

SATELLAR DIGITAL SYSTEM  
PART I: 2DS(d)/20DS  
QUICK GUIDE VERSION 1.7

# 2DS(d)/ 20DS

QUICK GUIDE



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Salo, Finland 2012

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

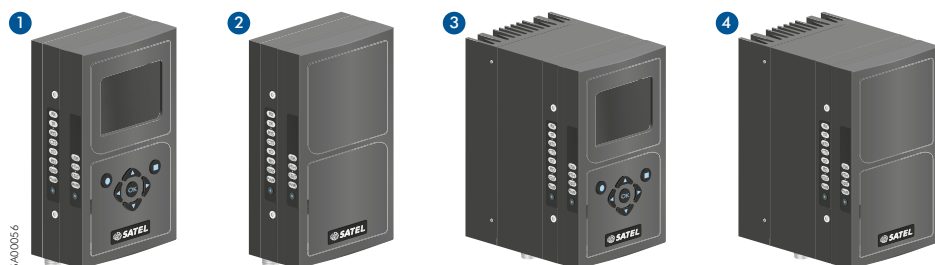


Figure 1.1 SATELLAR-2DS(d) and SATELLAR-20DS types:

1. SATELLAR-2DSd: Central unit (CU) with display and keypad + radio unit (RU) 1W
2. SATELLAR-2DS: 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

# 1

## 1.1 Connections

There are three sockets to be used:

- Connect the antenna to the RF port (TNC female, 50  $\Omega$ ). 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.

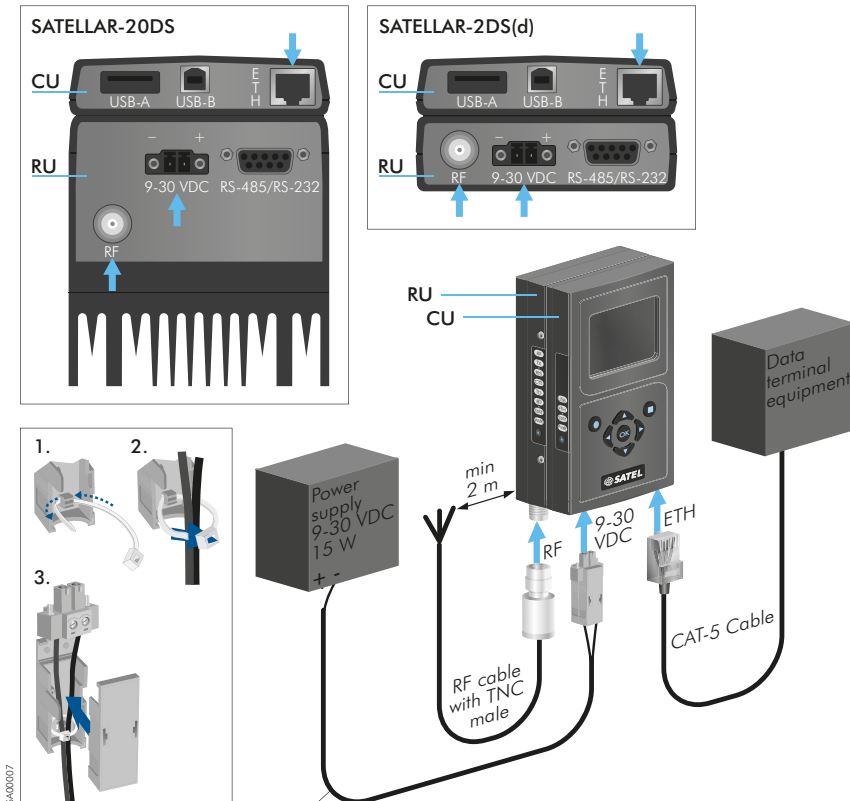


Figure 1.2 Basic connections for configuration and IP communication (RF, Power, Ethernet)

## 2. Starting up the unit

# 2. Starting up the unit

1

Radio boots up, when power socket is connected. Boot up time for SATELLAR-2DS(d) 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.

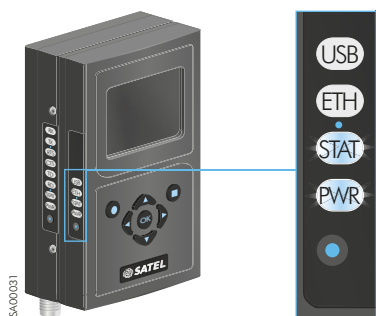


Figure 2.1 The LED indicators are located on the side of the unit

## 3. Accessing the web user interface

Connect your PC computer to SATELLAR-2DS(d) 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

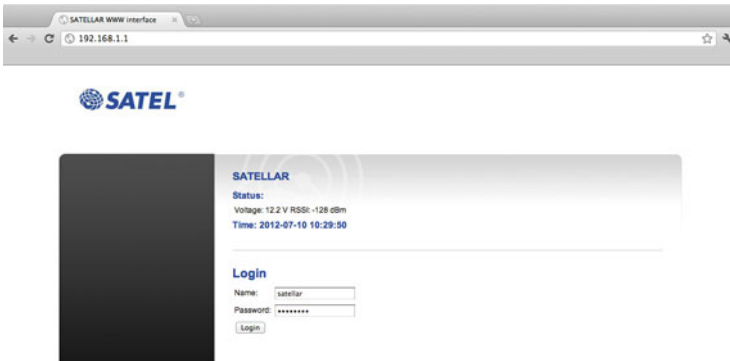


Figure 3.2 SATELLAR WWW interface Login view

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

- Username:           satellar
- Password:           Satel123



## 4. Configuring radio and routing parameters

1

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

- |                               |                                                                                                                                                     |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Apply Changes</b>          | 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. |
| <b>Commit Changes</b>         | Button is used for making all temporary changes permanent.                                                                                          |
| <b>Cancel applied changes</b> | Button will throw away the uncommitted changes.                                                                                                     |

### 4.1 Modem settings

#### 4.1.1 Network Protocol Mode

The screenshot shows the 'Network Protocol Mode' settings page in the SATELLAR web interface. The sidebar on the left contains a list of navigation items: Network Protocol Mode, Radio, Serial Connector Configuration, Data Port Settings, Serial Data Flow Control, Packet Mode Radio Access Control, General, Services, Commands, Remote Devices, SNMP, and Time Control. The main content area has a header with 'SATELLAR' and 'Status:'. Below the status, it shows 'Voltage: 12.1 V RSSI: -128 dBm' and 'Time: 2012-07-10 10:31:41'. The settings section includes three input fields: 'NetID' with the value 'Sate NG', 'Address (RMAC)' with the value '1', and 'Protocol Mode' with a dropdown menu set to 'Packet Routing'. An 'Apply Changes' button is located below these fields. At the bottom of the settings section, it says 'No uncommitted changes'. The sidebar also includes 'Refresh NMS values' with a 'Refresh' button and 'Reboot CU' with a 'Reboot' button.

Figure 4.1 Network Protocol Settings view

- 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.
- Set Address (RMAC) parameter. This is used as the modem address and source for generating the radio network IP address automatically.
- 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.

## 4.1.2 Radio

The screenshot shows the SATELLAR web interface. At the top, there are tabs for Modem Settings, Modem Info, Routing, Diagnostics, Firmware Updater, NMS Import, Encryption, Logs, and Logout. The 'Modem Settings' tab is active, and the 'Radio' sub-tab is selected in the left sidebar. The main content area displays the SATELLAR status and configuration parameters.

**SATELLAR**

**Status:**  
 Voltage: 12.1 V RSSI: -128 dBm  
 Time: 2012-07-10 10:32:19

---

TX Frequency:  MHz  
 RX Frequency:  MHz  
 RF Output Power:    
 Signal Threshold:  dBm  
 Over-the-Air Encryption:    
 Forward Error Correction:    
 Channel Spacing:    
 Air Speed:

No uncommitted changes

Figure 4.2 Radio settings view

- 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.
- Set RF Output Power according to your radio license. Use pull-down menu for selecting suitable frequency (100 mW steps available).
- Set Signal Threshold. By default this is -114 dBm, which typically is good option for basic system testing.
- 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.
- 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
- 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.
- Set Air Speed. Defines the data rate in the radio interface.  
**NOTE!** Must be set equally in all units in the network.

4. Configuring radio and routing parameters

4.1.3 Serial Connector Configuration

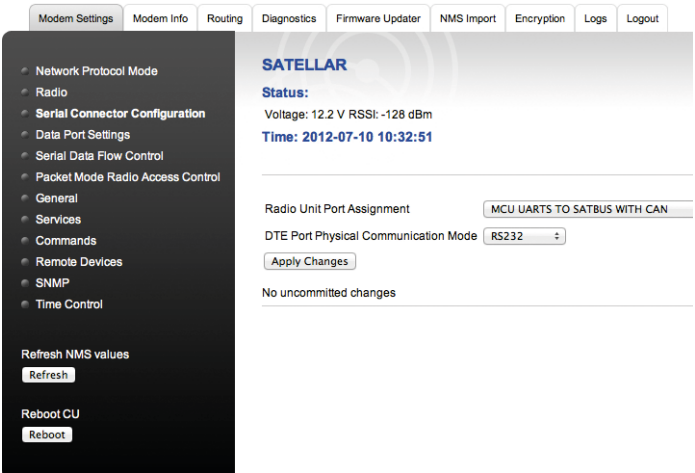


Figure 4.3 Serial Connector Configuration view

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

### 4.1.4 Packet Mode Radio Access Control

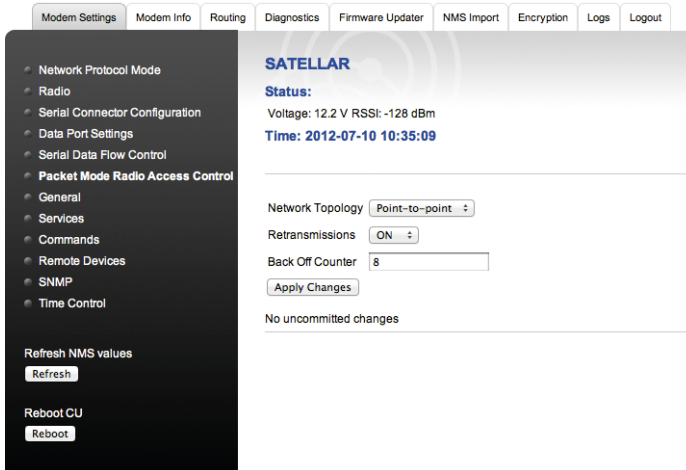


Figure 4.4 Packet Mode Radio Access Control view

- Set Network Topology according to your application. Choose Repeater for all cases where the number of modems is more than two.  
**NOTE!** Must be set equally in all units in the network.
- Set Maximum Number of RTS Retransmissions. By default it is 3, which typically is good option for basic system testing.  
**NOTE!** Must be set equally in all units in the network.
- Set Retransmissions. By default it is 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.  
**NOTE!** Must be set equally in all units in the network.
- 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. Configuring radio and routing parameters

4.2 Modem info

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

4.2.1 Radio Unit

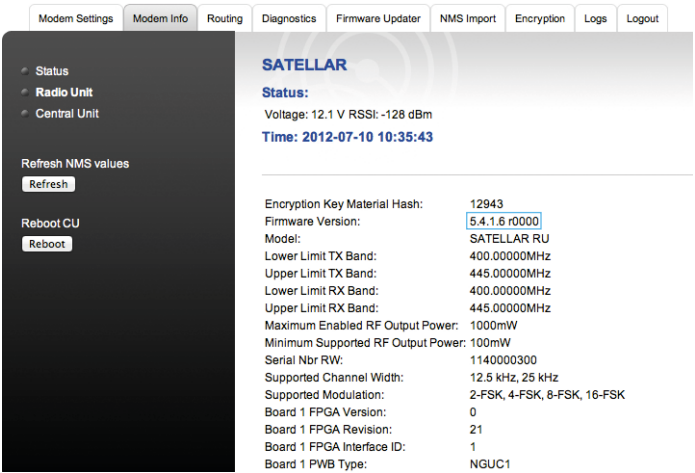


Figure 4.5 Modem Info / Radio Unit view

1 4.2.2 Central Unit

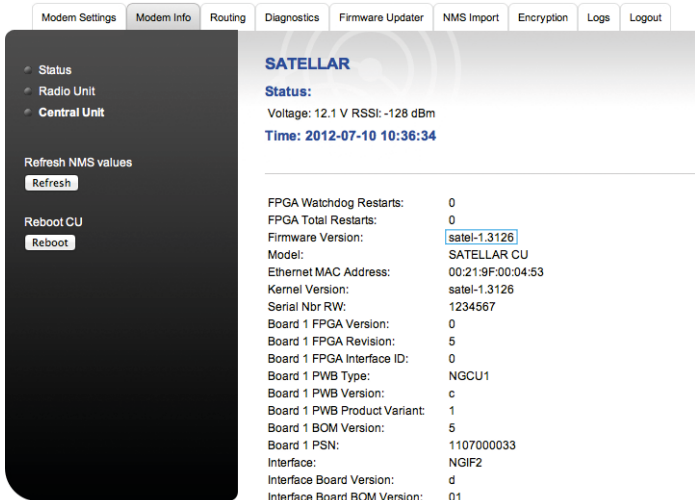


Figure 4.6 Modem Info / Central Unit view

## 4.3 Routing

SATELLAR-2DS(d) 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

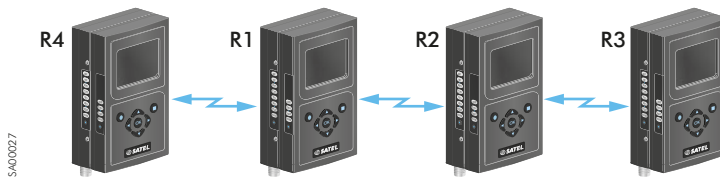


Figure 4.7 Radio topology example for defining the Packet Routing tables

### 1 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.

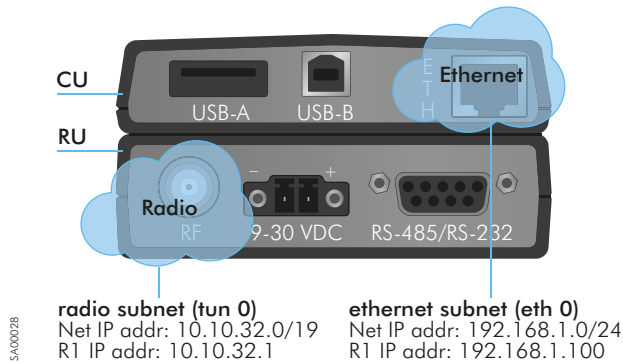


Figure 4.8 SATELLARs two different subnets

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 subnet 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 radio network address can be changed from Admin Tools, if necessary.

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



#### 4. Configuring radio and routing parameters

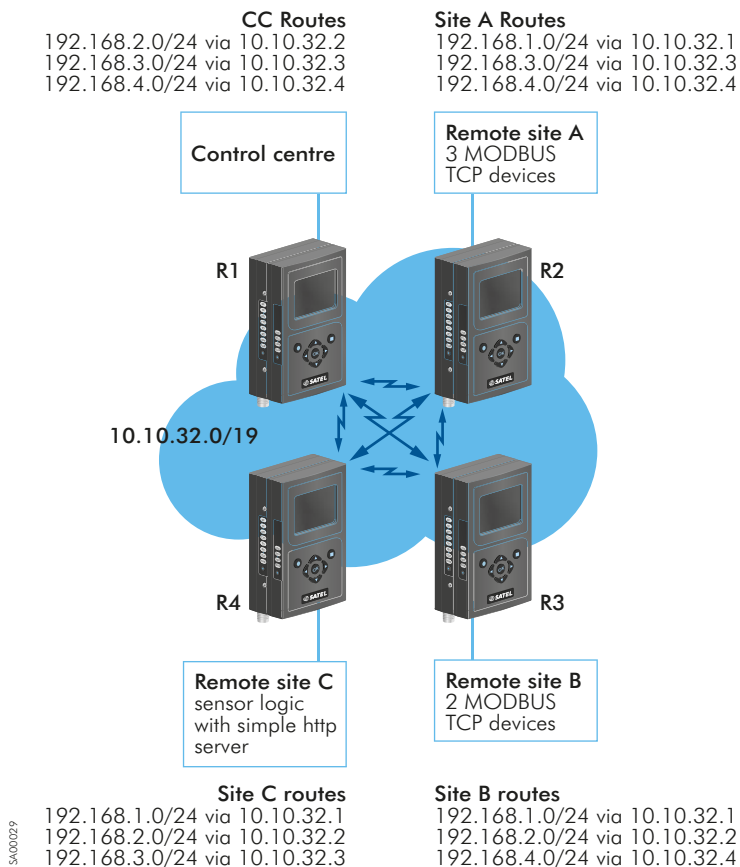


Figure 4.9 Example of the IP routes for a SATELLAR network

### 4.3.3 Creating Packet Routing Tables

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.

Click Add Routing Data button for applying the new packet routes.

The screenshot displays the SATELLAR web interface. At the top, there is a navigation bar with tabs: Modem Settings, Modem Info, Routing (selected), Diagnostics, Firmware Updater, NMS Import, Encryption, Logs, and Logout. On the left, a sidebar contains a list of menu items: Packet Routing Tables (selected), IP, IP Routes, Serial IP RS-232, and Serial IP USB-A. Below the menu items are buttons for 'Refresh NMS values' (with a 'Refresh' sub-button) and 'Reboot CU' (with a 'Reboot' sub-button). The main content area features the SATELLAR logo and status information: 'Status: Voltage: 12.1 V RSSI: -128 dBm Time: 2012-07-10 10:37:06'. Below this, there is a section titled 'Add New Packet Routes:' with input fields for 'Neighbor:' and 'Remotes:' (with a note '(separate with whitespace)'). An 'Add Routing Data' button is positioned below these fields. At the bottom of the main content area, it states 'No uncommitted changes'.

Figure 4.10 Packet Routing Tables view

4. Configuring radio and routing parameters

4.3.4 IP

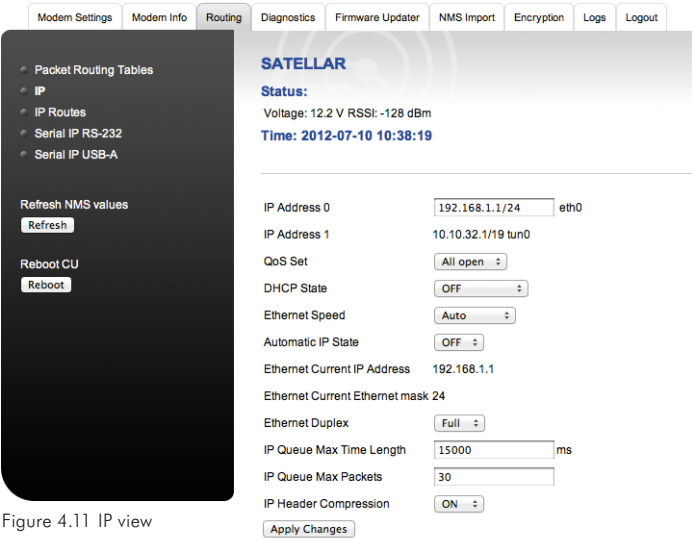


Figure 4.11 IP view

Set IP Address 1 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.

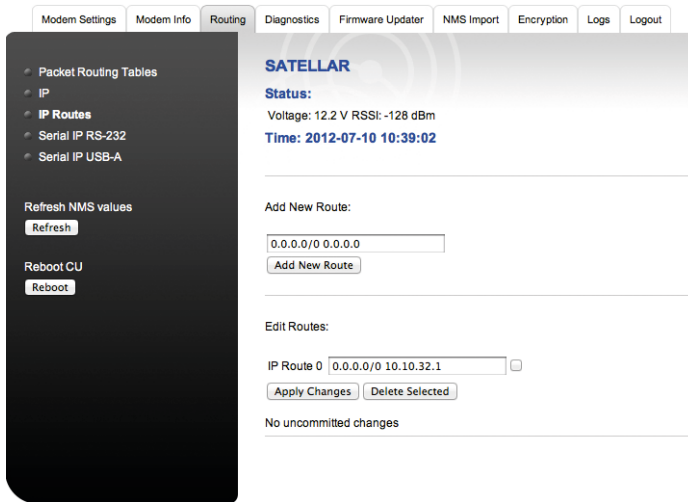


Figure 4.12 IP Routes view

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.

*Editing existing route* can be done by typing in the necessary changes, putting the tick mark to the check box and clicking Apply changes button.

*Deleting existing route* can be done by putting the tick mark to the check box and clicking Delete Selected button.

Commit the changes for making them permanent to the particular unit.

Complete the same procedure to all radio modems in the network and use e.g. ping command for testing the TCP/IP communication.

## 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.

## 1 5.1 Test equipment

- 2 pcs, SATELLAR-2DS(d)
- 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)



S4000030

Figure 5.1 Test equipment



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