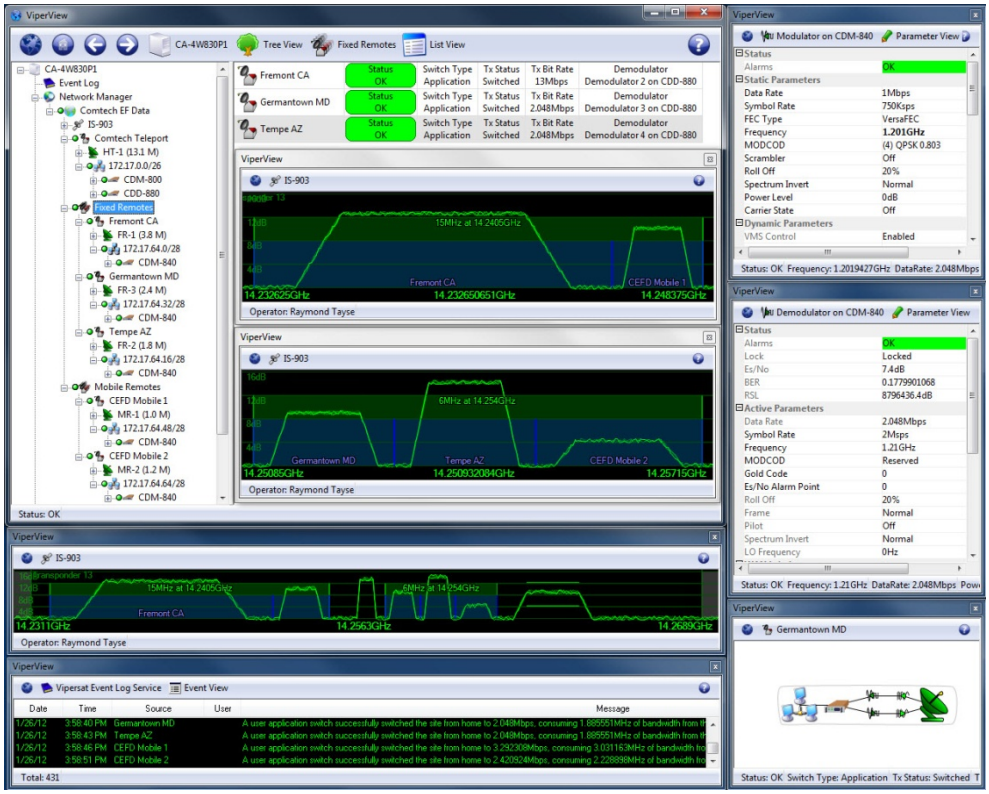
Vipersat Management System (VMS)

Network & Bandwidth Management



Typical Users

- Satellite Service Providers
- Government, Ministries & Militaries
- Offshore Oil & Gas Rig Owners
- Civil & Military Aviation Authorities
- Satellite News Gathering (SNG) Operators
- Cruise Ship Network Administrators

Common Applications

- Disaster Recovery & Emergency Communications
- Navy and Commercial Maritime Roaming
- Dynamic Satellite News Gathering
- Air Traffic Control Overlay Networks
- Secure Networks
- Mining and Exploration Communications Backhaul
- Communications on-the-Move
- Communications at-the-Pause
- Distance Learning / Health and Welfare Networks

Overview

The Vipersat Management System builds on years of providing our customers with the most advanced automated bandwidth and capacity management system in the industry. VMS is a feature-rich, comprehensive, intuitive operator's network configuration, management, and control tool. It is designed to enable network administrators and satellite service providers to easily configure networks and rapidly and effectively respond to network anomalies. More than a network monitor and control platform, VMS automates the carrier switching and spectrum management processes within the satellite network. These capabilities allow SCPC carriers to be switched automatically based on application, load, or schedule, providing on-demand services and unparalleled space segment savings.

Features

- Dynamic Single Channel per Carrier (dSCPC)
- Guaranteed bandwidth
- SatCom on-the-move
- Virtual Network Operator (VNO)
- ArrangeLink
- ViperGlobe
- Total system redundancy
- Multi-transponder operation
- Satellite cross strapping/banding support
- Active distribution lists
- On-demand meshing
- Advanced carrier resizing
- IP-based network control
- Antenna visibility mapping
- Point-to-point switching
- Over-the-air upgrades
- Dynamic Power Control (DPC)
- Multiple switching functions

Key Benefits

- Centralized satellite bandwidth management server
- Operates over multiple transponders and satellites
- True bandwidth-on-demand technology
- Automation of satellite ground terminal transmission plans
- Administratively-defined policies for transmission plan changes
- Dynamic star and mesh satellite topologies
- IP Layer 2, Layer 3, and hybrid networks supported
- Total system redundancy
- Scalable to address various network sizes

Our efficient modem technologies combined with our VMS provide dynamic SCPC capacity management solutions. dSCPC facilitates bandwidth sharing resulting in lower space segment operating costs. Efficient, low-latency and low-jitter SCPC connections can be established, torn down, and dynamically resized manually or automatically. Vipersat dSCPC networks are comprised of Comtech EF Data modulators, demodulators, and modems, which are centrally controlled by the VMS to provide dynamic bandwidth management. VMS is scalable, designed to accommodate future growth, and is capable of managing various network configurations.

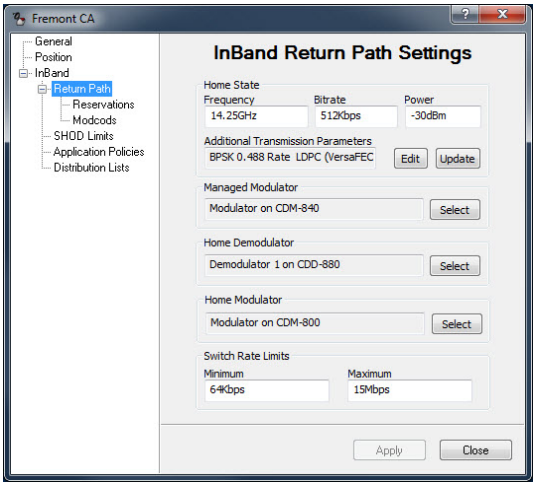
A variety of Comtech EF Data modems, modulators, demodulators and routers are manageable by the VMS. Different bandwidth saving features and capabilities are supported depending on the modem or terminal type. The modem or terminals that are manageable by the Vipersat VMS fall into two categories, In-Band and Out-of-Band management.

In-Band Management

In-Band modems are those which have a Vipersat or *d*SCPC feature activated. These IP-based modems are capable of automatic *d*SCPC through internal detection mechanisms. The VMS manages and controls these modems “in-band”, through the same IP interface that user data is carried. The IP capability of In-Band managed modems allows for a wide variety of *d*SCPC switching methods.

Out-of-Band Management

Out-of-band managed modems are typically used for point-to-point SCPC circuits that require connections using non-IP G.703, ASI, HSSI, V.35, high-speed Gigabit Ethernet, etc. interfaces. The VMS has the ability to monitor and control these modems through their 10/100/1000Base-T M&C interfaces. The management interface is separate from the primary user baseband interface; therefore, IP connectivity to the management interface is typically provided “out-of-band” using a separate IP-based connection. These modems allow for manual and scheduled *d*SCPC switching only.



Dynamic Single Channel per Carrier (dSCPC)

Traditional Single Channel per Carrier satellite communication links do not change. As link budgets and network throughput requirements are based on the worst case scenario, these links are often underutilized.

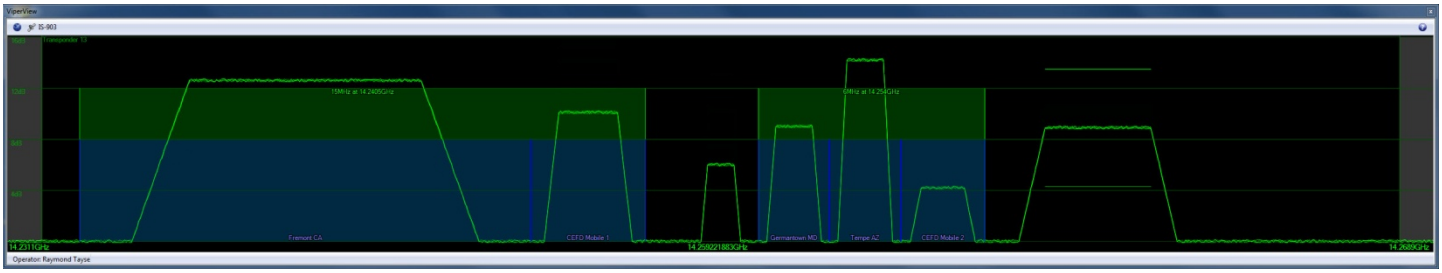
With increasing satellite bandwidth costs combined with increasing throughput requirements, you are looking for the most efficient utilization of your operating budget. Dynamic Single Channel per Carrier provides increased efficiency in bandwidth utilization, carrier management, as well as personnel required to manage the network.

Altering a link typically requires substantial resources on both sides of the link. An analysis must be done to determine what new data rate the modem will require to be optimized for the network traffic load. A new link budget must be performed, including power calculations. A new frequency plan must be created, often requiring changes to multiple sites to accommodate the change. Finally, personnel must be located at both sides of every link involved simultaneously in order to reduce outage time. Leveraging *d*SCPC enables automation of the above.

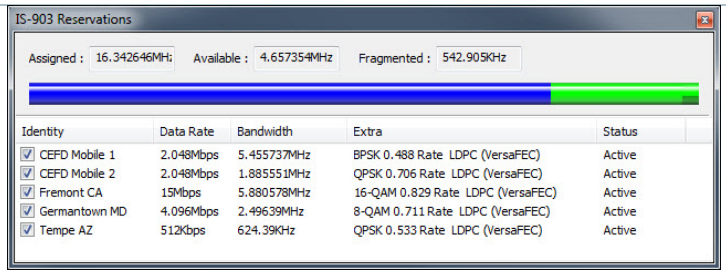
When a node in the satellite network detects a change in the amount of throughput required via several automatic detection algorithms, it will automatically request that change from the VMS. The VMS will look at all satellite resource allocations and automatically determine a new frequency plan, power level, data rate, FEC, and modulation schemes for all modulators and demodulators involved in the change. All associated devices will simultaneously be sent these parameters over the air without human intervention. These calculations are done in fractions of a second with the entire process taking less than one second of total data loss in most cases.

dSCPC yields true bandwidth-on-demand, providing low-latency, low-jitter dedicated SCPC connections when needed for real-time applications, such as Voice over IP (VoIP), video conference, broadcasts and large applications (file or image transfers).

At any time, the operator has full manual override ability, and can turn on/off the auto-detection mechanisms.



Guaranteed Bandwidth



Premium services offered by satellite service providers are far more attractive if Service Level Agreements (SLA) can be arranged through guaranteed bandwidth. A common business model is to offer quality of service in the form of a Committed Information Rate (CIR). Customers are willing to pay a premium for service where their access and experience will meet or exceed expectations. Low-latency and low-jitter connections are the hallmark of SCPC links. However, the drawback has always been the bandwidth wasted when the links are lightly loaded or offline and the inability to offer Peak Information Rates (PIR) that exceed the guarantee on a best effort basis. This has been a feature of TDMA solutions, but they do not provide the quality or efficiencies of SCPC circuits.

Our solution is the latest release of the Vipersat Management System. VMS has long been the industry standard for dynamic assignment of SCPC links. Now, incorporating a guaranteed bandwidth algorithm, it provides you with a flexible solution for offering the highest quality communications links which can be dynamically sized.

Service providers can now provide a service that guarantees bandwidth on a site basis, and can be reduced to a Minimum Information Rate (MIR) if the site is lightly loaded. If the site is offline, it consumes no bandwidth and enables the provisioning of the bandwidth for other sites. However, as soon as there is a need for bandwidth, VMS will resize other carriers (with as little network disruption as possible) to ensure the site gets its guaranteed bandwidth. In addition, you can provide your users with priority within the dynamic allocation of bandwidth. On a site by site basis, you can be assured that your most important links get the required bandwidth when needed.

In brief, there are three levels of service:

- Minimum Information Rate – A service level always available, ensuring the ability to enter a clear channel SCPC circuit or have a timeslot in STDMA.
- Committed Information Rate – Bandwidth that is guaranteed to be available instantaneously based on the demand or contention.
- Peak Information Rate – Bandwidth that can be used by any site on best effort availability, and categorized through multi-level prioritization.

SatCom On-The-Move (SOTM)

Our satellite on-the-move solution encompasses an integrated location server, Roaming Oceanic Satellite Server (ROSS), working in conjunction with the VMS and associated remote modems to ensure seamless global connectivity for oceanic vessels. ROSS enables remote modems to interface with stabilized, auto-tracking antenna, maintaining connectivity as vessels move through footprints of different satellites, change footprints on the same satellite, or switch teleports. ROSS stores the operational and configuration information on-board remote terminals. The satellite roaming functionality provides considerable added value, including:

- Link budget mapping – contains a series of images representing individual satellite footprints and calculates link budgets on the fly
- New transmission control mapping – identifies transmit or don't transmit regions; disables transmission based on location
- World vector shoreline database rendering – provides database of world vector shorelines with better resolution than the Federal Communication Commission (FCC) and Earth Station on Vessels (ESV) requirements

Our network solutions facilitate cost-effective, efficient and flexible satellite communications connectivity for maritime and government/military applications. In comparison to other satellite roaming options, our solution provides higher service availability. By pushing the network intelligence to the ship, a remote can make its own beam switching decisions when connectivity to the hub is interrupted, thereby avoiding an extended inoperative state. Our superior link performance and unique technologies can enable your organization to realize significant operating expense savings and solve key communications challenges.

Virtual Network Operator (VNO)

The VNO gives a satellite network administrator the ability to provide partitioned network management services using a single VMS. VNO allows administrators the ability to selectively expose resources in their primary network to external resellers, customers, operators, and/or partners. The VNO also provides the end user with the equivalent of their own dedicated VMS in their own virtual hub; allowing management of authorized aspects of their satellite network. Operators and administrators can perform configuration, monitor, and control functions relevant to their equipment and bandwidth allocation. This functionality is integrated in the VMS server as a web-based client/server architecture.

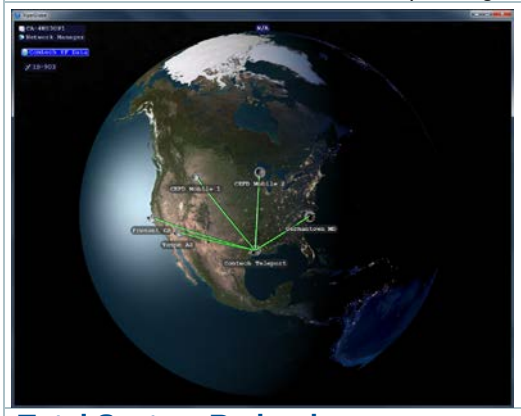
The Basic User Authorization feature provides a simple security mechanism that is integrated into the VNO service and, therefore, easy to deploy. If a more sophisticated security mechanism is needed to meet the network operator's requirements, this feature can be disabled and the network operator may elect to implement their own proprietary security mechanism. Since the VMS VNO interface is based on the common SOAP web services protocol, creating additional applications that provide custom security functions is facilitated by the wide variety of SOAP software development tools available.

VNO delivers significant benefits for satellite service providers, including:

- Lowers the barrier to entry for small networks leveraging larger established service providers
- Provides additional revenue generating value-added services via leveraging centralized network design expertise and first and second level help desk support
- Potential to reduce operating expenses for the primary satellite provider since the VNO user assumes a greater role in managing their own assigned resources
- Supports basic user authentication where access and operation privileges are granted to specific (virtual) networks
- Enables custom application development via software development kit

ArrangeLink

ArrangeLink is used to schedule network resources in support of a variety of critical applications including distance learning, video conferencing, news and sporting event video streaming, and scheduled broadcasting. Circuit assignment schedules can be created and executed based on circuit type, start/end date/time, transmission data rate, transmitter node, and receiver node. These schedules and their details can be viewed using user-defined filter sets. The ArrangeLink event log provides a generated report for network analysis with totals for successful, failed, and pending schedules.



ViperGlobe

ViperGlobe is an optional global network view application that is installed on VMS Client machines. The ViperGlobe option greatly enhances management capabilities by providing a geographical global representation of the Vipersat satellite network. ViperGlobe displays the networks that are created under the Network Manager and provides a visual global positioning of the network sites and the carrier links that exist between them. Network alarm status is also visually indicated in the globe view.

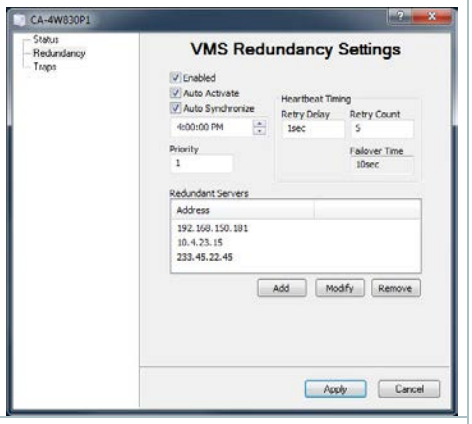
The operator can now anchor sites to true geographic locations. In a satellite on-the-move network, mobile sites are positioned based on GPS information received from the antenna control unit (ACU).

Total System Redundancy

We offer fully automated redundant hardware and software for both hub and remote locations. Our solutions can be placed online without personnel intervention, preserving the link and maintaining transmission of your mission-critical data.

- VMS redundancy provides automatic backup (N:1) with one primary and virtually unlimited geographically dispersed redundant servers.
- Hub outbound modem redundancy requires the hub redundancy feature and an Ethernet-controlled power strip; offers an N:M configuration where multiple outbound modems can be backed up by any number of spare modems.

Remote modem redundancy – requires hardware i.e. CRS-311, CRS-170A, CRS-180; offers a 1:1 configuration where a single modem is backed up by an online redundant modem.



Multi-Transponder Operation

Finding contiguous bandwidth can be a challenge when bandwidth requirements increase, often month or years after the initial purchase. VMS allows for any number of noncontiguous bandwidth pools to be allocated for *d*SCPC purposes. This provides you with the freedom to purchase less expensive, noncontiguous bandwidth to support growing network needs.

Satellite Cross Strapping/Banding Support

Due to various technical and financial factors, it is often required to use cross strapped, or cross banded satellite resources. Cross strapped transponders are often used in spot beam configurations where the satellite bandwidth provider has created a situation where a node is unable to see its own transmission on the receive side of the satellite link. This is often done for performance gains in what would otherwise be the edge of the satellite footprint locations.

Cross banded transponders use the same principle, but will have one side of the transmission Ku-Band and the other side C-Band. This type of satellite topology is often found over areas where the hub facility is in a superior rain fade area compared to the remote terminal location.

VMS provides the capability for applications involving satellite cross banding (cross strapping). This feature allows for greater flexibility when acquiring satellite bandwidth.

Active Distribution List

Distribution Lists provide the ability to define multiple receive locations in which the operator intends to include in a pre-defined transmission type such as multicast video distribution. The VMS is a transmission carrier management server; this means the transmission device is the device capable of asking for resource changes. However, often in the case of outages, a receiver needs to inform the VMS it is back online and needs to be recovered in any ongoing mesh connection with which it may be associated.

Active Distribution Lists actively monitor all dynamic mesh connections for outages at either side of the link. Upon detecting a failure, the VMS will place the failed demodulator in recovery mode, attempting to recover the circuit every 60 seconds.

On-Demand Mesh Connection

Until now, flexible and dynamic switching systems such as DAMA or multiple transmission link switches were bandwidth and equipment resource intensive. This was due to the constraints of traditional private serial modem interfaces. Switching multiple transmission links via satellite meant reducing flexibility for the benefit of lower latency circuit switches. On-demand mesh connection technology offers mesh connectivity based on switching at the application level. On-demand mesh connection provides significant and dynamic connectivity between remotes without the high costs associated with multiple carriers and/or 1-to-1 multi-receiver links.

Advanced Carrier Resizing

Traditional shared platforms such as TDM/TDMA networks provide a single type modulation/FEC scheme for their infrastructure. VMS in conjunction with our highly efficient modems provide flexibility in setting modulation and FEC rates when establishing SCPC carriers. This will allow you to leverage bandwidth on-demand and higher order modulation/FEC combinations to further optimize satellite links. For example, a remote can be switched out of its home state of QPSK 3/4 and into 8PSK or 16-QAM 7/8 automatically based on pre-defined policies.

IP-Based Network Control

All management operations and controls are accomplished using standard IP communications protocols. VMS uses a proprietary interface to communicate with our IP-enabled modems that dramatically lowers monitor and control overhead compared to traditional SNMP interfaces. The benefit is less bandwidth required and faster response to control and status messages.

Antenna Visibility Mapping

Antenna Visibility is a powerful tool to control the spectrum used by the VMS switching engine. It allows the operator on a site by site basis to block portions of the satellite or transponder bandwidth from being used by the RF manager, even if a defined bandwidth pool exists within the blocked portion.

There are many environments in which transmission jamming occurs. Whether it is a jamming carrier on the satellite or local interference with a C-Band link, the ability to react in a timely matter is imperative. As the VMS is an automated satellite bandwidth manager, Antenna Visibility Mapping allows you to define the affected satellite space segment to prevent any potential failures.

Point-to-Point Switching

A point-to-multipoint architecture does not always create the most efficient use of your satellite bandwidth. Situations like SOTM often introduce variable link budgets for every node in the network. In this case you would have to size your TDM outbound to the worst potential node, which can waste satellite resources. Point-to-point switching allows for *d*SCPC functionality in both directions, constantly adjusting carriers creating the most optimal usage of the satellite bandwidth.

Over-The-Air Upgrades

Every Vipersat-enabled modem is upgradeable over-the-air. The upgrades are done via a proprietary protocol that allows for efficient usage of bandwidth, eliminating the need for an IP accelerator. Multiple storage locations for firmware are on each modem, which allows installation of all firmware upgrades on each unit before committing the new firmware. This creates an environment where minimal downtime is required for network upgrades; the time it takes a device to reboot.

Dynamic Power Control (DPC)

Dynamic Power Control, though not a direct VMS feature, provides a mechanism whereby Vipersat satellite links have their transmit power levels adjusted to optimize the receive signal quality (as measured by the demodulator Eb/N0). This optimization process acts to either increase or decrease transmitted signal levels in order to:

- Achieve a minimum level of received Eb/N0 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

DPC can be selectively enabled and disabled on a link-by-link basis for both point-to-point and point-to-multipoint links. 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. Only the transmit site that matches the frequency and network ID number contained in the IP message will act on the message.

Multiple Switching Functions

VMS supports the below switching functions, many of which are generated within various in-band modems.

Manual Switching

- **Operator Switch Request** – Provides the ability to manually switch remote capacity as session-based services.
- **Diagnostic Switching** – Allows automatic switching to be disabled and carrier recovery mechanisms during test or antenna commissioning periods.

Automatic Switching

- **ToS Switching** – Each remote modem monitors all packets and recognizes pre-defined DiffServ values to request additional capacity per IP destination. Each of the 63 defined ToS values can have up to 128 destinations per entry with total overall of 128.
- **Load Switching** – Modems monitor WAN transmission buffer capacity fills, reporting changing conditions to central management system to either increase or decrease satellite bandwidth usage.
- **QoS Switching** – Each remote modem monitors eight levels of packet queues, which are pre-defined rules (i.e., protocol, source/destination IP, and source/destination port) and requests to be switched to pre-defined rates.
- **Vipersat External Switching Protocol (VESP) Switching** – Can be implemented in applications to provide full control of each modem's switch rate and duration.
- **Near Hitless Switching** – All In-Band modems have been optimized to account for the flight time of the packets over the air (approximately 250 ms, on average) before moving the receiving demodulator. This provides for less overall packets disruption during a switch.
- **Advanced Switching** – Remote modulators can be configured to change modulation and FEC combinations based on data rate usage.

Complete Network Solution

The combined network-based solution of Vipersat Network Products and our bandwidth-efficient modems offer unique features that minimize operating expenses and maximize transponder utilization. It is flexible, scalable and able to adjust to changing and expanding networks. The solution is deployed worldwide supporting a variety of applications.

We offer the widest range of bandwidth efficient modems available in the satellite industry. When using our satellite modems configured with the IP Module, VMS offers complete IP-based network control. And, a network powered with VMS also provides the switch up control of our non-IP modems that are used in high speed and/or secure transmission environments, such as military/government or native broadcast format applications.

Compatibility with Comtech EF Data Products

Product	Maximum Data Rate	In-Band	Out-of-Band	Mesh	dSCPC Switching Methods							
					Scheduled	Manual	ToS	Load	QoS	VESP	Hitless	Advanced
CDM-570 & CDM-570L	9.98 Mbps	•	•	•	•	•	•	•	•	•	•	•
CDD-562L	9.98 Mbps	•	•	•	•	•	•	•	•	•	•	•
CDD-564L & CDD-564	9.98 Mbps	•	•	•	•	•	•	•	•	•	•	•
CDM-800	160 Mbps		•									•
CDM-840	15.35 Mbps	•	•	•	•	•	•	•	•	•	•	•
CDD-880	15.35 Mbps	•	•	•	•	•	•	•	•	•	•	•
CDM-600 & CDM-600L	20 Mbps		•		•	•				•		•
CDM-625	25 Mbps		•		•	•				•		•
SLM-5650A	155 Mbps	•	•	•	•	•	•	•		•		•
CDM-750	169 Mbps		•		•	•				•		•

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