



Cable Modem Termination System 1500 (CMTS 1500)

A CableLabs® Qualified™ DOCSIS™ 1.1 scalable, interoperable headend solution that enables Broadband Service Providers to provide reliable, high-speed services to their customers. The CMTS 1500 is a key component in offering a carrier grade solution for advanced IP applications over DOCSIS and PacketCable™-compliant NIU devices.

5 minutes to full functionality.

Optimizes resources through simplified installation & management:

- Installs to full operational capacity in as little as 5 minutes after power-up
- Fully manageable by Cornerstone CPS 2000
- Remote control of CMTS using SNMP and CLI commands

30 seconds away from generating additional revenue.

Enables operators to maximize revenues by providing high-speed services to their customers:

- Enables operators to provide guaranteed data rates and implement tiered data services
- Supports DOCSIS™ 1.1-based Quality of Service standards enabling operators to provide advanced services such as IP telephony

So reliable you won't lose sleep at night.

Enables operators to reduce maintenance costs through increased network availability and performance:

- Employs Intelligent Channel Seek™ technology
- 28.9 year mean-time-between-failure rate and less than 20 minute mean-time-to-repair
- Provides redundant upstream support using 8th upstream receiver card as spare
- Reduces cost and network complexity via Ethernet path redundancy with automated switchover

The only way you would be more secure is if you weren't connected.

Ensures cable plant security with enhanced security features:

- Offers security features that comply with the base DOCSIS Baseline Privacy Plus Specification for cable plant security and private end-to-end communications
- Implements Layer 3 filtering and forwarding functionalities

Single investment for a lifetime of use.

Protects existing investments and prepares operators for tomorrow:

- Ability to upgrade current equipment to DOCSIS 1.1 functionality
- DOCSIS 1.1 qualified to support tiered data services and IP telephony
- Compliant with EuroDOCSIS specification without any hardware changes

***Build your network to suit subscribers...
...don't force subscribers to fit your network!***

Introducing the CMTS 1500

The Cornerstone CMTS 1500 is a scalable, interoperable headend solution that enables Broadband Service Providers to provide reliable, high-speed services to their customers. The Cornerstone CMTS 1500, a CableLabs[®] Qualified[™] (DOCSIS 1.0 & 1.1) and EuroDOCSIS Qualified headend, provides high-speed data services for any operator. The CMTS 1500 builds upon the CMTS 1000 capabilities. It contains the complete set of DOCSIS 1.0 and EuroDOCSIS features and adds support for DOCSIS 1.1 features to allow operators to provide advanced IP applications, including IP telephony and high speed data services.



The Cornerstone CMTS 1500 is a DOCSIS 1.0 and 1.1 qualified, scalable, interoperable, Layer 2/3 headend. It provides efficient message forwarding, with extensive advanced IP features such as Layer 3 filtering and multicast support and offers up to eight channels upstream and one channel downstream for flexibility. The CMTS 1500 has been qualified by CableLabs to meet the Data Over Cable Service Interface Specification (DOCSIS) standards that define standards for networking equipment that will be attached to the cable plant (i.e. the cable modem and cable modem termination system).

Featuring a high performance reduced instruction set computer (RISC)-based architecture, the CMTS 1500 delivers the data forwarding and filtering capabilities required by the most demanding applications. The CMTS 1500 also features dual 10/100 Mbps Ethernet interfaces and supports a 6 or 8 MHz 64 or 256 Quadrature Amplitude Modulation (QAM) cable TV (CATV) downstream channel and a variable-rate Quadrature Phase Shift Keying (QPSK) or 16 QAM upstream channel. These features enable a cable operator to provide users with a flexible, high-performance networking solution.

The CMTS 1500 is fully compliant with the DOCSIS Baseline Privacy Specifications to ensure cable plant security and private end-to-end communications. It also provides comprehensive filtering capabilities based on packet type, address, port or protocol, allowing cable operators to configure their security measures to fit their exact requirements.

The Cornerstone CMTS has always offered leading ingress avoidance technology. The CMTS 1500 expands on that experience by featuring Intelligent Channel Seek[™]. Intelligent Channel Seek, for ingress avoidance, allows the CMTS to intelligently and dynamically change modulation, FEC level, frequency and/or channel width information without operator intervention. This enables operators to customize their operations based on their particular cable plant characteristics and avoids problems caused by channels with high signal-to-noise characteristics.

The CMTS 1500 is Simple Network Management Protocol (SNMP) manageable by any SNMP management station. It can also be provisioned with its IP address and operational parameters over the network via standards-based provisioning platforms.

The Cornerstone product line scales to support thousands to millions of modems and enables cable operators to deploy products that flexibly support a variety of customer applications, from residential to small office/home office (SOHO) to large businesses.

DOCSIS 1.1 Qualified

The Cornerstone CMTS 1500 is DOCSIS 1.1 qualified and meets the standards that include radio frequency (RF) interfaces, data interfaces, security, and operations support system interface specifications. It is also compliant with the Physical Protocol (PHY) Layer and MAC Layer characteristics as defined by DOCSIS. This strict adherence to standards enables cable operators to implement multi-vendor networks cost-effectively and safely.

The CMTS 1500 also enables operators to provide differentiated services to extend their markets and create additional revenue opportunities. IP telephony and advanced data applications for both residential and business class services with guaranteed downstream bandwidth are examples of such services. IP telephony includes both primary and secondary line telephony with guaranteed latency and committed bit rate services.

EuroDOCSIS Certified

The CMTS 1500 offers support for the European Data Over Cable Service Interface Specification (EuroDOCSIS) requirements and will operate on a typical European cable infrastructure. The CMTS 1500 is EuroDOCSIS 1.0 Certified and has been designed with 1.1 requirements in mind. Deployment of EuroDOCSIS based products will enable operators to transition to DOCSIS 1.1, PacketCable and OpenCable features and functionality with lower cost and fewer equipment changeovers.

In order to meet the EuroDOCSIS requirements, the CMTS 1500 supports downstream channels widths of 8 MHz, an upstream split of 5 to 65 MHz and a 100-860 MHz downstream split. The change from DOCSIS to EuroDOCSIS is possible through a single step implemented through CPS 2000, SNMP sets or the Command Line Interface (CLI). The CMTS 1500 also supports ITU-T J.83 Annex A for Forward Error Correction (FEC).

High-Performance, Flexible Architecture

The CMTS 1500 provides operators with a flexible software architecture based on a high-performance RISC-based engine with integrated application-specific integrated circuits (ASICs). It supports up to eight channels upstream and one channel downstream to allow operators to match capital requirements with subscriber demands.

The CMTS 1500 provides dual 10/100 Mbps Ethernet network interfaces, a 6 or 8 MHz 64 or 256 QAM CATV downstream channel, and a variable-rate QPSK or 16 QAM upstream channel. The CMTS 1500 upstream and downstream settings are independent of each other. For example, a customer can operate in 5 to 65 MHz on the upstream and choose to use either 6- or 8MHz channel width on the downstream. This gives operators yet another mechanism to customize CMTS 1500 operations to their specific cable plant characteristics.

Redundant Upstream Receiver Support

Each CMTS 1500 supports eight upstream channel receivers, providing a 7:1 sparing configuration. The eighth receiver can be configured to act as a spare for any of the other seven receivers. If one receiver fails, the CMTS will automatically switch-over the eighth receiver into the path of the failed receiver in less than one second, protecting the operator from all single HFC interface faults and ensuring that subscribers remain happily unaware should an outage occur (not all eight ports need to be populated to activate this feature – only the 8th port and two others). Note: In the event the eighth receiver replaces a failed upstream receiver, Intelligent Channel Seek will be unavailable.

“Intelligent Channel Seek”

The CMTS 1500 employs a unique and highly intelligent ingress avoidance technology called “Intelligent Channel Seek”. The operator can utilize the 8th upstream receiver card to perform spectrum analysis. With ingress avoidance and spectrum analysis enabled, the spectrum analyzer continuously scans the frequency bands that have been designated as available for ingress avoidance actions. The CMTS prevents blind frequency jumping by collecting information about the “health” of a frequency prior to jumping to it to avoid noise.

The CMTS 1500 also allows the operator to provision ingress avoidance profiles. Each profile contains modulation, FEC level, frequency, channel width information. When a specified threshold is reached on a particular frequency is reached (either packet error rate or modem de-registration rate), the CMTS will automatically take actions pre-provisioned by the operator, such as changing profiles or frequency. This enables operators to customize their operations based on their particular cable plant characteristics and avoid problems caused by frequencies experiencing high signal-to-noise conditions, maximizing reliability and uptime.

The spectrum analyzer is available for troubleshooting activities. An operator can use the spectrum analyzer to scan any frequency that is of interest to identify potential problem areas before they affect service. It collects and formats the data and makes it readily available to the operator via MIB tables. (Note: since the spectrum analyzer resides in the 8th upstream port, if this port is used to replace another failed upstream, the spectrum analysis function will not be available.)

Redundant IP Interfaces

The CMTS 1500 provides another level of redundancy by offering two 10/100BaseT IP interfaces with path failure detection and automated switchover. The automated switchover is triggered to act on a link failure in milliseconds and a path failure in less than 5 seconds. This provides a significant decrease in cost and network complexity as compared to using two uplinks. Subscribers will also appreciate not having to refresh their browser screens often due to data interruptions occurring in the path or link.

CMTS Loss of Communications Alarms

The CMTS 1500 will generate alarms in the event of “loss of communications” (LOC) with NIU devices. The operator can provision the list of alarm-enabled NIUs via SNMP or the CLI. Once an alarm is raised, it remains in effect until the operator clears the alarm or a major alarm is raised (if ten or more LOC alarms occur on the same upstream frequency).

Cable Services Security with Baseline Privacy Plus

The CMTS 1500 offers a complete set of security features that comply with the base DOCSIS Baseline Privacy Plus specification. It provides efficient message forwarding, with extensive advanced IP features such as Layer 3 filtering and multicast support and delivers features that increase cable plant security and enable true end-to-end secure communications. The CMTS 1500 is a full spanning tree bridging device that forwards only to known destination addresses. Information on the cable channel is isolated from the 10/100 Ethernet channel of the CMTS 1500 unless destined for a device on that port. This forwarding method prevents unauthorized access to information and content, assuring subscribers and operators security and privacy in their communications.

The CMTS 1500 also prevents unauthorized and inadvertent access to services. Cable plant security is enabled via single Data Encryption Standard (DES) 56-bit encryption and key management. Each CMTS 1500 has an RSA public/private key pair used to exchange DES keys with a cable modem device.

Advanced IP Features

Layer 3 Filtering

The CMTS 1500 provides comprehensive Layer 3 filtering capabilities based on packet type, address, port or protocol. Its flexibility allows operators to apply a filter to a specific interface or to all interfaces on the CMTS 1500. Filters can also be applied to ingress packets, egress packets or both and are applied in a user-specified order. The CMTS 1500 also offers enhanced capabilities for restricting network access and control through Layer 2 filtering through standard logical link control (LLC) filters.

Ten Logical Link Control (LLC) protocol filter entries and 30 IP protocol filter entries are supported by the CMTS 1500. The LLC protocol filter entries can be used to limit the forwarding capability of the Cornerstone CMTS 1500 to a restricted set of Network Layer protocols such as IP, Internet Packet Exchange (IPX), Network Basic Input/Output System (NetBIOS), and AppleTalk. The IP protocol filter entries can be used to restrict upstream or downstream traffic based on source and destination IP addresses, Transport Layer protocols such as Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Internet Control Message Protocol (ICMP), and source and destination TCP/UDP port numbers.

Multicast Support

The CMTS 1500 supports IGMPv2 to manage multicast traffic. Without IGMPv2, multicast traffic is broadcast to all NIU devices. The devices that are members of the multicast would consume the data. With IGMPv2, the CMTS 1500 acts as a proxy. It notes which NIU devices have signed up for multicast membership and forwards the multicast traffic only to those devices. This feature helps reduce broadcast traffic and congestion on the HFC network.

DHCP Relay

By implementing DHCP relay, cable modems and CPE devices, including PCs, can be segregated and managed separately. Cable modems can be managed by a “cable” DHCP server, while other devices could be managed by ISP servers. This feature provides enhanced security and control and also facilitates open access by separating the cable server from the server managing the other devices (i.e. PCs).

The CMTS 1500 offers four modes of DHCP relay:

- Disabled: DHCP discovers are forwarded with the broadcast DAddr unaltered
- Enabled: DHCP discovers are forwarded to specific DHCP server(s) by altering the DAddr
- Enabled with Tagging: DHCP discovers are forwarded to specified DHCP server(s) and the CM MAC address is included in the discover message for CPE correlation

Front Panel Test Port

The CMTS 1500 allows operators to display RF characteristics of any upstream receiver card through the front panel test port. The front panel test port capabilities are configurable through the front panel display, CLI or MIB. This feature can be used in conjunction with ingress avoidance spectrum analysis. If spectrum analysis is enabled and the test port is redirected, the test port will be redirected for only 5 minutes. After 5 minutes, spectrum analysis will continue to run.

Integrated Upconverter

The CMTS 1500 provides an integrated upconverter, which converts the Intermediate Frequency (IF) to the downstream operational frequency. The integrated upconverter delivers the needed functionality to translate from lower to higher frequencies at a lower cost and smaller footprint with integrated management.

Command Line Interface

Operators can remotely control the CMTS 1500 operation using Command Line Interface (CLI) code commands. The CMTS 1500 commands enable the operator to display network conditions using MIB commands presented in a user-friendly format to remotely track problems and troubleshoot CMTS problems, thereby reducing truck rolls and mean-time-to-repair. The CLI is optimized for the Cornerstone CMTS 1500 and requires just 7 commands to perform high level network fault isolation.

SNMP-Based Management

The CMTS 1500 is fully SNMP manageable. It supports Internet Engineering Task Force (IETF) Management Information Bases (MIBs) including: Cable Device, Radio Frequency, Request for Comment (RFC) 1213 (MIB II), RFC 1398 (Ethernet), RFC 1493 (Bridge), RFC 1573 (Interface), and Cornerstone Private MIB Extensions. The CMTS 1500 also enables the operator to perform performance-enhancing software upgrades and modify parameters Trivial File Transfer Protocol (TFTP) operations.

Concatenation & Fragmentation

The CMTS 1500 provides concatenation and fragmentation; bandwidth management tools operators can utilize to increase performance and throughput. Concatenation allows multiple small messages to be put into one message and fragmentation allows large messages to be broken up into smaller ones. Both tools allow operators to make efficient use of their bandwidth.

Telnet Access

The CMTS 1500 provides identical CLI capabilities available via multiple-user Telnet sessions. This allows operators to manage their CMTSs remotely.

Existing Equipment is Upgradeable!

ARRIS provides operators with the ability to upgrade their current equipment (Cornerstone CMTS 1000) to DOCSIS 1.1 functionality via a field replacement. All upgraded equipment carries a 12 month warranty. These upgraded units will fit seamlessly into the operator's network without any additional provisioning needed.

Scalable for CMTS Redundancy

The Modular Redundant Chassis (MRC) is a patented, integrated chassis system for the CMTS 1500. The MRC contains five bays for the simple installation of five Cornerstone CMTS 1500 modules and allows for the configuration of CMTS protection groups, with one CMTS module serving as a spare for the four active CMTS modules in each chassis. The capacity is scalable with up to 4 MRC chassis per 7' bay and meets the demands of increasing deployments of data while adding IP telephony services in a compact solution that fits easily into existing headends. The MRC can be deployed in a variety of configurations based on operators' requirements and with its easy installation and configuration; changes to the system are accomplished in record time.

CMTS 1100

The CMTS 1000 can be upgraded to meet the requirements of DOCSIS 1.1. This updated unit is called a CMTS 1100 and it provides the same functionality as the CMTS 1500. For complete details on how the upgrade procedure is handled, please contact your ARRIS sales representative.

CMTS Release Feature Comparison

	CMTS 1000 3.4	CMTS 1000 3.5	CMTS 1500 4.0	CMTS 1500 4.0.5	CMTS 1500 4.2
Performance/Capacity Features					
Baseline DOCSIS 1.0 / EuroDOCSIS Features	X	X	X	X	X
DOCSIS 1.1 Qualification					X
SNMPv3			X	X	X
Multiple Session (Service Flows, Upstream & Downstream)			X	X	X
Classification to Assign Packets to Service Flow			X	X	X
Classifiers for Packet Prioritization			X	X	X
QoS, Sophisticated Bandwidth Allocation			X	X	X
QoS, Latency Control and Jitter Control			X	X	X
Best Effort and UGS Scheduling			X	X	X
Scheduling Service UGS/AD, rtPS, nrtPS					X
Dynamic Change of Service Flows					X
Dynamic Service Addition and Deletion					X
Payload Header Suppression					X
Concatenation	X	X	X	X	X
Fragmentation			X	X	X
Baseline BPI+			X	X	X
Multicasting BPI+					X
2.5 msec Request/Grant/Minislot Cycle	X	X	X	X	X
Max Rate Limiting	X	X	X	X	X
Committed Information Rate on Upstream			X	X	X
Committed Information Rate on Downstream					X
8 Upstreams x 1 Downstream	X	X	X	X	X
TOS Byte Marking Verification for DiffServ			X	X	X
IP Addressing (16K Forwarding Database Entries)	X	X	X	X	X
Traffic Shaping			X	X	X
Hardware Based Accelerator for QoS			X	X	X
Weighted Fair Queuing					X
Hardware Support for 4096 Priority Queues			X	X	X
2,000 Cable Modems Registrations		X	X	X	X
Provisionable Cable Modem Aging Timer		X			X
Carrier Class/Robustness Features					
Redundant Upstream Receiver			X	X	X
Intelligent Channel Seek – 2 Triggers, 4 Variables			X	X	X
Redundant 100 Base T PHY			X	X	X
Funnel Mode Security	X	X			X
1+1 IP Links			X	X	X
Loss of Comms Alarms			X	X	X
Traffic Statistics					X

CMTS Release Feature Comparison (Cont.)

	CMTS 1000 3.4	CMTS 1000 3.5	CMTS 1500 4.0	CMTS 1500 4.0.5	CMTS 1500 4.2
Advanced IP Features					
Multicast Support – IGMPv2	X	X	X	X	X
Layer 3 Filtering	X	X	X	X	X
Packet Filtering Capabilities	X	X	X	X	X
Logical Link Control (LLC) Filters	X	X	X	X	X
DHCP Relay	X	X	X	X	X
Mode B Forwarding	X	X			X
ARP Proxy	X	X			X
Spoofing Prevention	X	X			X
DHCP Relay – CM Only	X	X			X

Ordering Codes

<p>#254317: CMTS 1500 DOCSIS & EuroDOCSIS Headend Termination System, AC #254318: CMTS 1500 DOCSIS & EuroDOCSIS Headend Termination System, DC #708619K: CMTS 1000 to CMTS 1100 Upgrade Kit, AC, Includes Software v4.2 #254319: CMTS 1000 upgrade to CMTS 1100, AC #254498: CMTS 1000 upgrade to CMTS 1100, DC #708177: CMTS 1500 Software v4.0.5 #708177: CMTS 1500 Software v4.2 – DOCSIS 1.1 Qualified #708178: CMTS 1500 Software v4.2 upgrade – DOCSIS 1.1 Qualified</p>

CMTS 1500 Specifications

Standards

Based on DOCSIS 1.0	Yes - Qualified
Based on DOCSIS 1.1	Yes - Qualified
Based on EuroDOCSIS	Yes

Physical Characteristics

Packaging Type	19 inch Rack-Mount or Standalone
Dimensions	(HxWxD) 2.62 x 17.35 x 16.56 in. (6.65 x 44.0 x 42.0 cm)
Weight	18 lb
Operating Temperature	0° to 40°C
Storage Temperature	-40° to +66°C
Humidity	10% to 90% noncondensing

Power

Input voltage	88 to 264 VAC 47 – 63 Hz, or -48 VDC
Input power	100 W

Interfaces

To Backbone	Redundant, self-sensing 10BaseT/100BaseT Ethernet
To Cable Plant	9 F-connectors: 1 downstream, 8 upstream
Monitoring	2 RF connections on front of CMTS 1500

RF Electrical Specifications

Downstream:

RF Channel Spacing	6 MHz (North American DOCSIS) or 8 MHz (EuroDOCSIS)
Frequency Range	88 to 860 MHz (band edges)
Modulation	64 QAM or 256 QAM
Forward Error Correction	Reed Solomon
Output Signal Range	50 to 61 dBmV
Return Loss	14 dB
Transmit Output Power Accuracy	1 dB
Output Impedance	75 ohms

Upstream:

RF Channel Spacing	Variable, 200 kHz to 3.2 MHz
Frequency Range	5 to 42 MHz (band edges – North America DOCSIS) or 5 to 65 MHz (band edges – EuroDOCSIS)
Modulation	QPSK or 16 QAM
Forward Error Correction	Concatenation of Reed Solomon Block Code and Trellis Code
Receive Input Level	-4 to 26 dBmV (operator configurable)

For additional information or to arrange for a demonstration of Cornerstone products, please call 800-342-3763 or your ARRIS sales representative. You can also get more information at our web site: www.arrisi.com.

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