COMTECH
EF DATA ™

Vipersat
SLM-5650A

Satellite Network Modem Router
User Guide

Vipersat SLM-5650A
Satellite Network Modem Router

User Guide

COMTECH EF DATA

VIPERSAT Network Products Group
3215 Skyway Court
Fremont, CA 94539
USA

Phone: (510) 252-1462
Fax: (510) 252-1695
www.comtechefdata.com

Part Number MN-0000035
Manual Revision 5

Firmware Version 1.9.1

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

Comtech reserves the right to revise this publication at any time without obligation to provide notification of such revision. Comtech periodically revises and improves its products and, therefore, the information in this document is subject to change without prior notice. Comtech makes no warranty of any kind with regard to this material, including but not limited to the implied warranties of mechantability and fitness for a particular purpose. No responsibility for any errors or omissions that may pertain to the material herein is assumed. Comtech makes no commitment to update nor to keep current the information contained in this document.

Printed in the United States of America

Document Revision History

Revision	Date	Description
0	1/16/08	Preliminary Release 2.0.x
1	6/30/08	Update content to reflect NP v1.3.2
2	8/29/08	Update content to reflect NP v1.4.1
3	10/24/08	Update content to reflect NP v1.5.1
4	4/20/09	Update content to reflect NP v1.6.1
5	4/08/11	Update content to reflect NP v1.9.1 **New Features**: Satellite Roaming (SOTM); IGMP Multicast Routing; BPM Routing Mode; Multi-TDM Tunneling; STDMA Power Hunt.

{ This Page is Intentionally Blank }

Table of Contents

Chapter 1
General

Chapter 2
Quick Start Configuration

Chapter 3
Using the Web Server Interface (WSI)

Appendix A
Network Addressing

Appendix B
Automatic Switching

Appendix C
Dynamic Power Control

Appendix D
Glossary

Index

{ This Page is Intentionally Blank }

List of Figures

Appendix B Figures

Appendix C Figures

List of Tables

Chapter 2 Tables

Appendix B Tables

Appendix C Tables

{ *This Page is Intentionally Blank* }

1

GENERAL

How to Use This Manual

This manual documents the enhanced Vipersat features and functions of the SLM-5650A Satellite Network Modem Router, and guides the user in how to configure this product for use in a Vipersat network. The material covered addresses only those areas specific to an SLM-5650A running in Vipersat mode, and complements the universal features and functions described in the *SLM-5650A Installation and Operation Manual*.

Earth station engineers, technicians, and operators responsible for the configuration and maintenance of the SLM-5650A are the intended audience for this document.

Manual Organization

This User Guide is organized into the following sections:

Chapter 1 — **General**

Contains SLM-5650A product description, customer support information, and manual conventions and references.

Chapter 2 — **Quick Start Configuration**

Covers the initial basic steps that are necessary for configuring the SLM-5650A from a factory default state to a functional network element.

Chapter 3 — **Using the Web Server Interface (WSI)**

Describes the use of the Web Page for configuring and monitoring the SLM-5650A in a Vipersat network. Each HTTP screen is presented along with a detailed description and related commands.

Appendix A — **Network Addressing**

Supplemental reference information on binary math and network addressing to assist with integrating the SLM-5650A into a Vipersat network.

Appendix B — **Automatic Switching**

Supplemental reference information on the Vipersat feature that provides Load switching (response to network traffic load), and Entry Channel Mode switching functions.

Appendix C — **Dynamic Power Control**

A description of Vipersat's DPC and its relationship to a SLM-5650A configuration.

Appendix D **— Glossary**

A glossary of terms that pertain to Vipersat satellite network technology.

Conventions and References

The following conventions are utilized in this manual to assist the reader:

NOTE **Note:** Provides important information relevant to the accompanying text.

Tip: Provides complementary information that facilitates the associated actions or instructions.

Caution: Explanatory text that notifies the reader of possible consequences of an action.

Warning: Provides precautionary text that describes a potentially hazardous situation. Failure to take or avoid a specified action may result in damage to equipment.

The following documents are referenced in this manual, and provide supplementary information for the reader:

- *SLM-5650A Satellite Modem Installation and Operation Manual* (Part Number MN-SLM5650A)

- *Vipersat Management System User Guide* (Part Number MN/22156)

- *VLoad Utility User Guide* (Part Number MN/22117)

- *SLM-5650A Parameter Editor User Guide* (Part Number MN-0000041)

Product Description

Introduction

The Vipersat SLM-5650A Satellite Network Modem Router offers state of the art performance and reliability in a sophisticated and cost-effective 1RU package. The SLM-5650A integrates router functionality into the modem, completely eliminating external serial port cabling, and allowing connection of a four port 10/100/1000Base-T LAN switch directly to the modem.

Figure 1-1   SLM-5650A Modem Router Unit

The SLM-5650A integrated modem/router and communications controller operates as a Hub or Remote utilizing TDM/STDMA, SCPC, and IP circuit switched management, offering flexibility and control of private satellite networks. The SLM-5650A is designed to connect low- to high-speed data link connections between Ethernet LAN to WAN networks, providing a variety of communications services to Operators, Service Providers, and Enterprise Users. The benefit of this architecture yields seamless bandwidth management-on-demand, while simplifying network capacity needs.

Modem Features

- 52–88 MHz, 104–176 MHz IF Range or 950–2000 MHz L-Band Range

- BPSK, QPSK, OQPSK, 8-PSK, or 16-QAM Operation

- Data Rate Range from 64 kbps up to 155 Mbps, depending on modulation and FEC used {*with FAST feature upgrade*}

- Turbo Product Coding (TPC) FEC

- Fast Acquisition Demodulator

- Variable Bit Rate (to 1 bps)

- Plug-in Data interface supporting the optional Network Processor (NP) module

- Programmable TDM/STDMA or *d*SCPC (dynamic SCPC) Access Control

Router Features

- Fully Integrated Network Management using Vipersat Management System (VMS)

- Management Security {*FAST option*}

- Multi-Transponder Mode (MTM) Functions

- Dynamic Power Control (DPC) for Environment or Mesh Links

- Upstream Bandwidth Management for Load, Scheduled, and Manual Switching

- Dynamic SCPC (*d*SCPC) Bandwidth-On-Demand

- Satellite Roaming (SOTM)

- Antenna Handover {*FAST option*}

- Four Port 10/100/1000BaseT Ethernet LAN/WAN Interface

- Router and Bridged Point-to-Multipoint (BPM) Modes {*FAST option*}

- Per Route IP Filtering

- Multi-Protocol Support

- Software Version Management via WEB, FTP, or VLoad

Network and Bandwidth Management

The Vipersat network solution integrates this advanced modem/router with the powerful network management tool, the Vipersat Management System (VMS). The VMS provides for traditional monitor and control of the SLM-5650A modem, but more than just an M&C package, the VMS offers unique bandwidth management that is ideal for IP-switched networks. Short data transfers are typically executed using a shared Selective Time Division Multiple Access (STDMA) channel, and when large amounts of data transfer, voice, and/or video communications are needed, modems can be automatically switched to a dedicated SCPC channel.

Dynamic SCPC (*d*SCPC)

The VMS allows for dynamic point-to-point mesh connections to be established between remotes. Traffic inbounds from remotes can be switched: manually or automatically, load triggered, or scheduled, from shared STDMA (burst) mode to a dedicated SCPC connection. Once the session is completed, the remote is automatically switched back to shared mode.

While in SCPC mode, the VMS provides for dynamic bandwidth allocation, automatically altering the bandwidth based on traffic conditions. This effec-

tively enables the network to better handle connection oriented applications and reduce network congestion, jitter, and latency.

The result is an economical and flexible network with bandwidth shared and directed where it is needed for any mix of IP voice, video, and data traffic.

Turbo Product Coding

The Comtech Vipersat SLM-5650A incorporates a Turbo Product Codec (TPC). TPC is an FEC technique that delivers significant performance improvement when compared to Viterbi with concatenated Reed-Solomon. TPC simultaneously offers increased coding gain, lower decoding delay, and significant bandwidth savings.

New in this Revision

v1.7.1 Release

Dynamic Routing via OSPF

The Vipersat OSPF (Open Shortest Path First) feature in the Comtech SLM-5650A modem/router provides for dynamic routing functionality. Route changes from the Hub are broadcast to the Remotes via a dedicated WAN-to-WAN multicast address. Route changes from a Remote are unicast to the Hub. Static routes that are manually entered into the route table by the operator are separate from these dynamic routes and are not managed as part of the OSPF system.

DPC Calibration for Maximum Power

New controls relating to the calibration of the power control function—link *Margin* and maximum transmission parameters (*Maximum Data Rate*, *Maximum Modulation Type*, and *Maximum Coding Rate*)—can now be specified by the operator for site link budget calculation of the DPC *Maximum Power* value. These numbers are applied to compensate and limit modulator output power for a modem unit.

LAN Enhancements

Flow Control

Ethernet Flow Control can be implemented to manage limited network bandwidth and/or data rate send/receive disparities. The SLM-5650A NP interface

monitors the QoS queue depths and determines when to send the PAUSE frames (IEEE 802.3) for management of data flow traffic.

Proxy ARP

The Proxy ARP feature activates the SLM-5650A to perform as the proxy between the LAN and the satellite WAN and answer the ARP queries for a network address that is not on the given network.

VLAN

The Port VLAN feature allows one of the four available Ethernet ports on the SLM-5650A to be assigned for use by a specific VLAN, independent of the user or system that is attached to the port.

v1.8.1 Release

Acquisition Mode

The SLM-5650A modem/router now offers two modes of choice for the Hub Burst Controller to obtain acquisition of—detect and lock onto—the burst transmission from each Remote in the group: *Standard* and *Long*. Standard mode uses an uncoded preamble signature and results in a shorter preamble time. Long mode uses a combination of uncoded and coded portions of the signature that provides additional reliability, but results in a longer preamble time.

v1.9.1 Release

Satellite Roaming (SOTM)

The SLM-5650A modem/router now supports Satellite Roaming, allowing automatic network transitioning between multiple Hubs and/or satellites without operator intervention. The roaming feature requires the support of the Roaming Oceanic Satellite Server (ROSS) to help process commands and information onboard the vessel.

IGMP Multicast Routing

The SLM-5650A is capable of performing as an IGMP (Internet Group Management Protocol) multicast router to support IP network hosts that require management of their dynamic multicast group memberships on a given network.

Bridged Point-to-Multipoint (BPM) Routing Mode

Another option for Vipersat networks is the *BPM* routing mode that offers additional flexibility and scalability of the satellite network by providing a combination of routing and bridging functions. *Note that this option is only available if the NP BPM FAST feature has been installed on the modem/router*.

Multi-TDM Tunneling Mode

STDMA Power Hunt

Power Hunt is a transmission power control feature for the Remote modulator that functions while the Remote is in STDMA mode. This parameter provides compensation for instances when the initial (baseline) power value is insufficient or during periods of impaired transmission, and assists in maintaining return link integrity.

Customer Support

Contact Information

Contact Comtech Vipersat Network Products Customer Support for information or assistance with product support, service, or training on any Vipersat product.

Mail: Attn: CTAC
           Comtech EF Data – Vipersat Network Products
           3215 Skyway Court
           Fremont, CA 94539
           USA

Phone: 1+510-252-1462

Fax: 1+510-252-1695

Email: supportcvni@comtechefdata.com

Web: www.comtechefdata.com

Return Material Authorization

Any equipment returned to CEFD (in-warranty and out-of-warranty) must have a Return Material Authorization (RMA) issued prior to return. To return a Comtech Vipersat Networks Product for repair or replacement:

- Obtain an RMA form and number from either the CEFD Web Site, or via phone from a CTAC representative.
- Be prepared to supply the product model number and serial number of the unit.
- To ensure safe shipping of the product, pack the equipment in the original shipping carton/packaging.

Reader Comments / Corrections

If the reader would like to submit any comments or corrections regarding this manual and its contents, please forward them to a Vipersat Customer Support representative. All input is appreciated.

{ This Page is Intentionally Blank }

2

QUICK START CONFIGURATION

Introduction

This chapter describes the minimum configuration of an SLM-5650A Network Processor that is necessary in order for the equipment to function in a Vipersat network.

The CEFD SLM-5650A stores its configuration in an ASCII file named the **PARAM** file. Equipment configuration is typically performed through the use of the Web Server Interface (WSI) providing HyperText Transfer Protocol (HTTP), particularly the initial configuration. This configuration method is documented here. Alternatively, the Command Line Interface (CLI) can be used for configuration. Once the equipment is functioning in the network, additional configuration can be performed via the VMS.

Refer to Chapter 3, "Using the Web Server Interface (WSI)," for a more detailed description on the usage of this feature.

This manual covers the configuration specifics of the SLM-5650A when used in a Vipersat network. Refer to the *SLM-5650A Installation and Operation Manual* (Part Number MN-0000031) for general instruction on setting up, installing, and configuring this equipment.

NOTE | **Note:** Before attempting to configure an SLM-5650A to be used in a Vipersat network, make certain it has the Vipersat option installed and enabled.

Caution: Do not connect the TX cable until the modem is properly configured, and the Home State is verified and Saved.

Initial Configuration

NOTE	**Note:** Many of the settings required for equipment configuration are based on the LAN/WAN and Satellite network design, and should be obtained from the network administrator.

LAN Connection

For the purposes of this user guide, the configuration procedures are performed using the WSI from a workstation connected to the modem's Network Processor (NP) via a LAN connection to one of the five available Ethernet ports:

- When operating as Router, the LAN connection should be to one of the four traffic switched Ethernet ports (**1–4**) on the NP card.

- When operating as BPM, connect to the **J5** Ethernet port on the base modem.

A web browser (e.g., Internet Explorer ≥ 7.0, or Firefox ≥ 2.0) provides the application interface. Alternatively, other connection methods, as described in the *SLM-5650A Installation and Operation Manual*, may be used to perform the configuration.

Make a web connection by entering the target SLM-5650A NP IP address into the browser address field. The factory default IP address for a Vipersat-enabled unit is **192.168.1.177/24**. Once a web connection has been made, the SLM-5650A will respond with a Login prompt. The factory defaults are:

Login: **comtech**
Password: **comtech**

Following the operator login, the Network Processor web page splash screen is displayed, as shown in figure 2-1. Across the top of the page, the Main Menu bar is displayed.

Figure 2-1 NP Splash Screen

Network Role

The first and most important step prior to configuring the SLM-5650A is to define its network role.

The SLM-5650A is a flexible network component able to perform different functions depending on how it is used in a network. The role that is defined for each SLM-5650A will determine what functions are available for each unit to fill its role. Table 2-1 lists the network roles and the corresponding network functions for which the SLM-5650A can be configured.

Table 2-1 SLM-5650A Network Roles and Functions

Network Role / Function	Hub	Remote	Expansion
Hub Burst Controller providing STDMA Timing Maps	X		
Hub SCPC Modem	X		
Hub Switched Demodulator	X		X
Remote STDMA Modem		X	
Remote SCPC Modem		X	
Remote Mesh Demodulator (SHOD)		X	X

The procedure for setting the modem configuration to match the defined network role is presented later in this Quick Start ("Set the Vipersat Working Mode" on page 2-5).

Refer to the section "Vipersat Mode" on page 3-5 for additional details on the SLM-5650A's network role and setting the appropriate Vipersat Working Mode.

Setting Vipersat SLM-5650A Operating Parameters

The following procedure is an example of using the WSI to bring an SLM-5650A with factory default settings to the configuration which allows the Vipersat functions to be accessible.

Verify/Enter FAST Feature

1. From the **Admin** submenu, select **FAST Features**, as shown in figure 2-2.

2. Verify whether or not the Vipersat FAST Feature is **Installed** (as shown). The feature codes are entered per customer order prior to shipment from the factory; however, if the feature displays as Not Installed, an updated FAST code will have to be re-entered to enable the Vipersat features.
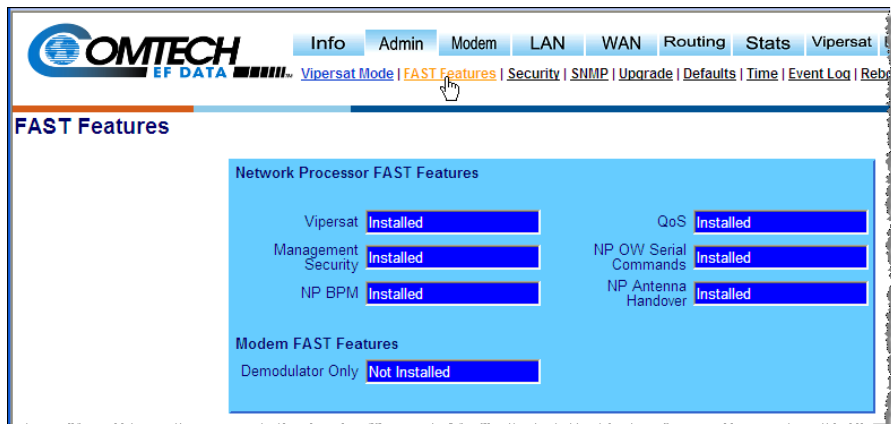
Figure 2-2 FAST Features Page

The FAST Feature codes are entered using the front panel of the modem (figure 2-3). With the keypad, select

Utility -> FAST -> Configuration -> Enter NP Code.

Enter the provided 20 digit code.

Figure 2-3 Front Panel, SLM-5650A Modem

Tip: The network administrator will have the FAST Feature codes. These are generated and stored by the unit serial number for the target SLM-5650A. The target unit's serial number can be found on the rear of the unit chassis, or on the FAST code menu.

Caution: Upgrading the FAST features will cause a modem reboot and reconfiguration of all modem parameters.

Set the Vipersat Working Mode

The operating parameters that will be configured in the SLM-5650A are, in part, determined by the role the modem is to fill in the network, as shown in table 2-1 and table 2-2.

Use the following procedure to configure an SLM-5650A to the network role it is to fill in a Vipersat network.

1. Return to the **Admin** submenu and select **Vipersat Mode** (figure 2-4).

2. Select the designated Mode by clicking on the corresponding radio button, then click on the **Submit** button.

    This will set the modem functionality to reflect the selection.

    Expansion Unit
    When configured as an *expansion unit*, either as a Hub (switched) or as a Remote (mesh), the SLM-5650A is set up so that the demod is in SCPC mode and available as a resource for dedicated communications with the other end of the satellite link.

Figure 2-4   Vipersat Working Mode Page

Once the Vipersat Mode has been set, the Vipersat submenu will be made available for configuring and setting the **Vipersat** features according to table 2-2, below.

Table 2-2   Vipersat Feature Configuration

Unit Mode	STDMA	Auto Switching
Vipersat Hub	Available	Enabled
Vipersat Hub Expansion	Not Available	Disabled
Vipersat Remote	Available	Enabled
Vipersat Remote Expansion (SHOD)	Not Available	Disabled

Routing Mode

The Routing Mode defaults to **Router**, which is the most typical mode for

Vipersat networks. For networks that call for **BPM**, see the section "Routing Mode" on page 3-6.

3. Save the settings to flash by selecting **Save** from the Main Menu bar.

Set the IP Addressing

1. From the **LAN** submenu, select **Interface** to open the LAN Interface page (figure 2-5).

    The **MAC Address** is displayed as a *read-only* field.

Figure 2-5 LAN Interface Page

2. Select **Single** or **Dual** IP Addressing Mode (default=Single).

Choosing *Single* mode sets the modem to accept all traffic—data, VMS, and management—that utilizes the Traffic IP Address of the Network Processor card for this modem. The Management IP Address is ignored.

Selecting *Dual* mode requires that data and VMS traffic be directed to the Traffic Address, while CLI, WSI, and SNMP communications must utilize the Management Address of the NP card. This provides additional security for remote connections.

Note that Dual mode is also utilized when operating in a redundant configuration; both the online modem and the offline modem must be set for Dual IP Addressing. For more information on using the SLM-5650A in redundancy configurations, refer to the pertinent redundancy switch *Installation and Operation Manual*.

Caution: When setting Dual mode, note the address change as the setting will drop communications to the management interface after submittal.

3. Enter the designated **Traffic IP Address** and **Subnet Mask** for this unit.

4. If *Dual Mode* is being used, enter the designated **Management IP Address** and **Subnet Mask** for this unit.

5. Click on the **Submit** button

6. Save the settings to flash by selecting **Save** from the Main Menu bar.

Configure the Route Table

Routing in a Vipersat Network

SLM-5650A Modem Routers operating in Vipersat mode do not use the HDLC Addressing as described in the *SLM-5650A Installation and Operation Manual*.

Because satellite networks are often used as extensions for access to services such as the Internet or the PSTN, they lend themselves quite readily to private addressing. For example, to provide Internet access to the satellite network, only the Hub requires a public IP address in order for the entire satellite network that is controlled by the Hub to have access to the Internet backbone. Utilizing Network Address Translation (NAT), the administrator can effectively address the network using a minimum number of static route statements.

Example:

The IP address 172.16.0.0 is the private address network number for class B networks. If there is a router at the Hub with a connection to the Internet, the operator can define the local network as a class B. If the operator splits the Class B in half and points the upper half toward the satellite, there will be over 16000 usable addresses at the Hub as well as at the Remotes. For details on IP addressing, refer to Appendix A, "Network Addressing".

By putting the one route statement "Remotes 172.16.128.0/17 WAN to LAN" in the TDM Hub modem, and by using the route statement "GW 0.0.0.0/0 WAN to LAN" at each of the remote modems, the network will successfully route packets. The remotes can then be subnetted as class C networks or below. Additional routers at the remotes can be added for unusually large sites, allowing an additional layer of NAT without requiring any more explicit routing within the Vipersat Modem/Routers.

Refer to the *SLM-5650A Modem Installation and Operation Manual* for additional information on entering routes.

Creating the Static Routes

The following procedure outlines the basic route structure that the target SLM-5650A will require for its role in the network. One of the key routes that must be created is a gateway address for routing the data traffic that is received by the unit.

1. In the Main Menu bar, select **Routes** from the **Routing** submenu (figure 2-6).

In a *Hub* configuration, the default route will typically point to a router on the same LAN as the SLM-5650A Hub unit. In the above figure, that router is specified as the Next Hop IP 10.1.0.1.

In a *Remote* configuration, the default route will typically point to the satellite modem (toWAN) used for communications back to the Hub.

2. From the **Add New Route** frame shown in figure 2-6, enter the first route that will define the default gateway.

    The system administrator can supply the information for each field, if necessary.

    In a Hub role, for example, enter the name of the route (e.g., **DFG**), enter **0.0.0.0** for the destination IP address and **0** for the mask, from the pull down dialog toLAN/toWAN select **toLAN** for Ethernet interface, then enter the **IP address** of the appropriate router or modem for the next hop.

If this Hub unit is providing the TDM outbound, a route statement or statements defining satellite communications with the Remote units must be entered as well, as illustrated in the figure. One recommended option is to enter a single super-route that will handle satellite communications with all of the remote subnets.

Figure 2-6 Routes Table Page (Hub)

3. Click the **Add Entry** button.

4. Continue to add entries until all desired routes are entered.

5. Save the settings to flash by selecting **Save** from the Main Menu bar.

Dynamic Routing with OSPF

For networks that will utilize the Vipersat OSPF (Open Shortest Path First) feature for dynamic routing, including SOTM roaming applications, additional routing configuration is required. See the section "Dynamic Routing" on page 3-40.

Multicast Routing with IGMP

For networks that will utilize the Vipersat IGMP (Internet Group Management Protocol) feature for multicast routing, additional routing configuration is required. See the section "Multicast Routing" on page 3-44.

Set the Satellite Modem Configuration

1. Select **Config** from the **Modem** submenu to access the Modem Configuration page (figure 2-7).

2. Set the **Transmit** parameters for Frequency, Data Rate, FEC, Code Rate, and Modulation as specified by the network administrator.

Figure 2-7   Transmit Configuration Frame (Hub)

NOTE

Note: Only **Turbo** Product Coding is acceptable for FEC when the SLM-5650A is running in Vipersat mode.

3. After all Tx parameters are entered, click the **Transmit Submit** button.

4. Similarly, set the **Receive** parameters for Frequency, Data Rate, FEC, Code Rate, and Demodulation as specified by the network administrator (figure 2-8).

Figure 2-8   Receive Configuration Frame (Hub)

5. After all Rx parameters are entered, click the **Receive Submit** button.

6. Save the settings to flash by selecting **Save** from the Main Menu bar.

Set the Vipersat Configuration

1. From the **Vipersat** submenu, select **Vipersat** to open the Vipersat Configuration page.

    The example shown in figure 2-9 depicts the page appearance for a *Hub* unit.

Figure 2-9 Vipersat Configuration Page (Hub)

The unit **Role** appearance reflects the Working Mode parameter setting (see "Set the Vipersat Working Mode" on page 2-5) and identifies the role of the target SLM-5650A.

2. Enter a descriptor for the **Node Name.**

    This a unit indentifier for operator management that is propagated though the network up to the VMS. The Node Name will appear together with the modem icon for each unit in the ViperView client.

3. Set the **Network ID**.

    The Network ID that is assigned to the unit defines to what network the target SLM-5650A will belong. All units used in a common network will have the same Network ID. This parameter is used by the VMS to identify

units common to a network and allows the VMS to manage multiple networks, each with its own unique network ID number.

4. Set the **Receive Multicast Address**.

    This IP address is the multicast address assigned to all Vipersat modem units in the network that are managed by the VMS server. The Receive Multicast Address of this SLM-5650A must match the corresponding Transmit Multicast Address that has been assigned to the VMS in order for the modem units to receive the maintenance and control packets that are multicast by the VMS.

5. Set the **Managing IP Address**.

    The Managing IP Address is the IP address of the active VMS server. This address is set automatically when receiving broadcast messages from the Hub.

6. **Hub Redundancy (Optional)**

    This field appears for Hub units only.

    The Hub Redundancy option provides backup of primary modems (e.g., TDM/Burst Controller). When enabled, this setting sends a message (HeartBeat) to the managing VMS on intervals of 2.5 seconds.

7. **Management Security (Optional)**

    The Management Security option works in conjunction with the Hub VMS, providing encryption on all messages passed between modem to modem and active VMS. The keys are set manually on both the VMS and the modem, and are entered either as a 64 character ASCII hex string or a passphrase.

NOTE

Note: VMS version 3.7.1 or greater is required for Management Security.

CAUTION

Caution: During the process of network-wide key distribution and enabling of encryption, communications may be lost as the STDMA control messages will be unreadable until all modems in the network are configured.

It is recommended that each of the Remote units be configured for Management Security first, and then the Hub units be configured. This method will reduce the need for on-site personnel during feature implementation.

Set the Home State

1. From the **Vipersat** submenu, select **Home State** to open the Home State Configuration page (figure 2-10).

2. Click the **Set Current Config As Home** command button in the lower portion of the page to set the current configuration as the Home State. This pulls the current Tx and Rx settings of the base modem and displays them here.

Figure 2-10   Home State Configuration Page

3. If any parameters require modifications, change the values then click the **Force Modem to Home State** command button. This will push the home state parameters that are displayed to the base modem.

4. Save the settings to flash by selecting **Save** from the Main Menu bar.

This completes the initial configuration of an SLM-5650A modem/router from the factory default settings to a functioning, Vipersat-enabled unit. Additional configuration parameters remain to be set depending on the network requirements for the specific customer application.

Proceed to Chapter 3, "Using the Web Server Interface (WSI)," for additional details on configuring the target Vipersat SLM-5650A.

3

USING THE WEB SERVER INTERFACE (WSI)

General

This chapter describes the use of the WSI for configuring and monitoring the SLM-5650A Modem Router in a Vipersat network. Each web page related to an SLM-5650A operating in Vipersat mode is presented, along with a detailed description of the available commands. For descriptions of all other screens, refer to the *SLM-5650A Installation and Operation Manual*.

Web (HTTP) access to the SLM-5650A is provided through the NP (Network Processor) card Ethernet traffic switch, and requires login with password. The physical LAN connection is made to one of the following RJ-45 interfaces:

- When operating with Router Mode set to **Router**, one of the four Ethernet ports, **1**–**4**, on the NP card should be used.

- When operating with Router Mode set to **BPM** (Bridge Point-to-Multipoint), network management can only be performed using the **J5** Ethernet port on the base modem.

The pages presented in this document are as they appear when the SLM-5650A is accessed using the Microsoft Internet Explorer web browser.

A Web connection is made by entering the target SLM-5650A NP IP address into the browser address field. The factory default IP address for a Vipersat-enabled unit is **192.168.1.177/24**. The SLM-5650A responds with a Login prompt. The factory defaults are:

Login: **comtech**
Password: **comtech**

Once the operator has logged in, the **Network Processor** splashscreen is displayed as shown in figure 3-1.

The WSI is an easy to use interface for configuring and monitoring all aspects of the SLM-5650A. By rolling the cursor over the Main Menu bar at the top of the page, the user can navigate to the desired page by selecting from the nested submenu links that appear.

Figure 3-1   Network Processor Splashscreen

Menu Descriptions

This section details the WSI menu pages, and briefly discusses the function of each of the parameters available on each menu page.

Main Menu Bar

The WSI **Main Menu Bar**, shown in figure 3-2, allows configuring both the modem and router functions of the target SLM-5650A Network Processor.

NOTE

Note: The **Vipersat** menu item will only be displayed if the target SLM-5650A has had the Vipersat option installed as described in the section "FAST Features" on page 3-7.
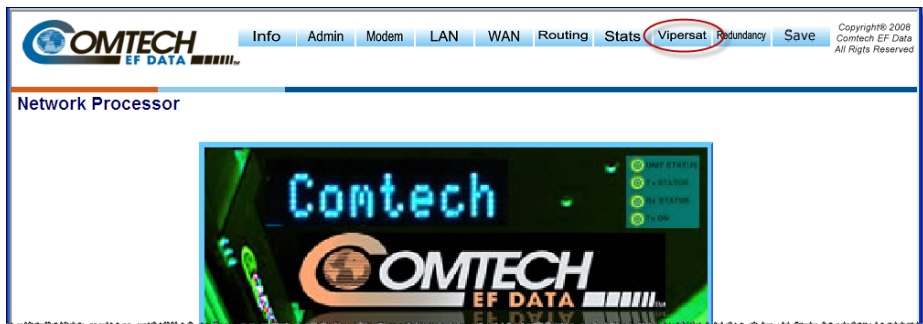
Figure 3-2 Main Menu Bar

A Vipersat SLM-5650A is normally shipped from the factory with the Vipersat FAST feature option already installed. This can be verified by checking that **Vipersat** appears in the Main Menu bar, as shown in Figure 3-2. Alternatively, this can be checked via the modem front panel under Utility: FAST ->View Options.

Each Main Menu item contains a nested submenu that will appear by performing a mouseover on that menu item. Clicking on a submenu item will open the associated page.

Common Menu Commands

The following common menu commands are executed as described below.

Save Parameters to Permanent Storage

To **Save** the current configuration to permanent Flash storage, select **Save** from the Main Menu bar, as shown in figure 3-3. Click on the **Save Now** button to initiate the save process, then click **OK** to confirm and complete the process. This command saves all data that has been entered from any of the web pages since the last save operation occurred.
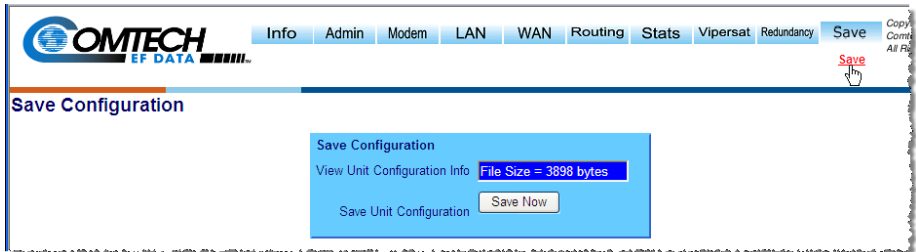
Figure 3-3 Save Configuration Command

Exiting a page after parameters have been changed without saving does not mean that the changes are not applied. However, if these changes are not saved prior to a system reset or power cycle, they will be lost.

Log Off

To terminate the WSI session and disconnect from the NP, select the **Logoff** command from the Info submenu, as shown in figure 3-4. Confirm the Log off request by clicking on the **Yes, log off now** button.
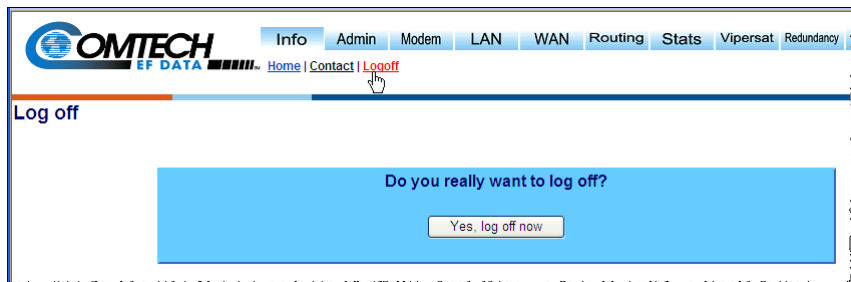
Figure 3-4 NP Logoff Command

Information

The specific firmware image versions and system up time for the Network Processor can be viewed by performing a mouseover on **Info** in the Main Menu bar and selecting **Home** from the submenu, as shown in figure 3-5. This information is useful, for example, when planning or performing upgrade operations for a unit.
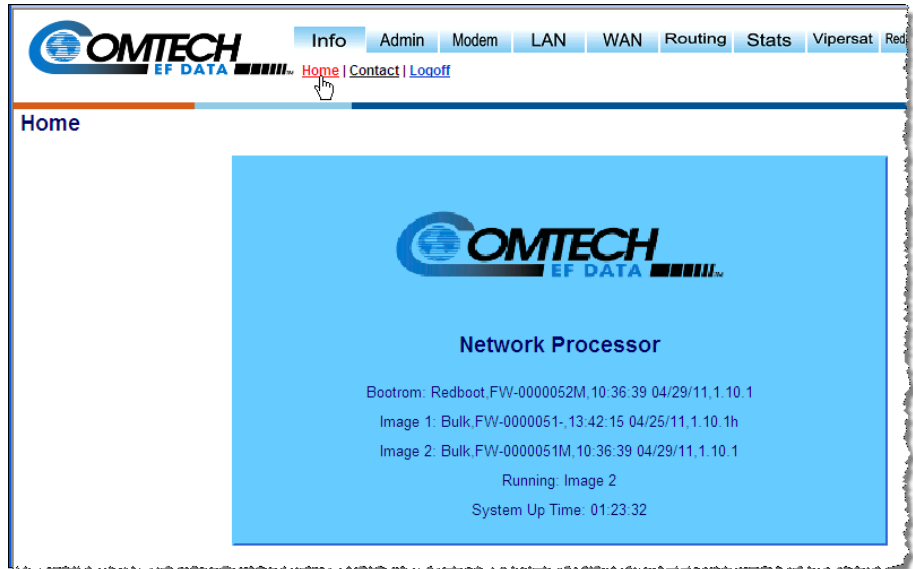
Figure 3-5 Home Page

Administration

The **Admin** Menu provides access to the major Administration features and commands (figure 3-6) for the SLM-5650A. The specific submenu items that are described here for a Vipersat network are *Vipersat Mode* and *FAST Features*.

Vipersat Mode

Select **Vipersat Mode** from the Admin submenu, as shown in figure 3-6. This setting determines whether the target SLM-5650A is to function as a *Vipersat Remote* or as a *Vipersat Hub* (and whether or not it is an *Expansion* unit) in the Vipersat satellite network. The Non-Vipersat Mode choices are not applicable when configuring a modem for deployment in a Vipersat network.

The choice that is made here will determine the role that this SLM-5650A will perform in the network, and what type of commands and functions it will receive from the VMS. Refer to table 2-1 for a breakdown of network roles and related functions and features.

NOTE

Note: If Vipersat Mode does not appear in the menu, the Vipersat FAST Code has not yet been installed in this unit. The FAST Code for the Vipersat option must first be re-entered as described in the next section.

Selecting the modem to be an Expansion device, either as a Hub (switched) or as a Remote (mesh), sets the demod of the SLM-5650A to operate in *d*SCPC mode, available as a resource for dedicated communications with the other end of a satellite link.
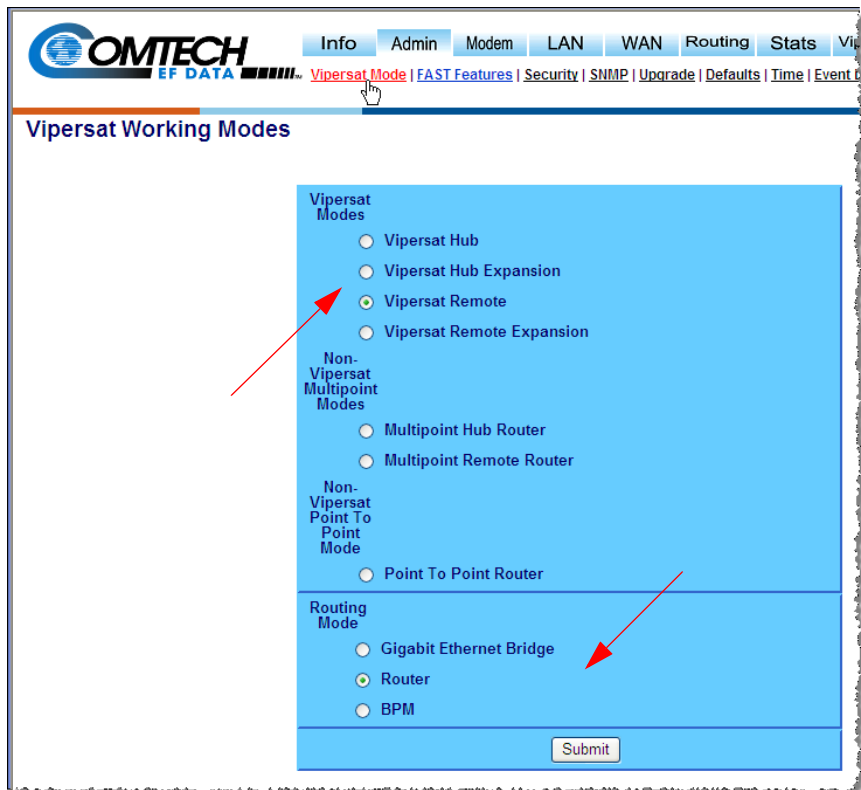
Figure 3-6 Working Mode Page

Routing Mode

The Routing Mode defaults to *Router*. Another option for Vipersat networks is the *BPM* routing (brouter) mode that offers additional flexibility and scalability

of the satellite network by providing a combination of routing and bridging functions. *Note that this option is only available if the NP BPM FAST feature has been installed on the modem/router.*

When BPM (Bridged Point-to-Multipoint) is selected as the routing mode, the function of the five Ethernet ports changes: NP module ports 1 through 4 change from routed Layer 3 traffic and management use to bridged Layer 2 traffic; base modem port J5 changes from remote control connector to routed Layer 3 traffic and management use.

Caution: When using a remote connection to change the Routing Mode from *Router* to *BPM*, ensure that the Ethernet connection that is being utilized is cabled to port **J5**. If the connection is utilizing one of the four ports on the NP module, connectivity with the modem will be lost as soon as the change is submitted.

Additional information about the BPM feature can be found in the *SLM-5650A Installation and Operation Manual*.

Ensure that the **Vipersat Working Mode** is set as specified for this unit. If it is not, change the setting by selecting the appropriate radio button(s) and clicking the **Submit** button. The modem unit will automatically be set up for the appropriate configuration parameters based on this setting, thus simplifying deployment.

FAST Features

From the Admin submenu, select **FAST Features** to display the FAST Feature page shown in figure 3-7.

This read-only page displays the status for both the Network Processor and the Modem FAST Features—*Installed* or *Not Installed*.
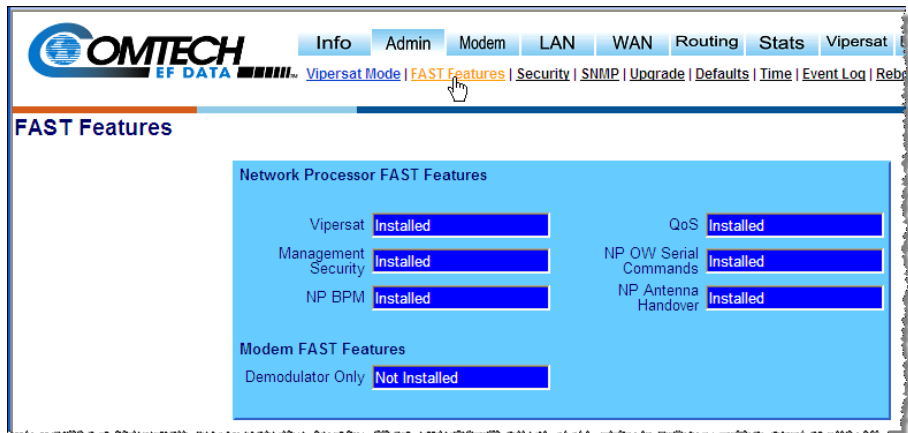
Figure 3-7 FAST Features Page

Verify whether or not the Vipersat FAST Feature is **Installed** (as shown). The codes are entered per customer order prior to shipment from the factory; however, if the feature displays as Not Installed, an updated FAST code will have to be re-entered to enable the Vipersat features.

The FAST Feature codes are entered using the front panel of the modem (figure 3-8). With the keypad, select

   Utility: FAST -> Configuration -> Enter NP Code.

Enter the 20 digit code that is provided by either the network administrator or Comtech Vipersat Networks Customer Support**.**

Figure 3-8 Front Panel, SLM-5650A Modem

Tip: The FAST Feature codes are generated and stored by the unit serial number for the target SLM-5650A. The target unit's serial number can be found on the rear of the unit chassis, or on the FAST code menu.

Caution: Upgraging the FAST features will cause a modem reboot and reconfiguration of all modem parameters.

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

Vipersat Configuration

Mouseover **Vipersat** in the Main Menu Bar, as shown in figure 3-9, to display the submenu used for configuring the Vipersat features and functions for the SLM-5650A.

The following sections describe each submenu in detail.

Vipersat

Selecting the first item in the submenu opens the **Vipersat** configuration page. The display will vary depending upon whether the Working Mode is defined as a *Hub* unit or a *Remote* unit. The example shown in figure 3-9 portrays a Vipersat Hub.

Figure 3-9 Vipersat Configuration Page (Hub)

An example of a Vipersat Remote is shown in figure 3-10. Much of the parameters that are displayed for a Hub unit are also common for a Remote. However, the Hub display includes the *Hub Redundancy* feature whereas the Remote display includes the *SOTM* feature. These parameters are described below.

Figure 3-10   Figure 3-10 Vipersat Configuration Page (Remote)

Vipersat Role

The **Role** field is display only, reflecting the *Vipersat Working Mode* setting that was configured earlier under Administration. The chosen mode is also identified by the Vipersat label that is displayed in the upper left portion of the page— "Vipersat Hub" in this example.

Node Name

The **Node Name** entry is used to assign a designator to the SLM-5650A that will identify this unit within the network. Any combination of up to 22 characters can be entered.

This name is displayed within the VMS ViperView, the graphical network management interface for Vipersat networks.

Network ID

The **Network ID** that is assigned to the unit defines to what network the target SLM-5650A will belong. All units used in a common network will have the same Network ID. Enter a value between the range of 0–255.

The Network ID is used by the VMS to identify units that are common to a network and allows the VMS to manage multiple networks, each with its own unique Network ID number.

Receive Multicast Address

The **Receive Multicast Address** is the multitcast IP address assigned to all SLM-5650A units in the Vipersat network that are managed by the VMS server. This address must match the VMS Transmit Multicast Address.

When the SLM-5650A receives a multicast from the VMS server, it receives maintenance and control packets, including the server's IP address. The SLM-5650A responds to the VMS server with a unicast containing its current configuration data, including the SLM-5650A's IP address. When the VMS receives the unicast response, it registers the SLM-5650A on the network.

Enter the Receive Multicast Address as assigned by the network operator/administrator.

Managing IP Address

The **Managing IP Address** parameter corresponds to the IP address of the server running the VMS.

This address is sent out with the VMS multicast to all of the Vipersat units and will be automatically updated during the registration process. The SLM-5650A sends a unicast registration request to the managing address every 60 seconds when requesting initial registration on the VMS network. Later, the SLM-5650A uses this address to send switch requests, network health status messages, etc. to the managing VMS server.

NOTE

Note: The managing address will be set automatically if the Receive Multicast Address is configured correctly and the modem is receiving the announcement multicast message. However, the modem WILL NOT send its registration request message until this address is set.

This managing address is automatically updated on a periodic basis for modems that are newly enabled, incorrectly set, or following VMS changeovers (redundancy switching).

Heart Beat

This menu item appears for the Hub modem only.

The **Heart Beat** feature is a redundancy heart beat message for primary Hub units that provides the option for a periodic communications check message to be sent from the Hub modem to the VMS for backup recovery in N:M redun-

dancy (protected) configurations. The message interval is set by the managing VMS which uploads it to the modem.

Activate this feature by selecting the **Enabled** radio button.

Management Security

Management Security is an optional Vipersat feature that provides encryption on all VMS management messages passed between the VMS and the network modems. When enabled, the VMS and all of the network modems must utilize a common Encryption Key that is manually set on each. The key can be entered either as an ASCII hex string of exactly 64 characters, or as a passphrase consisting of up to 63 characters.

For modems that operate with Management Security, *Enable* this feature and enter the Encryption Key that has been defined for the network.

NOTE

Note: VMS version 3.7.1 or greater is required for Management Security.

CAUTION

Caution: During the process of network-wide key distribution and enabling of encryption, communications may be lost as the STDMA control messages will be unreadable until all modems in the network are configured.

It is recommended that each of the Remote units be configured for Management Security first, and then the Hub units be configured. This method will reduce the need for on-site personnel during feature implementation.

SOTM

This feature appears for Remote units only.

For Remotes that are not utilized in an SOTM (Satcom-On-The-Move) network, this feature will be displayed at the bottom of the page as Disabled, as shown in figure 3-10 above. When a Remote has been enabled for SOTM via a ROSS unit, the feature can be disabled from the WSI Vipersat page by clicking on the **Disable SOTM** button (figure 3-11). Note that the disable command will not be executed until a Save operation is performed and the unit is rebooted.
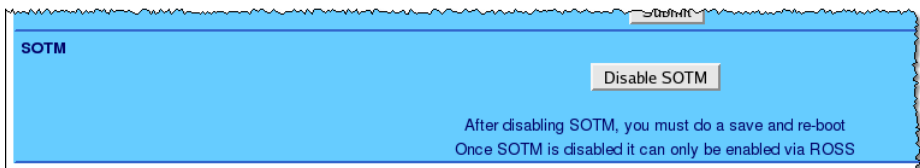
Figure 3-11 Disable SOTM for Remote

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

STDMA Mode

The STDMA parameters for this SLM-5650A are accessed by selecting **STDMA** from the Vipersat submenu.

The fields in the STDMA configuration page will vary depending on the function the target SLM-5650A performs in the network. The page shown in figure 3-12 is from an SLM-5650A serving as a *Hub* in the network.

Figure 3-12 STDMA Page (Hub, Dynamic Cycle mode)

For comparison, the STDMA menu for an SLM-5650A operating as a *Remote* unit is shown in figure 3-13. Note that the configuration items for the Remote screen are a small subset of those for a Hub.

Figure 3-13   STDMA Page (Remote)

Allocation Method

This parameter field is only displayed if the SLM-5650A is being used as a Hub in the network, and provides the functionality for the STDMA Burst Controller. Vipersat STDMA has five modes of operation:

- **Fixed** — all Remotes get the same data slot time (slot size) in the cycle, regardless of activity. Cycle time is fixed also.

- **Dynamic Slot** — data slot time of Remotes vary according to activity, cycle time does not.

- **Dynamic Cycle** — slot time and cycle time vary according to activity of Remotes.

- **GIR** (Guaranteed Information Rate) — each Remote always has at least the minimum data slot size when needed, and cycle time is variable up to a maximum of one second.

- **Entry Channel** — Remotes run in SCPC mode, but STDMA is used for maintenance and control channel.

The Hub can be configured to operate in one of the five modes by selecting the Allocation Method from the pull-down menu, as shown in figure 3-14.
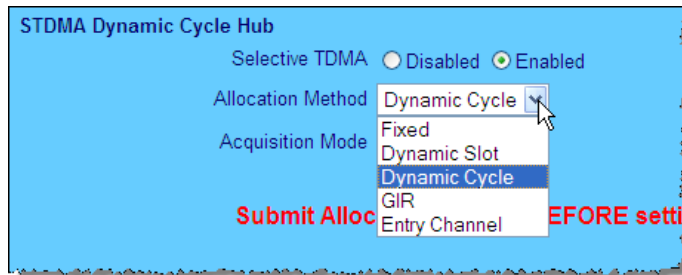
Figure 3-14 Hub Type Allocation Menu

This selection determines whether available bandwidth will be a static (fixed) assignment, or whether bandwidth allocation will be dynamic with automatic switching to dynamically optimize bandwidth utilization.

1 – Fixed

In the **Fixed** mode, all Remotes have the same data slot size regardless of type of traffic or load. This mode minimizes the amount of jitter between Remote transmission times, and is useful for tuning STDMA as well as for troubleshooting purposes.

2 – Dynamic Slot

In the **Dynamic Slot** mode, slot size is adjusted each cycle depending on the activity during the previous cycle. The slot size for each Remote is computed based on the time (at the current data rate) needed to transmit all the bytes in queue. If the result is less than the minimum slot size or more than the maximum slot size, the slot is adjusted accordingly. This mode allows the burst controller to provide additional slot time in the cycle to Remotes with higher traffic demands, increasing throughput and alleviating congestion.

3 – Dynamic Cycle

In the **Dynamic Cycle** mode, available bandwidth is allocated to Remotes proportionally based on their current bandwidth needs. The bandwidth requirements are determined by the number of bytes in queue for each Remote divided by the total number of bytes in queue for all Remotes, and results in the percentage of bandwidth to be allocated for each Remote. This mode provides improved efficiency of STDMA due to faster cycle times during periods of light traffic demands, thus providing minimum latency for the current load.

4 – GIR

In the **GIR** mode, the initial computed slot size value is the same as in the Dynamic Cycle mode except there is no maximum limit. After all Remotes have

been assigned slots, the burst map is checked to see if the total cycle length exceeds one second. If not, then all requirements are satisfied and the burst map is complete. However, if the cycle is greater than one second, then the slots are adjusted proportionally so that all Remotes receive at least their guaranteed rate plus whatever excess is still available.

GIR mode allows guaranteed information rates to be set for each Remote in the group. When the one second restriction is exceeded, Remotes without a specified GIR are reduced to the global minimum slot size and the remaining bandwidth is distributed to Remotes that have been assigned a GIR rate, thus ensuring additional bandwidth to these units when needed.

NOTE **Note:** GIR allocations are restricted so that assigned GIR totals cannot exceed the available bandwidth. This ensures proper bandwidth allocation when the network is overloaded.

The GIR setting for each Remote is specified using the STDMA Remote Policies screen (refer to the section "ECM Remotes" on page 3-25). When combined with Auto switching, GIR allows trigger points to be set where the Remote will jump out into SCPC mode. This is done using the Load Switch setting. Note that, for this function, Load switching must be *Enabled* on this Hub unit, and corresponding Remote modems must be configured with Load switching *Enabled* as well. Also, the settings for Step Up and Step Down Threshold values should be adjusted as necessary for the application.

5 – Entry Channel

The **Entry Channel** mode provides Remotes in the group with a shared channel in which they can gain initial access to the network. Since very small STDMA data rates are required in this configuration, a larger number of Remotes can share the cycle. As soon as the Hub receives an STDMA ACK from the Remote, it initiates an immediate switch to SCPC mode based on the policy set for that Remote. Note that the switch occurs as soon as the Hub receives an ACK even though there may not be traffic at that time. The persistence of the link will be determined by the unit's flag settings.

When choosing Entry Channel as the Hub type for the STDMA Controller, the Load switching feature must be *Enabled* on this Hub unit, and switching policies for the Remotes must be configured (refer to the section "ECM Remotes" on page 3-25). Corresponding Remote modems must be configured with Load switching *Enabled*. Note that the settings for Step Up and Step Down Threshold values should be adjusted as necessary for the application.

This mode is designed to accommodate the needs of a Remote that will not be continuously connected to the network, but which has the need to be able to make an on-demand connection when required, such as in a mobile application. In the event of a power outage, Entry Channel provides a bandwidth-efficient

method for remotes with low latency requirements to re-enter the network once power is restored.

Refer to Appendix B "Automatic Switching" for additional information on how each of the bandwidth allocation modes functions and the parameters used to calculate the commands for each mode.

Acquisition Mode

The SLM-5650A modem/router offers two modes of choice for the Hub BC to obtain acquisition of—detect and lock onto—the burst transmission from each Remote in the group: *Standard* and *Long*.
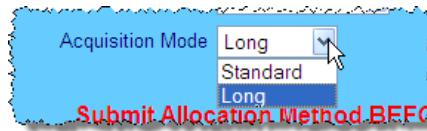
Figure 3-15 Hub STDMA Acquisition Mode

Standard mode uses an uncoded preamble signature and results in a shorter Preamble Time:

Data Rate = 64 to 447 kbps   Preamble = 30 ms
Data Rate $\geq$ 448 kbps   Preamble = 20 ms

Long mode uses a combination of uncoded and coded portions of the signature that provides additional reliability, but results in a longer Preamble Time, as is illustrated with the following two examples:

Data Rate = 256 kbps   Preamble = 26 + 79 = 105 ms
Data Rate = 3 Mbps   Preamble = 2 + 38 = 40 ms

Note that, as a consequence of a longer preamble, the time period available for data transmission is lessened. However, this trade-off is acceptable in those applications where the priority is given to increased reliability.

Standard mode is appropriate, for instance, when Entry Channel is used as the allocation method. Long mode is appropriate for a Hub controller whose Remotes are allocated larger slot sizes, and thus would suffer greater data loss per burst cycle with acquisition failure.

Group ID

The STDMA **Group ID** number defines a group of equipment (both Hub and Remote units) that will respond to the output of a single STDMA burst controller. This group is addressable within a network which, in turn, is defined by the Network ID number assigned to the SLM-5650A.

Allocation of bandwidth is shared among the Remotes in an STDMA group. Depending on the number of Remotes in a network, a Hub may have multiple burst controllers, each with its own set of Remotes. This is accomplished by assigning a unique Group ID number to each controller and its associated Remotes.

NOTE **Note:** The STDMA Group ID number and the Network ID number are independent. There can be multiple STDMA groups within a single network.

To set the Group ID for an SLM-5650A, enter the specified number for the associated group; range is 1–255 (figure 3-16). Click the **Submit** button.

Figure 3-16   Group ID field

Cycles Per Burst Map

This parameter, which appears for all Hub types *except Dynamic Cycle and GIR*, displays the number of spin cycles that will occur prior to each broadcast of the Burst Map by the burst controller to the Remotes. One cycle is the amount of time it takes for all Remotes in a group to burst on the common channel. The burst map provides each Remote with its allocated bandwidth and position in the cycle.

For Dynamic Cycle and GIR configurations, the number of cycles is *automatically set to one* in order to ensure optimum performance for these Hub types.

To modify this parameter from the Hub SLM-5650A, enter a value from 2–20 in the **Cycles Per Burst Map** field, then click the **Submit** button as shown in figure 3-17.

Figure 3-17   Cycles Per Burst Map field

Preamble Time

This parameter, which appears in all Hub configurations, displays the current Slot Preamble size in milliseconds for the Remotes in the group. The Preamble is the period between when the Remote begins to transmit (sends an ACK) to the Hub and when the first data packet is sent. This allows time for signal lock to occur before data is sent, thus preventing data loss.

The **Preamble Time** is automatically set based on internal calculations that correlate transmit burst acquisition preamble times to STDMA transmit data rates and Acquisition Mode selection. *Standard* Acquisition Mode uses an uncoded signature. *Long* Acquisition Mode uses both uncoded and coded portions of the preamble, as is shown for the example in figure 3-18. The sum of these two values equals the total Preamble Time; in this case, 40 ms.

Preamble Time 2ms / 38ms (uncoded / coded)

Figure 3-18 Slot Preamble Time display

Guard Band

This parameter, which appears for all Hub configurations, displays the current length of the Slot Guardband in milliseconds for the Remotes in the group. The Slot Guardband is the amount of time between the point when one Remote completes transmitting data and the point when the next Remote in the cycle begins transmitting. This prevents the Remote from overrunning the next terminal in the cycle. The setting for this parameter should be obtained using the *Vipersat STDMA Calculator*. Typically, a value of **30 ms** is sufficient.

Tip: Contact a Comtech Vipersat Networks representative for a copy of the latest Viper Calculator.

To modify this parameter on a Hub unit, enter a value from 0–250 in the **Guard Band** field, then click the **Submit** button. The value represents time in milliseconds.

Guard Band 30   (0-250) [Actual = 39ms]
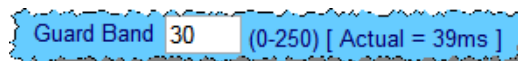
Figure 3-19 Slot Guardband field

Slot Data Length

This menu item displays the Slot Data Length in milliseconds as well as in bytes, and represents the amount of data that can be transmitted or received in

one spin of the STDMA cycle by each of the Remotes belonging to that group. This is the amount of time that the Remote is provided to send data in the cycle.

Depending on the Hub type that is defined for the modem, the appearance of this parameter will vary:

- *Fixed* – Slot Data Length
- *Dynamic Slot* – Nominal Data Length, Minimum Data Length
- *Dynamic Cycle* – Maximum Data Length, Minimum Data Length
- *Entry Channel* – Slot Data Length, Minimum Data Length
- *GIR* – Minimum Data Length

On a Hub unit, enter the specified value(s) in milliseconds within the allowed range, as shown in figure 3-20.

NOTE **Note:** When setting the Minimum Data Length, ensure that the slot length is not less than the maximum MTU (1500 bytes), as this would prevent large data packets from transmitting and result in the loss of data.

Figure 3-20 Slot Data Length (Dynamic Cycle)

Burstmap Multicast IP

This parameter is used to define the IP address for the Burstmap Multicast that is sent out by the STDMA burst controller at the Hub to all of the associated Remotes in that group. This address must be the same for all members of the group. The burst map is a proprietary message sent from the Hub to all Remotes, at regular intervals, specifying the relative start time and duration for each terminal to transmit.

To set this parameter, enter the specified Multicast IP address (figure 3-21), then click the **Submit** button.

Figure 3-21 Burstmap Multicast IP field

Power Hunt

Power Hunt is a transmission power control feature for the Remote modulator that functions while the Remote is in STDMA mode. This parameter provides compensation for instances when the initial (baseline) power value is insufficient or during periods of impaired transmission, and assists in maintaining return link integrity.

When a predetermined number of consecutive burst acknowledgements from the Remote are missed at the Hub, the power output is increased in 1 dB increments, up to a maximum of 3 dB. The value specified for the Power Hunt parameter (range is 0-3) determines the maximum power increase for this Remote.
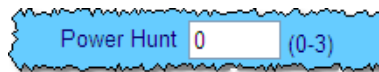
Figure 3-22 Power Hunt field

The Power Hunt function is disabled when the Remote switches from STDMA to SCPC mode, where the DPC feature is then applied. However, the Power Hunt value at the time of the switch is carried over as the initial DPC offset value. When switching back to STDMA from SCPC mode, the last DPC offset will be applied as the power hunt (delta) value.

A modem reboot or forced revert will clear the DPC offset and reset it to 0 dB.

Outbound IP

This parameter, which appears for all Hub configurations, displays the current TDM **Outbound IP** address. This specifies the Hub device that is supplying the TDM outbound carrier to the satellite (typically a SLM-5650A). Specifying this address is necessary when configuring a Hub that utilizes a burst controller that is a separate device from the TDM modem.

This address must also be defined when the DPC feature is implemented for a network. Note that the Outbound IP address will be the same as the burst controller address when the TDM modem and the burst controller are the same device.

To define the TDM **Outbound IP** address, enter the address of the TDM modem unit and click the **Submit** button. The dialog in figure 3-23 shows this Hub parameter field.

Figure 3-23   Outbound IP field

Automatic Remote Removal

The **Automatic Remote Removal** feature appears on the STDMA page when the Unit Role is *Hub*, and is used to define the removal parameters for the Remotes that belong to the STDMA group for the Hub Burst Controller.

Figure 3-24   Automatic Remote Removal

When *Enabled*, the value entered in the **Removal Timeout Cycles** field specifies the amount of time (seconds) with no communications from the Remote to the Hub before that Remote is removed from the Burstmap. If communications are lost for this period of time, the Remote is removed from the STDMA group, and the bandwidth resources it had been allocated are then made available for use by the other Remotes remaining in the group.

This feature is useful, for example, in an SNG application where a mobile Remote has finished its assignment and has shut down.

When a Remote has been removed from the STDMA group, the value that is entered for the **Removal Retry Cycles** parameter specifies the amount of time (seconds) that is allowed to pass before a retry attempt is made to return the removed Remote to the group. The Remote is re-entered into the burst map cycle; if the Remote does not burst back (ACK) to the Hub Burst Controller, it is once again removed from the Burst Map.

This allows, again using a mobile Remote as an example, shutting down the Remote at one location, moving it to a new location, and then automatically re-establishing a connection to the satellite network.

Remote List Table

The **Remote List Table** appears on the STDMA page when the Unit Role is *Hub*. The screen example shown in figure 3-25 is typical of the appearance for all allocation methods except for *GIR* and *ECM*, which are depicted in figure 3-26 and figure 3-27, respectively.

Figure 3-25   STDMA Remote List Table

This feature is used to assign and display the Remotes that belong to the STDMA group for the Hub burst controller. Remote units can be added/deleted to/from the list, and their status in the burst map can be set—*Enabled* or *Disabled*. Modifications to existing entries can be made by editing the desired field(s) and submitting the changes.

Figure 3-26 Remote List Table, GIR Hub

Figure 3-27 Remote List Table, ECM Hub

Add Remote to STDMA Group

In the Add New Entry section, enter the **Station Name** for the Remote unit and the **IP Address**, then click the **Add Entry** button. The new Remote will be listed in the table as a member of the STDMA group.

Once a Remote has been added to the STDMA group, its status in the group is displayed on the Vipersat **Stats** page (see "STDMA Hub Statistics" on page 3-27).

Set Remote Policies—GIR and ECM

The STDMA page for GIR and ECM Hub types allows the configuration of each Remote for specific data switching conditions.

GIR Remotes

As shown in figure 3-26, two additional parameters—**GIR** and **GIR Switch Rate**—are settable in the table for the GIR Remotes. Note that, above the table, data rate and bandwidth guidelines for setting the GIR values are provided as reference to assist the user with configuration of these parameters.

Set the Switch Rate to a value greater than the GIR to allow the Remote to be automatically switched out of STDMA and into SCPC mode when traffic exceeds the GIR. A switch rate of **0** (zero) will prevent the Remote from being switched.

Click the **Submit Changes** button following any parameter modifications.

ECM Remotes

The **SCPC Data Rate** and **Switch Type** parameters are two additional settings that can be configured in the table for the ECM Remotes, as shown in figure 3-27.

Set the SCPC Data Rate to the desired value (kbps) that will be the starting point for communications. Set the Switch Type as follows:

- Type **0** (zero) corresponds to Load Switching.
- Types **64** through **255** are user-defined, and must match VMS policies.

When choosing Load Switching as the switch type, the associated Remote must have the Load Switching feature *Enabled* (see the section "Vipersat Switching" on page 3-28).

Click the **Submit Changes** button following any parameter modifications.

Remove Remote from STDMA Group

From the STDMA Hub page, the **Delete Entry** feature is available as shown in figure 3-28, allowing a Remote to be removed from the table list for this Hub burst controller.

Enter the Index number from the table for the Remote station to be removed and click the **Delete Entry** button.

Figure 3-28   Delete Table Entry field

Enable/Disable Remote

Included in the Remote List Table is the Status column displaying whether the station is currently **Enabled** or **Disabled** (figure 3-29). This feature can be used to easily place a Remote in or out of the burstmap without having to perform Add/Delete Entry procedures.

Figure 3-29   Remote Status selection

Change the status setting by clicking on the pull-down arrow and selecting the other choice. Then click on the **Submit Changes** button.

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

STDMA Statistics

Selecting **Stats** from the Vipersat submenu displays the **STDMA Statistics** for either *Hub* or *Remote*, based on the Vipersat Mode setting for this modem, as shown in figure 3-30 and figure 3-31.

STDMA Hub Statistics

The **STDMA-Hub Statistics** page (figure 3-30) provides information on burst cycle intervals, number of missed and received ACK's per Remote, and the receive byte counts per burst.
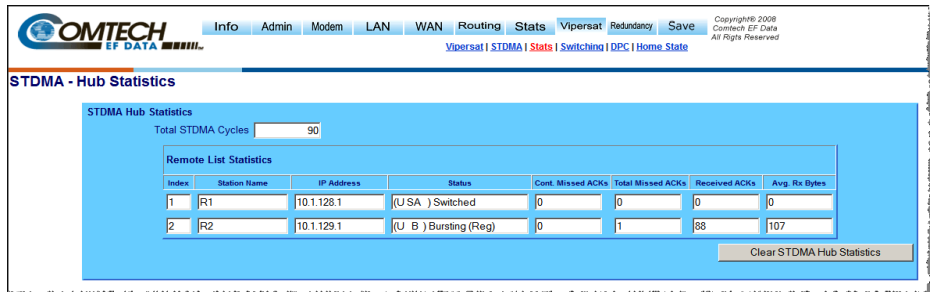
Figure 3-30   STDMA Hub Statistics Page

Statistics in the received ACK from each Remote are monitored by the Burst Controller. These statistics report the fill status of the burst data slot for each Remote. The Burst Controller builds a table of the group and calculates the relative data byte count for each Remote. It then calculates the length of the data slot for each Remote based on the Minimum Slot Length plus a percentage of the Available Bandwidth. Idle Remotes receive a data slot equal to the Minimum Slot Length.

The dynamic range of STDMA is a function of the difference between the Nominal Data Length and the Minimum Data Length parameters. These parameters are operator selectable. The speed with which STDMA reacts to changes in dynamic load is a function of the Cycles per Burst Map parameter, which is also operator selectable.

An informative indicator on the STDMA Hub Statistics page is the **Status** of the Remotes that appears in the first column to the right of the IP Address column. The Remote status is displayed using one or multiple of the following:

- **U** = **Used** – This Remote is being used in the burst map.
  Once a remote has been added to the STDMA group, this status will always be displayed.

- **B** = **Burstmap** – This Remote is currently in the burst map.
  This status will be displayed unless the remote has been removed (R), disabled (D), or switched (S) out of the STDMA burst map.

- **R** = **Removed** – This Remote is currently removed from the burst map.
  When displayed, this status indicates that the Hub has removed this remote from the burst map due to a communications fault.

- **D** = **Disabled** – This Remote is currently disabled and is not in the burst map.
  This status will be displayed when a remote is manually disabled by the operator or administrator.

- **S** = **Switched** – This Remote is currently switched into SCPC mode. When displayed, this status indicates that the VMS has automatically switched the remote out of the burst map and into SCPC operation.

- **H** = **Home** State Revert – This Remote is not currently receiving burst maps. When a remote, stuck in SCPC mode by failure to receive a VMS revert command, sees the burst map with this flag set, it will automatically revert to its home state and STDMA mode.

- **A** – This Remote has not sent an acknowledgement to the burst controller.

The Hub statistics are useful for tuning the Burst Controller. Preamble adjustments, up or down, are made using the missed ACKs statistic; a preamble and/or guardband that is too short will result in an accumulation of missed ACKs. The "Cont. Missed ACKs" column represents continuous—the number of sequential ACKs missed.

STDMA Remote Statistics

The **STDMA Remote Statistics** page (figure 3-31) provides information on Burst Maps received, Preamble Time, Guard Band period, and Slot Time for the Remote modem.
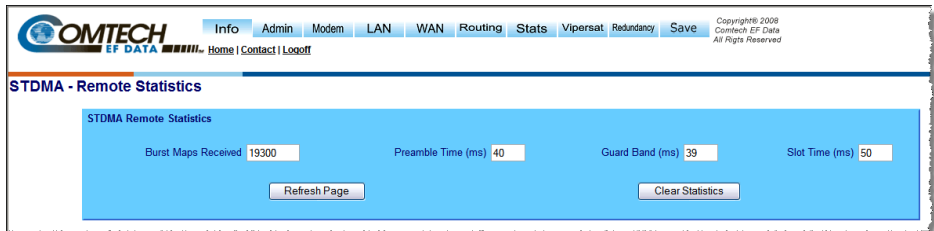
Figure 3-31   STDMA Remote Statistics Page

The Remote statistics are useful for determining the status of remote terminal reception and troubleshooting burst transmission problems.

Vipersat Switching

One of the most powerful features of the Vipersat SLM-5650A is the capability to perform automatic switching between STDMA mode and SCPC mode based

on bandwidth demand. The configuration options that are available to meet customer-specific requirements are extensive, and include switching based on Load and/or ToS (Type of Service).

For additional information, refer to Appendix B "Automatic Switching" in this document.

The functions available for configuring the switching operations depend on whether the target SLM-5650A is a *Hub* unit or if it is a *Remote* unit. Note that automatic switching does not apply to either a *Hub Expansion* unit or a *Remote Expansion* unit; these Vipersat working modes operate in dedicated SCPC mode and all switching control is performed by the VMS. As is shown in table 2-2, switching should be *Disabled* for these two modes.

Select **Switching** from the Vipersat submenu to display the Switching page for this modem, either Hub (figure 3-32) or Remote (figure 3-33).

Figure 3-32 Switching Page (Hub)

Load switching is controlled by both the Hub and the Remote, and thus related commands appear in both screens. The initial Load switch request is made by the Hub. Once in SCPC mode, subsequent Load switch requests (Step Up, Step Down) are made by the Remote.

ToS switching is controlled by the Remote, and thus appears only in the Remote Switching screen.

Figure 3-33 Switching Page (Remote)

Load Switching

One of the four automatic switching functions that the Vipersat SLM-5650A is able to perform is Load Switching. The system will detect variations in data rate and can be configured to switch from STDMA to SCPC based on bandwidth requirements.

The initial switch for a Remote SLM-5650A from STDMA mode to SCPC mode is determined by the Hub Burst Controller. Once the Remote is switched into SCPC, any requests to meet additional switching requirements within SCPC (Step Up or Step Down) are made by the Remote modem.

The **Load Switching** feature for the SLM-5650A is *Enabled* and *Disabled* by selecting the desired radial button at the top of the page.

NOTE	**Note:** Load switching must be *Enabled* for any SLM-5650A that will experience changing load conditions in order for the VMS to dynamically optimize network performance on these circuits.

STDMA Slot Capacity

This parameter field appears for Hub modems only.

The **STDMA Slot Capacity** parameter allows setting the threshold or level of slot capacity at which the Burst Controller sends a switch request to the VMS to switch the Remote from STDMA mode to SCPC mode.

A default setting (95%) is provided, but there may be unique network configurations that require modifying the STDMA slot capacity value. To change this setting, enter a value from 0–100% as shown in figure 3-34.

Figure 3-34   STDMA Slot Capacity field

STDMA Switch Delay

This parameter field appears for Hub modems only.

In order to minimize unnecessary switching from STDMA to SCPC due to transient conditions, such as a temporary spike in network traffic for example, an **STDMA Switch Delay** parameter is provided. This setting is used to specify a delay before a switch occurs.

A default value (10 seconds) is provided, but this value can be changed to accommodate a unique network configuration or application. To change this setting, enter a value from 0–50 seconds as shown in figure 3-35.

Figure 3-35   STDMA Switch Delay field

Percent Allocation

This parameter field appears for Hub modems only.

The **Percent Allocation** parameter allows adding a fixed percentage to the channel bandwidth request to accommodate additional bandwidth requirements which may occur after the switch is made from STDMA to SCPC mode.

Typically the default value (10%) will be sufficient, but if there may be a larger bandwidth requirement after the switch, the percent allocation value can be increased. In choosing a value for this allocation, future bandwidth requirements for the channel must be balanced against efficient bandwidth utilization.

To change this setting, enter a value from 0–100% as shown in figure 3-36.
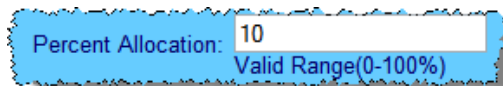
Figure 3-36   Percent Allocation field

SCPC Step Up Threshold

This parameter field appears for Remote modems only.

The **SCPC Step Up Threshold** establishes the percentage of bandwidth use that will trigger a switch up from the present SCPC rate to a higher rate to ensure that there is sufficient bandwidth available for current conditions.

A default value (95%) is provided, but if a different threshold is desired, an alternate value can be specified by entering a value from 0–100% as shown in figure 3-37.

Note that this value must be greater than the value specified for the *SCPC Step Down Threshold*.
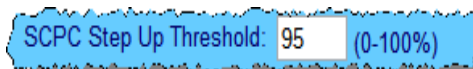
Figure 3-37   SCPC Step Up Threshold field

SCPC Step Down Threshold

This menu item appears for Remote modems only.

The **SCPC Step Down Threshold** establishes the percentage of bandwidth use that will trigger a switch down from the present SCPC rate to a lower rate to ensure efficient bandwidth usage.

A default value (65%) is provided, but if a different threshold is desired, an alternate value can be specified by entering a value from 0–100% as shown in figure 3-38.

Note that this value <u>must be less</u> than the value specified for the *SCPC Step Up Threshold*.

Figure 3-38 SCPC Step Down Threshold field

SCPC Switch Delay

This menu item appears for Remote modems only.

The **SCPC Switch Delay** feature provides a switching delay period to ensure that a premature switch up or down in the SCPC rate does not occur due to a temporary rise or fall in traffic.

A default value (10 seconds) is provided, but this parameter can be modified by entering a value from 0–50 seconds as shown in figure 3-39.

Figure 3-39 SCPC Switch Delay field

SCPC Step Up Excess

This menu item appears for Remote modems only.

During each SCPC Step Up switch, the excess capacity data rate value entered by this command is added to the new SCPC data rate. This excess is added each time an SCPC Step Up switch occurs. This setting makes additional bandwidth available for when the demand arises while minimizing Step Up switching events.

A default value (10%) is provided, but this parameter can be modified by entering a value from 0–100% as shown in figure 3-40.

Figure 3-40 SCPC Step Up Excess field

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

Dynamic Power Control Configuration

Dynamic Power Control (DPC) is a Vipersat feature that acts to regulate the transmit power of the Vipersat satellite modem, such that the specified receive signal level (E_b/N_0) for the Vipersat unit(s) receiving the transmission is met. DPC is driven by the receiver demod, which periodically notifies the transmitting modem of the current E_b/N_0 value that it is receiving.

Refer to Appendix C "Dynamic Power Control" in this document for additional information on the DPC feature.

The **Dynamic Power Control** configuration page, accessible from the **Vipersat** submenu, allows for setting the parameters for the SLM-5650A power levels. The information and commands in the menu will vary depending on the function that the target SLM-5650A performs in the network. The screen shown in figure 3-41 is for a Hub or Remote operating in SCPC mode. For comparison, the DPC configuration screen for a unit operating as a Hub Expansion Demod (SCPC mode) is shown in figure 3-42. Note that only the applicable settings appear in this screen.

Figure 3-41 DPC Configuration (Hub & Remote)
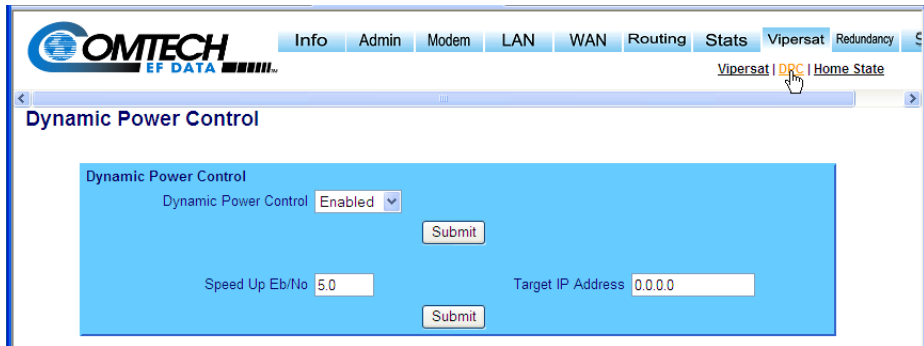
Figure 3-42 DPC Configuration (Hub Expansion Demod)

NOTE

Note: The following descriptions will refer to the SLM-5650A as either modulator or demodulator for simplicity and understanding.

Before enabling DPC, the operator should verify that a demodulator at another terminal is receiving from this modulator, and that there is a working communications channel from that receiving station back to the modulator terminal (In-Band communications). Additionally, since DPC controls potentially the full power range of the modulator's output power, it is recommended that the terminal be commissioned and calibrated before usage.

Tip: The DPC feature will not function unless the Outbound IP address is defined in the STDMA screen for the Hub BC modem. See page 3-21.

Dynamic Power Control

The DPC feature can be set to either *Enabled* or *Disabled* using the pull-down menu. The SLM-5650A is shipped with DPC turned off (Disabled) to allow entrance link levels calibration during terminal setup.

To activate DPC for this modem, select **Enabled** then click the **Submit** button.

Target Eb/No

The **Target E_b/N_0** is the desired operating receive level for closed loop servo control and is set in the transmit modem. This is the value used for comparison with the actual E_b/N_0 from the receiving modem. This information is processed by the transmitting terminal for output power level adjustment as necessary.

To modify this parameter, enter a value from 0.0–15.0 dB, then click the **Submit** button. The default value is 10.0 dB.

Speed-Up Eb/No

The **Speed-Up E_b/N_0** range parameter provides a means of decreasing the power adjustment period when an excessive delta occurs between the E_b/N_0 receive level and the target value. This ensures that an optimal receive level is maintained.

Normally, the DPC message is sent every 30 seconds from each terminal in the network. Should the received E_b/N_0 level at the demodulator ever fall outside the specified range, the terminal increases its message send rate to every 10 seconds until the receive level is again within the range set value. This provides a speed-up loop to rapidly regain link quality.

To modify this parameter, enter a value from 0.0–15.0 dB, then click the **Submit** button. The default value is 5.0 dB.

Target IP Address

The **Target IP Address** identifies the modem that is transmitting to this SLM-5650A, and will be receiving the DPC messages that provide the current E_b/N_0 value for this unit. Typically, all Remotes will specify the Hub modem that is supplying the TDM outbound. The Outbound IP address is sent out to all STDMA Remotes via the Burst Map, and the DPC Target for these Remotes is automatically mapped to that address.

Manually entering the Target IP Address is only necessary for modems that are SNMP managed Out-of-Band and will be utilizing the DPC feature. For In-Band modems, the target addresses are handled automatically by the VMS.

To manually configure the target address for an Out-of-Band modem, enter an IP Address, then click the **Submit** button.

The STDMA Burst Controller is not permitted to specify a DPC Target because the demodulator is receiving multiple bursts very rapidly from all Remotes in the group and is unable to utilize DPC to control the transmit power of the Remote modems. However, the transmit power of the Burst Controller adjusts to meet the target E_b/N_0 values for the Remotes in the group.

Maximum Power

The commissioning of a satellite terminal must comply with the calculated link budget that is conducted before terminal installation. Using these calculations, the maximum transmit power level permitted for the modulator(s) based on link/satellite parameters can be configured. This is the value set by the **Maximum Power** parameter.

This parameter field is read only, and reflects the result of the Max Power calculation that is performed by the operator when the **Calculate New Max**

Power button is clicked. Any modifications to the settings for Margin, Max Data Rate, Max Code Rate, and/or Max Modulation will require re-calculation of the Maximum Power value.

If the calculator returns an error [INVALID], either the base level is too high or the calibration parameter settings have exceeded the capacity of the equipment and must be modified.

Margin

The DPC **Margin** parameter is one of the *Max Power* calibration settings. This value is the offset between the current power level and the upper power limit for the waveform, and should match the fade margin that has been purchased. Margins are used to compensate for signal attenuation (e.g., rain) and define link availability.

To modify this parameter, enter a value from 0.0–15.0 dB, then click the **Submit** button. The default value is 5.0 dB.

Max Data Rate

The **Max Data Rate** parameter is one of the *Max Power* calibration settings. This value is the maximum achievable rate as calculated from the link budgetary numbers for this site.

To modify this parameter, enter a data rate, then click the **Submit** button. Note that the valid range for the data rate will vary depending on the Modulation type and Code Rate. The default setting is 1024000 bps.

Max Code Rate

The **Max Code Rate** parameter is one of the *Max Power* calibration settings. This value is the maximum achievable rate as calculated from the link budgetary numbers for this site.

Use the pull-down menu to select the required rate, then click the **Submit** button. Note that when operating in Vipersat mode, Rates of 1/2, 2/3, and 1/1 are not valid. The default setting for this parameter is Rate 3/4.

Max Modulation

The **Max Modulation** parameter is one of the *Max Power* calibration settings. This setting is the maximum achievable modulation as calculated from the link budgetary numbers for this site.

Use the pull-down menu to select the required modulation, then click the **Submit** button. The default setting for this parameter is QPSK.

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

Home State

An SLM-5650A's Home State consists of those parameters which provide a known RF configuration that the modem/router will return to, either as the result of a command by the VMS, or as it comes back on line from a reset or a power cycle. These Home State settings are typically selected so that the SLM-5650A goes to a configuration which is optimum for its function in the network.

Select **Home State** from the **Vipersat** submenu to display the Home State configuration page shown in figure 3-43.

Figure 3-43   Home State Configuration Page

Note that each of these Transmit and Receive parameters are the same as found in the *Transmit* and *Receive* sections of the **Modem Configuration** page (refer to the section "Set the Satellite Modem Configuration" on page 2-11 for details). To modify any of these settings, enter the new value then click the **Submit** button.

When Home State is *Enabled*, the valid settings for Code Rate, Modulation, and FEC are as follows:

- **Code Rate** — 3/4 or 5/16

- **Modulation** — QPSK or BPSK

- **FEC** — Turbo

Set Current Configuration as Home State

This command sets the SLM-5650A's current configuration as its Home State settings. Assuming the modem has been properly configured using the **Modem Configuration** page (Tx and Rx parameters) and the **Vipersat STDMA** page (Selective TDMA setting), these parameter values will be copied into the Home State configuration. Rather than entering each of these values individually, this command can be used as a shortcut for establishing the Home State settings.

Click on the **Set Current Config As Home** button in the **Home State** page to execute this command. Once saved, the modem will be configured with the Home State settings at boot time and when manually reset with the **Force Modem to Home State** command.

Tip: This command is useful when an SLM-5650A's initial set up is completed and the unit is functioning as desired in a network.

Force Modem to Home State

If at any time it is desired to have an SLM-5650A return to its Home State, the **Force Modem to Home State** command can be executed. The Home State parameter values are "forced" into the Base Modem configuration so that they match. The Base Modem parameters will be updated to reflect the configuration that has been set from this menu.

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

Additional Routing Configuration

Basic routing is configured using the **Routes** page that appears under the Routing menu (refer to the *SLM-5650A Installation and Operation Manual*, P/N MN-SLM5650A). Depending on specific customer network applications, additional routing features may have to be enabled and configured accordingly. The configuration of *OSPF dynamic routing* and *IGMP multicast routing* is described in the subsections below.

Dynamic Routing

The Vipersat OSPF (Open Shortest Path First) feature in the Comtech SLM-5650A modem/router provides for dynamic routing functionality. Two implementations of this feature are available, *Full Enable* and *Announcement Only*.

With *Full Enable*, route changes from the Hub are broadcast to the Remotes via a dedicated WAN-to-WAN multicast address. Route changes from a Remote are unicast to the Hub. Static routes that are manually entered into the route table by the operator are separate from these dynamic routes and are not managed as part of the OSPF system (see the section "Creating the Static Routes" on page 2-9).

The support for full OSPF functionality in the SLM-5650A modem causes routers that are external and connected to the Vipersat satellite network to "see" the entire SLM-5650A network as if it were a single router.

The *Announcement Only* mode is implemented for Hub SLM-5650As that are operating as the TDM Outbound for roaming Remotes (SOTM). When the VMS writes a new route to the Hub TDM for a roaming Remote, the new route will be announced on the Hub LAN.

If this SLM-5650A is in a network that utilizes dynamic routing, click on the **OSPF** submenu item that appears under Routing (*except for Expansion units*) to access and configure the Open Shortest Path First parameters for this unit, as shown in figure 3-44.

With the exception of Topology (Mesh/Star), the parameters on this page are used to configure the standard implementation of OSPF.

1. To activate the OSPF feature for this modem, select either **Full Enable** or **Announcement Only** from the OSPF pull-down menu.

For Hub SLM-5650As that are providing the TDM Outbound for a satellite roaming network, set OSPF to **Announcement Only**. For roaming Remotes, set OSPF to **Disabled**.

2. Set the parameter fields as described below. For the majority of networks, the default settings are recommended.

NOTE

Note: For systems that are already operating with OSPF, activation of any parameter changes will result in a momentary stopping and re-starting of the OSPF process.

Figure 3-44 OSPF Parameters Page

Topology

The **Topology** parameter identifies the network type for the specified interface, **Star** or **Mesh**. Note that this setting is only applicable to Hub routers; therefore, this field is active only when the Working Mode is set to either *Vipersat Hub* or *Multipoint Hub*.

In Star mode, route changes at each Remote are only updated in the Hub. In Mesh mode, route changes at each Remote are updated in the Hub as well as distributed to all of the other Remotes.

Caution: Setting the Topology for Mesh may require a larger number of routes, with the possibility of exceeding the limit of 270 total routes per modem/router.

Area Network Address

The **Network Address** parameter specifies the IP address of the network at this site. This is the network to be monitored for OSPF changes.

OSPF Area

This parameter specifies the OSPF **Area** for this network. The default value is 0 (backbone).

Range is 0-4294967295.

Cost

The **Cost** setting represents the link cost for the specified interface. This value is embedded in the router's LSA metric field and used for SPF calculation.

Default value is 65535. Range is 1-65535.

Retransmit Interval

The **Retransmit Interval** is the timer value for retransmitting Database Description and Link State Request packets.

Default value is 5 seconds. Range is 1-65535.

Transmit Delay

The **Transmit Delay** parameter sets the time period before transmitting the LSA.

Default value is 1 second. Range is 1–65535.

Priority

The higher the value for this setting, the more eligible the router will be to become the Designated Router. The **Priority** is also used for determining a Backup Designated Router. A value of zero (0) eliminates the router from being eligible for the DR or the BDR.

Default value is 1. Range is 0-255.

Hello Interval

The **Hello Interval** parameter is the timer value for sending the Hello packet on the specified interface. This is a periodic handshake and 'keepalive' message that establishes and tests the link up/down status to determine neighbor reachability.

Default value is 10 seconds. Range is 1-65535.

Dead Interval

The **Dead Interval** parameter is a timer value used for specifying the period after which a non-responding neighbor is considered dead. Note that this setting must be the same for all routers attached to a common network.

Default value is 40 seconds. Range is 1-65535.

Authentication Key

Setting the **Authentication Key** requires that all OSPF packets be authenticated, guaranteeing that only trusted routers will be allowed to propogate routing information. This can only be set when the Message Digest Key is <u>not</u> used.

A simple password of up to eight characters can be specified.

Message Digest Key

The **Message Digest Key** is a security key used to create the message digest, and serves as both CRC (for file integrity) and cryptographic hash function / security encryption (128-bit). This can only be set when an Authentication Key is <u>not</u> used.

Allows a cryptographic password of up to 16 characters to be specified. Note that, if the key type is not first specified, entering a string in the password field will cause this key to be used by default.

3. If parameter settings were changed, click on the **Submit** button.

OSPF Timeout Description

The Hub maintains a map list of all active Remotes (those sending Hellos).

Each router (SLM-5650A) maintains a counter of missed Hellos for each router (SLM-5650A) at the other end of the WAN (satellite link). This counter is reset to zero (0) upon receipt of a Hello. If the number of missed Hellos multiplied by the *Hello Interval* exceeds the *Dead Interval*, the counter is terminated, that router is removed from the Hub's map list, and any routes that originated from
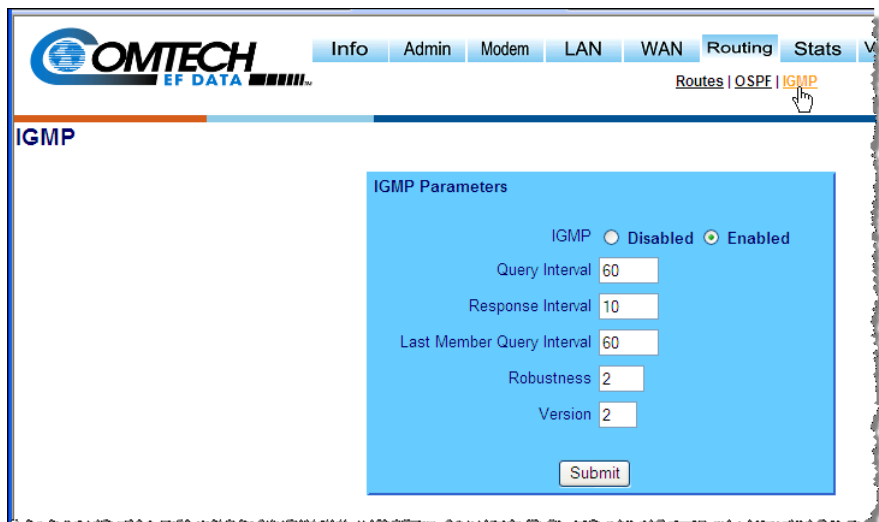
that SLM-5650A are deleted. If/when a subsequent Hello is received from this same modem/router, it is treated as a first Hello and the handshake protocol is initiated once again.

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

Multicast Routing

IGMP (Internet Group Management Protocol) is an IP routing protocol used by IP hosts to manage their dynamic multicast group memberships on a given network. This protocol allows a host to inform its local router that it wants to receive messages addressed to a specific multicast group. The SLM-5650A modem/router can be configured to perform IGMP multicast routing functions when required by a given network.

If this SLM-5650A is in a network that utilizes multicast routing, click on the **IGMP** submenu item that appears under Routing (*except for Expansion units*) to access and configure the IGMP parameters for this unit, as shown in figure 3-45.

Figure 3-45 IGMP Parameters Page

1. To activate the IGMP feature for this modem, select the **Enable** radio button.

2. Set the parameter fields as described below. For most applications, the default settings are recommended.

Query Interval

The **Query Interval** is the amount of time (in seconds) between IGMP general query messages sent by the router.

Default value is 60 seconds.

Response Interval

The **Response Interval** is the maximum amount of time (in seconds) that the IGMP router waits to receive a response to a general query message. This value must be less than the *Query Interval*.

Default value is 10 seconds.

Last Member Query Interval

The **Last Member Query Interval** is the amount of time (in seconds) that the IGMP router waits to receive a response to a group-specific query message. This is also the amount of time between successive group-specific query messages.

Default value is 60 seconds.

Robustness

The **Robustness** setting is a reflection of how susceptible the subnet is to lost packets. To ensure the chances of IGMP recovery, select a higher value setting for subnets that experience higher rates of lost packets. This variable should be set to a value of 2 or greater.

Default value is 2.

Version

The **Version** value reflects the IGMP implementation version that is being used for this network, either v1 or v2 (*v3 is not supported*).

Default value is 2.

3. If parameter settings were changed, click on the **Submit** button.

---

*To maintain any parameter changes in flash memory, select **Save** from the Main Menu bar.*

{ This Page is Intentionally Blank }

A

NETWORK ADDRESSING

Introduction

This Appendix is an overview of network addressing and how it applies to configuring the SLM-5650A for use in Vipersat Networks. The subjects covered are:

- OSI Model
- Binary Math
- IP Addressing
- Network Address Translation
- Subnets
- Network Segments
- Default Gateways
- MAC Addresses

The OSI Reference Model

OSI is an acronym for Open Systems Interconnection. This is a network model created by ISO (the International Standardization Organization.) The OSI model is the basic standard which forms the basis for all networking protocols.
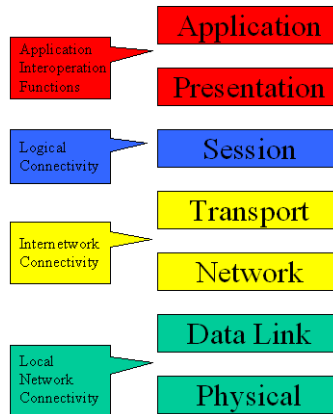
Figure A-1 The Seven OSI Protocol Layers

The OSI model defines the building blocks used to construct a working network protocol as shown in Figure A-1. The blocks on the right show the individual layers which make up the OSI model and the blocks on the left show the layer's functional grouping.

Each layer, as defined by the OSI model, is only aware of the layers directly above and below it.

Layers 1 – 3

Layer 1 / Physical – Layer 1 defines the physical means by which actual bits are sent and received. This layer, for example, is where connectors, cable lengths, and signaling specifications are defined.

Layer 2 / Data Link – Layer 2 consist of two sub-layers:

- Logical Link Control (LLC) – The LLC packages bytes received from the MAC into a format readable by the Network Layer above it.

- Media Access Control (MAC) – The MAC is concerned with obtaining access to the network at an appropriate time; i.e., when no other machines are communicating or when permission has been granted.

Together, these two sub-layer protocols are responsible for moving packets on and off the network.

Layer 3 / Network Layer – Layer 3 is responsible for routing packets through multiple networks. The Layer 3 protocol operates without regard to the underlying protocols in use. For example, routers operate at Layer 3.

Binary Math

Network devices communicate using BITS, where a bit is a single digit represented by a 1 or a 0, or by using BYTEs, where a byte is made up of eight bits in any combination of 1's or 0's. A byte is also referred to as an octet.
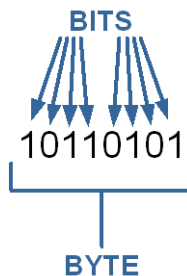
Figure A-2 Bits and Bytes

An octet can be converted to or from binary using the technique shown in the decimal conversion chart in Figure A-3. The conversion chart also shows the decimal equivalent of the binary number.

Figure A-3 Binary to Decimal Conversion

Bits containing a **1** in Figure A-3 determine which decimal values should be added. These decimal values, when added together, determine the decimal equivalent for the binary number.

This is an example of changing a number expressed in binary (base 2) to its decimal equivalent (base 10). The numeric value is the same, you have only

changed the numbering base (radix.) All digital processes are done in binary. The conversion to decimal is done whenever binary values need to be read or entered by humans as their decimal equivalents.

IP Addressing

An IP (Internet Protocol) address is a unique set of numbers assigned to a device on a network to uniquely identify that device (by its IP address).

An IP address is a unique number composed of four octets, with each octet separated by a dot. This notation style is called dotted decimal notation.

Each IP address can be broken down into two parts, as shown in the example below:

> Example: **128.121.188.201**
>
> The first two octets are the network ID: **128.121**
> The second two octets are the host ID: **188.201**

- **Network ID** - In this example, the 128.121 portion of the IP address defines the network that a host belongs to, and is equivalent to a street name in a mailing address.

- **Host ID** - The 188.201 portion of the IP address specifies a unique number assigned to the host on the network, and is equivalent to a house number in a mailing address.

IP Address Classes

IP addresses are assigned to classes according the schedule shown in Figure A-4. IP address classes are assigned as follows:

Class A

- 1.x.x.x to 126.x.x.x(0 and 127 are reserved)
- 126 Class As exist
- Can have 16,777,214 hosts on each Class A
- 8-bit network number
- 24-bit node number

Class B

- 128.0.x.x to 191.254.x.x
- 16,384 Class Bs exist
- Can have 65,354 hosts on each Class B

- 16-bit network number

- 16-bit node number

CLASS A
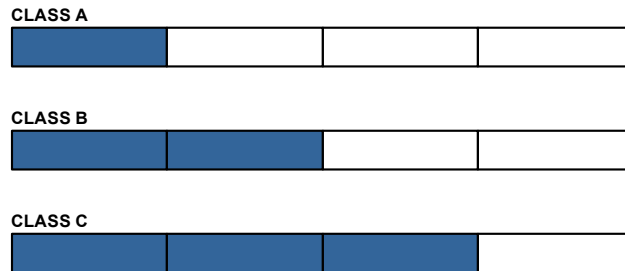
CLASS B

CLASS C

Address Class	High-Order-Bits	1st Octet Decimal Range	Networks Available	Hosts Available
Class A	0	1-126.x.y.z	126	16,777,214
Class B	10	128-191.x.y.z	16,384	65,534
Class C	110	192-223.x.y.z	2,097,152	254

Figure A-4 IP Address Classes A, B, C

Class C

- 192.0.1.x to 223.255.254.x

- 2,097,152 Class Cs exist

- Can have 254 hosts on each Class C

- 24-bit network number

- 8-bit node number

Class D

- 224.0.0.0 to 239.255.255.255

- Reserved for Multicast (messages sent to many hosts).

Class E

- 240.0.0.0 to 255.255.255.255

- Reserved for experimental use and limited broadcast

Private Network IP Addresses

RFC 1918 defines blocks of addresses for use on private networks:

- 10.0.0.0 – 10.255.255.255

- 172.16.0.0 – 172.31.255.255

- 192.168.0.0 – 192.168.255.255

Network Address Translation (NAT)

Private networks can only connect to the public Internet by using a Network Address Translation (NAT) device (a router, for example) or a proxy server which has been assigned a public IP address. These network devices use a public IP address to request information from the Internet on behalf of the private IP addressed devices on the associated private network.
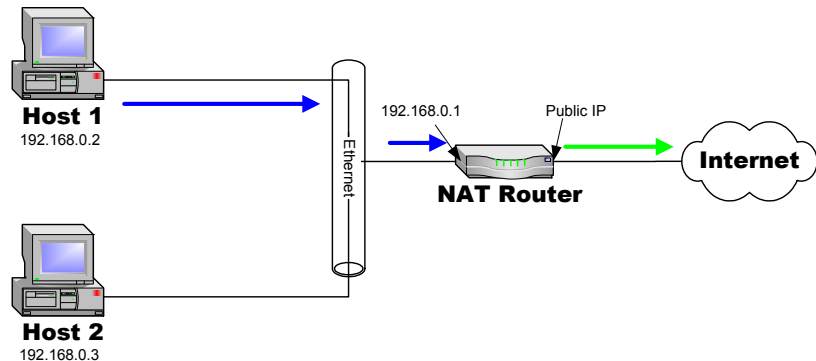
Figure A-5 NAT Router Example

This use of private addresses helps to conserve public IP addresses.

Subnets
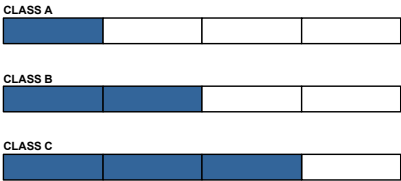
Subnets can be defined as the further segmentation of the InterNIC assigned Network ID IP address. The amount and type of subnetting performed by the organization is determined by the network layout.

In the process of subnetting, bits are borrowed from the host ID portion of an IP address and are then given to the network ID. Then a "Subnet Mask" gets assigned to the host along with the IP address.

Subnetting is required if the network is segmented.

Subnet Mask

The Subnet Mask is used by the host to determine if a destination IP address is on the local or on a remote network segment. The table in Figure A-6 shows the default subnet mask used for each class of IP address.

Address Class	Mask Decimal Value	Mask Binary Value
Class A	255.0.0.0	11111111.00000000.00000000.00000000
Class B	255.255.0.0	11111111.11111111.00000000.00000000
Class C	255.255.255.0	11111111.11111111.11111111.00000000

Figure A-6   Default Subnet Masks for IP Classes

The IP address and subnet mask work with each other to identify a network element or device. The subnet mask, like an IP address, contains 4 octets separated by a dot (.) and looks similar to an IP address.

The subnet mask determines what bits in the IP address are being used to determine the network ID by using the Boolean math operator **and** in a process called **and**ing. **And**ing compares each bit value in the IP address with the bit value in the subnet mask. The result of the **and**ing process determines which subnet the IP address is on. The Boolean **and** operator works as follows:

$$0 \text{ and } 0 = 0$$
$$1 \text{ and } 0 = 0$$
$$1 \text{ and } 1 = 1$$

The table shown in Figure A-7 shows the **and**ing of two binary values and the corresponding decimal equivalents for each of the values.

	Dotted Decimal Address	Binary Values
IP Address	192.168.2.66	11000000.10101000.00000010.01000010
Subnet Mask	255.255.255.0	11111111.11111111.11111111.00000000
ANDing Result	192.168.2.0	11000000.10101000.00000010.00000000

Figure A-7   ANDing an IP address and a subnet mask

A free calculator, available from SolarWinds, performs these IP and subnet mask calculations and can be found at:

www.solarwinds.com/products/freetools/

Network Segments

A "Network Segment" is a portion of a network that is bordered by two router interfaces as shown in Figure A-8.
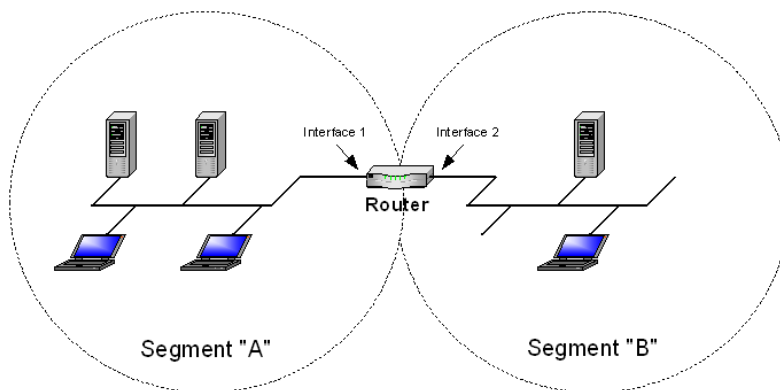
Figure A-8   Network Segments

Each network segment must either be on a different network or a different subnet. For example, if you have a single IP address available, you can change the default mask from 255.255.255.0 to 255.255.255.192. The resulting calculation yields four subnets:

- 192.168.100.0
- 192.168.100.64
- 192.168.100.128
- 192.168.100.192

Each of the four subnets can, in turn, support 64 members.

The example subnet used above yielded 4 subnets, but you can use a different mask to meet the specific requirements of your network.

Default Gateways

A default gateway is a network device, usually a router, that is responsible for routing data packets out of the local network segment.

The address of the gateway is entered into the devices on the local network, providing them with a location to send data that is destined for another segment.

Interface 1
IP: 192.168.150.1
MASK: 255.255.255.0

Interface 2
IP: 10.1.2.1
MASK: 255.0.0.0

Router

Node B
IP: 192.168.150.3
MASK: 255.255.255.0
DGW: 192.168.150.1

Node C
IP: 10.1.2.2
MASK: 255.0.0.0
DGW: 10.1.2.1
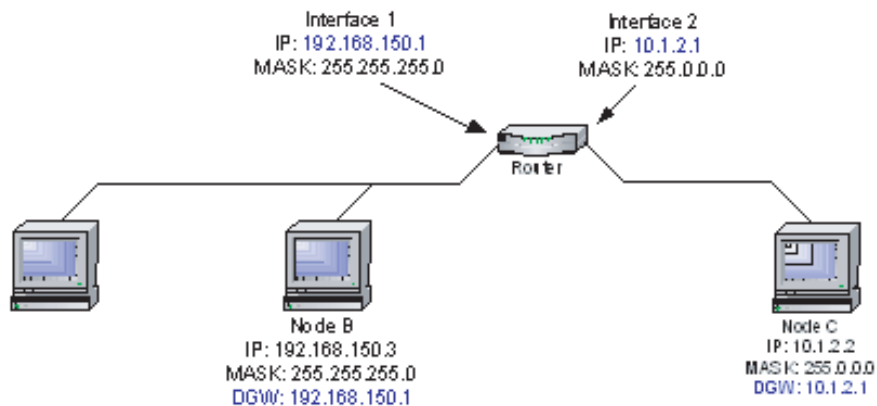
Figure A-9   Router as Default Gateway

MAC Addresses

A MAC address is a physical hardware address that gets assigned to the inter-face of a networking device. This address is typically created and burned into a device's ROM during the manufacturing process. MAC addresses are unique to the device and are not typically user-assignable.

The MAC address is used for Layer 2 (Data Link) communications between networking devices, and consists of 12 alpha-numeric characters as shown in the example below:

Example: **00-3f-bf-00-01-45**

- The first six characters are issued to the organization.

- The second six characters are assigned to the hardware interface by manufacturing.
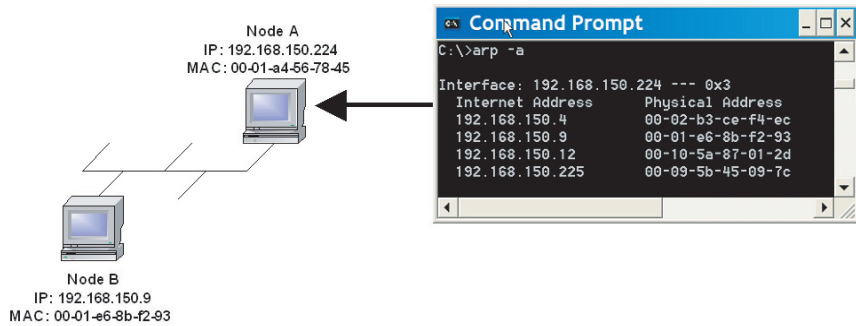
Figure A-10   Network Node MAC Addresses

AUTOMATIC SWITCHING

General

Automatic switching is a feature of the VMS that allows dynamically changing the network configuration in response to changes in either traffic type network traffic loads (Load switching) or Type of Service (ToS) detecting stamped packets with Diffserv values.

The following material applies to the Vipersat SLM-5650A. For purposes of simplicity, these units shall be referred to as modem/routers.

The basic signal topology in a Vipersat network is TDM (Time Division Multiplex) outbound and Vipersat's proprietary STDMA (Selected Time Division Multiple Access) inbound. The STDMA slots can have their duration and bandwidth allotments varied, tailoring bandwidth allocation to meet the bursty traffic load of a typical data network.

When required, a network is switched from STDMA to SCPC. SCPC bandwidth is allocated from a bandwidth pool by the VMS to meet QoS or other requirements for the duration of a connection. When the SCPC connection is no longer required, the bandwidth is returned to the pool for use by another client.

This basic structure gives the VMS-controlled network its flexible, automated network utilization and optimization capability.

The VMS has the intelligence to interpret the constantly changing statistics gathered by the Vipersat modem/routers and uses this data to issue commands back to these intelligent modem/routers, effectively managing the Vipersat network operation in real time, and optimizing each user's bandwidth usage to

meet their QoS and cost requirements within their bandwidth allocation. The result is a stable satellite network connection that automatically responds to the customer's requirements while continuously monitoring and reacting to changing load, data type, and QoS requirements.

Load Switching

Overview

There are three primary functional components involved in the load switching process.

- **Hub STDMA Burst Controller(s)**—These are the Hub units that provide the load switching detection mechanism for Remotes that are operating within the shared channel(s). Hub units that can serve as controllers include CDM-570, CDD-56X, and SLM-5650A.

- **Remote InBand Modem/Routers**—The Remote modem units provide the load switch detection mechanism when operating in dedicated SCPC return channel. These modems include CDM-570 and SLM-5650A.

- **VMS**—The Vipersat Management System provides the switched capacity and resource control for each request generated by the components described above.

Load Switching is the mechanism by which the Vipersat network switches a Remote terminal based on traffic levels at the Remote. This mechanism controls both the switch from STDMA to SCPC mode as well as switches for SCPC capacity changes. The main components of load switching in a Vipersat system: are the VMS (network management) and the Comtech modem/router. The VMS component receives switch requests from the modem/router, and based on policy settings and available resources, either grants or denies the request. Within the modem/router component, load switching is managed at either the Hub or the Remote, based on the current mode of operation. When a Remote is in STDMA mode, load switching requests for that Remote are managed by the Hub STDMA Controller. After a Remote has been switched to SCPC mode, it manages its own switching (or Step Up/Step Down) requests.

NOTE **Note:** For Hub STDMA Controllers operating in either *GIR* (Guaranteed Information Rate) or *Entry Channel Mode*, typical load switching *is not* the mechanism that performs the transition from STDMA to SCPC mode due to traffic load. In GIR mode, the Remote is switched to SCPC as soon as the GIR threshold is reached. In Entry Channel mode, the Remote is switched to SCPC as soon as the Hub receives the first transmission from the Remote.

For both GIR and ECM, the event of switching from STDMA to SCPC can only occur if the SCPC Switch Rate parameter is *set to a value greater than 0* (zero).

The basic concept for all load switching is that a running average of current utilization is maintained, and when that utilization exceeds a preset threshold, a

switch is initiated. The data rate for the switch is computed by determining the current bandwidth requirement of the Remote, and adding some percentage of excess margin.

The main difference between switching from STDMA to SCPC and adjusting within SCPC is that in STDMA mode, the current available bandwidth is constantly changing, while in SCPC mode, it is constant between switches. Furthermore, switches from STDMA to SCPC mode are always caused by the traffic level exceeding the switch rate threshold. Within SCPC mode, switches can be caused by traffic exceeding an upper threshold or dropping below a lower threshold. However, in both cases the new data rate is based on the actual traffic requirements adjusted up by the margin percentage. Also, based on policy settings in the VMS, if a Remote requests less than the specified threshold amount of bandwidth, the Remote is put back into STDMA mode. The exception to this is a Hub controller operating in ECM whose Remotes will remain in SCPC mode but drop down to the specified entry rate.

Bandwidth Allocation and Load Switching by the Hub STDMA Burst Controller

As part of normal STDMA processing, the Hub monitors the traffic levels from each of the Remotes for which it is allocating bandwidth. This is done using the STDMA ACK management message (table B-1) that is transmitted at the beginning of each burst from the Remote. The STDMA ACK contains two metrics that are used by the Hub:

- The number of bytes received for transmission (Queued Bytes) since the last cycle.
- The number of bytes currently waiting to be transmitted (Bytes In Queue).

These metrics are used by the Hub for three purposes:

- Determine the amount of STDMA bandwidth (slot size) to allocate in the next cycle.
- Provide statistics of the amount of activity at each Remote (Average Bytes Received).
- Determine if a Load switch is needed.

Table B-1 STDMA ACK Message

Data Type	Size in Bytes	Description	Unit of Measure	Notes
IP	4	IP Address of Remote	N/A	Used by Remote to identify itself
Unsigned	4	Queued Bytes	Bytes	Total number of bytes queued since last cycle (includes possible buffer overflow)
Unsigned	4	Bytes in Queue	Bytes	Number of bytes currently queued
Unsigned	1	Group Number	N/A	
Unsigned	1	Dropped Buffers	Packets	Number of packets dropped (due to limited bandwidth)

If there is adequate return path bandwidth available, the values of these two metrics will be the same. However, if there is not enough bandwidth to satisfy the traffic requirements of the Remote, or if the Remote has exceeded the maximum allocation, some data will be held for the next cycle. In this case, the number of Bytes in Queue will start to grow and will exceed the Queued Bytes. In other words, the Bytes in Queue is the sum of the data not yet transmitted plus the new data received.

If the condition is due to a short burst of data, the backlogged data will eventually be transmitted and the system will return to a sustainable rate. However, if the overload condition is due to long term increased activity, then the backlog condition will continue to grow and eventually trigger an SCPC switch. If the overload condition lasts long enough, buffer capacity will eventually be exceeded and some data may have to be discarded.

NOTE **Note:** This is not necessarily bad, as it is often more effective to discard old data than transmit it after it has become 'stale'.

The "Bytes in Queue" metric is used to determine the STDMA bandwidth allocated (slot size) for the next cycle; the goal being to keep the data backlog to zero. The Hub uses this metric to compute the slot size for each Remote in the next cycle as follows:

- **Fixed Mode** – All Remotes get the same slot size, regardless of need. This is the only mode that uses a static assignment of available bandwidth; the *Bytes in Queue* metric is not used here.

- **Dynamic Slot Mode –** The slot size for each Remote is computed based on the time (at the current data rate) needed to transmit all the "Bytes in Queue". If the result is less than the minimum slot size or more than the maximum slot size, the slot is adjusted accordingly.

- **Dynamic Cycle Mode –** Available bandwidth is allocated to Remotes proportionally, based on current need. The Bytes in Queue for each Remote is divided by the total Bytes in Queue for all Remotes to determine the percentage allocation of bandwidth for each Remote.

- **GIR (Guaranteed Information Rate) Mode –** Initially computed the same as Dynamic Cycle, except there is no maximum limit. After all Remotes have been assigned slots, the Burst Map is checked to see if the total cycle length exceeds one second. If not, then all requirements are satisfied and the Burst Map is complete. However, if the cycle is greater than one second, then the slots are adjusted proportionally so that all Remotes receive at least their guaranteed rate plus whatever excess is still available.

  In the current design, when the one second restriction is exceeded, Remotes without a specified GIR are reduced to the global minimum slot size and the remaining bandwidth is distributed amongst Remotes that have been assigned a GIR rate. This approach is based on the assumption that Remotes that have been assigned a GIR are paying a premium and should benefit from available excess bandwidth when needed.

  Note that the GIR allocations are restricted so that the assigned GIR totals cannot exceed available bandwidth. If this restriction is somehow violated, then it will not be possible to properly allocate bandwidth when the network is overloaded.

- **Entry Channel Mode –** This is the same as Dynamic Cycle, except that as soon as the Hub receives an STDMA ACK, it initiates a switch to SCPC mode based on the policy set for that Remote.

  Note that load switching is disabled for Remotes that operate in Entry Channel mode.

The important thing to understand about "Bytes in Queue" is that any data that is not transmitted (i.e., does not fit) in the next slot will be reported again in the next STDMA ACK. Thus the "Bytes in Queue" is not necessarily an accurate measure of the actual traffic being passed through the Remote.

The "Queued Bytes" on the other hand, reflects only the data that was received in the last cycle and thus is never duplicated (not including TCP retransmissions). This is the metric that is used for computing average load and initiating a load switch as needed.

Load Switching—STDMA Hub

Before discussing how load switching is determined, it is necessary to explain the modem/router parameters that control the switch.

Hub Switching Parameters

The screen shown in figure B-1 shows the entries in the Automatic Switching page at the Hub that are used to control load switching.

Figure B-1 Hub Load Switching Page

- **Load Switching** – This is a type of Automatic Switching that is based on the amount of traffic at a Remote. If this feature is not enabled, then no Remote in this STDMA group will be switched based on load.

- **STDMA Slot Capacity** – This is a threshold value. When the amount of outbound traffic at a Remote exceeds this percentage of the current STDMA slot capacity, a load switch is initiated. It is important to understand that in most STDMA modes, the amount of bandwidth allocated to a Remote varies with need and thus from cycle to cycle. Thus the amount of traffic that constitutes X% will also vary from cycle to cycle.

  Note for Dynamic Cycle mode:
  Since Dynamic Cycle mode tends to provide no more bandwidth than is needed, Remotes will typically appear to be near 100% capacity whenever they are passing real traffic. Thus, in this mode, if the threshold is set too low, switches will occur unnecessarily.

- **STDMA Switch Delay** – This is a built-in latency that forces a Remote to maintain an average load over some number of seconds after reaching a switch condition before the switch is actually initiated. This prevents switches due to momentary traffic bursts.

- **Percent Allocation** – This is an excess amount of bandwidth that is allocated beyond the current traffic rate when the switch to SCPC is made. For example, if the current average traffic at the time of the switch is 60 kbps, and the **Percent Allocation** is 10%, then the allocation will be for 60k + 6k = 66 kbps.

  Note that, because the Hub always allocates bandwidth in 8 kbps blocks, the 66 kbps will be rounded up to 72 kbps in this example.

Hub Switching Process

Each time the Hub receives an STDMA ACK, it computes the average load for that Remote. This average is then compared to the bandwidth currently allocated to the Remote.

For example, if a Remote gets a 50 ms slot in an upstream that is running at 512000 bps, then it can transmit 0.050 * 512000 = 25600 bits = 3200 bytes. If the Queued Bytes was 3000, then for that cycle, the Remote was at 3000/3200 = 93.75% of capacity. If the current cycle time is exactly 1 second, then the effective data rate of the Remote is also 25600 bits per second. However, if the cycle time is only 500 milliseconds, then the effective data rate is actually 25600/.5 = 51200 bits per second. The effective data rate is important for calculating switch data rates.

If the average bandwidth used exceeds the threshold percentage of available bandwidth, then a flag is set indicating a switch is pending. At this point, the statistics are reset and the traffic load is then computed for the time period specified by the switch delay. At the end of this delay, if the threshold is still exceeded, a switch is initiated. The data rate specified for the switch is determined by taking the current load, as indicated by the bytes queued during the delay period, multiplying it by the percent allocation and rounding up to the next 8 kbps.

A key point is that in most of the STDMA modes, the bandwidth allocated to each Remote is constantly being adjusted to the needs of the network. As long as the network is running below capacity, most Remotes will get the bandwidth they need and a switch will not be required. Only when a Remote requires more bandwidth than is available in STDMA will a switch occur.

In Dynamic Cycle mode, each Remote will always appear to be running at near 100% capacity, even when there is actually excess bandwidth available. This is because in this mode, the Remotes are almost never given more bandwidth than they need. As a result, the algorithm for this mode uses a maximum allowed slot size rather than the actual allocated slot size to calculate the effective data rate. This results in a more accurate estimate of the available STDMA bandwidth.

Load Switching—Remote

Once a Remote has been switched from STDMA mode to SCPC mode, it checks its bandwidth requirements to see if a change is needed. A running average of the data traffic passing over the WAN is maintained as a percentage of the current data rate for the Remote. This average is accumulated for at least the specified delay (Step Up/Step Down) period. Then, once per second, the current utilization is checked against the Step Up and Step Down Thresholds. If the utilization is outside the up/down range, a request is generated to switch to the calculated rate. After the request is granted, the running average is reset and the cycle is repeated.

Remote Switching Parameters

The parameters for controlling the Step Up/Step Down switching process are set in the page shown in figure B-2.

Figure B-2   Remote Load Switching Page

- **Load Switching** – This is a type of Automatic Switching that is based on the amount of traffic at the Remote. If this feature is not enabled, then this Remote will not be switched based on load.

- **SCPC Step Up Threshold** – This is a window threshold that initiates a load switch to a higher data rate when the amount of traffic as measured within the transmit queue exceeds this setting. The value is specified as a percentage of the current data rate.

  Similar to the Hub parameter *STDMA Slot Capacity*.

- **SCPC Step Down Threshold** – Similar to the *Step Up Threshold*, except *Step Down* is used to trigger a switch to a lower data rate when the average traffic load falls below the set value.

- **SCPC Step Delay** – This is a built in latency that forces the Remote to maintain an average load for the specified period (seconds) that exceeds the switch threshold before a switch to a new data rate is actually initiated.

Same as the Hub parameter *STDMA Switch Delay*.

- **SCPC Step Up Excess –** This is an additional amount of bandwidth that is allocated beyond the calculated traffic rate, and is added to each switch request.

  *Note that the value applies to both **Step Up** and **Step Down** switches, and is computed against the average traffic load at the time the switch is initiated*.

  For example, if the current average traffic at the time of the switch is 130 kbps, and the **Step Up Excess** is 10%, then the allocation will be for 130k + 13k = 143 kbps. And because bandwidth is always allocated in 8 kbps blocks, the rate will be rounded up to 144 kbps.

  Same as the Hub parameter *Percent Allocation*.

Determination for Switching

The following process is used to determine if bandwidth utilization warrants a change, and thus a switch to a new data rate.

The operator defines both a Step Up and Step Down threshold in terms of percent utilization, a bandwidth margin value, and a latency or averaging period. Once per second, the modem/router software determines the current percent utilization by dividing the bits transmitted by the current transmit data rate.

If the percent utilization exceeds the step up threshold or is less than the step down threshold for the entire latency period, then a Switch Request is sent to the VMS. The bandwidth requirement in the request is computed by taking the average percent utilization over the latency period and multiplying that by the current data rate to determine the actual data rate used over the measured interval. This number is multiplied by the margin value and rounded up to the nearest 8 kbps to determine the requested bandwidth.

Load Switch Example

An automatic load switching example, illustrated in the schematic diagram in figure B-3, illustrates how a network can respond to changes in traffic volume or load conditions. The network's capability and method of response to load changes is determined by the setting and capability of each of the components in the system, such as the transmitter power output, the antenna capabilities for each of the sites in the network, and the policies set in VMS.

The elements for determining policies and their interactions are covered in this section.
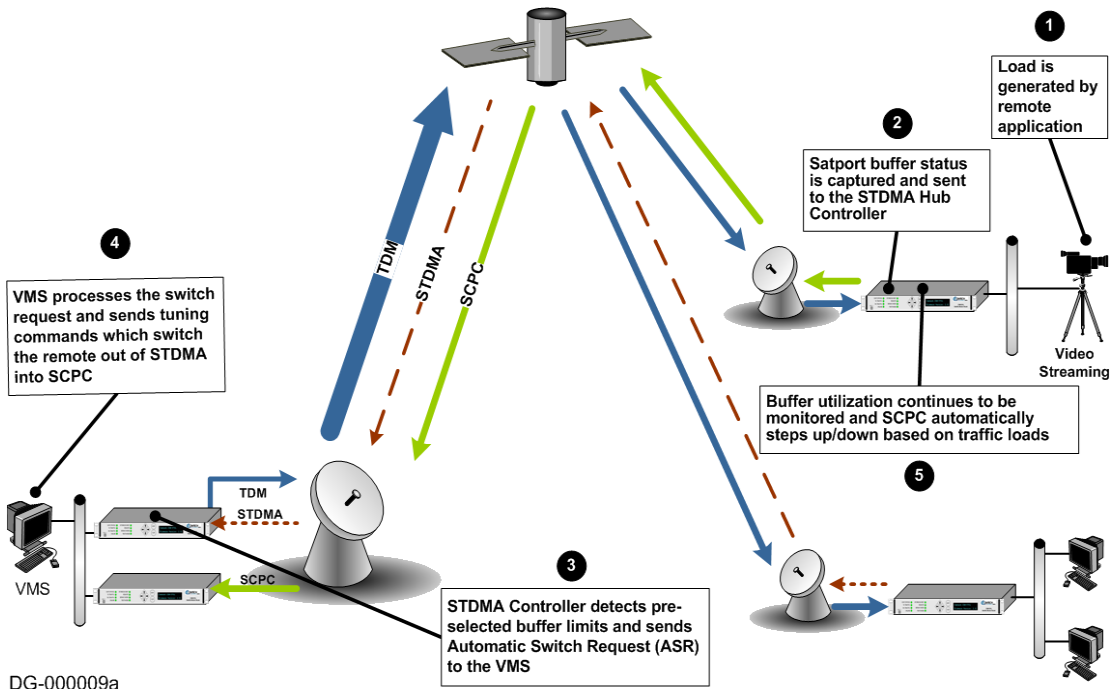
Figure B-3   Load Switching diagram

A load switch is illustrated in figure B-3 using the following process:

1. A load is generated by an application that is running at a Remote. In this example, the application is a video stream.

2. The data is connected to the Remote modem/router over an ethernet link for transmission to the satellite. While the data-stream transmission is in progress, the Satport buffer status is captured and the Remote's buffer status is sent to the STDMA Hub Controller.

3. The STDMA Controller compares the Remote's pre-selected buffer limits with its buffer status and, if the buffer status exceeds the preselected limits, the STDMA Controller increases the time-slot allocated to that channel. If this brings the buffer status within established limits, no further changes are made.

4. If the buffer status continues to exceed the preselected limits, the STDMA Controller sends an ASR to the VMS.

5. The VMS processes the switch request by checking for available resources: first determining if there is a free demodulator, and then determining the

channel space (bandwidth) requirements to accommodate the data flow requested by the STDMA Controller.

6. If the VMS finds available resources, it processes the switch request and sends tuning commands that switch the Remote out of STDMA and into SCPC mode.

The modem/router continuously monitors traffic flow volume. Whenever a preset upper or lower limit is exceeded, the modem/router sends a request to the VMS to change bandwidth by the amount needed to meet the new requirement. By this process, the bandwidth is continuously optimized in real time, precisely accommodating circuit traffic volume.

The ideal condition is for utilization of the channel to reach approximately 90%, thus optimizing the use of available bandwidth. The ability to actually accomplish this is limited by the currently available carrier bandwidth and, ultimately, the power output and antenna size available at the transmitting Remote site.

If the requested bandwidth is not available, the STDMA Controller will continue to receive buffer status reports from the Remote indicating that buffer flow is continuing, and the STDMA Controller will, in turn, continue to request additional bandwidth from the VMS. When bandwidth does become available, the VMS will perform the switch the next time that the STDMA Controller makes the request.

If the video data stream ends before the switch in bandwidth is completed, the channel is closed, the bandwidth which had been allocated is made available again to the pool, and no further action is taken.

Reduced Data Flow in Switched Mode (SCPC)

In the event the data flow is reduced—for example, a streaming file transfer terminates—the SCPC switched demodulator detects the reduced flow and notifies the VMS. The VMS will then send a switch command to reduce the size of the carrier bandwidth to the newly calculated requirement.

This entire process is automatic, following the policies established for the network. The network is dynamically modified, changing configuration to automatically respond to changes to the network's load.

The Home Threshold is the bit rate set to trigger a return to the home condition. This function is used when bandwidth has been allocated to meet load requirements, and then the load has been either removed or partially removed. The Home Threshold is used to determine whether the current bit rate has fallen below this preset level and, if so, the channel is switched back to its home condition (STDMA mode, for example).

ToS Switching

ToS Background

The Type of Service (ToS) byte is an 8-bit field contained within the IP header portion of an IPv4 packet. This field provides a means of marking packets for traffic identification and classification purposes. Devices within the network can utilize the ToS value to classify traffic and apply per hop queuing and Quality of Service (QoS) for different types of traffic.

The first 3 bits of the ToS byte are referred to as IP precedence bits. The IP precedence bits and the next 3 bits combined are known as the Differentiated Services Code Point bits (DSCP). The 6 bits of DSCP allow for 63 discrete traffic identifiers. The DSCP field is the portion of the ToS byte that can be detected by the SLM-5650A modems and can be used for dSCPC switching within a Vipersat network. Figure B-4 provides a graphical representation of the ToS field within an IPv4 packet.
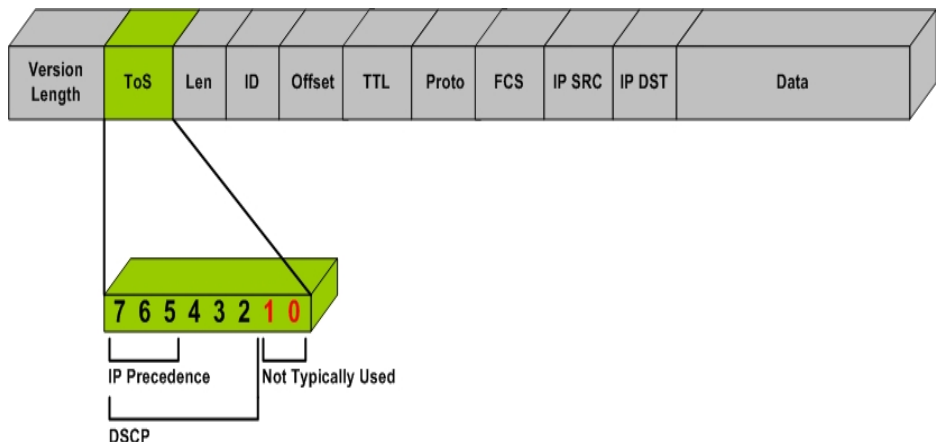
Figure B-4   ToS Field Location within the IP Header

The process of marking a packet with a ToS value is typically done in one of two places, either by the application device itself, i.e. VoIP phone, or by the packet marking capabilities of a network device such as a router.

Encrypted networks often pose additional limitations for prioritizing and classifying traffic. When encryption is applied to an IP packet a majority of the information is no longer available for classification. Application layer protocols can no longer be detected by routers for classification purposes. In many encrypted environments the IP header, which includes the ToS value, typically remains in

the clear and often provides the only mechanism for identifying and prioritize traffic within the network.

The ToS switching feature in the SLM-5650A provides a reliable method for performing automatic dSCPC switching and is the preferred method for most encrypted environments that leave the IP header intact.

Detection of ToS Stamped Packets

The configuration and detection of ToS stamped packets occurs in the Network Processor (NP) card of the remote modem. In the remote modem users define the ToS value in which they wish to detect and also specify the bandwidth to request if detected.

Once a packet with the ToS value is detected the modem will send a switch request to the VMS. The VMS will then determine if policy settings, hardware and bandwidth are available sending out tuning commands to reconfigure transmission communications.

Only IP traffic that is coming from the Ethernet port and is destined for the Satellite interface will trigger a switch. Traffic coming from the hub or another remote will not trigger a switch regardless of the ToS value within the packets. This means that an application or remarking device located at the remote must be the one stamping packets that are transmitted out of the remote site and over the satellite.

A tear down request is sent by the remote modem to the VMS if no more packets are detected with the ToS value after a user definable timeout.

ToS switching can also be utilized in non-encrypted networks. One advantage for this is that each packet associated with the application will have ToS set, thus making ToS switching extremely reliable. A drawback, however, is that unless each application can set a different ToS value, granular resolution per application will be lost.

NOTE **Note:** Only ToS stamped IP traffic that are coming from the Ethernet port of a remote modem and is destined for the Satellite (WAN) interface will trigger a switch request.

Configuration

The ToS switching feature can be configured within the SLM-5650A modem using either the CLI or the Web user interface. For simplicity, the Web interface (figure B-5) will be presented in this example.

Figure B-5 Remote ToS Switching menu

The remote ToS switching is optioned by selecting 'Enable' or 'Disable'. In addition to the enable/disable, the menu provides the ability to create a list of ToS Rules for which a switch will be initiated. In defining these fields, certain characteristics are created depicting what types of switch service connections are established. These fields are described in table B-2.

Table B-2 ToS Switching Settings

Field	Values	Description
Service Name	Text (20 Chars) max	A user defined ID.
ToS	1 - 63	The ToS value for which a switch should occur. Note that 0 can not be used to set a ToS based switch.
Type	64 - 254	The type of Vipersat switch which will occur for this ToS value.
Data Rate	Kbps	The data rate for the switched SCPC link.
Timeout	Seconds	The number of seconds of inactivity before the SCPC circuit will be torn down.

NOTE **Note:** Load switching by the VMS is not affected by enabling ToS detection.

Example Implementations

ToS Switching Per Device

For applications that require an increase in SCPC bit rate for each application device a separate ToS value must be assigned to each device individually. This provides granular switching for each device and also allows a mesh connection to be established for each device independently. Figure B-6 depicts a per device configuration Example.
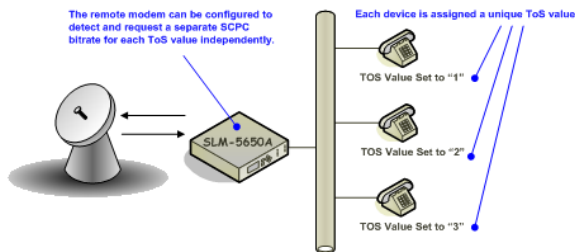
Figure B-6   Per Device ToS Switching Example

ToS Switching Per Traffic Type

For applications that only require a single SCPC bit rate, regardless of the number of active application devices, the same ToS value can be assigned to each device. This method does not provide granular switching for each device and a mesh connection will only be setup for the first device that sends packets with the designated ToS value. Figure B-7 depicts a per traffic type configuration example.
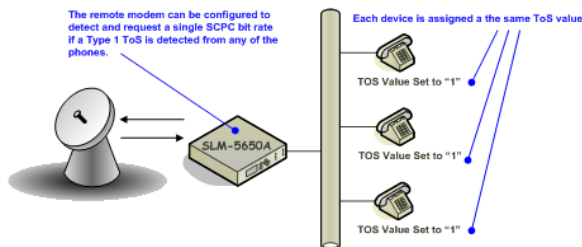
Figure B-7   Per Type ToS Switching Example

ToS Remarking

For situations where the application device is not capable of stamping a packet with a ToS value or where the application traffic is generated by a variety of different host and protocols ToS remarking should be considered. ToS remarking refers to a device, such as a router, that has the capability of re-stamping packets with a user defined ToS value. Devices that support remarking often allow users to assign a ToS value to packets that match, certain source or destination IP addresses, port numbers, and/or protocols.

Example 1: A user wants to switch up whenever a host performs an FTP across the satellite. A device that supports remarking can be placed between the applications and the remote modem. The device can then be configured to stamp all traffic that utilized FTP port 21 with a particular ToS value. The remote modem can then be configured to detect this value and switch to a specific SCPC bit rate.

Example 2: A remote customer is using an IP based video encoder to transmit video over the satellite. The encoder does not have the option to assign a ToS value for prioritization. Again, a remarking device can be placed between the encoder and the remote modem and configured to assign a ToS value to all packets received from the encoder.

Figure B-8 provides an example of a router performing ToS remarking for VoIP phones.
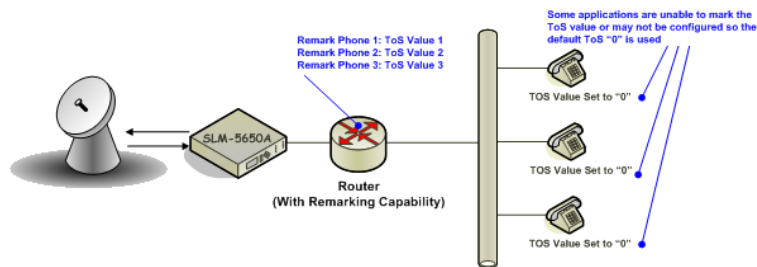
Figure B-8 ToS Remarking Application

ToS to DSCP Value Conversions

Application devices or remarking devices often have different ways of displaying or configuring the ToS or DSCP values used to mark packets. Some devices require the user to input the ToS value while others require input of the DSCP value. Depending on the manufacturer these values may be displayed in binary, hexadecimal, or decimal formats.

The information below can be used to convert between various formats:

Convert from ToS to DSCP - Divide the ToS decimal value by 4

Example: Convert a ToS decimal value of 184 to DSCP

DSCP = 184/4

DSCP = 46

Converting ToS and DSCP to/from Binary - Figure B-9 provides an example of the conversion to and from binary and can also be used to convert to and from ToS and DHCP values.
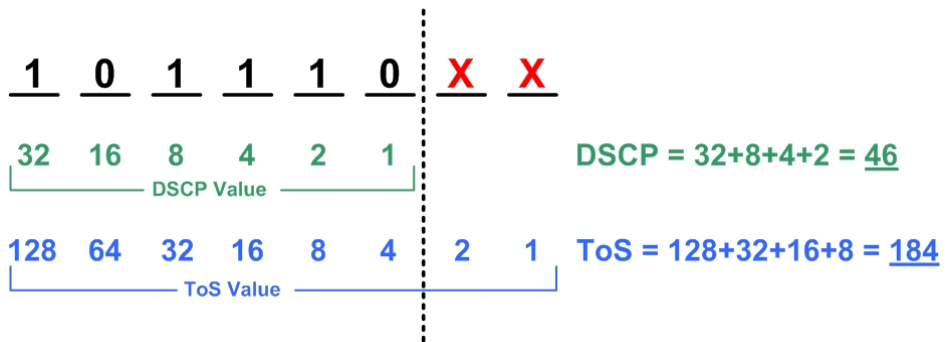
Figure B-9 ToS and DSCP Conversion Chart

Mesh Setup Based on ToS Detection

The detection of a ToS stamped packet by a remote modem has the ability to set up a Single Hop On Demand (SHOD) mesh connection from that remote to another remote within the network. *These SHOD connections assumes that each remote site that is part of the SHOD connection has at minimum one additional demodulation configured as a Remote Expansion.*

When a remote modem detects a packet that has been stamped with a ToS value that matches the user defined value, the modem will look at the destination IP address within the packet. The remote modem will then send an switch request to the VMS requesting the user defined bandwidth. The switch request also contains the destination address that the ToS stamped packet was destined for. The VMS processes the switch request and compares the destination address to the list of known subnets to determine if the destination belongs to another remote within the network. If the address does belong to another remote the VMS will look for available hardware and bandwidth and then issue tuning commands to setup the connection. Each direction of the mesh is setup independently, i.e. detection that occurs at remote 1 will establish a connection from

remote 1 to the other remote involved. However the other remote must also detect.

Entry Channel Mode (ECM) Switching

STDMA Entry Channel Mode provides a method for Remotes requiring SCPC access channels to enter/re-enter the network initially or after a power or other site outage. The switch time will be variable based on the burst rate (bps) of the STDMA group, the number of Remotes with slots in the group, and where in the burst cycle the Remote is when it acknowledges receipt of the Burst Map.

Initial SCPC rates are settable for each Remote in the STDMA group(s). Upon detection of a Burst Map acknowledgement from a Remote, the STDMA Burst Controller will send a switch request to the VMS with the operator-specified initial SCPC rate. Upon determining that there is an available demodulator and pool bandwidth, the VMS will send a multi-command to remove the Remote from the STDMA group, tune it and the switched demodulator to the specified initial bit rate and selected pool frequency. The Remote will stay at this initial rate unless an application (such as VTC) or consistent load cause it to request additional bandwidth from the VMS.

Entry Channel Mode is not driven by the presence or absence of customer traffic. Once in ECM, the switched initial data rate becomes the new temporary Home State. This temporary Home State sets the low limit data load threshold, where the Remote will stop sending load switch request commands. Remotes no longer require Burst Maps to maintain SCPC transmission.

After all Remotes are processed into ECM, the Burst Controller drops into sanity mode, sending a keep alive map to service Remotes which may have their SCPC carrier inhibit flag set. The keep alive message is sent once every two seconds until re-entry is invoked.

Fail-Safe Operation

For Entry Channel Mode switching, it is useful to describe the fail-safe mechanism used for freeing pool bandwidth.

If the VMS loses communications with a switched Remote for more than three minutes, it will attempt to return the Remote to its Home State. If the Revert-to-Home State command succeeds (restoring communications), Entry Channel Mode will cause the Remote to switch to its initial SCPC bit rate.

If the Revert-to-Home State command fails, the VMS will send a command to return the Remote and the Hub demodulator to the state where they were prior to losing communications, but leave the Remote enabled in the STDMA Burst Controller. This provides the Remote with 2 paths to rejoin the network:

1. If the outage was the result of power outage at the site, the Remote will reboot in its Home State (STDMA), then acknowledge the receipt of the first

Burst Map causing it to rejoin the network through ECM. The VMS will park the demodulator previously in use and free the bandwidth slot.

2. If the outage was due to an extended rain fade or other communications blockage with no loss of power, the Remote will rejoin the network via the previously assigned SCPC channel. When the VMS receives a PLDM it will send a Revert-to-Home State command and free the bandwidth slot and burst demodulator. The Remote will then rejoin the network through ECM.

Since it is not possible to know which of the above scenarios caused the communications outage, the VMS will not free the bandwidth slot except through operator intervention.

Figure B-10 and figure B-11 diagram the time state differences and the process of recovery. Note that the times referenced in the diagrams are approximate.

ECM Switch Recovery: < 3min.
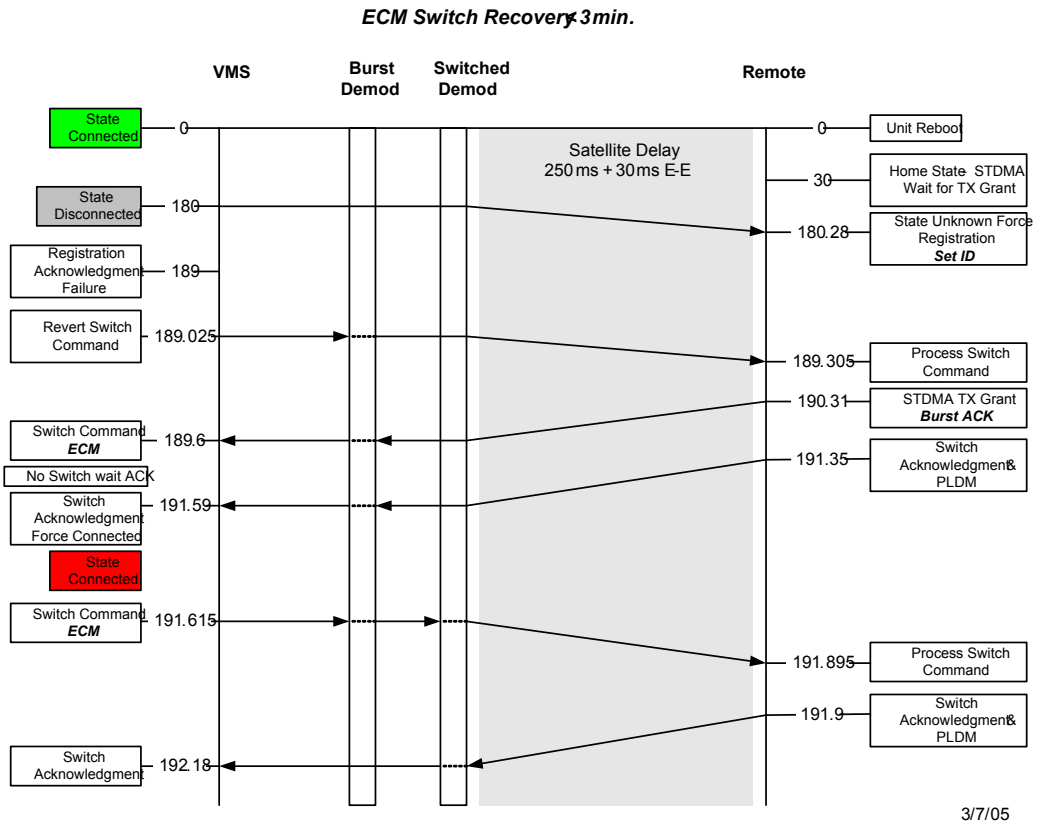
Figure B-10   ECM Switch Recovery: < 3 minutes

ECM Switch Recovery > 3 min.
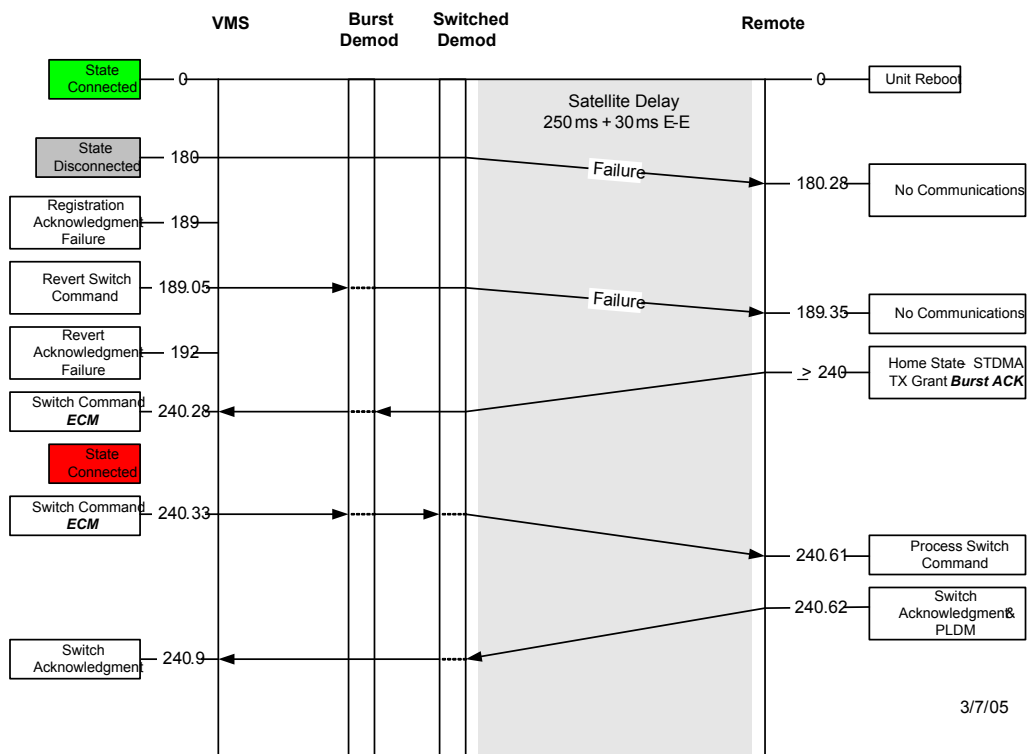
Figure B-11   ECM Switch Recovery: > 3 minutes

C

DYNAMIC POWER CONTROL

Introduction

Dynamic Power Control (DPC) provides a mechanism whereby Vipersat satellite links have their transmit power levels adjusted in order to optimize the receive signal quality, as measured by the corresponding demodulator E_b/N_0. This optimization process acts to either increase or decrease transmitted signal levels in order to:

- Achieve a minimum level of received E_b/N_0 consistent with providing an error-free link.

- Reduce transmit power where sufficient link margin exists in order to optimize station uplink and satellite transponder power usage, and reduce costs.

- Increase link availability when margins apply (typically Ku-band).

DPC can be selectively enabled and disabled on a unit-by-unit basis and functions as both a point-to-point and a point-to-multipoint control. DPC relies on the passing of an IP message between the receive site, where the receive quality is being measured, and the transmit site, where the power level is to be adjusted. These DPC packets are IP unicast messages, directed to the transmit site as forwarded from the corresponding dynamically assigned demodulator(s).

The Vipersat-optioned CEFD modem units have an algorithm that, when activated, automatically adjusts the modulator transmit power to maintain a constant nominal receive signal quality (E_b/N_0) at the corresponding receive site(s). This provides a mechanism to compensate for varying signal levels

caused, for example, by the use of different antenna sizes in a mesh network, or by rain fade conditions. Receive signal quality and use of system resources is optimized, resulting in a reduction in power amplifier intermodulation as well as conservation of satellite transmit power.

The power control algorithm is a closed loop servo-mechanism with the received E_b/N_0 values as the input function and the modulator transmit power as the output function. Only modulator transmit power is controlled by the algorithm since the transmit up-conversion chain is typically a fixed gain block. DPC can be applied to any or all of the modems, with the exception of the STDMA burst control demodulators. Since the STDMA burst demodulators are SCPC fast acquisition receivers, they cannot provide stable signal quality measurements (E_b/N_0). This value is critical in closing the power loop control mechanism.

NOTE

Note: The power control function for a DPC-enabled unit is active only when that unit is operating in SCPC mode, and is inactive when operating in STDMA mode.

Description

The behavior of the Dynamic Power Control feature is designed to regulate power by utilizing the uplink margin to limit the maximum effective transmitted power ($EIRP_C$) of the terminal. The DPC function in the IP-enabled Vipersat-optioned modems provides controls allowing an operator to input site budget numbers that compensate and limit modulator output power. This power is based on link margin and maximum transmission parameter settings (*Data Rate*, *Modulation*, and *Code Rate*), as referenced to Home State base configurations.

The starting point for all enabled modulators is the Home State *Power Level*. This modulator output power is applied during initial system startup and is the baseline power at which the remote site will initially transmit. The modulator will continue to transmit at the baseline power as long as the site remains in STDMA mode.

When the modem is switched out of STDMA mode and into SCPC mode, the modulator will begin to receive DPC packets from the allocated demodulator (DPC must be enabled on both ends of the link). The packets are unicast to the modulator via the IP address. Once the packet is received, the modem then compares the received E_b/N_0 value to the stored value, immediately trimming the transmit power level accordingly. Depending on whether the received value is low or high, the modulator transmit output level is adjusted up or down until the E_b/N_0 meets the defined target for no power adjustment.

If the received E_b/N_0 should, for any reason, fall below a minimum value set by the *Speed Up Eb/No* parameter, then the DPC messages will be transmitted at a faster rate until the nominal level is restored.

BER Waterfall Mapping

DPC *Target Eb/No* values are automatically adjusted using the higher order modulation BER waterfall curves. These BER curves, as defined by the modem specifications, provide greater accuracy of the DPC function throughout all TPC modes. The compensated calculations are based on the received VMS multi-command message for an SCPC switch that configures the frequency, power, bit rate, modulation, and code rate. If the configuration differs from the base settings as compared to the BER table, the Target E_b/N_0 is modified to sustain an acceptable bit performance over all possible waveform configurations.

Delta Power Compensation

When DPC is adjusting power because of environmental conditions, such as rain fade, the adjusted power becomes a delta *DPC Offset* from the *BaseLine Power* parameter setting. This offset is applied to any power value received through remote dynamic switching commands. Briefly described, any DPC

Offset adjustments to the modulator transmit power during rain fade conditions are applied to incoming switch commands from the VMS. This prevents possible link failures due to power value changes associated with changes in bandwidth, modulation, etc.

In more detail, the *BaseLine Power* obtains its value from either the Home State Power Level setting or the power given to the modem by the VMS during the last switch command. At boot-up, and prior to receiving switch commands from the VMS, this parameter will match the *Nominal Power Level* value. If a DPC adjustment occurs due to changes in environment or other factors, the adjustment will appear in the *DPC Offset*, and will remain until environmental conditions change or a unit reset occurs. The resultant modem power will be the combined sum of the *BaseLine Power* and the *DPC Offset*.

Example

A Remote modem has the home state bit rate set at 128 kbps, with a BaseLine Power value of -15 dBm. When the VMS sends a switch command for a new bit rate of 256 kbps, it will send a corresponding power value of -12 dBm (new BaseLine) to compensate for the additional energy required to maintain C/N.

If, prior to a switch, a fade condition causes the power to increase by 2 dB at the home state bit rate, the resulting modem power will be -13 dBm, creating a DPC Offset value of 2 dB. Now when the VMS sends a switch command to 256 kbps, the modem power will be adjusted to -10 dBm (-12 dBm plus 2 dB). This prevents loss of the link due to power value changes based on fade conditions.

This feature is automatic and requires no operator involvement.

Theory of Operation

DPC is referenced from the commissioned Home State settings (*Data Rate* and *Modulator Power Level*). The Home State calibration point relies on the basic antenna commissioning procedures and relative link budgetary numbers. After antenna alignment, the base (clear-sky) modulator power output is adjusted to achieve the desired BER (E_b/N_0), typically while operating in switched SCPC mode at the base rate. This commissioned power and the data rate make up part of the Home State parameters which determine the *BaseLine Power* value that is also set and matched in the VMS site policies.

The Max Power value is converted to power *Margin* control. This positive integer sets the upper limit on any data rate, modulation, and code rate, only allowing power increases per the site Margin level. The example below, figure C-1, shows the Max Power levels for a range of data rates from 64 kbps to 4.096

Mbps. With a set margin of 5 dB, the additive power is never greater than the set level at any rate, but still provides a full range of power, up to the site maximum.

Dynamic Power Control						
64000	Home State nominal DR (bps)					
-27	Home State nominal power (dB)					
5	Margin (dB) or Relative Power Allowance					
Max DR (bps)					New Nominal (dB)	Max Power (dB)
64000	-0.5	1	0	-0.5	-27.1	-22.1
128000	0.5	2	0.30103	30.6029996	-23.9	-18.9
256000	0.5	4	0.60206	60.7059991	-20.9	-15.9
512000	0.5	8	0.90309	90.8089987	-17.9	-12.9
1024000	0.5	16	1.20412	120.911998	-14.9	-9.9
2048000	0.5	32	1.50515	151.014998	-11.9	-6.9
4096000	0.5	64	1.80618	181.117997	-8.9	-3.9

Figure C-1 Data Rate to Power Relationship, DPC

Note that only base rates are used in this example, with no alternative modulation or code rates.

Margins are very important because they are used to compensate for rain attenuation which could be as severe as 8 dB in Ku-band frequencies. The value of the uplink margin depends on the availability numbers set for the link. It should be noted that the E_b/N_0 defines the link quality threshold (target), whereas the margin defines the link availability. The dynamically controlled margin servo-mechanism, tracking the target E_b/N_0, allows the link to operate with calculated quality during clear-sky, adjusting higher during impaired conditions or lower if satellite EIRP or link gain increases. When link gain increases, the DPC has full range to decrease the power to the hardware lower limit, -40 dBm (L-band), -25 dBm (IF).

Additionally, the system is required to cap or limit the site to never exceed the budgetary power. To prevent the use of excessive power (past the saturation point) that will drown out the signal and possibly cause damage to the satellite, the modulator calculates a maximum power value for transmit. This control is accomplished with the DPC command line calculator that determines the maximum achievable budgeted power (EIRP$_C$) for the site. This menu driven calculator (Telnet/CLI and WSI only) allows an operator to enter site budgetary numbers (DPC Margin, Max Data Rate, Max Code Rate, Max Modulation, and Max FEC Type) to determine if the calibrated modulator base value output can achieve the maximum power range, while also limiting the site to the calculated overall Max Power.

The Max Power calculator takes into consideration all the above variables and compares them to the modem BER waterfall curves to determine if the modulator range is sufficient to achieve the budgetary information. If the calculator returns an error [INVALID], the base level is either too high or the set parameters have exceeded the capacity of the equipment.

Warning: The DPC maximum power setting is NO substitute for not configuring the site maximum transmission parameters—bit rate, modulation and power—in the VMS to match budgeted numbers. During dynamic switching commands, the VMS could override DPC limitations, if allowed. All commissioning settings for the site should be matched in the VMS to prevent over-ranging of the DPC maximum set points. See the *VMS User Guide* for site limit settings.

Many variables come into play when calibrating the base value, modem output range, entrance link cable runs (length vs. attenuation), high power amplifier conversion gains, and link budget calculations. Example: if the base data rate value is 64 kbps calibrated to -15 dBm, and the site budget number was 1024 kbps, the resulting modulator Max Power value would surpass the hardware limit (0 dBm, L-band), diminishing the margin efficiency by 2 dB, as shown in figure C-2.

Dynamic Power Control						
64000	Home State nominal DR (bps)					
-15	Home State nominal power (dB)					
5	Margin (dB) or Relative Power Allowance					
Max DR (bps)					new nominal (dB)	Max Power (dB)
64000	-0.5	1	0	-0.5	-15.1	-10.1
128000	0.5	2	0.30103	30.60299957	-11.9	-6.9
256000	0.5	4	0.60206	60.70599913	-8.9	-3.9
512000	0.5	8	0.90309	90.8089987	-5.9	-0.9
1024000	0.5	16	1.20412	120.9119983	-2.9	2.1
2048000	0.5	32	1.50515	151.0149978	0.1	5.1
4096000	0.5	64	1.80618	181.1179974	3.1	8.1

Figure C-2 Excessive Max Power Example

If the gain in the HPA is increased or the cable length/attenuation is reduced, the modulator output could be decreased by 3 dB or more and the site could achieve the max rate with a 1 dB site margin to spare.

Note: When configuring the site for Max Data Rate, the system operator must test (commission) the antenna at the max rate to ensure that the relative leveling of the uplink power does not exceed the 1 dB gain compression

point of the HPA. *See "Signal Power Level Considerations" on page C-15 for more information*.

Configuration

The DPC menus (CLI, Parameter Editor, WSI) provide configuration and calibration control to set up the site maximum power level. Note, however, that the Parameter Editor and the WSI only support a subset of what is available in the Command Line Interface (CLI). The DPC menu items are divided into two parts, the maintenance parameters (*DPC Main Menu*, table C-1) and the calibration parameters (*Calculate Max Power Menu*, table C-2).

Table C-1 and table C-2 show the complete list of the operational parameters for DPC.

Table C-1 DPC Parameters, Main Menu

Parameter	Menu	Default	Description
DPC Enable	Main; Modulator, Demodulator	Disabled	Modulator/demodulator DPC feature control; must be Enabled on both ends of link to operate.
Max Power	Main; Modulator	Display Only	Maximum transmit power level permitted; system-calculated site budgetary number.
Calculate Max Power	Main; Modulator	Sub-Menu	Select to enter *Calculate Max Power* menu.
Target Eb/No	Main; Modulator	10.0 dB	Target E_b/N_0 value for which DPC is aiming; static setting on modulator, dynamic on assigned demodulator(s).
Speed Up Eb/No Range	Main; Modulator, Demodulator	5.0 dB	DPC process speeded up from default (30 sec interval); if E_b/N_0 is outside the range, interval is reduced to 10 sec.
Target DPC (IP) Address	Main; Modulator, Demodulator	0.0.0.0	Identifies the modem that is transmitting to this device and will receive E_b/N_0 values. All InBand systems should remain default (not defined).
BaseLine Power	Main; Modulator	Display Only	Either the Home State Power Level setting, or the power given to the modem by the VMS during the last switch command.
DPC Offset	Main; Modulator	Display Only	The difference between BaseLine Power and adjusted SCPC power control.

Table C-1 DPC Parameters, Main Menu

Parameter	Menu	Default	Description
SOTM Offset	Main; Modulator	Display Only	Satcom-On-The-Move hunt power adjustment when operating in STDMA mode. When enabled, this offset value is applied to the BaseLine Power when switching into SCPC mode. *Used for Roaming feature.*
Margin	Main; Modulator	Display Only	The site power margin as used in Max Power calculation. *See Calculate Max Power for more details.*

Table C-2 DPC Parameters, Calculate Max Power Menu

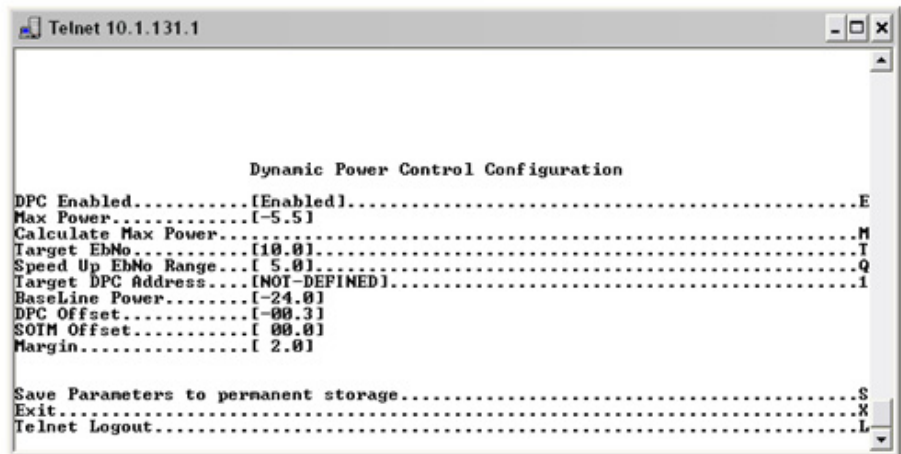| Parameter	Menu	Default	Description
Calibrated Data Rate	Calculate Max Power; Modulator	Display Only	The Home State or base value Data Rate from initial configuration and commissioning.
Nominal Power Level	Calculate Max Power; Modulator	Display Only	The Home State or base value Power Level from initial configuration and commissioning.
DPC Margin	Calculate Max Power; Modulator	5.0 dB	The site power Margin given by the calculated link budget, used to provide adjustment in clear or diminished conditions.
Max Data Rate	Calculate Max Power; Modulator	1024000 bps	The site maximum Data Rate given by the calculated link budget, used to provide stop limit adjustment in clear or diminished conditions. *See modem specifications for valid range.*
Max Code Rate	Calculate Max Power; Modulator	Rate 3/4	The site maximum Code Rate given by the calculated link budget, used to provide stop limit adjustment in clear or diminished conditions. *See modem specifications for valid range.*
Max Modulation	Calculate Max Power; Modulator	QPSK	The site maximum Modulation given by the calculated link budget, used to provide stop limit adjustment in clear or diminished conditions. *See modem specifications for valid range.*
Max FEC Type	Calculate Max Power; Modulator	Undefined	The site maximum FEC Type given by the calculated link budget, used to provide stop limit adjustment in clear or diminished conditions. *See modem specifications for valid range.*

Table C-2   DPC Parameters, Calculate Max Power Menu

Parameter	Menu	Default	Description
Calculate Max Power	Calculate Max Power; Modulator	Calculate Command	After entering all maximum budgetary settings, this menu command will generate the Max Power value for the modulator.
Max Power	Calculate Max Power; Modulator	Display Only	The calculated modulator maximum Power at all maximum settings (Data Rate, Code Rate, Modulation, FEC Type). Controls upper limit of modulator output power.

Main DPC Menu

The main menu provides the basic configurable parameters: Enable DPC, Target Eb/No, Speed Up Eb/No Range, and Target DPC Address. Each of these main menu parameters are configurable from either the CLI or the Parameter Editor, as shown in figure C-3 and figure C-4.

For simplicity, only CDM-IP menus are shown.

When using the CLI, select **Dynamic Power Control** from the main Vipersat Configuration menu. When using the Parameter Editor, click on **DPC** from the tree list.


```
 Telnet 10.1.131.1                                                    _ □ ×


                       Dynamic Power Control Configuration
DPC Enabled...........[Enabled]...................................................E
Max Power.............[-5.5].....................................................
Calculate Max Power...................................................................M
Target EbNo...........[10.0].....................................................T
Speed Up EbNo Range...[ 5.0].....................................................Q
Target DPC Address....[NOT-DEFINED]..............................................1
BaseLine Power........[-24.0]
DPC Offset............[-00.3]
SOTM Offset...........[ 00.0]
Margin................[ 2.0]


Save Parameters to permanent storage.............................................S
Exit.............................................................................X
Telnet Logout....................................................................L
```

Figure C-3   DPC Configuration screen, CLI

As can be seen, the Maximum Power is display only. The Margin is also display only, as shown in these two figures. These parameter settings can only be

changed from the CLI Calculate Max Power menu (figure C-5). The calculator function is not available from the Parameter Editor because it does not contain the information for the modem BER waterfall curves, which is vital to calculate maximum power. Consequently, the Parameter Editor provides display-only values for the maximum settings from when the parameter file was acquired from the modem. Thus, this dialog (figure C-6) is labeled DPC *Calibration* rather than Calculation.
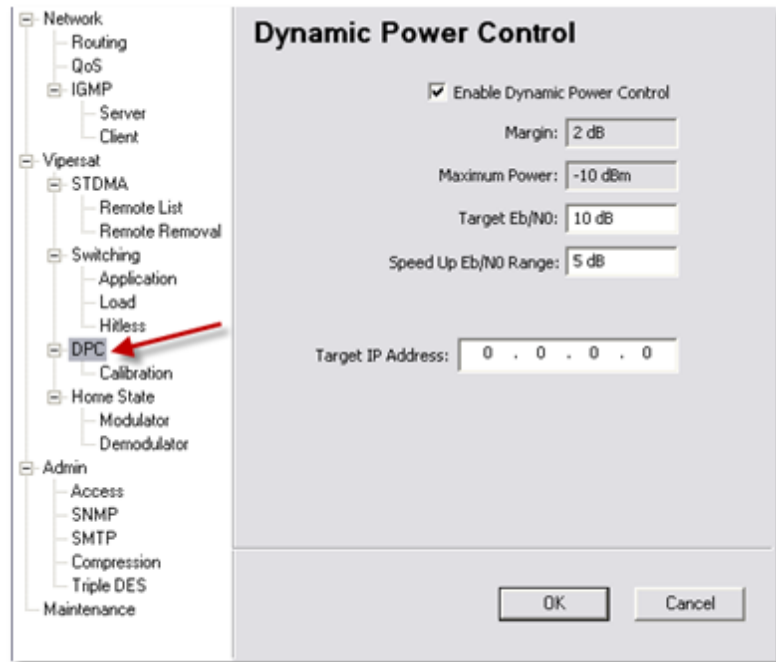

Figure C-4 DPC dialog, Parameter Editor

Enable DPC

When implementing the DPC function, it is necessary to enable DPC for each modem that will utilize this feature and any of the corresponding demodulator devices that it may link with, as the function is a peer-to-peer protocol.

Target Eb/No

The Target Eb/No value is entered as defined in the site link budget calculations and provides the desired signal strength for the DPC process, which is a closed loop servomechanism. The modulator closed loop servomechanism relies on an IP packet (message) that is generated by the corresponding receiving demodulator (distant end), is sent every 30 seconds, and contains a processed E_b/N_0

carrier value. When this value is received by the transmitting modulator, it is compared to the set value; if they are different, the modulator servos its output power level to achieve the targeted E_b/N_0 level.

The modulator DPC function can support multiple demodulators as assigned by the system. As each active demodulator is assigned, a separate DPC message is received invoking the modulator process to add the demodulator to a list, which is then scanned to determine the worst case demodulator. After each scan, the demodulator with the lowest E_b/N_0 is posted for the next DPC power servo cycle. This process is repeated upon reception of each demodulator DPC message. The list is renewed every 65 seconds and if, for any reason, a demodulator fails to respond during active cycles, it is removed from the list.

Speed Up Eb/No Range

Normally, the DPC message is sent every 30 seconds from the corresponding receiving demodulator(s) in the network. The *Speed Up Eb/No Range* is a window value centered on the modulator set Target Eb/No value. However, the demodulator does not have a user settable target value; it would be impossible to predetermine this value for active demodulators, as they are dynamically assigned during switch setup. On the flipside, the modulator does have this value and, upon reception of the first DPC message from the corresponding demodulator(s), it sends a message back to the demodulator for setting the Target Eb/No value.

Now, if the measured demodulator E_b/N_0 value falls outside the window range, the demodulator DPC process will increase the message interval rate to every 10 seconds until the measured value is back within the set range.

Target DPC (IP) Address

In a standard Vipersat network where the modems are being used as switched InBands, the VMS handles the assignment of the target IP address for the receive units. When a remote is switched into SCPC mode and DPC is enabled, the VMS writes the corresponding modulator IP address into the allocated demodulator, hub or remote. This particular control is reserved for Out-of-Band devices only, because in this case the system <u>does not</u> automatically assign this target address. *This entry is left as default 0.0.0.0 for dynamic SCPC usage*.

Calculate Max Power Menu

Using the CLI, selecting *Calculate Max Power* from the DPC Main menu will present the Calculate Max Power menu, as shown in figure C-5. Note that the Parameter Editor presents the calibrated values for visual reference only, as shown in figure C-6, and does not provide the calculate function.

This calculator uses the site budgetary numbers to determine the maximum power value when operating at peak transmission settings. After the operator enters all parameters and selects the *Calculate Max Power* command, the calculator compares the values to base numbers and selected BER tables to determine the power budget based on the total margin.
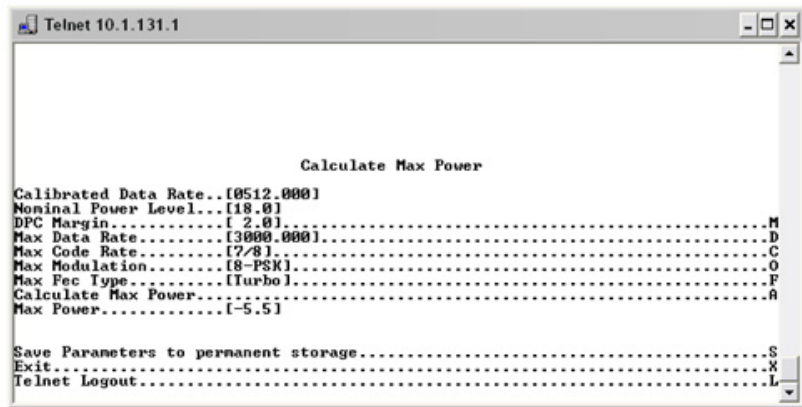

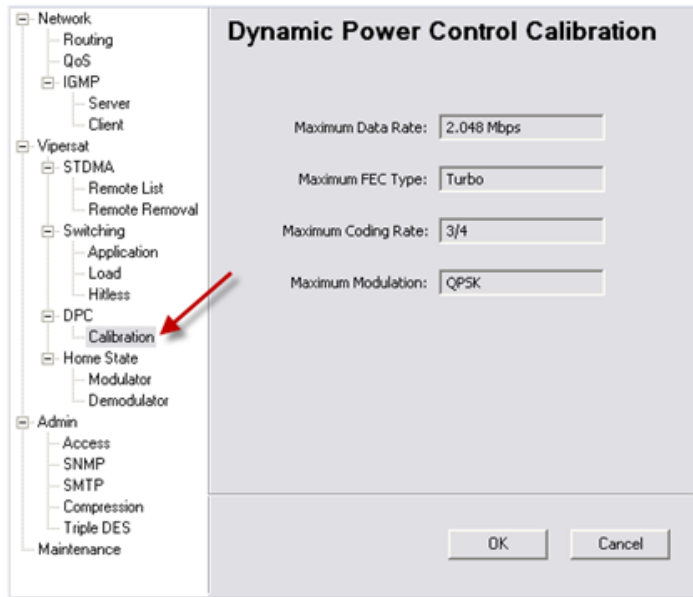**Figure C-5** DPC Calculate Max Power screen, CLI

Figure C-6 DPC Calibration dialog, Parameter Editor

Calibrated Data Rate

This is the Baseline Home State Data Rate and is used as the base reference value to calculate the maximum DPC Margin.

DPC Margin

The Margin setting governs the upper power limit for all combinations of waveforms given.

Nominal Power Level

This is the Baseline Home State modulator Power Level and is used as the base reference value to calculate the maximum DPC Margin.

Max Data Rate

This is the Maximum Data Rate achievable as calculated through site budgetary numbers.

Max Code Rate

This is the Maximum Code Rate achievable as calculated through site budgetary numbers.

Max Modulation

This is the Maximum Modulation achievable as calculated through site budgetary numbers.

Max FEC Type

This is the Maximum FEC Type achievable as calculated through site budgetary numbers.

Calculate Max Power

This is the command to generate a maximum achievable modulator site power as calculated using each of the budgetary numbers. If the entrance link cabling attenuation and High Power Amplifier gain variables are balanced, the calculation will return a modulator output value within equipment limits. If any one of these uplink variables is under or over, the returned value will display INVALID.

See "Signal Power Level Considerations" on page C-15 for more information.

Max Power

After entering all site budgetary numbers and selecting the Calculate Max Power command, the system processes the max settings against the BER tables to determine and display the site maximum power limit. This maximum power value is achieved only when all parameters are dynamically set to maximum and the environmental conditions are at diminished capacities.

Signal Power Level Considerations

There are many parameters to consider when planning and commissioning a site for satellite transmission. Among the most important are selections for location, antenna size, and High Power Amplifier. Do not forget entrance link cabling. These pre-selections determine maximum operability of the site in freedom of range and limitations. Uplink power gain limitations and cable losses are the main focus of this section.

The following sub-sections describe the basic segments in adjusting uplink gains to properly achieve a balance between minimum and maximum transmission throughputs.

The example block diagram shown in figure C-7 represents a typical remote station with relevant signal power levels in the transmit and receive chain.
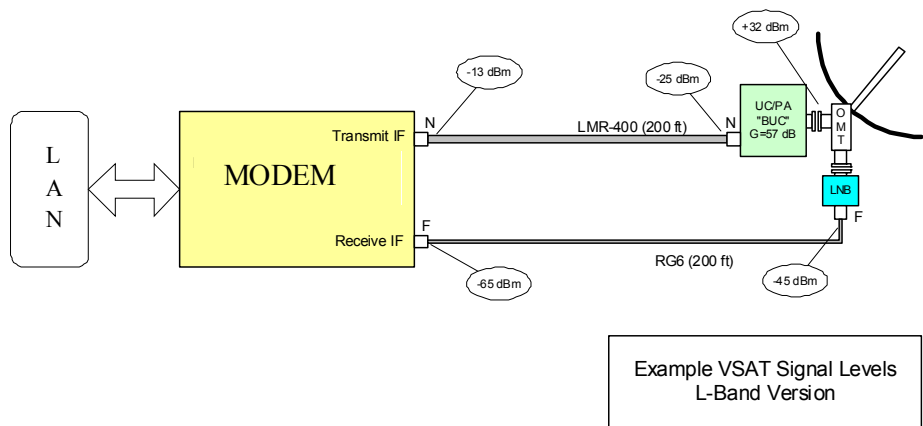
Figure C-7   Signal Power Levels, Remote Site

There is virtually no control over the receive signal levels short of setting the antenna size, as the demodulator uses a sliding AGC window with an approximate AGC range of 55 dB at any given data rate.

However, the transmit levels must be carefully controlled. Most BUCs have no internal gain control and therefore represent a fixed gain block. The output power is thus directly proportional to the input level, up until the amplifier is driven to its 1 dB gain compression point (P1dB), beyond which the output level no longer increases (nonlinear). Some types of amplifiers (such as TWTs) will actually result in a lower output level as the input is increased. What is important, therefore, is to know the maximum input level of the BUC, or the gain and P_{out} at the 1 dB compression point. The maximum modulator output

level is then calculated based on the BUC's P_{in} max minus the transmit cable loss.

The levels shown in the example above assume a transmit cable loss of about 12 dB. Apply this calculated value to the returned Max Power value to determine if *one*, the maximum power is within gain/loss limits and *two*, the total range is achievable.

Power Considerations

The amount of power is defined by the link budget. As a rule of thumb, there should be at least 2 dB of headroom (margin) left when operating at the highest bit rate that the remote is expected to transmit at C-band. Ku-band should typically have 5 or 6 dB of headroom to compensate for rain fade. Transmission equipment works best when it is operated mid range. Typically, any BUC larger than 8 W will need an external power supply.

Cabling Considerations

L-band frequencies are much more susceptible to signal loss over cable runs than IF frequencies in the 70/140 MHz range. For example, RG214 is commonly used for IF frequency runs. At 70 MHz, the loss per 100 ft of cable is approximately 1.7 dB. However, at 1.2 GHz (L-band), the loss is more than 8 dB. A higher quality cable such as LMR400, which exhibits approximately 4.5 dB of loss per 100 feet, is recommended. Note, however, that in some cases—such as short cable runs—additional losses may be required to maintain that balance between min/max ranges.

It is much simpler to add/subtract excess cable to increase/decrease losses for proper adjustment. The alternative of inserting an attenuator that can pass power to the BUC is considerably more expensive.

The transmit cable must carry a heavy current on the order of 1 to 5 amps to power the BUC/PA. The DC resistance and cable voltage drop must allow this gear to receive their minimum voltage, plus enough margin for variation with time and temperature.

The transmit and receive cables must be separated and definitely not bundled directly together with cable ties, especially on longer runs because of the tremendous difference between the transmit and receive levels. This is made worse on long cable runs because the modem end will have higher transmit levels and the receive end will have lower levels than on a short run. The better cables in this regard have double shielding (two braids or a braid/foil combination) and a shielding efficiency of 100 dB or better.

A good note here is that, with the typical LO frequencies as shown in the example above, transmit and receive L-band frequencies are widely separated. If the signals were within the LNB stability/drift frequency limits, there might be a tendency for the receive side to attempt locking to its own transmit signal.

Considering the L-band IF range is 950 MHz or more spanning close to an octave, the variation in loss between the high and low ends of the IF range may be significant.

A nominal design point may be to allow for 10 to 15 dB of total cable loss and select cable that will reliably achieve this. A more accurate "rule of thumb" would be to design for a total gain from the antenna to modem receive input of -40 dBm. For example, if the receive LNB has a gain of 60 dB and there are no other losses, then the cable can have a maximum loss of 20 dB (60 – 40 dB). In formula form this is:

Loss (cable max) = Gain (LNB) – 40 – Loss (misc)   in dB

Or, for the transmit side, the cable loss should not keep the input to the BUC from reaching its Power input for 1 dB compression point. Arbitrarily allowing a 3 dB margin in the modem output, this formula would be:

Loss (cable max) = +3 – BUC Pin (1dB) – Loss (misc)   in dB

Notice that this assumes no miscellaneous losses in the transmit or receive side, but there may be other losses such as from a splitter or output sample port, if used.

See table 6-1 below for typical cable characteristics (note that cable prices are estimates only).

Table C-3   Typical Coaxial Cable Characteristics

Cable Type	Max. Freq. (MHz)	O.D. (inch)	Loss/100 feet (dB) @1.2 GHz	Shielding Efficiency (dB)	Estimated Cost/ft. (USD)
RG58 (50Ω)	1,000	0.19	21.0	70	0.39
RG59 (75Ω)	1,000	0.25	18.0	70	0.39
RG6 (75Ω)	2.200	0.25	10.0	>90	0.89
RG11 (75Ω)	2.200	0.405	5.0	>90	0.89
Times LMR-240 (50Ω)	5,000	0.24	9.2	>90	0.47
Times LMR-300 (50Ω)	5,000	0.30	6.8	>90	0.53

Table C-3   Typical Coaxial Cable Characteristics

Cable Type	Max. Freq. (MHz)	O.D. (inch)	Loss/100 feet (dB) @1.2 GHz	Shielding Efficiency (dB)	Estimated Cost/ft. (USD)
Times LMR-400 (50Ω)	5,000	0.405	4.8	>90	0.64
Times LMR-600 (50Ω)	5,000	0.59	3.1	>90	1.30
Belden 9913 (50Ω)	5,000	0.405	5.2	>90	0.60
RG214 (50Ω)	5,000	0.405	10.1	>90	1.70
3/8-inch LDF (50Ω)	5,000	0.44	4.1	>90	1.89
½-inch Superflex (50Ω)	5,000	0.52	4.2	>90	1.89

D

GLOSSARY

A

ACK   A signal used in computing and other fields to indicate **ack**nowledgement, such as a packet message used in TCP to acknowledge the receipt of a packet.

ARP   **A**ddress **R**esolution **P**rotocol – A protocol for a LAN device to determine the MAC address of a locally connected device given its IP address. See also MAC.

ASR   **A**utomatic **S**witch **R**equest – A switch request message generated by older Vipersat modems (e.g., CDM-570/L) that is sent to the VMS to establish a new satellite link or adjust bandwidth between source and destination IP addresses.

B

Base Modem   The main component in a satellite communications modem that consistes of a circuit board with the modem hardware and firmware and the associeated inter-faces.

BER   **B**it **E**rror **R**ate (sometimes **R**atio) – A measure of the number of data bits received incorrectly compared to the total number of bits transmitted.

bps   **b**its **p**er **s**econd – A measure of the bit rate or transmission speed of a digital communication link. See also *kbps* and *Mbps*.

BPM	**B**ridge **P**oint-to-**M**ultipoint – Routing mode option available in the SLM-5650A satellite modem.
BPSK	**B**inary **P**hase **S**hift **K**eying – Sometimes referred to as 2-PSK. A digital modulation technique in which the carrier is phase shifted +/-180 degrees (two phases). The simplest and most robust of all PSKs, but unsuitable for high data-rate applications when bandwidth is limited due to encoding just one bit per symbol. See also *QPSK* and *OQPSK*.
BUC	**B**lock **U**p **C**onverter – An upconverter so called because it converts a whole band or "block" of frequencies to a higher band. The IF is converted to final transmit frequency for satellite communications. The BUC is part of the satellite ODU/transceiver.

C

C-band	A frequency band commonly used for satellite communications (and sometimes terrestrial microwave). For terrestrial earth stations, the receive frequency band is 3.7–4.2 GHz and the transmit frequency band is 5.925–6.425 GHz. See also *Ku-band* and *L-band*.
CDD	**C**omtech **D**ata **D**emodulator
CDM	**C**omtech **D**ata **M**odem
CIR	**C**ommitted **I**nformation **R**ate – The guaranteed minimum bandwidth assigned to a remote terminal.
CLI	**C**haracter **L**ine **I**nterface – A mechanism for interacting with a computer operating system or software by typing commands to perform specific tasks.
Codecast	A network coding based ad hoc multicast protocol well-suited for multimedia applications with low-loss, low-latency constraints. Because data is streamed with no verification, high delivery ratios are obtained with very low overhead.
CRC	**C**yclic **R**edundancy **C**heck – A method of applying a checksum to a block of data to determine if any errors occurred during transmission over communications links.
CXR	Carrier – A radio frequency transmission linking points and over which information may be carried.

D

DAMA **D**emand **A**ssigned **M**ultiple **A**ccess – A process whereby communications links are only activated when there is an actual demand.

dBm **D**eci**b**el referenced to 1 **m**illiwatt.

DES **D**ata **E**ncryption **S**tandard – A federal standard method for encrypting information for secure transmission. The Vipersat system offers 3xDES (Triple DES) for encrypting traffic.

DHCP **D**ynamic **H**ost **C**onfiguration **P**rotocol – An Internet protocol for automating the configuration of computers that use TCP/IP.

DLL **D**ynamic **L**ink **L**ibrary – The implementation of the shared library concept in the Microsoft Windows system.

DPC **D**ynamic **P**ower **C**ontrol

DSCP **D**ifferentiated **S**ervices **C**ode **P**oint – The 6-bit field in an IP packet header that is used for packet classification purposes and is the portion of ToS that is detected by Vipersat modems.

DVB **D**igital **V**ideo **B**roadcasting – A suite of internationally accepted open standards for digital television. DVB-S, DVB-S2, and DVB-RCS are the standards utilized by satellite services.

DVP **D**igital **V**oice **P**rocessor – Used in packet voice applications.

E

E_b/N_0 The ratio of E_b (energy per bit) and N_0 (noise power density per Hz). The bit error rate (BER) for digital data is a decreasing function of this ratio. E_b is the energy of an information bit measured in Joules or, equivalently, in Watts per Hertz.

F

FAST Code **F**ully **A**ccessible **S**ystem **T**opology Code – Designation for feature code used by Comtech EF Data for their satellite modems. The FAST method makes it

easy to quickly upgrade the feature options of a modem while it is running live in the network, either on site or remotely.

FDMA **F**requency **D**ivision **M**ultiple **A**ccess – A technique where multiple users can access a common resource (e.g. satellite) by each being allocated a distinct frequency for operation. See also *TDMA* and *STDMA*.

FEC **F**orward **E**rror **C**orrection – A process whereby data being transmitted over a communications link can have error correction bits added which may be used at the receiving end to determine/correct any transmission errors which may occur.

Flash Non-volatile computer memory that can be electrically erased and repro-grammed.

Forward Path Transmission path from the Hub site to a Remote site.

FTP **F**ile **T**ransfer **P**rotocol – An application for transferring computer files over the Internet. See also *TFTP*.

G

G.729 ITU standard for LD-CELP (Low Delay – Code Excited Linear Prediction) voice encoding at 8 kb/s.

GIR **G**uaranteed **I**nformation **R**ate

Group ID A number assigned to equipment which defines it as a member of a group when addressed by the VMS burst controller.

GUI **G**raphical **U**ser **I**nterface – A form of graphical shell or user interface to a computer operating system or software application.

H

H.323 A protocol standard for multimedia communications designed to support real-time transfer of audio (such as voice over IP) and video data over packet networks. Quality of Service is a key feature of H.323. An alternative to SIP.

HDLC **H**igh Level **D**ata **L**ink **C**ontrol – A standard defining how data may be transmit-ted down a synchronous serial link.

HPA **H**igh **P**ower **A**mplifier – The amplifier used in satellite communications to raise the transmit signal to the correct power level prior to transmission to satellite.

HTTP **H**yper **T**ext **T**ransfer **P**rotocol – The Internet standard for **W**orld **W**ide **W**eb (**WWW**) operation.

Hub The central site of a network which links to a number of satellite earth sites (Remotes).

I

ICMP **I**nternet **C**ontrol **M**essage **P**rotocol

IDU **In**d**o**or **U**nit – In a VSAT system, the satellite modem is referred to as the IDU.

IF **I**ntermediate **F**requency – In satellite systems, IF frequencies are usually centered around 70/140 MHz (video/TV), or 1200 MHz (L-band).

IFL **I**ntra-**F**acility **L**ink – The coaxial cabling used to connect the satellite ODU to the IDU. Carries the inbound and the oubound signals, and the 24 VDC for the LNB.

Image A binary firmware file that provides the operational code for the processor(s) in a network unit.

IP **I**nternet **P**rotocol – A format for data packets used on networks accessing the Internet.

ISP **I**nternet **S**ervice **P**rovider – A company providing Internet access.

ITU **I**nternational **T**elecommunications **U**nion

K

kbps **k**ilo **b**its **p**er **s**econd – 1000 bits/second. A measure of the bit rate or transmission speed of a digital communication link. See also *bps* and *Mbps*.

Ku-band A frequency band used for satellite communications. For terrestrial earth stations, the receive frequency band is in the range 10.95–12.75 GHz and the transmit frequency band is 13.75–14.5 GHz. See also *C-band* and *L-band*.

L

L-band A frequency band commonly used as an IF for satellite systems using block up/down conversion. Typically 950–1450 MHz Rx, 1250–1750 MHz Tx. See also *C-band* and *Ku-band*.

LAN **L**ocal **A**rea **N**etwork

LLA **L**ow **L**atency **A**pplication

LNA **L**ow **N**oise **A**mplifier – An amplifier with very low noise temperature used as the first amplifier in the receive chain of a satellite system.

LNB **L**ow **N**oise **B**lock – A downconverter so called because it converts a whole band or "block" of frequencies to a lower band. The LNB (similar to an LNA) is part of the satellite ODU/transceiver.

LNC **L**ow **N**oise **C**onverter – A combined low noise amplifier and block downconverter, typically with an L-band IF.

LO **L**ocal **O**scillator – A component used in upconverters, downconverters, and transponders for frequency translation (heterodyne) of the carrier signal.

M

M&C **M**onitor **&** **C**ontrol

MAC **M**edia **A**ccess **C**ontrol – A protocol controlling access to the physical layer of an Ethernet network.

Mbps **M**ega **b**its **p**er **s**econd – 1 Million bits/second. A measure of the bit rate or transmission speed of a digital communication link. See also *bps* and *kbps*.

Modem **Mod**ulator and **dem**odulator units combined.

Multicast Transmitting a single message simultaneously to multiple destinations (group) on the IP network.

Multi-command A command that allows multiple input choices in a single command execution.

N

NAT   **N**etwork **A**ddress **T**ranslation – An Internet standard that enables a LAN to use one set of IP addresses for internal (private) traffic and a second set of addresses for external (public) traffic.

NIC   **N**etwork **I**nterface **C**ontroller – The network interface for a PC/workstation that provides Ethernet connectivity. Depending on the computer, the NIC can either be built into the motherboard, or be an expansion card. Some computers (e.g., servers) have multiple NICs, each indentified by a unique IP address.

NMS   **N**etwork **M**anagement **S**ystem

NOC   **N**etwork **O**perations **C**enter – The main control center for network operations. A NOC can interrogate, control, and log network activities for the satellite Hub as well as any Remote node.

NP   **N**etwork **P**rocessor – Also referred to as the IP Module. An optional assembly for Comtech EF Data modems that provides the 10/100 BaseT Ethernet interface that is required when used in Vipersat networks.

O

ODU   **O**ut**d**oor **U**nit – In a VSAT system, the RF components (transceiver) are usually installed outdoors on the antenna structure itself and are thus referred to as an ODU. The ODU typically includes the BUC and LNB, and is connected to the IDU/modem by the IFL cabling.

OQPSK   **O**ffset **Q**uadrature **P**hase **S**hift **K**eying – A variant of phase-shift keying using four different values of the phase to transmit. Offsetting the bit timing limits the phase shift and yields lower amplitude fluctuations as compared to QPSK, and is sometimes preferred for communications systems. See also *QPSK* and *BPSK*.

OSPF   **O**pen **S**hortest **P**ath **F**irst – An open standard interior gateway routing protocol used to determine the best route for delivering the packets within an IP network. OSPF routers use the *Shortest Path First* link state algorithm to calculate the shortest path to each node in the network. The Vipersat OSPF feature in the Comtech SLM-5650A modem/router provides for dynamic routing functionality.

P

PLDM   **P**ath **L**oss **D**ata **M**essage – A packet message that is sent by older Vipersat modems (e.g., CDM-570/L) to the VMS every sixty seconds, providing status update and operating parameter information.

PSK   **P**hase **S**hift **K**eying – A digital modulation scheme that conveys data by changing the phase of a base reference signal, the carrier wave. Different PSKs are used, depending on the data rate required and the signal integrity. Examples are binary phase-shift keying (BPSK or 2-PSK) which uses two phases, and quadrature phase-shift keying (QPSK or 4-PSK) which uses four phases.

PSTN   **P**ublic **S**withed **T**elephone **N**etwork – The world's public circuit-switched telephone network, digital and analog, and includes mobile as well as land-line voice and data communications.

Q

QAM   **Q**uadrature **A**mplitude **M**odulation – A digital modulation technique in which the amplitude of two carrier waves is changed to represent the data signal. These two waves are 90 degrees out of phase with each other.

QoS   **Q**uality **o**f **S**ervice

QPSK   **Q**uadrature **P**hase **S**hift **K**eying – Sometimes referred to as 4-PSK, or 4-QAM. A modulation technique in which the carrier is phase shifted +/-90 or +/-180 degrees. With four phases, this modulation can encode two bits per symbol— twice the rate of BPSK. However, it also uses twice the power. See also *OQPSK* and *BPSK*.

R

Remote   Satellite earth site that links to a central network site (Hub).

Return Path   Transmission path from a Remote site to the Hub site.

RF   **R**adio **F**requency – A generic term for signals at frequencies above those used for baseband or IF.

RFC	**R**equest **F**or **C**omment – The official publication channel for Internet standards (such as communication protocols) issued by the Internet Engineering Task Force (IETF).
RIP	**R**outing **I**nformation **P**rotocol
ROSS	**R**oaming **O**ceanic **S**atellite **S**erver
RS-232	A common electrical/physical standard issued by the IEEE used for point to point serial communications up to approximately 115 kb/s.
RTP	**R**eal-time **T**ransport **P**rotocol – A standardized packet format for delivering real-time applications such as audio and video over the Internet. Frequently used in streaming media systems, videoconferencing, and VoIP.
Rx	**R**eceive

S

SCPC	**S**ingle **C**hannel **P**er **C**arrier – A satellite communications technique where an individual channel is transmitted to the designated carrier frequency. Some applications use SCPC instead of burst transmissions because they require guaranteed, unrestricted bandwidth.
SIP	**S**ession **I**nitiation **P**rotocol – A general purpose protocol for multimedia communications, commonly used for voice over IP (VoIP) signaling. An alternative to the H.323 protocol.
SLM	**S**atellite **L**ink **M**odem
SNG	**S**atellite **N**ews **G**athering – A satellite uplink van/truck with television crew on location conducting a live report for a newscast.
SNMP	**S**imple **N**etwork **M**anagement **P**rotocol – A protocol defining how devices from different vendors may be managed using a common network management system.
SOTM	**S**atCom-**O**n-**T**he-**M**ove – The ability of a mobile remote terminal to roam across satellite beams to preserve link integrity and to automatically connect from one satellite and/or hub to another in a global network.
Star Topology	A network topology which, if drawn as a logical representation, resembles a star with a hub at the center.
STDMA	**S**elective **T**ime **D**ivision **M**ultiple **A**ccess – A multiple access technique where users time-share access to a common channel with variable-sized time slots allocated on usage.

Streamload Protocol	A proprietary Vipersat data streaming protocol.
SUM	**S**tatus **U**pdate **M**essage – A packet message that is sent by newer Vipersat modems (e.g., SLM-5650A) to the VMS every sixty seconds, providing status update and operating parameter information.

T

TCP/IP	**T**ransmission **C**ontrol **P**rotocol / **I**nternet **P**rotocol – A standard for networking over unreliable transmission paths. See also *UDP*.
TDM	**T**ime **D**ivision **M**ultiplexing – A method of multiplexing that provides the transmission of two or more signals on the same communication path or channel, but at different times by utilizing recurrent timeslots.
TDMA	**T**ime **D**ivision **M**ultiple **A**ccess – A multiple access technique where users contend for access to a common channel on a time-shared basis. See also *FDMA* and *STDMA*.
TFTP	**T**rivial **F**ile **T**ransfer **P**rotocol – A simple file transfer protocol used over reliable transmission paths. See also *FTP*.
ToS	**T**ype **o**f **S**ervice
Tx	**T**ransmit

U

UDP	**U**ser **D**atagram **P**rotocol – A standard for networking over reliable transmission paths.
UDP Multicast	A multicast transmission using the UDP protocol.
Unicast	Transmitting information/data packets to a single destination on the IP network.

V

VESP **V**ipersat **E**xternal **S**witching **P**rotocol – A switch-request protocol that allows external VPN equipment and Real-time proprietary applications to negotiate bandwidth requests between any two subnets on a Vipersat network. VESP is used by newer Vipersat modems (e.g., SLM-5650A) to send a switch request to the VMS to establish a new satellite link or adjust bandwidth for an existing link.

VCS **V**ipersat **C**ircuit **S**cheduler – The ArrangeLink VCS is a proprietary satellite communication scheduling system used to schedule Vipersat network resources in support of a variety of high-priority applications such as video conferencing and scheduled broadcasting.

VFS **V**ipersat **F**ile **S**treamer – A file transfer application utilizing UDP and a proprietary Streamload protocol to transmit data across the Vipersat network.

VLoad **V**ipersat **Load** Utility – A comprehensive tool for managing and distributing application, configuration, and identification information for the modem/routers in Vipersat satellite networks.

VMS **V**ipersat **M**anagement **S**ystem – A comprehensive M&C tool providing rapid and responsive control of Vipersat satellite networks. Comprised of client and server components.

VNO **V**irtual **N**etwork **O**perator – A provider of management services that does not own the telecommunication infrastructure. The Comtech Vipersat Network Products' VNO solution allows satellite space segment operators to selectively expose resources in their satellite network to other service providers, customers, or partners.

VoIP **V**oice **o**ver **IP** – The routing of voice communications over the Internet or through any IP-based network.

VOS **V**ipersat **O**bject **S**ervice – The main software service of the VMS application.

W

Wizard A specialized program which performs a specific function, such as installing an application.

WRED **W**eighted **R**andom **E**arly **D**etection – A queue management algorithm with congestion avoidance capabilities and packet classification (QoS) providing prioritization.

{ This Page is Intentionally Blank }

INDEX