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Vipersat **CDM-570/570L**

**Satellite Network Modem Router
User Guide**

Vipersat CDM-570/570L

Satellite Network Modem Router



User Guide

Part number MN/22125
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GENERAL

How to Use This Manual

This manual documents the enhanced Vipersat features and functions of the CDM-570/570L 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 a CDM-570/570L running in Vipersat mode, and complements the universal features and functions described in the *CDM-570/570L Installation and Operation Manual*.

Earth station engineers, technicians, and operators responsible for the configuration and maintenance of the CDM-570/570L are the intended audience for this document.

Manual Organization

This User Guide is organized into the following sections:

Chapter 1 — General

Contains CDM-570/570L 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 CDM-570/570L from a factory default state to a functional network element.

Chapter 3 — Using the Command Line Interface (CLI)

Describes the use of the CLI for configuring and monitoring the CDM-570/570L in a Vipersat network. Each CLI 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 CDM-570/570L into a Vipersat network.

Appendix B — Automatic Switching

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

Appendix C — Dynamic Power Control

A description of Vipersat's DPC and its relationship to a CDM-570/570L configuration.

Appendix D — ECM Migration

Procedural instructions on migrating a Vipersat network of CDM-570/CDD-56X series equipment from STDMA Entry Channel Mode (ECMv1) to Dynamic Entry Channel Mode (ECMv2).

Appendix E — 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: 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: Explanatory text that notifies the reader of potential harm as the result of an action.

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

- *CDM-570/570L Modem Installation and Operation Manual* (Part Number MN/CDM570L.IOM)
- *CDD-564L Quad Demodulator Installation and Operation Manual* (Part Number MN/CDD564L.IOM)
- *Vipersat CDD-56X Series User Guide* (Part Number MN/22137)
- *Vipersat CDM-570/L, CDD-56X Parameter Editor User Guide* (Part Number MN-0000038)
- *Vipersat Management System User Guide* (Part Number MN/22156)
- *Vload Utility User Guide* (Part Number MN/22117)

Product Description

Introduction

The Vipersat CDM-570 and CDM-570L (L-band) Satellite Network Modem Routers offer state of the art performance and reliability in a sophisticated and cost-effective 1RU package. The CDM-570/570L integrates router functionality into the modem, completely eliminating external serial port cabling, and allowing connection of a 10/100 Base-T LAN/WAN directly to the modem.

The CDM-570/570L 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 CDM-570/570L 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

- 50–90 MHz or 100–180 MHz IF Range (CDM-570)
950–1950 MHz IF Range (CDM-570L)
- BPSK, QPSK, OQPSK, 8-PSK, 8-QAM, or 16-QAM Operation
- Data Rate Range from 2.4 kbps up to 9.98 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)
- Programmable TDM/STDMA or dSCPC (dynamic SCPC) Access Control
- BUC 10 MHz Reference and FSK Communications, and optional BUC Power Supplies (CDM-570L)
- LNB Power Supply and 10 MHz Reference (CDM-570L)
- 1:1 Remote, and N:M Hub Modem Redundancy Schemes

Router Features

- Fully Integrated Network Management using Vipersat Management System (VMS)
- Single Hop On Demand (SHOD) Functions

- Multi-Transponder Mode (MTM) Functions
- Dynamic Power Control (DPC) for Environment or Mesh Links
- Upstream Bandwidth Management Switching for Application, Load, Scheduled, Manual, or VESP
- Dynamic SCPC (dSCPC) Bandwidth-On-Demand
- 10/100BaseT Ethernet LAN/WAN Interface
- Per Route IP Filtering
- Multi-Protocol Support
- Built-In Header and Payload Compression for Improved Satellite Bandwidth Efficiencies
- Built-In Quality of Service (QoS) Functions for Traffic Prioritization
- Software Version Management via FTP or VLoad
- 3xDES Decryption

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 CDM-570/570L 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 (dSCPC)

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, application or 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 effectively 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 CDM-570/570L 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.

Header Compression

Configurable on a per route basis, Header Compression reduces the required Voice over Internet Protocol (VoIP) bandwidth by as much as 60%. Example: a G.729 voice codec operating at 8 kbps will occupy 32 kbps once encapsulated into IP framing on a LAN. Using IP/UDP/RTP Header Compression, the same traffic only needs 10.8 kbps total WAN satellite bandwidth to cross the link. Normal Web/HTTP traffic can be reduced by an additional 10% via IP/TCP Header Compression.

Payload Compression

Compressing Payload condenses the size of data frames and reduces the satellite bandwidth required to transmit across the link. Configurable on a per route basis, Payload Compression optimizes traffic and reduces bandwidth up to 40%.

Quality of Service

The CDM-570/570L supports multi-level QoS that minimizes jitter and latency for real time traffic, provides priority treatment to mission critical applications, and allows non-critical traffic to use the remaining bandwidth. Three modes are available: Max/Priority, Min/Max, and Diff Serv.

Data Encryption

The CDM-570/570L provides 3xDES data encryption to prevent unauthorized access to data over the satellite link. Encryption is configurable on a per route basis

New in this Release

The following firmware versions incorporate a number of additional features and enhancements.

1.6.11/2.6.11 Release

Dynamic Entry Channel Mode

Dynamic ECM (ECMv2) utilizes a modified slotted Aloha method for Remotes to establish registration in the network and obtain the means for switching into SCPC mode. Rather than sharing an STDMA burst map, as is the method with STDMA ECM, the Remotes rely on communicating with the Hub channel controller through the use of a multicast Transmission Announcement Protocol (TAP) message. This eliminates the restriction in the number of Remotes in an Entry Channel group that is inherent with the burst map method.

Customer Support

Contact Information

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

- Mail:** 3215 Skyway Court
Fremont, CA 94539
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- Phone:** 1+510-252-1462 ext. 2
- Fax:** 1+510-252-1695
- Email:** supportcvni@comtechefdata.com
- Web:** www.comtechefdata.com

Return Material Authorization

Any equipment returned to Vipersat 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 Vipersat Customer Support.
- 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.

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.

QUICK START CONFIGURATION

Introduction

This chapter describes the minimum configuration of a Vipersat CDM-570/570L Modem/Router that is necessary in order for the equipment to function in a Vipersat network.

The Vipersat CDM-570/570L stores its configuration in an ASCII file named the **PARAM** (parameter) file. Equipment configuration is typically performed through the use of the Command Line Interface (CLI), particularly the initial configuration. Once the equipment is functioning in the network, additional configuration can be performed via the VMS.

Refer to Chapter 3, “Using the Command Line Interface,” for a detailed description on the usage of this feature.

This manual covers the configuration specifics of the CDM-570/570L when used in a Vipersat network. Refer to the *CDM-570/570L Installation and Operation Manual* (Part Number MN/CDM570L.IOM) for general instruction on setting up, installing and configuring this equipment.



Note: Before attempting to configure a CDM-570/570L 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.



Caution: Do not connect the TX and RX cables to test equipment without the use of a DC voltage block. If BUC or LNB power is disabled through the CLI, the setting must be Saved to prevent accidental re-enabling during modem reboot or power-cycle.

Initial Configuration



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.

Terminal Connection

These procedures are performed using the CLI from a workstation connected to the modem/router either via a direct connection to the **Console** port (a console cable is shipped with each unit), or via a telnet connection to the **Traffic 100** port. Alternatively, HyperTerminal or any of the other connection methods described in the *CDM-570/570L Installation and Operation Manual* may be used.

Make a terminal connection to the target CDM-570/570L modem/router. If connecting via the Traffic 100 Ethernet port (do **not** use the M&C port), enter the IP address of the unit. The factory default IP address for a Vipersat enabled unit is **192.168.254.1**. Configure the terminal for VT-100 emulation mode. Once a terminal connection has been made, the CDM-570/570L will respond with a Login prompt. The factory defaults for accessing the *Admin level* are:

Login: **comtech**

Password: **comtech**

Once the operator has logged in, the **Main Menu** shown in figure 2-1 is displayed.

Network Role

The first and most important step prior to configuring the CDM-570/570L is to define its network role.

The CDM-570/570L 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 CDM-570/570L 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 CDM-570/570L can be configured.

Table 2-1 CDM-570/570L Network Roles and Functions

Network Role / Function	Hub	Remote	Expansion
Hub Burst Controller providing STDMA Timing Maps	X		
Hub Point-to-Point SCPC Modem	X		
Hub Switched Demodulator	X		X
Remote STDMA Modem		X	
Remote Point-to-Point SCPC Modem		X	
Remote Mesh Demodulator		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 Configuration” on page 2-11).

Refer to the section “Unit Role” on page 3-49, and the following section “Expansion Unit”, for additional details on setting a CDM-570/570L’s network role.

Setting Vipersat CDM-570/570L Operating Parameters

The following is an example of using the CLI to bring a Vipersat CDM-570/570L with factory default settings to the configuration which allows the Vipersat functions to be accessible.

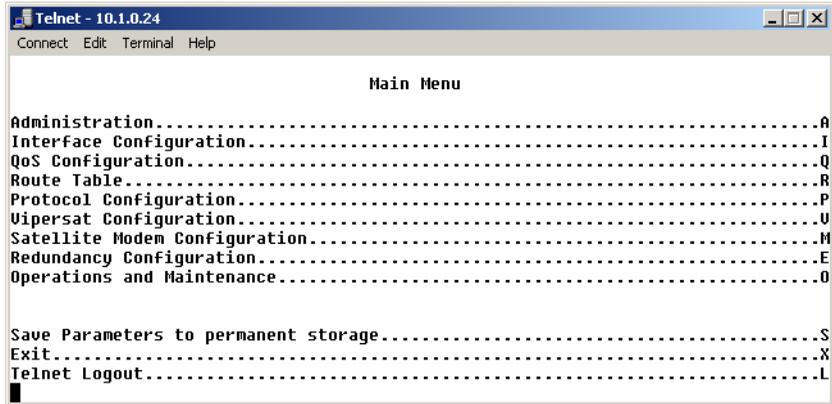
Set the Feature Configuration

The operating parameters that will be configured in the target CDM-570/570L are, in part, determined by the role the CDM-570/570L is to fill in the network, as shown in table 2-1 and table 2-2.

Initial Configuration

Use the following procedure to configure a CDM-570/570L to the network role it is to fill in a Vipersat network.

1. From the **Main Menu** shown in figure 2-1, select the **Administration** command by entering **A** at the command prompt.



```
Telnet - 10.1.0.24
Connect Edit Terminal Help

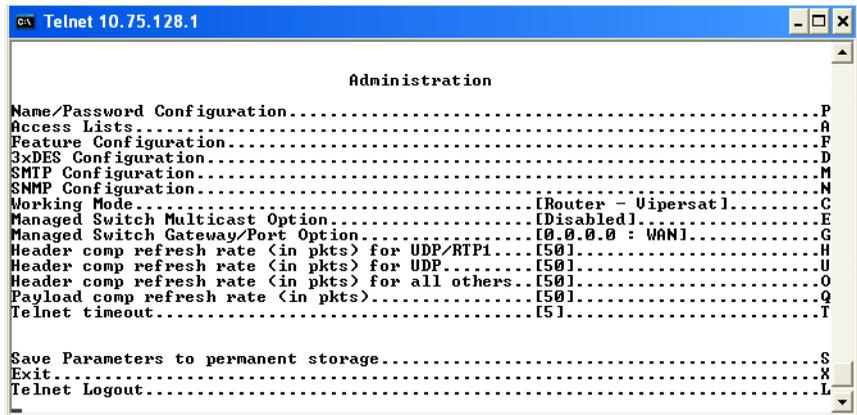
Main Menu

Administration.....A
Interface Configuration.....I
QoS Configuration.....Q
Route Table.....R
Protocol Configuration.....P
Vipersat Configuration.....U
Satellite Modem Configuration.....M
Redundancy Configuration.....E
Operations and Maintenance.....O

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

Figure 2-1 Main Menu screen

2. From the **Administration** screen shown in figure 2-2, select the **Features Configuration** command by entering **F** at the command prompt.



```
Telnet 10.75.128.1

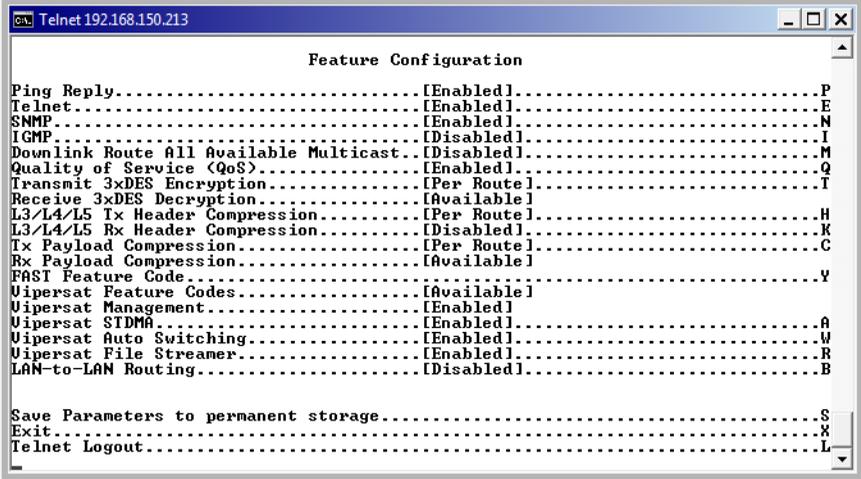
Administration

Name/Password Configuration.....P
Access Lists.....A
Feature Configuration.....F
3xDES Configuration.....D
SMTP Configuration.....M
SNMP Configuration.....N
Working Mode.....[Router - Uipersat].....C
Managed Switch Multicast Option.....[Disabled].....E
Managed Switch Gateway/Port Option.....[0.0.0 : WAN].....G
Header comp refresh rate (in pkts) for UDP/RIP1.....[50].....H
Header comp refresh rate (in pkts) for UDP.....[50].....U
Header comp refresh rate (in pkts) for all others.....[50].....Q
Payload comp refresh rate (in pkts).....[50].....O
Telnet timeout.....[5].....T

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

Figure 2-2 Administration screen

- From the **Feature Configuration** menu shown in figure 2-3, verify whether or not the **Vipersat Feature Codes** are **Available** (appears as shown in the figure). These codes are entered prior to shipment from the factory; however, if the codes display as Unavailable, they will have to be re-entered.



```

Telnet 192.168.150.213

Feature Configuration

Ping Reply.....[Enabled].....P
Telnet.....[Enabled].....E
SNMP.....[Enabled].....N
IGMP.....[Disabled].....I
Downlink Route All Available Multicast.....[Disabled].....M
Quality of Service (QoS).....[Enabled].....Q
Transmit 3xDES Encryption.....[Per Route].....T
Receive 3xDES Decryption.....[Available]
L3/L4/L5 Tx Header Compression.....[Per Route].....H
L3/L4/L5 Rx Header Compression.....[Disabled].....K
Tx Payload Compression.....[Per Route].....C
Rx Payload Compression.....[Available]
FAST Feature Code.....Y
Vipersat Feature Codes.....[Available]
Vipersat Management.....[Enabled]
Vipersat STDMA.....[Enabled].....A
Vipersat Auto Switching.....[Enabled].....W
Vipersat File Streamer.....[Enabled].....R
LAN-to-LAN Routing.....[Disabled].....B

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

```

Figure 2-3 Feature Configuration screen

To enter the feature code, enter **Y** at the command prompt, then enter the 20 digit **FAST Feature Code**, as shown in figure 2-4.



```

Telnet 10.1.0.16

Y
Enter the FAST Feature Code (Must be exactly 20 digits)

```

Figure 2-4 FAST Feature Code dialog



Tip: The network administrator will have the FAST Feature codes. These are generated and stored by the unit serial number for the target CDM-570/570L. The target unit's serial number can be found on the rear of the unit chassis.

- After entering the FAST Feature code, return to the **Administration** screen (shown in figure 2-2) by entering **X** at the command prompt from the Feature Configuration menu. Ensure that the **Working Mode** is set to **Router-Vipersat**. If it is not, enter **C** and change the setting by selecting **4**, as shown in figure 2-5. The unit will automatically reboot in order to implement the change for this setting.

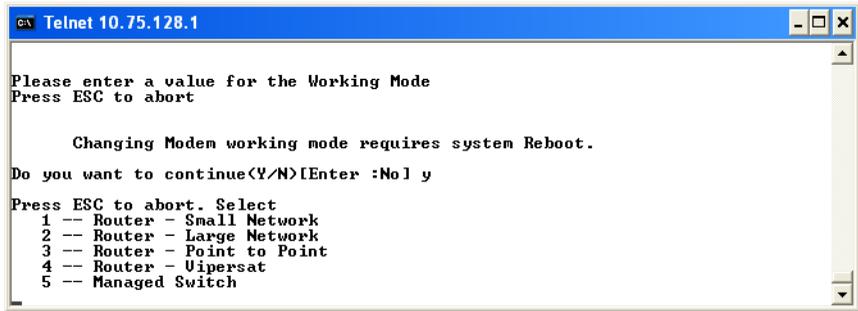


Figure 2-5 Working Mode dialog

- When the reboot is completed, return to the Feature Configuration screen and configure the settings for **Vipersat STDMA** and **Auto Switching** according to the table below.

Table 2-2 Vipersat Feature Configuration

Unit Role	Vipersat	STDMA	Auto Switching
Hub	Enabled	(optional) Enabled	(optional) Enabled
Hub Expansion	Enabled	Disabled	Disabled
Remote	Enabled	(optional) Enabled	(optional) Enabled
Remote Expansion	Enabled	Disabled	Disabled

- Save the settings to flash by entering **S** at the command prompt.

Set the IP Address

- From the Main Menu, enter **I** to access the **Interface Configuration** menu screen, then enter **E** to access the **Ethernet Interface** screen, as shown in figure 2-6.

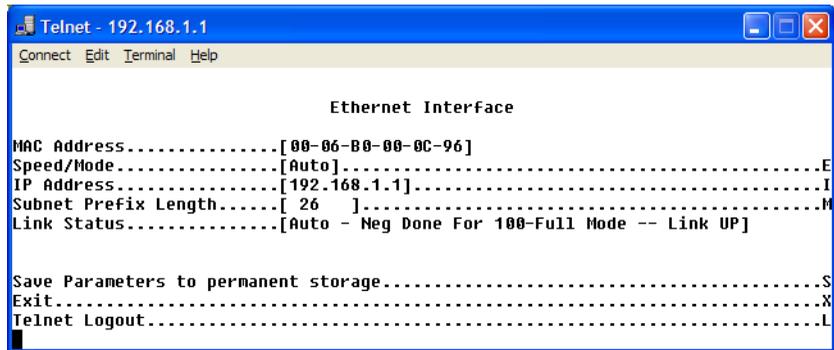


Figure 2-6 Ethernet Interface screen

2. Enter **I** at the command prompt, and enter the designated **IP address** for this unit.
3. Save the settings to flash by entering **S** at the command prompt.

Configure the Route Table

Routing in a Vipersat Network

CDM-570/570L Modem Routers operating in Vipersat mode do not use the small or large network described in the *CDM-570/570L Installation and Operation Manual*. There is no HDLC address in a Vipersat network; instead, the CDM-570/570L role designation — Hub or Remote, Expansion unit or not — determines routing rules that prevent multicast loops. This simplifies the configuration of a Vipersat network.

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".

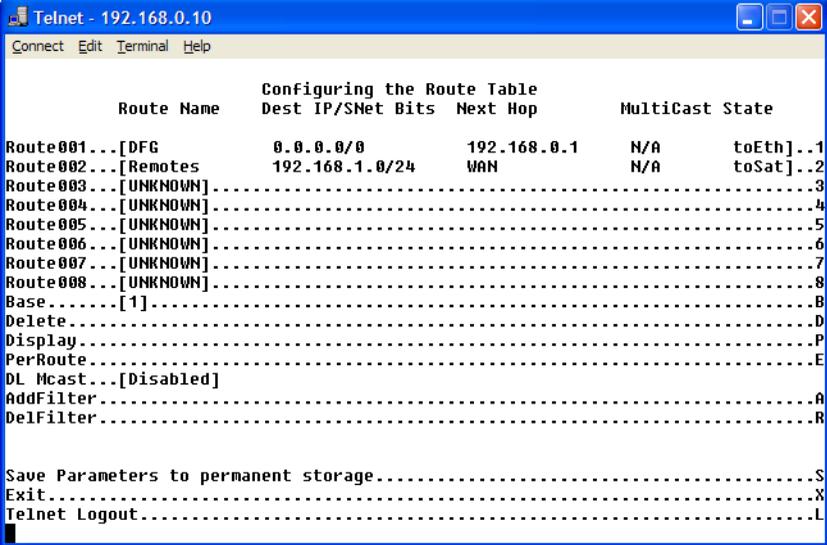
By putting the one route statement "Remotes 172.16.128.0/17 Wan to Sat" in the TDM Hub modem, and by using the route statement "GW 0.0.0.0/0 Wan to Sat" at each of the remote modems, the network will successfully route packets. The remotes can then be sub-netted as class C networks or below. Additional 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 *CDM-570/570L Installation and Operation Manual* for additional information on entering routes.

Creating the Routes

The following procedure outlines the basic route structure that the target CDM-570/570L 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. From the **Main Menu** shown in figure 2-1, select **Route Table** by entering **R** at the command prompt.
2. From the **Configuring the Route Table** screen shown in figure 2-7, enter **1** at the command prompt to set the first route that will define the default gateway.



```

Telnet - 192.168.0.10
Connect Edit Terminal Help

                Configuring the Route Table
      Route Name  Dest IP/SNet Bits  Next Hop      MultiCast State
Route001...[DFG          0.0.0.0/0          192.168.0.1   N/A          toEth]..1
Route002...[Remotes     192.168.1.0/24    WAN           N/A          toSat]..2
Route003...[UNKNOWN].....3
Route004...[UNKNOWN].....4
Route005...[UNKNOWN].....5
Route006...[UNKNOWN].....6
Route007...[UNKNOWN].....7
Route008...[UNKNOWN].....8
Base.....[1].....B
Delete.....D
Display.....P
PerRoute.....E
DL Mcast...[Disabled]
AddFilter.....A
DelFilter.....B

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

```

Figure 2-7 Configuring the Route Table screen

In a Hub configuration, the default route will typically point to a router on the same LAN as the CDM-570/570L Hub unit.

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

3. When prompted, enter the **Route Name** (GW), the **IP Address**, the **Number of Bits** in the subnet mask, the **Route Interface** (Ethernet or Satellite), and the **Next Hop** address. The system administrator can supply this information, 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, enter **E** 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. One recommended option is to enter a single super-route that will handle satellite communications with all of the remote subnets; an example of this is shown as Route002 in figure 2-7, above.

If there are multiple burst controllers at the Hub and they are not using the same default address (239.1.2.3), then a route with the Burstmap Multicast

Address must be defined also. Otherwise, this route is automatically created and can be viewed with the **Display** command.

4. Enter **S** at the command prompt in figure 2-7 to save the settings to flash.

Set the Satellite Modem Configuration

1. Enter **M** from the **Main Menu**, then enter **C** from the **Satellite Modem** menu to access the **Configuration** screen.
2. Enter **T** to access the **Tx Configuration** screen shown in figure 2-8. Set the Tx parameters for **Frequency**, **Data Rate**, **FEC**, **Code Rate**, and **Modulation** as specified by the network administrator.



Note: Only **Turbo** Product Coding is acceptable for FEC when the CDM-570/570L is running in Vipersat mode.

```

Telnet - 192.168.0.10
Connect Edit Terminal Help

                                Tx Configuration

Tx Frequency.....[1205.0000].....Q
Tx Data Rate.....[1024.000].....D
Tx Symbol Rate.....[0682.667]
Tx FEC.....[Turbo].....T
Tx Code Rate.....[3/4].....R
Tx Modulation.....[QPSK].....M
Tx Spectrum Inversion..[Normal].....U
Tx Data Inversion.....[Normal].....I
Tx Scrambling.....[On-Default].....B
Tx Power Level.....[18.0].....P
Tx Carrier.....[0n].....C
Tx Clock Source.....[Internal]

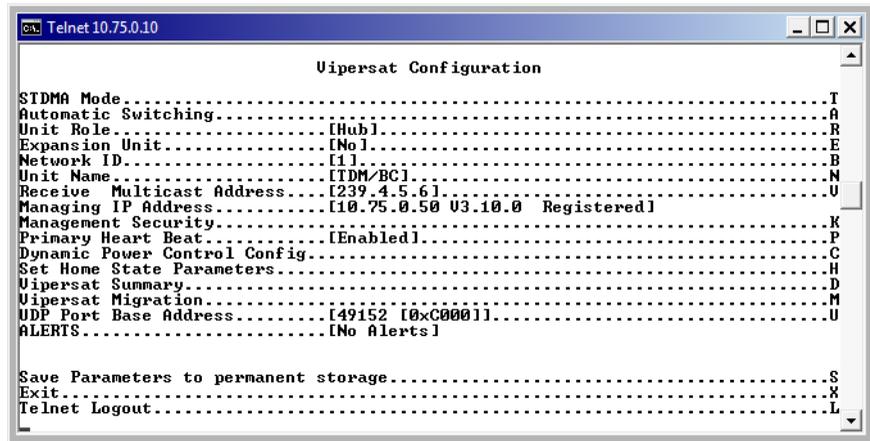
Save Parameters to permanent storage.....S
Exit.....X
Telnet Logout.....L
    
```

Figure 2-8 Tx Configuration screen

3. Enter **R** to access the **Rx Configuration** screen, and set the Rx parameters as specified by the network administrator.
4. Save the settings to flash by entering **S** at the command prompt.

Set the Vipersat Configuration

1. Enter **V** at the **Main Menu** command prompt shown in figure 2-1 to select the **Vipersat Configuration** menu shown in figure 2-9.



```

Telnet 10.75.0.10

Vipersat Configuration

STDMA Mode.....T
Automatic Switching.....A
Unit Role.....[Hub].....R
Expansion Unit.....[No].....E
Network ID.....[1].....B
Unit Name.....[TDM/BC1].....M
Receive Multicast Address.....[239.4.5.6].....U
Managing IP Address.....[10.75.0.50 03.10.0 Registered]
Management Security.....K
Primary Heart Beat.....[Enabled].....P
Dynamic Power Control Config.....C
Set Home State Parameters.....H
Vipersat Summary.....D
Vipersat Migration.....M
UDP Port Base Address.....[49152 [0xC000]].....U
ALERTS.....[No Alerts]

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

```

Figure 2-9 Vipersat Configuration screen (Hub)

2. Enter **R** at the command prompt to toggle the **Unit Role** to either **Hub** or **Remote**.
This parameter will determine the role the target CDM-570/570L will perform in the network and what type of commands and functions it will receive from the VMS.
3. Enter **E** to set the **Expansion Unit** value (**Yes** or **No**).
When configured as an expansion unit, either as a hub (switched) or as a remote (mesh), the CDM-570/570L 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.
4. Enter **B** at the command prompt to set the **Network ID**.
The Network ID that is assigned to the unit defines to what network the target CDM-570/570L will belong. All units used in a 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.
5. Enter **N** at the command prompt to set the **Unit Name**.
6. Enter **V** at the command prompt to set the **Receive Multicast Address**.
This IP address is the multicast address assigned to the VMS and to all

Initial Configuration

units in the network that are managed by the VMS. The Receive Multicast Address of this CDM-570/570L must match the Transmit Multicast Address that has been assigned to the VMS.

7. Enter **I** at the command prompt to set the **Managing IP Address**. The Managing IP Address is the IP address of the VMS server.
8. Management Security (*Optional*)
If this is an encrypted network, enter **K** at the command prompt to configure **Vipersat Management Security**.
9. Enter **H** to go to the **Home State Configuration** menu screen, then enter **W** to set the current configuration as the Home State.
10. **Save** the settings to flash by entering **S** at the command prompt.

This completes the initial configuration of a CDM-570/570L from the factory default settings to a functioning, Vipersat-enabled unit. Additional configuration parameters must be set depending on the network requirements for a specific application.

Refer to Chapter 3, “*Using the Command Line Interface*,” for additional details on configuring the target Vipersat CDM-570/570L.

USING THE COMMAND LINE INTERFACE (CLI)

General

This chapter describes the use of the CLI for configuring and monitoring the CDM-570/570L Modem Router in a Vipersat network. Each CLI screen related to a CDM-570/570L operating in Vipersat mode is presented, along with a detailed description of the available commands. For descriptions of all other screens, refer to the *CDM-570/570L Installation and Operation Manual*.

Access to the CLI is provided through either the **Console** port (local, RS-232) or the 10/100BaseT Ethernet **Traffic** port (Telnet, IP). Access via Telnet requires login with password, Console access does not require login. The screens presented in this document are as they appear when the CDM-570/570L is accessed using Telnet.

When a Telnet terminal connection is made, the CDM-570/570L responds with a Login prompt. The factory defaults are:

Login: **comtech**

Password: **comtech**

Once the operator has logged in, the **Main Menu** shown in figure 3-1 is displayed.

Common Screen Commands

The following commands appear on each of the menu screens:

Save Parameters to Permanent Storage

To **Save** the current parameter settings to permanent storage, enter **S** at the command prompt. This command saves all data that has been entered from any of the CLI screens since the last save was executed. Exiting a screen without saving after parameters have been changed 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.

Exit

To **Exit** the current menu screen and return to the previous screen in the menu tree, enter **X** at the command prompt.

Telnet Logout

Enter **L** at the command prompt to **Logout** of the Telnet session. This command appears only when connected via Telnet.

Menu Descriptions

This section details the CLI command menus and briefly discusses the function of each of the commands available on each menu.

Main Menu

The **Main Menu**, shown in figure 3-1, allows configuring both the modem and router functions of the target CDM-570/570L.



Note: The entry **Vipersat Configuration** shown in figure 3-1 will only be displayed if the target CDM-570/570L has had the Vipersat option enabled as described in the section “Setting Vipersat CDM-570/570L Operating Parameters” on page 2-3.

```

Telnet - 10.1.0.24
Connect Edit Terminal Help

Main Menu

Administration.....A
Interface Configuration.....I
QoS Configuration.....Q
Route Table.....R
Protocol Configuration.....P
Vipersat Configuration.....V
Satellite Modem Configuration.....M
Redundancy Configuration.....E
Operations and Maintenance.....O

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

```

Figure 3-1 Main Menu screen

A Vipersat CDM-570/570L is normally shipped with the Vipersat option enabled. You can verify the CDM-570/570L configuration by checking that the command line **Vipersat Configuration** is displayed on the menu as shown in Figure 3-1.

Administration

The **Administration Menu** provides access to the major Vipersat CDM-570/570L features and commands. Entering an **A** at the prompt in the **Main Menu**, shown in figure 3-1 displays the **Administration** screen shown in figure 3-2.

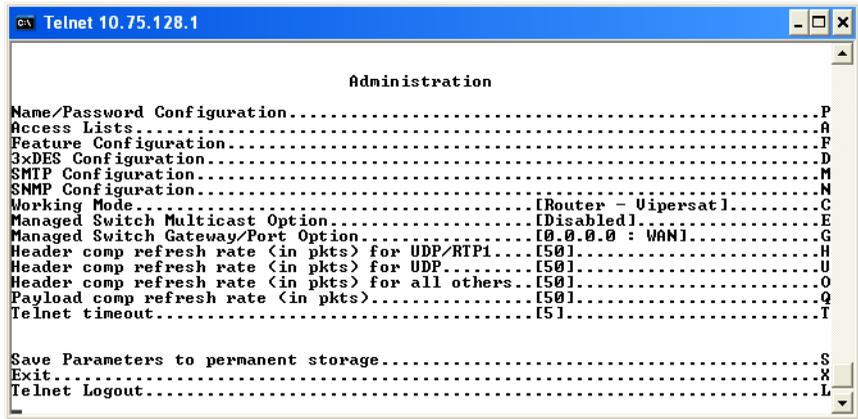


Figure 3-2 Administration screen

Ensure that the **Working Mode** is set to **Router-Vipersat**.

If it is not, enter C at the command prompt and change the setting by selecting 4, as shown in figure 3-3. The unit will automatically reboot in order to implement the change for this setting.

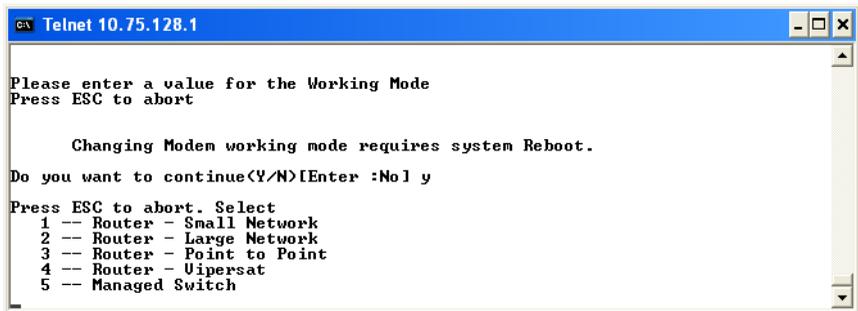


Figure 3-3 Working Mode dialog



Note: If the Router-Vipersat option does not appear as a selection, the Vipersat Feature Code has not yet been entered into this unit. Input the Vipersat code as described in the next section.

From the Administration menu, enter an F at the prompt to display the **Feature Configuration** screen shown in figure 3-4.

Feature Configuration

The **Feature Configuration** screen shown in figure 3-4 allows the **Enabling** and **Disabling** of the major Vipersat CDM-570/570L features.

```

Feature Configuration
Ping Reply.....[Enabled].....P
Telnet.....[Enabled].....E
SNMP.....[Enabled].....N
IGMP.....[Disabled].....I
Downlink Route All Available Multicast [Disabled].....M
Quality of Service (QoS).....[Enabled].....Q
Transmit 3xDES Encryption.....[Per Route].....T
Receive 3xDES Decryption.....[Available]
L3/L4/L5 Tx Header Compression.....[Per Route].....H
L3/L4/L5 Rx Header Compression.....[Disabled].....X
Tx Payload Compression.....[Per Route].....C
Rx Payload Compression.....[Available]
FAST Feature Code.....Y
Vipersat Feature Codes.....[Available]
Vipersat Management.....[Enabled]
Vipersat STDMA.....[Enabled].....A
Vipersat Auto Switching.....[Enabled].....W
Vipersat File Streamer.....[Enabled].....R
LAN-to-LAN Routing.....[Disabled].....B

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

```

Figure 3-4 Feature Configuration screen

Use this menu to enable and disable Vipersat features such as:

- **Vipersat STDMA** — Burst mode operation
- **Vipersat Auto Switching** — Allows switching to SCPC mode
- **Vipersat File Streamer** — Rapid file transfers over satellite network



Note: These Vipersat features must be enabled or disabled using this menu. They cannot be enabled or disabled from the Vipersat Configuration screen.

Vipersat Feature Codes

From the Feature Configuration menu, verify whether or not the Vipersat Feature Codes are **Available** (appears as shown in figure 3-4). These codes are entered prior to shipment from the factory; however, if the codes display as Unavailable, they will have to be re-entered. To enter the FAST Feature code, enter **Y** at the command prompt.

The Vipersat FAST Feature Code can be entered as 20 hexadecimal digits at the command prompt as shown in figure 3-5.



Figure 3-5 FAST Feature Code dialog



Tip: Contact either the network administrator or Comtech Vipersat Networks Customer Support to obtain the FAST Feature code. A convenient option is to use the Vipersat Vload utility to manage Feature codes.

Vipersat Management

This item is an information only display and indicates whether **Vipersat Management** is enabled or disabled in the target Vipersat CDM-570/570L. Activation of the Vipersat Feature Code automatically enables the Vipersat Management feature.



Caution: This command must be **Enabled** in order to utilize any of the Vipersat capabilities of the CDM-570/570L.

Vipersat STDMA

In order to utilize the **Vipersat STDMA** feature (burst mode) in the target Vipersat CDM-570/570L, this feature must be **Enabled**. Enter **A** at the command prompt to toggle On or Off.

Refer to table 2-2 for the relationship between Unit Role and STDMA. For a Hub STDMA Burst Controller or a Remote STDMA modem, this feature must be Enabled. For a private point-to-point SCPC modem, Hub or Remote, this feature must be Disabled.

Vipersat Auto Switching

The **Vipersat Auto Switching** feature allows the CDM-570/570L to automatically adjust to varying bandwidth demands in the Vipersat network by switching between STDMA and SCPC connections for Load, Application, ToS, and QoS. Auto switching must be Enabled on a CDM-570/570L if that modem will be sending any switch requests to the VMS. Refer to table 2-2 for the relationship between Unit Role and Auto Switching.

To activate the Vipersat Auto Switching capabilities of the target CDM-570/570L, toggle the Auto Switching command to **Enabled** by entering **W** at the command prompt.

See the section “STDMA/SCPC Automatic Switching” on page 3-31 for more details on the use of this feature. For additional information, refer to Appendix B, “Automatic Switching.”

Vipersat File Streamer

Vipersat File Streamer (VFS) is an optional feature that allows rapid file transfers over the satellite network between host PCs that are running the client VFS application. To activate the Vipersat File Streaming capabilities of the target CDM-570/570L, toggle this command to **Enabled** by entering **R** at the command prompt.

Once the parameters on the Feature Configuration screen have been set as desired, return to the Main Menu and enter the **V** command to display the **Vipersat Configuration** screen shown in figure 3-6.

Vipersat Configuration

Enter **V** at the command prompt from the CDM-570/570L **Main Menu** shown in figure 3-1 to display the **Vipersat Configuration** screen shown in figure 3-6.

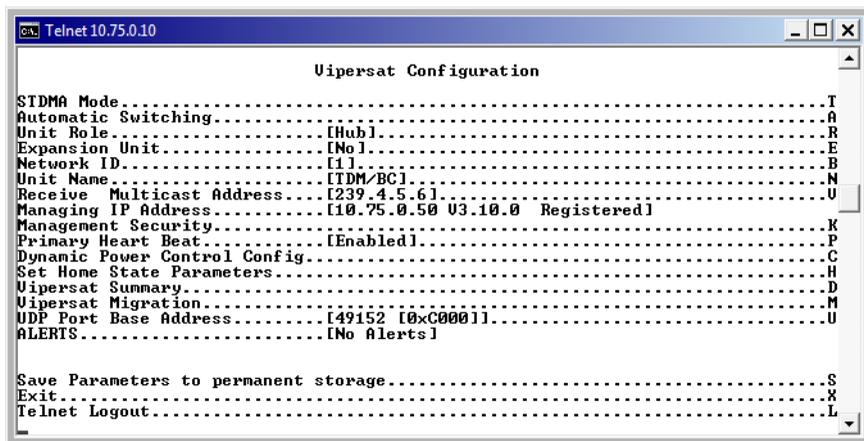


Figure 3-6 Vipersat Configuration screen (Hub)

This menu lists the available commands for configuring a Vipersat CDM-570/570L. Note that for the Hub modem only, the command **Primary Heart Beat** is displayed in the Vipersat Configuration screen. For the Remote modem only, the status of the **Home State Revert** setting is displayed.

Each of these commands is explained in the following sections.

STDMA Mode

The **STDMA Mode** parameters for this CDM-570/570L are accessed by entering **T** at the Vipersat Configuration screen command prompt.

The items in the **STDMA** menu will vary depending on the function the target CDM-570/570L performs in the network (Hub or Remote) and the Hub Type that is designated. The CDM-570/570L STDMA menu shown in figure 3-7 is from a CDM-570/570L serving as a Hub in the network, with the Hub Type designated as *Dynamic Cycle*.

For comparison, the STDMA menu for a CDM-570/570L operating as a Remote unit is shown in figure 3-8. Note that some of the command items differ between these two screens, and most of the items on the Remote screen are information-only display.

```

Telnet - 192.168.150.71
Connect Edit Terminal Help

                          STDMA
STDMA.....[Enabled]
STDMA Tx Rate.....[512000 bps]
Hub Type.....[Dynamic Cycle].....T
Group ID.....[100].....I
Low Data Rate Fast Acquisition..[Disabled].....A
Burstmap Multicast IP.....[239.10.10.10].....M
Outbound IP.....[192.168.150.71].....O
Slot Guardband.....[ 50 mSec ( 3200 bytes)].....G
Slot Preamble Length.....[ 55 mSec ( 3520 bytes)].....P
Maximum Data Length.....[ 200 mSec (12800 bytes)].....B
Minimum Data Length.....[ 50 mSec ( 3200 bytes)].....M
Slot Cycle Length.....[ 316 mSec (20224 bytes)].....C
Set Remotes.....[ ].....R
STDMA Statistics.....[ ].....U
Show Hub Statistics.....[ ].....W

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

```

Figure 3-7 STDMA screen (Hub, Dynamic Cycle type)

```

Telnet 10.75.128.1
                          STDMA
STDMA.....[Enabled]
STDMA Tx Rate.....[64000 bps]
Group ID.....[10].....I
STDMA Power Hunt.....[Disabled].....H
Low Data Rate Fast Acquisition..[Enabled].....L
Burstmap Multicast IP.....[239.1.2.3].....M
Cycles Per Burst Map.....[5].....C
Slot Guardband.....[ 70 mSec ( 560 bytes)].....G
Slot Preamble Length.....[135 mSec (1080 bytes)].....P
Nominal Data Length.....[209 mSec (1672 bytes)].....B
Slot Cycle Length.....[1242 mSec (9936 bytes)].....C
Slot Start in Cycle.....[ 0 mSec ( 0 bytes)].....S
STDMA Statistics.....[ ].....U

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

```

Figure 3-8 STDMA screen (Remote)

STDMA

This menu item is read-only and shows the current state of STDMA in the CDM-570/570L. In order to change the STDMA state in the CDM-570/570L, refer to the section “Feature Configuration” on page 3-5.

STDMA Tx Rate

This menu item shows the STDMA transmit rate in bps. This item is read-only and cannot be modified in this menu.

Hub Type

This menu item is only displayed if the CDM-570/570L is being used as a Hub in the network, and provides the functionality for the STDMA Burst Controller. Vipersat STDMA has six 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.
- **ECMv2** — utilizes a modified slotted Aloha method for remotes to establish registration in the network and obtain the means for switching into SCPC mode.

The Hub can be configured to operate as one of the six types by entering a **T** at the command prompt to display the dialog shown in figure 3-9.

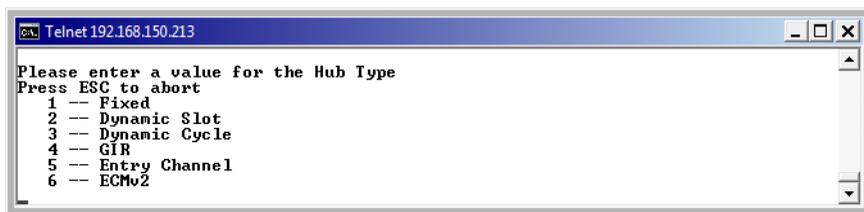


Figure 3-9 Hub Type prompt

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.

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.

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 allocate 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 for these units when needed.



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 “Set Remote Policies” on page 3-22). 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, Auto switching must be Enabled on this Hub unit, and corresponding Remote modems must be configured with Auto switching and Load switching Enabled. 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 Auto switching feature must be Enabled on this Hub unit, and switching policies for the remotes must be configured (refer to the section “Set Remote Policies” on page 3-22). Corresponding Remote modems must be configured with Auto switching and 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.

6 – ECMv2

The **ECMv2** (*Dynamic Entry Channel*) mode is very similar to the regular Entry Channel mode. However, the associated limitation in the number of Remotes is eliminated via the modified slotted Aloha method that is utilized for this mode. No cycle is used, and a Remote List is not necessary.

The Hub broadcasts an announcement message to all Remotes that are tuned to receive it that provides the available slots and the tuning parameters for transmitting back to the Hub. The Remotes transmit on a contention basis and should a collision occur, the Remote will back off for a specified period and try again. Once it obtains one of the available slots, the Remote will hold onto the slot

until it registers with the VMS and receives assignment into *dSCPC*, or until all necessary transactions are completed. The slot is then released for use by another Remote unit that is attempting to enter the channel.

Remotes can be set to one of four operating modes—*Disable*, *Offline*, *Wait*, and *Online*—from the ECMv2 Mode command in the STDMA menu. In addition, commands for setting parameters to accommodate any mismatches between the Hub LNB and the Remote BUCs are presented: *LNB LO Frequency* (Hub), *BUC LO Frequency* (Remote), and *Satellite Conversion Frequency*.

ECMv2 Mode

This menu item appears for Remote modems operating in ECMv2 only.

Each Remote can be set to a designated mode of operation in ECM:

- **Disable** – the ECM function for this Remote is disabled.
- **Offline** – the Remote will not transmit (muted).
This mode may be chosen for radio silence applications.
- **Wait** – the Remote will register with the controller and remain in the ECM wait queue without assignment for switching into *dSCPC* mode. This mode may be chosen by operators who wish to manually control (via diagnostic switch) when a Remote is to be switched and utilize bandwidth from the pool.
- **Online** – the Remote will register with the controller and request *dSCPC* bandwidth for switching.

In order for a Remote to automatically switch into SCPC mode and pass data traffic, the ECMv2 Mode *must be set to Online*.

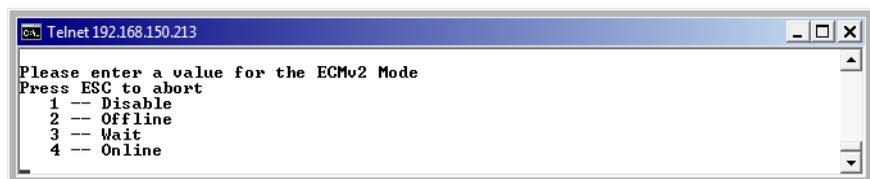


Figure 3-10 ECMv2 Mode prompt



Tip: For purposes of commissioning the terminal with a continuous carrier, the Entry Channel mode can be set temporarily to Disable. Once this process is completed, set the Remote back to the desired mode for normal operation.

Group ID

The STDMA **Group ID** number defines a group of equipment (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 CDM-570/570L.

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

The target CDM-570/570L Group ID can be modified by entering an **I** at the command prompt to display the dialog shown in figure 3-11.

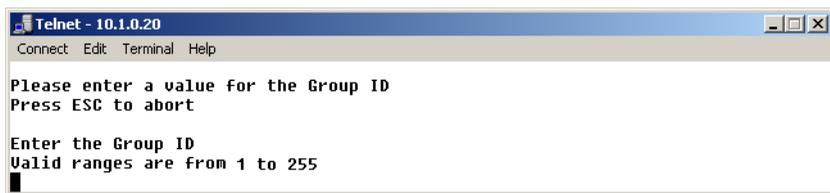


Figure 3-11 Group ID prompt

STDMA Max Power Hunt

This menu item appears for Remote modems only.

Should link reception from a Remote be incorrect or impaired (e.g., poor environmental conditions), the **STDMA Max Power Hunt** feature is an option on the Remote modem that automatically adjusts the Remote transmit power to ensure that burst map acknowledgements from that unit are received by the Hub burst controller. When enabled, the burst controller sets a flag in the burst map that indicates it is not receiving acknowledgements from an enabled Remote. When the Remote receives the burst map, it will see the flag and automatically increase power up to the maximum value specified with this parameter (3, 6, or 9 dB) above the default or Home State setting. If this closes the link, the burst controller will clear the flag. Note that if the dB increase is more than is necessary, DPC will make a down adjustment to the appropriate level and this adjustment will be added to the DPC Offset.

This feature option is Enabled/Disabled by entering **H** at the command prompt.



```

Telnet 192.168.150.213
Please enter a value for the STDMA Max Power Hunt
Press ESC to abort
1 -- Disabled
2 -- 3.0 dB
3 -- 6.0 dB
4 -- 9.0 dB

```

Figure 3-12 STDMA Max Power Hunt prompt

Low Data Rate Fast Acquisition

Configurable on a Hub Burst Controller only.

This menu item is a toggle used to Enable or Disable the Vipersat **Burst Fast Acquisition Timing (BFAT)** feature that functions at low data rates (64 kbps to 256 kbps). This feature allows for significantly faster acquisition times at these data rates, even with higher noise, resulting in improved efficiency of the shared STDMA channel. Since signal lock is faster at higher data rates, BFAT is not active above 256 kbps.

Entering **A** at the command prompt will toggle this feature On or Off.

This feature requires Base Modem firmware version 1.5.2 or later, together with Router firmware version 1.5.3 or later. Modems must be operating at either 3/4 QPSK or .95 QPSK in order to utilize BFAT.



Note: Use of BFAT is NOT recommended with ECMv2.

When this feature is enabled with any other allocation method, the Preamble parameter becomes fixed (not settable by the user) and this value is automatically determined by the system—appears as display only in the CLI; not displayed in the Parameter Editor.

Burstmap Multicast IP

This menu item 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 burstmap 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 change the current address, enter **N** at the command prompt to display the dialog shown in figure 3-13.



Figure 3-13 Burstmap Multicast IP prompt

Outbound IP

This menu item, which appears for all Hub configurations, displays the current Outbound IP address. This specifies the Hub device that is supplying the TDM outbound to the satellite (typically a CDM-570/570L). 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 using the following features:

- DPC
- SOTM

The Outbound IP address will be the same as the burst controller IP address when the burst controller and the TDM modem are the same device.

To define the TDM outbound address, enter **O** at the command prompt. The dialog shown in figure 3-14 will be displayed.

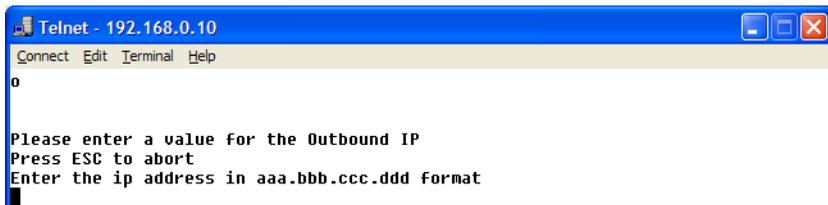


Figure 3-14 Outbound IP prompt

Cycles Per Burst Map

This menu item, which appears for Hub types *Fixed*, *Dynamic Slot*, and *Entry Channel*, 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.

This parameter can be modified from the Hub CDM-570/570L by entering a **C** at the command prompt as shown in figure 3-15.

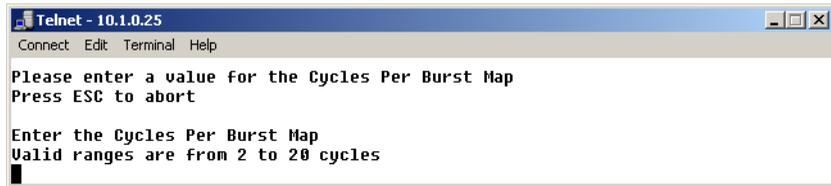


Figure 3-15 Cycles per Burst Map prompt

On Remote units, this menu item is an information-only display.

Slot Guardband

This menu item, which appears for all Hub configurations, displays the current length of the Slot Guardband in milliseconds and in bytes 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*.



Tip: For a copy of the latest Viper Calculator, contact a Comtech Vipersat Networks representative.

On a Hub unit, this value can be modified by entering **G** at the command prompt to display the dialog shown in figure 3-16 and entering a new value.



Figure 3-16 Slot Guardband prompt

On Remote units, this menu item is an information-only display.



Note: The value entered at the command line in figure 3-16 is in milliseconds. The corresponding value expressed in bytes is calculated by the CDM-570/570L based on the STDMA transmit bit rate as shown in the menu in figure 3-7.

Slot Preamble Length

This menu item, which appears in all Hub and Remote configurations, displays the current Slot Preamble size in milliseconds and bytes for the remotes in the group. The Slot 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. Higher data rates allow for a shorter preamble, since it is easier to achieve signal lock. The setting for this parameter should be obtained using the *Vipersat STDMA Calculator*.



Note: When either the BFAT feature is enabled or the Hub type is ECMv2, the preamble length is set automatically for the unit.

On a Hub unit, entering **P** at the command prompt allows changing the preamble duration in milliseconds.

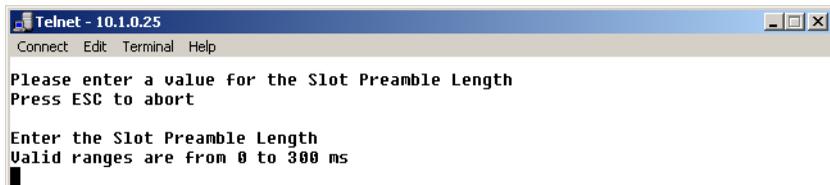


Figure 3-17 Slot Preamble Length prompt

On Remote units, this menu item is an information-only display.

Slot Data Length

This menu item displays the Slot Data Length in milli-seconds and bytes for the remotes in the group, 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
- *GIR* – Minimum Data Length
- *Entry Channel* – Data Length, Minimum Data Length

- *ECMv2* – Slot Data Length

On a Hub unit, entering **B** and **M** at the command prompt brings up the dialogs for specifying the data length in milliseconds for the target CDM-570/570L, as shown in figure 3-18.

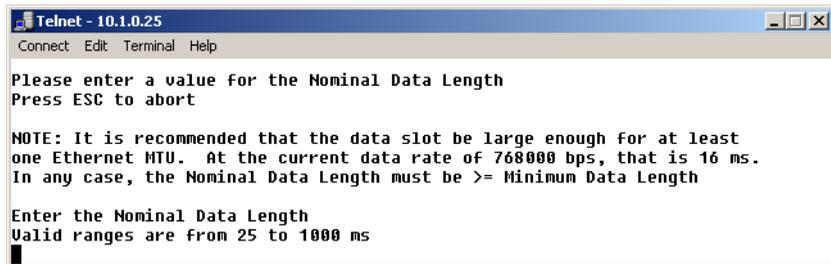


Figure 3-18 Slot Data Length (Nominal)

On Remote units, this menu item is an information-only display.

Total Slot Count

This menu item appears for Hub units operating in ECMv2 only.

This parameter defines the number of time slots per cycle available for assignment to the Remotes in queue that are to be switched from ECM into dSCPC. These are the Remotes that are tagged for **Online** mode. By design, ECM works on a contention basis, with the number of slots being some fraction of the total number of Remotes. In order for this ratio to be optimized, a Vipersat calculator is available to determine this setting.



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

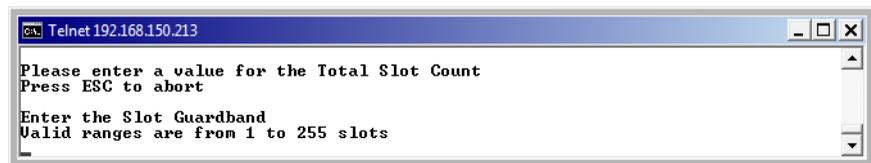


Figure 3-19 Total Slot Count prompt

Entering **R** at the command prompt allows changing the slot count. Valid range is 1 to 255.

Slot Cycle Length

This menu item is for information only and displays the Slot Cycle Length in milliseconds and bytes for the remotes in the group. This value represents the total amount of time—preamble, data length, and guardband—allocated to the remote modem during one spin cycle.

Slot Start in Cycle

This menu item is an information-only display for Remote modems, and indicates how much time passes from the start of the spin cycle until this Remote is provided a time slot. In the example shown in figure 3-8, the Remote is provided the first slot in the cycle (0 mSec).

Set Remotes

This menu item appears in the STDMA screen when the Unit Role is **Hub**, *except for Hub Type ECMv2*.

From a Hub CDM-570/570L, entering **R** at the command prompt displays the **STDMA Remotes Menu**.

```

Telnet - 192.168.0.10
Connect Edit Terminal Help

                          STDMA Remotes Menu
                          Remote Name      Remote IP      Status
Remote01.....[Remote 1      192.168.1.1    0011 (U B )].1
Remote02.....[Remote 2      192.168.1.65   0011 (U B )].2
Remote03.....[Remote 3      192.168.1.129  0011 (U B )].3
Remote04.....[UNKNOWN].....4
Remote05.....[UNKNOWN].....5
Remote06.....[UNKNOWN].....6
Remote07.....[UNKNOWN].....7
Remote08.....[UNKNOWN].....8
Remote09.....[UNKNOWN].....9
Base.....[1].....B
Remote Count.....[3]
Set Remote Policies.....P
Delete.....D
Enable/Disable.....E
View.....V
Remove Timeout.....[0].....R
Remove Retry Timeout..[0].....T

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

```

Figure 3-20 STDMA Remotes Menu screen

The menu shown in figure 3-20 is used to define and make modifications to the Remotes that belong to the STDMA group for the Hub burst controller, as well as to display each Remote's burstmap status information.

Adding a Remote to the STDMA Group

Entering the item number for the Remote modem/router brings up the dialog shown in figure 3-21. A prompt to enter the **Name** for the Remote unit appears, followed by a prompt to enter the **IP Address**.



Figure 3-21 Adding a Remote to the STDMA group

Once a Remote has been added to the group, its Status in the group is displayed by the use of the following letters:

- **U = Used** – This Remote is being used in the burstmap.
Once a remote has been added to the STDMA group, this status will always be displayed.
- **B = Burstmap** – This Remote is currently in the burstmap.
This status will be displayed unless the remote has been removed (R), disabled (D), or switched (S) out of the STDMA burstmap.
- **R = Removed** – This Remote is currently removed from the burstmap.
When displayed, this status indicates that the Hub has removed this remote from the burstmap due to a communications fault.
- **D = Disabled** – This Remote is currently disabled and is not in the burstmap.
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 burstmap 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.

- **CF** – This Remote has not sent an acknowledgement to the burst controller since it was enabled.

Base

Entering a **B** at the command prompt in figure 3-20 allows entering the Remote number to start displaying remotes in this menu screen. Entering the number 1, as shown in figure 3-20, displays nine remotes, 1 through 9. If the number 4 had been entered, the display would show the nine remotes starting with remote 4 (i.e., remotes 4 through 12).



Figure 3-22 Modifying Remote Display Base

Remote Count

The **Remote Count** menu item in figure 3-20 is an information only display showing the total number of Remotes that currently belong to the STDMA group for this Hub burst controller.

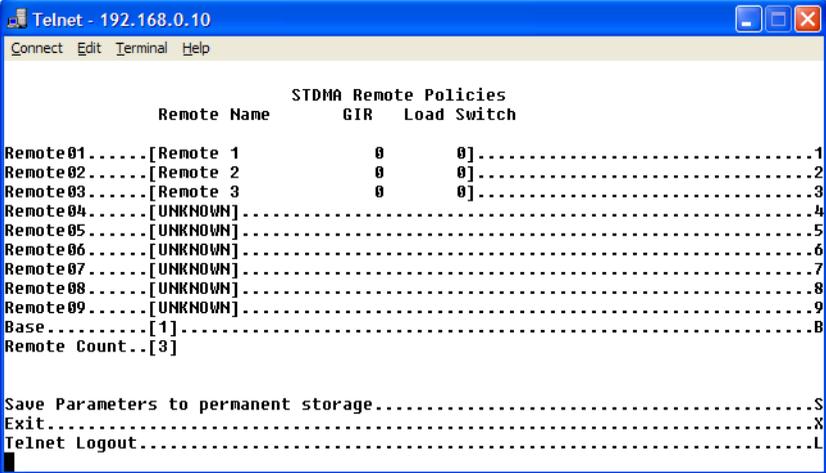
Set Remote Policies

This menu item, which appears for *GIR and Entry Channel* Hub types, allows each Remote to be configured for specific data switching conditions.

For Hub STDMA Controllers operating in either GIR 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). If the switch rate for a Remote is set to 0 kbps, that Remote will remain in STDMA mode and will only switch to SCPC mode due to an application switch or a diagnostic (manual) switch.

Entering **P** at the **STDMA Remotes Menu** command prompt displays the **Remote Policies** screen shown in either figure 3-23 (GIR Hub) or figure 3-25 (Entry Channel Hub).



```

Telnet - 192.168.0.10
Connect Edit Terminal Help

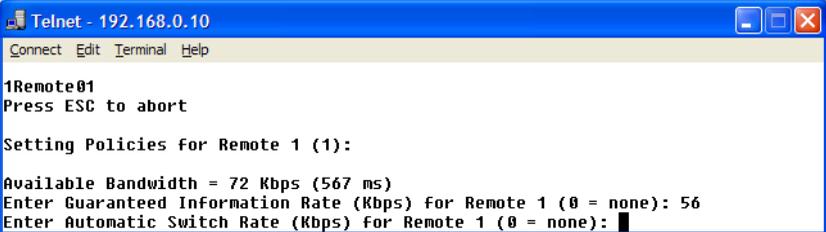
                          STDMA Remote Policies
Remote Name      GIR      Load Switch
Remote01.....[Remote 1      0      0].....1
Remote02.....[Remote 2      0      0].....2
Remote03.....[Remote 3      0      0].....3
Remote04.....[UNKNOWN].....4
Remote05.....[UNKNOWN].....5
Remote06.....[UNKNOWN].....6
Remote07.....[UNKNOWN].....7
Remote08.....[UNKNOWN].....8
Remote09.....[UNKNOWN].....9
Base.....[1].....8
Remote Count..[3]

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

```

Figure 3-23 STDMA Remote Policies screen (GIR Hub)

Entering the Remote number at the command prompt in figure 3-23 allows the **Guaranteed Information Rate** and the **Automatic Load Switch Rate** for that Remote to be set, as shown in figure 3-24. Note that the Available Bandwidth is displayed for reference in this screen to assist with entering the appropriate rates. The cycle length for GIR is limited to a maximum of one second.



```

Telnet - 192.168.0.10
Connect Edit Terminal Help

1Remote01
Press ESC to abort

Setting Policies for Remote 1 (1):

Available Bandwidth = 72 Kbps (567 ms)
Enter Guaranteed Information Rate (Kbps) for Remote 1 (0 = none): 56
Enter Automatic Switch Rate (Kbps) for Remote 1 (0 = none): 0

```

Figure 3-24 GIR Remote Policies prompt

Set the Automatic Load 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** will prevent the Remote from being switched out of STDMA and into SCPC mode.

The Remote Policies screen for an Entry Channel Hub type allows the SCPC data rates and switch types to be specified for when the Remotes will switch and the desired starting points for communications.

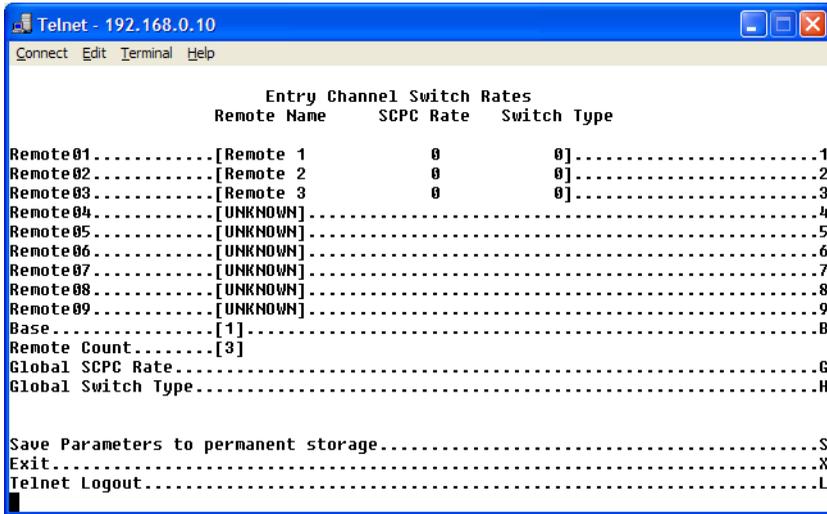


Figure 3-25 Entry Channel Switch Rates screen

Entering the Remote number at the command prompt in figure 3-25 allows the **SCPC Data Rate** and the **Switch Type** for that Remote to be set, as shown in figure 3-26. Switch type **0** corresponds to Load Switching; switch 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 “STDMA/SCPC Automatic Switching” on page 3-31).

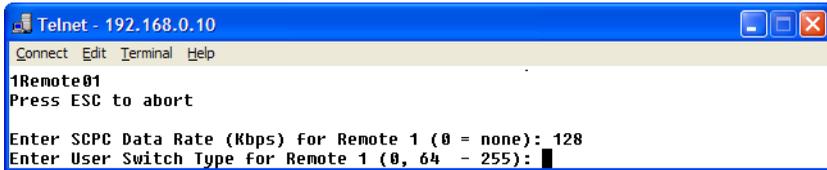


Figure 3-26 Remote SCPC Data Rate and Switch Type prompt

The **Global SCPC Rate** command can be used to set the data rate for all or a majority of the Remotes. This allows the rate to be entered just once instead of entering the rate for each remote individually. Enter **G** at the command prompt.

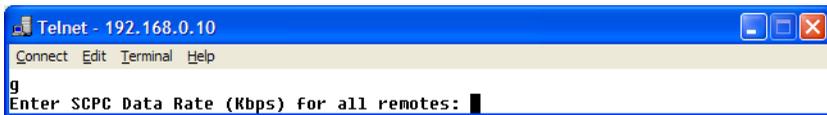


Figure 3-27 Global SCPC Data Rate prompt

Similarly, the **Global Switch Type** command can be used to set the switch type for all or a majority of the Remotes. Enter **H** at the command prompt.

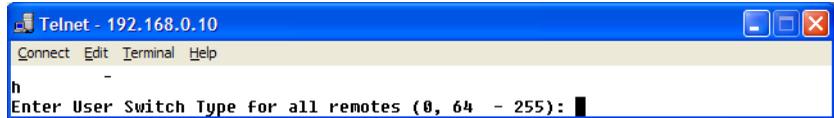


Figure 3-28 Global Switch Type prompt

Delete Remote

Entering **D** at the command prompt shown in figure 3-20 brings up the **Delete Remote** dialog shown in figure 3-29.



Figure 3-29 Delete Remote prompt

Enter the number of the Remote CDM-570/570L at the command prompt to delete it from the STDMA group for this Hub burst controller.

Enable/Disable Remote

Enter **E** at the command prompt in figure 3-20 to display the dialog shown in figure 3-30. The Remotes in the STDMA group are displayed, indicating whether each is currently **Enabled (E)** or **Disabled**.



Figure 3-30 Enable/Disable Remote prompt

Enter the number of the Remote at the command prompt to toggle the Remote from its current Enable/Disable configuration.

In the example screen shown above, Remotes 1 and 2 are Enabled and Remotes 3 and 4 are Disabled.

View Remote(s)

Entering **V** at the command prompt shown in figure 3-20 will display the listing of Remote(s) that belong to the STDMA group for this Hub burst controller, and their status, as shown in figure 3-31.

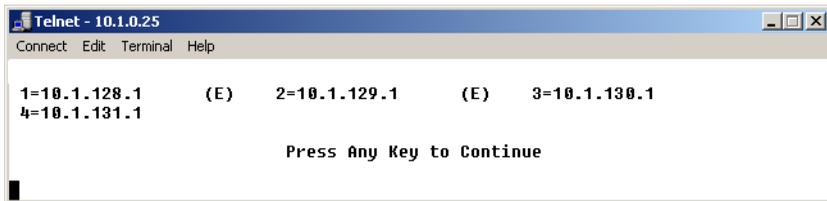


Figure 3-31 View Remote(s) screen

The display is for information only and pressing any key will return the screen to the menu shown in figure 3-20.

Remove Timeout

Entering **R** at the command prompt shown in figure 3-20 will display the **Remove Timeout** dialog shown in figure 3-32. Note that this menu item shows the current setting (in seconds) for this parameter.

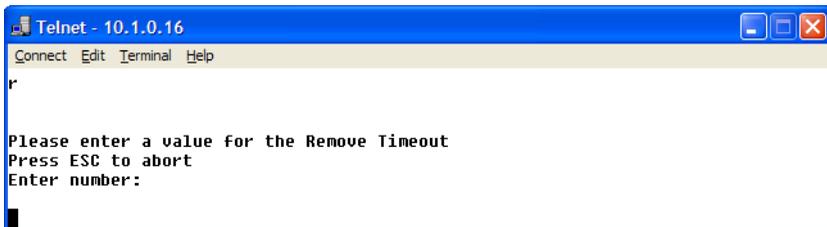


Figure 3-32 Remove Timeout prompt

The value entered at the command prompt defines the amount of time (in seconds) with no communication from a 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.

Remove Retry Timeout

Entering **T** at the command prompt in figure 3-20 will display the **Remove Retry Timeout** dialog shown in figure 3-33.



Figure 3-33 Remove Retry Timeout prompt

When a Remote is removed from the STDMA group, as described in the section “Remove Timeout” above, entering a value in the Remove Retry Timeout dialog defines the amount of time (in 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 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.

LNB LO Frequency

This menu item appears for an ECMv2 Hub type only.

This parameter, together with the Satellite Frequency Conversion setting, is critical for determining RF frequency translations between Hub and Remote offsets or data spectral inversions. Take care in setting these correctly.

Enter **Z** at the command prompt and specify the correct LNB Local Oscillator frequency (MHz) that this Hub unit will be receiving.



Figure 3-34 LNB LO Frequency prompt

BUC LO Frequency

This menu item appears for ECMv2 modems only.

This parameter is critical for determining RF frequency translations between Hub and Remote offsets or data spectral inversions. Take care in setting this correctly.

Enter **B** at the command prompt and specify the correct BUC Local Oscillator frequency (MHz) that this Remote will be transmitting.



Figure 3-35 BUC LO Frequency prompt

Satellite Frequency Conversion

This menu item appears for the ECMv2 Hub type only.

This parameter, together with the LNB LO Frequency setting, is critical for determining RF frequency translations between Hub and Remote offsets or data spectral inversions. Take care in setting these correctly.

Enter **F** at the command prompt and specify the correct Satellite Frequency Conversion value (MHz) that this Hub unit.



Figure 3-36 Satellite Frequency Conversion prompt

STDMA Statistics

Entering **V** at the command prompt in the **STDMA** screen displays the **STDMA Statistics** as shown in either figure 3-37 (Hub) or figure 3-38 (Remote). These screens provide information for the number of Bursts (Remote only), number of Burst Maps, and the current STDMA Cycle Length.

Because the Remote modem bursts back to the Hub once every cycle, the number of Bursts displayed should be a multiple of the number of Burst Maps displayed, with this multiple determined by the number of cycles per burst map (1, 2, or more) that has been defined at the Hub. For the example shown in figure 3-38 (Dynamic Cycle), the number of cycles per burst map is one, and therefore the number of Bursts equals the number of Burst Maps.

```

Telnet - 192.168.150.71
Connect Edit Terminal Help

                          STDMA Statistics
Number of Burst Maps.....[36057]
Current Cycle Length.....[ 316 mSec (20224 bytes)]
Stats Accumulation Window(Sec)..[10].....W
CLEAR.....C

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

```

Figure 3-37 STDMA Statistics screen (Hub)

```

Telnet - 192.168.2.1
Connect Edit Terminal Help

                          STDMA Statistics
Number of Bursts.....[36826]
Number of Burst Maps.....[36826]
Current Cycle Length.....[ 316 mSec (20224 bytes)]
CLEAR.....C

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

```

Figure 3-38 STDMA Statistics screen (Remote)

The window of time that is used to average the **accumulation of statistics** can be set by entering **W** at the command prompt in the Hub screen, then entering the number of seconds (from 1 to 20).

To **clear** (reset to 0) these statistics, enter **C** at the command prompt.

Show Hub Statistics

Entering a **W** at the command prompt in the **STDMA** screen (figure 3-7) displays the current statistics for the target CDM-570/570L Hub, as shown in figure 3-39.

Current Spins =		3616		Missed	Acks	Rcvd	Average	Average	Average
IP Address		At Hub	Total	ACKs	Rx	Bytes	Slot	Usage	Slot
		Cont						(MSecs)	
1.	10.1.128.1	E	0	25	3155	34	37.8%	283	
2.	10.1.129.1	E	0	17	3438	45	41.5%	311	
3.	10.1.130.1	E	0	40	2957	4471	13.1%	98	
4.	10.1.131.1	E	0	8	3145	5	7.6%	56	

Press 'C' to Clear Statistics or any other key to Continue

Figure 3-39 Hub Statistics screen

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.

In figure 3-39, Remote 1 with IP address 10.1.128.1 had activity during the averaging period. It captured 37.8% of the total slot time and had an average slot length of 283 ms. Remotes 2, 3, and 4 had 41.5%, 18.1%, and 7.6% respectively. 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 Statistics Accumulation Window parameter and the Cycles per Burst Map parameter, both of which are also operator selectable.

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” column represents continuous—the number of sequential ACKs missed.

An informative indicator in the Hub Statistics screen is the STDMA status of the Remotes that appears in the first column to the right of the IP Address list. The Remote status is displayed in one of three possible modes:

- **E** – Remote is **E**nabled and active in the STDMA group; the Hub burst controller is receiving ACKs from this Remote.
- **ER** – Remote is **E**nabled but has been **R**emoved from the STDMA group due to missed ACKs at the Hub burst controller.

- (Blank) – Remote either has been manually Disabled, such as through the STDMA Remotes Menu Enable/Disable command, or has been switched out of STDMA to SCPC mode by the VMS.

STDMA/SCPC Automatic Switching

One of the most powerful features of the Vipersat CDM-570/570L 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, Application (Voice and Video RTP), ToS, and QoS.

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



Note: Care must be taken when configuring the Auto Switching features of the Vipersat system to ensure that there is no duplication or overlap of switching functions between Application, ToS, and QoS for a particular traffic flow. Only one of these switching methods should be utilized for any one flow requirement.

The functions available for configuring the switching operations depend on whether the target CDM-570/570L 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, Auto Switching should be Disabled for these two modes.

In order for the target CDM-570/570L to be automatically switched between STDMA and SCPC modes, the **Auto Switching** feature must be Enabled as described in the section “Feature Configuration” on page 3-5.

Selecting **Automatic Switching** from the **Vipersat Configuration** screen shown in figure 3-6 (enter **A**) will display the **STDMA/SCPC Auto Switching** screen shown in either figure 3-40 (Hub modem) or figure 3-41 (Remote modem).

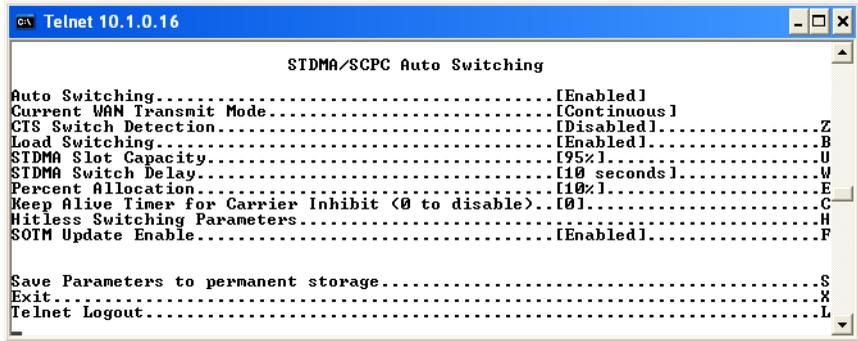


Figure 3-40 STDMA/SCPC Auto Switching screen (Hub)

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.

Application switching, ToS switching, and QoS switching are controlled by the Remote, and thus appear only in the Remote Auto Switching screen.

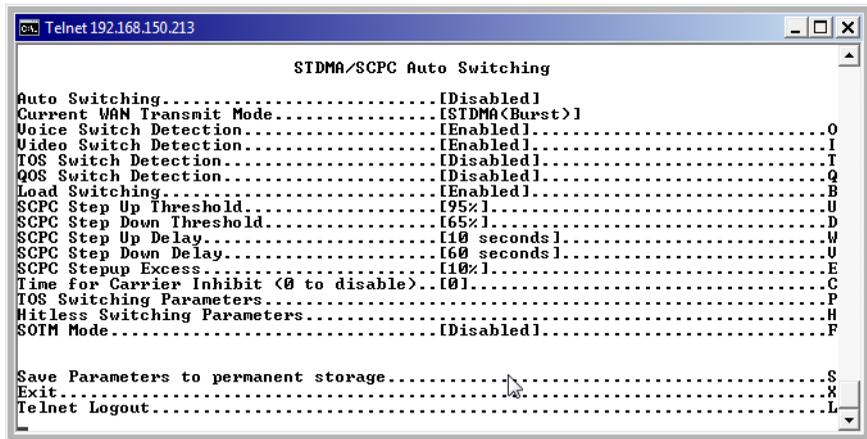


Figure 3-41 STDMA/SCPC Auto Switching screen (Remote)

Auto Switching

The **Auto Switching** item is for information only and shows the current configuration of this feature for the target CDM-570/570L. This feature is Enabled and Disabled as described in the section “Feature Configuration” on page 3-5. Auto Switching must be **Enabled** in order to utilize any of the related features/commands in this menu.

Note that Auto Switching must be Enabled on a Hub STDMA Controller that is configured for Entry Channel mode.

Current WAN Transmit Mode

The **Current WAN Transmit Mode** item is for information only and reflects the current status (STDMA mode or SCPC mode) of the CDM-570/570L. If the CDM-570/570L is functioning as a Hub in the network, this item will always read **Continuous** as shown in figure 3-40. If the CDM-570/570L is functioning as a Remote in the network and STDMA is enabled, this item will show **STDMA (Burst)** when in STDMA mode, as shown in figure 3-41, or **Continuous** when switched out into SCPC mode.



Tip: This menu item is useful for determining whether a Remote modem is currently operating in STDMA or SCPC mode.

Voice & Video Application Switching

One of the four automatic switching functions that the Vipersat CDM-570/570L is able to perform is **Application Switching**. The Vipersat CDM-570/570L provides application switching for non-encrypted SIP and/or H.323 traffic that is detected on the satellite network. When encryption prevents the detection of this type of traffic, an alternate means of SCPC switching can be configured using the ToS auto switching feature.

Detection of the voice and video traffic occurs in the Remote modem classifier, which looks at traffic that is passed in both directions (Hub-to-Remote and Remote-to-Hub). Once the Voice and Video Switch Detection features are enabled, the Remote modem will send an Automatic Switch Request (ASR) to the VMS when an SIP and/or H.323 call is detected. The ASR contains the destination IP address of the RTP packets. If available hardware and bandwidth exist, the VMS will establish the SCPC carrier automatically.



Note: Application switching (Voice and Video) must be Enabled for each CDM-570/570L in a network that is going to perform Application switching in order for the VMS to dynamically optimize network circuit parameters to accommodate these applications.

Load switching by the VMS is not affected by this setting.

Voice Switch Detection

This menu item appears for Remote modems only.

Voice Switch Detection is one of the Application switching commands that provides for a dedicated SCPC connection when an SIP and/or H.323 voice call is made over the satellite network.

Entering **O** at the command prompt toggles the **Voice Switch Detection** command for the CDM-570/570L between **Enabled** and **Disabled**. When enabled, a voice data-stream will be detected, causing the CDM-570/570L to send a switch request to the VMS to switch from STDMA to SCPC mode.

Video Switch Detection

This menu item appears for Remote modems only.

Video Switch Detection is one of the Application switching commands that provides for a dedicated SCPC connection when an H.323 video call is made over the satellite network.

Entering **I** at the command prompt toggles the **Video Switch Detection** command for the CDM-570/570L between **Enabled** and **Disabled**. When enabled, a video data-stream will be detected, causing the CDM-570/570L to send a switch request to the VMS to switch from STDMA to SCPC mode.

ToS Switch Detection

This menu item appears for Remote modems only.

One of the four automatic switching functions that the Vipersat CDM-570/570L is able to perform is **ToS (Type of Service) Switching**. ToS is defined by an eight bit field within an IP packet header that is used to set up per-hop-based QoS rules for prioritizing packets. Because the ToS field remains untouched by most encryption methods, ToS switching provides an alternative means of SCPC switching when encryption prevents the detection of SIP and H.323 protocols.

ToS detection occurs in the Remote modem which only looks at traffic that is passed in the LAN-to-SAT (Remote to Hub) direction. Once the ToS Switch Detection feature is enabled, the Remote modem will send an ASR to the VMS when a packet stamped with the ToS is detected. The ASR contains the destination IP address of the ToS stamped packet, the desired SCPC rate, and the VMS Switch Type (policy #). If available hardware and bandwidth exist, the VMS will establish the SCPC carrier automatically.

Entering **T** at the command prompt in figure 3-41 toggles the **TOS Switch Detection** command for the CDM-570/570L between **Enabled** and **Disabled**. When enabling ToS switching, the ToS switching control parameters must be defined as described in the section “ToS Switching Parameters” on page 3-45.

Applying a ToS value to an application (VoIP, IPVC, or priority data) through either preservation or classification packet stamping allows the Vipersat switching system to function in an encrypted network. Normally in a non-encrypted Vipersat network, packets are classified by the Remote CDM-570/570L using protocol classification detection and the results are forwarded to VMS via

VESP (Vipersat External Switching Protocol) or, in legacy VMS systems, via an ASR (Automatic Switch Request) message. The VMS switch detector service then applies the required or requested bandwidth using policies which have been pre-configured in the VMS. Refer to the *VMS User's Guide* for details.

For example, if in a non-encrypted network a voice application service connection is started, the CDM-570/570L's classifier analyzes signaling and data protocols (H.323, SIP, & Data RTP) being routed through the CDM-570/570L. After connection detection, the process waits for data (RTP). Data is normally sent after the receiving party answers, which then triggers the system to process an ASR. Using the ToS classification, the detection function allows application-based switching in encrypted networks where the signaling protocols are encrypted or effectively hidden.



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

QoS Switch Detection

This menu item appears for Remote modems only.

One of the four automatic switching functions that the Vipersat CDM-570/570L is able to perform is **QoS (Quality of Service) Switching**. The optional QoS capabilities available in each modem/router may be utilized whenever a modem will be handling high-priority traffic, such as video or voice. While developing the QoS rules to be applied to the unit, the type of traffic the modem is expected to handle must be considered.

With this feature, an STDMA to SCPC switch can be initiated based upon any type of IP traffic flow that matches a defined QoS queue. QoS detection occurs in the Remote modem classifier, which looks at traffic that is passed in both directions (Hub-to-Remote and Remote-to-Hub). When an IP packet matches a defined QoS rule, the Remote modem sends an ASR to the VMS that contains the destination address of the detected packet, the defined bit rate, and the policy type. If available hardware and bandwidth exist, the VMS will establish the SCPC carrier automatically.

Enable Quality of Service (QoS) Feature



Note: Quality of Service is an optional modem/router feature. If the QoS feature (FAST feature code) has not been purchased for this modem, the QoS menu item will not be displayed.

The QoS feature must be enabled in order for the QoS Switch Detection feature to function. The QoS feature is Enabled/Disabled from the **Feature Configuration** screen (see figure 2-3).

Configure QoS Rules

The Vipersat CDM-570/570L is capable of performing automatic switching based on the QoS rules for a Remote modem. QoS rules can be assigned to different flow types that are user-defined by any combination of traffic type protocol (FTP, UDP, RTP, etc.), source/destination IP (specific or range), and/or Layer 3 source/destination port.

The Vipersat QoS Switching feature is designed to manage single, specific sessions or flow types, such as a UDP video stream targeted to a specific port. When defining QoS rules for QoS based switching, it is best to make them as specific as possible so as to avoid unintended or multiple sessions/flows being generated with that rule. A QoS rule that creates multiple flows will result in poor switching performance. With voice traffic, for example, prioritize by using the VOCE protocol rather than prioritizing with RTP or UDP.

From the **Main Menu** for the Remote modem, enter **Q** to access the **QoS Configuration** screen, as shown in figure 3-42.

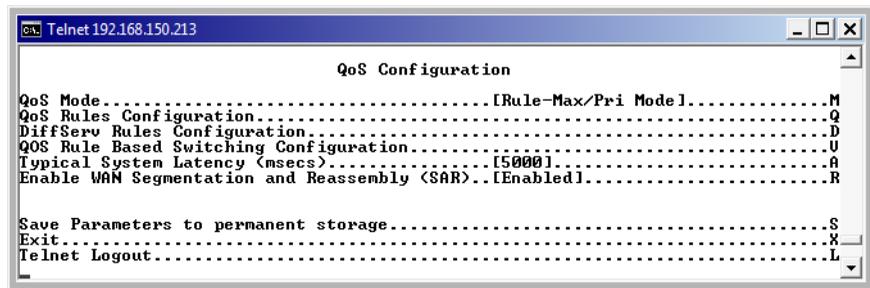


Figure 3-42 QoS Configuration screen

Enter **M** at the command prompt to designate one of four **Modes** of QoS operation (figure 3-43):

- **Rule Max/Priority** – QoS rules based on maximum bandwidth and priority
- **Rule Min/Max** – QoS rules based on minimum and maximum bandwidth
- **Diff Serv** – QoS rules based on Differentiated Services settings
- **VLAN** – QoS rules based on the user priority field in the VLAN header



Figure 3-43 QoS Mode prompt

The QoS mode that is chosen will determine the settable parameters for defining QoS rules.

Enter **Q** at the command prompt in figure 3-42 to access the **QoS Rules Configuration** screen. The example shown in figure 3-44 is for Max/Priority mode.

```

Telnet - 10.1.128.1
Connect Edit Terminal Help

                QoS Rules Configuration

      SrcIP          DestIP          Prot SPort  DPort MaxBW PWFS
RL01..[10.1.128.100/32  10.1.0.100/32  UDP  ***   ***  99999 2NNY  ]-1
RL02..[ ***/*          ***/*          UDP  6000   ***  99999 3VNY  ]-2
                ~6000   ***
RL03..[UNKNOWN].....-3
RL04..[UNKNOWN].....-4
RL05..[UNKNOWN].....-5
RL06..[UNKNOWN].....-6
RL07..[UNKNOWN].....-7
RL08..[UNKNOWN].....-8
Def...[ ***/*          ***/*          ALL  ***   ***  99999 9NNN  ]-R

      [ P-Priority  W-WRED(Yes/No)  F-Filter(Yes/No)  S-Switching(Yes/No) ]
Del.....-D
Base..[1].....-B
Stat.....-T
QoS...[          QoS Enabled          ]

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

Figure 3-44 QoS Rules Configuration screen, Max/Priority Mode

Enter **D** at the prompt in figure 3-42 to access the **DiffServ Rules Configuration** screen.

```

Telnet 192.168.150.213

                DiffServ Rules Configuration

      Class          DSCP          Min          Max          Max
Rule01.....[UNKNOWN].....1
Rule02.....[UNKNOWN].....2
Rule03.....[UNKNOWN].....3
Rule04.....[UNKNOWN].....4
Rule05.....[UNKNOWN].....5
Rule06.....[UNKNOWN].....6
Rule07.....[UNKNOWN].....7
Rule08.....[UNKNOWN].....8
Base.....[1].....B
Precedence Priority..[Disabled].....C
ASF Max Bandwidth...[DataRate].....M

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

Figure 3-45 DiffServ Rules Configuration screen

Configure the desired number of rules that are necessary for the applications to be used for this network. Refer to the *CDM-570/570L Installation and Operation Manual* for details on configuring QoS Rules for the CDM-570/570L.

Configure QoS Rules Based Switching

Enter **V** at the command prompt in figure 3-42 to access the **QoS Rules Based Switching** screen for the Remote modem, as shown in figure 3-46.

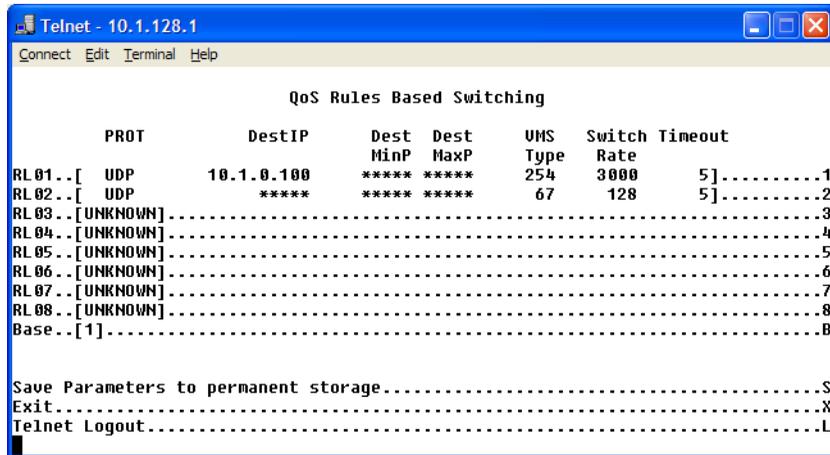


Figure 3-46 QoS Rules Based Switching screen

Determine which QoS rules will be used as a basis for performing SCPC switching, then configure the VMS policy type, the SCPC switch rate, and the timeout value to be associated with each rule. Assigning a 0 (zero) value means that no SCPC switch will occur for that rule.

Typical System Latency

Enter **A** at the command prompt in figure 3-42 to configure the **Typical System Latency** parameter for the Remote modem, as shown in figure 3-47.

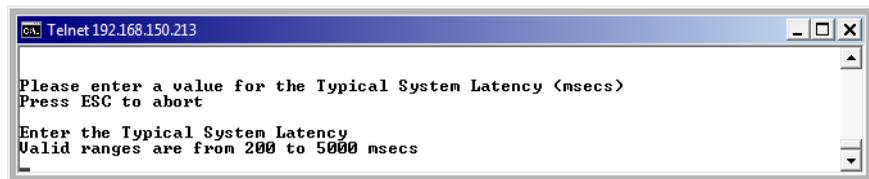


Figure 3-47 Typical System Latency prompt

This setting corresponds to the buffer queue depth and should be set according to the type of traffic. In the majority of applications, the recommended setting is

between 200 and 500 msec. For higher traffic priority, a lower latency is desired. Voice traffic, for example, would call for a setting of 200 msec to minimize latency effects.

Valid range is 200 to 5000 msec.

Enable WAN SAR

Packet Segmentation and Reassembly (SAR) can be enabled for QoS. With this feature, packets are made smaller to speed them through the network and to satisfy specified packet size restrictions for a given path.

SAR is an adaptive process; it will trigger only if the packet latency exceeds the threshold value (default is 20 msec). Latency value is calculated based on the satellite transmission bandwidth. The minimum segment size is limited to 480 bytes—excluding satellite HDLC header information—in order to avoid satellite overhead and consumption of CPU cycles.

Enter **R** at the prompt in figure 3-42 to toggle between Enabled/Disabled.

Enable QoS Switch Detection Feature

Once QoS has been enabled and configured as described above, the last step in implementing QoS switching is to **Enable** the **QoS Switch Detection** feature. Entering **Q** at the command prompt in figure 3-41 toggles the QoS Switch Detection feature between Enabled and Disabled.

Load Switching

One of the four automatic switching functions that the Vipersat CDM-570/570L 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 CDM-570/570L 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** command on the **Auto Switching** menu is a toggle that Enables and Disables Load Switching on the target CDM-570/570L. Entering **B** at the command prompt will toggle between these two states.



Note: Load switching must be Enabled for any CDM-570/570L that will experience changing load conditions in order for the VMS to dynamically optimize network performance on these circuits.

Application switching by the VMS, such as for Voice and/or Video, is not

affected by this setting. However, using Load switching for real-time applications is not recommended.

STDMA Slot Capacity

This menu item appears for Hub modems only.

The **STDMA Slot Capacity** command 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 **U** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-48.

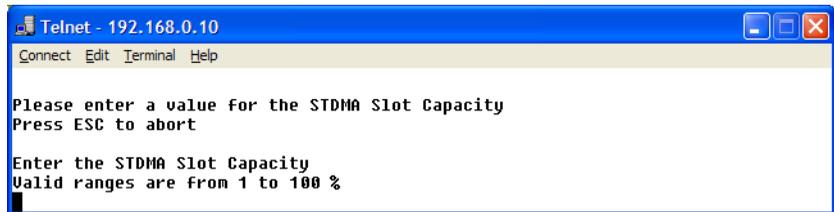


Figure 3-48 STDMA Slot Capacity prompt

STDMA Switch Delay

This menu item 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, a 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 **W** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-49.

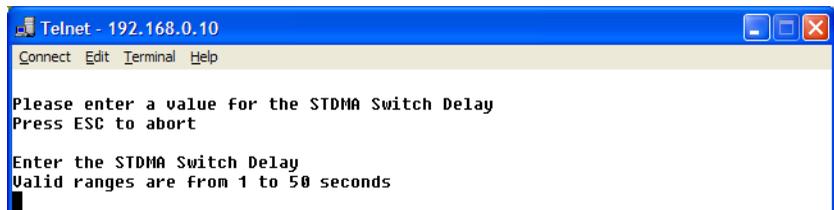


Figure 3-49 STDMA Switch Delay prompt

Percent Allocation

This menu item appears for Hub modems only.

The **Percent Allocation** menu item 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 **E** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-50.

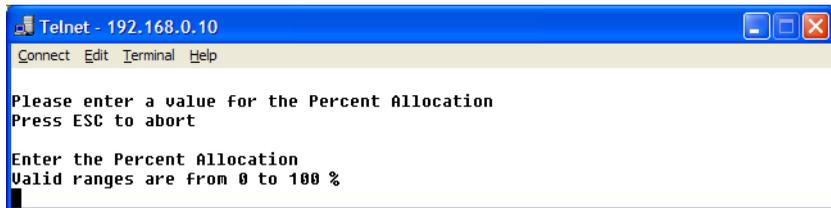


Figure 3-50 Percent Allocation prompt

SCPC Step Up Threshold

This menu item 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 **U** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-51. Note that this value must be greater than the value specified for the SCPC Step Down Threshold.



Figure 3-51 SCPC Step Up Threshold prompt

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 **D** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-52. Note that this value must be less than the value specified for the SCPC Step Up Threshold.



Figure 3-52 SCPC Step Down Threshold prompt

SCPC Step Up Delay

This menu item appears for Remote modems only.

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

A default value (10 seconds) is provided, but this parameter can be modified by entering **W** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-53.

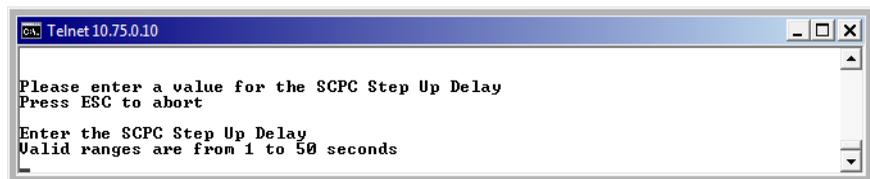


Figure 3-53 SCPC Step Up Delay prompt

SCPC Step Down Delay

This menu item appears for Remote modems only.

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

A default value (60 seconds) is provided, but this parameter can be modified by entering **V** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-53.



Figure 3-54 SCPC Step Down Delay prompt

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 **E** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-55.

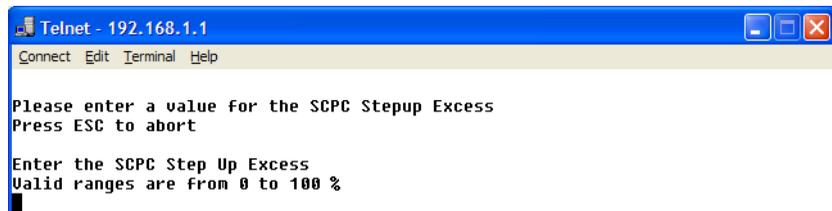


Figure 3-55 SCPC Step Up Excess prompt

Keep Alive Timer for Carrier Inhibit

This menu item appears for Hub modems only.

The **Keep Alive Timer for Carrier Inhibit** parameter provides a fixed setting that can be specified for the keep alive message sent to the Remotes from the Hub. This provides an alternate to the burst map which is variable and may become excessively long in certain applications. An example of this is a burst

map containing a large number (up to 100) of remotes running in ECM mode where the burst period exceeds the Remote carrier inhibit timer.

When implemented, this parameter is set at either the TDM outbound unit or a switched demod, not at the STDMA Controller, in order to prevent a problem should the burst controller be rebooted.

Enter **C** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-56.

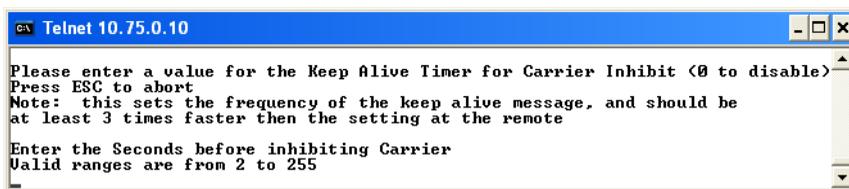


Figure 3-56 Keep Alive Timer for Carrier Inhibit prompt

Note that this timer setting should be at least three times faster (shorter in duration) than the timer setting at the Remote(s) to ensure that network links are maintained.

Time for Carrier Inhibit

This menu item appears for Remote modems only.

The **Time for Carrier Inhibit** feature provides a time period to be specified for how long the Remote modem has not received the Burst Map from the Hub STDMA Controller (loss of link) before that Remote mutes its transmitter. This feature is useful, for example, in an SNG application for a mobile Remote whose antenna is no longer aligned with the satellite and should not continue to transmit the carrier signal.

Enter **C** at the command prompt in the **Auto Switching** screen to display the dialog shown in figure 3-57. This parameter is configured on an individual, per Remote basis.

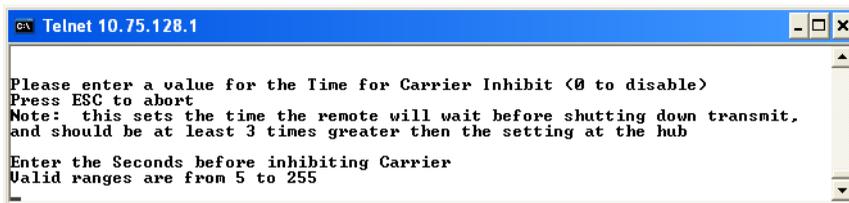


Figure 3-57 Time for Carrier Inhibit prompt

Note that this timer setting should be at least three times greater (longer in duration) than the timer setting at the Hub to ensure that the network link is maintained.

ToS Switching Parameters

This menu item appears for Remote modems only.

When ToS switching is enabled on a CDM-570/570L, the parameters for ToS switching must be defined by entering **P** from the STDMA/SCPC Auto Switching screen (see figure 3-41). The **TOS Switching Control** menu shown in figure 3-58 is displayed, allowing parameter entry for the desired ToS service to be applied.

Service Name	TOS Value	Control Switch Type	Switch Rate	Timeout
TOS01	1	64	32	51
TOS02	5	65	450	71
TOS03	10	70	1000	101
TOS04	[UNKNOWN]			
TOS05	[UNKNOWN]			
TOS06	[UNKNOWN]			
TOS07	[UNKNOWN]			
TOS08	[UNKNOWN]			
TOS09	[UNKNOWN]			
Base	[1]			
TOS ID Count	[3]			
Max Streams	[1]			
Delete				
View				
Dump Table				

Figure 3-58 ToS Switching Control screen

ToS Switching Entry

After determining what ToS value to use, either application or router classifier, select a ToS entry from the list for configuration or edit. The screen will prompt for inputs to the list of range-checked values, as shown in the sample dialog in figure 3-59 that displays the entries for TOS 03.

```

3TOS03
Press ESC to abort
Creating new table entry:
Enter Name for TOS ID []: UFS 1
Enter the TOS ID; Valid range is from 1 to 63 [0]: 10
Enter the Switch Type; Valid range is from 64 to 254 [0]: 70
Enter the TOS SCPC Data Rate; Valid range is from 0 to 10000 Kbps [0]: 1000
Enter the TOS SCPC Timeout; Valid range is from 1 to 60 seconds [0]: 10_

```

Figure 3-59 ToS Switching Entry dialog

- **Enter Name for TOS ID []** - At the prompt, enter a user-defined text label for circuit identification.
- **Enter the TOS ID** - Enter an integer value in the range of 1 to 63. Entering a value of **0** will result in no switch.
- **Enter the Switch Type** - Enter an integer value in the range of 64 to 254 at the prompt to inform the VMS what switching policy to use. Entering a value of **0** will result in no switch.
- **Enter the TOS SCPC Switch Data Rate** - Enter the desired data rate for this service type. Valid entries are from 0 to 10,000 Kbps. This setting will override the VMS set policy value.
- **Enter the TOS SCPC Timeout** - This timer monitors the defined packet flow. Once data stops for the duration of the timer setting, the link state will be restored to the home state condition. Valid entries are from 1 to 60 seconds.

After entering the timeout value, pressing the Enter key will update the **TOS Switching Control** menu with the changes.

Max Streams

The maximum number of simultaneous ToS switched sessions for a Remote can be specified by entering **M** at the command prompt in the **ToS Switching Control** screen. Valid range is from 1 to 127.



Figure 3-60 ToS Max Streams prompt

Delete

Enter **D** at the command prompt in figure 3-58 to **Delete** a ToS entry, as shown in figure 3-61.

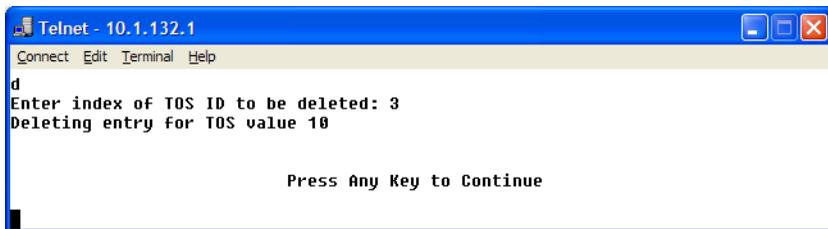


Figure 3-61 ToS Delete prompt



Note: The value shown in the **TOS Value** column is the **TOS ID** associated with the ToS entry to be deleted.

View

Entering a **V** at the command prompt will display the **Internal TOS Table** for active entries as shown in figure 3-62.

Note that, due to binary conversion, the **ID** value is a multiple of 4 and the **Timeout** value is a multiple of 2.

```

Telnet - 10.1.132.1
Connect Edit Terminal Help
v
Internal TOS Table: Active Entries Only
ID      Type   Data Rate  Timeout  State   Time Since Last Packet
4       User   32000     10000   0       9 00:41:06.939 (1560133879)
20      User   450000    14000   0       9 00:41:06.939 (1560133879)
40      User   1000000   20000   0       9 00:41:06.939 (1560133879)

Press Any Key to Continue

```

Figure 3-62 ToS View screen

Hitless Switching Parameters

Unless inherent delays in configuring both ends of a satellite bandwidth link during dynamic switching are accounted for, transmitted data may be lost during the transition. The time for a switch command to be sent across the satellite link (~ 250 ms), the command processing time, as well as receiver acquisition time must be considered. The Vipersat **Hitless Switching** feature provides a means to coordinate timing and utilize buffering to eliminate these data outages.

To access the Hitless Switching screen, enter **H** from the STDMA/SCPC Auto Switching screen (see figure 3-41).

```

Telnet 10.75.0.10
Hitless Switching
Delay for hitless switching of Mod (MSecs)... [0].....M
Delay for hitless switching of Demod (MSecs)... [0].....D
Restore Default lock times.....R
Set LockTime for 64kbps..... [300].....1
Set LockTime for 128kbps..... [250].....2
Set LockTime for 256kbps..... [80].....3
Set LockTime for 512kbps..... [40].....4
Apply Delay Values.....A

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

```

Figure 3-63 Hitless Switching screen

This screen will initially display all lock times as -1, indicating that Hitless Switching is currently disabled. To enable the Hitless Switching feature, enter **R** at the command prompt to restore default lock times.

Delay for Mod

This parameter allows the operator to insert additional delay to buffer more data after modulator transmission is ceased. Enter **M** to modify this parameter.

Delay for Demod

This parameter allows the operator to insert additional delay to account for the tuning of the demodulator. Enter **D** to modify this parameter.

LockTimes

LockTime settings for the four data rates displayed can be adjusted either up or down, but default settings based on satellite testing should be used as a starting point. These defaults are stored in each modulator/demodulator unit and are restored by entering **R** at the command prompt.

Once restored, the lock time for each data rate can be modified by entering the corresponding number.



Figure 3-64 Set LockTime prompt

To disable Hitless Switching, enter **-1** for all lock times.

Apply Delay Values

To implement any modifications to the Hitless Switching parameters, enter **A** at the command prompt to apply these values to the modem.

SOTM Update

This menu item appears for the Hub modem only.

The **SOTM Update** enables RIPv2 (Routing Information Protocol) in forward routes, providing dynamic updates to the routing table. This allows routing configurations for Remotes to be written by the VMS via the Hub TDM. When the VMS writes the routes, the TDM unit will generate a RIPv2 routing update

to its default gateway, specifying the new hop router for the Remote. This will ensure that the edge router has a current table of routes to all of the remote sites. Refer to the *Vipersat VMS User Guide* for implementation details.

In applications utilizing SOTM (Satellite On The Move) where multiple TDMs share one router, this option should be enabled because of the potential that the Hub TDM may change, and thus the path to the default gateway to the Remote will change as well. It is not necessary to enable this option when each TDM has its own router.

In a fixed environment, enabling this feature will allow an operator to use the VMS to maintain the route tables for the Hub TDM.

```

Telnet 10.1.0.16
Configuring the Route Table
Route Name      Dest IP/Net Bits  Next Hop      MultiCast State
Route001... IDFG              0.0.0.0/0     10.1.0.1      N/A           toEth1..1
Route002... IUMS_rt36     10.1.129.0/24  WAN           N/A           toSat1..2
Route003... IUMS_rt37     10.1.129.0/24  WAN           N/A           toSat1..3
Route004... IUMS_rt38     10.1.130.0/24  WAN           N/A           toSat1..4
Route005... IUMS_rt39     10.1.131.0/24  WAN           N/A           toSat1..5
Route006... IUNKNOWN1..... 6
Route007... IUNKNOWN1..... 7
Route008... IUNKNOWN1..... 8
Base..... I1..... B
Delete..... D
Display..... P
PerRoute..... E
DL Mcast... IDisabledI..... A
AddFilter..... R
DelFilter..... L

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

```

Figure 3-65 VMS Routes in Route Table

Enter **F** at the command prompt to toggle this setting.

SOTM Mode

This menu item appears for Remote modems only.

When a Remote modem is utilized in a SOTM application, it is under the control of the ROSS. Should the ROSS fail, control of the modem can be regained by disabling the SOTM mode by entering **F** at the command prompt.

Note that this command is an override only; it is not an enable/disable toggle.

Unit Role

The **Unit Role** configuration determines whether the target CDM-570/570L is to function as a **Remote** or as a **Hub** in the Vipersat satellite network. From the

Vipersat Configuration screen (figure 3-6), enter **R** to display the dialog shown in figure 3-66.



Figure 3-66 Unit Role prompt

The choice made in this command will determine the role the target CDM-570/570L will perform in the network and what type of commands and functions it will receive from the VMS. Refer to table 2-1 and table 2-2 for a breakdown of network roles and related functions and features.

Expansion Unit

The **Expansion Unit** menu item in the **Vipersat Configuration** screen (figure 3-6) defines whether the target CDM-570/570L is to function as an Expansion unit (the demod configured to operate in SCPC mode) or not. Entering **E** at the command prompt will display the dialog shown in figure 3-67.



Figure 3-67 Expansion Unit prompt

The VMS uses this data when monitoring and controlling the network to determine the target CDM-570/570L's function. When configured as an Expansion unit, either as a Hub (switched) or as a Remote (mesh), the CDM-570/570L 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.

Refer to table 2-1 and table 2-2 for a breakdown of network roles and related functions and features.

Network ID

The **Network ID** that is assigned to the unit defines to what network the target CDM-570/570L will belong. All units used in a network will have the same Network ID. Enter **B** at the command prompt in the **Vipersat Configuration** screen (figure 3-6) to display the dialog shown in figure 3-68.

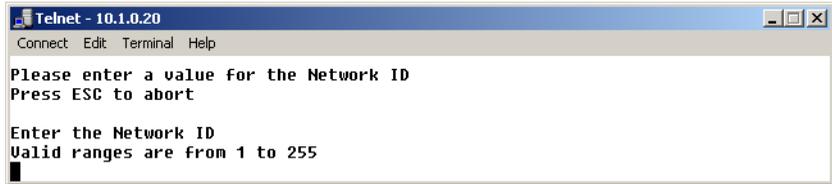


Figure 3-68 Network ID prompt

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.

Unit Name

The **Unit Name** command in the **Vipersat Configuration** screen (figure 3-6) is used to assign a name to the target CDM-570/570L. Enter **N** at the command prompt to display the dialog shown in figure 3-69. Any name, up to 16 characters, can be entered for the unit.

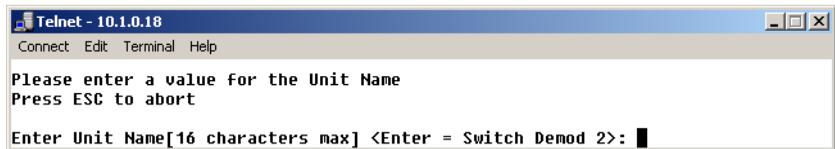


Figure 3-69 Unit Name prompt

This name is displayed by the VMS and identifies the unit in Network Manager, the graphical network display.

Receive Multicast Address

The **Receive Multicast Address** is the multicast IP address assigned to all CDM-570/570L units in the Vipersat network that are managed by the VMS server. This address must match the VMS Transmit Multicast Address.

When the CDM-570/570L receives a multicast from the VMS server, it receives maintenance and control packets, including the server's IP address. The CDM-570/570L responds to the VMS server with a unicast containing its current configuration data, including the CDM-570/570L's IP address. When the VMS receives the unicast response, it registers the CDM-570/570L on the network.

Enter **V** at the command prompt in the **Vipersat Configuration** screen (figure 3-6) to display the dialog shown in figure 3-70.



Figure 3-70 Receive Multicast IP Address prompt

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

Managing IP Address

The **Managing IP Address** command in the **Vipersat Configuration** screen (figure 3-6) allows the IP address for the server running VMS to be entered. Enter **I** at the command prompt to display the dialog shown in figure 3-71.



Figure 3-71 Managing IP address menu

The Managing IP Address of the VMS is sent out with the multicast to all of the Vipersat units and will be automatically updated during the registration process. The CDM-570/570L sends a unicast registration request to the Managing Address every 60 seconds when requesting initial registration on the VMS network. Later, the CDM-570/570L uses this address to send switch requests, network health status messages, etc. to the managing VMS server.



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.

Once the modem is registered, the **I** command is removed from the Vipersat Configuration menu.

This managing address is automatically updated on a periodic basis for modems that are newly enabled, incorrectly set, or following VMS changeovers (redundancy switching). The status of the registration process is displayed for this parameter as follows:

- **NOT-DEFINED** — modem has booted up, but is unaware of the managing address.
- **No STDMA Xmit Grant** — operator has entered managing address, but modem (Remote) is not currently receiving burst maps.
- **Sending Registration (n)** — modem is receiving burst maps and the number of registration attempts (n) is displayed.
- **Registered** — modem is registered with the VMS. For VMS v3.6.0 and later, the VMS version number is also displayed (as shown in figure 3-6).

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



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.

If the FAST feature key for Management Security has been purchased for the target modem, then it will appear as a menu item on the *Vipersat Configuration* screen (figure 3-6).

Enter **K** at the command prompt to configure this feature, as shown in figure 3-72, below.

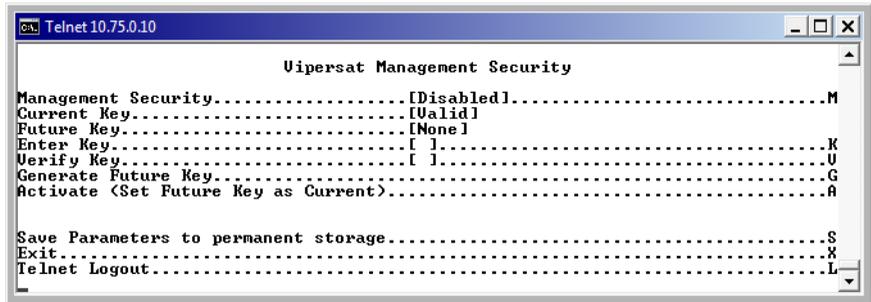


Figure 3-72 Vipersat Management Security screen

Enter **M** at the command prompt to toggle between Enabled/Disabled. Note that the feature must be set to **Enabled** in order to configure the encryption key.

Enter **K** at the command prompt and **Enter** the required key (figure 3-73). (Following entry, the characters will be temporarily displayed in the menu for reference purposes.)



Figure 3-73 Encryption Key Entry prompt

Enter **V** at the command prompt and re-enter the same key to **Verify** it. (Following entry, the characters will be temporarily displayed in the menu for reference purposes.)

Enter **G** at the command prompt to execute the verification process and **Generate** the hex key.

The *Future Key* menu item will display **Valid** to indicate successful verification of the key and that it is ready for activation.

Enter **A** at the command prompt to **Activate** the key for current use.

The *Current Key* menu item will display **Valid** to indicate successful activation.

Primary Heart Beat

This menu item appears for the Hub modem only.

The **Primary 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 redundancy (protected) configurations. The message interval is hard-coded in the modem.

Enter **P** at the command prompt in the **Vipersat Configuration** screen (figure 3-6) to toggle this feature between **Enabled** and **Disabled**.

Home State Revert

This menu item appears for the Remote modem only.

The **Home State Revert** feature allows automatic resource recovery to be performed on SCPC connections when a communications failure occurs between the VMS and a Remote, such as a rain fade condition, a Remote unit power down, or a hardware failure. The period of time (in minutes) for a failure is configured in the VMS for each Remote in the network. Should communications be lost for more than the specified time period, the Remote will automatically revert to its Home State settings and the VMS will remove all allocated resources (bandwidth, demod(s)), freeing them for use by any other Remote in the Vipersat network.

Because this feature is configured in the VMS, the status (Disabled, or the Time Period in minutes) appears as an information-only display in the **Vipersat Configuration** menu (figure 3-6).

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 (Eb/No) is met for the receiving Vipersat units in the group. DPC is driven by the receiver demod, which notifies the transmitting modem of the current Eb/No value.

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

The **Dynamic Power Control Configuration** screen (enter **C** in the Vipersat Configuration menu) allows for setting the parameters for the CDM-570/570L

power levels. The information and commands in the menu will vary depending on the function that the target CDM-570/570L performs in the network. The screen shown in figure 3-74 is for a Hub or Remote operating in STDMA mode. For comparison, the DPC Config screen for a unit operating as a Hub or Remote with Expansion (SCPC mode) is shown in figure 3-75. Note that only the applicable settings appear in this screen.

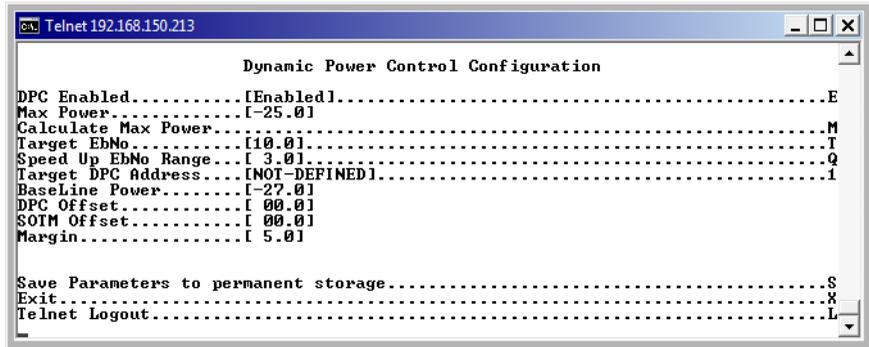


Figure 3-74 DPC Configuration screen (STDMA mode)

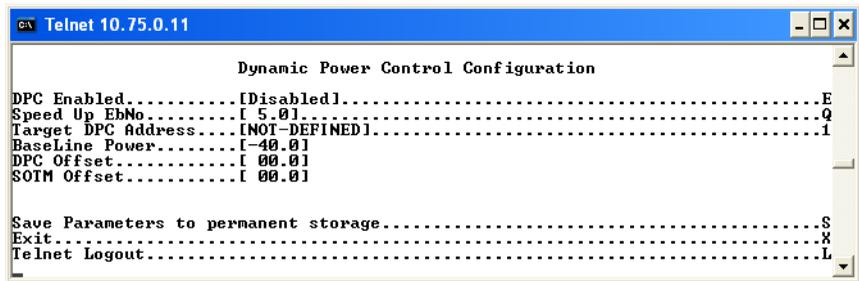


Figure 3-75 DPC Configuration screen (SCPC mode)



Note: The following descriptions will refer to the CDM-570/570L 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 (inband 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.

DPC Enabled

The **DPC Enabled** command (enter **E**) is a toggle that allows the DPC feature to be either **Enabled** or **Disabled**. The CDM-570/570L is shipped with the DPC Enabled menu item turned off (Disabled) to allow entrance link levels calibration during terminal setup.

Max 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 all SCPC modulator(s) based on link/satellite parameters can be configured. This is the value displayed as the **Max Power** in the **DPC Configuration** menu. The Calculate Max Power command is used to set this value, as described in the following section.

Max Power initially displays as *INVALID* until the DPC operating parameters are defined and the **Calculate** command is executed from the Calculate Max Power screen. The calculation should return a modulator output value that falls within equipment limits. However, if the calculator returns an error [INVALID], one of the following has occurred:

- The base level is too high.
- The operating parameter settings have exceeded the capacity of the equipment.
- The uplink variables for the entrance link cabling attenuation and the High Power Amplifier gain are not balanced.

Calculate Max Power

Enter **M** at the command prompt in the DPC Configuration screen to access the **Calculate Max Power** screen (figure 3-76).

```

Telnet 192.168.150.213
Calculate Max Power
Calibrated Data Rate..[2048.000]
Nominal Power Level..[27.0]
DPC Margin.....[ 5.0]
Max Data Rate.....[1024.000]
Max Code Rate.....[3/4]
Max Modulation.....[QPSK]
Max Fec Type.....[Turbo]
Calculate Max Power.....
Max Power.....[ -25.0]

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

Figure 3-76 Calculate Max Power screen

Calibrated Data Rate

This menu item is for information only and displays the **Calibrated Data Rate** in kbps for the target CDM-570/570L. This value is pulled from the Home State, and is the base value data rate from initial configuration and commissioning.

There is a proportional relationship between data rate and power level; as the data rate increases, there is a corresponding increase in transmit power level, and vice versa.

Nominal Power Level

This menu item is for information only and displays the **Nominal Power Level** in dB for the modulator. This value is pulled from the Home State and will vary as the data rate varies.

DPC Margin

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

Enter **M** at the command prompt to set the DPC Margin.

Max Data Rate

The **Max Data Rate** setting corresponds to the highest achievable data rate that was determined by the site link budget calculation.

Enter **D** at the command prompt to set this value.

Max Code Rate

The **Max Code Rate** setting corresponds to the highest achievable code rate that was determined by the site link budget calculation.

Enter **C** at the command prompt to set this value.

Max Modulation

The **Max Modulation** setting corresponds to the highest achievable modulation that was determined by the site link budget calculation.

Enter **O** at the command prompt to set this value.

Max FEC Type

The **Max FEC Type** setting corresponds to the highest achievable FEC type that was determined by the site link budget calculation. Only the **Turbo** setting

is recommended; although DPC will function using Viterbi, this type requires significantly more power to operate and is not recommended.

Enter **F** at the command prompt to set this parameter.

Calculate Max Power

Once all of the Max Power parameters have been set, enter **A** at the command prompt to execute the maximum power calculation for this site.

Max Power

This menu item is information only and displays the result of the last calculation that was performed for the maximum achievable power level. During network operations, this level will only be reached when the environmental conditions are at diminished capacities (e.g., rain fade) and all of the DPC power parameters have reached their maximums.

Target EbNo

The **Target EbNo** is the desired operating receive level for closed loop servo control. This is the value used by the receiving CDM-570/570L for comparison with the actual received E_b/N_0 . This information is sent back to the transmitting terminal for output power level adjustment as necessary.

Enter **T** at the command prompt in the **DPC Configuration** screen to display the Target EbNo dialog shown in figure 3-77. The default value for this parameter is 10 dB.



Figure 3-77 Target EbNo prompt

Speed Up EbNo

Normally, the DPC message is sent every 60 seconds from each terminal in the network. If the received E_b/N_0 level at the demodulator drops below the **Speed Up EbNo** set value, the corresponding terminal increases its message send rate to every 15 seconds until the receive level is greater than the set value. This provides a loop speed up to rapidly regain link quality.

Enter **Q** at the command prompt in the **DPC Configuration** screen to display the Speed Up EbNo dialog shown in figure 3-78. The default value for this parameter is 5 dB.

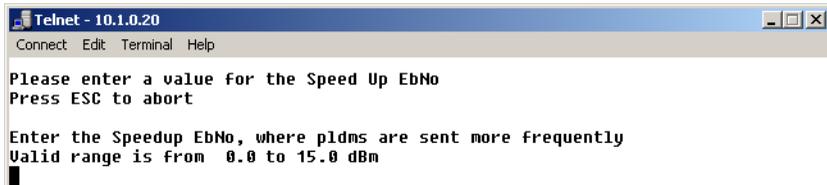


Figure 3-78 Speed Up EbNo prompt

Target DPC Address

The **Target DPC Address** identifies the modem that is transmitting to this CDM-570/570L, and will be receiving the DPC messages that provide the current Eb/No value for this CDM-570/570L. 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.

The Target DPC Address command is used only for modems that are 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 **1** at the command prompt. The Target DPC Address dialog shown in figure 3-79 will appear.



Figure 3-79 Target DPC Address prompt

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 Eb/No values for the Remotes in the group. These Remotes and their status and Eb/No values are displayed in the Vipersat Summary screen, DPC details (see “Vipersat Summary” on page 3-67).

BaseLine Power

The **BaseLine Power** is an information only display, and is a function of the power given to the modem by the VMS for the last switch command based on link budget calculations. At boot up and prior to receiving a switch command, this value will match the Nominal Power Level (Home State value). The given modem power is the sum of the BaseLine Power and either the DPC Offset or the SOTM Offset.

In SOTM mode, the BaseLine Power value is based on the modem being at the center of the satellite beam.

DPC Offset

The **DPC Offset** is an information only display, and is a power value shared between STDMA Power Hunt (when in STDMA mode) and DPC (when in dSCPC mode with DPC enabled). For DPC, the offset is the power adjustment made to account for changes in the environment (rain fade) or other factors in order to maintain link connectivity. The resultant modem power is the sum of the DPC Offset and the BaseLine Power.

SOTM Offset

The **SOTM Offset** is an information only display, and is only applied when SOTM is enabled.

This value is a power adjustment received from the ROSS based on the current location of the modem within the satellite footprint. This offset accounts for the variation of power as the modem moves away from the center of the satellite beam. The resultant modem power is the sum of the SOTM Offset and the BaseLine Power.

Margin

This menu item is information only and displays the value of the DPC **Margin** that was set from the *Calculate Max Power* screen. The margin governs the upper power limit for all combinations of waveforms given.

Set Home State Parameters

A CDM-570/570L's **Home State** consists of those parameters which provide a known RF configuration that the CDM-570/570L 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

CDM-570/570L goes to a configuration which is optimum for its function in the network.

Enter **H** at the command prompt in the **Vipersat Configuration** screen to display the **Home State Configuration** screen shown in figure 3-80.

Note that each of these Transmit and Receive parameters are the same as found in the **Tx Configuration** and the **Rx Configuration** screens that are in the **Satellite Modem Configuration** menu.

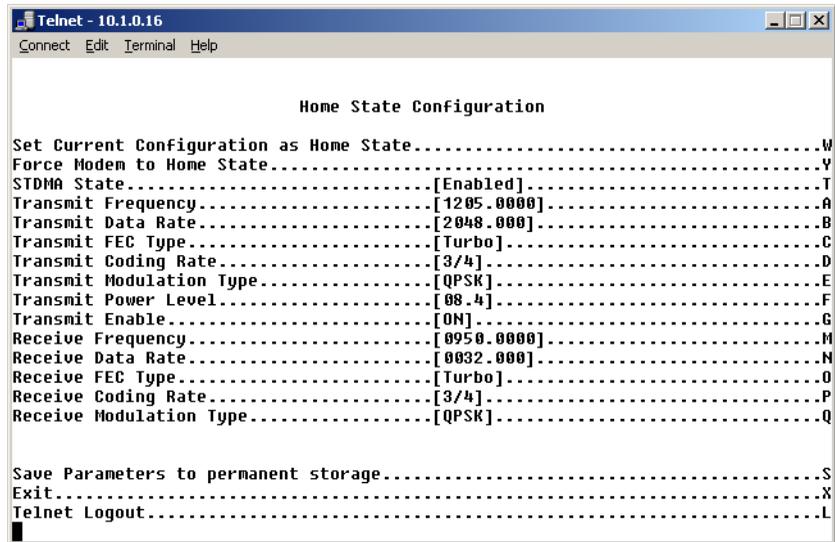


Figure 3-80 Home State Configuration screen

Set Current Configuration as Home State

This command sets the CDM-570/570L’s current configuration as its Home State settings. Assuming the modem has been properly configured using the **Satellite Modem Configuration** menu (Tx and Rx parameters) and the **Feature Configuration** menu (Vipersat STDMA 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.

Enter **W** at the command prompt in the **Home State Configuration** screen 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 a CDM-570/570L’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 a CDM-570/570L return to its Home State, this command (enter **Y**) 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.

A warning message is displayed as shown in figure 3-81, requiring the command to be confirmed before it is executed.



Figure 3-81 Force Modem to Home State warning

STDMA State

This command (enter **T**) toggles the setting of STDMA in the target CDM-570/570L’s Home State between **Enabled** and **Disabled**. This is the same feature that is set from the **Feature Configuration** menu screen shown in figure 3-4.

Transmit Frequency

Enter **A** at the command prompt to use the dialog shown in figure 3-82 to set the **Transmit Frequency** for the target CDM-570/570L’s Home State.

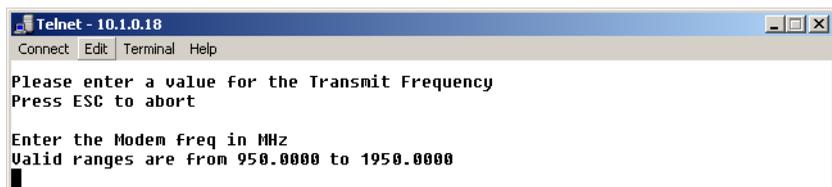


Figure 3-82 Transmit Frequency prompt

Note that this screen dialog example displays the frequency range for the CDM-570L L-Band modem. For the CDM-570, the range displayed will be either 50 to 90 MHz or 100 to 180 MHz.

Transmit Data Rate

Enter **B** at the command prompt to use the dialog shown in figure 3-83 to set the **Transmit Data Rate** for the target CDM-570/570L’s Home State.

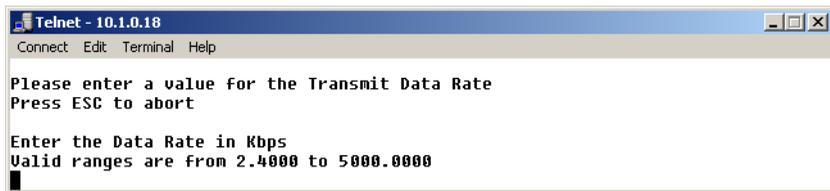


Figure 3-83 Transmit Data Rate prompt

Note that the valid range for this parameter will vary depending on the Modulation Type, Coding Rate, and FAST feature Data Rate.

Transmit FEC Type

Enter **C** at the command prompt to use the dialog shown in Figure 3-84 to enter the **FEC Coding Type** for the CDM-570/570L's Home State. **Turbo** must be selected when operating in Vipersat mode.



Figure 3-84 Transmit FEC Type prompt

Transmit Coding Rate

Enter **D** at the command prompt to use the dialog shown in figure 3-85 to set the **Transmit Coding Rate** for the target CDM-570/570L's Home State.

Note that Coding Rates **3** (1/2), **4** (2/3), and **8** (1/1) are not valid selections when operating in Vipersat mode with Turbo Product Coding.

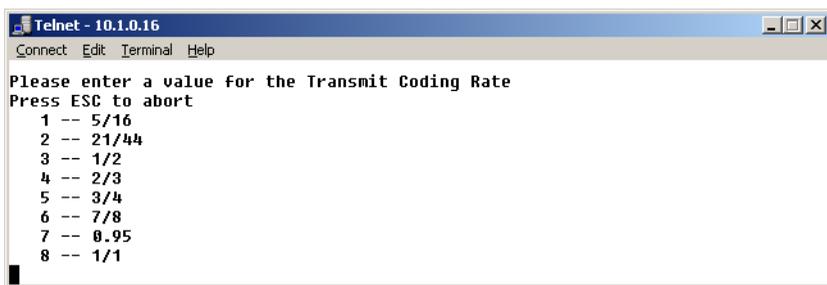


Figure 3-85 Transmit Coding Rate prompt

Transmit Modulation Type

Entering **E** at the command prompt to use the dialog shown in figure 3-86 to set the **Transmit Modulation Type** for the target CDM-570/570L's Home State.

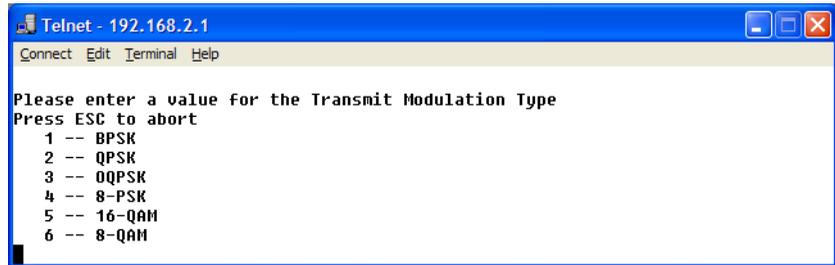


Figure 3-86 Transmit Modulation Type prompt

Transmit Power Level

Enter **F** at the command prompt to use the dialog shown in Figure 3-87 to set the **Transmit Power Level** for the target CDM-570/570L's Home State.

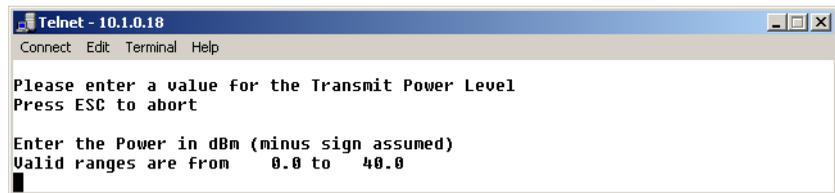


Figure 3-87 Transmit Power Level prompt

Transmit Enable

The modem transmitter can be Enabled or Disabled with this command. Enter **G** at the command prompt to toggle the **Transmit Enable** for the target CDM-570/570L's Home State between On and Off.

Receive Frequency

Enter **M** at the command prompt to use the dialog shown in Figure 3-88 to set the **Receive Frequency** for the target CDM-570/570L's Home State.

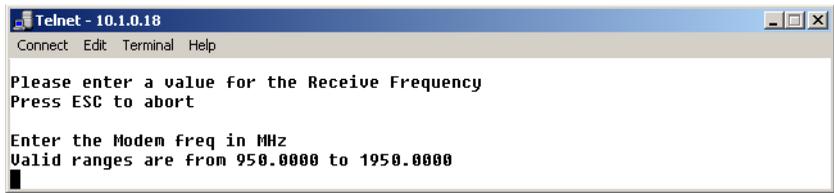


Figure 3-88 Receive Frequency prompt

Note that this screen dialog example displays the frequency range for the CDM-570L L-Band modem. For the CDM-570, the range displayed will be either 50 to 90 MHz or 100 to 180 MHz.

Receive Data Rate

Enter **N** at the command prompt to use the dialog shown in Figure 3-89 to set the **Receive Data Rate** for the target CDM-570/570L's Home State.



Figure 3-89 Receive Data Rate prompt

Note that the valid range for this parameter will vary depending on the Modulation Type, Coding Rate, and FAST feature Data Rate.

Receive FEC Type

Enter **O** at the command prompt to use the dialog shown in figure 3-90 to set the **Receive FEC Type** for the target CDM-570/570L's Home State. **Turbo** must be selected when operating in Vipersat mode.

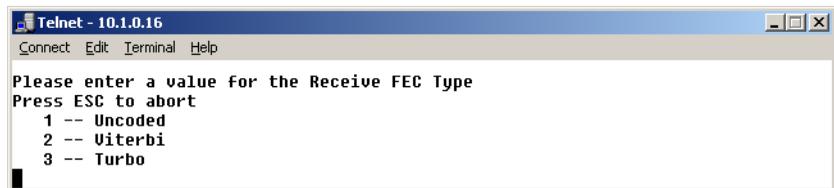


Figure 3-90 Receive FEC Type prompt

Receive Coding Rate

Enter **P** at the command prompt to use the dialog shown in Figure 3-91 to set the **Receive Coding Rate** for the target CDM-570/570L's Home State.

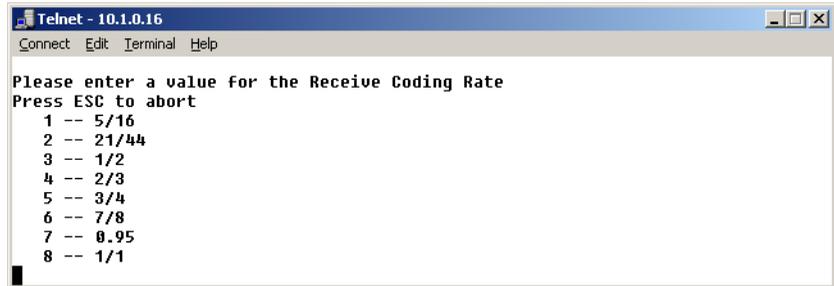


Figure 3-91 Receive Coding Rate prompt

Note that Coding Rates **3** (1/2), **4** (2/3), and **8** (1/1) are not valid selections when operating in Vipersat mode with Turbo Product Coding.

Receive Modulation Type

Enter **Q** at the command prompt to use the dialog shown in Figure 3-92 to set the **Receive Modulation Type** for the target CDM-570/570L's Home State.

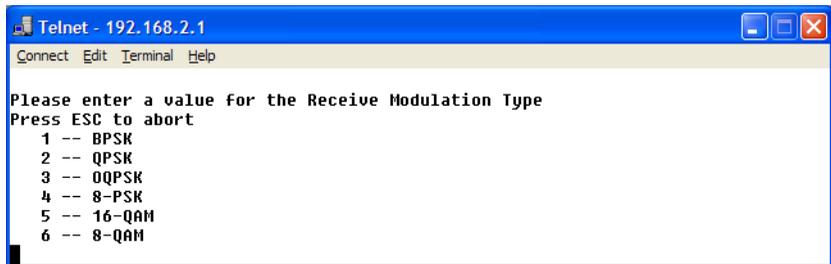


Figure 3-92 Receive Modulation Type prompt

Vipersat Summary

The **Vipersat Summary** screen can be viewed by entering **D** at the command prompt in the **Vipersat Configuration** screen (figure 3-6).

```

dUipersat debug information
Node ID: 4
Dev#: 0 Freq: IF=1200000000 AF=1200000000 Inverted=0
Dev#: 1 Freq: IF=1200000000 AF=1200000000 Inverted=0
DPC target = 0.0.0.0
Primary Heart Beat Interval = 0 (<0 seconds)
Current Switch Cache:
Dev 0: F=1275000000 DR=2000000 P=-125 CR=5 M=1 FEC=6 Tx= 1 STDMA=1
Dev 1: F=1275840000 DR= 64000 P= -1 CR=4 M=1 FEC=6 Tx=255 STDMA=255

          Press 'D' to display DPC details or any other key to Continue

dIP Address      Status  Cnt   EbNo   expires in
10.75.130.1:    Active  1     10     56
10.75.129.1:    Active  1      9     31

Target EbNo values for Demod devices
Device[0] Target EbNo = 0

          Press Any Key to Continue

```

Figure 3-93 Vipersat Summary screen (Hub)

The **Node ID** number that appears in this screen verifies that the unit is registered with the VMS and is active in the network. This number is automatically assigned by the VMS.

The two frequency listings are for the modulator (**0**) and the demodulator (**1**) for the CDM-570/570L. The **IF** values represent the Intermediate Frequency (Hz) that this unit is currently using. The **AF** values represent Adjusted Frequency (Hz), a translation of the IF that is used by the VMS for internal tracking of switching commands.

The **DPC target** entry is the IP address of the modulator that is to receive the DPC messages from this unit, and is assigned by the VMS when the modem is switched in SCPC mode. For a Remote unit, this address will either be the Hub TDM, or another Remote in a SHOD configuration. For a Hub unit (as shown in figure 3-93), this field will typically display all zeros because there are multiple target Remotes, as listed in **DPC details**. In this example, the DPC will be adjusted for Remote 10.75.129.1 since this is the worst case EbNo value.

The **Primary Heart Beat Interval** represents the time period between the communication check message that is sent from the primary Hub modem to the VMS in an N:M redundancy configuration. This interval is specified in the VMS.

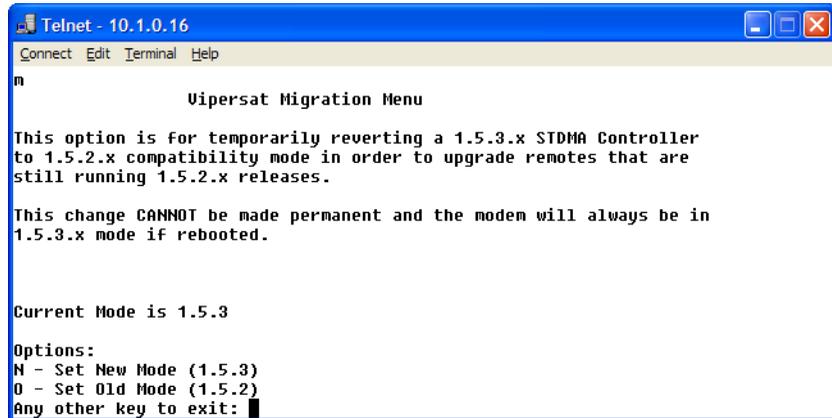
Data for the **Current Switch Cache** reflects either the Home State information immediately after the unit boots, or the last switch command from the VMS (the last command sent to the base modem).

DPC details provide the status and EbNo values for active Remotes in the group.

Vipersat Migration

The **Vipersat Migration** command is used to set the compatibility mode for the Hub Burst Controller when conducting a firmware upgrade on the associated CDM-570/570L Remotes. Although this command appears in the menu for both the Hub modem and the Remote modem, it only applies to STDMA Controllers and TDM Outbound modems at the Hub.

Enter **M** at the command prompt in the **Vipersat Configuration** screen to display the Vipersat Migration dialog shown in figure 3-94.



```

Telnet - 10.1.0.16
Connect Edit Terminal Help
m
                Vipersat Migration Menu

This option is for temporarily reverting a 1.5.3.x STDMA Controller
to 1.5.2.x compatibility mode in order to upgrade remotes that are
still running 1.5.2.x releases.

This change CANNOT be made permanent and the modem will always be in
1.5.3.x mode if rebooted.

Current Mode is 1.5.3

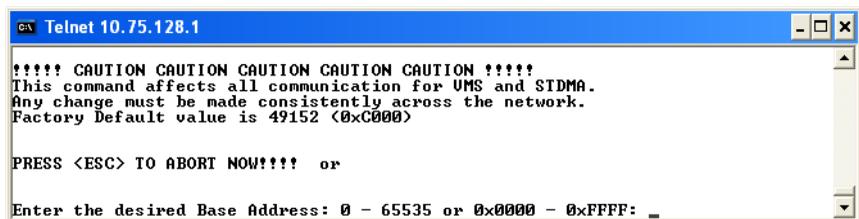
Options:
N - Set New Mode (1.5.3)
O - Set Old Mode (1.5.2)
Any other key to exit:

```

Figure 3-94 Vipersat Migration prompt

UDP Port Base Address

Should a particular network application require a specific **UDP port base address** be used, the default address can be changed by entering **U** at the command prompt in the **Vipersat Configuration** screen (figure 3-6).



```

Telnet 10.75.128.1
!!!! CAUTION CAUTION CAUTION CAUTION CAUTION !!!!
This command affects all communication for UMS and STDMA.
Any change must be made consistently across the network.
Factory Default value is 49152 (0xC000)

PRESS <ESC> TO ABORT NOW!!!! or

Enter the desired Base Address: 0 - 65535 or 0x0000 - 0xFFFF:

```

Figure 3-95 UDP Port Base Address prompt



Caution: This command affects all communications for the VMS and STDMA. If the base address is changed, it must be changed in the VMS as well as in all modems in all networks controlled by the VMS. The base address must also be changed when using VLOAD with this network.

Alerts

The Alerts menu item in the Vipersat Configuration screen is for information only and serves to display alert messages to the operator.

- *Example:* “Critical error: should not be in map”

This alert typically occurs when there are multiple STDMA burst controllers at the Hub incorrectly configured with the same Group ID, thus causing Remotes to appear in more than one burstmap. A Remote may already be switched out into dSCPC mode, yet continue to appear in a burstmap that is received from another controller.



NETWORK ADDRESSING

Introduction

This Appendix is an overview of network addressing and how it applies to configuring the CDM-570/570L 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.

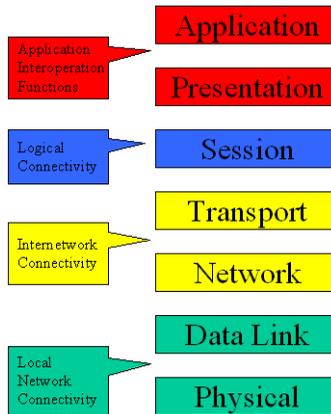


Figure A-1 The Seven OSI Protocol Layers

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.

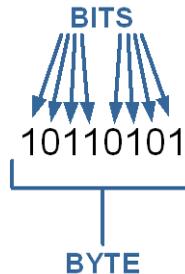


Figure A-2 Bits and Bytes

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.

128	64	32	16	8	4	2	1	
1	0	1	0	0	1	0	1	= 165
1	1	0	0	0	0	1	0	= 194
1	1	1	1	1	1	1	1	= 255

128	
32	
4	
1	
<hr style="width: 50px; margin-left: auto; margin-right: 0;"/>	
165	

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:

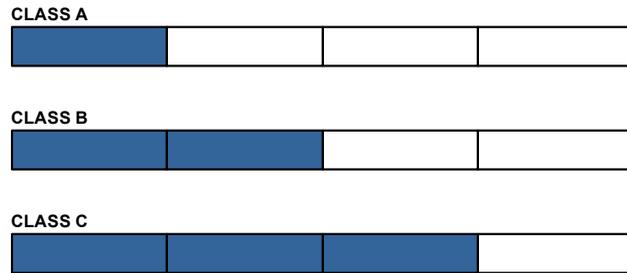
Class A

- 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



Address Class	High-Order-Bits	1 st 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.

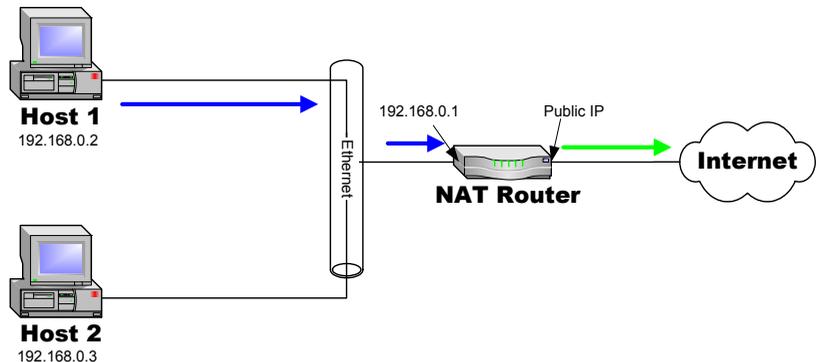


Figure A-5 NAT Router Example

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

Subnets

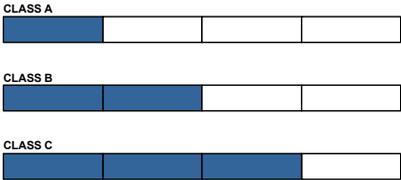
Subnets can be defined as the further segmentation of the InterNIC assigned Network ID IP address. The amount and type of subnetting performed by the organization is determined by the network layout.

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 **anding**. **Anding** compares each bit value in the IP address with the bit value in the subnet mask. The result of the **anding** 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 **anding** 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 calculator, available from SolarWinds, performs these IP and subnet mask calculations and can be found at:

<http://support.solarwinds.net/updates/SelectProgramFree.cfm>

Network Segments

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

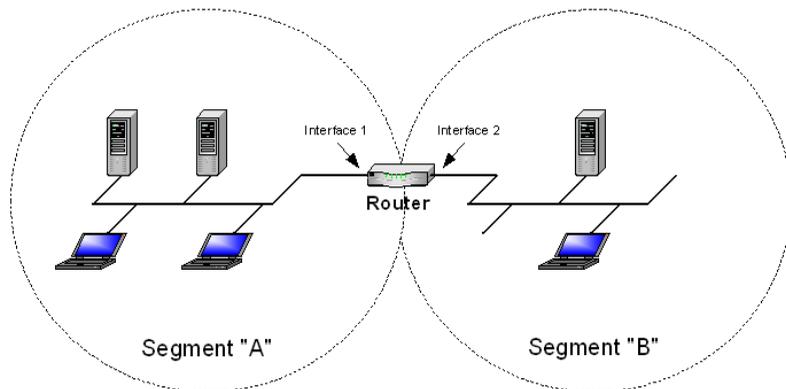


Figure A-8 Network Segments

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.

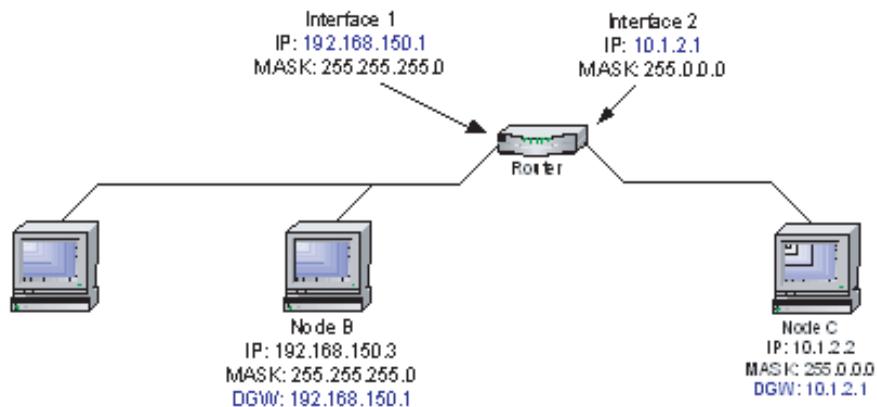


Figure A-9 Router as Default Gateway

MAC Addresses

A MAC address is a physical hardware address that gets assigned to the interface 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**

IP Addressing

- The first six characters are issued to the organization.
- The second six characters are assigned to the hardware interface by manufacturing.

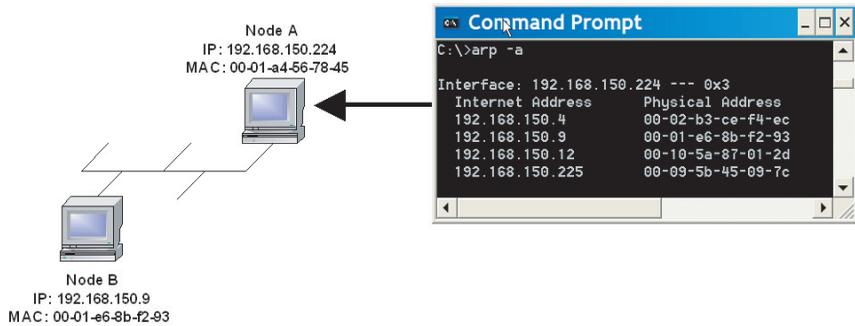


Figure A-10 Network Node MAC Addresses

B

AUTOMATIC SWITCHING

General

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

These switching types are presented in the following material which uses CDM-570/L, SLM-5650A, and Series800 modem units for purposes of illustration. For 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 site'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 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, CDD-880, 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, CDM-880, 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: 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: 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 ECM Remotes while operating in STDMA 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 screens shown in figure B-1 (CDM-570/570L modem/router) and figure B-2 (SLM-5650A modem/router) are examples that show the entries in the Automatic Switching page at the Hub that are used to control load switching.

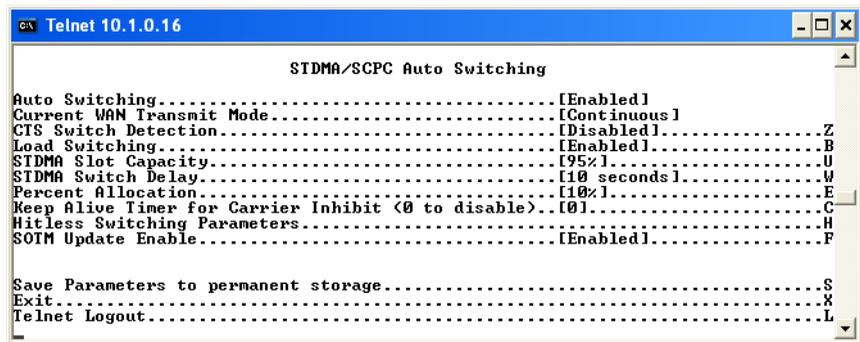


Figure B-1 Auto Switching Menu, CDM-570/570L Hub

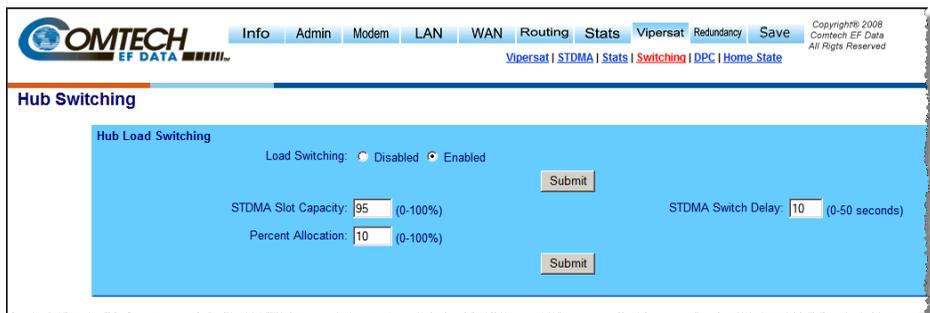


Figure B-2 Hub Load Switching Page, SLM-5650A

- **Auto Switching** – This is a Vipersat feature that is enabled in the CDM-570/570L **Features** menu. If Auto Switching is not enabled, Load Switching will be ignored. There is no automatic switching enable button in the SLM-5650A modem configuration menus; the operator enables each switching function individually.

- **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 for a CDM-570/570L Remote are set in the page shown in figure B-3. An example of this page for an SLM-5650A Remote is shown in figure B-4.

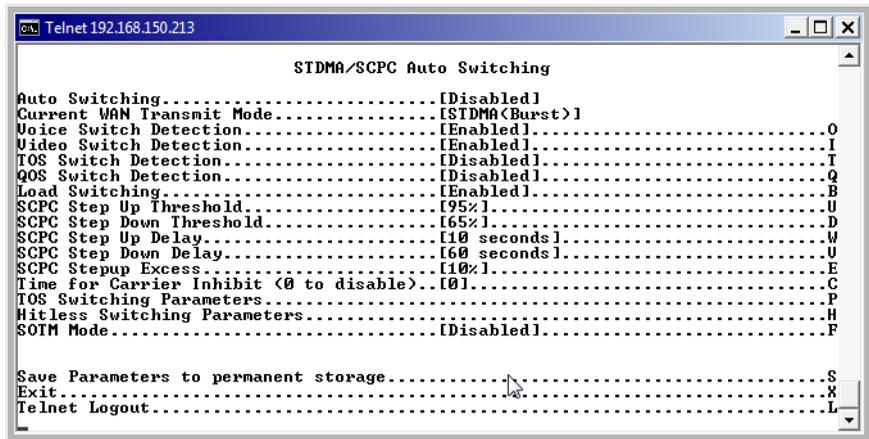


Figure B-3 Auto Switching Menu, CDM-570/570L Remote

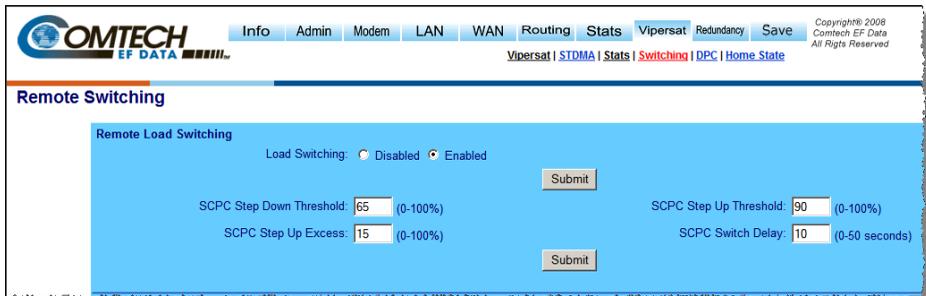


Figure B-4 Remote Load Switching Page, SLM-5650A

- **Auto Switching** – This is a Vipersat feature that is enabled in the CDM-570/570L **Features** menu. If Auto Switching is not enabled, Load Switching will be ignored. There is no automatic switching enable button in the SLM-5650A modem configuration menus; the operator enables each switching function individually.
- **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-5, 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.

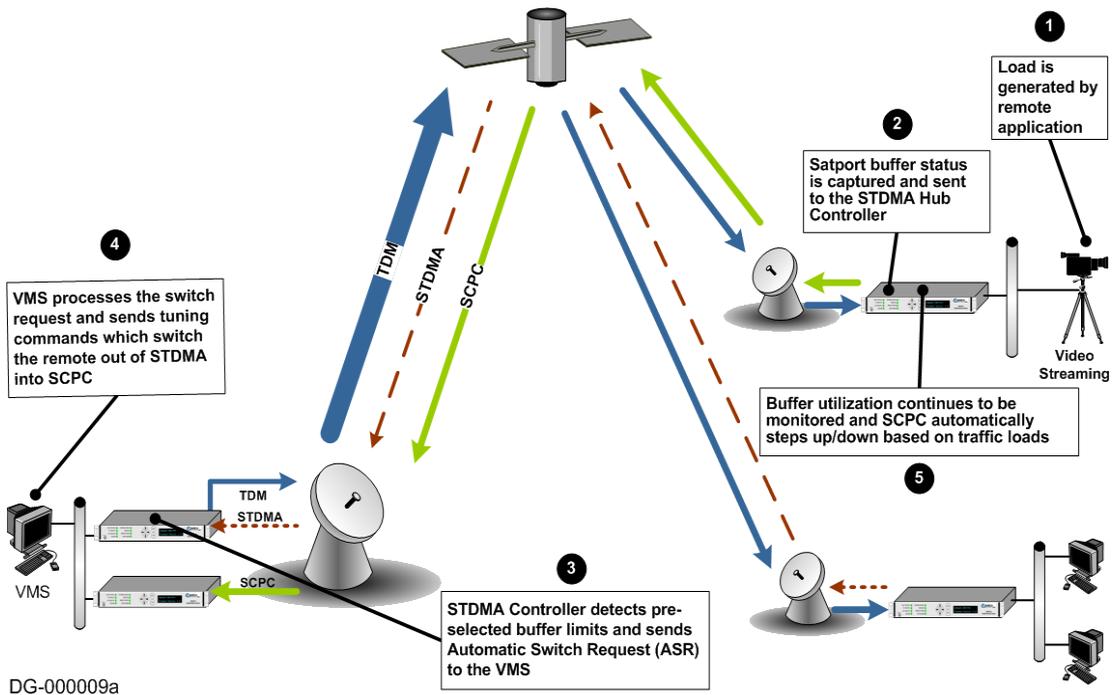


Figure B-5 Load Switching diagram

A load switch is illustrated in figure B-5 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.

Load Switching

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.

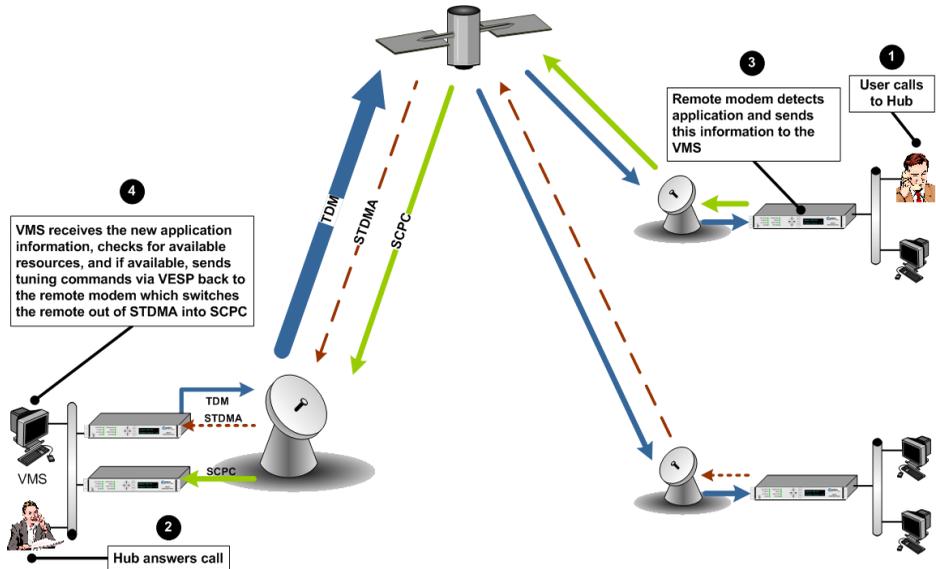
The Home Threshold is the bit rate set to trigger a return to the home condition. This function is used when bandwidth has been allocated to meet load requirements, and then the load has been either removed or partially removed. The Home Threshold is used to determine whether the current bit rate has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

Application Switching



Note: This Application Switching section refers to functionality of the CDM-570/570L modem/router. Application Switching is not available for SLM-5650A modem/routers.

Application switching, illustrated in figure B-6, also is capable of changing bandwidth use, but the change is determined entirely by the type of application being requested, ignoring load requirements.



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Figure B-6 Application Switching diagram

In a system configured for application switching, the Remote site modem/router looks for a packet in the data stream coming from the LAN that is configured using the H.323 stack protocol and containing an H.225 signaling protocol. In the diagram above, the signal is a voice call initiated at the Remote site.

The packet is examined to determine the port number, then, from the allocated port ranges, the modem/router determines the type of application being sent.

The modem/router sends a switch request to the VMS requesting a carrier for the application type. Typical applications include:

- Video
- Voice over IP (VoIP)

Each application type will have been assigned a bandwidth allocation when the policy for the Remote is established. The voice application, for example, might have had the bandwidth set in the policy to handle three simultaneous voice connections. When a VoIP protocol is detected in the H.225 signaling protocol, the modem/router requests the VMS to switch the bandwidth to accommodate three voice circuits.

The same process applies if the protocol detected is Video.

When *both* VoIP and Video are requested, the bandwidth required for the Video is used and the VoIP, which has priority, shares the SCPC with the Video.

Once the VMS receives the request to switch, it determines if there is a free demodulator and if there is bandwidth space available to handle the requested application. If the resources are available, the VMS then performs the switch.

Applications are streaming data. The Remote looks at the streaming data flow until it sees a break in the data exceeding 10 seconds. Once a break is detected the modem/router presumes that the application is terminated (or has malfunctioned), drops the carrier, and makes the bandwidth resources available for another service.

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-7 provides a graphical representation of the ToS field within an IPv4 packet.

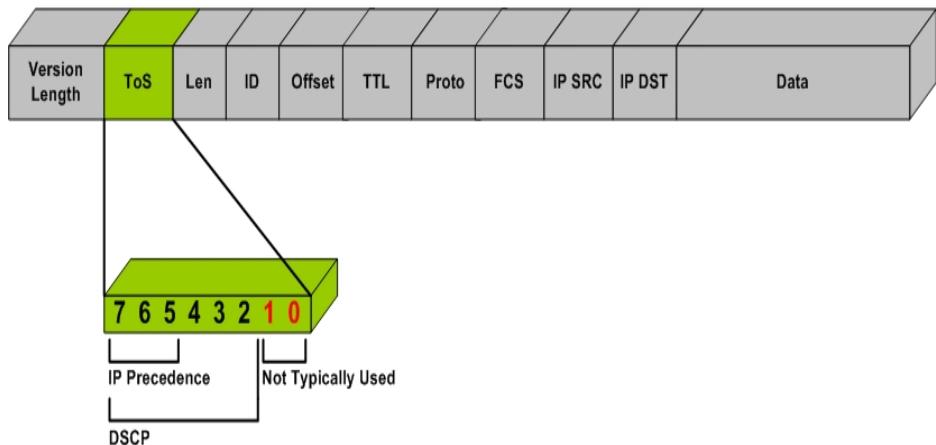


Figure B-7 ToS Field Location within the IP Header

The process of marking a packet with a ToS value is typically done in one of two places, either by the application device itself (e.g., 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, the user defines the ToS value to be detected and specifies the bandwidth to be requested, should that value be 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, before 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 source for 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 occurs.

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: Only ToS stamped IP traffic that is 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-8) will be presented in this example.

Figure B-8 Remote ToS Switching menu

The remote ToS switching is optioned by selecting 'Enable' or 'Disable'. In addition to the enable/disable control, 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 (15 char max)	A user defined ID association.
ToS ID	1 - 63	The ToS value for which a switch should occur. Note that 0 can not be used to set a ToS based switch.
Switch Type	64 - 254	The type of Vipersat switch which will occur for this ToS value.
SCPC Data Rate	kbps	The data rate for the switched SCPC link.
SCPC Timeout	seconds	The number of seconds of inactivity before the SCPC circuit will be torn down.



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-9 depicts a per device configuration example.

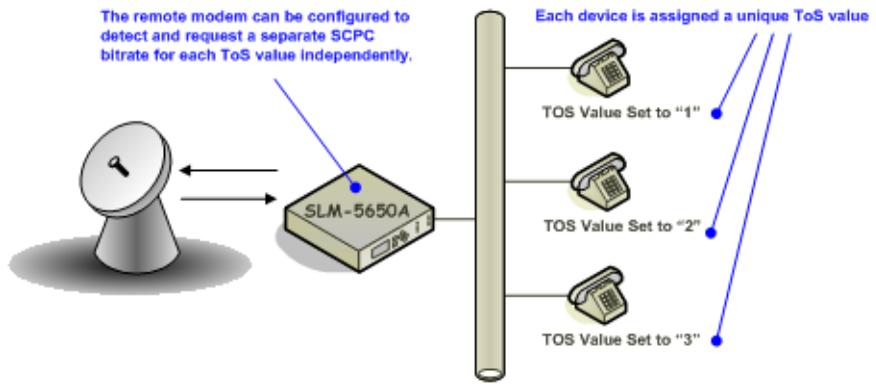


Figure B-9 Per Device ToS Switching Example

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 set up for the first device that sends packets with the designated ToS value. Figure B-10 depicts a per traffic type configuration example.

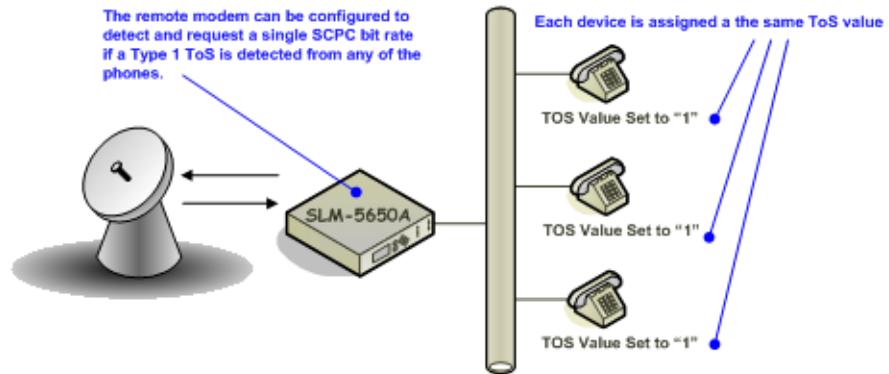


Figure B-10 Per Type ToS Switching Example

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 hosts 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-11 provides an example of a router performing ToS remarking for VoIP phones.

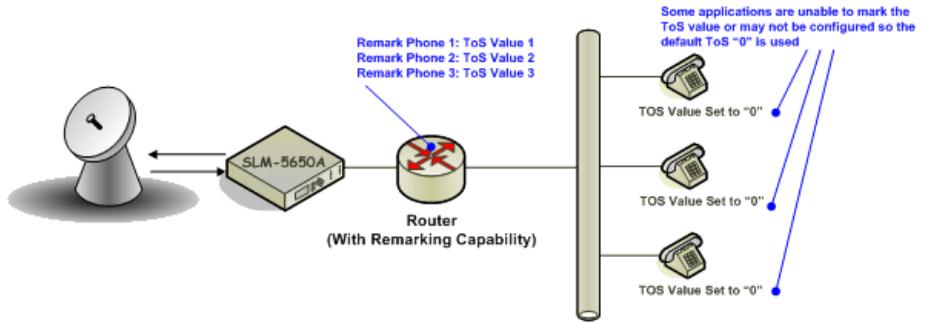


Figure B-11 ToS Remarking Application

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, decimal, or hexadecimal 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

$$\text{DSCP} = 184/4$$

$$\text{DSCP} = 46$$

Converting ToS and DSCP to/from Binary - Figure B-12 provides an example of the conversion to and from binary and can also be used to convert to and from ToS and DHCP values.

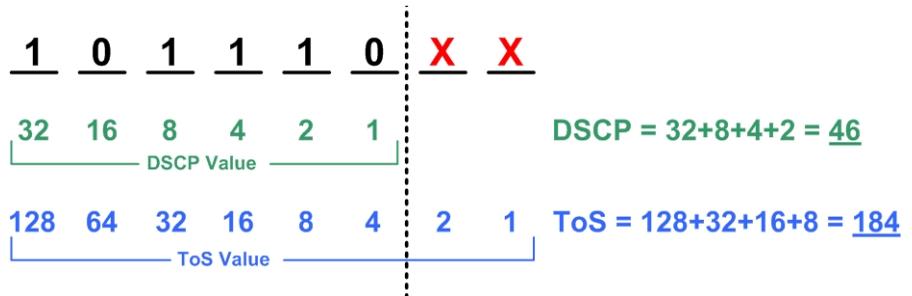


Figure B-12 ToS and DSCP Conversion Chart

Mesh Setup Based on ToS Detection

The detection of a ToS stamped packet by a remote modem can provide the means for setting up a Single Hop On Demand (SHOD) mesh connection from that remote to another remote within the network. *For these SHOD connections, it is assumed that each remote site that is part of the SHOD connection has, at minimum, one additional demodulator 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 a switch request to the VMS requesting the user defined bandwidth. The switch request also contains the 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 set up the connection. Each direction of the mesh is set up independently; i.e., the detection that occurs at remote 1 will establish a connection from remote 1 to the other remote involved. However, the other remote must perform detection for set up in the opposite direction.

Entry Channel Mode Switching

Entry Channel Mode (ECM) provides a method for Remotes requiring SCPC access channels to enter/re-enter the network, initially or after a power or other site outage.

Two versions of Entry Channel Mode switching are used in Vipersat networks. The version that is available for implementation in a Vipersat network will vary depending on the satellite modem model that is deployed in the network. *STDMA ECM* is currently available for CDM-570/L and SLM-5650A modems. *Dynamic ECM* (ECMv2) is currently available for CDM-570/L modems and the Advanced VSAT Series800 modems that include the CDM-800, CDM-840, and CDD-880.

STDMA Entry Channel Mode

With STDMA Entry Channel Mode, 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 sufficient 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 causes it to request additional bandwidth from the VMS.

The initial switch from Entry Channel Mode to SCPC mode is not driven by the presence or absence of customer traffic. Once in SCPC mode, 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. ECM Remotes in SCPC mode do not require burst maps to maintain SCPC transmission.



Note: Remotes operating in ECM toggle directly from STDMA to SCPC. The initial SCPC switch state is used instead of the modem's internal Home State.

After the ECM Remotes are processed into SCPC, 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.

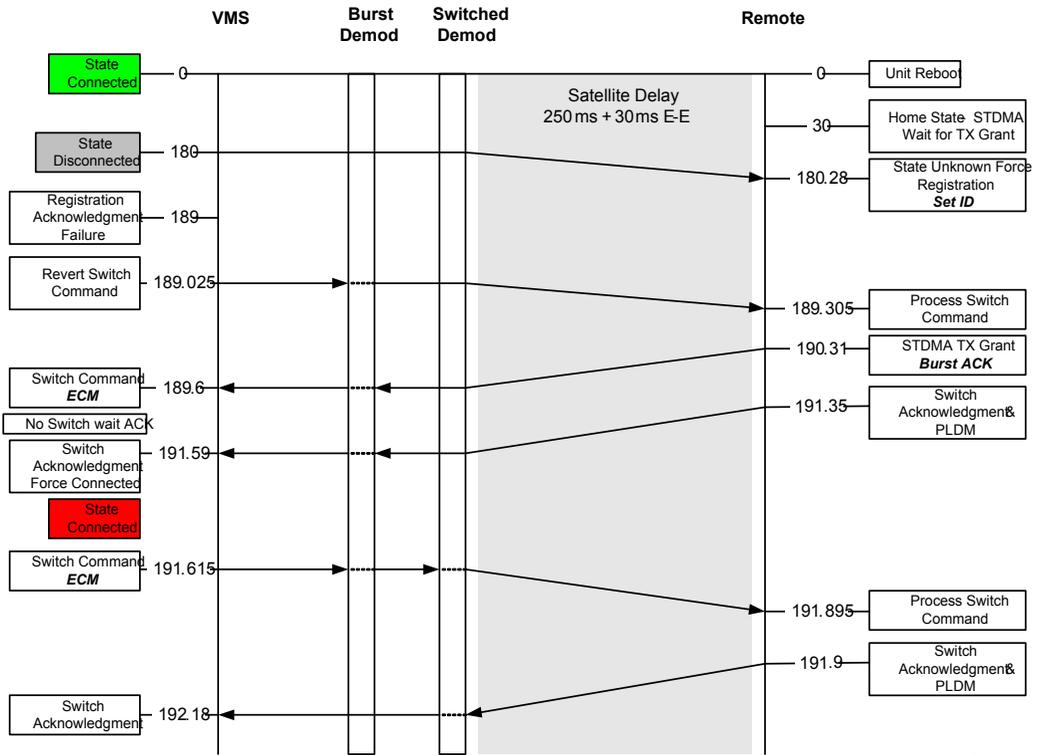
If the revert-to-home state command fails, the VMS will send a command to return the Remote and the Hub demodulator to the state where they were prior to losing communications, but leave the Remote enabled in the STDMA burst controller. This provides the Remote with 2 paths to rejoin the network:

1. If the outage was the result of a power loss 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-13 and figure B-14 diagram the time state differences and the process of recovery. Note that the times referenced in the diagrams are approximate.

ECM Switch Recovery 3min.



3/7/05

Figure B-13 ECM Switch Recovery: < 3 minutes

ECM Switch Recovery 3min.

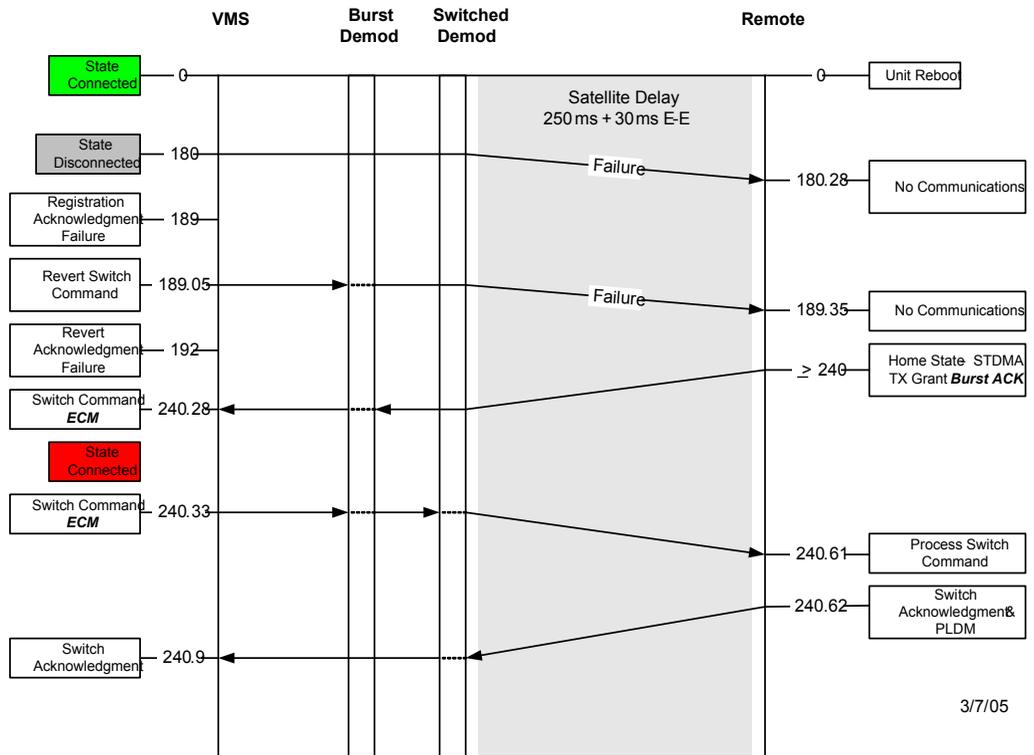


Figure B-14 ECM Switch Recovery: > 3 minutes

Using STDMA ECM

Entry Channel mode operates slightly differently from other STDMA modes due to the STDMA burst controller losing the ability to automatically control the modem unit once it is operating in SCPC mode.

Once the switch from ECM to SCPC has occurred in the modem, the unit no longer sends switch requests so VMS does not have a switch request to respond to switch the modem back to STDMA from SCPC mode. The operator will have to manually intervene to force a switch back into STDMA mode.

The following procedure illustrates this and demonstrates how to change the operation of a modem operating in SCPC mode back to STDMA mode.

Figure B-15 shows the STDMA page for the CDM-570/570L set up to run in Entry Channel mode.



Note: Refer to the Vipersat SLM-5650A modem manual for Entry Channel configuration setup. The text referenced within is similar between the CDM-570/L and the SLM-5650A; the UI page appearances may differ, however.

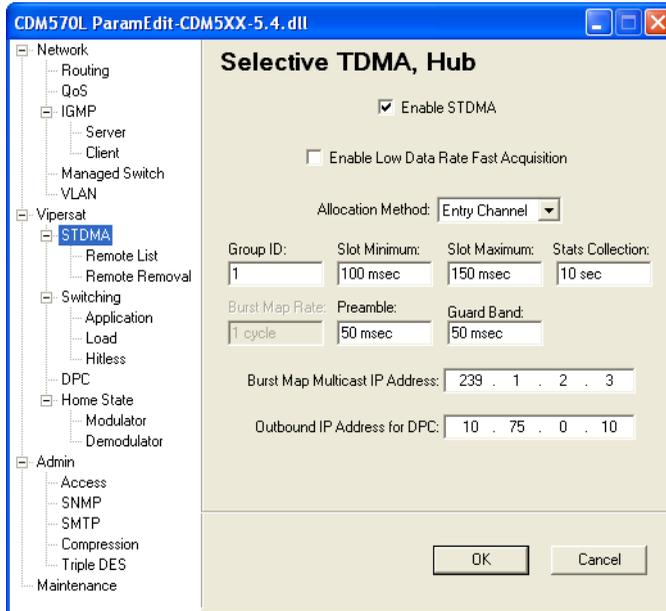


Figure B-15 STDMA Page with Entry Channel Mode, CDM-570/570L

Switching an ECM Remote from SCPC to STDMA

Use the following procedure to switch an ECM Remote operating in SCPC mode back to STDMA mode.



Note: This switch must be performed manually.

1. Click the **Remote List** menu item on the **STDMA** page shown in figure B-15 above to display the **STDMA Remote List** shown in figure B-16.

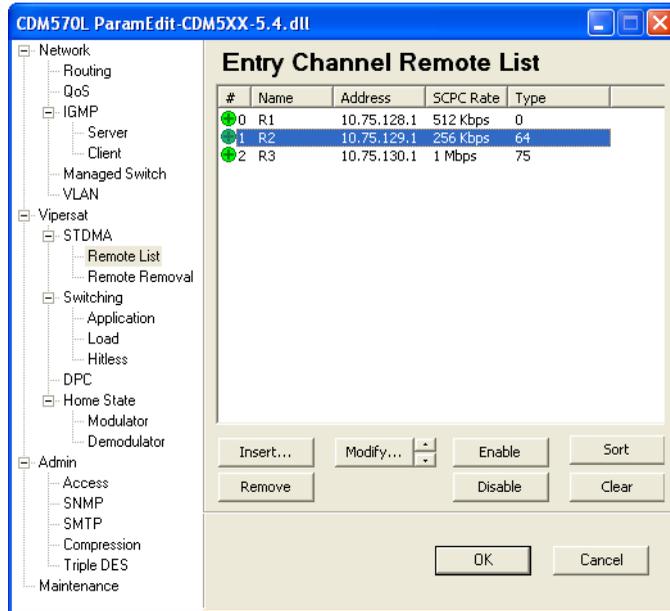


Figure B-16 ECM Remote List Page, CDM-570/570L

- From the **STDMA Remote List**, select the Remote modem unit to be switched from running in SCPC to STDMA mode. Use the up and down arrows next to the Modify button to change the selected Remote.
- Click the **Modify...** button to display the **Remote Entry** dialog shown in figure B-17.

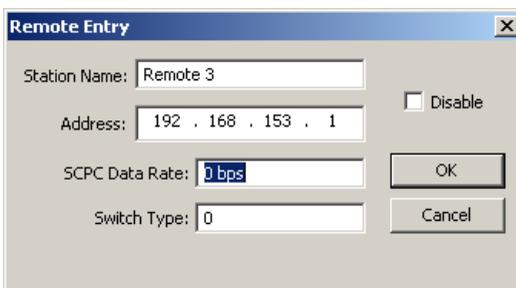


Figure B-17 Remote Bandwidth Entry, CDM-570/570L

- To force a switch from ECM SCPC mode to STDMA mode, set the current value in the **SCPC Data Rate** dialog box to 0 (zero), then click the **OK** button.
Note that the 0 bps setting will cause the modem to remain in STDMA ECM

and not switch out to SCPC unless either an application switch occurs or a manual switch is invoked.

- In VMS, right-click on the Remote as shown in figure B-18, then select the **Revert Uplink Carrier** command from the drop-down menu. The VMS will send the revert command to the target modem, causing it to revert to its STDMA home state.

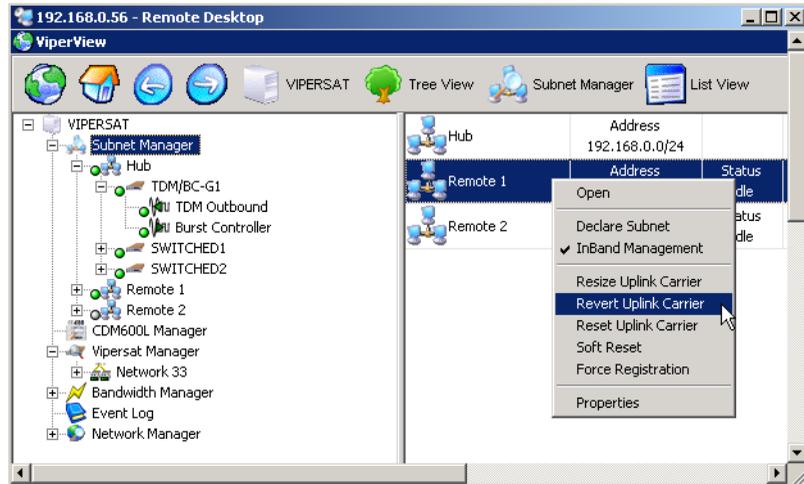


Figure B-18 Revert Uplink Carrier Command, VMS modem

This completes resetting the Remote modem to operate in the STDMA mode.

Dynamic Entry Channel Mode

Dynamic ECM (ECMv2) utilizes a modified slotted Aloha method for Remotes to establish registration in the network and obtain the means for switching into SCPC mode. Rather than sharing an STDMA burst map, as is the method with STDMA ECM, the Remotes rely on communicating with the Hub channel controller through the use of a multicast *Transmission Announcement Protocol* (TAP) message. This eliminates the restriction in the number of Remotes in an Entry Channel group that is inherent with the burst map method.

The TAP, broadcast periodically, supplies the Remotes with the transmit parameters that are required for transmitting back to the Hub. In addition, the TAP provides timing information in the form of slot parameters that define the

required acquisition time of the receiver and the amount of time allowed for M&C packet transactions.

All Remotes will receive the TAP message from the Hub, but a Remote will only transmit back to the Hub if it is a member of the specified group. Upon receipt of the TAP, the Remote resets its timing and uses the provided slot information to determine the next transmit opportunity. This allows each Remote to transmit at a discrete time to minimize the chance of collision. When a transmission to the Hub is not received, the Remote uses a random back-off (next slot) algorithm to further reduce contention, and will try again until a Hub response is received.

Upon valid reception of the Remote's transmission, the Hub channel controller will place the Remote into queue for assignment of switching into a *d*SCPC channel. The Remote will be registered in the VMS, then await the availability of the hardware and bandwidth resources necessary for execution of the switch request. The TAP will continue to be received even after the Remote has been switched out into SCPC.

Only management traffic is allowed while a Remote is in ECM. No data traffic is transmitted until the Remote is switched out of ECM and is operating in *d*SCPC mode.

Hub Configuration

The Hub channel controller is a dedicated demodulator that has been selected as an ECM controller. The Entry Channel configuration settings of this demodulator (figure B-19) determine the channel parameters that are transmitted in the TAP message and include:

- ECMv2 Enable
- Group ID
- TAP IP Multicast Address
- Preamble
- Guard Band
- LNB LO Frequency
- Satellite Frequency Conversion
- Total Slot Count

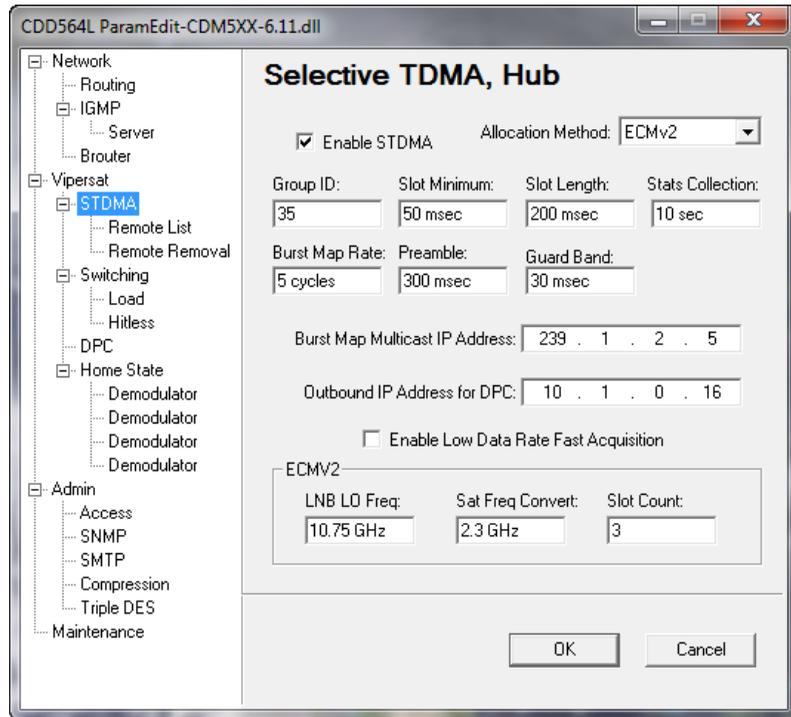


Figure B-19 Entry Channel Mode v2 Configuration, Hub

Remote Configuration

The demodulator (receive) configuration of each Remote in the group must be set appropriately in order to receive the TAP from the Hub. Because the TAP provides the necessary transmit parameters for the Remotes, manual modulator configuration by the operator is unnecessary. The Entry Channel configuration of the Remote (figure B-20) must include:

- ECMv2 Mode (Online, Wait, Offline)
- Group ID
- TAP IP Multicast Address
- BUC LO Frequency

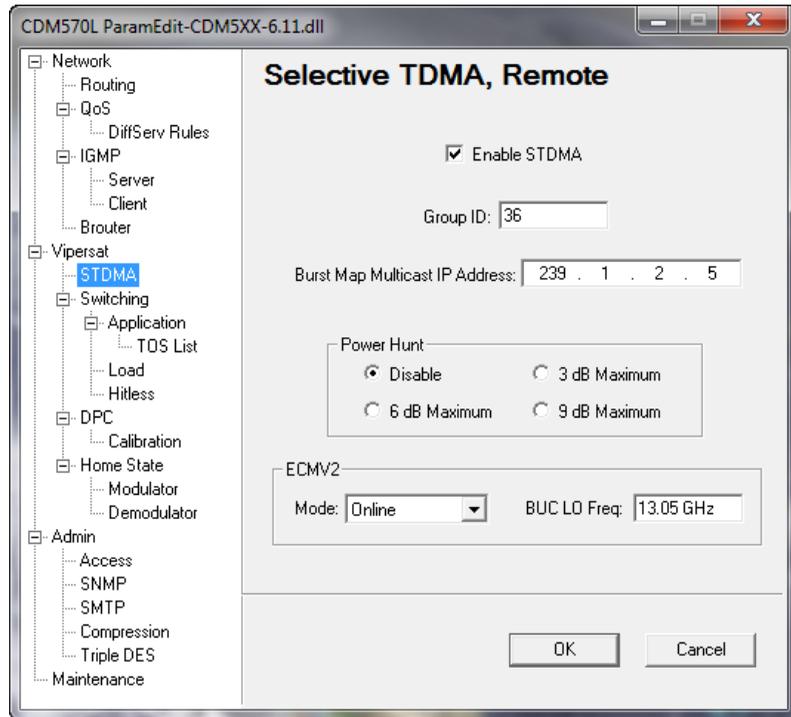


Figure B-20 Entry Channel Mode v2 Configuration, Remote

ECM Processing

A detailed representation of the sequence of steps that occur between the Hub units (the channel controller and a switched demodulator), the Remote unit, and the VMS during the ECM process is shown in figure B-21.

Entry Channel Mode Switching

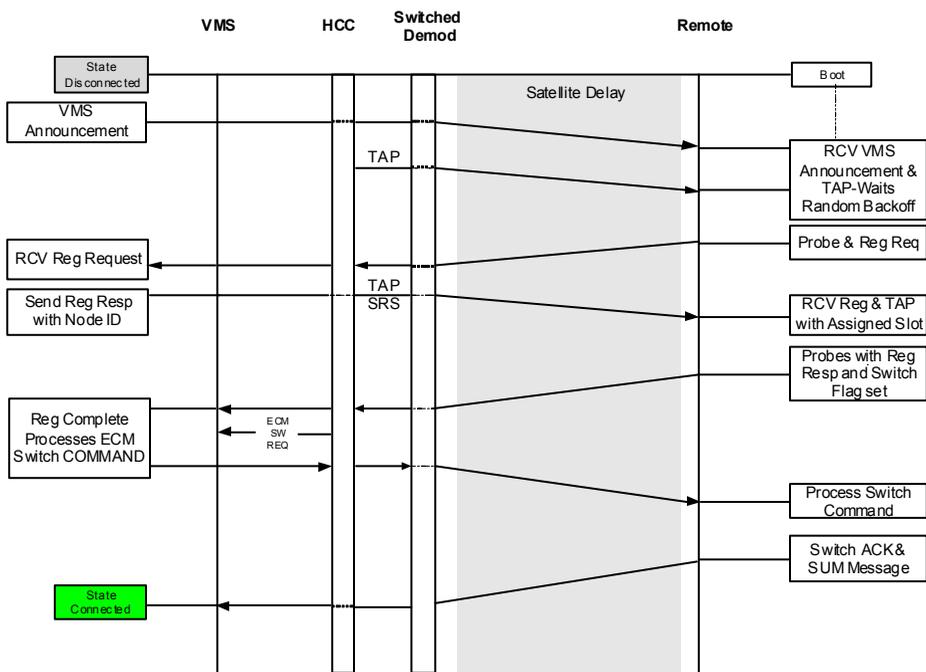


Figure B-21 ECMv2 Processing Diagram

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-optional 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: 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-optional 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.

Description

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 <i>Calculate Max Power</i> 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. <i>Used for Roaming feature.</i>
Margin	Main; Modulator	Display Only	The site power margin as used in Max Power calculation. <i>See Calculate Max Power for more details.</i>

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. <i>See modem specifications for valid range.</i>
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. <i>See modem specifications for valid range.</i>
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. <i>See modem specifications for valid range.</i>
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. <i>See modem specifications for valid range.</i>

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.

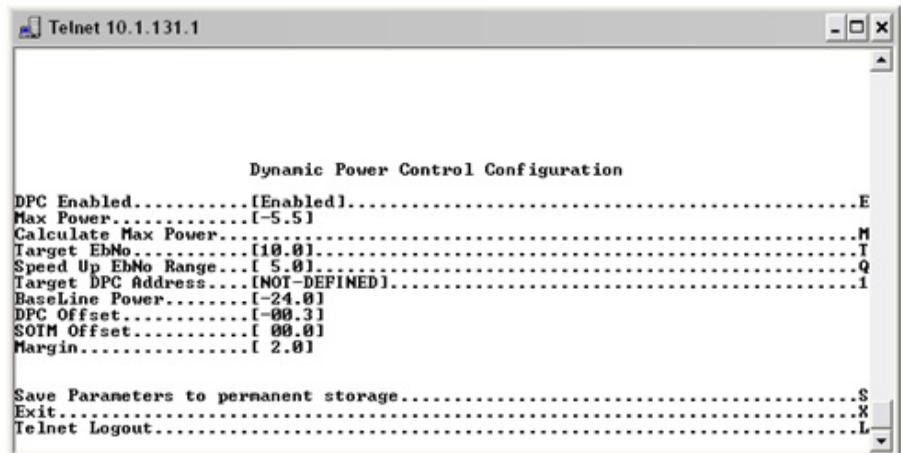


Figure C-3 DPC Configuration screen, CLI

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.

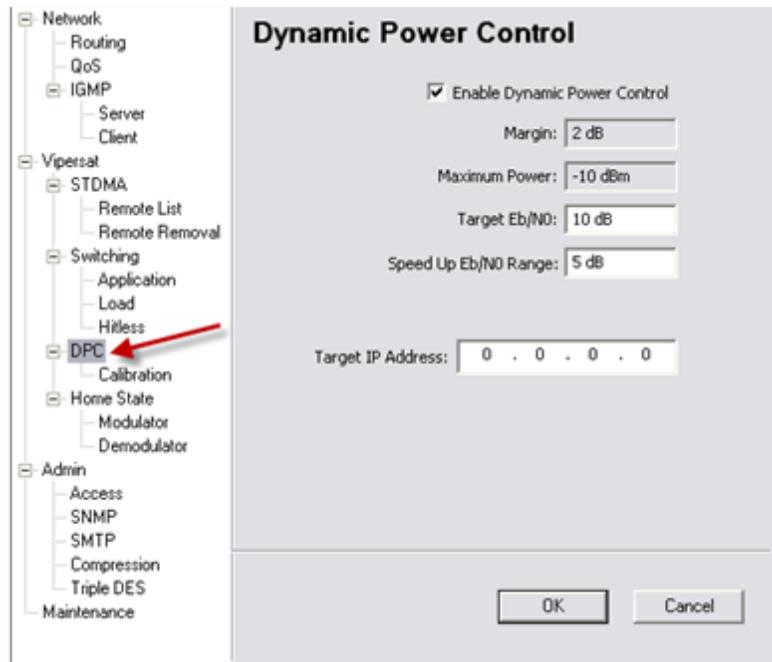


Figure C-4 DPC dialog, Parameter Editor

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 does not 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.

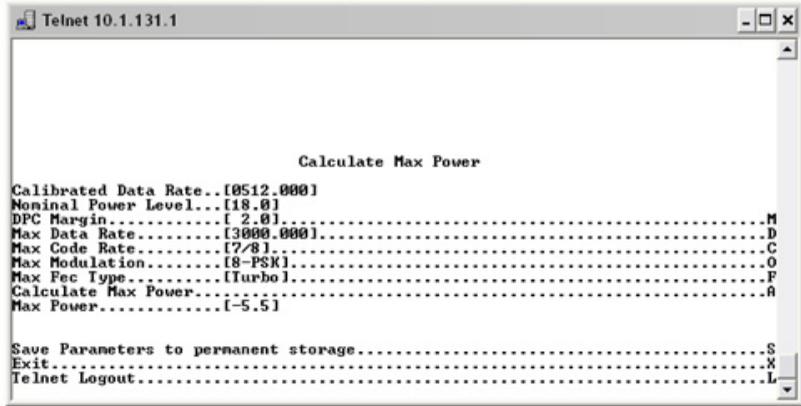


Figure C-5 DPC Calculate Max Power screen, CLI

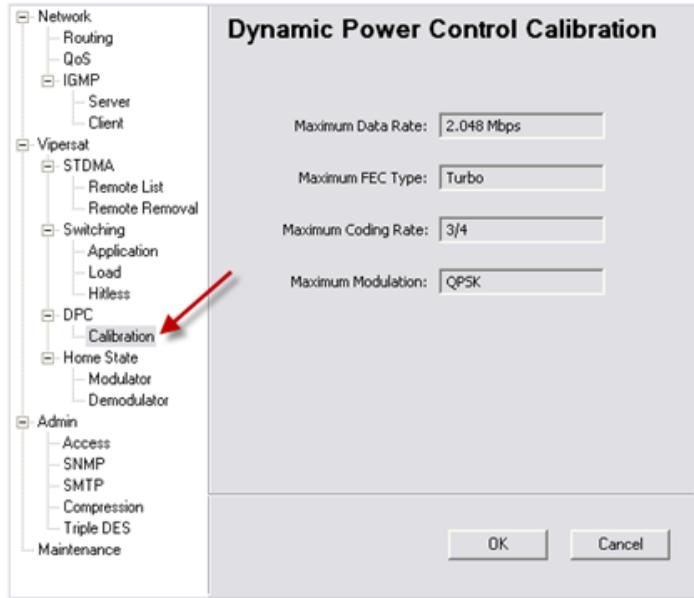


Figure C-6 DPC Calibration dialog, Parameter Editor

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.

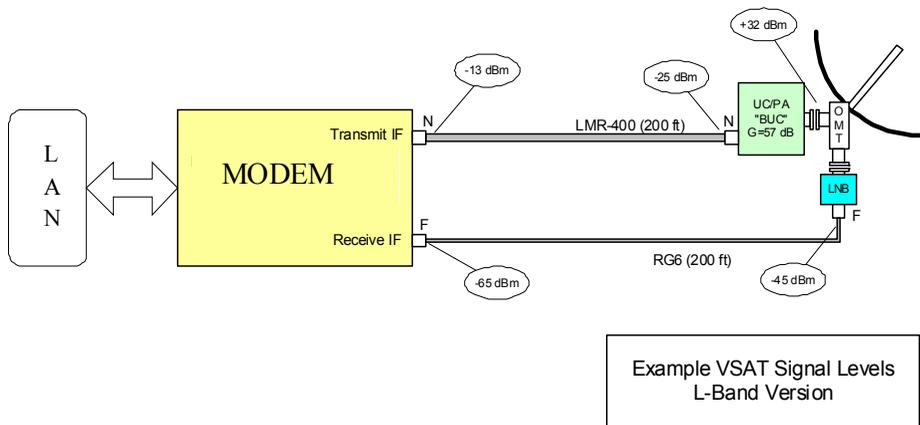


Figure C-7 Signal Power Levels, Remote Site

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 (P_{1dB}), 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:

$$\text{Loss (cable max)} = \text{Gain (LNB)} - 40 - \text{Loss (misc)} \quad \text{in dB}$$

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:

$$\text{Loss (cable max)} = +3 - \text{BUC Pin (1dB)} - \text{Loss (misc)} \quad \text{in dB}$$

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
1/2-inch Superflex (50Ω)	5,000	0.52	4.2	>90	1.89

D

ECM MIGRATION

Migrating from STDMA/ECMv1 to Aloha/ECMv2

General

The material in this appendix is offered to provide a step-by-step procedure for network operators to migrate an STDMA/ECMv1 control channel to the latest version of Aloha/ECMv2. This new Entry Channel feature is based on modified slotted Aloha and differs from the current STDMA/ECM control protocol, but it does leverage some of the STDMA software foundation to support the feature changes.

The two ECM versions share common code from the point of STDMA feature enable, multicast IP address, group ID, preamble, and guardband settings. However, ECMv2 differs by providing the following:

Hub Control

- Hub Controller demodulator receive parameter set is propagated to all listening Remotes for auto-configuration of transmit parameter sets
- No list of Remotes required for control; offers unsolicited access
- Simple control channel carrier mobility

Remote Control

- Transmit carrier parameters controlled by Hub Channel Controller
- No customer data traffic sent while in Entry Channel mode; only M&C

All other standard controls for access into *d*SCPC are maintained, but because of a new fixed entry switch type, **VMS version 3.9.2** or greater is required.

Because most networks are likely to have Remote sites off-the-air for various reasons, the task of upgrading all locations during a planned maintenance period introduces complexity, particularly where the upgrade breaks current protocol. If this is the case, it will be required to provide additional resources during the migration to assure all sites—active or inactive—make the transition.

Sites that are active are much simpler to upgrade and modify, but sites that are inactive must have the old (current) hardware or configuration running to assure that an upgrade path is available when they reactivate.

These additional resources typically have at least one STDMA Burst Controller programmed for the inactive sites. This will assure that, when the Remote activates, it can enter the network as always and allow the operator to upgrade and migrate the site to the new ECMv2 channel.

Migration Procedure

This procedure is intended for Remote sites that are online or offline with Hub communications. The following steps are accomplished remotely through communication links from Hub to Remote site.

1. Save backup parameter configuration files for all of the Remotes. Store these files as current configuration to facilitate the option to fall back to STDMA ECM.
2. Upgrade firmware in all active Remotes that will participate in ECMv2 operation to version 1.6.11 (or 2.6.11 for CDM-570 with version 2 hardware).
3. Add the supplied editor file (ParamEdit-CDM5XX-6.11.dll) to the VMS bin directory, which will allow proper editing response through the new GUI.

Path C:\Program Files (x86)\Vipersat\VMS\3.0\bin

Configure Remote Units

There are two options for configuring the Remote units:

- From the Hub site, use the **Configure** command in the VMS ViperView interface. The use of this method is illustrated in this procedure.
- From the Remote site *with local access only*, use the **CLI** via either the Console port or Telnet.

Note: Do Not attempt to execute this procedure using the CLI via remote Telnet (over the air). When using the CLI, the BUC LO frequency parameter can not be accessed until the ECMv2 Mode has been enabled first. However, enabling this feature will immediately initiate TAP communications and block the ability of the user to set the BUC LO value.

With the Remotes switched into *dSCPC*, configure each modem using the **STDMA** page, as shown in figure D-1.

1. Enter the **BUC LO Freq** parameter, making sure the units are set correctly.

The BUC frequency is very important. This allows any frequency translation between Hub downlink and Remote uplink to properly match for inversions or offsets.
2. Enable ECMv2 by selecting **Online** mode.

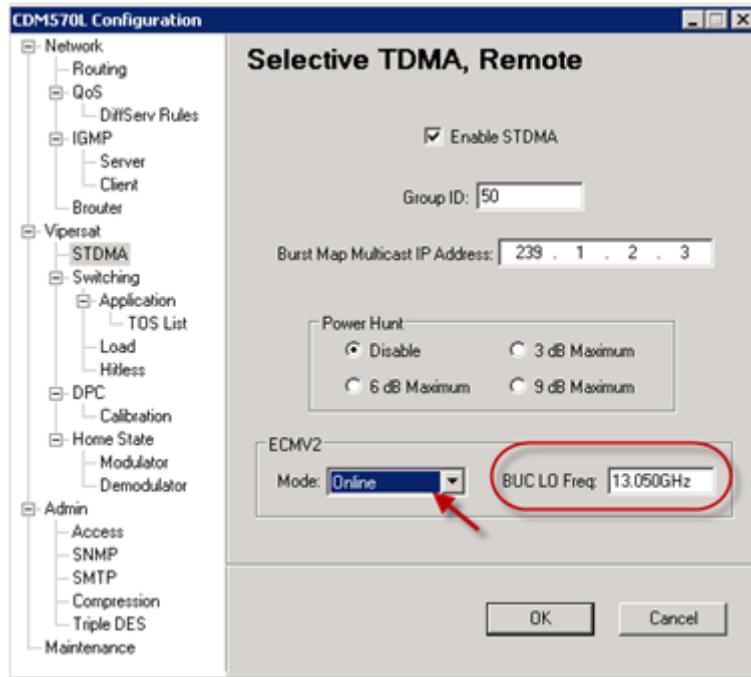


Figure D-1 STDMA Configuration Page, Remote CDM-570/L

3. Click on the **OK** button to implement the change, and **Save to Flash** when prompted to ensure that this new configuration is preserved during Hub configuration.

The new configuration parameters will be uploaded and the Remote will be forced to its Home State, awaiting new TAP messages. The transmit may be disabled during the time period for Hub reconfiguration.

Notice that the VMS will time out during the writing process (indicated with the progress bar). This is okay, as communications to the Remote modem will be temporarily lost.

4. Repeat the above steps for each Remote before proceeding with the Hub configuration.

Configure Hub Unit

Once all active Remotes have been configured to ECMv2/Online state, the next step is to configure the ECM Hub Channel Controller, which can be the demodulator on either a CDM-570 or a CDD-56X.



Caution: If a separate controller is in use while the current STDMA unit(s) are running, make absolutely sure that the **Group ID** is unique from what is currently configured in the running STDMA's. The multicast IP address can be the same; this is not a problem.

Ensure that the **Low Data Rate Fast Acquisition** feature is disabled. Set the Preamble accordingly. If unsure, contact CTAC for the correct value to match the active configuration.

1. From the CLI Main Menu, navigate to **Vipersat configuration > STDMA Mode** screen.
2. Enter **T** at the command prompt for **Hub Type**, and then enter **6** to select **ECMv2** (figure D-2).

```

Telnet 10.73.0.2

                                STDMA
STDMA.....[Enabled]
STDMA Tx Rate.....[64000 bps]
Hub Type.....[Entry Channel]
Group ID.....[50]
Low Data Rate Fast Acquisition.....[Disabled]
Burstmap Multicast IP.....[239.1.2.3]
Outbound IP.....[10.73.0.2]
Cycles Per Burst Map.....[2]
Slot Guardband.....[ 60 nSec < 400 bytes>]
Slot Preamble Length.....[ 300 nSec < 2400 bytes>]
Slot Data Length.....[ 150 nSec < 1200 bytes>]
Minimum Data Length.....[ 50 nSec < 400 bytes>]
Slot Cycle Length.....[3010 nSec <24000 bytes>]
Set Remotes.....
STDMA Statistics.....
Show Hub Statistics.....

Save Parameters to permanent storage.....
Exit.....
Telnet Logout.....

Please enter a value for the Hub Type
Press ESC to abort
 1 -- Fixed
 2 -- Dynamic Slot
 3 -- Dynamic Cycle
 4 -- GIR
 5 -- Entry Channel
 6 -- ECMv2

```

Figure D-2 STDMA Configuration Menu, Hub Type Selection

After the Hub Type is changed to ECMv2, the controller will start sending TAP multicast messages using the burst map multicast address 239.1.2.3, and broadcasting to the group the frequency, data rate, and timing as well as where and when the Remotes can transmit.

Note that the frequency value is sent in RF uplink format, so it is very important to set the Hub LNB LO Frequency as well as the Satellite Frequency Conversion parameter values in the STDMA menu (figure D-3).

3. Enter **Z** at the command prompt to specify the **LNB LO Frequency**.
Enter **F** at the command prompt to specify the **Satellite Frequency Conversion**.

These values should *NEVER* remain as zero (default).

```

Telnet 10.73.0.2

                                STDMA
STDMA ..... [Enabled]
STDMA Tx Rate ..... [64000 bps]
Hub Type ..... [ECMv2]
Group ID ..... [50]
Low Data Rate Past Acquisition ..... [Disabled]
Burstmap Multicast IP ..... [239.1.2.3]
Outbound IP ..... [10.73.0.2]
Slot Guardband ..... [ 60 nSec < 480 bytes>]
Slot Preamble Length ..... [ 300 nSec < 2400 bytes>]
Slot Data Length ..... [ 201 nSec < 1608 bytes>]
Total Slot Count ..... [10]
Slot Cycle Length ..... [5968 nSec <46908 bytes>]
LNB LO Frequency (MHz) ..... [10750]
Satellite Frequency Conversion (MHz) ..... [2300]
STDMA Statistics .....
Show Hub Statistics .....
Save Parameters to permanent storage .....
Exit .....
Telnet Logout .....
  
```

Figure D-3 STDMA Menu, ECMv2 Hub Type

At this point, the Remotes will start bursting in the new, temporary frequency or the same slot as the original STDMA channel. To move the ECMv2 slot, modify the Hub demodulator frequency or data rate for the desired new location.

One of the many advantages of ECMv2 is that the Remote modulator will no longer have to be configured; the modem will automatically update its Home State transmit parameters to match the ECMv2 slot as soon as it receives the next TAP message from the Hub.

It is recommended that the operator update and save the Home State on the Hub Controller to ensure that the parameters will remain during a reboot.

4. Adjust the ECMv2 calibration as necessary with the **Slot Guardband**, **Slot Preamble Length**, and **Total Slot Count** parameter settings.

Example: The recommended settings for 64 kbps, QPSK, 3/4

- Guardband—60 msec
- Preamble Length—300 msec
- Total Slot Count—10



Tip: A Vipersat calculator is available to optimize these settings. Contact a Comtech Vipersat Networks representative for a copy of the latest *Vipersat ECM Calculator*.

There is no *Remote List* for ECMv2 like there is for ECMv1. Therefore, there is no need to enable the Remotes in the burst map, nor to set a desired *dSCPC* switch rate.

With ECMv2, the Remote sites will switch out to *dSCPC* using the **Minimum Switch Rate Limit** from the **InBand Return Path** settings, as shown in figure D-4 below.

The screenshot shows the 'InBand Return Path Settings' window for 'SITE 3'. The left sidebar lists navigation options: General, Position, InBand (expanded), Return Path (selected), Reservations, Modcodes, SHOD Limits, Application Policies, and Distribution Lists. The main content area is titled 'InBand Return Path Settings' and contains the following sections:

- Home State:** Frequency (14.34GHz), Bitrate (64kbps), Power (-26dBm).
- Additional Transmission Parameters:** QPSK, 3/4, Turbo. Includes 'Edit' and 'Update' buttons.
- Managed Modulator:** Modulator 1 on Remote570-ECM. Includes a 'Select' button.
- Home Demodulator:** ECMv2 Controller on HUB-Intelsat-VII. Includes a 'Select' button.
- Home Modulator:** Modulator 1 on HUB-Intelsat-VII. Includes a 'Select' button.
- Switch Rate Limits:** Minimum (64kbps), Maximum (4.5Mbps). A red arrow points to the Minimum field.

At the bottom of the window are 'Apply' and 'Close' buttons.

Figure D-4 Switch Rate Limits, InBand Return Path Settings Page

Migration Procedure

5. Save the configuration to Flash on the ECM Hub Controller.

This concludes the ECM migration procedure.

E

GLOSSARY

A

- ACK** A signal used in computing and other fields to indicate **acknowledgement**, such as a packet message used in TCP to acknowledge the receipt of a packet.
- ACM** **Adaptive Coding and Modulation** – A technique that optimizes throughput in a wireless data link by adapting the forward error correction code rate and the modulation order according to the noise conditions (or other impairments) on the link. A feature that is supported in CEFD modems such as the CDM-840 Remote Router.
- ARP** **Address Resolution Protocol** – A protocol for a LAN device to determine the MAC address of a locally connected device given its IP address. See also MAC.
- ASR** **Automatic Switch Request** – 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 consists of a circuit board with the modem hardware and firmware and the associated interfaces.

- BER** **Bit Error Rate** (sometimes **Ratio**) – A measure of the number of data bits received incorrectly compared to the total number of bits transmitted.
- BPM** **Bridge Point-to-Multipoint** – Routing mode option available in the SLM-5650A satellite modem.
- bps** **bits per second** – A measure of the bit rate or transmission speed of a digital communication link. See also *kbps* and *Mbps*.
- BPSK** **Binary Phase Shift Keying** – 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** **Block Up Converter** – 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** **Comtech Data Demodulator** (CEFD model designator; e.g., CDD-564)
- CDM** **Comtech Data Modem** (CEFD model designator; e.g., CDM-570)
- CEFD** **Comtech EF Data** – Global leader in satellite bandwidth efficiency and link optimization, and supplier of advanced communication solutions. A subsidiary of Comtech Telecommunications Corporation.
- CIR** **Committed Information Rate** – A specified data rate up to which a remote terminal is always guaranteed to be granted service from reserved bandwidth in the shared pool.
- CLI** **Character Line Interface** – 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** **Cyclic Redundancy Check** – 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** **Demand Assigned Multiple Access** – A process whereby communications links are only activated when there is an actual demand.
- dBm** **Decibel referenced to 1 milliwatt.**
- DES** **Data Encryption Standard** – A federal standard method for encrypting information for secure transmission. The Vipersat system offers 3xDES (Triple DES) for encrypting traffic.
- DHCP** **Dynamic Host Configuration Protocol** – An Internet protocol for automating the configuration of computers that use TCP/IP.
- DLL** **Dynamic Link Library** – The implementation of the shared library concept in the Microsoft Windows system.
- DPC** **Dynamic Power Control**
- DSCP** **Differentiated Services Code Point** – 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** **Digital Video Broadcasting** – 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** **Digital Voice Processor** – Used in packet voice applications.

E

- E_b/N_0 The ratio of E_b (energy per bit) and N_0 (noise power spectral density per Hz). This is a normalized signal-to-noise ratio (SNR) measure, also known as the “SNR per bit”. 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.

- E_s/N_0 The ratio of E_s (energy per symbol) and N_0 (noise power spectral density per Hz). This is closely approximate to the carrier-to-noise ratio (C/N). E_s is the energy of a bit (not an information bit) measured in Joules or, equivalently, in Watts per Hertz. This measurement is typically used to quantify a DVB-S2 carrier.
- ECM** **Entry Channel Mode** – In a Vipersat network, ECM provides a quick and reliable method for Remotes requiring SCPC access channels to enter/re-enter the network initially or after a power or other site outage.

F

- FAST Code** **Fully Accessible System Topology 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** **Frequency Division Multiple Access** – 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** **Forward Error Correction** – 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 reprogrammed.
- Forward Path** Transmission path from the Hub site to a Remote site.
- FTP** **File Transfer Protocol** – An application for transferring computer files over the Internet. See also *TFTP*.

G

- G.703** ITU-T standard for transmitting voice or data over digital carriers such as T1 and E1.
- G.729** ITU standard for LD-CELP (Low Delay – Code Excited Linear Prediction) voice encoding at 8 kb/s.

- GIR** **Guaranteed Information Rate**
- Group ID** A number assigned to equipment which defines it as a member of a group when addressed by the VMS Hub Controller.
- GUI** **Graphical User Interface** – 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.
- HCC** **Hub Channel Controller** – A dedicated Hub demodulator that has been designated as the ECM (ECMv2) controller, and which provides the TAP multicast message to the Remotes.
- HDLC** **High Level Data Link Control** – A standard defining how data may be transmitted down a synchronous serial link.
- HPA** **High Power Amplifier** – The amplifier used in satellite communications to raise the transmit signal to the correct power level prior to transmission to satellite.
- HTTP** **Hyper Text Transfer Protocol** – The Internet standard for **World Wide Web (WWW)** operation.
- Hub** The central site of a network which links to a number of satellite earth sites (Remotes).

I

- ICMP** **Internet Control Message Protocol**
- IDU** **Indoor Unit** – In a VSAT system, the satellite modem is referred to as the IDU.
- IF** **Intermediate Frequency** – In satellite systems, IF frequencies are usually centered around 70/140 MHz (video/TV), or 1200 MHz (L-band).
- IFL** **Intra-Facility Link** – The coaxial cabling used to connect the satellite ODU to the IDU. Carries the inbound and the outbound signals, and the 24 VDC for the LNB.

- IGMP** **I**nternet **G**roup **M**anagement **P**rotocol – An IP communications protocol used by network hosts and adjacent routers to establish multicast group memberships.
- 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 **Local Oscillator** – A component used in upconverters, downconverters, and transponders for frequency translation (heterodyne) of the carrier signal.

M

M&C **Monitor & Control**

MAC **Media Access Control** – A protocol controlling access to the physical layer of an Ethernet network.

Mbps **Mega bits per second** – 1 Million bits/second. A measure of the bit rate or transmission speed of a digital communication link. See also *bps* and *kbps*.

MIB **Managed Information Base** – A database used for managing the entities in a communications network. Typically associated with Simple Network Management Protocol (SNMP).

MIR **Minimum Information Rate** – A minimum level of service available to a remote terminal, ensuring the ability to enter a clear channel SCPC circuit or have a timelot in STDMA.

Modem **Modulator and demodulator** 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 **Network Address Translation** – 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.

NBI **Northbound Interface** – The SNMP interface offered by the VMS to extend services to an external network management system (NMS).

NIC **Network Interface Controller** – 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 identified by a unique IP address.

NMS **Network Management System**

- NOC** **Network Operations Center** – 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** **Network Processor** – 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** **Outdoor Unit** – 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** **Offset Quadrature Phase Shift Keying** – 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** **Open Shortest Path First** – 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

- PIR** **Peak Information Rate** – The bandwidth available for use by any remote terminal on best effort basis, categorized through multilevel prioritization.
- PLDM** **Path Loss Data Message** – 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** **Phase Shift Keying** – 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** **Public Switched Telephone Network** – The world’s public circuit-switched telephone network, digital and analog, and includes mobile as well as land-line voice and data communications.
- PUM** **Periodic Update Message** – A packet message that is sent by newer Vipersat modems (e.g., CDM-840) to the VMS every sixty seconds, providing either registration request or status update and operating parameter information (SUM).

Q

- QAM** **Quadrature Amplitude Modulation** – 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** **Quality of Service**
- QPSK** **Quadrature Phase Shift Keying** – 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** **Radio Frequency** – A generic term for signals at frequencies above those used for baseband or IF.
- RFC** **Request For Comment** – The official publication channel for Internet standards (such as communication protocols) issued by the Internet Engineering Task Force (IETF).
- RIP** **Routing Information Protocol**
- ROSS** **Roaming Oceanic Satellite Server** – A satellite mobility controller that is a key component in the CEFD SOTM technology solution for marine vessels. Provides for transition of link communications between roaming remote terminal and satellite or Hub with minimal service interruption.

- 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 **Real-time Transport Protocol** – 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 **Receive**

S

- SCPC **Single Channel Per Carrier** – 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 **Session Initiation Protocol** – A general purpose protocol for multimedia communications, commonly used for voice over IP (VoIP) signaling. An alternative to the H.323 protocol.
- SLM **Satellite Link Modem** (CEFD model designator; e.g., SLM-5650A)
- SNG **Satellite News Gathering** – A satellite uplink van/truck with television crew on location conducting a live report for a newscast.
- SNMP **Simple Network Management Protocol** – A protocol defining how devices from different vendors may be managed using a common network management system.
- SOTM **SatCom-On-The-Move** – 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 **Selective Time Division Multiple Access** – 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 **Status Update Message** – 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

- TAP** **T**ransmission **A**nnouncement **P**rotocol – A proprietary multicast message sent out by the HCC to all associated Remotes in the group, specifying the relative start time and duration for each terminal to transmit while in Entry Channel mode (ECMv2).
- 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 of **S**ervice
- Tx** **T**ransmit

U

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

V

- VCM** **V**ariable **C**oding and **M**odulation – A technique that optimizes bandwidth utilization in a wireless data link by varying the forward error correction code rate and the modulation order within a single carrier. A feature of DVB-S2 that is supported in CEFD modems such as the CDM-800 Gateway Router.

- VCS** Vipersat **Circuit Scheduler** – 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.
- VersaFEC** Advanced forward error correction technology from CEFD that provides maximum coding gain with lowest possible latency to support latency-sensitive data applications, such as voice, video, and cellular backhaul.
- VESP** Vipersat **External Switching Protocol** – 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.
- VFS** Vipersat **File Streamer** – A file transfer application utilizing UDP and a proprietary Streamload protocol to transmit data across the Vipersat network.
- ViperView** The graphical user interface for the client component of the VMS that provides the means to configure, control, and monitor Vipersat satellite networks.
- VLoad** Vipersat **Load Utility** – A comprehensive tool for managing and distributing application, configuration, and identification information for the modem/routers in Vipersat satellite networks.
- VMS** Vipersat **Management System** – A comprehensive M&C tool providing rapid and responsive control of Vipersat satellite networks. Comprised of client and server components.
- VNO** **Virtual Network Operator** – 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** **Voice over IP** – The routing of voice communications over the Internet or through any IP-based network.
- VOS** Vipersat **Object Service** – 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.

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