NETWORK MANAGEMENT SYSTEM

USER MANUAL

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Preface

Network management systems are nowadays among the most essential elements of a successfully functioning computer network. The maintenance and configuration of network devices, servers and services are the key parameters of a network management system. To ensure the reliable and secure management of devices and services, it is necessary to design a network in such a manner that it provides the highest level of security isolation of management traffic from production traffic. Another aspect of the successful management of computer network concerns the network protocols used for this purpose, as well as their implementation i.e. the way they are used.

Frog Cellsat NMS provides real-time network management tool which can monitor the repeater network 24X7 and provide alerts. It is developed in compliance with FCAPS (an ISO Telecommunication Management Network model & framework for network management) the system embraces fault, configuration, administration, performance & security management features.

With the capability to remotely monitor and control, the system enables easier diagnosis and troubleshooting activities. Repeater parameters such as UL and DL gain setting and band tunability can be controlled remotely. The architecture leads to easy maintenance and availability management. NMS is easily deployable, customizable and scalable.

NMS Proposal	
Software Name	NMS
Proposed by	Frog Cellsat Limited.
Developed by	Frog Cellsat Limited.
Authorized User	Production Dept, R&D Dept, Operator

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Chapter 1

Introduction to GPRS NMS

1.1 Framework of GPRS NMS

GPRS NMS is an easy-to-use web-based application that allows users to supervise the repeater performance inside a bigger network management framework. It assists with network device discovery, network device monitoring and intelligent notifications (synthesizer alarm/electricity alarm). It usually records data from a network's remote points to carry out central reporting to a system administrator.

The key benefit to NMS is that it permits users to monitor or manage the repeater performance using a single server. Thus, it is not only a cost effective but also an improved and productive solution.

1.2 Architecture of GPRS NMS

Repeater Access through NMS

Network Management System **(NMS)** is a GPRS based application. So, to ascertain the repeater performance, both NMS server and repeater should have internet access. Repeaters get internet connectivity through SIM Module. As soon as the GPRS enabled SIM will be inserted in the repeater, it gets register to the network & a dynamic IP will be assigned. Now, these repeaters start sending data **(like repeater id, location etc.)** to NMS Server on a dedicated static IP/Port (TCP Port-1001) in encrypted format on TCP/IP enabled platform.
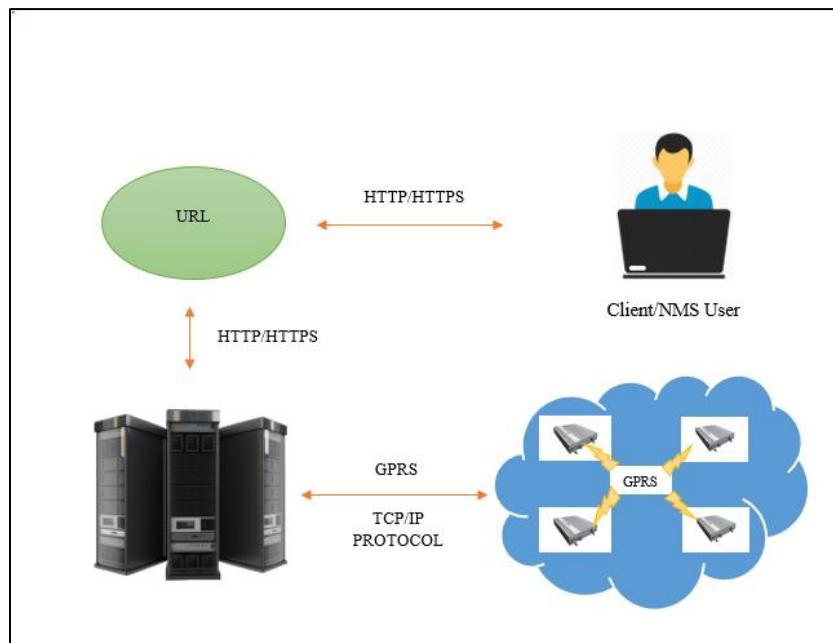

Figure 1 NMS Network Architecture

Whenever any information is required, NMS server connects with repeater on TCP/IP connection, fetches the information and displays on the internal webpage on https Protocol.

Access Point Name (APN): An **Access Point Name** (**APN**) is a gateway between a GSM, GPRS, 3G or 4G mobile network and another computer network, frequently the public Internet. A mobile device making a data connection must be configured with an **APN** to present to the carrier.

Frog Cellsat Ltd. needs client's standard APN to make out the repeater performance incessantly through NMS. Even as the client provides the standard APN, our company sets up the APN details at the repeater level and when the SIM **(provided by the clients)** is inserted in the repeater, it will be automatically connected to internet. The APN details will be programmed within the repeater, a customized APN can also be deployed which will work only with repeater firmware and hence be more secure.

Repeater Connectivity to network

As the data traffic arises at the repeater, it goes to base transceiver station over the air. Then, the BTS facilitates the wireless communication between user equipment and networks in control of Base station controller. BSC is responsible for the allocation of radio resources to a mobile call and for the handovers that are made between base stations under its control.

The PCU or Packet Control Unit is a hardware router that is added to the BSC. It differentiates data destined for the standard GSM network **(circuit switched data)** and for the GPRS network **(Packet Switched Data)**.
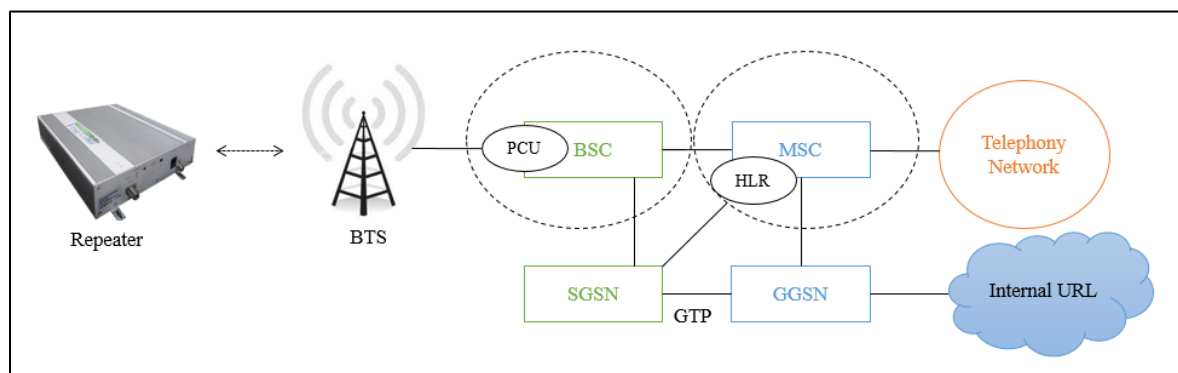

Figure 2 Repeater Connectivity to network

MSC: A mobile switching center **(MSC)** is the centerpiece of a network switching subsystem (NSS). The MSC is mostly associated with communication switching functions, such as call set-up, release, and routing. However, it also performs a host of other duties, including routing.

SMS messages, conference calls, fax, and service billing as well as interfacing with other networks, such as the public switched telephone network **(PSTN).**

The MSC is structured so that base stations connect to it, while it connects to the PSTN. Because cellphones connect to these base stations, all forms of communication, whether between two cell phones or between a cell phone and a landline telephone, travel through the MSC.

A small network operator may employ only one MSC, while a large operator requires multiple MSCs. The MSC plays a significant role in handovers, particularly handovers involving multiple base station controllers - known as inter-BSC or intra-MSC handovers - as well as those involving multiple MSCs, known as inter-MSC handovers.

GSN: GPRS Support Node **(GSN)** is a network node which supports the use of GPRS in the GSM core network. All GSNs should have a **Gn interface** and support the GPRS tunneling protocol. There are two key variants of the GSN, namely SGSN and GGSN.

SGSN: Serving GPRS Support Node **(SGSN)** performs the same function as Mobile Switching Centre (MSC) does for voice traffic. It forms the gateway within the network and provides a variety of services to the mobiles:

- Packet routing and transfer
- Mobility management
- Attach/detach
- Authentication

There is a location register within the SGSN and it stores location information **(e.g., current cell, current VLR).** It also stores the user profiles (e.g., IMEI, packet addresses used) for all the GPRS users registered with the SGSN.

GGSN: Gateway GPRS Support Node **(GGSN)** forms the gateway to the outside world. It can be a combination of a gateway, router and firewall as it hides the internal network to the outside. In operation, when the GGSN receives data addressed to a specific user, it checks if the user is active, then forwarding the data. In the opposite direction, packet data from the mobile is routed to the right destination network by the GGSN.

1.3 NMS Data Polling

Network Management System **(NMS)** uses the data polling to gather the repeater status continually. GPRS NMS Data can be achieved via URL Polling.
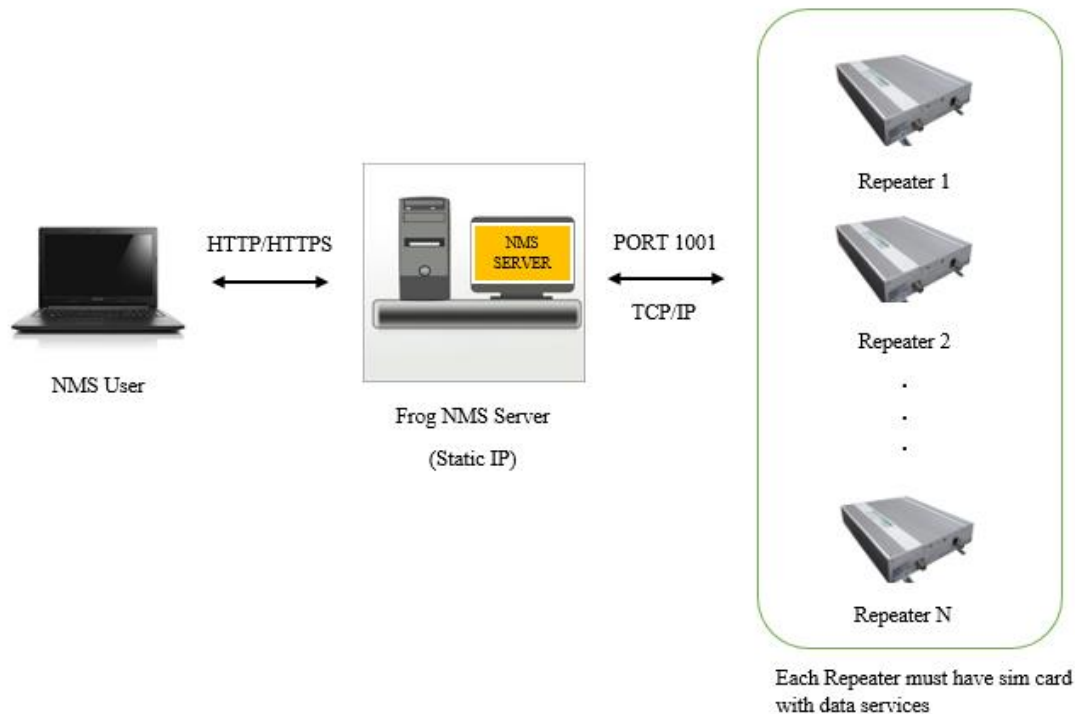
Figure 3 NMS Data Polling

URL Polling: In URL Polling, the service engineer can login the internal URL in the format of aaa.bbb.ccc.ddd:zzzz **(aaa.bbb.ccc.ddd represents the static IP and zzzz states the port number)** on the web page & can fetch information of the status of any circle network as well as individual repeater.

1.4 NMS Alarm Communication

As the repeater will ping the NMS server over TCP/IP Protocol, the repeater condition will be updated at the NMS server. And if there is a panic condition, the repeater will generate a specific alarm **(Synthesizer fail alarm/Power alarm/Electricity alarm/Status)** using **SNMP (Simple Network Management Protocol)** and send it to the NMS Server.

Then, the user will keep a watch on the received alarms and will rectify the issues through the remote monitoring system.

- **NMS Alarms**
  NMS will offer provision for alarms in multple situation as stated below:

- ➢ **Synthesizer fail alarm-** When the repeater will not generate a required local oscillator frequency, no signal can be amplified. Then the repeater will manifest a **FAIL** status on NMS, Otherwise **PASS** status will be shown on it.
- ➢ **Power alarm-** This alarm indicates the power level for uplink and downlink **(High/Low).**
- ➢ **Electricity alarm-** When the electricity supply of repeater goes down, this alarm will generate and show **FAIL** status of Electricity Alarm on NMS, otherwise **OK**.
- ➢ **Status-**This alarm will show **repeater connectivity** to the NMS and the **updated time** when NMS had fetched the data from repeater last time. If the repeater is connected then **YES** will be shown in connected column.
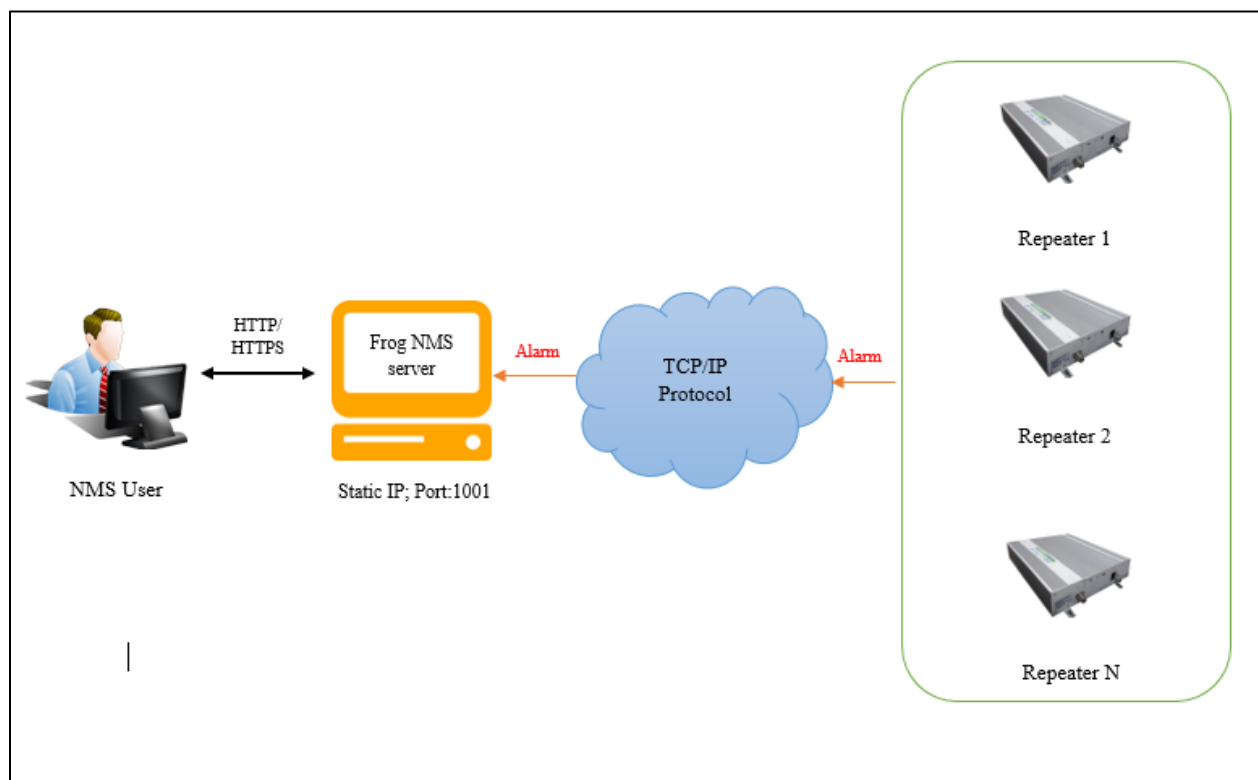
Figure 4 Alarm Communication

Please Note: If any band (GSM/DCS1/DCS2/UMTS) is not present in the repeater, then NMS will show NA(Not Available) for that band.

Chapter 2

NMS Access and Authentication

2.1 NMS Access

To access the GPRS NMS, every user should have a URL (static IP) provided by Frog Cellsat. URL acts as an interface between user and the web-based application. It contains the name of the protocol to be used to access the resource and a resource name. The first part of a URL identifies what protocol to use. The second part identifies the IP address or domain name where the resource is located. Without URL, no one can access the GPRS NMS web page.

User can configure the repeater parameters only after login his NMS account through GPRS-NMS connectivity.

2.2 NMS Authentication

NMS Authentication

NMS is a web-based application and it is authenticated for 3 types of users:

- Monitor User
- Admin User
- Super User

Monitor User	Admin User	Super User
Monitor User has monitoring rights only	Admin User has permissions to configure as well as monitor repeater parameters in their respective circle	Super User has an open access to NMS i.e. they have rights to access all the services (User creation, Control & Monitor etc.)
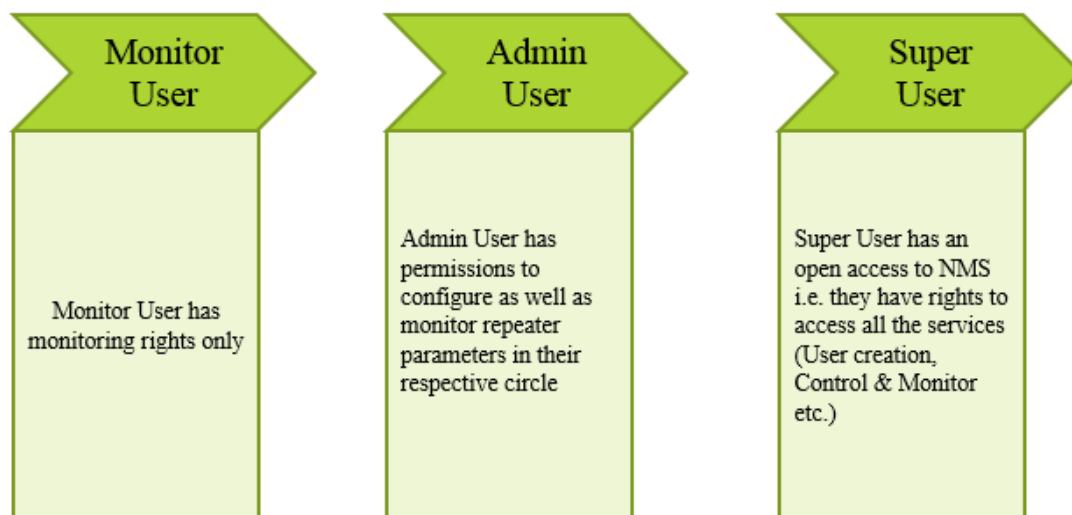
Figure 5 NMS Users

Field Process Flowchart
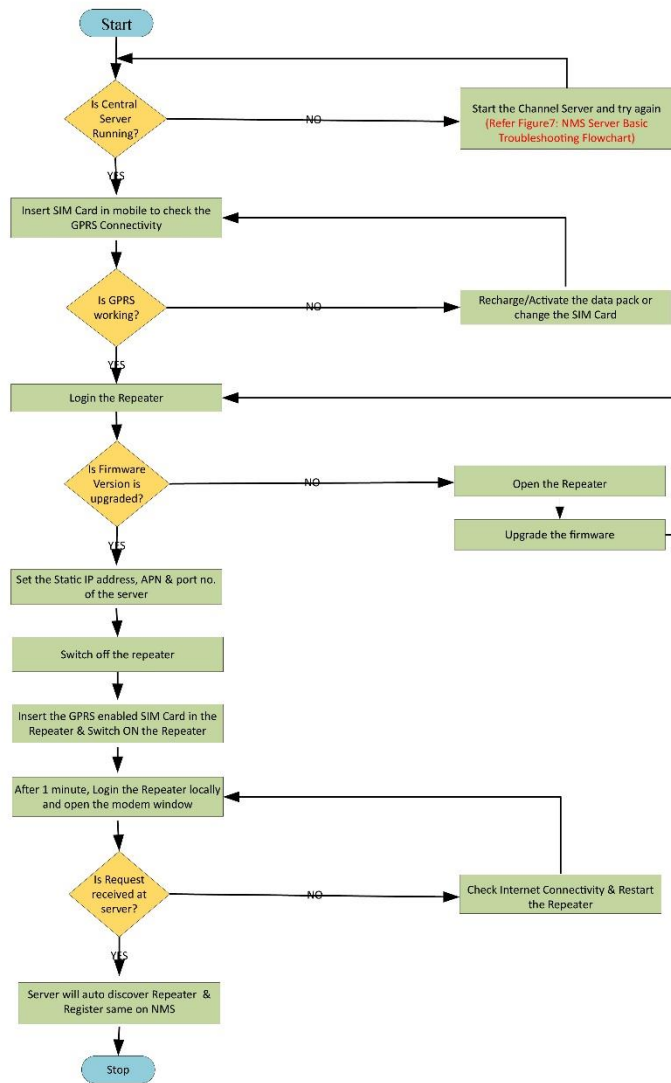
Figure 6 Field Process Flowchart

NMS Server Basic Troubleshooting Flowchart
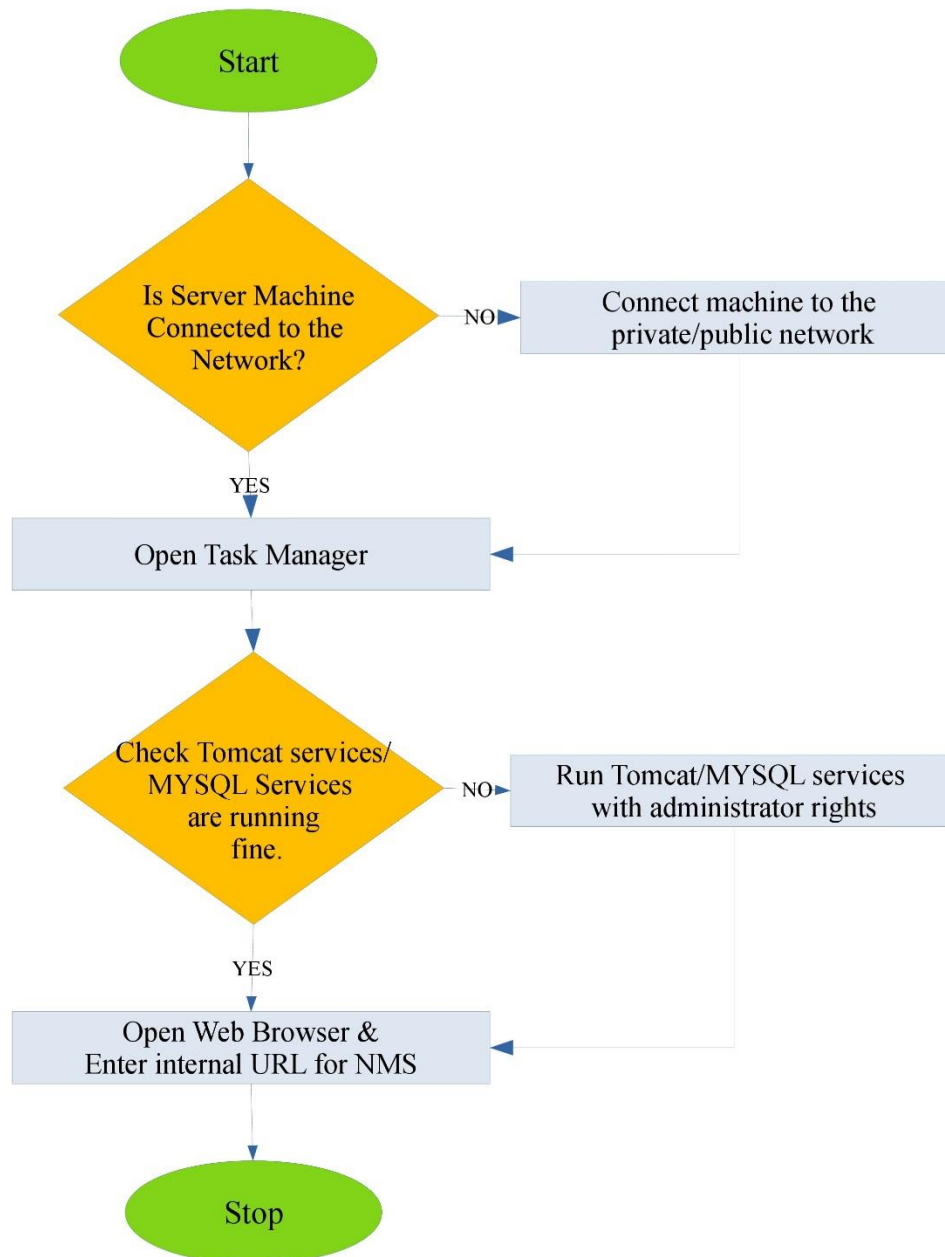
Figure 7 NMS Server Basic Troubleshooting Flowchart

Chapter 3

Networking with GPRS NMS

3.1 Application Workspace

Let's dive into GPRS NMS.

3.1.1 Dashboard

The whole point of the NMS **dashboard** is that it lets you visualize the total sites integrated on NMS and its status (in context of alarms) with its site name, Circle Name and Band Name at a glance.

Site Details are limited to Users.

- o If a super user login the NMS, then all the integrated site details will available and the user can configure the parameters as per the requirement.
- o Admin user can access only its circle repeater details
- o Monitor User can only see all the integrated site details.
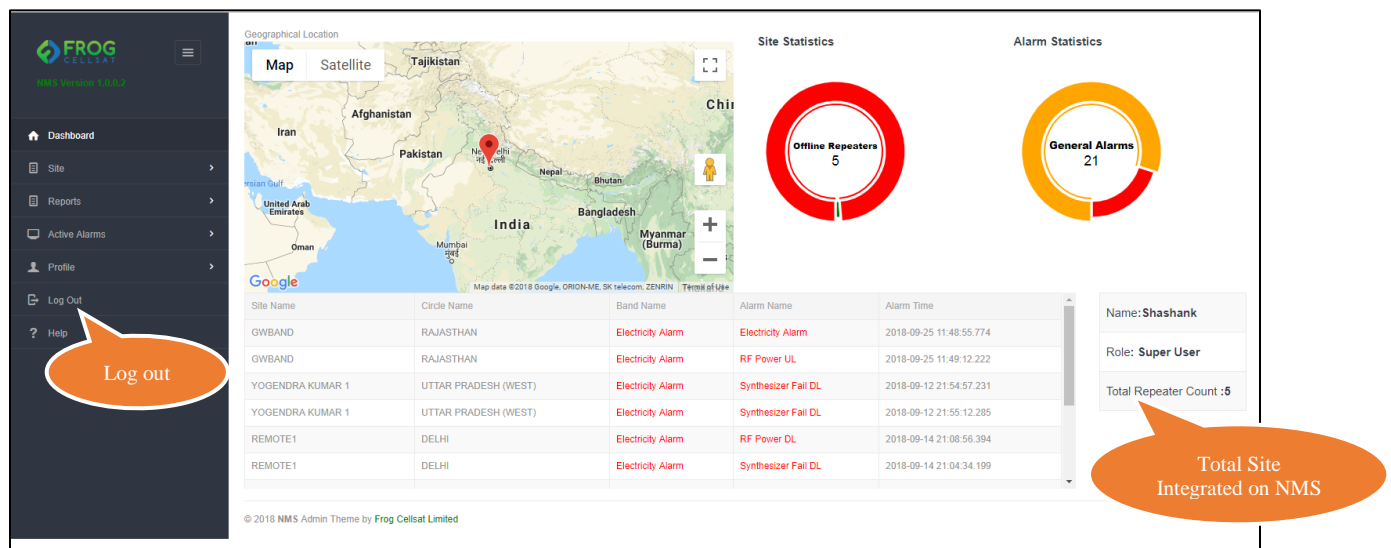
Figure 8 Dashboard

Site Statistics:

🟢 ——▶ Online Repeaters

🔴 ——▶ Offline Repeaters

Alarm Statistics:

🟡 ——▶ General Alarms

🔴 ——▶ Critical Alarms

3.1.2 Site

Navigation Bar renders a site menu which is used to view the repeater status (online/offline). User can also configure the repeater parameters (Band Parameters & System Configuration) as per the need by clicking the configuration key inside the Site List Table.
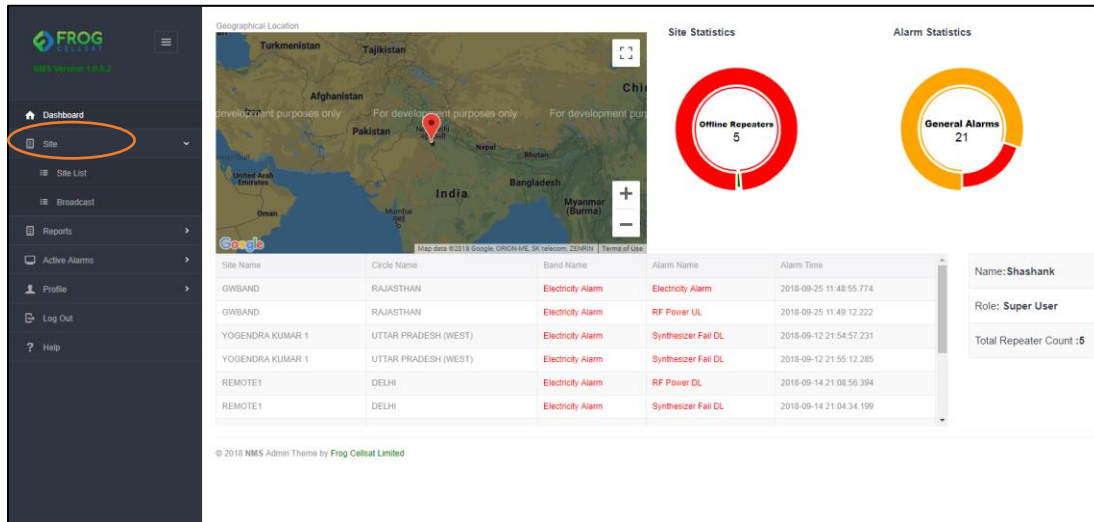
Figure 9 Site

Site: Site List
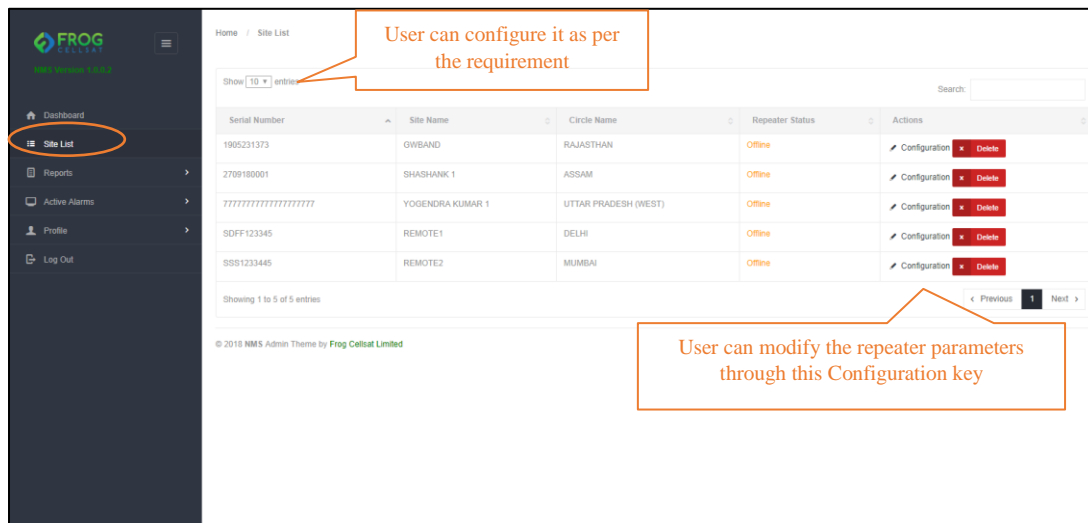
Figure 10 Site List

Site List: Band Details

Figure 11 Site List: Band Details

Site List: System Details
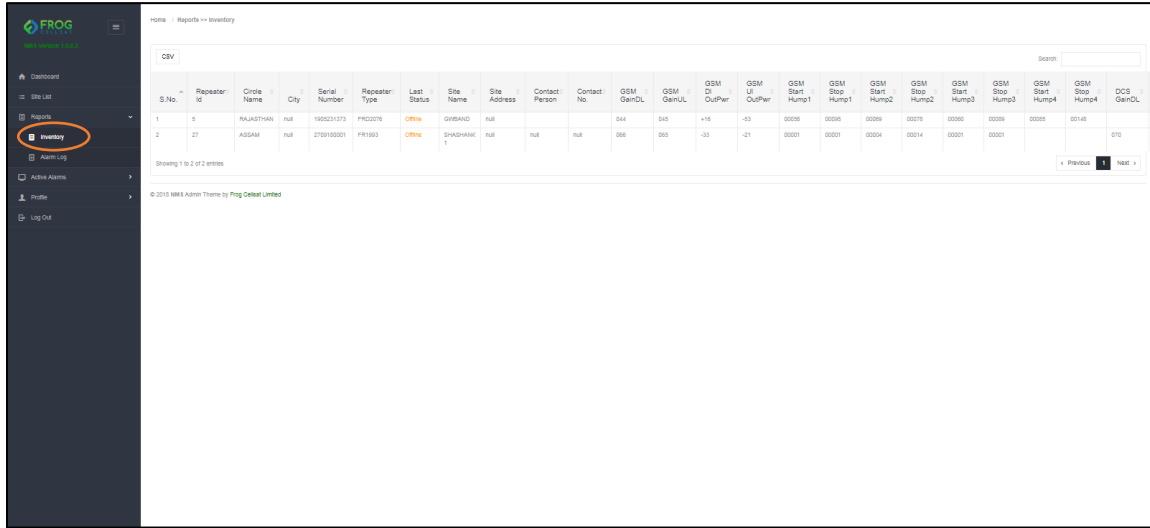
Figure 12 Site List: System Details

3.1.3 Reports

Report Section allows the user to access the Inventory and Alarm Log.

Reports: Inventory

Inventory section keeps storing all the details regarding to RF frequency and RF power of each band for every repeater. But user can see limited repeaters information as per the authority.
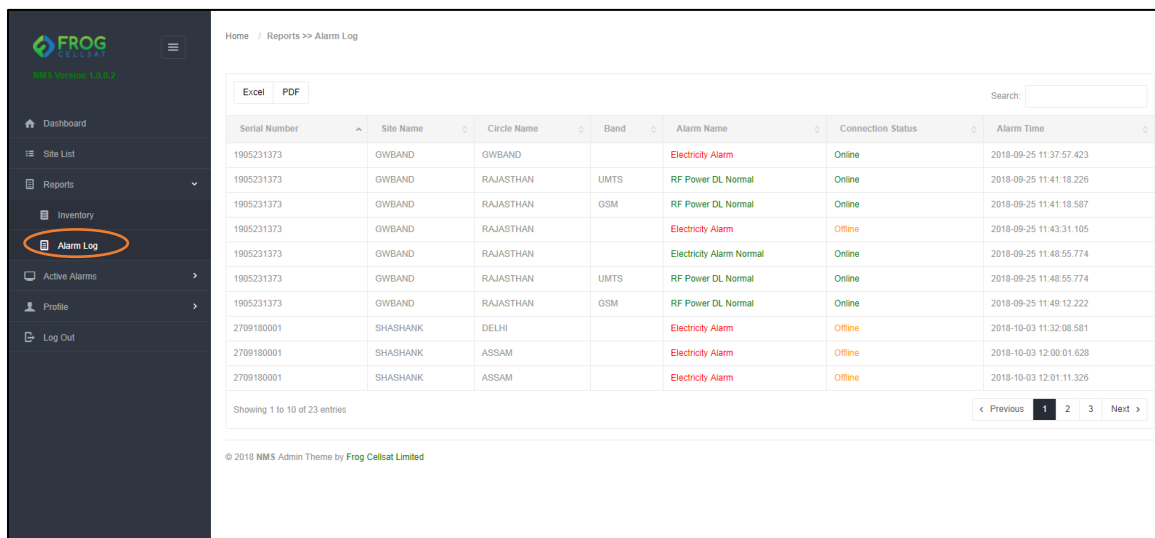
Figure 13 Reports: Inventory

Reports: Alarm Log

User can access all the alarm activities. It displays the repeater connection status, arisen Alarm and alarm timing with its serial number, site name, Circle name and band name.

Figure 14 Reports: Alarm Log
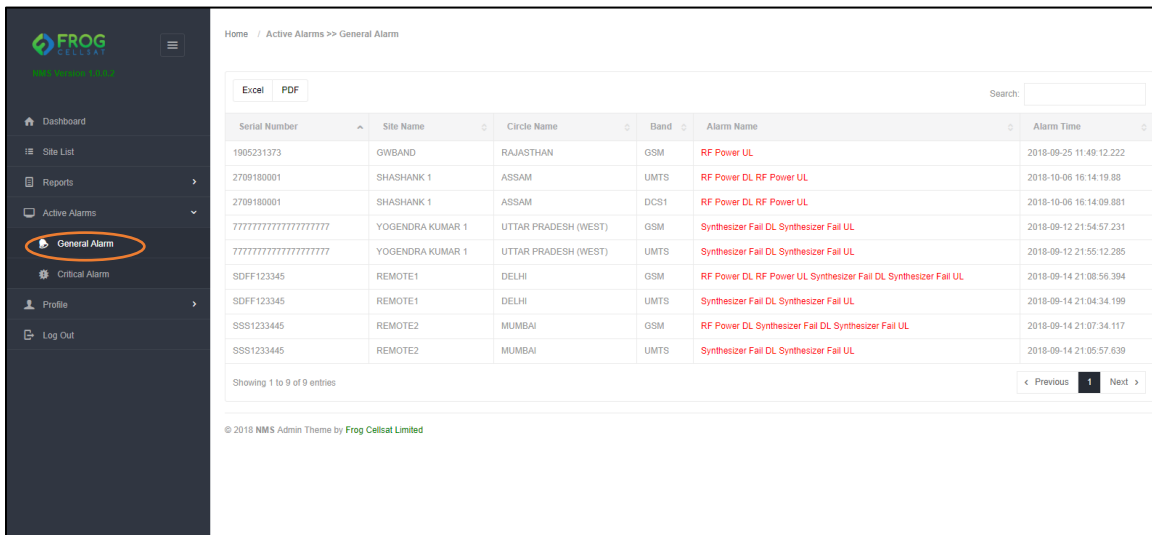
3.1.4 Active Alarms

Active Alarms are categorized into 2 sections.

- o   General Alarms
- o   Critical Alarms

Active Alarms: General Alarms
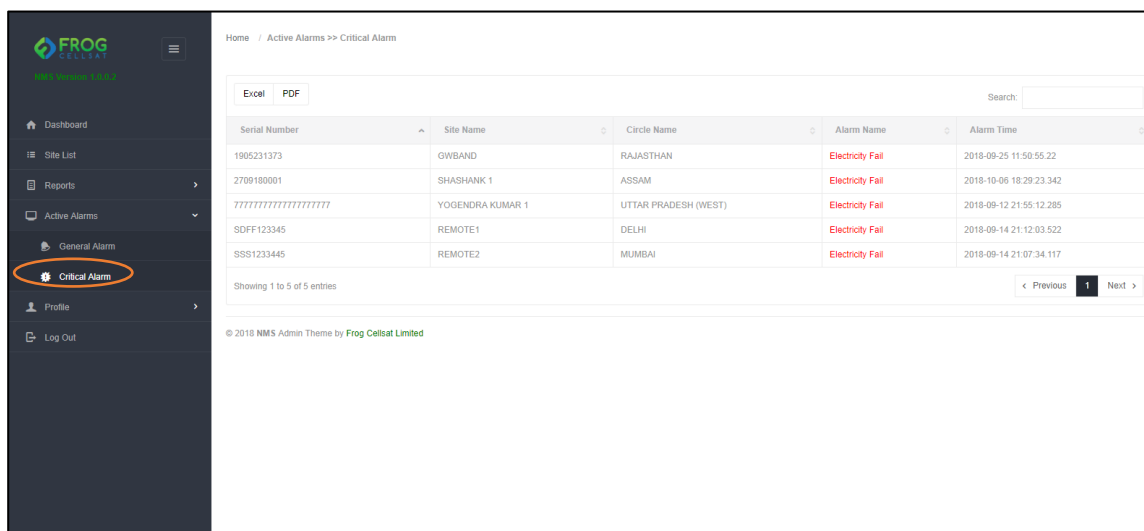
General Alarms include RF Power Alarm (U/L, D/L) and Synthesizer Fail Alarm (U/L, D/L).

Figure 15 Active Alarms: General Alarms

Active Alarms: Critical Alarms

Figure 16 Active Alarms: Critical Alarms

3.1.5 Profile

Profile: Edit Profile

User can modify the profile through the Edit Profile menu item and it is required to select the button "Apply Settings" after editing.
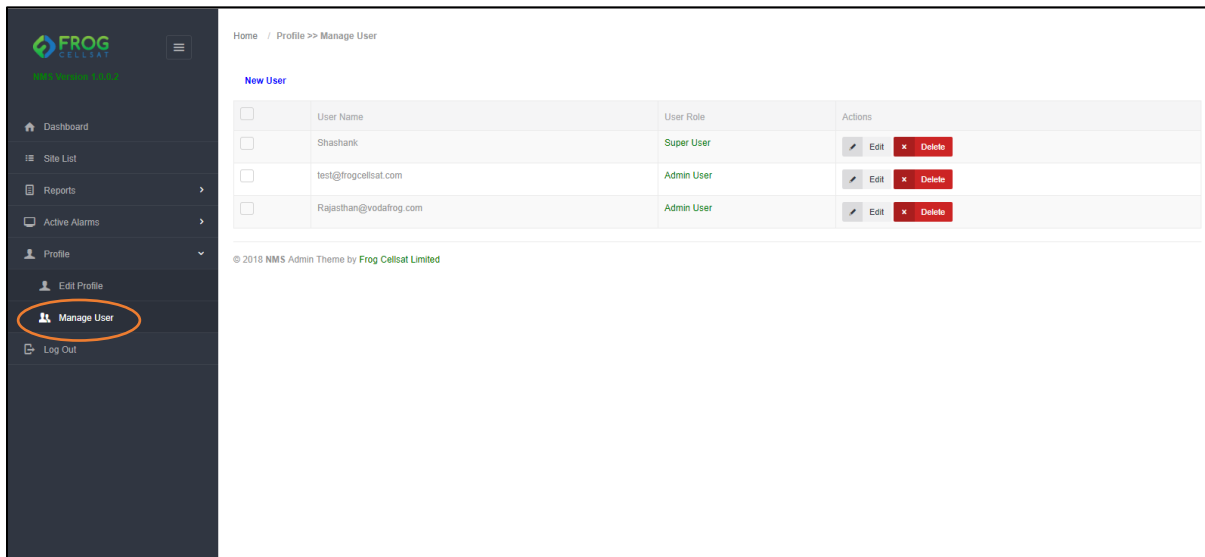
Figure 17 Profile

Profile: Manage User

This option will be available only for super user. Super user can update the profile whether it is admin or monitor user.

Figure 18 Manage User

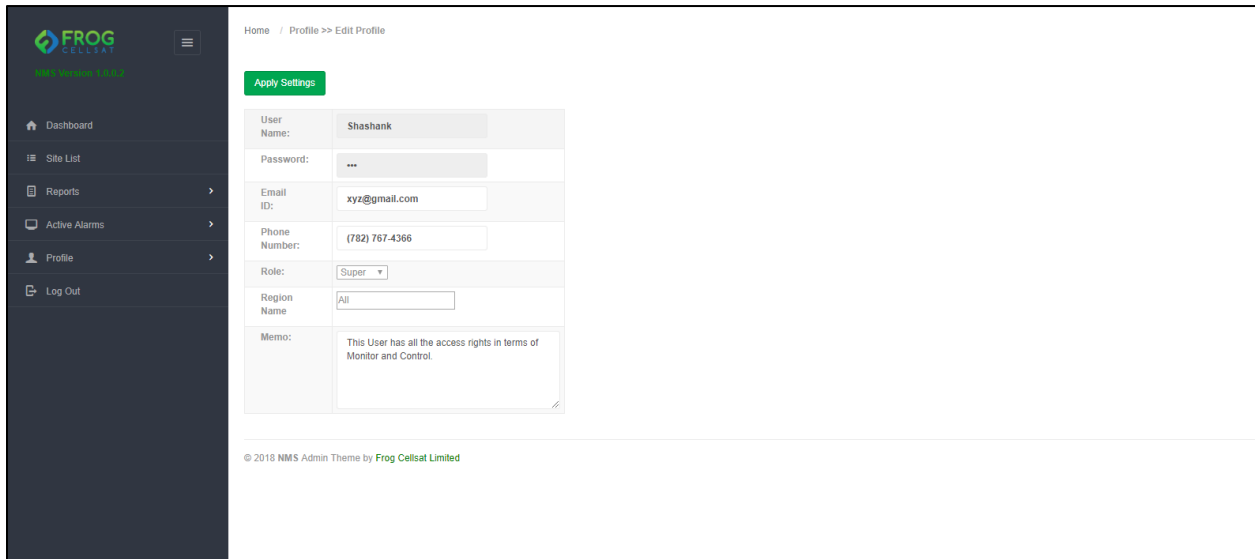**Profile: Manage User Edit Profile**
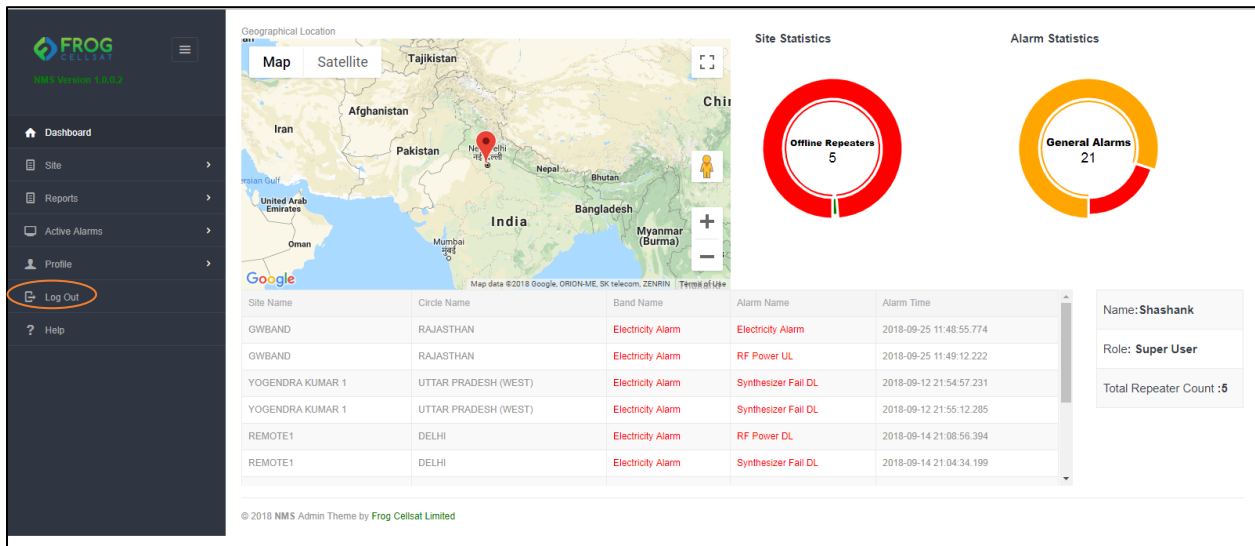
Figure 19 Edit Profile

3.1.6 Log Out

When the work has been finished, users are suggested to leave the NMS page by selecting the **Log out** button placed on the navigation menu or by closing their browser.

Figure 18 Log Out

3.1.7 Help

A help menu is a documentation component of NMS software that explains the features of the program and helps the user understand its capabilities. If user confronts with some issue, Help button would provide great assistance.

Figure 20 Help

Troubleshooting

ALARM / TRAP	CAUSE	CORRECTION
Synthesizer Fail Alarm	Required reference frequency is not generated due to which PLL (Phase Locked Loop) is not getting locked or synced.	• Verify from NMS, if frequency configured is correct and within the band specification or not. • Try to reconfigure the frequency. • Restart the Repeater and check whether issue is resolved or not. • If problem remains unresolved then contact Frog's Service Center or Helpdesk.
Low Power	Repeater RF Output power is below the set threshold value for output power, which may be due to any of the below reasons: ✓ PA OFF ✓ Low GAIN configures in the Repeater ✓ Input RF power to the Repeater is very low ✓ Hardware FAIL	• Check PA status on NMS and Set ON if observed OFF. • Check the GAIN setting in the Repeater and set it to maximum if it is low. • Check input RF power to the Repeater and optimize the pickup (field activity). • If problem remains unresolved then contact Frog's Service Center or Helpdesk.
Electricity	Electricity Power fails at Repeater site.	• Wait for some time. • Site to be visited by Service Engineer.

Appendix A

Abbreviations

Abbreviation	Stands for
3G	3rd Generation
4G	4th Generation
APN	Access Point Name
BSC	Base Station Controller
BTS	Base Transceiver Station
DCS	Digital Cellular System
DL	Downlink
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
GSN	GPRS Support Node
HTTP	Hypertext Transfer Protocol
IMEI	International Mobile Equipment Identity
IP	Internet Protocol
MSC	Mobile Switching Centre
NSS	Network Switching Subsystem
PCU	Packet Control Unit
PSTN	Public Switched Telephone Network
SGSN	Serving GPRS Support Node
SIM	Subscriber Identity Module
SMS	Short Message Service
TCP/IP	Transmission Control Protocol/Internet Protocol
UL	Uplink
UMTS	Universal Mobile Telecommunication System
URL	Uniform Resource Locator
VLR	Visitor Location Register