

DRAFT

THUNDER 255

TETRA Base Station

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1. About This Document

The purpose of this document is to give instructions for the installation & configuration of the TETRA Base Station **THUNDER 255** and to ensure that installation & configurations are carried out correctly.

2. FCC Information

Model Name: Thunder 255

FCC ID: 2BFHD-THUNDER255

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication

3. Abbreviations

TETRA - Terrestrial Trunked Radio

TETRA is a professional mobile radio (PMR). It has been the standard for public safety and commercial use in Europe since 1995. The FCC approved the technology in 2013 for commercial use in the US.

LAN – Local Area Network

A Local Area Network or LAN is a network that interconnects computers and other devices over a small space.

Ethernet API – Application Program Interface for Ethernet

URL - Uniform Resource Locator

A string of characters that identifies the location of a resource

BSU – Base Station Unit

The control center and hub of the TETRA communication network

4. Intended Use

This user manual is intended for well-trained technical/telecom operators and technicians only. Please read the manual carefully to ensure safe and effective use of the product. Installation,

commissioning, integration, configuration and maintenance measures concerning the THUNDER 255 may be performed only by properly trained and authorized personnel.

5. About Thunder 255

The Thunder 255, Smart Route's flagship TETRA base station, is a deployable high-performance TETRA radio base station unit supporting multiple carriers. It is a scalable, dynamic TETRA radio base station system. Thunder 255 comes with configurable software support that enables the system to be configured for transmission over a wide spectrum.

6. Safety Information

6.1. Public Safety at Base Station Installation

Radio frequency (RF) energy might have thermal effects. Hence, base stations must be installed adhering to compliance boundaries in order to ensure public safety. These boundaries prevent exposure levels from exceeding safety limits. Only authorized personnel should access areas within these boundaries.

6.2. Installer Safety

Installers are expected to be aware of RF energy's thermal risks and maintain proper safety distances from antennas. The minimum safe distance is specified in meters.

6.3. Application of SAR measurements

European standards EN 50383, EN 50384 and EN 50385 do not require whole body Specific Absorption Rate (SAR) measurements for transmitters with negligibly low maximum output power levels. The exclusion power levels for SAR are based on worst-case assumptions.

Localized SAR measurements used to assess the absorption rate in specific parts of the body are applicable only if:

1. The distance between the measurement phantom and the energy source is less than 40 cm.
2. The surface area of the energy source is less than 60 cm x 30 cm.
3. The frequency of the energy is between 800 and 3000 MHz

Based on these criteria, the SAR measurements are not applicable to TETRA Base Stations.

6.4. Compliance boundary for Antennas

The compliance boundary is the safe area around the antenna as defined by the limits in 47 CFR 1.1310. As the antenna is customer provided, Smart Route can only provide a calculation based on a defined antenna type. As the typical application for a TETRA radio would use an omni directional antenna, the antenna gain is defined as 2.15 dB based on the Laird FG4500 base station antenna for 450-470 MHz for the purpose of this calculation. The table below defines the values used and resulting minimum safe distance required.

Table1: Compliance Boundary Dimensions for Thunder 255

Test Frequency	450 MHz (Minimum operational frequency)
Power, Conducted mW (P)	47772.8 (Rated power of +46 dBm + 20 %)
Antenna Gain Isotropic	2.15 dB
Antenna Gain Numeric (G)	1.64
Antenna Type	Laird FG4500 Omni-directional
Limit (f/1500) (L)	0.3
Distance (R) ($R = (\sqrt{PG/4\pi L})$ cm)	144.2

If a higher gain antenna is used by the customer, the calculations need to be repeated to determine the safe area around the antenna.

6.5. Typical Configuration

The antenna connects to the base station through a connector and cable.

Typical and Worst Case Configurations:

- **Power (P out):** 40 W per antenna (Supports 2 transmit antennas each at 40W average power)
- **Peak Power:** Under 80 W per antenna
- **Number of Transmitter Units:** 2

7. Caution

Security during installation and maintenance - Follow all installation and maintenance instructions for personnel safety.

Electromagnetic fields – ensure that the installation personnel are aware of the emissions from nearby antennas while connecting a new antenna.

Electrostatic discharge protection - always handle electrostatic sensitive devices with care. Use a grounding strap to prevent discharge damage to the equipment or personnel.

Antenna connectors – make sure that the base station is powered off before disconnecting any antenna connectors. This is an essential step to avoid electrical hazards.

For storage and transportation - Keep the units in their original packaging to prevent mechanical damage, to maintain traceability and to protect against static electricity.

CAUTION: While handling electro-sensitive TETRA units, always wear a snug-fitting grounding wrist strap around your bare wrist. This ensures that your body remains at the same electrical potential as the equipment that is being handled. Use one of the M8 screws on the front panel of the system to attach a lug for a ground strap.

8. Warning

Potential dangers that may cause physical injury or death.

Follow these precautions while using the Thunder 255 Base station

- Read all instructions carefully before installing and using the Thunder 255.
- Keep the manual for the Thunder 255 Base Station for further reference.
- Only trained and authorized personnel should install, commission, integrate or maintain the TETRA Base station of Thunder 255.
- Access to the base station should be limited to authorized personnel only at all times.
- The system may carry potentially lethal voltages. Switch off all power supplies before any maintenance
- Ensure proper earthing in installation to avoid lethal voltages from capacitors.

- Dispose of the equipment responsibly according to regional regulations. This equipment can release toxic fumes (hydrogen fluoride and hydrogen chloride) when burned.
- This equipment emits radio frequency energy with possible thermal effects. Comply with access boundaries in order to prevent unsafe exposure.

Warning sticker**

WARNING: Do not go beyond the compliance boundary of a live antenna.

Compliance boundaries are based on European standards EN 50383, EN 50384, EN 50385, and Council Recommendation 1999/519/EC and 47 CFR 1.1310.

9. Product Overview

Components and Features

- Portable TETRA base station
- 8 carrier support
- Robust and durable design
- Easy-to-use control interface
- High-quality signal processing

10. Technical Specifications

Frequency bands

Rx: 455.0 – 475.0 MHz Tx: 450.0 – 470.0 MHz

Transmitter/Receiver Separation MHz

5 MHz

RF Power Control

+46 dBm to +28 dBm in 2 dB Steps

RF Power Level Accuracy

+/-2 dB @25 C

+3/-4 dB over Temperature Range

Max power at TRX output:

+46 dBm Single Carrier per Tx Path

+42 dBm Two Carriers per Tx Path

+36 dBm Three Carriers per Tx Path

+32 dBm Four Carrier per Tx Path

Operating Bandwidth

2.5 MHz

Carrier Spacing

200 kHz minimum

Receiver Static Sensitivity dBm

-117 dBm

Receiver Dynamic Sensitivity dBm

-108 dBm

Operating Ambient Temperature

-30 to 50 °C

Humidity

90% to 95% RH @ +50 °C for 8 hours

Dust/Water intrusion

IP67

Input power

110-120vac

Power Consumption

1000W

Salt Fog

?? hour exposure to 5% saline solution

Width x Height x Depth

27.6 x 17.3 x 12.2 inches

Weight

150 pounds

11. Setup and Installation

11.1. Site Survey and Planning

1. Site Selection:

- Select the location that satisfies the coverage requirements.
- For indoor installations select a location that has minimal obstructions
- Ensure necessary permissions from local authorities / property owners

2. Pre installation checklist

- Familiarize yourself with the general overview of the Thunder 255 installation process by using the installation manual. Ensure full comprehension of the procedure from start to finish.
- Verify the availability of all necessary tools as outlined in Section 11.5
- Acquaint yourself with the warnings and precautions detailed in Section 6 to ensure safe handling.

- Test all equipment to ensure functionality
- Check for any software or firmware updates prior to the actual installation.
 - Confirm the availability of all required documents listed in the references section
 - Cross-check received cases against the packing list. Document and report if you find any discrepancy
- Ensure the stability of the mounting structure (like stands or shelves for indoor installation and poles for outdoor installations)
 - Inspect the components for any transport related damages.

11.2. Site preparations

General

- Conduct a site survey to ensure proper preparation and identification of any special requirements (such as the need for lifting equipment).
- Check that the equipment room temperature meets specified limits according to engineering instructions and the Environmental Conditions documentation.
- Verify accessibility to the installation site and visually inspect to ensure compliance with site-specific instructions, cleanliness
- Make sure that the site survey report has been completed and is available.
- Ensure all external connections required for the cabinet installation are available. This includes
 1. earthing points
 2. mains power that adheres to national requirements (AC)
 3. transmission interfaces to the exchange
 4. TX and RX antenna cables
 5. GPS cable etc.
- Confirm the availability of necessary lifting and other equipment for safe installation
- Ensure adequate working space.

Outdoor Installation:

- Make sure the mounting structure (like a pole) is structurally sound for the installation of the base station and antennas.
- Mark the point for antenna installation at an appropriate height for desired coverage.
- Ensure grounding systems and lightning protection to safeguard the equipment.
- Set up the power supply, including any necessary backup systems like batteries or generators.
- Verify power availability and stability.

Indoor Installation:

- Ensure the mounting structure is suitable for installation with adequate space and ventilation
- Ensure the area is free from potential hazards such as water leaks or excessive dust.
- Plan for proper cable management
- Ensure access to a stable power supply with appropriate grounding.

11.3. Unboxing

➤ List of items included in the package.

- Thunder 255 base station
- Power cord
- User manual
- Ethernet cable
- Mounting brackets (if applicable)
- Visual guide to the components.

11.4. Connectors

(Back panel – Picture is expected. Need to denote with number and description)

AC Power: 110 VAC

Unit Connector: Amphenol PWC-03PMFS-LC7001

Mating Connector: Amphenol PWC-03AFMM-LL7Axx, where xx is length in meters,
01, 02, 03, 04, 05, 07, 10.

Pin Assignment: 1: AC Line, 2: Ground, 3: AC Neutral

GPS Antenna:

SMA Female, Antenna power provided, +5V DC up to 55 mA. Open detection below 4 mA, Short detection above 150 mA.

RF Connections:**With External Duplexer or separate TX/RX Antennas**

- TX1: Type N Female, Transmit Output from TX1 Path
- TX2: Type N Female, Transmit Output from TX2 Path
- RX1: SMA Female, Main RX Antenna Input
- RX2: SMA Female, Diversity RX Antenna Input (If supported)

With Internal Duplexer Option

- TX1: Type N Female, Transmit Output from TX1 Path and Main RX Antenna Input
- TX2: Type N Female, Transmit Output from TX2 Path and Diversity RX Antenna Input (If supported)

LAN:

- Unit Connector: Amphenol LTW RCP-5SPFFH-SCM7001, RJ45 Female
- Mating Connector: Indoor Application: Any RJ45 Male Connector
Outdoor Application: RCM-00BMMA-SLM7001 (For User provided cable, OD 4.5 to 7.5 mm)

USB: Field Technician Interface

- Unit Connector: Sure Seal IPUSB-2BABHD
- Mating Connector: USB-B

Fuses:

- Digital/RF Module: Littlefuse 0218002.HXP, 2A, 5mm x 20mm
- PA1 Module: Littlefuse 0326015.HXP, 15A, 1/4" x 1 1/4"
- PA2 Module: Littlefuse 0326015.HXP, 15A, 1/4" x 1 1/4"

11.5. Tools needed

The following tools and proficiency in using them is expected while installing THUNDER 255

Table 2: Installation Tools

The following tools and proficiency in using them is expected while installing THUNDER 255

Tool	Quantity
12 mm open-end wrench for pole mounting	1
12 mm socket with ratchet for pole mounting	1
Tools for connecting power cord to AC power supply	1
Tools for making RJ-45 cable connection	1
8 mm eyebolts for lifting equipment	2

11.6. Assembly Instructions

Product identification labels

THUNDER 255 base stations are labelled with permanent product identification tags that are designed to last throughout its lifespan. Ensure that these identification labels remain in place and are undamaged.

12. Initial Setup

12.1. Connecting the Antennas

Connecting the TX/RX and GPS antennas

- Securely mount the TX/RX antenna/ GPS antenna in the desired location.
- Install appropriate lightning surge protection devices on the antenna cables going to the Thunder 255 unit. For indoor installations where the antenna is located outside, lightning surge protection device are to be installed at the building entry point.
- Attach the antenna cables to the respective connector ensuring that there are no loose connections.
- Carefully route the antenna cable towards the Thunder 255 unit avoiding sharp bends
- Attach the other end of the antenna cables into the designated ports on the Thunder 255 unit ensuring that they are securely connected.

12.2. Connecting to Power

- a. Plug the mating connector of the power cord into the power port of Thunder 255.
- b. Connect the other end of the power cord to an AC power source.

12.3. Powering On

- Press the power button for DIG_RF and PA1.
- Press the power button for PA2 if the 2nd transmit path is to be utilized.
- Wait for the status indicators to light up.

12.4. Connecting Thunder 255 to a network

Indoor Installation:

- Connect an Ethernet cable from your computer to the Ethernet port on the Thunder 255.

Outdoor Installation:

- Pass the connector cable through the back shell of the weatherized connector.
- Attach the RJ-45 connector to the end of cable.
- Plug the RJ-45 connector into the unit.
- Connect the back shell to the unit and tighten it around the cable to create a watertight seal.

General

- Ensure your computer is configured to obtain an IP address automatically or set a static IP address within the same subnet as the Thunder 255.
- Thunder 255 has a default static IP of 192.168.0.203. To connect to the base station, the private network set up in the computer must be in the same subnet.
- Go to the TCP/IP v4 properties in the Network/ Ethernet settings and assign a manual IP of the format 192.168.0.### to the computer. (Ex: 192.168.0.201)
- (You can find more details on how to setup the network at <https://www.wikihow.com/Set-up-a-Private-Network>)

12.4.1. Accessing the Web Interface

- a. Open a web browser on your connected device.
- b. Enter the Thunder 255's IP address in the address bar to access the web interface.
 - i. The URL for accessing the Thunderbird-255's web interface is
<http://192.168.0.203:8124>
- c. Log in using the default username and password (refer to the product label or manual for default credentials).

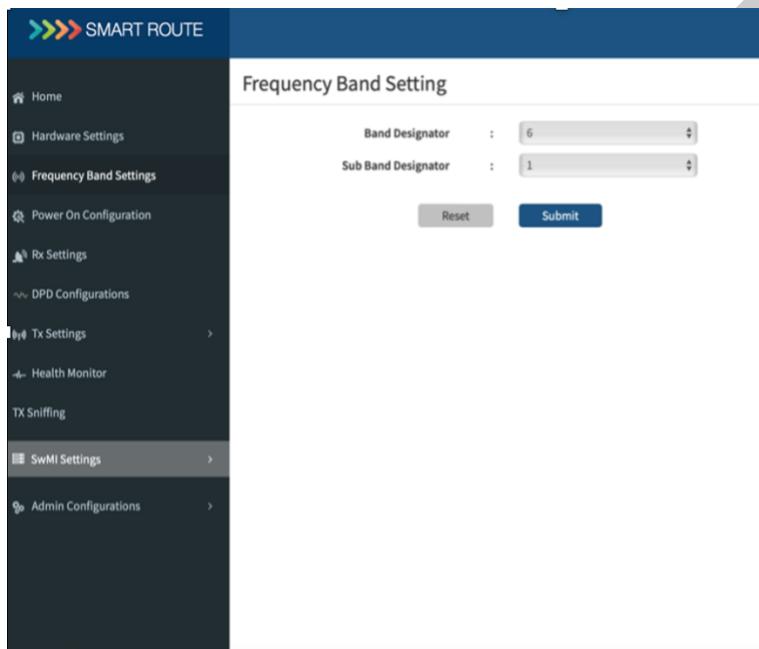
User Name: operator

Password: password

13. Configuration

13.1. Frequency Band

The TETRA radio frequency is configured according to operator's regional band specifications and according to operator's choice within the range. The Tx and Rx frequency ranges of this version of Thunderbird-255 is shown in the table below. The Band Designator value, 1 through 7, shall be defined in the factory portion of the configuration data.



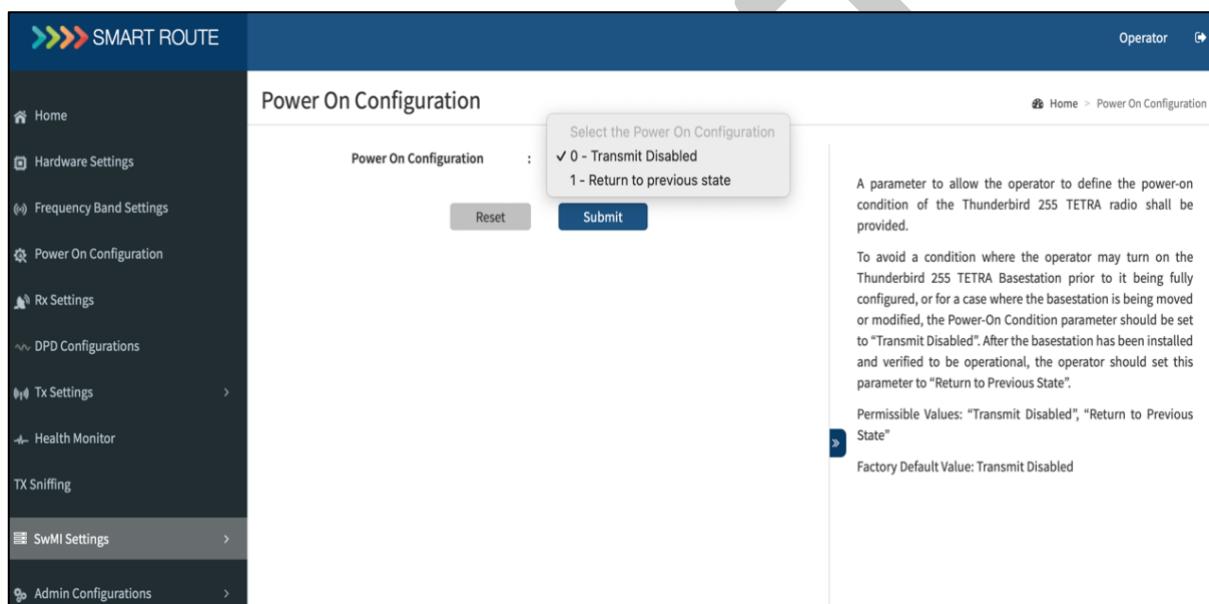
The screenshot shows the 'Frequency Band Setting' page of the Smart Route web interface. On the left is a navigation sidebar with links like Home, Hardware Settings, Frequency Band Settings (which is selected and highlighted in grey), Power On Configuration, Rx Settings, DPD Configurations, Tx Settings, Health Monitor, TX Sniffing, SwMI Settings (also highlighted in grey), and Admin Configurations. The main content area has a title 'Frequency Band Setting' and two dropdown menus: 'Band Designator' set to 6 and 'Sub Band Designator' set to 1. Below these are 'Reset' and 'Submit' buttons. To the right of the UI is a table showing frequency ranges for each band designator from 1 to 7.

Band Designator	Transmit Frequency Range	Receive Frequency Range
1	390.01250 - 395.00000 MHz	380.01250 - 385.00000 MHz
2	395.00625 - 399.98750 MHz	385.00625 - 389.98750 MHz
3	420.01250 - 425.00000 MHz	410.01250 - 415.00000 MHz
4	425.00625 - 429.98750 MHz	415.00625 - 419.98750 MHz
5	450.01250 - 459.98750 MHz	455.01250 - 464.98750 MHz
6	460.00000 - 464.98750 MHz	465.00000 - 469.98750 MHz
7	465.00000 - 469.98750 MHz	470.00000 - 474.98750 MHz

13.2. Power On Configuration

The operator can configure the state to which the system will be restored on powering on after a shut down. You can choose to power on to.

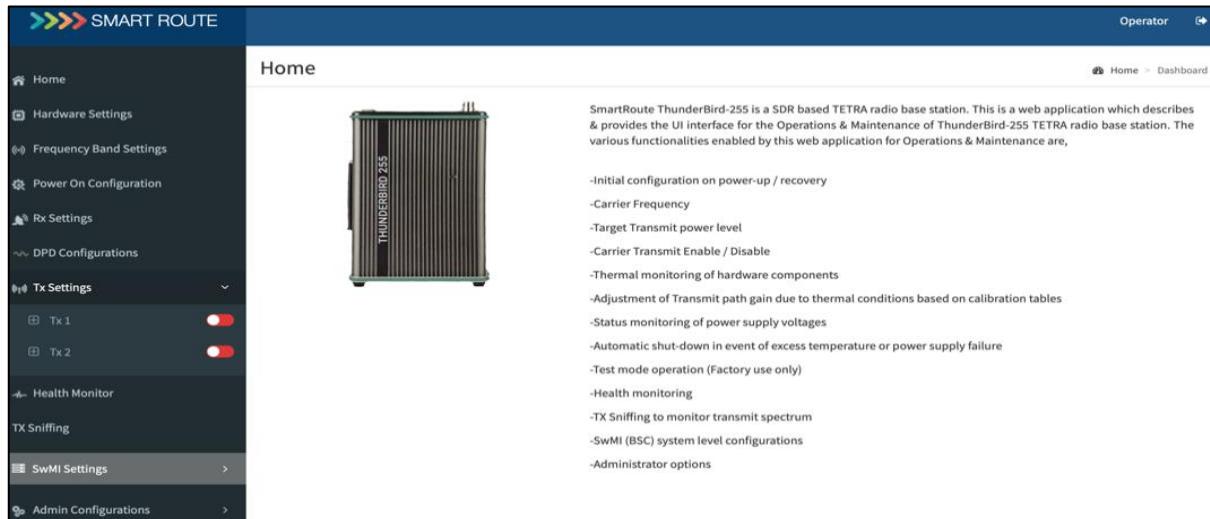
- Transmit disabled – upon choosing this setting, the system will power on to an idle state with all its transmission carriers disabled.
- Return to previous state – upon choosing this setting the unit will power on to the same state where it was left off. I.e. all the transmit carriers that were on will remain on and all those that were off will remain in an off condition.



Initially, the power on condition is set to “transmit disabled” on your Thunder 255. This ensures that the TETRA base station does not go online before the carriers are configured. Once the carriers are configured, set to “Return to the previous state” to assure operation resumes after a power outage.

13.3. TX (Tx 1 & Tx2)

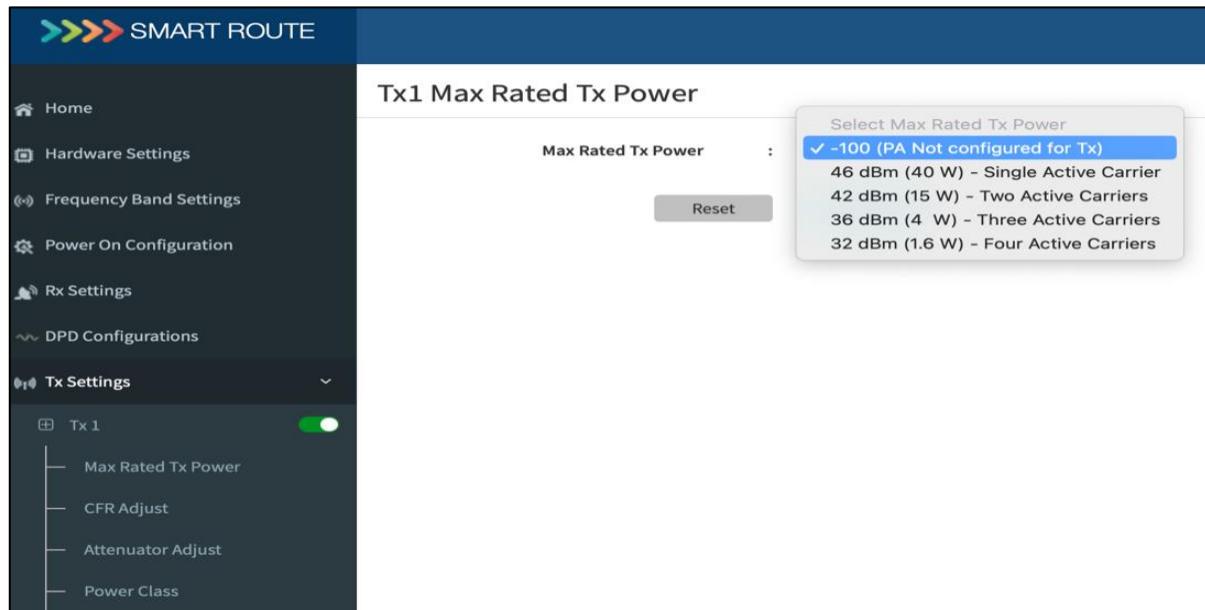
13.3.1. On / Off (Need to add description)



To Enable “Tx 1”, click on the right side of the red bubble next to the “Tx 1” label. The bubble will turn green. Similarly to Enable “Tx 2”, click on the right side of the red bubble next to “Tx 2” label.

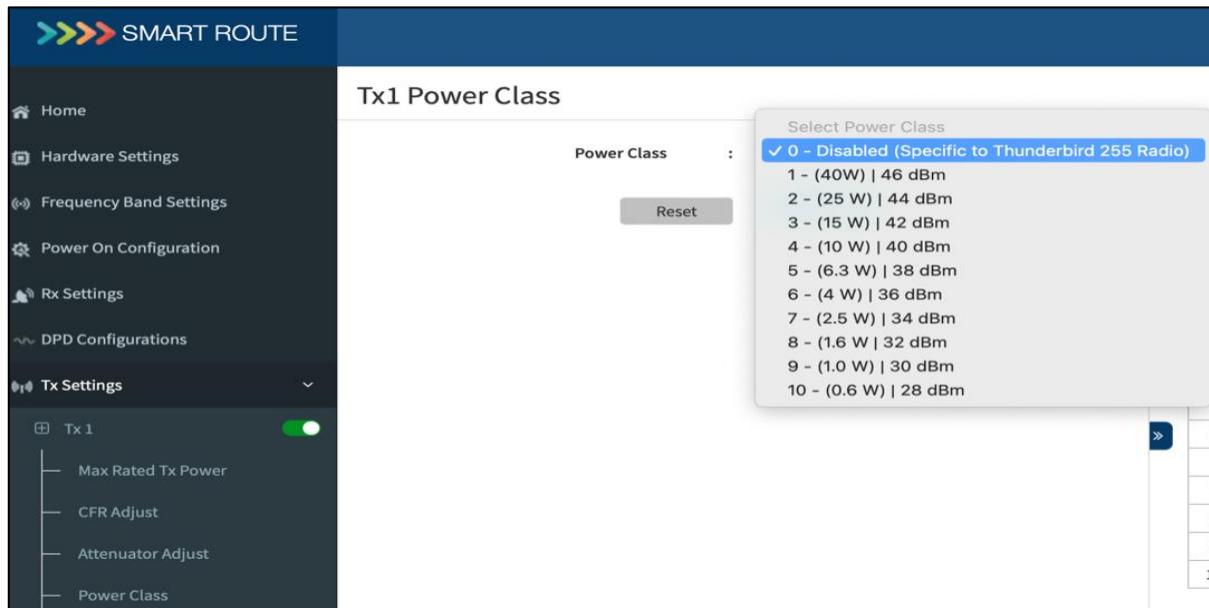
13.3.2. Max TX Power

THUNDER 255 can be configured for the TX power & power class based on the number of carriers licensed by the operator. The options available are listed in the drop down menu.



13.3.3. Power Class

THUNDER 255 can be configured for the TX power & power class based on the number of carriers licensed by the operator. The options available are listed in the drop down menu.

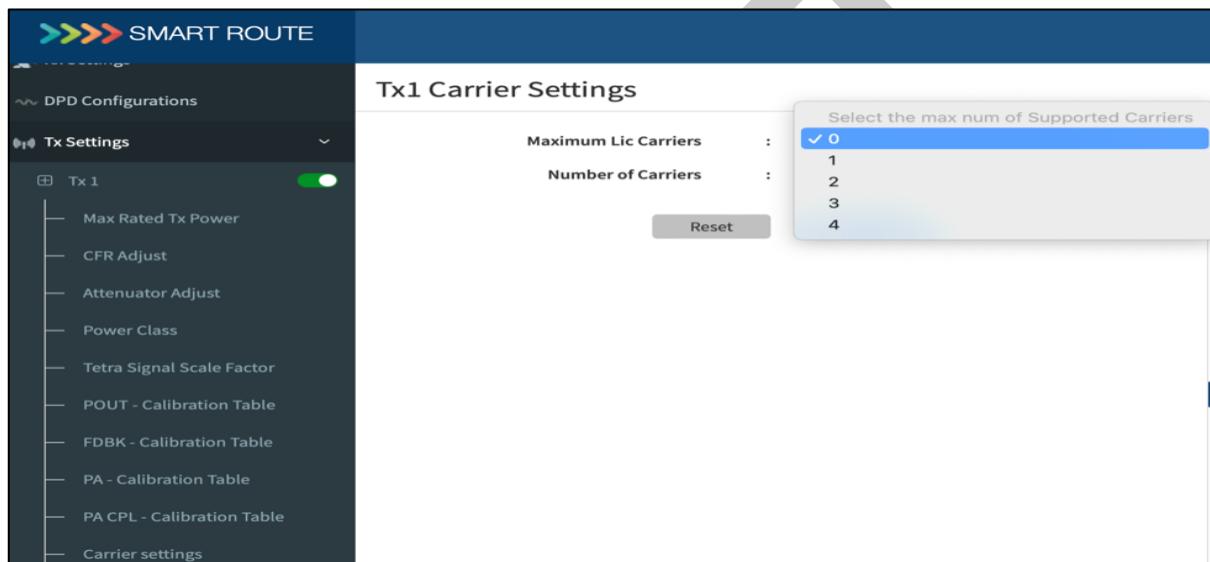


13.3.4. Carrier Setting

THUNDER 255 supports a maximum of 8 carriers. The THUNDER 255 is designed to have two Tx paths with each path supporting 4 carriers.

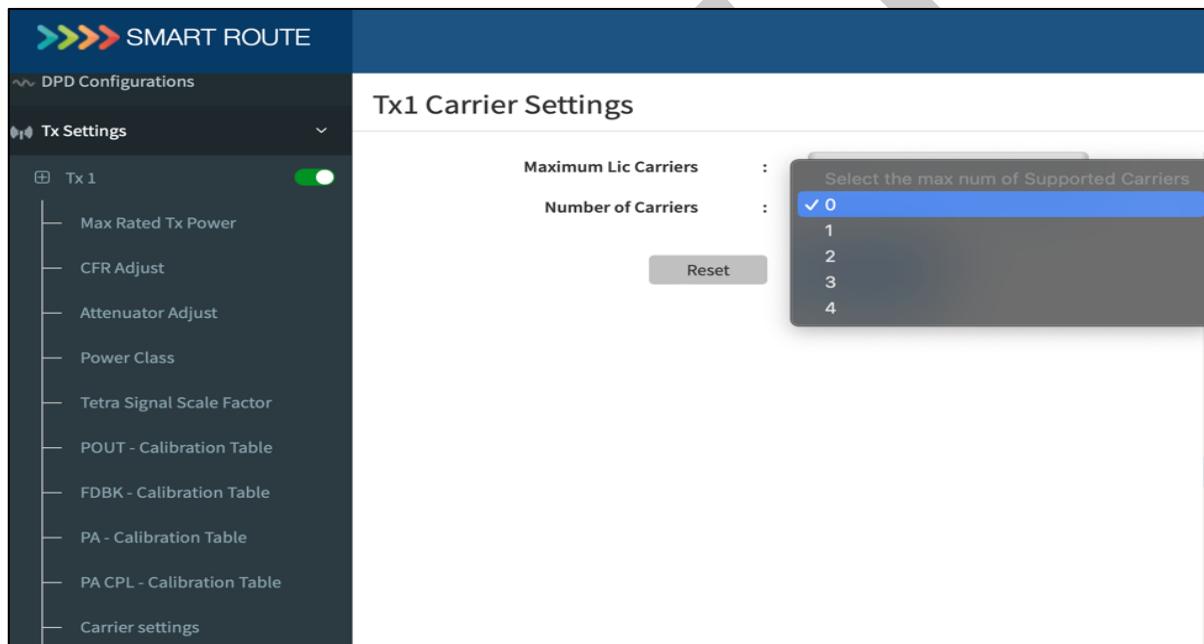
13.3.4.1. Number of Licensed Carriers

The number of licensed carriers is limited to the maximum number of supported carriers by the system. The number of licensed carriers is to be configured with maximum of 4 carriers per Tx path.



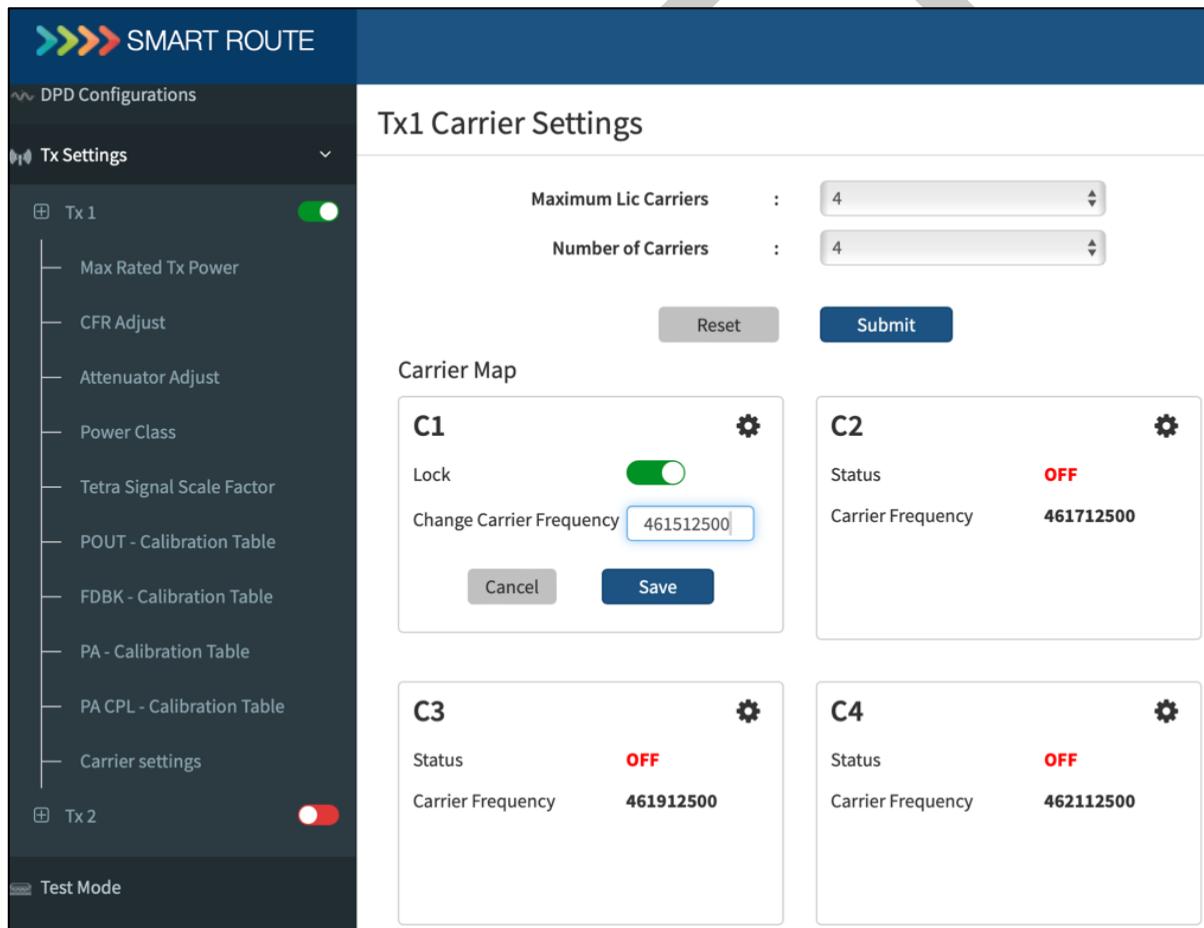
13.3.4.2. Number of Carriers

The operator can choose to change the number of active carriers per Tx path at any point of time subject to a minimum of 1 and maximum of 4 for Tx 1 path based on the number of licenses available. Initially, this value is set to zero, i.e. all carriers come disabled before the operator starts configuring them. The Primary (Main Control Channel enabled) carrier is always assigned as the 1st carrier frequency on Tx 1 path. Additional carriers may be configured between the two Tx paths up to the number of licensed carriers for the base station.



13.3.4.3. Carrier Frequency

Once the Number of Carriers is defined, the carrier settings page will display a carrier map for the selected number of carriers (refer the image below below). Click on the symbol to the right of the Carrier number. This will bring up a red bubble where “OFF” was. Click on the right side of the bubble and it will turn green. Enter the desired frequency in Hz. Then click “Save. The carrier will then display “ON” in yellow indicating that the carrier has been enabled and is ramping the transmit power up slowly to allow DPD adaption to minimize out-of-band emissions. Once the carrier is at the desired power level, the “ON” will turn green. This can take several minutes. While the display is yellow, no other carriers on either Tx path can be enabled or disabled. It is recommended to stay on this page until the “ON” turns green”



The image shows the 'Tx1 Carrier Settings' page of the Smart Route software. The left sidebar shows 'Tx Settings' for 'Tx 1' and 'Tx 2', with 'Tx 1' currently selected. The main area displays 'Tx1 Carrier Settings' with 'Maximum Lic Carriers' set to 4 and 'Number of Carriers' set to 4. Below this is a 'Carrier Map' section with four slots labeled C1, C2, C3, and C4. Each slot has a status indicator (green for C1, red for C2, red for C3, red for C4) and a 'Carrier Frequency' field (461512500 for C1, 461712500 for C2, 461912500 for C3, 462112500 for C4). A 'Save' button is visible in the C1 slot.

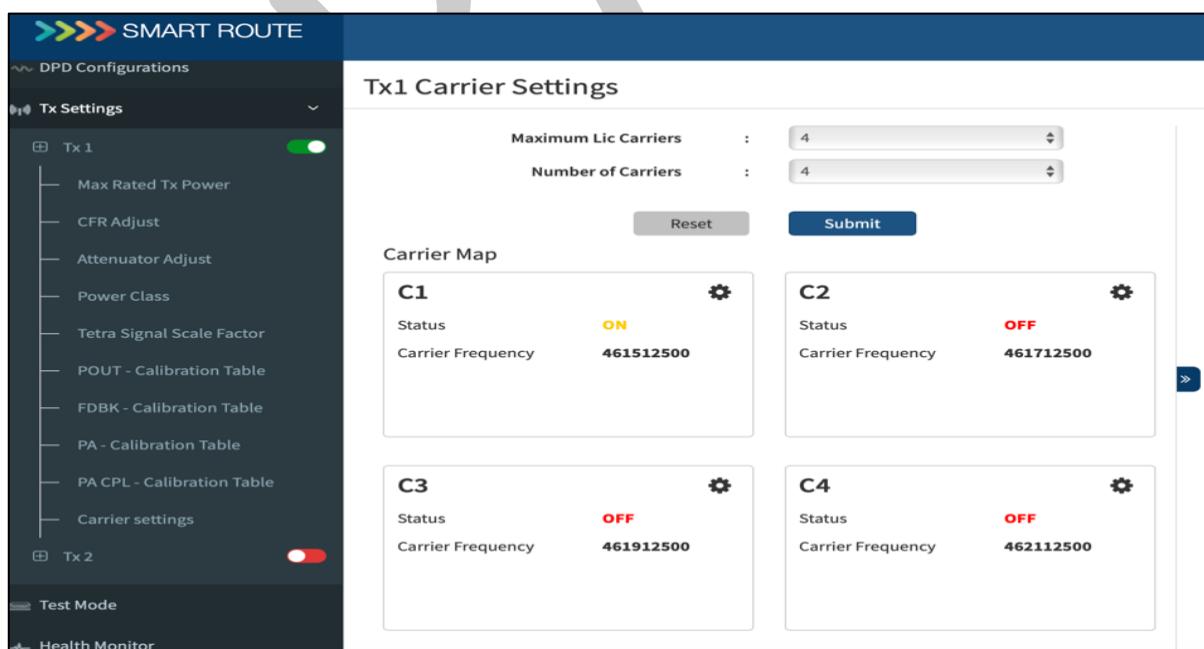
The carrier frequency entered by the operator will be validated upon ‘save’. For a frequency to be successfully validated it has to be

- A frequency within the range as specified in section 12.1
- It should be a multiple of 6.25 KHz
- It should be at least 200 KHZ apart from any of the previously entered carrier frequencies

13.3.4.4. Enabling / Disabling Carrier

To change the state of an individual carrier, click on the symbol to the right of the Carrier number. This will bring up a red (locked) or green (unlocked) bubble. Clicking the bubble will toggle the color of the bubble. Click “Save” to execute the change in state. The carrier will then display either “OFF” or “ON” in yellow indicating that the carrier state is changing. Once the state change is complete, the display will either be “OFF” in red or “ON” in green.

To lock all carriers on a Tx Path, click the left side of the green bubble next to the Tx 1 or Tx 2 label on the left hand side of the display. This will immediately lock all carriers on the Tx path and turn the bubble color to red. The Tx path must then be manually unlocked and each carrier unlocked as described previously.



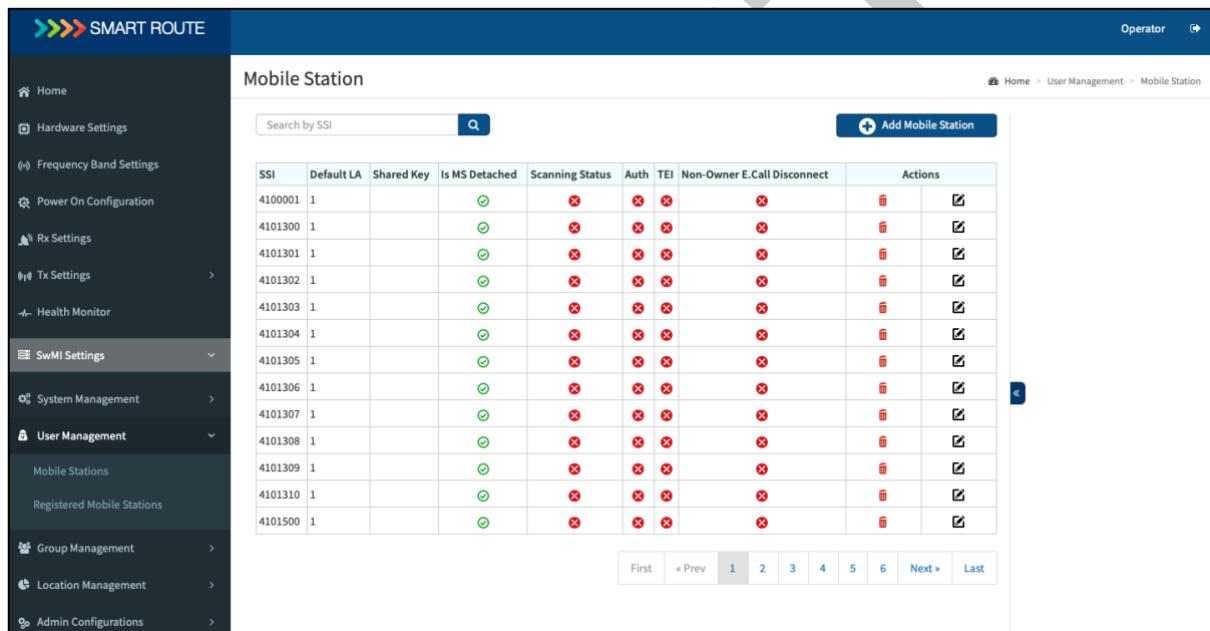
13.4. User Management

You can add, delete or modify user to the system by following the steps as below.

- On the left pane click on SwMI Settings -> User management
- Click on “Mobile Stations”
- You will see a list of registered mobile stations on the right pane.

13.4.1. Create

Click on the add mobile station button on the right-hand top corner



The screenshot shows the 'Mobile Station' page within the Smart Route web interface. The left sidebar is a navigation menu with the following items:

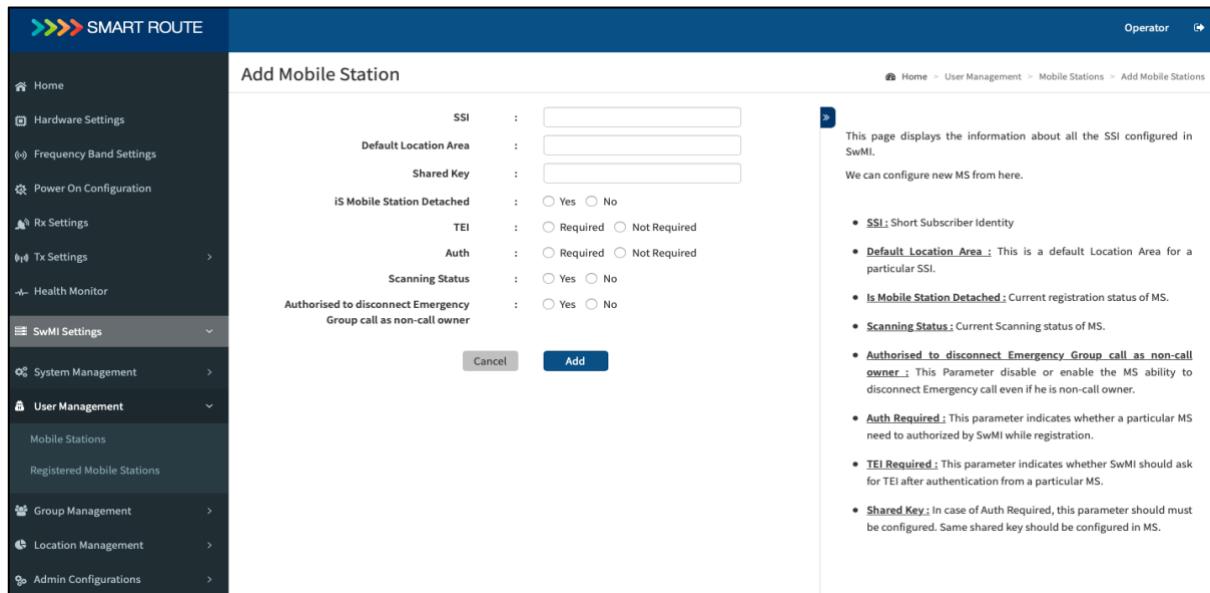
- Home
- Hardware Settings
- Frequency Band Settings
- Power On Configuration
- Rx Settings
- Tx Settings
- Health Monitor
- SwMI Settings** (selected)
- System Management
- User Management** (selected)
- Mobile Stations
- Registered Mobile Stations
- Group Management
- Location Management
- Admin Configurations

The main content area is titled 'Mobile Station' and contains a table of registered mobile stations. The table has the following columns:

SSI	Default LA	Shared Key	Is MS Detached	Scanning Status	Auth	TEI	Non-Owner E.Call Disconnect	Actions
4100001	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101300	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101301	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101302	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101303	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101304	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101305	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101306	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101307	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101308	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101309	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101310	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					
4101500	1	<input checked="" type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>					

At the top right of the table is a blue button labeled 'Add Mobile Station' with a plus sign icon. Below the table is a navigation bar with buttons for 'First', '< Prev', '1' (highlighted in grey), '2', '3', '4', '5', '6', 'Next >', and 'Last'.

The form to add a new mobile station will be displayed

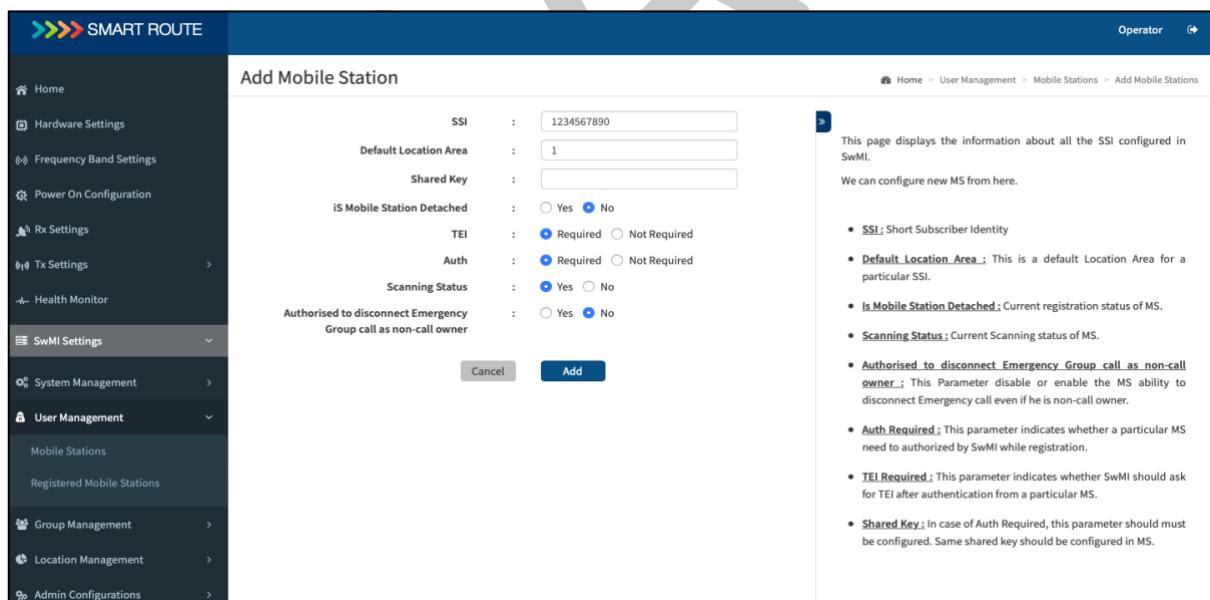


This page displays the information about all the SSI configured in SwMI.

We can configure new MS from here.

- SSI:** Short Subscriber Identity
- Default Location Area:** This is a default Location Area for a particular SSI.
- IS Mobile Station Detached:** Current registration status of MS.
- Scanning Status:** Current Scanning status of MS.
- Authorised to disconnect Emergency Group call as non-call owner:** This Parameter disable or enable the MS ability to disconnect Emergency call even if he is non-call owner.
- Auth Required:** This parameter indicates whether a particular MS need to authorized by SwMI while registration.
- TEI Required:** This parameter indicates whether SwMI should ask for TEI after authentication from a particular MS.
- Shared Key:** In case of Auth Required, this parameter should must be configured. Same shared key should be configured in MS.

Enter the details for the new user/mobile station and click on add

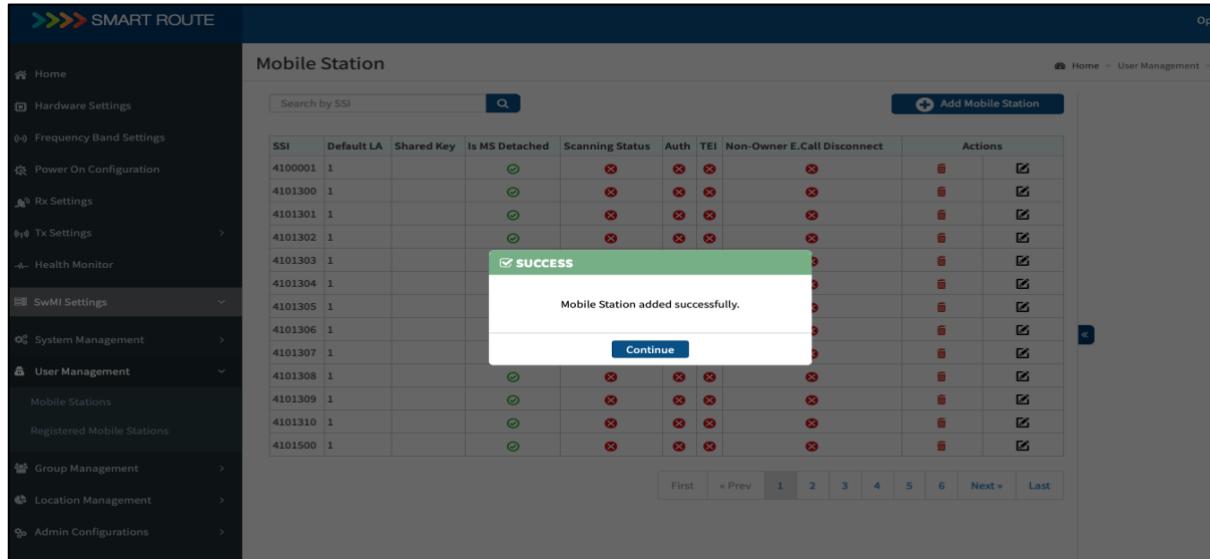


This page displays the information about all the SSI configured in SwMI.

We can configure new MS from here.

- SSI:** Short Subscriber Identity
- Default Location Area:** This is a default Location Area for a particular SSI.
- IS Mobile Station Detached:** Current registration status of MS.
- Scanning Status:** Current Scanning status of MS.
- Authorised to disconnect Emergency Group call as non-call owner:** This Parameter disable or enable the MS ability to disconnect Emergency call even if he is non-call owner.
- Auth Required:** This parameter indicates whether a particular MS need to authorized by SwMI while registration.
- TEI Required:** This parameter indicates whether SwMI should ask for TEI after authentication from a particular MS.
- Shared Key:** In case of Auth Required, this parameter should must be configured. Same shared key should be configured in MS.

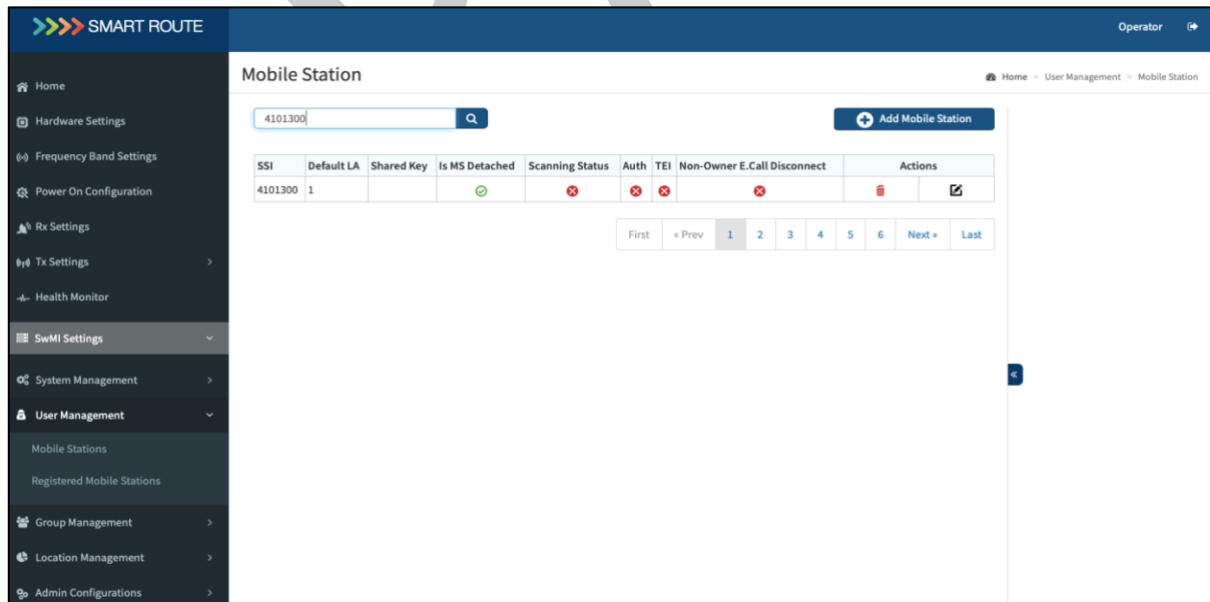
You will get a confirmation pop up upon successful addition of a new user



The screenshot shows the 'Mobile Station' list page. A modal window titled 'SUCCESS' is displayed in the center, stating 'Mobile Station added successfully.' with a 'Continue' button. The main table lists mobile stations with columns: SSI, Default LA, Shared Key, Is MS Detached, Scanning Status, Auth, TEI, Non-Owner E.Call Disconnect, and Actions. The 'Actions' column contains edit and delete icons. The table has 15 rows, with the last row being the newly added one.

13.4.2. Update

Navigate to user management, mobile stations and search for the user you wish to edit using the search box. In the search results select the mobile station / user you need to edit. In the tab actions, click on the edit button.



The screenshot shows the 'Mobile Station' list page with a search bar containing '4101300'. The table displays a single row for the user with SSI 4101300 and Default LA 1. The 'Actions' column for this row contains edit and delete icons. The table has 15 rows in total.

Edit the user details in the form that is displayed. Confirm and save the edit. A pop up appears on successful change of user configuration.

SMART ROUTE

Home > User Management > Mobile Stations > Update Mobile Stations

Operator

Update Mobile Station

SSI : 4101300

Default Location Area : 1

Shared Key :

iS Mobile Station Detached : Yes No

TEI : Required Not Required

Auth : Required Not Required

Scanning Status : Yes No

Authorised to disconnect Emergency Group call as non-call owner : Yes No

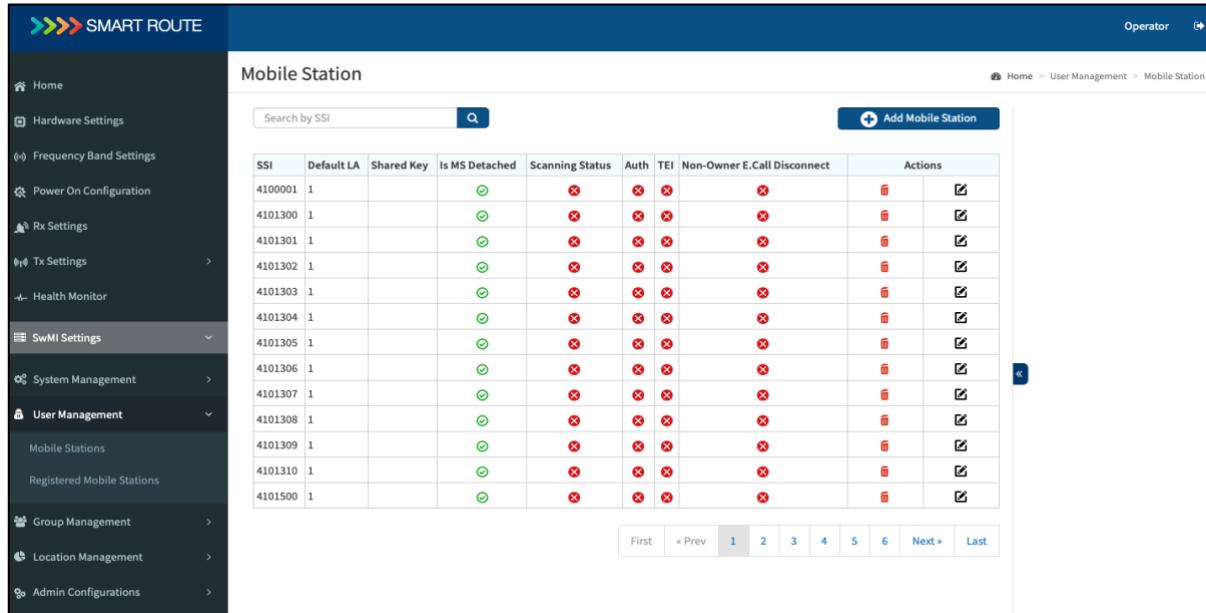
Cancel **Update**

This page displays the information about all the SSI configured in SwMI.
We can configure new MS from here.

- SSI:** Short Subscriber Identity
- Default Location Area :** This is a default Location Area for a particular SSI.
- iS Mobile Station Detached :** Current registration status of MS.
- Scanning Status :** Current Scanning status of MS.
- Authorised to disconnect Emergency Group call as non-call owner :** This Parameter disable or enable the MS ability to disconnect Emergency call even if he is non-call owner.
- Auth Required :** This parameter indicates whether a particular MS need to authorized by SwMI while registration.
- TEI Required :** This parameter indicates whether SwMI should ask for TEI after authentication from a particular MS.
- Shared Key :** In case of Auth Required, this parameter should must be configured. Same shared key should be configured in MS.

13.4.3. Delete

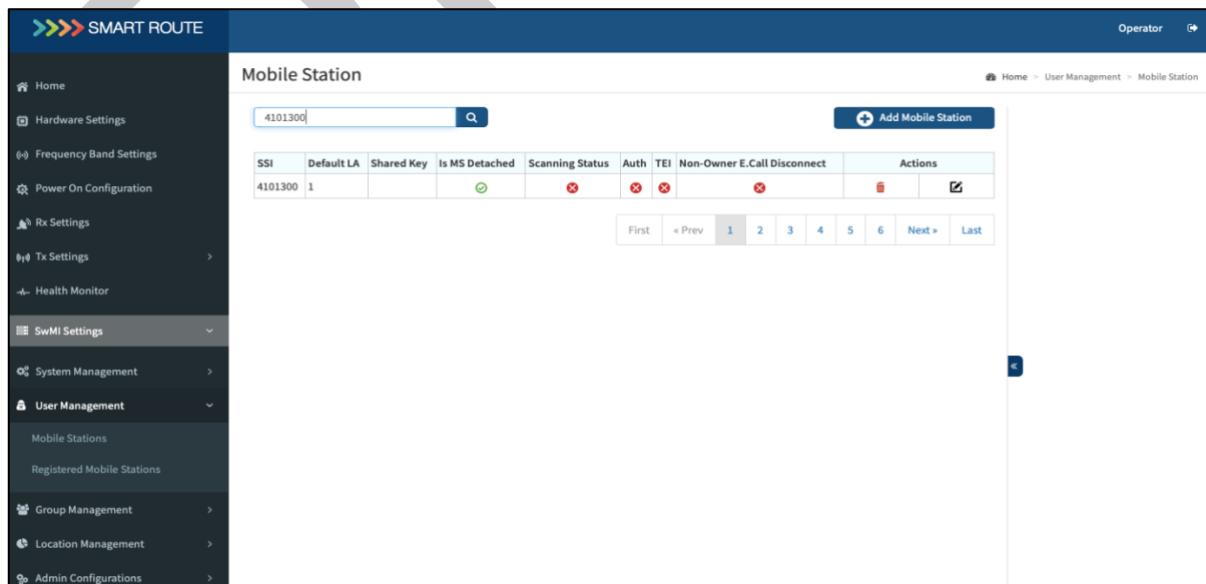
Click on user management & Navigate to “Mobile Stations”. A list of all mobile stations already added will be displayed.



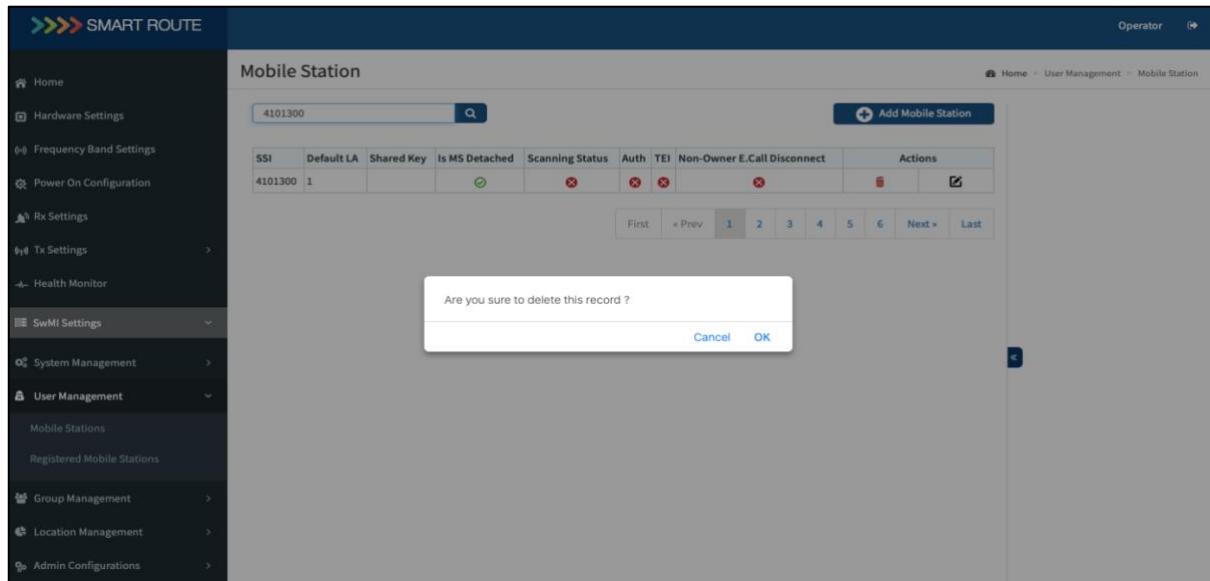
The screenshot shows the 'Mobile Station' list page. The left sidebar has 'User Management' selected. The main area shows a table of mobile stations with columns: SSI, Default LA, Shared Key, Is MS Detached, Scanning Status, Auth, TEI, Non-Owner E.Call Disconnect, and Actions. A search bar at the top is empty. A blue 'Add Mobile Station' button is in the top right. Page navigation buttons (First, < Prev, 1, 2, 3, 4, 5, 6, Next >, Last) are at the bottom.

SSI	Default LA	Shared Key	Is MS Detached	Scanning Status	Auth	TEI	Non-Owner E.Call Disconnect	Actions	
4100001	1		Green	Red	Red	Red	Red		
4101300	1		Green	Red	Red	Red	Red		
4101301	1		Green	Red	Red	Red	Red		
4101302	1		Green	Red	Red	Red	Red		
4101303	1		Green	Red	Red	Red	Red		
4101304	1		Green	Red	Red	Red	Red		
4101305	1		Green	Red	Red	Red	Red		
4101306	1		Green	Red	Red	Red	Red		
4101307	1		Green	Red	Red	Red	Red		
4101308	1		Green	Red	Red	Red	Red		
4101309	1		Green	Red	Red	Red	Red		
4101310	1		Green	Red	Red	Red	Red		
4101500	1		Green	Red	Red	Red	Red		

Search for the mobile station that you want to delete using the search box above the list. The details of the particular user will be displayed. In the tab ‘actions’, click on the recycle button to delete the corresponding user. A pop up will ask you to confirm the action. Click on ‘Yes’ to confirm and to delete the user.



The screenshot shows the 'Mobile Station' list page with a search bar containing '4101300'. The table and other elements are identical to the previous screenshot.



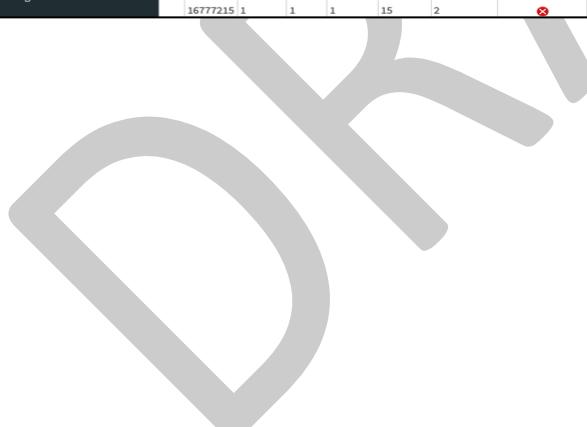
The screenshot shows the 'Mobile Station' page within the Smart Route web interface. The left sidebar contains navigation links for Home, Hardware Settings, Frequency Band Settings, Power On Configuration, Rx Settings, Tx Settings, Health Monitor, SwMI Settings (selected), System Management, User Management, Mobile Stations, Registered Mobile Stations, Group Management, Location Management, and Admin Configurations. The main content area is titled 'Mobile Station' and displays a table with a single row for SSI 4101300 and Default LA 1. The table includes columns for Shared Key (green circle), Is MS Detached (red X), Scanning Status (red X), Auth (red X), TEI (red X), Non-Owner E.Call Disconnect (red X), and Actions (trash and edit icons). A search bar with value '4101300' and a magnifying glass icon is at the top. A 'Add Mobile Station' button is in the top right. Below the table is a navigation bar with buttons for First, < Prev, 1, 2, 3, 4, 5, 6, Next >, and Last. A modal dialog box in the center asks 'Are you sure to delete this record?' with 'Cancel' and 'OK' buttons. The top right corner of the main content area shows 'Operator' and a gear icon.

13.5. Group Management

You can also add, configure Talk groups to Thunderbird-255 system similar to radio user addition. You can add, delete or modify settings for user groups by following the steps as below

- On the left pane click on SwMI Settings -> Group Management
- Click on Groups

You will see a list of groups that are already configured to Thunderbird-255

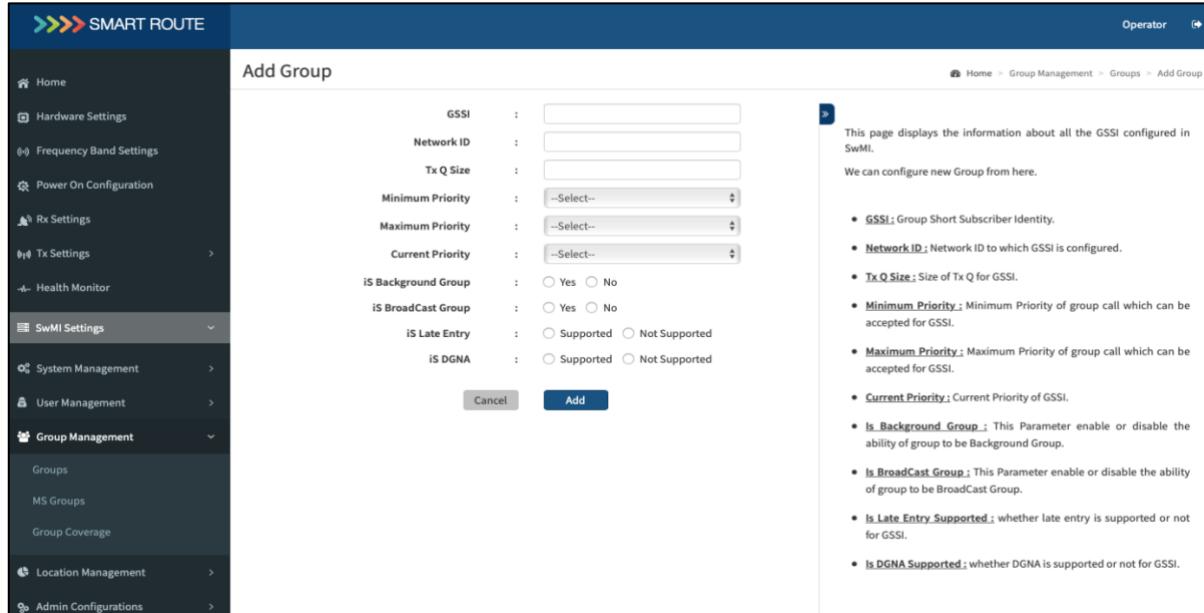


The screenshot shows the 'Groups' management interface in the Smart Route software. The left sidebar navigation includes Home, Hardware Settings, Frequency Band Settings, Power On Configuration, Rx Settings, Tx Settings, Health Monitor, SwMI Settings (selected), System Management, User Management, Group Management (selected), Groups, MS Groups, Group Coverage, Location Management, and Admin Configurations. The main content area is titled 'Groups' and displays a table of configured groups. The table columns are: GSSI, Network ID, Tx Q Size, Min Priority, Max Priority, Current Priority, IS Background Group, IS Broadcast Group, IS LE Supported, IS DGNA Supported, and Actions. The table contains 20 rows of data, each representing a group configuration. The 'Actions' column includes edit and delete icons. A blue 'Add Group' button is located at the top right of the table area. The top right corner of the interface shows the 'Operator' status.

GSSI	Network ID	Tx Q Size	Min Priority	Max Priority	Current Priority	IS Background Group	IS Broadcast Group	IS LE Supported	IS DGNA Supported	Actions
7101001	1	3	1	15	2	✗	✗	✗	✗	 
7101002	1	3	1	15	2	✗	✗	✗	✗	 
7101003	1	3	1	14	2	✗	✗	✗	✗	 
7101004	1	3	1	15	2	✗	✗	✗	✗	 
7101005	1	3	1	15	2	✗	✗	✗	✗	 
7101111	1	3	1	15	2	✗	✗	✗	✗	 
7102001	1	3	1	15	2	✗	✗	✗	✗	 
7102002	1	3	1	15	2	✗	✗	✗	✗	 
7102003	1	3	1	15	2	✗	✗	✗	✗	 
7102004	1	3	1	15	2	✗	✗	✗	✗	 
7109999	1	3	1	15	2	✗	✗	✗	✗	 
7110000	1	3	1	15	2	✗	✗	✗	✗	 
7777777	1	3	1	15	2	✗	✗	✗	✗	 
11112221	1	3	1	15	2	✗	✗	✗	✗	 
11112222	1	3	1	15	2	✗	✗	✗	✗	 
11112223	1	3	1	14	2	✗	✗	✗	✗	 
11112224	1	3	1	15	2	✗	✗	✗	✗	 
16777215	1	1	1	15	2	✗	✗	✗	✗	 

13.5.1. Create

Click on the add group button on the right-hand top corner & and form a to add new groups would appear. Enter the details for the group and click on add.



This screenshot shows the 'Add Group' form in the Smart Route web interface. The form fields are as follows:

- GSSI:
- Network ID:
- Tx Q Size:
- Minimum Priority:
- Maximum Priority:
- Current Priority:
- iS Background Group: Yes No
- iS BroadCast Group: Yes No
- iS Late Entry: Supported Not Supported
- iS DGNA: Supported Not Supported

Buttons: Cancel, Add

Page Header: SMART ROUTE

Page Title: Add Group

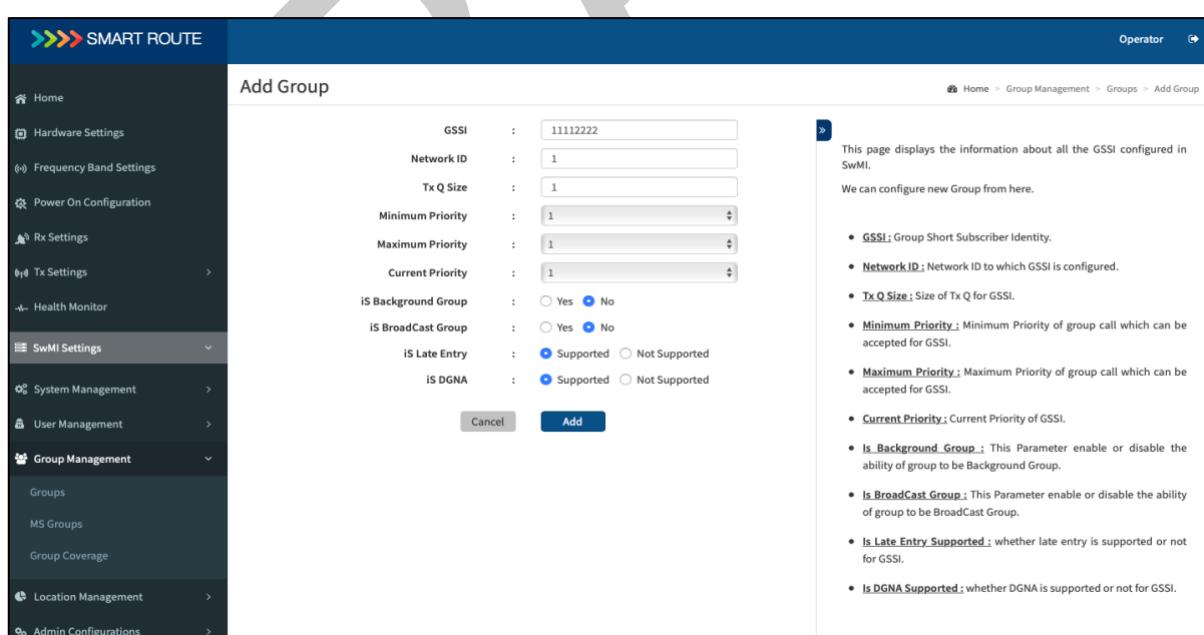
Page Sub-Header: Home > Group Management > Groups > Add Group

Page Footer: Operator

Right Panel Description: This page displays the information about all the GSSI configured in SwMi. We can configure new Group from here.

Right Panel List:

- **GSSI:** Group Short Subscriber Identity.
- **Network ID:** Network ID to which GSSI is configured.
- **Tx Q Size:** Size of Tx Q for GSSI.
- **Minimum Priority:** Minimum Priority of group call which can be accepted for GSSI.
- **Maximum Priority:** Maximum Priority of group call which can be accepted for GSSI.
- **Current Priority:** Current Priority of GSSI.
- **iS Background Group:** This Parameter enable or disable the ability of group to be Background Group.
- **iS BroadCast Group:** This Parameter enable or disable the ability of group to be BroadCast Group.
- **iS Late Entry Supported:** whether late entry is supported or not for GSSI.
- **iS DGNA Supported:** whether DGNA is supported or not for GSSI.



This screenshot shows the 'Add Group' form in the Smart Route web interface. The form fields are as follows:

- GSSI:
- Network ID:
- Tx Q Size:
- Minimum Priority:
- Maximum Priority:
- Current Priority:
- iS Background Group: Yes No
- iS BroadCast Group: Yes No
- iS Late Entry: Supported Not Supported
- iS DGNA: Supported Not Supported

Buttons: Cancel, Add

Page Header: SMART ROUTE

Page Title: Add Group

Page Sub-Header: Home > Group Management > Groups > Add Group

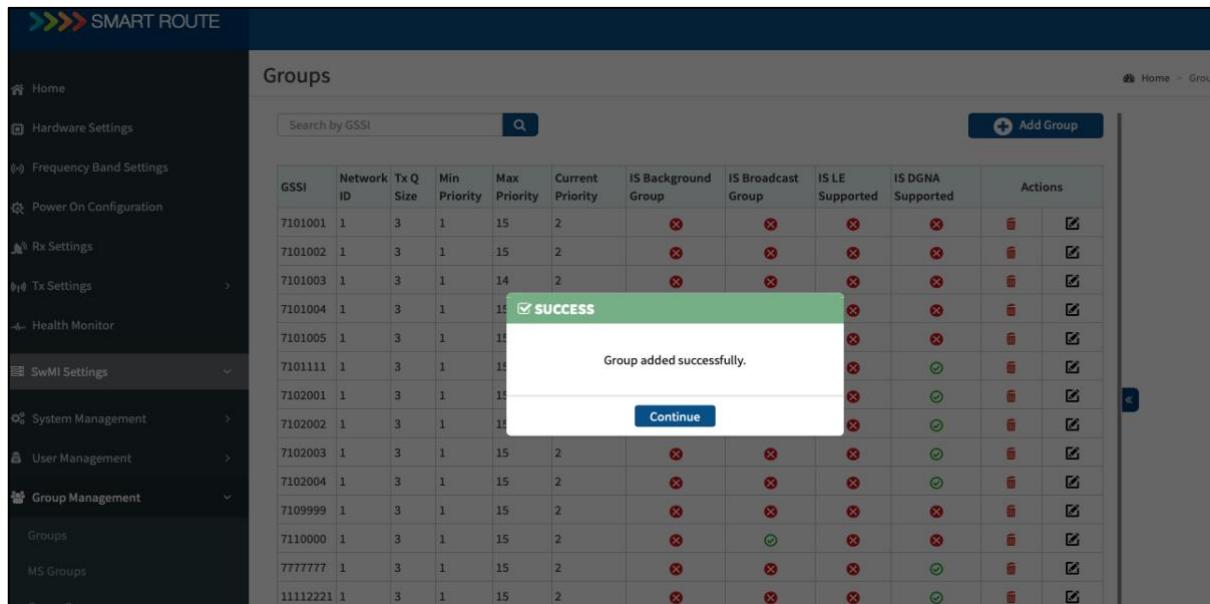
Page Footer: Operator

Right Panel Description: This page displays the information about all the GSSI configured in SwMi. We can configure new Group from here.

Right Panel List:

- **GSSI:** Group Short Subscriber Identity.
- **Network ID:** Network ID to which GSSI is configured.
- **Tx Q Size:** Size of Tx Q for GSSI.
- **Minimum Priority:** Minimum Priority of group call which can be accepted for GSSI.
- **Maximum Priority:** Maximum Priority of group call which can be accepted for GSSI.
- **Current Priority:** Current Priority of GSSI.
- **iS Background Group:** This Parameter enable or disable the ability of group to be Background Group.
- **iS BroadCast Group:** This Parameter enable or disable the ability of group to be BroadCast Group.
- **iS Late Entry Supported:** whether late entry is supported or not for GSSI.
- **iS DGNA Supported:** whether DGNA is supported or not for GSSI.

You will get a confirmation upon successful addition of a new group. Click on 'Continue' to save.

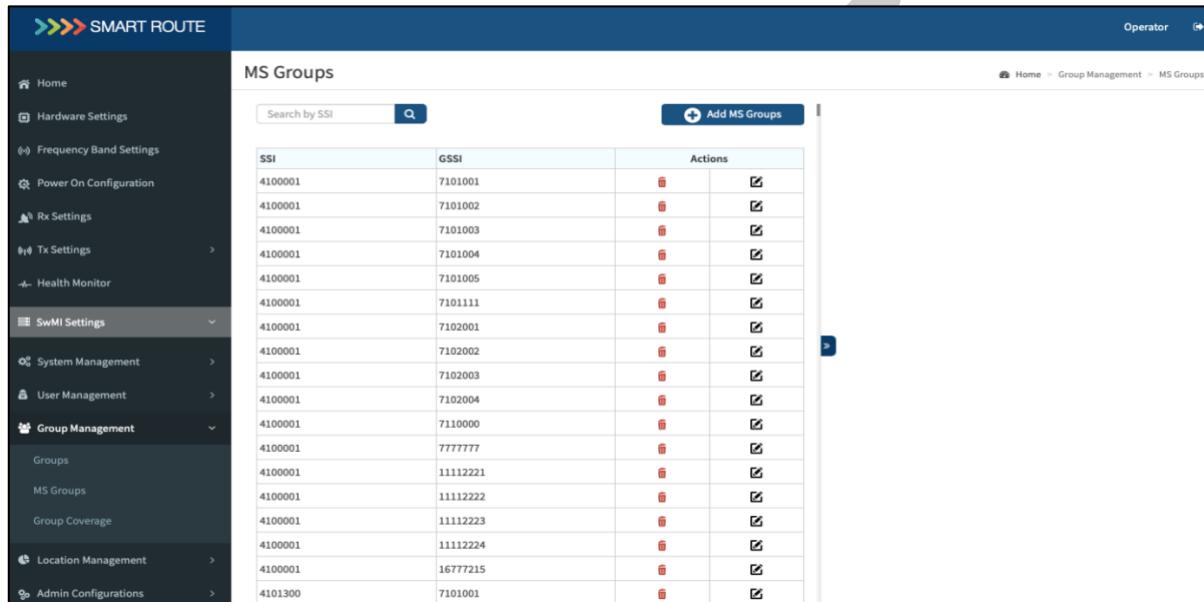


The screenshot shows the 'Groups' page in the Smart Route web interface. The left sidebar includes options like Home, Hardware Settings, Frequency Band Settings, Power On Configuration, Rx Settings, Tx Settings, Health Monitor, SwMI Settings (selected), System Management, User Management, and Group Management. The main content area displays a table of groups with columns: GSSI, Network ID, Tx Q Size, Min Priority, Max Priority, Current Priority, IS Background Group, IS Broadcast Group, IS LE Supported, IS DGNA Supported, and Actions. A modal window in the center of the table area is titled 'SUCCESS' and contains the message 'Group added successfully.' with a 'Continue' button. The table contains 15 rows of group data.

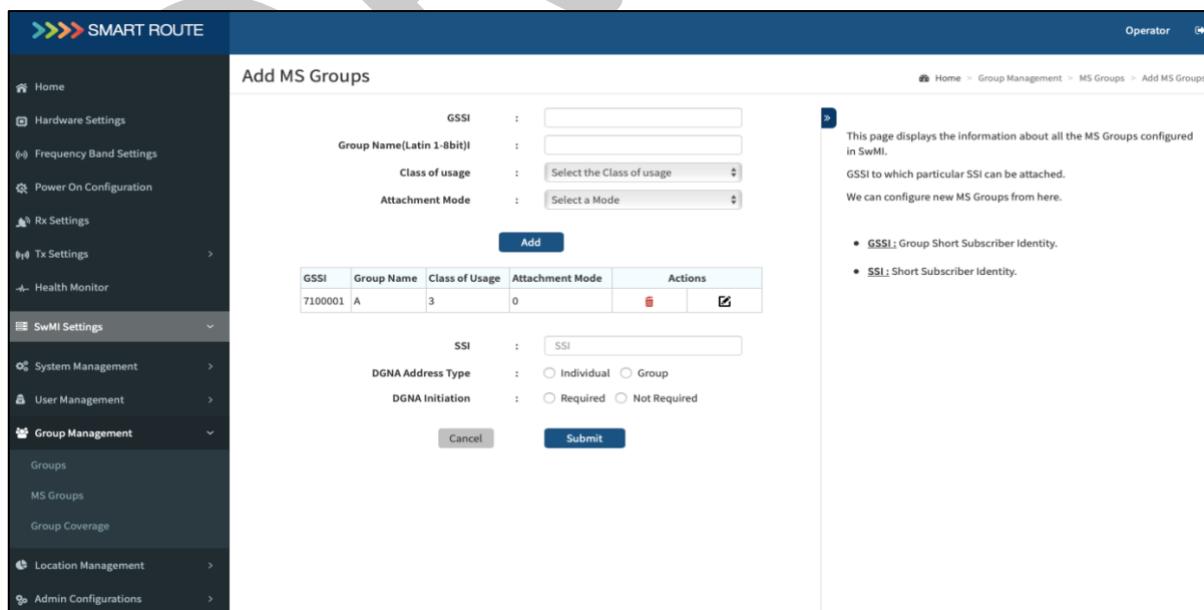
GSSI	Network ID	Tx Q Size	Min Priority	Max Priority	Current Priority	IS Background Group	IS Broadcast Group	IS LE Supported	IS DGNA Supported	Actions	
7101001	1	3	1	15	2	✗	✗	✗	✗		
7101002	1	3	1	15	2	✗	✗	✗	✗		
7101003	1	3	1	14	2	✗	✗	✗	✗		
7101004	1	3	1	15	2	✗	✗	✗	✗		
7101005	1	3	1	15	2	✗	✗	✗	✗		
7101111	1	3	1	15	2	✗	✗	✗	✗		
7102001	1	3	1	15	2	✗	✗	✗	✗		
7102002	1	3	1	15	2	✗	✗	✗	✗		
7102003	1	3	1	15	2	✗	✗	✗	✗		
7102004	1	3	1	15	2	✗	✗	✗	✗		
7109999	1	3	1	15	2	✗	✗	✗	✗		
7110000	1	3	1	15	2	✗	✗	✗	✗		
7777777	1	3	1	15	2	✗	✗	✗	✗		
111122221	1	3	1	15	2	✗	✗	✗	✗		

13.5.2. Assign a radio user (SSI) to a talk group (GSSI)

- Click on Group management -> MS Groups
- Click on the Add MS Group button on the right-hand top corner
- This option opens an editable form, in which a new assignment to be done as shown below
- Enter the SSI, GSSI and other required information.
- Addition of a Radio user to a Talk group initiates DGNA notification to add the radio to the group immediately.



SSI	GSSI	Actions
4100001	7101001	
4100001	7101002	
4100001	7101003	
4100001	7101004	
4100001	7101005	
4100001	7101111	
4100001	7102001	
4100001	7102002	
4100001	7102003	
4100001	7102004	
4100001	7110000	
4100001	7777777	
4100001	11112221	
4100001	11112222	
4100001	11112223	
4100001	11112224	
4100001	16777215	
4101300	7101001	



This page displays the information about all the MS Groups configured in SwMI. GSSI to which particular SSI can be attached. We can configure new MS Groups from here.

- **GSSI:** Group Short Subscriber Identity.
- **SSI:** Short Subscriber Identity.

GSSI	Group Name	Class of Usage	Attachment Mode	Actions
7100001	A	3	0	

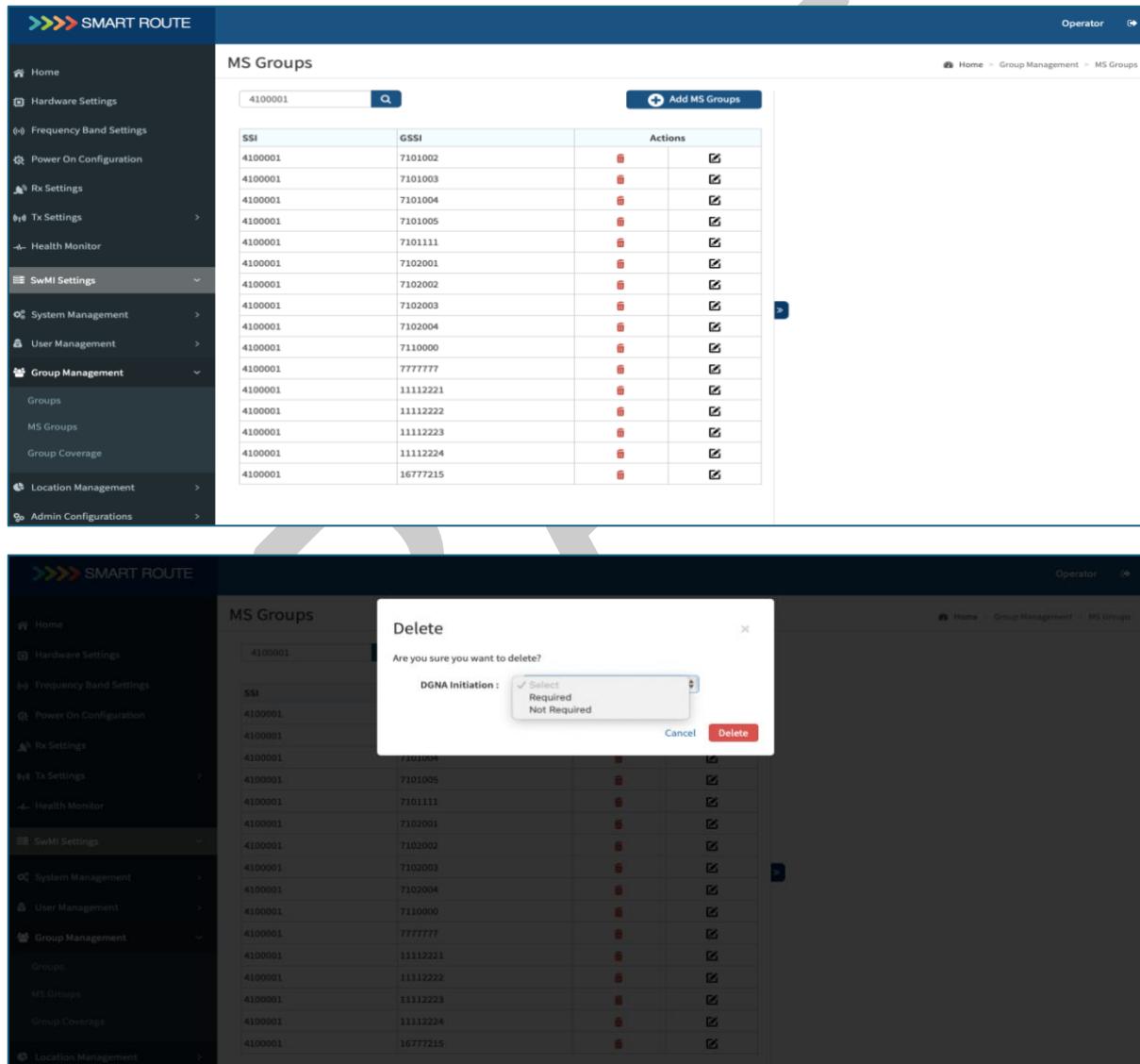
Add

SSI	DGNA Address Type	DGNA Initiation
SSI	<input type="radio"/> Individual <input type="radio"/> Group	<input type="radio"/> Required <input type="radio"/> Not Required

Cancel **Submit**

13.5.3. Unassign a radio user (SSI) from a talk group (GSSI)

- Click on Group management
- Go to MS Groups
- Search for the Radio user by SSI, and select delete option under Actions
- Select corresponding delete option under actions for the Talk group which has to be removed for the Radio user.
- Doing that would show a pop up to select DGNA action to be done.
- Select appropriate DGNA action and confirm.



The image contains two screenshots of the Smart Route web interface. Both screenshots are titled 'MS Groups' and are located under the 'Group Management' section of the navigation bar.

Screenshot 1: MS Groups List

This screenshot shows a table of MS Groups. The columns are labeled 'SSI' and 'GSSI'. Each row contains two SSI values. To the right of each row are two actions: a red delete icon and a green edit icon. The table contains approximately 20 rows of data.

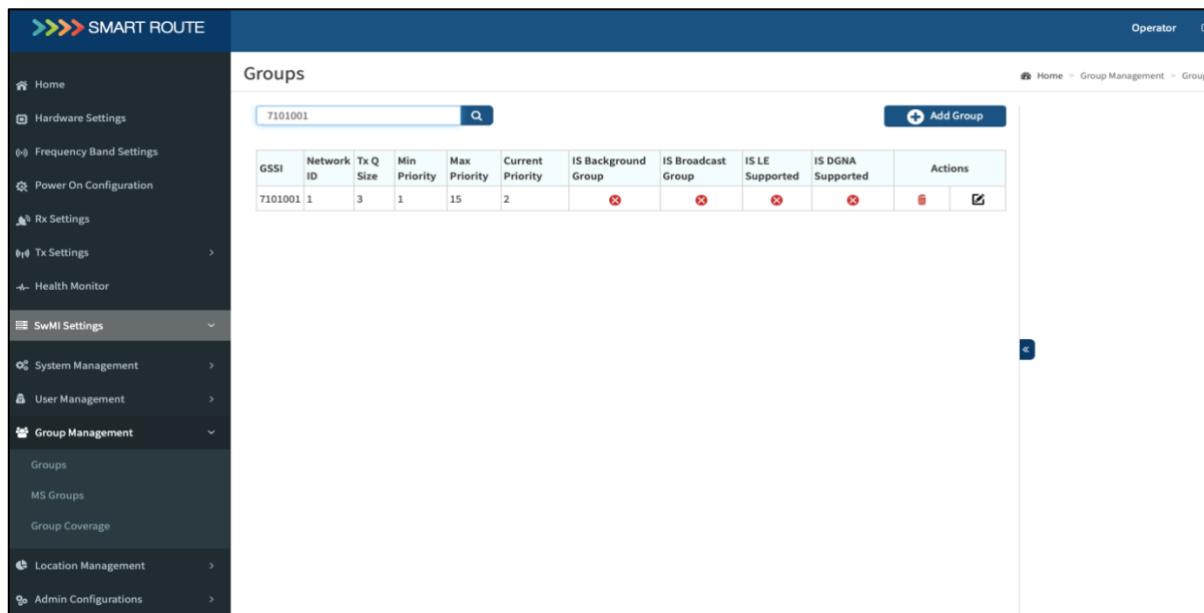
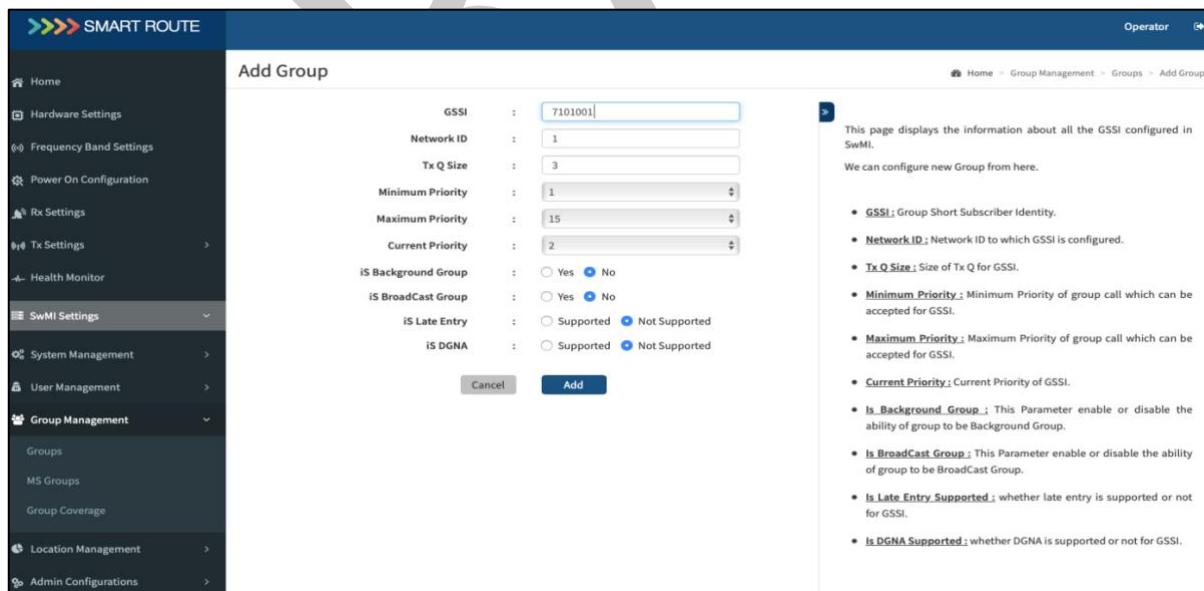
SSI	GSSI	Actions
4100001	7101002	
4100001	7101003	
4100001	7101004	
4100001	7101005	
4100001	7101111	
4100001	7102001	
4100001	7102002	
4100001	7102003	
4100001	7102004	
4100001	7110000	
4100001	7777777	
4100001	11112221	
4100001	11112222	
4100001	11112223	
4100001	11112224	
4100001	16777215	

Screenshot 2: Delete Confirmation Pop-up

This screenshot shows a 'Delete' confirmation dialog box. The text inside the box reads: 'Are you sure you want to delete?'. Below this is a dropdown menu labeled 'DGNA Initiation' with three options: 'Select', 'Required', and 'Not Required'. At the bottom of the dialog are 'Cancel' and 'Delete' buttons.

13.5.4. Update

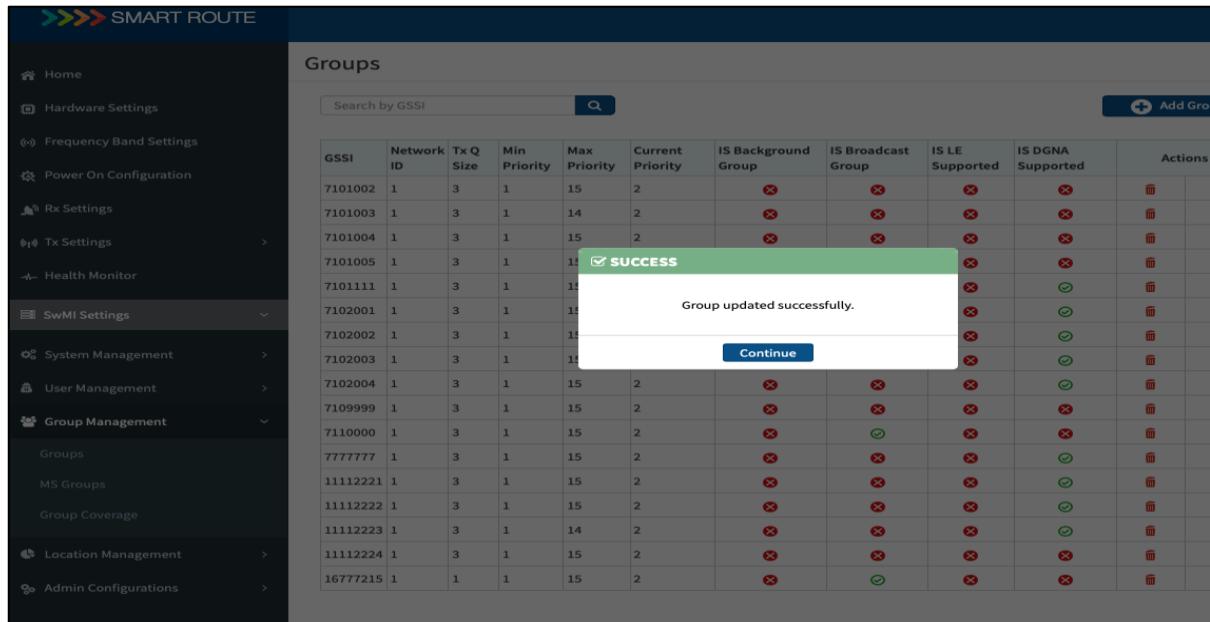
- Click on Group management -> Groups
- Search for the group you wish to edit using the search box
- From the search results select the group that you need to edit
- Under actions, click on the edit button corresponding to the particular group
- Edit group details in the form that is displayed

This page displays the information about all the GSSI configured in SwMI. We can configure new Group from here.

- **GSSI:** Group Short Subscriber Identity.
- **Network ID:** Network ID to which GSSI is configured.
- **Tx Q Size:** Size of Tx Q for GSSI.
- **Minimum Priority:** Minimum Priority of group call which can be accepted for GSSI.
- **Maximum Priority:** Maximum Priority of group call which can be accepted for GSSI.
- **Current Priority:** Current Priority of GSSI.
- **Is_Broadcast_Group:** This Parameter enable or disable the ability of group to be Broadcast Group.
- **Is_Late_Entry_Supported:** whether late entry is supported or not for GSSI.
- **Is_DGNA_Supported:** whether DGNA is supported or not for GSSI.

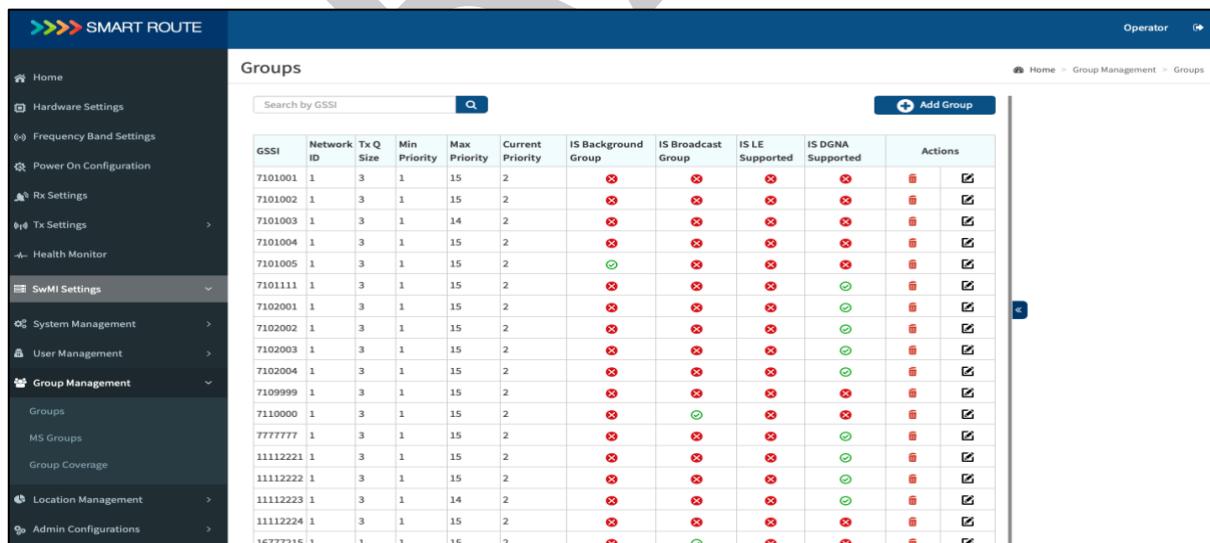
Enter the new values in respective fields and save it.



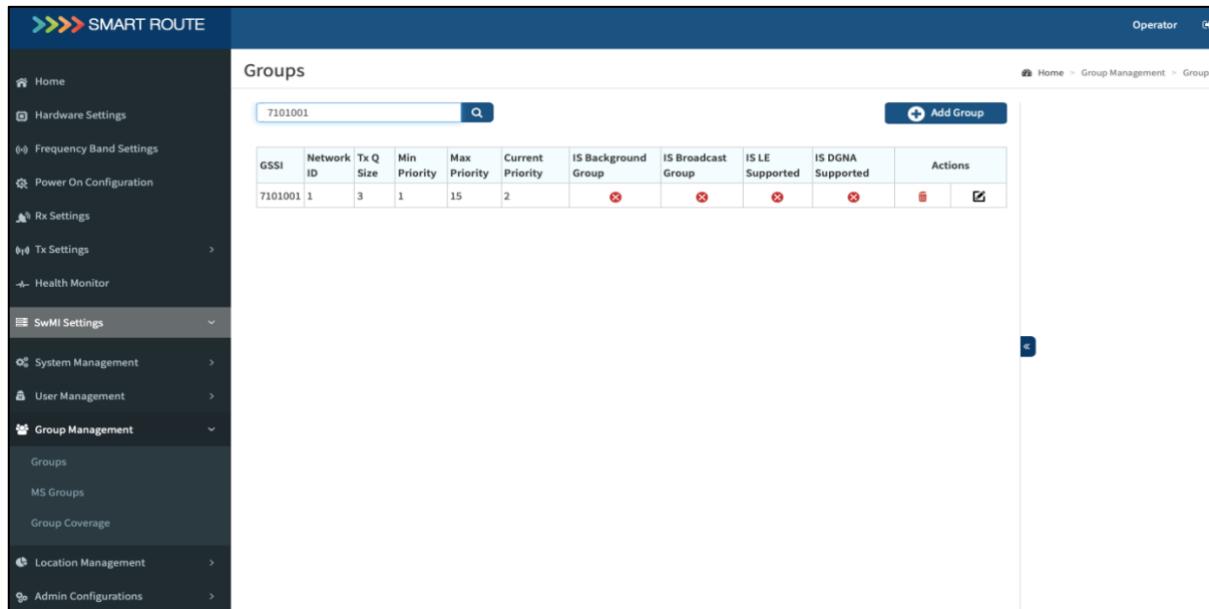
The screenshot shows the Smart Route web interface with the 'Groups' page selected. The left sidebar includes options like Home, Hardware Settings, Frequency Band Settings, Power On Configuration, Rx Settings, Tx Settings, Health Monitor, SwMI Settings, System Management, User Management, Group Management (selected), Location Management, and Admin Configurations. The main content area displays a table of user groups with columns: GSSI, Network ID, Tx Q Size, Min Priority, Max Priority, Current Priority, IS Background Group, IS Broadcast Group, IS LE Supported, IS DGNA Supported, and Actions. A modal window in the center says 'SUCCESS' and 'Group updated successfully.' with a 'Continue' button.

13.5.5. Delete

- Click on Group management
- Go to Groups
- A list of all user groups already registered will be displayed
- Use the search box above the list to search for the group that you want to delete

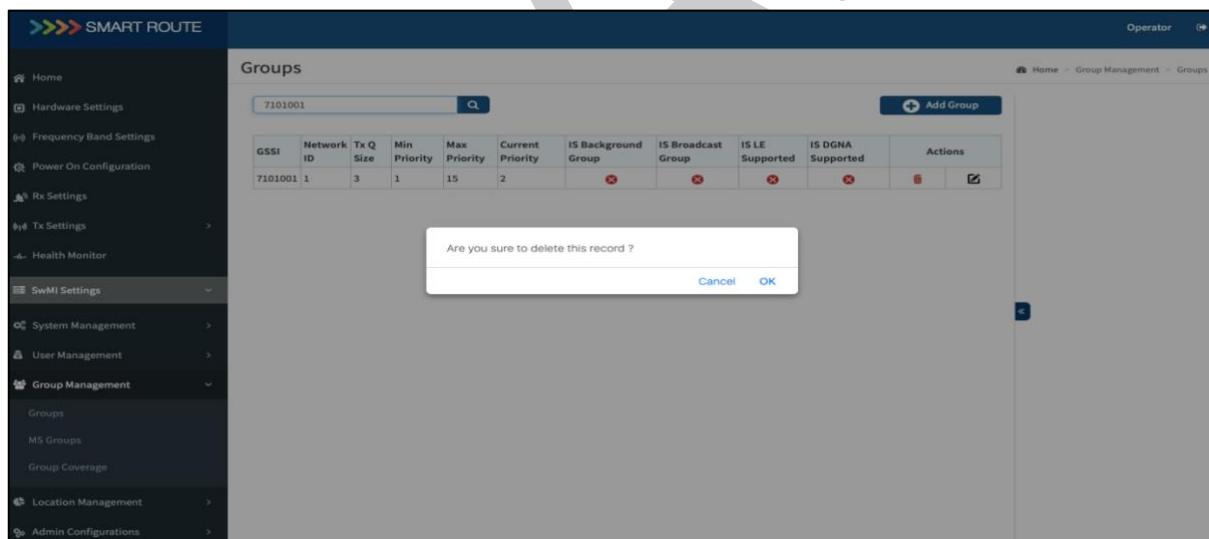


The screenshot shows the Smart Route web interface with the 'Groups' page selected. The left sidebar includes options like Home, Hardware Settings, Frequency Band Settings, Power On Configuration, Rx Settings, Tx Settings, Health Monitor, SwMI Settings (selected), System Management, User Management, Group Management (selected), Location Management, and Admin Configurations. The main content area displays a table of user groups with columns: GSSI, Network ID, Tx Q Size, Min Priority, Max Priority, Current Priority, IS Background Group, IS Broadcast Group, IS LE Supported, IS DGNA Supported, and Actions. A modal window in the center says 'SUCCESS' and 'Group updated successfully.' with a 'Continue' button.



The screenshot shows the 'Groups' page in the Smart Route web interface. The left sidebar contains navigation links for Home, Hardware Settings, Frequency Band Settings, Power On Configuration, Rx Settings, Tx Settings, Health Monitor, SwMI Settings, System Management, User Management, Group Management (selected), Location Management, and Admin Configurations. The main content area is titled 'Groups' and shows a table with one row of data. The table columns are: GSSI, Network ID, Tx Q Size, Min Priority, Max Priority, Current Priority, IS Background Group, IS Broadcast Group, IS LE Supported, IS DGNA Supported, and Actions. The data row is 7101001, with values: 1, 3, 1, 15, 2, empty, empty, empty, empty, empty, and Actions (Recycle bin icon). A search bar with '7101001' and a magnifying glass icon is at the top. A blue 'Add Group' button is on the right. The top right corner shows 'Operator'.

- The details of the particular group will be displayed
- Under actions, click on the recycle button to delete the corresponding group
- Click 'Yes' on the popup dialogue box to confirm and to delete the group.

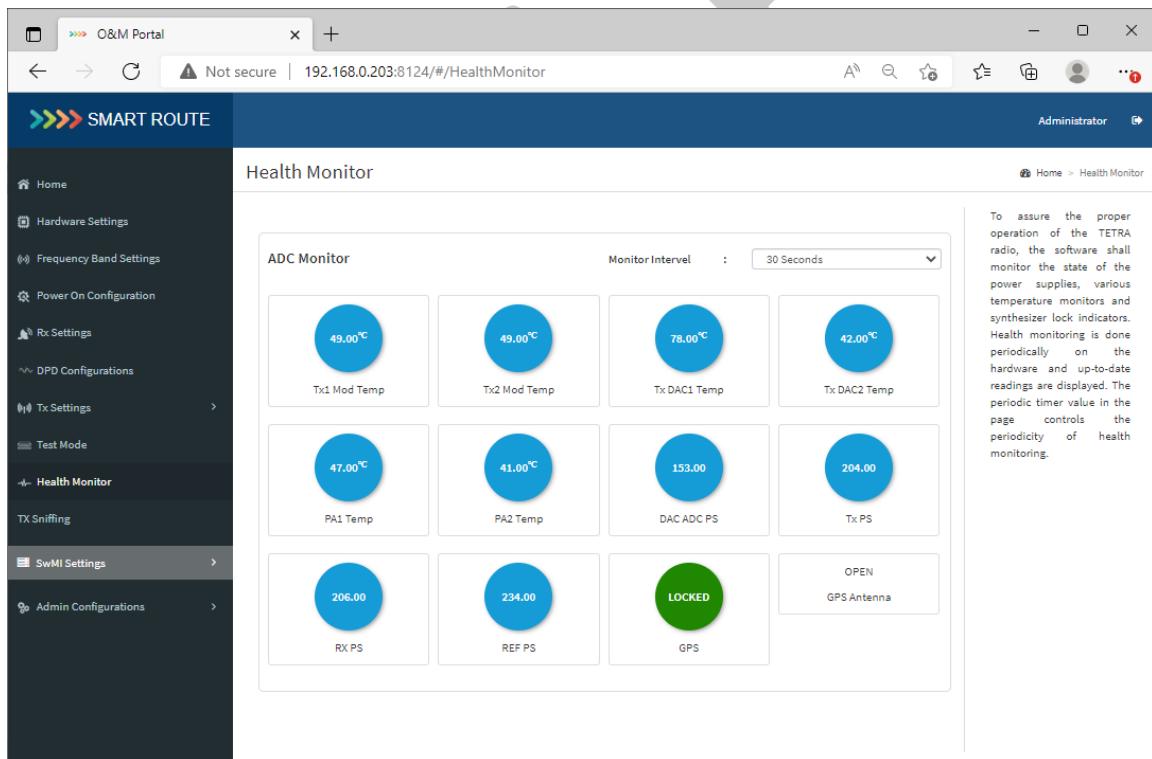


The screenshot shows the 'Groups' page with a delete confirmation dialog box. The dialog box contains the text 'Are you sure to delete this record ?' with 'Cancel' and 'OK' buttons. The background table and sidebar are identical to the previous screenshot.

14. Trouble Shooting

14.1. Health Monitor

To assure the proper operation of the TETRA radio, the software monitors the state of the power supplies, various temperature monitors, GPS Status and synthesizer lock indicators periodically. The current state of some of the monitored conditions are displayed on the Health Monitor screen as shown below. Temperatures are indicative of the various board and PA temperatures. If defined thresholds are exceeded, an alarm will be raised and transmission halted. Operator action is required to return carriers to service once the fault condition has cleared. The Power Supply (PS) monitor values are compared to internal thresholds for each board to validate the proper power supply voltages on that board. Valid Power Supply values are indicated by Blue. A Power Supply failure will be indicated by red.



Health Monitor

ADC Monitor

	Monitor Interval	Value
Tx1 Mod Temp	30 Seconds	49.00°C
Tx2 Mod Temp		49.00°C
Tx DAC1 Temp		78.00°C
Tx DAC2 Temp		42.00°C
PA1 Temp		47.00°C
PA2 Temp		41.00°C
DAC ADC PS		153.00
Tx PS		204.00
RX PS		206.00
REF PS		234.00
GPS		LOCKED

OPEN GPS Antenna

To assure the proper operation of the TETRA radio, the software shall monitor the state of the power supplies, various temperature monitors and synthesizer lock indicators. Health monitoring is done periodically on the hardware and up-to-date readings are displayed. The periodic timer value in the page controls the periodicity of health monitoring.

14.1.1. GPS Status

The GPS status is displayed as two items. The GPS indicator shows the current state of the GPS receiver. Displayed values are as follows:

- “INVALID”, indicating that the GPS receiver is initializing after power on;
- “LOCKED”, indicating that the GPS receiver is locked to the satellite constellation and frequency reference is synchronized to GPS;
- “UNLOCKED”, indicating that the GPS signal has been lost and a time in seconds is displayed indicating the holdover time. If the GPS signal is not restored prior to the holdover time reaching 86400 seconds (24 hours), transmission will be disabled.

The second indicator shows the state of the GPS Antenna. Displayed values are as follows:

- “INVALID”, indicating that the GPS receiver is initializing after power on and has not reported the state of the antenna connection;
- “OPEN”, indicating that the current draw is below 8 mA which is a valid condition if the GPS signal is coming from a distribution system and the antenna is not being powered by the Thunder 255;
- “NORMAL”, indicating the antenna is drawing between 8 and 150 mA;
- “SHORT”, indicating the antenna is drawing more than 150 mA. This conditions should be investigated by the operator should it be observed.