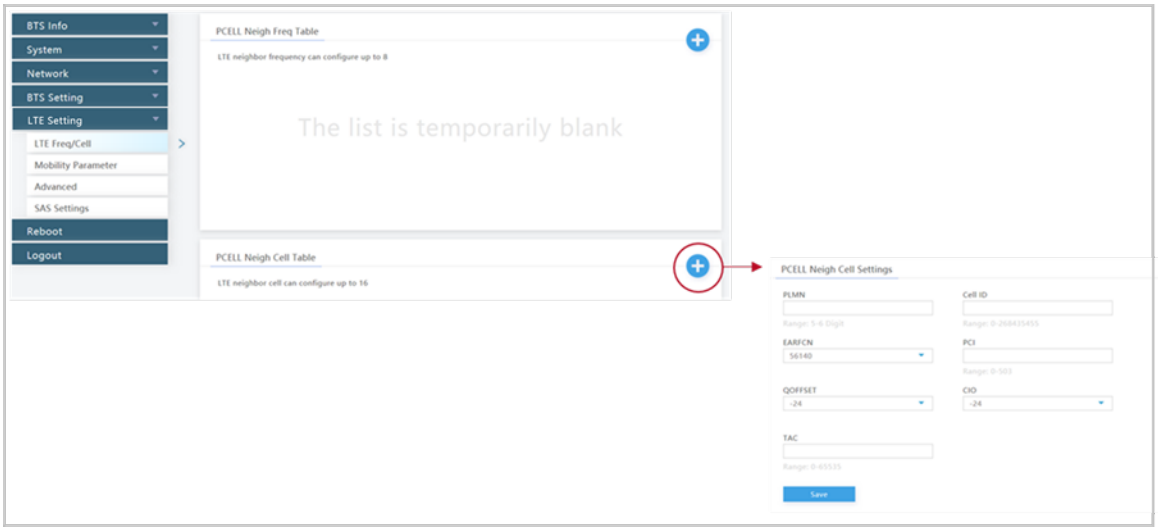


Table 2-46: LTE Freq/Cell > Neigh Cell Settings (QRTB)

Field Name	Description
PLMN	The 5- or 6-digit Public Land Mobile Network (PLMN) that the neighbor cell belongs to.
Cell ID	The cell ID of the neighbor cell. Range is 0-268,435,455.
EARFCN	Frequency point of the neighbor cell. EARFCN stands for Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access (E-UTRA) Absolute Radio Frequency Channel Number.
PCI	Physical Cell Identifier (PCI) of the neighbor cell. Range is 0-503.
QOFFSET	Frequency offset of this neighbor cell. Indicates the difference in signal level between the serving and this neighboring eNB, as determined by the received signal level at the UE. If the received signal level is better from this neighbor eNB by at least this amount of difference in dB, the UE will reselect this cell. Range is +24 to -24 dB. A typical value is 0 dB.
CIO	Cell Individual Offset (CIO) is this neighbor eNB's cell offset, which is one of the variables used to determine which eNB will best serve a given UE. Range is -24 to 24 dB. A typical value is 0 dB.
TAC	Tracking Area Code (TAC) of this neighbor cell. Range is 0-65535.

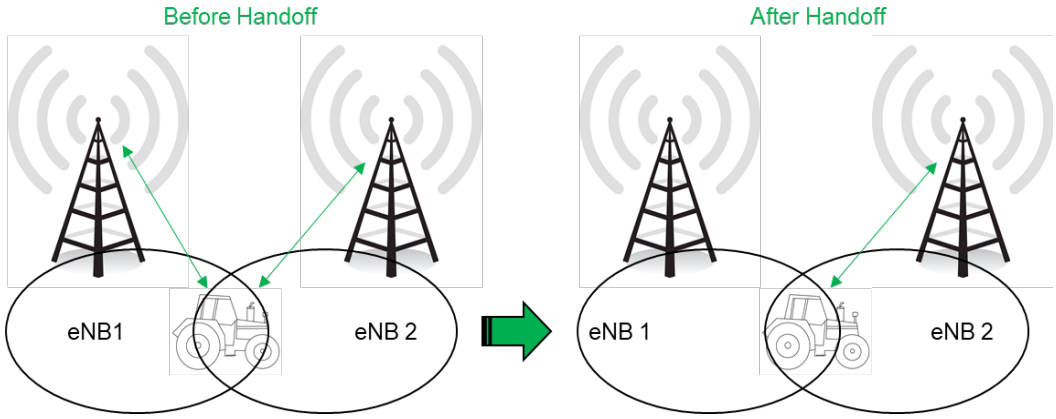
2.10.3 Mobility Parameter

The *Mobility Parameter* menu pertains to how roaming UE sessions are handled between different eNBs in the same service area. When a UE is actively connected to an eNB, the current eNB is referred to as the serving eNB or cell. The other eNBs in the area are referred to as either neighbor or target eNBs or cells.

The process of a device moving from cell to cell and changing over from its serving eNB to a neighbor (target) eNB is called handoff or handover. The UE exchanges information with its serving eNB to perform cell selection and reselection based on parameters which you will set for each eNB. Refer to Figure 2-115: Handoff (QRTB).

NOTE 1: The terms *handoff* and *handover* are used interchangeably in LTE.
NOTE 2: Handoff is not supported at this time on an eNB operating in HaloB mode.
NOTE 3: Cloud EPC cannot perform handoffs currently.

Figure 2-115: Handoff (QRTB)



What the UE measures that determines cell selection and reselection is the Reference Signal Received Power (RSRP) of the serving as well as neighboring eNBs. The measurements are sent periodically to the serving eNB, which then determines if the UE would be better served by an adjacent eNB. Refer to the case study in section 2.11 Real-World LTE to LTE Handoff Configuration Example.

The default settings in the *Mobility Parameter* sub-menus represent standard LTE deployments. Many of the mobility settings should be left with their default values. Any modification should be determined only by experienced wireless professionals.

Figure 2-116 shows the sub-menus for the mobility parameters. In terms of LTE to LTE handoff, only the *A1*, *A2, A3*, *A5*, *Measurement Control*, *Cell Selection Parameter*, and *Cell ReSelection Parameter* fields are used.

NOTE: The *B2 Event Threshold* fields pertain only to TD-SCDMA and GSM adjacent cells, not to adjacent LTE cells. For more information about *B2 Event Threshold* fields, see section 2.9.5.

You will configure these mobility parameters for every adjacent eNB. If the serving eNB determines that more than one adjacent eNB meets the RSRP event thresholds, the *Cell Reselection* settings will determine to which adjacent eNB the serving eNB would hand off.

To begin the configuration, next to *A1 Event Threshold* and the other event thresholds, select the **+** icon. The resulting window presents the fields for each sub-menu: *A1, A2, A3,* and *A5 Event Threshold* (Figure 2-117). The configuration values in the figure are the recommended settings for the eNB in this operator example. Table 2-47 describes each of the event threshold fields.

Figure 2-116: Mobility Parameters (QRTB)

Figure 2-117: A1, A2, A3, and A5 Event Thresholds (QRTB)

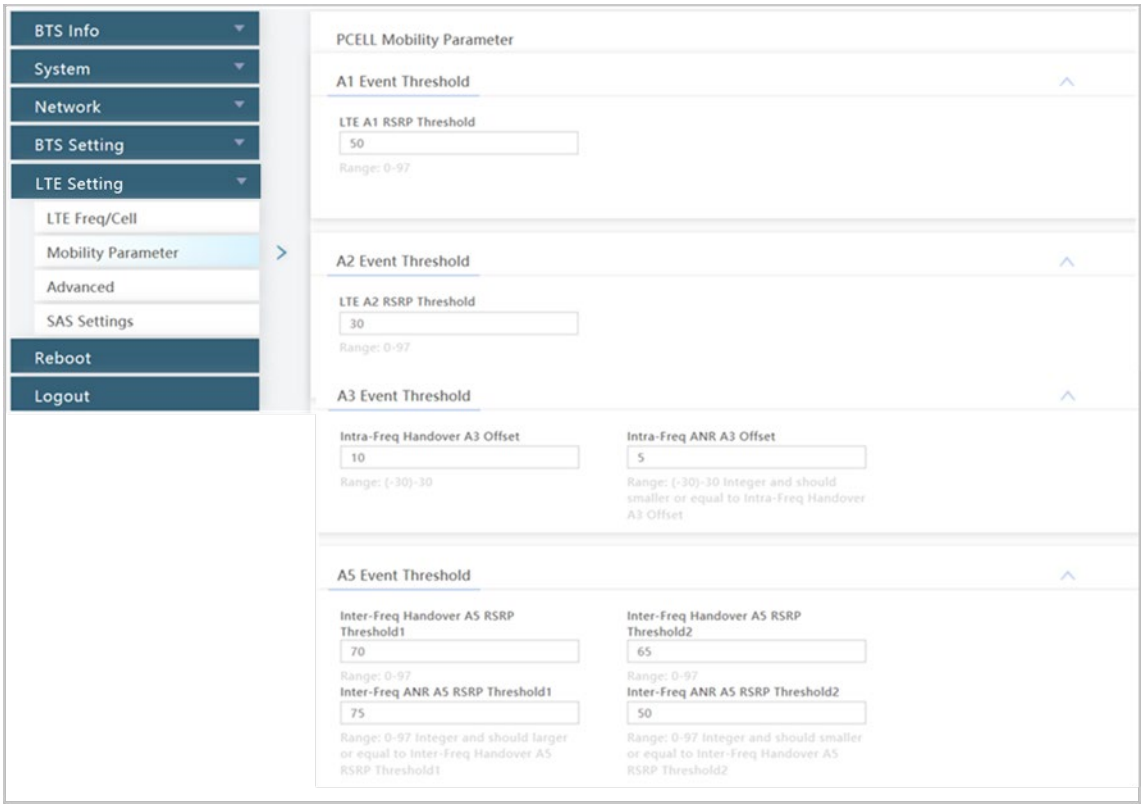


Table 2-47: A1, A2, A3, and A5 Event Threshold Fields (QRTB)

Field Name	Description
A1 Event Threshold	
LTE A1 RSRP Threshold	The LTE A1 event is triggered when the serving cell's Reference Signal Received Power (RSRP) becomes better than the A1 threshold. The A1 event can be used to turn off certain inter-cell measurements. Range is 0-97 (integer). Default value is 90. In this example, the recommended value is 45 (integer), which means -140 dBm + 45 = -95 dBm.
A2 Event Threshold	
LTE A2 RSRP Threshold	The LTE A2 event is triggered when the serving cell's Reference Signal Received Power (RSRP) becomes worse than the A2 threshold. Range is 0-97 dB. The default is 65. In this example, the recommended value is 40 (integer), which means -140 dBm + 40 = -100 dBm. Refer to the Baicells Tip concerning A2 settings: *https://www.facebook.com/groups/baicellsoperatorsupportgroup/permalink/1760449424249426/*
A3 Event Threshold	
Intra-Freq Handover A3 Offset	The LTE A3 event is triggered when a neighbor cell becomes better than the serving cell by as much as the offset value. The offset can be either positive or negative. Range is -30 dB to 30 dB. The default is 10. In this example, the recommended value also is 10 (integer), which means 10*0.5 = 5 dB.
Intra-Freq ANR A3 Offset	The offset of Automatic Neighbor Relation (ANR) A3 event for intra-frequency handover. The offset can be either positive or negative. Range is -30 dB to 30 dB.
A5 Event Threshold	
Inter-Freq Handover A5 RSRP Threshold 1	The LTE A5 event is triggered when the serving cell becomes worse than Threshold 1 while a neighbor cell becomes better than Threshold 2. Range is 0-97 (integer). The default is 70. In the example, the recommended value is 40 (integer): equals -140 dBm + 40 = -100 dBm.
Inter-Freq Handover A5 RSRP Threshold 2	Range is 0-97 (integer). The default is 65. In this example, the recommended value is 45 (integer), which equals -140 dBm + 45 = -95 dBm.
Inter-Freq ANR A5 RSRP Threshold 1	The threshold 1 of Automatic Neighbor Relation (ANR) A5 event for inter-frequency handover. Range is 0-97 (integer).
Inter-Freq ANR A5 RSRP Threshold 2	The threshold 2 of Automatic Neighbor Relation (ANR) A5 event for inter-frequency handover. Range is 0-97 (integer).

NOTE: The *B2 Event Threshold* fields pertain to TD-SCDMA and GSM adjacent cells, not to adjacent LTE cells. Therefore, the *B2 Event Threshold* fields are not configured for eNBs running BaiBS_QRTB_2.6.2 software. See section 2.9.5 for more information on the *B2 Event Threshold* fields.

The Measurement Control parameters determine how frequently the UE measures the serving and neighboring eNBs' RSRP values and at what level of hysteresis-based RSRP triggers a handoff (Figure 2-118 and Table 2-48). The UE evaluates the RF conditions around it and reports the information to the serving eNB. The eNB's radio resource management function evaluates the measurements and determines whether or not to hand off the session to a neighbor eNB. The parameters shown in the figure reflect the recommended settings for this operator example.

Figure 2-118: Measurement Control Parameters (QRTB)

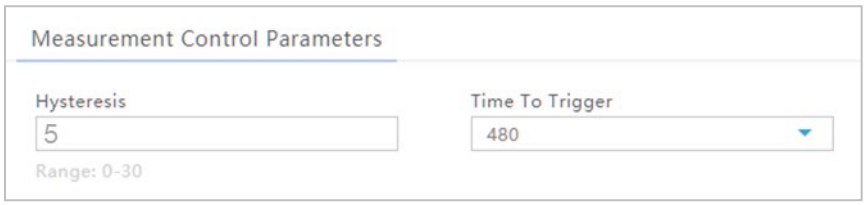


Table 2-48: Measurement Control Fields (QRTB)

Field Name	Description
Hysteresis	Refers to the hysteresis (historical records) of the handover measurement events. The value is used to avoid the frequent triggering of cell handover evaluation due to the fluctuation in wireless signals. This setting tells the UE, if you hear another eNB with at least this amount of dB better, initiate a handover. The lower the number the sooner the handover is initiated. If set too low, it may cause the UE to ping-pong between eNBs. Such events are tracked by the EPC, but not by the eNB. Range is 0-30 dB. The default is 0. In this example, the recommended value is 5 dB.
Time To Trigger	Length of time the target cell RSRP value is better than the serving cell before the UE initiates a handover request. The range is 0-5120 ms. The default is ms480 (recommended). Range: ms0 - ms5120.

The *Cell Selection Parameter* and *Cell ReSelection Parameter* sub-menus are shown in Figure 2-119 and described in Table 2-49. The parameters shown in the figure reflect the settings recommended in this example.

Figure 2-119: Cell Selection and Cell ReSelection Parameters (QRTB)

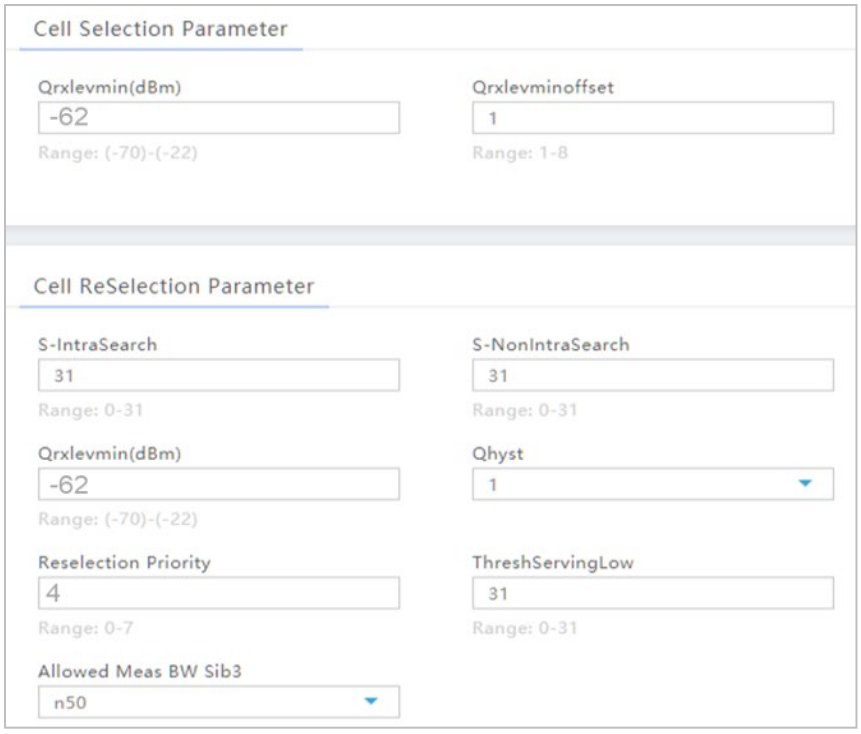


Table 2-49: Cell Selection and Cell ReSelection Fields (QRTB)

Field Name	Description
Cell Selection Parameter	
Qrxlevmin(dBm)	Minimum acceptable signal level at the UE before cell selection. Range is -70 dBm to -22 dBm. The default is -60. In this example, the recommended value is -62 dBm. The value will be this number x 2, e.g., if set to -60 the value will actually be -120 dBm, minus the offset.
Qrxdevminoffset	Minimum level offset (difference) in RSRP at the UE needed for cell selection. Range is 1-8 dB. The default is 1. In this example, the recommended value is 1 dB.
Cell ReSelection Parameter	
S-IntraSearch	Intra-band measurement threshold that must be met before the UE will reselect a neighbor eNB. Range is 0-31 (integer). In this example, the recommended value is 31 (integer), which means 31*2 = 62 dB.
S-NonIntraSearch	Inter-band measurement threshold that must be met before the UE will reselect a neighbor eNB. Range is 0-31 (integer). In this example, the recommended value is 31 (integer), which means 31*2 = -62 dB.
Qrxlevmin(dBm)	Minimum level for reselection. Range is -70 to -22 (integer). In this example, the recommended value is -62 (integer), which means -62*2 = -124 dBm.
Qhyst	Delay time for reselection. Range is 0-24 dB. In this example, the recommended value is 1 dB.
Reselection Priority	Priority for reselection. Range is 0-7 (integer). In this example, the recommended value

Field Name	Description
	is 4.
ThreshServingLow	Threshold for selection to cells of lower priority. Range is 0-31 dB. In this example, the recommended value is 31 dB.
Allowed Meas BW Sib3	Measurement bandwidth allowed. Choices are n15, n25, n50, n75, or n100. The default value is n50.

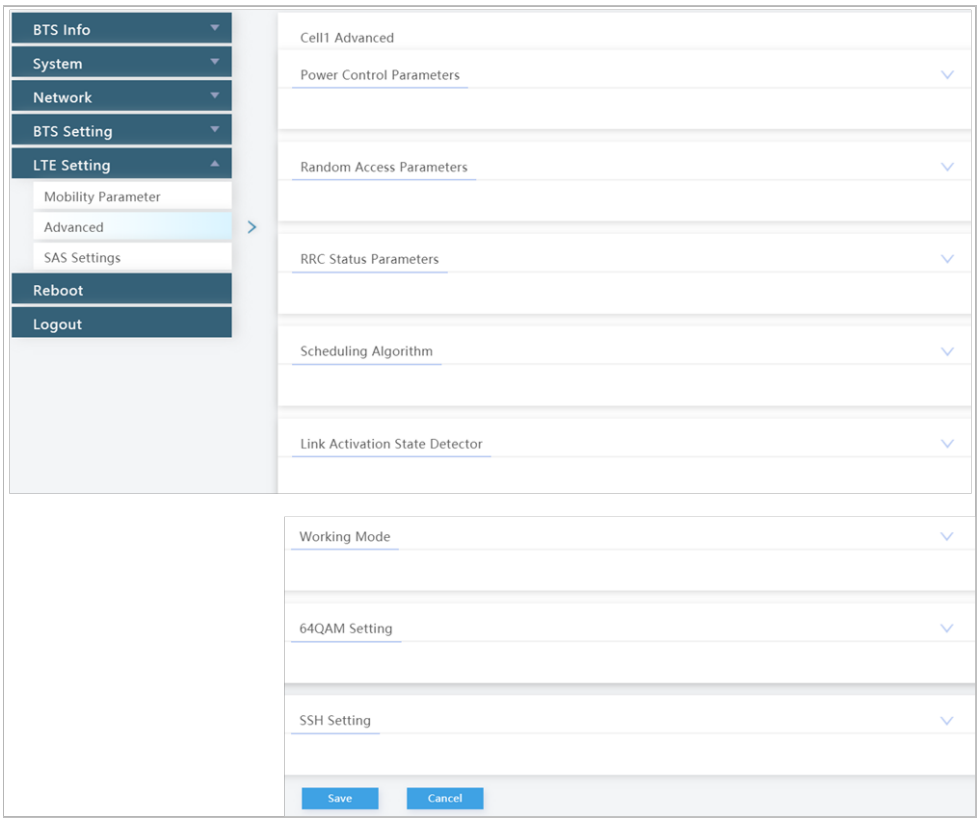
2.10.4 Advanced

Caution: Many, if not all, of the *Advanced* settings should be left with their default values. Any modifications should be determined only by experienced wireless professionals.

The Advanced settings are primarily used to fine-tune the RF settings and to configure special features. Figure 2-120 shows the LTE Setting > Advanced sub-menus which are explained in this section.

NOTE: On a two-carrier eNB running BaiBS_QRTB_2.6.2 software version, the Advanced settings are configured on the primary cell (Cell1) for both the primary cell and the secondary cell (Cell2).

Figure 2-120: Advanced (QRTB)



2.10.4.1 Power Control Parameters

The *Power Control Parameters* help to limit UE transmit power to the eNB being configured, including the power of the transmitted reference signals. The parameters factor into the overall RF link budget. The power control parameters are shown in Figure 2-121 and described in Table 2-50.

Figure 2-121: Power Control Parameters (QRTB)

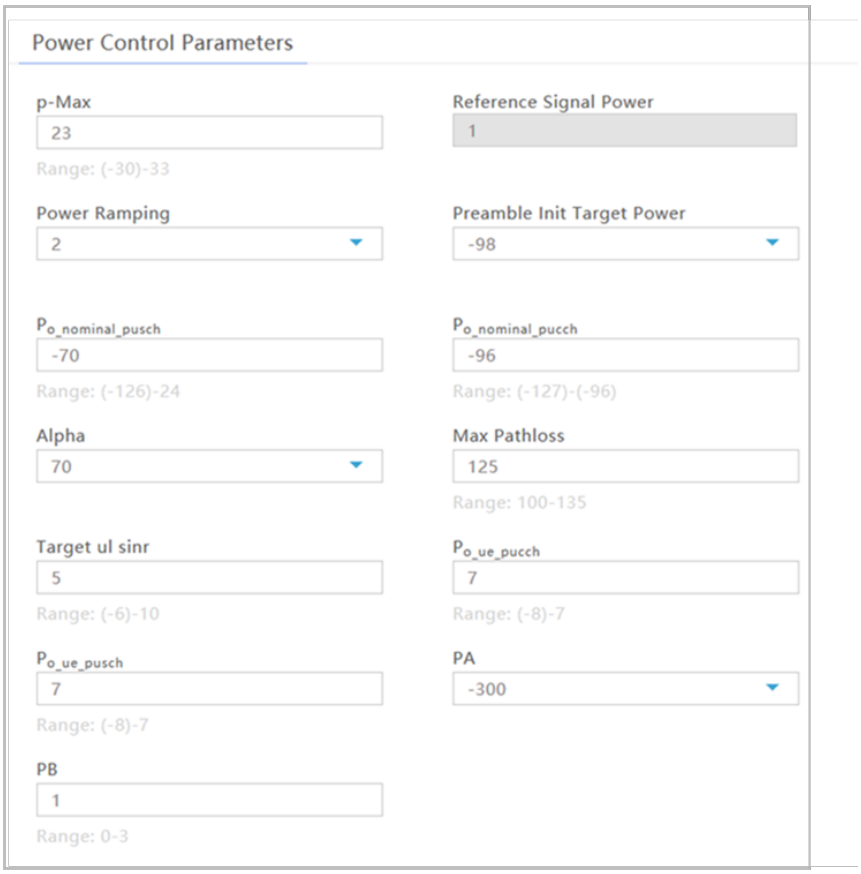


Table 2-50: Power Control Parameters (QRTB)

Field Name	Description
p-Max	The maximum power that a UE can transmit in this cell. Range is -30 dB to 33 dB.
Reference Signal Power	Transmit power of the reference signals. Auto-set to 2.
Power Ramping	Step size of the Physical Random-Access Channel's (PRACH's) power index broadcast to the UEs via a Layer 1 channel used by UEs to access the mobile network for call setup and bursty data transmission. Options are 0, 2, 4, or 6.
Preamble Init Target Power	Initial power of the Physical Random-Access Channel (PRACH). Range is -90 to -120.
Po_nominal_pusch	Physical Uplink Shared Channel (PUSCH) carries user data. It supports Quadrature Phase Shift Keying (QPSK) and 16 Quadrature Amplitude Modulation (QAM), with 64QAM being optional. Range is -126 to 24 dB.
Po_nominal_pucch	Physical Uplink Control Channel (PUCCH) is used to carry Uplink Control Information (UCI). LTE UEs can never transmit both PUCCH and Physical Uplink Shared Channel

Field Name	Description
	(PUSCH) during the same subframe. Range is -127 to -96 dB.
Alpha	Power control loss compensation factor, which controls the UE power. Range is 0 to 100.
Max Pathloss	Maximum threshold at which the UE determines not to transmit to the eNB based on pathloss. Pathloss is the difference between the transmitted reference signal information and the actual received signal power. Range is 100 to 135.
Target ul sinr	Desired Signal-to-Interference-Plus-Noise Ratio (SINR) level to ensure an acceptable level of communication between the UE and eNB, while also controlling interference that might be caused to neighboring cells. Range is -6 dB to 10 dB.
Po_ue_pucch	Initial UE transmit power when using Physical Uplink Control Channel (PUCCH). Range is -8 dB to 7 dB.
Po_ue_pusch	Initial UE transmit power when using Physical Uplink Shared Channel (PUSCH). Range is -8 dB to 7 dB.
PA	Physical Downlink Shared Channel (PDSCH) is the main data bearing channel. Power boosting the reference signal is allocated to UEs on a dynamic and opportunistic basis. The relative PDSCH power is determined by two computed parameters: P_A and P_B. Traffic loading must be balanced with controlling interference to neighboring cells. Auto-set to -3.
PB	See description for field “PA”. Range is 0-3.

To optimize channel conditions on the eNB, please refer to the BaiTip posted on the Baicells website: *https://community.na.baicells.com/t/recommened-advanced-settings-on-the-enb-to-optimise-channel-conditions/531*

2.10.4.2 Random Access Parameters

The preamble format to be used in a specific cell is messaged from the eNB to the UEs using a Physical Random-Access Channel (PRACH) configuration index. The UE uses the preamble to access the network when it is first powered on. The settings for *Random Access Parameters* are shown in Figure 2-122 and explained in Table 2-51.

Figure 2-122: Random Access Parameters (QRTB)

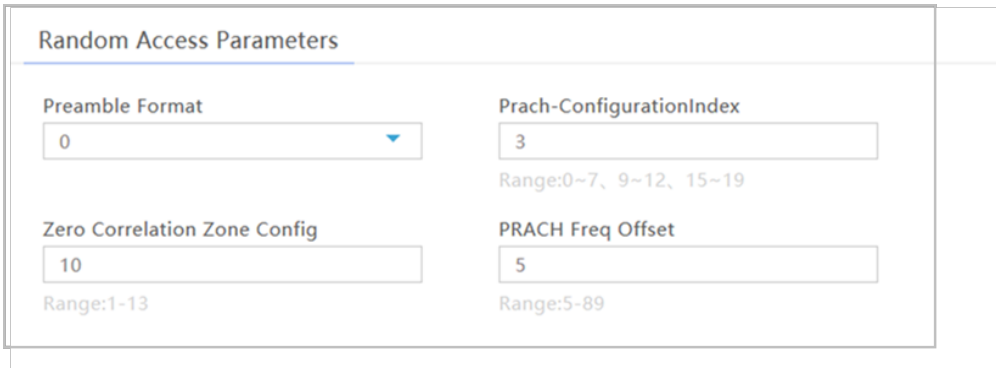


Table 2-51: Random Access Parameters (QRTB)

Field Name	Description
Preamble Format	Packet preamble format [based on the Physical Random-Access Channel (PRACH) index] to be used for this cell and communicated to UEs. Options are 0, 2, or 4.
Prach-Configuration Index	The PRACH configuration index number that will be broadcast to the UEs via SIB2. Options are: 0, - 4, 6, 9, 10, 12, 15, 16, or 18.
Zero Correlation Zone Config	Specifies the cyclic shift intervals to generate the preamble sequence. Range is 0-15 in the standard eNB GUI. The range is 0-63. Default is 10. Refer to the BaiTip on this setting: *https://community.na.baicells.com/t/baitip-of-the-day-december-14th-2016-subframes-and-special-subframes/163*
PRACH Freq Offset	Determines the location of the PRACH preamble in the frequency domain. Range: 5 – 89.
PRACH Root Sequence	Index broadcast by the eNB and used by UEs to calculate the preamble they should use to attach to the eNB. The default value is 12. Range: 0 - 837.

2.10.4.3 RRC Status Parameters

Under Radio Resource Control Status (*RRC Status Parameters*), you will configure parameters related to how the RRC protocol in the air interface control plane establishes, maintains, and releases an RRC connection between UEs and the eNB. If the *Ue Inactivity Timer* is set to 0, the timer does not take effect. The UE inactive status duration is equal to the RRC inactivity timer times the maximum expiry count. Refer to Figure 2-123 and Table 2-52.

Figure 2-123: RRC Status Parameters (QRTB)

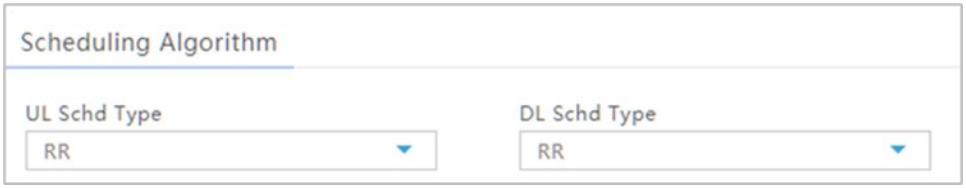
Table 2-52: RRC Status Parameters (QRTB)

Field Name	Description
Ue Inactivity Timer	Expire time of the UE inactive status timer(s). Range is 0-4294967 seconds. If set to 0, the timer does not take effect.
Max Expiry Count	Maximum number of times the UE's inactive status timer expires. The range is 1-65,535 times.

2.10.4.4 Scheduling Algorithm

The Scheduling Algorithm fields are important for smooth RF operation and can impact key performance indicators such as cell throughput, cell edge users, Voice Over IP (VoIP) capacity, and data Quality of Service (QoS). The most common scheduling strategy is round robin (RR), which is the default type for both UL and DL. Refer to. Figure 2-124.

Figure 2-124: Scheduling Algorithm (QRTB)



2.10.4.5 Link Activation State Detector

The *Link Activation State Detector* is used to enable or disable a link watchdog. If you select *Enable*, a watchdog action will check the UE every "x" minutes to see if it is connected or disconnected from the EPC, LAN, or both, and if disconnected after "x" number of minutes the watchdog will perform a warm reboot the UE. If you select *Disable*, the watchdog will not reboot the UE. Refer to Figure 2-125 and Table 2-53.

Figure 2-125: Link Activation State Detector (QRTB)

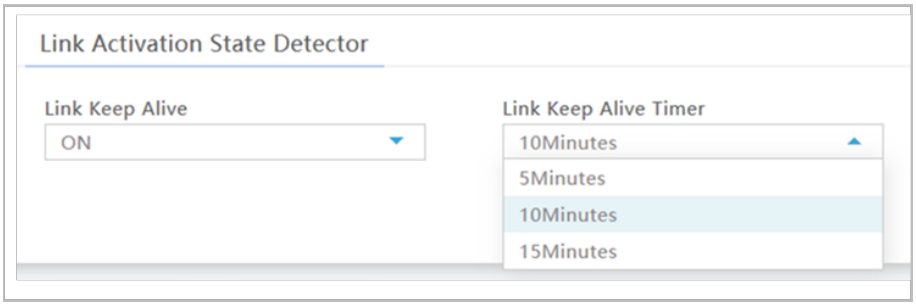


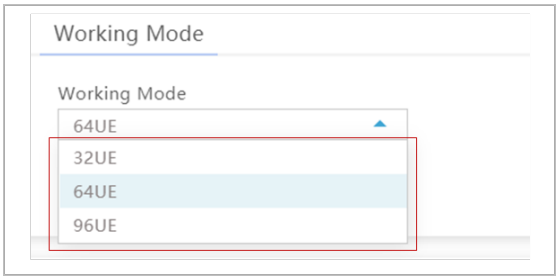
Table 2-53: Link Activation State Detector (QRTB)

Field Name	Description
Link Keep Alive	Select ON/OFF to enable/disable the link activation state detector between the UE and EPC, LAN, or both
Link Keep Alive Timer	Select 5, 10, or 15 minutes for the link keep alive timer. 5 minutes is the default.

2.10.4.6 Working Mode

The *Working Mode* menu (Figure 2-126) allows you to configure the maximum* number of simultaneous, connected users or limit it to service a maximum of 32 users. When this value is set to *32UE*, fewer users will be served but will have more capacity than when the value is set to handle the maximum of 96 users. Otherwise, select *96UE* to support the highest possible number of users.

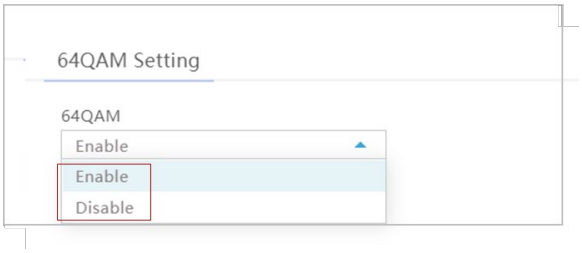
Figure 2-126: Working Mode (QRTB)



2.10.4.7 64QAM Setting

Use the *64QAM Setting* menu to disable or enable the 64QAM function (Figure 2-127).

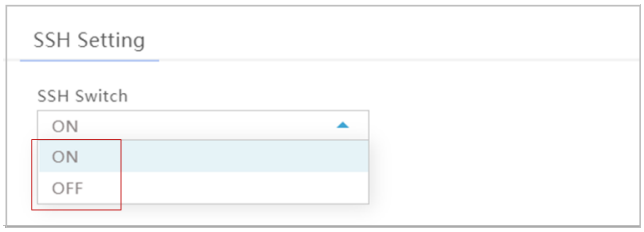
Figure 2-127: 64QAM Setting (QRTB)



2.10.4.8 SSH Setting

Use the *SSH Setting* menu to disable or enable the SSH function (Figure 2-128).

Figure 2-128: SSH Setting (QRTB)



2.10.5 SAS Settings

Reference: *SAS Deployment Guide*

The Citizens Broadband Radio Service (CBRS) band covers 3.55-3.65 GHz and was officially launched in January 2020. Operators must sign up with a Spectrum Access System (SAS) provider for services to handle

the dynamic frequency assignment and release process. Baicells provides FCC Part 96 certified eNBs and CPEs as CBRS Service Devices (CBSDs) that can operate within the FCC rules for CBRS, and certification will be an ongoing process as new products are introduced. The SAS vendors currently available to manage spectrum usage are Amdocs, CommScope, Federated Wireless, and Google.

The Baicells eNBs use domain proxy (DP) to connect to the SAS server by leveraging the existing connection with the OMC. All eNBs will need to be connected to the OMC in order to connect to the SAS.

The following are the current software levels for SAS to work:

- Nova227/233: BaiBS_RTS_3.7.5
- Nova436Q/Neutrino430: BaiBS_QRTB_2.6.2
- OMC: BaiOMC 7.0.4

NOTE 1: This section covers eNBs running QRTB software. See section 2.9.7 to configure eNBs running RTS software.
NOTE 2: Legacy Gen 1 CPEs do not support SAS.

*****This section covers only the eNB LTE Setting > SAS Settings. Please refer to the *SAS Deployment Guide* for the full instructions to implement CBRS SAS operation.*****

In the eNB GUI, the LTE Setting > SAS Settings menu opens by default as disabled. When you enable SAS, you will enter the installation information and the Certified Professional Installer (CPI) credentials. The SAS vendor will control the eNB's power and frequency point, as required by CBRS regulations. Refer to Figure 2-129, Figure 2-130, and Table 2-54.

NOTE 1: When SAS is enabled, the standard BTS Info > Quick Setting for *Band, Bandwidth, Frequency,* and *Power Modify* will become greyed out; the eNB will use the configuration based on the SAS settings response. However, you can configure your preferences for these settings by selecting a *Frequency Selection Logic*. Refer to the *SAS Deployment Guide*.
NOTE 2: There are two SAS setting registration types: Single-step and Multi-step. The difference in these types is that in Single-step registration, all configuration is accomplished on the eNB GUI itself and there is no need to use a SAS portal. The Multi-step registration type has fewer fields for configuring the eNB, but the rest of the configuration must be accomplished using the SAS portal.
NOTE 3: Each SAS vendor provides their own GUI to assist you in using their SAS portal.
NOTE 4:If you choose to use the Single-step registration type, have your CPI info and all antenna requirements ready to input before you start the configuration procedures.
NOTE 5: With the software update from QRTB 2.5.4 to QRTB 2.6.2, the “Channel Reuse” check box moved from the SAS Settings GUI to the Quick Setting GUI. See section 2.4.2 for more information.

Figure 2-129: SAS Settings (Registration Type Multi-step) (QRTB)

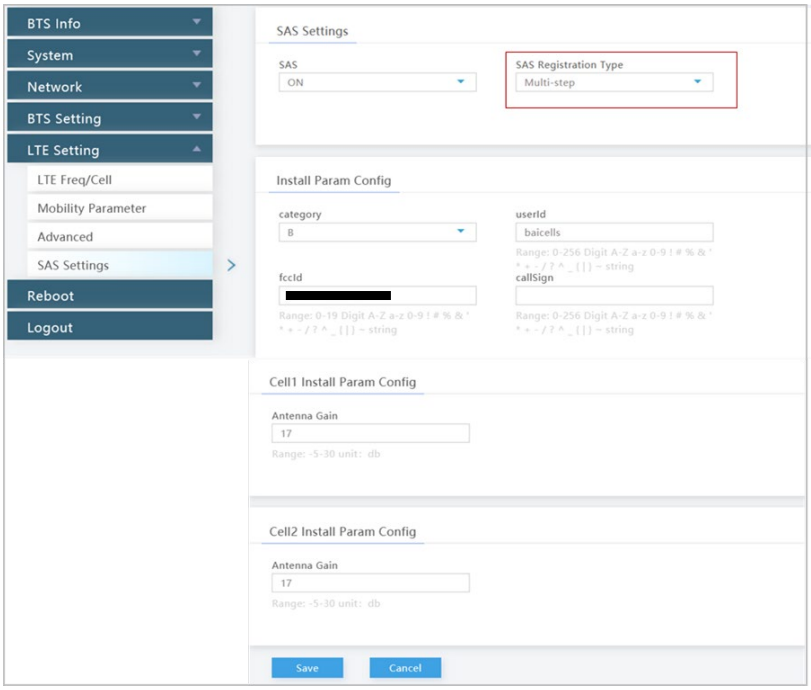


Figure 2-130: SAS Settings (Registration Type Single-step) (QRTB)

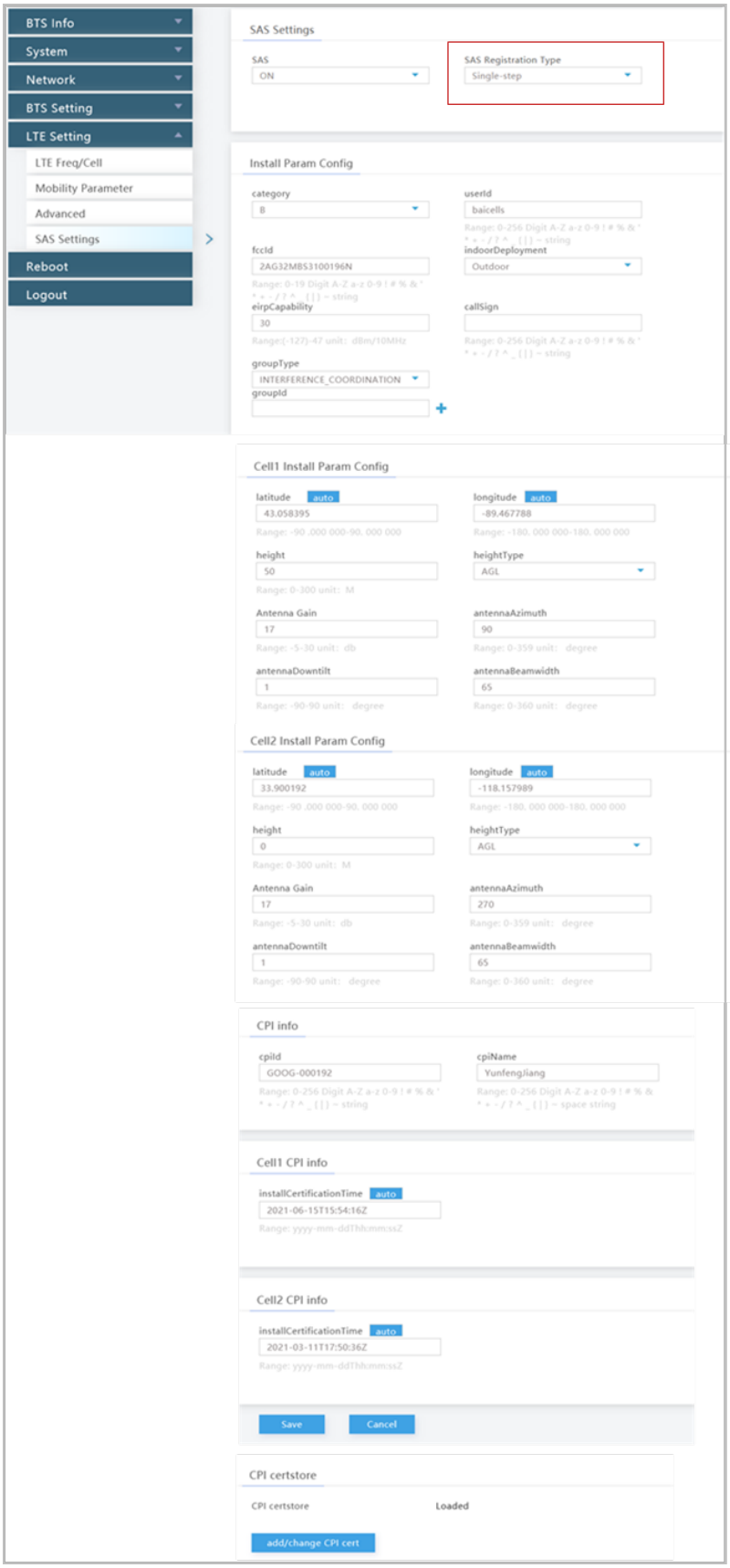
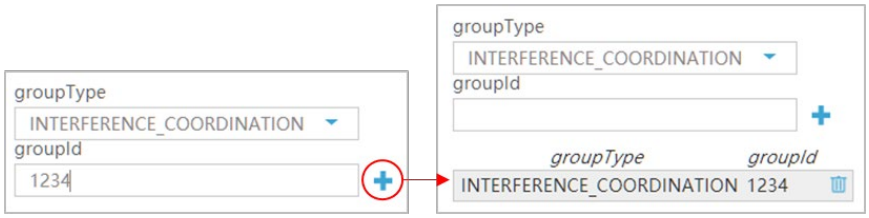


Table 2-54: SAS Settings (QRTB)

Field Name	Description
SAS Settings	
SAS	ON/OFF to enable or disable the SAS function
SAS Registration Type	Select Multi-step or Single-step method to register the eNB with the SAS vendor.
Multi-step method	
Install Param Config (Multi-step method)	
category	Either A or B according to the CBRS device designation. The main difference between these two categories is the power limit (see *SAS Deployment Guide*). The eNB is typically Category B.
userid	Enter a user ID, which is provided by your SAS vendor and is associated with this SAS-enabled eNB. Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
fccid	The eNB's FCC certification number. Range is 0 to 19 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
callSign	Optional: Parameter that is useful to identify the PAL license under which the operator is deploying a CBSD. The parameter is not necessary to configure for the GAA spectrum (3550 – 3700 MHz). Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
Cell1 Install Param Config (Multi-step method)	
Antenna Gain	Set the primary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dBi.
Cell2 Install Param Config (Multi-step method)	
Antenna Gain	Set the secondary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dBi.
Single-step method	
Install Param Config (Single-step method)	
category	Either A or B according to the CBRS device designation. The main difference between these two categories is the power limit (see *SAS Deployment Guide*). The eNB is typically Category B.
userid	Enter a user ID, which is provided by your SAS vendor and is associated with this SAS-enabled eNB. Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
fccid	The eNB's FCC certification number for the device. Range is 0 to 19 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
indoorDeployment	Select Outdoor or Indoor to indicate whether the eNB is an Indoor or Outdoor unit. Default is Outdoor.

Field Name	Description
eirpCapability	The Effective Isotropic Radiated Power (EIRP) capabilities of the transmitting antenna. Range is -127 to 47 dB/10 MHz.
callSign	Optional: Parameter that is useful to identify the PAL license under which the operator is deploying a CBSD. The parameter is not necessary to configure for the GAA spectrum (3550 – 3700 MHz). Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
groupType	Optional: Only INTERFERENCE_COORDINATION may be selected at this time. Adding a Group is also optional at this time. CBSD grouping is currently not being used by SAS vendors, but will be used in the future when General Authorized Access (GAA) coexistence is introduced.
groupId	Optional: You must enter a group ID if using a group type. You cannot leave the groupID field blank when using a group type. Specify the group ID using letters, numbers, or special characters. When you add the ID, it will be displayed beneath this field. 
Cell1 Install Param Config	
latitude	Latitude of the primary cell eNB's location in a two-carrier configuration. Select auto to autofill the latitude based on GPS data; otherwise, enter the latitude. Range is -90.000000 to 90.000000.
longitude	Longitude of the primary cell eNB's location in a two-carrier configuration. Select auto to autofill the longitude based on GPS data; otherwise, enter the longitude. Range is -180.000000 to 180.000000.
height	Enter the primary cell antenna height, in meters, in a two-carrier configuration. Range: 0-300 meters.
heightType	Primary cell height type in a two-carrier configuration. Only Above Ground Level (AGL) may be selected.
Antenna Gain	Set the primary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dBi.
antennaAzimuth	Enter the primary cell antenna azimuth, in degrees, in a two-carrier configuration. Default is 180°. Range: 0 - 359°
antennaDowntilt	Enter the degrees of primary cell antenna downtilt in a two-carrier configuration. Default is 5°. Range: -90° to 90°.

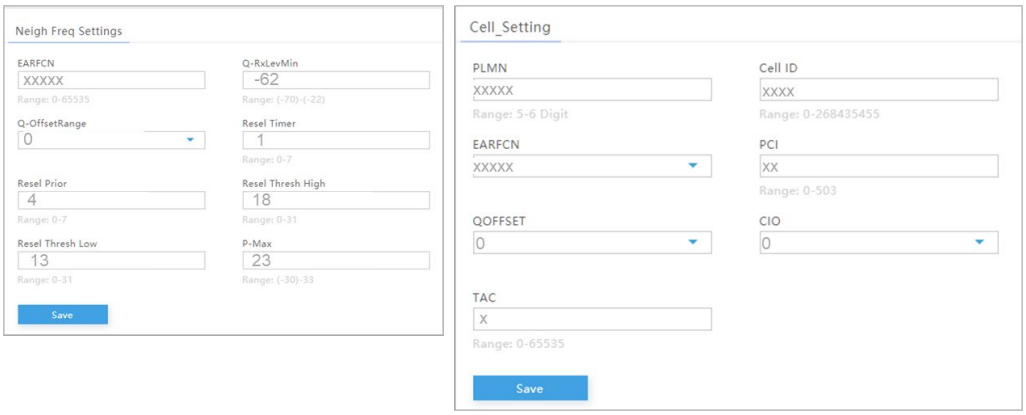
Field Name	Description
antennaBeamwidth	Enter the degrees of primary antenna beamwidth in a two-carrier configuration. Default is 65°. Range: 0 - 360°.
Cell2 Install Param Config	
latitude	Latitude of the secondary cell eNB's location in a two-carrier configuration. Select auto to autofill the latitude based on GPS data; otherwise, enter the latitude. Range is -90.000000 to 90.000000.
longitude	Longitude of the secondary cell eNB's location in a two-carrier configuration. Select auto to autofill the longitude based on GPS data; otherwise, enter the longitude. Range is -180.000000 to 180.000000.
height	Enter the secondary cell antenna height, in meters, in a two-carrier configuration. Range: 0-300 meters.
heightType	Secondary cell height type in a two-carrier configuration. Only Above Ground Level (AGL) may be selected.
Antenna Gain	Set the secondary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dBi.
antennaAzimuth	Enter the secondary cell antenna azimuth, in degrees, in a two-carrier configuration. Default is 180°. Range: 0 - 359°
antennaDowntilt	Enter the degrees of secondary cell antenna downtilt in a two-carrier configuration. Default is 5°. Range: -90° to 90°.
antennaBeamwidth	Enter the degrees of secondary cell antenna beamwidth in a two-carrier configuration. Default is 65°. Range: 0 - 360°.
CPI info	
cpiId	Enter the Certified Professional Installer's identification number. Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
cpiName	Enter the Certified Professional Installer's name. Use an underscore to separate first name and last name; you cannot use a space in this field. Range is 0 to 256 characters (using upper-case letters A-Z, lower-case letters a-z, and digits 0-9).
Cell1 CPI info	
installCertificationTime	Enter the primary cell date and time of installation in a two-carrier configuration: yyyy-mm-ddThh:mm:ssZ. Select auto to autofill the primary cell installation date and time.
Cell2 CPI info	
installCertificationTime	Enter the secondary cell date and time of installation in a two-carrier configuration: yyyy-mm-ddThh:mm:ssZ. Select auto to autofill the secondary cell installation date and time.

Field Name	Description
CPI certstore	
CPI certstore	Used to view the status of CPI certifications that have already been uploaded in the system when using the System > CertStore menu.
Loaded	Indicates if the CPI Certificate is loaded
Missing	Indicates if the CPI Certificate is missing
add/change CPI cert	Select to upload or change the CPI certificate. You can also use the System > CertStore menu to upload the certificate.

2.11 Real-World LTE to LTE Handoff Configuration Example

Following is an example of the LTE mobility-related parameters based on eNB software version RTS 3.4.8 or higher, to illustrate how the system performs based on the configuration settings. Figure 2-131 shows how the *LTE Neigh Frequency* and *Neigh Cell Table* settings are configured in this customer example.

Figure 2-131: LTE Neigh Freq and Neigh Cell



Explanation of the event thresholds: The serving eNB starts the A2 and A3 event threshold measurements. If the A3 event threshold is met by a neighbor intra-frequency cell, the UE session will be handed off to that target eNB. If the A2 event threshold is met, it stops the A2 measurement and triggers the A1 and A5 measurements. Then, if the A1 event threshold is met, it stops the A1/A5 measurements and starts the A2 evaluation again. Assuming the A5 measurement indicates the neighbor inter-frequency cell is better than the serving cell, the serving eNB will hand off the session to the neighbor eNB.

Example: For the *A1 Event Threshold*, assume the starting measurement is set to 45 (Figure 2-132). If the UE measures RSRP > -95 dBm, the UE will report the A1 event and the network will stop the A1 and A5 event measurements and start the A2 event measurement.

Figure 2-132: A1 Threshold

Under the *A2 Event Threshold*, assume the *LTE A2 RSRP Threshold* value is set to 40 (Figure 2-133). If the UE measures RSRP < -100 dBm, the UE will report the A2 event and the network will start the A1 and A5 event measurements.

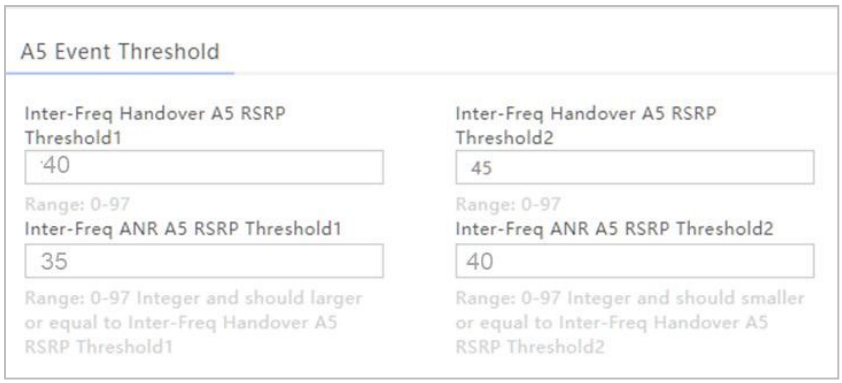
Figure 2-133: A2 Threshold

For *A3* assume the *Intra-Freq Handover A3 Offset* value is set to 10 (Figure 2-134). If the UE reports an A3 event (offset > 10*0.5 = 5 dB), the eNB may command the UE to hand off to the target intra-frequency cell.

Figure 2-134: A3 Threshold

For the *A5 Event Threshold*, assume the *Inter-Freq Handover A5 RSRP Threshold1* value is set to 40 and *Inter-Freq Handover A5 RSRP Threshold2* value is set to 45 (Figure 2-135). If the UE reports an A5 event (RSRP of the serving cell < -100 dBm, and the RSRP of the neighbor cell is > -95 dBm), the eNB may command the UE to hand off to the target inter-frequency cell.

Figure 2-135: A5 Threshold



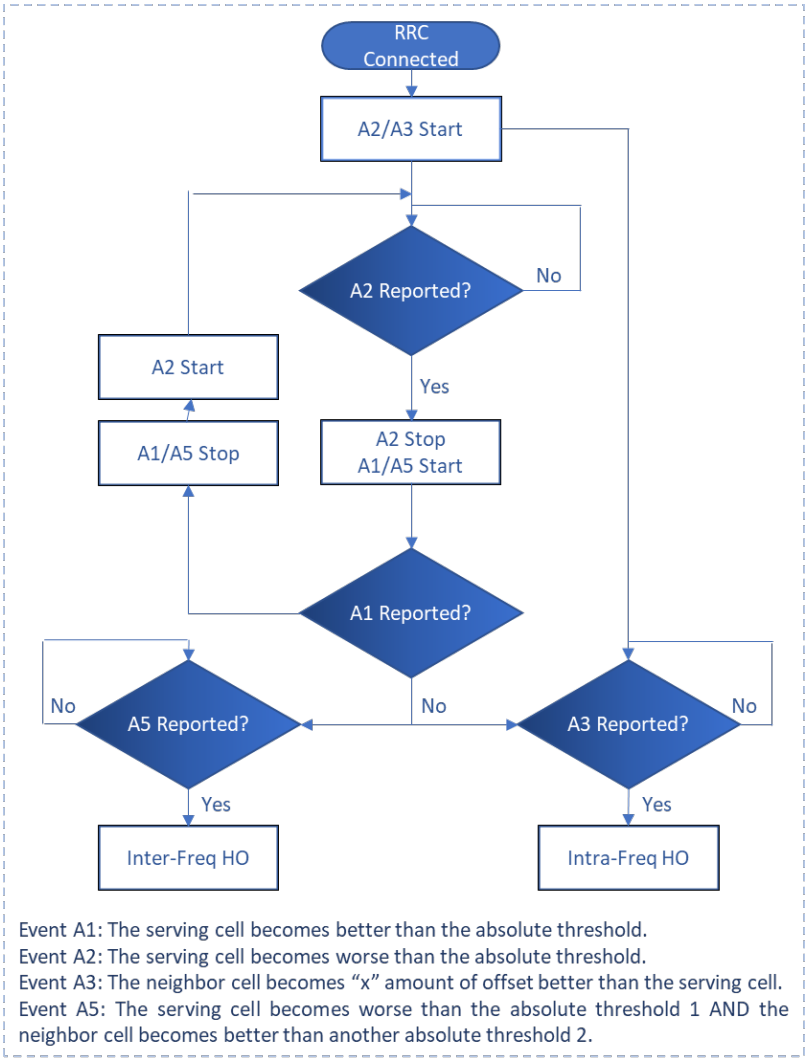
Assume that *X2* is enabled (Figure 2-136). To ensure X2 handover is successful, the Mobility Management Entity (MME) must support eNB configuration transfer and MME configuration transfer S1 message handling.

Figure 2-136: X2

With any changes to these configuration parameters, perform a warm reboot the eNB for the new configuration to take effect.

The chart in Figure 2-137 shows the flow of these handoff event thresholds.

Figure 2-137: Flowchart of Handoff Event Thresholds



2.12 Reboot

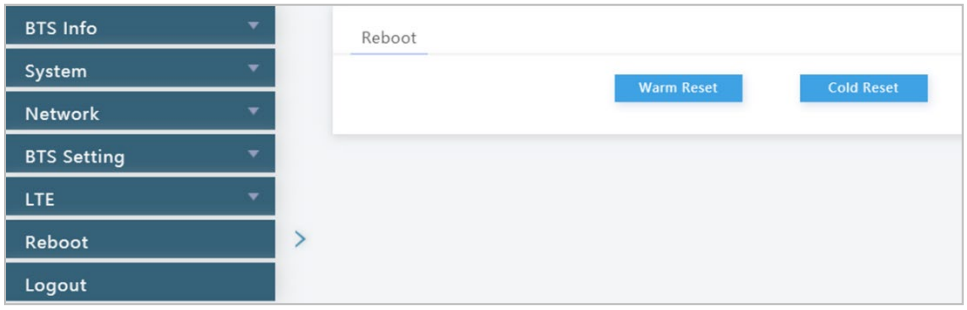
To reboot the eNB go to the *Reboot* menu (Figure 2-138). You are presented with two options: Warm Reset and Cold Reset.

- Warm reset - Does not power off the eNB to perform the reboot. It will retain all of the configuration database.
- Cold reset - In the event you have an issue that cannot be recovered by a warm reset, you may need to use cold reset. A cold reset will power off the eNB for a short period of time, and then it will start back up. It will retain all of the configuration database.

Caution: The reboot action will disrupt eNB service.

NOTE 1: When you need to reboot the eNB, Baicells recommends that you collect logs on the eNB before you reboot it. That data may be needed for troubleshooting.
NOTE 2: In a lab test environment, you can disable GPS Sync to reduce the reboot time.

Figure 2-138: Reboot



2.13 Logout

To log out of the eNB GUI, click on the *Logout* menu shown in Figure 2-139. You will automatically be logged out of the GUI and presented with the login screen.

Figure 2-139: Logout