



SAS Deployment Guide

CloudCore OMC – Version 7.3.5

BaiBS_RTS_3.7.11

BaiBS_QRTB_2.9.10

BaiCE_BG_1.6.20

BaiCE_AP_2.4.7_NA

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Version 1.21

About This Document

This document is intended for operators who are utilizing the Citizens Broadband Radio Service (CBRS) spectrum and the shared Spectrum Access System (SAS). The information is targeted to the CBRS network operator and the Certified Professional Installer (CPI) and covers how to plan and deploy the SAS setup in the Baicells CBRS Service Devices (CBSDs). This document does not cover the background on CBRS commercialization, how to become a SAS vendor, or how to become a CPI, for which there are many industry websites, such as:

- Wireless Innovation Forum (WINNF): <https://www.wirelessinnovation.org/information-documents>
- CBRS Alliance (LTE-based OnGo): <https://www.cbrsalliance.org/>

Users of this document should already be familiar with and have some experience deploying and using the Baicells equipment and software applications.

The information in this document is based on the following Baicells software versions:

- eNB: BaiBS_RTS_3.7.11 (Nova227 and Nova233)
- eNB: BaiBS_QRTB_2.9.10 (Neutrino430, Nova430e, Nova430i, and Nova436Q)
- CPE: BaiCE_BG_1.6.20 (AtomOD06H, OD06L, ID06B, OD15)
- CPE: BaiCE_AP_2.4.7_NA (AtomOD04H, OD04L)
- OMC: Version 7.3.5

Terms used in this document or related to Long Term Evolution (LTE) are listed in alphabetical order and described in [Acronyms and Abbreviations](#), which can be found at Baicells > Resources > [Documents](#).

New in This Release

The following updates have been provided in this release:

- Added CBSD states in Table 4-1
- Added eNB SAS settings for QRTB 2.9.10 in Table 4-3
- Removed Virtual eNBs and Virtual CPEs and integrated them into eNB and CPE
- Graphical User Interface (GUI) improvements in the CBSD log page

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Revision Record

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Resources

- **Documentation** – Baicells product data sheets, technical manuals, and a list of acronyms and abbreviations can be found at Baicells.com > Resources > [Documents](#).
- **Support** – Open a support ticket, process an RMA, and the Support Forum are at Baicells.com > [Support](#).

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Table of Contents

1. OVERVIEW	8
2. REFERENCE INFORMATION	9
3. PREPARATION	9
3.1 SAS ACCOUNT.....	9
3.2 CERTIFIED PROFESSIONAL INSTALLER	9
3.3 EQUIPMENT AND SOFTWARE.....	9
4. CONFIGURATION	10
4.1 SAS REGISTRATION OPTIONS	10
4.2 CBSD CONFIGURATION	12
4.2.1 <i>eNB Configuration</i>	12
4.2.2 <i>CPE Configuration</i>	20
4.3 DOMAIN PROXY (OMC) CONFIGURATION	23
4.3.1 <i>Register eNBs and CPEs with SAS</i>	25
4.3.2 <i>Check eNBs and CPEs Connectivity with SAS</i>	29
4.3.3 <i>Import CBSD to OMC</i>	30
4.3.4 <i>Access Device Logs</i>	33
4.4 PERFORM ACTIONS ON MULTIPLE DEVICES SIMULTANEOUSLY	38
4.5 SAS INSTALLATION PARAMETERS.....	40

List of Figures

FIGURE 4-1: EXPORT TO GOOGLE SAS PORTAL	11
FIGURE 4-2: SAS SETTINGS (RTS 3.7.11, SINGLE-STEP REGISTRATION)	13
FIGURE 4-3: SAS SETTINGS (RTS 3.7.11, MULTI-STEP REGISTRATION)	14
FIGURE 4-4: SAS SETTINGS (QRTB 2.9.10, COUNTRY CODE)	15
FIGURE 4-5: SAS SETTINGS (QRTB 2.9.10, SINGLE-STEP REGISTRATION) (1 OF 2)	15
FIGURE 4-6: SAS SETTINGS (QRTB 2.9.10, SINGLE-STEP REGISTRATION) (2 OF 2)	16
FIGURE 4-7: SAS SETTINGS (QRTB 2.9.10, MULTI-STEP REGISTRATION)	16
FIGURE 4-8: CERTIFICATE UPLOAD (RTS 3.7.11)	17
FIGURE 4-9: CERTIFICATE UPLOAD (QRTB 2.9.10)	17
FIGURE 4-10: QUICK SETTING (RTS 3.7.11)	19
FIGURE 4-11: QUICK SETTING (QRTB 2.9.10)	20
FIGURE 4-12: SAS (CAT4)	21
FIGURE 4-13: SAS CAT6/7/15	22
FIGURE 4-14: SAS CERTIFICATE CAT6/7/15	23
FIGURE 4-15: OMC – ENABLE SAS	24
FIGURE 4-16: CHECK ENB ACTIVE STATUS	25
FIGURE 4-17: REGISTER CBSD WITH SAS (PAGE 1 OF 3)	26
FIGURE 4-18: REGISTER CBSD WITH SAS (PAGE 2 OF 3)	26
FIGURE 4-19: REGISTER CBSD WITH SAS (PAGE 3 OF 3)	27
FIGURE 4-20: MODIFY CBSD ANTENNA PARAMETERS	28
FIGURE 4-21: CONFIRM CBSD SAS CONNECTIVITY	29
FIGURE 4-22: CHECK CBSD CONNECTION DETAILS (EXAMPLE 1, UNREGISTERED)	29
FIGURE 4-23: CHECK CBSD CONNECTION DETAILS (EXAMPLE 2, AUTHORIZED)	30
FIGURE 4-24: IMPORT CBSD DATA FILE	31
FIGURE 4-25: DOWNLOAD SAMPLE TEMPLATE	32
FIGURE 4-26: ACCESS DEVICE LOGS (ALL KEY EVENTS)	33
FIGURE 4-27: VERIFY AUTHORIZED CHANNELS IN USE	34
FIGURE 4-28: VIEW DEVICE LOGS (FILTER – CALENDAR TOOL)	35
FIGURE 4-29: VIEW DEVICE LOGS (FILTER – SET DATE RANGE)	35
FIGURE 4-30: VIEW DEVICE LOGS (FILTER – SET TIME INTERVAL)	36
FIGURE 4-31: EXPORT SAS AND CBSD LOGS	37
FIGURE 4-32: ASSIGN USER ID TO MULTIPLE DEVICES SIMULTANEOUSLY	38
FIGURE 4-33: ENABLE SAS ON MULTIPLE DEVICES SIMULTANEOUSLY	39
FIGURE 4-34: DISABLE SAS ON MULTIPLE DEVICES SIMULTANEOUSLY	40

List of Tables

TABLE 2-1: CBSD CATEGORIES 9

TABLE 3-1: PRODUCTS AND SOFTWARE VERSIONS 9

TABLE 4-1: CBSD STATES 37

TABLE 4-2: ENB SAS SETTINGS FOR RTS 3.7.11 SOFTWARE 40

TABLE 4-3: ENB SAS SETTING FOR QRTB 2.9.10 SOFTWARE 42

TABLE 4-4: CPE SAS SETTINGS 49

TABLE 4-5: BAICELLS CBSD PRODUCT INFORMATION 49

1. Overview

The Citizens Broadband Radio Service (CBRS) covers the once regulated 3.55–3.7 GHz band. The Federal Communications Commission (FCC) freed up the previous military-only CBRS band for commercial use. CBRS officially launched in January 2020. The ability for operators to use CBRS provides an economical way for existing operators to increase coverage and capacity. In addition, it offers a low-cost solution for start-up operators to enter the market. Not only does CBRS add an available spectrum, but it also rivals current Wi-Fi networks due to its (a) propagation characteristics and (b) planned design and support for next-generation mobility and 5G networks.

In terms of implementation, what makes CBRS especially different is the way the 3.55–3.7 GHz band can be accessed. CBRS commercialization is based on the concept of a “shared” spectrum, where the spectrum is dynamically assigned and released on an as-needed basis. CBRS has three tiers of spectrum use Tier 1 (high priority), Tier 2 (second priority), and Tier 3 (low priority). Tier 1 is Incumbent users – High-power shipboard and land-based radar, Tier 2 is Priority Access License (PAL) users – licensed users who acquire spectrum through auction, and Tier 3 is General Authorized Access (GAA) users.

Shared spectrum assignment is handled by Spectrum Access System (SAS) vendors. Amdocs, Federated Wireless, and Google are FCC Part 96 certified SAS vendors. To use the CBRS spectrum, the CBRS Service Devices (CBSD) such as the Baicells eNodeB (eNB) and Customer Premise Equipment (CPE) also must go through certification. Certification will be an ongoing process as new products are introduced. In addition, all CBSDs must be installed by a Certified Professional Installer (CPI) to operate within the designated spectrum of CBRS lawfully.

The CBSD equipment must be configured to connect to a SAS vendor for band assignment. A CBSD transmits Radio Frequency (RF) in the CBRS band and is subject to FCC rules. The SAS enforces the FCC rules. When the assigned band is no longer needed, SAS can free it up so that other users can operate in that band. A CBSD is served by a SAS either directly or through a Domain Proxy (DP). A DP is an aggregation point that interfaces with the SAS on behalf of all the devices behind it. The Baicells CBRS/SAS solution includes a DP. The Baicells eNodeB (eNB) uses DP to connect to the SAS by leveraging the existing connection with the Baicells Operations Management Console (OMC). All eNBs will need to connect to the OMC to connect to the SAS.

As a champion of CBRS commercialization for years, Baicells is ready to work with operators. Once you have your SAS vendor account and are approved to be a Baicells trial user, follow this guide to configure the eNB and user equipment and associate your OMC account to your SAS account.

2. Reference Information

For certification, the CBSD equipment is categorized as shown in Table 2-1.

Table 2-1: CBSD Categories

Device	Power	Max EIRP (dBm/10 MHz)	Max PSD (dBm/MHz)
End User Device (EUD)	23 dBm or 200 mV	23	N/A
CAT A CBSD	30 dBm or 1 W	30	20
CAT B CBSD	47 dBm or 50 W	47	37

The 'dBm/10 MHz' means EIRP power density per 10 MHz in dBm.

EIRP: Effective Isotropic Radiated Power

PSD: Power Spectral Density

3. Preparation

3.1 SAS Account

You will need to create a SAS account directly with an approved SAS vendor for services to authorize transmission within the CBRS spectrum. The supported SAS administrators are Amdocs, Federated Wireless, and Google.

3.2 Certified Professional Installer

You will need at least one CPI's credentials entered in the CBSD, DP, or SAS portal configuration. Each SAS vendor provides their own GUI to assist you in using their SAS portal.

3.3 Equipment and Software

The products listed in Table 3-1 are the current Baicells eNB/CPE models and OMC software versions that support SAS.

Table 3-1: Products and Software Versions

Product	Software
Nova227/233	BaiBS_RTS_3.7.11
Neutrino430, Nova430e, Nova430i, and Nova436Q	BaiBS_QRTB_2.9.10
AtomOD06H/OD06L/ID06B/OD15	BaiCE_BG_1.6.20
AtomOD04H/OD04L	BaiCE_AP_2.4.7_NA
OMC	BaiOMC 7.3.5

NOTE 1: The first generation (Gen 1) Baicells CPEs do not support SAS.

NOTE 2: Gen 1 CAT4 CPEs are now End Of Life (EOL).

NOTE 3: Future release CAT4 CPE software is BaiCE_BM_2.5.

NOTE 4: BaiOMC can be cloud-based (cloudcore.baicells.com) or local (a private network).

4. Configuration

Reference: *CloudCore Configuration & Network Administration Guide*, *eNodeB Configuration Guide*, and *CPE Configuration Guide*. These three documents cover all Baicells GUIs/configuration menus.



Caution: Once you have an account with an approved SAS vendor and enable SAS on the CBSD and in the OMC (DP), current users attached to the CBSD will be disconnected until the CBSD reaches transmission state with the SAS. Once the SAS authorizes the CBSD and reaches the transmission state, users will automatically reconnect.

NOTE 1: Throughout this document, the term CBSD can mean eNB or CPE. If a procedure is specific to one device type, it will be identified.

NOTE 2: Each SAS vendor provides their own GUI to assist you in using their SAS portal.

NOTE 3: When SAS is enabled on the eNB, the standard *BTS Info > Quick Setting* (RTS 3.7.11) or *Basic Setting > Quick Setting* (QRTB 2.9.10) 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*, described in detail in [section 4.2.1](#).

NOTE 4: The GUI fields vary between RTS 3.7.11 and QRTB 2.9.10 software versions.

4.1 SAS Registration Options

The operator has three options for registering CBSDs with the SAS provider. The first two options use a Single-Step registration method, where all CBSD configuration is performed in the Baicells device GUIs or by using the OMC. Option three uses a Multi-Step registration method, where only the CBSD's basic information is configured using the OMC. Then all other installation parameters are entered in the SAS portal. The following information provides more details:

NOTE 1: Regardless of which registration option you use, you must configure the CBSD's basic information for successful registration with SAS.

NOTE 2: For Option 3, when using the Multi-Step registration method, Baicells recommends that you upload all CBSD information in the SAS portal before enabling SAS on the CBSD.

NOTE 3: The CPI must upload the certificate directly through the SAS portal.

- **Option 1: Configure installation parameters directly in the CBSD GUI**

The CPI certificate is uploaded directly to the CBSD, which effectively signs and encodes all installation parameters. The encoded CPI data is sent to the OMC (DP), which is then passed to the SAS registration. It is unnecessary to add the CBSD in the SAS portal when using this method. SAS settings are configured as follows:

- CBSD GUI: Set *SAS Registration Type* to *Single-Step*.
- OMC (DP): Select *Single-Step* and upload CPI certificate.

- **Option 2: Configure installation parameters using the OMC (DP)**

The installation parameters are entered using the OMC (DP) and signed by the CPI. It is unnecessary to add the CBSD in the SAS portal when using this method. SAS settings are configured as follows:

- CBSD GUI: Set *SAS Registration Type* to *Single-Step*.
- OMC (DP): Select *Single-Step* and upload CPI certificate.

- **Option 3: Configure installation parameters in the SAS portal**

The installation parameters are entered directly in the SAS portal and signed by the CPI. Only the basic CBSD info (such as Category, User ID, and FCC ID) is entered on the CBSD. SAS settings are configured as follows:

- CBSD GUI: Set *SAS Registration Type* to *Multi-Step*.
- OMC (DP): Select *Multi-Step*.

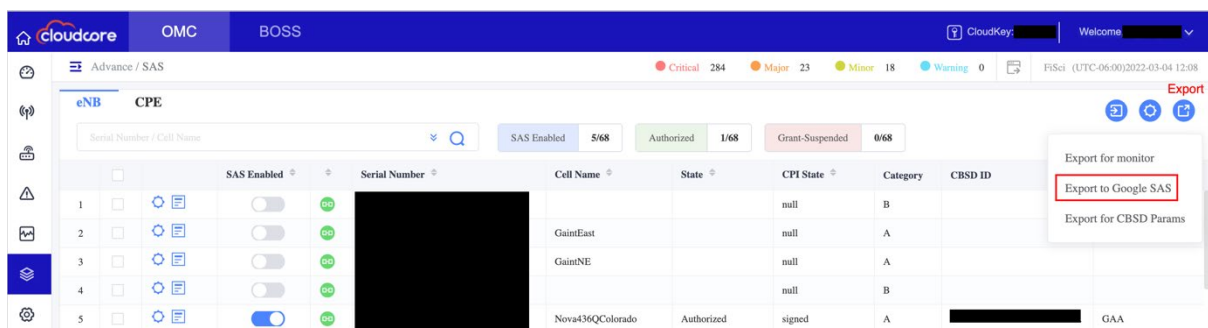
For operators who have chosen Google as their SAS provider, a new OMC feature allows you to export CBSD data directly onto the Google SAS portal when using the Multi-Step registration method. The export function is shown in Figure 4-1.

NOTE 1: Choose the Export to Google SAS function only if Google is your SAS vendor.

NOTE 2: Baicells is committed to working with all certified SAS vendors to support this functionality as it becomes available to assist you with SAS deployment activities.

NOTE 3: The Export for CBSD Param function is used to import the parameters to the Domain Proxy.

Figure 4-1: Export to Google SAS Portal



4.2 CBSD Configuration

4.2.1 eNB Configuration

Follow the steps below to complete the eNB/CBSD configuration.

Prerequisites: Verify that the management server URL is correct on the eNB GUI. Since the eNB uses a domain proxy (DP) method to connect to the SAS, an OMC connection is required.

1. Go to *BTS Setting > Management Server*:
 - a. For the CloudCore OMC, enter **baiomc.cloudapp.net:48080/smallcell/AcsService**.
 - b. For a Local OMC, enter the Local OMC server URL, e.g.,
xx.xx.xx.xx:8080/smallcell/AcsService.
2. If using the CloudCore OMC, enter your unique CloudKey shown at the top of your CloudCore account window. (The CloudKey is not required for Local OMC).
3. If you choose to use the Single-Step registration type, have your CPI info and all antenna requirements ready to input before starting the configuration procedures.

4.2.1.1 Configure the CBSD SAS settings on eNB RTS 3.7.11 GUI

NOTE: With OMC 7.3.5 software, you can now configure and modify all the CBSD settings directly in the OMC if desired. Refer to *CloudCore Configuration & Network Administration Guide* for more information.

1. Go to *LTE > SAS Settings*.
2. *SAS*: Set to *Enable*.
3. *SAS Registration Type*: For the field in this menu, select either *Single-Step* or *Multi-Step* from the drop-down list. The fields displayed beneath the registration type will depend on which option you select, as shown in Figure 4-2 and Figure 4-3.

NOTE 1: More about each registration option (Single-Step or Multi-Step) is covered in *section 4.1* and *section 4.3*.

NOTE 2: HaloB-enabled eNBs operate as standalone entities and do not support mobility, so the *LTE* menu options change depending on the HaloB function setting. Therefore, as you select the *SAS Settings* sub-menu from the *LTE* menu, you may notice differences between your eNB GUI and how the *LTE* menu is depicted in Figure 4-2, Figure 4-3, Figure 4-5, Figure 4-6, and Figure 4-7.

4. *Install Param Config*: Refer to Table 4-2 in *section 4.5* for each parameter's description to complete the SAS configuration in this menu.
5. *CPI info*: If you selected the Single-Step method for registration type, enter the CPI ID, name, and installation information.
6. *CPI certstore*: If you selected the Single-Step method for registration type, this section displays the CPI certification if it is already uploaded, and it provides an add/change function to upload or change the certificate here.

Figure 4-2: SAS Settings (RTS 3.7.11, Single-Step Registration)

SAS Settings

SAS: Enable

SAS Registration Type: Single-step

Install Param Config

category: B

fccId: [Redacted]

longitude: 0

heightType: AGL

antennaGain: 13

antennaDowntilt: 0

callSign: [Redacted]

userId: [Redacted]

latitude: 0

height: 0

indoorDeployment: Outdoor

antennaAzimuth: 0

antennaBeamwidth: 65

groupType: INTERFERENCE_COORDINATION

groupId: [Redacted]

CPI info

cpiId: [Redacted]

cpiName: [Redacted]

installCertificationTime: [Redacted]

CPI certstore

CPI certstore: [Redacted]

add/change CPI cert

Save Reset

Figure 4-3: SAS Settings (RTS 3.7.11, Multi-Step Registration)

4.2.1.2 Configure the CBSD SAS settings on eNB QRTB 2.9.10 GUI

NOTE: With OMC 7.3.5 software, you can now configure and modify all the CBSD settings directly in the OMC if desired. Refer to the [CloudCore Configuration & Network Administration Guide](#) for more information.

1. Go to *Basic Setting > Quick Setting*.
2. *Country Code*: Select USA-FCC(CBRS) from the drop-down list (Figure 4-4). Scroll down to see the SAS Preferred Setting (Figure 4-5).
3. *SAS Registration Type*: For the field in this menu, select either *Single-Step* or *Multi-Step* from the drop-down list. The fields displayed beneath the registration type will depend on which option you select (Figure 4-5).

NOTE: More about each registration option (Single-Step or Multi-Step) is covered in [section 4.1](#) and [section 4.3](#).

4. *Install Param Config*: Refer to Table 4-3 in [section 4.5](#) for each parameter's description to complete the SAS configuration in this menu.
5. *CPI info*: If you selected the Single-Step method for registration type, enter the CPI ID, name, and installation information.
6. *CPI Certificate*: If you selected the Single-Step method for registration type, this section displays the CPI certification if it is already uploaded, and it provides an add/change function to upload or change the certificate here.

Figure 4-4: SAS Settings (QRTB 2.9.10, Country Code)

Basic Setting / Quick Setting

Quick Setting

Duplex Mode: TDDMode

Carrier Mode: Single Carrier

Quick Interface Binding: WAN

HaloB: OFF

Cloud EPC: OFF

* TAC: 1
Range: 0-65535

S1 Connection Mode: All

* S1 Link Port: 36412
Range: 0-65535

Country Code: USA-FCC(CBRS)

USA-FCC(CBRS)

Other

PLMN: 314030

PLMN ID: 314030

MME IP: 314030

Save Cancel

Figure 4-5: SAS Settings (QRTB 2.9.10, Single-Step Registration) (1 of 2)

Basic Setting / Quick Setting

Cell Quick Setting

MME IP	PLMN	Status	Operate
10.3.0.9	314030	Connected	
10.5.0.9	314030	Connected	

Band: 48

Bandwidth: 20

* EARFCN: 55990
Range: 55340-56640

Frequency(MHz): 3625

SubFrame Assignment: 1 (DL:UL = 2:2)

Special SubFrame Patterns: 7

* PCI: 500
Range: 0-503

* Cell ID: 136274068
Range: 0-268435455

RF Status: OFF

Power Modify: 2 X 24dBm

SAS Preferred Setting

SAS Registration Type: Single-step

Legacy Mode: Disable

Frequency Selection Logic: Power,Bandwidth,Frequency
Order of importance when selecting frequency

Preferred Bandwidth: 20MHz

Preferred Power: 2 X 24dBm

Preferred Frequency: Cell 3560

Figure 4-6: SAS Settings (QRTB 2.9.10, Single-Step Registration) (2 of 2)

Baicells Welcome, [User] English

Basic Setting Basic Setting / Quick Setting

Basic Info

Quick Setting

Network

BTS Setting

LTE Setting

System

Install Param Config

CBSD Category: B

User ID: SAS-Baicells

FCC ID: 2AG32PBS31010

Latitude: 0

Longitude: 0

Height: 0

HeightType: AGL

Deployment: Outdoor

* Antenna Azimuth: 0

* Antenna Downtilt: 0

* Antenna Gain: 15

* Antenna Beamwidth: 0

Call Sign:

Group Type: INTERFERENCE_COORDINATION

Group ID:

CPI Info

CPI ID:

CPI Name:

Install Cert Time: auto

CPI Certificate

CPI Certificate: Missing

p12 File:

Certificate List

Index	Type	Certificate Name	Operate
No Data Available			

Save Cancel

Figure 4-7: SAS Settings (QRTB 2.9.10, Multi-Step Registration)

Baicells Welcome, [User] English

Basic Setting Basic Setting / Quick Setting

Basic Info

Quick Setting

Network

BTS Setting

LTE Setting

System

SAS Preferred Setting

SAS Registration Type: Multi-step

Legacy Mode: Disable

Frequency Selection Logic: Power,Bandwidth,Frequency

Preferred Bandwidth: 20MHz

Preferred Power: 2 X 24dBm

Preferred Frequency: Cell 3560

Install Param Config

CBSD Category: B

User ID: SAS-Baicells

FCC ID: 2AG32PBS31010

* Antenna Gain: 15

Call Sign:

Save Cancel

4.2.1.3 Upload the CPI certificate on eNB GUI

The steps below are required to upload the CPI certificate before performing steps in [section 4.3.1](#), where you register the CBSD with the SAS vendor. For RTS 3.7.11, see Figure 4-8; for QRTB 2.9.10, see Figure 4-9.

1. Go to *System > CertStore* (RTS 3.7.11) or *System > Certificate* (QRTB 2.9.10).
2. *SAS CPI certstore*: If you use a p12 file format, select the check box, and enter a password. Choose *Select File* and navigate to the certificate file. Select *Upload*. The file name appears in the *Certificate List* window.

NOTE: Certificate file types supported are p12 and pem. One of the pem formats is pkcs8.

–If you select file type p12, you must input a password.

–If you select file type pkcs8, you do not need a password.

Figure 4-8: Certificate Upload (RTS 3.7.11)

Figure 4-9: Certificate Upload (QRTB 2.9.10)

4.2.1.4 Configure Quick Setting parameters on eNB GUI

The steps below are required to configure the eNB Quick Setting parameters. For RTS 3.7.11, see Figure 4-10. For QRTB 2.9.10, see Figure 4-11.

1. Go to *BTS Info > Quick Setting* (RTS Software) or *Basic Setting > Quick Setting* (QRTB Software).
2. *Legacy Mode*: If you have CPEs that only support Bands 42 or 43, set the Legacy mode to “Enable.” The default value is “Disable.”
3. *Frequency Selection Logic*: After sending a request for spectrum from the SAS, the DP selects the first channel available from the SAS’s response. But operators can configure their preferred frequencies, channel bandwidth, and power by selecting a *Frequency Selection Logic* and entering the *Preferred Bandwidth*, *Preferred Power*, and *Preferred Frequency*.

For example, if you choose Power, Frequency, and Bandwidth for this setting, the DP uses power as the most important value to calculate CBRS channel selection.

Select one of the following to indicate the order of importance for the frequency selection logic:

- Frequency, Bandwidth, Power
 - Frequency, Power, Bandwidth
 - Bandwidth, Frequency, Power
 - Bandwidth, Power, Frequency
 - Power, Bandwidth, Frequency (default)
 - Power, Frequency, Bandwidth
4. *Preferred Bandwidth*: Enter the preferred bandwidth for this eNB.
 5. *Preferred Power*: Enter the preferred power for this eNB. Preferred power is the total TX power (in dBm) transmitted per carrier. For example, if it is desired for the eNB to emit 2W of power (2x1W) per carrier, then the preferred power would be 33 (dBm).
 6. *Preferred Frequency*: Enter the preferred frequency for this eNB. You can add more than one preferred frequency and set the priority. Click on the + (Add) icon to add more preferred frequencies, enter the value(s), and select the priority. For example, if the eNB is a two-carrier eNB, enter the preferred frequency or frequencies for the Primary Cell (Pcell) and Secondary Cell (Scell).

NOTE 1: When applying any changes to these preferred parameters, the DP will automatically relinquish the eNB’s existing grant and restart the spectrum inquiry and grant procedure.

NOTE 2: If you have purchased a Priority Access License (PAL) when using the frequency selection logic, the DP chooses that channel type instead of a General Authorized Access (GAA) channel. You can view SAS logs to verify the authorized channels in use. See [section 4.3.1](#) and Figure 4-27 for more information.

NOTE 3: For eNBs running QRTB 2.9.10 software, the “Channel Reuse” check box in the SAS Preferred Setting pane displays only when the eNB is set to Dual Carrier mode.

NOTE 4: The *Basic Setting > Quick Setting* GUI labels vary slightly depending on the carrier setting configured in *BTS Setting > Carrier Setting*. If the eNB is set to Single Carrier mode, one cell will be configured. If the eNB is set to Dual Carrier (DC)/split mode, two cells will be configured and will display fields for Cell1 and for Cell2. If the eNB is set to Carrier Aggregation mode, fields display as "Pcell" and "Scell".

NOTE 5: SAS vendors recommend requesting grants before 12:00 AM or after 3:00 AM PST.

Figure 4-10: Quick Setting (RTS 3.7.11)

Quick Setting

Duplex Mode: TDDMode

Legacy Mode: Disable

Band: 48

Bandwidth: 10MHz

Frequency: 55690(3595MHz)

SubFrame Assignment: 1 (DL:UL = 2:2)

Special SubFrame Patterns: 7

PCI: 64
Range: 0-503

ECI (ECI=eNB_ID*256+Cell_ID): 67262143
Range: 0-268435455

Transmission interface binding(Non-IPSec): WAN

S1 Connection Mode: All

TAC: 1
Range: 0-65535

RF Status: Enable

Power Modify: 2 x 24dBm

PLMN: Primary NotReserved
Range: 5-6 Digit

PLMN ID	Primary PLMN	Reserved
314030	Yes	NotReserved

Frequency Selection Logic: Frequency,Bandwidth,Power
Order of importance when selecting frequency

Preferred Power: 2 x 24dBm

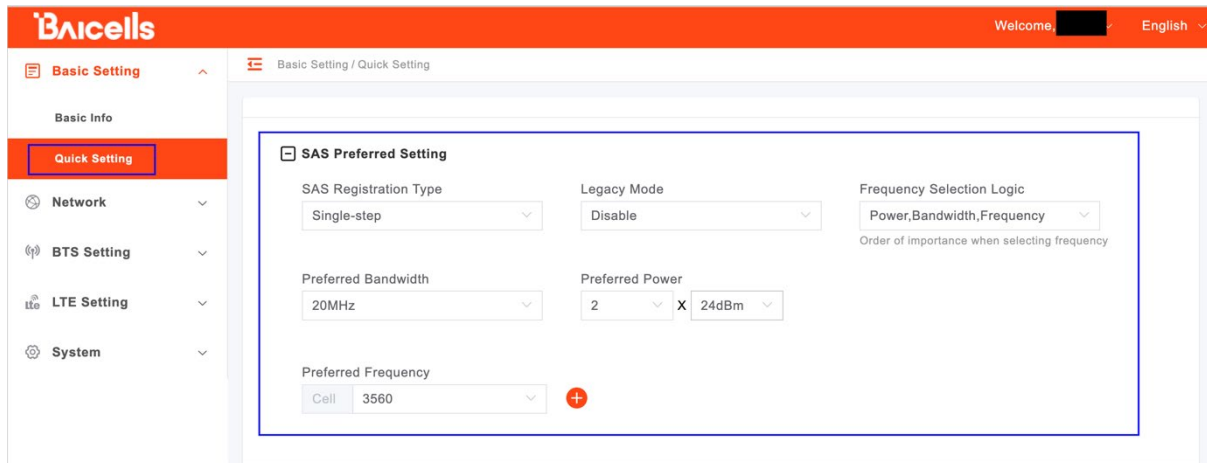
Preferred Bandwidth: 10MHz

Preferred Frequency: 3555MHz

Frequency Priority: 3595MHz 0

Save Reset

Figure 4-11: Quick Setting (QRTB 2.9.10)



4.2.2 CPE Configuration

The Baicells CPE model must be a CBRs SAS certified CBSD. Before enabling SAS on the CPE, you must import the CBSD information into the SAS vendor's portal.

Since the OMC functions as a domain proxy (DP) between CBSDs and the SAS, you must configure the CPE to connect with the OMC. Because the OMC acts as an Automatic Configuration Server (ACS), the field for "pointing" the CPE to the OMC is called *ACS Address*.

Verify that the OMC/ACS URL has been entered correctly, as follows:

1. Go to *System > TR-069*, and ensure the *ACS Address* field is configured correctly.
 - a. For the CloudCore OMC, enter
`http://baiomc.cloudapp.net:48080/smallcell/AcsService`
 - b. For a Local OMC, enter the Local OMC server URL, e.g.,
`http://xx.xx.xx.xx:8080/smallcell/AcsService`

If using the Baicells CloudCore OMC, enter the operator's unique CloudKey shown at the top of the CloudCore account window. (The CloudKey is not required for Local OMC.)

4.2.2.1 Configure SAS on the CAT4 CPE GUI

To enable SAS operation on a certified CAT4 CPE device (Figure 4-12):

NOTE: Refer Table 4-4 in [section 4.5](#) for the CPE parameter description to complete the SAS configuration.

1. Go to *System > SAS* and enter the *User ID* provided by the SAS vendor.
2. Optional: Enter the *Call Sign*, which is a parameter that is useful to identify the PAL license under which the operator is deploying a CPE. The parameter is not necessary to configure the GAA spectrum (3550–3700 MHz). The range is 0 to 256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9).

3. The *Category* field, which refers to the CBRS equipment category, leave the default setting of *A* for an indoor CPE. If this is an outdoor CPE, leave the default setting of *B*. See the Baicells CBSD Product Information Table (Table 4-5 in [section 4.5](#)) if you need further assistance.
4. All the other fields will either be (a) auto-filled based on the model of CPE you have, or (b) are the CPE SAS status indications.
5. When you are ready for this CPE to operate in SAS mode, click on the *Enable* checkbox.
6. Click on *SAVE & APPLY*.

Figure 4-12: SAS (CAT4)

Baicells

Status
Network
LTE
Security
VPN
System
NTP
Account
Dynamic DNS
WEB Setting
FTP Auto Upgrade
TR-069
SNMP
Restore/Update
Ping Watchdog
SAS
Diagnosis
Reboot
Logout

SAS

SAS Information

SAS Status	Unregistered
Radio Status	Disabled
Granted EIRP(10MHz)	N/A

SAS Settings

SAS	<input checked="" type="checkbox"/> Enable
User ID	[Redacted]
Call Sign	x
Category	B
FCC ID	[Redacted]
Serial Number	[Redacted]
Radio Technology	E_UTRA
Antenna Gain	14 (-127 ~ 128 dBd)

SAVE & APPLY

4.2.2.2 Configure SAS on the CAT6/7/15 CPE GUI

To enable SAS operation on a certified CAT6/7/15 CPE device (Figure 4-13):

1. Go to *System > SAS*, and select *Access Method (Domain Proxy or Direct SAS)* from the pull-down menu. If you choose *Domain Proxy*, go to [step 2](#). If you choose *Direct SAS*, go to [step 3](#).
2. When you choose *Domain Proxy*, the *Registration Method* will default to *Multi-Step*, and the *SAS Server URL* will auto-fill to CloudCore OMC URL (<http://baiomc.cloudapp.net:48080/smallcell/AcsService>). Proceed to [step 14](#).

3. When you choose *Direct SAS*, you can select the *Single-Step* radio button for the *Registration Method* and configure the remaining fields in the GUI. Proceed to [step 4](#).
4. Enter the *SAS Server URL* that the SAS vendor has provided.
5. Enter the *User ID* provided by the SAS vendor.
6. Optional: Enter the *Call Sign*, which is a parameter that is useful to identify the PAL license under which the operator is deploying a CPE. The parameter is not necessary to configure the GAA spectrum (3550–3700 MHz). The range is 0 to 256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9).
7. Enter the *Latitude* of the CPE's location (range is -90.0° to 90.0°).
8. Enter the *Longitude* of the CPE's location (range is -180.0° to 180.0°).
9. Select *True* or *False* from the pull-down menu to indicate *Indoor Deployment*.
10. Enter the *Antenna Height* in meters.
11. Enter the *Antenna Azimuth* in degrees (range is 0° to 359°, and the default is 0).
12. Enter the *Antenna Downtilt* in degrees (range is -90° to 90°, and the default is 0).
13. Enter the *Antenna Beamwidth* in degrees (range is 0° to 360°, and the default is 26).
14. When you are ready for this CPE to operate in SAS mode, click on the *Enable* checkbox.
15. Click on *Apply*.

Figure 4-13: SAS CAT6/7/15

CAT6/7/15

Bicells

SAS

SAS Informations

SAS Status : Transmission

Radio Status : Enabled

Granted EIRP(10MHz) :

SAS Settings

SAS : ☒ Enable

Access Method : Direct SAS

Registration Method : ☐ Multi-Step ☒ Single-Step

SAS Server URL : https://example.sas.server:5000

User ID :

Call Sign :

Latitude : (-90.0° ~ 90.0°)

Longitude : (-180.0° ~ 180.0°)

Indoor Deployment : False

Antenna Height : meters

Antenna Azimuth : 0 (0° ~ 359°)

Antenna Downtilt : 0 (-90° ~ 90°)

Antenna Beamwidth : 26 (0° ~ 360°)

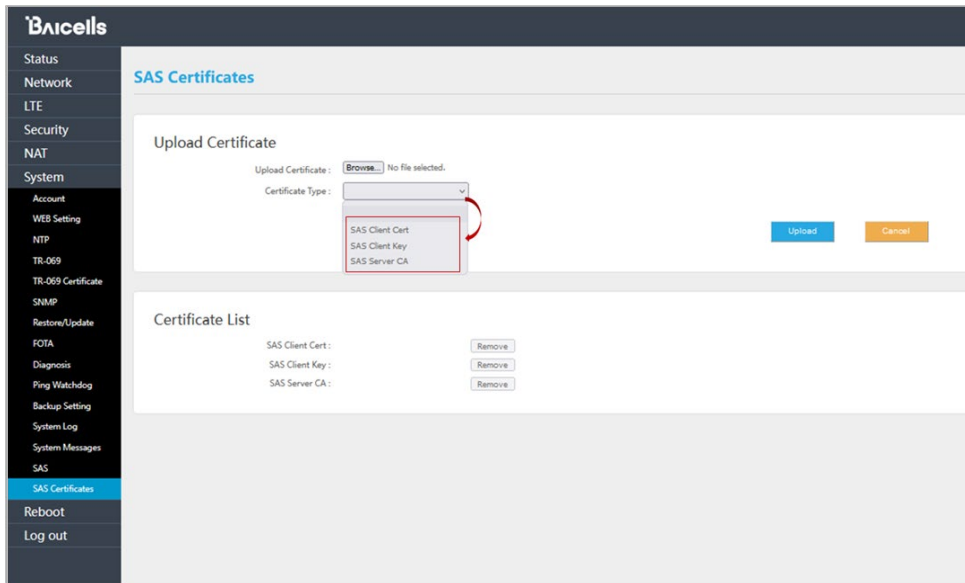
Apply Cancel

4.2.2.3 SAS Certificates (CAT6/7/15)

The *System > SAS Certificates* sub-menu is used to upload and manage SAS certificates (Figure 4-14).

Select the *Certificate Type* from the pull-down menu (*SAS Client Cert*, *SAS Client Key*, or *SAS Server CA*) in the *Upload Certificate* pane in the SAS Certificates window. Then, click *Browse...* to navigate to the desired file and click on *Upload*. The certificates already uploaded can be viewed in the *Certificate List* pane. You can use the *Remove* button next to an uploaded certificate you would like to delete from the CPE.

Figure 4-14: SAS Certificate CAT6/7/15



4.3 Domain Proxy (OMC) Configuration

Enable the SAS domain proxy (OMC)

1. Go to *Advance > SAS* and click on the *Settings* icon (Figure 4-15).
2. In the *Settings* pane that displays, enable “Auto Registration”, and select the SAS Provider you are using. Next, enter the User ID provided by your SAS vendor and click *OK*. The *Settings* pane closes.
3. In *Advance > SAS*, all devices that have been or will be authorized to operate in SAS mode will be listed in device tabs labeled *eNB* and *CPE*. Select the desired device tab to view device details and register CBSDs.

NOTE: The OMC display defaults to the eNB device tab.

Figure 4-15: OMC – Enable SAS

The screenshot shows the OMC SAS configuration interface. At the top, there are status indicators for Critical (284), Major (23), Minor (18), and Warning (0). The main table lists eNBs with columns for Serial Number, Cell Name, and State. The 'SAS Enabled' column has a toggle switch. A red box highlights the 'Settings' button in the top right corner. Below the table, a 'Settings' dialog box is shown with the following fields:

CPI State	Category	CBSID ID
null	B	
null	A	
null	A	
null	B	
signed	A	

The 'Settings' dialog box contains the following fields:

- Auto Registration: Enable (dropdown)
- SAS Provider: [Redacted] (dropdown)
- User ID: [Empty text field]

Buttons: OK, Cancel

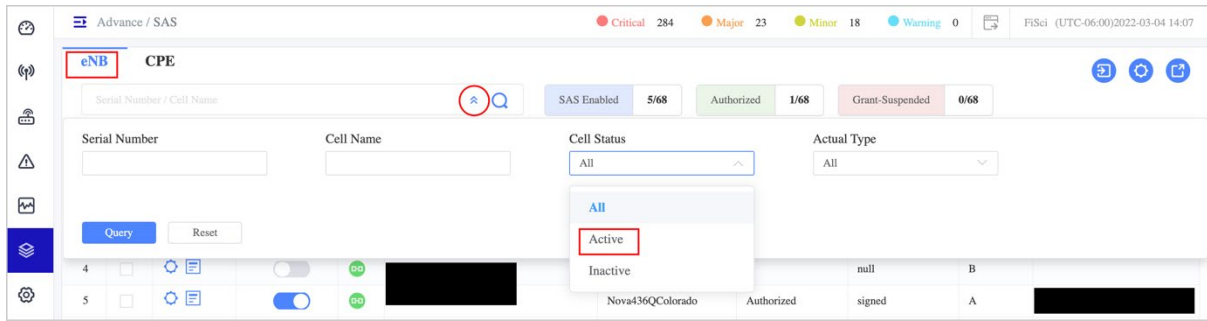
The CBSID-SAS connection setup progresses in the order shown below.



You can use the OMC query or advanced query functions Figure 4-16 to search for a specific eNB device or check its active status.

NOTE: Refer to the *CloudCore Configuration & Network Administration Guide* for more information about non-SAS-related searches you can perform.

Figure 4-16: Check eNB Active Status



There are two options from which you can choose to register the eNB and CPE CBSDs with SAS using the domain proxy (OMC) as described here.

- Choice 1 (Single-Step): Use the OMC to configure all the required parameters.
- Choice 2 (Multi-Step): Configure only the CBSD's basic information using the OMC, and then use the SAS portal to configure the antenna installation parameters.

NOTE 1: Regardless of the registration type, you must configure the CBSD's basic information for successful registration with SAS.

NOTE 2: You must upload a CPI certificate (signature) to use Single-Step registration.

NOTE 3: CPI Certificate only needs to be uploaded once per login session.

NOTE 4: See [section 4.2.1.4](#) for configuring eNB preferred frequency settings.

4.3.1 Register eNBs and CPEs with SAS

The following procedure describes how to register eNB or CPE device types using the OMC to configure all the required parameters (Single-Step registration):

1. First, identify all antenna requirements before starting the procedure.
2. Then, on the OMC, go to *Advance > SAS*.

NOTE 1: The OMC display defaults to the eNB device tab list, and you can click on the CPE device tab when needed.

NOTE 2: Each CBSD device row includes a Settings icon to the left of the row.

NOTE 3: All figures in this section show eNB GUIs because most of the SAS Setting parameters for eNB and CPE device types are the same.

3. Click the Settings icon on the left of the desired device to display its Settings window (Figure 4-17, Figure 4-18, and Figure 4-19).

Figure 4-17: Register CBSD with SAS (Page 1 of 3)

Settings

Procedure State

Unregistered → Registered → Granted → Authorized

CBSD Configuration ⓘ The following parameters are mandatory for successful registration with SAS.

Preferred Settings

- * Frequency Selection Logic: Power,Bandwidth,Frequency
- * Legacy Mode: Disable
- * Preferred Bandwidth: 20M
- * Preferred Power: 0
- Contiguous: ☒
- Preferred Frequency: Auto (Limit of 15)
 - 1 Auto
- Only follow selected list: ☐

Synchronize

NOTE 1: The Synchronize icon can be used to immediately synchronize the eNB SAS settings with the OMC. One practical example for using this function is to upload a new CPI certificate from here by synchronizing with an eNB that has the certificate already loaded.

NOTE 2: Device logs can be viewed by clicking on the Logs icon. See [section 4.3.4](#) and Figure 4-26 for more information.

Figure 4-18: Register CBSD with SAS (Page 2 of 3)

Basic Information

CBSD Category: A B

* User ID: baicells

Call Sign: length: 0 - 256

* FCC ID: 2AG32MBS3100196N

* Serial Number: 120200024019APP0169

Cell Name: Nova436QColorado

Antenna Gain: 5

Air Interface

Radio Technology: E-UTRA

Group (Limit of 5)

Group Type: INTERFERENCE_COORDINATE

Group ID: number , letter and _

Figure 4-19: Register CBSD with SAS (Page 3 of 3)

Installation Parameter

Single-Step registration is currently selected.

• Antenna

Deployment: Outdoor

Latitude: Longitude: Height: m HeightType: AGL

Azimuth: Down Tilt: Gain: Beamwidth:

Professional Installer Data

CPI ID: CPI Name: Install Cert Time: Modify

CPI Signature Data

OK Cancel

4. Configure the required preferred settings parameters, which can vary depending on the CBSD device type.

NOTE: Set Legacy Mode to “Enable” if there are legacy CPEs that only support Bands 42 or 43.

5. Configure the required basic information parameters, which can vary depending on the CBSD device type.

NOTE: Your SAS vendor provides the User ID. The Call Sign is a unique company identifier issued by the FCC. You can configure the Call Sign, but it’s not mandatory.

6. Configure the required air interface parameters (Radio Technology and Group). At this time, for Radio Technology, you will see only E_UTRA, and the field is greyed out. E_UTRA identifies that the eNB CBSD is using LTE technology. Currently, only INTERFERENCE_COORDINATION is used in the Group pane. SAS vendors will likely use CBSD groups in the future when General Authorized Access (GAA) coexistence is introduced.
7. Configure or modify antenna parameters by clicking the “Modify” button and uploading your CPI certificate information (Figure 4-20).

Figure 4-20: Modify CBSD Antenna Parameters

Install Parameter

Single-Step registration is currently selected.

• **Antenna**

Deployment: ☐ Indoor ☒ Outdoor

Latitude: Longitude: Height: m HeightType:

Azimuth: Down Tilt: Gain: Beamwidth:

Professional Installer Data

CPI ID: CPI Name: Install Cert Time:

CPI Signature Data

Install Parameter

• **Antenna**

Deployment: ☐ Indoor ☒ Outdoor

Click the button to automatically synchronize and fill in the equipment reported value

Latitude: Longitude: Height: m

HeightType: AMSL Azimuth: Down Tilt:

Gain: Beamwidth:

Professional Installer Data

Notice: CPI file and password is neither stored on client nor on the server.

CPI Certificate: ☒ P12 Password:

CPI ID:

CPI Name:

8. Configure antenna installation parameters (Deployment, Longitude, Latitude, Height, HeightType, Azimuth, Down Tilt, Gain, and Beamwidth).
9. Click *OK*; then, click the X icon on the upper right-hand side of the screen to close the Settings pane.

NOTE: For any newly added CBSD, you only need to add the CPI Certificate once in the OMC.

4.3.2 Check eNBs and CPEs Connectivity with SAS

1. Check CBSD SAS connectivity (Figure 4-21): Go to *Advance > SAS*, click on the CBSD device tab on the upper left-hand side of the screen, and confirm the CBSD is listed and connected by checking the following columns: *SAS Enabled*, *Serial Number*, and *State*.

Figure 4-21: Confirm CBSD SAS Connectivity

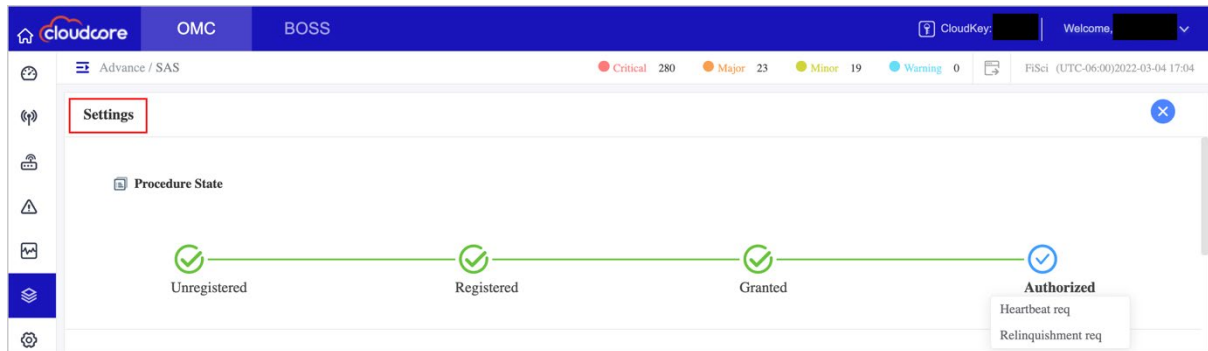
	SAS Enabled	Serial Number	Cell Name	State	CPI State	Category	CBSD ID
1						B	
2						A	
3						A	
4						B	
5				Authorized		A	2AG32MBS3100196N00356...
6				Unregistered		B	

2. Check the CBSD's connection state by clicking on the Settings icon for the device you want to check, and the Settings pane displays. You'll see a Procedure State diagram at the top of the Settings pane. If you hover over one of the Procedure State icon labels, you will get a drop-down menu to take action on *that* step of the connection setup process. In Figure 4-22, for example, the device is not registered yet and is shown as *Unregistered*. Another scenario would enable SAS to request device registration manually using the Procedure State diagram rather than the auto-registration option. When you hover over the *Unregistered* Procedure State icon label, the drop-down menu displays the action you perform at this point: *Register req*. Select this action to start the request. In Figure 4-23, for example, the device Procedure State shows *Authorized*, and the drop-down menu displays two actions you can perform: *Heartbeat req* and *Relinquishment req*.

Figure 4-22: Check CBSD Connection Details (Example 1, Unregistered)



Figure 4-23: Check CBSD Connection Details (Example 2, Authorized)



4.3.3 Import CBSD to OMC

The OMC also supports CBSD registration with a mass data file importing function, allowing you to register the devices in your inventory with SAS before putting the devices online and connecting to the OMC. Then, once the devices are online on the OMC (DP), they will immediately be authorized by SAS. The function works for both types of CBSDs (eNBs and CPEs).

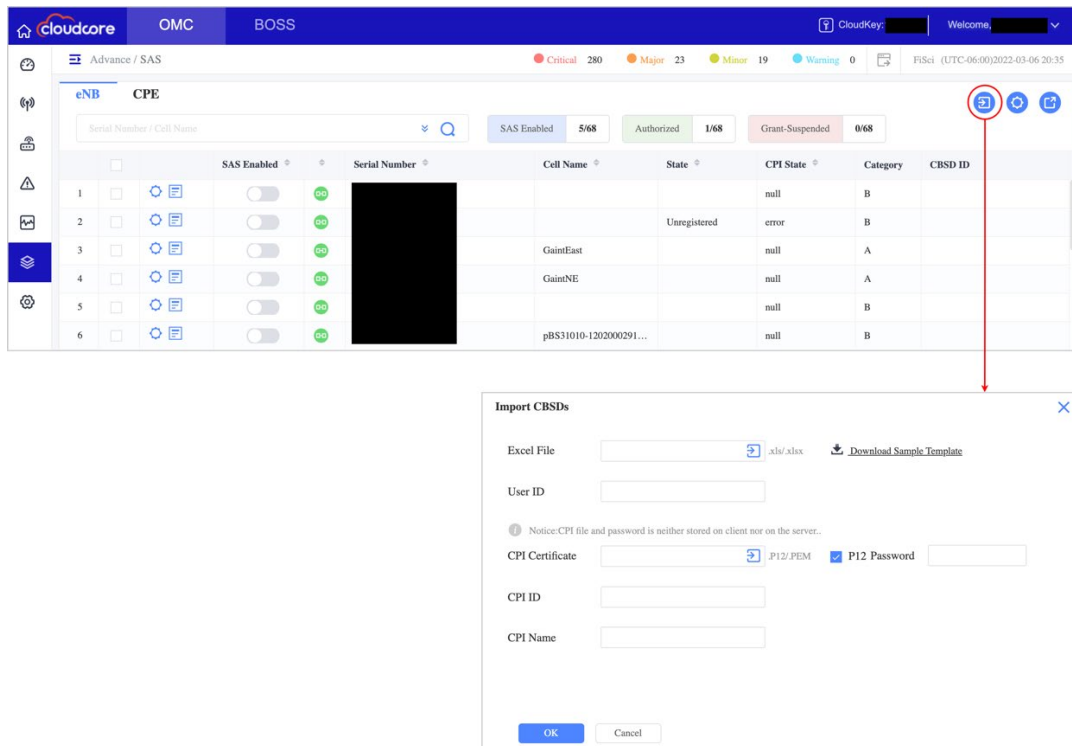
NOTE 1: Before beginning this procedure, we recommend creating your CBSD data file, so it is ready to import to the OMC when you are prompted. Instructions are provided below to assist if you need help creating a CBSD data file.

NOTE 2: Device logs can be viewed by clicking on the Logs icon. See [section 4.3.4](#) and Figure 4-26 for more information.

1. On the OMC, go to *Advance > SAS*.
2. Click on the eNB tab or CPE tab, and then click on the Import icon to access the Import CBSDs pane (Figure 4-24).

NOTE: All the fields in this pane, and the associated files and certificates, are required for successful CBSD data file import.

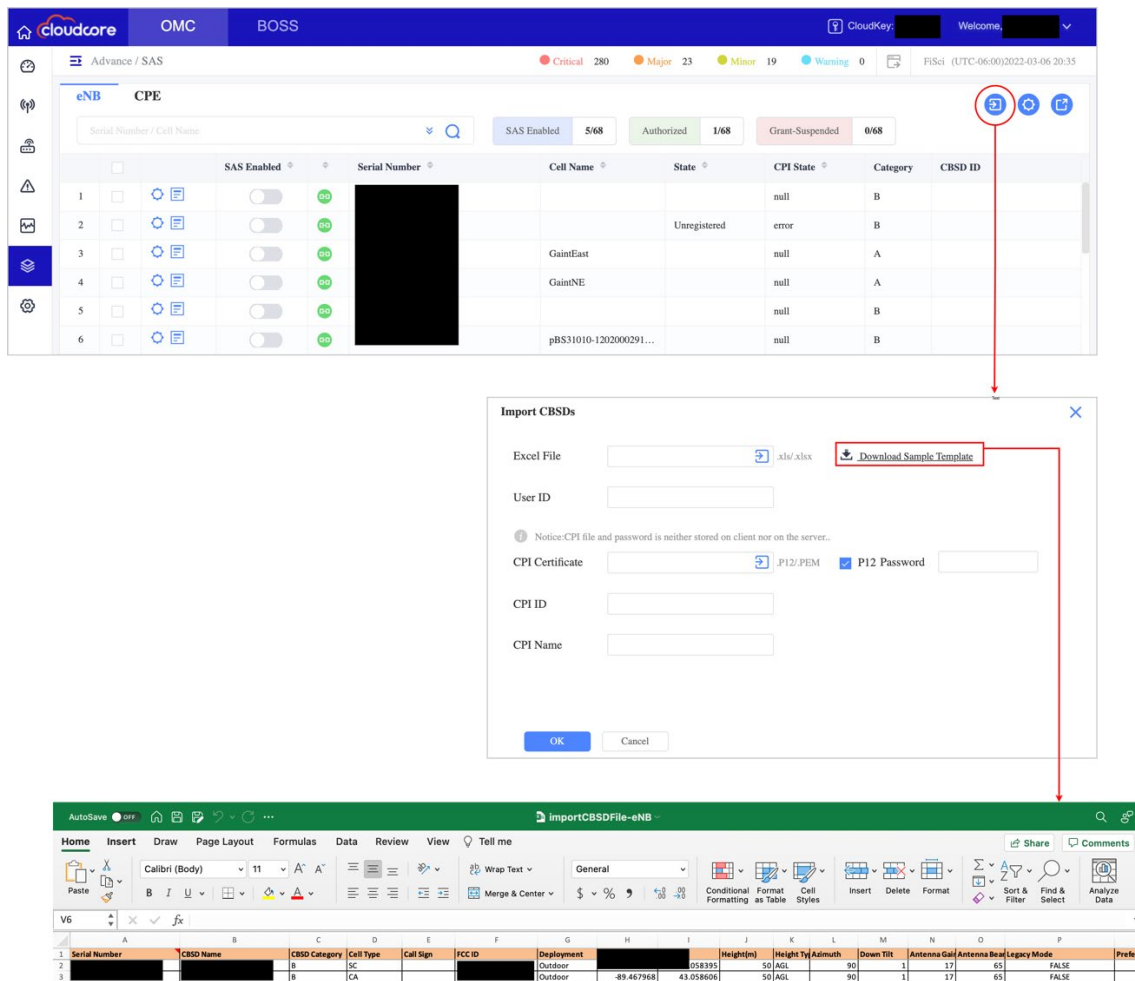
Figure 4-24: Import CBSD Data File



3. Click on the blue arrow icon to upload your CBSD data's Excel file. If you need help creating a CBSD data file, proceed to [step 4](#). If not, skip to [step 5](#).
4. Click on the "Download Sample Template" link and open or save the .xlsx file; then, once the file opens, follow the instructions provided (Figure 4-25).

NOTE: Do not remove the template instruction page from the template file.

Figure 4-25: Download Sample Template



5. Input your User ID.
 6. Click on the blue arrow icon to upload your CPI certificate.
- NOTE: If your CPI certificate is in p12 format, your p12 password is required.
7. Input your CPI ID and CPI Name.
 8. Click OK; then, click the X icon on the upper right-hand side of the screen to close the Import CBSDs pane.
 9. Check CBSD SAS connectivity. Go to *Advance > SAS*, click on the *eNB* tab or *CPE* tab, and confirm the CBSD is listed and connected by checking the following columns: *SAS Enabled*, *Serial Number*, and *State*.
 10. Put the CBSDs online on the OMC (DP) to connect them to the network, and SAS immediately authorizes them.

4.3.4 Access Device Logs

Access device logs by clicking the *Logs* icon on the left of the desired device to display all the critical events for the device since it was registered with SAS. Figure 4-26 shows an example of Message Logs (SAS logs) and Logs (CBSD logs) with critical events for the selected device.

The logs show information pertaining to CBSD <-> OMC (DP) <-> SAS communications, i.e., messages sent to and from SAS. There are two types of logs: Message Logs (SAS logs) and Logs (CBSD logs). In the Message Logs, the columns show the direction (From/To), Log Name, Message, and the date and time* of the event. Hover over the Message to see the message request from DP and reply from SAS. The Logs columns show the CBSD ID, GRANT ID, State (all CBSD states are described in Table 4-1 in [section 4.3.4.1](#)), and the date and time* of the event.

Figure 4-26: Access Device Logs (All Key Events)

The figure displays two screenshots of the SAS interface. The top screenshot shows the 'eNB CPE' table with columns: SAS Enabled, Serial Number, Cell Name, State, CPI State, Category, and CBSD ID. A red arrow points from the 'Logs' icon in the left sidebar to the 'Logs' tab in the bottom screenshot. The bottom screenshot shows the 'Logs' tab with two sub-tables: 'Message Logs' and 'Logs'.

Message Logs

From	To	Log Name	Message
1	SAS	RelinquishmentR...	{ "relinquishmentResponse": { { "cbidId": "2AG32PB...
2	DP	RelinquishmentR...	{ "relinquishmentRequest": { { "cbidId": "2AG32PBS2...
3	SAS	GrantResponse	{ "grantResponse": { { "cbidId": "2AG32PBS212096N...
4	DP	GrantRequest	{ "grantRequest": { { "cbidId": "2AG32PBS212096N/c...
5	SAS	SpectrumInquiry...	{ "spectrumInquiryResponse": { { "cbidId": "2AG32P...
6	DP	SpectrumInquiry...	{ "spectrumInquiryRequest": { { "cbidId": "2AG32PB...
7	SAS	RelinquishmentR...	{ "relinquishmentResponse": { { "cbidId": "2AG32PB...
8	DP	RelinquishmentR...	{ "relinquishmentRequest": { { "cbidId": "2AG32PBS2...

Logs

CBSD ID	GRANT ID	State	Time(UTC)
1	2AG32PBS212096N/...	Granted	2022-03-04 11:56:47
2	2AG32PBS212096N/...	Granted	2022-03-04 11:56:46
3	2AG32PBS212096N/...	Authorized	2022-03-04 11:36:19
4	2AG32PBS212096N/...	Authorized	2022-03-04 11:36:19
5	2AG32PBS212096N/...	Authorized	2022-03-04 11:11:55
6	2AG32PBS212096N/...	Authorized	2022-03-04 11:11:55
7	2AG32PBS212096N/...	Authorized	2022-03-04 10:47:56
8	2AG32PBS212096N/...	Authorized	2022-03-04 10:47:56
9	2AG32PBS212096N/...	Authorized	2022-03-04 10:24:10

*NOTE: The time reported is in Coordinated Universal Time (UTC) format.

Check “spectrumInquiryResponse” messages in the Message logs (Figure 4-27) or the Channel Type column in the *Advance > SAS* to verify the types of channels (GAA and PAL) being requested for use according to the frequency selection logic settings you selected in [section 4.2.1.4](#).

Figure 4-27: Verify Authorized Channels in Use

The screenshot shows the cloudcore OMC BOSS interface. The top navigation bar includes 'cloudcore', 'OMC', and 'BOSS'. The main area displays 'Advance / SAS' with a status bar showing 'Critical 274', 'Major 23', 'Minor 20', and 'Warning 0'. The 'Logs' section is active, showing a list of messages. A detailed view of a message is shown, highlighting the 'spectrumInquiryResponse' field. The response includes 'channelType' set to 'GAA' and 'ruleApplied' set to 'FCC_PART_96'. The 'Logs' table on the right shows columns for 'CBSD ID', 'GRANT ID', 'State', and 'Time(UTC)'. The table contains 9 rows of data, all with a 'State' of 'Authorized'.

From	To	Log Name	Message
1	SAS	DP	RelinquishmentR...
2	DP	SAS	RelinquishmentR...
3	SAS	DP	GrantResponse
4	DP	SAS	GrantRequest
5	SAS	DP	SpectrumInquiry... { "spectrumInquiryResponse": { { "cbidId": "2AG32P..."
6	DP	SAS	SpectrumInquiry... { "spectrumInquiryRequest": { { "cbidId": "2AG32PB..."
7	SAS	DP	RelinquishmentR... { "relinquishmentResponse": { { "cbidId": "2AG32PB..."
8	DP	SAS	RelinquishmentR... { "relinquishmentRequest": { { "cbidId": "2AG32PBS2..."

CBSD ID	GRANT ID	State	Time(UTC)
1	2AG32PBS212096N/...	Granted	2022-03-04 11:56:47
2	2AG32PBS212096N/...	Granted	2022-03-04 11:56:46
3	2AG32PBS212096N/...	Authorized	2022-03-04 11:36:19
4	2AG32PBS212096N/...	Authorized	2022-03-04 11:36:19
5	2AG32PBS212096N/...	Authorized	2022-03-04 11:11:55
6	2AG32PBS212096N/...	Authorized	2022-03-04 11:11:55
7	2AG32PBS212096N/...	Authorized	2022-03-04 10:47:56
8	2AG32PBS212096N/...	Authorized	2022-03-04 10:47:56
9	2AG32PBS212096N/...	Authorized	2022-03-04 10:24:10

After accessing logs, you can filter and view a sub-set of them online according to a preferred date and time range by performing the following steps:

NOTE 1: The time range you specify cannot exceed seven calendar days (to the exact hour, minute, and second), or you will receive an error message.

NOTE 2: To configure a time range filter, you must first select a start and end date.

1. Click the Time Range field to display a calendar (Figure 4-28).
2. Without clicking anywhere else, click on a calendar day to select your preferred time range start date. Then, click on a second calendar day to choose your preferred time range end date (Figure 4-29).

NOTE: The date range fields are at the top of the calendar update to display the days you selected.

Figure 4-28: View Device Logs (Filter – Calendar Tool)

The screenshot shows the SAS Advance / SAS interface. At the top, there are status indicators for Critical (281), Major (23), Minor (19), and Warning (0). The main window is titled "Logs (SN:1202000107181CP0040)". Below the title bar, there is a date range filter: "2022-02-27 00:11:54 -- 2022-03-05 00:11:54". A red box highlights this filter, and a red arrow points to it with the text "Click here to display calendar". The main content area shows a table of logs with columns: From, To, Log Name, and Message. The table lists 8 logs. To the right of the table, there is a calendar tool for filtering. The calendar shows the months of March and April 2022. The date range filter is set to "2022-02-27 00:11:54 -- 2022-03-05 00:11:54". The calendar tool has a "Time(UTC)" column on the right. The bottom of the window shows pagination: "50/page", "Total 8", and "Go to 1".

- If you want to set the specific time intervals for the filter, see [step 4](#) through [step 7](#). Otherwise, go to [step 8](#).

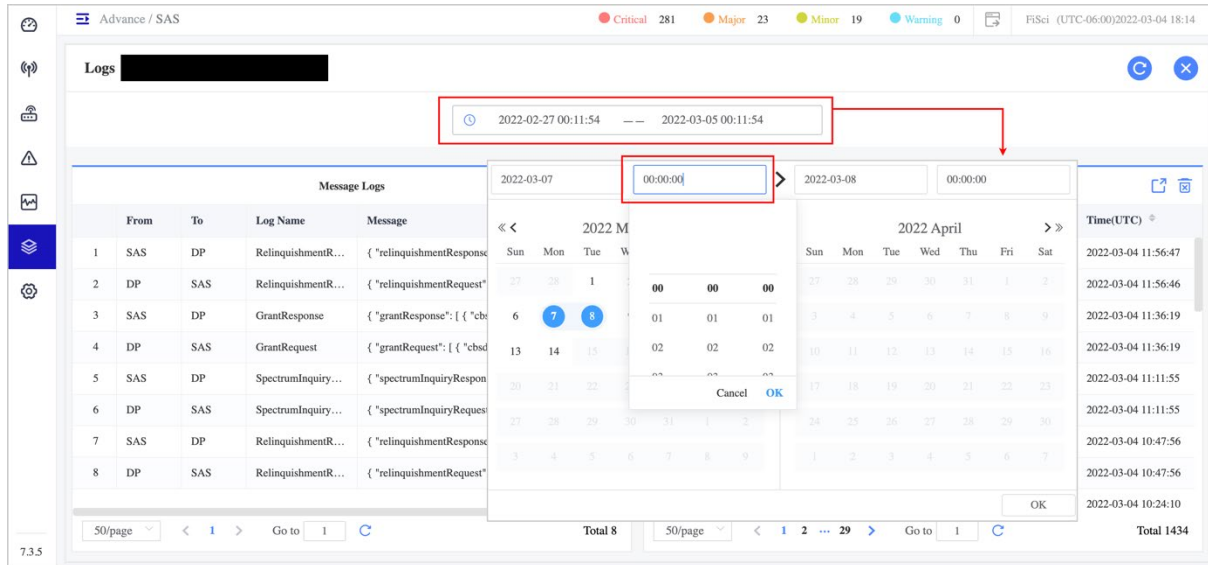
Figure 4-29: View Device Logs (Filter – Set Date Range)

The screenshot shows the SAS Advance / SAS interface. At the top, there are status indicators for Critical (281), Major (23), Minor (19), and Warning (0). The main window is titled "Logs [REDACTED]". Below the title bar, there is a date range filter: "2022-02-27 00:11:54 -- 2022-03-05 00:11:54". A red box highlights this filter, and a red arrow points to it with the text "Click here to display calendar". The main content area shows a table of logs with columns: From, To, Log Name, and Message. The table lists 8 logs. To the right of the table, there is a calendar tool for filtering. The calendar shows the months of March and April 2022. The date range filter is set to "2022-02-27 00:11:54 -- 2022-03-05 00:11:54". The calendar tool has a "Time(UTC)" column on the right. The bottom of the window shows pagination: "50/page", "Total 1434", and "Go to 1".

NOTE: The logs retention period governs how far back in time you can retrieve the logs. In this case, the logs retention period is seven calendar days. Therefore, you can only view/export logs of the last seven days.

- Click on the start date-time interval field to display the time set box (Figure 4-30), which contains three columns for setting hours, minutes, and seconds.

Figure 4-30: View Device Logs (Filter – Set Time Interval)



- Click in the first column, scroll to the hour you want, and select it. Then, repeat the process to select minutes from the middle column and seconds from the third column, in that order.

NOTE: The time intervals can also be entered in the interval fields instead of using the time set boxes. Ensure you enter the times using the "hh:mm:ss" format with colons separating each increment.

- Click OK in the time set box.
- Click on the end date-time interval field to display its associated time set box. Next, specify the end date-time interval.
- Click OK in the main Logs window to apply the filters (Figure 4-30).

4.3.4.1 Export Logs

After accessing the Logs, you can filter and export a sub-set of them according to a preferred date and time range by performing the following steps:

1. For each CBSD, we can see the logs by clicking the Logs icon on the left of the desired device (Figure 4-26 in [section 4.3.4](#)).
2. Filter the export by selecting the date and time. Refer to [section 4.3.4](#).
3. The Logs show the state of the CBSD. Refer to Table 4-1 to see a detailed description of the CBSD states.
4. To export the Message Logs (SAS logs), click on the export icon on the Message Logs column (Figure 4-31).
5. To export the Logs (CBSD logs), click on the export icon on the Logs column (Figure 4-31).

Figure 4-31: Export SAS and CBSD Logs

NOTE: We recommend applying the filters while using the Export function if you plan to export the device logs file instead of viewing online. Refer to [section 4.3.4](#).

Table 4-1: CBSD States

State	Description
Unregistered	The CBSD is not yet approved or registered by the SAS or deregistered.
Registered	The CBSD is registered with SAS but does not have any grants.
Authorized	The CBSD is authorized to transmit through the grant.
Granted	The CBSD received the grant, but it is not currently heart beating on the grant.
Grant-Suspended	The grant is suspended when Incumbent or PAL status has changed temporarily. Then, the CBSD can wait until the grant is re-enabled or relinquish the grant and request another.

4.4 Perform Actions on Multiple Devices Simultaneously

There are three actions you can perform on multiple eNBs and CPEs simultaneously:

- Assign a User ID
- Enable SAS
- Disable SAS

NOTE: The actions described in this section can only be performed on the same device types (eNBs or CPEs).

Perform the following steps to assign a User ID (Figure 4-32):

1. Go to *Advance > SAS*.
2. Select the *eNB* or *CPE* device tab on the upper left-hand side of the screen to display the eNB or CPE device list.
3. Click on the check box next to a target device(s) or click the check box at the column header to select all the devices in the list.
4. Click the *Settings* button at the bottom of the page to open the Settings pane.
5. Input your User ID (required) and Call Sign (Optional).
6. Click *OK*.

Figure 4-32: Assign User ID to Multiple Devices Simultaneously

The screenshot displays the 'Advance / SAS' interface. At the top, there are status indicators for Critical (280), Major (23), Minor (19), and Warning (0). Below this, the 'eNB' tab is selected, showing a list of devices. The table has columns for Serial Number, Cell Name, State, CPI State, Category, and CBSID ID. Two devices are selected, indicated by blue checkboxes. At the bottom, the 'Settings' button is highlighted with a red box, along with 'SAS ON', 'SAS OFF', and 'Cancel' buttons. The 'Selected Devices (2)' indicator is also visible.

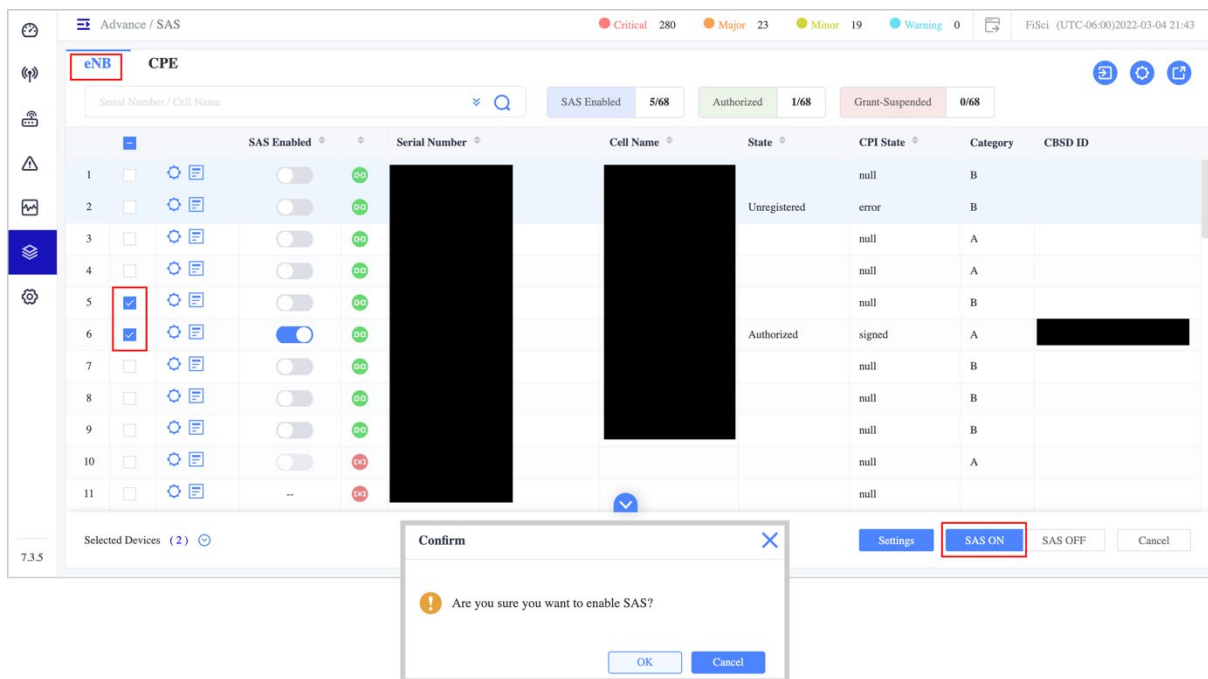
	Serial Number	Cell Name	State	CPI State	Category	CBSID ID
1				null	B	
2			Unregistered	error	B	
3				null	A	
4				null	A	
5				null	B	
6			Authorized	signed	A	
7				null	B	
8				null	B	
9				null	B	
10				null	A	
11				null		

Perform the following steps to enable SAS (Figure 4-33):

NOTE: You should configure all the devices' installation parameters and upload them to the SAS portal before enabling SAS on multiple devices.

1. Go to *Advance > SAS*.
2. Select the *eNB* or *CPE* device tab on the upper left-hand side of the screen to display the eNB or CPE device list.
3. Click on the check box next to a target device(s) or click the check box at the column header to select all the devices in the list.
4. Click the *SAS ON* button at the bottom of the page to open the Confirm pane.
5. Click *OK* when prompted to enable SAS in the Confirm pane.

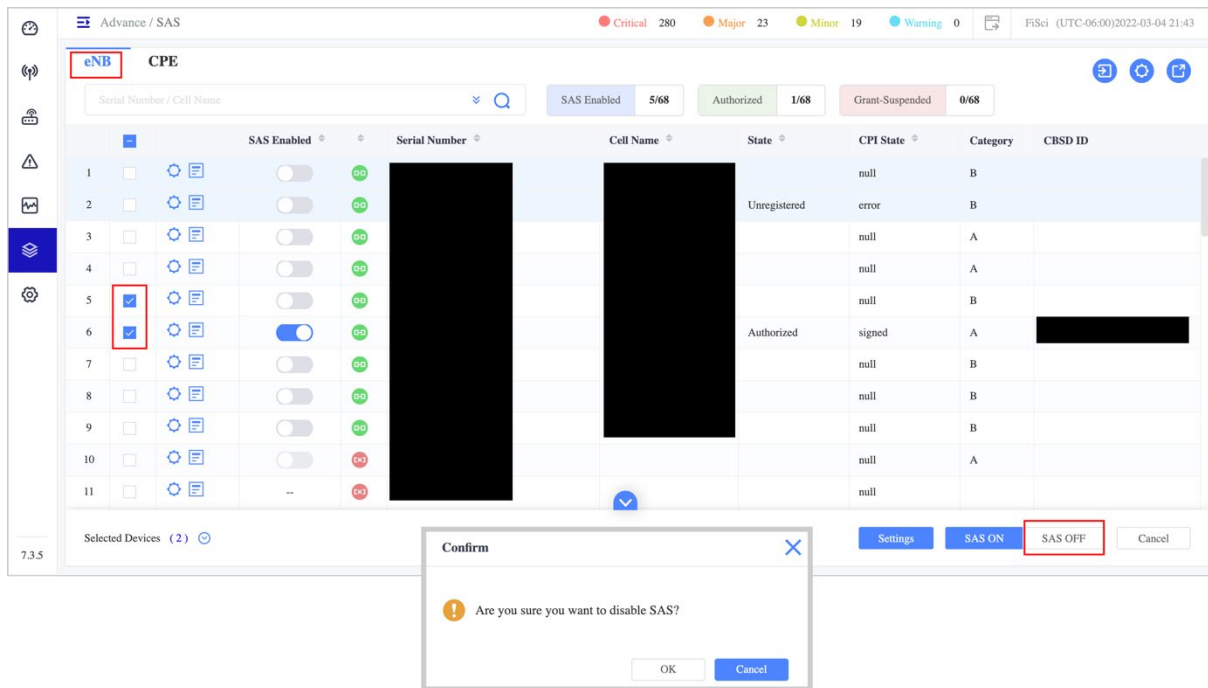
Figure 4-33: Enable SAS on Multiple Devices Simultaneously



Perform the following steps to disable SAS (Figure 4-34):

1. Go to *Advance > SAS*.
2. Select the *eNB* or *CPE* device tab on the upper left-hand side of the screen to display the eNB or CPE device list.
3. Click on the check box next to a target device(s) or click the check box at the column header to select all the devices in the list.
4. Click the *SAS OFF* button at the bottom of the page to open the Confirm pane.
5. Click *OK* when prompted to disable SAS in the Confirm pane.

Figure 4-34: Disable SAS on Multiple Devices Simultaneously



4.5 SAS Installation Parameters

This section discusses the possible configuration parameters used in the eNB or CPE to enable the SAS features, which are essential so that SAS can guarantee the efficient channel allocation, bandwidth, and operation of power on each channel. In addition, all these parameters listed in Table 4-2 (eNB SAS Settings for RTS 3.7.11), Table 4-3 (eNB SAS Settings for QRTB 2.9.10), and Table 4-4 (CPE SAS Settings) help identify the GAA/PAL interference in the nearby region. It also helps to protect the Tier 1 Incumbent and Tier 2 PAL users, such as PAL protected areas.

Table 4-2: eNB SAS Settings For RTS 3.7.11 Software

Parameter	Description
SAS Settings Pane	
SAS	Enable (ON)/Disable (OFF) the SAS function.
SAS Registration Type	Select Single-Step or Multi-Step method to register the eNB with the SAS vendor.
Install Param Config Pane	
category	Either A or B according to the eNB's designation. See Table 4-5 for more information.
userid	Enter a user ID provided by your SAS vendor and is associated with this SAS-enabled eNB. The 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.
latitude	Latitude of the eNB's location. Select auto to autofill the latitude based on GPS data; otherwise, enter the latitude.

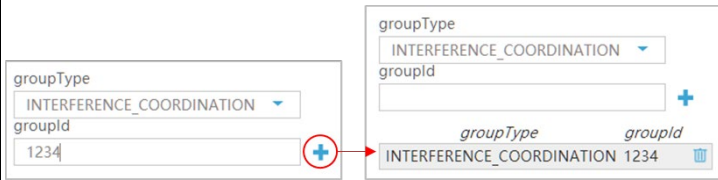

Parameter	Description
longitude	Longitude of the eNB's location. Select auto to autofill the longitude based on GPS data; otherwise, enter the longitude.
height	Enter the antenna height in meters. Range: 0–300 meters.
heightType	Only Above Ground Level (AGL) can be selected
indoorDeployment	Indicate whether the eNB is an Indoor or Outdoor (default) unit
Antenna Gain	Set the eNB's 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 the GAA spectrum (3550–3700 MHz). The 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 can 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. Instead, specify the group ID using letters, numbers, or special characters. When you add the ID, it will be displayed beneath this field. 
CPI info Pane	
cpild	Enter the Certified Professional Installer's identification number.
cpiname	Enter the Certified Professional Installer's name. Use an underscore to separate first and last names; you cannot use a space in this field.
installCertificationTime	Select "Auto" to enter the date and time of installation automatically: yyyy-mm-ddThh:mm:ssZ
CPI certstore Pane	
CPI certstore	Displays the CPI's certificate if it has been uploaded
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 <i>System > CertStore</i> menu to upload the certificate.

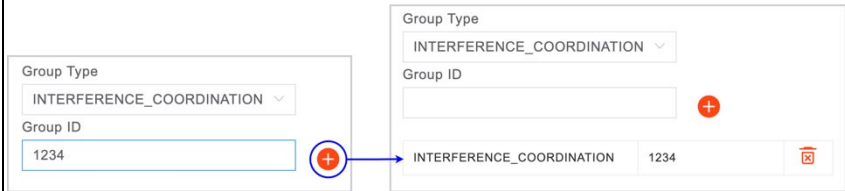
Table 4-3: eNB SAS Settings For QRTB 2.9.10 Software

Parameter	Description
Quick Setting Pane	
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.
Carrier Mode	<p>The carrier mode options supported by the eNB:</p> <ul style="list-style-type: none"> • Single Carrier: The eNB supports only one cell in this mode. • Dual-Carrier: The eNB supports two cells in this mode. Cell1 and Cell2 must both be configured in <i>Basic Setting > Quick Setting</i> because the two carriers are independent of each other. • Carrier Aggregation: In this mode, the eNB supports one cell, but the bandwidth and throughput are twice what is possible in Single Carrier mode. The primary carrier is responsible for signaling and services, while the second carrier is responsible for services only.
Quick Interface Binding	Used to assign the interface connected to the MME. The interface should be selected from among the network interfaces. Default is the WAN interface.
HaloB	<p>Shows HaloB status (ON or OFF) as set in <i>BTS Settings > Core Network</i>.</p> <p>NOTE: This field will not display if Cloud EPC function is ON.</p>
Cloud EPC	<p>The BaiCells CloudCore Evolved Packet Core (EPC) is either ON or OFF. When you enable it (ON), the fields for TAC, S1 Link Port, PLMN, MME IP (<i>Quick Setting</i> pane) and CELL ID (<i>Cell Quick Setting</i> pane) are automatically assigned and will become greyed-out. When you disable the Cloud EPC setting (OFF), the greyed-out fields are unlocked again. Also, when you change the Cloud EPC setting, it will perform a reboot of the eNB.</p> <p>NOTE: This field will not display in HaloB mode.</p>
TAC	Track 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 1–65535. The default is 1.
S1 Connection Mode	<p>The connection mode of the S1 interface between the eNB and the core network.</p> <ul style="list-style-type: none"> • One: The eNB will connect only to the first MME. • All: The eNB will connect to all MMEs configured.
S1 Link Port	The S1 link port is used.
Country Code	<p>Used to select operating mode:</p> <ul style="list-style-type: none"> • USA-FCC (CBRS): Used to enable the eNB to operate in CBRS SAS mode. • Other: Used to operate in normal mode.
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 . When you configure the PLMN, it displays in the PLMN ID list.

Parameter	Description
MME IP	<p>The IP address of the associated MME, which is identical to the IP address of the MME at the core network side. If you're using the Baicells CloudCore, you must set the <i>MME IP</i> address fields to 10.3.0.9 and 10.5.0.9. When you configure the MME, it displays in the table below the MME IP field.</p> <p>NOTE: The field will not display in HaloB mode or when IP MME Pool is enabled.</p>
Cell 1 and Cell 2 Quick Setting Pane	
Band	The eNB's operating frequency band, which is auto-selected based on the hardware model. If SAS is enabled, the band will be assigned by the SAS vendor and the field will be greyed-out.
Bandwidth	For TDD mode, the channel bandwidth the eNB can 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 and the field will be greyed out.
EARFCN	Used to set the absolute radio frequency channel number as allocated by the operator. Range is 55340–56640. If SAS is enabled, the EARFCN will be assigned by the SAS vendor and the field will be greyed-out.
Frequency(MHz)	The eNB's operating frequency (MHz) as selected by the operator. Range depends on the eNB hardware model, country code, and whether SAS is enabled or not. Example for B41: 44190 (3660 MHz) to 44490 (3690 MHz). If SAS is enabled, the frequency will be assigned by the SAS vendor and the field will be greyed out.
SubFrame Assignment	<p>Downlink (DL) and uplink (UL) subframe configuration, where:</p> <ul style="list-style-type: none"> 1 = DL:UL is 2:2 transmission ratio 2 = DL:UL is 3:1 transmission ratio (default) 6 = DL:UL is 3:5 transmission ratio <p> 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</p>
Special SubFrame Patterns	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. Either 5 or 7. The default setting is 7.
PCI	<p>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.</p> <p>NOTE: Baicells does not use and does not work with PCI 0.</p>
Cell ID	Unique identification number for the Cell ID. Range from 0 to 268435455.

Parameter	Description
RF Status	Turn <i>ON</i> or <i>OFF</i> the eNB's RF antenna to allow it to transmit and receive (<i>ON</i>) or to keep it from transmitting and receiving (<i>OFF</i>). The default is <i>ON</i> .
Power Modify	Output power on each port, typically left with the default values (30 dBm x 2 = 33 dBm). Every 3 dB doubles the power. This field can 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.
SAS Preferred Setting Pane NOTE: The <i>SAS Preferred Setting</i> pane and all the associated fields will not display unless SAS is enabled.	
SAS Registration Type	There are two types of SAS registration: Single-Step and Multi-Step.
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 display 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. Default is "Power, Bandwidth, Frequency". NOTE: This field will not display unless SAS is enabled.
Preferred Bandwidth	Used to set the preferred bandwidth for the eNB. NOTE: This field will not display 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. The power can be set to the maximum transmitting power supported by the eNB in increments of 1 dBm. The default is 2 x 24 dBm. NOTE: This field will not display 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 display unless SAS is enabled.

Parameter	Description
Channel Reuse (Dual Carrier mode only)	Used 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 Channel Reuse check box is selected, then only the <i>Preferred Frequency</i> field for Cell1 should display in <i>Basic Setting > Quick Setting</i> . NOTE: This field and check box will not display unless SAS is enabled and the <i>Carrier Mode</i> is set to <i>Dual-Carrier</i> .
Install Param Config Pane (Multi-step SAS Registration Type) NOTE: The <i>Install Param Config</i> pane and all the associated fields will not display unless SAS is enabled.	
CBSD Category	The eNB type. A: Home eNB or B: Macro eNB Either A or B according to the CBRS device designation. The main difference between these categories is the power limit (see Table 2-1 in section 2). The eNB is typically Category B.
User ID	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).
FCC ID	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).
Call Sign	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).
Cell 1 Install Param Config Pane (Multi-step SAS Registration Type) NOTE: The <i>Cell1 Install param Config</i> pane and all the associated fields will not display unless SAS is enabled.	
Antenna Gain	Set the primary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dB.
Cell2 Install Param Config Pane (Multi-Step SAS Registration Type) NOTE: The <i>Cell2 Install Param Config</i> pane and all the associated fields will not display unless SAS is enabled.	
Antenna Gain	Set the secondary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dB.

Parameter	Description
Install Param Config Pane (Single-Step Registration Type)	
<p>NOTE: The <i>Install Param Config</i> pane and all the associated fields will not display unless SAS is enabled.</p>	
CBSD Category	<p>The eNB type: A: Home eNB or B: Macro eNB</p> <p>Either A or B according to the CBRS device designation. The main difference between these categories is the power limit (see Table 2-1 in section 2). The eNB is typically Category B.</p>
User ID	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).
FCC ID	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).
Deployment	Select Outdoor or Indoor to indicate whether the eNB is an Indoor or Outdoor unit.
Call Sign	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).
Antenna Configuration (Dual Carrier mode only)	<p>Select one or two antennas.</p> <p>NOTE: This field will not display unless SAS is enabled and the <i>Carrier Mode</i> is set to <i>Dual-Carrier</i>.</p>
Group Type	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.
Group ID	<p>Optional: You must enter a group ID if using a group type. You cannot leave the group ID 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.</p> 

Parameter	Description
Cell1 Install Param Config Pane (Single-Step Registration Type)	
NOTE: The <i>Cell1 Install Param Config</i> pane and all the associated fields will not display unless SAS is enabled.	
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. Select auto to autofill the antenna height. Range: 0–300 meters or 0–984 feet. NOTE: You can express the height in feet if that is easier. The SAS will convert feet to meters.
HeightType	Primary cell height type in a two-carrier configuration: <ul style="list-style-type: none"> • Above Ground Level (AGL) • Above Mean Sea Level (AMSL)
Antenna Gain	Set the primary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dB.
Antenna Azimuth	Enter the primary cell antenna azimuth, in degrees, in a two-carrier configuration. Default is 180°. Range: 0–359°.
Antenna Downtilt	Enter the degrees of primary cell antenna downtilt in a two-carrier configuration. Default is 5°. Range: -90° to 90°.
Antenna Beamwidth	Enter the degrees of primary antenna beamwidth in a two-carrier configuration. Default is 65°. Range: 0–359°.
Cell2 Install Param Config Pane (Single-Step Registration Type)	
NOTE: The <i>Cell2 Install Param Config</i> pane and all the associated fields will not display unless SAS is enabled.	
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 or 0–984 feet. NOTE: You can express the height in feet if that is easier. The SAS will convert feet to meters.

Parameter	Description
HeightType	Primary cell height type in a two-carrier configuration: <ul style="list-style-type: none"> Above Ground Level (AGL) Above Mean Sea Level (AMSL)
Antenna Gain	Set the secondary cell eNB antenna gain in a two-carrier configuration. Range: -5 to 30 dB.
Antenna Azimuth	Enter the secondary cell antenna azimuth, in degrees, in a two-carrier configuration. Default is 180°. Range: 0–359°.
Antenna Downtilt	Enter the degrees of secondary cell antenna downtilt in a two-carrier configuration. Default is 5°. Range: -90° to 90°. Enter the degrees of secondary cell antenna downtilt in a two-carrier configuration. Default is 5°. Range: -90° to 90°.
Antenna Beamwidth	Enter the degrees of secondary cell antenna beamwidth in a two-carrier configuration. Default is 65°. Range: 0–359°.
CPI Info Pane	
CPI ID	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).
CPI Name	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 Pane	
Install Cert Time	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 Pane	
Install Cert Time	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.
CPI Certificate Pane	
CPI Certificate	Displays the CPI's certificate in the <i>Certificate List</i> if it has been uploaded. Displays <i>Missing</i> when the certificate is missing.
p12 File	Certificate file types are p12 and pem . One of the pem formats is pkcs8 . If you select the <i>p12 File</i> check box, you must input a password. No other file type requires inputting a password.

Table 4-4: CPE SAS Settings

Parameter	Description
SAS Settings Pane	
SAS	Enable/Disable the SAS function.
User ID	Enter a user ID provided by your SAS vendor associated with this SAS-enabled CPE. The range is 0 to 256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9).
Call Sign	Optional: Parameter that is useful to identify the PAL license under which the operator is deploying a CPE. The parameter is not necessary to configure the GAA spectrum (3550–3700 MHz). The range is 0 to 256 characters (using upper-case letters A–Z, lower-case letters a–z, and digits 0–9).
Category	Either A or B according to the CPEs designation. See Table 4-5 for more information.
FCC ID	The CPEs FCC certification number is auto-filled based on the CPE model.
Serial Number	The CPEs unique serial number.
Radio Technology	Auto-filled as “E_UTRA,” and the field is greyed out. E_UTRA identifies that the CPE is using LTE technology.
Antenna Gain	Auto-filled based on the CPE model and the field is greyed out.

Table 4-5: Baicells CBSD Product Information

Model	Part Number	Antenna Gain	Antenna Beamwidth	CBSD Category	FCC-Certified Maximum EIRP (10 MHz)	FCC Identification
eNB CBSDs						
Neutrino430	pBS31010	3	360	A	30	2AG32PBS31010
Nova227*	pBS2120	13	65	B	40	2AG32PBS212096N
Nova233 Gen1	mBS1100			B	47	2AG32MBS110096N
Nova233 Gen2	mBS1105			B	47	2AG32MBS110596N
Nova430e	pBS3101SE			B	44	2AG32PBS3101SE
Nova430i	pBS3101S	13	65	B	40	2AG32PBS3101S
Nova436Q	mBS31001			B	47	2AG32MBS3100196N
CPE CBSDs						
AtomOD06LX	EG8013L-M11			B	40	2AG32EG8013LM11
AtomOD04H	EG7035E	19	25	B	43	2AG32EG7035E96
AtomOD04L	EG7035L	14	60	B	37	2AG32EG7035L96

Model	Part Number	Antenna Gain	Antenna Beamwidth	CBSD Category	FCC-Certified Maximum EIRP (10 MHz)	FCC Identification
AtomID06B	EG2013B-M11	6	360	A	30	2AG32EG2013BM11
AtomOD06H	EG7010A-M11	14	25	B	40	2AG32EG7010AM11N
AtomOD06L	EG7010C-M11	11	70	B	37	2AG32EG7010CM11N
AtomOD15G	EG8015G-M11	18	26	B	44	2AG32EG8015GM11

*NOTE: The Nova227 (PBS2120) has a 10-degree electrical down tilt.