



WIRELESS WORLD – LOCAL SOLUTION

SATELLAR-2DS / -2DSd

Digital system

Quick Guide



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Salo, FINLAND 2011

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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 -2DSd units. The screen shots apply on the firmware versions – RU 5.3.0.3 and CU 0.2752.

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

SATELLAR-2DS/-2DSd unit is a wireless IP router. Therefore all SATELLARs should be configured to operate as the gateway for individual subnets.

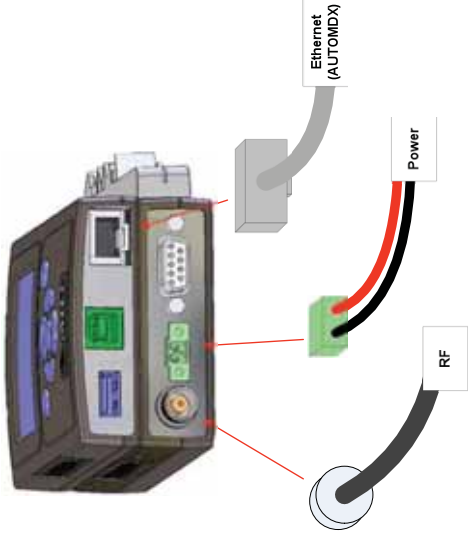
1 HARDWARE

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

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 workshop), 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 ... +30Vdc.
- * Connect the Ethernet cable. The SATELLAR supports the Auto-MDIX, so the Ethernet cable can be direct or crossed.



Picture 1. 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/-2DSd 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.

3 ACCESSING THE WEB USER INTERFACE

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

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

By default the IP related settings are:

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

Open your web browser and enter the default IP to the address field.



Picture 2. SATELLAR WWW interface Login view.

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

- * Username: satellar
- * Password: Sate1123

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.

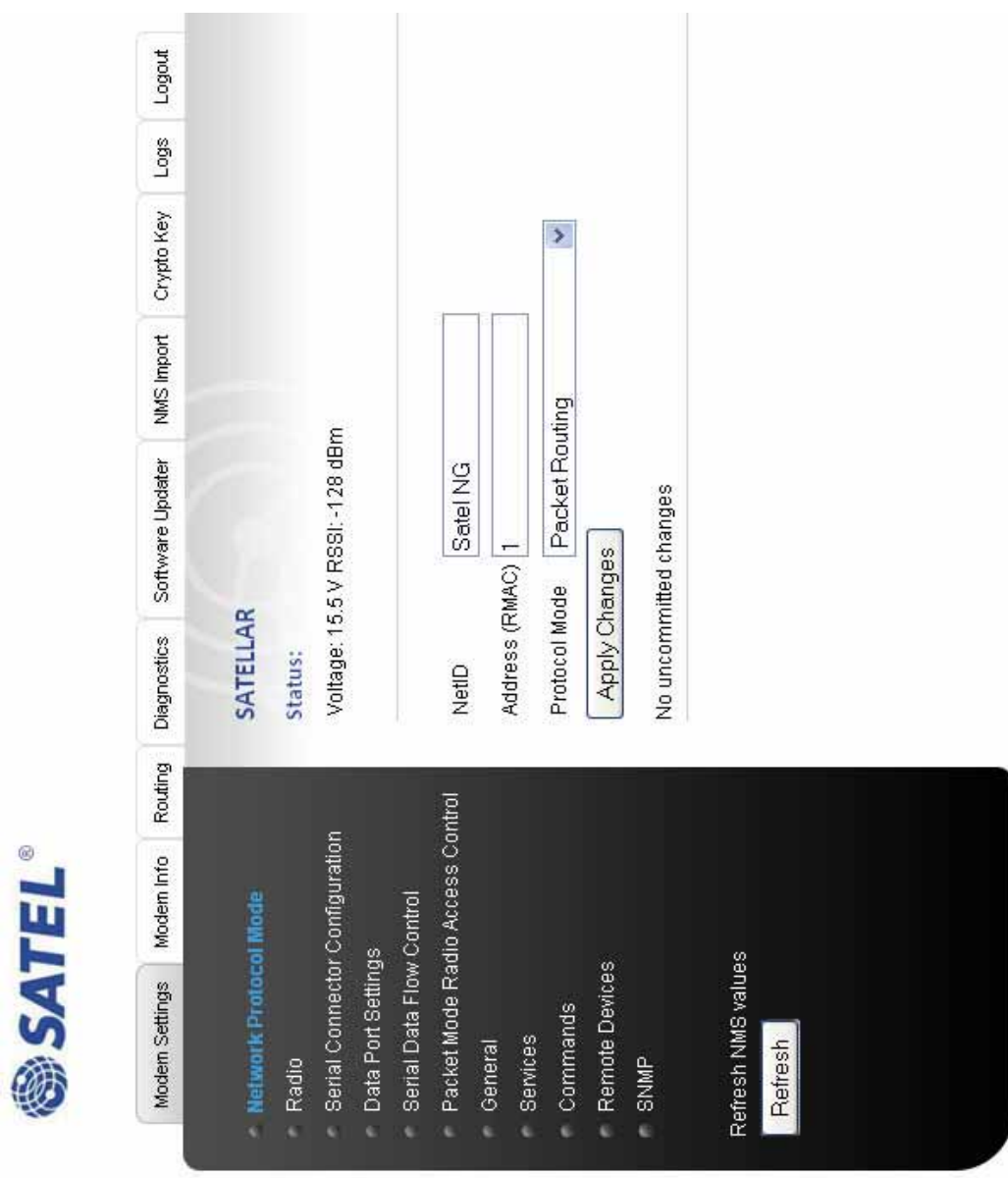
Cancel

Button will throw away the uncommitted changes.

4.1 Modem settings

4.1.1 Network Protocol Mode

- 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.



Picture 3. Network Protocol Settings view.

4.1.2 Radio

- 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 frequency (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.



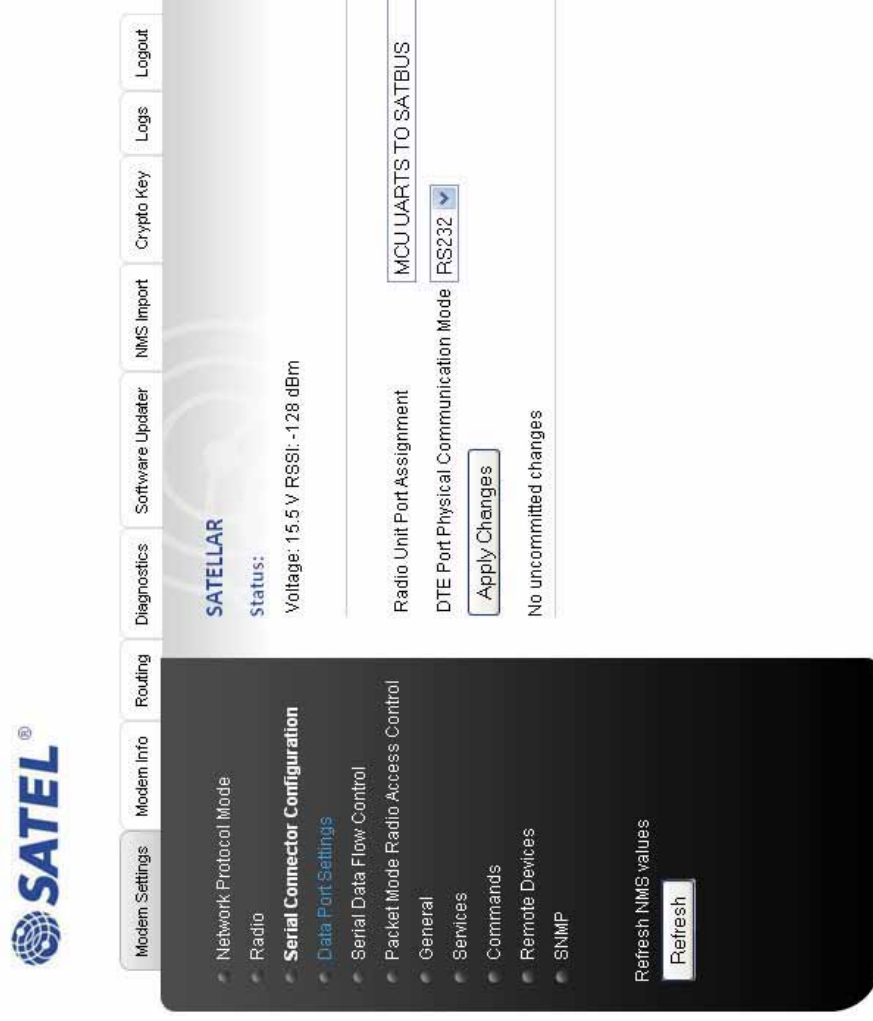
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Picture 4. Radio settings view.

- 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

- 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.



Picture 5. Serial Connector Configuration view.

4.1.4 Packet Mode Radio Access Control

a) Set Network Topology according to your application. Choose Repeater for all cases where the number of modems is more than two.

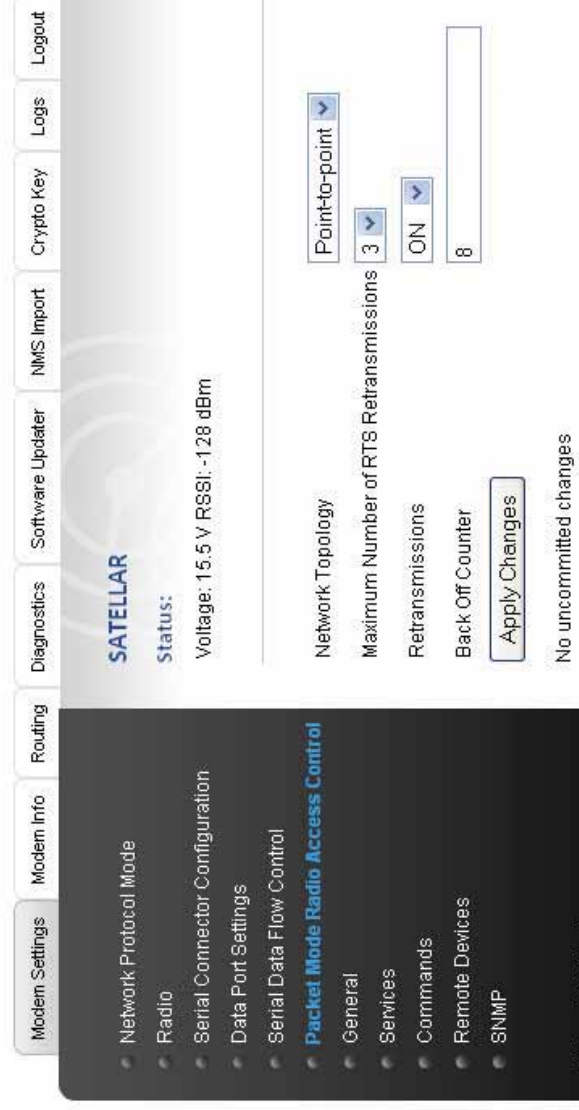
NOTE! Must be set equally in all units in the network.

b) 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.

c) 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.

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.



Picture 6. Packet Mode Radio Access Control view.

4.2 Modem info

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

4.2.1 Radio Unit

Check that the firmware version of the Radio Unit is 5.3.0.3 or later.



The screenshot shows the SATELLAR GUI with the 'Modem Info' tab selected. The 'Radio Unit' section is active, and the 'Refresh NMS values' button is visible. The 'Firmware Version' is highlighted as 5.3.0.3.

Parameter	Value
Crypto Key Material Hash:	12943
Firmware Version:	5.3.0.3
Model:	SATELLAR
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:	
Supported Channel Width:	12.5 kHz, 25 kHz
Supported Modulation:	2-FSK, 4-FSK, 8-FSK
Board 1 FPGA Version:	0
Board 1 FPGA Revision:	21
Board 1 FPGA Interface ID:	1

Picture 7. Modem Info / Radio Unit view.

4.2.2 Central Unit

Check that the firmware version is 0.2752 or later.



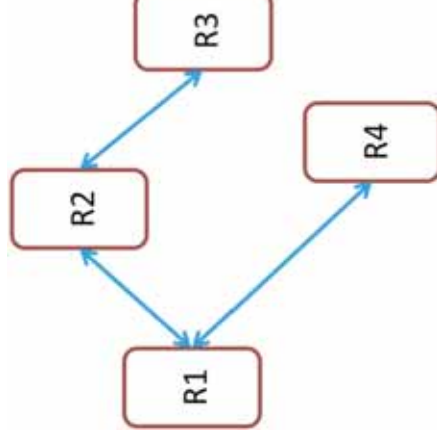
Picture 8. Modem Info / Central Unit view.

4.3 Routing

SATELLAR-2DS/-2DSd uses 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:

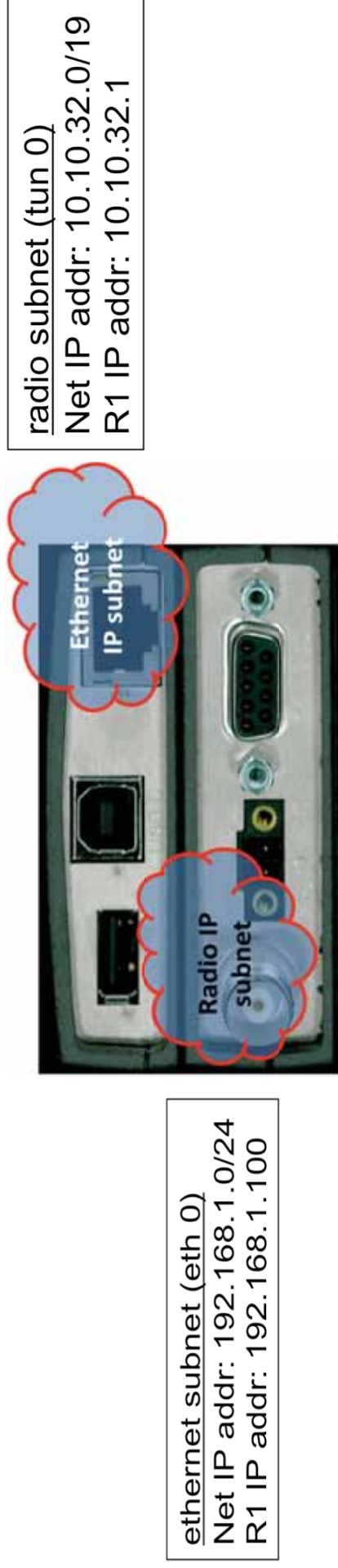
- * R1 has two neighbors – R2 and R4.
- * R2 has two neighbors – R1 and R3.
- * R3 has one neighbor – R2.
- * R4 has one neighbor – R1.

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

Picture 9. Radio topology example for defining the Packet Routing tables.

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.

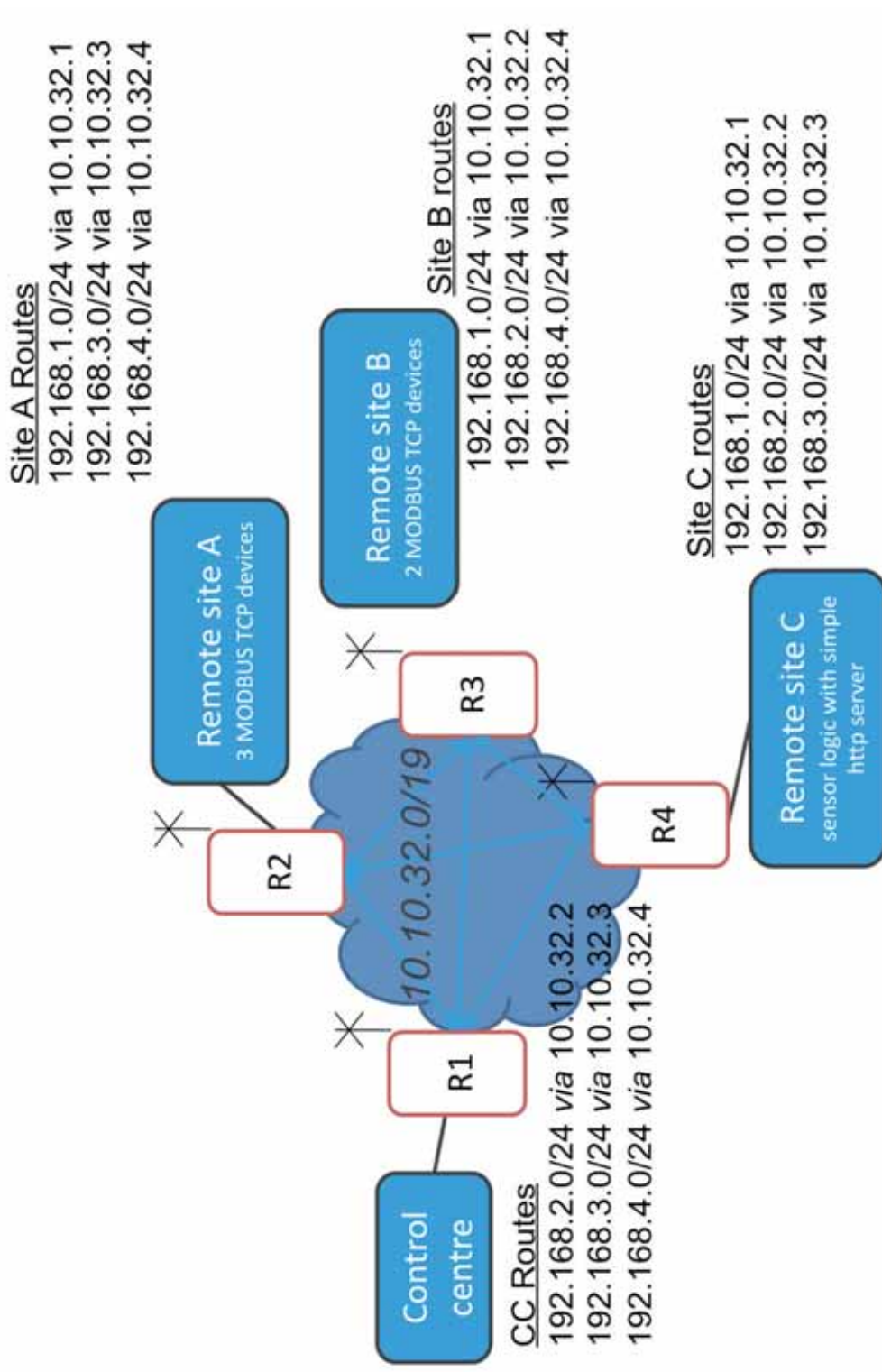


Picture 10. SATELLARs two different subnets.

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.



Picture 11. 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.

- o Neighbor: The RMAC of a direct neighbor.
- o 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.

Picture 12. Packet Routing Tables view.



4.3.4 IP

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.



Picture 13. IP 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.



Picture 14. IP Routes view.

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.

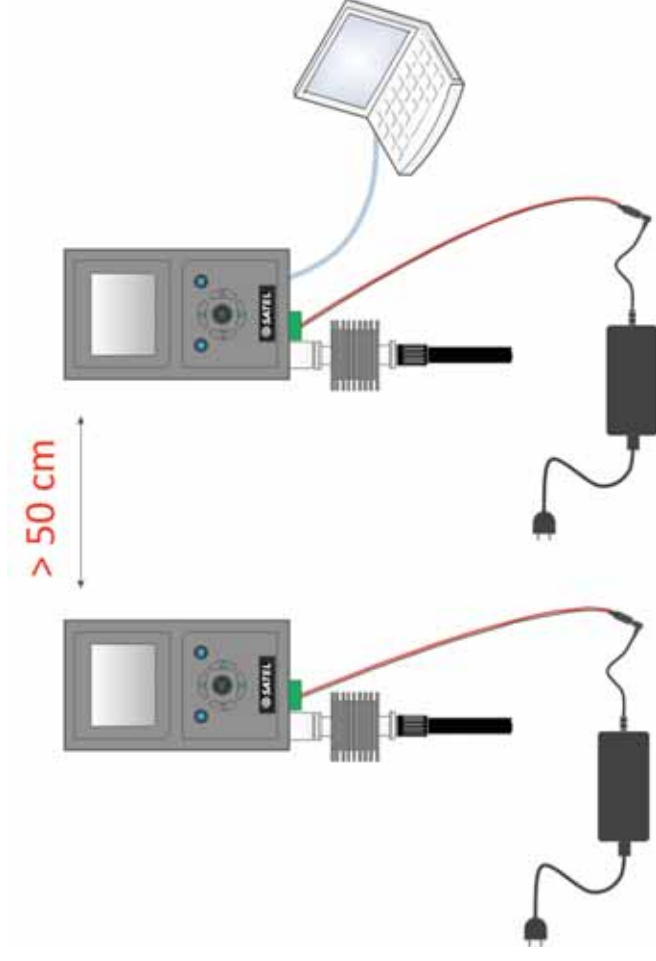
This level can be (typically) reached by using:

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

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

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)



Picture 15. Test equipment.



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