NovelSat NS3000 IP Networking

App Note

Version 1.1

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NovelSat USA: 25 Tanglewood Rd. Newton, MA 02459

Contents

1 Introduction

NovelSat modems have the ability to control both receiving and transmitting IP data with an internal router and bridge.

These two internal logic elements are controllable and configurable from the native menus.

There are three modes of operations for the NovelSat modem's IP card which are called data forwarding modes. These data forwarding modes are used for different data applications, the modes are:

- L2 Transparent bridging
- L2 VLAN switching
- L3 IP routing

2 Data forwarding modes

2.1 L2 transparent bridging mode

This mode can be used for any type of data transmission for point-to-point, or point-to-multipoint configuration. In this mode, any data entering the LAN interface (GigE connector) in the modulator will turn out at the other end in the demodulator LAN interface (GigE connector).

When working in P-t-P configuration this mode has no fault or problem in usage, however when shifting to a P-t-MP application, several issues may rise, as explained below.

Let us consider, a 1-to-3 application, where 250Mbps transmitted from the hub, to three different remotes, receiving 100Mbps, 80Mbps and 70Mbps respectively. Each remote transmits back 25Mbps to the hub, as shown in the figure below.

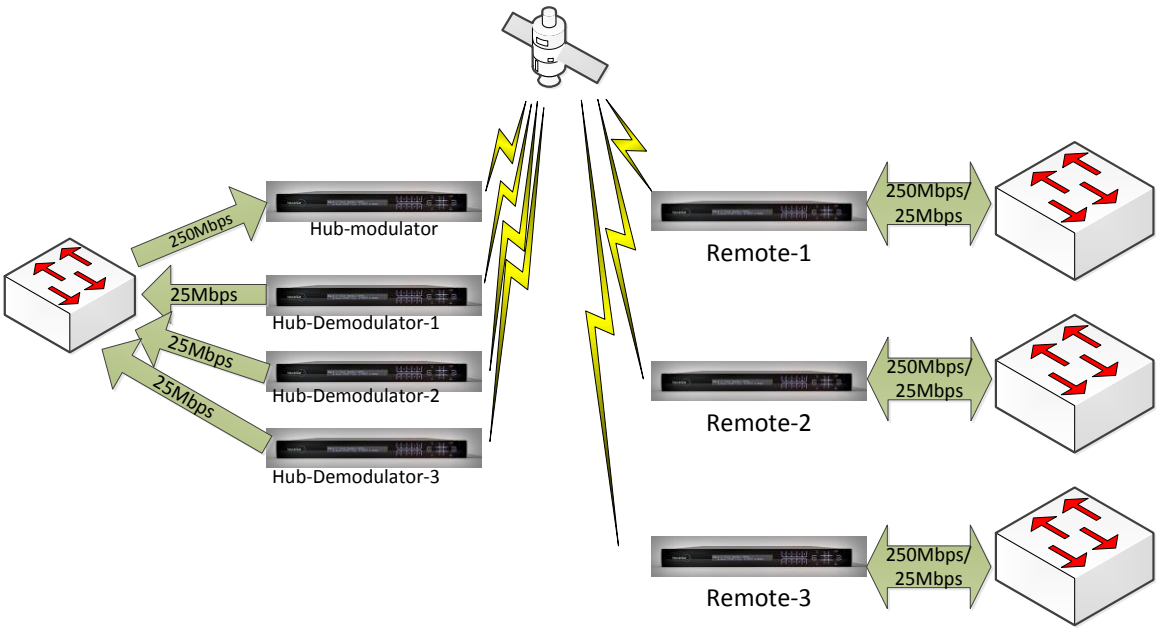


Figure 1 - Simple P-t-MP configuration example

In this case, we may be exposed to the following issues:

- Security breach – All remotes can receive the 250Mbps, where, each remote should only see its own bitrate.
- Higher Data Rates at the Modem GigE – 250Mbps instead of 100Mbps (80Mbps or 70Mbps), so a switch/router with 1Gbps must be used.
- All remotes must use the same MODCOD, since data stream cannot be distinguished between each remote, and this may cause a lower utilization of the space segment, as the remote with lowest reception condition will be the bottle neck and will determine a lower MODCOD for all remotes.

In order to solve these issues the next modes (L2 VLAN switching and L3 IP Routing) are suggested.

2.2 L2 VLAN Switching

Let us now, explore the functionality of this mode, and how it solves the above mentioned issues. With this mode, the user needs to define the remotes, and then one can assign a different tagged VLAN per remote. Several VLANs may be assigned to a single remote, however only one remote can be assigned to a certain VLAN.

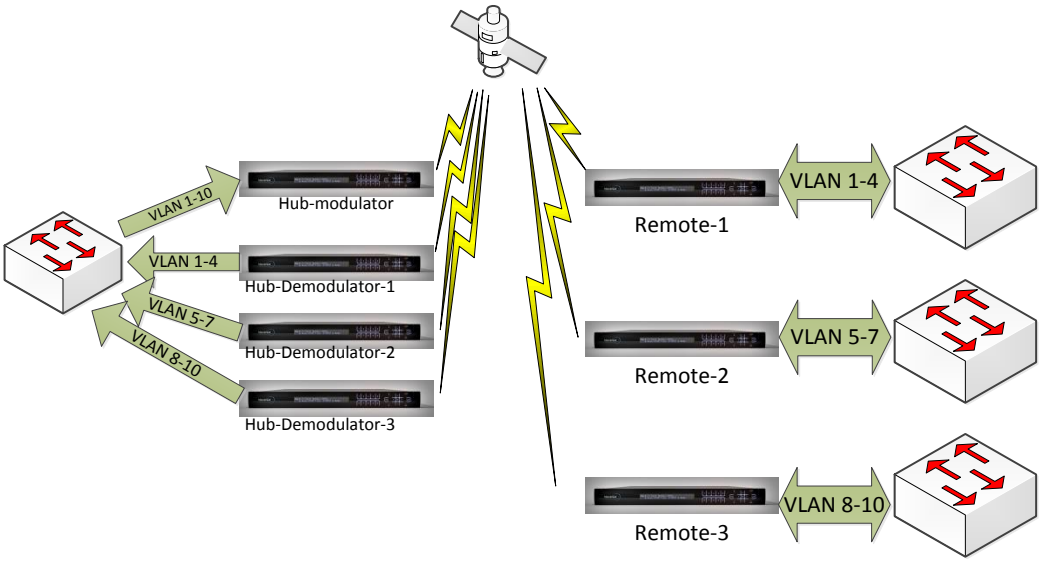


Figure 2 - Typical P-t-MP application

With this configuration, we can set each remote to a different MODCOD, thus optimizing the space segment. We can also make sure each modem on the remote filters out only the allowed VLANs, solving the other two issues.

Since the hub consists of modulator and demodulators, an additional aggregation setup is required at the hub Ethernet switch to ensure correct port allocation for data transmission and data gathering to a single port. This requirement is shown in the figure below.

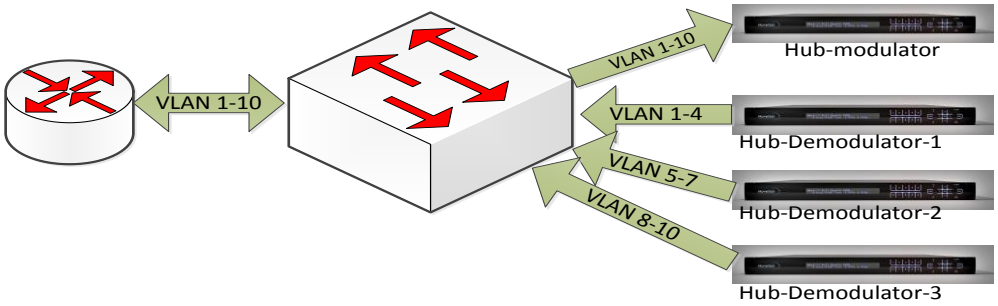


Figure 3 - Switch Aggregation at the HUB

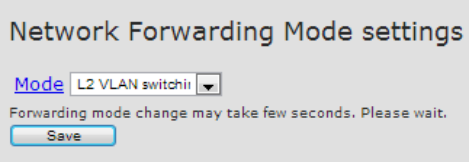
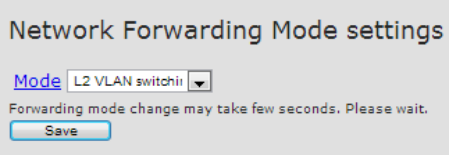
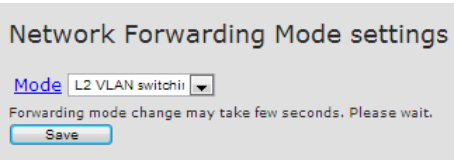
A summary table is shown below with all requirements, and the proper implementation.

Target / Outbound	Bit Rate [Mbps]	VLANs	MODCOD
Remote-1	100	1-4	8PSK 2/3
Remote-2	80	5-7	QPSK 1/4
Remote-3	70	8-10	16APSK 2/3
Target / Inbound	**Bit Rate [Mbps]**	**VLANs**	**MODCOD**
Demodulator-1	25	1-4	8PSK 3/4
Demodulator-2	25	5-7	8PSK 3/4
Demodulator-3	25	8-10	8PSK 3/4

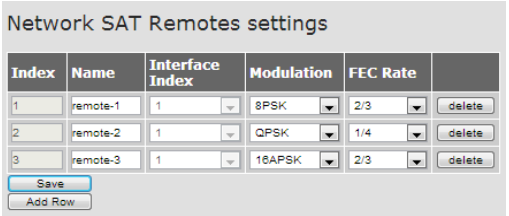
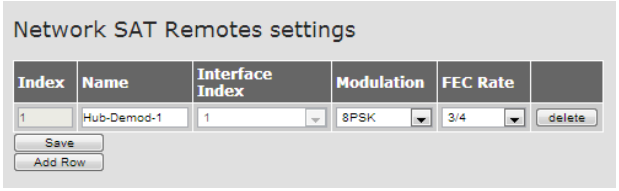
2.2.1 Implementation

The following steps will demonstrate how to configure the modem to achieve this goal on the Hub and on the remote side. For convenience purposes, only demodulator 1 configuration is shown, but it is very similar for the other two.

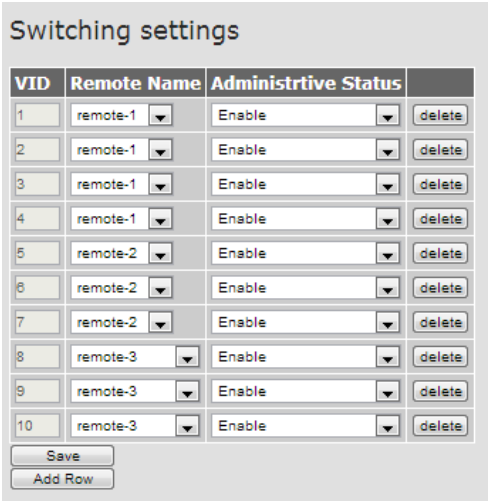
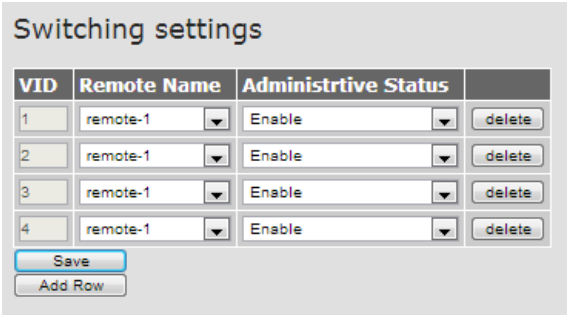
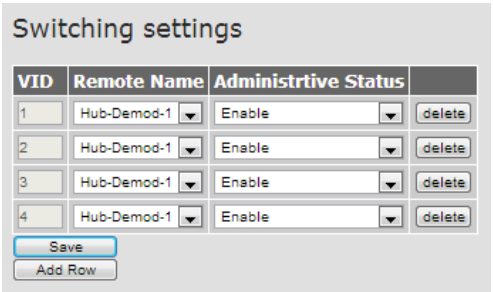
2.2.2 Forwarding mode setting

Hub Modulator	Remote Modem
Network config->forwarding mode 	Network config->forwarding mode 
Hub Demodulator-1	
Network config->forwarding mode 	

2.2.3 Remotes setting

Hub Modulator	Remote Modem
Network config->remotes 	Network config->remotes 

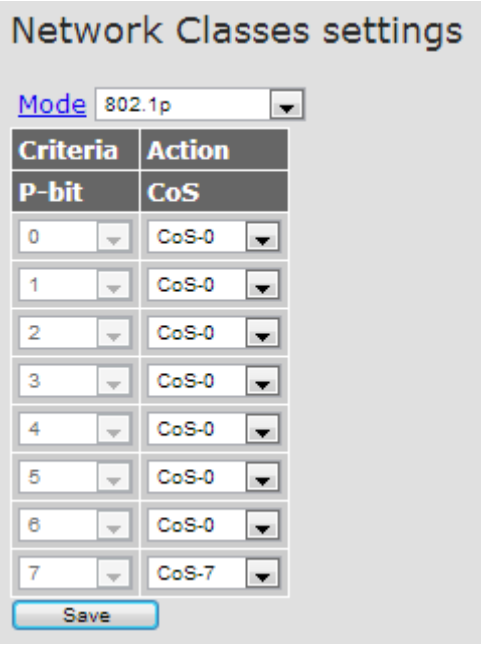
2.2.4 Switching setting

Hub Modulator	Remote Modem
Network config->switching 	Network config->switching 
Hub Demodulator-1	
Network config->switching 	

By now, all configurations have been performed and data will flow to each remote respectively. However, what would happen if we have more important data to send to remote-1 with higher priority than remote-2 and remote-3 and due to weather conditions the line rate drops to 220Mbps? In this case, we may want to utilize the built-in QoS (Quality of Service) mechanism.

The VLAN tag holds 3 priority bits (out of 16 bits), setting the packet priority, and it can be determined to which queue (class of service or CoS) this packet would divert. Let us assume, that in our example, VLAN 3, and VLAN 6 have the highest priority (P-bit is 7) and all the rest have the same priority level (P-bit = 0).

2.2.5 QoS settings for L2 VLAN switching

Hub Modem	Remote Modem
Network config->QoS->Classification 	

We can further configure the queues' behavior in case there are several data sources competing for the same line rate resource.

2.2.6 Queues setting

Now we have two different scheduling options ahead: Strict and DRR (Deficit Round Robin)

Strict – This scheduling option will always transmit its data at the expense of starving other queues. Usually used for real time data (e.g., voice).

DRR - This scheduling option can give different weighting factor to its data in order to prioritize data transmission without starving other queues.

We now wish to make sure CoS-7 data will be transmitted as it arrives, therefore it receives strict priority. Then lower priority CoS0-5 will have a round robin

mechanism with equal priority, whereas, CoS-6 will have a higher priority than CoS0 to Cos5.

The Queue Depth parameter sets the queue buffer size in bytes. It determines the maximal burst size the queue can absorb but also affects the maximal delay of the data in this queue. Therefore, real time data will usually derive smaller queue sizes.

Drop Discipline sets the policy on dropping data when the queue is congested. Possible options are:

Tail Drop:

Will drop last incoming packets when queue is congested.

WRED – Weighted Random Early Drop:

Randomly will drop packets out of the queue when over a given threshold (set by the user).

Typically useful for TCP/IP sessions, to avoid synchronization of the TCP window.

Hub Modem	**Remote Modem**
Network config->QoS->Classification COS Queues settings COS / Scheduling Method / Weight / Queue Depth / Drop Discipline CoS-0 DRR 10 1000 TAIL DROP CoS-1 DRR 10 1000 TAIL DROP CoS-2 DRR 10 1000 TAIL DROP CoS-3 DRR 10 1000 TAIL DROP CoS-4 DRR 10 1000 TAIL DROP CoS-5 DRR 10 1000 TAIL DROP CoS-6 DRR 100 1000 TAIL DROP CoS-7 Strict priority 10 1000 TAIL DROP Save	

2.3 L3 IP Routing

Similar to the L2 switching functionality, L3 IP Routing handles the different streams of information but routes them to their pre-configured IP address destinations according to the routing table and the correct interfaces.

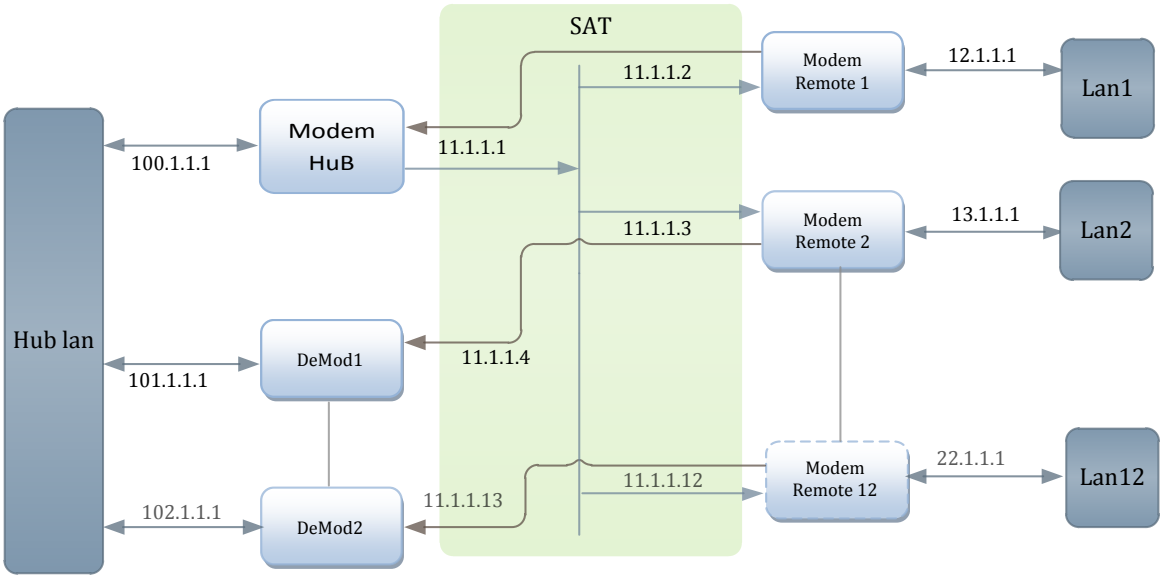
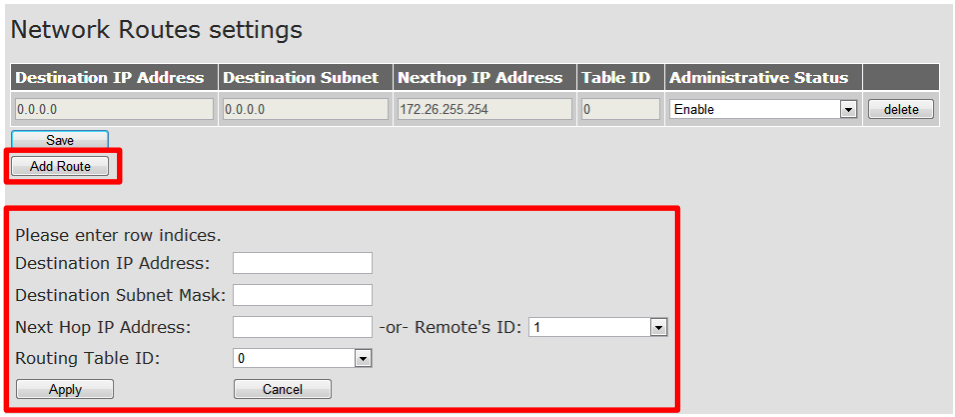


Figure 12 – IP Routing example of a system

2.3.1 Routing settings

In each device, a routing table for known IPs must be created in order to achieve a proper allocation of traffic.

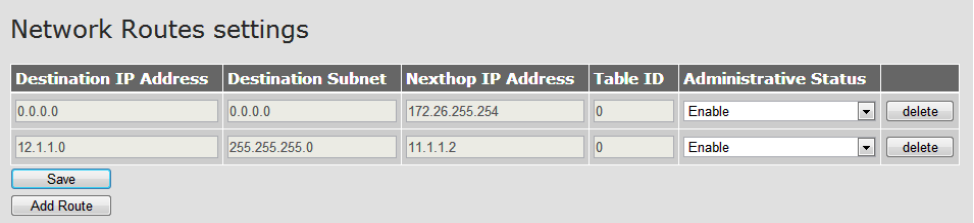
Opened field boxes, then press Apply, a new row will be created in the routing table for this route.



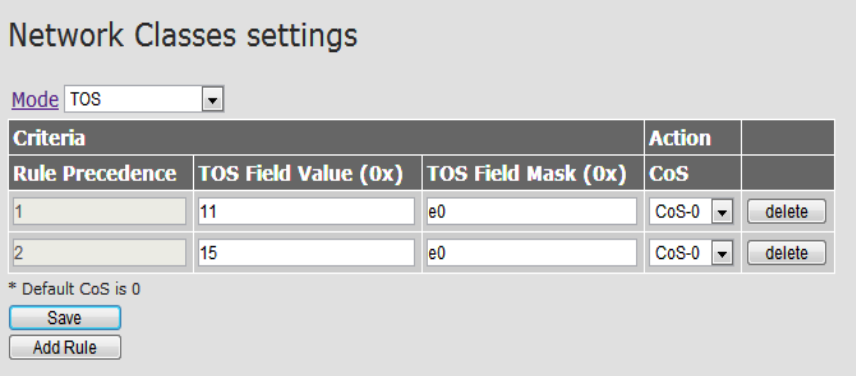
The first line, already Enabled, is for the Default gateway, if needed, this line can be deleted and changed according to the system's correct default gateway.

Routing example:

Routing Packet for 12.1.1.1 received at the hub modem:

Hub Modem
Network config->Routing->Routes  Make sure to Enable Administrative Status.

2.3.2 QoS settings for L3 IP Routing

Hub Modem	Remote Modem
Network config->QoS->Classification  To enter a new Rule, press the Add Rule button, enter a priority for the rule and press Apply. Afterwards the rule's TOS field value and Mask value will determine which packets will be affected by the rule by looking on the incoming 8 bit precedence in HEX and applying them to the corresponding CoS action with consideration of the Rule precedence. Press Enter after each entry of every field box.	

We can further configure the queues' behavior in case there are several data sources competing for the same line rate resource.

2.3.3 Queues setting

Now we have two different scheduling options ahead: Strict and DRR (Deficit Round Robin)

Strict – This scheduling option will always transmit its data at the expense of starving other queues. Usually used for real time data (e.g. voice).

DRR - This scheduling option can give different weighting factor to its data in order to prioritize data transmission without starving other queues.

We now wish to make sure CoS-7 data will be transmitted as it arrives, so that it receives strict priority. Then lower priority CoS0-5 will have round robin mechanism with equal priority, whereas, CoS-6 will have a higher priority than CoS0 through Cos5.

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Drop Discipline sets the policy on dropping data when queue is congested. Possible options are:

Tail Drop:

Will drop last incoming packets when queue is congested.

WRED – Weighted Random Early Drop:

Randomly will drop packets out of the queue when over a given threshold (set by the user) – not yet applicable.

Typically useful for TCP/IP sessions, to avoid synchronization of the TCP window.

Hub Modem	Remote Modem
Network config->QoS->Classification COS Queues settings COS / Scheduling Method / Weight / Queue Depth / Drop Discipline CoS-0 DRR 10 1000 TAIL DROP CoS-1 DRR 10 1000 TAIL DROP CoS-2 DRR 10 1000 TAIL DROP CoS-3 DRR 10 1000 TAIL DROP CoS-4 DRR 10 1000 TAIL DROP CoS-5 DRR 10 1000 TAIL DROP CoS-6 DRR 100 1000 TAIL DROP CoS-7 Strict priority 10 1000 TAIL DROP Save	

3 About NovelSat

NovelSat is a technology company dedicated to providing the next-generation modulation standard for satellite communications. NovelSat NS3™ technology – encompassing ultra-high end modulators, demodulators, modems and ASICs – essentially replaces DVB-S2 as the industry standard. NovelSat delivers the fastest data rates, the widest pipe and the most compelling ROI. That means you get the best performance at the lowest costs, resulting in the highest profits.

3.1 Contact Information

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