CMTS

User Manual

Version 3.0.3 Build 3000

Important Notice

Technical Support:

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Safety Instructions

 **Caution! Risk of electric shock!** 

 **Do not open the cover under any circumstances.** 

- Dangerous voltages inside.
- No user serviceable parts inside.
- Refer to qualified service personnel.

Explanation of Graphical Symbols:

 This symbol is intended to alert the user to the presence of non-insulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of lethal electric shock to persons.

 This symbol is intended to alert the user to the presence of important operating, maintaining and servicing instructions in the literature accompanying the appliance. Failing to comply with this instruction may result in a hazard.

- Power sources - Connect this unit only to power sources specified in the Operating Instructions, and as marked on the unit back.
- This unit must be disconnected from power supply prior to servicing.
- When disconnecting the AC power cord, pull it out by the AC power plug. Do not pull the cord itself.
- Never handle the AC power plug or cable with wet hands, as this could result in fire or an electrical shock.
- Power cords should be routed to avoid being severely bent, pinched, or walked upon. Pay particular attention to the cord from the unit to the power socket.
- To help prevent electric shock and fire hazard avoid connecting the unit through an extension cord.
- Do not remove or attach cables to the unit during a thunderstorm.

- The CMTS must be installed near a wall power outlet.
- Do not place heavy objects on top of the box.
- Do not try to bend the box.

Environmental Conditions for the CMTS

- This unit must be installed in an office environment in a temperature-controlled location where the temperature is between 0º and 40º Celsius, far away from rain, water sources, heat sources, inflammable liquids, inflammable vapors, dust and flammable materials.
- If installed in a rack, air ventilation should be provided for the CMTS. The surrounding temperature inside the rack around the CMTS should not be over 40º Celsius.
- Do not impair the airflow around the CMTS especially near the air vents located at the sides of the unit as shown in the figure below. This may result in a hazard.
- The CMTS was designed to work at heights between –200 meters below sea level and to 2000 meters above sea level.
- If the CMTS is brought in from a cold place to a hotter place, condensation may occur. Wait one hour before connecting to power.

About This Manual

This manual describes how to prepare your site and install the Blonder Tongue CMTS system. It is intended for qualified engineers familiar with RF and IP (Internet Protocol) networks.

This guide contains the following chapters:

- **Chapter 1 – Introduction —** introduces the Blonder Tongue CMTS system, describes its components and provides technical specifications.
- **Chapter 2 - Site Preparation —** describes the hardware, software, and environmental requirements necessary for the installation at the headend and end-user sites.
- **Chapter 3 - Installing the CMTS —** describes the procedure for installing the Blonder Tongue CMTS system and testing an end-user site from your location.
- **Chapter 4 – Upgrade Instructions —** describes the procedure to upgrade the Blonder Tongue CMTS system.
- **Chapter 5 – Advanced Operations —** describes advanced commands and configuration of the Blonder Tongue CMTS system.
- **Chapter 6 – Command Reference —** describes the commands utilized by the Blonder Tongue CMTS system.
- **Appendix A – Cable Diagrams —** provides cable pin-outs and diagrams.
- **Appendix B – LED Descriptions —** provides LED information.
- **Appendix C – Inserting the Upstream Card —** provides instructions for Upstream Module(s) insertion.
- **Appendix D – DOCSIS Notes —** provides DOCSIS RF requirements.
- **Appendix E – Troubleshooting —** provides troubleshooting flowchart.
- **Appendix F – Technical Specifications —** provides Technical information on the CMTS.

Table of Contents

CHAPTER 1

Introduction

This chapter introduces the Blonder Tongue CMTS, describes the system components, presents a system diagram and lists its technical specifications.

About this chapter

- **What is the Blonder Tongue CMTS —** describes the components and features of the Blonder Tongue CMTS.
- **CMTS Main Features and Benefits —** describes the Blonder Tongue CMTS' main features and benefits.

What is the Blonder Tongue CMTS?

Blonder Tongue's CMTS is a DOCSIS/EuroDOCSIS based CMTS (Cable Modem Termination System) head-end unit. It is an ideal solution for cable operators of any size seeking a standard, scaleable and cost-effective solution for delivering broadband services over cable networks.

Conceptually, the CMTS converts Ethernet digital data to RF signals and vice versa, allowing two-way transmission of digital data over coaxial cable or Hybrid Fiber Coax (HFC) networks. It requires a two-way capable network to function.

In the downstream direction, the CMTS receives data from the WAN (Wide Area Network). This data typically consists of Internet traffic, video, VoIP (Voice over IP), etc. This traffic is modulated and broadcast to its final destination over the cable television network. Other frames received by the CMTS are IP packets designated to the CMTS it self. Those will typically be SNMP management queries, Ping messages to test CMTS network connectivity or Telnet sessions used to control and monitor the CMTS. In the upstream direction, the CMTS aggregates upstream traffic from the cable television network and forwards that traffic either to a local LAN (usually at the head-end) or to the Wide Area Network (usually the Internet). The CMTS connects to the Wide Area Network (WAN) or head-end Ethernet backbone using a 10/100BaseT Ethernet port. Traffic forwarding is handled in layer-2 as a transparent bridge.

Blonder Tongue designed the CMTS to be installed in a cable operator's headend facility or distribution hub and to function as a Cable Modem Termination System (CMTS) to any DOCSIS/EuroDOCSIS Customer Premises Equipment (CPE) that is CableLabs/tComLabs ™ certified. The scalable hardware design of the Blonder Tongue CMTS using DOCSIS and Euro-DOCSIS 1.1 standards offers a single downstream channel using 64 or 256QAM enabling speeds up to 55.61 Mbps and upstream channel supporting QPSK and 16QAM enabling bit rates up to 10.24 Mbps. The architecture supports up to 8 upstream channels with single channel expansion cards that can be factory or field installed.

The Blonder Tongue CMTS is controlled and managed by its Network Management System (NMS). The NMS implements a client-server and SNMP based architecture. With a powerful server accessing a database and a Web based client, it provides a complete easy-to-use solution for CMTS configuration, service provisioning, subscriber authentication and authorization, performance analysis, and billing interface. Any standard Provisioning System that includes DHCP, TFTP, TOD servers and a SNMP manager can also control the CMTS.

Blonder Tongue CMTS Features and Benefits

DOCSIS/Euro-DOCSIS — The Blonder Tongue CMTS is based on the widely used DOCSIS and Euro-DOCSIS 1.1 standards making interoperability easy.

Upstream Load Balancing — Subscriber satisfaction during peak usage times is maintained through CMTS' control of upstream traffic with dynamic load balancing algorithms and support for upstream frequency reuse.

Bridge Operation — The CMTS connects to the Wide Area Network (WAN) or headend Ethernet backbone using a 10/100BaseT Ethernet port. Traffic forwarding is handled in layer-2 as a transparent bridge.

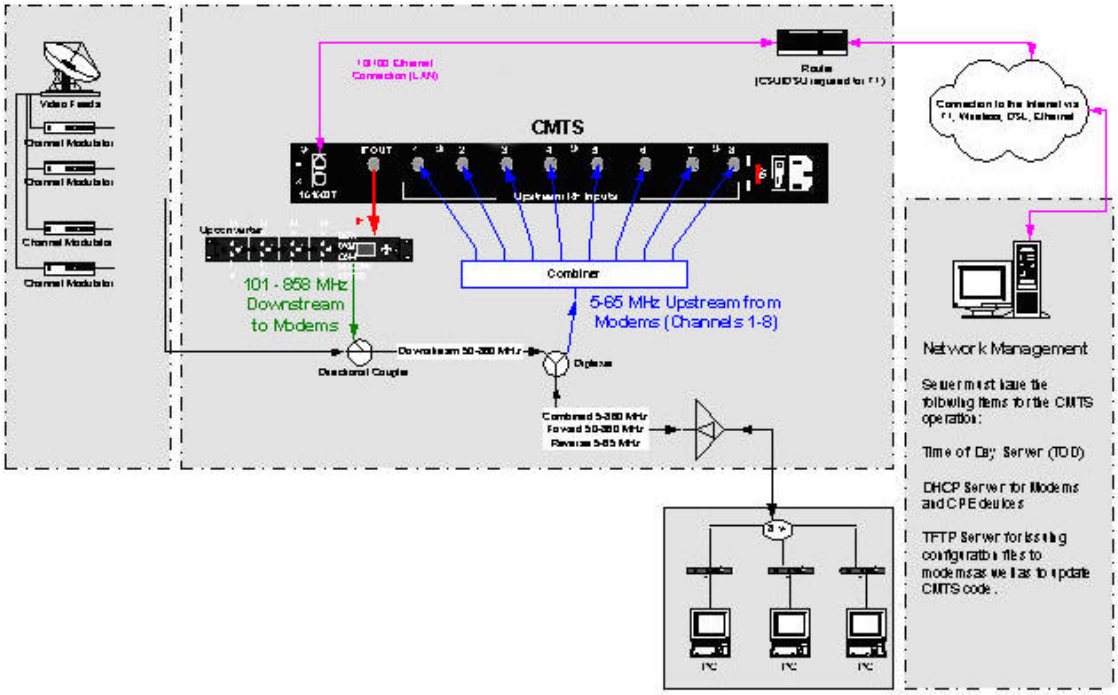
Remote Upgrades — The Blonder Tongue CMTS remote download feature supports TFTP and FTP server delivery of new software. The Blonder Tongue CMTS configuration file editor supports remote file download and uploads which dramatically reduces the complexity and time required for installation.

Up to 8 Upstream Channels — The scalable hardware design architecture supports up to 8 upstream channels with single channel expansion cards that can be factory or field installed.

Security Tools — Security on the Internet affects all subscribers and operators. The CMTS provides tools such as BPI, DHCP and ARP monitoring to prevent unauthorized access and use of the internet.

Complete Management — Blonder Tongue CMTS is controlled and managed by Linux based NMS (EMS) - an advanced, features rich, easy-to-use SNMP based operation and control system.

Reference Architecture



The Management Server can be located at the head end or remotely. The Blonder Tongue CMTS requires DHCP, TOD (Time of Day) and TFTP servers before cable modems will operate. The recommendation is to have at least 1.8GHz Pentium 4 with at least 1GB of memory; if everything is on one computer.

CHAPTER 2

Site Preparation

This chapter discusses the prerequisites and computer parameters to prepare before installing the Blonder Tongue CMTS, as described in Chapter 3. Make sure that all these requirements are fulfilled before installing the CMTS.

About this chapter:

- Overview — provides an overview of site preparation requirements.
- System Components — describes the Blonder Tongue CMTS hardware and software requirements.
- Basic Configuration — describes the requirements of a typical configuration.
- Preparing the RF Network — describes the prerequisites needed to prepare the headend site.
- Preparing the Ethernet Network — describes the prerequisites needed to prepare the Ethernet Network.

Overview

To install the Blonder Tongue CMTS system, you must ensure that the environment in which you plan to place the system contains all the necessary hardware and software components. You will also need to prepare:

- A management computer.
- DHCP, TOD & TFTP Servers.
- The RF Network.
- An end-user test site in your local environment.
- An Internet Router and Internet connections.

System Components

The Blonder Tongue CMTS comes with various components that may differ depending on the items you ordered.

Open your package and check that you received the following:

- Blonder Tongue CMTS
- CMTS DB9 serial cable (female to male)
- Straight-through Ethernet Cable
- CD ROM containing the latest software versions and documentation

Basic Configuration

The basic configuration of the CMTS system consists of:

- Blonder Tongue CMTS
- Blonder Tongue QAM Upconverter
- Management system software (optional)
- EuroDOCSIS/DOCSIS modems connected through the RF network
- DHCP (Dynamic Host Configuration Protocol), TOD (Time of Day) and TFTP (Trivial File Transfer Protocol) Servers

The CMTS contains the following:

- Boot Image: The initial code that is activated when the CMTS is turned on.
- Application Image: This is the CMTS software that the boot loads from the flash.
- Configuration file: The CMTS configuration information is kept in this file (besides the minimal required information for the boot step - this information is in NVRAM). All files are being kept on the flash. The CMTS configuration file is in a binary format.

The Blonder Tongue CMTS is configured from the computer using different protocols that enable it to communicate with the CMTS:

- Serial Monitor (HyperTerminal/Terminal)
- Telnet - Up to eight concurrent connections
- EMS – Blonder Tongue Management System
- TFTP – Trivial File Transfer Protocol

Each protocol can be used under different circumstances. For example, the monitor (HyperTerminal) is used when configuring the CMTS for the first time, whereas the EMS can be used for subsequent configurations.

Preparing the RF Network

The headend site refers to the environment in which the Blonder Tongue CMTS is to be installed. At the headend site you must do the following:

- Prepare the Headend Site.
- Prepare the Ethernet Network Parameters.

Preparing the Headend Site

Prepare your RF Network to be compatible with the Blonder Tongue CMTS after you have prepared the management computer.

In this section, it is assumed that your cable network is capable of two-way communication, supporting both Upstream (return) and Downstream (forward) communication.

To prepare the RF Network, you must determine the following factors:

- **Channel Frequencies and Attenuation Level**
- **Upconverter Support**
- **Spectrum Analyzer Support**
- **Fixed Value Attenuators**
- **BNC Test Port Compatibility**

Channel Frequencies and Attenuation Level

The Blonder Tongue CMTS requires certain minimum channel frequencies. The frequencies are determined by DOCSIS and EuroDOCSIS specifications. Check the following:

- The downstream frequency (center frequency 101 -858 MHz) to be used (Country standard dependent). It is strongly recommended to use frequencies higher than 130 MHz.
- The upstream frequencies to be used (between 5MHz to 42MHz for DOCSIS) (5MHz to 65MHz for Euro-DOCSIS). It is recommended to use frequencies 20MHz and higher.
- The attenuation of the entire cable network, both upstream and downstream channels.

Upconverter Support

An Upconverter is used to transform signals from the IF range to the RF range. If you are using the Upconverter supplied by Blonder Tongue, you can skip this section.

If you are using your own IF/RF Upconverter, ensure that it supports:

- DOCSIS and EuroDOCSIS compliant
- US (NTSC) Dependent on country
- International (PAL) Dependent on country
- 64QAM & 256QAM Modulated Data Transmitting

Spectrum Analyzer Support

A Spectrum Analyzer is a device commonly used for measuring the RF network for installation and adjustment of the RF sequence. Ensure that your Spectrum Analyzer supports frequencies between 5-900MHz, average and maximum measurements, spectrum and maximum hold.

In addition, please make that you have the following:

- An engineer familiar with the operation of the Spectrum Analyzer.
- Ensure that there is an F connector for the IF input.

Fixed Value Attenuators

When installing the Blonder Tongue CMTS, you must have fixed value attenuators on your site that can reduce the signal level as required.

BNC Test Port

The CMTS has a BNC test port available on the front of the Chassis. The port is -20dB of the output IF signal.

Preparing the Ethernet Network

Ethernet network parameters refer to the network parameters located at the headend site. To set up this aspect of the site, you must obtain the following information:

- Internet Information, below
- Ethernet Network Checklist

Internet Information

An Internet Router is needed for (layer 3) routing of IP packets between the Blonder Tongue CMTS, Cable Modems and CPE on one side and the Internet on the other. The router is also required in case the Provisioning server is located on a different subnet than the CMTS. The Internet router can also be used as a DHCP server in some cases. Ensure that you have the following information about your Internet Router or Network Services:

- The IP address and Subnet Mask of your Router.
- Fixed or static IP addresses.
- DNS IP Address. Short for ***D****omain* ***N****ame* ***S****ystem* (or ***S****ervice* or ***S****erver*), an Internet service that translates *domain names* into IP addresses. Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address.
- DHCP server. Short for ***D****ynamic* ***H****ost* ***C****onfiguration* ***P****rotocol*, a protocol for assigning dynamic IP addresses to devices on a network. With dynamic addressing, a device can have a different IP address every time it connects to the network. In some systems, the device's IP address can even change while it is still connected. DHCP also supports a mix of static and dynamic IP addresses.
- TOD (Time of Day) server that provides the Time of Day to the EURODOCSIS/DOCSIS Cable modems. The TOD server listens on a UDP or TCP specific port (37). On EURODOCSIS/DOCSIS modems and CMTS the UDP protocol is used. (Blonder Tongue's

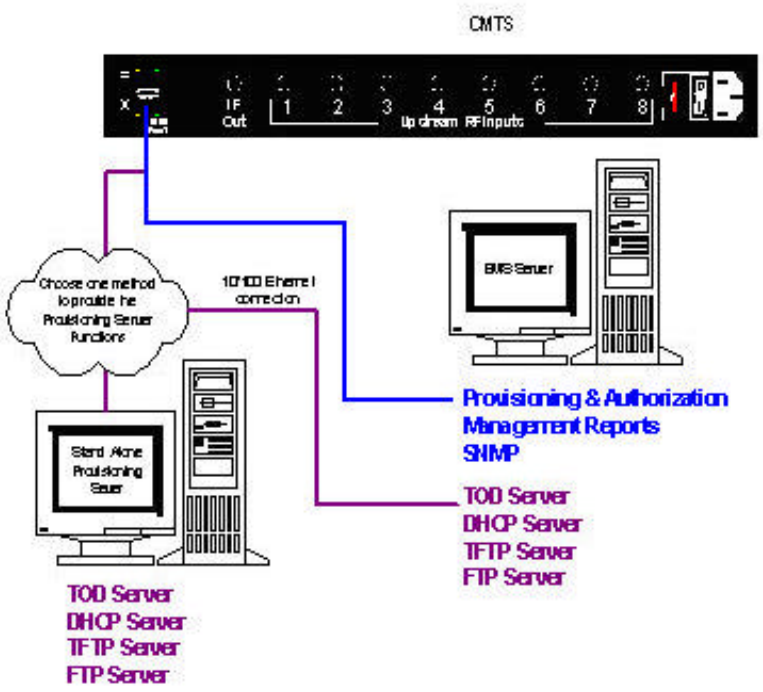
TOD server supports both TCP and UDP). An entity wishes to know the correct time sends an empty message to this port at the server IP. The server treats empty messages as TOD requests. It replies to the sender IP with a TOD response consisting of a 4 byte response. These 4 bytes contain the number of seconds passed since 1990. 4 bytes can contain about 130 years in seconds. This means it will be good until year 2036. (4294967295 seconds /60 = 71582788.25 minutes / 60 = 1193046.47 hours = 49710.26 days /365 = 136.19).

The TOD server usually uses the system time on the machine it is running. (It can also take the time from another server).

The TOD client (CM or CMTS) calculates this number and presents the current time and date. It can apply a GMT offset to display the correct time. The CMTS has these parameters so you can configure it. The CM is supposed to take this parameter (GMT offset) from the DHCP response. If you configure the DHCP server to provide option 2 (GMT offset) then the modems are supposed to use it before displaying their time. The CMTS will contact the TOD server every hour.

- TFTP (Trivial File Transfer Protocol) server that enables the configuration files for the modem to be downloaded to the modem.
- Modem & PC IP Pool Ranges. If the IP addresses are public addresses you must request a pool range from your Internet Service Provider based on the number of customers you are serving.
- NAT support. Short for ***N****etwork* ***A****ddress* ***T****ranslation*, an Internet standard that enables a local-area network (LAN) to use one set of IP addresses for internal traffic and a second set of addresses for external traffic. A *NAT box* located where the LAN meets the Internet makes all necessary IP address translations. NAT serves two main purposes:
  - ? Security - Provides a type of firewall by hiding internal IP addresses
  - ? Minimizes Cost - a LAN that uses private IP Addresses needs only few public ones
- Internet connection type and line speed.

- The following drawing illustrates the components required:



EMS Server Functions

The EMS Server is a web based utility that allows remote management of the BT CMTS unit. Using the NMS software an operator can control the following functions:

1. Provisioning and Authorization of subscribers from the database.
2. SNMP functions such as resetting DOCSIS modems, display of modem logs, and display of modems Transmit and Receive levels.
3. Management Reports depicting downstream usage, upstream usage, and system Signal to Noise Ratio.

Stand Alone Provisioning Server

The BT CMTS is a layer 2 device that requires the following services to operate.

These services can be run from the EMS Server or a Remote/Local server that has IP connectivity to the CMTS.

1. Time of Day (TOD) – Standalone cable headend systems can obtain the correct time of day from larger systems as part of a low maintenance, background function.
2. DHCP Server – DOCSIS Cable Modems as well as customer premise equipment (CPE) devices require IP addresses to function. These DHCP scopes can be configured to hand out either public or private IP addresses. The DHCP server works in conjunction with the TFTP server. The DHCP server can be configured to act as a provisioning server by allowing certain MAC (Media Access Control) addresses.
3. TFTP & FTP Server – (Trivial File Transfer Protocol & File Transfer Protocol) are Internet software utilities for transferring files.

DOCSIS cable modems require a configuration file that dictates the operational parameters to the modem. The TFTP server is responsible for issuing the configuration file to the modem after the modem has received an IP address from the DHCP server. The modem configuration file then either allows or denies the CPE device the ability to acquire an IP address from the DHCP server. The modem configuration file specifies the modem downstream and upstream minimum and maximum speeds. This is how Quality of Service (QoS) is achieved in most scenarios.

Note: It is recommended that the DHCP server will be located at the headend.

Ethernet Network Checklist

The following must be on site and operative before installing and operating the Blonder Tongue CMTS:

- Internet router and Internet connectivity.
- An available 10/100BaseT Ethernet switch.
- Computers (management/server) with working LAN boards.

To make sure you have a working Ethernet connection, install the management computer to the Switch and Router and make sure that the management computer has access to the Internet. Check the following factors to determine if you have an operational Ethernet connection:

- The router is operational.
- You have a connection to the Internet.
- The Switch is operational.

CHAPTER 3

Installing the Blonder Tongue CMTS

This chapter takes you through the installation process for a lab and a typical live configuration. If you have any questions about your particular installation, refer to *Appendix A, Contacting Blonder Tongue*.

About this chapter

- **Part 1: Setting Up the CMTS and Upconverter Connection —** describes how to set up the CMTS and Upconverter and connect it to a lab setup and then connect it to an RF network.
- **Part 2: Setting Up an End-User Site —** describes how to set up an end-user test site at your location.

Part 1: Setting Up the CMTS and Upconverter Connection

In the first part of the installation process you set up the Blonder Tongue CMTS and Upconverter in the following stages:

- **Connecting the CMTS and the Upconverter in a Lab Environment**
- **Connecting the CMTS to a Live Cable Plant**

Connecting the CMTS and the Upconverter in a Lab Environment

When connecting the Blonder Tongue CMTS and Upconverter in a lab environment, the following steps are performed:

Step 1. Attaching the CMTS and Upconverter to a Rack

Step 2. Connecting the RF Cable to the CMTS

For this step you will need:

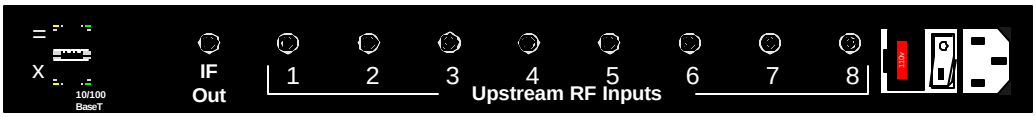
- One Blonder Tongue CMTS
- One Upconverter
- Four RF cables (Different Lengths)
- Attenuators (at least 40 db)

Step 1. Attaching the CMTS and Upconverter to a Rack

Attach the CMTS and Upconverter to a standard 19" rack or place them on your desktop. Make sure to leave a distance of at least 4.5 cm between them.

Step 2. Connecting the Cables to the CMTS

The following describes the connectors that appear on the rear panel of the Blonder Tongue CMTS.



Rear Panel View (explained right to left below)

- **Power**: 110 - 220 Volt at 50 - 60 Hz. The voltage connector is auto-sensing, which allows you to input any voltage without configuring the power connector.
- **Upstream RF Input**: F-Connector. Depending on the configuration ordered you can have up to eight (8) RF upstream data inputs to the CMTS.
- **IF Out**: F-Connector (on the left). The downstream data output from the CMTS modulated on an IF frequency.
- **LAN 10/100BaseT**: 100Base-T connector or 10Base-T connector for Ethernet connection. The (=) connector denotes a straight-through cable should be used. The (x) denotes it can be connected directly to a switch or cross-over cable should be used.

To connect the RF cables to the CMTS:

1. Connect the RF cables to the CMTS using the following diagram and instructions as a guide:

2. Connect one RF cable to the IF Out connector on the CMTS.

3. Attach approximately 20 dB of attenuators to the other end of the cable.

Note: The attenuation process ensures that the Upconverter receives the appropriate signal. The Upconverter utilized must comply with DOCSIS/EuroDOCSIS requirements. Refer to the Upconverter Specification for the desired input level. The CMTS outputs the following signal: PAL: 36.125 MHz at ~40dBmV NTSC: 44.00 MHz at ~40 dBmV

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4. Connect the side of the RF cable with the attenuators to the IF IN connector on the back of the Upconverter.

5. Connect the second RF cable to the Upconverter RF OUT connector. Connect (2) 20 dB attenuators to the other side of the cable, and leave it hanging. This will be used for the downstream channel.

Note: The attenuation process ensures that the modem receives the appropriate signal. The modem should receive a signal of ~ 0 dBmV (+ or – 8 dB).

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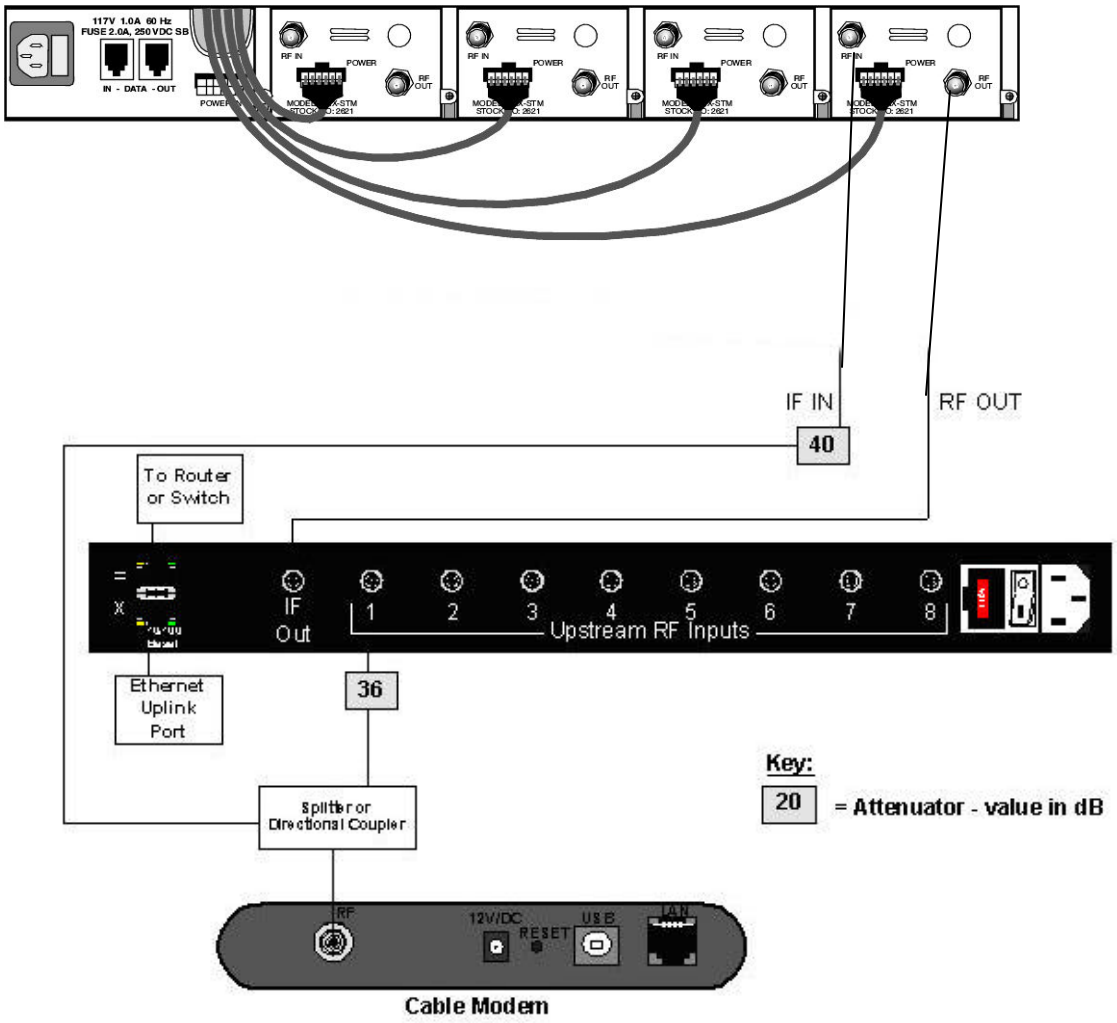
6. Connect a third RF cable to the Blonder Tongue CMTS Upstream IF Input connector. Connect 36 dB of attenuation to the other side of the cable, and leave it hanging. This will be used for the upstream channel.

Note: The CMTS default RX power level is 0. The nominal_rx_level parameter can be changed through EMS or CLI (Command Line Interface) located in the root/cable/upstream directory. The attenuation process ensures that the CMTS receives the appropriate signal.

Blonder Tongue CMTS & Digital Upconverter Rear Panel Connection Diagram



Note: All attenuation values given here are approximate. Check signal strengths using a spectrum analyzer to determine necessary attenuation. Check the Upconverter specifications to ensure you input the proper signal into the Upconverter from the CMTS.

Note: The Upconverter utilized must comply with DOCSIS and EuroDOCSIS requirements.

Note: We recommend starting with downstream modulation of 64 QAM and upstream modulation of QPSK. Other modulation types require very clean RF signals and a well balanced RF network.

Connecting the CMTS to a Live Cable Plant

After you have successfully tested the CMTS and Upconverter in a lab environment, the next step is to integrate the CMTS into the cable plant. Just as in a lab environment, the signal levels on a live cable plant must be measured to ensure that the Blonder Tongue CMTS and Upconverter are operating at optimum efficiency.

Step 1. Determining cable plant Connection method

Step 2. Calculating downstream attenuation.

Step 3. Calculating upstream attenuation

Step 4. NTSC and PAL Overlapping Channels

Before starting this procedure, ensure the following:

- the CMTS power is turned ON
- the Upconverter power is turned ON
- you have a Spectrum Analyzer

Step 1: Determining Cable Plant Connection Method

Note: There are often several viable methods to connect a CMTS system into a cable plant. Below are several examples. If you should have any questions regarding the methods available to you, please contact Blonder Tongue Support.

The configuration of the Blonder Tongue CMTS into the live cable plant is one of the most important steps for successful and reliable operation. Often, future problems with signal levels on both the downstream and upstream can be avoided by taking careful steps to ensure that the guidelines below are met.

Downstream - refers to the RF signal (101-858 MHz) from the Upconverter to the end user.

Upstream - refers to the RF signal (5-65 MHz) from the end user cable modems to the CMTS.

Most common scenarios:

A. Combining Network
B. HFC/Plants with off-site combining networks and feeds

A. Combining Network

Cable Plants using a combining network are the most common configuration. A series of modulators and Upconverters integrate 6 MHz for NTSC and 8 MHz for PAL RF channels in a signal spectrum that is amplified and distributed throughout a coaxial network. See Fig. A

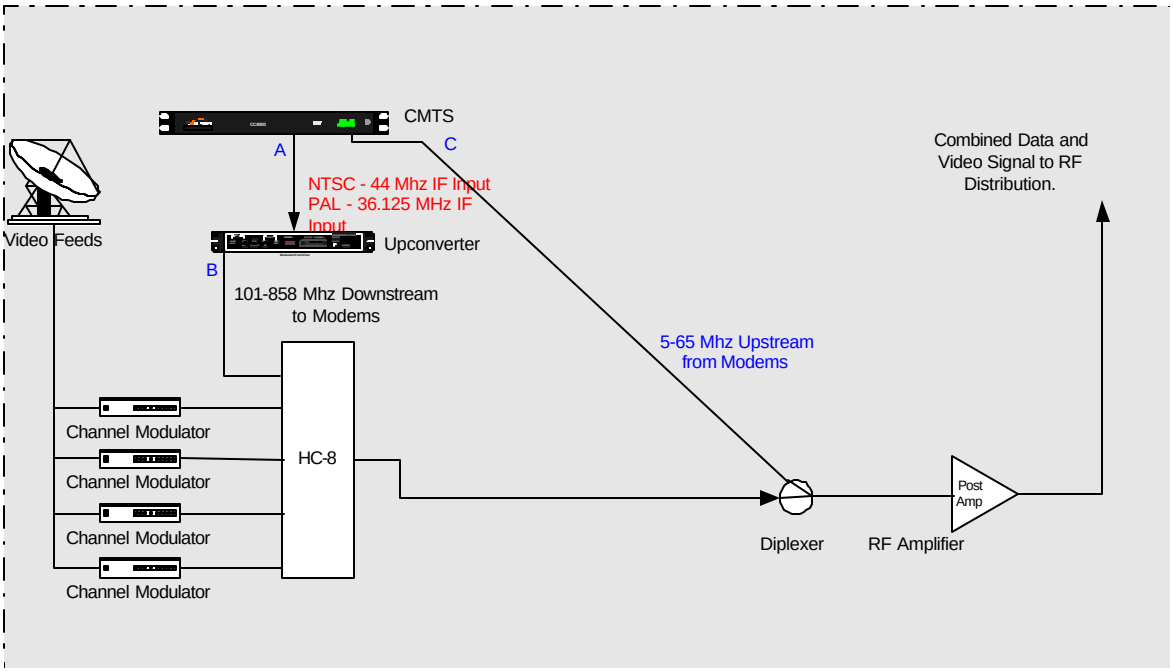


Fig. A

B. HFC / Plants with off-site combining networks and feeds

The Blonder Tongue CMTS does not necessarily have to be located in the same space as the combining network. In cases where the video is fed from an off-site location, the CMTS downstream and upstream signals are inserted at the property amplifier. Please refer to Fig. B

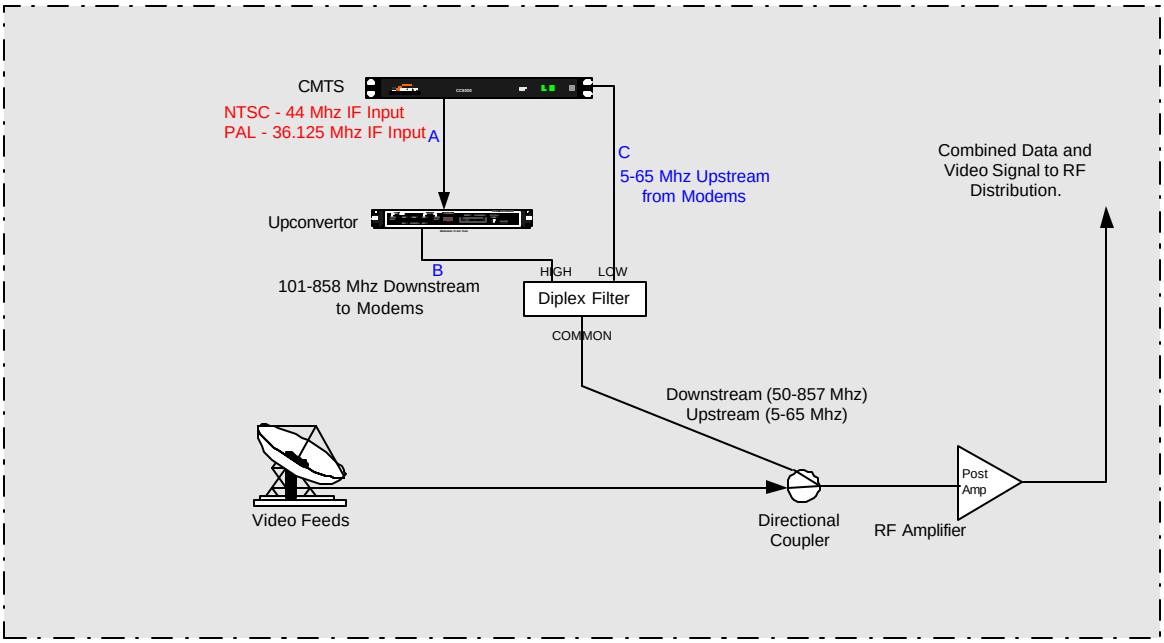


Fig. B

Step 2: Calculating Downstream Attenuation

Refer to Fig. A and B above for the following definitions:

IF OUTPUT (Index A) of the Blonder Tongue CMTS is 44Mhz signal for DOCSIS and 36.125Mhz for EuroDOCSIS that is inserted into the Upconverter for the downstream Data Channel. The RF channel assignment is handled by the Upconverter only. The Blonder Tongue CMTS has an output power of +40dBmV +/- 1 dB. Measure this 44Mhz or 36.125Mhz and attenuate the signal accordingly to ensure the Upconverter is not overdriven. Exceeding the maximum IF INPUT level of the Upconverter can result in low Carrier to Noise ratio and poor Bit Error Rate (BER) performance.

RF OUTPUT (Index B) of the Upconverter is the downstream data signal. This signal is a QAM 64/256 signal and must be inserted into the RF network for distribution to the cable modems. To measure the downstream signal for NTSC systems, add 1.75MHz to the video carrier of the data channel (i.e. if channel 55 is the downstream signal, add 1.75 MHz to the video carrier of 409.25 MHz to get the data frequency of 411 MHz. The signal level should be 6 to 10dB below the video carrier of the adjacent analog video channel. The downstream data channel should reach the end-user cable modem at a 0dBmV +/- 8 dB. If the modem received level (downstream) is too low, the modem will have an intermittent connection. If the modem receive level is too high, the modem may reset or be damaged over time.

Note: In order for the modems to operate, the carrier to noise ratio of the downstream signal received at the modem must be at least 26 dB.

Step 3: Calculating Upstream Attenuation

Refer to Fig. A and B above for the following definition:

CMTS Upstream RF Inputs (Index C) The upstream data from the cable modems on the RF distribution returns to the CMTS in the 5-65 MHz range. Some combiners do not support Return path frequencies. In most cases you can use a directional coupler (DC8) or splitter at the input of the launch amplifier. It is best to use a diplexer at the output of the launch amplifier to pull off the upstream frequencies. If the combining network used does support return path frequencies, ensure that the insertion loss of the combiner is not reducing the upstream signal of the modems to an unusable level. The modems have an output power range of 8-58 dBmV. The modems cannot be used to balance the return portion of the plant as the output power constantly changes. In order to properly balance the RF distribution return amps, use a signal generator with a constant output level.

Balancing Return Path: The most effective method to balance the return path is to apply a constant IF frequency to the end of the line of each trunk and/or leg of the RF distribution via a signal generator. Measure the output of the signal generator before inserting onto the cable plant and use this number as the baseline transmit level. This will typically be between +40 to +50 dBmV. Next connect the signal generator to the end of line and measure the RF output frequency of the generator at the insertion point of the CMTS Upstream RF Inputs. Adjust the active components' return amplification or attenuation to maximize the received signal level at the headend. Repeat these steps on all trunks and legs to adjust the return path received level to within +/- 5dB. Apply attenuators at the insertion point of the CMTS Upstream RF Inputs to ensure that the upstream return path is at 0dBmV at the back of the CMTS. It is better to balance the return modules of the RF distribution plant's active

components to deliver as much signal as possible at the headend without overdriving the amplifiers. The attenuation can then be reduced or increased at the back of the CMTS by changing the pad values.

Note: In order for the modems to operate, the carrier to noise ratio of the upstream signal transmitted from the modem to the CMTS must be at least 21 dB.

Consideration of NTSC and PAL systems may need to be considered and below describes the frequencies that are affected.

Step 4: NTSC and PAL Overlapping Channels

Frequency MHz		NTSC Video		PAL Video	
Video	Center	CH	Preset	CH	Preset
133.25	135	C	16	S-5	20
175.25	177	7	07	E-5	05
217.25	219	J	23	E-11	11
259.25	261	Q	30	S-15	30
319.25	321	DD	40	S-23	38
343.25	345	HH	44	S-26	41
367.25	369	LL	48	S-29	44
415.25	417	TT	56	S-22	37
439.25	441	XX	60	S-38	53
463.25	465	BBB	64	S-41	56
487.25	489	FFF	68	23	59
511.25	513	JJJ	72	26	62
535.25	537	NNN	76	29	65

Configuring the CMTS Using Terminal Commands

The initial configuration of the CMTS using the HyperTerminal is done to connect the CMTS, management computer and router. Subsequent configurations of the CMTS can be done using NMS (optional).

The following steps are required:

Step 1: Connect the CMTS to the Management Computer

Step 2: Define the CMTS IP, Gateway, and TFTP Server Addresses

Step 3: Define the CMTS Boot Variables

Step 4: Save Changes and Reboot the CMTS

Step 5: Setup the DCHP server

Step 1. Connect the CMTS to the Management Computer

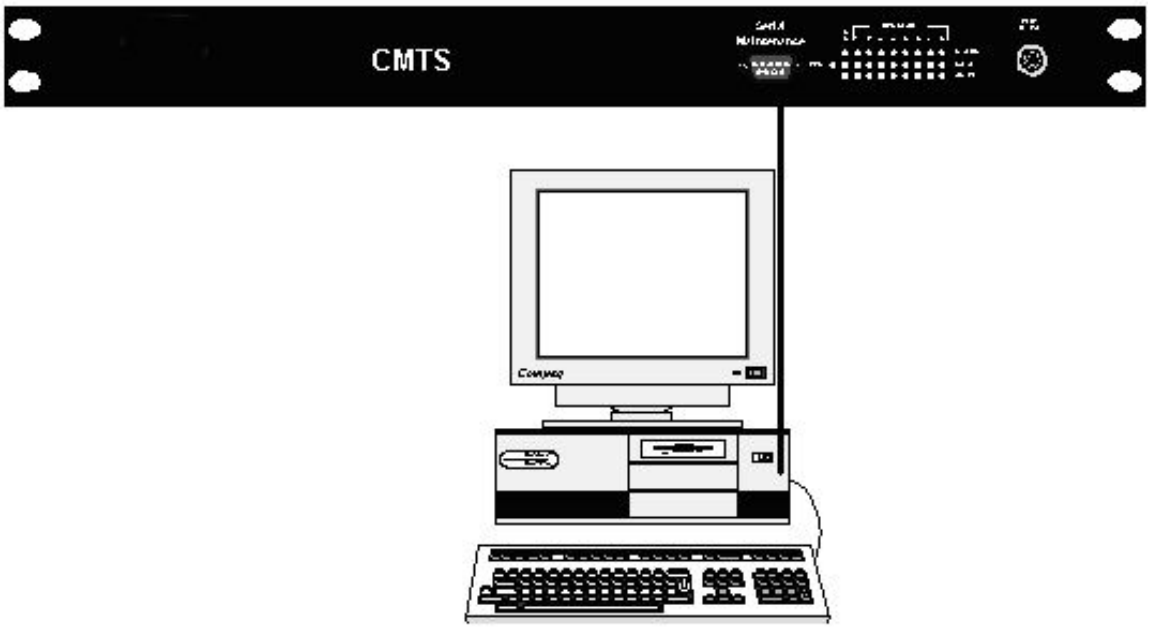
Before you begin, ensure the following:

- Your management computer is on
- The CMTS power is turned OFF
- Your management computer has HyperTerminal or another terminal emulation package installed

1. Connect the Ethernet cable to the CMTS, as follows:

- Connect one end of the Ethernet cable to the PC's Network Ethernet switch.
- Connect the other side of the Ethernet cable to one of the CMTS 10/100BaseT ports.

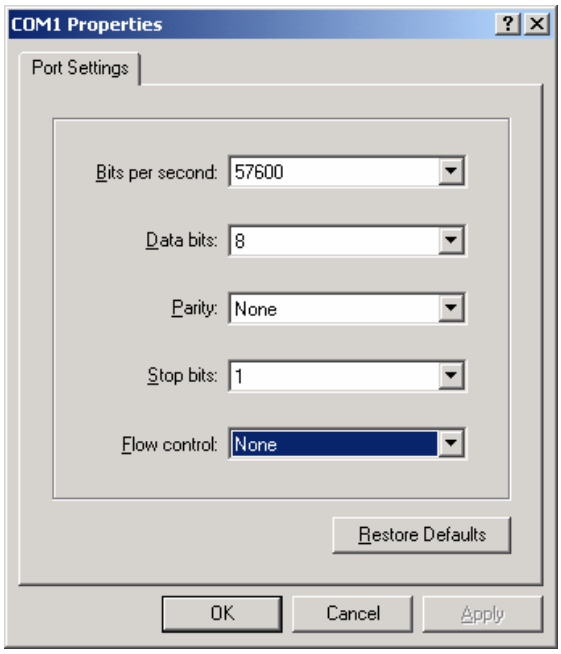
2. Connect the serial cable supplied (Serial Cable is a straight thru cable M/F) to the computer serial port and the serial port on the front of the CMTS. Cable diagram is located in Appendix B.



3. Open the HyperTerminal application 

on your management computer and establish the connection by entering a connection name.

4. The *COM Properties* dialog box is displayed. Enter the parameters as shown below and click **OK**:



You are now ready to connect the Blonder Tongue CMTS to the management computer and router.

Step 2: Define the CMTS IP Address, Netmask and Gateway

1. Turn On the CMTS, Watch the Serial Terminal and wait for a login prompt.
2. Logging into the CMTS, There are two different login names available; *admin* and *user*. The admin login has full read/write capabilities and the user login only has read capabilities.
   e.g. Login: *admin* (Enter).
3. Default password for the Admin login name is *operator*. The default password for the User login is *password*. Refer to Chapter 6 Commands Reference to change the passwords.
   e.g. Password: ******** (Enter).
4. The CMTS will need to be configured with IP addresses defined by the Network Administrator
5. Change to boot directory
   e.g. -->root> cd /admin/boot (Enter).
6. To display the boot parameter in the CMTS
   e.g. -->root/admin/boot>show (Enter).

ip-address	*= 192.168.111.120*
ip-mask	*= 255.255.255.0*
gateway	*= 192.168.111.1*
boot-server	*= 192.168.111.150*
boot-method	*= tftp*
app-pathname	*= 3.0.3.300b3000*
boot-pathname	*= boot-v2.0.0.7*
config-pathname	*= default.evc*

update-app = *0*
update-boot = *0*
update-config = *0*
username = *ftp*
password =*ftp*
gateway-mac =*00-01-aa-bb-cc-01*

7. To set the IP address in the CMTS

Syntax: *set ip-address x.x.x.x*
- where x is the IP address

8. To set the IP Netmask in the CMTS

Syntax: *set ip-mask x.x.x.x*
- where x is the netmask

9. To set the IP Gateway in the CMTS

Syntax: *set gateway x.x.x.x*
- where x is the gateway IP Address

Step 3: Define the CMTS Boot Variables

1. The default CMTS Boot Variables are configured to enable the CMTS to boot up into operational mode. This section will describe the Boot Variables and what they represent.

Boot Image – This is the first application the CMTS runs at boot time.

Application Image – This is the CMTS software that the boot loads from the flash. Contact Blonder Tongue Technical Support for the latest release available.

Configuration File – This file keeps the entire CMTS Configuration, this file is in binary format and cannot be viewed by anything other than the Blonder Tongue CMTS Configuration File editor which is provided on the CDROM which is shipped with the product. After saving the configuration with the file editor the file can be uploaded to the CMTS. The CMTS configuration file will be burned to the flash, and will take affect only after CMTS reboot. It is not required to download a new configuration file. You can modify the existing configuration file. The CMTS has the ability to save your configuration file to a FTP/TFTP server. The utility to upload and download configuration files is located in the -->root/admin/flash directory.

2. To configure the boot parameters you must utilize the -->root/admin/boot directory. The commands are described later in this manual under Directory Commands. You must select the method of download to be either TFTP or FTP and the server to be utilized. You must make sure the pathname is correct for the different images or configuration files. Refer to Chapter 4, Upgrade Instructions for information to load Application Image software.

Step 4: Save Changes and Reboot the CMTS

1. The CMTS will need to be saved and rebooted for the changes to be implemented.

- Save the parameters in CMTS

e.g. -->root/ admin/boot>write (Enter).

writes boot parameters to nvram
write success

The write command is used ONLY in the boot directory and is used to save the boot parameters. Utilizing the save command does work as well but it is recommended to use the write command in the boot directory.

- Reboot the CMTS

e.g. -->root/admin/boot> reboot (Enter).

CMTS will reboot now. Are you sure ? (y/n)

Select y

Step 5: Setup the DHCP server and configuring a relay agent

1. The CMTS supports DHCP relay agents, which enables the CMTS to forward the DHCP traffic from the Cable Modems and CPE (Computer) to the appropriate DHCP server. A DHCP Relay MUST be used in case the DHCP server is located behind the CMTS router (on a different network). A DHCP relay can also be used to support different subnets for CMs and CPEs.

Note: DHCP servers, DHCP relays, IP subnetting and NAT configuration requires a thorough knowledge of the Internet Protocol. Make sure you do not have more than one DHCP server on the same subnet.

2. DHCP server configuration is dependent of the server type. Before configuring your server, please read the server user manual. How pools are defined on your network will depend on how your network is configured, consult your network administrator. DHCP can be utilized by networking devices such as Routers, Windows and Linux servers or 3rd party DHCP server for PCs.

Please be sure you know how to:

- Define IP address pools
- Setup the DHCP options for pool
- Setup Netmask (Required for Modems & CPE)
- 003 Router (Required for Modems & CPE)
- 004 Time Server (Optional)
- 006 DNS Servers (Required for CPE)
- 007 Log Servers (Required for Modems)
- 015 DNS Domain Name (Optional)
- 028 Broadcast Address (Required for Modems)
- 066 Boot Server Host Name (Required for Modems)
- 067 Bootfile Name (Required for Modems)
- Optional: Setting up IP Address reservations
- Optional: Excluding ranges from pools

3. The following displays the DHCP relay configuration on the CMTS to support modems getting DHCP addresses on a private network. Network configurations may require private addresses for the Cable Modems and public addresses for the CPE. From security reasons

it is strongly recommended that the Cable Modems will use private IP addresses and public addresses will be used only for the CPE. This way the CM will not be accessible from the Internet.

relay-status – The status must be activated before DHCP relay will function. Please refer to Chapter 6 for command.

relay-ip - The relay-ip is configured for the CMTS to relay the DHCP request. In this case the relay IP address is set to 172.0.11.4. This address should usually be from the subnet of the pool defined in the DHCP server and MUST not conflict with any other addresses on the 172.0.11.0 subnet. Make sure there is proper routing between the DHCP Server and this address. Please refer to Chapter 6 for command.

relay-gateway – The relay gateway is the address of the router (if the DHCP server is behind the router) or IP address of the DHCP server it self (if the DHCP server is connected to the CMTS Ethernet segment, as illustrated in step 14. Please refer to Chapter 6 for command.

dhcp-server – This is the IP address of the DHCP server. Please refer to Chapter 6 for command.

append-remote-id – When enabled, the CM MAC Address is appended to the original DHCP requests sent by both modems and CPE. A DHCP server can identify the CPE by the addend CM MAC Address to the CPE DHCP requests and to use this information to logically link a CPE to the CM. The DHCP module in the CMTS is using a DHCP relay option number 82. According to the DOCSIS standard the CMTS must append this option to the DHCP traffic forwarded, but if the DHCP server is not using it, then it should be disabled. Note that the CMTS will act in this matter according to this configurable setting regardless of the relay status. Please refer to Chapter 6 for command.

/root/admin/ip-services/dhcp/>show

source-type	*relay-status*	*relay-ip*	*relay-gateway*	*dhcp-server*	*append-remote-id*
cm(1)	*active(1)*	*172.0.11.4*	*172.0.11.1*	*192.168.11.150*	*disable(0)*
cpe(2)	*inactive(0)*	*0.0.0.0*	*0.0.0.0*	*0.0.0.0*	*disable(0)*

Note: Reboot the CMTS after changing the relay configuration for the DHCP relay to work correctly.

4. The following tables lists the options required to work with the Blonder Tongue USB modem and minimal requirements for the CPE (Customer Premise Equipment) with possible values:

Option	Name	Vendor	Possible Value	Class
002	SubNet	Standard	255.255.255.0	None
003	Router (Gateway)	Standard	10.0.6.1	None
006	DNS Servers	Standard	10.0.6.12	None
007	Log Servers	Standard	10.0.6.12	None
028	Broadcast Address	Standard	10.0.6.255	None
066	Boot Server Host Name	Standard	10.0.6.12	None
067	Bootfile Name	Standard	Full_DS.cfg	None

CPE Pool Mandatory

Option	Name	Vendor	Value	Class
002	SubNet	Standard	255.255.255.0	None
003	Router (Gateway)	Standard	10.0.6.254	None
006	DNS Servers	Standard	192.116.202.99	None

Note: You can now run the prov-test command from the CMTS CLI to test your CMTS and provisioning server configuration. Please Refer to Chapter 6 for details on this command.

Part 2: Setting Up an End-User Site

After you have successfully completed setting up the headend site, you are ready to connect a Cable Modem to an end-user computer and set up an end-user test site. This test is usually performed using a dedicated computer at your location.

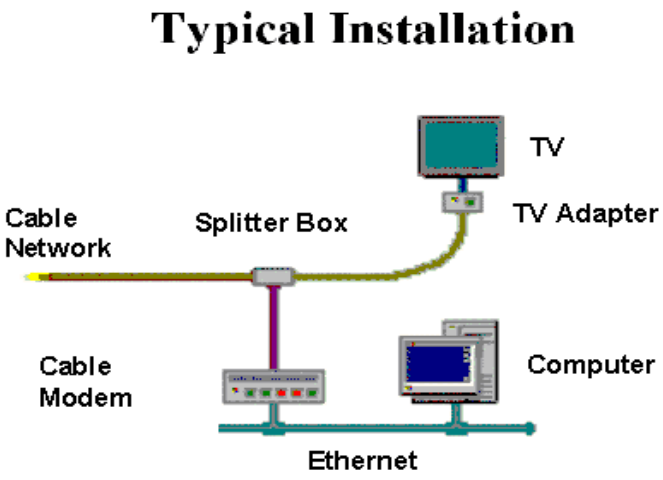
Setting up an end-user site consists of the following stages:

- **Before You Begin**
- **Installing and Configuring the DOCSIS Modem**
- **Test the System**

Make sure that this computer is connected to LAN boards with proper drivers to enable the Ethernet connection.

Before You Begin

Ensure that your end-user site is installed as shown in the diagram on the next page.



Before you begin to test the functionality of the EuroDOCSIS/DOCSIS modem at an end-user site:

Headend Site

1. Ensure the CMTS is powered ON.

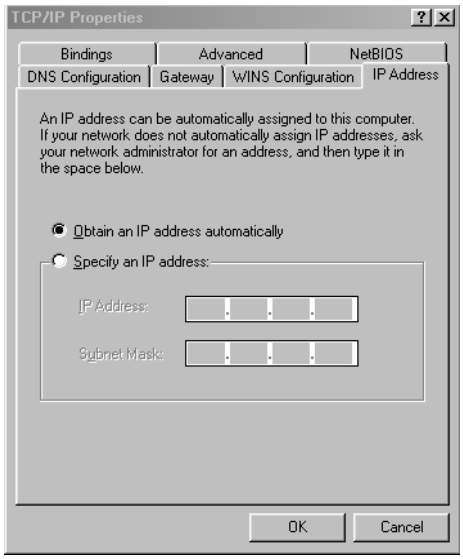
2. Ensure the RF wiring is attached and assembled correctly.

End-User Site

1. Turn the end-user PC on.

2. Connect the EuroDOCSIS/DOCSIS modem to the Ethernet card and RF network, as described in the modem's documentation.

3. Make sure that the Ethernet card is operational and can obtain an automatic IP address. Access the Control Panel>Network>Configuration card. Double click on the appropriate TCP/IP component, and ensure that it is set to Obtain an IP address automatically as shown on the next page:



Installing and Configuring the EuroDOCSIS/DOCSIS Modem

Install and configure the EuroDOCSIS/ DOCSIS modem by following instruction in the modem's documentation. The first time the modem connects to system can take a few minutes. Usually the modem has a LED describing the status of the connection. Be sure that the LED shows the modem is connected.

Test the System

Now that the modem is successfully connected to the system, ping the server to check the connection.

1. You need to be sure your PC has received a valid IP address. A valid IP address will be an address that belongs to the pool defined as the CPE's pool. Some operating systems require a user intervention to get an IP Address. On Microsoft Operating Systems use ipconfig /renew from command line or winipcfg.exe(windows 95/8) to renew which requests an IP address for your PC (Refer to your OS user manual). To ping the server, open a Command Prompt window. Enter the following command: ping <server_ip_address>.

Congratulations, you have just successfully installed your Blonder Tongue CMTS!

CHAPTER 4

Upgrade Instructions

This chapter discusses procedures to upgrade the Blonder Tongue CMTS software. Always refer to the release notes to learn about the possible last minutes changes in this procedure. To obtain the latest software see *Appendix A, Contacting Blonder Tongue*.

About this chapter:

- Prerequisites before performing an upgrade.
- Step by step instructions to upgrade the CMTS software.

Part 1: Prerequisites before Performing an Upgrade

After you have successfully downloaded the software from Blonder Tongue's website you must place the software in the appropriate directory for TFTP or FTP.

Setting up TFTP

If you are utilizing TFTP, make sure the service is running.

To verify if TFTP server is working on your server type the following in a Command Prompt window on your server:

C:\ >tftp -i 192.168.111.150 get v300b3000
Transfer successful: 5947045 bytes in 2 seconds, 2785272 bytes/s

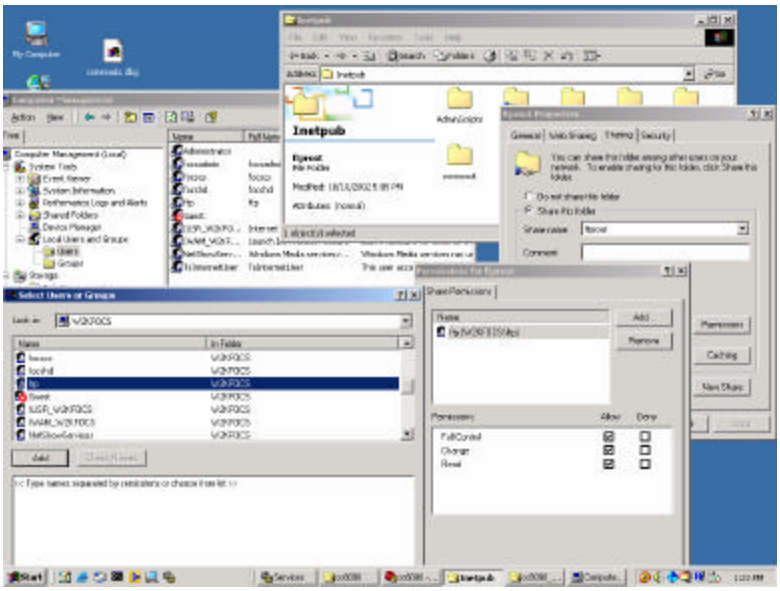
Note: File sizes can be large so allow time for the command to complete.

If the above command did not succeed then you must make sure the TFTP is configured properly on your server. You can check to make sure the service is running or it is not conflicting with another TFTP program. If the above command worked then you are ready to perform the upgrade instructions via TFTP below.

Setting up FTP

1. FTP is usually enabled on most servers however some Network Administrators restrict anonymous logins on FTP servers. Blonder Tongue CMTS software allows you to set up individual user access to enable use of a secured FTP server.

2. If you are utilizing Win2000 as your FTP server you can set up users using Computer Management and then you would define permissions for the directory for the FTP.



3. To verify the FTP is working on your server type the following in a Command Prompt window on your server:

C:\ >ftp 192.168.111.150
Connected to 192.168.111.150

220 w2kNMS Microsoft FTP Service (Version 5.0).

User (192.168.111.150:(none)): ftp

331 Anonymous access allowed, send identity (e-mail name) as password.

Password:

230 Anonymous user logged in.

ftp> bin

200 Type set to I.

ftp> get 3.0.3.300b3057

200 PORT command successful.

150 Opening BINARY mode data connection for 3.0.3.300b3057 (5970545 bytes).

226 Transfer complete.

ftp: 5970545 bytes received in 5.29Seconds 983.93Kbytes/sec.

Step by Step Instructions to Upgrade the CMTS

Now that you have downloaded the file and the TFTP or FTP are configured and working properly you can now set the CMTS to perform the upgrade.

Note: It is recommended that the following steps are accomplished through serial shell only. This is recommended in case the upgrade fails or the CMTS is hung in the boot mode.

- Logging into the CMTS as admin
- Default password for the Admin login name is *operator*
- Change to boot directory

e.g. -->root> cd /admin/boot (Enter).

- Display current settings

e.g. -->root/admin/boot> show (Enter).

ip-address	*= 192.168.111.120*
ip-mask	*= 255.255.255.0*
gateway	*= 192.168.111.1*
boot-server	*= 192.168.111.150*
boot-method	*= tftp*
app-pathname	*= 3.0.3.300b3000*
boot-pathname	*= boot-v2.0.0.7*
config-pathname	*= default.evc*
update-app	*= 0*
update-boot	*= 0*
update-config	*= 0*
username	*= ftp*
password	*=ftp*
gateway-mac	*=00-01-aa-bb-cc-01*

- Set the path in the CMTS

e.g. -->root/admin/boot> set app-pathname 3.0.3.300b3000 (Enter).

- Set the TFTP or FTP server IP (Check if O.K.)

e.g. -->root/admin/boot>set boot-server 192.168.111.1 (Enter).

- Set the Boot Method in the CMTS (FTP or TFTP)

e.g. -->root/admin/boot> set boot-method ftp (Enter).

Note: If you are using FTP you must configure username and password. If you are using TFTP you do not need to modify these parameters.

- Set the FTP username in the CMTS

e.g. -->root/admin/boot> set username ftp (Enter).

- Set the FTP password in the CMTS

e.g. -->root/admin/boot>set password ftp (Enter).

- Enable the application boot parameter in the CMTS

e.g. -->root/admin/boot> set update-app 1 (Enter).

- Verify all setting by displaying the variables in the CMTS

e.g. -->root/admin/boot>show (Enter).

- Save the parameters in CMTS

e.g. -->root/admin boot>write (Enter).

- Reboot the CMTS

e.g. -->root/admin/boot> reboot (Enter) then enter y.

CMTS will reboot now. Are you sure ? (y/n)

Rebooting

Note: The next couple of pages will display the download and rebooting of the CMTS.

ROM Checksum test ...Complete
SRAM memory test ...Complete
SDRAM memory test ...Complete
NVRAM memory test ...Complete

Press any key to stop auto-boot...
0
auto-booting...

Created dos File System
BOOTFS: formatted
Attaching network interface lo0... done.
Attached gm0
Microengine initialized.
Microengine started.
Downloading application...
.....
Verifying file
Writing to flash
=5==10==15==20==25==30==35==40==45==50==55==60==65==70==75==80==85==90==95==100=
File write to flash success
Checking configuration file...
Boot application
Load image from flash
Loading image 0, start c0c0000, size 6159837
3432524 + 1893356 + 81435916
Load module success
All Microengines stopped
Starting at 0x1000...

Host Name: bootHost
Target Name: vxTarget

Adding 10952 symbols for standalone.
CPU: Intel ixp1200eb - ARM IXP1200. Processor #0.
Memory Size: 0xc000000. BSP version 1.2/1.02.

Starting CMTS application

ROOT: Max non-cached size 524288, actual 390144
MAParray:start c321c200, size 1f400
SDRAM 2K:start c323b600, size 20000

SDRAM 2K-2:start c325b600, size 20000
created partitions
Created dos File System
CMTS formatted
File CMTS/config/bootupCfg restored from flash
spawned all tasks
0xb72a240 (ROOT): DUS API call 0: DUSInit
0xb72a240 (ROOT): dus_init
0xb72a240 (ROOT): DUS: DUS API call 0: DUSLogFcnSet: fcn = 0x99cec
0xb72a240 (ROOT): DUSInit returns 0
Initializing bcm from Mac Manager
Microengine initialized.
Ethernet Link Status is UP - On Port 2, 100Mbps Fast Ethernet, full-duplex.
Microengine started.
Attaching network interface lo0... done.
priority tasks active
CLI initialized
Initializing Chanl Mgr
Initializing Chanl Mgr...done
Blonder Tongue-CMTS<<HW_REV: 1.1; VENDOR: Blonder Tongue LTD.; BOOTR: 2.0.0.8
>>SW Ver. Jan 21 2005 02:28:08 cmts.3.0.3.30
1 >> build #3080
arpm init 0!
snmpmm init 0!
dhcpm init 0!
radiusm init 0!
Restoring saved configuration data...
SNMP config success
PCI DMA test passed
Map:5000(100) -- usec (mslot)
Upstream 1 MAP enable with advance time 102 minislots
Map:5000(100) -- usec (mslot)
Upstream 2 MAP enable with advance time 102 minislots
Map:5000(100) -- usec (mslot)
Upstream 3 MAP enable with advance time 102 minislots
Map:5000(100) -- usec (mslot)
Upstream 4 MAP enable with advance time 102 minislots
Map:5000(100) -- usec (mslot)
Upstream 5 MAP enable with advance time 102 minislots
Map:5000(100) -- usec (mslot)
Upstream 6 MAP enable with advance time 102 minislots
Map:5000(100) -- usec (mslot)
Upstream 7 MAP enable with advance time 102 minislots
Map:5000(100) -- usec (mslot)
Upstream 8 MAP enable with advance time 102 minislots
symbolRate 16, modulation 1
Map:5000(100) -- usec (mslot)
Upstream 1 MAP enable with advance time 102 minislots
symbolRate 16, modulation 1
Map:5000(100) -- usec (mslot)
Upstream 2 MAP enable with advance time 102 minislots
symbolRate 16, modulation 1

symbolRate 16, modulation 1
symbolRate 16, modulation 1
symbolRate 16, modulation 1
symbolRate 16, modulation 1
symbolRate 16, modulation 1
all tasks active
========== CMTS IP ==========
CMTS IP:10.254.0.100
CMTS Gateway:10.254.0.1
==
========== DHCP configuration
==============================
CM Relay status=1 IP=10.254.129.254 Gateway=10.254.0.3 Server=10.254.0.3
CPE Relay status=1 IP=172.1.1.254 Gateway=172.1.1.250 Server=10.254.0.3
==========
==========
Current number arrays 63, max number 1000, Current number memory slots 240527, max number 393216
all mgmt arrays initialized
Launching Telnet Server Task.
TSA enabled
======== CMTS READY ========
CM Relay Gateway MAC:00-0C-F1-DA-ED-6E
CMTS Gateway MAC:00-10-4B-2B-50-B9
CPE Relay Gateway MAC:00-0C-F1-DA-ED-6E

Verifying the code is running on the CMTS.

- Logging into the CMTS
- Display the system versions (The bold number displays the application version)

e.g. -->root/> show (Enter).

description = Blonder Tongue CMTS<<HW_REV: 1.1; VENDOR: Blonder Tongue LTD.; BOOTR:
*2.0.072>>SW Ver. Oct 19, 2004 14:00:33 cmts.**2.0.3.300 >> build #3000***
name = CMTS
location = Somewhere around the world
up-time = 0 days, 0 hours, 0 minutes, 57 seconds

CHAPTER 5

Advanced Operations

This chapter describes the advanced features, commands and operations of the Blonder Tongue CMTS.

About this chapter

- **Part 1: DHCP Monitoring —** describes how DHCP monitoring can be utilized
- **Part 2: ARP and Bridging —** describes the Proxy ARP module within the CMTS; commands such as ARP Monitoring and Reflection Mode.
- **Part 3: Load Balancing —** describes load balancing techniques on the upstream channels.
- **Part 4: Cable Modem Filters —** describes Cable Modem filters that can be implemented.

Part 1: DHCP Monitoring

The DHCP protocol is used to provide IP addresses and other configuration parameters for a configurable amount of time (lease time). Hackers can use security holes in the DHCP protocol to steal IP addresses from the DHCP server and thus create problems in the network. The DHCP monitor is used to prevent this from happening.

DHCP servers need a unique identification for a requesting station before it can allocate an IP address to that station. By default DHCP protocol uses the MAC address of the requesting station and a field called Client Identifier together to form a unique identifier for the stations in the network. This is supposed to guarantee that the server will not lease the same IP address to two different stations. Hackers can mangle DHCP packets with various MAC addresses and Client Identifiers and thus cause chaos in the network. The DHCP Monitor keeps track of all DHCP traffic and stores in the CMTS memory all needed details (used MAC address, Client ID, lease time, gateway address etc.) and verifies the consistency of the DHCP sessions along the time. The DHCP monitor also verifies other means of legitimate DHCP frames to make sure they were not mangled. The DHCP Monitor blocks illegal (or inconsistent) packets and drops them.

Part 2: ARP and Bridging

The Blonder Tongue CMTS can handle the ARP request and replies in different ways. The CMTS must have a proper configuration if it is required to allow communication between the different entities on the network.

ARP works by broadcasting a packet to all hosts attached to an Ethernet. The packet contains the IP address the sender is interested in communicating with. Most hosts ignore the packet. The target machine, recognizing that the IP address in the packet matches its own, returns an answer.

Hosts typically keep a cache of ARP responses, based on the assumption that IP-to-hardware address mapping rarely change.

CPE Traffic Flow with CMTS

The Blonder Tongue CMTS provides configuration options that disable internal bridging, which stops any traffic loop back (from upstream to downstream) inside the CMTS. The external router decides if back packets should be routed to the downstream.

To enable two CPEs to 'talk' IP under the same CMTS, a special Proxy ARP module is included in the software. This module will reply to CPE ARP requests with the CPE gateway MAC address (as learned by the CMTS from the CPE DHCP response). The CPE will send the IP Packets to the gateway. The gateway can choose to loop them back to the downstream direction. The CMTS supports multiple CPE gateways, so each CPE will receive the proper ARP response.

The Proxy ARP module will also forward a modified ARP request to the CPE gateway. The gateway will maintain a correct ARP table of its own, which relates to its LAN Ethernet clients. These features are optionally configured and non-standard. When disabled the CMTS will operate as a regular DOCSIS/Euro-DOCSIS CMTS according to the forwarding rules specified in the DOCSIS/Euro-DOCSIS specification.

ARP Monitor

The Address Resolution Protocol (ARP) is used to enable the IP protocol to communicate over an Ethernet network. Each ARP frame carries the Sender Mac Address and IP Address. Mangled ARP frames can lead the routers and other stations to hold an incorrect ARP table and thus create a security hole in which IP packets can be sent to other than their original destinations. The ARP Monitor verifies the sender information (Mac, IP Pair) as it appears in the packet is consistent with the CMTS database that holds this information. The CMTS database is build from one or two different sources. Some networks are configured in such a way were the CPE are using DHCP to receive their IP Address, some use Static IP Addresses and most are using a combination of those two.

Since the CMTS is the pipe for all traffic it uses the DHCP protocol to learn about the Mac, IP addresses pair. Whenever the CMTS forwards a DHCP acknowledge message it stores the info in the database.

Static IP Addresses are assigned by the operator and thus the CMTS has no way to know about them unless their uploaded to the CMTS. The CMTS can upload a list of IP Address pairs (and their matching Router). When such a file is uploaded the CMTS stores the information in the database. The ARP monitor will not operate correctly (it will drop ARP packets) if static IP Addresses are used and the file is not loaded to the CMTS. If a change in the configuration is required a new file (or an updated one) can be loaded on runtime using either CLI or SNMP to tell the CMTS to update the static database.

Reflection Mode

The Blonder Tongue-CMTS is operating in a bridging mode. Unlike an Ethernet network, Ethernet frames sent on the upstream channel of a cable planet can not be 'heard' by all other stations in the network. To enable two Ethernet stations to communicate a CMTS must use some forwarding rules that would send some frames received on the upstream back to the downstream.

When reflection is on (standard mode) the forwarding rules (Upstream only) for a bridging CMTS are:

1. Learn which MAC addresses are on the RFI of the CMTS
2. Whenever an Ethernet frame is received on the upstream examine the destination MAC address.
3. If destination address is the broadcast address send frame to both downstream and NSI.
4. If destination address is unicast and this address was learned to be on the RFI send the packet back to the downstream
5. If destination address is unicast and this address was NOT learned to be on the RFI send the packet to the NSI

When reflection is off (secured mode) the forwarding rules (Upstream only) for an Blonder Tongue-CMTS are:

1. Never send an upstream frame to the downstream. Always send to NSI.
2. Use a special Proxy ARP that will answer all ARP requests with the MAC address of the router. When the router will receive the frame it will decide according to its policies, configuration and packet destination whether to send it back on the same interface (which will cause this packet to go back to the downstream).

We refer to this mode as secured because it prevents intrusions of unauthorized users to other machines using broadcast messages and it allows a single point of configuration (the router) to block some types of packets from being forwarded.

Part 3: Load Balancing between Upstream Receivers

The CMTS offers few different ways to configure load balancing between the upstream receivers. The following section describes the key steps required to enable load balancing:

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- Definition of upstream groups. The Cable Operator defines sets of channels within the CMTS domain. A valid set must assure that when a CM has joined one channel in the group, it can physically join the other channels in the same group.
- Within each group the CMTS can perform load balancing according to one of the following policies:
    1. Average channel bit rate
    2. Number of connected cable modems
    3. Number of active cable modems

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- Load Balancing can be configured to operate at the CM connection time (Initial Ranging) or/and in a periodical manner. When enabling the periodical Load Balancing, the CMTS will dynamically move cable modems between the channels using the Upstream Channel Change message. Using this way will keep the upstream channels in a balanced state even after modems and/or CPE's disconnected from the CMTS.

Load balancing is configured through a proprietary MIB or CLI that supports the upstream grouping and the Load Balancing Policy used for each group.

Note: When programming the same frequency for the same upstream channels the upstream alignment will start automatically and will switch off the Load Balancing.

Part 4: Cable Modem Filters

A EURODOCSIS/DOCSIS cable modem has MIB definitions for filters that can apply by the CM to filter out some traffic based on some characteristics. Among them are all common fields from the IP and UDP/TCP header. The CMTS can be configured to control these filters using the following method:
A CM configuration file holds two sets of filters, an Initial set and an Operational set. The Initial set allows only DHCP traffic to go through. The Operational set allows only IP traffic from a certain source IP address.

When the CM is joining it receives the configuration file. Until a valid DHCP discover/response/request/acknowledge sequence, the Initial set filters apply and block everything but DHCP. Upon completion of a successful DHCP transaction the CMTS will set the CM filters to the operational mode, and will update the CM MIB with the valid source IP address.
When the lease time is over (i.e. no renew occurred) the CMTS will set the filters back to the initial mode.
This way if a user changes his DHCP allocated address to a static address, when the lease will be over he will be blocked. The user must use DHCP again to open the filters. The filters are not accessible to the user from the CM Ethernet side. The CMTS is MUST be pre-configured with a valid SNMP community for the CM's.

Note: When using cm-snmp-filters a proper CM configuration file must be used. The CMTS CD contains a sample file. Refer to the CD content for details.

CHAPTER 6

Command Reference

This chapter describes the command line structure and examples of commands utilized by the Blonder Tongue CMTS system.

About this chapter

- **Part 1: Logging on to the System,** describes how to log into the Blonder Tongue CMTS system.
- **Part 2: General Notes,** describes the command structures and layout of the directories on the Blonder Tongue CMTS system.
- **Part 3: Global Commands,** describes the global commands used by the Blonder Tongue CMTS system.
- **Part 4: Directory Commands,** describes the commands used in each specific directory used by the Blonder Tongue CMTS system.

Logging on to the System

The Shell system is available only via Serial or Telnet connection to the CMTS. A maximum of eight (8) concurrent Telnet sessions is supported. Once the CMTS is assigned an IP address, Gateway, and Subnet using the Serial terminal, EMS Client may be used to complete the configuration.

Default logins are:

"admin" and the password is "operator" (Full Read/Write Capabilities)

"user" and the password is "password". (Read Only Capabilities)

General Notes

- Use only valid commands and symbols described in this document.
- A directory may consist of variables, sub-directories or special operations (items).
- Each user has special access rights to each item in the Shell system according to the user's authorization.
- Symbols used by the Shell system are:
    - 'R' – Indicates that this item is read only for the current user (only for dir, rdir, show, rshow commands).

- 'RW' – Indicates that this item is read/write for the current user (only for dir, rdir, show, rshow commands).
- <VAR> - Indicates that this item is a variable (used only in dir, rdir, commands).
- <DIR> - Indicates that this item is a sub-directory (used only in dir, rdir, commands).
- <COM> - Indicates that this item is a command.

- When executing local directory commands that have the same name as a global command, the global commands will not be executed only the local command will be executed.
- Different sub-directories may have items with the same names, they are completely unrelated.
- You may specify a minimum unique prefix instead of the full directory or variable name. For example: *cd sy* instead *cd system*
- The symbol '/' is used when changing directories.
For example: commands *cd /admin/boot*.
- Use the Up/Down arrow keys to navigate in history of commands.
- Use the TAB key to auto-complete directory names, variable names, commands and optional parameters.

Global Commands

The following describes the global commands used in the Shell system. These commands can be executed anywhere in the Shell except if the command exists already as an operational command in the current sub directory

Command:	**?**
Description:	Displays all available commands at this location.
Notes:	None
Syntax:	*?*

Command:	**Command ?**
Description:	Displays next available parameters for **Command**.
Notes:	None
Syntax:	*set ?* *show ?*

Command:	**Command /?**
Description:	Displays help about **Command**.
Notes:	None
Syntax:	*set /?* *show /?*

Command:	**show**
Description:	Displays all variables with their respected values under the specified directory. If no directory is specified, the variables under the current directory are displayed.
Notes:	None
Syntax:	*show [dir]*

Where dir is the directory name.

Command:	**rshow**
Description:	Displays all variables under the specified directory and under all sub directories. If a directory is not specified then variables under the current directory are displayed.
Notes:	None
Syntax:	*rshow* Where dir is the directory name.

Command:	**set**
Description:	Sets new values to parameters.
Notes:	If the parameter is a string, including blanks, the parameter must be specified in quotation marks.
Syntax:	*set <param> [arg1], .. ,[argN] [value]* - where param is the name of the parameter to be set. - where value is the value to be set to the parameter <param>. - where arg1 .. argN are additional arguments required.

Command:	**cd**
Description:	Changes current directory to the specified directory.
Notes:	a) A short path may be specified. For example: cd a/ip/d instead of cd services/admin/ip-services/dhcp b) Symbol '..' means one directory level up. **Note**: No space between the '..' commands are allowed (cd .. and cd.. are equal). For example: The command -->root\admin\boot >cd .. will result in: -->root\admin\ > The command -->root\admin\ip-services\tod > cd ..\sy will result in: -->root\admin\ip-services\syslog> c) The commands cd\ and cd/ mean "go to root directory".
Syntax:	*cd <dir>* - where dir is the path and directory name.

Command:	**dir**
Description:	Displays all items under the specified directory. If no directory is specified then it only displays directories under the current directory.
Notes:	None
Syntax:	*dir*

Command:	**rdir**
Description:	Displays all items under the specified directory and down to the bottom of the Shell directories' tree. If no directory is specified it displays all directories under the current directory.
Notes:	None
Syntax:	*rdir*

Command:	**tdir**

Description:	Displays all items under the specified directory in a directory tree. If no directory is specified then it all displays all directories under the current directory in a directory tree.
Notes:	None
Syntax:	*tdir*

Command:	**logout**
Description:	Logouts the current user from the system and enables login of a new user. Maximum of eight (8) telnets are supported.
Notes:	None
Syntax:	*logout*

Command:	**leases**
Description:	Display the leases of Cable Modems (*cm*) Customer Premise Equipment (*cpe*) or static (*static*) leases. Leases will be removed when the device performs a release or the lease time is over.
Notes:	None
Syntax:	*leases cm* *cpe* *static*
Example 1:	leases cm
Output 1:	

CM: MAC:00-04-BD-E3-96-60 IP:172.0.11.13 GW:172.0.11.1 Ends in:811 secs
CM: MAC:00-30-54-FF-3F-E9 IP:172.0.11.12 GW:172.0.11.1 Ends in:813 secs
CM: MAC:00-30-54-FF-BF-80 IP:172.0.11.16 GW:172.0.11.1 Ends in:797 secs
CM: MAC:00-30-54-FF-CE-96 IP:172.0.11.11 GW:172.0.11.1 Ends in:815 secs
CM: MAC:00-30-54-FF-D2-2B IP:172.0.11.18 GW:172.0.11.1 Ends in:802 secs

Note: **The DHCP Monitor keeps the leases as long as they are alive and the CMTS is on. A lease will be deleted only if the owner released the address or the lease time is over. If the lease time in the DHCP server is infinite than the leases command will show Never Expires. CPE Static IP addresses will not be shown as they were not configured through DHCP unless they were previously downloaded using the ARP static database file.**

Command:	**prov-test**
Description:	This command tests the provisioning system according the current DHCP configuration the CMTS is running. This command is utilized when testing your DHCP server, TFTP server and network configuration.
Notes:	This test covers most common configurations. In some configurations the command will result in test failure where actually system configuration is still correct.
Syntax:	*prov-test*

Command:	**ping-nsi**
Description:	Pings an IP address on the Network Side Interface of the CMTS.
Notes:	None

Syntax:	*ping-nsi x.x.x.x [-n y](where x = IP address and y is an optional number of messages to send)*

Command:	**ping-rfi**
Description:	Pings an IP address on the RF Interface of the CMTS.
Notes:	None
Syntax:	*ping-rfi x.x.x.x [-n y] (where x = IP address and y is an optional number of messages to send)*

Command:	**reboot**
Description:	Reboots the system.
Syntax:	*reboot*

Command:	**save**
Description:	Saves all parameters that can be saved in permanent storage memory. There are no parameters, which will be saved automatically without the Save command.
Syntax:	*save*

Directory Commands

These commands are only utilized in the specific directory which they are displayed. You must be in the current working directory before you can utilize these commands.

root Directory

Directory:	**root**
Directory path:	None
Description:	Main shell directory and displays CMTS information including hardware revision, software versions and CMTS serial number.
Sub Directories:	admin, cable, debug (not available via telnet), Ethernet, interfaces and modems
Commands/ Parameters:	set, show, description, name, location, up-time, serial, max-upstreams
Special Operations:	None

Parameter:	**show**
Full path:	root/show
Description:	This command displays CMTS information including hardware revision, software versions, serial number, Name, Location and Up-time.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

description = Blonder Tongue-CMTS<<HW_REV: 1.1; VENDOR: Blonder Tongue LTD.; BOOTR: 2.0.0.8
>>SW Ver. Oct 19 2004 14:00:33 cmts.3.0.3.300 >> build #3045

name = Support CMTS
location = Blonder Tongue headquarters Tel-Aviv Israel
up-time = 0 days, 3 hours, 25 minutes, 26 seconds
serial = 00-00-00-0a-03-40-00-a8
max-upstreams = 8

Parameter:	**description**
Full path:	root/description
Description:	Displays the hardware revision, Boot code, software version and date and CMTS serial number.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**name**
Full path:	root/name
Description:	The command defines the name used by the CMTS.
Syntax:	*set name* - Value (1-64 Characters)
Commands:	*set name Blonder Tongue Headquarters*
Example 1:	show name
Output 1:	name = Blonder Tongue Headquarters

Parameter:	**location**
Full path:	root/location
Description:	The command defines the location used by the CMTS.
Syntax:	*set location* - Value (1-64 Characters)
Commands:	*set location Livermore Ca. 94550*
Example 1:	show location
Output 1:	name = Livermore Ca. 94550

Parameter:	**up-time**
Full path:	root/ description
Description:	Displays the up-time of the CMTS in days, hours, minutes and seconds.
Syntax:	none (display only)
Example 1:	show or show uptime
Output 1:	See show command above. show uptime up-time = 0 days, 3 hours, 46 minutes, 36 seconds

Parameter:	**serial**
Full path:	root/serial
Description:	Displays the serial number of the CMTS.
Syntax:	none (display only)
Commands:	*show or show serial*
Example 1:	show or show serial
Output 1:	serial = 00-00-00-0a-03-40-00-a8

Parameter:	**max-upstreams**
Full path:	root/max-upstreams
Description:	Displays the maximum number of upstreams that can be utilized by the CMTS.
Syntax:	none (display only)
Commands:	*show or show max-upstreams*
Example 1:	show or show max-upstreams
Output 1:	max-upstreams = 8

root/admin Directory

Directory:	**admin**
Directory path:	root/admin
Description:	CMTS boot and services administration.
Sub Directories:	access-control, boot, flash, ip-services and sec-services
Commands/Parameters:	set, show, serial-log-level, update-prov
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/show
Description:	This command displays the logging level for the CLI console output.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	serial-log-level = info(1)

Parameter:	**serial-log-level**
Full path:	root/admin/serial-log-level
Description:	This command sets the logging level for the CLI console output.
Syntax:	*set serial-log-level none(0)* *info(1) Default setting* *detailed(2)*
Example 1:	set serial-log-level 2
Output 1:	No output provided

Parameter:	**update-prov**
Full path:	root/admin/update-prov
Description:	This command is used to upgrade a Limited Users/Upstreams CMTS to a full CMTS. To upgrade the CMTS to more users or upstream a special key must be entered to the CMTS. This key is provided by Blonder Tongue support team and is useful on a per CMTS basis.
Syntax:	*update-prov xxxx (where xxxx is special key)*
Example 1:	update-prov 3745gf657
Output 1:	update provisioning succeeded

root/admin/access-control Directory

Directory:	**access-control**
Directory path:	root/admin/access-control
Description:	Manage the shell access control parameters and enables the management of stations access which enhances CMTS security.
Sub Directories:	access-station-table and shell-access-control
Parameters:	set, show, enable-access-stations
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/show
Description:	This command displays the status of the access station list.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	enable-access-stations = disable

Parameter:	**enable-access-stations**
Full path:	root/admin/access-control/enable-access-stations
Description:	This command sets the status of the access station list. You must configure the access station list in the root/admin/access-control/access-station-table directory prior to enabling this command.
Syntax:	*set enable-access-stations disable(0)* *enable(1)*
Example 1:	set enable-access-stations 1
Output 1:	No output provided

root/admin/access-control/access-station-table Directory

Directory:	**access-station-table**
Directory path:	root/admin/access-control/access-station-table
Description:	Manages the access-station-table parameters. IP addresses that belong to the subnets listed in the table will be the only stations allowed access if the root/admin/access-control/enable-access-stations command is enabled. To protect users from configuration mistakes the following rules are applied: * A row status cannot be changed to the enabled state if both the IP Address and the IP mask are 0.0.0.0. * The enable-access-stations can be set to enable only if there is at least one active row in the table. If this flag was set to enable and the last active row is deactivated this flag will be implicitly set to disabled.
Sub Directories:	None
Commands/Parameters:	set, show, status, ip-address, ip-mask
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/ access-control/access-station-table/show

Description:	This command displays the access station list.
Syntax:	*show*
Commands:	*show*
Example 1:	show

Output 1:

index	status	ip-address	ip-mask	hits
1	enable	192.168.11.200	255.255.255.0	5322
2	disable	0.0.0.0	0.0.0.0	0
3	disable	0.0.0.0	0.0.0.0	0
4	disable	0.0.0.0	0.0.0.0	0
5	disable	0.0.0.0	0.0.0.0	0
6	disable	0.0.0.0	0.0.0.0	0
7	disable	0.0.0.0	0.0.0.0	0
8	disable	0.0.0.0	0.0.0.0	0
9	disable	0.0.0.0	0.0.0.0	0
10	disable	0.0.0.0	0.0.0.0	0

Parameter:	**index**
Full path:	root/admin/access-control/access-station-table/index
Description:	Displays the index number of the station allowed access.
Syntax:	*none*
Commands:	None
Example 1:	None
Output 1:	See Show command.

Parameter:	**status**
Full path:	root/admin/access-control/access-station-table/status
Description:	Displays the status of the index number. A row in this table will be considered only if the status is enabled.
Syntax:	*set status x disable(0)* *enable(1)* - where x is the index number
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	See Show command

Parameter:	**ip-address**
Full path:	root/admin/access-control/access-station-table/ip-address
Description:	Displays the IP address of the management system.
Syntax:	*set ip-address 1 x.x.x.x* - where 1 is the index number - where x is the IP address of the management system
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	See Show command

Parameter:	**ip-mask**
Full path:	root/admin/access-control/access-station-table/ip-mask
Description:	Displays the IP netmask of the management system.

Syntax:	*set ip-mask 1 x.x.x.x* - where 1 is the index number - where x is the IP netmask of the management system
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	See Show command

Parameter:	**hits**
Full path:	root/admin/access-control/access-station-table/hits
Description:	Displays number of station requests that access over this subnet. Whenever the CMTS receives a Telnet connection or an SNMP request from a certain subnet, the hits counter for this subnet will be incremented by one. If two rows in the table share a subnet than only the first row hits counter will be incremented.
Syntax:	*none*
Commands:	*none*
Example 1:	show
Output 1:	See Show command

root/admin/access-control/shell-access-control Directory

Directory:	**shell-access-control**
Directory path:	root/admin/access-control/shell-access-control
Description:	Manage the shell access control parameters. These parameters allow access to the CMTS CLI (Command Line Interface) via telnet or serial port.
Sub Directories:	None
Commands/Parameters:	set, show, admin-login, admin-password, user-login, user-password
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/access-control/shell-access-control/show
Description:	This command displays the access control list. The passwords are blocked out for security. If passwords are lost then restoring the default configuration will restore factory default passwords. (See root/admin/boot or root/admin/flash directories)
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	admin-login = admin admin-password = ******** user-login = user user-password = ********

Parameter:	**admin-login**
Full path:	root/admin/access-control/ shell-access-control/admin-login

Description:	The shell admin level login name. set command - You can input up to a 15 character string in this field, default = admin
Syntax:	*set admin-login*
Commands:	*show, set* (standard commands)
Example 1:	show admin-login
Output 1:	admin-login = admin
Special Operations:	none.

Parameter:	**admin-password**
Full path:	root/admin/access-control/ shell-access-control/admin-password
Description:	The shell admin level login name. set command - You can input up to a 15 character string in this field, default = operator
Syntax:	*set admin-password*
Commands:	*show, set* (standard commands)
Example 1:	show admin-password
Output 1:	admin-password = ********
Special Operations:	You will be requested to enter the new admin password twice for validation. Asterisks will be shown on console while typing.

Parameter:	**user-login**
Full path:	root/admin/access-control/shell-access-control/user-login
Description:	The shell admin level login name. set command - You can input up to a 15 character string in this field, default = user
Syntax:	*set user-login*
Commands:	*show, set* (standard commands)
Example 1:	show user-login
Output 1:	user-login = user
Special Operations:	none

Parameter:	**user-password**
Full path:	root/admin/access-control/shell-access-control/user-login
Description:	The shell admin level login name. set command - You can input up to a 15 character string in this field, default = password
Syntax:	*set user-login*
Commands:	*show, set* (standard commands)
Example 1:	show user-login
Output 1:	user-login = ********
Special Operations:	You will be requested to enter the new user password twice for validation. Asterisks will be shown on console while typing.

root/admin/boot Directory

Directory:	**boot**
Directory path:	root/ admin/boot
Description:	Manage CMTS boot parameters.
Sub Directories:	None
Commands/ Parameters:	set, show, write, ip-address, ip-mask, gateway, boot-server, boot-method, app-pathname, boot-pathname, config-pathname, update-app, update-boot, update-config, username, password, gateway-mac
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/boot/show
Description:	This command displays the boot parameters.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

ip-address = 192.168.11.220
ip-mask = 255.255.255.0
gateway = 192.168.11.1
boot-server = 192.168.11.200
boot-method = tftp
app-pathname = 2.0.15.200b1503
boot-pathname = V1.0.0.2
config-pathname = default.evc
update-app = 0
update-boot = 0
update-config = 0
username = anonymous
password = ftp@
gateway-mac = 00-20-78-d6-5c-eb

Parameter:	**ip-address**
Full path:	root/admin/boot/ip-address
Description:	CMTS IP Address. set command
Syntax:	*set ip-address x.x.x.x* - where x is the IP address
Commands:	*show, set* (standard commands)
Example 1:	show ip-address
Output 1:	ip-address = 192.168.11.220

Parameter:	**ip-mask**
Full path:	root/admin/boot/ip-mask
Description:	CMTS Netmask. set command
Syntax:	*set ip-netmask x.x.x.x* - where x is the netmask
Commands:	*show, set* (standard commands)

Example 1:	show ip-netmask
Output 1:	ip-netmask = 255.255.255.0

Parameter:	**gateway**
Full path:	root/admin/boot/gateway
Description:	CMTS Gateway Address. set command
Syntax:	*set gateway x.x.x.x* - where x is the Gateway IP Address
Commands:	*show, set* (standard commands)
Example 1:	show gateway
Output 1:	gateway = 192.168.11.1

Parameter:	**boot-server**
Full path:	root/admin/boot/boot-server
Description:	IP Address of the TFTP or FTP Server that will be used in a boot upgrade process. set command
Syntax:	*set boot-server x.x.x.x* - where x is the IP Address of the TFTP or FTP Server
Commands:	*show, set* (standard commands)
Example 1:	show boot-server
Output 1:	boot-server = 192.168.11.200

Parameter:	**boot-method**
Full path:	root/admin/boot/boot-method
Description:	Determines the file download method (TFTP, FTP) used when the boot downloads new files to the CMTS. set command
Syntax:	*set boot-method tftp* *set boot-method ftp*
Commands:	*show, set* (standard commands)
Example 1:	show boot-method
Output 1:	boot-method = ftp

Parameter:	**app-pathname**
Full path:	root/admin/boot/app-pathname
Description:	CMTS Application pathname. A full pathname may be required depending on the FTP/TFTP server utilized. set command
Syntax:	*set app-pathname 3.0.3.300b3000*
Commands:	*show, set* (standard commands)
Example 1:	show app-pathname
Output 1:	app-pathname = 3.0.3.300b3000

Parameter:	**boot-pathname**
Full path:	root/admin/boot/boot-pathname
Description:	CMTS Boot file pathname that will be used in a boot upgrade set command
Syntax:	*set boot-pathname boot*
Commands:	*show, set* (standard commands)

Example 1:	show boot-pathname
Output 1:	boot-pathname = bootv2008

Parameter:	**config-pathname**
Full path:	root/admin/boot/config-pathname
Description:	CMTS Configuration file full pathname. set command
Syntax:	*set config-pathname default.evc*
Commands:	*show, set* (standard commands)
Example 1:	show config-pathname
Output 1:	config-pathname = default.evc

Parameter:	**update-app**
Full path:	root/admin/boot/update-app
Description:	Toggles from True(1)/False(0), if set to true, the boot application will update the application image in the Flash on the next CMTS boot set command,
Syntax:	*set update-app 1*
Commands:	*show, set* (standard commands)
Example 1:	show update-app
Output 1:	update-app = 1

Parameter:	**update-boot**
Full path:	root/admin/boot/ update-boot
Description:	Toggles from True(1)/False(0), if set to true, the boot application will update the boot image in the Flash on the next CMTS boot set command
Syntax:	*set update-boot 1*
Commands:	*show, set* (standard commands)
Example 1:	show update-boot
Output 1:	update-boot = 1

Parameter:	**update-config**
Full path:	root/admin/boot/ update-config
Description:	Toggles from True(1)/False(0), if set to true, the boot application will update the CMTS configuration file in the Flash on the next CMTS boot. set command
Syntax:	*set update-config 1*
Commands:	*show, set* (standard commands)
Example 1:	show update-config
Output 1:	update-config = 1

Parameter:	**username**
Full path:	root/admin/boot/username
Description:	The ftp user-name to be used if the boot-method is set to ftp. set command – The user must match the settings in the FTP server.
Syntax:	*set username Blonder Tongue*
Commands:	*show, set* (standard commands)

Example 1:	show username
Output 1:	username = Blonder Tongue

Parameter:	**password**
Full path:	root/admin/boot/password
Description:	The ftp password to be used if the boot-method is set to ftp. set command – The password must match the settings in the FTP server.
Syntax:	*set password Blonder Tongue01*
Commands:	*show, set* (standard commands)
Example 1:	show password
Output 1:	password = Blonder Tongue01

Parameter:	**gateway-mac**
Full path:	root/admin/boot/ gateway-mac
Description:	Displays the MAC address of the gateway as discovered by the CMTS at initialization.
Syntax:	*show gateway-mac*
Commands:	*show*
Example 1:	show gateway-mac
Output 1:	gateway-mac = 00-20-78-d6-5c-eb

Parameter:	**write**
Full path:	root/admin/boot/write
Description:	The write command saves the current boot parameters.
Syntax:	*write*
Commands:	*write*
Example 1:	write
Output 1:	writes boot parameters to nvram write success

root/admin/flash Directory

Directory:	**flash**
Directory path:	root/admin/flash
Description:	Manages the Runtime flash images.
Sub Directories:	None
Commands:	download-image, download-config, upload-config
Special Operations:	None

Parameter:	**download-image**
Full path:	root/admin/flash/download-image
Description:	This command is used to download new application image from a server.
Syntax:	*download-image tftp ://192.168.11.200/3.0.3.300b3000*
Commands:	*download-image*
Example 1:	download-image tftp ://192.168.11.200/3.0.3.300b3000

Output 1:	Start download APP IMAGE A 3.0.3.300b3000 , host 192.168.11.200 ..... File has MD5 chksum hdr Verifying file Overload control level 1 is on. Writing to flash =4==8==12==17==21==25==29==34==38==42==47==51==55==59==64==68==72==77==81==85==89==94==98==100= File write to flash success Overload control is off.

Parameter:	**download-config**
Full path:	root/admin/flash/download-config
Description:	This command downloads a new configuration file from a server.
Syntax:	*download-config tftp ://192.168.11.200/default.cfg*
Commands:	*download-config*
Example 1:	download-config tftp ://192.168.11.200/default.cfg
Output 1:	Start download CONFIG file default.cfg, host 192.168.11.200 File has MD5 chksum hdr Verifying file Writing to flash =100= File write to flash success

Parameter:	**upload-config**
Full path:	root/admin/flash/upload-config
Description:	This command uploads current CMTS configuration file to a server. Save your changes before the upload to make the current configuration file match the CMTS current configuration.
Syntax:	*upload-config tftp ://192.168.11.200/default1.cfg*
Commands:	*upload-config*
Example 1:	upload-config tftp ://192.168.11.200/default.cfg
Output 1:	Start upload CONFIG file default1.cfg, host 192.168.11.200 Copy file from flash success tftp put file default.cfg to host 192.168.11.200

root/admin/ip-services Directory

Directory:	**ip-services**
Directory path:	root/admin/ip-services
Description:	Manages CMTS IP services.
Sub Directories:	dhcp, radius, syslog, tod
Parameters:	None
Special Operations:	None

root/admin/ip-services/dhcp Directory

Directory:	**dhcp**
Directory path:	root/admin/ip-services/dhcp
Description:	Manages DHCP configurations.
Sub Directories:	None
Commands/ Parameters:	set, show,, source-type, relay-status, relay-ip, relay-gateway, dhcp-server, append-remote-id
Special Operations:	None

Note: If there are changes in the DHCP relay, the CMTS must be rebooted.

Parameter:	**source-type**
Full path:	root/admin/ip-services/dhcp/source-type
Description:	Source-type is displayed with the show command.
Syntax:	*show*
Commands:	*None*
Example 1:	show
Output 1:	source-type = cpe(2) relay-status = inactive(0) relay-ip = 0.0.0.0 relay-gateway = 0.0.0.0 dhcp-server = 0.0.0.0 append-remote-id = disabled(0)

Parameter:	**relay-status**
Full path:	root/admin/ip-services/dhcp/relay-status
Description:	The command sets the relay-status to CM or CPE
Syntax:	*set relay-status 2 1*
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	source-type = cpe(2) relay-status = Active(1) relay-ip = 0.0.0.0 relay-gateway = 0.0.0.0 DHCP-server = 0.0.0.0 append-remote-id = disable(0)

Parameter:	**relay-ip**
Full path:	root/admin/ip-services/dhcp/relay-ip
Description:	The command sets the relay-ip address. This is an internal IP address used by the CMTS to relay the DHCP info to the DHCP server.
Syntax:	*set relay-ip 2 x.x.x.x* - where x is the relay agent IP Address
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	source-type = cpe(2) relay-status = Active(1) relay-ip = 172.16.20.4

relay-gateway = 0.0.0.0
DHCP-server = 0.0.0.0
append-remote-id = disable(0)

Parameter:	**relay-gateway**
Full path:	root/admin/ip-services/dhcp/relay-gateway
Description:	The command sets the relay-gateway address. This is the router IP address if the DHCP server is located on another subnet or the DHCP server IP address if it is located on the same subnet as the CMTS.
Syntax:	*set relay-gateway 2 x.x.x.x* - where x is the relay agent gateway IP Address
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	source-type = cpe(2) relay-status = Active(1) relay-ip = 172.16.20.4 relay-gateway = 172.16.20.1 DHCP-server = 0.0.0.0 append-remote-id = disable(0)

Parameter:	**dhcp-server**
Full path:	root/admin/ip-services/dhcp/dhcp-server
Description:	The command sets the DHCP server address.
Syntax:	*set dhcp-server 2 x.x.x.x* - where x is the IP Address of this DHCP server
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	source-type = cpe(2) relay-status = Active(1) relay-ip = 172.16.20.4 relay-gateway = 172.16.20.1 DHCP-server = 209.34.2.6 append-remote-id = disable(0)

Parameter:	**append-remote-id**
Full path:	root/admin/ip-services/dhcp/append-remote-id
Description:	When enabled, the CM MAC Address is appended to the original DHCP requests sent by both modems and CPE. A DHCP server can identify the CPE by the addend CM MAC Address to the CPE DHCP requests and use this info to logically link a CPE to the CM. The DHCP module in the CMTS is using a DHCP relay option number 82. According to the DOCSIS standard the CMTS must append this option to the DHCP traffic forwarded, but if the DHCP server is not using it, then it should be disabled.
Syntax:	*set append-remote-id 2 1*
Commands:	*show, set* (standard commands)
Example 1:	show
Output 1:	source-type = cpe(2) relay-status = Active(1) relay-ip = 172.16.20.4 relay-gateway = 172.16.20.1

DHCP-server	= 209.34.2.6
append-remote-id	= disable(1)

root/admin/ip-services/radius Directory

Directory:	**radius**
Directory path:	root/admin/ip-services/radius
Description:	Manages radius configurations. Radius is utilized in conjunction with NMS software to gather traffic statistics for each registered modem. Radius is not used for authentication for the Blonder Tongue CMTS.
Sub Directories:	None
Parameters:	set, show, primary-server-ip, enable-accounting, billing-period, inactive-timeout, shared-secret, secondary-server-ip
Special Operations:	None

Parameter:	**show**
Full path:	root/ admin/ip-services/radius/show
Description:	The command displays the all radius configuration and statistics. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	primary-server-ip = 192.168.11.200 enable-accounting = enable(1) billing-period = 720 inactive-timeout = 60 shared-secret = ******** secondary-server-ip = 0.0.0.0 current-server-ip = 192.168.11.200 ack-messages = 1 drop-messages = 0

Parameter:	**primary-server-ip**
Full path:	root/admin/ip-services/radius/primary-server-ip
Description:	The command sets the primary radius server IP address.
Syntax:	*set primary-server-ip x.x.x.x* - where x is the IP Address of the Radius Server
Commands:	*show, set* (standard commands)
Example 1:	show primary-server-ip
Output 1:	primary-server-ip = 192.168.11.200

Parameter:	**enable-accounting**
Full path:	root/admin/ip-services/radius/ enable-accounting
Description:	The command enables (1) or disables (0) accounting.
Syntax:	*set enable-accounting 1* - where 1 enables accounting and 0 disables accounting
Commands:	*show, set* (standard commands)
Example 1:	show enable-accounting
Output 1:	enable-accounting = enable(1)

Parameter:	**billing-period**
Full path:	root/admin/ip-services/radius/billing-period
Description:	The command defines the time between two consecutive billing events for the same cable modem. The time is in minutes and range is 30 to 1440. The default value is 720.
Syntax:	*set billing-period 1440*
Commands:	*show, set* (standard commands)
Example 1:	show billing-period
Output 1:	billing-period = 1440

Parameter:	**inactive-timeout**
Full path:	root/admin/ip-services/radius/inactive-timeout
Description:	The command sets the time in seconds before a cable modem is declared inactive. The range is from 60 to 3660 seconds. The default value is 60 seconds.
Syntax:	*set inactive-timeout 120*
Commands:	*show, set* (standard commands)
Example 1:	show inactive-timeout
Output 1:	inactive-timeout = 120

Parameter:	**shared-secret**
Full path:	root/admin/ip-services/radius/shared-secret
Description:	The command defines the Radius server authentication shared secret. The default value should not be changed. Contact Blonder Tongue support team if you want to use an alternate Radius server.
Syntax:	*N/A*
Commands:	*show, set* (standard commands)

Note: The shared-secret should not be changed until the NMS supports the change.

Parameter:	**secondary-server-ip**
Full path:	root/admin/ip-services/radius/secondary-server-ip
Description:	The command sets the secondary radius server IP address, for redundancy purposes.
Syntax:	*set primary-server-ip x.x.x.x* - where x is the IP Address of the secondary Radius server
Commands:	*show, set* (standard commands)
Example 1:	show secondary-server-ip
Output 1:	secondary-server-ip = 192.168.11.6

Parameter:	**current-server-ip**
Full path:	root/admin/ip-services/radius/current-server-ip
Description:	This displays the currently used radius server IP address.
Syntax:	*show*
Commands:	*show,* (standard command)
Example 1:	show current-server-ip
Output 1:	current-server-ip = 192.168.11.200

Parameter:	**ack-messages**
Full path:	root/admin/ip-services/radius/ack-messages

Description:	This displays statistic information describing the number of acknowledgments received by the CMTS from the radius server. If the radius server is connected this number should constantly increment for each billing event sent to the radius server.
Syntax:	*show*
Commands:	*show*, (standard command)
Example 1:	show ack-messages
Output 1:	ack-messages = 2057

Parameter:	**drop-messages**
Full path:	root/admin/ip-services/radius/drop-messages
Description:	This displays statistic information describing the number of billing events that were dropped by the CMTS because no response was received from the radius server. If the radius server is connected this number should remain zero. If this numbers increments, then there is a problem with the radius server connection.
Syntax:	*show*
Commands:	*show*, (standard command)
Example 1:	show drop-messages
Output 1:	drop-messages = 0

root/admin/ip-services/syslog Directory

Directory:	**syslog**
Directory path:	root/admin/ip-services/syslog
Description:	Manages syslog configurations.
Sub Directories:	None
Commands/Parameters:	set, show, server-ip, log-level, syslog-status, log-dhcp
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/ip-services/syslog/show
Description:	The command displays the all syslog configuration parameters. . The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	server-ip = 192.168.11.200 log-level = emergency(128) syslog-status = disabled(1) log-dhcp = disabled(0)

Parameter:	**server-ip**
Full path:	root/admin/ip-services/syslog/server-ip
Description:	The command sets the Syslog server IP address.
Syntax:	*set server-ip x.x.x.x* - where x is the IP Address of the Syslog Server
Commands:	*show, set* (standard commands)
Example 1:	show server-ip

Output 1:	server-ip = 192.168.11.200

Parameter:	**log-level**
Full path:	root/admin/ip-services/syslog/log-level
Description:	The command sets the Syslog log level.
Syntax:	*set log-level 127* Minimum level of messages will be sent to Sys Log server. For example, when the Sys Log level is set to 129 then Alert and Emergency will be sent to the Sys Log server and other messages will not be sent. The following are the Sys Log levels: SYSLOG_NONE = 127 SYSLOG_EMERGENCY =128 SYSLOG_ALERT = 129 SYSLOG_CRITICAL = 130 SYSLOG_ERROR = 131 SYSLOG_WARNING = 132 SYSLOG_NOTICE = 133 SYSLOG_INFO = 134 SYSLOG_DEBUG = 135
Commands:	*show, set* (standard commands)
Example 1:	show log-level
Output 1:	log-level= 127

Parameter:	**syslog-status**
Full path:	root/admin/ip-services/syslog/syslog-status
Description:	The command sets the Syslog status to enabled or disabled.
Syntax:	*set syslog-status 1* - where 1 is for enabled and 0 is for disabled
Commands:	*show, set* (standard commands)
Example 1:	show syslog-status
Output 1:	syslog-status = enabled(1)

Parameter:	**log-dhcp**
Full path:	root/admin/ip-services/syslog/log-dhcp
Description:	The command determines if CMTS will send syslog info message for every DHCP acknowledgement.
Syntax:	*set log-dhcp 1* - where 1 is for enabled and 0 is for disabled
Commands:	*show, set* (standard commands)
Example 1:	show log-dhcp
Output 1:	log-dhcp = enabled(1)

root/admin/ip-services/tod Directory

Directory:	**tod**
Directory path:	root/admin/ip-services/tod
Description:	The CMTS uses the TOD protocol to acquire the correct time from an external server. This time reference is later used by the CMTS when generating events to the console to help system debug and monitoring.
Sub Directories:	None

Commands/Parameters:	set, show, date-time, server-ip, direct-gmt, hour-gmt, min-gmt
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/ip-services/tod/show
Description:	The command displays the all TOD configuration parameters. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	server-ip = 192.168.11.200 direct-gmt = negative(0) hour-gmt = 7 min-gmt = 0

Parameter:	**date-time**
Full path:	root/admin/ip-services/tod/date-time
Description:	The command displays the date and time.
Syntax:	*date-time*
Commands:	*date-time*
Example 1:	date-time
Output 1:	date - 07/10/2004 time – 23:33:20

Parameter:	**server-ip**
Full path:	root/admin/ip-services/tod/server-ip
Description:	The command sets the TOD (Time of Day) server IP address.
Syntax:	*set server-ip x.x.x.x* - where x is the ip address for the TOD server
Commands:	*show, set* (standard commands)
Example 1:	show server-ip
Output 1:	server-ip = 192.168.11.200

Parameter:	**direct-gmt**
Full path:	root/admin/ip-services/tod/direct-gmt
Description:	The command sets the offset of your location in relation to GMT (Greenwich Mean Time) to either positive or negative offset.
Syntax:	*set direct-gmt 1* - where 1 is positive and 0 is negative
Commands:	*show, set* (standard commands)
Example 1:	show direct-gmt
Output 1:	direct-gmt = positive(1)

Parameter:	**hour-gmt**
Full path:	root/admin/ip-services/tod/hour-gmt
Description:	The command sets the hour difference of your location in relation to GMT (Greenwich Mean Time).
Syntax:	*set hour-gmt 8*
Commands:	*show, set* (standard commands)
Example 1:	show hour-gmt

Output 1:	hour-gmt = 8

Parameter:	**min-gmt**
Full path:	root/admin/ip-services/tod/min-gmt
Description:	The command sets the minute difference of your location in relation to GMT (Greenwich Mean Time).
Syntax:	*set hour-gmt 30*
Commands:	*show, set* (standard commands)
Example 1:	show min-gmt
Output 1:	min-gmt = 30

root/admin/sec-services Directory

Directory:	**sec-services**
Directory path:	root/admin/sec-services
Description:	Manages the CMTS security services. Refer to Chapter 5 Advanced Operations for descriptions of security services.
Sub Directories:	arpm-static-db
Commands/Parameters:	set, show, dhcp-monitoring, arp-monitoring, cm-snmp-filters, max-cpe-per-cm, cm-snmp-community, cmts-prov-secret, reflection-mode, drop-cm-on-lease-expire
Special Operations:	None

Parameter:	**show**
Full path:	root/admin/sec-services/show
Description:	This command displays the all security services configuration parameters. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	dhcp-monitoring = disable(0) arp-monitoring = disable(0) cm-snmp-filters = disable(0) max-cpe-per-cm = 16 cm-snmp-community = public cmts-prov-secret = 123456 reflection-mode = no-reflection(0) drop-cm-on-lease-expire = disabled(0)

Parameter:	**dhcp-monitoring**
Full path:	root/admin/sec-services/dhcp-monitoring
Description:	The command determines whether to monitor and validate DHCP traffic authenticity. .
Syntax:	*set dhcp-monitoring 1* - where 1 is enabled and 0 is disabled
Commands:	*set dhcp-monitoring*
Example 1:	show dhcp-monitoring
Output 1:	dhcp-monitoring = enable(1)

Parameter:	**arp-monitoring**

Full path:	root/admin/sec-services/arp-monitoring
Description:	The command determines whether to monitor and validate ARP traffic authenticity.
Syntax:	*set arp-monitoring 1* - where 1 is enabled and 0 is disabled
Commands:	*set arp-monitoring*
Example 1:	show arp-monitoring
Output 1:	arp-monitoring = enable(1)

Parameter:	**cm-snmp-filters**
Full path:	root/admin/sec-services/cm-snmp-filters
Description:	The command determines whether to set IP spoofing filters on the cable modems.
Syntax:	*set cm-snmp-filters 1* - where 1 is enabled and 0 is disabled
Commands:	*set cm-snmp-filters*
Example 1:	show cm-snmp-filters
Output 1:	cm-snmp-filters = enable(1)
Special Operations:	Using this option requires a special CM configuration file. A sample CM configuration file can be found on the installation CD.

Parameter:	**max-cpe-per-cm**
Full path:	root/admin/sec-services/max-cpe-per-cm
Description:	The command determines the maximum number of CPEs per modem the DHCP monitor will allow through the CMTS. This setting will be used as a default setting whenever this setting is missing from the CM configuration file.
Syntax:	*set max-cpe-per-cm 4* - where 1 is minimum and 16 is maximum
Commands:	*set max-cpe-per-cm*
Example 1:	show max-cpe-per-cm
Output 1:	max-cpe-per-cm = 4

Parameter:	**cm-snmp-community**
Full path:	root/admin/sec-services/cm-snmp-community
Description:	The command defines the community string that will be used when sending SNMP filters to the CM.
Syntax:	*set cm-snmp-community public* - You can input up to a 32 character string in this field.
Commands:	*set cm-snmp-community*
Example 1:	show cm-snmp-community
Output 1:	cm-snmp-community = public

Parameter:	**cmts-prov-secret**
Full path:	root/admin/sec-services/cmts-prov-secret
Description:	The command defines the string that will be used to authenticate CM configuration files during the registration process. This command is also referred to as the MIC (Message Integrity Check).
Syntax:	*set cmts-prov-secret private*

	-You can input a 32 character string in this field. - Default = 123456
Commands:	*set cmts-prov-secret*
Example 1:	show cmts-prov-secret
Output 1:	cmts-prov-secret= private
Special Operations:	Be sure to update NMS or change the CM configuration file properly before changing this value.

Parameter:	**reflection-mode**
Full path:	root/admin/sec-services/reflection-mode
Description:	This command defines the forwarding mode used by the CMTS. When reflection is on, the CMTS will internally loop back any unicast message received on the upstream designated to a CM or CPE under the CMTS. Broadcast messages (i.e ARP requests) will be send to both the downstream and the NSI. When reflection mode= no-reflection no packets will be looped internally to the downstream. A Proxy ARP will enable communication between two CPE under the same CMTS if the router supports that.
Syntax:	*set reflection-mode* Default = 0 (enables ICMP redirects)
Commands:	*set reflection-mode 1 (Disables ICMP redirects)*
Example 1:	show reflection-mode
Output 1:	reflection-mode = reflection(1)
Special Operations:	None

Note: When using reflection mode = no-reflection it is strongly recommended to disable the ICMP redirect messages in the system's router.

root/cable Directory

Directory:	**cable**
Directory path:	root/cable
Description:	Manages cable interface commands and statistics.
Sub Directories:	bpi, downstream, modulation, upstream
Commands/Parameters:	set, show, physical-address, sync-interval, ucd-interval, max-service-ids, invited-ranging-attempts, insert-interval, map-advance-factor, map-base-time, ip-complete-timeout, registration-timeout
Special Operations:	None

Parameter:	**show**
Full path:	root/cable/show
Description:	This command displays physical-address, sync-interval, ucd-interval, max-service-ids, invited-ranging-attempts, insert-interval, map-advance-factor, map-base-time, ip-complete-timeout, registration-timeout defined for the cable interface. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show

Output 1:	physical-address = 00-01-cb-28-00-a8 sync-interval = 20 ucd-interval = 1000 max-service-ids = 3000 invited-ranging-attempts = 16 insert-interval = 10 map-advance-factor = 0 map-base-time = 2600 ip-complete-timeout = 15 registration-timeout = 15

Parameter:	**physical-address**
Full path:	root/cable/show
Description:	The CMTS's cable physical-address is displayed when performing a show command. This address is the MAC Address used in the DOCSIS MAC Management messages. It cannot be seen outside the RF network.
Syntax:	none (display only)
Example 1:	show physical-address
Output 1:	physical-address = 00-01-cb-28-00-a8

Parameter:	**sync-interval**
Full path:	root/cable/sync-interval
Description:	The command defines the time interval between consecutive MAC sync messages in milliseconds.
Syntax:	*set sync-interval* 25 - Value 1 -200, default = 20
Commands:	*set sync-interval 25*
Example 1:	show sync-interval
Output 1:	sync-interval = 25

Parameter:	**ucd-interval**
Full path:	root/cable/ucd-interval
Description:	The command defines the time interval between consecutive MAC UCD messages for each upstream channel (tenth seconds).
Syntax:	*set ucd-interval* 1500 - Value 1 – 2000, default = 1000
Commands:	*set ucd-interval 1500*
Example 1:	show ucd-interval
Output 1:	ucd-interval = 1500

Parameter:	**max-service-ids**
Full path:	root/cable/max-service-ids
Description:	The command displays the maximum number of concurrent Service Identifiers (SID) on the Blonder Tongue CMTS.
Syntax:	*show max-service-ids or show*
Commands:	*show max-service-ids*
Example 1:	show max-service-ids
Output 1:	max-service-ids = 3000

Parameter:	**invited-ranging-attempts**
Full path:	root/cable/invited-ranging-attempts
Description:	The command displays the number of ranging solicitation attempts before the CMTS can drop a non-responsive CM.
Syntax:	*show invited-ranging-attempts or show*
Commands:	*show invited-ranging-attempts*
Example 1:	show invitited-ranging-attempts
Output 1:	invited-ranging-attempts=16

Parameter:	**insert-interval**
Full path:	root/cable/insert-interval
Description:	The command defines the time interval between two consecutive ranging opportunities (tenth milliseconds).
Syntax:	*set insert-interval* 100 - Value 0 – 200, default = 10.
Commands:	*set insert-interval 100*
Example 1:	show
Output 1:	physical-address =00-01-cb-28-00-12 sync-interval =25 ucd-interval =1000 max-service-ids =3000 invited-ranging-attempts=16 insert-interval =100

Parameter:	map-advance-factor
Full path:	root/cable/map-advance-factor
Description:	The command defines a factor that will be used by the CMTS in the calculations of the look a head time required before MAP transmissions. Each unit in this factor represents additional 200 microseconds that will be added to the look a head that is used based on the downstream interleave and modulation. Long distant HFC networks and older modems may require use of additional look a head time.
Syntax:	*set map-advance-factor 4. (default is 0) – Value 0- 10*
Commands:	*set map-advance-factor*
Example 1:	*set map-advance-factor 2*
Output 1:	Upstream 1 Advance Time change to 60 minislots

Parameter:	map-base-time
Full path:	root/cable/map-base-time
Description:	The command lets the operator change the minimum map length used by the CMTS scheduler. The map length is dependant of a fixed minimum and the number of pending request. By default the minimum map length is 2600 microseconds. Some modems appear to work better with longer maps. In general small systems will have greater throughput with shorter maps. For larger systems the difference is minor and the CMTS can perform better with longer maps. Changing this parameter will only take affect after the channel will be restarted.
Syntax:	*set map-base-time 4000. (default is 2600) – Value 2200-5600*

Commands:	*set map-base-time*
Example 1:	*set map-base-time 3500*
Output 1:	No output for this command

Parameter:	ip-complete-timeout
Full path:	root/cable/ip-complete-timeout
Description:	The command lets the operator control the timeout (in minuets) used before a CM that didn't complete a DHCP transaction will get disconnected. By default this timeout is identical to the registration timeout that is defined by the DOCSIS spec. to be 15 minuets. In most cases this timeout is to long. When a CM fails DHCP it can usually be as a result of some other systems malfunctions. Reducing this timeout can provide earlier detection of such a problem.
Syntax:	*set ip-complete-timeout 4. (default is 15) – Value 1-15*
Commands:	*set ip-complete-timeout*
Example 1:	*set ip-complete-timeout 4*
Output 1:	No output for this command

Parameter:	registration-timeout
Full path:	root/cable/registration-timeout
Description:	The command lets the operator control the timeout (in minuets) used before a CM that didn't complete TFTP download of the configuration file and registration will get disconnected. By default this timeout is defined by the DOCSIS spec. to be 15 minuets. In most cases this timeout is to long. When a CM fails TFTP it can usually be as a result of some other systems malfunctions. Reducing this timeout can provide earlier detection of such a problem.
Syntax:	*set registration-timeout 6. (default is 15) – Value 1-15*
Commands:	*set registration-timeout*
Example 1:	*set registration-timeout 6*
Output 1:	No output for this command

root/cable/bpi Directory

Directory:	**bpi**
Directory path:	root/cable/bpi
Description:	Manages the Baseline Privacy tables. When BPI (Base Line Privacy) is enabled, data traffic in the RF channel is encrypted. BPI is enabled on a per CM basis, from the CM configuration file. Refer to the DOCSIS RFI for more details.
Sub Directories:	auth-table, tek-table
Parameters:	set, show, auth-lifetime, tek-lifetime, auth-requests, auth-replies, auth-rejects, auth-invalids
Special Operations:	None

Parameter:	**show**
Full path:	root/cable/bpi/show

Description:	This command displays the auth-lifetime, tek-lifetime, auth-requests, auth-replies, auth-rejects, auth-invalids defined for the cable interface. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	auth-lifetime = 604800 tek-lifetime = 43200 auth-requests = 0 auth-replies = 0 auth-rejects = 0 auth-invalids = 0

Parameter:	**auth-lifetime**
Full path:	root/cable/bpi/auth-lifetime
Description:	The command sets the default lifetime, in seconds, the CMTS assigns to a new authorization key
Syntax:	*set auth-lifetime 604899*
Commands:	*set auth-lifetime 604899*
Example 1:	show auth-lifetime
Output 1:	auth-lifetime = 604899

Parameter:	**tek-lifetime**
Full path:	root/cable/bpi/tek-lifetime
Description:	The command sets the default lifetime, in seconds, the CMTS assigns to a new Traffic Encryption key
Syntax:	*set tek-lifetime 46000*
Commands:	*set tek-lifetime 46000*
Example 1:	show tek-lifetime
Output 1:	tek-lifetime = 46000

Parameter:	**auth-requests**
Full path:	root/cable/bpi/auth-requests
Description:	The command displays the number of times the CMTS has received an Authorization Request message from any CM.
Syntax:	*show auth-requests or show*
Commands:	*show auth-requests*
Example 1:	show auth-requests
Output 1:	auth-requests = 0

Parameter:	**auth-replies**
Full path:	root/cable/bpi/auth-replies
Description:	The command displays the number of times the CMTS has transmitted an Authorization Reply message to any CM.
Syntax:	*show auth-replies or show*
Commands:	*show auth-replies*
Example 1:	show auth-replies
Output 1:	auth-replies = 0

Parameter:	**auth-rejects**
Full path:	root/cable/bpi/auth-rejects

Description:	The command displays the number of times the CMTS has transmitted an Authorization Reject message to any CM.
Syntax:	*show auth-rejects or show*
Commands:	*show auth-rejects*
Example 1:	show auth-rejects
Output 1:	auth-rejects = 0

Parameter:	**auth-invalids**
Full path:	root/cable/bpi/auth-invalids
Description:	The command displays the number of times the CMTS has transmitted an Authorization Invalid message to any CM.
Syntax:	*show auth-invalids or show*
Commands:	*show auth-invalids*
Example 1:	show auth-invalids
Output 1:	auth-invalids = 0

root/cable/bpi/auth-table Directory

Directory:	**auth-table**
Directory path:	root/cable/bpi/auth-table
Description:	Manages the attributes of each CM authorization.
Sub Directories:	None
Commands/Parameters:	set, show, cm-key-seq, cm-expires, cm-lifetime, cm-grace-time, cm-reset, cm-requests, cm-replies, cm-rejects, cm-invalids, reject-error-code, reject-error-string, invalid-error-code, invalid-error-string.
Special Operations:	None

Parameter:	**show**
Full path:	root/cable/bpi/auth-table/show
Description:	This command displays the auth-table parameters. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-key-seq**
Full path:	root/cable/bpi/auth-table/cm-key-seq
Description:	This command displays the authorization key sequence number for this CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-expires**
Full path:	root/cable/bpi/auth-table/cm-expires
Description:	This command displays the actual clock time when the current authorization for this CM expires.

Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-lifetime**
Full path:	root/cable/bpi/auth-table/cm-lifetime
Description:	This command displays lifetime, in seconds, the CMTS assigns to an authorization key for this CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-grace-time**
Full path:	root/cable/bpi/auth-table/cm-grace-time
Description:	This command displays grace time for the authorization key in seconds.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-reset**
Full path:	root/cable/bpi/auth-table/cm-reset
Description:	When setting this command it affects the current CM authorization key.
Syntax:	*set cm-reset 00-30-54-ff-09-96*
Commands:	*set cm-reset 00-30-54-ff-09-96*
Example 1:	show
Output 1:	

Parameter:	**cm-requests**
Full path:	root/cable/bpi/auth-table/cm-requests
Description:	This command displays number of times the CMTS has received an Authorization Request message from this CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-replies**
Full path:	root/cable/bpi/auth-table/cm-replies
Description:	This command displays number of times the CMTS has transmitted an Authorization Request message to this CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-rejects**

Full path:	root/cable/bpi/auth-table/cm-rejects
Description:	This command displays number of times the CMTS has transmitted an Authorization Reject message to this CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**cm-invalids**
Full path:	root/cable/bpi/auth-table/cm-invalids
Description:	This command displays number of times the CMTS has transmitted an Authorization Invalid message to this CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**reject-error-code**
Full path:	root/cable/bpi/auth-table/reject-error-code
Description:	This command displays the enumerated description of the Error-Code in most recent Authorization Reject transmitted to the CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**reject-error-string**
Full path:	root/cable/bpi/auth-table/reject-error-string
Description:	This command displays in most recent Authorization Reject message transmitted to the CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**invalid-error-code**
Full path:	root/cable/bpi/auth-table/invalid-error-code
Description:	This command displays the enumerated description of the Error-Code in most recent Authorization Invalid transmitted to the CM.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**invalid-error-string**
Full path:	root/cable/bpi/auth-table/invalid-error-string
Description:	This command displays in most recent Authorization Invalid message transmitted to the CM.
Syntax:	*show*

Commands:	*show*
Example 1:	show
Output 1:	

root/cable/bpi/tek-table Directory

Directory:	**tek-table**
Directory path:	root/cable/bpi/tek-table
Description:	Manages the attributes of each CM Traffic Encryption Key.
Sub Directories:	None
Commands/Parameters:	set, show, tek-lifetime, tek-grace-time, tek-expires-old, tek-expires-new, tek-reset, key-requests, key-replies, key-rejects, tek-invalids, key-reject-error-code, key-reject-error-string, tek-invalid-error-code, tek-invalid-error-string.
Special Operations:	None

Parameter:	**show**
Full path:	root/cable/bpi/tek-table/show
Description:	This command displays the tek-table parameters. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-lifetime**
Full path:	root/cable/bpi/tek-table/tek-lifetime
Description:	This command displays the lifetime, in seconds, the CMTS assigns to keys for this TEK association.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-grace-time**
Full path:	root/cable/bpi/tek-table/tek-grace-time
Description:	This command displays the grace time in seconds.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-expires-old**
Full path:	root/cable/bpi/tek-table/tek-expires-old
Description:	This command displays the actual clock time for expiration of the immediate predecessor of the most recent TEK.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-expires-new**
Full path:	root/cable/bpi/tek-table/tek-expires-new
Description:	This command displays the actual clock time of the most recent TEK.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-reset**
Full path:	root/cable/bpi/tek-table/tek-reset
Description:	Setting this object to TRUE causes the CMTS to invalidate the current active TEK(s) and to generate a new TEK for the associated SID.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**key-requests**
Full path:	root/cable/bpi/tek-table/key-requests
Description:	This command displays the amount of times the CMTS has received a Key Request message.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**key-replies**
Full path:	root/cable/bpi/tek-table/key-replies
Description:	This command displays the amount of times the CMTS has transmitted a Key Reply message.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**key-rejects**
Full path:	root/cable/bpi/tek-table/key-rejects
Description:	This command displays the amount of times the CMTS has transmitted a Key Rejects message.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-invalids**
Full path:	root/cable/bpi/tek-table/tek-invalids
Description:	This command displays the amount of times the CMTS has transmitted a TEK Invalid message.

Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**key-reject-error-code**
Full path:	root/cable/bpi/tek-table/key-reject-error-code
Description:	This command displays enumerated description of the Error-Code in the most recent Key Reject message sent in response to a Key Request for this BPI SID.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**key-reject-error-string**
Full path:	root/cable/bpi/tek-table/key-reject-error-string
Description:	This command displays the most recent Key Reject message sent in response to a Key Request for this BPI SID.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-invalid-error-code**
Full path:	root/cable/bpi/tek-table/tek-invalid-error-code
Description:	This command displays the Error-Code in the most recent TEK Invalid message sent in association with this BPI SID.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

Parameter:	**tek-invalid-error-string**
Full path:	root/cable/bpi/tek-table/tek-invalid-error-code
Description:	This command displays the most recent TEK Invalid message sent in association with this BPI SID.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

root/cable/downstream Directory

Directory:	**downstream**
Directory path:	root/cable/downstream
Description:	Manages downstream interface commands and statistics.
Sub Directories:	None
Commands/Parameters:	set, show, set-all, admin-status, channel-id, frequency, width, modulation-type, interleave, annex

Special Operations:	None

Parameter:	**show**
Full path:	root/cable/downstream/show
Description:	The command displays the status, channel-id, frequency, width, modulation, interleave and annex defined for the downstream channel. The descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	description = DOCSIS 30.34 Mbps admin-status = up(1) channel-id = 128 frequency = 0 width = 6000000 modulation-type = qam64(3) interleave = taps32Increment4(5) annex = annexB(4) registered-cms = 30 active-cms = 20 average-bitrate = 1327

Command:	**set-all**
Full path:	root/cable/downstream/set-all
Description:	The command can be used as a single command to configure all downstream parameters.

When performing the set-all command your downstream signal will be down. Modems will not stay connected

Syntax:	*set-all* - Values are described below.
Commands:	*set-all*
Example 1:	set-all
Output 1:	wait while settings admin status down... frequency = 0 ->> modulation-type = 4 ->> interleave = 5 ->> etc...

Parameter:	**admin-status**
Full path:	root/cable/downstream/admin-status
Description:	The command defines the administration status of the downstream interface.

Setting the admin-status to 2 does affect your downstream signal. Modems will not stay connected until you set admin-status 1

Syntax:	*set admin-status* 2 - Value 1 = up and 2 = down
Commands:	*set admin-status 2*

Example 1:	show admin-status
Output 1:	admin-status = down(2)

Parameter:	**channel-id**
Full path:	root/cable/downstream/admin-status
Description:	The command displays the downstream channel identifier (ID)
Syntax:	*show channel-id*
Commands:	*show channel-id or show*
Example 1:	show channel-id
Output 1:	channel-id = 128

Parameter:	**frequency**
Full path:	root/cable/downstream/frequency
Description:	Actual RF frequency is set by the up converter connected to the CMTS. This parameter is used for management purposes only, and can be used by the management system to support load-balancing between different CMTS by adding this value to the CM configuration file.
Syntax:	*set frequency 363000000* - Value - 0..1000000000
Commands:	*set frequency 363000000*
Example 1:	show frequency
Output 1:	frequency = 363000000

Parameter:	**width**
Full path:	root/cable/downstream/width
Description:	The command displays the downstream channel bandwidth in Hz. The downstream channel width is read-only and is automatically set by the CMTS according to the downstream module used (DOCDIS or EuroDOCSIS).
Syntax:	*show width*
Commands:	*show width or show*
Example 1:	show width
Output 1:	width = 6000000

Parameter:	**modulation-type**
Full path:	root/cable/downstream/modulation-type
Description:	The command defines modulation type, 64QAM or 256QAM.

Setting the modulation-type does affect your downstream signal. Modems will not stay connected.

Syntax:	*set modulation-type 4* - Value 3 = 64QAM and 4 = 256QAM
Commands:	*set modulation-type 4*
Example 1:	show modulation-type
Output 1:	modulation-type = qam256(4)

Parameter:	**interleave**
Full path:	root/cable/downstream/interleave

Description:	The interleave value can be changed only in DOCSIS. For Euro-DOCSIS CMTS the CMTS will automatically set this value (to 8). For DOCSIS CMTS it will use the configuration file supplied value. If this value is out of range it will automatically set it to (5). This value was tested to perform best on most cases. See Appendix E for more detailed explanation.

Setting the interleave changes timing on downstream flow. Modems will have to reconnect.

Syntax:	*set interleave 3-8* - Value - Default is 32 (5) - Values are defined as follows: taps8Increment16(3) taps16Increment8(4): taps32Increment4(5): taps64Increment2(6): taps128Increment1(7):
Commands:	*set interleave 5*
Example 1:	show interleave
Output 1:	interleave = taps32Increment4(5)

Parameter:	**annex**
Full path:	root/cable/downstream/annex
Description:	The command displays the annex type used on the downstream channel.
Syntax:	*show annex*
Commands:	*show annex or show*
Example 1:	show annex
Output 1:	annex = annexB(4)

Parameter:	**registered-cms**
Full path:	root/cable/downstream/registered-cms
Description:	This displays the number of cable modems currently registered on this downstream.
Syntax:	*show registered-cms*
Commands:	*show registered-cms or show*
Example 1:	show registered-cms
Output 1:	registered-cms = 30

Parameter:	**active-cms**
Full path:	root/cable/downstream/active-cms
Description:	This displays the number of cable modems that requested data grants in the past 60 seconds on this downstream.
Syntax:	*show active-cms*
Commands:	*show active-cms or show*
Example 1:	show active-cms
Output 1:	active-cms = 20

Parameter:	**average-bitrate**
Full path:	root/cable/downstream/average-bitrate

Description:	This displays the calculated average bitrate on this downstream based on samples taken on a periodic basis.
Syntax:	*show average-bitrate*
Commands:	*show average-bitrate or show*
Example 1:	show average-bitrate
Output 1:	average-bitrate = 1327

root/cable/modulation Directory

Directory:	**modulation**
Directory path:	root/cable/modulation
Description:	Manages the modulation profiles. The modulation profile is transferred in the UCD message and is used by both the CM and the CMTS to be able to communicate properly in the upstream.
Sub Directories:	None
Commands/ Parameters:	show, set, set-all, add, del, index, iuc, control, type, preamble-start, preamble-len, diff-encode, fec-error-cor, fec-code-len, scrambler-seed, max-burst-size, last-code-word, scrambler
Special Operations:	None

Only experts should try to change settings in the modulation profile table. Applying improper values will result in bad system performance in the best case and non-working system in the worst case.

Parameter:	**show**
Full path:	root/cable/upstream/show
Description:	The command displays the all modulation profiles defined. The show command can be used with the modulation profile to only display the modulation profile desired. The lines display the IUC (Interval Usage Codes) and each value related to the IUC. The text wraps to the next line. There are two modulation profiles provided by default. The descriptions are explained below.
Syntax:	*show mp1-mp8or show*
Commands:	*show mpx (where x is the number of the modulation profile defined)*
Example 1:	show mp1
Output 1:	

modulation profile - 1
==========

iuc	control	type	pre-start	pre-len
request(1)	active(1)	qpsk(2)	56	64
initial ranging(3)	active(1)	qpsk(2)	0	128
periodic ranging(4)	active(1)	qpsk(2)	0	128
short data(5)	active(1)	qpsk(2)	48	72
long data(6)	active(1)	qpsk(2)	40	80

diff-encode	fec-err-cor	fec-code-len	scram-seed	max-burst	last-cw	scrambler

false (2)	0	16	338	0	false(2)	true (1)
false (2)	5	34	338	64	false(2)	true (1)
false (2)	5	34	338	100	false(2)	true (1)
false (2)	5	75	338	32	false(2)	true (1)
false (2)	8	220	338	240	false(2)	true (1)

modulation profile - 2

iuc	control	type	pre-start	pre-len
request(1)	active(1)	qam16(3)	688	64
initial ranging(3)	active(1)	qam16(3)	640	128
periodic ranging(4)	active(1)	qam16(3)	640	128
short data(5)	active(1)	qam16(3)	680	72
long data(6)	active(1)	qam16(3)	672	80

diff-encode	fec-err-cor	fec-code-len	scram-seed	max-burst	last-cw	scrambler
false (2)	0	16	338	0	false (2)	true (1)
false (2)		5	34	338	0	false (2)	true (1)
false (2)		5	34	338	0	false (2)	true (1)
false (2)		5	75	338	14	false (2)	true (1)
false (2)	8	220	338	0	false (2)	true (1)

Parameter:	**add**
Full path:	root/cable/modulation/add
Description:	This command is used to add a modulation profile. QPSK and QAM16 can be selected.
Syntax:	*add qpsk* - Value – QPSK or QAM16
Commands:	*add qpsk*
Example 1:	show mp3
Output 1:	

modulation profile - 3

iuc	control	type	pre-start	pre-len
request(1)	active(1)	qpsk(2)	56	64
initial ranging(3)	active(1)	qpsk(2)	0	128
periodic ranging(4)	active(1)	qpsk(2)	0	128
short data(5)	active(1)	qpsk(2)	48	72
long data(6)	active(1)	qpsk(2)	40	80

diff-encode	fec-err-cor	fec-code-len	scram-seed	max-burst	last-cw	scrambler
false (2)	0	16	338	0	false(2)	true (1)
false (2)	5	34	338	64	false(2)	true (1)
false (2)	5	34	338	100	false(2)	true (1)
false (2)	5	75	338	32	false(2)	true (1)
false (2)	8	220	338	240	false(2)	true (1)

Parameter:	**set-all**
Full path:	root/cable/modulation/set-all
Description:	This command is used to set the profile related to each Interval Usage Code (IUC) for a specified modulation profile. Errors or incompatible configurations in the profile(s) cause modems to drop connectivity, drop short or long data packets, or fail to connect to the network. You cannot use the set-all command if the modulation profile is used by an active upstream channel. You must create a new modulation with the add command or set the admin-status of the upstream channels that use this profile to down.
Syntax:	*set-all mp5 3 (1st number is Profile, 2nd number is IUC)* - Value – mp1 through mp8 profiles are available. IUC values are mp1, mp2, mp3, mp4, mp5, mp6, mp7, mp8.
Commands:	*set-all mp5 3*
Example 1:	set-all mp5 3
Output 1:	control = 1 -> modulation-type = 3 ->
preamble-len = 128 ->
differential-encoding = 2 ->
fec-error-correction = 5 ->
fec-codeword-length = 34 ->
scrambler-seed = 338 ->
max-burst-size = 0 ->
last-codeword-shortened = 2 ->
scrambler = 1 ->

Parameter:	**del**
Full path:	root/cable/modulation/del
Description:	This command is used to delete a modulation profile.
Syntax:	*del mp1-mp8* - Value – mp1 through mp8 profiles are available.
Commands:	*del mp 5*
Example 1:	show mp5
Output 1:	(no output will be shown, it is deleted)

Parameter:	**index**
Full path:	root/cable/modulation/index
Description:	This displays the index of the modulation profile. This is a display only.
Syntax:	*N/A* - Value N/A.
Commands:	*show or show mp1 – mp8*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**iuc**
Full path:	root/cable/modulation/iuc

Description: This displays the Interval Usage Code of the modulation profile. IUC is defined as a code that defines the usage of the packet/field. This is a display only.

Syntax: *N/A*
- Valid entries are:
  - request(1)
  - initial ranging(3)
  - periodic ranging(4)
  - short data(5)
  - long data(6).

Commands: *show or show mp1 – mp8*

Example 1: show

Output 1: See show command previously displayed.

Parameter: **control**

Full path: root/cable/modulation/control

Description: This displays the profile entry status

Syntax: *show*

Commands: *show or show mp1 –mp8*

Example 1: show

Output 1: See show command previously displayed.

Parameter: **type**

Full path: root/cable/modulation/type

Description: This command sets the modulation type of the IUC for the selected profile. Selections are QPSK(2) or QAM16(3).

Syntax: *set type mp2 1 1 (setting the request to QPSK)*
- Values - QPSK(2) or QAM16(3)

Commands: *set type mp2 1 1 or set-all mp2 1*

Example 1: show

Output 1:

iuc	control	type	pre-start	pre-len
request(1)	active(1)	qpsk(2)	688	64
initial ranging(3)	active(1)	qam16(3)	640	128
periodic ranging(4)	active(1)	qam16(3)	640	128
short data(5)	active(1)	qam16(3)	680	72
long data(6)	active(1)	qam16(3)	672	80

Parameter: **preamble-start**

Full path: root/cable/modulation/preamble-start

Description: This command displays the preamble start offset of the IUC in this profile. The preamble start is read-only.

Syntax: show

Commands: *show*

Example 1: show

Output 1: See show command previously displayed.

Parameter: **preamble-len**

Full path: root/cable/modulation/preamble-len

Description:	This command set the preamble length for this modulation profile in bits.
Syntax:	*set-all mp2 3* - Value 0 – 1024. Default value is the minimum needed by the implementation of the CMTS for the given modulation profile.
Commands:	*set preamble-len mp2 3 or set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**diff-encode**
Full path:	root/cable/modulation/diff-encode
Description:	This command enables or disables differential encoding for this modulation profile.
Syntax:	*set-all 5 3* - Value True (1) and False(2). Default value is False(2)
Commands:	set diff-encode mp2 3 1*set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**fec-error-cor**
Full path:	root/cable/modulation/fec-error-cor
Description:	This command determines the number of bytes that can be corrected per FEC (Forward Error Correction) code word. FEC is defined as a system of error control for data transmission wherein the receiving device has the capability to detect and correct any character or code block that contains fewer than a predetermined number of symbols in error. FEC is accomplished by adding bits to each transmitted character or code block, using a predetermined algorithm.
Syntax:	*set-all mp2 3* - Value 0 – 10. Default value is the minimum needed by the implementation of the CMTS for the given IUC in the modulation profile.
Commands:	*set fec-error-cor mp2 3 10 or set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**fec-code-len**
Full path:	root/cable/modulation/fec-code-len
Description:	This command determines the FEC code word length.
Syntax:	*set-all mp2 3* - Value 0 – 235. Default value is the minimum needed by the implementation of the CMTS for the given IUC in the modulation profile.
Commands:	*set fec-code-len mp2 3 32 or set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**scrambler-seed**
Full path:	root/cable/modulation/scrambler-seed

Description:	This command determines Scrambler Seed for the given IUC in the modulation profile. The seed value is used to calculate the scrambler bit.
Syntax:	*set-all mp2 3* - Value 0 – 32767. Default value is the 338
Commands:	*set scrambler-seed mp2 3 512 or set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**max-burst-size**
Full path:	root/cable/modulation/max-burst-size
Description:	This command determines burst length for the given IUC in the modulation profile. A burst length of 0 mini-slots in the Channel Profile means that the burst length is variable (no limit) on that channel for that burst type.
Syntax:	*set-all mp2 3* - Value 0 – 255. Default value is the minimum needed by the implementation of the CMTS for the given IUC in the modulation profile.
Commands:	*set max-burst-size mp2 3 128 or set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**last-code-word**
Full path:	root/cable/modulation/last-code-word
Description:	This command determines FEC last codeword mode for the given IUC in the modulation profile. Determines if the FEC last codeword mode is shortened or fixed.
Syntax:	*set-all mp2 3* - Value True(1) and False(2). Default value is False(2)
Commands:	*set fec-code-len mp2 3 1 or set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

Parameter:	**scrambler**
Full path:	root/cable/modulation/scrambler
Description:	This command determines scrambler status for the given IUC in the modulation profile. Turning the scrambler off can cause packet loss and disabling the scrambler should only be used in lab testing.
Syntax:	*set-all mp2 3* - Value True(1) and False(2). Default value is False(2)
Commands:	*set fec-code-len mp2 3 1 or set-all mp2 3*
Example 1:	show
Output 1:	See show command previously displayed.

root/cable/upstream Directory

Directory:	**upstream**
Directory path:	root/cable/upstream

Description:	Manages the upstream group parameters.
Sub Directories:	group
Parameters:	set, show, set-all, admin-status, channel-id, frequency, width, modulation-profile, slot-size, rx-backoff-start, rx-backoff-end, tx-backoff-start, tx-backoff-end, group-id, registered-cms, active-cms, average-bitrate, automatic-iri, nominal-rx-power, rx-tolerance
Special Operations:	None

Parameter:	**show**
Full path:	root/cable/upstream/show
Description:	The command displays the upstream channel configuration, the descriptions are explained below.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

channel-id	admin-status	frequency	width	modulation-profile	slot-size
1	up	21000000	3200000	1	8
2	up	13000000	3200000	1	8
3	down	17000000	1600000	1	8
4	down	29000000	3200000	2	8
5	down	25000000	3200000	1	8
6	down	5000000	3200000	1	8
7	down	33000000	3200000	1	8
8	down	37000000	3200000	1	8

rx-backoff-start	rx-backoff-end	tx-backoff-start	tx-backoff-end	group-id
1	3	2	9	0
1	3	2	9	0
1	3	2	9	0
1	3	2	9	0
1	3	2	9	0
1	3	2	9	0
1	3	2	9	0
1	3	2	9	0

snr	registered cms	active cms	average bitrate	automatic iri	nominal rx-power	rx tolerance	
24	0	0	988	1	0	2	
27	28	0	657	1	0	2	
0	0	0		0	1	0	2
0	0	0		0	1	10	6
0	0	0		0	1	0	2
0	0	0		0	1	0	2
0	0	0		0	1	0	2
0	0	0		0	1	0	2

Parameter:	**set-all**
Full path:	root/cable/upstream/group/set-all
Description:	The command defines the group status of the upstream interface.

When performing the set-all command your upstream channel will be down. Modems must reconnect.

Syntax:	*set-all 3* - Value 1 – 8 (for upstream channel)
Commands:	*set- all 3*
Example 1:	set-all 3
Output 1:	frequency = 17000000 -> width = 3200000 -> modulation-profile = 1 -> rx-backoff-start = 1 -> rx-backoff-end = 3 -> tx-backoff-start = 2 -> tx-backoff-end = 9 -> group-id = 0 -> automatic-iri = 1 -> nominal-rx-power = 0 -> rx-tolerance = 2 ->

Parameter:	**admin-status**
Full path:	root/cable/upstream/admin-status
Description:	The command defines the administration status of the upstream interface.
Syntax:	*set admin-status 6 1 (sets admin up for upstream 6)* - Value up(1) and down(2)
Commands:	*set admin-status 6 1*
Example 1:	show admin-status
Output 1:	admin-status = up(1)

Parameter:	**channel-id**
Full path:	root/cable/upstream/admin-status
Description:	The command displays the upstream channel identifier (ID)
Syntax:	*show channel-id*
Commands:	*show channel-id or show*
Example 1:	show channel-id
Output 1:	channel-id = 128

Parameter:	**frequency**
Full path:	root/cable/upstream/frequency
Description:	The command defines the frequency used in Hertz.
Syntax:	*set frequency 3 29000000 (sets upstream 3 to 29Mhz)* - Value 5 - 42000000
Commands:	*set frequency 3 29000000*
Example 1:	show

Output 1:	See show command above

When frequencies are programmed to the same frequency Load Balancing will be disabled for those channels.

Parameter:	**width**
Full path:	root/cable/upstream/width
Description:	This specifies the bandwidth for the upstream channel. See Appendix E for more information.
Syntax:	*set width 3 1600000*
Commands:	*set width 3 1600000 or set-all 3*
Example 1:	show
Output 1:	See show command above

Parameter:	**modulation-profile**
Full path:	root/cable/upstream/modulation-profile
Description:	The command defines the index of the modulation profiles used by the upstream channel. The modulation profiles are located in >root/cable/modulation directory.
Syntax:	*set modulation-profile 4 2(sets upstream 4 to 16QAM)* - Value 1 = QPSK and 2 = 16QAM
Commands:	*set modulation-profile 4 2 or set-all 4*
Example 1:	show
Output 1:	See show command above

Parameter:	**slot-size**
Full path:	root/cable/upstream/slot-size
Description:	The command sets the upstream slot size in mini-slots.
Syntax:	*set slot-size 1 8*
Commands:	*set slot-size 1 8*
Example 1:	show
Output 1:	See show command above

Parameter:	**rng-backoff-start**
Full path:	root/cable/upstream/rng-backoff-start
Description:	The command defines the initial random backoff window to use when retrying Ranging Requests.
Syntax:	*set rng-backoff-start 4 4 (define channel & value)* - Value 0-15 and default = 2
Commands:	*set rng-back-off-start 4 4*
Example 1:	show
Output 1:	See show above.

Parameter:	**rng-backoff-end**
Full path:	root/cable/upstream/rng-backoff-end
Description:	The command defines the final random backoff window to use when retrying Ranging Requests.
Syntax:	*set rng-backoff-end 4 7(define channel & value)* - Value 0-15 and default 3
Commands:	*set rng-back-off-start 4 7*
Example 1:	show

Output 1:	See show above.

Parameter:	**tx-backoff-start**
Full path:	root/cable/upstream/tx-backoff-start
Description:	The command defines the initial random backoff window to use when retrying Data Requests.
Syntax:	*set tx-backoff-start 4 4 (define channel & value)* - Value 0-15 and default 2
Commands:	*set tx-back-off-start 4 4*
Example 1:	show
Output 1:	See show above.

Parameter:	**tx-backoff-end**
Full path:	root/cable/upstream/tx-backoff-end
Description:	The command defines the final random backoff window to use when retrying Data Requests.
Syntax:	*set rx-backoff-end 4 13(define channel & value)* - Value 0-15 and default 9
Commands:	*set tx-backoff-start 4 13*
Example 1:	show
Output 1:	See show above.

Parameter:	**group-id**
Full path:	root/cable/upstream/group-id
Description:	The command defines group identifier for this upstream channel. Groups are identified in the >root/cable/upstream/groups directory
Syntax:	*set group-id 4 1(define upstream channel & group number)* - Value 0-4 and default 0
Commands:	*set group-id 4 1*
Example 1:	show
Output 1:	See show above.

Parameter:	**registered-cms**
Full path:	root/cable/upstream/registered-cms
Description:	This displays the number of Cable Modems currently registered per upstream channel.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show above.

Parameter:	**active-cms**
Full path:	root/cable/upstream/active-cms
Description:	This displays the number of Cable Modems currently active per upstream channel. This is defined as the number of CMs that have requested data grants in the past 60 seconds.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show above.

Parameter:	**average-bitrate**
Full path:	root/cable/upstream/average-bitrate
Description:	The calculated average bit-rate on the specified upstream channel.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show above.

Parameter:	**automatic-iri**
Full path:	root/cable/upstream/automatic-iri
Description:	The command disables or enables this feature for the defined upstream channel. Automatic IRI stands for Automatic Initial Ranging Interval. The CMTS uses this Ranging Interval (also referred as 'Insertion interval') to determine how long to wait before granting a Broadcast Ranging Opportunity in the MAP messages. If this insertion interval is 100 the CMTS will give this opportunity 1 time a second. Cable modems must use this opportunity to do the initial ranging. When many modems try to connect at the same time they will collide and use their back-offs mechanisms so statistically eventually they will reach the CMTS without collision. After reaching the CMTS at a readable power level, the CMTS will grant Unicast ranging opportunities for each modem and the Broadcast Opportunity will not be used (just for new modems or modems that reset). When the CMTS starts running (after reboot) there's a high chance that many modems will try to join in the same time. When the auto-IRI enabled, the CMTS will use IRI=5 instead of the configured number. (20 opportunities a second). As time goes by the CMTS will increase this value to the configured one. (Insertion Interval in the CMTS configuration file editor, or insert-interval under cable in the CLI).
Syntax:	*set automatic-iri 4 01(define channel & value)* - Value 0 = disabled and enabled =1, Default = 1
Commands:	*set automatic-iri 4 1*
Example 1:	show
Output 1:	See show above.

Parameter:	**nominal-rx-power**
Full path:	root/cable/upstream/nominal-rx-power
Description:	The command defines the receive nominal power level at the CMTS. The CMTS will direct the CM to reach the CMTS at this level. The high range for this value is Symbol Rate dependant, and is taken from the DOCSIS specification. The CMTS will also allow controlling the tolerance allowed to succeed ranging. When using low values the SNR may go down. Default is 0. Nominal-Rx-Level – valid values are:

Symbol	Low	high

Rate		
1.28	-28 dBmV	23 dBmV
2.56	-28 dBmV	26 dBmV

Syntax:	*set nominal-rx-power 4 10(define upstream channel & nominal power level)* - Value -7 – 26 dBmV
Commands:	*set nominal-rx-power 4 10*
Example 1:	show
Output 1:	See show above.

Each upstream can be configured to use it's own levels. When possible, it is best to leave the default values as is. If the RF network is balanced these setting will achieve best performance in the CMTS receiver.

Parameter:	**rx-tolerance**
Full path:	root/cable/upstream/rx-tolerance
Description:	The command defines the difference from the nominal power level where the CMTS will accept the cable modem ranging. The tolerance the CMTS is using is 2 dB (A CM can reach the CMTS at the range –2 to 2 dBmV). CM that cannot achieve these restrictions will fail ranging. For some network scenarios these restrictions will cause some modems to fail connection.
Syntax:	set rx-tolerance 4 6 (define upstream channel & tolerance) - *Value 0 - 6*
Commands:	*set rx-tolerance 4 6*
Example 1:	show
Output 1:	See show above.

root/cable/upstream/group Directory

Directory:	**group**
Directory path:	root/cable/upstream/group
Description:	Manages upstream interface commands and statistics.
Sub Directories:	None
Parameters:	show, set, group-status, lb-method, lb-on-join, lb-on-timer, cm-min-threshold, br-min-threshold
Special Operations:	None

When frequencies are programmed to the same frequency Load Balancing will be disabled for those channels.

Parameter:	**show**
Full path:	root/cable/upstream/group/show
Description:	The command displays the upstream group configuration, the descriptions are explained below.

Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

group-id	group-status	lb-method	lb-on-join	lb-on-timer	cm-min-threshold	br-min threshold
1	inactive(0)	on-join(1)		registered-cms(2)	active-cms(3)	2 50000
2	inactive(0)	on-join(1)		registered-cms(2)	active-cms(3)	2 50000
3	inactive(0)	on-join(1)		registered-cms(2)	active-cms(3)	2 50000
4	inactive(0)	on-join(1)		registered-cms(2)	active-cms(3)	2 50000

Parameter:	**group-status**
Full path:	root/cable/upstream/group/group-status
Description:	The command defines the group status.
Syntax:	*set group-status* 4 2 - Value (1-4 group ID & (Value inactive(0) - load-balancing(2))
Commands:	*set group-status 4 2*
Example 1:	show group-status
Output 1:	group-status 4 = load-balancing(2)

Parameter:	**lb-method**
Full path:	root/cable/upstream/group/lb-method
Description:	The command defines the method to perform load balancing on the group interface selected.
Syntax:	*set lb-method* 4 3 - Value (1-4 group ID & (Value on-join(1) - on-timer(2) - both(3)
Commands:	*set lb-method 4 3*
Example 1:	show lb-method
Output 1:	lb-method 4 = both(3)

Parameter:	**lb-on-join**
Full path:	root/cable/upstream/group/lb-on-join
Description:	This command determines the method used to select a best upstream when a CM is joining the CMTS. If lb-on-join is registered CM the best upstream is defined to be the upstream with the least number of registered CMs. If the method selected is active CM, then the best upstream is defined to be the one with the least number of active CM. If the method is bit-rate then the best upstream is the one with the lower average bit rate. The Joining CM will be directed to the best available upstream in the group according to the selected method.
Syntax:	*set lb-on-join* 4 2 - Value (1-4 group ID & Value bit-rate(1) - registered-cms(2) - active-cms(3)

Commands:	*set lb-on-join 4 2*
Example 1:	show lb-on-join 4
Output 1:	lb-on-join 4 = registered-cms(2)

Parameter:	**lb-on-timer**
Full path:	root/cable/upstream/group/lb-on-timer
Description:	This command defines the method for the best upstream selection used when performing the periodical load-balancing.
Syntax:	*set lb-on-timer* 4 2 - Value (1-4 group ID & Value bit-rate(1) - registered-cms(2) - active-cms(3)
Commands:	*set lb-on-timer 4 2*
Example 1:	show lb-on-timer 4
Output 1:	lb-on-timer 4 = registered-cms(2)

Parameter:	**cm-min-threshold**
Full path:	root/cable/upstream/group/cm-min-threshold
Description:	The command defines the threshold (between the number of registered modems on one upstream and the number of registered modems on the second upstream channel) to consider an upstream channel as a valid target for channel change on the selected group interface. The algorithm specifies if one of the other upstreams in this group has a number of connected modems that is smaller then upstream Y by at least X (X is the threshold) then direct this modem to move from channel Y to the most free upstream channel within the group.
Syntax:	*set cm-min-threshold* 2 10 - Value (1-4 group ID & Value 2- 20)
Commands:	*set cm-min-threshold 2 10*
Example 1:	show cm-min-threshold 2
Output 1:	cm-min-threshold = 10

Parameter:	**br-min-threshold**
Full path:	root/cable/upstream/group/br-min-threshold
Description:	The command defines the threshold (bits per second -bps) to consider an upstream channel as a valid target for channel change on the selected group interface.
Syntax:	*set br-min-threshold* 2 60000 - Value (1-4 group ID & Value 50000- 100000)
Commands:	*set br-min-threshold 2 60000*
Example 1:	show br-min-threshold 2
Output 1:	br-min-threshold = 60000

Example of Setting up a group:

```
/root/cable/upstream/group/>set group-status 1 ?    // set group status of group 1 and options are:
                                                       inactive(0)
                                                       load-balancing(2)
/root/cable/upstream/group/>set group-status 1 2    // we set group 1 to load-balancing
/root/cable/upstream/group/>set lb-method 1 ?         // set load balancing method of group 1 and options
                                                       are:
                                                       on-join(1)
```

on-timer(2)
both(3)

```
/root/cable/upstream/group/>set lb-method 1 3          // we set the method of group 1 to 3 (both)
/root/cable/upstream/group/>set lb-on-join 1 ?         // the on-join best upstream will be according to:
                                                       bit-rate(1)
                                                       registered-cms(2)
                                                       active-cms(3)
/root/cable/upstream/group/>set lb-on-join 1 2         // registered cms
/root/cable/upstream/group/>set lb-                    //TAB Completion Example
                                                       lb-method
                                                       lb-on-join
                                                       lb-on-timer
/root/cable/upstream/group/>set lb-on-timer 1 ?        // the on-timer best upstream will be according to:
                                                       bit-rate(1)
                                                       registered-cms(2)
                                                       active-cms(3)
/root/cable/upstream/group/>set lb-on-timer 1 3        // active cms
/root/cable/upstream/group/>set cm-min-threshold 1 ?  // the threshold for best upstream  2..20
/root/cable/upstream/group/>set cm-min-threshold 1 2  // 2 modems difference
/root/cable/upstream/group/>set br-min-threshold 1 50000  //If we use bit-rate then it will be meaningful
                                                       50000..1000000
/root/cable/upstream/group/>show
```

group-id	group-status	lb-method	lb-on-join	lb-on-timer	cm-min-threshold	br-min-threshold
1	load-balancing(2)	both(3)	registered-cms(2)	active-cms(3)	2	50000
2	inactive(0)	both(3)	registered-cms(2)	active-cms(3)	2	50000
3	inactive(0)	both(3)	registered-cms(2)	active-cms(3)	2	50000
4	inactive(0)	both(3)	registered-cms(2)	active-cms(3)	2	50000

```
/root/cable/upstream/group/>cd ..
/root/cable/upstream/>show          //BEFORE WE CHOOSE A SPECIFIC UPSTREAM CHANNEL
```

channel-id	admin-status	frequency	width	modulation-profile	slot-size
1	up	21000000	3200000	1	8
2	up	25000000	3200000	1	8
3	down	29000000	3200000	1	8
4	down	33000000	3200000	1	8
5	down	37000000	3200000	1	8
6	down	41000000	3200000	1	8
7	down	5000000	3200000	1	8
8	down	9000000	3200000	1	8

rx-backoff-start	rx-backoff-end	tx-backoff-start	tx-backoff-end	group-id

```
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
```

snr	registered cms	active cms	average bitrate	automatic iri	nominal rx-power	rx tolerance	
24	40	30		988	1	0	2
27	20	6	657	1	0	2	
0	0	0		0	1	0	2
0	0	0		0	1	10	6
0	0	0		0	1	0	2
0	0	0		0	1	0	2
0	0	0		0	1	0	2
0	0	0		0	1	0	2

```
/root/cable/upstream/>set group-id 1 ?    // we here tell upstream 1 to belong to group 1  0..4
/root/cable/upstream/>set group-id 1 1
/root/cable/upstream/>set group-id 2 1   // we here tell upstream 2 to belong to group 1
/root/cable/upstream/>show
```

channel-id	admin-status	frequency	width	modulation-profile	slot-size
1	up	21000000	3200000	1	8
2	up	25000000	3200000	1	8
3	down	29000000	3200000	1	8
4	down	33000000	3200000	1	8
5	down	37000000	3200000	1	8
6	down	41000000	3200000	1	8
7	down	5000000	3200000	1	8
8	down	9000000	3200000	1	8

```
rx-backoff-start   rx-backoff-end   tx-backoff-start   tx-backoff-end  group-id
----------------   --------------   ----------------   --------------  --------
1                3                2                9                1
1                3                2                9                1
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
1                3                2                9                0
```

snr	registered cms	active cms	average bitrate	automatic iri	nominal rx-power	rx tolerance	
24	31	18		988	1	0	2
27	29	18		657	1	0	2

0	0	0	0	1	0	2
0	0	0	0	1	10	6
0	0	0	0	1	0	2
0	0	0	0	1	0	2
0	0	0	0	1	0	2
0	0	0	0	1	0	2

root/debug Directory

Directory:	**debug**
Directory path:	root/debug
Description:	Directory for debug tools. Debug tools can only be use while serial connected to the CMTS. You cannot use the debug command via telnet.
Sub Directories:	None
commands:	dump-map, dump-ucd, debug-cm, debug-cm-syslog, debug-dhcp-drops
Special Operations:	None

Parameter:	**dump-map**
Full path:	root/debug/dump-map
Description:	The command displays/dumps an upstream map.
Syntax:	*dump-map 1*
Commands:	*dump-map 1*
Example 1:	dump-map 1
Output 1:	======= MAP Dump current count 4524786 (0x450af2) c2 00 00 34 ff ff Management Hdr ---------- DA = 01 e0 2f 00 00 01 SA = 00 01 cb 28 00 12 LEN:022 DSAP:00 SSAP:00 Ctl:03 Ver:01 Type:03 rsvd:00 MAP Hdr ---------- US:1 UCD:1 Elem:3 Rsvd:0 Alloc Start 06450b40 Ack Time 0644bd1f RngStart:1 RngEnd:3 DataStart:2 DataEnd9 IE 0 : SID:0x3fff IUC:0x01 Offset:0x 0 IE 1 : SID:0x3fff IUC:0x01 Offset:0x 1 IE 2 : SID:0x 0 IUC:0x07 Offset:0x 78

Parameter:	**dump-ucd**
Full path:	root/debug/dump-ucd
Description:	The command displays an upstream UCD (Upstream Channel Descriptor) info.
Syntax:	*dump-ucd 1*
Commands:	*dump-ucd 1*
Example 1:	dump-ucd
Output 1:	us-channel-id = 1 ds-channel-id = 128 mini-slot-size = 8 ucd-count = 1

frequency = 9000000
symb-rate = 16

Parameter:	**debug-cm**
Full path:	root/debug/debug-cm
Description:	The command tells the CMTS to display information about specific cable modem to the console. Only one CM can be debugged at the same time.
Parameters:	Off – turns off cm debugging Rng – will show ranging information on the CM. Reg – will show registration information on this CM. Dhcp – will show DHCP information on this CM. Sm – will show station maintenance grants issued for this CM. All – will show all of the above for this CM.
Syntax:	*debug-cm all 172.0.11.12 or debug-cm all 00-30-54-ff-ce-96*
Commands:	*debug-cm all 00-30-54-ff-ce-96*
Example 1:	debug-cm all 00-30-54-ff-ce-96
Output 1:	

Issue SM Sid=0x3 Channel=1 00:30:54:FF:CE:96
Station Ranging Received on channel 1 payload-sid=0x3MAC:00:30:54:FF:CE:96
Ranging Response Chan=1 Sid=0x3 MAC:00:30:54:FF:CE:96 Status=3, Adjs: Power(dBmV)=0.00 Freq=0 Time=-1

Parameter:	**debug-cm-syslog**
Full path:	root/debug/debug-cm-syslog
Description:	The command displays/dumps the syslog messages generated by the CM to the console. The purpose of this feature is to enable the operator on the setup phase (before the EMS or the syslog server is installed) to view the CM syslog messages.
Syntax:	*debug-cm-syslog on /off*
Commands:	*debug-cm-syslog on*
Example 1:	debug-cm-syslog on
Output 1:	

Parameter:	**debug-dhcp-drops**
Full path:	root/debug/debug-dhcp-drops
Description:	The command display messages generated by the DHCP monitor to the console triggered by illegal DHCP messages detected by this module. The purpose of this feature is to provide the operator detailed information on the DHCP activity. Enable this command when encountering DHCP problems to learn if the source of the problem is the DHCP monitor. Turn off this feature when debug is over as it can generate many messages to the CMTS console.
Syntax:	*debug-dhcp-drops on / off*
Commands:	*debug-dhcp-drops on*
Example 1:	debug-dhcp-drops off
Output 1:	

root/ethernet Directory

Directory:	**ethernet**
Directory path:	root/ethernet
Description:	Displays Ethernet MAC address
Sub Directories:	None
Parameters:	show
Special Operations:	None

Parameter:	**show**
Full path:	root/ ethernet/show
Description:	This command displays the NSI Ethernet MAC address.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	physical-address = 00-01-cb-20-00-12

root/interfaces Directory

Directory:	**interfaces**
Directory path:	root/interfaces
Description:	Displays all interface statistics.
Sub Directories:	None
Parameters:	show, description, type, mtu, speed, physical-address, admin-status, operation-status, last-change, rx-bytes, rx-pkts, rx-discards, rx-errors, tx-bytes, tx-pkts, tx-discards, tx-errors.
Special Operations:	None

Parameter:	**show**
Full path:	root/ interfaces/show
Description:	This command displays all the interface statistics. You can enter the interface index/description as to display a specific interface. Interfaces are described as upstream1 – upstream8, mac and Ethernet. Index 1 through 8 are equal to upstream1 – upstream8, Index 9 is equal to mac and Index 10 is equal to Ethernet.
Syntax:	*show or show mac*
Commands:	*show or show mac or show upstream1 – upstream8, show downstream, show ethernet*
Example 1:	show and show mac
Output 1:	

index type mtu speed op-status last-change rx-bytes rx-pkts rx-discards rx-errors

index	type	mtu	speed	op-status	last-change	rx-bytes	rx-pkts	rx-discards	rx-errors	
1	129	1764	10240000	up	312	0	0	0	0	
2	129	1764	0	down	0	0	0	0	0	
3	129	1764	0	down		0	0	0	0	0
4	129	1764	0	down	0	0	0	0	0	
5	129	1764	0	down	0	0	0	0	0	
6	129	1764	0	down	0	0	0	0	0	
7	129	1764	0	down	0	0	0	0	0	

```
 8     129     1764  0            down    0
 9     128     1764  30341646     up      312             0        0        0        0
 10    127     1500  30341646     up    312               0        0        0        0
 11      6        0 100000000     up    0   169787        3554     0        0
```

```
 tx-bytes tx-pkts tx-discards tx-errors
 -------- ------- ----------- ---------
       0       0           0         0
       0       0           0         0
       0       0           0         0
       0       0           0         0
       0       0           0         0
       0       0           0         0
       0       0           0         0
       0       0           0         0
  169787    1671           0         0
  169787    1671           0         0
       0    3549           0         0
```

----show mac----

```
description      = Blonder Tongue-CMTS, Mac Interface
type             = docsCableMaclayer(127)
mtu              = 1500
speed            = 30341646
physical-address = 00-01-cb-28-00-12
admin-status     = up
operation-status = up
last-change      = 00h:40m:06s
rx-bytes         = 1444765
rx-pkts          = 23458
rx-discards      = 0
rx-errors        = 0
tx-bytes         = 188431
tx-pkts          = 1859
tx-discards      = 0
tx-errors        = 0
```

Parameter:	**description**
Full path:	root/interfaces/description
Description:	Displays the interface description as defined by the DOCSIS MIB.
Syntax:	none (display only)
Example 1:	show mac
Output 1:	See show mac command above.

Parameter:	**index**
Full path:	root/interfaces/index
Description:	Displays the index number as defined by the DOCSIS MIB.
Syntax:	none (display only)
Example 1:	show

Output 1:	See show command above.

Parameter:	**type**
Full path:	root/interfaces/type
Description:	Displays the interface type defined by the DOCSIS MIB.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**mtu**
Full path:	root/interfaces/mtu
Description:	Displays the MTU (Maximum Transfer Unit) defined by the DOCSIS MIB. MTU is defined as the maximum transfer unit size which may be transferred over this interface.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**speed**
Full path:	root/interfaces/speed
Description:	Displays the interface speed.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**physical-address**
Full path:	root/interfaces/physical-address
Description:	Displays the physical address of the interface.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show command above.

Parameter:	**admin-status**
Full path:	root/interfaces/admin-status
Description:	Displays the admin-status of the interface. To change the admin status you must define the status in the appropriate directory.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**operation-status**
Full path:	root/interfaces/operation-status
Description:	Displays the operational status of the interface. This reflects the actual status of the interface; up or down. If you do not

	have an interface physically connected the status will be displayed as down.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**last-change**
Full path:	root/interfaces/last-change
Description:	Displays the CMTS uptime on last change of the interface status.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**rx-bytes**
Full path:	root/interfaces/rx-bytes
Description:	Displays the number of bytes received on the interface selected.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**rx-pkts**
Full path:	root/interfaces/rx-pkts
Description:	Displays the number of packets received on the interface selected.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**rx-discards**
Full path:	root/interfaces/rx-discards
Description:	Displays the number of discarded packets received on the interface selected. EURODOCSIS/DOCSIS Specification defines discards as the number of inbound packets which were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**rx-errors**
Full path:	root/interfaces/rx-errors
Description:	Displays the number of packets with errors received on the interface selected. EURODOCSIS/DOCSIS Specification defines errors as the number of inbound packets that contained

	errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**tx-bytes**
Full path:	root/interfaces/tx-bytes
Description:	Displays the number of bytes transmitted on the interface selected.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**tx-pkts**
Full path:	root/interfaces/tx-pkts
Description:	Displays the number of packets transmitted on the interface selected.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**tx-discards**
Full path:	root/interfaces/tx-discards
Description:	Displays the number of discarded packets transmitted on the interface selected. EURODOCSIS/DOCSIS Specification defines discards as the number of outbound packets which were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

Parameter:	**tx-errors**
Full path:	root/interfaces/tx-errors
Description:	Displays the number of packets with errors transmitted on the interface selected. EURODOCSIS/DOCSIS Specification defines errors as the number of outbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, the number of outbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol.
Syntax:	*show*

Commands:	*show*
Example 1:	show
Output 1:	See show or show mac command above.

root/modems Directory

Directory:	**modems**
Directory path:	root/modems
Description:	Displays cable modem information and resetting of cable modems.
Sub Directories:	None
Commands/ Parameters:	show, reset-cm, reset-all, index, service-id, ranging-state, up-id, ip-address, mac-address, power-adj, freq-offset, time-offset
Special Operations:	None

Parameter:	**show**
Full path:	root/modems/show
Description:	This command displays all the connected modems.
Syntax:	*show*
Commands:	*show*
Example 1:	show
Output 1:	

index	sid	ranging state	up-id	ip-address	mac-address	power adj	freq offset	time offset
1.	3	registered+	1	192.168.0.26	00-30-54-FF-CE-87	0.00	-25000	510
2.	1	registered	1	192.168.0.22	00-30-54-FF-D2-2B	0.25	-21406	512
3.	2	registered	1	192.168.0.23	00-30-54-FF-BF-80	0.00	-25078	2789
4.	5	registered+	1	192.168.0.29	00-04-BD-E3-96-60	0.25	-24062	512
5.	6	registered	1	192.168.0.27	00-30-54-FF-C0-5B	0.00	-23671	2849

Parameter:	**reset-cm**
Full path:	root/modems/reset-cm
Description:	The command resets an individual modem.
Syntax:	*reset-cm by-ip xxx.xxx.xxx.xxx* - Value by-ip. Where X= IP address - Value by-mac Where X=MAC address
Commands:	*reset-cm by-ip 192.168.0.22*
Example 1:	show
Output 1:	Modems will not appear until they are registered again.

index	sid	ranging state	up-id	ip-address	mac-address	power adj	freq offset	time offset
1.	3	registered	1	192.168.0.26	00-30-54-FF-CE-87	0.00	-25000	510
2.	1	registered	1	192.168.0.22	00-30-54-FF-D2-2B	0.25	-21406	512
3.	2	registered	1	192.168.0.23	00-30-54-FF-BF-80	0.00	-25078	2789
4.	5	registered	1	192.168.0.29	00-04-BD-E3-96-60	0.25	-24062	512

5. 7687 ranging 1 0.0.0.0 00-30-54-FF-C0-5B 0.00
-23671 2849

index	sid	ranging state	up-id	ip-address	mac-address	power adj	freq offset	time offset
1.	3	registered	1	192.168.0.26	00-30-54-FF-CE-87	0.00	-25000	510
2.	1	registered	1	192.168.0.22	00-30-54-FF-D2-2B	0.25	-21406	512
3.	2	registered	1	192.168.0.23	00-30-54-FF-BF-80	0.00	-25078	2789
4.	5	registered	1	192.168.0.29	00-04-BD-E3-96-60	0.25	-24062	512
5.	7687	rng-complete	1	0.0.0.0	00-30-54-FF-C0-5B	0.00	-23671	284

index	sid	ranging state	up-id	ip-address	mac-address	power adj	freq offset	time offset
1.	3	registered	1	192.168.0.26	00-30-54-FF-CE-87	0.00	-25000	510
2.	1	registered	1	192.168.0.22	00-30-54-FF-D2-2B	0.25	-21406	512
3.	2	registered	1	192.168.0.23	00-30-54-FF-BF-80	0.00	-25078	2789
4.	5	registered	1	192.168.0.29	00-04-BD-E3-96-60	0.25	-24062	512
5.	6	registered	1	192.168.0.27	00-30-54-FF-C0-5B	0.00	-23671	2849

Parameter:	**reset-all**
Full path:	root/modems/reset-all
Description:	The command resets all registered modem.
Syntax:	*reset-all* - Value- None
Commands:	*reset-all*
Example 1:	show
Output 1:	Modems will not appear until they are registered again.

Parameter:	**index**
Full path:	root/ modems/index
Description:	Displays the internal index number.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**service-id**
Full path:	root/modems/service-id
Description:	Displays the upstream service identifier of the specified modem.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**ranging-state**
Full path:	root/modems/ranging-state
Description:	Displays the ranging state of the specified modem. The ranging state could be one of the following: Ranging- cm is in ranging process rng-complete – cm is in the acquire ip process

	ip-complete – cm is the tftp or registration process registered – cm registered, but inactive registered+ - cm is registered with active CPE.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**up-chan-id**
Full path:	root/modems/up-chan-id
Description:	Displays the upstream identifier used by the specified modem.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**ip-address**
Full path:	root/modems/ip-address
Description:	Displays the IP address used by the specified modem.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**mac-address**
Full path:	root/modems/mac-address
Description:	Displays the MAC address of the specified modem.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**pwr-adjust**
Full path:	root/modems/power-adj
Description:	Displays the last power adjustment sent to this CM.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**freq-offset**
Full path:	root/modems/freq-offset
Description:	Displays the accumulated frequency offsets of this CM.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

Parameter:	**time-offset**
Full path:	root/modems/time-offset
Description:	Displays the accumulated time offsets of the CM.
Syntax:	none (display only)
Example 1:	show
Output 1:	See show command above.

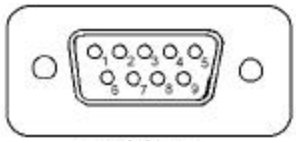
APPENDIX A

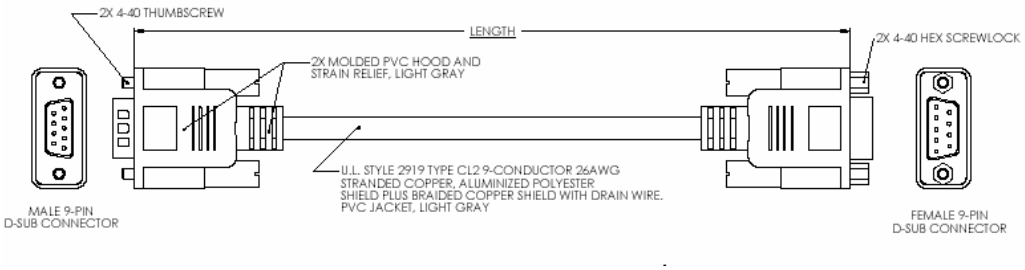
Cable Diagrams

DB9 M/F Straight Through Cable

Pin Signals

- Pin 1 - Received Line Signal Detect (Not used)
- Pin 2 - Received Data
- Pin 3 - Transmitted Data
- Pin 4 - Data Terminal Ready (DTR) (Not used)
- Pin 5 - Signal Ground
- Pin 6 - Data Set Ready (DSR) (Not used)
- Pin 7 - Request to Send (RTS) (Not used)
- Pin 8 - Clear to Send (CTS) (Not used)
- Pin 9 - Ring Indicator (RI) (Not used)





APPENDIX B

LED Descriptions

Front LED Descriptions

The front panel of the CMTS has several LEDS. The LED matrix shows three major functions (STATUS, DATA, and ACTIVE) per upstream channel and downstream transmitter. In addition AC Power (PWR) is also monitored.

STATUS will be lit when the hardware either upstream receiver or downstream transmitter is physically installed in the CMTS.

DATA will be lit when packets are being passed through the associate port.

ACTIVE will be lit when the hardware either upstream receiver module or downstream transmitter is activated in the software and operational.

PWR will be lit when AC Power has been turned on.

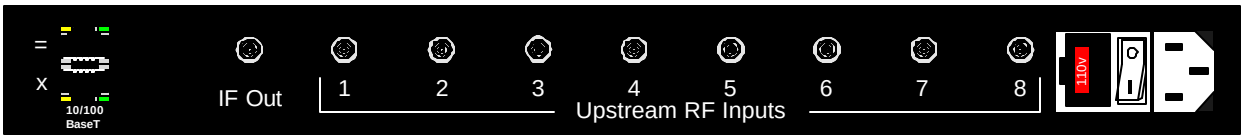
DS means downstream transmitter

UPSTREAM means upstream receiver

1 2 3 4 5 6 7 8 represents the individual channel numbers of the upstream receivers.

Rear LED Descriptions

The rear panel of the CMTS has LEDs associated with the Ethernet ports.



The green LED, link light, on the right will be lit when there is a link to another Ethernet device. The yellow LED, traffic light, on the left will be lit when Ethernet packets are being passed.

APPENDIX C

Inserting Upstream Cards

Step 1 – Power down CMTS and remove cables and power cord

Step 2 – Remove from rack and place on flat surface, such as a table.

Step 3 – Un-screw cover on CMTS, there are 16 flathead Phillips screws, 4 on each side and set aside.

Step 4 – Remove cover and set aside.

Step 5 – Use anti-static wristband provided or ground your self to a valid ground source

Step 6 – Remove insert/s in chassis, it does not matter which slot the card is inserted into.

Step 7 – Remove the screw/s on the main-board pertaining to the slot the US (Upstream) board will be inserted into. Set it aside for now.

Step 8 – Open the anti-static bag/s containing the US card and remove the first barrel nut on the f-connector of the US card. Set the nut aside for now.

Step 9 – Insert the card from the inside by sliding the F-connector through the hole. Gently push the card onto the main board. ****Do NOT Force**** If the card does not go in easily then screw the 2nd barrel nut toward the US board and try again.

Step 10 – Once it is inserted then use the screw in Step 7 and tighten the board to the main chassis.

Step 11 – Take the barrel nut in Step 9 and tighten the nut toward the chassis. Then take the barrel nut in Step 8 and place it on the F-connector and tighten. ****Do not over-tighten or the US board will twist out of its socket. ****

Step 12 – Place cover back on CMTS by inserting the 16 flathead Phillips screws in Step 3.

Step 13 – Place CMTS back in rack and connect power, RF and Ethernet cables.

Step 14 – Power CMTS back on.

Step 15 – Refer to Chapter 5 for configuring the US channel/s

APPENDIX D

DOCSIS Notes

Interleave Effect

Electrical burst noise from amplifier power supplies and utility powering on the downstream path can cause errors in blocks. This will cause worse problems with throughput quality than errors that are spread out from thermal noise. In an attempt to minimize the affect of burst errors, a technique known as interleaving is used, which spreads data over time. By intermixing the symbols on the transmit end, then reassembling them on the receive end, the errors will appear spread apart. Forward error correction (FEC) is very effective on errors that are spread apart. A relatively long burst of interference can cause errors that can be corrected by FEC when using interleaving. Since most errors occur in bursts, this is an efficient way to improve the error rate.

DOCSIS specifies five different levels of interleaving. 128:1 is the highest amount of interleaving and 8:16 is the lowest. This indicates that 128 codewords made up of 128 symbols each will be intermixed on a 1 for 1 basis, whereas, the 8:16 level of interleaving indicates that 16 symbols will be kept in a row per codeword and intermixed with 16 symbols from 7 other codewords.

The possible values for "Downstream Interleave Delay" are as follows in microseconds (us):

	64-QAM	256-QAM
I = 8, J = 16	220	150
I = 16, J = 8	480	330
I = 32, J = 4,	980	680
I = 64, J = 2,	2000	1400
I = 128, J = 1,	4000	2800

Interleaving doesn't add overhead bits like FEC, but it does add latency, which could affect voice and real-time video. It also increases the Request/Grant round trip time (RTT). Increasing the RTT may cause you to go from every other MAP opportunity to every third or fourth MAP. That is a secondary affect, and it is that effect, which can cause a decrease in peak Upstream (US) data throughput. Therefore, you can slightly increase the US throughput (in a PPS per modem way) when the value is set to a number lower then the typical default of 32.

As a workaround to the impulse noise issue, the interleaving value can be increased to 64 or 128. However, by increasing this value, performance (throughput) may degrade, but noise stability will be increased in the Downstream (DS). In other words, either the plant must be maintained properly, or more un-correctable errors (lost packets) in the DS will be seen to a point where modems start loosing connectivity and/or you end up with more retransmission.

By increasing the interleave depth to compensate for a noisy DS path, a decrease in peak CM US throughput must be factored in. In most residential cases, that is not an issue, but it's good to understand the trade-off. Since the plant RTT is on the order of 0.8 ms, going to a lower interleave value of less than the typical interleave depth of 32:4 at .98 ms may not provide much throughput increase. Going to the maximum interleave depth of 128:1 at 4 ms will have a significant, negative impact on US throughput. Notice the delay is different for 64 vs. 256-QAM.

For upstream robustness to noise, DOCSIS modems allow variable or no FEC. Turning off US FEC will get rid of some overhead and allow more packets to be passed, but at the expense of robustness to noise. It's also advantageous to have different amounts of FEC associated with the type of burst. Is the burst for actual data or for station maintenance? Is the data packet made up of 64 bytes or 1518 bytes? You may want more protection for larger packets.

There is no interleaving in the upstream currently because the transmission is in bursts, and there isn't enough latency within a burst to support interleaving. Some chip manufacturers are adding this feature for DOCSIS 2.0 support, which could have a huge impact considering all the impulse noise from home appliances.

Overhead Calculations

The actual data bandwidth that can be achieved per upstream and downstream is dependent on the number CM's connected to the system and the applications used by the CPE's. In Blonder Tongue Lab tests show 8 Mbps per upstream and 48 Mbps downstream of actual data transfer in a EuroDOCSIS based system.

Ethernet Packet Processing

The maximum theoretical rates for a Euro-DOCSIS CMTS are 56 Mbps downstream and 10 Mbps. From these rates we should subtract the following overheads:

MPEG framing:

- 5 bytes header for each 184 bytes frame.
- 16 bytes FEC are added to each 188 bytes MPEG frame.

Downstream:

- MAC Header: 6 bytes per frame.
- Additional Overhead for MAC management messages is estimated to be up to 2%. (Number of modems and number of upstream channels dependant)

Upstream:

- MAC Header: 6 bytes per frame:
- Preamble and FEC overheads are per packet and are configuration dependant. (Could theoretically rise to more than 100% overhead!!!)
- Mac Management messages: Ranging, Bandwidth Allocation Requests
- Contention Slots for Ranging and Requests.

Total overheads calculation is very complicated and configuration dependant (specially for upstream direction). In most common cases the overhead is increased dramatically for small packets. We estimate the average upstream overhead to be 20% of the theoretical rate and the average downstream overhead to be 15%.

For instance, theoretically, the downstream channel can transmit 109375 PPS of 64 bytes each. But, each frame will have additional 6 bytes of MAC header - 9.3 %.
FEC and MPEG framing will also add 21 bytes for each actual 184 bytes, which is 11.4%. Ignoring the other overheads downstream can really transmit with these overheads just 87500 (44.8 Mbps)

SNR and Symbol Rates

If you increase the input power level, CM's on your HFC network will increase their transmit power level. This increases the carrier-to-noise ratio (C/N) on the network, but also increases distortion products. The return path laser immediately enters a nonlinear mode called clipping and all communication is no longer reliable. Many return lasers send "short" bursts above the clipping thresholds and fail on longer or successive bursts.

It is important not to adjust the [Nominal_Rx_Power] during CMTS normal operation (Not initial setting) by more than 5 dB in a 60-second interval. If you increase the power level by more than 5 dB within 60 seconds, Or If you decrease the [Nominal_Rx_Power] by more than 5 dB within 60 seconds, Upstream interfaces on your network are forced offline.

SNR Recommendations

DOCSIS requirements for Downstream and Upstream SNR should be adhered to. We know that Cable Modems and CMTS can operate at lower levels than DOCSIS Specifications. Having lower SNR values will cause errors on the system and in turn cause the lower throughput. Having a well balanced system will increase your SNR values.

DOCSIS Recommended SNR Values
Downstream - 35dB and above
Upstream - 26dB and above

Usable SNR Values
Downstream - 31dB and above
Upstream - 21dB and above

Symbol Rates

Downstream
In DOCSIS there are 2 different symbol rates for downstream:
Bit rate calculation
QAM64 = 6 Bits/Symbol
QAM256 = 8 Bits/Symbol
Symbol Rate
QAM64 - 5.05 M_Symbol/Sec
QAM256 - 5.36 M_Symbol/Sec
Theoretical Throughput
QAM64 - 6 * 5.05 = **30.3 Mbit/Sec**
QAM256 - 8 * 5.36 = **42.88 Mbit/Sec**

The ES / NO *10 mse is the SNR where 363 = 36.3
The CW error rate is important over 10-9 considered to be good

Upstream

DOCSIS defines the following symbol rates:

Upstream Data Rates (DOCSIS 1.0 & 1.1)

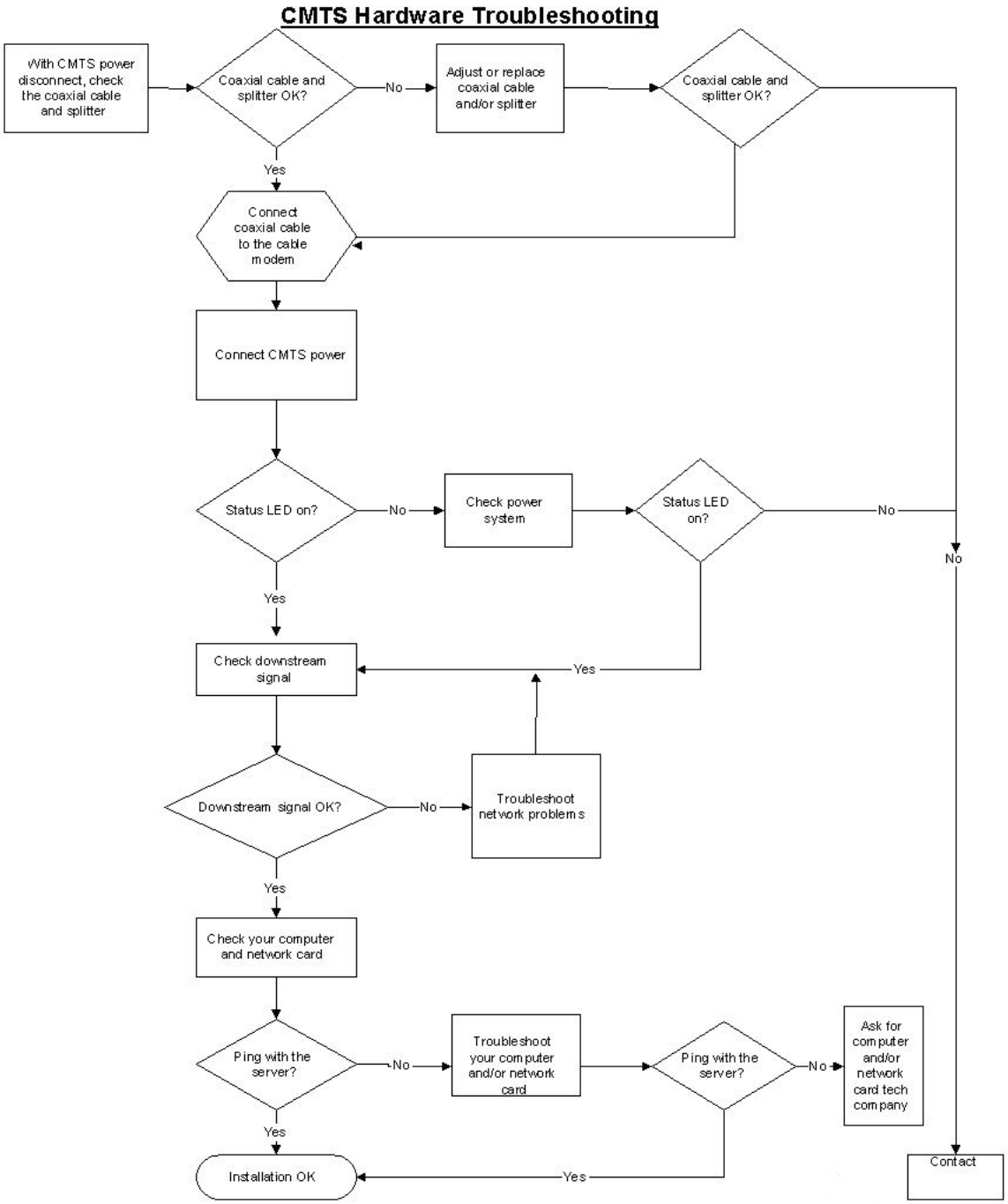
Symbol Rate	Bandwidth Used (KHz)	QPSK Data Rate (Kb/s)	16-QAM Data Rate (Kb/s)
160	200	320	640
320	400	640	1280
640	800	1280	2560
1280	1600	2560	5120
2560	3200	5120	10240

QPSK = 2 Bits/Symbol
QAM16 = 4 Bits/Symbol
QPSK
2 (bit/symbol)* 1.28 M symbol rate = 2.56 Mb in upstream (1.6Mhz)
2 (bit/symbol)* 2.56 M symbol rate = 5.12 Mb in upstream (3.2Mhz)
QAM16
4 (bit/symbol)* 1.28 M symbol rate = 5.12 Mb in upstream (1.6Mhz)
4 (bit/symbol)* 2.56 M symbol rate = 10.24 Mb in upstream (3.2Mhz)

APPENDIX E

Troubleshooting

Use the following flowchart to troubleshoot your installation.



APPENDIX F

Technical Specifications

	DOCSIS 1.0/1.1	EuroDOCSIS 1.0/1.1
Downstream		
IF Output	44 MHz	36.125 MHz
RF Channel Spacing	6 MHz channel	8 MHz channel
Modulation Type	64QAM and 256QAM	64QAM and 256QAM
Symbol Rate (nominal)	5.056 Msms/s 64QAM, 5.360 Msms/s 256QAM	6.952 Msms/s 64QAM 6.952 Msms/s 256QAM
Bandwidth	6 MHz	8 MHz
Output Impedance	75 Ohms	75 Ohms
Output Return Loss	>14 dB	>14 dB
Output Level	+40 dBmV	+40 dBmV
Connector	Fconnector	Fconnector
Upstream Receiver		
Frequency Range	5 MHz up to 42 MHz	5 MHz up to 65 MHz
Carrier-to-noise Ratio in Active Channel	Not less than 22 dB	Not less than 22 dB
Level Range (one channel)	-4 to +26 dBmV	-4 to +26 dBmV
Modulation Type	QPSK and 16QAM	QPSK and 16QAM
Symbol Rate (nominal)	160, 320, 640, 1280 and 2560 ksym/s	160, 320, 640, 1280 and 2560 ksym/s
Bandwidth	200, 400, 800, 1600, 3200 KHz	200, 400, 800, 1600, 3200 KHz
Connector	Fconnector	Fconnector

LAN and Maintenance Interfaces

LAN Interface	10BaseT/100BaseT Fast Ethernet full duplex
Serial Interface	EIA-232 9 pin D

System Standards and Protocols

DOCSIS/EuroDOCSIS 1.0 RF Specification, SNMP, Radius, PPPoE, Telnet

Environmental

Operating Temperature	0° to 40°C
Storage Temperature	-10°to 60°C
Humidity	10% to 90% non-condensing
Power Consumption	34 watt
Voltage Range	Rated, automatic selection 100-240V, 47-63 Hz
Safety Compliance	UL, CE

Physical

Size	435mm (W) x 44mm (H) x 500mm (D) (EIA rack mount)
Weight (fully equipped)	9 kg
HFC Configuration	1 Downstream, 8 Upstream channels
LEDs	AC Power, WAN Link, WAN Traffic, Downstream Traffic, Downstream Module Installed, Downstream Module activated, Upstream Traffic, Upstream Module Installed, Upstream Module Activated

Blonder Tongue Limited Warranty

Blonder Tongue Laboratories, Inc. (BT) will at its sole option, either repair or replace (with a new or factory reconditioned product, as BT may determine) any product manufactured by BT which proves to be defective in materials or workmanship or fails to meet the specifications which are in effect on the date of shipment or such other specifications as may have been expressly agreed upon in writing (i) for a period of one (1) year from the date of original purchase (or such shorter period of time as may be set forth in the license agreement specific to the particular software being licensed), with respect to MegaPort & CMTS Data products and iCentral™ (hardware and software) and all other software products (including embedded software) licensed from BT, (ii)) for a period of one (1) year from the date of original purchase, with respect to all fiber optics receivers, transmitters, couplers and integrated receivers/distribution amplifiers (including TRAILBLAZER™, RETRO-LINX™ and TWIN STAR™ products) as well as for VideoCipher® & DigiCipher® satellite receivers, and (iii) for a period of three (3) years from the date of original purchase, with respect to all other BT products. Notwithstanding the foregoing, in some cases, the warranty on certain proprietary sub-assembly modules manufactured by third-party vendors and contained in BT products and on certain private–label products manufactured by third-parties for resale by BT are of shorter duration or otherwise more limited than the standard BT limited warranty. In such cases, BT's warranty with respect to such third-party proprietary subassembly modules and private-label products will be limited to the duration and other terms of such third-party vendor's warranty. In addition, certain products, that are not manufactured but are resold by BT, carry the original OEM warranty for that product. The limited warranty set forth in this paragraph does not apply to any product sold by BT, which at the time of sale constituted a Closeout Product.

BT will at its sole option, either repair or replace (with a new or factory reconditioned product, as BT may determine) any product sold by BT which at the time of sale constituted a closeout item (“Closeout Product”), which proves to be defective in materials or workmanship or fails to meet the specifications which are in effect on the date of shipment or such other specifications as may have been expressly agreed upon in writing, for a period of ninety (90) days from the date of original purchase. Notwithstanding the foregoing, in some cases, the warranty on third party software and on certain proprietary sub-assembly modules manufactured by third-party vendors and contained in BT products and on certain private–label products manufactured by third-parties for resale by BT are of shorter duration or otherwise more limited than the BT limited warranty for Closeout Products. In such cases, BT's warranty for Closeout Products constituting such third party software, third-party proprietary sub-assembly modules and private-label products will be limited to the duration and other terms of such third-party vendor's warranty. In addition, notwithstanding the foregoing, (i) certain Closeout Products that are not manufactured (but are resold) by BT, carry the original OEM warranty for such products, which may be longer or shorter than the BT limited warranty for Closeout Products. All sales of Closeout Products are final.

To obtain service under this warranty, the defective product, together with a copy of the sales receipt or other satisfactory proof of purchase and a brief description of the defect, must be shipped freight prepaid to: Blonder Tongue Laboratories, Inc., One Jake Brown Road, Old Bridge, New Jersey 08857.

This warranty does not cover damage resulting from (i) use or installation other than in strict accordance with manufacturer's written instructions, (ii) disassembly or repair by someone other than the manufacturer or a manufacturer-authorized repair center, (iii) misuse, misapplication or abuse, (iv) alteration, (v) lack of reasonable care or (vi) wind, ice, snow, rain, lightning, or any other weather conditions or acts of God.

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