DMR604 USER MANUAL

Copyright © 2019 Bird Technologies

Contents

Contents

1 Introduction 2
2 DMR Operational Description 2
3 DMR Specifications 3
4 Installationguidelines 4
4.1 Health and Safety 5
4.2 Installing the DMR Repeater Unit 7
4.2.1 Antenna Connections 8
4.2.2 Power AC 8
5 DMR Repeater Commissioning 9
5.1 Commissioning using Remote Gateway (RGW) 9
5.2 Repeater commissioning locally 13
5.2.1 Login 13
5.2.2 Home page 13
5.2.3 RF Config 14
5.2.4 Advanced RF Config 15
5.2.5 RF Status 16
5.2.6 Software 17
5.2.7 Notepad 18
5.2.8 Access 18
5.2.9 Communication 19
5.2.10 Alarms 20
5.2.11 Hardware 22
5.2.12 Advanced 22

1 Introduction

This document contains quick guidelines on how to operate the Bird DMR Repeater family and how to install, commission and maintain a Repeater unit.

The DMR 604 Series is a medium power repeater in an IP65 enclosure. It was developed for use in below ground environments but may also be used as a fixed multiband
and multi operator indoor coverage solution.

The DMR Repeater consists of an IP65 enclosure containing one channelized Radio Frequency Unit (RFU), and a Power Supply Unit (PSU).

Standalone repeater applications can also be modified and used in the fiber DAS systems where base stations are not available for signal feeding to the system.

2 DMR Operational Description

The DMR 604 repeater series is a wall mounted medium power radio repeater. It can operate in the stand-alone applications as well in the fiber fed DAS systems where the repeaters are used for off air feeding of the DAS network where Base stations are not available.

DMR604 Repeater unit series is for the 462.4125 and 467.4125 MHz band. The system consists of following parts:

- Power supply Unit (PSU)
- Internal Duplex Filters (DPX) filtering Uplink and Downlink frequencies and necessary RF combiners depending on the Remote Unit configuration.
- Band selecting Repeater board.
- Optional- Remote Gateway unit (called RGW) used for remote access/configuration and alarm supervision

The User can set the following parameters in the Repeater unit via web-based GUI application:

- Gain Values (UL & DL)
- Bandwidth (UL&DL)
- ALC threshold (UL & DL)
- Self-oscillation protection
- Gain Link Symmetry-Gain trail (UL&DL)

3 DMR Specifications

GENERAL SPECIFICATIONS

Modulation Type		FM 6.25 FM 12.5	kHz
Gain		50 - 86	dB in 1dB steps
Noise Figure		< 6	dB
Delay		< 6	µs
Power Supply	Mains	85 – 264	VAC or VDC
Power Consumption DC	12-28 V	< 35	W
Dimensions	WxDxH	12 x 16.5 x 5.6	inches
Weight (Module)		29	lbs
Operating Temperature		-25 - +55	ºC
Casing		IP42	
Environmental standard		50155	
Safety standard		IEC60950	
EMC standard		EN50121-3-2	
Vibration and shock standard		EN50155	EN61373

AVAILABLE PRODUCTS, AMERICAN CELLULAR

Product	System	UL Frequency MHz	DL Frequency MHz	Pout UL/DL, dBm	Standard
DMR604	462/467	462.4125	467.4125	25	FCC

4 Installation guidelines

Part 90 Signal Boosters	THIS IS A 90.219 CLASS A DEVICE
WARNING This is NOT a consumer device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS.** You **MUST** have an **FCC LICENSE** or express consent of an FCC licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.	

CAUTION
Changes or modifications not expressly approved by the party responsible for compliance 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 A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

4.1 RF Exposure

The distance quoted below is calculated when the product is used with a **10dBi** antenna. The antenna used with the DMR604 should provide a **maximum** gain of 10 dBi. An antenna providing < 10dBi of gain will decrease the minimum distance quoted below.

This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with the following minimum distances between the radiator and your body: 34 cm

The user must determine the antenna best suited for the installation location, directional or omnidirectional antenna may be used.

4.2 Health and Safety

Bird Repeater system is an advanced system and should be handled by skilled staff. Bird offers training for installation service providers, when necessary.

Read all available documentation and warnings before handling the equipment! Equipment failures due to improper handling are normally not covered by the product warranty!

Respect all warning signs on the equipment and in the documentation. Make sure to only operate the equipment on frequencies allowed to use. **Do not modify the equipment!** The equipment may from case to case contain a Class 3B laser and the equipment is Class 1. **Never look into the Laser beam directly or indirectly, it is strong invisible light and may cause serious damage to human eyes!**

Always use protective hat on fiber (if used in the application) and connector end when fiber is removed from socket! Always clean socket and connector after a fiber has been removed before you re-attach it again!

Keep passwords and other operational information away from unauthorized personnel!

- Bird Repeater system is an advanced technology system and should be handled by FCC Licensee or FCC approved staff.
- Read all documentation and warnings before handling the equipment.
- Obey all warning signs on the equipment and in documentation.
- The equipment may get hot during operation, do not operate outside permitted temperature range and keep away from heat sensitive material!
- The equipment contains ESD sensitive components. Open the equipment ONLY in a safe location designed for handling ESD products and use grounding devices! Opening the unit is not intended for field maintenance!
- The equipment contains ESD sensitive components. If not handled with care critical components may be damaged or destroyed. To avoid any damage due to ESD standard ESD precautions shall be used when handling the equipment.
- The product transmits RF signals keep away from Antennas and other radiating devices.
- Repeaters generate radio signals which are transmitted by the connected antennas. Installations should always be done so that the radiation exposure doesn't exceed the recommendation set up by local authorities.
- Consult a FCC licensee or other applicable regulation body for details on RF requirements and safety issues on RF!
- Electrical installation shall be done in accordance with local safety regulations and laws.
- Make sure to use the equipment only in its intended applications and on the allowed frequencies.
- Avoid overheating by avoiding sunlight exposure!

Part 90 Signal Boosters	THIS IS A 90.219 CLASS A DEVICE

WARNING

This is NOT a consumer device.

It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS.** You **MUST** have an **FCC LICENSE** or express consent of an FCC licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

4.2.1 Installing the DMR Repeater Unit

The DMR604 is designed to be wall mounted. The Unit is secured to the wall bracket by four screws. The chassis of the repeater should be grounded to a potential bar or safety grounding bar when operated.

All electrical installations should be done by an FCC Licensee or/and a certified electrician only!

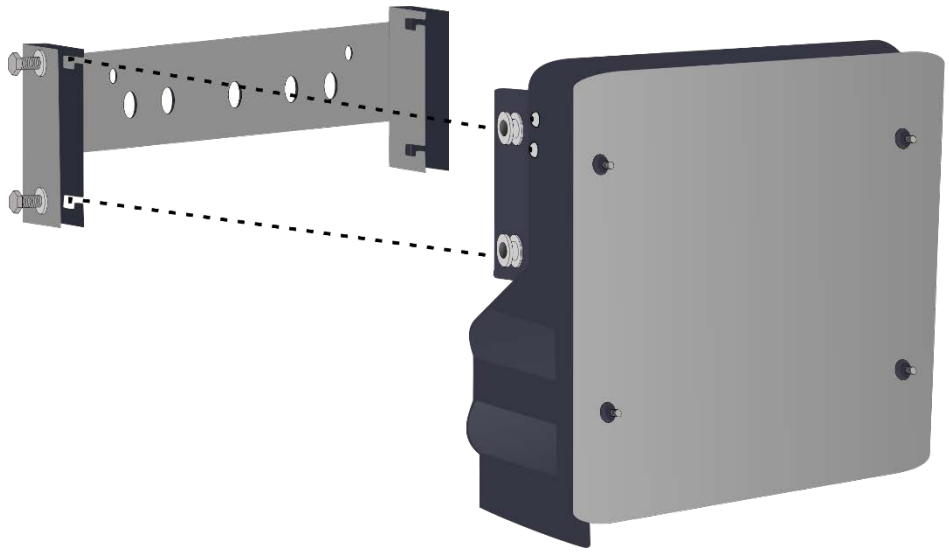


Figure 1. DMR wall mounted Chassis

4.2.2 Antenna Connections

The antenna used with the DMR604 should provide a maximum gain of 10 dBi. The user must determine the antenna best suited for the installation location, directional or omnidirectional antenna may be used.

Connectors and connections of the DMR are shown in figure 2.
Service and Donor Antenna are connected to the connectors on the DMR input panel.

Figure 2. Connections on the DMR604

If a DMR repeater unit is used for feeding the fiber optic DAS system where a base station is not provided, then the fibers should be connected to the Fiber-Optic connector.

4.2.3 Power AC

All electrical installations should be done by an FCC Licensee only!

AC Input power cable is connected to the bottom of the unit as shown in figure 2.

5 DMR Repeater Commissioning

After the successful mounting installation and powering of the DMR Repeater, user can now start commissioning the Repeater unit.

Accessing the DMR Repeater units is through the Remote Station Gateway (RGW).

Login and access information such as username and passwords are provided separately by Bird application engineers.

5.1 Commissioning using Remote Gateway (RGW)

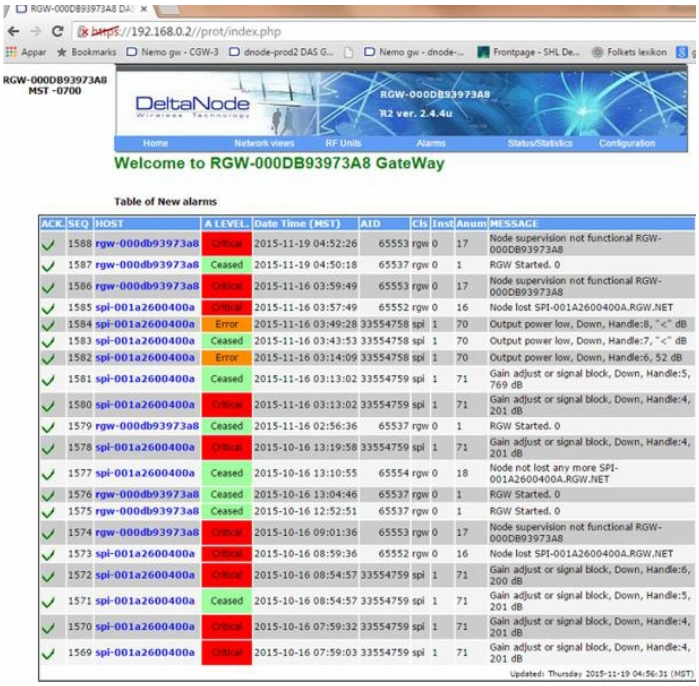
Bird DMR Repeater units are equipped with an RGW. The RGW is basically a PC/server used for handling multiple units, alarm management, remote access, commissioning and configurations.

Follow the steps below to set up the repeater network. RGW uses a secure protocol and its IP is by factory default set to use 192.168.0.2 IP address.

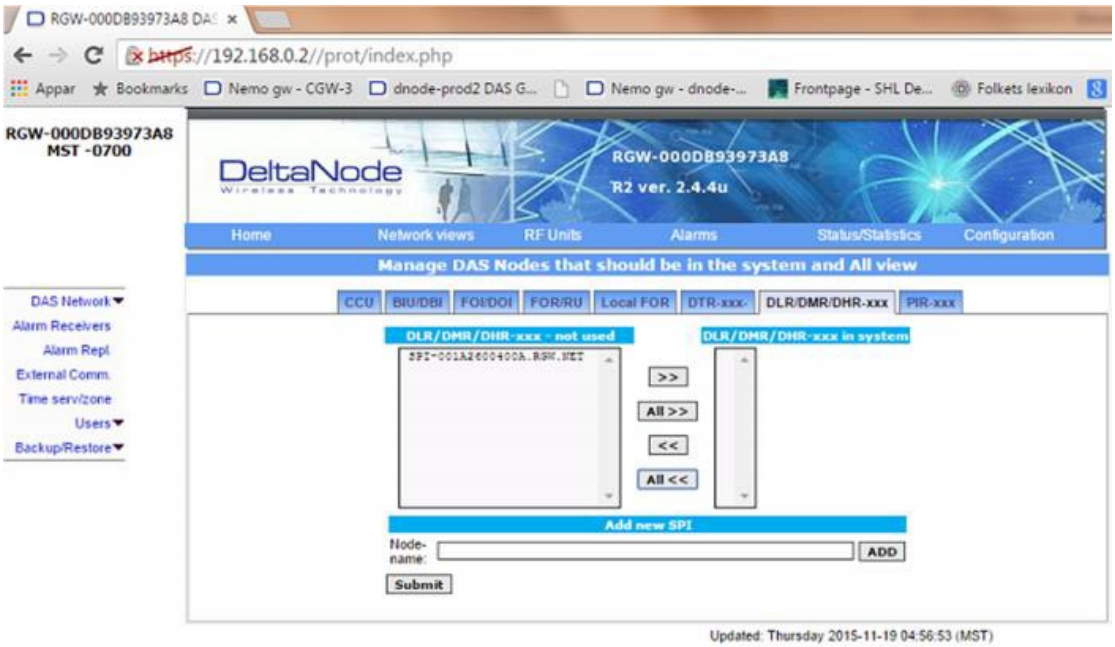
After configuring the PC to use the static IP, open the Web browser and enter the following: https://192.168.0.2

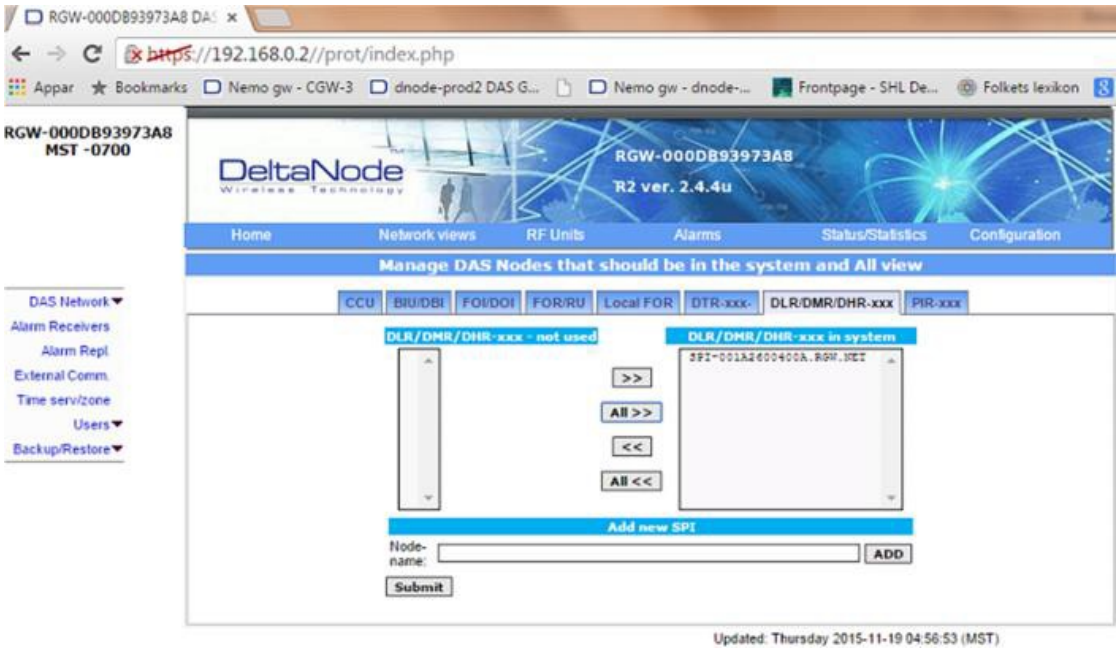
Log into the RGW with the username and password provided by Bird application engineering.

When logged in, navigate to the **configuration menu** and put the managed repeater unit into the **DNS** of the **RGW**. See pictures below for reference.



When in configuration menu, click on the **DLR/DMR/DHR- xxx** option. Move the managed **DLR/DMR/DHR** unit from **NOT USED** window to **DLR/DMR/DHR- xxx in the system** window and press **Submit**.

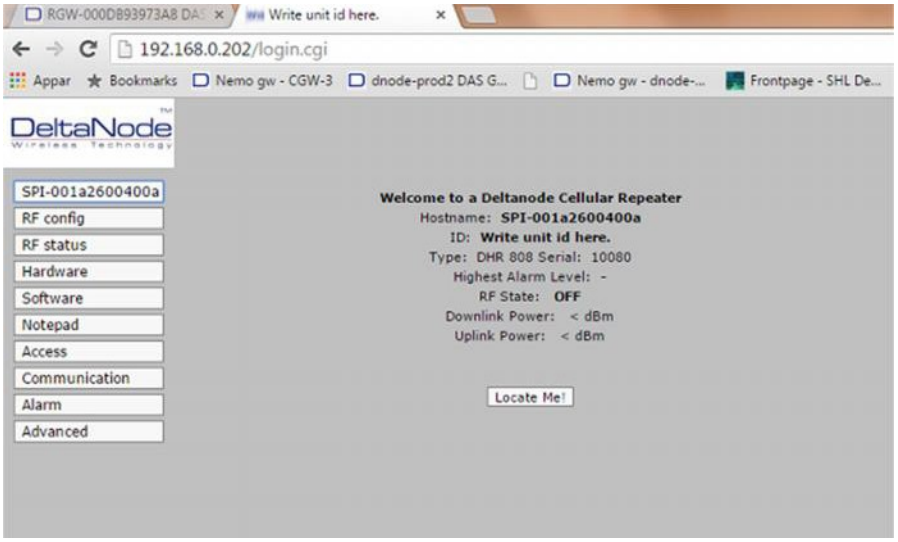




Now the managed Repeater unit has been added to the RGW DNS.

Navigate to the **Network views** menu and log into the managed repeater unit by clicking on it.

See picture below for reference.



When logged into the managed repeater, the user can now begin with commissioning of the managed repeater unit.

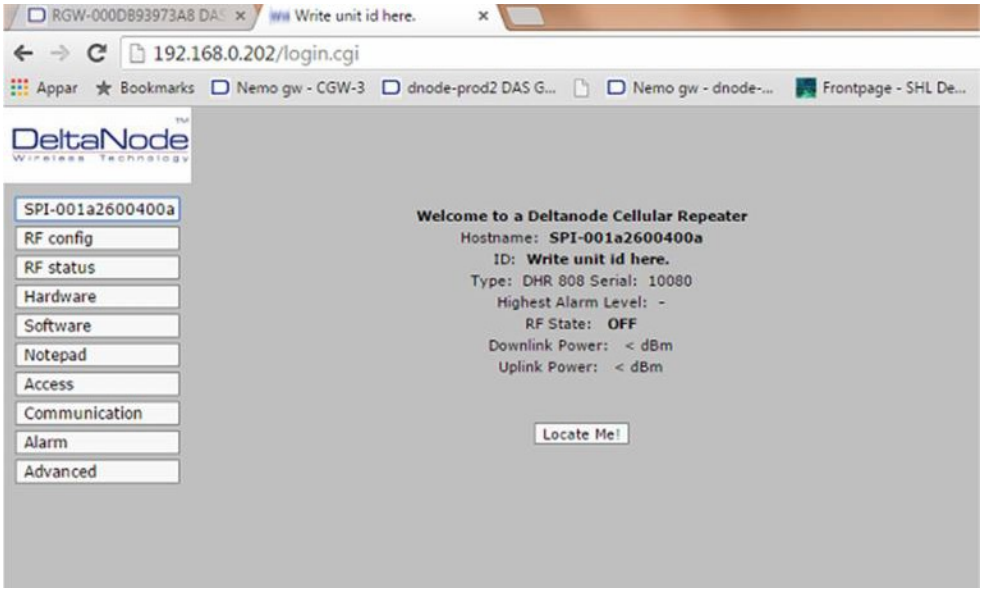
5.2 Repeater commissioning locally

5.2.1 Login

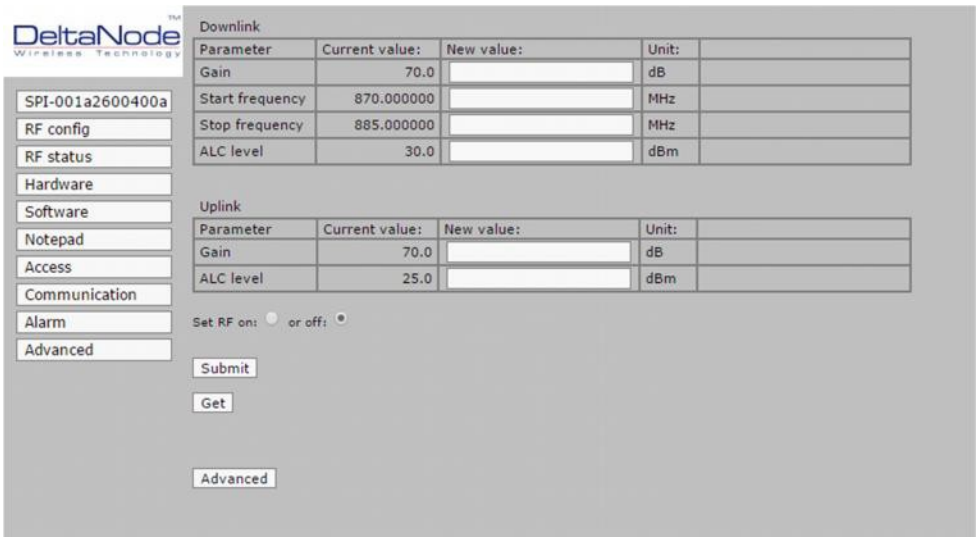
Log into the RGW with the username and password provided by Bird application engineering.

5.2.2 Home page

When logged into the repeater, home page is displayed, showing the factory default name of the repeater, which is basically a unique MAC ID of the actual repeater, article and serial number, RF state (OFF/ON), and the current output power of the repeater. On the left hand side are the different configuration menu´s.



5.2.3 RF Config



RF Config menu contains configuration fields for setting the **Gain, ALC level**, **frequency band** and the **bandwidth** of the actual DMR Repeater unit.

Gain and **ALC** level can be set for **Downlink** and **Uplink** separately. The resolution in setting is adjustable by the 0, 1 dB.

As mentioned the DMR Repeater unit has the **adjustable bandwidth**. User can set the Downlink start and stop frequency path. The uplink path uses a fix duplex distance.

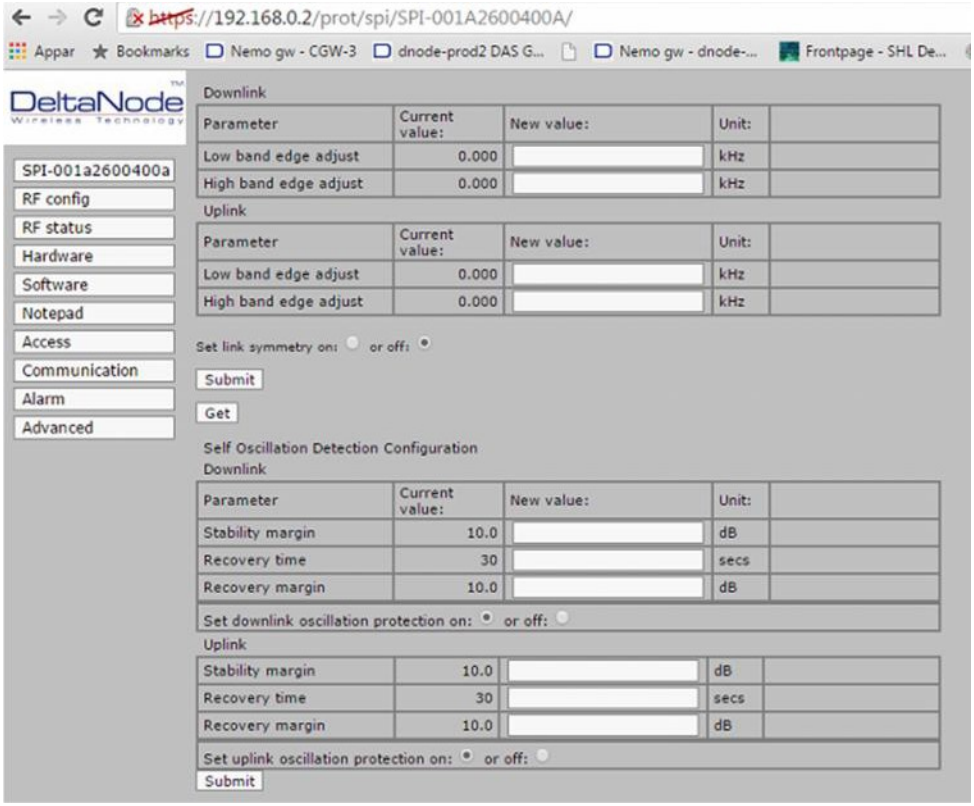
The threshold for the **Automatic Level Control (ALC)** is set in dBm for downlink and uplink respectively. The ALC feature controls the gain of the repeater so that the output power never ends up in exceeding the actual set level of the output power.

When changing any parameters a submit button must be pressed in order to send the data to the repeater. Get button reads current set parameters.

If a different parameter (other than the specified validation range) is entered and submitted, an Error message will be displayed on the right hand side of the configuration fields. Error message will even show the valid range of the actual parameter.

5.2.4 Advanced RF Config

Advanced mode **in RF config** menu gives user a possibility to control and fine tune the **frequency band edges**, set up **link symmetry**, and **self-oscillation** protection.



Band edges control gives user a possibility to fine tune the set band width with **0-100 kHz** up or down of the actual set frequency band.

Link symmetry is a function that is mainly developed for usage in moving application setups, like in-train, boats for example. What is does basically is that UL gain is controlled by the DL gain. When this feature is activated, the repeater will reduce the gain in UL as in DL with the same symmetrical pattern. The UL gain is determined by the actual automatically controlled gain used in DL. The originally set gain difference between Uplink and Downlink is kept as originally set.

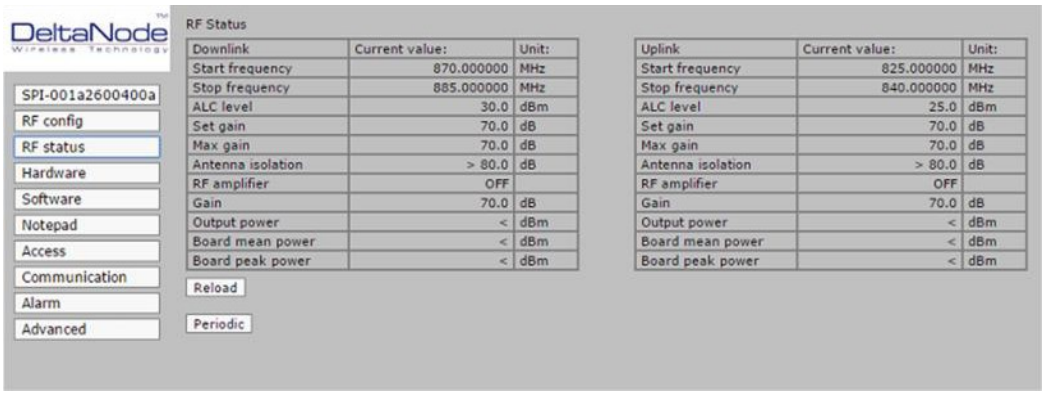
Link symmetry feature is used to minimize the amount of Noise level to the BTS and is developed mainly for moving applications as mentioned above such as trains, boats for example when/if the signal from the BTS fluctuates.

Self-oscillation protection is a function for detection of eventual issues/problems related to the **Antenna isolation** between **Service** and **Donor** Antenna´s. In case of **low isolation** between the two antennas (**Service & Donor**) the repeater will begin to **self-oscillate** in the usual manner, but however self-oscillation protection in this case will immediately intervene and lower the gain to a safe level equal to the isolation minus the stability margin. There are separate settings for UL and DL respectively;

- ON/OFF
- **Stability margin**. The value set of how much lower the gain should be than the calculated isolation in case of issues with the isolation between the antennas. Range of this value is from 0.0 – 20 dB.
- **Recovery time**. This is the time limit before the repeater tries to reset the gain to the originally actual set gain in **RF config**. Range for the recovery time is between 30 – 86400 seconds.
- **Recovery margin**. Set value of gain level above the actual set gain (specified in RF config) that is used when the repeater recovers after the **Recovery time**. Range is between 0.0 – 20.0 dB.

5.2.5 RF Status

Generally this menu gives a current status overview for both of the links in the repeater.



Downlink	Current value:	Unit:
Start frequency	870.000000	MHz
Stop frequency	885.000000	MHz
ALC level	30.0	dBm
Set gain	70.0	dB
Max gain	70.0	dB
Antenna isolation	> 80.0	dB
RF amplifier	OFF	
Gain	70.0	dB
Output power	<	dBm
Board mean power	<	dBm
Board peak power	<	dBm

Uplink	Current value:	Unit:
Start frequency	825.000000	MHz
Stop frequency	840.000000	MHz
ALC level	25.0	dBm
Set gain	70.0	dB
Max gain	70.0	dB
Antenna isolation	> 80.0	dB
RF amplifier	OFF	
Gain	70.0	dB
Output power	<	dBm
Board mean power	<	dBm
Board peak power	<	dBm

Start and stop frequency of both UL and DL are displayed in the firs field as seen in above screen shot.

Set gain is gain value defined and set by the user. **Max gain** is the parameter that ALC and other algorithms, such as the link symmetry feature and antenna oscillation detection, defines/sets is the current maximum gain of the repeater.

For example, if the antenna oscillation detection algorithm detects antenna isolation issues, Max gain will be automatically be reduced to a new calculated value. The operation is performed as Antenna isolation minus set stability margin, which in that case is lower than the set gain. **Gain** field reflects the actual gain value set by the user.

If by any chance antenna isolation is an issue while commissioning for example, the field for antenna isolation will display a certain value measured in dB, and the alarm will be generated. Gain will be automatically reduced with a certain margin in respect to the Antenna isolation.

For example, if displayed Antenna isolation value is >90dB, then there should be no problem.

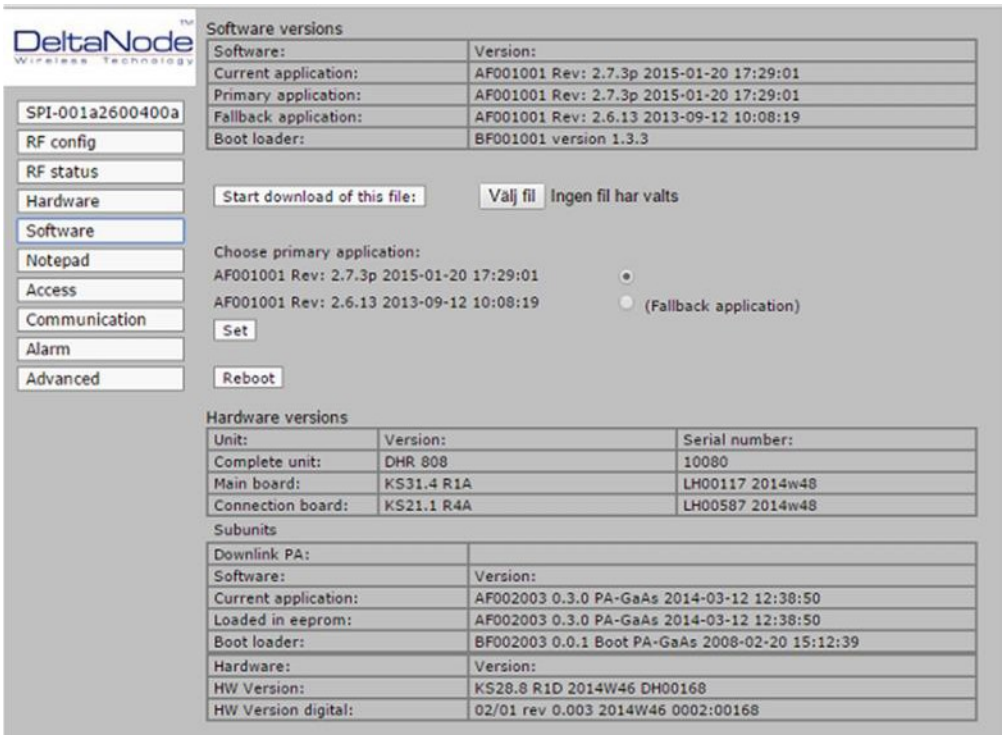
Automatic Level Control (**ALC**) threshold are also displayed and shown in tenths of a dBm. If the set gain differs from the Max gain for example, this a sign that the ALC is active.

Output power field is displaying RMS power of the repeater measured at the antenna port. Different modulation waveforms might have a slight impact on the measured value at the antenna port.

User has a possibility also to set up a **periodic mode**. The window will collect and update the data displayed every two seconds.

5.2.6 Software

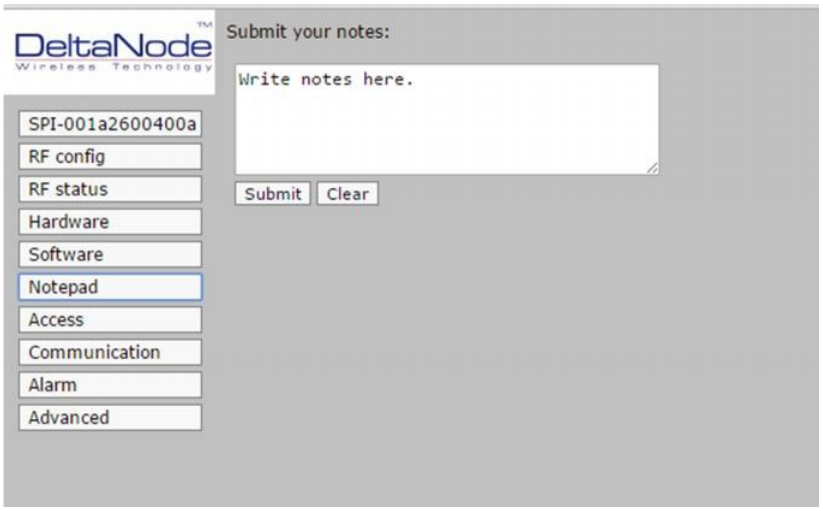
Software menu displays the actual application **SW version**, **fallback application**, **boot loader version**, **serial and article numbers**, **dates of manufacturing** of the unit and its board units used in the actual repeater product.



When logged in ***Extended*** user mode, there are allowed possibilities for Software upgrades, changing of current application versions, and Reboot option. All actions such as SW upgrades and application version swap require a command **Set** which must be followed by a **reboot** of the repeater for the changes to properly apply.

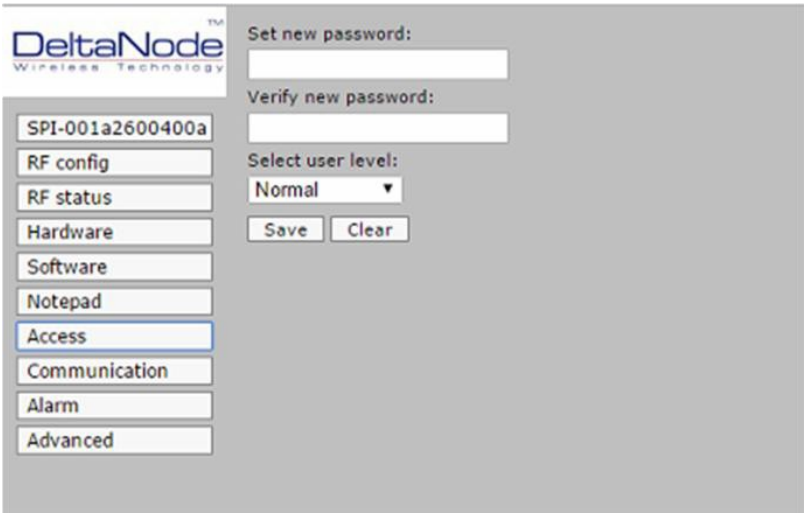
5.2.7 Notepad

Notepad menu is basically a small scratch pad for text. It is stored in a non-volatile memory. It is meant to be used as a feature to enter notes about the installation, repeater unit, commissioning etc. Maximum allowed character number is 255.



5.2.8 Access

In Access menu, user has the possibility to define other passwords for the 2 different level accesses, ***Extended*** and ***Normal***.



When using the ***Extended*** level access, there are a number of extra parameters and features displayed and allowance for change. ***Extended*** level can be explained as administrator access level, while the ***Norma***l access level can be defined as a light version access level.

5.2.9 Communication

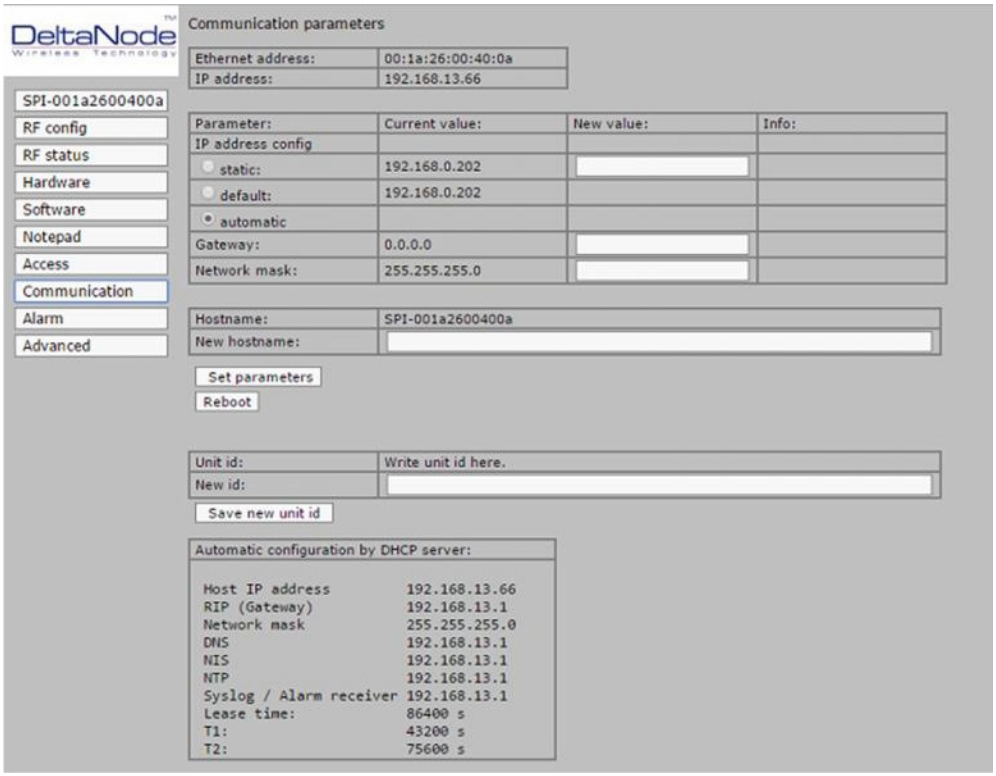
The Communication menu contains a number of settings, giving the user the ability to define the communications with the repeater. Ethernet IP addresses, MAC ID are displayed.

User has three options for the IP configuration settings.

- Static- IP address that is manually defined by the user.
- Default- IP address is set to the factory default address, 192.168.0.202
- Automatic. IP address is provided by a DHCP server. This option is used only when the Remote Gateway (RGW) is optionally used in the actual repeater.

User has a possibility to change the hostname and the Unit ID of the repeater. Unit ID is the name of the repeater seen in the web interface.

This change must be manually set which follows by a reboot command for the change to take place.



5.2.10 Alarms

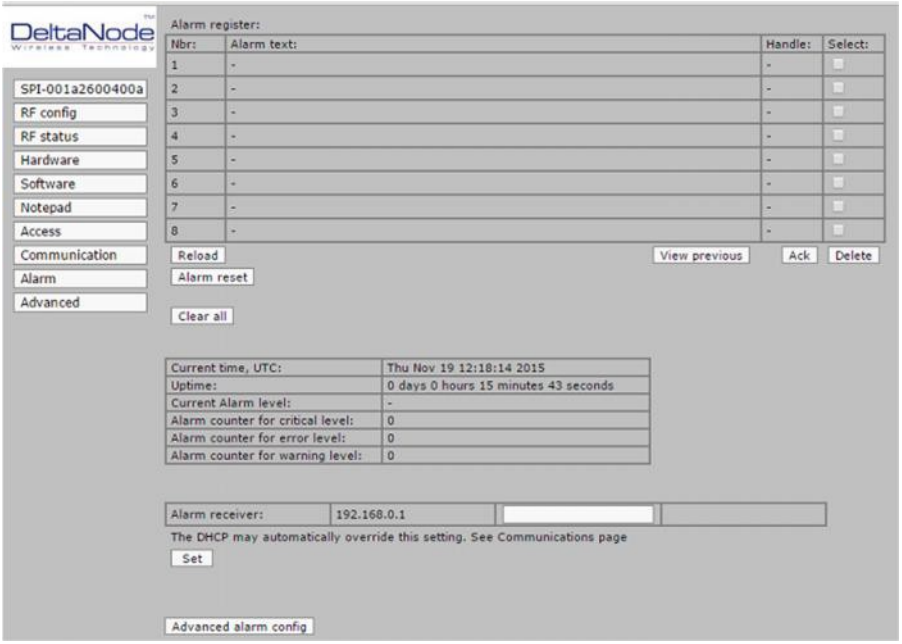
Alarm log clearly displays all alarm events in the repeater. The log itself is located in volatile memory and is cleared every time the repeater is restarted/ rebooted.

There are three levels of severity defined in the repeater.

- Warning
- Error
- Critical

All alarms can be forwarded to external alarm receiver. In order to forward the alarms from the repeater, **syslog UDP port 514** must be used and the correct IP address of external receiver must be defined. This change as every other mentioned in previous chapters must be manually **Set** and the repeater must be rebooted for the changes to apply.

The receiver IP address might be changed automatically by the DHCP server if a Remote Gateway (RGW) is used.



In the alarm menu is also a feature called **advanced alarm config,** where user has the possibility define the alarm power levels of UL and DL respectively, and the time out function for these. Further on the user has possibility to define the ALC gain reduction thresholds.

In case of where external alarm relay is used in combination with the repeater the user has the possibility to define own descriptions of External alarms generated by the repeater.

User can even generate the **Test Alarm** in order to test either **External Alarm** functionality or alarm forwarding feature.

There are even some cosmetic possibilities like **LED intensity** and **LED style** available for user to change if required.

DeltaNode Wireless Technology

SPI-001a2600400a
RF config
RF status
Hardware
Software
Notepad
Access
Communication
Alarm
Advanced

Downlink tx supervision

Parameter	Current value:	New value:	Unit:	
Tx power threshold	15.0		dBm	
Tx power timeout	60		secs.	

Set downlink output power supervision on: or off:

Uplink tx supervision

Parameter	Current value:	New value:	Unit:	
Tx power threshold	0.0		dBm	
Tx power timeout	60		secs.	

Set uplink output power supervision on: or off:

Config tx supervision

Downlink ALC alarm configuration

Parameter	Current value:	New value:	Unit:	
ALC gain reduction threshold	20.0		dB	

Uplink ALC alarm configuration

Parameter	Current value:	New value:	Unit:	
ALC gain reduction threshold	20.0		dB	

Config ALC alarm

External alarm port configuration

Parameter	Current value:	New value:	
Alarm level External 1	-1		
Alarm text External 1			
Alarm level External 2	-1		
Alarm text External 2			
Alarm level External 3	-1		
Alarm text External 3			
Alarm level External 4	-1		
Alarm text External 4			

Config external alarms

Select Alarm LED Style: DAS or DxR

LED Intensity: (100) %

Config LED Style

Generate test alarm

Submit

Test alarm cease

Cease

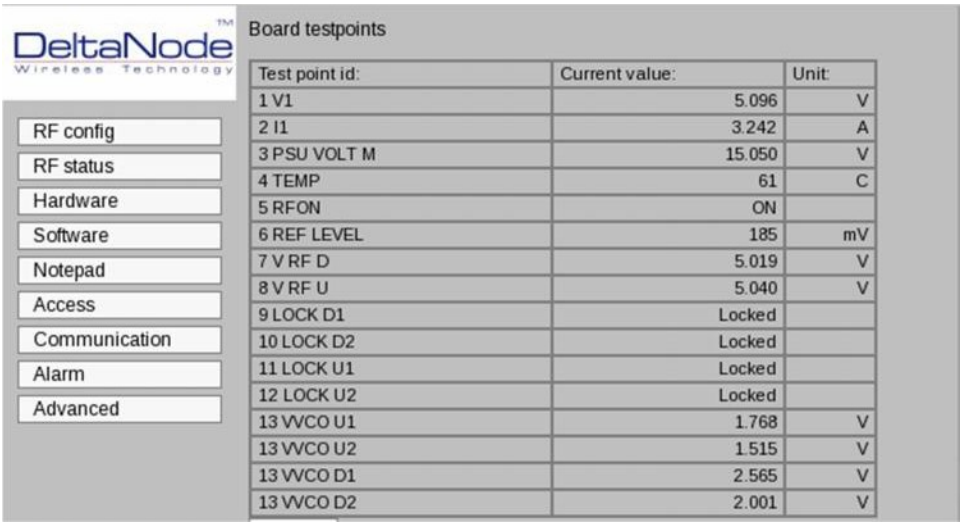
Activate periodic keep alive message (Deactivated)

Activate

Deactivate

5.2.11 Hardware

Hardware menu contains internal hardware test points like different driver and synth voltages, temperatures, etc. This menu is mainly helpful for the advanced users when troubleshooting for example.



Test point id:	Current value:	Unit:
1 V1	5.096	V
2 I1	3.242	A
3 PSU VOLT M	15.050	V
4 TEMP	61	C
5 RFON	ON	
6 REF LEVEL	185	mV
7 V RF D	5.019	V
8 V RF U	5.040	V
9 LOCK D1	Locked	
10 LOCK D2	Locked	
11 LOCK U1	Locked	
12 LOCK U2	Locked	
13 VVCO U1	1.768	V
13 VVCO U2	1.515	V
13 VVCO D1	2.565	V
13 VVCO D2	2.001	V

5.2.12 Advanced

The Advanced menu displays DAC (Bit) hardware values. It is not of much interest for the normal use. As Hardware menu described above, this is mainly used for the troubleshooting and reference for the advanced users developers and RMA personnel.