Release Notes V1.2

RUGGEDCOM
WIN SAS - GW

SW Version 1.2

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1 General

1.1 Background & Overview

During 2014 the FCC released a Report and Order regarding the creation of the Citizens Broadband Radio Service (CBRS), a shared spectrum scheme for 150 MHz in the 3.5 GHz to 3.7GHz Band. CBRS requires the commissioning of a Spectrum Access System (SAS) which is built by Several private companies as a cloud service. Without the use of SAS, no newly deployed products Are allowed to use this band. Siemens intend to connect its WIN 3.7GHz products to SAS, through a SAS Gateway (SAS-GW). SAS gateway will be software which allows the BS to communicate with SAS service providers. The Wireless Innovation Forum is the SAS protocol creator. A collaboration Agreement with at least one SAS vendor, named federated Wireless was achieved to allow the SASGW Development. It should be noted the SW will be published as standalone SW and not part of any BS version.
The Wireless Innovation Forum defined a SAS as a system to dynamically manage spectrum access And while supporting multiple tiers of users. The method includes: at a spectrum access server, Receiving a request from a device to access a segment of spectrum; determining which tier of the Multiple tiers is associated with the request; if the request is from a second tier user and the request Does not interfere with first tier users, granting the request; and if the request is from a third tier user And the request does not interfere with first tier users and authorized second tier users, granting the Request.
First tier users comprise incumbent users, the second tier users comprise priority access users (PAL), And the third tier users comprise generally authorized access users (GAA).

1.2 Purpose

The purpose of the SAS-GW is to allow current customers as well as new customer to deploy new WIN products in the 3.55GHz to 3.7GHz band.

1.3 Definitions

SAS – Spectrum Access System
SAS GW – SAS Gateway
FedW – Federated Wireless
FCC – Federal Communication Commission
BS/BST – Base Station
CPE/SS – Subscriber Station
CBRS - Citizens Broadband Radio Service

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CBSD - Citizens Broadband Radio Service Device
PAL - Priority Access License
GAA - General Authorized Access

1.4 Important details

The SAS-GW is required to support sales of RUGGEDCOM WIN products in the 3.5 to 3.7GHz band in the US.

- WIN5137-AC CPE (3550-3700 MHz)
- WIN5137-DC CPE (3550-3700 MHz)
- WIN5137-AC-IS , CPE (3550-3700 MHz)
- WIN5237-IS, CPE (3550-3700 MHz)
- WIN5237 CPE (3550-3700 MHz)
- WIN5137-V CPE (3550-3700 MHz MHz Rail)
- WIN5137-V-GPS CPE (3550-3700 MHz MHz Rail with GPS)
- WIN7237 (3550-3700 MHz) Base station

Full interoperability tests were conducted and PASS with Federated Wireless SAS Server (Support 'TS' API), version: 1.3

SAS Server is HTTPS based.

Following actions were verified: Registration (request to register for a new BS and CPE), Spectrum inquiry (ask for specific frequency), Relinquish (Give back the right to operate for specific BS or CPE), .De-registration (Remove registration from SAS, Send heartbeat (keep-alive) message from every device To SAS).

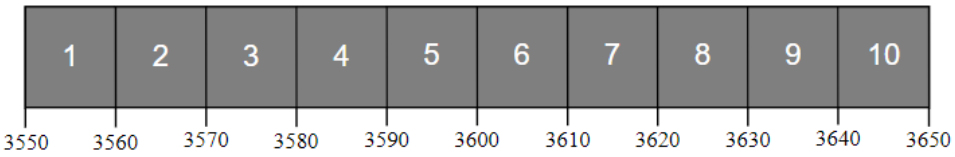
Products above fully support 150 MHz band: 3.55 to 3.7GHz.

1.5 Spectrum Channels

The spectrum, 3550 – 3700 MHz is divided to 15 10 MHz channel that can be used by a GAA devices.

PAL channels are between 3550 – 3650 MHz bands.

PAL Channels:



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Base station center frequency configuration on GUI:

Channel #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
BST center freq	3555	3565	3575	3585	3595	3605	3615	3625	3635	3645	3655	3665	3675	3685	3695

1.6 Software Versions

SAS GW version 1.2

No.	Part	SAS GW	SAS Server	remarks
1	Software Version	1.2	1.3	FedW server
2	Ubuntu server	18 LTS		
3	apache	2.4.29		
4	MySQL	5.7.23		
5	PHP	7.2		
6	python	2.7.15		
7	Twilo			
8	Open SSL	1.1.0g		

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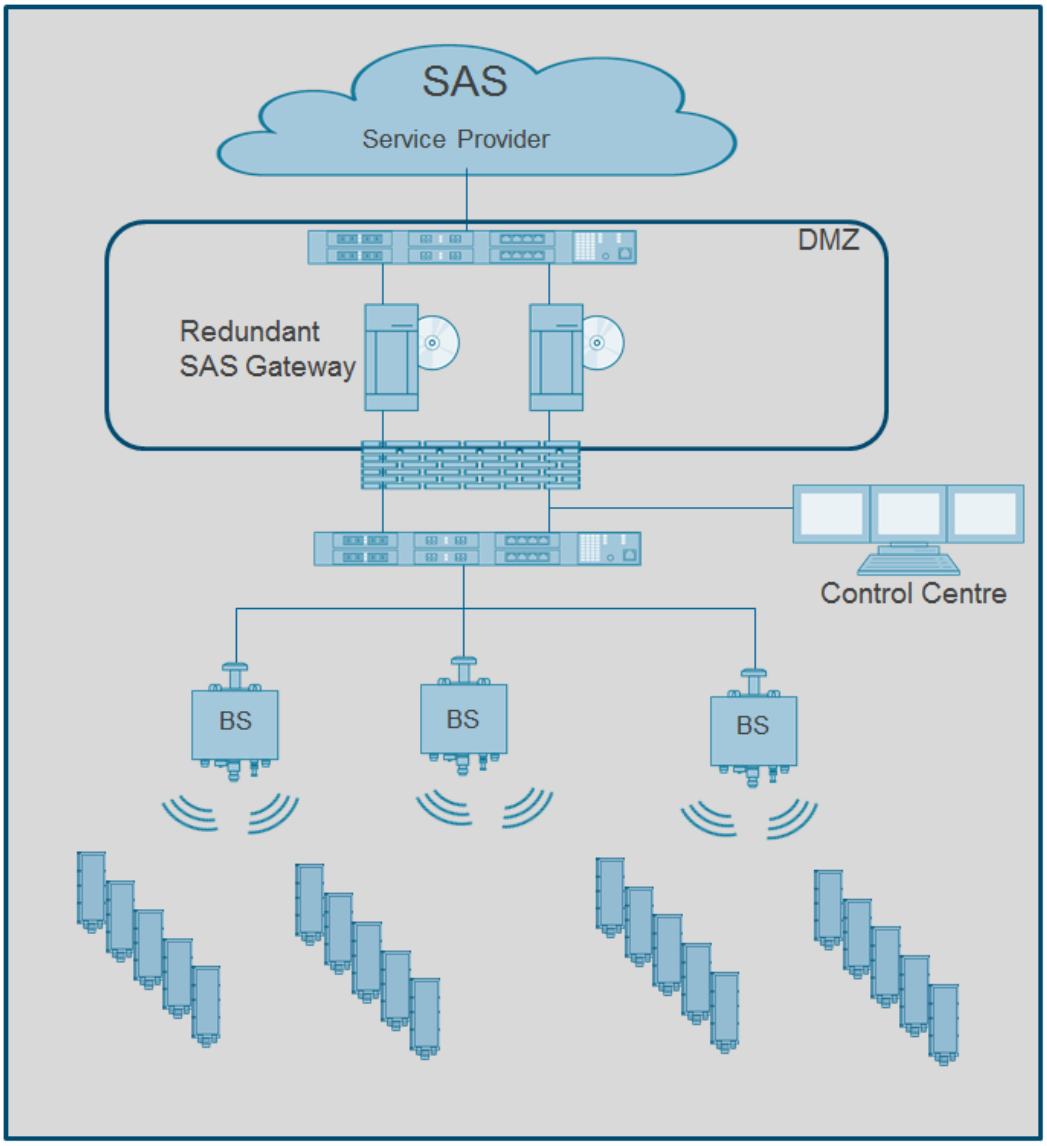
2 Network Basic diagram



SAS GW shall be installed in the DMZ. The SAS GW uses udp port 161 for SNMP management towards the private network.
SAS GW uses TCP port 443 for outgoing HTTPS communication with the SAS server. SAS GW can be managed with HTTPS and SSH.

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3 Configuring

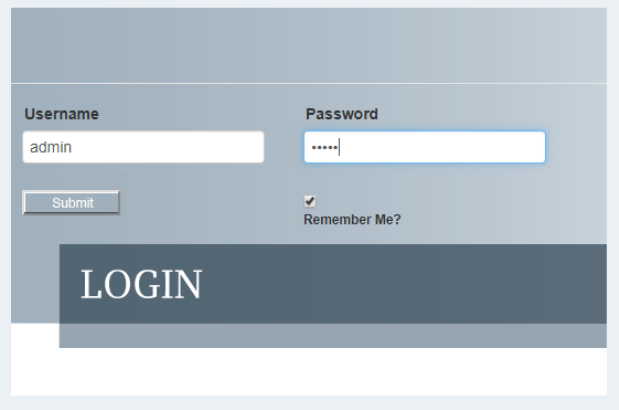
The SAS-GW uses the SAS API to communicate with SAS service providers.
The SAS-GW uses SNMPv2/3 to communicate with the BSs. All required info to/from the CPE is delegated to the BS, to prevent intensive querying of the CPE with over the air traffic.
The SAS-GW is a standalone SW running on Linux, The SAS-GW is available as a VM.
MySQL Database holds all required information about:
Base stations
SSs
Administration data:

- SAS Server configuration
- SAS-GW user information
- SNMP configuration

Event notification: Email and SMS
Logs: errors and information.
Apache Webserver: User interface is browser based, served by a Webserver. Apache use OpenSSL to provide HTTPS connection.
Browsers supported:
Chrome
IE
Firefox
Opera

3.1 SAS GW login page:

After installation enter to a web browser the IP of the SAS GW using format: https://sas-gw-ip/.
Default user name and password: admin.



Note: IP address of the SAS GW is manually configured by the system administrator.
It is assumed that the SAS GW has at least 2 interfaces, and the web GUI runs on all interfaces.

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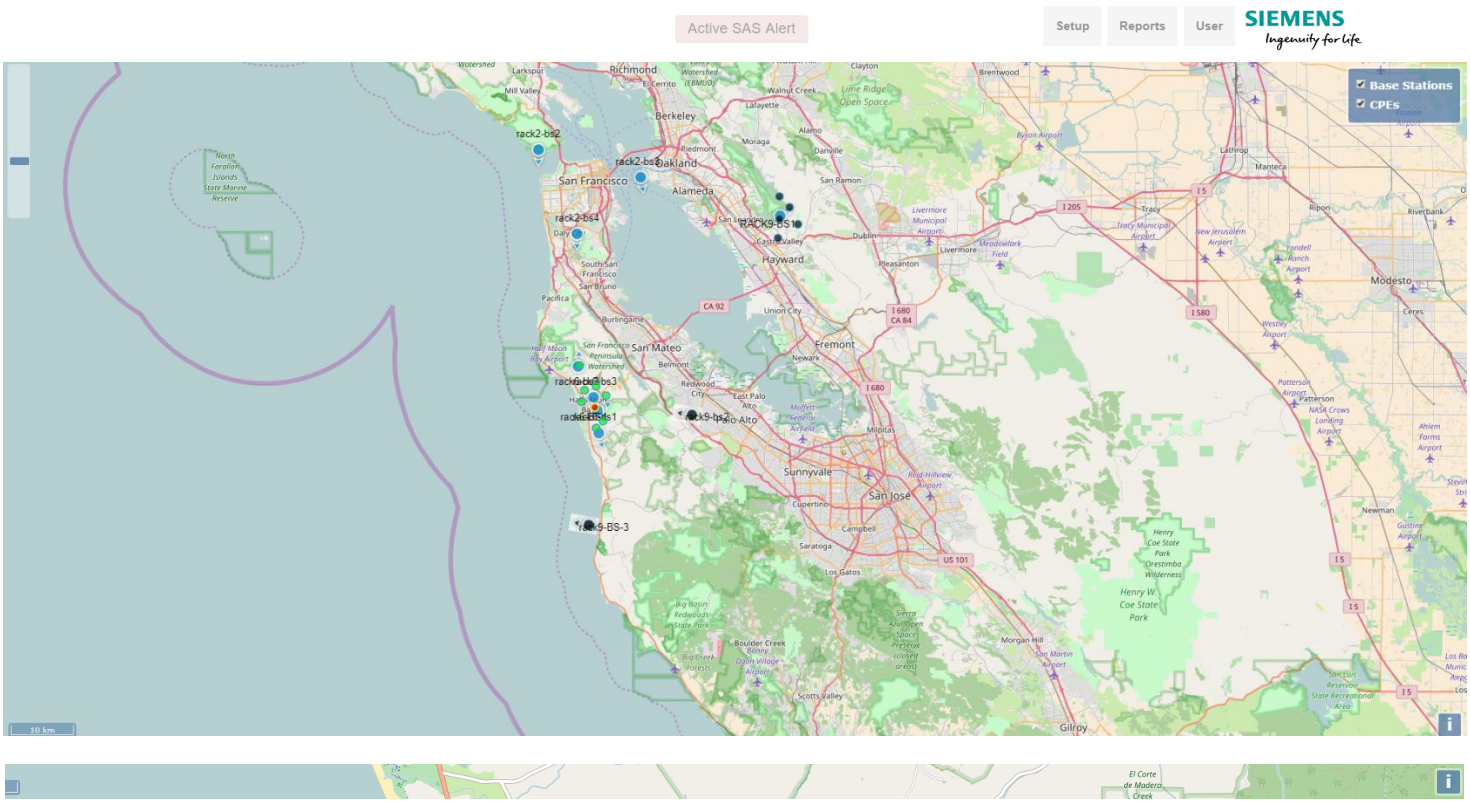
3.2 User GUI home page:



BASE STATION: RUGGEDCOM WIN BS 1

CPE Name	State	SAS Status	DL CINR	UL CINR	DL RSSI	Link Uptime (d HH:MM:SS)
user8@rack6	Operational	hb_ok	28	25	-40	05:26:27

SAS ALERTS

Alert Name	State	Last Event Time	Note	Acknowledge
SAS Down	Off			
Spectrum Relinquish	Off			
BS Grant Refused or failed	Off			
SS Grant Refused or failed	Off			
SS not configured	Off			

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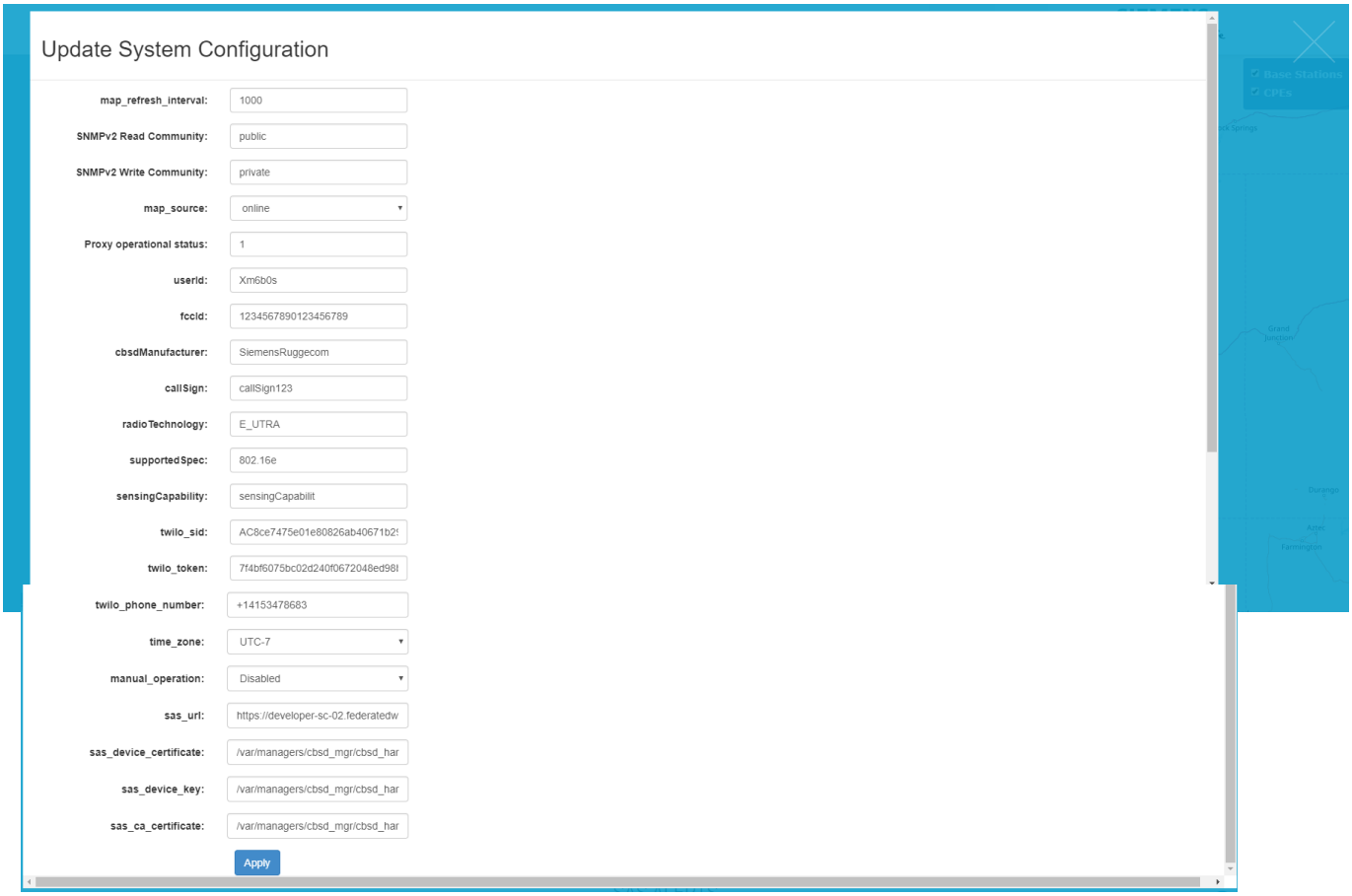
3.3 Settings page

Click Setup→Settings:



The SAS GW communicates with the SAS server using TLS 1.2 protocol and AES256-GCM-SHA384 cipher.

In order to successfully authenticate with the SAS server, configure the path of the SAS CA certificate, device certificate and device key files.

Those shall be provided by SAS service provider and uploaded the SAS GW.

The SAS GW will mutual authenticate with the SAS server in every initiation of communication, which occurs periodically every 15 seconds.

All SAS GW to SAS server communication is encrypted with AES256-GCM-SHA384 cipher.

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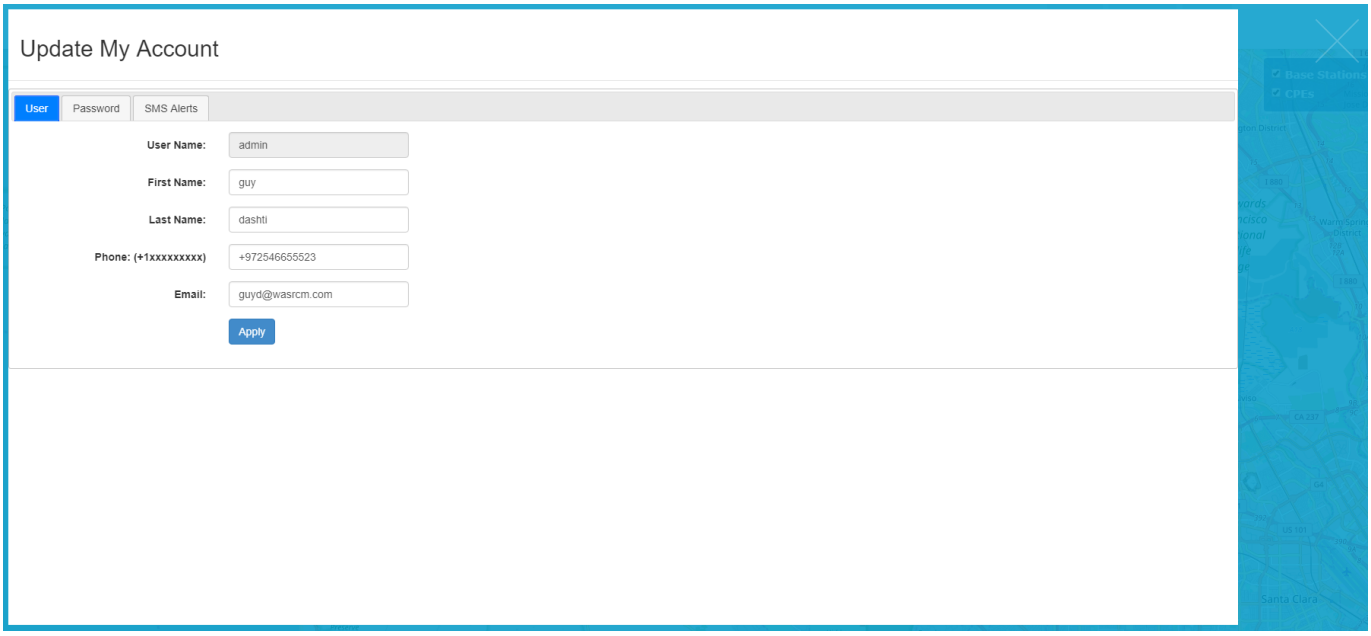
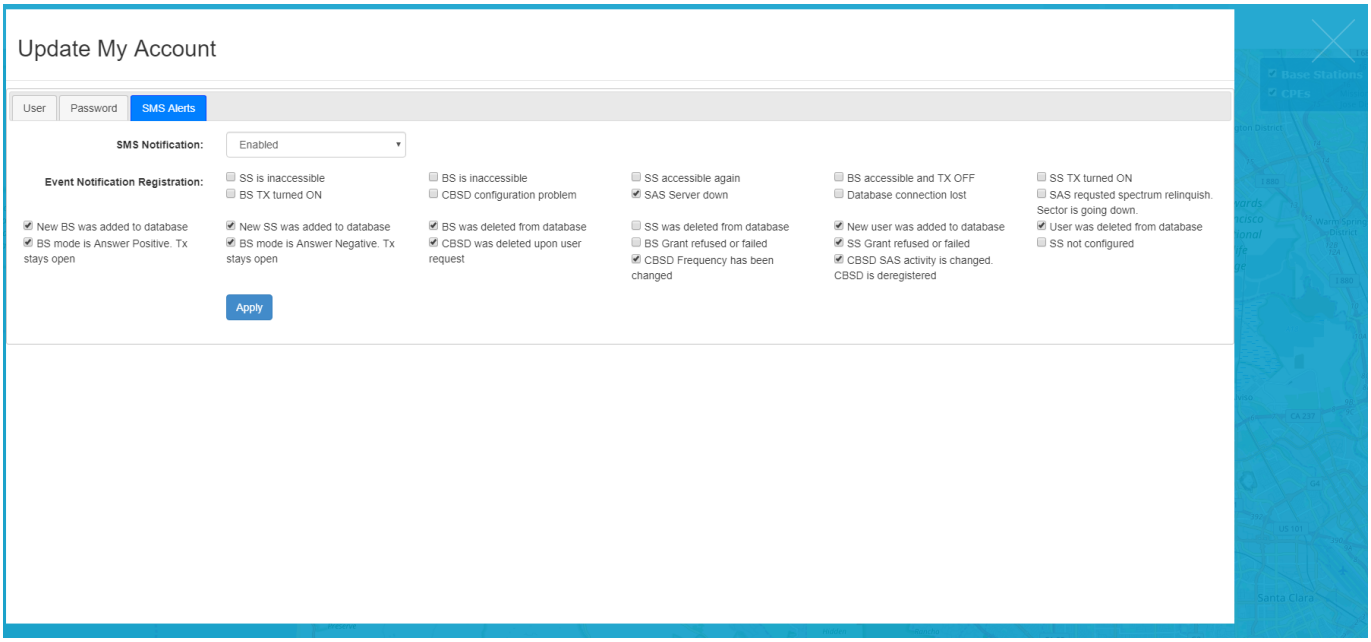
3.4 User Accounts

For user account settings, click User→My Account. A new password can be set:



Configuring user SMS/Email alerts settings:



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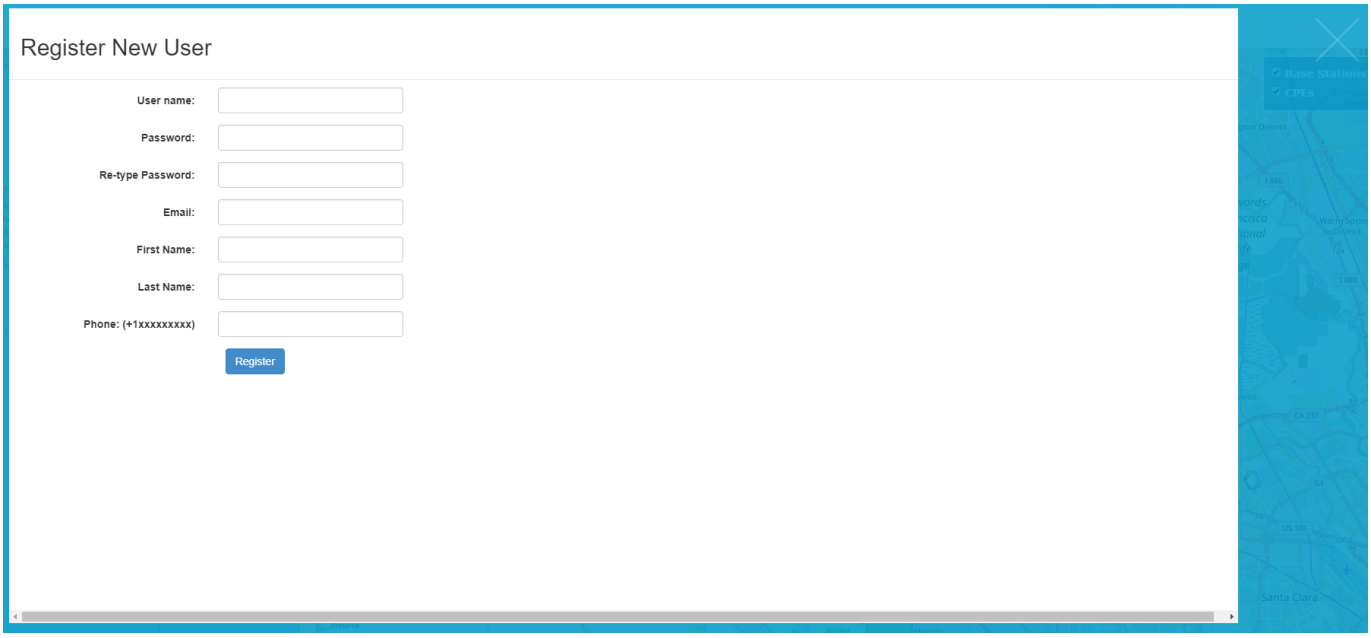
Adding a user, click User→Add user:



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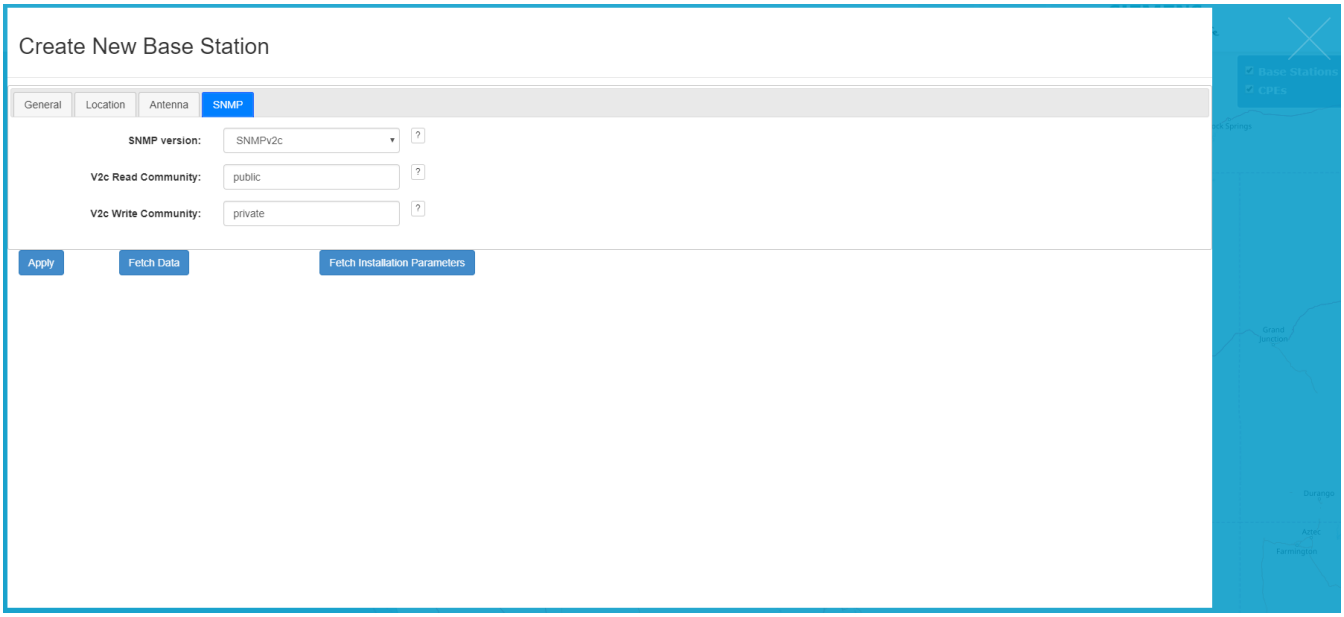
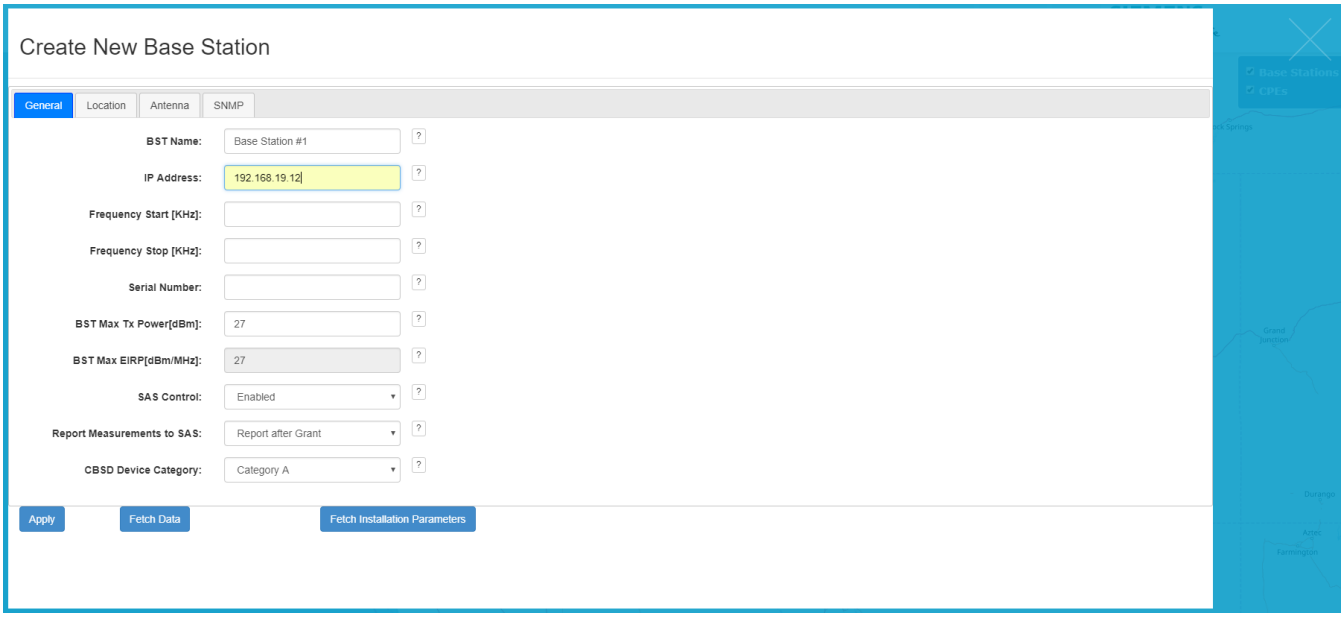
3.5 Adding a new BST

To add a new BS, use Setup→add BS:
It is possible to fetch data from the BS when it's up and SNMP configuration is set:



Insert the BS IP address and click "Fetch Data"



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Fetch installation parameters:

Additional option of fetching data from the CBSD is available.

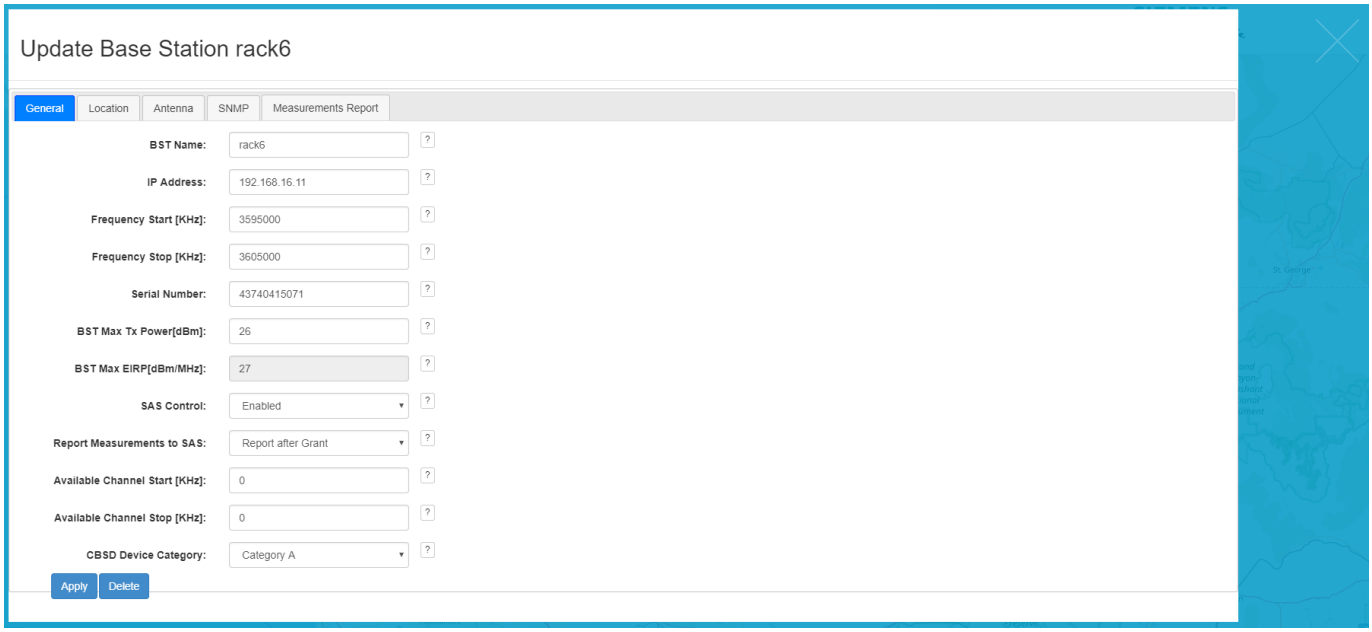
This option enables fetching the installation data only, from the CBSD.

The installation parameters:

- Latitude
- Longitude
- Height
- Height Type: AGL (ground level)/AMSL (sea)
- Horizontal
- Vertical accuracy (optional)
- Indoor true/false

3.6 Editing BS information:

BST general parameters:



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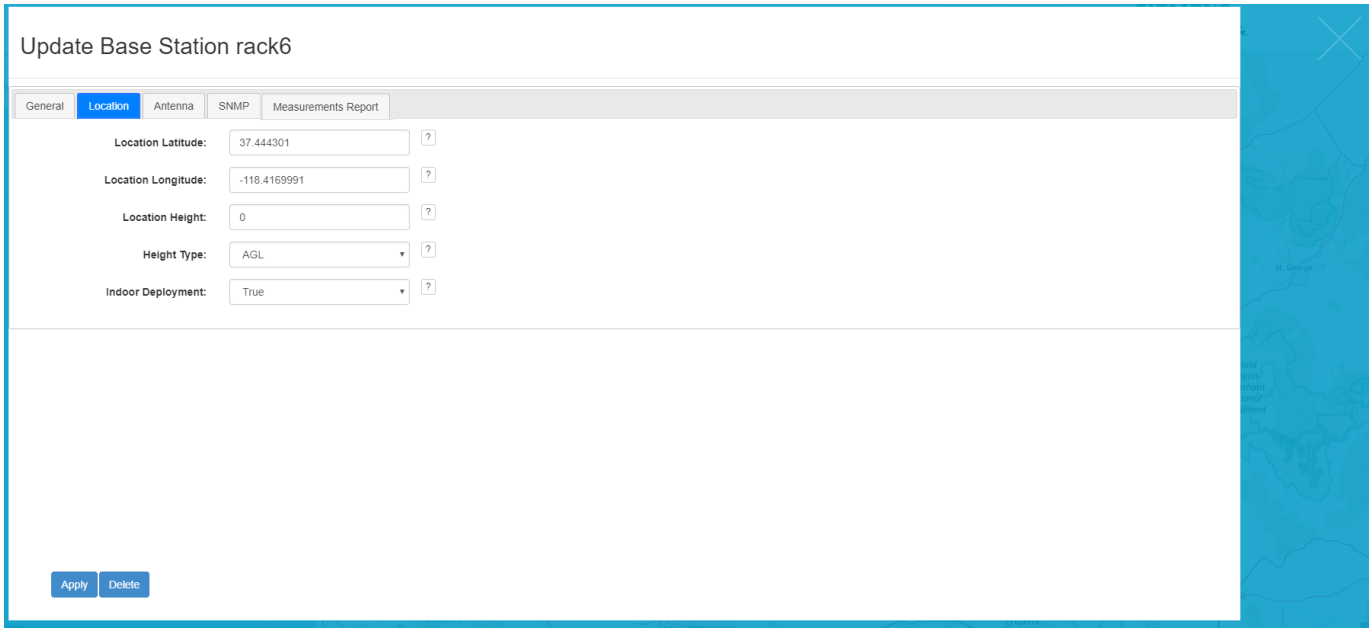
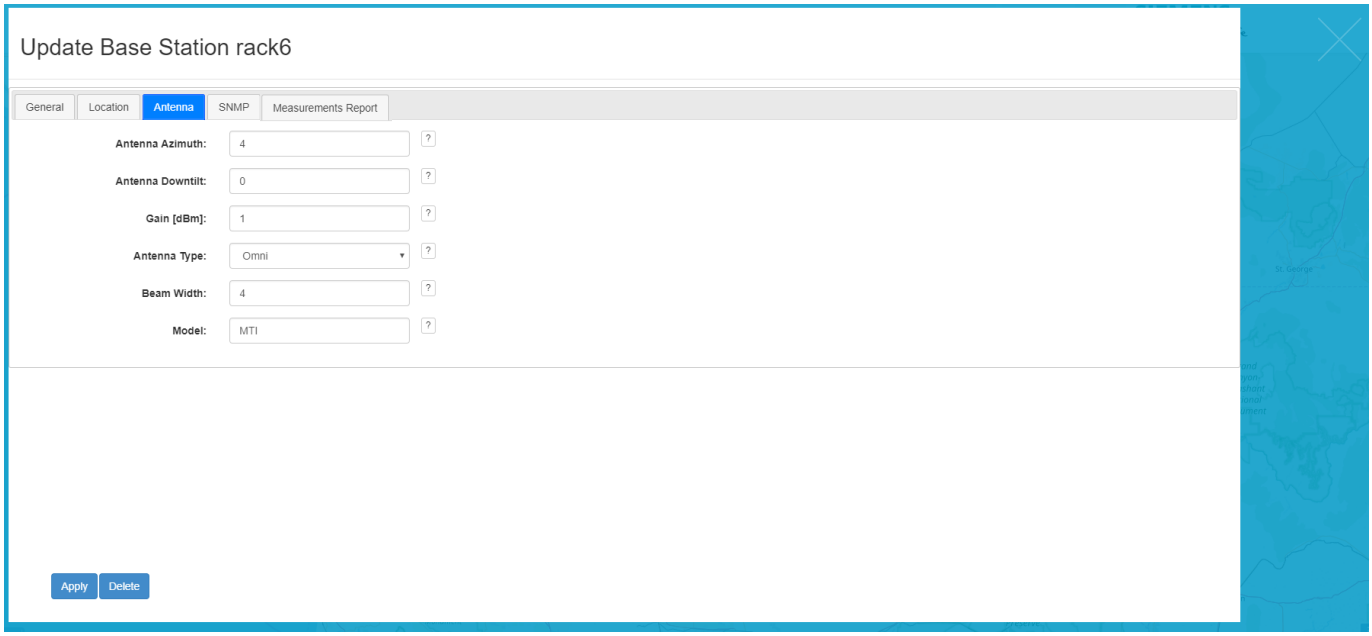
BST location settings:



BST antenna settings:



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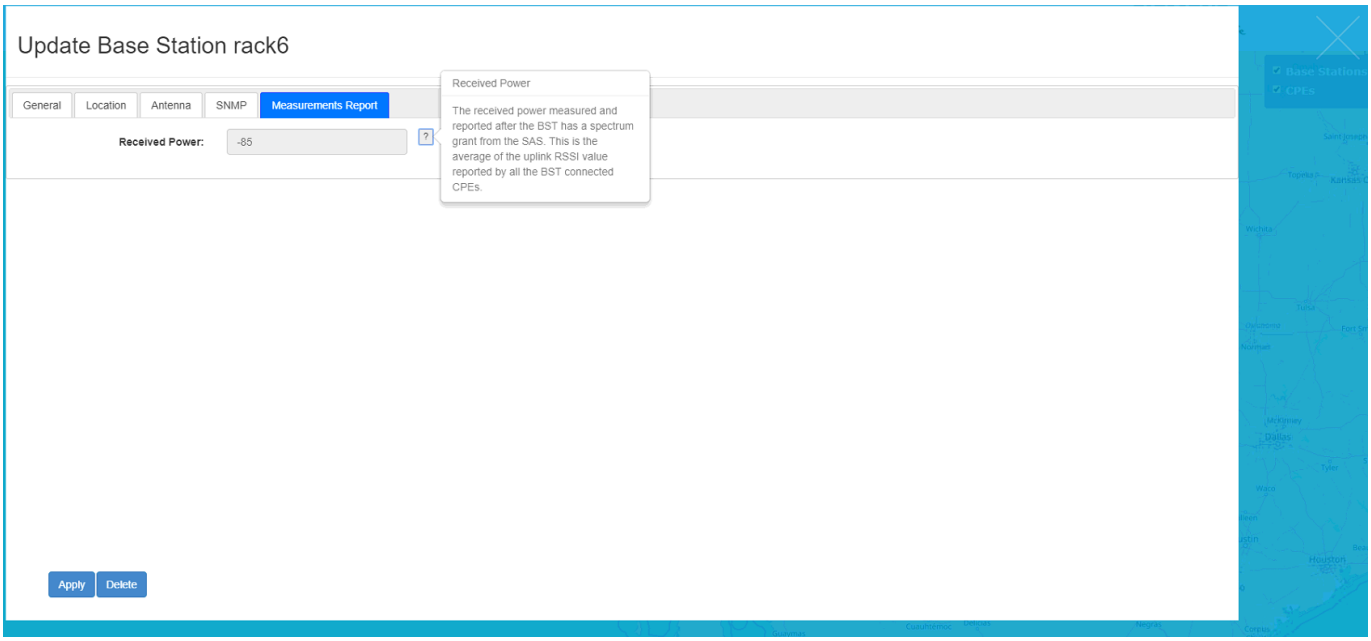
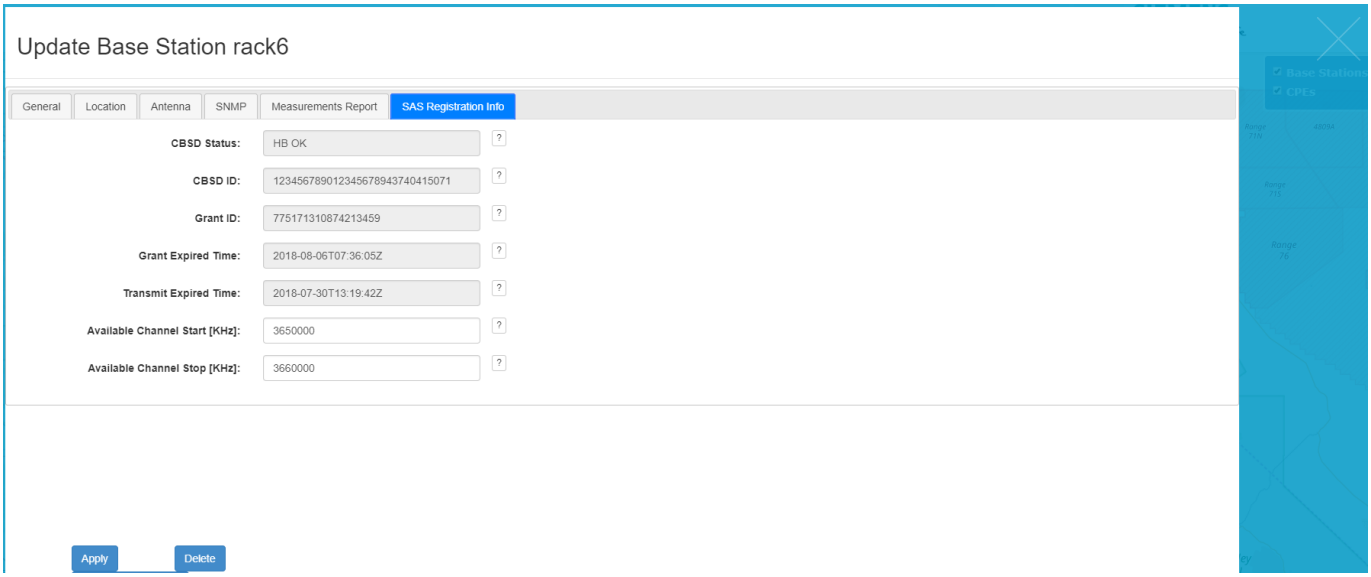
Viewing Base Station measurements report:



Viewing SAS registration information:



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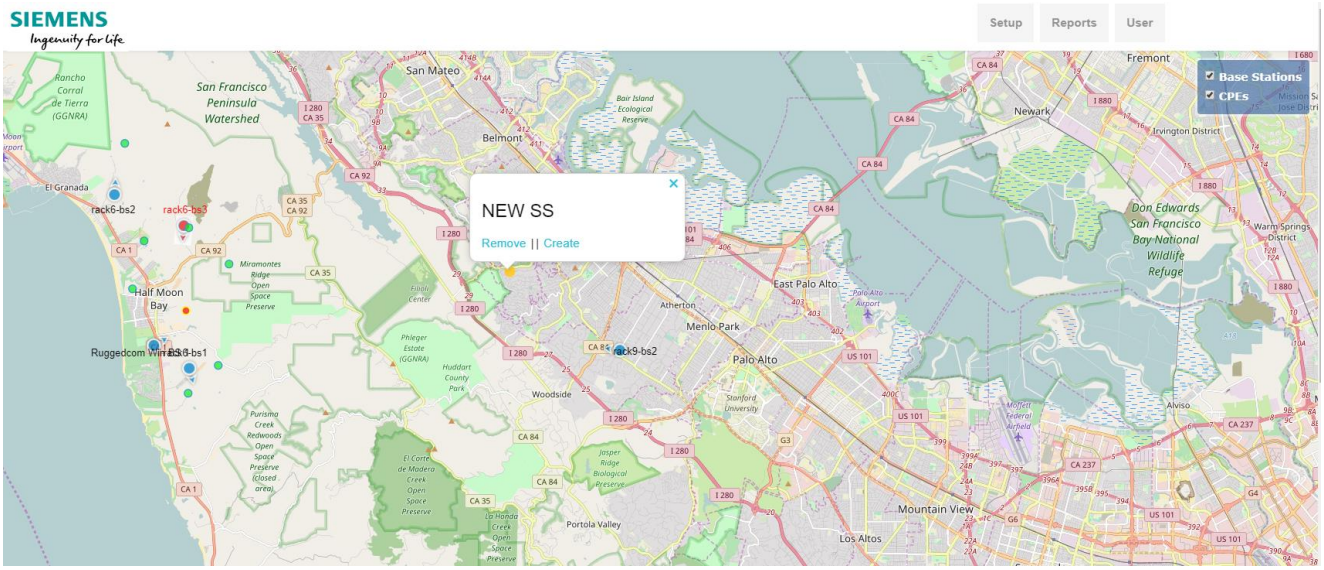
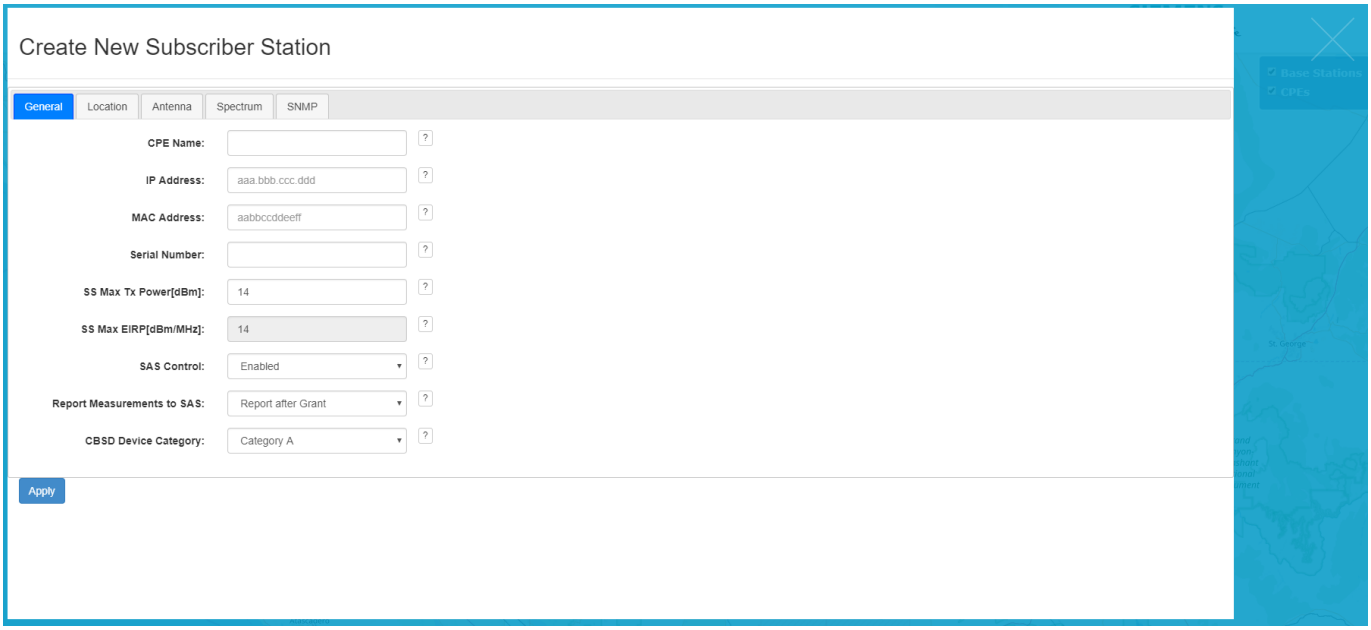
3.7 Adding a new Subscriber station

To add a new SS, user Setup→Add SS→Place the dot in the map where the SS installed→click “Create”:



Fill the necessary information:



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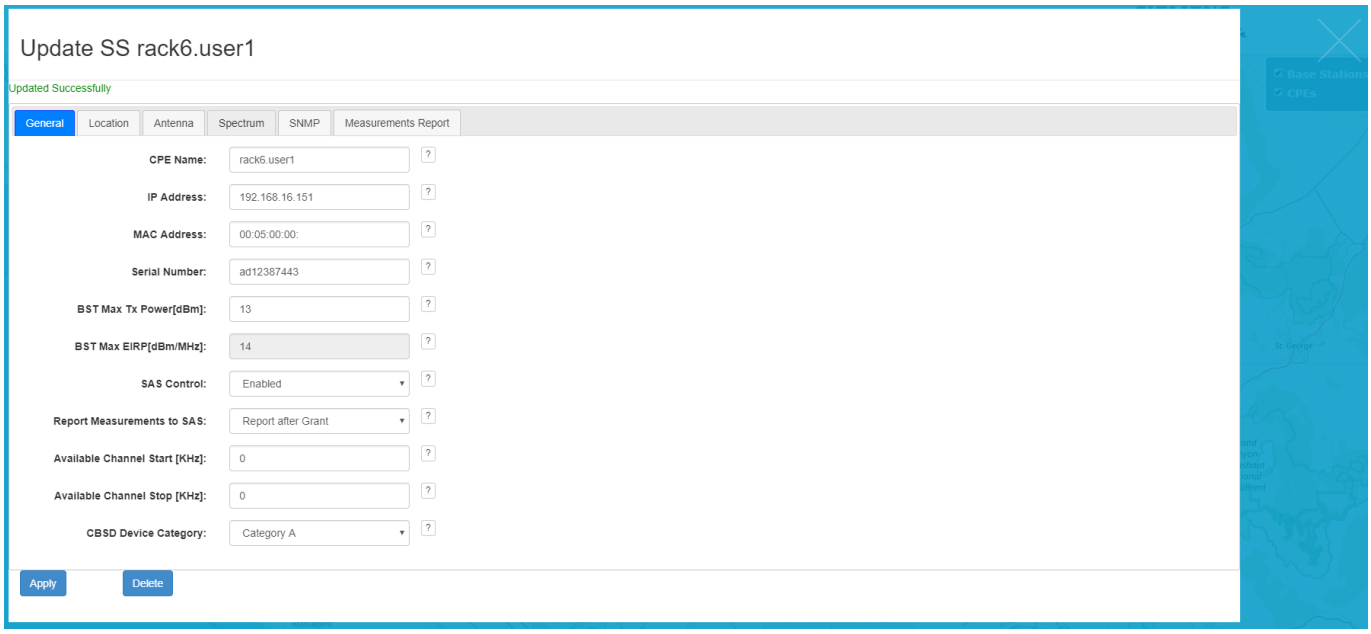
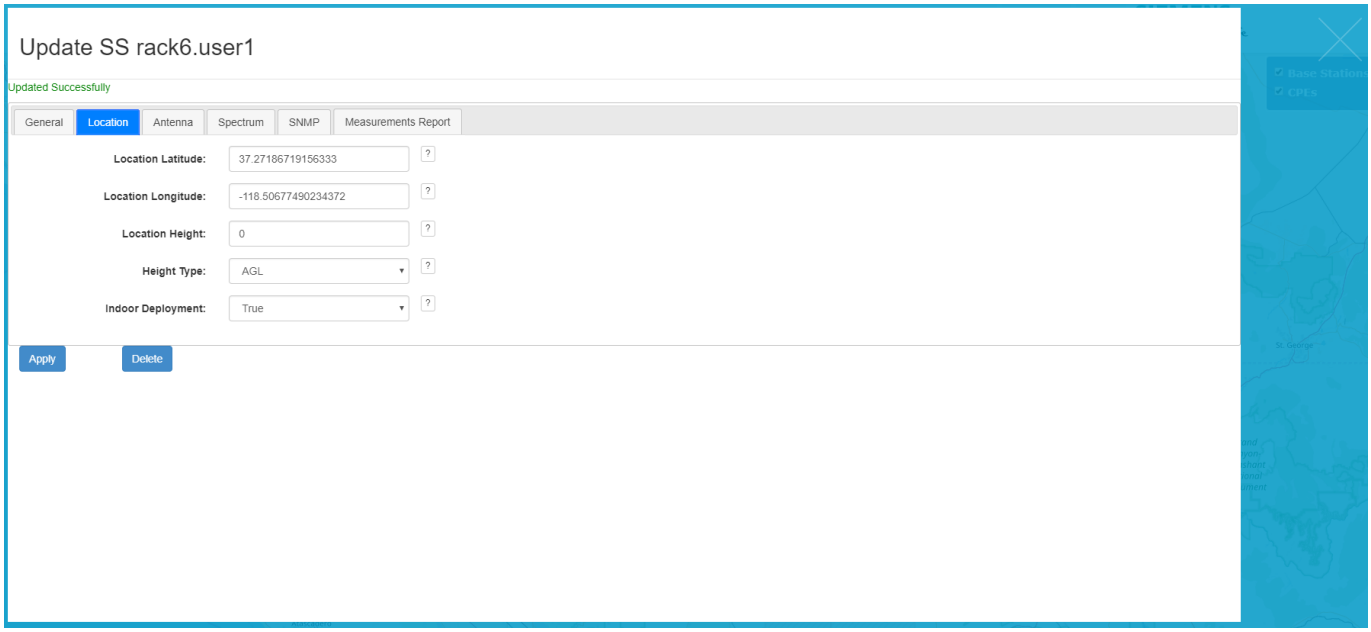
Editing an existing SS, click on SS→edit:



SS location settings:



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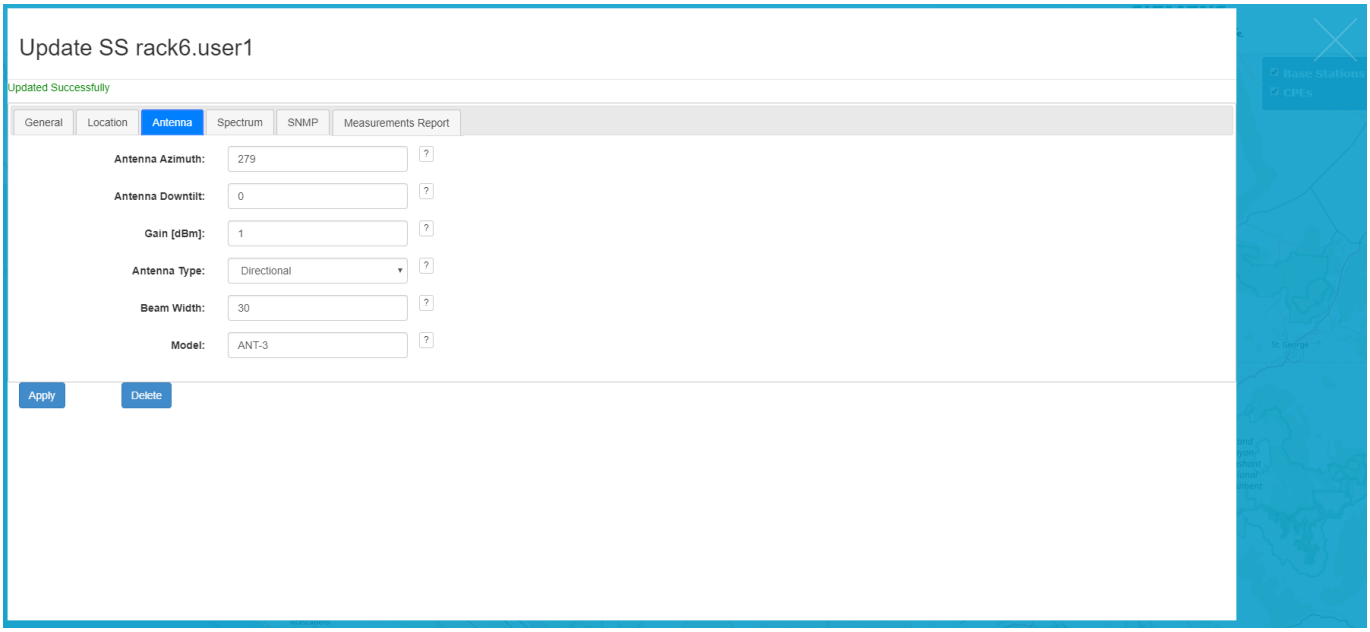
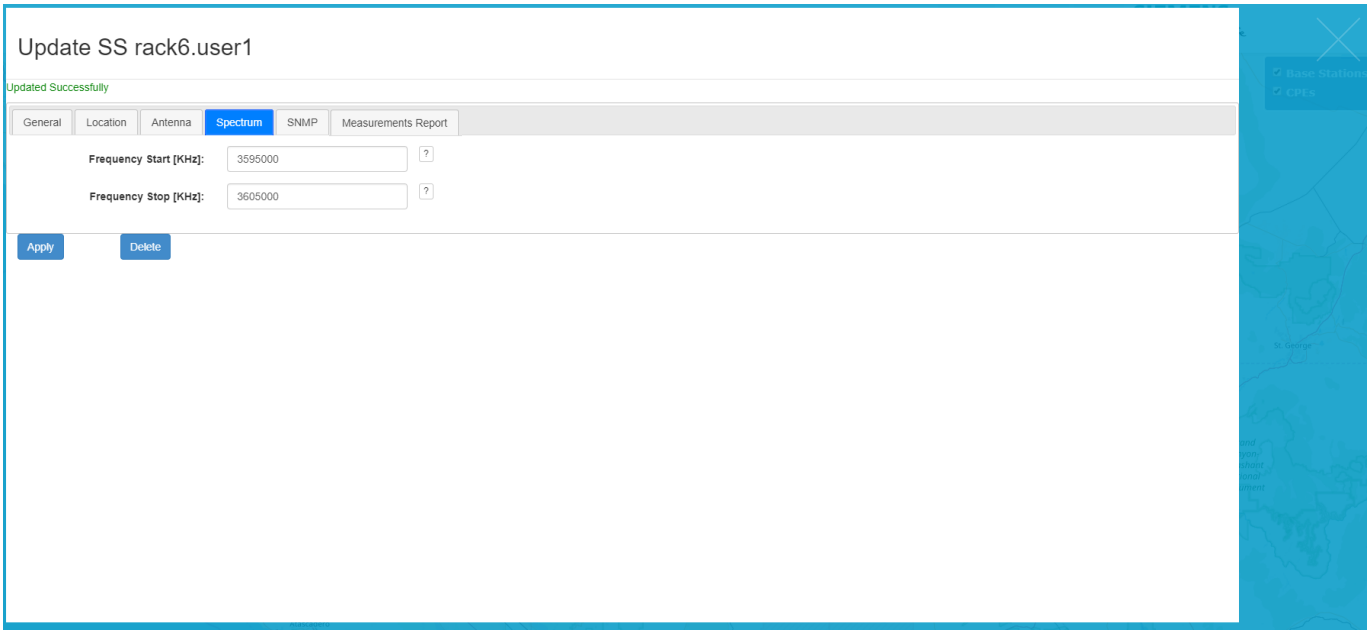
SS antenna settings:



SS spectrum settings:



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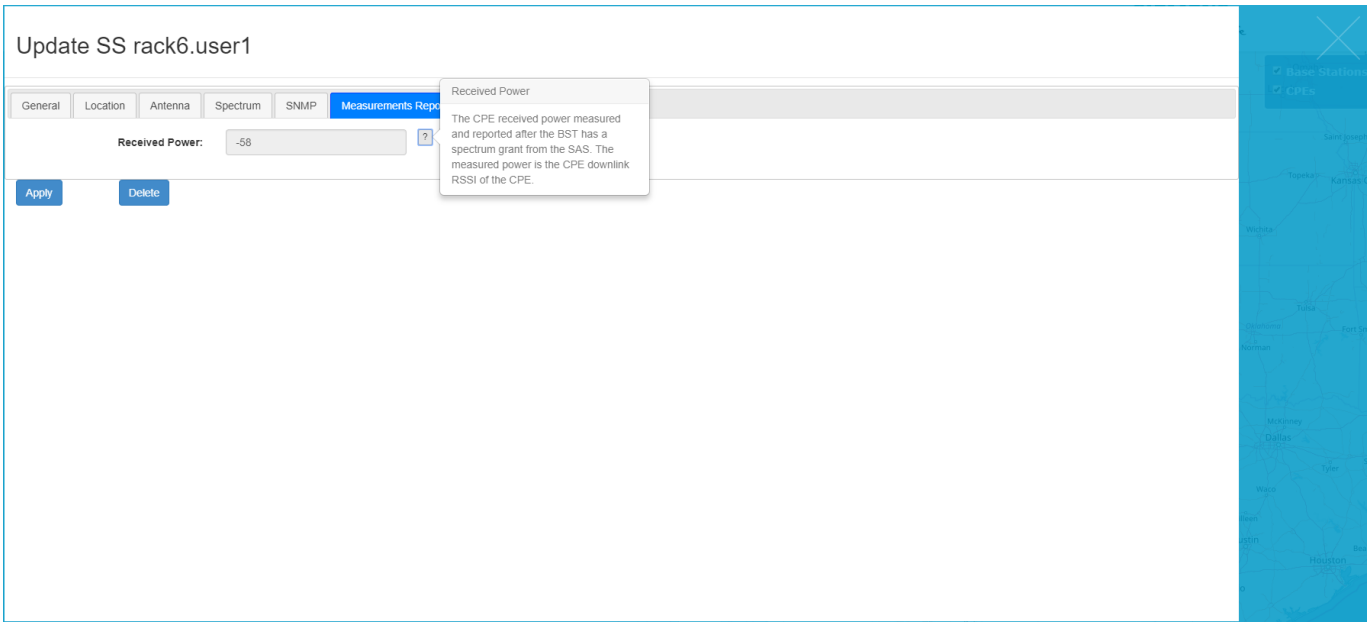
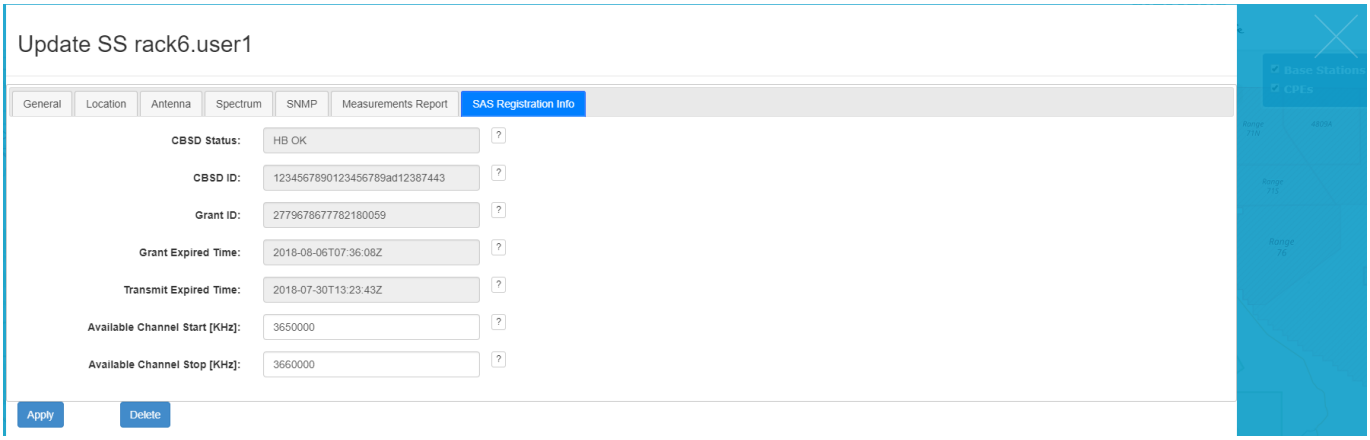
Viewing Suscriber Station measurment report:



Viewing Suscriber Station registration inforamation:



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3.8 BST and SS parameters:

- **BST name** – name of the base station
- **IP address** – IP address of the device
- **Frequency start** – the BST center frequency minus 5MHz
- **Frequency stop** – the BST center frequency plus 5MHz
- **Serial Number** – manufacture serial number
- **BST Max TX power** – current TX power of the BST
- **SAS control** – “enable” SAS control on the device, “disable” SAS control or “off the grid”.
- **Category device A\B** –

  Category A:

  A lower power CBSD that meets the general requirements applicable to all CBSDs and the specific requirements for Category a CBSDs set forth in par. 96.41 and 96.43. Maximum EIRP limit is 30 dBm/10MHz

  Category B:

  A higher power CBSD that meets the general requirements applicable to all CBSDs and the specific requirements for Category B CBSDs set forth in par. 96.41 and 96.45. Maximum EIRP limit is 47 dBm/10MHz
- **Max EIRP (**read only parameter) – the sum of the max TX power and the Antenna gain. The maximum EIRP is in the units of dBm/MHz
- **Height type** – AGL (Height measured relative to the ground level) o AMSL (Height measured relative to the mean sea level)
- **Indoor deployment** – Category A configuration: Whether the CBSD antenna is indoor or not. True: indoor. False: outdoor
- **Report Measurements to SAS** – report after grant or no report at all. Default value is report after grant
- **Available Channel Start [KHz**] – Low value of the available channel given by the SAS. Range 3550000 - 3700000 [KHz].

  This parameter can be displayed only after the CBSD is registered to SAS (in the edit BS\CPE page)
- **Available Channel Stop [KHz**] **-** High value of the available channel given by the SAS. Range 3550000 - 3700000

  [KHz]
- **Location Latitude** – BST latitude
- **Location Longitude** – BST longitude
- **Location height** – BST installation height
- **Antenna azimuth** – BSTs antenna azimuth
- **Antenna down tilt -** BSTs antenna down tilt
- **Gain** – BSTs antenna gain in dBm

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- **Antenna type** – BSTs antenna type, Omni or Directional.
- **Beam width** - BSTs antenna beam width
- **Antenna model** - BSTs antenna model
- **SNMP Read\write community**

Maximum EIRP validation:

All CBSDs must meet the maximum EIRP limit:

- Category **A** CBSD maximum EIRP is **30** dBm/10MHz
- Category **B** CBSD maximum EIRP is **47** dBm/10MHz

The EIRP is the sum of the maximum Tx power and the Antenna gain, therefore any modification of the following 3 parameters will be validated accordingly:

- Antenna gain
- Maximum Tx power
- Device Category

In case the EIRP value doesn't meet the maximum EIRP limit based on the CBSD category, warning pop up appears and the last configuration will not be saved.

Measurements report

The CBSD initiates the Registration procedure by sending a Registration Request to the SAS. The measCapability parameter in the Registration Request identifies the measurement reporting capabilities of the CBSD. The SAS responds to the CBSD with a Registration Response. The response parameter indicates whether the registration succeeded or failed. If the registration succeeded and the measReportConfig parameter is included in the Registration Response, the CBSD shall send the requested measurement report to the SAS (as indicated by the value of the measReportConfig parameter) per the defined semantics of the measurement capabilities defined below.

The measurement report requested by the SAS shall be consistent with the CBSD measurement capabilities indicated in the registration request.

Spectrum Inquiry

Spectrum inquiry request will be sent to the SAS after the CBSD finishes registration and before granting.

The CBSD will NOT change its channel based on the spectrum inquiry response.

The SAS available channel bill be saved to the DB and will be displayed in the CBSD WEB GUI.

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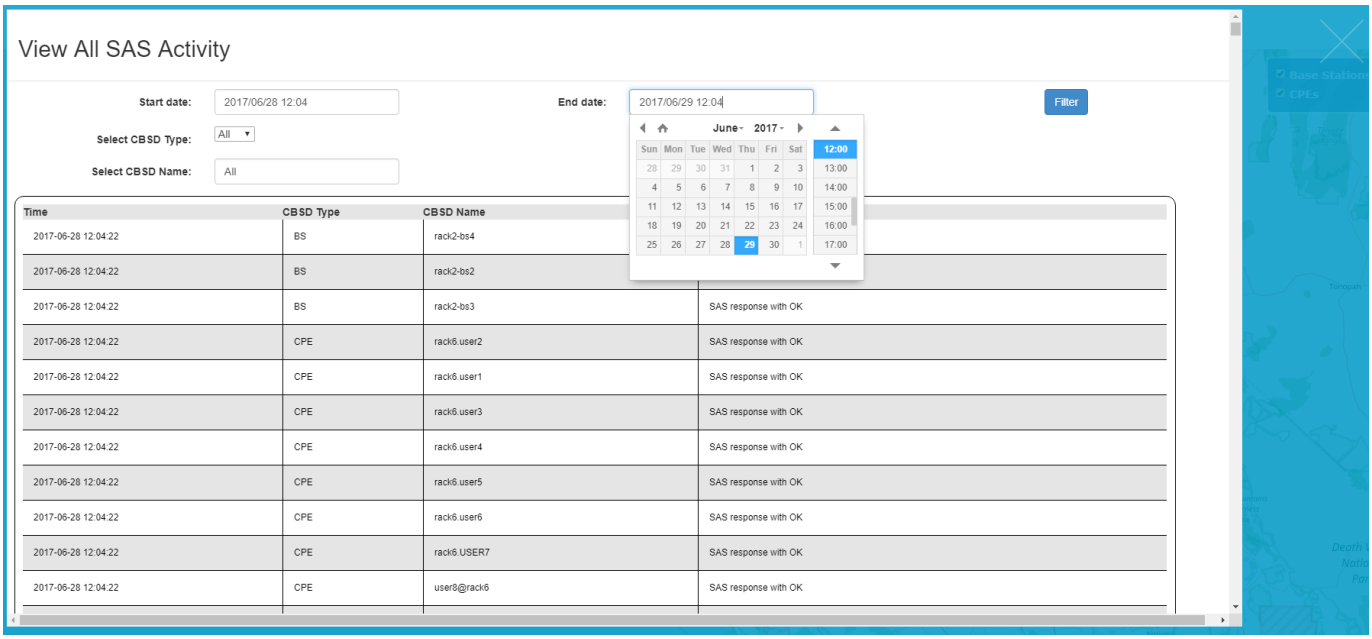
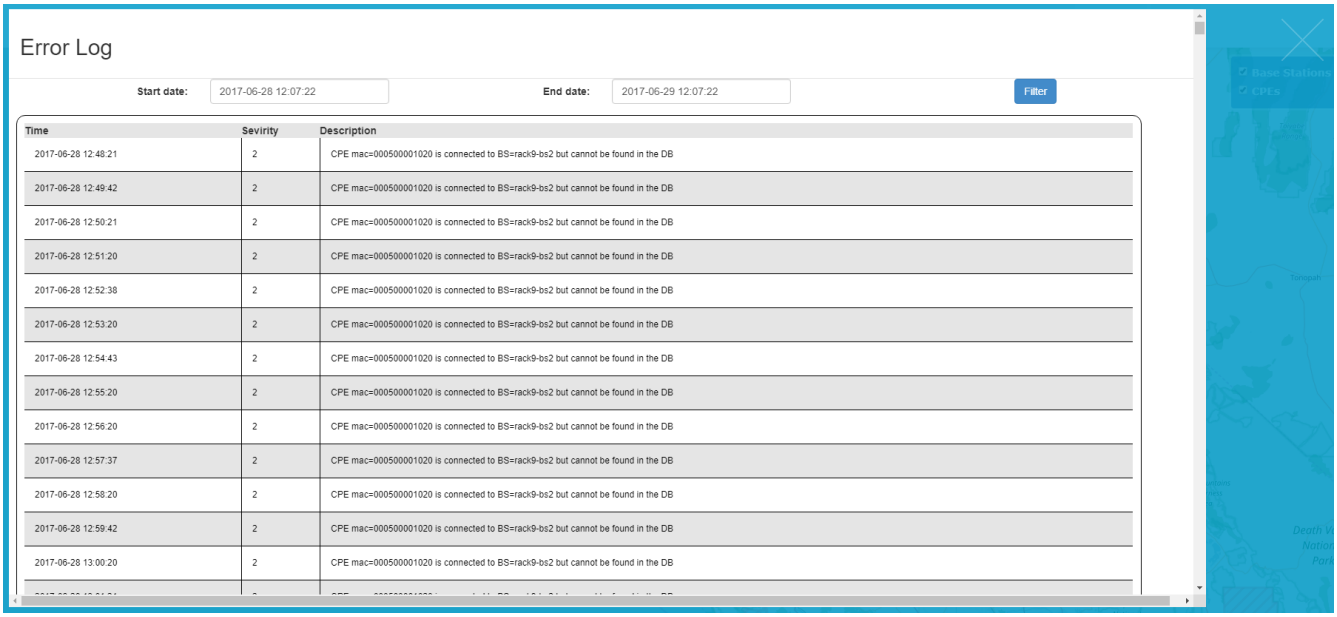
3.9 Viewing logs

To view SAS activity click on Reports→CBSD activity:



To view the Error log click Reports→Error log:



To view the system log click Reports→System log:

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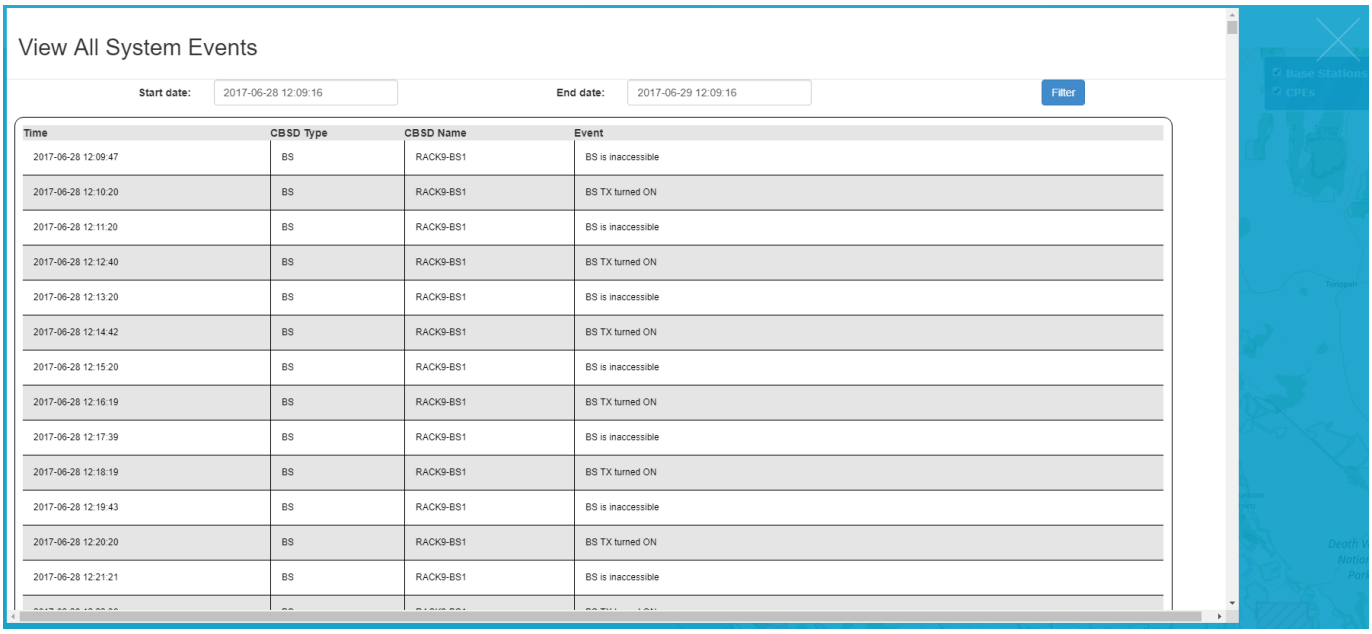

Time	CBSD Type	CBSD Name	Event
2017-06-28 12:09:47	BS	RACK9-BS1	BS is inaccessible
2017-06-28 12:10:20	BS	RACK9-BS1	BS TX turned ON
2017-06-28 12:11:20	BS	RACK9-BS1	BS is inaccessible
2017-06-28 12:12:40	BS	RACK9-BS1	BS TX turned ON
2017-06-28 12:13:20	BS	RACK9-BS1	BS is inaccessible
2017-06-28 12:14:42	BS	RACK9-BS1	BS TX turned ON
2017-06-28 12:15:20	BS	RACK9-BS1	BS is inaccessible
2017-06-28 12:16:19	BS	RACK9-BS1	BS TX turned ON
2017-06-28 12:17:39	BS	RACK9-BS1	BS is inaccessible
2017-06-28 12:18:19	BS	RACK9-BS1	BS TX turned ON
2017-06-28 12:19:43	BS	RACK9-BS1	BS is inaccessible
2017-06-28 12:20:20	BS	RACK9-BS1	BS TX turned ON
2017-06-28 12:21:21	BS	RACK9-BS1	BS is inaccessible

3.10 Viewing SS measurements

Click on an existing BS and scroll the page down to the SS measurements table:

BASE STATION: RUGGEDCOM WIN BS 1

CPE Name	State	SAS Status	DL CINR	UL CINR	DL RSSI	Link Uptime (d HH:MM:SS)
user8@rack6	Operational	hb_ok	28	25	-40	05:26:27

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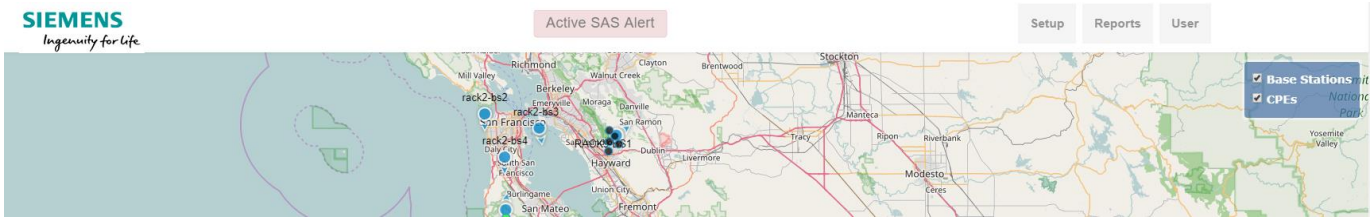
3.11 SAS GW Alerts

For Viewing Alerts, click on the flashing “Active SAS Alert”:



SAS alerts table located on the bottom of the page:

SAS ALERTS

Alert Name	State	Last Event Time	Note	Acknowledge
SAS Down	Off			
Spectrum Relinquish	Off			
BS Grant Refused or failed	Off			
SS Grant Refused or failed	Off			
SS not configured	On	2017-06-29 09:10:20	BS names: rack9-bs2	clear

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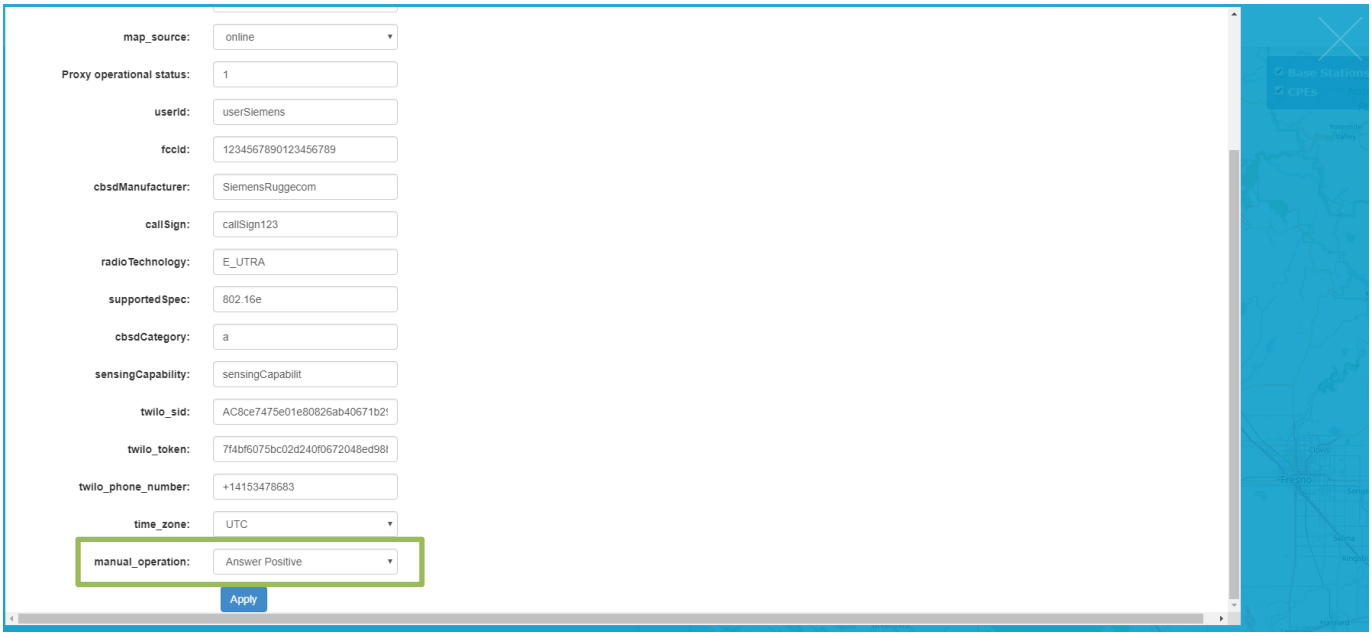
3.12 Manual Operation

Setting manual operation, click on Setup→Settings:



Manual operation for SAS requests:

In some cases the user may choose to run the system in safe mode, for evaluation purposes or under debugging conditions. In this mode the SAS activity will be handled normally, however will not change the operation of the wireless network.

Disabled – default option.

Answer Positive - In this case the SAS GW will never stop the TX on any WIN device and answer all SAS request as if it was done. Event will be logged.

Answer Negative – in this case the SAS GW will never stop the TX on any WIN device and answer to SAS it was not done. Event will be logged.

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4 Known bugs and limitations

- SNMPv3 is not implemented.
- Number of SS per BST is limited to 20 devices

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