



Capacicom

NBX R1000-RF

User Manual

V 2.0

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Versions:

Version	Description	Author	Date
2.0	Base 2.0	*	28/11/2021

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.**
- Increase the separation between the equipment and receiver.**
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
- Consult the dealer or an experienced radio/TV technician for help.**

This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

1 Introduction

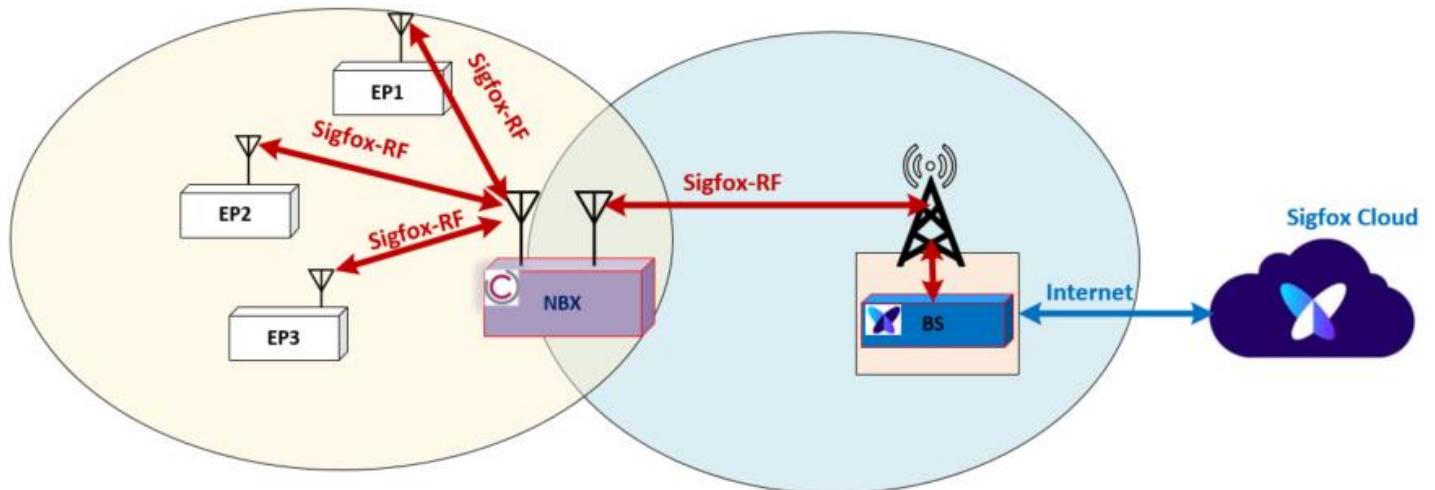
The **Narrow Band eXtension (NBX) R1000-RF** is used to extend the Sigfox IoT network coverage by repeating Sigfox messages.

Main features:

- Supports Sigfox message repetition, including UL and DL.
- High capacity: up to 10 Million messages/day, 1000/300 simultaneous UL messages @ 100/600 baud
- Sigfox waveform compliant:
 - Sub GHz ISM (multi region – **RC1** to **RC7**)
 - RX : sensitivity -134dBm @600 baud, -142dBm @100 baud, band >200KHz, Multi carrier
 - TX: Multi carrier
 - Device mode
- Flexible high-performance design:
 - SDR & FPGA SoC
 - Receive diversity (2x Antennas)
- Characteristics:
 - M&C Connectivity: Wi-Fi & Bluetooth (BLE), Ethernet (<100Mbps), USB master (to 4G modem)
 - Power: Passive PoE, 10-48V, <5W (excluding optional USB modem)
 - Physical : IP67 , Outdoor and indoor, -30°C + 55°C, 185x185x57mm



Figure 1: NBX General Application



2 Definitions and Abbreviations

2.1 Definitions

Following terms and definitions apply:

Base-Station (BS): Radio hub which connects endpoints (via RF) to Sigfox cloud (via IP).

Downlink (DL): Unidirectional communication from the BS to the EP.

End-Point (EP): Sigfox capable device.

Narrow Band eXtension (NBX): Narrow-Band message repeater network coverage extension system.

Uplink (UL): Unidirectional communication from the EP to the BS.

2.2 Abbreviations

Following abbreviations apply:

AES	Advanced Encryption Standard
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
BS	Base-Station
CRC	Cyclic Redundancy Check
DL	Downlink
ERP	Effective Radiated Power
EP	End-Point
ETSI	European Telecommunication Standards Institute
FCC	Federal Communications Commission
FPGA	Field-Programmable Gate Array
GPS	Global Positioning System
GW	Gate-Way
IoT	Internet of Things
IP	Internet Protocol
ITU	International Telecommunication Union
LAN	Local Area Network
LBT	Listen Before Talk
LPWA	Low Power Wide Area
LPWAN	Low Power Wide Area Network
LTE	Long Term Evolution (4G)
NB-IoT	Narrow-Band Internet of Things (3GPP LPWAN)
NBN	Narrow-Band Network
NBW	Narrow-Band Waveform

NBX	Narrow-Band eXtension
OTA	Over The Air
PAN	Private Area Network
PHY	Physical layer
RX	Receiver
SDR	Software Defined Radio
TX	Transmitter
UL	Uplink
UNB	Ultra-Narrow Band

3 Package contents

3.1 Package Contents

- NBX R1000-RF repeater.
- Standard mounting kit.
- RJ-45 extender.
- 2x Antennas.



3.2 Accessories available separately

- Passive PoE injector.
- Tilted pole mounting kit.
- Passive 24V PoE power supply.
- Window mounting kit.
- Various Antennas.



4 Installation

The R1000-RF repeater can be installed indoors or outdoors (IP67).

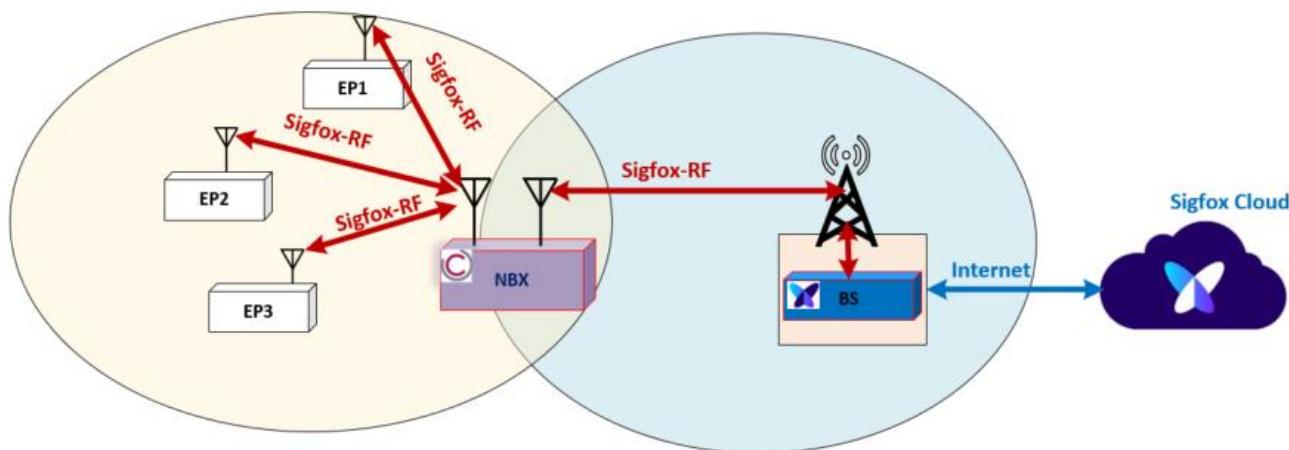
It can be mounted on a tower, pole, wall, window, or any other stable structure.

The main considerations for the choice of the installation location are:

- NBX coverage of the Sigfox devices.
- RF communication with Sigfox Base-station or other NBX repeater (daisy chain).
- Power supply (<5w with 10-48V).

Best practice for RF interference reduction is to place the NBX R1000-RF as far away from other RF equipment and not in direct line of site of cellular antennas.

In general, placement considerations for the NBX repeater are similar to those of the Sigfox base-station with the only difference being the need to be within coverage of one or more Sigfox base-stations (or another NBXs when in daisy chain mode).



4.1 Radio planning:

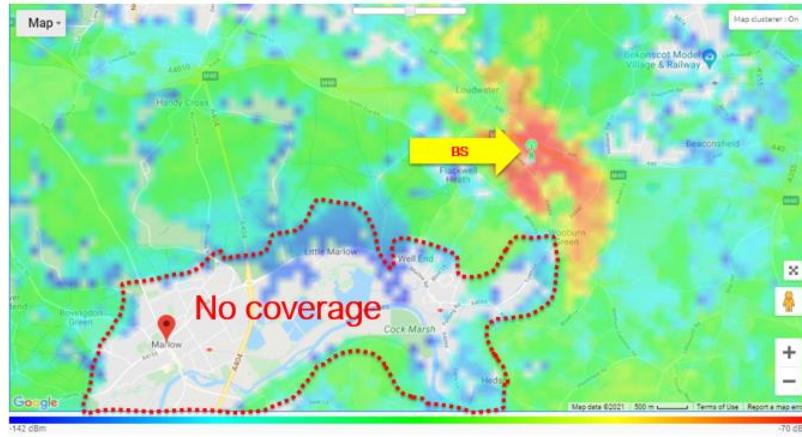
For radio planning, one may use the standard Sigfox tool for a candidate site. If using an external 5dBi antenna, the parameters should be the same as a Sigfox Macro configuration (5dBi antenna + LNA +..).

In the Sigfox backend, make sure that the chosen site is covered by one or more Sigfox BSs and add the NBX as a candidate site to predict coverage. Coverage check can be made with Simple coverage, as there will be a 10+ dB improvement at rooftop level relative to ground level (which the Backend estimates).

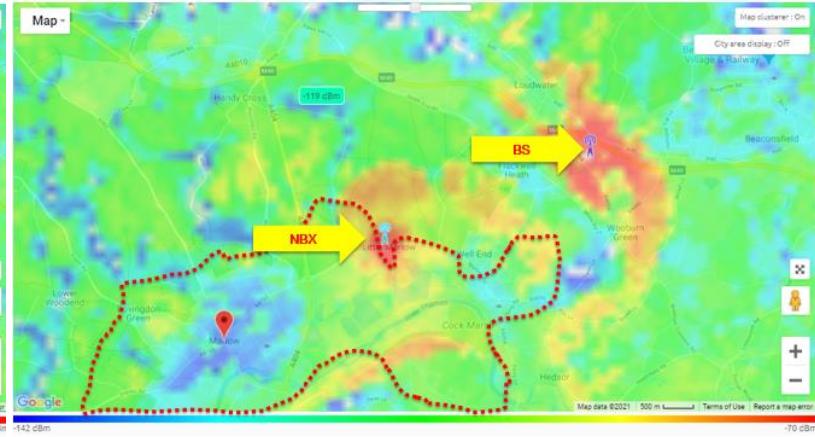
Then change the antenna gain by selecting “other” and for **basic** antenna use 0 dBi as a worst case **OR** 5dBi/TBD for **external** antenna you use.

Simulation spot information		Radio climate	
Identifier	5da5e212a93b155d5b5aa8e	Continental temperate	Continental temperate
Name	NBX	Earth conductivity	Average ground
Description		Earth dielectric constant	Average ground
Hardware family	Standard	Polarization	Vertical
Uplink center frequency (Hz)	920800000	Atmospheric bending constant	301.0
Antenna height AGL (m)	8	Fraction of situation	0.5
Environment loss (dB)	5.0	Fraction of time	0.5
Cable loss (dB)	1.0	Tst elevation	1
Lat (-90° to +90°)	-32.17708999163863	Planned	
Lng (-180° to +180°)	148.93982476969109	Planned date	
Radius (km)	30	Antenna specifications	
Candidate		Antenna model	Other
Radio climate	Continental temperate	Gain (dBi)	0.0
Earth conductivity	Average ground		
Earth dielectric constant	Average ground		
Polarization	Vertical		
Atmospheric bending constant	301.0		
Fraction of situation	0.5		

Without NBX



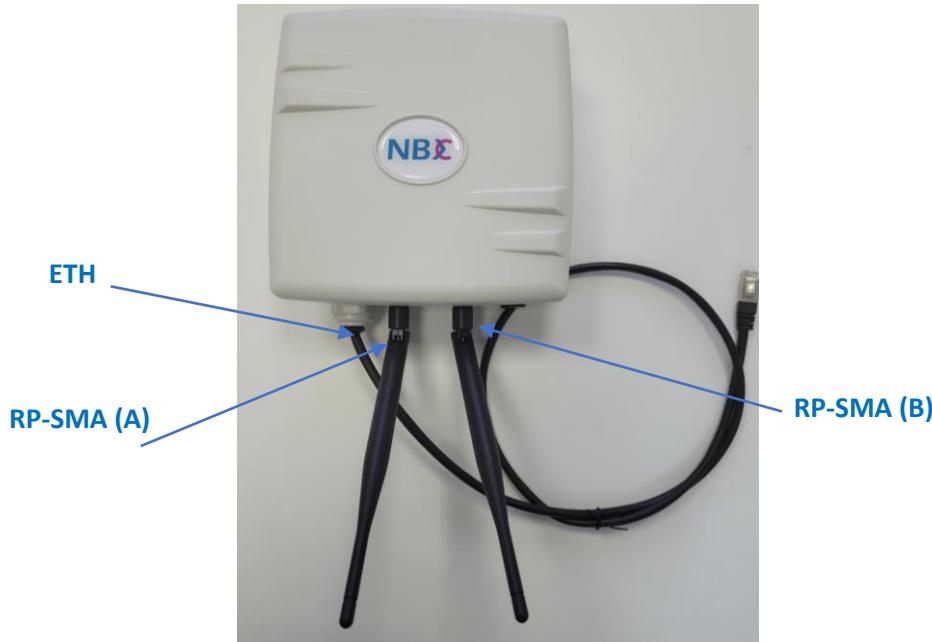
With NBX



5 Connectivity

5.1 Interfaces

- Waterproof Ethernet (RJ-45) - for power and IP communication
- RP-SMA x2 – for antennas



5.2 Power

The NBX uses passive PoE for supplying power. The power is provided by an AC/DC adapter through a passive PoE DC injector (Pins 4,5 (+) and 7,8 (-)).

Supported voltage range: 10V to 48V DC.

Average R1000-RF power consumption - up to 5Watt (excluding USB modem).

5.3 IP Connectivity

IP connectivity is not mandatory.

The NBX R1000-RF repeater relies on RF communication to one or more BS for its functionality.

IP connectivity is mainly used for expert/technical management, control access and FW upgrades.

IP connectivity options:

- **RJ-45**
- **Wi-Fi/BT**
- **USB dongle**

See section 12.1 for **initial** setup guidelines.

5.3.1 USB Dongle

Following models are supported:

- Huawei E8732/E3372
- Huawei MS2131
- ZTE MF833V
- ZTE MF110
- Onyx Soracom

See section 12.2 for **initial** setup guidelines.

5.4 RF Connectivity

The NBX R1000-RF repeater includes two RP-SMA external antenna ports (A & B).

5.4.1 Antennas

Any antenna with RP-SMA connector can be used. The frequency range should be selected according to the RC zone.

Two 2.15 dBi antennas are supplied with each NBX-R1000-RF unit.

But in some cases, a higher gain antenna can be used.

6 Monitor & Configuration – Web Interface

In general, most configurations are done automatically without any user intervention.

Some of the settings described below are temporary for manual configuration or advanced settings.

There are three levels of user permissions: Super-User, Admin, User.

Possible methods for accessing the NBX R1000-RF are:

- **Web** (over IP).
- **CLI** (over IP).
- **SNMP** (over IP).
- **IoT** (Sigfox messages).
- **Bluetooth** (Using dedicated application).

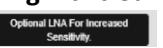
This section will describe the **web** access mode.

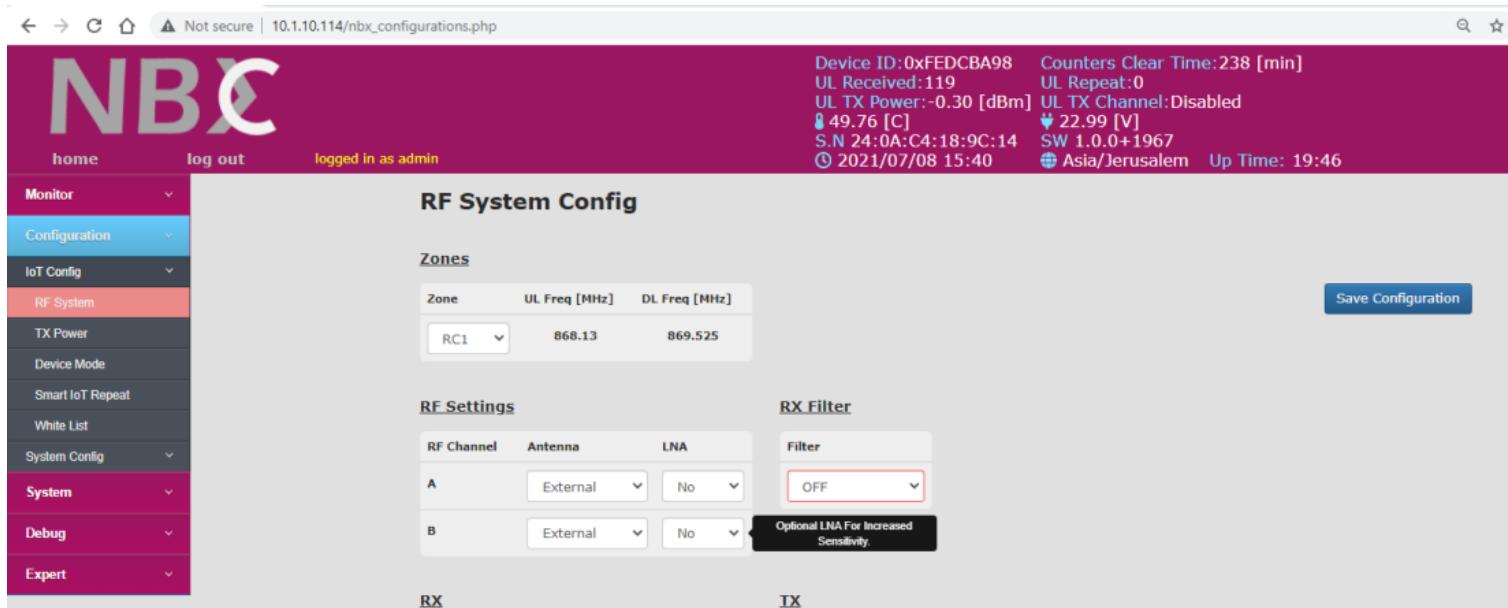
It is recommended to use **Chrome** web-browser.

There are special commands and menus which are available only in **expert** mode and are not required for normal operation of the unit.

6.1 Web Interface Convention and Main Menu

In a typical web page, the following apply:

- **Open sub menu's** – highlighted in blue. 
- **Current page** – highlighted in salmon. 
- **Field change before applying** – circled in red. 
- **Tooltip** – white on black 



Device ID:0xFEDCBA98 Counters Clear Time:238 [min]
UL Received:119 UL Repeat:0
UL TX Power:-0.30 [dBm] UL TX Channel:Disabled
Temperature: 49.76 [C] Voltage: 22.99 [V]
S.N 24:0A:C4:18:9C:14 SW 1.0.0+1967
① 2021/07/08 15:40 ② Asia/Jerusalem Up Time: 19:46

RF System Config

Zones

Zone	UL Freq [MHz]	DL Freq [MHz]
RC1	868.13	869.525

Save Configuration

RF Settings RX Filter

RF Channel	Antenna	LNA	Filter
A	External	No	OFF
B	External	No	Optional LNA For Increased Sensitivity.

RX TX

6.1.1 Dash Board

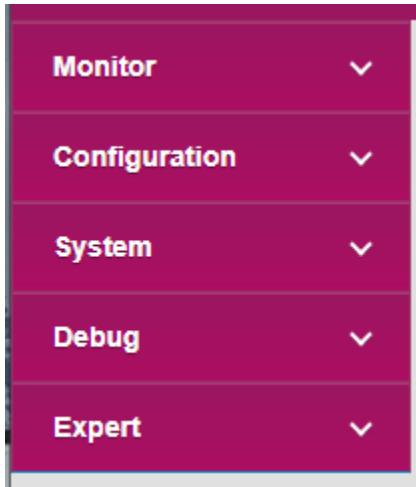
Appeared on the top right corner of the web page.

Device ID:0xFEDCBA98 Counters Clear Time:239 [min]
UL Received:119 UL Repeat:0
UL TX Power:-0.30 [dBm] UL TX Channel:Disabled
Temperature: 49.76 [C] Voltage: 22.99 [V]
S.N 24:0A:C4:18:9C:14 SW 1.0.0+1967
① 2021/07/08 15:41 ② Asia/Jerusalem Up Time: 19:48

- **Device ID:** The Sigfox device ID of the unit
- **Counters Clear Time:** time since last clear of the message's counters [minutes].
- **UL Received:** How many unique UL messages were received.
- **UL Repeat:** How many UL messages were repeated.
- **UL TX Power :** Uplink transmit power [dBm]
- **UL TX Channel :** which channel the UL is being transmitted on (A/B/Disabled)
-  : Temperature [°C]
-  : Voltage [V]
- **S.N. :** Serial number
- **SW :** SW version
-  : Current date/time
-  : Time zone
- **Up Time:** Time since reboot.

6.1.2 Main Menu

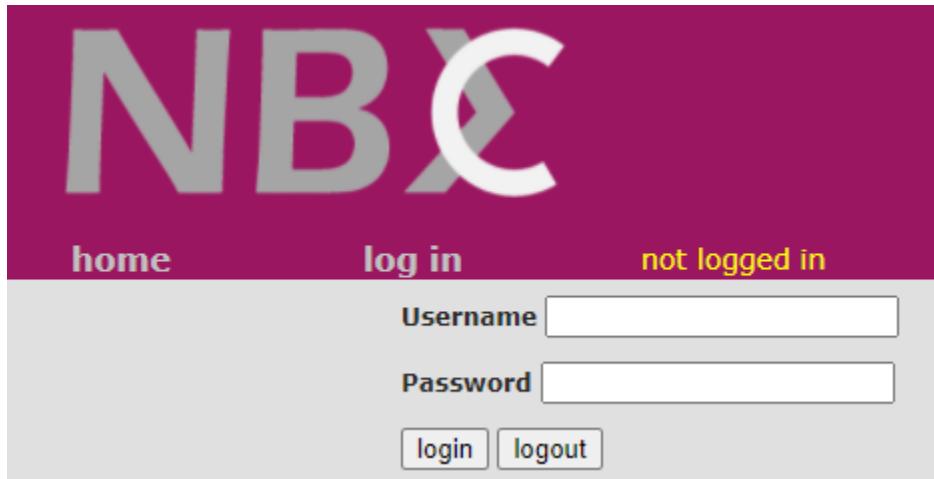
Appeared on the left side of the page.



Divided to 5 main areas:

- **Monitor:** Display status information.
- **Configuration:** Configure the unit settings.
- **System:** Various system tasks (e.g. SW upgrade).
- **Debug:** Debug features.
- **Expert:** Advance expert-mode settings (not needed for normal operation).

6.2 Login



After identifying the NBX R1000-RF IP, it can be accessed via web browser.

Username and password are required.

Default username and password for **Super-User** mode are:

Username: **admin**

Password: **Admin**

The password can be changed.

Login session has a timeout of 15 minutes, after which a logout is automatically performed.

6.3 System



Under **System** all users will see the following sections.

System configuration and monitor are under the general “**Monitor**”, “**Configuration**” menus.

- **Version** – Product versions details.
- **Software Upgrade** – SW upgrade operations.
- **Database** – Database management.
- **Users** – User management.
- **System Debug** – Debug files.
- **General** – Date/Time, reboot.
- **Safe Mode** – Safe mode operation.

6.3.1 Version

Version

Product	Serial number	HW Version	SW Version	Build Date (D.M.Y)	WiFi/BT SW Version
NBX-R1000RF	24:0a:c4:18:9c:14	5	1.4.0+2007 [20/07/2021-19:36]	15.2.21 build 1	1.0.6.0

Display the NBX-R1000-RF SW and HW versions and S/N.

- **Product Name**
- **Serial Number**
- **HW Version**
- **SW Version**
- **Build Date**
- **Wi-Fi/BT SW Version**

6.3.2 Software Upgrade

The screenshot shows the 'Software Upgrade' interface. It has two main sections: 'Main Software' and 'Backup Software'. Under 'Main Software', the version is listed as '1.0.0+1248'. Under 'Backup Software', the version is listed as '1.0.0+1245'. Below these sections is a 'Download Package' section. Inside this section, the 'Upgrade Status' is shown as a progress bar at 0%. At the bottom of this section are three buttons: 'Download and extract to backup', 'Swap to backup', and 'Clear DB'.

Upgrading the software.

There are two SW versions on the unit: Main and Backup. During SW upgrade process the NBX R1000-RF is downloading and extracting a new SW version, replacing the backup copy.

After the **download and extraction** process is finished, the user can **swap** to the new SW version, which causes the unit to reboot with the new version.

So, the normal process is as follows:

- Download the SW to a local folder accessible by your PC
- Use "**Download and extract to backup**" to select the new SW.
- After the file is extracted and shown in the "Backup Software", do "**Swap to backup**"
- Then the unit will reboot with the new SW version.

The user can revert to the older version at any time by pressing the "Swap to Backup" button.

If the IP connectivity is slow, then it is recommended to use **tftp** process via **CLI**, instead of **Web** interface.

There is also an optional "Clear DB" feature - **internal use**.

6.3.3 Database

Database



The screenshot shows a user interface for managing database files. At the top, there is a text input field labeled 'Name' with a placeholder 'Enter name'. Below it is a row of buttons: 'Save', 'Save As', 'Load', 'Delete', 'Upload', 'Factory Defaults', and a larger 'Download' button. Below these buttons is a section titled 'Current Database files' with a table header. The table has columns 'No' and 'Name'. A message 'No data available in table' is displayed. At the bottom of the table area, it says 'Showing 0 to 0 of 0 entries' and has 'Previous' and 'Next' navigation buttons.

Database is used to store the unit configurations.

Save, download, upload database from/to the NBX.

Save – save the current configuration into the permanent storage (db0.db).

Save As - save the current configuration into specific file given by “Name”.

Load – Activate saved database (the unit will reboot).

Delete – Delete saved database.

Upload – Upload database from the NBX to the computer.

Factory Defaults – Reset current configuration to factory defaults settings (the unit will reboot).

Download – Download database file from the computer into the NBX (without activation).

6.3.4 User Management

Users

Name	Group	
<input type="text"/>	SU <input type="button" value="▼"/>	
Password	Confirm Password	
<input type="password"/>	<input type="password"/>	
<input type="button" value="Add"/>	<input type="button" value="Change Password"/>	<input type="button" value="Delete"/>

Current users

No	Name	Group
1	admin	SU
2	oper	Admin
3	user	User

Managing users.

The logged-in user can only change/add users with same or lower level.

6.3.5 System Debug

System Debug

System Logs

[Download System Log 1](#)

[Download System Log 2](#)

[Download Crash Log](#)

[Download State Log](#)

Download log files from the unit to the PC for debug purpose.

6.3.6 System General

System General

Set Time Of Day

Date: **Set Date**

Timezone

Select a Region... **Set Timezone**

System Actions

Reboot

General system functions:

- **Set Time of Day**
- **Select Time zone**
- **Reboot**

6.3.7 Safe Mode

Safe mode can be used during configuration changes. Safe Mode ensures that the communication to the unit is still active following any configuration changes.

The user can configure the timeout period in seconds. The User needs to exit Safe Mode before the timer expires.

If the user did not exit the safe mode after the configuration and before timer expiry, then the unit will revert to the previous configuration and reboot.

This prevents mistakes in configuration which can disconnect the unit.

When in safe mode, the screen color scheme changes, and there is a countdown timer in the top right corner.



- **Set safe mode time.**
- **Enter safe mode.**

Once activated Exit Safe Mode appears on the following screen.



6.4 Configuration



Under **Configuration** there are two main sections – **IoT** and **System**:

- **IoT Config:**
 - **RF System** – Configure the IoT RF parameters, including filtering and antenna connectivity
 - **TX Policy** – UL and DL transmission power levels and UL frames limit
 - **Device Mode** – Device mode configuration
 - **Smart IoT Repeat** – Smart IoT Repeat (**SIR**) Configuration.
 - **White List** – Devices which will be repeated (other device-id's are dropped).
- **System Config:**
 - **SNMP** – SNMP settings
 - **IP Interfaces** – IP Interface settings (IP, GW, DHCP...)
 - **IP Routes** – IP static routes settings
 - **IP DNS** – IP static DNS settings
 - **IPSec** – IP VPN settings
 - **DAS** – DAS Settings
 - **IP Ping** – Ping command
 - **Wi-Fi** – Wi-Fi configuration
 - **Bluetooth** – Bluetooth configuration
 - **General** – system general settings (name, location...)

6.4.1 IoT - RF System Configuration

RF System Config

Zones

Zone	UL Freq [MHz]	DL Freq [MHz]
RC7	868.8	869.1

Save Configuration

RF Settings

RF Channel	Antenna	LNA
A	External	No
B	External	No

RX Filter

Filter
ON

RX

RF Function	RF Channel
UL	Dual
DL	Disabled

TX

RF Function	RF Channel
UL	Disabled
DL	Disabled

Configure the IoT RF mode and connectivity.

After setting a new configuration, it is necessary to save it.

RC zone:

<u>Zones</u>		
Zone	UL Freq [MHz]	DL Freq [MHz]
RC1	868.13	869.52

Selects the RC zone : *RC1,RC2...RC7*

The UL and DL center frequencies are specified after selecting the RC. The other characteristics per RC will be implemented (e.g. 100Hz /600Hz baud etc.).

RF setting:

<u>RF Settings</u>		
RF Channel	Antenna	LNA
A	External	Yes
B	Internal	No

The NBX-R1000-RF includes two RF channels (A&B) with external antennas. Currently, the Internal Connectors are not being used.

Each channel has an optional LNA which can be selected (this is for increased sensitivity).

LNA can be turned off if devices are in close proximity to the NBX, e.g. several meters distance from the repeater.

RX Filter:

<u>RX Filter</u>	
Filter	
ON	▼

There are embedded RF filters which can mitigate RF noise in adjacent frequencies (similar to the cavity filter functionality). Normally those filters should be used. Only in an isolated/quite places those filters can be turned off (for having an extra sensitivity).

RX :

RF Function	RF Channel
UL	Dual
DL	A

Selects which channels will be used for receiving the UL & DL.

For UL, both channels can be used simultaneously (receive diversity).

For DL, it is normally selected according to the best positioned antenna towards the nearby base-station(s).

UL RF channel options: *A, B, Dual, Disabled*

DL RF channel options: *A, B, Disabled*

TX:

RF Function	RF Channel
UL	A
DL	B

Selects which channel will be used for transmitting for the UL & DL separately.

For UL, it is normally selected according to the best positioned antenna towards the nearby base-station(s).

UL RF channel options: *A, B, Disabled*

DL RF channel options: *A, B, Disabled, Auto* (Auto selects the antenna based on the UL signal quality)

6.4.2 IoT - TX Policy

TX Policy

UL Tx-power [dBm]	DL Tx-power [dBm]	Limit UL Max Frames In Block	Max UL Frames In Block	
10.0	10.0	12	12	Set Tx Policy

Selects the transmission power. The R1000-RF uses multi-carrier transmission mode, which enables higher capacity with minimal interference and adheres to the regulations.

The UL power level must be set to balance enough base stations receiving the repeated messages without reaching too many.

UL Tx-power [dBm]: Power per transmitted UL frame. Actual power will be calculated based on multi-carrier scenario.

DL Tx-power [dBm]: DL frame transmitted power. The DL TX power is recommended to be set to 27dBm for the DL link budget to match the UL sensitivity.

Limit UL Max Frames In Block: Allows to limit the maximum UL frames per transmission to a value less or equal to the **Max UL Frames In Block**). For example, the user can change this value from 12 to 1. In this case if 12 UL frames are received simultaneously, they will be transmitted 1 frame at a time.

Max UL Frames In Block: The maximum number of UL frames, calculated according to the **UL Tx-power** (information only).

6.4.3 IoT - Device Mode Configuration

Device Mode Config

App Sleep Time [sec]
600

Default TX Channel
Channel A

Default TX Antenna
External

Symbol Rate
600HZ

Set App config **TX NBX SFX Message**

Device ID	Message Counter
0xFEDCBA98	385

Configure the Device-mode setting:

Note that some of the settings will be configured automatically in a future SW release.

- **App Sleep Time [sec]** – Time interval between UL messages generated
- **Default TX Channel** – Which **Channel (A/B)** to transmit the Device messages
- **Default TX Antenna** – Which **Antenna (Internal/External – only external available)** to transmit the messages
- **Symbol Rate** – What symbol rate (**100/600Hz**) to transmit the Device messages (600Hz is recommended)
- **Set App Config** – Change the configuration
- **TX NBX SFX Message** – Transmit a device message – used for calibration of the TX power.
- **Device ID + Message counter** – Current Device-ID and message counter (information only).

The Device ID and key are unique per NBX unit.

6.4.4 IoT – Smart IoT Repeat (SIR)

Smart IoT Repeat Configuration

White List Filter Black List Filter

Repeat Options

UL Type	Repetition Bit	Repetition Frame Number
Unidirectional	ON	F#1
Bidirectional	OFF	F#1

Repeat Frame Number Filter

UL Type	Frame number 1	Frame number 2	Frame number 3
Unidirectional	Rep Off: Repeat, Rep On: Repeat	Rep Off: Repeat, Rep On: Repeat	Rep Off: Repeat, Rep On: Repeat
Bidirectional	Repeat, Repeat	Repeat, Repeat	Repeat, Repeat

Save Changes

Configure the **Smart IoT Repeat (SIR)** setting:

Note that some of the settings will be configured automatically in a future SW release.

The **SIR** functionality minimizes unnecessary repetitions and repeats only the required messages. e.g. in multi hop scenario.

How to repeat the incoming messages:

- **White-list** – enable/disable
- **Black-list** – enable/disable
- **Repeat Options** – Frame number and Repeat Bit selection for repeated messages
- **Repeat Frame Number Filter** – filtering for selecting frames to be repeated .

Repeat options allows selection of the frame number and repeater bit settings for repeated messages.

Use automatic or manual settings.

Frame # : 1,2,3,Auto, **Repeater-bit** = On,Off

Repeat Options

UL Type	Repetition Bit	Repetition Frame Number
Unidirectional	OFF	F#2
Bidirectional	ON	F#3

Selects whether to turn on the repetition bit for UL messages (Sigfox backend will show the message as having been repeated) according to the message type.

The default is to turn it on for unidirectional only. (Currently, the Sigfox backend will not send a DL message to the NBX if the Repeater bit is turned on for bidirectional messages)

Repeat Frame Number Filter

Repeat Frame Number Filter

UL Type	Frame number 1		Frame number 2		Frame number 3	
Unidirectional	Rep Off	Rep On	Rep Off	Rep On	Rep Off	Rep On
	Rep	Rep	Rep	Rep	Rep	Rep
Bidirectional	Rep	Rep	Rep	Rep	Rep	Rep
	Rep	Rep	Rep	Rep	Rep	Rep

Select which Frames to be repeated according to frame number and repeater bit. This can be used to filter unnecessary frames.

6.4.5 IoT - White List

Devices which will be repeated (other device-id's are dropped – depending on general S/R options).

The White-list can be updated manually via the GUI or by loading a text file which contains the device-id's.

- **csv file:** Text files need to include separate line per device-id and assumes hexa-decimal format (can be with or without 0x prefix) lower or uppercase are accepted.
And indication on enable/disable per device-id (0/1)

e.g. all the below are valid formats (second dev-id is disabled in the example):

```
0x1234AB , 1
333aB , 0
Fe44ba22 , 1
```

- **Web GUI:** The current White-list is displayed and can be changed via the GUI.

Following options supported:

- **Add** - add specific device-id
- **Delete** – delete specific device-id
- **Enable/Block** – Enable or Block specific device-id
- **Search** – all device-id that match the search pattern
- **Upload** – upload csv file
- **Export** – export current white list to csv file

White List Config

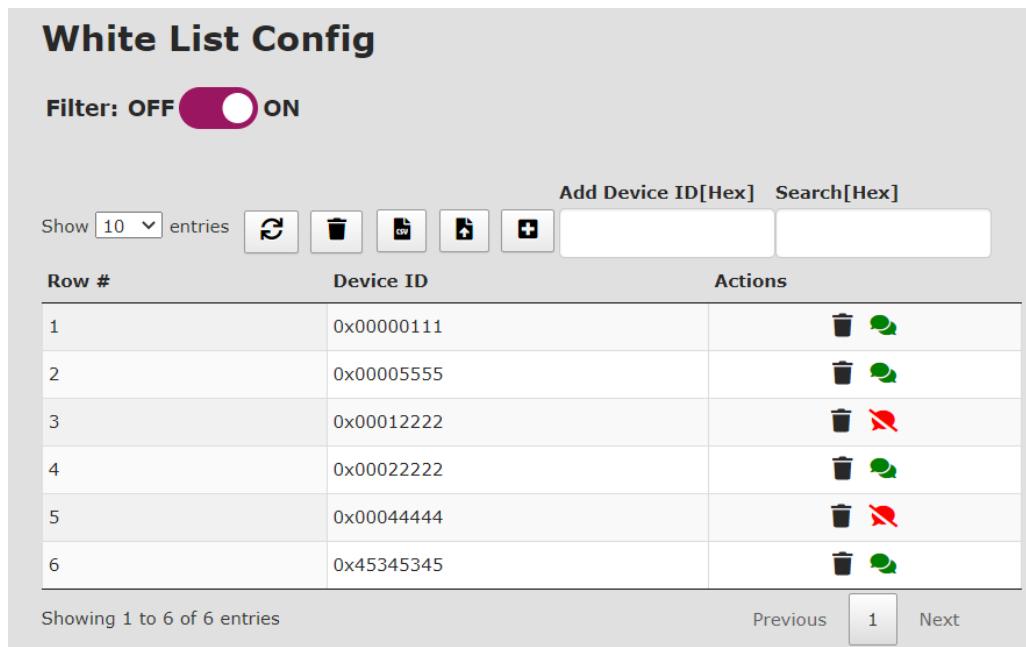
Filter: OFF ON

Add Device ID[Hex] Search[Hex]

Show 10 entries

Row #	Device ID	Actions
1	0x000000111	<input type="button"/> <input type="button"/>
2	0x00005555	<input type="button"/> <input type="button"/>
3	0x00012222	<input type="button"/> <input type="button"/>
4	0x00022222	<input type="button"/> <input type="button"/>
5	0x00044444	<input type="button"/> <input type="button"/>
6	0x45345345	<input type="button"/> <input type="button"/>

Showing 1 to 6 of 6 entries Previous 1 Next



6.4.6 IoT - Black List

Devices which will be blocked (other device-id's are dropped – depending on general *S/R* options).

The Blck-list can be updated manually via the GUI or by loading a text file which contains the device-id's.

- **csv file:** Text files need to include separate line per device-id and assumes hexa-decimal format (can be with or without 0x prefix) lower or uppercase are accepted.
And indication on enable/disable per device-id (0/1)

e.g. all the below are valid formats (second dev-id is disabled in the example):

```
0x1234AB , 1
333aB , 0
Fe44ba22 , 1
```

- **Web GUI:** The current Black-list is displayed and can be changed via the GUI.

Following options supported:

- **Add** - add specific device-id
- **Delete** – delete specific device-id
- **Enable/Block** – Enable or Block specific device-id
- **Search** – all device-id that match the search pattern
- **Upload** – upload csv file
- **Export** – export current Black list to csv file

Black List Config

Filter: OFF ON

Add Device ID[Hex] Search[Hex]

Show 10 entries

Row #	Device ID	Actions
1	0x10000000	<input type="button"/> <input type="button"/>
2	0x13000000	<input type="button"/> <input type="button"/>
3	0x16000000	<input type="button"/> <input type="button"/>
4	0x19000000	<input type="button"/> <input type="button"/>
5	0x1C000000	<input type="button"/> <input type="button"/>
6	0x1F000000	<input type="button"/> <input type="button"/>
7	0x22000000	<input type="button"/> <input type="button"/>
8	0x25000000	<input type="button"/> <input type="button"/>
9	0x28000000	<input type="button"/> <input type="button"/>
10	0x2B000000	<input type="button"/> <input type="button"/>

Showing 1 to 10 of 43 entries Previous 1 2 3 4 5 Next

6.4.7 System - SNMP Configuration

SNMP Configuration

Version
V1&V2

Read Only Community
public

Read/Write Community
private

Trap Version
V2

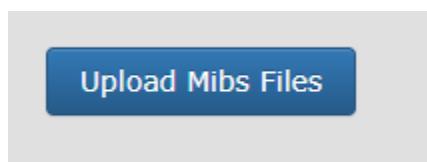
Trap Host 1
192.168.71.169

Trap Community 1
public

Trap Host 2
10.1.12.141

Trap Community 2
public

Save



Configure the SNMP setting:

- **Version** – SNMP version: V1&V2 or V3
- **Read Only Community** – Read only community name
- **Read/Write Community** – Read/Write community name
- **Trap version** – versions - V1 or V2
- **Trap Host 1** – IP of trap host 1
- **Trap Community 1** – name of trap host 1 community
- **Trap Host 2** – IP of trap host 2
- **Trap Community 2** – name of trap host 2 community
- **Upload Mibs Files** – upload the Mibs file to the local PC

6.4.8 System - IP Interfaces

IP Interfaces

Configuration

Name	State	DHCP		
wwan0	Enabled	Enabled		
MAC Address (Hex)	IP Address	Subnet Mask	Default GW	
00:1E:10:1F:00:00	10.122.51.201	255.255.255.252	10.122.51.202	
WEB Access	APN	User Name	Password	Roaming
Enabled	internet.golantelecom.net.			Disabled

Apply

Current Interfaces

Name	State	DHCP	WEB Access	MAC	IP	Mask	Default GW	Metric	APN	User Name	Roaming	Description
eth0	Enabled	Enabled	Enabled	24:0A:C4:19:77:27	10.1.10.120	255.255.0.0	10.1.1.1	0	NA		Disabled	Local Ethernet
wlan1	Enabled	Enabled	Disabled	24:0A:C4:19:77:24				0	NA		Disabled	Local WiFi
eth0:0	Enabled	Disabled	Enabled	24:0A:C4:19:77:27	192.168.1.1	255.255.0.0		0	NA		Disabled	Local Ethernet
wwan0	Enabled	Enabled	Enabled	00:1E:10:1F:00:00	10.122.51.201	255.255.255.252	10.122.51.202	0	internet.golantelecom.net.il		Disabled	Huawei MS2131 4G USB
ipsec0	Enabled	Enabled	Enabled	00:00:00:00:00:00	192.168.29.11	255.255.255.255		0	NA		Disabled	VPN

Display the NBX-R1000-RF IP interfaces settings.

- **Name:** The name of the interface
- **Status:** Enabled/disabled
- **DHCP:** Enabled/disabled. If disabled, the interface is in STATIC IP mode.
- **MAC:** MAC address
- **IP Address**
- **Subnet Mask**
- **Default GW**
- **Metric:** To set interface precedence.
- **WEB Access:** Enabled/disabled. If disabled, the GUI will not be available.
- **APN:** Only for PPP 3G/4G interface
- **User Name:** Only for PPP 3G/4G interface
- **Password:** Only for PPP 3G/4G interface
- **Roaming:** Only for 3G/4G interface

Both ETH0 and ETH0:0 linked to the RF-45 interface.

By default, ETH0 is set to DHCP and ETH0:0 is set to STATIC IP 192.168.1.1 / MASK 255.255.255.0.

If ETH0 is set to STATIC, ETH0:0 is disabled.

6.4.9 System – IP Routes

IP Routes

Configuration

Destination IP Address	Subnet Mask	Gateway	Admin State
0.0.0.0	0.0.0.0	10.122.51.202	Disabled
Metric	Interface		
0	wwan0		

Add **Remove** **Edit**

Current Routes

Admin State	IP Destination	Mask	Gateway	Metric	Type	Interface
Enabled	0.0.0.0	0.0.0.0	10.122.51.202	0	Dynamic	wwan0
Enabled	0.0.0.0	0.0.0.0	10.1.1.1	100	Dynamic	eth0
Enabled	10.1.0.0	255.255.0.0	0.0.0.0	0	Dynamic	eth0
Enabled	10.122.51.200	255.255.255.252	0.0.0.0	0	Dynamic	wwan0
Enabled	192.168.71.0	255.255.255.0	10.1.1.1	0	Dynamic	eth0

Displays the NBX current routing table and allows insertion/deletion of static routes.

Admin State – Enable/Disable this route.

IP Destination – IP network address.

Mask – IP network subnet mask.

Gateway – IP router address for this network.

Metric – Metric of this route for priorities in case of multiple routes.

Type – Connection type (Dynamic / persistent).

Interface – The interface which the route relates to.

6.4.10 System – IP DNS

IP DNS

Configuration

Destination IP Address
192.168.71.3

Add Remove

Current DNSs

IP	Type
192.168.71.14	Dynamic
192.168.71.3	Dynamic
192.168.71.3	Dynamic
194.90.0.11	Dynamic
212.143.0.11	Dynamic

Display the current domain name servers and allows to adding or removing static DNS.

Destination IP address – IP address of the DNS.

6.4.11 System – IPSec

IPSec

Mode	Interface
Disabled	Auto

Apply
Restart

Connections

Name	State	Server Address	Server ID	Server Subnet	Server Auth	Client ID	Client Auth
ipsec-ikev1-vpn-client	START	vpn.capacicom.com	192.116.194.54	10.1.0.0/16	PSK	nbx	PSK
capacicom-ipsec-ikev2-vpn-client	START	vpn101.capacicom.com	vpn101.capacicom.com	10.2.0.0/16	PUBKEY	nbx-30AEA4AD0434@capacicom.com	EAP-MSCHAPV2

Add
Remove
Edit
Download Config File
Upload Config File

Secrets

Selectors	Authentication	File Name
	PSK	
nbx-30AEA4AD0434@capacicom.com	EAP	

Add
Remove
Edit

Files

Name	Type	File Type	Remove	Download Certificate File
Capacicom.crt	CA	RSA-ECDSA	Remove	Download Certificate File

IPSEC – Configure a secure IPSec VPN tunnel.

Mode – Enable / disable all IPSEC tunnels.

Interface – Select on which IP interface the IPSEC will be initialize. AUTO for the IPSEC to initialize on the first available interface that allows an internet connection, otherwise will try to initialize only on the selected interface.

Restart – Manually restart the IPSEC tunnels and try to reconnect.

Connections – Define the IPsec connection settings

Add – Add a new connection to the list.

Remove – Remove a connection from the list.

Edit – Edit an existing connection.

Download Config File – Download a pre-configured connection setup from the PC to the NBX.

Upload Config File – Upload the existing connections from the NBX to the PC.

Form fields:

- Name: ipsec-ikev1-vpn-client
- State: START
- Server Address: vpn.capacicom.com
- Server ID: 192.116.194.54
- Server Subnet: 10.1.0.0/16
- Server Authentication: PSK
- Client ID: nbx
- Client Authentication: PSK

Buttons: Cancel, OK

Name – The name of the connection

State – Add - loads a connection without starting it.

Route - loads a connection and installs kernel traps. If traffic is detected, a connection is established.

Ignore - ignores the connection.

Start - loads a connection and brings it up immediately.

Server Address – the other VPN endpoint address. IP or fully-qualified domain name (FQDN).

Server ID – ID of the other VPN endpoint, used also for authentication. Can be an IP address, a fully-qualified domain name, an email address or a Distinguished Name for which the ID type is determined automatically and the string is converted to the appropriate encoding.

Server Subnet - network/netmask of the other VPN endpoint.

Server Authentication - Authentication method require from the other VPN endpoint.

Client ID - ID of the NBX.

Client Authentication - Authentication method use locally.

Secrets – Defines the VPN secrets.

Form fields:

- Selectors: (empty)
- Secret Authentication: PSK
- Secret Key: (redacted)
- Secret File: (empty)

Buttons: Cancel, OK

Selectors - A selector is an IP address, a Fully Qualified Domain Name, user@FQDN, %any or %any6.

Secret Authentication - type of the secret:

RSA - defines an RSA private key.

ECDSA - defines an ECDSA private key.

P12 - defines a PKCS#12 container.

PSK - defines a pre-shared key.

EAP - defines EAP credentials.

NTLM - defines NTLM credentials.

XAUTH - defines XAUTH credentials.

Secret Key – Password to use with the Key.

Secret File – Secret File used with the Key – the file should download using the “Download certificate file” button with the current type.

Files – Enable downloading or removing of a certificate file according to the type selected.

6.4.12 DAS

DAS

Mode
Master

Interface
eth0

DAS

Mode
Slave

Interface
eth0

Master IP Address
0.0.0.0

DAS – Allows multiple NBXs to work together, connected via IP, where the Master, in addition to operating as a repeater, is also responsible relaying messages to/from Sigfox base stations and the Slaves communicate with the devices.

Disabled – Disable DAS.

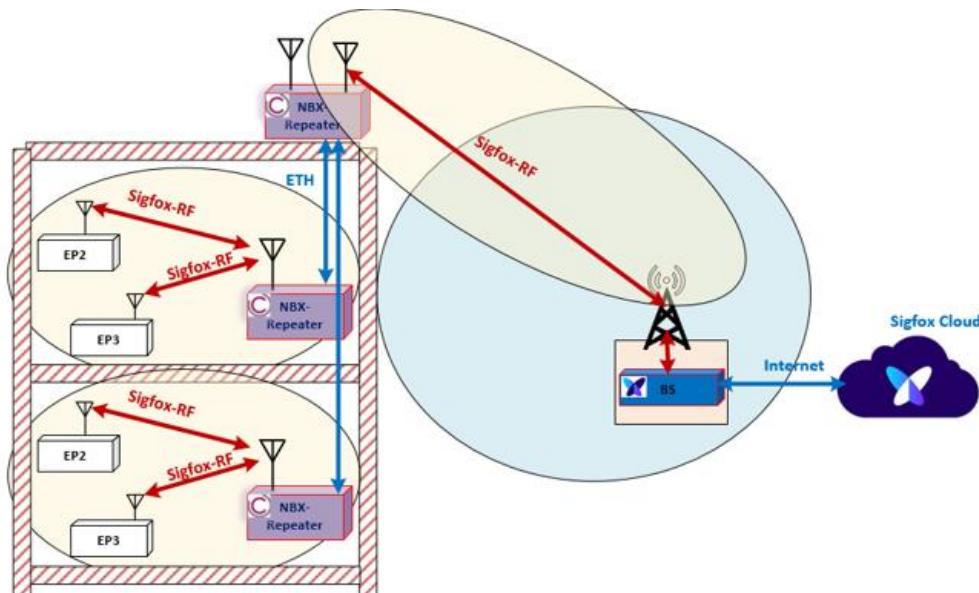
Slave Mode – All Sigfox uplink messages received by RF from Sigfox devices will be sent over IP to the MASTER. Downlink messages coming from the MASTER over IP will be sent by RF to the devices.

Master Mode – Uplink messages received over IP from the SLAVE will be sent by RF to the base station. RF downlink messages received from the base station and associate with a device that located behind the SLAVE will be send over IP.

Slave can have only one master.

Master can have up to 10 slaves.

To switch between MASTER and SLAVE modes, you must first change the Mode to Disabled.



6.4.13 System – IP Ping

IP Ping

Configuration

Target IP Address / Domain Name	Interface
8.8.8.8	eth0
Count 0-100000 (0- for Endless)	Timeout 1-10 (Seconds)
3	1

Status

State	Trasmitted	Received	Trasmit Error	Receive Error	Receive Failed	Average mSec	Percent Packet Loss
Not Active	3	3	0	0	0	70.544309	0.000000

Stop **Start**

Ping an IP address:

- **Target Ip Address / Domain name:** The IP address / Domain name to ping.
- **Interface:** The IP interface from which the Ping will be send. Use **Auto** to try all interfaces.
- **Count 0-100000 (0 – for endless):** Set the number of pings to be sent or 0 for endless pings.
- **Timeout 1-10 (Seconds):** Set the ping timeout.
- **Start:** Start pinging.
- **Stop:** Stop pinging.

Status: Display the current pinging status and statistics.

6.4.14 System – Wi-Fi

WiFi

Configuration

Mode	Antenna
Access Point Auto off	Internal
Disabled	
Station	
Access Point	
Access Point Auto off	

Apply

State	SSID	IP	NetMask	GateWay
NA	NA	192.168.0.2	255.255.255.0	

Configure Wi-Fi interface :

- **Disabled:** Disable the Wi-Fi.
- **Station:** The NBX is in station mode – connecting to available access points.
- **Access Point:** The NBX is in Access Point mode

Access Point Auto off: The NBX is in Access Point mode when powered up. After 15 minutes, the AP turns off automatically until the unit is again powered on. This feature allows the use of Wi-Fi for the initial configuration, or for on-site configuration. Change to any other mode to disable this mode. To switch between Station / Access Point / Access Point Auto off modes, you must first change the Mode to Disabled.

6.4.14.1 System - Wi-Fi – Station

WiFi

Configuration

Mode	Antenna
Station	Internal
SSID	Password
nbx-30AEA4AD0578	

Status

State	SSID	IP	NetMask	GateWay
READY	NA			

Stations

Show 50 entries

Index	SSID	RSSI	Authentication mode	Channel
0	nbx-30AEA4AD0578	-42	WPA_WPA2_PSK	1
1	Fastnet	-53	OPEN	11
2	FastGuest	-53	OPEN	11
3	Ccom	-53	OPEN	11
4	DIRECT-d8-HP M426 LaserJet	-59	WPA2_PSK	6
5	nbx-240AC4195A54	-60	OPEN	1
6	Rapac_ENG_Workers	-68	WPA2_ENTERPRISE	1
7	Rapac_Energy_Guest	-69	WPA2_PSK	1
8	MTU GUEST	-73	WPA2_PSK	1
9	MTU	-73	WPA2_PSK	1
10	TambourNet	-85	WPA2_ENTERPRISE	7
11	TamGuests	-85	WPA_WPA2_PSK	7
12	TamMobile	-87	WPA2_ENTERPRISE	7
13	DIRECT-YYASAFR-LP-RDmsPL	-90	WPA2_PSK	6
14	Rapac_ENG_Workers	-93	WPA2_ENTERPRISE	11

Previous **1** Next

Scan for available access points → press Scan.

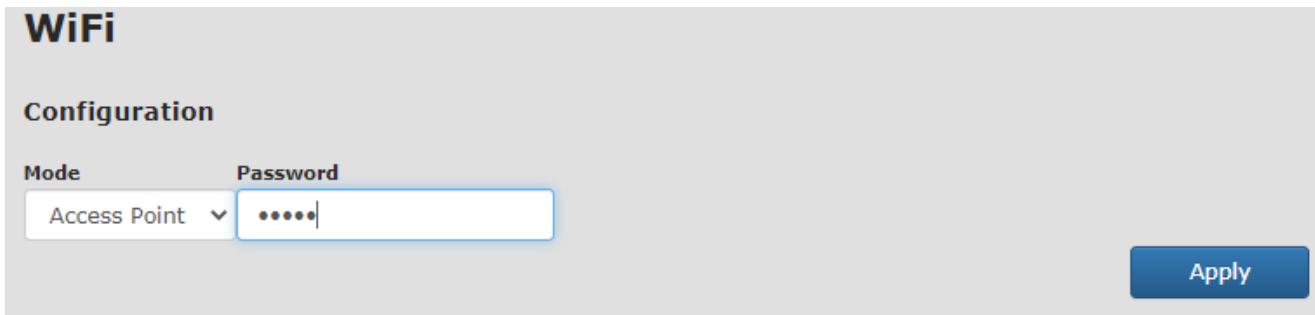
To connect: Select the desired access point from the list → provide password → press Connect or alternatively enter the SSID and Password manually and press Connect.

After connecting to the AP, an IP will be provided.

Status

State	SSID	IP	NetMask	GateWay
STATION CONNECTED	FastGuest	192.168.102.159	255.255.255.0	192.168.102.254

6.4.14.2 System - Wi-Fi – Access Point

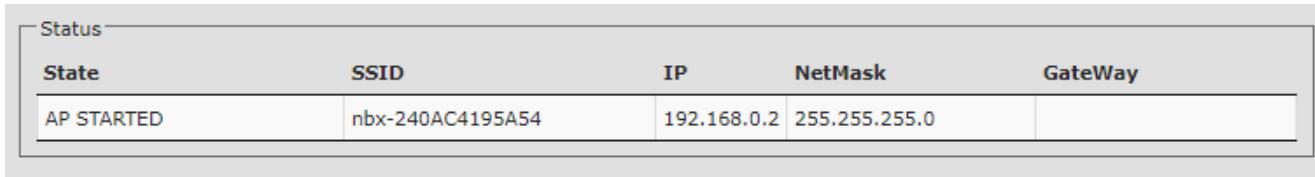


The screenshot shows a configuration interface for WiFi. At the top, the word "WiFi" is displayed in a large, bold, black font. Below it, the word "Configuration" is in a smaller, bold, black font. There are two input fields: "Mode" and "Password". The "Mode" field is a dropdown menu set to "Access Point". The "Password" field contains the text "*****". To the right of these fields is a blue "Apply" button.

To enable: Select *Access Point* mode → provide *password* (optional) → *Apply*

After enabling the access point, it provides the details of the SSID and the user may connect to it from an external device,

The IP Address to connect to the NBX via the AP is listed (192.168.0.2)



The screenshot shows a "Status" table for the WiFi interface. The table has columns for "State", "SSID", "IP", "NetMask", and "GateWay". There is one row of data: "AP STARTED" in the "State" column, "nbx-240AC4195A54" in the "SSID" column, "192.168.0.2" in the "IP" column, "255.255.255.0" in the "NetMask" column, and an empty cell in the "GateWay" column.

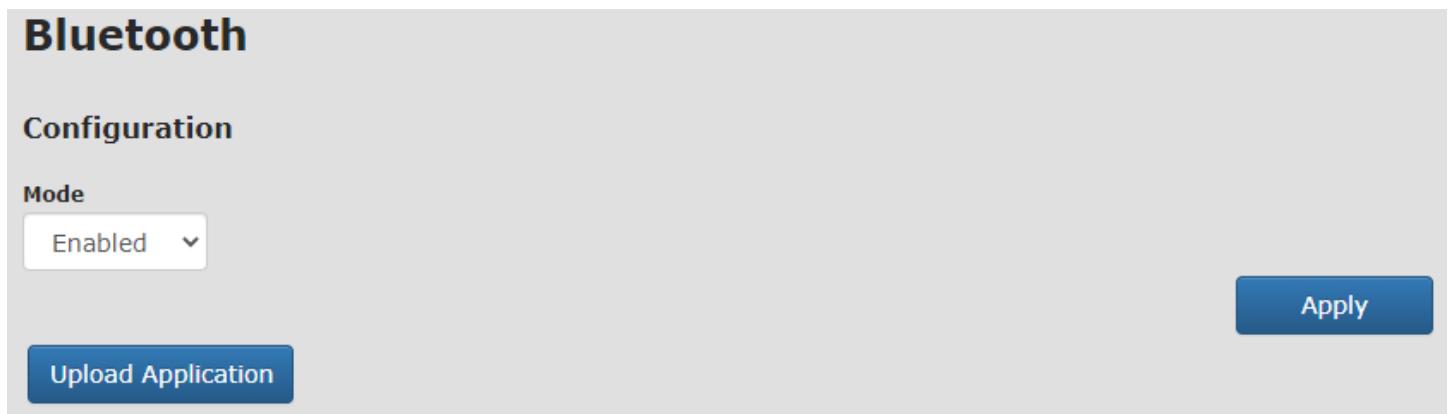
Status				
State	SSID	IP	NetMask	GateWay
AP STARTED	nbx-240AC4195A54	192.168.0.2	255.255.255.0	

6.4.14.3 System - Wi-Fi – Access Point Auto off

Same as 6.4.12.2 (Access Point), but with 15 minutes timeout after power-on / reboot, after which the AP will be automatically disabled until the next power up.

Default password: **12345678**

6.4.15 System - Bluetooth



The screenshot shows a configuration interface for the Bluetooth module. At the top, the word 'Bluetooth' is displayed in a large, bold, dark font. Below it, the word 'Configuration' is in a smaller, bold, dark font. On the left, the word 'Mode' is in a bold, dark font. To its right is a dropdown menu with the text 'Enabled' and a small downward arrow. On the right side of the interface is a blue rectangular button with the word 'Apply' in white. At the bottom left, there is a blue rectangular button with the text 'Upload Application' in white.

Configure Bluetooth interface :

- **Mode:** Enable/Disable.
- **Upload Application:** Upload the Android APK application from the NBX to the PC. This application can be installed on any Android machine to control & manage the NBX via BT.

6.4.16 System – General Configuration

General Configuration

Name
NBX-240AC4189C14 R1000RF

Location
This Location

Description
NBX - IoT Repeater

Contact
support@capacicom.com

Alias
NBX-114

Latitude
32.284734

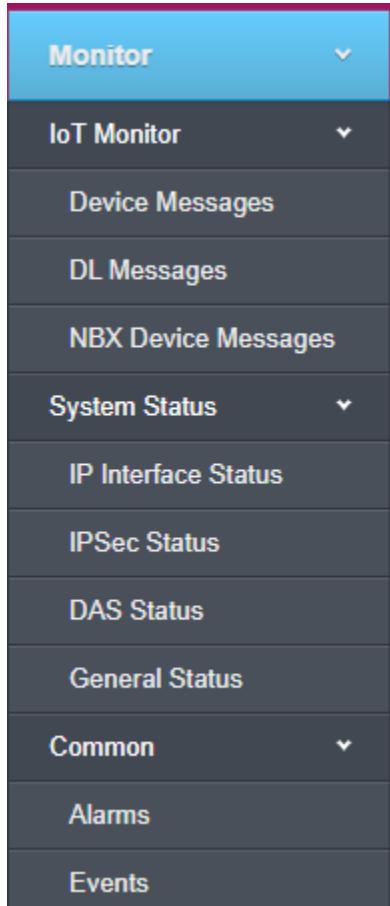
Longitude
34.872138

Save

General configuration to be read by SNMP and other control tools:

- **Name:** The name of the unit
- **Location:** Text describing the location
- **Description:** Description of the unit
- **Contact:** Support email contact
- **Alias:** An alias name for the unit. Will be displayed in the browser tab and CLI prompt.
- **Latitude:** The geo-location latitude value in a range of -90 - +90 degrees.
- **Longitude:** The geo-location longitude value in a range of -180 - +180 degrees.

6.5 Monitor



Under **Monitor** there are two main sections – **IoT** and **System**:

- **IoT Monitor:**
 - **Device Messages** – Displays UL messages received and repeated by the unit as well as DL messages received and associated to UL frames received
 - **DL Messages** – display all DL frames received, including those which not associated with a corresponding UL.
 - **NBX Device Messages** – Self Messages generated from/to the NBX unit
- **System Status:**
 - **IP Interface Status** – Statistics of the IP interfaces
 - **IPSEC Status** – Status of the IPSEC VPNs
 - **DAS Status** – Statistics of the DAS messages
 - **General Status** – General Status (temperature, Voltage...)
- **Common:**
 - **Alarms** – Current Alarms
 - **Events** – Events log

6.5.1 IoT - Device Messages

Device Messages		# Unique Devices		# Unique Messages		Total Received		Repeated		<input checked="" type="checkbox"/> Collect Messages					
Show 100 entries		<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	48	<input type="button" value=""/>	1296	1296	0	<input type="button" value=""/>				
Receive											Repeat				
Dev ID	MSG Counter	Type	TOD	BF	REP	Payload	Frame #	RF CHN	RSSI [dBm]	Freq [kHz]	Status	TOD	Freq [kHz]	TX CHN	Power [dBm]
Search Dev ID											Search Container				
0X12345678	1234	UL	2020-07-09 13:41:23	B	0	AA BB CC 00 EE FF 11 11 11 11 11 11	1/3	A	-64.82	-0.06	Repeated	13:41:24	25.500	A	10.13
												22 22 22 22 22 22 22	A	-68.36	25.42
0X00000041	14	UL	2020-07-09 13:39:58	B	0	11 11 11 11 11 11 11 11 11 11 11 11	1/3	A	-64.41	-0.07	Repeated	13:39:58	0.500	A	10.13
												22 22 22 22 22 22 22	A	-59.57	0.41
0X00000040	13	UL	2020-07-09 13:38:36	B	0	22 22 22 22 22 22 22 22 22 22 22 22	1/3	A	-64.81	-0.07	Repeated	13:38:36	-24.500	A	10.13
												22 22 22 22 22 22 22	A	-59.62	-24.57

Displaying the messages received and repeated by the unit (including associated DL messages).

All the relevant information for each unique message is displayed:

- **Receive**

- **Dev-ID:** Device ID (can **search** for specific device-ID's)
- **MSG Counter:** Message counter (can **search** for specific MC's)
- **Type:** UL, UL100 or DL (UL100 are UL messages at 100Hz Baud)
- **TOD:** Time of Day
- **BF:** Bi-directional or Uni-directional mode (ACK or not)
- **REP:** Repetition bit on (1) / off (0)
- **Payload:** payload data (can **search** for specific data) – available in **Expert mode** only
- **Frame #:** how many frames out of the 3 were received
- **RF CHN:** The strongest RSSI frame, RF channel (A or B)
- **RSSI[dBm]:** The strongest RSSI frame
- **Freq.[kHz]:** The strongest RSSI frame, frequency (relative to the central band).

- **Repeat**

- **Status:** the status of the repetition: Repeated, pending, ...
- **TOD:** Time of Day of the transmitted
- **Freq.:** transmitted frequency (relative to the central band – N.B. it is different for both UL and DL).
- **TX Channel –** Which channel the message was repeated from
- **Power[dBm]:** Transmitted power

DL messages are placed below the associated UL message which triggered it.

Collect Messages – Enable/disable message collection mechanism.

# Unique Devices	# Unique Messages	Total Received	Repeated	<input checked="" type="checkbox"/> Collect Messages
48	<input type="button" value=""/>	1296	1296	<input type="button" value=""/>

Detailed message information: can be displayed when clicking on the message (+):

Dev ID	MSG Counter	Type	TOD	BF	REP	Payload			Frame #	RF CHN	RSSI [dBm]	Freq [kHz]	Status	TOD	Freq [kHz]	TX CHN	Power [dBm]
Search Dev ID		Search MC		Search Container													
0X12345678	1234	UL	2020-07-09 13:41:23	B	0	AA BB CC DD EE FF 11 11 11 11 11 11	1/3	A	-64.82	-0.06	Repeated	13:41:24	25.500	A	10.13		
		DL	2020-07-09 13:41:48			22 22 22 22 22 22 22		A	-68.36	25.42	Repeated	13:41:49	-0.06	A	30.00		
UL Container: 24 D2 78 56 34 12 AA BB CC DD EE FF 11 11 11 11 11 11 77 5E																	
		UL	2020-07-09 13:41:24		0			1	B	-30.49	25.50						
		UL	2020-07-09 13:41:23		0			1	B	-74.16	-0.06						
		UL	2020-07-09 13:41:23		0			1	A	-64.82	-0.06						

All the related information details of each frame are displayed.

OOB/Control message information: detailed the Sigfox control message information.

VDD-Idle, VDD-TX, Temperature, RSSI.

④	0XFEDCBA98	275	UL	2020-08-11 08:22:16	U	0	09 50 55 50 55 12 02 39	1/1			Transmitted
⑤	UL Container: 01 13 98 BA DC FE 09 50 55 50 55 12 02 39 F6 B3 13 52 00 00					VDD-IDLE: 21.840[V], VDD-Tx: 21.840[V], TEMP: 53.0[C], RSSI: -43[dBm]					
			UL	2020-08-11 08:22:16		0		1	A		-100.13
⑥	0XFEDCBA98	274	UL	2020-08-11 08:21:48	B	0	08 50 55 50 55 12 02 00	1/3			Transmitted
			DL	2020-08-11 08:22:16			43 64 64 56 45 74 37 57		A	-43.03	-24.51

Statistics: displays the overall messages statistics. How many were received and how many were repeated.

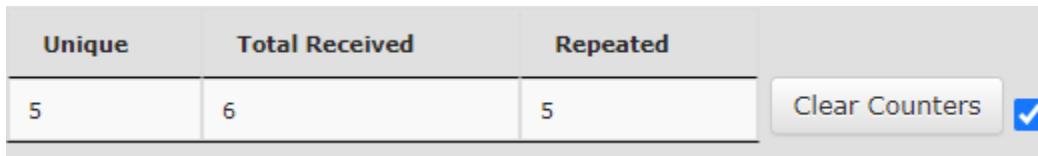
# Unique Devices	# Unique Messages	Total Received	Repeated	<input checked="" type="checkbox"/> Collect Messages	
48		1296	1296	0	

- **# Unique Devices**: Number of unique device-id's
- **# Unique Messages**: Message counter
- **Total Received** : How many messages were received
- **Repeated** : Total messages repeated

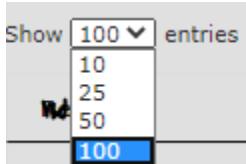
Actions:



- **Clear counters:** Clear the statistics.



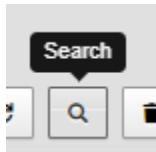
- **Show:** display 10,25,50 or 100 entries



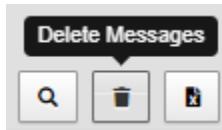
- **Refresh:** refresh the message monitor



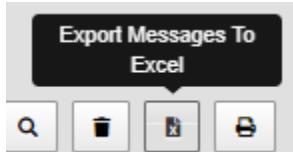
- **Search:** Search according to search criteria in other fields



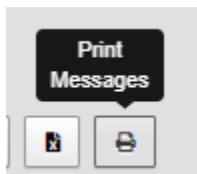
- **Delete:** clear all the messages



- **Export:** export the messages displayed to Excel file



- **Print:** Print the displayed messages



6.5.2 IoT - DL Messages

DL Messages						
		Unique	Total Received	Repeated		
		3	3	3	Clear Counters	
Show	100	entries				
TOD	Associate Dev ID	Associate MSG Counter	DL-PHY-CONTENT	RSSI [dBm]	Freq [kHz]	Status
2020-07-09 13:41:48	0X12345678	22136	1A CB 12 FD DB F2 3F FE D0 87 02 57 C0 79 6C	-68.36	25.420	Repeated
2020-07-09 13:41:48			1A CB 12 FD DB F2 3F FE D0 87 02 57 C0 79 6C	-70.10	25.650	Replication
2020-07-09 13:41:48			1A CB 12 FD DB F2 3F FE D0 87 02 57 C0 79 6C	-68.36	25.420	Repeated
2020-07-09 13:40:22	0X00000041	65	45 DC D1 DE 63 AB A3 6F 04 FD EB 59 37 CC 85	-59.57	0.406	Repeated
2020-07-09 13:39:00	0X00000040	64	EA D0 72 4D F4 94 A3 D4 5A E9 3F 67 FA 6F FA	-59.62	-24.568	Repeated

Displays all DL received frames, including ones which not associated with UL repeated by the unit.

For each unique message all the relevant information is displayed:

- **TOD:** Time of Day
- **For associated messages:**
 - **Dev-ID:** Device ID
 - **MSG Counter:** Message counter
 - **DL-PHY-Content**
 - **RSSI[dBm]** : The strongest RSSI frame, RSSI
 - **Freq.[kHz]** : The strongest RSSI frame, frequency (relative the central band).
 - **Status:** Confirmation if it was repeated.

Detailed message information: Displays more details when clicking on the message (+).

Actions:

Similar to Device messages screen.

Show	100	entries				
------	-----	---------	--	--	--	--

- **Clear counters:** Clear the statistics.
- **Show:** display 10,25,50 or 100 entries
- **Refresh:** refresh the message monitor
- **Delete:** clear all the messages
- **Export:** export the messages displayed to Excel file
- **Print:** Print the displayed messages

6.5.3 IoT - NBX Device Messages

Self Messages															
<input checked="" type="checkbox"/> Collect Messages															
Show 100 entries     															
Receive							Repeat								
Dev ID	MSG Counter	Type	TOD	BF	REP	Payload	Frame #	RF CHN	RSSI [dBm]	Freq [kHz]	Status	TOD	Freq [kHz]	TX CHN	Power [dBm]
 0XFEDCBA98	1924	UL	2020-07-09 13:43:27	B	0	08 05 00 05 00 32 00 00	1/3				Transmitted	13:43:28	50.500	A	10.13
 0XFEDCBA98	1923	UL	2020-07-09 13:33:27	B	0	01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00	1/3				Transmitted	13:33:27	75.500	A	10.13
 0XFEDCBA98	1922	UL	2020-07-09 13:23:27	B	0	08 05 00 05 00 31 00 00	1/3				Transmitted	13:23:27	-24.500	A	10.13

Showing 1 to 3 of 3 entries

Previous  1 Next

Display NBX Device Messages created by the unit.

Similar fields as in Device messages screen.

Actions:

Like Device messages screen.

Show 100 entries					
------------------	---	---	---	---	---

- **Clear counters:** Clear the statistics.
- **Show:** display 10,25,50 or 100 entries
- **Refresh:** refresh the message monitor
- **Search:** Search according to search criteria in other fields
- **Delete:** clear all the messages
- **Export:** export the messages displayed to Excel file
- **Print:** Print the displayed messages

6.5.4 System – IP Interface Status

IP Interfaces Status

Name	State	DHCP	WEB Access	MAC	IP	Mask	Defult GW	RX Packets	TX Packets	RX Bytes	TX Bytes	Description
eth0	Enabled	Enabled	Enabled	30:AE:A4:AC:FB:3F	192.168.128.14	255.255.255.0	192.168.128.1	47592	40133	6943650	6383944	Local Ethernet
wlan1	Enabled	Enabled	Enabled	30:AE:A4:AC:FB:3C	192.168.30.2	255.255.255.0		0	60	0	11248	Local WiFi
wwan0	Enabled	Enabled	Enabled	00:1E:10:1F:00:00	10.45.149.76	255.255.255.248	10.45.149.73	5062	5910	476133	1284570	Huawei MS2131 4G USB
eth0:0	Enabled	Disabled	Enabled	30:AE:A4:AC:FB:3F	192.168.1.1	255.255.255.0						Local Ethernet
ipsec0	Enabled	Enabled	Enabled	00:00:00:00:00:00	10.219.0.31	255.255.255.255		0	15	0	720	VPN

USB 4G/3G Status

Name	RSSI	BER	System Service	Service Domain	Roaming	System Mode	SIM Card	Sub Mode	Network Mode	Network Access	Network Name	Connection State
wwan0	-101	NA	Valid	PS+CS	No	WCDMA	Valid	HSDPA	Auto-Manual	UTRAN GSM-w/EGPRS	YES OPTUS	Connected

Display the NBX-R1000-RF IP interfaces and USB Dongle, status and statistics.

6.5.5 System – IPSEC Status

IPSec Status

Connection Name	State	Duration	Source IP	Destination IP	Source Net	Destination Net
capacicom-ipsec-ikev2-vpn-client	ESTABLISHED	27 seconds	192.168.43.96	31.168.237.101	10.219.0.15/32	10.2.0.0/16

Display the status of IPSEC VPN in NBX-R1000-RF.

- **Name**
- **State**
- **Duration**
- **Source IP**
- **Destination IP**
- **Source Net**
- **Destination Net**

6.5.6 System – DAS Status

Display the NBX-R1000-RF IPSec status and statistics. The Status info depends on DAS setting, **Master/Slave/None**

- **Slave/Master ID** – Which Master/Slave ID
- **Socket**
- **IP** – IP Address
- **Port** – IP port
- **UL Packets** – number of UL packets
- **DL Packets** – number of DL packets
- **KA Packets** – number of Keep Alive packets
- **Actions** – Clear counters

Master:

DAS Status

Connected Devices

Show 10 entries

Slave ID	Socket	IP	Port	UL Packets	DL Packets	KA Packets	Actions
0	44	10.1.10.127	57346	127	0	63	
2	55	10.1.10.12	47214	128	0	64	

Showing 1 to 2 of 2 entries

Previous Next

Slave:

DAS Status

Connected Devices

Show 10 entries

Master ID	Socket	IP	Port	UL Packets	DL Packets	KA Packets	Actions
0	47	10.1.10.158	8888	260	0	128	

Showing 1 to 1 of 1 entries

Previous Next

None:

DAS Status

Connected Devices

Show 10 entries

Master ID	Socket	IP	Port	UL Packets	DL Packets	KA Packets	Actions
No data available in table							

Showing 0 to 0 of 0 entries

Previous Next

6.5.7 System – General Status

General Status	
Voltage [V]	Temperature [°C]
22.94	49.76
FW Status	
System Up Time	
1:58	

Display the NBX-R1000-RF general status:

- **Voltage [V]** – Input Voltage [Volt]
- **Temperature** (SDR chip Temperature) [°C]
- **System up Time** – time elapsed since system boot

6.5.8 Common – Alarms

Alarms

Current Alarms

Description	Type	Severity	State
No data available in table			

Display the NBX-R1000-RF Alarms.

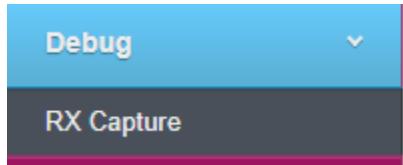
6.5.9 Common – Events

Events

Events Log			
Show 50 entries			
Index	Time	Description	State
157	2021-07-21 08:05:09	Finish Setting New RF Configuration	On
156	2021-07-21 08:05:07	Finish Setting TX Policy	On
155	2021-07-21 08:05:07	Trigger Setting TX Policy	On
154	2021-07-21 08:05:07	Trigger Setting New RF Configuration	On
153	2021-07-21 08:05:07	Device power up	On
152	2021-07-20 14:26:00	Finish Setting New RF Configuration	On
151	2021-07-20 14:25:59	Finish Setting TX Policy	On
150	2021-07-20 14:25:59	Trigger Setting TX Policy	On
149	2021-07-20 14:25:59	Trigger Setting New RF Configuration	On
148	2021-07-20 14:25:59	Device power up	On
147	2021-07-20 12:36:57	Finish Setting New RF Configuration	On
146	2021-07-20 12:36:56	Finish Setting TX Policy	On
145	2021-07-20 12:36:56	Trigger Setting TX Policy	On
144	2021-07-20 12:36:55	Trigger Setting New RF Configuration	On

Displays events on the NBX-R1000-RF.

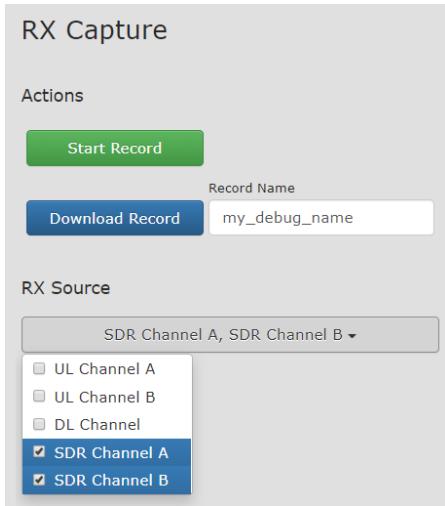
6.6 Debug



Under **Debug** there are the following sections:

- **RX Capture** – Captures the raw RF samples and analyzes the spectrum
- **Additional – available only in Expert mode**

6.6.1 RX Capture

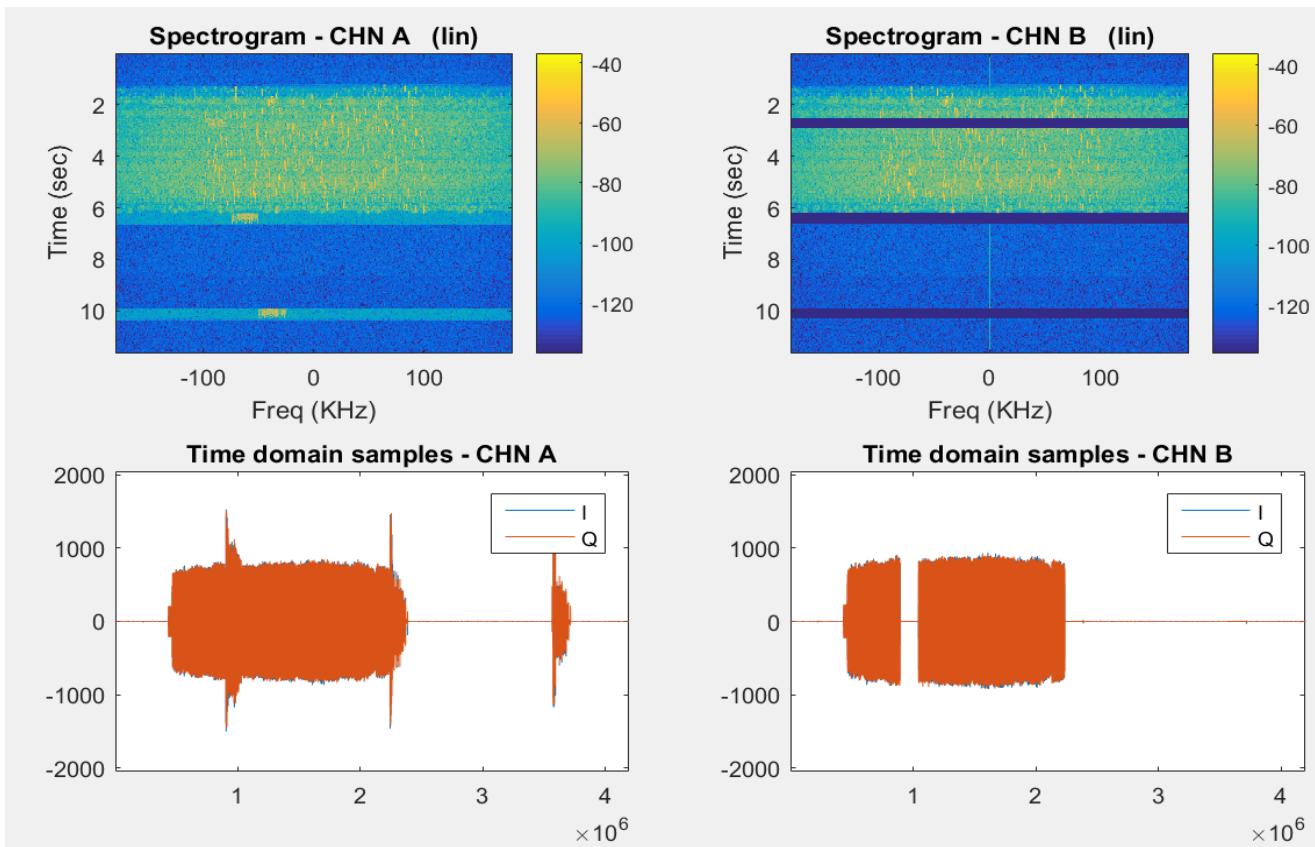


RX Source: Captures samples from the RF channel chosen for offline analysis. Either the entire band (SDR: UL+DL) or for each channel narrow band (UL-A, UL-B, DL).

Start Record/Stop Record: Starts and stops the recording of the chosen band(s). Can capture up to: 10 or 20 seconds for single/dual channel mode or 1 or 2 seconds for the entire band.

Download Record: Downloads the file. File name can be selected - every new capture, increase the name number suffix (#).

Choose a File: Select a previously recorded file to show the analysis. Embedded analysis tool included in the “RX Capture” page. Data can also be analyzed offline by expert tools. e.g.:



6.6.1.1 RX Capture - Analysis

Upload the captured data by selecting the file:

Graphs

Choose File

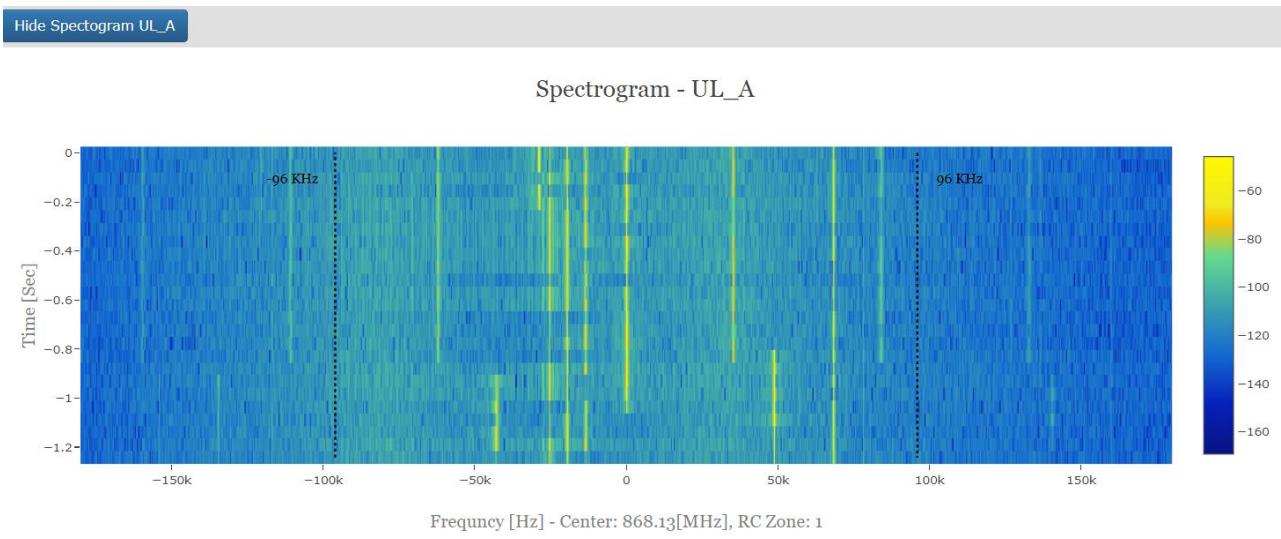
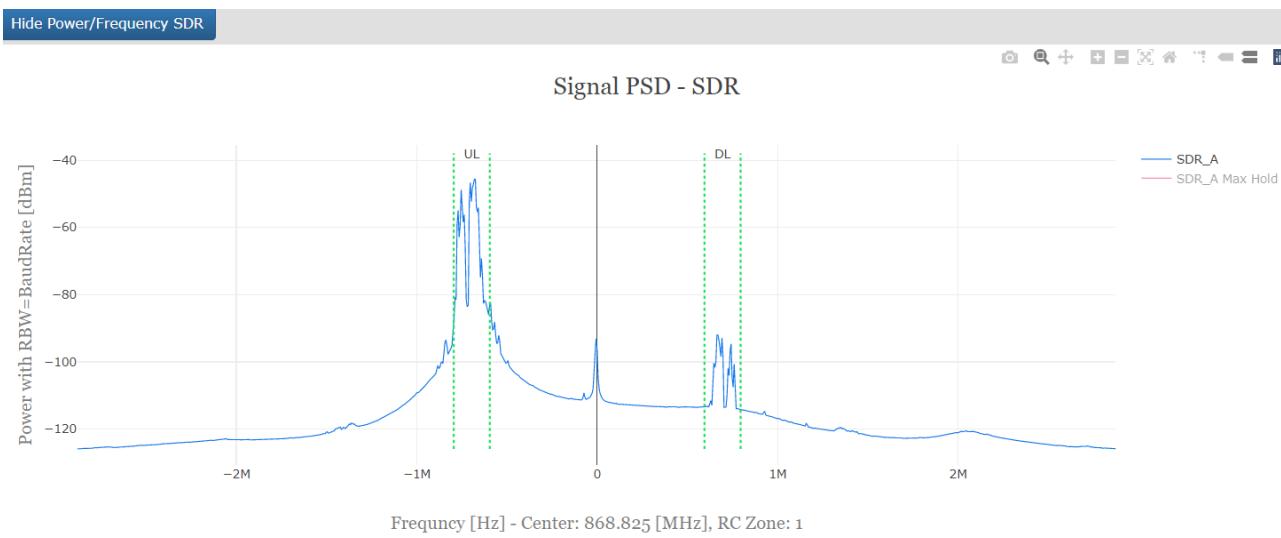
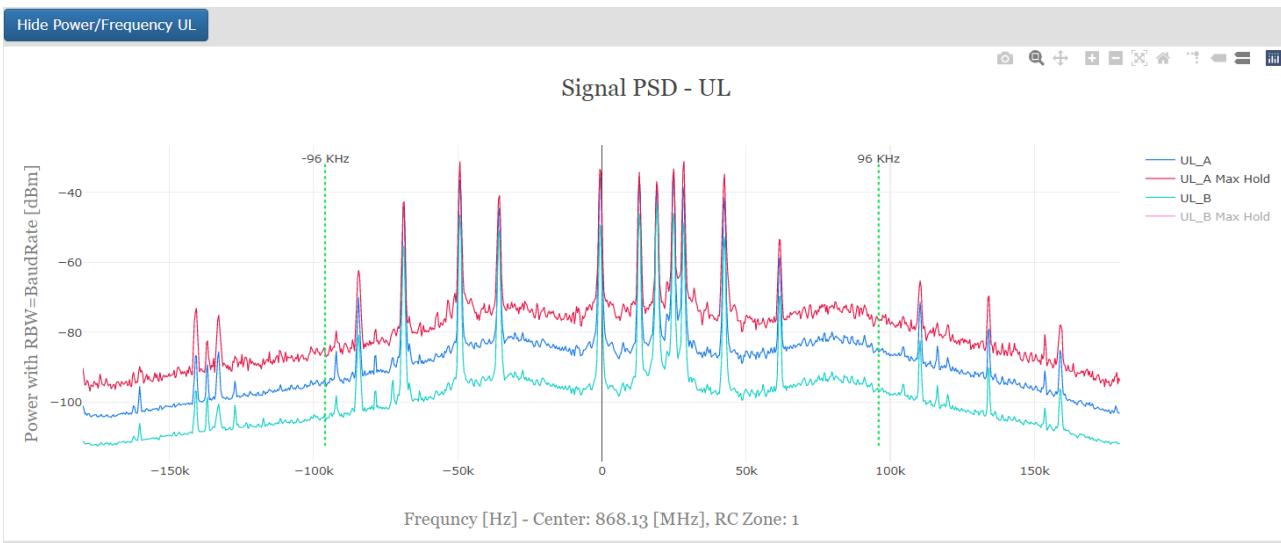
UL and DL captures occupy 360KHz around the RC zone central frequencies. 192KHz is Sigfox usable band.

SDR captures occupy 5.7MHz around the mid. Frequency between UL and DL, so, it displays both bands.

There are several analysis options (pressing on the legend turn on/off the display) :

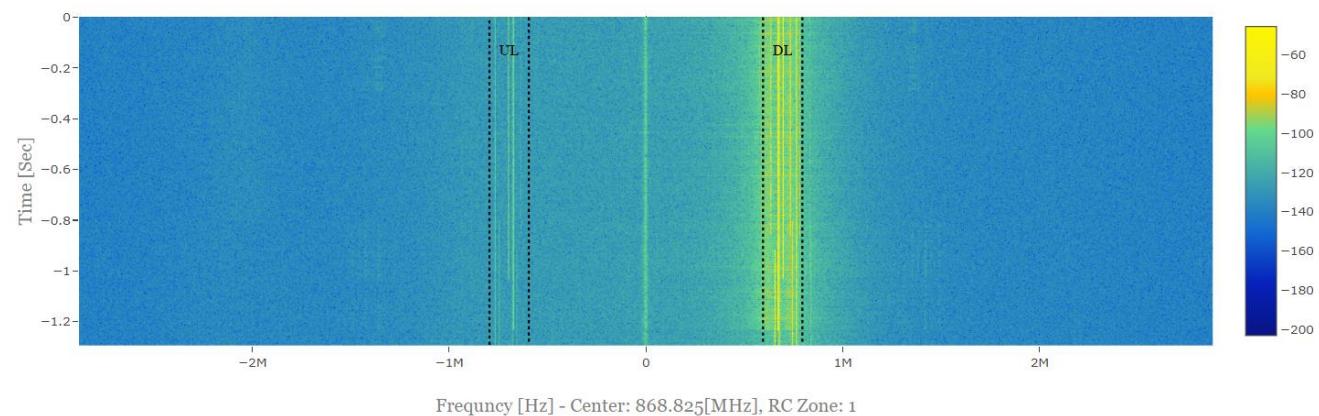
- Average PSD (Power Spectral Density)
- Max-Hold PSD
- Spectrogram (freq. over time)

The limits and frequencies are displayed according to the current selected RF configuration of the unit. E.g.:

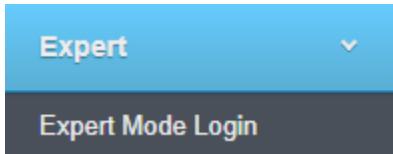


[Hide Spectrogram SDR_A](#)

Spectrogram - SDR_A

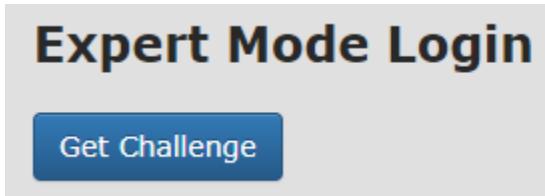


6.7 Expert



Under **Expert** there are the additional sections which are for “expert” user (**Super-User** group) and **internal** use:

Need to login first:



Each time a different challenge is generated to login.

7 Monitor & Configuration– CLI

This section will describe some **BASIC CLI** access mode. A more detailed reference manual can be used.

7.1 General - CLI

After identifying the NBX R1000-RF IP Address, it can be access via SSH using standard tools, e.g. putty).

After login, there are 3 main functionalities:

- **Debug** – special debug instructions {internal use}
- **Enable** – Configure various setting in the device.
- **Show** – display current status of the device

In addition, there are **global** CLI commands:

- **?** – display help (at any stage of the CLI – even during command entry)
- **Exit** – exit one level up
- **Help** – display help
- **History** – display current session CLI history
- **Logout** – Logout from the CLI session
- **Top** – Return to default mode

```
!      Comments
debug  Change to the debug mode
enable Turn on privileged commands
exit   Exit from the CLI
help   Display an overview of the CLI syntax
history Display the current session's command line history
logout Logout of the current CLI session
show   Change to the show mode
top    Return to the default mode
```

Menu commands are indicated by **(M)**. At each hierarchy the current location is in the command prefix.

e.g. in the **enable** menu :

```
#  
? →  
...  
configure (M) Enter configuration mode  
...  
in the sub menu enable>config>system>general  
(config-system-general) #
```

7.2 Login - CLI

Need to provide user-name and password.

```
login as: admin
admin@10.1.12.12's password:****

*****
*      Capacicom NBX CLI      *
*                                *
*      WARNING: Authorized Access Only  *
*****
```

Welcome admin it is Thu Jan 1 00:02:22 UTC 1970
>

7.3 System - CLI

Under **System** all users will see the following sections.

System configuration and monitor are under the general “**Monitor**”, “**Configuration**” menus.

- **Version** - SW and HW version, S/N
- **Software Upgrade** – SW upgrade
- **Database** – Database management
- **Users** – User management
- **System Debug** – log files for debug
- **General** – reboot
- **Safe Mode** – Safe mode

7.3.1 Version

Display the NBX-R1000-RF SW and HW versions and S/N.

```
> show system serial_number
24:0a:c4:19:77:24
> show system hw_version
5
> show system version
1.0.0+1836
> show system esp_version
software version: 1.0.5.0
> show system all
Temperature: 48.812817
Voltage: 22.608000
Product: NBX-R1000RF
Serial Number: 24:0a:c4:19:77:24
System HW Version: 5
System Version: 1.0.0+1836 [25/05/2021-16:13]
System Version Backup: 1.0.0-local+1822 [04/05/2021-15:06]
Build Date (D.M.Y): 15.2.21 | Build: 1
ESP software version: 0.0.0.0
```

7.3.2 Software Upgrade

Need to have a **tftp server** to access the SW package.

First need to download and extract (in the enable-system menu):

```
(system) # software_upgrade < Software.tar.gz file> < tftp file server IP> <server type>
```

e.g.

```
(system) # software_upgrade sw.package.iot_nbx_40MHz.1.0.0+1351.tar.gz 10.1.1.2 tftp
```

Afterwards, need to swap to backup:

```
(system) # swap_software
```

8 Monitor & Configuration—SNMP

Following are the SNMP settings and commands. The IP address and the general settings. Need to be known in order to access the unit.

SWNMP discovery tool can be used. See section

8.1 SNMP General Configuration

Before starting to work with the unit via SNMP, it needs to be configured according to your NMS requirements.

Configuring the SNMP setting:

- **Version** – SNMP version: V1&V2 or V3
- **Read Only Community** – Read only community name
- **Read/Write Community** – Read/Write community name
- **Trap version** – versions - V1 or V2
- **Trap Host 1** – IP of trap host 1
- **Trap Community 1** – name of trap host 1 community
- **Trap Host 2** – IP of trap host 2
- **Trap Community 2** – name of trap host 2 community

8.2 SNMP Commands (MIB)

MIB files are delivered with the SW version. There are 3 NBX specific command files:

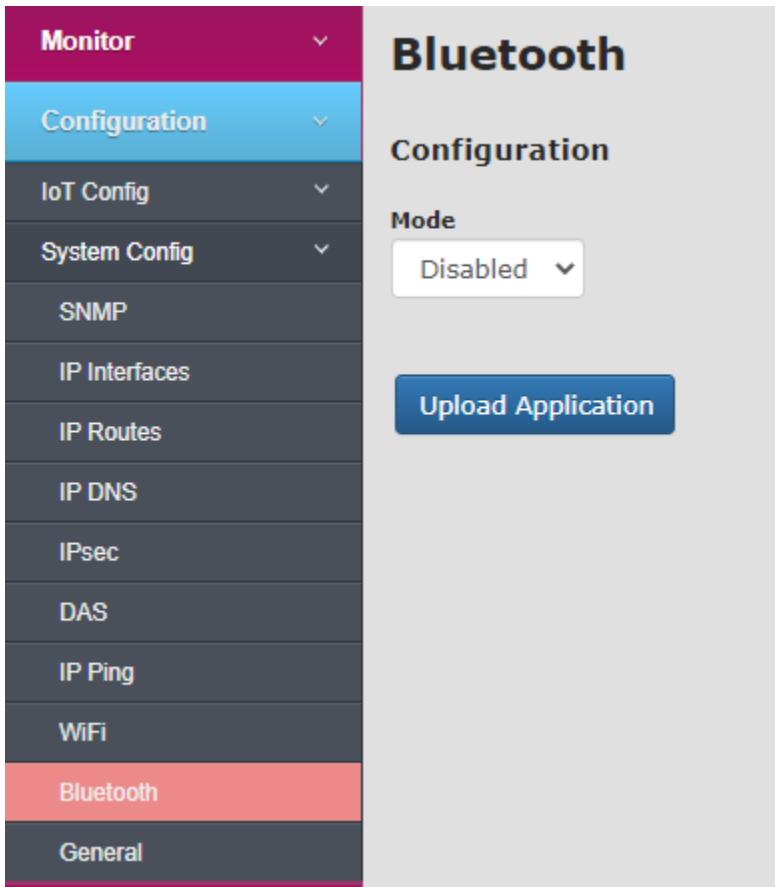
- **CAPACICOM-COMMON.mib** – basic capacicom product commands (e.g., Software upgrade)
- **CAPACICOM-NBX.mib** - specific NBX R1000-RF commands (e.g., IoT RF settings)
- **CAPACICOM-ROOT.mib** – link to the global mib tree

Detailed commands are described within the mib files.

9 Monitor & Configuration – Bluetooth

To configure and monitor the device through Bluetooth you need first to install the application (nbx.apk) on Android device.

The application can be uploaded directly from the NBX under the Configuration→System Config → Bluetooth menu.

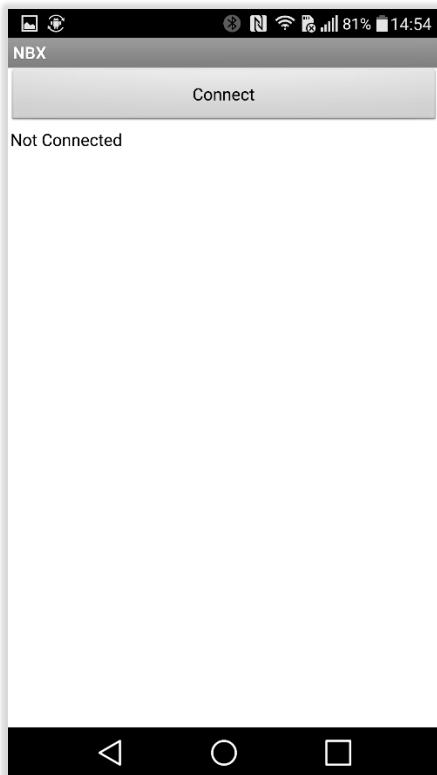


Download the application file (nbx.apk) to your Android device.

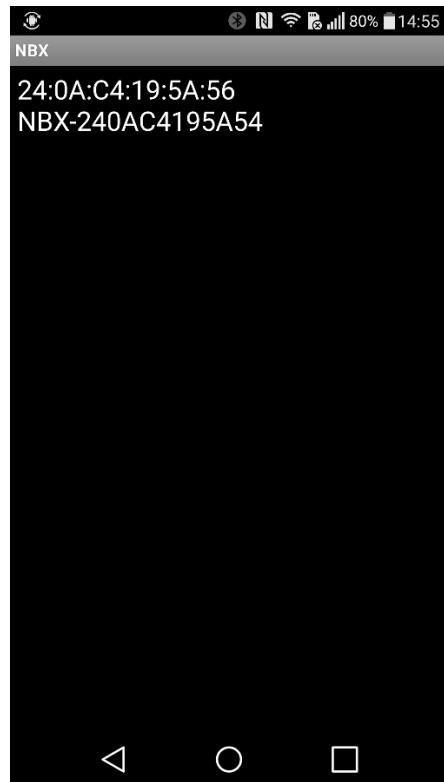
Open the file and accept installing an application from unknown source.

In your Android Bluetooth Settings menu on your device, activate the search and find the NBX device (named: NBX-<serial-number>), select it to pair the two together.

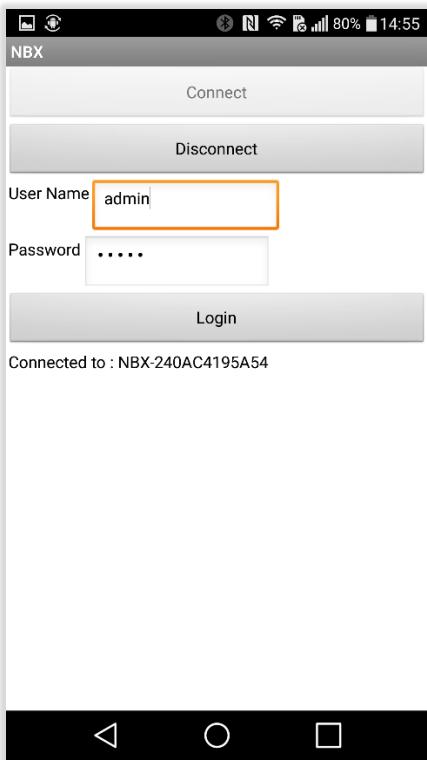
Once pairing is finished, open the application, you should get the following screen:



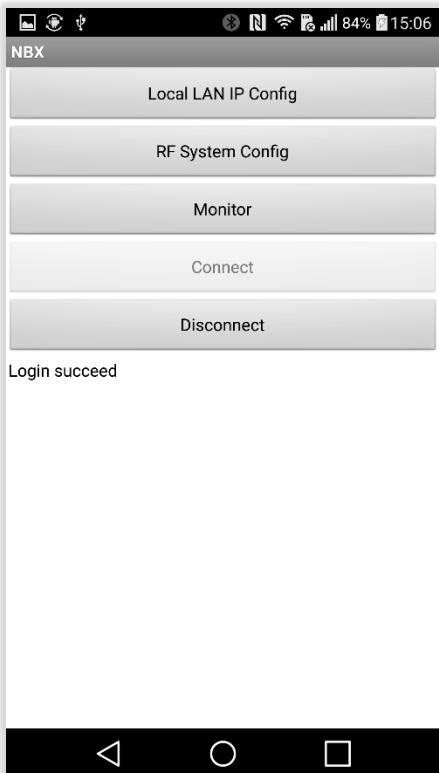
Press connect and select the NBX from the list:



You should get the login screen:

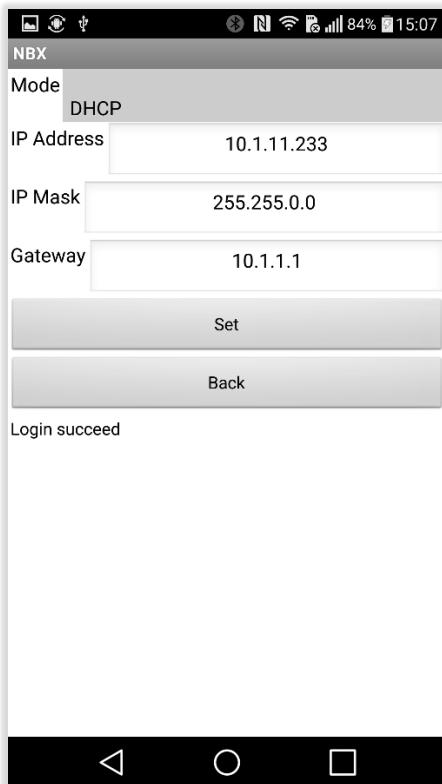


Enter username and password and press “Login”, if user authenticated succeed you should get the main menu screen:

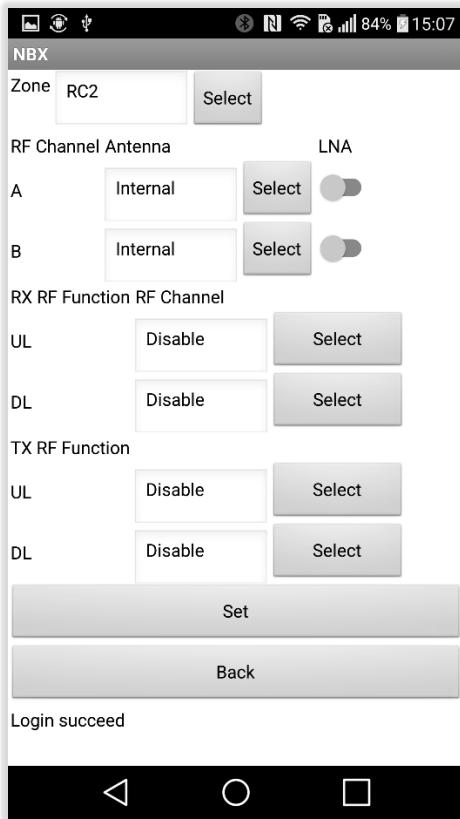


Depending on your selection you will get one of the following screens:

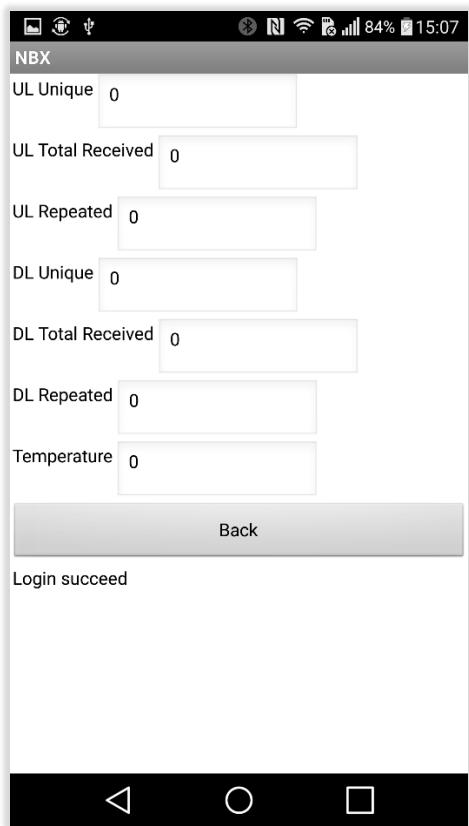
Monitor and configure IP settings:



RF Settings:



Monitoring:



10 Monitor & Configuration – IoT - Sigfox Protocol

The NBX R1000-RF is also a Sigfox device which can be accessed over the Sigfox network

10.1 NBX Device Mode - General Configuration

The NBX unit can immediately be accessed over Sigfox network as a device without specific configuration.

Expert mode enables additional settings to the default configuration.

- **App Mode** – Private, Public or Test mode – encryption key used.
- **Auth Layer** – Disabled, Active – Message authentication state.
- **Reset MC** – Reset the message counter.
- **Test Key** – Set the test key to be used.
- **Set Test Key** – Change the test-key according to the Test Key field.
- **Message Type** – Set the control message to be sent via the TX NBX SFX Message button.
- **Download Device Key** – Download an encrypted device KEY/ID from PC to NBX (need reboot to activate).
- **Set App Config** – Save the new configuration.

The Device ID and key are unique per NBX unit.

This will be provided for production units.

10.2 NBX Device Mode - General Flow

The NBX sends periodic status UL messages, indicating the unit status (power, repeated messages, etc.). The user can reply with a DL message with specific command, e.g., change configuration, send advance status etc.

The DL message will reconfigure NBX unit accordingly.

An application server can be used to manage all the repeaters in the network.

Any change to the RF configuration will put the unit in safe mode until an acknowledge is sent.

10.3 NBX Device Mode – Messages

Detailed message types and information are outlined in a separate document.

11 Specifications

The following are the NBX-R1000-RF specifications

Table 1 NBX specifications

Radio - IoT	
Standard	Sigfox UNB Protocol – All regions (100bps and 600 bps)
Operational Frequencies	865 MHz to 928 MHz (depend on country/regulations)
Receiver Sensitivity	-140dBm @ 100bps / -134dBm @ 600bps
Receiver Throughput	1000 @100bps /300 @600bps simultaneous messages (10 M/day)
Max output Power	27 dBm (depend on country/regulations)
RF channels	2 simultaneous RX/TX channels
Antennas	2 x External
Interfaces/Connectivity	
Ethernet	1 x RJ45 (10/100BaseT)
EXT Antennas	2 x RP-SMA
Cellular	1 x USB dongle (internal)
Wi-Fi/BT	1 x Wi-Fi/BT internal antenna
Power	
Power input	Passive PoE, 10 – 48 V
Power Consumption	<5W typical
Mechanical	
Casing (W x H x D)	185 x 185 x 57 mm
Weight	540 gr
Mounting options	Wall, Window, Pole, Desk mounts
Environmental	
Operating Temperature	-30 to +55°C
Protection	IP67
Compliance	
Safety	EN 60950-22, IEC 60950-22; EN 62368-1, IEC 62368-1
Radio	EN 300 220-2 ; EN 300 220-1 ; FCC part 15.247 ; ARIB STD-T108, ETSI-300-328 (Wi-Fi / BT)
EMC	EN 301 489-3; EN 301 489-1 FCC Part 15 B; FCC 15.207 and FCC 15.209

12 Appendix

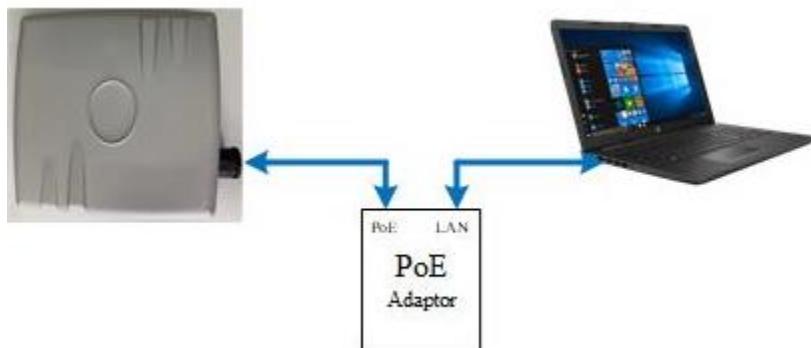
12.1 Initial IP Connectivity Setup

IP connectivity uses port **80** for WEB GUI and port **22** for **SSH CLI**. Make sure that the network defined policies are not blocking these ports.

In addition, a VPN may be set to secure the unit access.

IP connectivity to the unit can be obtained by the following guidelines:

12.1.1 RJ-45 IP port



IP Interfaces

Configuration

Name	State	DHCP	
eth0:0	Enabled	Disabled	
MAC Address (Hex)	IP Address	Subnet Mask	Default GW
30:AE:A4:AD:04:8B	192.168.1.1	255.255.255.0	
WEB Access	APN	<input type="button" value="Apply"/>	
Enabled	NA	<input type="button" value="Apply"/>	

Name	State	DHCP	WEB Access	MAC	IP	Mask	Default GW	APN	User Name	Roaming	Description
eth0	Enabled	Enabled	Enabled	30:AE:A4:AD:04:8B	10.1.10.69	255.255.0.0	10.1.1.1	NA		Disabled	Local Ethernet
wlan1	Enabled	Enabled	Enabled	30:AE:A4:AD:04:88	192.168.0.2	255.255.255.0		NA		Disabled	Local WiFi
eth0:0	Enabled	Disabled	Enabled	30:AE:A4:AD:04:8B	192.168.1.1	255.255.255.0		NA		Disabled	Local Ethernet

Both ETH0 and ETH0:0 linked to the RJ-45 interface.

By default, ETH0 is set to DHCP and ETH0:0 is set to STATIC IP 192.168.1.1 / MASK 255.255.255.0.

If connected to a switch or directly to a PC / LAPTOP, then the PC / LAPTOP should be set to STATIC IP in the 192.168.1.XXX subnet (XXX value in the range of 2 to 254). Then enter the 192.168.1.1 address to a chrome browser to open the GUI login page, or open SSH terminal with these IP.

If connected to a network which has a DHCP server, the unit will automatically allot an IP address to ETH0. Obtain the allotted IP address and enter it to the browser to open the GUI login page, or open SSH terminal with these IP.

12.1.1.1 DNS

If you have a DNS with multicast DNS protocol enabled, you can access the NBX by its name “nbx-<serial-number>”, e.g., nbx-30AEA4AD0488.

The NBX name can be obtain from the DNS server, or by concatenating the “nbx-“ with the serial number found on the sticker.

Enter the unit name to a chrome browser to access the unit login page.

12.1.2 Wi-Fi interface



WiFi

Configuration

Mode	Antenna
Access Point Auto off	Internal

Apply

Status

State	SSID	IP	NetMask	GateWay
AP STARTED	nbx-240AC4189C14	192.168.30.2	255.255.255.0	

By default, the unit arrives from the factory with Wi-Fi in “**Access Point Auto off**” mode in which the AP is enabled for 15 minutes each time the unit is powered-on or rebooted, to allow the user an “on-the-fly” connection, to be able to modify the unit settings. Unless the mode is changed each time the unit is powered-on or rebooted the 15 minutes time-out will be available. To obtain a quick connection:

1. Make sure your LAPTOP / mobile phone Wi-Fi interface is enabled.
2. Obtain the unit serial-number from the sticker.
3. Scan the Wi-Fi APs and locate the one with SSID corresponding to the serial-number.
4. Connect to the unit SSID.
5. Use the connection properties to get the unit AP IP address (usually **192.168.30.2**).
6. default password is: **12345678**
7. Open a chrome browser and enter the IP to access the GUI login page, or open SSH terminal with these IP.
8. To keep the Wi-Fi AP constant enter the SYSTEM-CONFIG > Wi-Fi page and change the mode to Access Point.

12.2 Cellular USB Dongle Setup

This guide describes the steps that are needed to connect and manage the Cellular USB Dongle.

It is used to connect the NBX-R1000-RF to the cellular network.

Following models are supported:

- Huawei E8732/E3372
- Huawei MS2131
- ZTE MF833V
- ZTE MF110

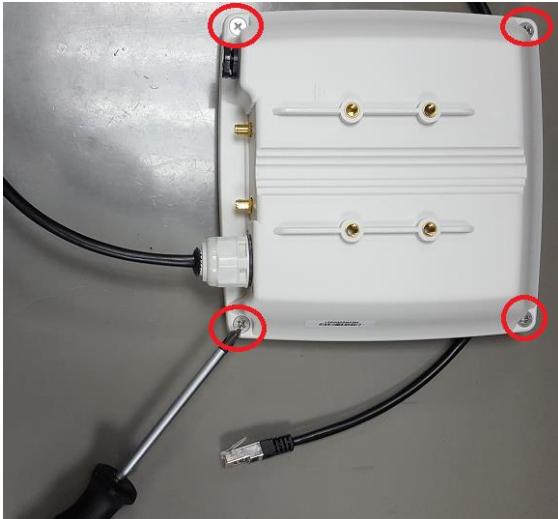


12.2.1 Cellular USB Dongle Installation

- Obtain a USB Cellular Dongle. Below is an example of a Huawei dongle. Make sure the SIM card plugged in.



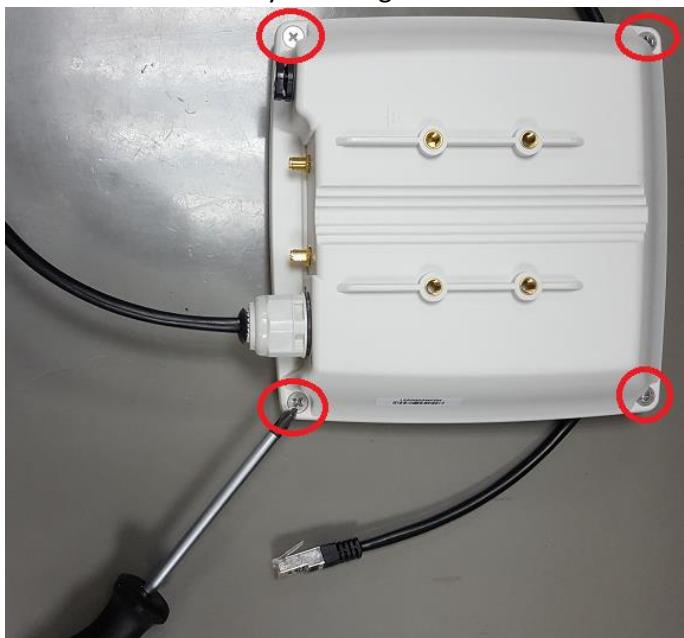
- Open the NBX cover by unscrewing the 4 screws.



- Connect the dongle to the NBX upper USB port.



- Close the NBX cover by screwing the 4 screws.

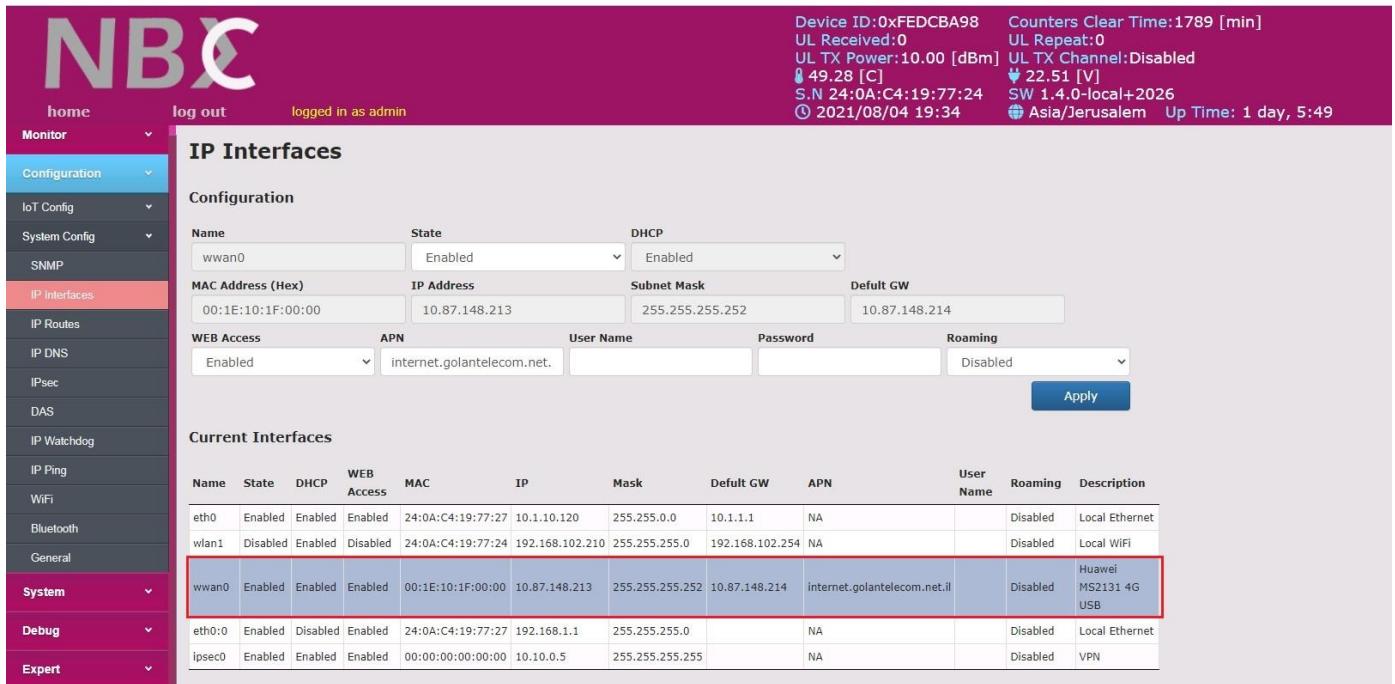


- Power up the NBX.

12.2.2 USB Dongle Parameters Setup

- From the Chrome browser, type in the NBX IP to open the NBX GUI.
- Go to **CONFIGURATION > SYSTEM-CONFIG > IP-INTERFACES** page.
- In the Current-Interfaces table, select the **wwan0** interface and type in the Configuration fields type in the **APN**, **User, Password**, and press **Apply**.
- Wait for the dongle (**wwan0**) to get an IP connection as seen in the below example.

Note that if it is a **PPP** connection, the interface name will display **PPP**. If the dongle is a HiLink type, the APN information must be populated in the Dongle from a laptop and the Dongle will show up as **ETH1** with an IP address given by the Dongle's DHCP server



IP Interfaces

Configuration

Name	State	DHCP
wwan0	Enabled	Enabled

MAC Address (Hex)	IP Address	Subnet Mask	Defult GW
00:1E:10:1F:00:00	10.87.148.213	255.255.255.252	10.87.148.214

WEB Access	APN	User Name	Password	Roaming
Enabled	internet.golantelecom.net			Disabled

Current Interfaces

Name	State	DHCP	WEB Access	MAC	IP	Mask	Defult GW	APN	User Name	Roaming	Description
eth0	Enabled	Enabled	Enabled	24:0A:C4:19:77:27	10.1.10.120	255.255.0.0	10.1.1.1	NA		Disabled	Local Ethernet
wlan1	Disabled	Enabled	Disabled	24:0A:C4:19:77:24	192.168.102.210	255.255.255.0	192.168.102.254	NA		Disabled	Local WiFi
wwan0	Enabled	Enabled	Enabled	00:1E:10:1F:00:00	10.87.148.213	255.255.255.252	10.87.148.214	internet.golantelecom.net.il		Disabled	Huawei MS2131 4G USB
eth0:0	Enabled	Disabled	Enabled	24:0A:C4:19:77:27	192.168.1.1	255.255.255.0		NA		Disabled	Local Ethernet
ipsec0	Enabled	Enabled	Enabled	00:00:00:00:00:00	10.10.0.5	255.255.255.255		NA		Disabled	VPN

12.2.3 USB Dongle Status Monitoring

- In the NBX GUI, go to **MONITOR > SYSTEM-STATUS > IP-INTERFACE-STATUS** page.
- Verify that the dongle is connected and there is TX/RX traffic.
- In the USB 4G/3G status table, verify the dongle PHY status (RSSI, MODE, etc).

The screenshot shows the NBX GUI interface. The top right corner displays system status: Device ID:0xFEDCBA98, Counters Clear Time:1789 [min], UL Received:0, UL Repeat:0, UL TX Power:10.00 [dBm], UL TX Channel:Disabled, 49.28 [C], 22.56 [V], S.N 24:0A:C4:19:77:24, SW 1.4.0-local+2026, 2021/08/04 19:35, Asia/Jerusalem, and Up Time: 1 day, 5:49.

The left sidebar navigation menu includes: home, log out, logged in as admin, IP Interface Status, IPsec Status, DAS Status, General Status, Common, Configuration, IoT Config, System Config, SNMP, IP Interfaces, IP Routes, IP DNS, IPsec, DAS, IP Watchdog, IP Ping, WiFi, Bluetooth, and General. The 'Configuration' item is currently selected.

IP Interfaces Status

Name	State	DHCP	WEB Access	MAC	IP	Mask	Default GW	RX Packets	TX Packets	RX Bytes	TX Bytes	Description
eth0	Enabled	Enabled	Enabled	24:0A:C4:19:77:27	10.1.10.120	255.255.0.0	10.1.1.1	1405305	16125	520820724	3989301	Local Ethernet
wlan1	Disabled	Enabled	Disabled	24:0A:C4:19:77:24	1	255.255.255.0	192.168.102.254	0	58	0	7085	Local WiFi
wwan0	Enabled	Enabled	Enabled	00:1E:10:1F:00:00	10.87.148.213	255.255.255.252	10.87.148.214	35076	41945	4494298	7396814	Huawei MS2131 4G USB
eth0:0	Enabled	Disabled	Enabled	24:0A:C4:19:77:27	192.168.1.1	255.255.255.0						Local Ethernet
ipsec0	Enabled	Enabled	Enabled	00:00:00:00:00:00	10.10.0.5	255.255.255.255		8585	11699	943829	3047851	VPN

USB 4G/3G Status

Name	RSSI	BER	System Service	Service Domain	Roaming	System Mode	SIM Card	Sub Mode	Network Mode	Network Access	Network Name	Connection State
wwan0	-73	NA	Valid	PS+CS	Yes	WCDMA	Valid	HSDPA	Auto-Manual	UTRAN GSM-w/EGPRS	Cellcom IL	Connected