HaloB User Guide

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Version 1.3

About This Document

This document is intended for wireless service providers/operators upgrading a Baicells eNodeB (eNB) to the HaloB operating mode. Baicells's HaloB feature enables "lite core" functions that allow the eNB to continue servicing subscribers even when it has no connection to the Evolved Packet Core (EPC). The information overviews the HaloB architecture and explains the steps for upgrading an eNB to HaloB software and enabling the feature. Users of this document should already be familiar with the eNB GUI and the Baicells CloudCore Operations Management Console (OMC) and Business Operations Support System (BOSS).

The information in this document is based on OMC version 3.4.4 and BOSS version 3.4.1.

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Revision Record

Date	Version	Description	SMEs/Contributors	Author/Editor
13-Mar-2018	V1.4, V1.3	Updated for OMC v3.4.4 and BOSS 3.4.1	Jesse Raasch Rick Harnish Sonny May	Sharon Redfoot
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15-Jan-2018	V1.0	Original guide from China	Fu Tian	Fu Tian

Related Documents

Other Baicells technical documents may be found on the Baicells support website (under "Contact Us"). Following is a list of the technical documents.

UE – Gen 1	Atom 5dBi Indoor CPE User Manual
	Atom 11dBi Outdoor CPE User Manual
	Atom 19.5dBi Outdoor CPE User Manual
UE – Gen 2	Atom ID04/06-6.5 User Manual
	Atom OD04/06-14/19.5 User Manual
eNB – Gen 1	Nova 1W Base Station Installation Guide
	Nova 1W Quick Start Guide
	Nova 10W Base Station Installation Guide
	Nova 10W Quick Start Guide
eNB – Gen 2	Nova-227 Outdoor 2x250mW TDD eNB Installation Guide
	Nova-227 Quick Start Guide
	Nova-233 Outdoor 2x1WG2 FDD-TDD eNB Installation Guide
	Nova-233 Quick Start Guide
	Nova-243 Outdoor 2x10WG2 FDD-TDD eNB Installation Guide
	Nova-243 Quick Start Guide
	Nova-436 Outdoor 4x1W CCA TDD eNB Installation Guide
	Nova-436 Quick Start Guide
	Nova-446 Outdoor 4x10W FDD eNB Installation Guide (forthcoming)
	Nova-446 Quick Start Guide (forthcoming)
	elfcell-220 Indoor 2x50mW FDD eNB Installation Guide (forthcoming)
	elfcell-220 Quick Start Guide (forthcoming)
	NeutralCell Indoor Multi FDD-TDD Small Cell Installation Guide (forthcoming)
	NeutralCell Quick Start Guide (forthcoming)
	Neutrino-224 Indoor 2x125mW FDD-TDD eNB Installation Guide (forthcoming)
	Neutrino-224 Quick Start Guide (forthcoming)
	SolarCell Outdoor Solution Installation Guide (forthcoming)
	SolarCell Quick Start Guide (forthcoming)
	Spectra LTE-U Outdoor 2x500mW FDD eNB Installation Guide (forthcoming)
	Spectra LTE-U Quick Start Guide (forthcoming)
System, CloudCore, OAM	Baicells Configuration & Network Administration Guide
	Baicells Handoff Configuration Guidelines (Beta trial)
	Baicells BOSS API Manual
	Baicells HaloB User Guide (this document)
	Baicells Operation, Maintenance, & Troubleshooting Guide (forthcoming)
	Baicells Enterprise EPC Deployment Guide (forthcoming)
	Baicells Enterprise EPC User Guide (forthcoming)

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1. Introduction

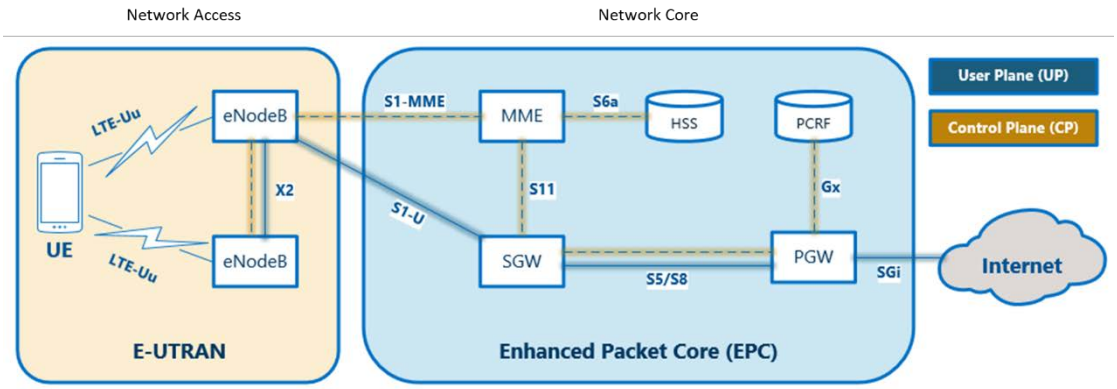
1.1 Solution Overview

HaloB is an invention of Baicells Technologies, developed to address certain wireless service provider scenarios. In particular, HaloB addresses:

- Operators who are concerned about adding core network functions to the network when full-blown end-to-end Long-Term Evolution (LTE) networking may not be necessary; and
- Operators who want subscriber service to continue in case there is a situation where the Evolved Packet Core (EPC) becomes unavailable (e.g., severe weather).

Operators in these situations need a way to offer or continue offering subscribers service but not be dependent on the availability of the core LTE EPC functions in order to do so. The Baicells eNodeB (eNB) base stations and user equipment (UE) are part of the LTE network access system (NAS). The core LTE EPC functions, shown in Figure 1-1, include the Mobility Management Entity (MME), Serving Gateway (SGW), Packet Data Network Gateway (PGW), Home Subscriber Server (HSS), and the Policy and Charging Rule Function (PCRF).

Figure 1-1: LTE EPC Functions



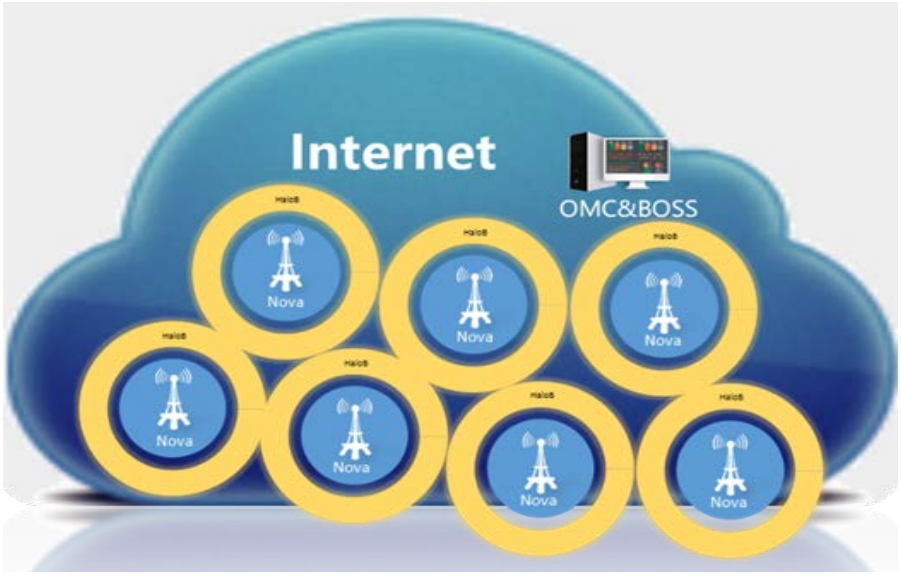
In simple terms, HaloB is an eNodeB (eNB) with onboard “lite” EPC capabilities. HaloB can be purchased as an add-on feature that the operator can enable/disable as needed on a per-eNB basis.

When an eNB is operating in HaloB mode, it provides the necessary EPC functions for UE attachment, signaling, and control. There are no S1 tunnels from the eNB to the EPC. Each eNB running HaloB software controls its subscribers independently. All signaling stays local, within the eNB.

A HaloB eNB eliminates the transport layer between the EPC and the eNB by embedding a lite EPC directly on the eNB. Therefore, critical control plane signaling is kept local. With HaloB installed, S1 (transport) failures are eliminated. This removes wireless point-to-point (PTP) backhaul failures, fiber outages, or routing mistakes from causing customer service disruption.

The only other network components involved in implementing HaloB are the Baicells Operations Management Console (OMC) and Business Operations Support System (BOSS) (Figure 1-2). During HaloB operation, the CloudCore is still available for OMC monitoring and upgrade functions, and the BOSS Home Subscriber Server (HSS) functions. Subscriber Identity Module (SIM) card activation and bandwidth package assignment are still performed by the BOSS.

Figure 1-2: HaloB Enablement



A HaloB-enabled eNB uses the TR069 connection to the cloud to download subscriber information. If a new subscriber attempts to attach to the HaloB eNB, the eNB does a quick query to the OMC/BOSS to validate and download the subscriber's information.

A SIM card's International Mobile Subscriber Identity (IMSI) can attach to multiple HaloB eNBs, and each will store the SIM data for future attachments. In the event of a rare CloudCore outage, new installs may not be able to attach during the outage if the SIM data has never been downloaded from the BOSS before. This is not a mission-critical event in most cases, and once the CloudCore connection is resumed, the HaloB eNB will collect the SIM data for the new install and commence with the attachment.

Operators using the Baicells application protocol interface (API) for billing software integration will see no change. When a UE attempts to attach to a HaloB eNB, the HaloB eNB contacts the BOSS to verify the IMSI is valid and active, and collects the bandwidth package information. All information is downloaded to the HaloB eNB's memory bank. Once stored in the eNB memory, the UE will remain attached indefinitely. In the event of an eNB or UE reboot, attachment only needs to check the local HaloB memory data for the UE to reattach.

1.2 Benefits

With HaloB:

- The Network Access System (NAS) is processed by each HaloB-enabled eNB, which means the UEs will always be online (barring any eNB equipment failure, of course).
- Operators can enter the world of fixed wireless with a lower initial investment.
  - Operators do not have to invest in local EPC hardware to offer wireless network access services. The eNBs and the core network functions are decoupled.
  - The simplified structure means there is no need for professional network design and maintenance.
- The self-configuration, plug-and-play deployment model means a shorter time-to-market (TTM) and faster return-on-investment (ROI).

While there is a great deal of intelligence operating in the background of the HaloB feature, Baicells designed the feature to run efficiently and be easy to configure and manage. Even with HaloB operating on the eNB, in the control plane there is no huge impact on memory or processing. The eNB performs at the same level it normally would.

HaloB is a software feature that works with existing eNB hardware; you do not have to upgrade the hardware equipment to get the HaloB feature. The software upgrade to HaloB does require a unique feature key generated by Baicells for each eNB.

HaloB is an example of the industry movement to make LTE technology more accessible and less complicated, and to move more of the processing closer to the users. In essence, a HaloB eNB becomes a local EPC right on the tower!

1.3 How to Get HaloB

Operators wishing to take advantage of the HaloB solution for existing eNBs should contact their distributor. You can purchase the HaloB feature on a per-eNB or bundle basis. As part of the purchase process, you will be asked to provide the eNB serial numbers to Baicells. Baicells will use the eNB serial numbers to generate the feature keys. Be sure the eNBs that you target for HaloB operation are assigned to you, the operator.

The next two sections of this document pertain to how operators implement the HaloB solution in an existing network. You can use either the CloudCore OMC Section 2 (e.g., to upgrade multiple eNBs) or the local/Web eNB GUI Section 3 (e.g., to upgrade a single eNB) to perform the procedures. Go to the appropriate section based on the application you will be using.

2. OMC Procedures

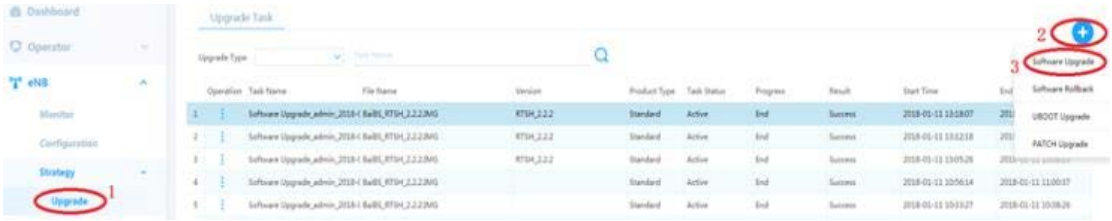
2.1 Upgrade eNBs

Be sure the eNodeBs (eNBs) that you target for HaloB operation are assigned to you, the operator. The HaloB feature will query for only the subscribers' International Mobile Subscriber Identities (IMSIs) which are associated with the operator to which the eNB belongs in the Baicells Operations Management Console (OMC). If an eNB was not properly onboarded and the eNB remains assigned to the default operator, then none of your subscribers' IMSIs will be able to attach.

You will use the same, familiar upgrade task format that you normally use when upgrading an eNB's firmware using the OMC. Follow the steps below to perform the eNB upgrade to HaloB software.

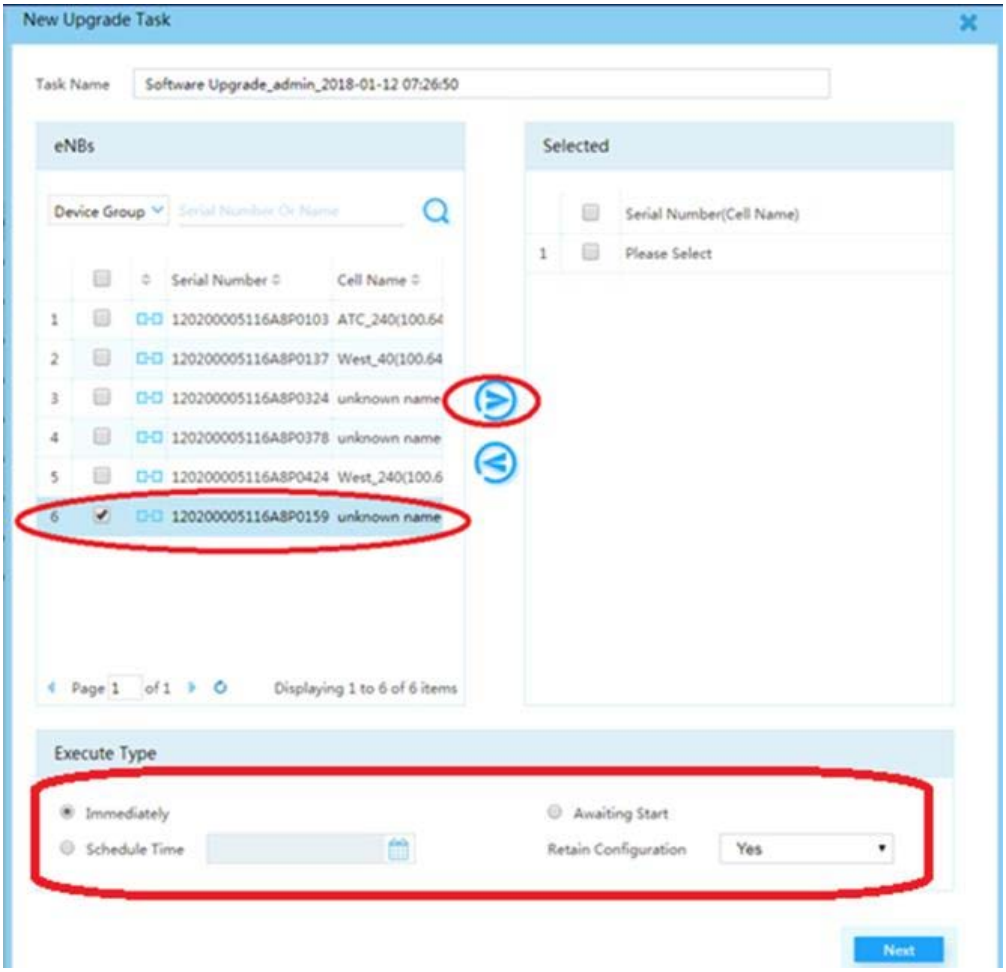
1. Go to the OMC, and select **eNB > Strategy > Upgrade**. Click on the **+** (Add) icon, and select **Software Upgrade** to add a new upgrade task. Refer to Figure 2-1.

Figure 2-1: New Upgrade Task



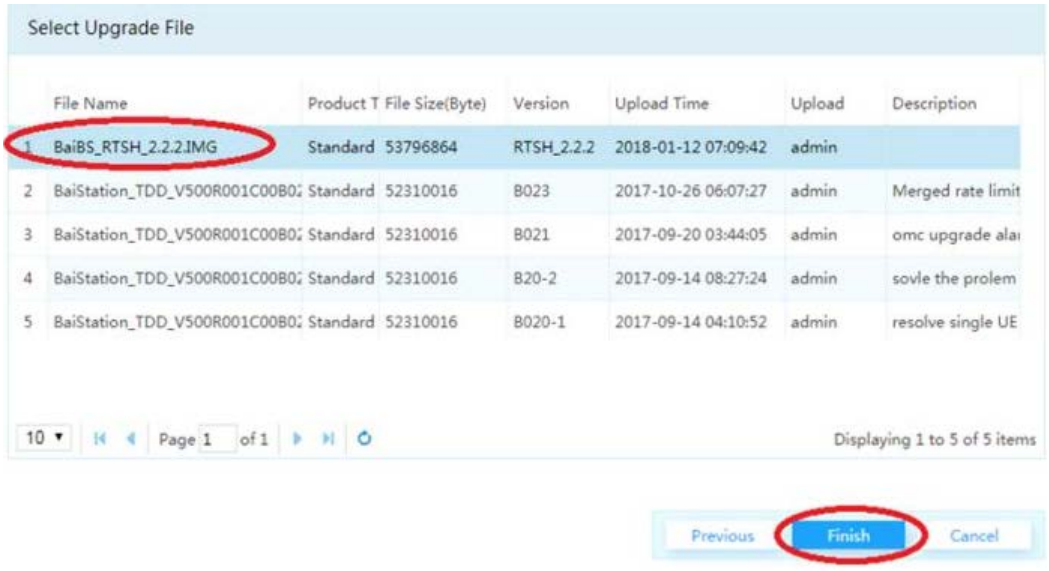
2. Select the eNBs to be upgraded, and choose the Execute Type settings (immediately or schedule upgrade time, retain configuration yes or no). If you select Yes for retain configuration, the current eNB configuration will be retained after the upgrade. Refer to Figure 2-2. Note that the subscriber information is retained in the HaloB eNB's hard memory, so it will not be erased whenever the eNB is rebooted.

Figure 2-2: Select eNBs to be Upgraded



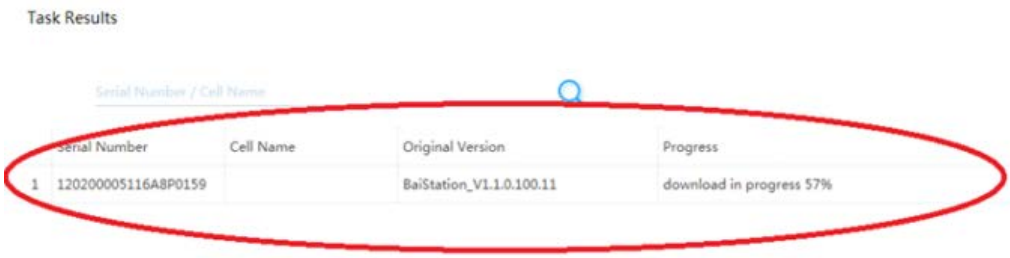
3. Select the correct HaloB software file, which at this time is **BaiBS_RTSH_2.2.2.IMG** (Figure 2-3). Click on **Finish**.

Figure 2-3: Select HaloB Software File



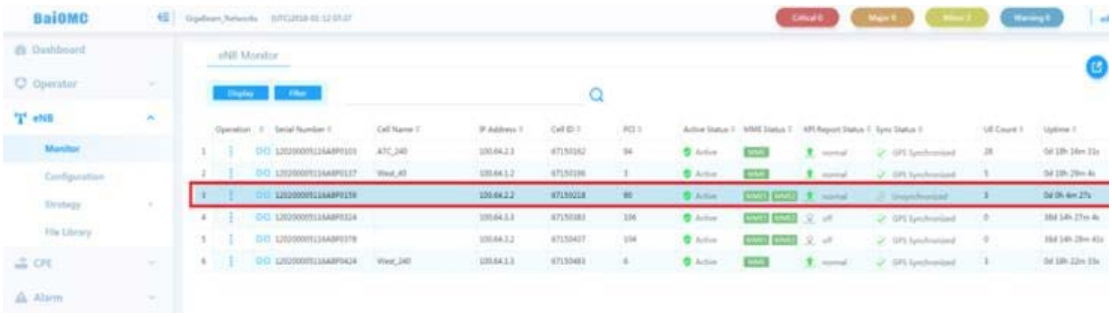
The task results window will indicate the software download progress (Figure 2-4).

Figure 2-4: Upgrade Task Results



4. After the HaloB software is loaded on the eNB, go to **eNB > Monitor** and check that the status reported is **Active** (Figure 2-5). Until the feature key is activated (next step), the eNB Monitor page will continue to show two Mobility Management Entities (MMEs) per eNB.

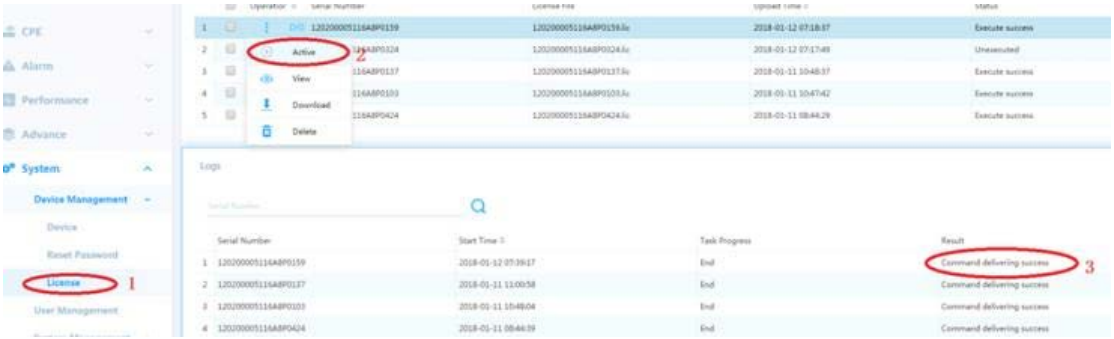
Figure 2-5: Check eNB Status After Upgrade



2.2 Activate Feature Keys

Once the license keys are imported, either Baicells or you will need to activate the feature keys. Go to the OMC, and select **System > Device Management > License.** The feature key names match the serial numbers of the eNBs. Locate the feature keys in the list, click on the 3 bubble icons, and select **Active** for activate (Figure 2-6).

Figure 2-6: Activate License



2.3 Enable HaloB Feature

The last step, enabling the HaloB feature, will be performed for each HaloB-enabled eNB using the eNB GUI. Click on this link (section 3.2 Enable HaloB Feature) to go to the procedure in the eNB GUI section.

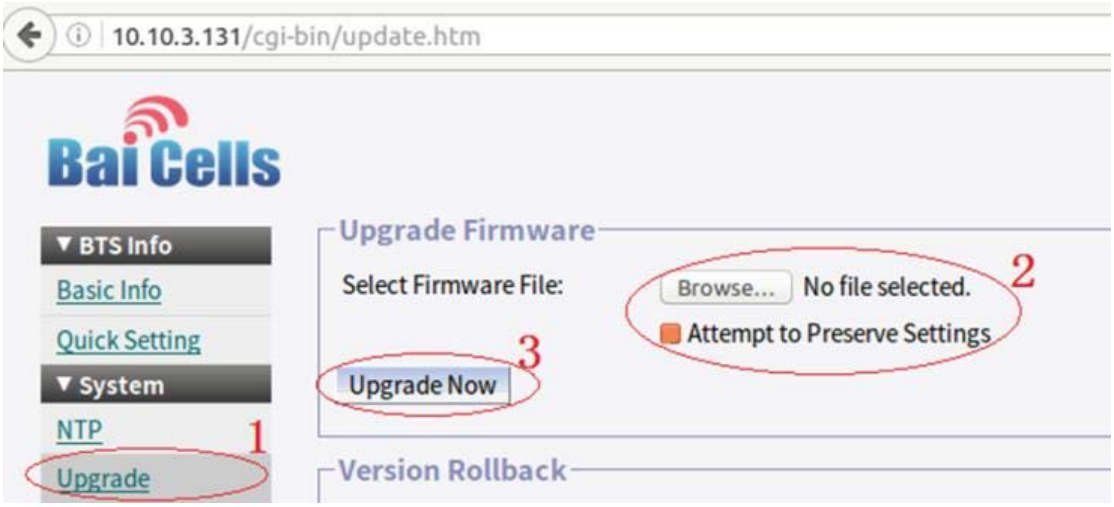
3. eNB GUI Procedures

3.1 Upgrade eNB

You can upgrade a single eNodeB (eNB) at a time using the local or Web GUI application. Be sure the eNB is assigned to you, the operator. The HaloB feature will query for only the subscribers' International Mobile Subscriber Identities (IMSIs) which are associated with the operator to which the eNB belongs in the Baicells Operations Management Console (OMC). If an eNB was not properly onboarded and the eNB remains assigned to the default operator, then none of your subscribers' IMSIs will be able to attach.

1. Log in to the eNB GUI, and select **System > Upgrade**.
2. Browse to the target software version, which at this time is **BaiBS_RTSH_2.2.2.IMG**. If you wish to retain the eNB configuration database, click the check box next to **Attempt to Preserve Settings**. Then, click on **Upgrade Now.** Refer to Figure 3-1.

Figure 3-1: Upgrade eNB



3. After the HaloB software is loaded on the eNB, go to **BTS Info > Basic Info** and check that the Cell Status reported is **Active**. Note: Until the feature key is activated (next step), the eNB Monitor page will continue to show two Mobility Management Entities (MMEs) per eNB.

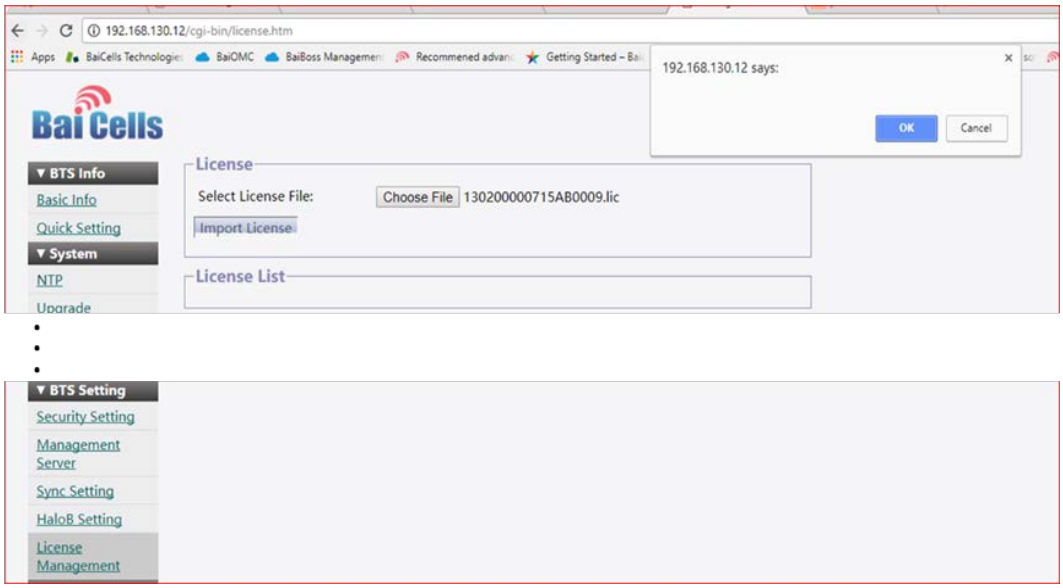
3.2 Import Feature Key

1. Go to **BTS Setting > License Management** (Figure 3-6). Navigate to the HaloB feature key file that was provided by Baicells and is unique to this eNB. The feature key file name is the same as the eNB's serial number.

Figure 3-6: Choose HaloB eNB's Feature Key File

2. After finding the file, select **Import License** (Figure 3-7). The feature key file name will display next to Choose File.

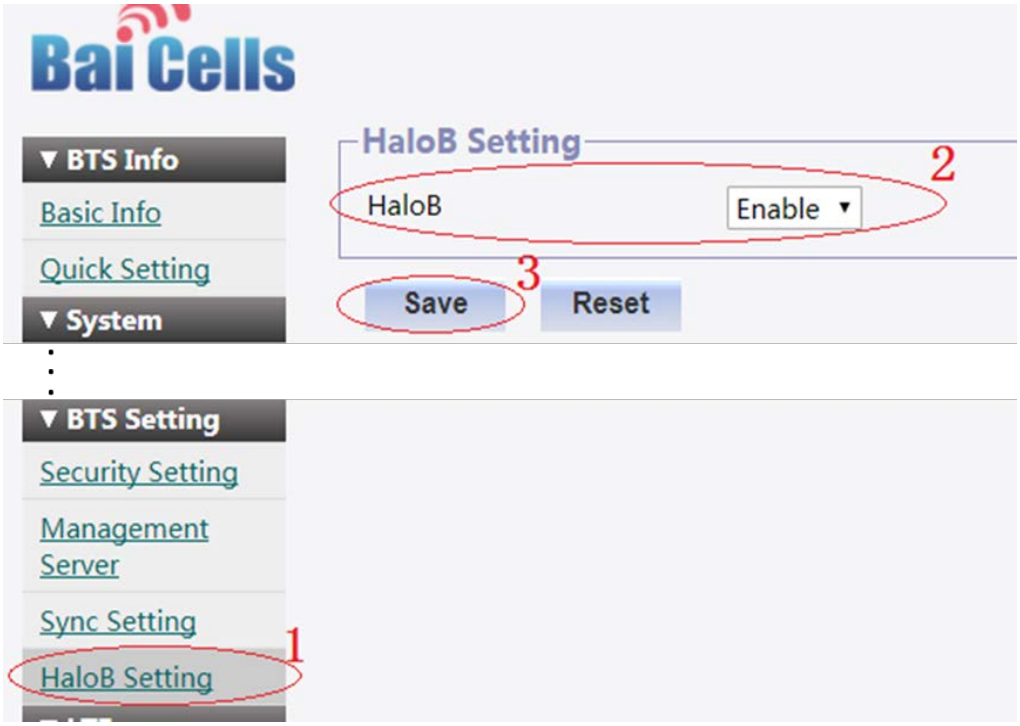
Figure 3-7: Import HaloB License



3.2 Enable HaloB Feature

1. Go to **BTS Setting > HaloB Setting**, and use the pull-down menu to select **Enable**. This enables the HaloB feature on the eNB. Click on **Save**. Refer to Figure 3-2.

Figure 3-2: Enable HaloB Feature

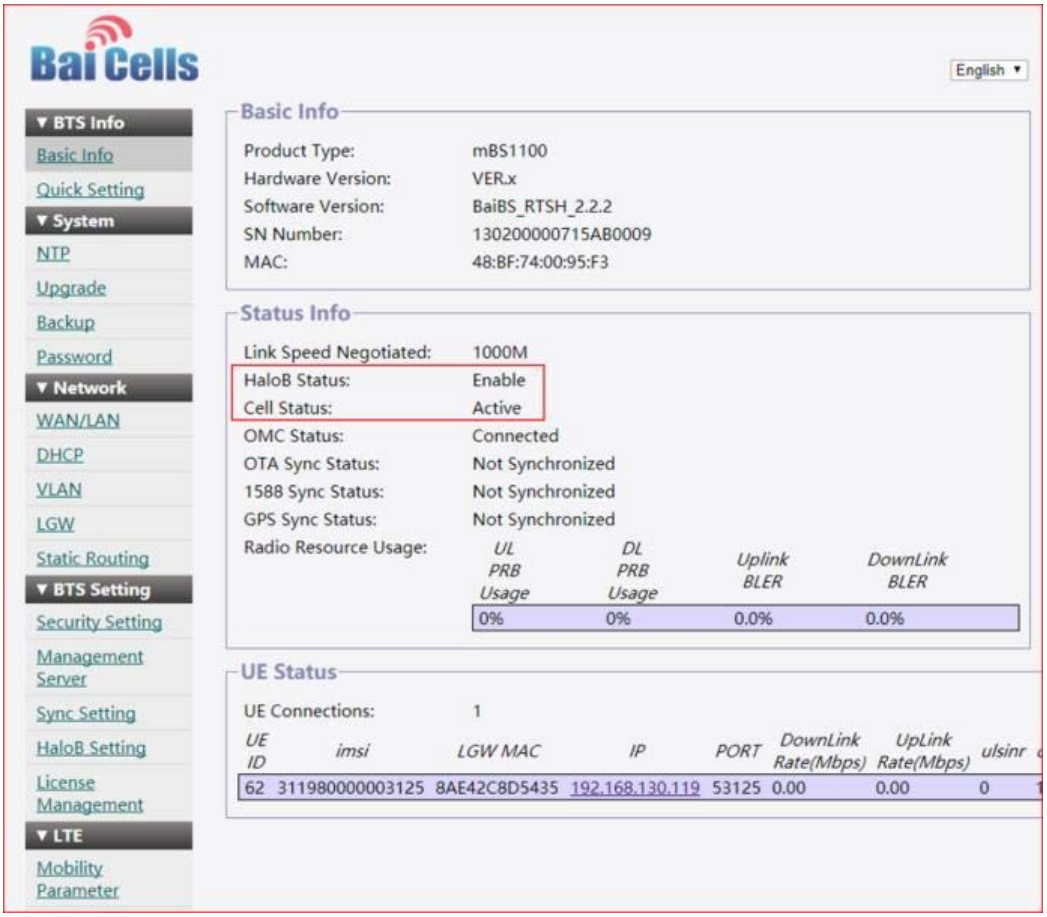


2. **Reboot the eNB** for the HaloB settings to take effect.

NOTE: Rebooting the eNB is an important step. If you do not reboot the eNB after enabling HaloB, the status will incorrectly show that HaloB is On, but this only checks the parameter and does not check whether or not the feature is actually running. An eNB reboot is required before the HaloB feature can run.

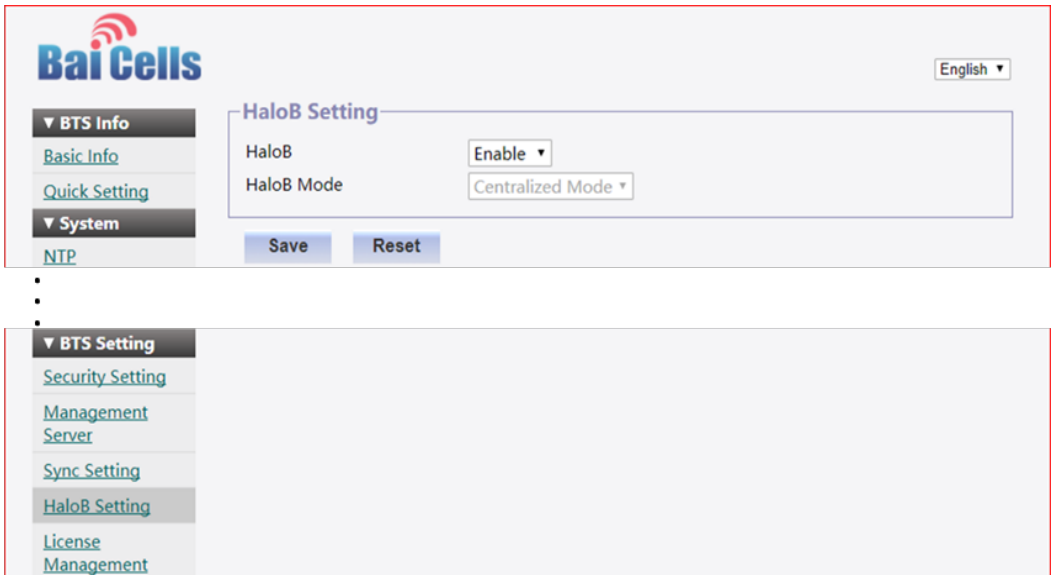
3. After the reboot, go to **BTS Info > Basic Info** and check that the HaloB Status is set to **Enable** and the Cell Status shows **Active** (Figure 3-3). Note: You will see only 1 MME for each HaloB eNB. This is the MME that is now local to the HaloB-enabled eNB.

Figure 3-3: Check HaloB Status



4. Go back to **BTS Setting > HaloB Setting**, and verify that the Mode field is set to **Centralized Mode** (Figure 3-4). (That is the only option at this time.) Click on **Save**.

Figure 3-4: HaloB Mode = Centralized Mode



5. Go to **BTS Info > Basic Info**, and check that the HaloB Status still shows **Enable** (Figure 3-5).

Figure 3-5: HaloB Status