AFAS Operation manual

Doc: Runcom AFAS User Operation Manual RN–PMG-011215 V-2.0

About this Document

This document describes the AFAS (Advanced Frequency Allocation Software) element as part of the TV White Space solution, describes the interaction between each element of the entire solution to guaranty proper operation under the FCC requirements and describes in details the command and operation the AFAS unit

Notice

Note: *THE AFAS SHALL BE OPERATED ONLY IN CONJUNCTION WITH THE SPECTRUM BRIDGE TVWS DATA BASE, THE RNU-4000TVWS Base Stations (FCC Identifier: XYMBSTVWS-1) AND THE RUNCOM CPE-O-R-WS (FCC Identifier: XYMCPETVWS-1)*

Table of Contents

List of Figures:

1 Introduction- TVWS Solution

Runcom's TVWS solution is a standard WIMAX 802.16e system which includes adaptations to support the TVWS spectrum and management requirements under FCC Part 15 mandatory requirements.

Runcom's TVWS solution includes all network elements, management element and traffic control to guarantee high quality voice, video and data services over the TVWS spectrum.

The following diagram describes the core network elements, and management resources of the entire WIMAX TVWS solution.

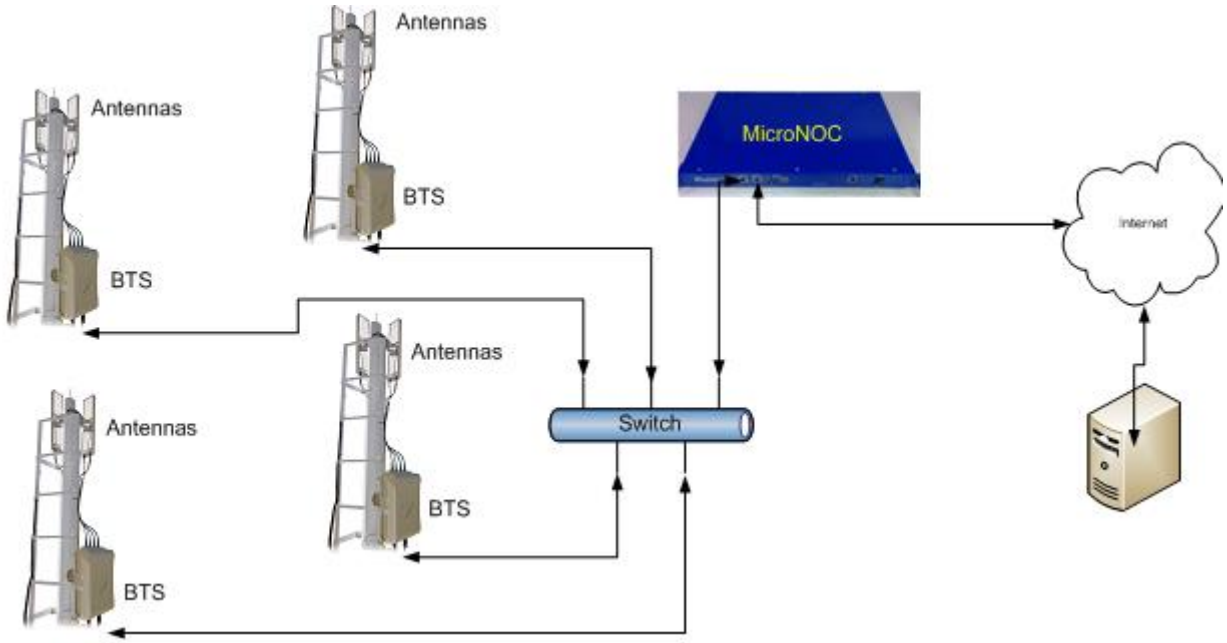

Figure 1: WIMAX TVWS core network diagram

1.1 Solution elements

1.1.1 AFAS

AFAS, Advanced Frequency Allocation Software is a mediation device between authorized FCC TVWS location & frequency database and the base station radio units.

The AFAS allocate frequencies to BTSs according to the BTS location, allowed frequencies, and in the future the algorithm will take into account measured interference parameters. The update cycle is lower than once a day, and it is configurable. Each BTS and CPE is recognized by its MAC address so no mistakes are possible.

The AFAS is a software implemented on Python using Django open source framework and run on a Linux machine using OS Ubunto version 14.04.

The AFAS requires internet connectivity in order to communicate with Spectrum Bridge TVWS Data Base at least once in 24 hours.

The AFAS communicate with TVWS Data Base using Spectrum Bridge DB client and communicate with Runcom equipment using SNMP V2.

1.1.2 NOC (MicroNOC, Compact NOC)

The xNOC unit is the main network operation controller of any WIMAX 802.16e network. The unit performs the following functions:

- ASM gateway (Access Service Network Gateway). This element enforce all users and WIMAX element network's policies (bandwidth control, total traffic control, AAA profile, scheduling and more)
- DHCP server or mediation device between external DHCP server and the WiMAX elements.
- DNS server or mediation device between external DNS server and the WiMAX elements.
- Basic AAA. If higher level of AAA required the unit can be a mediation device to any AAA server which meet the RADIUS standards

The xNOC units are identical for TVWS and all WIMAX networks, Runcom and non Runcom radio devices.

For more information, commands, services and more please refer to SG-UM-8500 V13 user manual (or later), SG-1 Vendor-Specific attributes user manual and Runcom's public database.

1.1.3 Base Station

Runcom's base station (BTS) is the center radio point which connects the customers' premises equipment and the users behind it to the core network and the internet. BTS support multiple CPEs (up to 128), mobility, network management (via SNMP V2) and GUI interface. The BTS fully support WiMAX standards with the adaptations needed to comply with the TWVS FCC regulations.

For more information, installation procedures, configuration commands and more please refer to Runcom RNU4000BS User Manual –RN–PMG-230914 V-3.8 user manual.

1.1.4 CPE

The customer premises equipment (CPE) is the unit which connects the users to the internet over the TVWS core network. For information regarding the CPE installation and operation please refer to the CPE-O-R-WS User and Installation Manual (RN–PMG-300516)

2 AFAS – Internal operation

The AFAS unit is a software with access to the internet with permission to access the TVWS database and the NOC.

2.1 Adding new Base Station (BS)

Prior to deployment of new BS, operator needs to update AFAS with the BS information, the expected installation location, the radio capabilities, and the initial frequency which is selected from the database manually and take into account the known interference in that area. After adding is done and the BS is active, the AFAS is automatically submitting a query to TVWS DB for allowed transmission channels for the new BS (double check that all process is working properly).

After receiving the TVWS DB response, AFAS will check that the initial frequency is in the allowed list, and in case of reject, it will use the best frequency selection algorithm and will send a set frequency command to the BS followed by start transmission command.

Note: In phase 2 of AFAS development, AFAS will send measurement request to BS in order to verify the freshness of the environment noise levels which are crucial inputs to the channel selection algorithm.

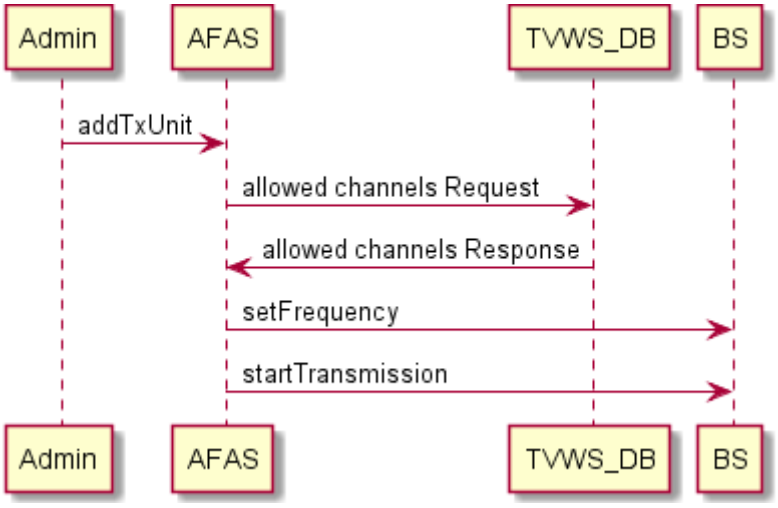

Figure 2 - Adding a new BS to the network

2.2 Adding new CPE

Installation of new CPE or CPE which has moved from its original location, the following actions must be done (Please also refer to the CPE-O-R-WS User and Installation Manual):

1. Register the CPE at the AFAS with the expected location (longitude, altitude, height of the antenna)
2. Select the requested frequency for the CPE (the BTS frequency which this CPE is targeted to connect)
3. The AFAS will check the new CPE TVWS channel allocation (the requested channels) by sending the information to TVWS DB using Spectrum Bridge client.
4. After receiving the response from the Data Base, AFAS will get a list of allowed frequencies for that CPE.
5. AFAS will create an allowed list for the CPE taking into consideration also the available BS in the CPE area, and will update the CPE device.

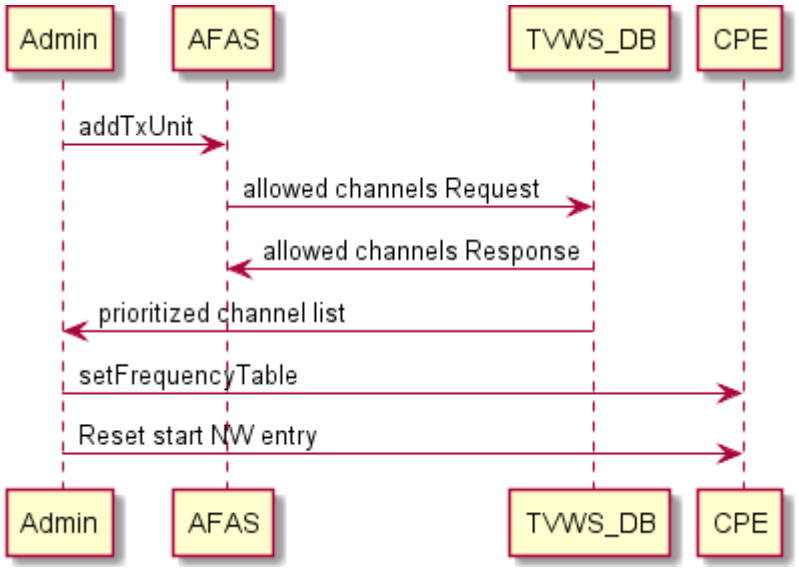

Figure 3 - Adding a new CPE to the network

2.3 Periodic update

Periodic update is the process which must be done at least once every 24 hour. The procedure can be initiated by the system admin using AFAS frontend web interface or by the expiry of a timer using synced tasks in the AFAS management system.

After getting the TVWS DB response, If the response does not have any changes in the TVWS channel availability the AFAS will not do any action to the TVWS system, If the response from the Data Base is different from the previous response AFAS will run a channel allocation algorithm which will allocate a TVWS channel to each BS and a set of allowed frequencies to each CPE

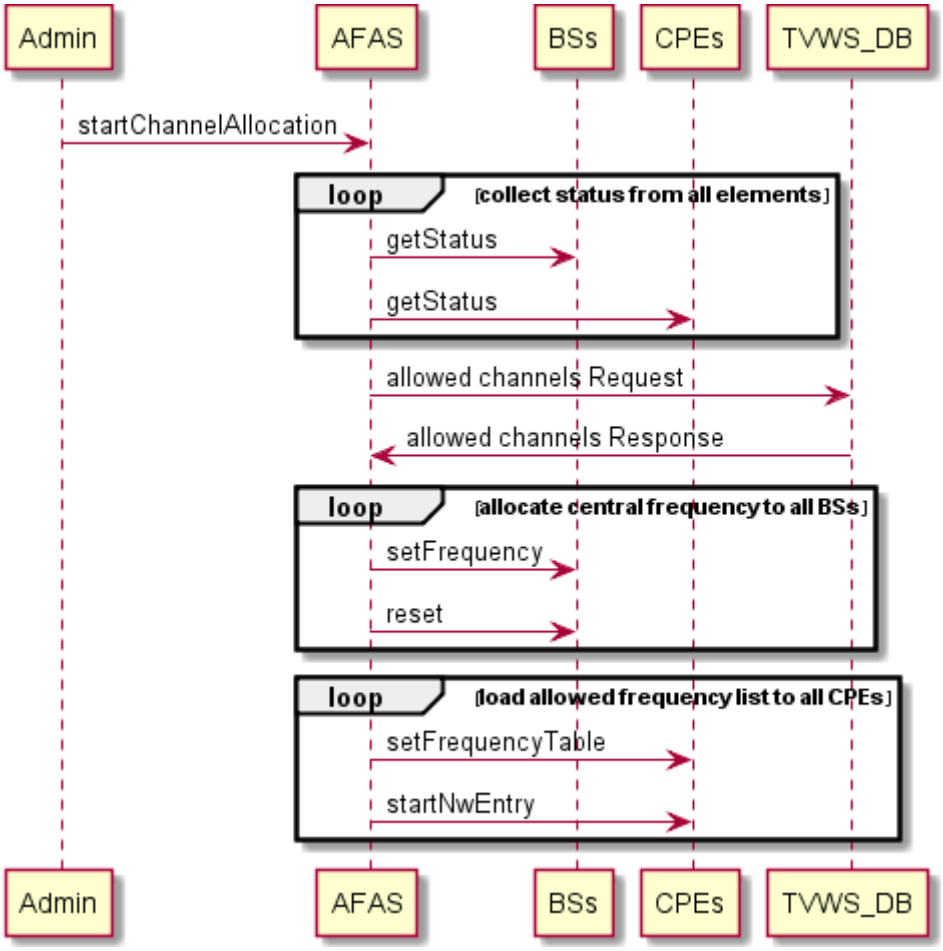

Figure 4 - Periodic channels update

3 AFAS – Configuration

The AFAS GUI is based on WEB pages which are presented by FIREFOX browser. Leafing through pages can be done by double clicking on the selected subject or using the back or next arrows. Returning back to upper hierarchies can be done by double clicking on the name of the directory in the first row as shown in the below figure.

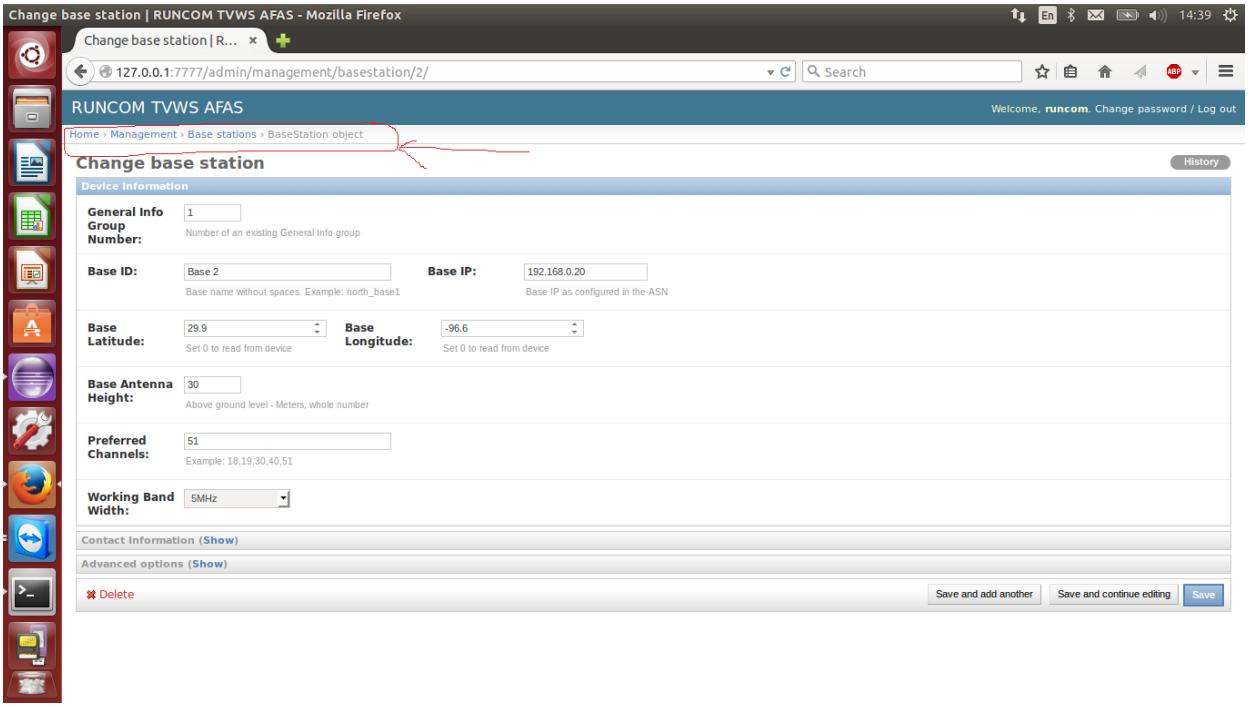

Figure 5: Hierarchy Leafing

3.1 Home page

After turning on the AFAS server the system enters to the HOME page.

The management section is active in this version, and the options to add or change base station.

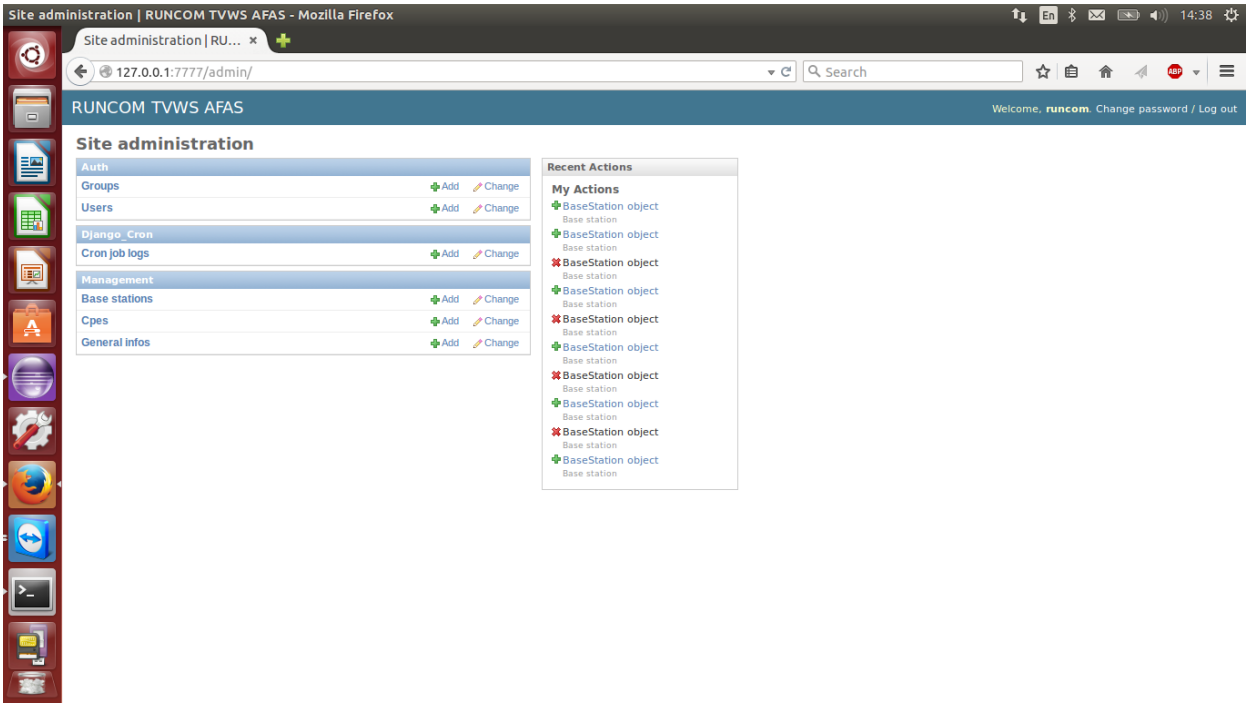

Figure 6: Home page

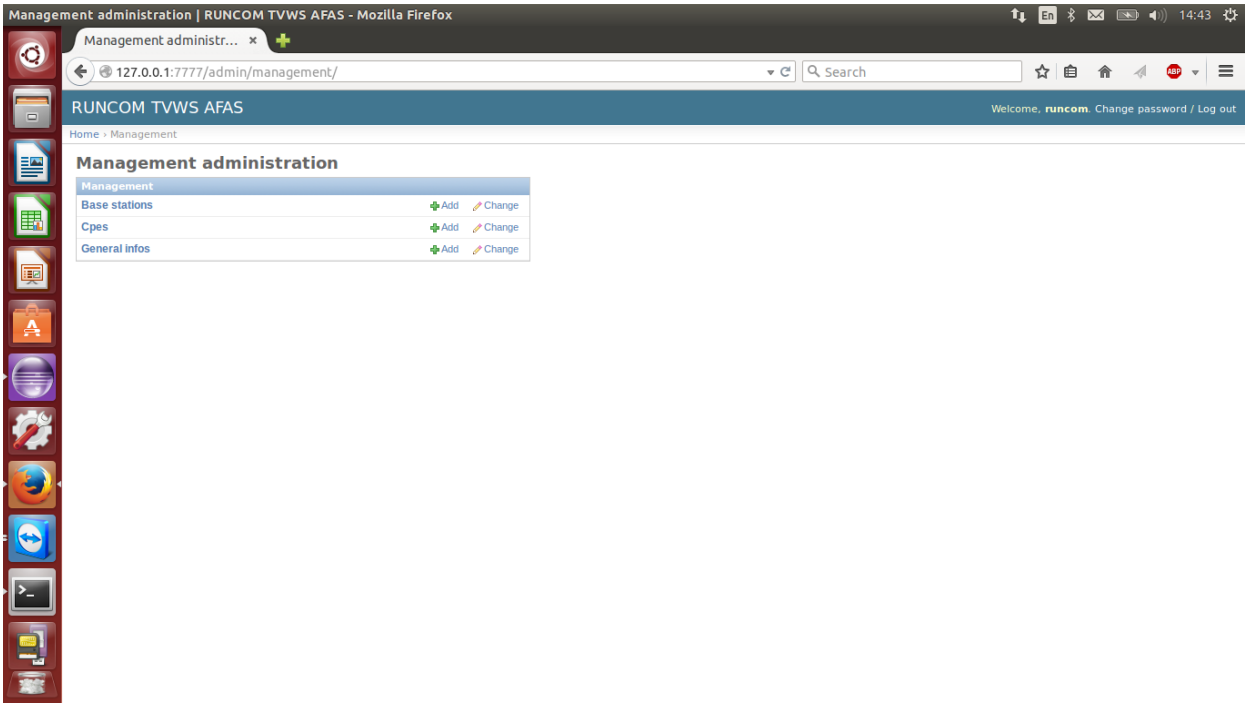

Figure 7: management Administration Page

3.2 Add Base Station

Three options to add base station to be synchronized and operate under the FCC standard:

- From HOME page at the Management/base station row - push the add

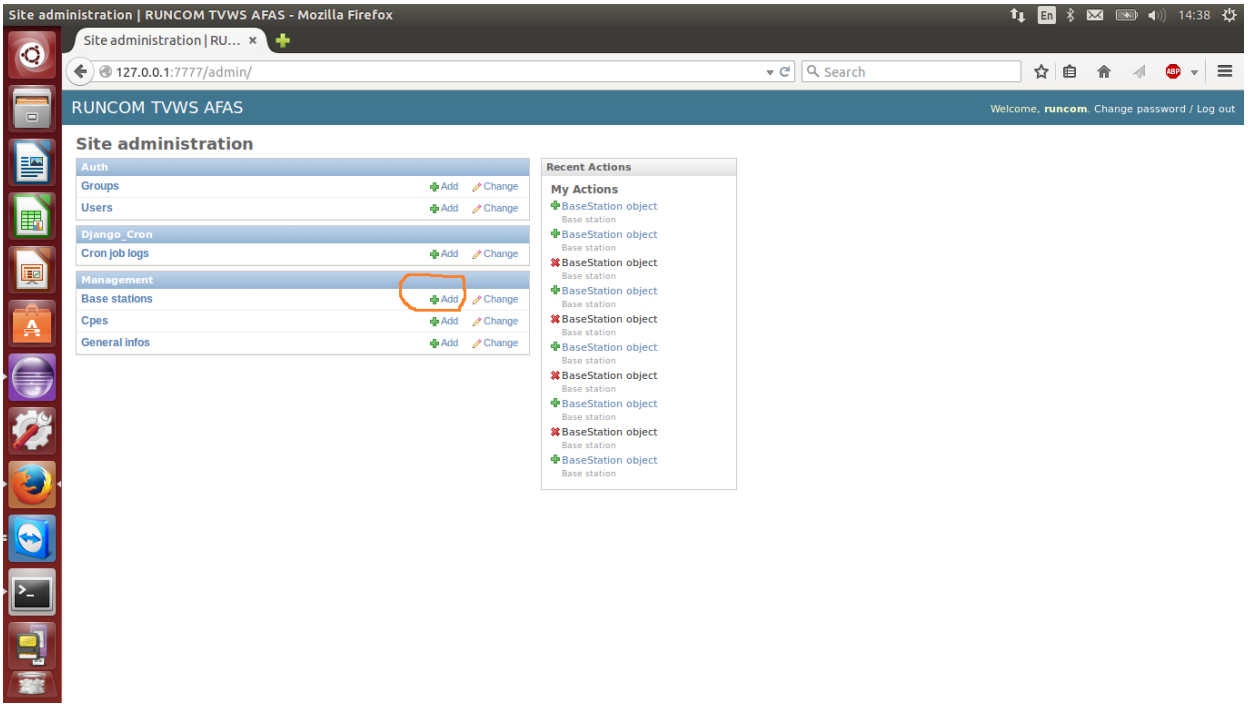

Figure 8: Add Base Station - option 1

- From the management administration page, at the base station row - push the add

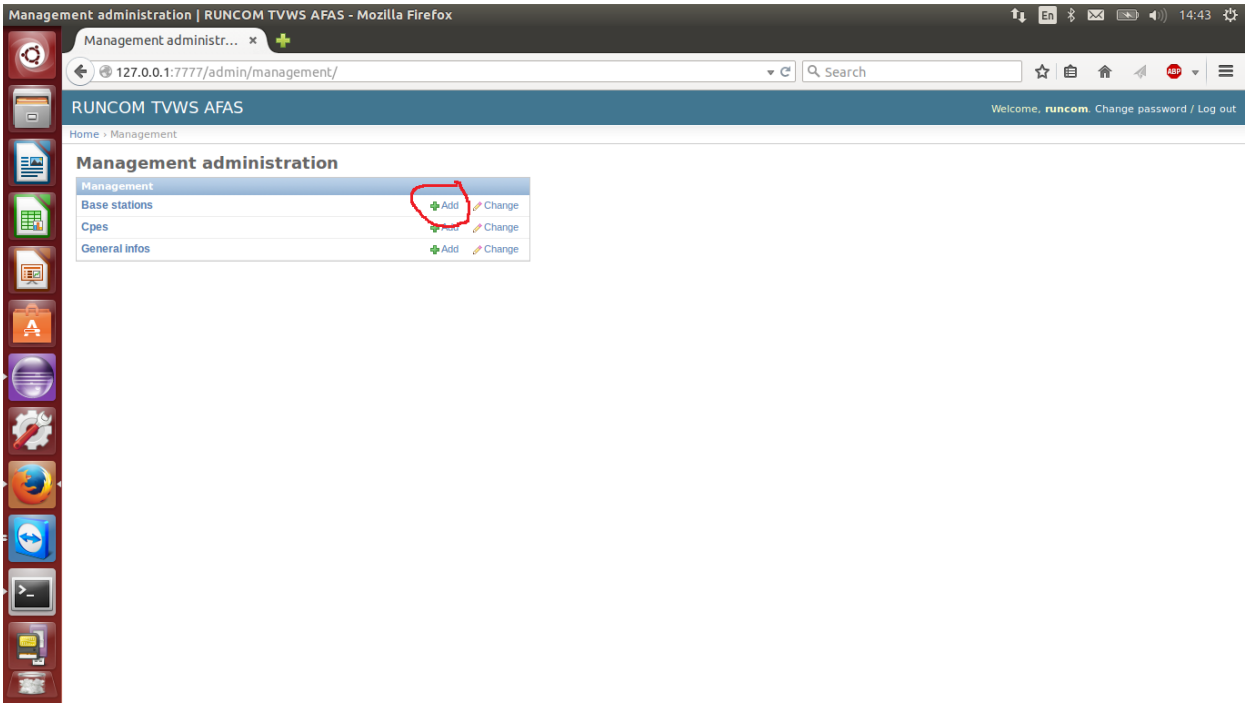

Figure 9: Add Base Station - Option 2

- From the base stations list – push add base station button.

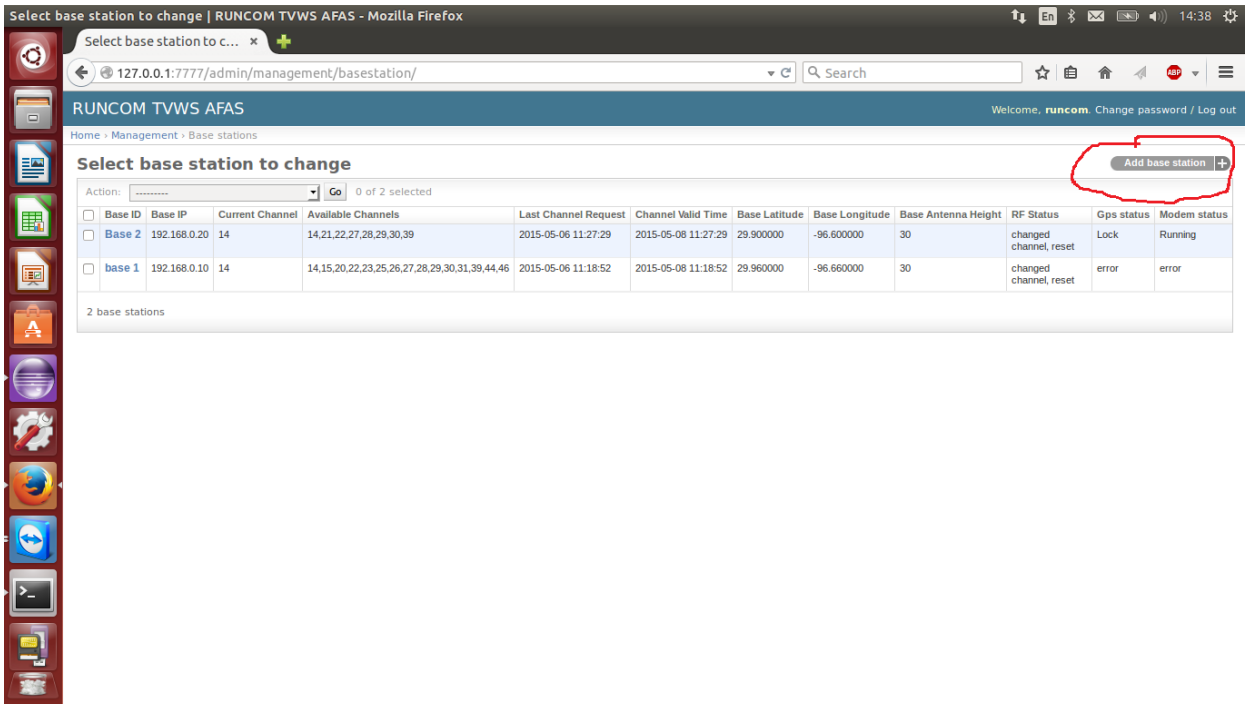

Figure 10: Add Base Station - option 3

After entering to the "add base station" form the following page should be filling with the following information

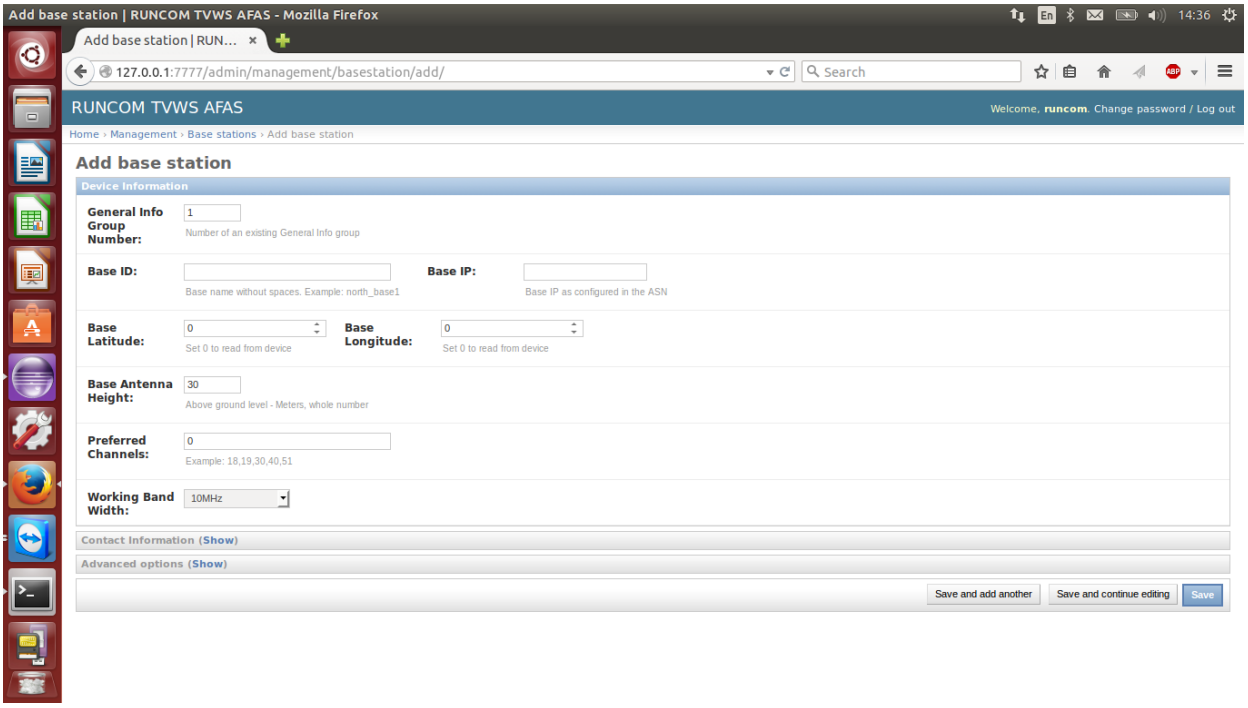

Figure 11: Add base Station page 1- Device Information

- **Base** Station **ID** : Logical name of the BS which helps to identify it – use for AFAS only
- **Base** Station **IP**: the IP address of the base station as presented in the xNOC device
- GIS information**: Base Longitude, Base Latitude** the location of the base station. Keep "0" for automatic update from the BS unit.
- **Base Antenna Height**: the height of the antennas element. If more than one antenna is used, enter the highest antenna parameter.
- **Preferred channel**: During installation it is recommended to measure all possible channels and to use the best. Enter the best first in row, and followed by comma the second best and so on. If "0" is entering the AFAS will use its algorithm to select channel.
- **Channel bandwidth**: It is possible to use single channel or two adjacent channels if found. 5MHz is single 6 MHz channel; 10MHz is two adjacent channels – 12 MHz

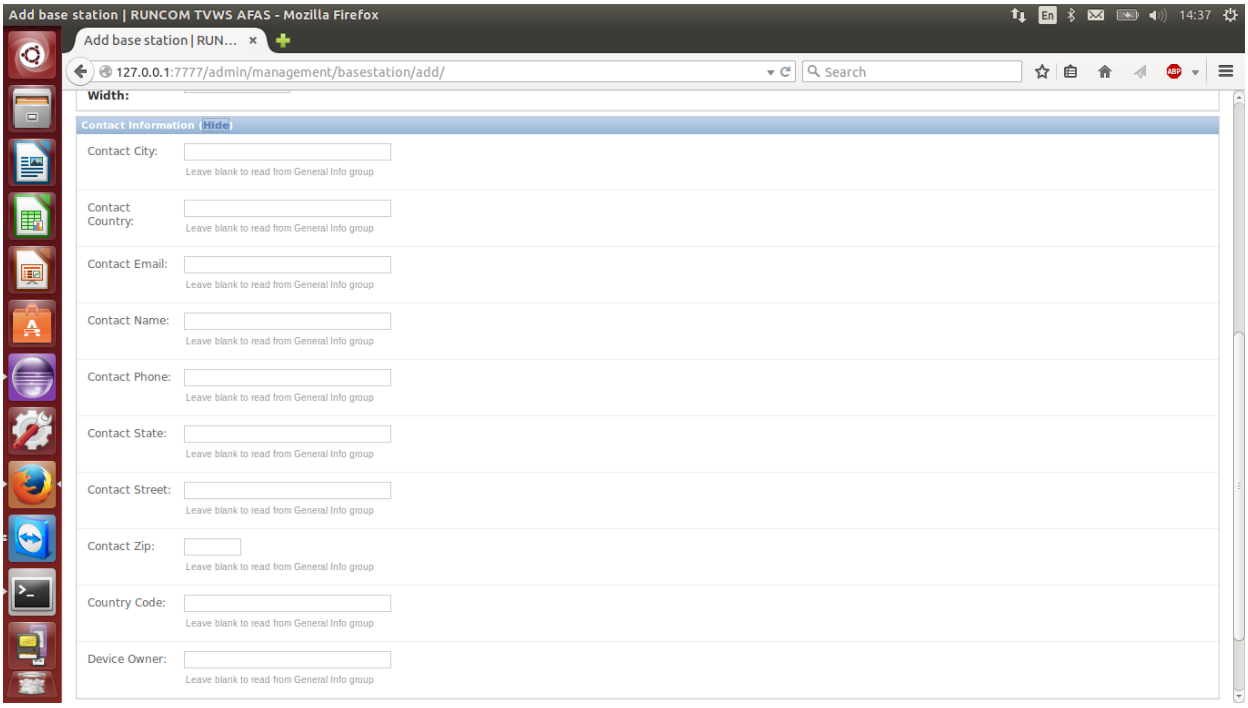

Figure 12: Add Base Station page 2 – Contact Information

The contact information page includes the information of the person (or officer in duty) which in-charge on the site, and is authorized and capable to perform maintenance, site ON and OFF, etc.

If fields in the web page are left blank, the information will be added automatically from the group information which this site is connected.

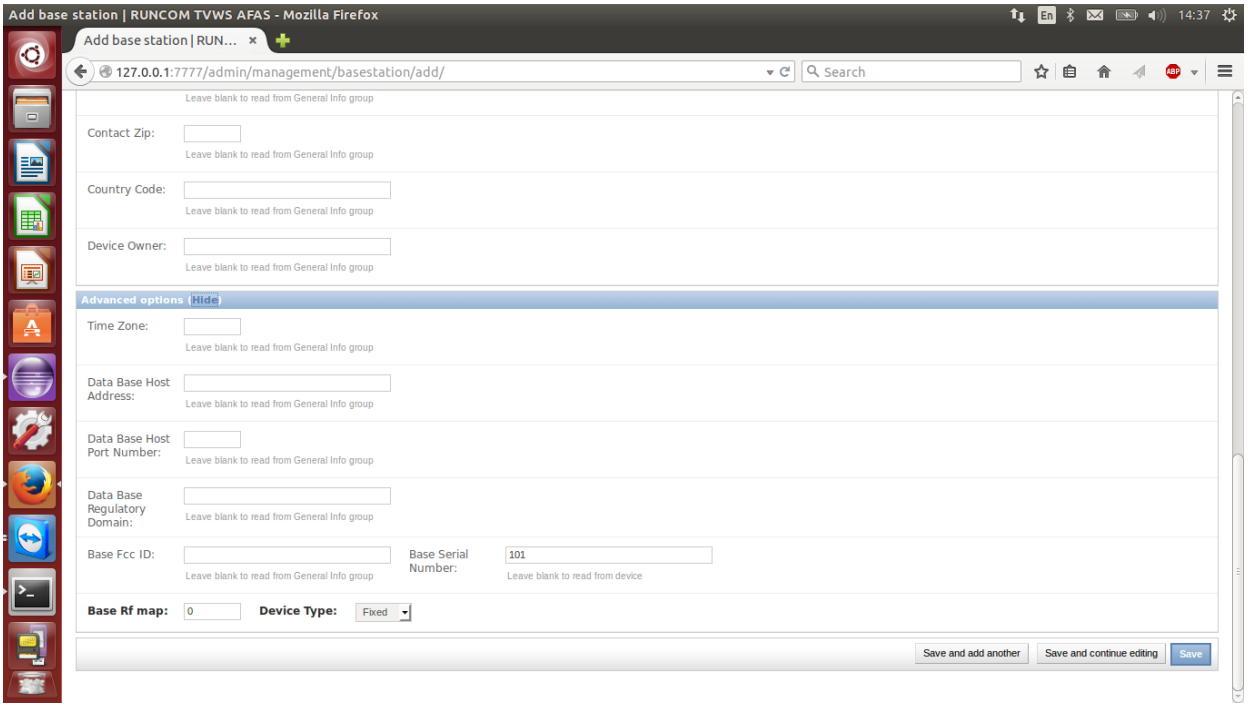

Figure 13: Add Base Station page 3 – Advanced Information

The advanced option web page includes information on the database which this device gets the operation authorization frequencies. Blank fields are automatically updated from the group information.

- **Time Zone**: indicates the time zone where the BS is operation. The time zone should be winter time zone all year.
- **Data Base Host Address**: IP address of the server from which the authorized frequencies are downloaded. Currently Runcom is using SpectrumBridge database only. In the future additional databases will be available.
- **Data Base Host Port Number**: the port number which is open for access to the database.
- **Data Base Regulatory ID**: "US" for United States.
- **Base FCC ID**: the FCC authorization ID as received after passing the tests.
- **Base Station Serial Number**: the serial number of the unit.
- **Device type**: fixed (the only option for BS units)

3.3 View Registered Base Stations

From the HOME page, push the Base Station button and enter into the base station page

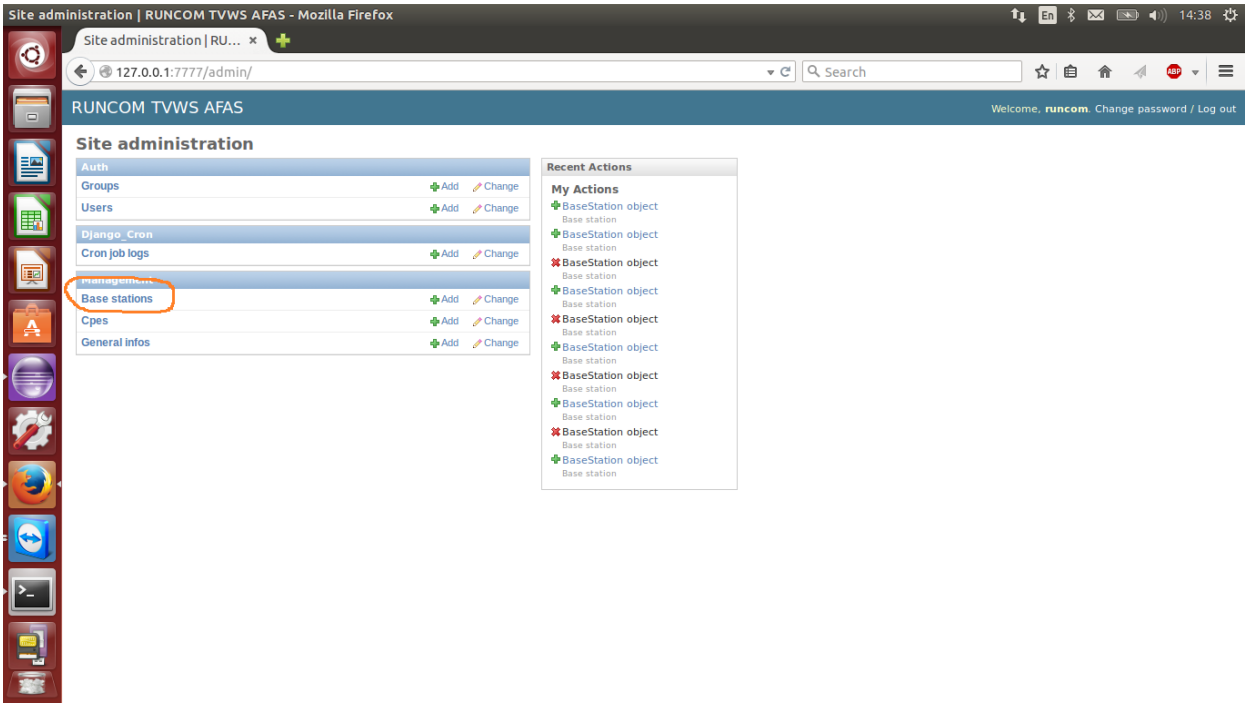

Figure 14: Base Station Page Selection

The following web page shows all registered base stations, their authorization status, GIS information and operation status

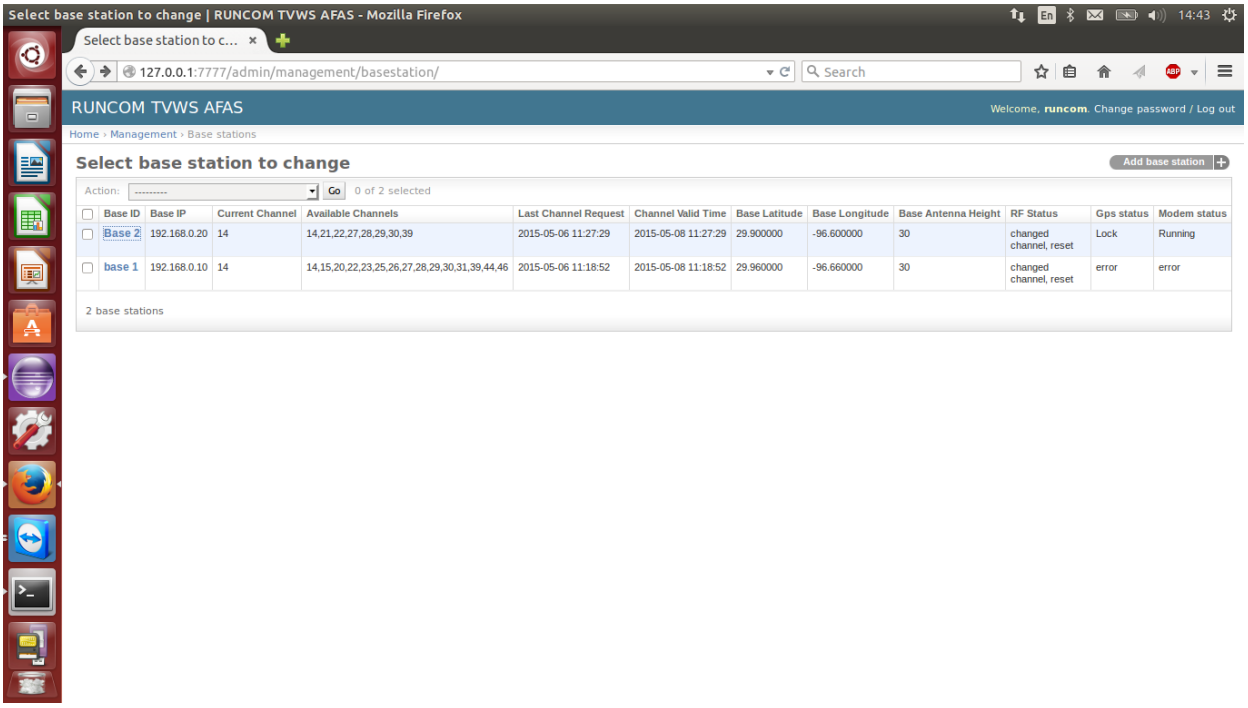

Figure 15: Registered Base Stations Information

- **Base ID:** the BS unique identifier.
- **Base IP:** Base Station IP address.
- **Current Channel:** the channel which the AFAS selected for the BTS from the allowed channel list for this Base Station
- **Available channels:** The list of available channels for that GIS information and Base station ID as received from the FCC database.
- **Last Channel Request**: the date and time for the last AFAS request.
- **Channel Valid Time**: the expiration time if no renew is performed.
- GIS information: **Base Latitude, Base Longitude, Antenna height**.
- **RF Status**: the last action on the RF module in the BS.
- **GPS Status**: GPS lock status.
- **Modem Status**: shows if the base station is active (Running), standby, down or faulty (error).

3.4 View / Change Base Stations Information

By clicking on the **Base ID** field in figure 16, the base station entire information is presented. Information can be changed, or the base station can be deleted from the database.

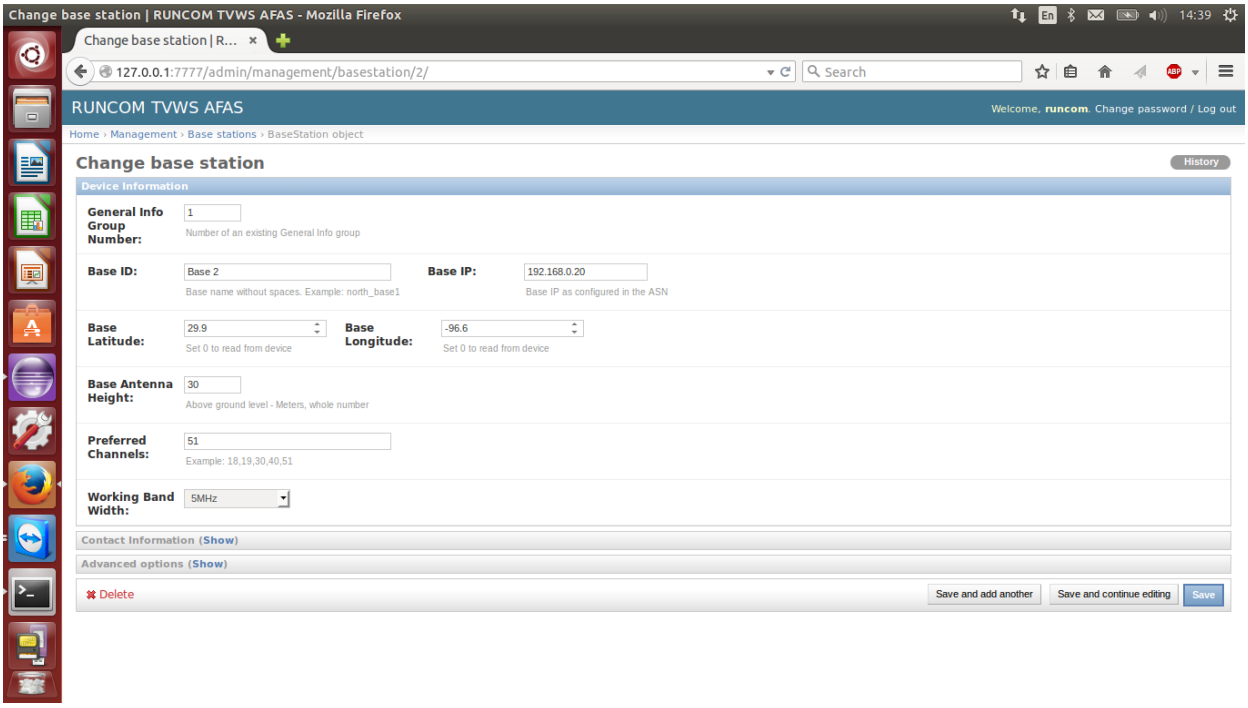

Figure 16: Base Station Information page 1- Device Information

This page includes the device static and operation information. The **Preferred Channel** is the field which expected to change manually. After installation the preferred channel (from the allowed list) should be selected for the best RF operation.

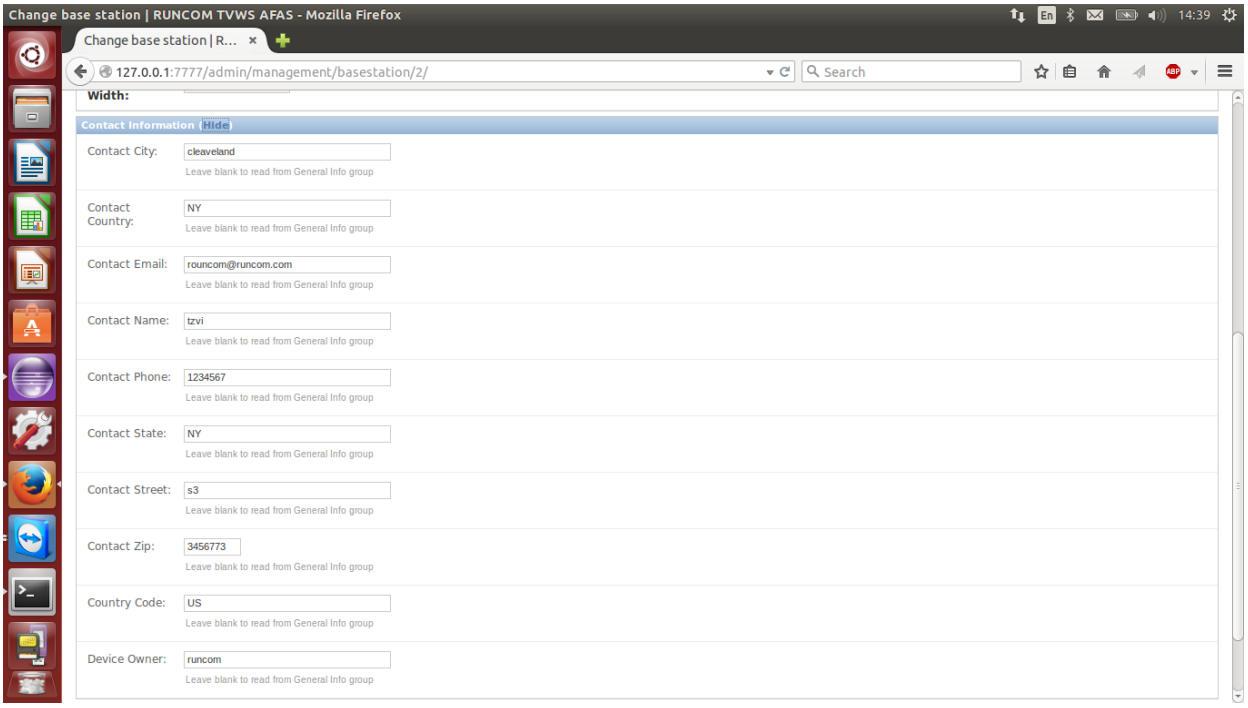

Figure 17: Base Station Information page 2 – Contact Information

The contact information tab includes the current contact information, as defined in the installation or in the last update. It should be used in case that the device need maintenance of repair.

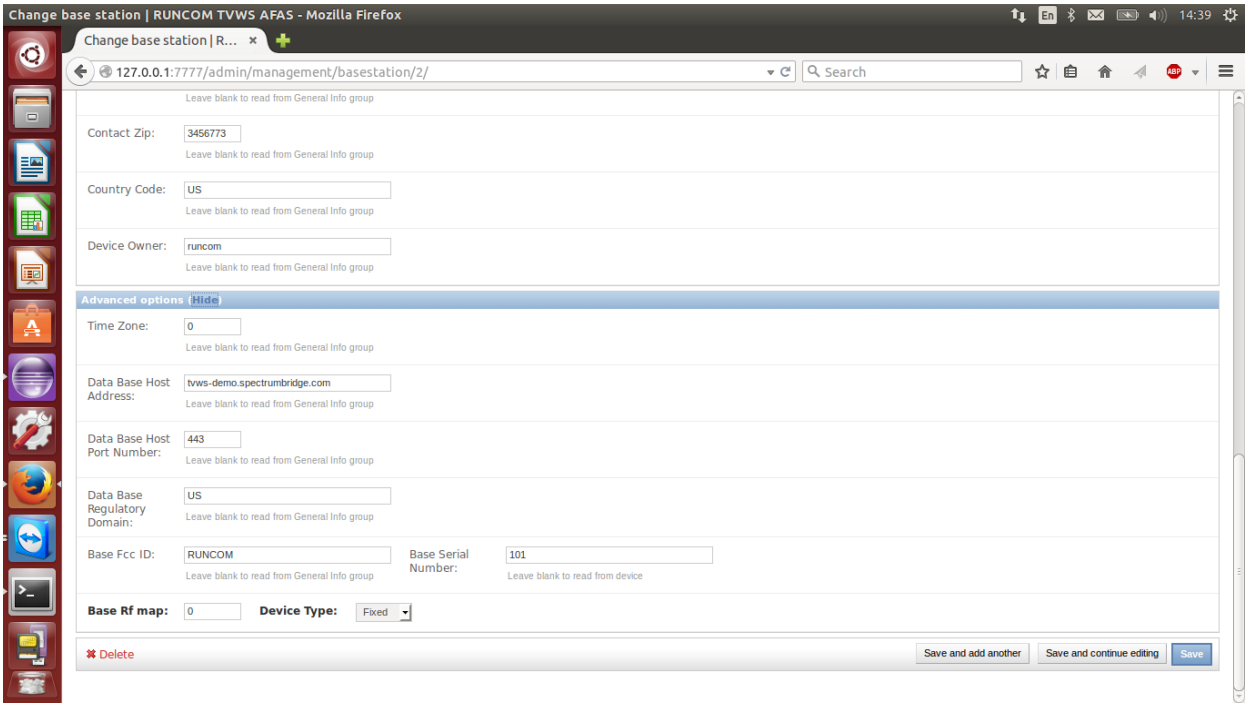

Figure 18: Base Station Information page 2 – Advanced options

The advance option tab includes information on the allocating frequencies source database, and FCC device operation approval. Any change in this information must be done carefully. Wrong information will cause the base station to stop it service and shut down.

4 AFAS – Connection Status

AFAS internet connectivity is important to keep the TVWS WIMAX network in normal and healthy conditions. The internet connectivity is required to support two major functions:

- Connection to the FCC frequencies allocation database (currently supported by Spectrum Bridge)
- Connection to the base stations via the NOC.

4.1 FCC Database connection lost

If connection between AFAS and the FCC database is lost, during the next refresh information cycle, the AFAS will notify the operator (on screen) for each base station separately, that the connection to the TVWS database is not available.

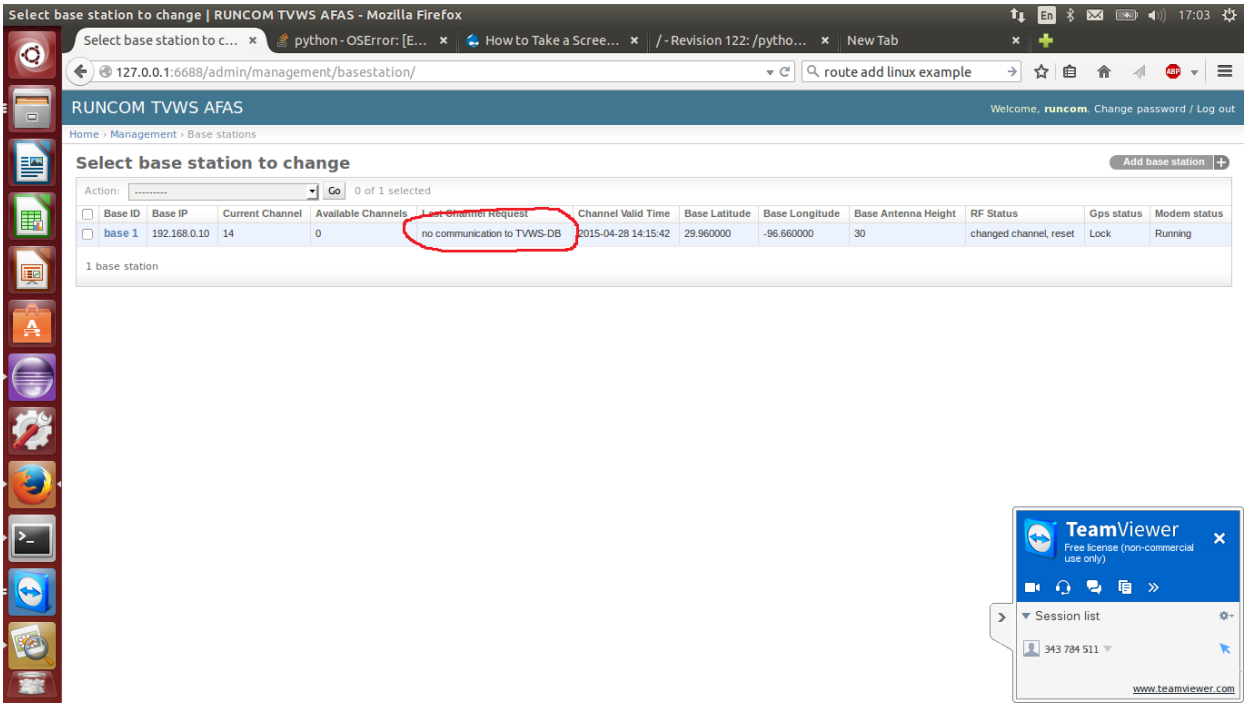

Figure 19: No Connection to DataBase

After validity expiration of the database the following message is published and the base station informed to stop service and shut transmission down till further action. Figure 21 shows the status

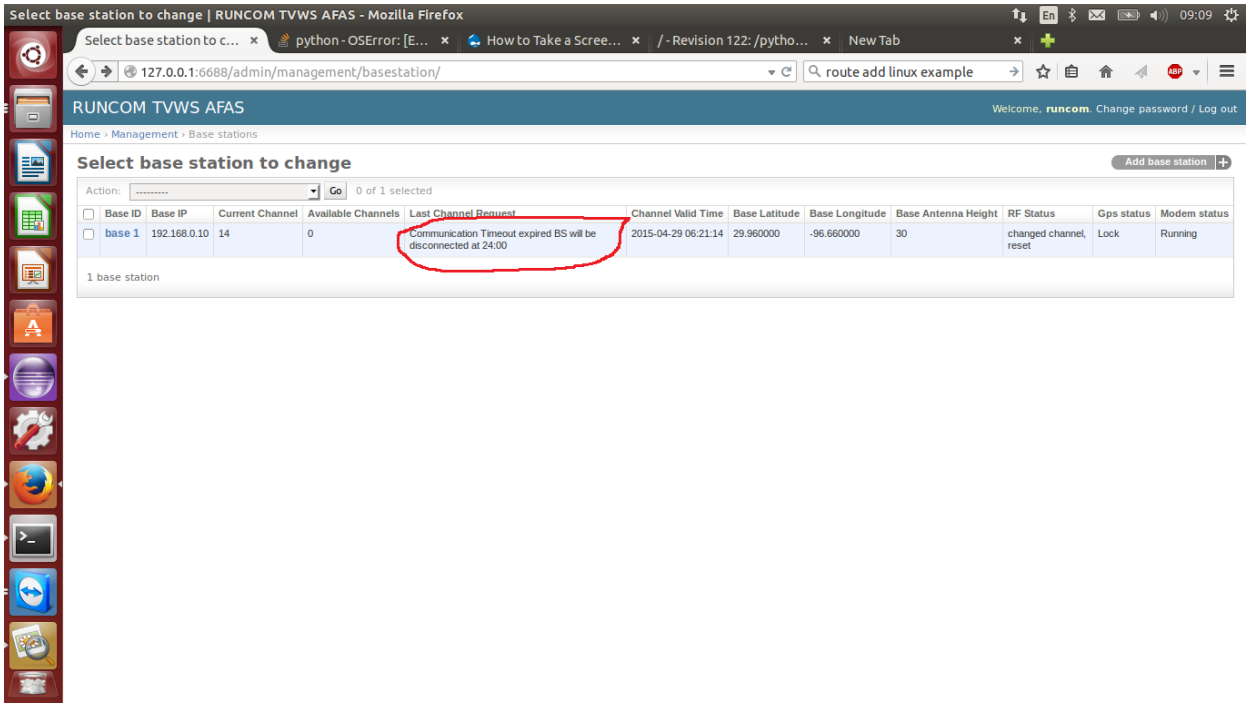

Figure 20: Database validity expiered

5 Adding CPE to the AFAS

To add a CPE in the AFAS open the “Site administration” page in the AFAS and Choose CPE as shown in Figure 21 below.

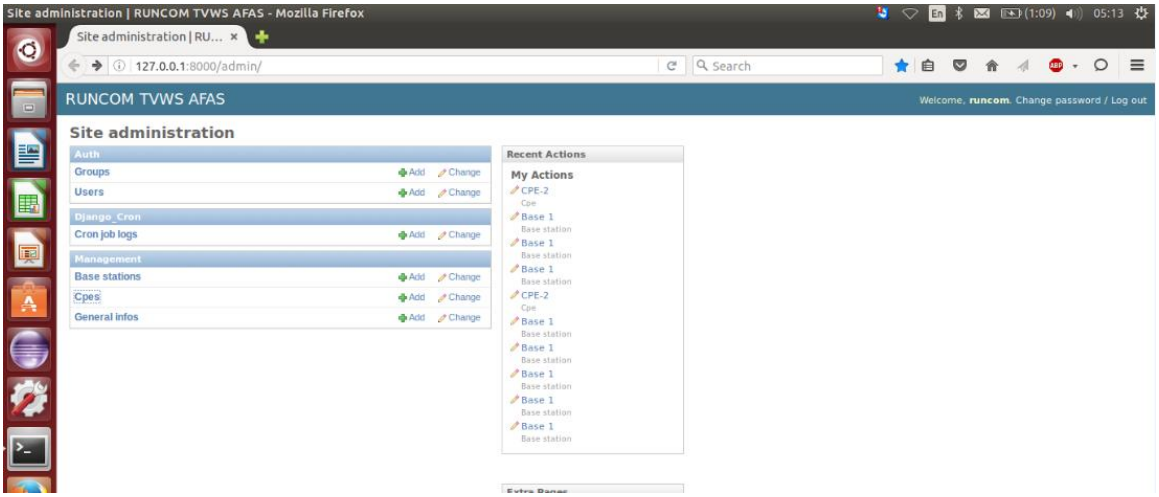

Figure 21: AFAS Site administration page

The AFAS SW will open the “Select CPE” page, on this page click the “Add cpe” option as shown in figure 22 below.

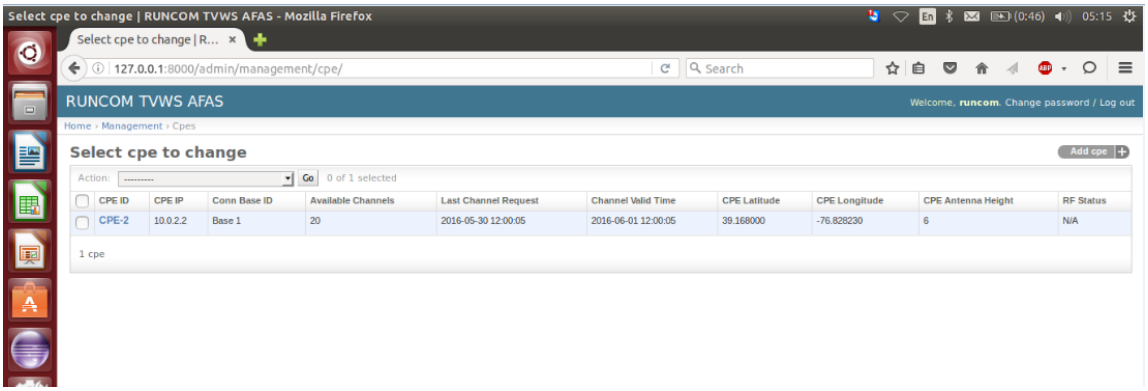

Figure 22: AFAS Select CPE page

On the “Add cpe” page fill the CPE ID, CPE IP, CPE Latitude and Longitude, the Connecting Base ID, The CPE antenna Height, MAC ID and save it as shown in Figure 23 below:

NOTE: Each CPE MAC ID will have one set of location data (Latitude, Longitude and Antenna Height) associated to it at the AFAS

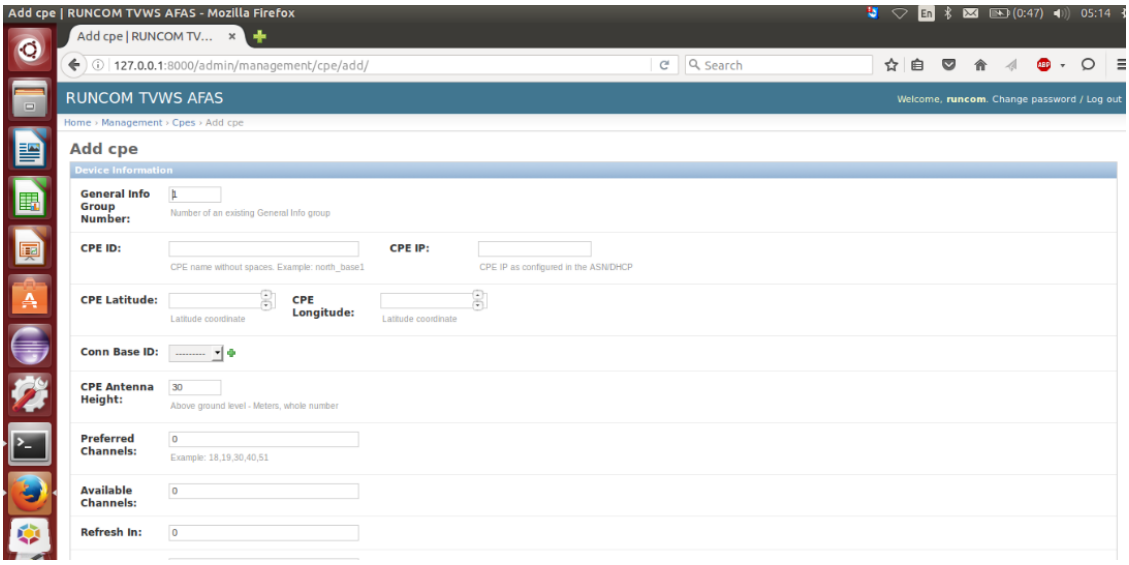

Figure 23: AFAS CPE configuration page

After completion of entering the information in the “Add cpe page” click the "Channel request to select Devices" and press "Go" and the AFAS will ask for channels from the Data Base as shown in Figure 24 below.

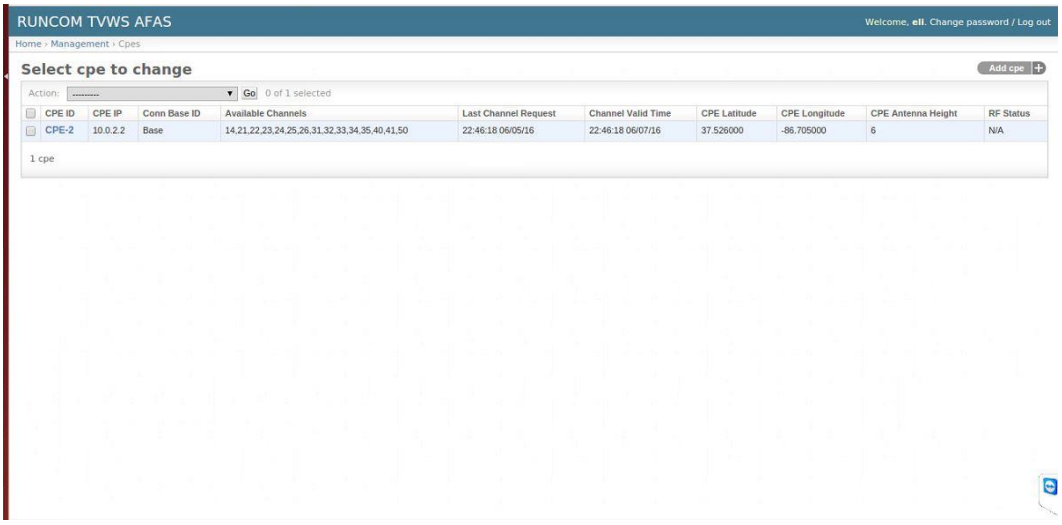

Figure 24: AFAS CPE available channels request

After receiving the available channels from the Data Base, AFAS will load the allowed channels to the CPE and the CPE will establish the link with the Base Station in one of the allowed channels.