

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

2DS(d)/ 20DS

QUICK GUIDE



Copyright: 2012 SATEL Oy

No part of this document may be reproduced, transmitted or stored in a retrieval system in any form or by any means without the prior written permission of SATEL Oy. This document is provided in confidence and must not be distributed to third parties without the express permission of SATEL Oy.

Contents

Important notice	4
Introduction	4
1. Hardware	5
1.1 Connections	6
2. Starting up the unit	7
3. Accessing the web user interface	8
4. Configuring radio and routing parameters	9
4.1 Modem settings	9
4.1.1 Network Protocol Mode	9
4.1.2 Radio	10
4.1.3 Serial Connector Configuration	11
4.1.4 Packet Mode Radio Access Control	12
4.2 Modem info	13
4.2.1 Radio Unit	13
4.2.2 Central Unit	14
4.3 Routing	15
4.3.1 Packet Routing	15
4.3.2 IP Routing	16
4.3.3 Creating Packet Routing Tables	18
4.3.4 IP	19
5. Testing environment	21
5.1 Test equipment	22

1 Important notice

All rights to this manual are owned solely by SATEL OY (referred to in this user guide as SATEL). All rights reserved. The copying of this manual (without written permission from the owner) by printing, copying, recording or by any other means, or the full or partial translation of the manual to any other language, including all programming languages, using any electrical, mechanical, magnetic, optical, manual or other methods or devices is forbidden.

SATEL reserves the right to change the technical specifications or functions of its products, or to discontinue the manufacture of any of its products or to discontinue the support of any of its products, without any written announcement and urges its customers to ensure that the information at their disposal is valid.

SATEL software and programs are delivered "as is". The manufacturer does not grant any kind of warranty including guarantees on suitability and

applicability to a certain application. Under no circumstances is the manufacturer or the developer of a program responsible for any possible damages caused by the use of a program. The names of the programs as well as all copyrights relating to the programs are the sole property of SATEL. Any transfer, licensing to a third party, leasing, renting, transportation, copying, editing, translating, modifying into another programming language or reverse engineering for any intent is forbidden without the written consent of SATEL.

SATEL PRODUCTS HAVE NOT BEEN DESIGNED, INTENDED NOR INSPECTED TO BE USED IN ANY LIFE SUPPORT - RELATED DEVICE OR SYSTEM - RELATED FUNCTION NOR AS A PART OF ANY OTHER CRITICAL SYSTEM AND ARE GRANTED NO FUNCTIONAL WARRANTY IF THEY ARE USED IN ANY OF THE APPLICATIONS MENTIONED.

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.

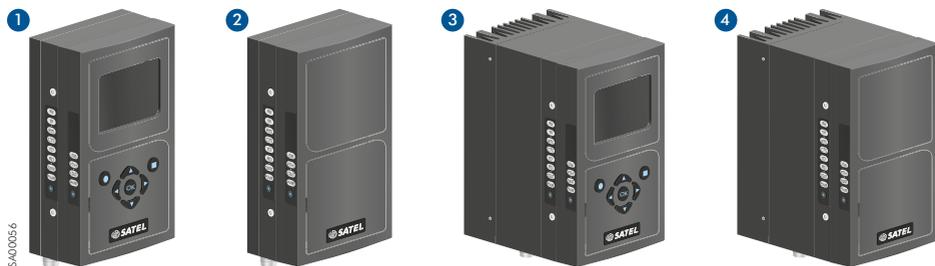


Figure 1.1 SATELLAR-2DS(d) and SATELLAR-20DS types:

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 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.

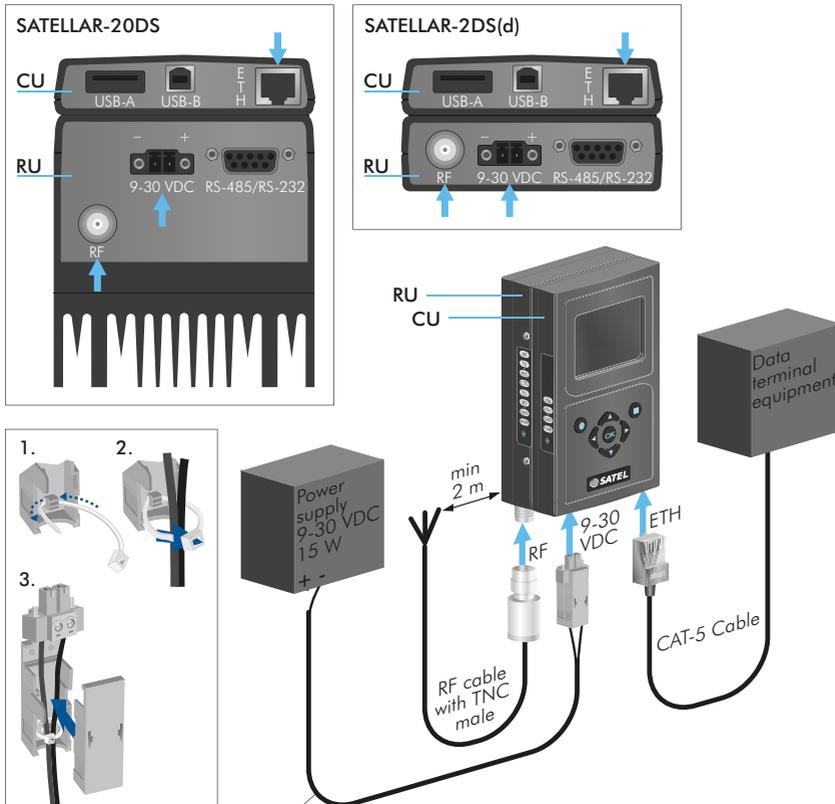


Figure 1.2 Basic connections for configuration and IP communication (RF, Power, Ethernet)

2. Starting up the unit

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.

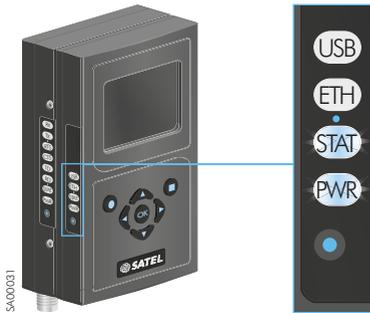


Figure 2.1 The LED indicators are located on the side of the unit

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

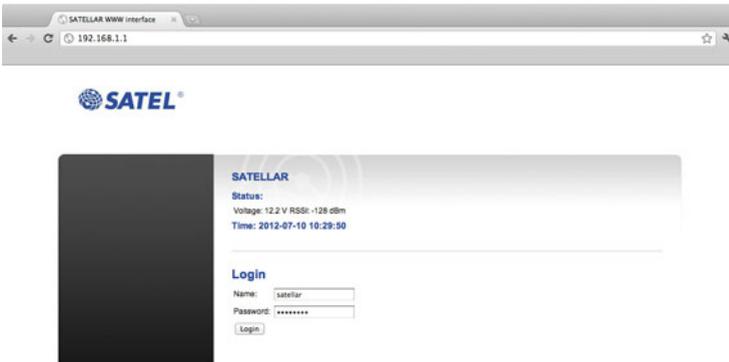


Figure 3.2 SATELLAR WWW interface Login view

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

- Username: satellar
- Password: Satel123

4. Configuring radio and routing parameters

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

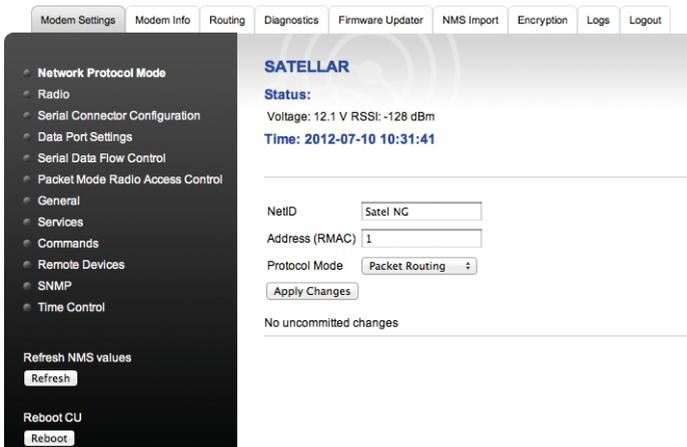


Figure 4.1 Network Protocol Settings view

- 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 'Radio' configuration page in the SATELLAR web interface. The left sidebar contains a navigation menu with options like 'Network Protocol Mode', 'Radio', 'Serial Connector Configuration', etc. The main content area displays the following settings:

- TX Frequency:** 420.00000 MHz
- RX Frequency:** 420.00000 MHz
- RF Output Power:** 1000 mW
- Signal Threshold:** -114 dBm
- Over-the-Air Encryption:** OFF
- Forward Error Correction:** OFF
- Channel Spacing:** 25.00 kHz
- Air Speed:** 19200 bps

At the bottom of the settings area, there is an 'Apply Changes' button and a message: '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

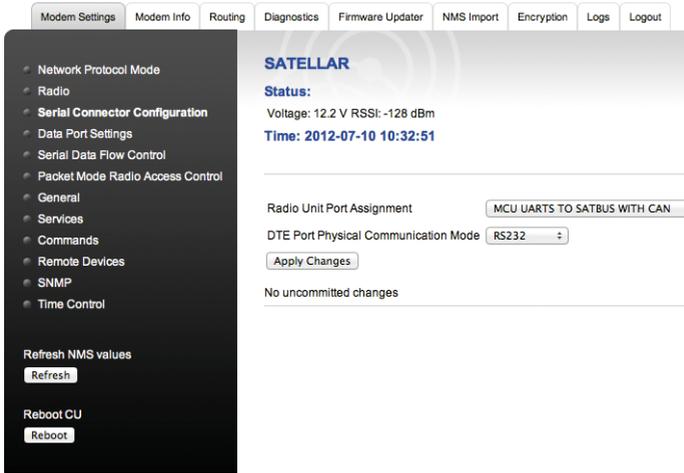


Figure 4.3 Serial Connector Configuration view

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

4.1.4 Packet Mode Radio Access Control

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 main content area is titled 'SATELLAR' and shows the following information:

- Status:** Voltage: 12.2 V RSSI: -128 dBm
- Time:** 2012-07-10 10:35:09

Below the status information, there are configuration options:

- Network Topology:** A dropdown menu set to 'Point-to-point'.
- Retransmissions:** A dropdown menu set to 'ON'.
- Back Off Counter:** A text input field containing the value '8'.
- Apply Changes:** A button to save the configuration.

At the bottom of the configuration area, it says 'No uncommitted changes'. On the left side, there is a dark sidebar menu with the following items:

- Network Protocol Mode
- Radio
- Serial Connector Configuration
- Data Port Settings
- Serial Data Flow Control
- Packet Mode Radio Access Control** (highlighted)
- General
- Services
- Commands
- Remote Devices
- SNMP
- Time Control

Below the menu, there are two buttons: 'Refresh NMS values' with a 'Refresh' button, and 'Reboot CU' with a 'Reboot' button.

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

Encryption Key Material Hash:	12943
Firmware Version:	5.4.1.6 r0000
Model:	SATELLAR RU
Lower Limit TX Band:	400.00000MHz
Upper Limit TX Band:	445.00000MHz
Lower Limit RX Band:	400.00000MHz
Upper Limit RX Band:	445.00000MHz
Maximum Enabled RF Output Power:	1000mW
Minimum Supported RF Output Power:	100mW
Serial Nbr RW:	1140000300
Supported Channel Width:	12.5 kHz, 25 kHz
Supported Modulation:	2-FSK, 4-FSK, 8-FSK, 16-FSK
Board 1 FPGA Version:	0
Board 1 FPGA Revision:	21
Board 1 FPGA Interface ID:	1
Board 1 PWB Type:	NGUC1

Figure 4.5 Modem Info / Radio Unit view

4.2.2 Central Unit

The screenshot shows the SATELLAR web interface. At the top, there are navigation tabs: Modem Settings, Modem Info, Routing, Diagnostics, Firmware Updater, NMS Import, Encryption, Logs, and Logout. The 'Modem Info' tab is active. On the left, a dark sidebar contains a menu with 'Status', 'Radio Unit', and 'Central Unit' (selected). Below the menu are buttons for 'Refresh NMS values' (with a 'Refresh' button) and 'Reboot CU' (with a 'Reboot' button). The main content area is titled 'SATELLAR' and shows the following information:

Status:
Voltage: 12.1 V RSSI: -128 dBm
Time: 2012-07-10 10:36:34

FPGA Watchdog Restarts:	0
FPGA Total Restarts:	0
Firmware Version:	satel-1.3126
Model:	SATELLAR CU
Ethernet MAC Address:	00:21:9F:00:04:53
Kernel Version:	satel-1.3126
Serial Nbr RW:	1234567
Board 1 FPGA Version:	0
Board 1 FPGA Revision:	5
Board 1 FPGA Interface ID:	0
Board 1 PWB Type:	NGCU1
Board 1 PWB Version:	c
Board 1 PWB Product Variant:	1
Board 1 BOM Version:	5
Board 1 PSN:	1107000033
Interface:	NGIF2
Interface Board Version:	d
Interface Board BOM Version:	01

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

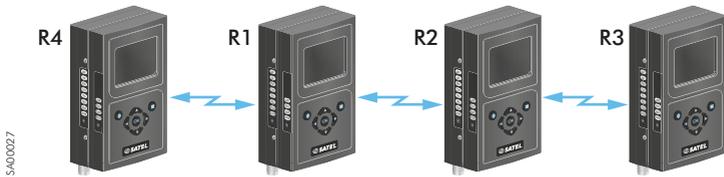


Figure 4.7 Radio topology example for defining the Packet Routing tables

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.

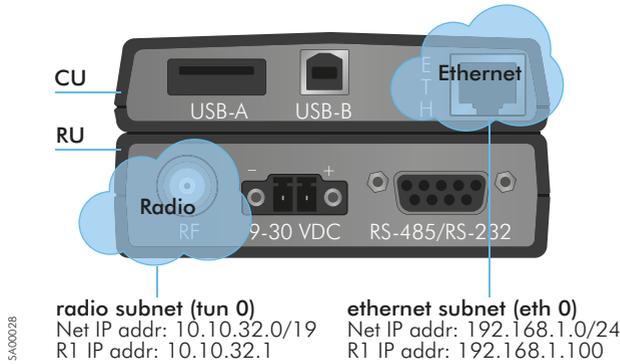


Figure 4.8 SATELLARs two different subnets

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

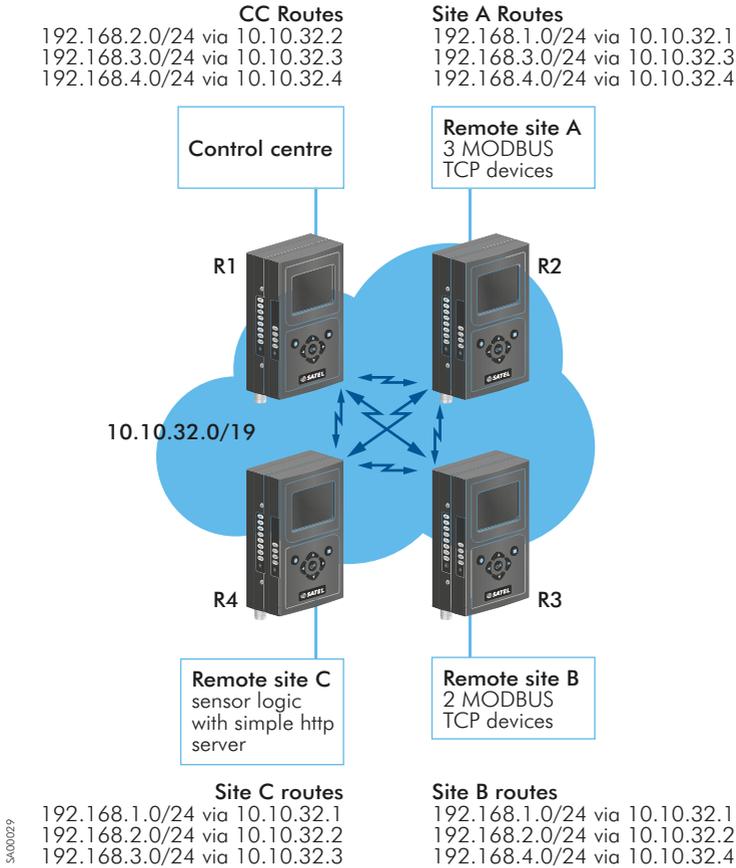


Figure 4.9 Example of the IP routes for a SATELLAR network

1

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 side, a dark sidebar menu contains the following items: Packet Routing Tables (selected), IP, IP Routes, Serial IP RS-232, and Serial IP USB-A. Below the menu are two sections: 'Refresh NMS values' with a 'Refresh' button, and 'Reboot CU' with a 'Reboot' button. The main content area has a header 'SATELLAR' and a 'Status:' section showing 'Voltage: 12.1 V RSSI: -128 dBm' and 'Time: 2012-07-10 10:37:06'. Below this is a section titled 'Add New Packet Routes:' with two input fields: 'Neighbor:' and 'Remotes:'. A note '(separate with whitespace)' is next to the Remotes field. An 'Add Routing Data' button is positioned below the input fields. At the bottom of the main content area, it says 'No uncommitted changes'.

Figure 4.10 Packet Routing Tables view

4. Configuring radio and routing parameters

4.3.4 IP

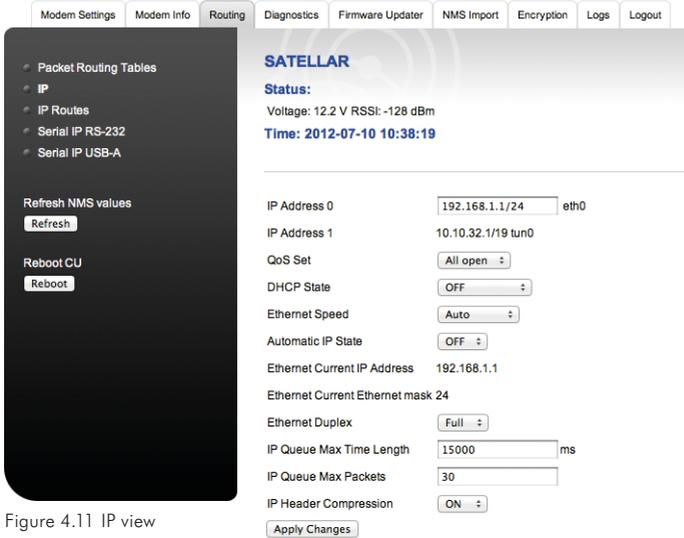


Figure 4.11 IP view

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.

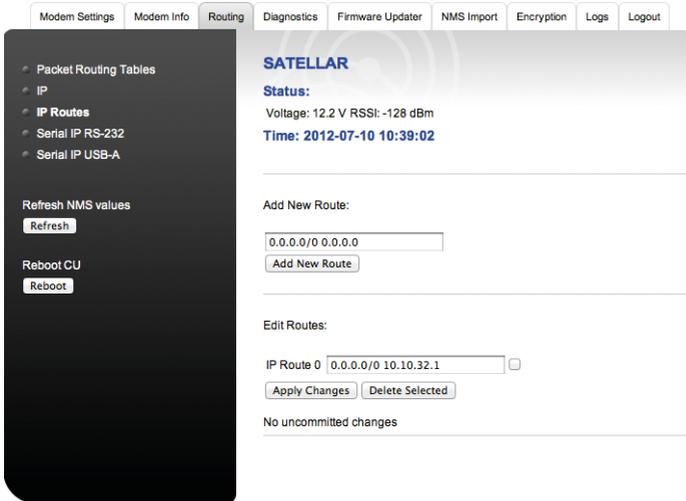


Figure 4.12 IP Routes view

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)



SA000030

Figure 5.1 Test equipment

SATEL Oy
Meriniitynkatu 17, P.O.Box 142
FI-24101 Salo, Finland
Tel. +358 2 777 7800
info@satel.com
www.satel.com