SATELLAR DIGITAL SYSTEM
PART I: 2DS/20DS
QUICK GUIDE VERSION 1.9

2DS/ 20DS

QUICK GUIDE

WIRELESS WORLD – LOCAL SOLUTION

SATEL®

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Salo, Finland 2014

Introduction

The purpose of this document is to provide the basic operating information and describe the setup procedure for establishing IP communication link by using SATELLAR-2DS and -20DS units.

It is recommended to get familiar with SATELLAR Central Unit and SATELLAR Radio Unit user guides before starting the actual configuration process.

SATELLAR-2DS and -20DS units are wireless IP routers. Therefore all SATELLARs should be configured to operate as the gateway for individual subnets.

1. Hardware

SATELLAR-2DS and -20DS contains two modules – the Radio Unit (RU) and the Central Unit (CU), which are stacked together.

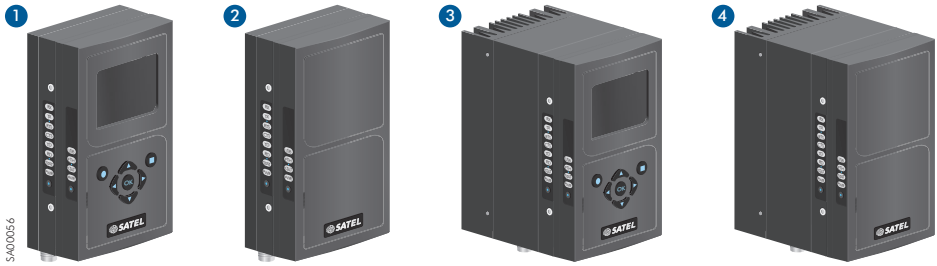

Figure 1.1 SATELLAR-2DS and SATELLAR-20DS types:
1. SATELLAR-2DS with display: Central unit (CU) with display and keypad + radio unit (RU) 1W
2. SATELLAR-2DS without display: Central unit (CU) without display and keypad + radio unit (RU) 1W
3. SATELLAR-20DS with display: Central unit (CU) with display and keypad + radio unit (RU) 10W
4. SATELLAR-20DS without display: Central unit (CU) without display and keypad + radio unit (RU) 10W

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1.1 Connections

There are three sockets to be used:

- Connect the antenna to the RF port (TNC female, 50 Ω). You can use antenna cable, if found necessary. When testing the units over short radio links (e.g. in the office), it is recommended to use attenuator (e.g. 20dB) in RF port.
- Connect the Power socket. Note the polarity of the power wires. The operating voltage range is +9...+30 Vdc.
- Connect the Ethernet cable. The SATELLAR supports the Auto-MDIX, so the Ethernet cable can be direct or crossed.

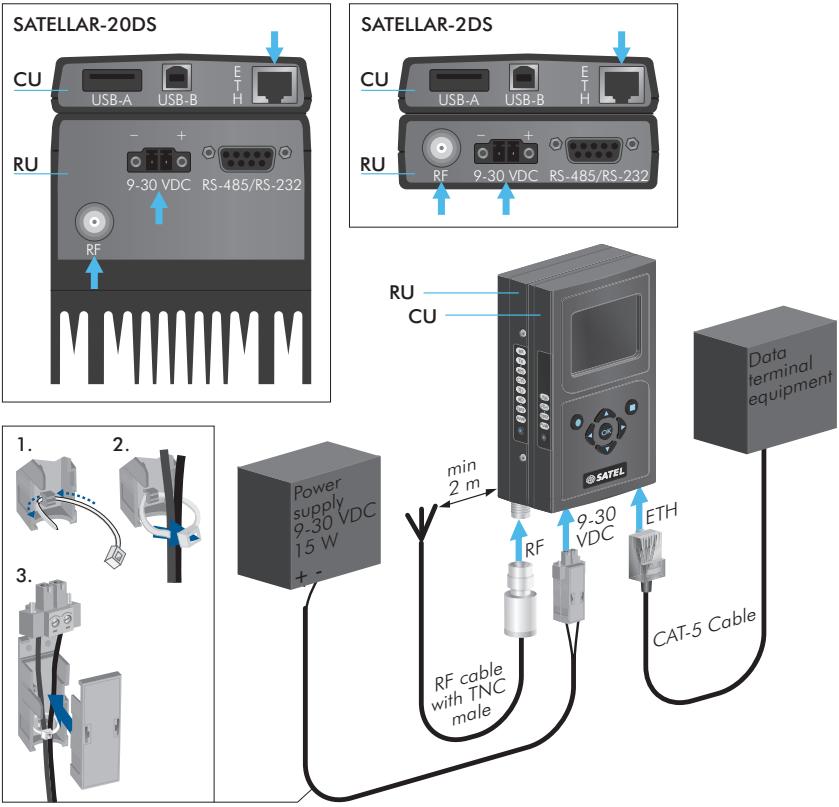

Figure 1.2 Basic connections for configuration and IP communication (RF, Power, Ethernet)

2. Starting up the unit

Radio boots up, when power socket is connected. Boot up time for SATELLAR-2DS and -20DS unit is approx. 2 minutes. When the unit is in operation mode, the STAT and PWR LEDs are constantly lit. The ETH and USB LEDs in the Central Unit are blinking if the connectors are not connected and are lit when connected.

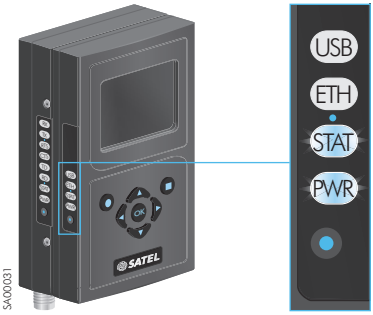

Figure 2.1 The LED indicators are located on the side of the unit

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3. Accessing the web user interface

Connect your PC computer to SATELLAR-2DS and -20DS Ethernet port and set the network card properties (IP address for PC, subnet mask and default gateway) accordingly.

The ETH LED will be lit constantly indicating proper Ethernet connection between the PC and Central Unit.

Figure 3.1 ETH LED indicates the proper Ethernet connection

Open your web browser and enter the IP (SATELLAR) to the address field.

By default the IP related settings are:

- IP address: 192.168.1.2 (PC) 192.168.1.1 (SATELLAR)
- Subnet mask: 255.255.255.0
- DHCP: OFF

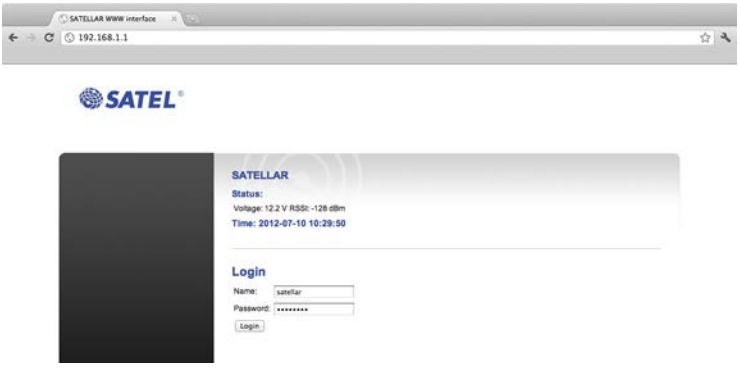

Figure 3.2 SATELLAR WWW interface Login view

Enter the username and password for logging in (please note the character case):

- Username: satellar
- Password: Satel123

4. Configuring radio and routing parameters

There is a specific procedure to follow for changing/modifying the settings and parameters.

Apply Changes	Button is used for saving the modified parameter temporarily. These changes will be listed/shown in the list of Uncommitted changes in the web GUI.
Commit Changes	Button is used for making all temporary changes permanent.
Cancel applied changes	Button will throw away the uncommitted changes.

4.1 Modem settings

4.1.1 Network Protocol Mode

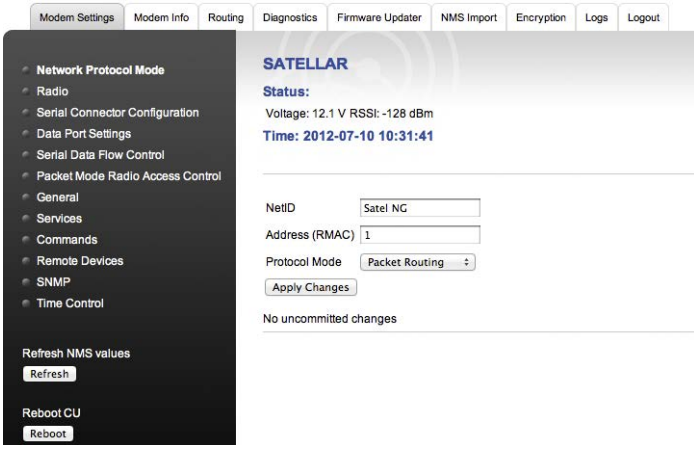

Figure 4.1 Network Protocol Settings view

a) Set NetID parameter. This parameter should be considered a basic password, which is used for determining that the messages belong to this specific network. The maximum length of the NetID is eight (8) characters.
NOTE! Must be set equally in all units in the network.
b) Set Address (RMAC) parameter. This is used as the modem address and source for generating the radio network IP address automatically.
c) Choose Protocol Mode from the pull-down menu. By default this is Packet Routing, which is correct option for IP communication.
NOTE! Must be set equally in all units in the network.

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4.1.2 Radio

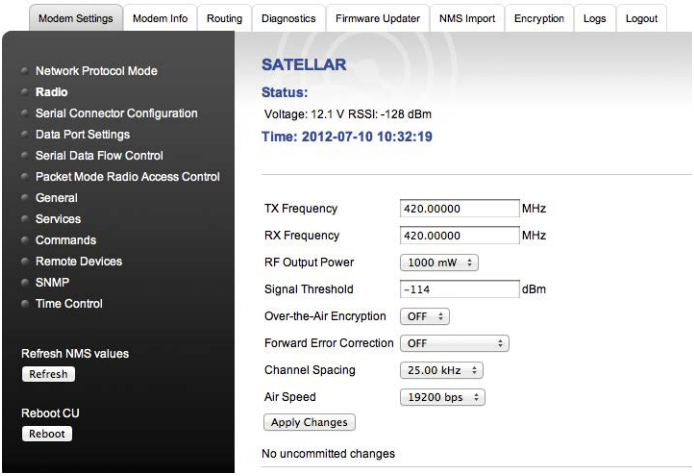

Figure 4.2 Radio settings view

a) Set TX Frequency and RX Frequency. Typically the local authorities give the operating frequency.
NOTE! Must be set equally in all units in the network.
b) Set RF Output Power according to your radio license. Use pull-down menu for selecting suitable power (100 mW steps available).
c) Set Signal Threshold. By default this is -114 dBm, which typically is good option for basic system testing.
d) Set Over-the-Air Encryption. By default this is OFF, which typically is good option for basic system testing.
NOTE! Must be set equally in all units in the network.
e) Set Forward Error Correction. This feature will add some characters to the messages while transmitted and this way increases delays in the data transmission. At the same time it improves the radio performance under weak signal levels.
NOTE! Must be set equally in all units in the network
f) Set Channel Spacing. By default this is 25 kHz, which provides maximum data rate over the air.
NOTE! Must be set equally in all units in the network.
g) Set Air Speed. Defines the data rate in the radio interface.
NOTE! Must be set equally in all units in the network.

4.1.3 Serial Connector Configuration

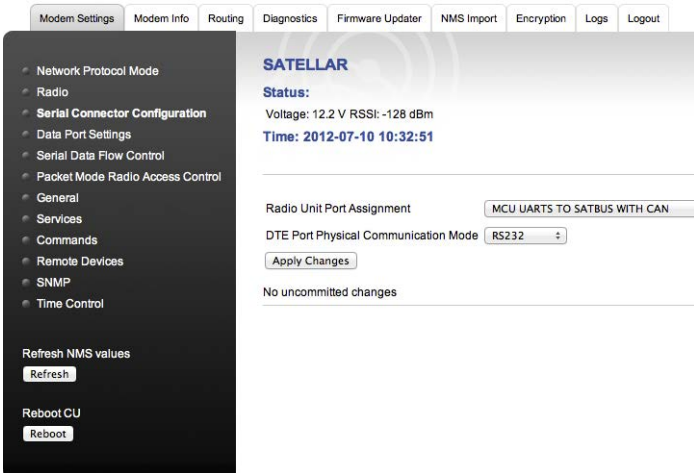

Figure 4.3 Serial Connector Configuration

a) Check Radio Unit Port Assignment parameter. By default it is MCU UARTS TO SATBUS WITH CAN, which is correct option for IP communication.
b) DTE Port Physical Communication Mode parameter can be left without attention in TCP/IP communication.

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4.1.4 Packet Mode Radio Access Control

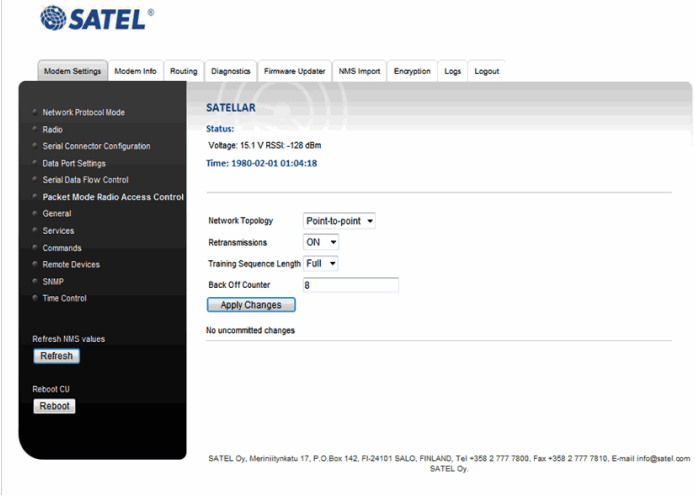

Figure 4.4 Packet Mode Radio Access Control view

a) Set Network Topology according to your application.
b) Retransmissions is by default ON, which means that the radio protocol already follows the message flow and can notice, if some data packets are lost and they need to be retransmitted. The number of retransmissions is one. **NOTE!** Must be set equally in all units in the network.
c) Training Sequence Length values are Full and Half. Half means half size of the original sequence length. This mode improves protocol efficiency and the overall data speed becomes faster.
d) Set Back Off Counter value. This parameter defines the number of RTS time slots the radio must wait before starting the transmission in case the radio network is busy.

The length of the RTS time slot depends on the radio parameters (e.g. 25 kHz/4FSK/FEC OFF it is approx. 15 ms.) By default this value is 8, which typically is good option for basic system testing. **NOTE!** Must be set equally in all units in the network.

4.2 Modem info

Choose the Modem Info -tab from the GUI for accessing the following information.

4.2.1 Radio Unit

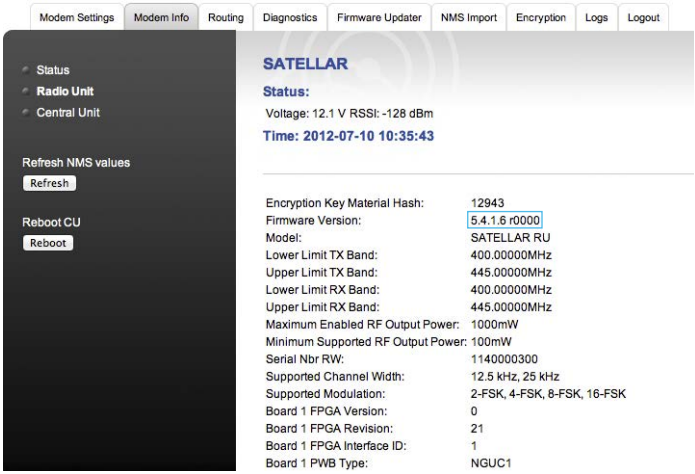

Figure 4.5 Modem Info / Radio Unit view

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4.2.2 Central Unit

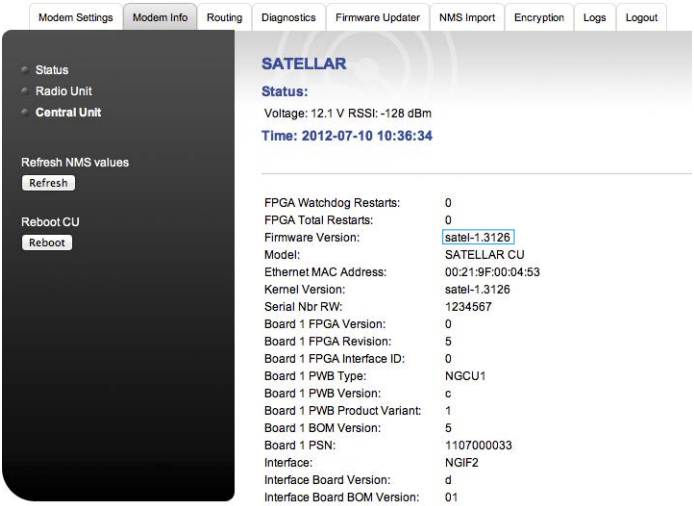

Figure 4.6 Modem Info / Central Unit view

4.3 Routing

SATELLAR-2DS and -20DS use two different types of routing – Packet Routing and IP routing. IP routing works on top of the Packet Routing layer. Both must be correctly configured for IP traffic.

4.3.1 Packet Routing

In Packet Routing every radio must know how to reach ALL the other radios in the network. This information is stored locally to each radio and they all have unique routing tables defining the neighbor and remote radios. The Neighbor radio can be accessed via direct radio link. The Remote is a radio, which can communicate only by using some other radio to repeat the original message.

In the picture the following routes can be found:

- R1 has two neighbors – R2 and R4
- R2 has two neighbors – R1 and R3
- R3 has one neighbor – R2
- R4 has one neighbor – R1

- R1 has one remote – R3
- R2 has one remote – R4
- R3 has two remotes – R1 and R4
- R4 has two remotes – R2 and R3

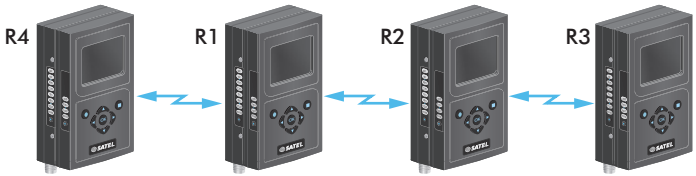

Figure 4.7 Radio topology example for defining the Packet Routing tables

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4.3.2 IP Routing

There are two IP addresses in each SATELLAR unit; one for radio and one for ethernet. The ethernet subnets of each SATELLAR must have **different** network IP addresses.

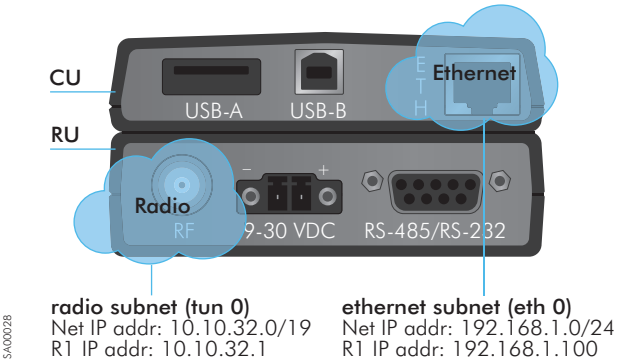

Figure 4.8 SATELLARs two different subnets

The *radio* subnets of each SATELLAR must have the same network IP address. All radios belong to the same subnet.

The network address (10.10.32.x) of the radio is defined automatically by SATELLAR. The unit address (.x) is based on the **RMAC addresses** given under Network Protocol Mode tab (4.1.1 Network Protocol Mode). The base IP-address of radio subnet can be changed from Admin Tools, if necessary.

The user must define the IP routes for reaching the desired subnets.

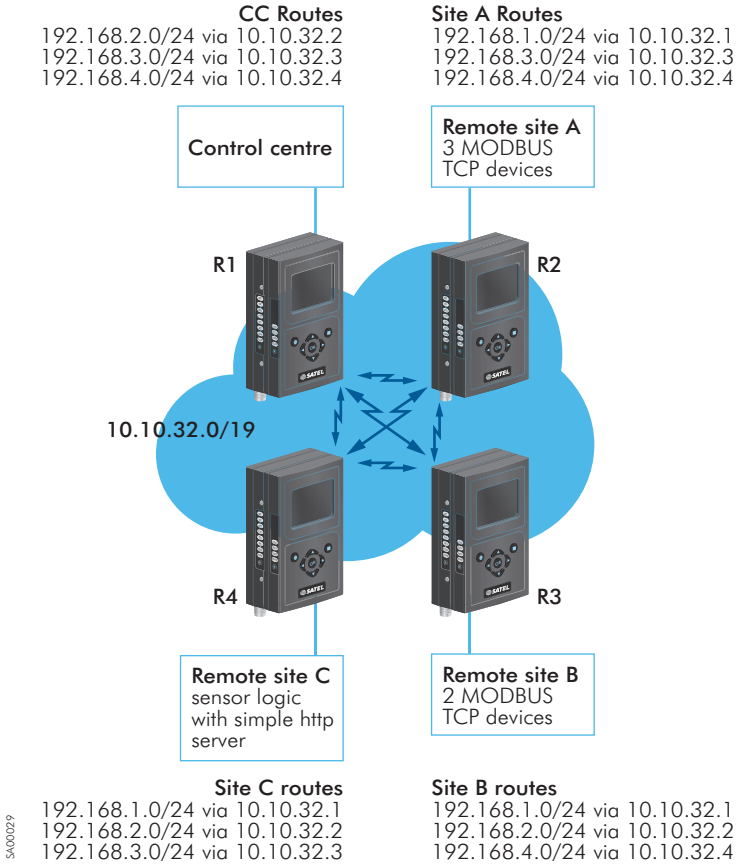

Figure 4.9 Example of the IP routes for a SATELLAR network

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4.3.3 Routing settings

Access the Routing tab for entering the Packet Routes, IP address and IP Routes accordingly.

- Neighbor: The RMAC of a direct neighbor.
- Remotes: RMACs of modems found behind of that neighbor.

Set RMAC addresses of neighbor and remote radio units accordingly.
Select Add Routing Data button for applying the new packet routes.

Multiple routes can be configured with one step by defining a range of addresses. For example, setting the First Address to 5 and the Last Address to 10 creates routes to the following neighbors: 5, 6, 7, 8, 9 and 10. The changes are applied by selecting Create a set of routes to neighbors.

Multiple routes to remotes can also be added similarly, by setting values to the First Address and Last Address fields. The neighbor that has these addresses behind is defined by setting the correct address to the Neighbor field. The changes are applied by selecting Create a set of routes to remotes. For example, setting address 5 to Neighbor field, number 6 to First Address and number 10 to Last Address field, creates routes to remotes from 6 to 10 via the Neighbor 5.

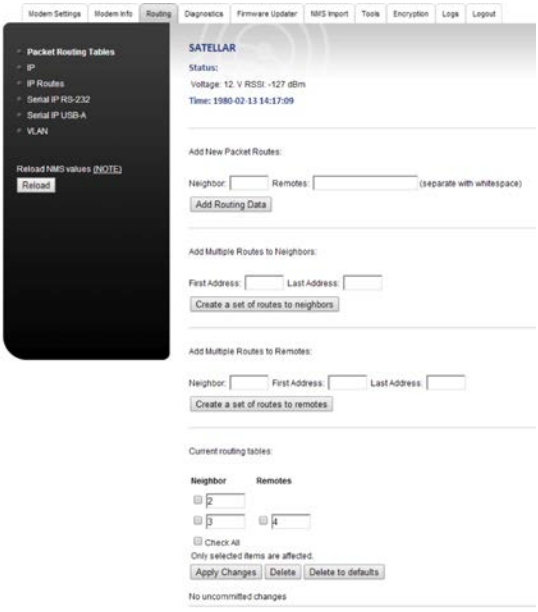


Figure 4.10 Packet Routing Tables view

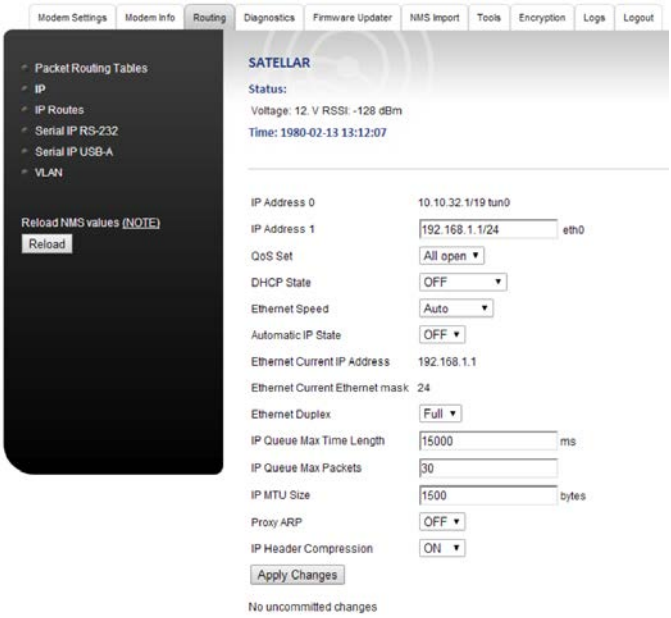


Figure 4.11 IP view

Set eth0 IP Address according to your networks. Subnet mask should be given in /nn format (e.g. /24 stands for 255.255.255.0).

NOTE! Other parameters can typically left as they are in basic testing procedures.

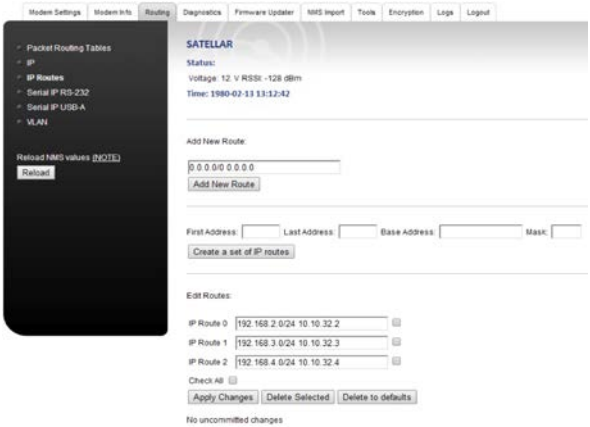


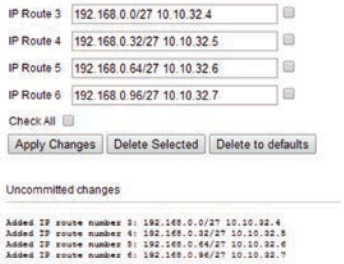
Figure 4.12 IP Routes view

Add IP route to each subnet the unit should communicate to. The format is IP address/Subnet mask Gateway (e.g. 192.168.2.0/24 10.10.32.2).

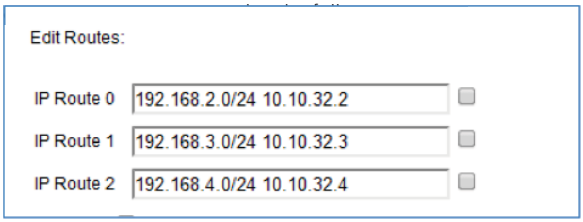
Add New Route button applies new routes.

Set of IP Routes can also be created automatically, based on the provided parameters. The parameters are used as follows: the parameter Base address, together with the Mask, defines the destination network for the first route. The next hop to this network will be the radio network IP address of the neighboring modem provided to the field First Address. For the next automatically created route, the destination network will be the next available network according to the Mask value. For example, with the Mask 27, the network size will be 32 addresses. So if the first automatically created route is to network 192.168.0.0/27, the next one will be to 192.168.0.32/27. The next hop for the next route will be next radio network IP address in sequence. Automatic route creation will be applied further on for the next network and next radio IP address, until the address specified in teh filed Last Address is reached.

Example 1. Setting Base Address: 192.168.0.0 Mask: 27 First Address: 4 Last Address: 7
creates routes as presented in the following picture:



Example 2. Setting the following "Base Address: 192.168.2.0 Mask: 24 First Address: 2 Last Address: 3" creates routes as presented in the following picture:



To delete a route with WWW interface, mark the checkbox and select the Delete Selected button. It is also possible to mark checkbox Check All to select all routes. Deleting all routes at once is not recommended if you have more than 500 routes.

To delete a route with GUI, highlight the correct route and select Menu -> Delete Target

With the WWW interface, Delete to defaults button deletes all routes from device. This is useful especially with large amounts of routes. Note that this action does not ask for confirmation, but the routes are removed immediately.

If you have entered an invalid route, SATELLAR will print a red error text and the invalid route is not added. Finally, remember to click on the *Commit Changes* button, or *Cancel* applied changes if you made a mistake.

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5. Testing environment

When testing the radio performance on the desk, the signal strength may become so high that the receiver gets blocked. The critical value with 16-FSK modulation (allowing the maximum baud rate over the air) is approx. -20 dBm.

This level can be (typically) reached by using:

- 0 dBi antennas
- 20 dB attenuator in both ends of the link
- 100 mW transmission power
- > 50 cm distance between radio units.

Unless attenuators are available, the distance between radio units should be increased to some meters.

5.1 Test equipment

- 2 pcs, SATELLAR-2DS
- 2 pcs, Antennas (e.g. MiniFlex, 0 dBi)
- 2 pcs, Attenuator (20 dB / 10W, TNCm/TNCf connectors)
- 2 pcs, Power cables
- 2 pcs, Power supplies (9...30 Vdc / 30W)

Figure 5.1 Test equipment

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