



Configuring the Cisco uBR-MC16U/X Cable Interface Line Card

This document describes the Cisco uBR-MC16U/X cable interface line card, which is a next-generation Data-over-Cable Service Interface Specifications (DOCSIS) Broadband Processing Engine (BPE) for the Cisco uBR7246VXR universal broadband router. The card provides one downstream port and six upstream ports configured in one CMTS MAC domain.

The Cisco uBR-MC16U/X card supports DOCSIS 1.1 and EuroDOCSIS 1.1 Time Division Multiple Access (TDMA) modulation profiles, and also provides improved Radio Frequency (RF) performance, higher performance, and advanced spectrum management capabilities. The card also supports the Advanced Time Division Multiple Access (A-TDMA) modulation profiles used in DOCSIS 2.0 and EuroDOCSIS 2.0 networks.

Feature Specifications for Cisco uBR-MC16U/X Cable Interface Line Card

Feature History

| Release | Modification |
|---------------------|--|
| Release 12.2(15)CX | This feature was introduced for the Cisco uBR7246VXR router. |
| Release 12.2(15)CX1 | The modulation profiles were optimized for the Cisco uBR-MC16U/X card. |
| Release 12.2(15)BC2 | Support was added to Cisco IOS Release 12.2 BC. |

Note See the “[Important—Upgrading to Cisco IOS Release 12.2\(15\)CX1 and 12.2\(15\)BC2](#)” section on page 3 for important information on using Cisco IOS Release 12.2(15)CX1 or 12.2(15)BC2.

Supported Platforms

Cisco uBR7246VXR router

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.



Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Copyright © 2003 Cisco Systems, Inc. All rights reserved.

Contents

This document includes the following major sections:

- [Prerequisites for Cisco uBR-MC16U/X, page 2](#)
- [Restrictions for Cisco uBR-MC16U/X, page 4](#)
- [Information About Cisco uBR-MC16U/X, page 5](#)
- [How to Configure the Cisco uBR-MC16U/X Card, page 13](#)
- [Monitoring the Cisco uBR-MC16U/X Cable Interface Line Card, page 26](#)
- [Configuration Examples for Cisco uBR-MC16U/X Card, page 30](#)
- [System Error Messages, page 36](#)
- [Additional References, page 42](#)
- [Command Reference, page 44](#)

Prerequisites for Cisco uBR-MC16U/X

The Cisco uBR-MC16U/X cable interface line card has the following prerequisites:

- The Cisco uBR-MC16U/X card is supported only in a Cisco uBR7246VXR universal broadband router.
- The Cisco uBR7246VXR router must be configured with the default scheduler allocate values, using the **scheduler allocate 4000 400** command, to support the Cisco uBR-MC16U/X card. Otherwise, the router might not provide sufficient resources for the processes on the Cisco uBR-MC16U/X card, resulting in the card resetting during periods of heavy use.
- The Cisco uBR-MC16U/X card provides the same number of downstream and upstream ports as the Cisco uBR-MC16C and Cisco uBR-MC16S cards, but the cards are not identical. Because the cards are different, the Cisco uBR7246VXR does not preserve the card configuration if you replace a Cisco uBR-MC16C or Cisco uBR-MC16S card with a Cisco uBR-MC16U/X card. If you intend to replace the older cards with the newer cards, you must reconfigure the newer cards after they have been installed.



Tip

To preserve the existing configuration when replacing the Cisco uBR-MC16C card with a Cisco uBR-MC16U/X card, save the existing configuration using the **copy running-config startup-config** command. Then remove the old card and insert the new card. Restore the saved configuration using the **copy startup-config running-config** command. Then see the [“Upgrading from a Cisco uBR-MC16C/E/S Card” section on page 10](#) for information on the additional commands that are needed. (If using the Cisco uBR-MC16U card, at the very least you must use the **cable downstream rf-power** and **no cable downstream rf-shutdown** commands to enable each downstream’s integrated upconverter.)

- The Cisco uBR7246VXR router must be using an NPE-400 or UBR7200-NPE-G1 processor that is running Cisco IOS Release 12.2(15)CX or later. If you try to use the Cisco uBR-MC16U/X card on a router with a different processor, the following error message is displayed on the console:

```
%MPU-3-LOWCPU: MCU port adapter in Slot [dec] requires CPU card type NPE400 or higher
```

**Tip**

The NPE-400 processor must have at least 128 MB of DRAM memory, and the UBR7200-NPE-G1 processor must have at least 256 MB of DRAM memory to support the Cisco uBR-MC16U/X card. However, if you are using more than one Cisco uBR-MC16U/X card, Cisco recommends installing 256 MB of DRAM memory on the NPE-400 processor, and installing either 512 MB or 1 GB of DRAM memory on the UBR7200-NPE-G1 processor, to ensure best performance.

- Cable modems must be DOCSIS-compliant. If cable modems go offline, or appear to be online but do not pass traffic when in the mixed TDMA/ATDMA mode, upgrade the modem software to a DOCSIS-compliant version.
- The following are required to support the DOCSIS 2.0 ATDMA features:
 - Cable modems must be DOCSIS 2.0 capable.
 - The DOCSIS configuration file for the cable modem must either omit the DOCSIS 2.0 Enable field (TLV 39), or it must set TLV 39 to 1 (enable). If you set TLV 39 to 0 (disable), a DOCSIS 2.0 CM uses the TDMA mode.
 - The upstream must be configured for either ATDMA-only or mixed TDMA/ATDMA mode. To use the 6.4 MHz channel width, the upstream must be configured for ATDMA-only mode.
- Complete a basic configuration of the Cisco uBR7246VXR router; this includes, at a minimum, the following tasks:
 - Configure a host name and password for the router.
 - Configure the router to support Internet Protocol (IP) operations.
 - Install and configure at least one WAN adapter to provide backbone connectivity.
- Determine a channel plan for your Cisco uBR7246VXR router and all of its cable interfaces.
- Verify that your headend site includes all necessary servers to support DOCSIS and Internet connectivity, including DHCP, ToD, and TFTP servers.
- The system clock on the Cisco uBR7246VXR router should be set to a current date and time to ensure proper communications between the Cisco uBR-MC16U/X card and NPE processor card.

Important—Upgrading to Cisco IOS Release 12.2(15)CX1 and 12.2(15)BC2

Cisco IOS Releases 12.2(15)CX1 and 12.2(15)BC2 have optimized the default modulation profiles for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cable interface line cards. When upgrading to Cisco IOS Release 12.2(15)CX1 or 12.2(15)BC2 from 12.2(15)CX, you need to delete the existing default profiles to force the Cisco uBR7246VXR router to replace them with the new, optimized profiles. To do this, give the following commands at the global configuration mode prompt:

```
no cable modulation profile 41
no cable modulation profile 141
no cable modulation profile 241
```

This procedure needs to be done only once, after a router running Cisco IOS Release 12.2(15)CX has been upgraded to Cisco IOS Release 12.2(15)CX1 or 12.2(15)BC2.

Restrictions for Cisco uBR-MC16U/X

The Cisco uBR-MC16U/X feature has the following restrictions and limitations:

- Supports all cable interface line card features in Cisco IOS Release 12.2(15)BC1, except for the following, which are not supported. These features are expected to be supported in a future release of the Cisco IOS Release 12.2 BC train.
 - Spectrum management of DOCSIS 2.0 mixed-mode and A-TDMA upstreams. This includes guided frequency hopping, dynamic upstream modulation, and proactive CNR-based frequency hopping and channel width changes. These features are supported only for DOCSIS 1.X TDMA-only channels.



Note Advanced hardware-based spectrum management is still supported for the DOCSIS 1.0/1.1 TDMA-only mode, and is scheduled to be supported for A-TDMA operations in a future release of the Cisco IOS software.

- Cable Monitor
 - Communications Assistance for Law Enforcement Act (CALEA) support
 - Cisco CMTS Load Balancing
 - PacketCable
 - Port bundling
 - N+1 HCCP redundancy
 - Subscriber Traffic Management
 - Transparent LAN Service over Cable (**cable l2-vpn-service** command)
 - Virtual interfaces
- On the Cisco uBR-MC16U (with integrated upconverter), the IF frequency is fixed at 44 MHz for both Annex A and Annex B modes of operation. The Cisco uBR-MC16X (without integrated upconverter) outputs an IF frequency at 36.125 MHz in Annex A mode and at 44 MHz in Annex B mode (as configured by the **cable downstream annex** command).
 - The center frequency for the downstreams on the Cisco uBR-MC16U/X (as configured by the **cable downstream frequency** command) must be specified in 250 KHz increments.
 - When changing the symbol rate, the **show controller cable upstream** command may show `US_phy SNR_estimate - Unknown` for a brief period of time. Wait a moment and reissue the command to obtain an accurate SNR value.
 - The configuration of the downstream and upstream ports is fixed into the two domains that are listed in [Table 3 on page 9](#).
 - Cisco IOS Release 12.2(15)CX and 12.2(15)BC2 support a maximum of 10 modulation profiles for each of the three DOCSIS modes (DOCSIS 1.x TDMA, mixed, and DOCSIS 2.0 A-TDMA), for a total maximum of 30 modulation profiles per chassis.
 - Changing the DOCSIS mode of an upstream takes all cable modems on that upstream offline, which forces the cable modems to reregister, so that the CMTS can determine the capabilities of the cable modems on the new channels.
 - Packet filters can be created on the Cisco uBR-MC16U/X using the standard SNMP commands, but cannot be created using command line interface (CLI) commands.

- The packet counters that are displayed by the **show interface cable** and **show interface cable service-flow counters** commands could show slight differences in the byte counts. This is because the **show interface cable** command uses the actual byte count, while the **counters** option assumes that all packets that are smaller than the minimum packet size actually have the minimum number of bytes.
- Also, the NPE processor on the Cisco uBR7246VXR router periodically collects the packet statistics from the Cisco uBR-MC16U/X card every five seconds, the counters shown by the **show** commands are not actual real-time statistics but could reflect up to a five-second delay in showing the actual network activity.
- For optimum performance, do not change the default value of the **scheduler allocate** command (**scheduler allocate 4000 400**) on the Cisco uBR7246VXR router.

Debug Output to the Console Can Be Incomplete

Cable interface line cards that have their own onboard processor, such as the Cisco uBR-MC16U/X card, initially collect the debug messages and then pass them on to the processor card using interprocess communications (IPC) messages. Because a large volume of debug messages could interfere with normal operations, especially when messages are sent to the console, debug messages are subject to rate-limiting that could drop part of abnormally large messages.

To avoid missing parts of the debug output, enabling logging to a buffer, using the **logging** commands. Then use the **show logging slot** command to display the results for the specific cable interface line card.

If you do not need or desire timestamps on the debug messages, you can reduce the volume of output by turning off timestamps for debug messages using the **no service timestamps debug datetime msec** command.

Show Interface Counters are Separate for Master and Slave Interfaces

The Cisco uBR-MC16U/X card uses a distributed architecture that does not include the slave interface input packet counters when you use the **show interface** command to display information for a master cable interface. This is different than normal behavior for most Cisco interfaces, where the input packet counters on the master interface include the input packet counts for all associated slave interfaces. On the Cisco uBR-MC16U/X card, you must use the **show interface** command on both the master and slave cable interfaces to get a total count of the input packets.

Information About Cisco uBR-MC16U/X

This section describes the Cisco uBR-MC16U/X cable interface line card:

- [Feature Overview, page 6](#)
- [DOCSIS 2.0 A-TDMA Support, page 9](#)
- [Upgrading from a Cisco uBR-MC16C/E/S Card, page 10](#)
- [Other Differences Between the Cisco uBR-MC16C and Cisco uBR-MC16C/E/S Cards, page 11](#)
- [Benefits, page 12](#)

Feature Overview

The Cisco uBR-MC16U and Cisco uBR-MC16X (Cisco uBR-MC16U/X) cards each contain one downstream port and six upstream ports. In Cisco IOS Release 12.2(15)CX and later releases, the downstream ports support 64-QAM and 256-QAM, and the upstream ports support QPSK, 8-QAM, 16-QAM, 32-QAM, and 64-QAM modulation, depending on the upstream's mode of operation.

The Cisco uBR-MC16U and Cisco uBR-MC16X cards are two of the new Broadband Processing Engine (BPE) series of cable interfaces that are available for the Cisco uBR7246VXR universal broadband router. The BPE cards provide increased performance and advanced Radio Frequency (RF) management, as well as innovative, integrated tools for sophisticated content, traffic and network management.

Modes of Operation

Depending on the configuration, the Cisco uBR-MC16U/X line card supports either DOCSIS or Euro-DOCSIS operation:

- DOCSIS cable networks are based on the ITU J.83 Annex B physical layer standard and Data-over-Cable Service Interface Specifications (DOCSIS, Annex B) specification, which use 6 MHz National Television Systems Committee (NTSC) channel plans. In this mode, the downstream uses a 6 MHz channel width in the 85 to 860 MHz frequency range, and the upstream supports multiple channel widths in the 5 to 42 MHz frequency range.
- EuroDOCSIS cable networks are based on the ITU J.112 Annex A physical layer standard and European DOCSIS (EuroDOCSIS, Annex A) specification, which use 8 MHz Phase Alternating Line (PAL) and Systeme Electronique Couleur Avec Memoire (SECAM) channel plans. In this mode, the downstream uses an 8 MHz channel width in the 85 to 860 MHz frequency range, and the upstream supports multiple channel widths in the 5 to 65 MHz frequency range.



Note

The Cisco uBR-MC16U/X card also supports the extended frequency ranges that are used in Japanese Annex B networks: 70 to 860 MHz (downstream) and 5 to 55 Mhz (upstream).



Tip

The difference between DOCSIS and EuroDOCSIS is at the physical layer. To support a DOCSIS or EuroDOCSIS network requires the correct configuration of the Cisco uBR-MC16U/X card, as well as upconverters, diplex filters, and other equipment that supports the network type.

When operating in either the DOCSIS or EuroDOCSIS mode of operation, the Cisco uBR-MC16U/X card supports the following types of networks:

- TDMA-only mode, which supports only DOCSIS 1.0 and DOCSIS 1.1 cable modems.
- A-TDMA-only mode, which supports DOCSIS 2.0 cable modems.
- Mixed TDMA/A-TDMA mode, which supports both DOCSIS 1.0/DOCSIS 1.1 and DOCSIS 2.0 cable modems on the same upstream.

The Cisco uBR-MC16U/X card supports all DOCSIS 1.1-specified and all DOCSIS 2.0-specified ATDMA radio frequency (RF) data rates, channel widths, and modulation schemes. [Table 1](#) shows the maximum supported DOCSIS 1.1 data rates, and [Table 2](#) shows the maximum supported DOCSIS 2.0 (ATDMA-mode) data rates.

Table 1 Maximum DOCSIS and EuroDOCSIS 1.1 Data Rates

| Upstream Channel Width | Modulation Scheme | Baud Rate Sym/sec | Maximum Raw Bit Rate Mbit/sec |
|------------------------|-------------------|-------------------|-------------------------------|
| 3.2 MHz | 16-QAM QPSK | 2.56 M | 10.24 5.12 |
| 1.6 MHz | 16-QAM QPSK | 1.28 M | 5.12 2.56 |
| 800 kHz | 16-QAM QPSK | 640 K | 2.56 1.28 |
| 400 kHz | 16-QAM QPSK | 320 K | 1.28 0.64 |
| 200 kHz | 16-QAM QPSK | 160 K | 0.64 0.32 |

Table 2 Maximum DOCSIS and EuroDOCSIS 2.0 (ATDMA-mode) Data Rates

| Upstream Channel Width | Modulation Scheme | Baud Rate Sym/sec | Maximum Raw Bit Rate Mbit/sec |
|------------------------|---|-------------------|---|
| 6.4 MHz | 64-QAM 32-QAM 16-QAM 8-QAM QPSK | 5.12 M | 30.96 25.80 20.64 15.48 10.30 |
| 3.2 MHz | 64-QAM 32-QAM 16-QAM 8-QAM QPSK | 2.56 M | 15.48 12.90 10.30 7.68 5.12 |
| 1.6 MHz | 64-QAM 32-QAM 16-QAM 8-QAM QPSK | 1.28 M | 7.68 6.45 5.12 3.84 2.56 |
| 800 kHz | 64-QAM 32-QAM 16-QAM 8-QAM QPSK | 640 K | 3.84 3.20 2.56 1.92 1.28 |

Table 2 Maximum DOCSIS and EuroDOCSIS 2.0 (ATDMA-mode) Data Rates (continued)

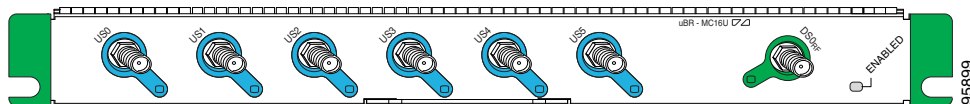
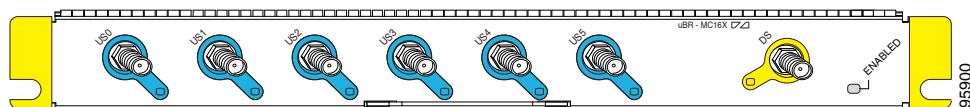
| Upstream Channel Width | Modulation Scheme | Baud Rate Sym/sec | Maximum Raw Bit Rate Mbit/sec |
|------------------------|-------------------|-------------------|-------------------------------|
| 400 kHz | 64-QAM | 320 K | 1.92 |
| | 32-QAM | | 1.60 |
| | 16-QAM | | 1.28 |
| | 8-QAM | | 0.96 |
| | QPSK | | 0.64 |
| 200 kHz | 64-QAM | 160 K | 0.96 |
| | 32-QAM | | 0.80 |
| | 16-QAM | | 0.64 |
| | 8-QAM | | 0.48 |
| | QPSK | | 0.32 |

Physical Description

The Cisco uBR-MC16U/X card provides one downstream port and six upstream ports, organized into a single DOCSIS MAC domain. The new card comes in two versions, the Cisco uBR-MC16U and the Cisco uBR-MC16X, which are identical except for the type of upconverter that the downstream ports use:

- Cisco UBR-MC16U card (part number UBR-MC16U)—Each downstream port includes an onboard integrated upconverter that generates an RF signal suitable for connection to a combiner and transmission on the coaxial cable network, without the need for any external upconverters. This can save both the money and rack space required by an external upconverter, as well as reduce the complexity of the equipment at the headend site.
- Cisco uBR-MC16X card (part number UBR-MC16X)—The downstreams on this card do not include integrated upconverters. Instead, the downstream ports generate an IF signal that must be converted through an external upconverter before transmission on the cable network. This allows the Cisco uBR-MC16X card to easily replace existing line card installations that currently use external upconverters.

Figure 1 shows the front panel of the Cisco uBR-MC16U card, and Figure 2 shows the front panel of the Cisco uBR-MC16X card:

Figure 1 Cisco uBR-MC16U Cable Interface Line Card Front Panel**Figure 2** Cisco uBR-MC16X Cable Interface Line Card Front Panel

**Note**

The downstream on the Cisco uBR-MC16U card is labelled “DS0 RF” to indicate that it outputs an RF-wave from the internal upconverter. The downstream on the Cisco uBR-MC16X card is labelled “DS” to indicate that it outputs an IF-wave that requires an external upconverter.

Table 3 shows the association between the downstream ports and their upstream ports on the Cisco uBR-MC16U/X card. Table 3 also shows the interface label to use when referring to the port when using command-line interface (CLI) commands.

Table 3 Interface to Port Mapping

| Port Set | Physical Ports | CLI Cable Interface Label ¹ |
|-----------|---|--|
| Domain #0 | DS0 RF (Cisco uBR-MC16U) DS0 (Cisco uBR-MC16X) | CX/0 |
| | US0 | CX/0 U0 |
| | US1 | CX/0 U1 |
| | US2 | CX/0 U2 |
| | US3 | CX/0 U3 |
| | US4 | CX/0 U4 |
| | US5 | CX/0 U5 |

1. The X in the CLI Cable Interface Label column refer to the physical card slot in which the card is installed. The value for X can range from 3 to 6.

**Note**

The Cisco uBR-MC16U/X cable interface line card also contains two internal Ethernet interfaces that are used to transmit interprocess communications (IPC) messages between the line card and the router's processor card. These interfaces cannot be configured but do appear in some command-line interface (CLI) displays, such as the **show ip route** and **show arp** command.

DOCSIS 2.0 A-TDMA Support

The Cisco uBR-MC16U/X card improves the maximum upstream bandwidth on existing DOCSIS 1.0 and DOCSIS 1.1 cable networks by providing a number of advanced PHY capabilities that have been specified by the new DOCSIS 2.0 specifications. This feature incorporates the following advantages and improvements of DOCSIS 2.0 networks:

- Builds on existing DOCSIS cable networks by providing full compatibility with existing DOCSIS 1.0 and DOCSIS 1.1 cable modems. (The registration response (REG-RSP) message contains the DOCSIS version number to identify each cable modem's capabilities.)
- Upstreams can be configured for three different modes to support different mixes of cable modems:
 - An upstream can be configured for TDMA mode to support only DOCSIS 1.0 and DOCSIS 1.1 cable modems.
 - An upstream can be configured for A-TDMA mode to support only DOCSIS 2.0 cable modems.
 - An upstream can be configured for a mixed, TDMA/A-TDMA mode, to support both DOCSIS 1.0/DOCSIS 1.1 and DOCSIS 2.0 cable modems on the same upstream.

**Note**

DOCSIS 2.0 A-TDMA cable modems will not register on a TDMA upstream if an A-TDMA or mixed upstream exists in the same MAC domain, unless the CMTS explicitly switches the cable modem to another upstream using an Upstream Channel Change (UCC) message. DOCSIS 1.0 and DOCSIS 1.1 cable modems cannot register on an A-TDMA only upstream.

- A-TDMA mode defines new interval usage codes (IUC) of A-TDMA short data grants, long data grants, and Unsolicited Grant Service (UGS) grants (IUC 9, 10, and 11) to supplement the existing DOCSIS 1.1 IUC types
- Increases the maximum channel capacity for A-TDMA upstreams to 30 Mbps per 6 MHz channel.
- A-TDMA and mixed modes of operation provide higher bandwidth on the upstream using new 32-QAM and 64-QAM modulation profiles, while retaining support for existing 16-QAM and QPSK modulation profiles. In addition, an 8-QAM modulation profile is supported.
- Supports a minislot size of 1 tick for A-TDMA operations.
- Increases channel widths to 6.4 MHz (5.12 Msymbol rate).
- A-TDMA and mixed modes of operation provide a more robust operating environment with increased protection against ingress noise and other signal impairments, using a number of new features:
 - Uses a symbol (T)-spaced adaptive equalizer structure to increase the equalizer tap size to 24 taps, compared to 8 taps in DOCSIS 1.x mode. This allows operation in the presence of more severe multipath and microreflections, and can accommodate operation near band edges where group delay could be a problem.
 - Supports new QPSK0 and QPSK1 preambles, which provide improved burst acquisition by performing simultaneous acquisition of carrier and timing lock, power estimates, equalizer training and constellation phase lock. This allows shorter preambles, reducing implementation loss.
 - Increases the forward error correction (FEC) T-byte size to 16 bytes per Reed Solomon block (T=16) with programmable interleaving.

To simplify the administration of A-TDMA and mixed TDMA/A-TDMA modulation profiles, the Cisco uBR-MC16U/X card provides a number of preconfigured modulation profiles. Each mode of operation also defines a default modulation profile that is automatically used when a profile is not specifically assigned to an upstream.

**Note**

Cisco IOS Release 12.2(15)CX does not support the Synchronous Code Division Multiple Access (S-CDMA) modulation technique that is also specified in the DOCSIS 2.0 specification.

Upgrading from a Cisco uBR-MC16C/E/S Card

If you replace a Cisco uBR-MC16C, Cisco uBR-MC16E, Cisco uBR-MC16S cable interface line card with a Cisco uBR-MC16U/X card, the Cisco uBR7246VXR router erases the previous interface configuration because the old and new cards are different cards with different capabilities. For this reason, you should consider this change to be an upgrade, as opposed to a simple replacement of cards.

If you want to preserve the existing card's configuration, you must first save it to a text file (either by capturing it to your terminal program's capture buffer or by copying it to a TFTP server), and then edit the configuration as desired. At the very least, you must make the following changes to the previous configuration to allow it to be used with the Cisco uBR-MC16U/X card:

- Because the downstreams on the Cisco uBR-MC16U card are using integrated upconverters, you **MUST** configure and enable the upconverters on each downstream, using the **cable downstream rf-power** and **no cable downstream rf-shutdown** commands. (You do not need to use these commands on the Cisco uBR-MC16X card.)
- Existing modulation profiles can continue to be used on the Cisco uBR-MC16U/X card, but only if you change the profile numbers to be within the range of 41 to 50 (which is the valid range of DOCSIS 1.x profiles for the Cisco uBR-MC16U/X card). If you want to use the advanced modulation profiles available on the card (robust profiles, mixed mode, or ATDMA mode), you must create new modulation profiles and assign them to the card.
- Upstreams default to the DOCSIS 1.0/1.1 TDMA-only mode. To use the mixed or ATDMA modes, you must use the **cable upstream docsis-mode** command to configure the upstream for the new mode.
- To EuroDOCSIS channels on the card, first enter the **cable freq-range european** command in global configuration mode to enable EuroDOCSIS operations on the Cisco CMTS chassis. Then enable Annex A on each downstream that is used for EuroDOCSIS operations, using the **cable downstream annex a** command in interface configuration mode. For example:

```
Router(config)# cable freq-range european
Router(config)# interface cable 3/0
Router(config-if)# cable downstream annex a
Router(config-if)#
```

- You can optionally configure each upstream for the following options:
 - To specify a range of allowable channel widths, use the **cable upstream channel-width** command.
 - To change the ingress noise cancellation value, use the **cable upstream ingress-noise-cancellation** command.
- In addition, if you are using the card in the DOCSIS 1.0/1.1 TDMA-only mode, you can optionally configure the card's advanced hardware spectrum management capabilities.

For information on the new configuration procedures, see the [“How to Configure the Cisco uBR-MC16U/X Card”](#) section on page 13.

Other Differences Between the Cisco uBR-MC16C and Cisco uBR-MC16C/E/S Cards

In addition to the differences listed in the previous section, [Upgrading from a Cisco uBR-MC16C/E/S Card, page 10](#), the Cisco uBR-MC16U/X card has the following differences with the Cisco uBR-MC16C/E/S cable interface line cards:

- The Cisco uBR-MC16C/S cards operate only in the DOCSIS 1.0/1.1 TDMA mode, and the Cisco uBR-MC16E card operates only in the EuroDOCSIS 1.0/1.1 TDMA mode, using cable modulation profiles in the range of 1 to 10. The Cisco uBR-MC16U/X uses the following modulation profile numbers, depending on the mode of operation:
 - In DOCSIS 1.X TDMA-only mode, uses modulation profiles 41 to 50.

- In DOCSIS 1.X/DOCSIS 2.0 TDMA/A-TDMA mixed mode, uses modulation profiles 141 to 150.
- In DOCSIS 2.0 A-TDMA-only mode, uses modulation profiles 241 to 250.
- The default modulation profile for the Cisco uBR-MC16C/E/S cards is profile 1. The default for the Cisco uBR-MC16U/X cards is 41 (DOCSIS 1.X TDMA-only mode), 141 (DOCSIS 1.X/2.0 mixed mode), and 241 (DOCSIS 2.0 A-TDMA-only mode).
- The **show cable flap-list** command on the Cisco uBR-MC16C/E/S cards sorts the flap-list by the user-specified option. On the Cisco uBR-MC16U/X card, the **show cable flap-list** command sorts the flap list first by the cable interface card slot, and then by the user-specified option.
- Because the Cisco uBR-MC16U/X card uses a distributed architecture, the NPE processor periodically polls the processor that is onboard the Cisco uBR-MC16U/X card to obtain the packet counters for the cable interface. This polling is done approximately every 5 seconds, so SNMP applications should not poll the Cisco uBR7246VXR router more frequently than every five seconds, because the counters could otherwise appear to be inaccurate or random.

Benefits

The Cisco uBR-MC16U/X card provides the following benefits to cable service providers and their partners and customers. Unless otherwise noted, all features apply to both the Cisco uBR-MC16U and Cisco uBR-MC16X card:

- Provides improved RF performance over current cable interface line cards.
- Cable operators can efficiently deploy tiered services while effectively managing peer-to-peer traffic, allowing the CMTS to deliver highly competitive service bundles to both the consumer and business marketplaces.
- Full compatibility with DOCSIS 1.0 and DOCSIS 1.1 cable modems (CMs) and cable modem termination systems (CMTS).
- Additional channel capacity in the form of more digital bits of throughput capacity in the upstream path.
- Increased protection against electronic impairments that occur in cable systems, allowing for a more robust operating environment.
- (Cisco uBR-MC16U Only) Includes integrated upconverters for each downstream port, removing the requirement for an external upconverter.
- Provides hardware-based support for DOCSIS 1.1 features such as concatenation, fragmentation, and payload headers suppression (PHS).
- Provides hardware-based spectrum management features.
- Gives cable operators additional flexibility in partitioning the cable plant to address growing subscriber bandwidth demands; enables cost-effective scalability of services and subscribers.
- Supports most earlier Cisco cable interface line card features including online insertion and removal (OIR), allowing key system components to be added or removed without powering off the chassis.
- Interoperates with DOCSIS-compliant cable modems and other RF customer premises equipment (CPE) devices.

How to Configure the Cisco uBR-MC16U/X Card

This section describes the following tasks that are required to configure the Cisco uBR-MC16U/X cable interface line card:

- [Creating Modulation Profiles, page 13](#)
- [Configuring and Enabling the Downstream Ports, page 18](#)
- [Configuring and Enabling the Upstream Ports, page 20](#)
- [Shutting Down a Downstream Port, page 24](#)
- [Configuring Spectrum Management on the Cisco uBR-MC16U/X Card, page 25](#)

**Note**

The Cisco uBR7246VXR router should be operational before beginning the following procedures to configure the Cisco uBR10-MC16U/X cable interface line card.

Configuring the Scheduler Allocate Values

To ensure that the processor on the Cisco uBR7246VXR router has sufficient processor time to handle the communication with the Cisco uBR-MC16U/X card, you must ensure that the router is configured for the default scheduler allocate values, using the **scheduler allocate 4000 400** command in global configuration mode. For example:

```
Router# configure terminal
Router(config)# scheduler allocate 4000 400
Router(config)#
```

If the router is not configured for these values, the processor could not have sufficient time to process the various requests from the processor that is onboard the Cisco uBR-MC16U/X card, which could result in the card being reset during periods of heavy use.

**Tip**

The **scheduler allocate 4000 400** command configures the router so that it spends a maximum of 4,000 microseconds on fast switching within an individual network interrupt context. This command also configures the router so that it spends a minimum of 400 microseconds at the process level when network interrupts are disabled.

Creating Modulation Profiles

This section describes how to create modulation profiles for the different modes of DOCSIS operations, using the preconfigured modulation profile options.

- [Creating a TDMA Modulation Profile, page 14](#)
- [Creating a Mixed Mode Modulation Profile, page 15](#)
- [Creating an A-TDMA Modulation Profile, page 16](#)

Creating a TDMA Modulation Profile

This section describes how to create a modulation profile for the DOCSIS 1.0/DOCSIS 1.1 TDMA mode of operation, using one of the preconfigured modulation profiles.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable modulation-profile** *profile* {**mix** | **qam-16** | **qpsk** | **robust-mix**}
4. **exit**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | enable Example: Router> enable Router# | Enables privileged EXEC mode. Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal Router(config)# | Enters global configuration mode. |
| Step 3 | cable modulation-profile <i>profile</i> { mix qam-16 qpsk robust-mix } | Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type: <ul style="list-style-type: none"> • <i>profile</i> = Specifies the modulation profile number. For the DOCSIS 1.0/DOCSIS 1.1 TDMA mode on the Cisco uBR-MC16U/X, the valid range is 41 to 50. The system creates profile 41 as a default TDMA-only modulation profile. • The following preconfigured profiles are available: <ul style="list-style-type: none"> – mix = Default QPSK/16-QAM profile. – qam-16 = Default 16-QAM profile. – qpsk = Default QPSK profile. – robust-mix = Default QPSK/16-QAM profile that is more robust and more able to deal with noise than the mix profile. |

| Command or Action | Purpose |
|---|---|
| <p>Note You can also create custom modulation profiles with the cable modulation-profile command by configuring the values for the individual burst parameters. These parameters, however, should not be modified unless you are thoroughly familiar with how changing each parameter affects the DOCSIS MAC layer. Cisco recommends using the preconfigured default modulation profiles for most cable plants.</p> | |
| <p>Step 4 <code>exit</code></p> <p>Example: Router(config)# <code>exit</code> Router#</p> | <p>Exits global configuration mode.</p> |

Creating a Mixed Mode Modulation Profile

This section describes how to create a modulation profile for the mixed TDMA/A-TDMA mode of operation, using one of the preconfigured modulation profiles.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `cable modulation-profile profile {mix-high | mix-low | mix-mid | mix-qam | qam-16 | qpsk | robust-mix-high | robust-mix-mid | robust-mix-qam}`
4. `exit`

DETAILED STEPS

| | Command or Action | Purpose |
|----------------------|---|---|
| <p>Step 1</p> | <p><code>enable</code></p> <p>Example: Router> <code>enable</code> Router#</p> | <p>Enables privileged EXEC mode. Enter your password if prompted.</p> |
| <p>Step 2</p> | <p><code>configure terminal</code></p> <p>Example: Router# <code>configure terminal</code> Router(config)#</p> | <p>Enters global configuration mode.</p> |

| Command or Action | Purpose |
|--|--|
| <p>Step 3</p> <pre>cable modulation-profile profile {mix-high mix-low mix-mid mix-qam qam-16 qpsk robust-mix-high robust-mix-mid robust-mix-qam}</pre> <p>Example:</p> <pre>Router(config)# cable modulation-profile 143 mix-medium Router(config)# cable modulation-profile 144 mix-high</pre> | <p>Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:</p> <ul style="list-style-type: none"> <i>profile</i> = Specifies the modulation profile number. For the DOCSIS 1.x and DOCSIS 2.0 mixed mode on the Cisco uBR-MC16U/X, the valid range is 141 to 150. The system creates profile 141 as a default mixed mode modulation profile. The following preconfigured profiles are available: <ul style="list-style-type: none"> mix-high and robust-mix-high = Default QPSK/64-QAM profile. mix-low = Default QPSK/16-QAM profile. mix-mid and robust-mix-mid = Default QPSK/32-QAM profile. mix-qam and robust-mix-qam = Default 16-QAM/64-QAM profile. qam-16 = Default 16-QAM modulation profile. qpsk = Default QPSK modulation profile. <p>Note The robust-mix profiles are similar to but more robust than the mix profiles, so that they more able to detail with noise on the upstream.</p> |
| <p>Note</p> <p>You can also create custom modulation profiles with the cable modulation-profile command by configuring the values for the individual burst parameters. These parameters, however, should not be modified unless you are thoroughly familiar with how changing each parameter affects the DOCSIS MAC layer. Cisco recommends using the preconfigured default modulation profiles for most cable plants.</p> | |
| <p>Step 4</p> <pre>exit</pre> <p>Example:</p> <pre>Router(config)# exit Router#</pre> | <p>Exits global configuration mode.</p> |

Creating an A-TDMA Modulation Profile

This section describes how to create a modulation profile for the DOCSIS 2.0 A-TDMA mode of operation, using one of the preconfigured modulation profiles.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable modulation-profile profile {mix-high | mix-low | mix-mid | mix-qam | qam-8 | qam-16 | qam-32 | qam-64 | qpsk | robust-mix-high | robust-mix-low | robust-mix-mid}**
4. **exit**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | <p>enable</p> <p>Example: Router> enable Router#</p> | Enables privileged EXEC mode. Enter your password if prompted. |
| Step 2 | <p>configure terminal</p> <p>Example: Router# configure terminal Router(config)#</p> | Enters global configuration mode. |
| Step 3 | <p>cable modulation-profile <i>profile</i> {mix-high mix-low mix-mid mix-qam qam-8 qam-16 qam-32 qam-64 qpsk robust-mix-high robust-mix-low robust-mix-mid}</p> <p>Example: Router(config)# cable modulation-profile 242 qam-32 Router(config)# cable modulation-profile 243 qam-64</p> | <p>Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:</p> <ul style="list-style-type: none"> • <i>profile</i> = Specifies the modulation profile number. For the DOCSIS 2.0 A-TDMA only mode on the Cisco uBR-MC16U/X, the valid range is 241 to 250. The system creates profile 241 as a default DOCSIS 2.0 A-TDMA profile for the Cisco uBR-MC16U/X. • The following preconfigured profiles are available: <ul style="list-style-type: none"> – mix-high and robust-mix-high = Default QPSK/64-QAM profile. – mix-low and robust-mix-low = Default QPSK/16-QAM profile. – mix-mid and robust-mix-mid = Default QPSK/32-QAM profile. – mix-qam = Default 16-QAM/64-QAM profile. – qam-8 = Default 8-QAM profile. – qam-16 = Default 16-QAM profile. – qam-32 = Default 32-QAM profile. – qam-64 = Default 64-QAM profile. – qpsk = Default QPSK modulation profile. <p>Note The robust-mix profiles are similar to but more robust than the mix profiles, so that they more able to detail with noise on the upstream.</p> |

| Command or Action | Purpose |
|---|---|
| <p>Note You can also create custom modulation profiles with the cable modulation-profile command by configuring the values for the individual burst parameters. These parameters, however, should not be modified unless you are thoroughly familiar with how changing each parameter affects the DOCSIS MAC layer. Cisco recommends using the preconfigured default modulation profiles for most cable plants.</p> | |
| <p>Step 4 <code>exit</code></p> <p>Example: Router(config)# <code>exit</code> Router#</p> | <p>Exits global configuration mode.</p> |

Configuring and Enabling the Downstream Ports

This section describes how to configure and enable the downstream ports on the Cisco uBR-MC16U or Cisco uBR-MC16X card. Unless otherwise noted, all tasks apply to both versions of the card.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface cable x/y`
4. `cable downstream annex {A | B}`
5. `cable downstream modulation {64qam | 256qam}`
6. `cable downstream interleave-depth {8 | 16 | 32 | 64 | 128}`
7. `cable downstream frequency down-freq-hz`
8. `cable downstream channel-id id`
9. `cable downstream description string`
10. `cable downstream rf-power power-level`
11. `no cable downstream rf-shutdown`
12. `no shutdown`
13. `exit`
14. `exit`

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|--|
| Step 1 | <p>enable</p> <p>Example: Router> enable Router#</p> | Enables privileged EXEC mode. Enter your password if prompted. |
| Step 2 | <p>configure terminal</p> <p>Example: Router# configure terminal Router(config)#</p> | Enters global configuration mode. |
| Step 3 | <p>interface cable <i>x/y</i></p> <p>Example: Router(config)# interface cable 5/0 Router(config-if)#</p> | <p>Enters interface configuration mode for the specified cable interface (MAC domain).</p> <ul style="list-style-type: none"> • <i>x</i> = card slot number (can range from 3 to 6) • <i>y</i> = downstream number (must be 0) |
| Step 4 | <p>cable downstream annex {A B}</p> <p>Example: Router(config-if)# cable downstream annex B Router(config-if)#</p> | <p>(Optional) Configures the downstream for the Motion Picture Experts Group (MPEG) framing format:</p> <ul style="list-style-type: none"> • A = Configures the downstream for Annex A (EuroDOCSIS J.112) channel plan framing. • B = Configures the downstream for Annex B (DOCSIS ITU J.83) channel plan framing (default). <p>Note The Cisco uBR-MC16U/X supports both Annex A and Annex B operation in both DOCSIS and EuroDOCSIS mode.</p> |
| Step 5 | <p>cable downstream modulation {64qam 256qam}</p> <p>Example: Router(config-if)# cable downstream modulation 256qam Router(config-if#)</p> | <p>(Optional) Sets the downstream modulation rate:</p> <ul style="list-style-type: none"> • 64qam = Modulation rate is 6 bits per downstream symbol (default). • 256qam = Modulation rate is 8 bits per downstream symbol. |
| Step 6 | <p>cable downstream interleave-depth {8 16 32 64 128}</p> <p>Example: Router(config-if)# cable downstream interleave-depth 64 Router(config-if#)</p> | <p>(Optional) Sets the downstream interleave depth, in number of rows of codewords. The default is 32.</p> |
| Step 7 | <p>cable downstream frequency <i>down-freq-hz</i></p> <p>Example: Router(config-if)# cable downstream frequency 669000000 Router(config-if)#</p> | <p>(Cisco uBR-MC16U only) Sets the fixed center frequency for the integrated upconverter for this domain's downstream RF carrier in Hz. The value for <i>down-freq-hz</i> should be the center frequency of the 6-MHz downstream RF carrier channel for that downstream port.</p> <p>Note The digital carrier frequency is not the same as the video carrier frequency.</p> |

| | Command or Action | Purpose |
|---------|--|--|
| Step 8 | <p>Command: <code>cable downstream channel-id id</code></p> <p>Example: <pre>Router(config-if)# cable downstream channel-id 12 Router(config-if)#</pre></p> | (Optional) Sets the downstream channel ID. The valid range for <i>id</i> is 1 to 254, with the default being the unique unit number that is assigned by the CMTS. |
| Step 9 | <p>Command: <code>cable downstream description string</code></p> <p>Example: <pre>Router(config-if)# cable downstream description "Downstream 0 for Node 12" Router(config-if)#</pre></p> | (Optional) Adds a description for this downstream to the router's configuration, to aide in management and troubleshooting. The <i>string</i> can be any arbitrary string that contains this downstream's purpose, node, or any other information. |
| Step 10 | <p>Command: <code>cable downstream rf-power power-level</code></p> <p>Example: <pre>Router(config-if)# cable downstream rf-power 60 Router(config-if)#</pre></p> | (Cisco uBR-MC16U only) Sets the RF power output level, in dBmV, on the integrated upconverter. The <i>power-level</i> can range from 45 to 63 dBmV, with a default of 58 dBmV for the Cisco uBR-MC16U cable interface line card. |
| Step 11 | <p>Command: <code>no cable downstream rf-shutdown</code></p> <p>Example: <pre>Router(config-if)# no cable downstream rf-shutdown Router(config-if)#</pre></p> | (Cisco uBR-MC16U only) Enables the integrated upconverter for the downstream. |
| Step 12 | <p>Command: <code>no shutdown</code></p> <p>Example: <pre>Router(config-if)# no shutdown Router(config-if)#</pre></p> | Activates the downstream port on a cable modem card for digital data transmission over the cable plant. |
| | Note Repeat Step 3 through Step 12 for each downstream port. | |
| Step 13 | <p>Command: <code>exit</code></p> <p>Example: <pre>Router(config-if)# exit Router(config)#</pre></p> | Exits interface configuration mode. |
| Step 14 | <p>Command: <code>exit</code></p> <p>Example: <pre>Router(config)# exit Router#</pre></p> | Exits global configuration mode. |

Configuring and Enabling the Upstream Ports

This section describes how to configure and enable the upstream ports on the Cisco uBR-MC16U or Cisco uBR-MC16X card. All tasks apply to both versions of the card.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface cable** *x/y*
4. **cable upstream** *port frequency up-freq-hz*
or
cable upstream *port spectrum-group group-number*
5. **cable upstream** *port power-level dbmv*
6. **cable upstream** *port channel-width first-choice-width [last-choice-width]*
7. **cable upstream** *port minislot-size size*
8. **cable upstream** *port docsis-mode { atdma | tdma | tdma-atdma }*
9. **cable upstream** *port modulation-profile profile [profile2]*
10. **cable upstream** *n ingress-noise-cancellation interval*
11. **no cable upstream** *port shutdown*
12. **exit**
13. **exit**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | enable Example: Router> enable Router# | Enables privileged EXEC mode. Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal Router(config)# | Enters global configuration mode. |
| Step 3 | interface cable <i>x/y</i> Example: Router(config)# interface cable 5/0 Router(config-if)# | Enters interface configuration mode for the specified cable interface (MAC domain). <ul style="list-style-type: none"> • <i>x</i> = card slot number (can range from 3 to 6) • <i>y</i> = downstream number (must be 0) |

| | Command or Action | Purpose |
|--------|--|---|
| Step 4 | <p>cable upstream <i>port</i> frequency <i>up-freq-hz</i></p> <p>Example: Router(config-if)# cable upstream 0 frequency 10000000 Router(config-if)#</p> <p>or</p> <p>cable upstream <i>port</i> spectrum-group <i>group-number</i></p> <p>Example: Router(config-if)# cable upstream 0 spectrum-group 1 Router(config-if)#</p> | <p>Sets the center frequency for the upstream in Hz. The valid range for <i>port</i> is 0 to 5.</p> <p>Assigns the upstream to a spectrum group that defines the valid range of upstream frequencies. The valid range for <i>port</i> is 0 to 5. The valid range for <i>group-number</i> is 1 to 32, with no default.</p> |
| | Note You must configure each upstream with either a fixed center frequency or assign it to a spectrum group. | |
| Step 5 | <p>cable upstream <i>port</i> power-level <i>dbmv</i></p> <p>Example: Router(config-if)# cable upstream 0 power-level 20 Router(config-if)#</p> | <p>(Optional) Sets the input power level for the upstream in dBmV. The valid range for <i>port</i> is 0 to 5. The valid range for <i>dbmv</i> is -10 to +25 dBmV, with a default of 0.</p> |
| Step 6 | <p>cable upstream <i>port</i> channel-width <i>first-choice-width</i> [<i>last-choice-width</i>]</p> <p>Example: Router(config-if)# cable upstream 0 channel-width 800000 Router(config-if)# cable upstream 1 channel-width 1600000 3200000</p> | <p>(Optional) Specifies the allowable upstream channel widths for the upstream port.</p> <ul style="list-style-type: none"> <i>port</i> = Number for the upstream port. The valid range is 0 to 5. <i>first-choice-width</i> = Upstream channel width in hertz (Hz). Valid values are: 200,000 (160,000 symbols/sec), 400,000 (320,000 symbols/sec), 800,000 (640,000 symbols/sec), 1,600,000 (1,280,000 symbols/sec), and 3,200,000 (2,560,000 symbols/sec). <i>last-choice-width</i> = (Optional) Upstream channel width in hertz. The valid values are the same as those for the <i>first-choice-width</i> parameter. The symbol rate automatically steps up from the <i>first-choice-width</i> value to the highest value until a stable channel is established. |
| Step 7 | <p>cable upstream <i>port</i> minislot-size <i>size</i></p> <p>Example: Router(config-if)# cable upstream port minislot-size 8 Router(config-if)#</p> | <p>(Optional) Specifies the minislot size in time ticks.</p> <ul style="list-style-type: none"> <i>port</i> = Number for the upstream port. The valid range is 0 to 5. <i>size</i> = Minislot size. Valid values are 2 (32 symbols), 4 (64 symbols), 8 (128 symbols), 16 (256 symbols), 32 (512 symbols), 64 (1024 symbols), and 128 (2048 symbols). |

| | Command or Action | Purpose |
|---------|--|---|
| Step 8 | <p>Command: <code>cable upstream port docsis-mode {atdma tdma tdma-atdma}</code></p> <p>Example: Router(config-if)# cable upstream 0 docsis-mode atdma Router(config-if)# cable upstream 1 docsis-mode tdma-atdma Router(config-if)#</p> | <p>Configures the upstream for the desired DOCSIS mode of operation:</p> <ul style="list-style-type: none"> • <i>port</i> = Specifies the upstream port. The valid range is 0 to 5. • atdma = Configures the upstream for DOCSIS 2.0 A-TDMA modulation profiles only. • tdma = Configures the upstream for DOCSIS 1.X TDMA modulation profiles only (default). • tdma-atdma = Configures the upstream for both A-TDMA and TDMA operation (mixed mode). |
| Step 9 | <p>Command: <code>cable upstream port modulation-profile profile [profile2]</code></p> <p>Example: Router(config-if)# cable upstream 0 modulation-profile 241 Router(config-if)# cable upstream 1 modulation-profile 131</p> | <p>Assigns the particular modulation profile to this upstream.</p> <ul style="list-style-type: none"> • <i>port</i> = Specifies the upstream port. The valid range is 0 to 5. • <i>profile</i> = Specifies the modulation profile to be used on this upstream. The valid range for the <i>profile</i> parameter depends on the current DOCSIS mode: <ul style="list-style-type: none"> – If the upstream is configured for DOCSIS 1.0 and DOCSIS 1.1 mode, the valid range is 41 to 50 on the Cisco uBR-MC16U/X. – If the upstream is configured for DOCSIS 1.x and DOCSIS 2.0 mixed mode, the valid range is 141 to 150 on the Cisco uBR-MC16U/X. – If the upstream is configured for DOCSIS 2.0 A-TDMA mode, the valid range is 241 to 250 on the Cisco uBR-MC16U/X. • <i>profile2</i> = (Optional) Specifies the number of a secondary modulation profile that the interface uses when noise on the upstream increases to the point that the primary modulation profile can no longer be used. (The secondary profile should specify a more robust profile, in terms of coping with noise, than the primary profile.) <p>Note The type of modulation profiles must match the DOCSIS mode configured for the upstream, using the cable upstream docsis-mode command.</p> |
| Step 10 | <p>Command: <code>cable upstream n ingress-noise-cancellation interval</code></p> <p>Example: Router(config-if)# cable upstream 0 ingress-noise-cancellation 400 Router(config-if)#</p> | <p>(Optional) Configures how often, in milliseconds, a line card should sample the signal on an upstream to correct any ingress noise that has appeared on that upstream.</p> <ul style="list-style-type: none"> • The valid range for <i>port</i> is 0 to 5. • The valid range for <i>interval</i> is 10 to 3000 milliseconds, with a default value of 200 milliseconds. |

| | Command or Action | Purpose |
|---------|--|--|
| Step 11 | no cable upstream <i>port</i> shutdown Example: Router(config-if)# no cable upstream 0 shutdown Router(config-if)# | Activates the RF carrier on the upstream port. Each upstream port must be activated to enable upstream data from the cable modems on your network to the Cisco uBR7246VXR router. The valid range for <i>port</i> is 0 to 5. |
| | Note Repeat Step 4 through Step 11 for each upstream port, changing the <i>port</i> parameter from 0 through 3. | |
| Step 12 | exit Example: Router(config-if)# exit Router(config)# | Exits interface configuration mode. |
| Step 13 | exit Example: Router(config)# exit Router# | Exits global configuration mode. |

Shutting Down a Downstream Port

This section describes how to shut down the downstream port on a cable interface, which should be done when permanently removing a Cisco uBR-MC16U/X card from the Cisco uBR7246VXR chassis. When you shut down an interface, it is designated *administratively down* in the **show** command displays.



Tip

You do not need to shut down an interface when you are replacing the cable interface line card using online insertion and removal (OIR).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface cable *x/y***
4. **shutdown**
5. **cable downstream rf-shutdown**
6. **exit**
7. **exit**

DETAILED STEPS

| | Command or Action | Purpose |
|---|--|---|
| Step 1 | enable Example: Router> enable Router# | Enables privileged EXEC mode. Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal Router(config)# | Enters global configuration mode. |
| Step 3 | interface cable x/y Example: Router(config)# interface cable 5/0 Router(config-if)# | Enters interface configuration mode for the specified cable interface (MAC domain). <ul style="list-style-type: none"> x = card slot number (can range from 3 to 6) y = downstream number (must be 0) |
| Step 4 | shutdown Example: Router(config-if)# shutdown Router(config-if)# | Shuts down the cable interface line card. |
| Step 5 | interface cable x/y Example: Router(config-if)# cable downstream rf-shutdown Router(config-if)# | (Cisco uBR-MC16U only) Shuts down the integrated upconverter for the downstream. |
| Repeat Step 3 through Step 5 for each downstream. | | |
| Step 6 | exit Example: Router(config-if)# exit Router(config)# | Exits interface configuration mode. |
| Step 7 | exit Example: Router(config)# exit Router# | Exits global configuration mode. |

Configuring Spectrum Management on the Cisco uBR-MC16U/X Card

To configure the Cisco uBR-MC16U/X card's advanced hardware-based spectrum management features, see the chapter *Spectrum Management for the Cisco CMTS* in the *Cisco CMTS Feature Guide*. See the [“Additional References” section on page 42](#) for more information.

**Note**

Spectrum management is not supported for DOCSIS 2.0 mixed-mode and A-TDMA upstreams. Advanced spectrum management features (such as guided frequency hopping, dynamic upstream modulation, and proactive CNR-based frequency hopping and channel width changes) can be configured only on DOCSIS 1.X and EuroDOCSIS 1.X upstreams (modulation profiles 41–50). You cannot use these features on channels configured for mixed mode or DOCSIS 2.0 A-TDMA mode (modulation profiles 141–150 and 241–250, respectively). Advanced hardware-based spectrum management for A-TDMA operations is scheduled to be supported in a future release of the Cisco IOS software.

Monitoring the Cisco uBR-MC16U/X Cable Interface Line Card

The following sections describe the major **show** commands that provide information about the Cisco uBR-MC16U/X cable interface line card:

- [Verifying a Downstream Port and Integrated Upconverter, page 26](#)
- [Verifying Downstream Center Frequency, page 27](#)
- [Verifying the Upstream Port, page 27](#)
- [Displaying Cable Modulation Profiles, page 28](#)
- [Displaying Cable Modem Capabilities and Provisioning, page 29](#)

Verifying a Downstream Port and Integrated Upconverter

To display the status of a downstream port and its integrated upconverter, use the **show controllers** command. The following example shows a typical display for the Cisco uBR-MC16U card that shows that the upconverter is enabled and configured for a frequency of 453 MHz and RF power of 55.1 dBmV.

**Note**

The display for the Cisco uBR-MC16X card is similar, except that the card is identified as “Hardware is MC16X (F-connector)”.

```
Router# show controllers c5/0

Interface Cable5/0
Hardware is MC16U (F-connector) with Integrated Up-converter
JIB version 60
Cable5/0 Upconverter is Enabled Output is Enabled
Model: 74-2094-02 Serial Number: 0WAV05530001 CLEI Code: EAIFBB0BAA
HW Rev: PC2D0108 SW Rev: 007, NVRAM Rev: 006 ECI number 289389
Downstream Frequency 453.0000 MHz
RF Power 55.1 dBmV

idb 0x60E18D30 MAC regs 0x20000000 SDRAM 0x28000000
mac ring entries 32 bandwidth ring entries 128 tx ring entries 128 MAP tx ring entries
128
MAC ring 0xF24F2A0 shadow 0x60E7A538 head 18 count 203634 full 0
Bandwidth ring 0xF24F360 shadow 0x60E7A628 head 117 count 21237 full 0
PCI low priority ring 0xF24F5A0 shadow 0x60E7A898 head 0 count 0 full 0
High priority Tx ring 0xF24EE60 shadow 0x60E7A0C8 head 112 tail 114 count 1161886450 full
0
Low priority Tx ring 0xF24EA20 shadow 0x60E79C58 head 126 tail 0 count 99648 full 0
Timestamp is from local oscillator
throttled 0 enabled 0 disabled 0
```

```

Rx: spurious 0 framing_err 0 hcs_err 0 no_buffer 0 short_pkt 0
    no_enqueue 0 no_enp 0 miss_count 0 latency 0
    invalid_sid 0 invalid_mac 0 bad_ext_hdr_pdu 0 concat 0 bad-concat 0
Tx: full 0 drop 0 stuck 0 latency 0
MTx: full 0 drop 0 stuck 0 latency 0
Slots 0 NoUWCollNoEngy 0 FECorHCS 2 HCS 0
Req 0 ReqColl 0 ReqNoise 0 ReqNoEnergy 0
ReqData 0 ReqDataColl 0 ReqDataNoise 0 ReqDataNoEnergy 0
Rng 0 RngColl 0 RngNoise 0
FECBlks 0 UnCorFECBlks 0 CorFECBlks 0
MAP FIFO overflow 0, Rx FIFO overflow 0, No rx buf 0
DS FIFO overflow 0, US FIFO overflow 0, US stuck 0
Bandwidth Requests= 0x1DC0
Piggyback Requests= 0x18A9
Ranging Requests= 0x18530
Timing Offset = 0x0
Bad bandwidth Requests= 0x0
Bad REG_ACK= 0x0
No MAP buffer= 0x0
No REG_RESP buffer= 0x0
Cable5/0 Downstream is up
  Frequency 453.0000 MHz, Channel Width 6 MHz, 64-QAM, Symbol Rate 5.056941 Msps
  FEC ITU-T J.83 Annex B, R/S Interleave I=32, J=4
  Downstream channel ID: 0
  Dynamic Services Stats:
  DSA: 0 REQs 0 RSPs 0 ACKs
  0 Successful DSAs 0 DSA Failures
  DSC: 0 REQs 0 RSPs 0 ACKs
  0 Successful DSCs 0 DSC Failures
  DSD: 0 REQs 0 RSPs
  0 Successful DSDs 0 DSD Failures
  DCC: 0 REQs 0 RSPs 0 ACKs
  0 Successful DCCs 0 DCC Failures

```

Router#

Verifying Downstream Center Frequency

To verify the downstream center frequency of each domain, enter the **show controllers cable downstream** command:

```

Router# show controllers cable 4/0 downstream

Cable4/0 Downstream is up
  Frequency 576.0000MHz, Channel Width 6MHz, 64-QAM, Symbol Rate
  5.056941 Msps
  FEC ITU-T J.83 Annex B, R/S Interleave I=32, J=4
  Downstream channel ID: 0

```

Router#

Verifying the Upstream Port

To verify the current configuration of an upstream port, use the **show controllers cable** command for the desired upstream port. The following example shows a typical display that shows that the upstream is configured for a frequency of 6.0 Mhz, with a channel width of 1.6 MHz and 16-QAM modulation.

```

Router# show controllers cable5/0 upstream 0

```

```

Cable5/0 Upstream 0 is up
  Frequency 6.000 MHz, Channel Width 1.600 MHz, 16-QAM Symbol Rate 1.280 Msps
  Spectrum Group is overridden
  SNR - Unknown - no modems online.
  Nominal Input Power Level 0 dBmV, Tx Timing Offset 0
  Ranging Backoff automatic (Start 0, End 3)
  Ranging Insertion Interval automatic (60 ms)
  Tx Backoff Start 0, Tx Backoff End 4
  Modulation Profile Group 1
  Concatenation is enabled
  Fragmentation is enabled
  part_id=0x0952, rev_id=0x00, rev2_id=0x00
  nb_agc_thr=0x0000, nb_agc_nom=0x0000
  Range Load Reg Size=0x58
  Request Load Reg Size=0x0E
  Minislot Size in number of Timebase Ticks is = 8
  Minislot Size in Symbols = 64
  Bandwidth Requests = 0x0
  Piggyback Requests = 0x0
  Invalid BW Requests= 0x0
  Minislots Requested= 0x0
  Minislots Granted = 0x0
  Minislot Size in Bytes = 32
  Map Advance (Dynamic) : 2180 usecs
  UCD Count = 54528

```

Router#



Note

The upstream frequency displayed by the **show controllers cable** command output might not exactly match the frequency configured with the **cable upstream frequency** command, because Cisco cable interface line cards use frequencies in 16 KHz increments. For example, if you specify a frequency of 27 MHz, the upstream is programmed for a center frequency of 27.008 MHz, which is the next highest 16-KHz boundary.

Displaying Cable Modulation Profiles

To display the modulation profiles that are currently defined on the CMTS, use the **show cable modulation-profile** command without any options:

Router# **show cable modulation-profile**

| Mod | IUC | Type | Preamb length | Diff enco | FEC T | FEC k | Scrambl seed | Max B | Guard time | Last CW | Scrambl short | Preamb offset |
|-----|---------|-------|---------------|-----------|-------|-------|--------------|-------|------------|---------|---------------|---------------|
| | | | | | BYTES | BYTES | | size | size | | | |
| 1 | request | qpsk | 64 | no | 0x0 | 0x10 | 0x152 | 0 | 8 | no | yes | 0 |
| 1 | initial | qpsk | 128 | no | 0x5 | 0x22 | 0x152 | 0 | 48 | no | yes | 0 |
| 1 | station | qpsk | 128 | no | 0x5 | 0x22 | 0x152 | 0 | 48 | no | yes | 0 |
| 1 | short | qpsk | 72 | no | 0x5 | 0x4B | 0x152 | 6 | 8 | yes | yes | 0 |
| 1 | long | qpsk | 80 | no | 0x8 | 0xDC | 0x152 | 0 | 8 | yes | yes | 0 |
| 141 | request | qpsk | 64 | no | 0x0 | 0x10 | 0x152 | 0 | 8 | no | yes | 0 |
| 141 | initial | qpsk | 128 | no | 0x5 | 0x22 | 0x152 | 0 | 48 | no | yes | 0 |
| 141 | station | qpsk | 128 | no | 0x5 | 0x22 | 0x152 | 0 | 48 | no | yes | 0 |
| 141 | short | qpsk | 72 | no | 0x5 | 0x4B | 0x152 | 6 | 8 | yes | yes | 0 |
| 141 | long | qpsk | 80 | no | 0x8 | 0xDC | 0x152 | 0 | 8 | yes | yes | 0 |
| 141 | a-short | 64qam | 128 | no | 0x5 | 0x63 | 0x152 | 10 | 8 | yes | yes | 0 |
| 141 | a-long | 64qam | 128 | no | 0xF | 0xC8 | 0x152 | 0 | 8 | yes | yes | 0 |
| 241 | request | qpsk | 64 | no | 0x0 | 0x10 | 0x152 | 0 | 8 | no | yes | 0 |
| 241 | initial | qpsk | 128 | no | 0x5 | 0x22 | 0x152 | 0 | 48 | no | yes | 0 |
| 241 | station | qpsk | 128 | no | 0x5 | 0x22 | 0x152 | 0 | 48 | no | yes | 0 |

```

241 a-short 64qam 128 no 0x5 0x63 0x152 10 8 yes yes 0
241 a-long 64qam 128 no 0xF 0xC8 0x152 0 8 yes yes 0
241 a-ugs 16qam 80 no 0x3 0xE7 0x152 0 8 yes yes 0

```

Router#

To display a specific modulation profile in detail, specify the profile number with the **show cable modulation-profile** command:

Router# **show cable modulation-profile 242**

```

Mod IUC      Type  Pre Diff FEC  FEC  Scrm Max Guard Last Scrm Pre  Pre  RS
           len enco T   k   seed B  time CW  offst Type
           BYTE BYTE  siz size short
242 request qpsk  68  no  0x0 0x10 0x152 0  8  no  yes  0  qpsk0 no
242 initial qpsk   2  no  0x0 0x10 0x0   0  0  no  no   0  qpsk1 no
242 station qpsk  128 no  0x5 0x22 0x152 0 48  no  yes  0  qpsk0 no
242 a-short 32qam 160 no  0x9 0x4C 0x152 6  8  yes  yes  0  qpsk1 no
242 a-long  64qam 132 no  0xC 0xE7 0x152 0  8  yes  yes  0  qpsk1 no
242 a-ugs   16qam  80  no  0x3 0xE7 0x152 0  8  yes  yes  0  qpsk1 no

```

Router#

Displaying Cable Modem Capabilities and Provisioning

To display the capabilities of the online cable modems and how the modems were provisioned, use the **show cable modem mac** command:

Router# **show cable modem mac**

```

MAC Address      MAC          Prim Ver   Prov   Frag Concat PHS Priv DS   US
                State       Sid
0007.0e03.69a1  online      2     DOC1.1 DOC1.1 yes  yes   yes BPI+ 0   4
0007.0e03.6a05  online      3     DOC1.1 DOC1.1 yes  yes   yes BPI+ 0   4
0007.0e03.6981  online      4     DOC1.1 DOC1.1 yes  yes   yes BPI+ 0   4
0007.0e03.69e9  online      2     DOC1.1 DOC1.1 yes  yes   yes BPI+ 0   4
0090.963e.d312  online(pt)  4     DOC1.1 DOC1.0 no   yes   yes BPI   8   4
0008.0e06.7a90  online(pt)  56    DOC1.0 DOC1.0 no   yes   no  BPI   0   0
0002.8a0e.a392  online(pt)  57    DOC1.0 DOC1.0 no   no    no  BPI   0   0
0000.39e8.9a4e  online(pt)  58    DOC1.0 DOC1.0 no   yes   no  BPI   0   0
0000.39ac.4e57  online      151   DOC2.0 DOC1.0 no   yes   no  BPI   0   0
0090.963e.d314  online(pt)  152   DOC1.1 DOC1.0 no   yes   yes BPI   8   4
0008.0e06.7ab8  online(pt)  153   DOC2.0 DOC1.0 no   yes   no  BPI   0   0
0007.0e03.6cf5  online(pt)  154   DOC1.0 DOC1.0 no   yes   no  BPI   0   0
0007.0e03.69f1  online      155   DOC1.1 DOC1.0 no   yes   yes BPI+ 0   4
0007.0e03.6855  online      156   DOC1.1 DOC1.0 no   yes   yes BPI+ 0   4
0007.0e03.6ca1  online      157   DOC1.1 DOC1.0 no   yes   yes BPI+ 0   4
0050.daf8.0296  online(pt)  158   DOC1.0 DOC1.0 no   no    no  BPI   0   0
0002.8a0e.a38c  online(pt)  159   DOC2.0 DOC2.0 no   no    no  BPI   0   0

```

Router#

To display how many cable modems of each DOCSIS type are online each upstream, use the **show cable modem mac summary** command:

Router# **show cable modem mac summary**

```

                          Cable Modem Summary
                          -----
                          Mac Version                Provision Mode
Interface      Total  DOC2.0  DOC1.1  DOC1.0  Reg/Online  DOC 2.0  DOC1.1  DOC1.0
Cable3/0/U1    1      0       1       0       1           0       1       0
Cable3/0/U2    1      0       1       0       1           0       1       0

```

```

Cable3/0/U3      1      0      1      0      1      0      1      0
Cable6/0/U1      9      1      5      3      9      1      0      8
Cable6/0/U2      1      0      1      0      1      0      0      1
Cable6/0/U2      2      2      0      0      2      2      0      0

```

```
Router#
```

Configuration Examples for Cisco uBR-MC16U/X Card

This section lists sample configurations for the Cisco uBR-MC16U/X cable interface line card.

- [Modulation Profiles, page 30](#)
- [Cisco uBR-MC16U/X Cable Interface Configurations, page 33](#)

Modulation Profiles

This section lists sample configurations for creating the following types of upstream modulation profiles:

- [Default Modulation Profiles, page 30](#)
- [DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles, page 31](#)
- [Mixed TDMA/A-TDMA Modulation Profiles, page 31](#)
- [DOCSIS 2.0 A-TDMA Modulation Profiles, page 31](#)

Default Modulation Profiles

The following sample configurations show the default modulation profiles that are created on the Cisco CMTS for DOCSIS 1.X, DOCSIS 1.X/2.0 Mixed, and DOCSIS 2.0 ATDMA mode of operation:

```

! Default DOCSIS 1.X Mixed QPSK/16-QAM Modulation Profile
cable modulation-profile 41 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 41 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 41 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 41 short 6 76 7 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 41 long 8 231 0 8 16qam scrambler 152 no-diff 160 shortened

! Default DOCSIS 1.X/2.0 Mixed Modulation Profile
cable modulation-profile 141 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 141 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 141 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 141 short 6 76 7 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 141 long 8 231 0 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 141 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened qpsk1 1 2048
cable modulation-profile 141 a-long 12 231 0 8 64qam scrambler 152 no-diff 132 shortened qpsk1 1 2048

! Default DOCSIS 2.0 ATDMA Modulation Profile
cable modulation-profile 241 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed qpsk0 1 2048
cable modulation-profile 241 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed qpsk0 1 2048
cable modulation-profile 241 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed qpsk0 1 2048
cable modulation-profile 241 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened qpsk1 1 2048
cable modulation-profile 241 a-long 12 231 0 8 64qam scrambler 152 no-diff 132 shortened qpsk1 1 2048
cable modulation-profile 241 a-ugs 3 231 0 8 16qam scrambler 152 no-diff 80 shortened qpsk1 1 2048

```

DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles

The following sample configurations show typical modulation profiles for the DOCSIS 1.0/DOCSIS 1.1 TDMA mode of operation. Profiles 42 and 43 use the preconfigured 16-QAM and QPSK modulation profiles. Profile 44 is a typical QPSK/16-QAM mixed modulation profile using some customized burst parameters.

```
cable modulation-profile 42 qam-16
cable modulation-profile 43 qpsk

cable modulation-profile 44 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 44 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 44 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 44 short 0 17 0 0 16qam no-scrambler no-diff 44 fixed
cable modulation-profile 44 long 8 231 0 8 16qam scrambler 152 no-diff 160 shortened
```

Mixed TDMA/A-TDMA Modulation Profiles

The following sample configurations show typical modulation profiles for the DOCSIS 1.X/DOCSIS 2.0 mixed TDMA/A-TDMA mode of operation. Profiles 143 through 147 use the preconfigured mixed mode modulation profiles. Profile 141 is a typical mixed mode modulation profile some customized burst parameters.

```
cable modulation-profile 143 mix-high
cable modulation-profile 144 mix-low
cable modulation-profile 145 mix-medium
cable modulation-profile 146 qam-16
cable modulation-profile 147 qpsk

cable modulation-profile 141 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 141 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 141 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 141 short 6 76 7 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 141 long 8 231 0 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 141 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened qpsk1 1 2048
cable modulation-profile 141 a-long 12 231 0 8 64qam scrambler 152 no-diff 132 shortened qpsk1 1 2048
```

DOCSIS 2.0 A-TDMA Modulation Profiles

The following sample configurations show typical modulation profiles for the DOCSIS 1.X/DOCSIS 2.0 mixed TDMA/A-TDMA mode of operation. Profiles 242 through 246 use the preconfigured A-TDMA mode modulation profiles. Profiles 247 through 249 are A-TDMA mode modulation profiles using customized burst parameters.

```
cable modulation-profile 242 qam-8
cable modulation-profile 243 qam-16
cable modulation-profile 244 qam-32
cable modulation-profile 245 qam-64
cable modulation-profile 246 qpsk
!
cable modulation-profile 247 request 4 16 0 8 64qam scrambler 152 diff 132 fixed qpsk1 1 2048
cable modulation-profile 247 reqdata 13 116 32 23 qpsk scrambler 32 diff 2 fixed qpsk0 32 23
cable modulation-profile 247 initial 5 34 0 48 64qam scrambler 152 diff 128 fixed qpsk1 1 2048
cable modulation-profile 247 station 5 34 0 48 64qam scrambler 152 diff 128 fixed qpsk1 1 2048
cable modulation-profile 247 a-short 9 76 5 8 64qam scrambler 152 diff 160 shortened qpsk1 1 2048
cable modulation-profile 247 a-long 12 231 0 8 64qam scrambler 152 diff 132 shortened qpsk1 1 2048
cable modulation-profile 247 a-ugs 6 253 0 0 16qam scrambler 0 diff 4 fixed qpsk0 255 18
!
cable modulation-profile 248 request 0 16 0 8 32qam scrambler 152 no-diff 132 fixed qpsk1 1 2048
cable modulation-profile 248 initial 7 34 0 48 32qam scrambler 152 no-diff 130 fixed qpsk1 1 2048
```

```
cable modulation-profile 248 station 7 34 0 48 32qam scrambler 152 no-diff 130 fixed qpsk1 1 2048
cable modulation-profile 248 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened qpsk1 1 2048
cable modulation-profile 248 a-long 12 231 0 8 32qam scrambler 152 no-diff 132 shortened qpsk1 1 2048
cable modulation-profile 248 a-ugs 7 231 0 8 32qam scrambler 152 no-diff 80 shortened qpsk1 1 2048
!
cable modulation-profile 249 request 0 16 0 8 16qam scrambler 152 no-diff 68 fixed qpsk1 1 2048
cable modulation-profile 249 initial 5 34 0 48 16qam scrambler 152 no-diff 128 fixed qpsk1 1 2048
cable modulation-profile 249 station 5 34 0 48 16qam scrambler 152 no-diff 128 fixed qpsk1 1 2048
cable modulation-profile 249 a-short 6 76 7 8 16qam scrambler 152 no-diff 160 shortened qpsk1 1 2048
cable modulation-profile 249 a-long 9 231 0 8 16qam scrambler 152 no-diff 132 shortened qpsk1 1 2048
cable modulation-profile 249 a-ugs 3 231 0 8 16qam scrambler 152 no-diff 80 shortened qpsk1 1 2048
```


Cisco uBR-MC16U/X Cable Interface Configurations

This section provides the following sample configurations for the cable interfaces on the Cisco uBR-MC16U line card:

- [DOCSIS 1.X Configuration, page 33](#)
- [DOCSIS 2.0 ATDMA Configuration, page 34](#)
- [EuroDOCSIS 1.X Configuration, page 34](#)
- [EuroDOCSIS 2.0 ATDMA Configuration, page 35](#)

The configurations for the Cisco uBR-MC16X are identical to these configurations, except that the following commands for the integrated upconverter are not used:

- **cable downstream rf-power**
- **cable downstream rf-shutdown**

DOCSIS 1.X Configuration

```

!
interface Cable6/0
  description For DOCSIS 1.1 (North American) Cable Modems
  no ip address
  load-interval 30
  no keepalive
  shutdown
  cable bundle 2
  cable downstream annex B
  cable downstream modulation 64qam
  cable downstream interleave-depth 32
  cable downstream frequency 555000000
  cable downstream channel-id 0
  cable downstream description This is the downstream 0 on MC16U for cable interface 6/0
  no cable downstream rf-shutdown
  cable downstream rf-power 58
  cable upstream 0 frequency 10000000
  cable upstream 0 power-level 0
  cable upstream 0 channel-width 1600000 1600000
  cable upstream 0 minislots-size 4
  cable upstream 0 data-backoff automatic
  cable upstream 0 modulation-profile 41
  no cable upstream 0 shutdown
  cable upstream 1 channel-width 1600000 1600000
  cable upstream 1 minislots-size 4
  cable upstream 1 modulation-profile 41
  cable upstream 1 shutdown
  cable upstream 2 channel-width 1600000 1600000
  cable upstream 2 minislots-size 4
  cable upstream 2 modulation-profile 41
  cable upstream 2 shutdown
  cable upstream 3 channel-width 1600000 1600000
  cable upstream 3 minislots-size 4
  cable upstream 3 modulation-profile 41
  cable upstream 3 shutdown
  cable upstream 4 channel-width 1600000 1600000
  cable upstream 4 minislots-size 4
  cable upstream 4 modulation-profile 41
  cable upstream 4 shutdown
  cable upstream 5 channel-width 1600000 1600000
  cable upstream 5 minislots-size 4

```

```

cable upstream 5 modulation-profile 41
cable upstream 5 shutdown

```

DOCSIS 2.0 ATDMA Configuration

```

!
interface Cable3/0
 ip address 10.10.0.1 255.255.0.0
 ip helper-address 10.10.2.2
 no ip mroute-cache
 load-interval 30
 no keepalive
 cable downstream annex B
 cable downstream modulation 256qam
 cable downstream interleave-depth 32
 cable downstream frequency 555000000
 cable downstream channel-id 3
 no cable downstream rf-shutdown
 cable upstream 0 frequency 30000000
 cable upstream 0 docsis-mode atdma
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 6400000 6400000
 cable upstream 0 minislots-size 1
 cable upstream 0 modulation-profile 242
 no cable upstream 0 rate-limit
 no cable upstream 0 shutdown
 cable upstream 1 frequency 30000000
 cable upstream 1 docsis-mode atdma
 cable upstream 1 power-level 0
 cable upstream 1 channel-width 6400000 6400000
 cable upstream 1 minislots-size 1
 cable upstream 1 modulation-profile 241
 no cable upstream 1 rate-limit
 no cable upstream 1 shutdown
 cable upstream 2 frequency 13008000
 cable upstream 2 power-level 0
 cable upstream 2 channel-width 3200000 1600000
 cable upstream 2 minislots-size 2
 cable upstream 2 modulation-profile 41
 no cable upstream 2 rate-limit
 cable upstream 2 shutdown
 cable upstream 3 frequency 17008000
 cable upstream 3 power-level 0
 cable upstream 3 channel-width 3200000 1600000
 cable upstream 3 minislots-size 2
 cable upstream 3 modulation-profile 41
 no cable upstream 3 rate-limit

```

EuroDOCSIS 1.X Configuration



Tip

EuroDOCSIS configurations are identical to the DOCSIS configurations, except that the downstream is configured for Annex A mode, using the **cable downstream annex A** command, and the upstream supports the greater frequency range (5 to 65 MHz) used on EuroDOCSIS networks.

```

!
interface Cable6/0
 no ip address
 no ip mroute-cache

```

```

load-interval 30
cable bundle 1 master
cable downstream annex A
cable downstream modulation 256qam
cable downstream frequency 666000000
cable downstream channel-id 0
no cable downstream rf-shutdown
cable upstream 0 description Node23 0
cable upstream 0 spectrum-group 1
cable upstream 0 power-level -10
cable upstream 0 channel-width 3200000 1600000
cable upstream 0 minislot-size 4
cable upstream 0 data-backoff automatic
cable upstream 0 modulation-profile 42
no cable upstream 0 shutdown
cable upstream 1 description Node23 1
cable upstream 1 spectrum-group 2
cable upstream 1 power-level -10
cable upstream 1 channel-width 3200000 1600000
cable upstream 1 minislot-size 4
cable upstream 1 data-backoff automatic
cable upstream 1 modulation-profile 42
no cable upstream 1 shutdown
cable upstream 2 description Node23 2
cable upstream 2 spectrum-group 3
cable upstream 2 power-level -10
cable upstream 2 channel-width 3200000 1600000
cable upstream 2 minislot-size 4
cable upstream 2 data-backoff automatic
cable upstream 2 modulation-profile 42
no cable upstream 2 shutdown
cable upstream 3 description Node23 3
cable upstream 3 spectrum-group 4
cable upstream 3 power-level -10
cable upstream 3 channel-width 3200000 1600000
cable upstream 3 minislot-size 2
cable upstream 3 data-backoff automatic
cable upstream 3 modulation-profile 42
no cable upstream 3 shutdown
cable upstream 4 channel-width 1600000 1600000
cable upstream 4 minislot-size 4
cable upstream 4 modulation-profile 41
cable upstream 4 shutdown
cable upstream 5 channel-width 1600000 1600000
cable upstream 5 minislot-size 4
cable upstream 5 modulation-profile 41
cable upstream 5 shutdown

```

EuroDOCSIS 2.0 ATDMA Configuration



Tip

EuroDOCSIS configurations are identical to the DOCSIS configurations, except that the downstream is configured for Annex A mode, using the **cable downstream annex A** command, and the upstream supports the greater frequency range (5 to 65 MHz) used on EuroDOCSIS networks.

```

!
interface Cable3/0
ip address 10.10.0.1 255.255.0.0
ip helper-address 10.10.2.2
no ip mroute-cache

```

```

load-interval 30
no keepalive
cable downstream annex A
cable downstream modulation 256qam
cable downstream interleave-depth 32
cable downstream frequency 555000000
cable downstream channel-id 3
no cable downstream rf-shutdown
cable upstream 0 frequency 30000000
cable upstream 0 docsis-mode atdma
cable upstream 0 power-level 0
cable upstream 0 channel-width 6400000 6400000
cable upstream 0 minislots-size 1
cable upstream 0 modulation-profile 242
no cable upstream 0 rate-limit
no cable upstream 0 shutdown
cable upstream 1 frequency 30000000
cable upstream 1 docsis-mode atdma
cable upstream 1 power-level 0
cable upstream 1 channel-width 6400000 6400000
cable upstream 1 minislots-size 1
cable upstream 1 modulation-profile 241
no cable upstream 1 rate-limit
no cable upstream 1 shutdown
cable upstream 2 frequency 13008000
cable upstream 2 power-level 0
cable upstream 2 channel-width 3200000 1600000
cable upstream 2 minislots-size 2
cable upstream 2 modulation-profile 41
no cable upstream 2 rate-limit
cable upstream 2 shutdown
cable upstream 3 frequency 17008000
cable upstream 3 power-level 0
cable upstream 3 channel-width 3200000 1600000
cable upstream 3 minislots-size 2
cable upstream 3 modulation-profile 41
no cable upstream 3 rate-limit

```

System Error Messages

Cisco IOS Release 12.2(15)CX adds the following system error messages to support the Cisco uBR-MC16U/X cable interface line card.

MCU

The following system error messages display information about the Cisco uBR-MC16U/X cable interface card's hardware or initialization problems.

%MCU-1-CONFIGNOTETHER: Cannot configure any of the IPC ethernet interfaces

Explanation The internal Ethernet interfaces on the cable interface line card, which are used for interprocess communications (IPC) with the main processor, cannot be configured.

Recommended Action Remove and reinsert the specified cable interface line card. Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCU-1-DISCOVER: Cannot initialize bay [dec], shutting down bay

Explanation The Cisco CMTS router could not initialize the indicated backplane bay and is shutting down the bay to prevent possible hardware problems.

Recommended Action Remove and reinsert the Cisco uBR-MC16U/X card. If the problem persists, reload the Cisco CMTS router.

%MCU-3-EREVENT: slot ([dec]):([chars])

Explanation The cable interface line card in the indicated slot experienced the indicated error event or failure.

Recommended Action Remove and reinsert the specified cable interface line card. Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCU-3-GENERAL: [chars]

Explanation The cable interface line card in the indicated slot experienced a general failure, as defined by the failure string.

Recommended Action Remove and reinsert the specified cable interface line card. Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCU-6-HWREV: Slot [dec]: HW revision is [dec]

Explanation An informational message that displays the current hardware revision for the Cisco uBR-MC16U/X cable interface line card.

Recommended Action No action is needed.

%MCU-6-OLDHWREV: Slot [dec]: HW revision is below 1.8 - board should be upgraded

Explanation The Cisco uBR-MC16U/X cable interface line card in the indicated slot has a pre-release hardware revision. The card must be at hardware revision 1.8 or above to be able to run current Cisco IOS software.

Recommended Action Contact your Cisco technical support representative to arrange for the Cisco uBR-MC16U/X card to be upgraded to the proper hardware revision.

%MCU-5-RESET: MCU port adapter was in slot [dec] was reset

Explanation The indicated cable interface line card was reset, either by a user manually resetting the card from the command-line interface (CLI), or by the system.

Recommended Action No action is needed.

MCUCLC

The following system error messages display information about errors that have occurred during the operation of the Cisco IOS software on the Cisco uBR-MC16U/X cable interface card.

%MCUCLC-3-EREVENT: [chars]

Explanation The cable interface line card in the indicated slot experienced a general failure, as defined by the failure string.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUCLC-6-PCIENBDISAB: NPE PCI data interface [[dec]]: [chars]

Explanation The network processing engine (NPE) PCI data interface has been enabled or disabled, as indicated.

Recommended Action No action is needed.

%MCUCLC-3-PCIANALYZE: PCI device ([dec]) initialization failed

Explanation The PCI device initialization failed on the cable interface line card. This typically indicates a system fault with the card.

Recommended Action Remove and reinsert the specified cable interface line card. Verify that you are running released software on the CMTS. If the problem persists, contact your Cisco technical support representative to arrange for the Cisco uBR-MC16U/X card to be upgraded or replaced.

%MCUCLC-3-NOTMCU: PCI device ID seen as [hex], expected [hex]

Explanation The Cisco IOS software could not recognize the Sibyte chips on the cable interface line card. This could indicate a faulty or incomplete initialization of the cable interface line card.

Recommended Action Power down the Cisco CMTS router, remove and reinsert the cable interface line card, and reboot. If the message reoccurs, verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. Contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUCLC-3-UNKEVENT: [chars]: [dec]

Explanation The Cisco IOS software received an unknown event from the cable interface line card. This could indicate that the Cisco IOS software release that is running on the cable interface line card is not the same release that is running on the Cisco CMTS router.

Recommended Action Verify that you are running released software on the CMTS. Remove and reinsert the cable interface line card to force it to reload its onboard Cisco IOS software. If the problem persists, issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

MCUFSM

The following system error messages display information about unexpected events that have occurred with the finite state machine (FSM) that operates on the Cisco uBR-MC16U/X cable interface card to control online insertion and removal (OIR) operations.

%MCUFSM-3-BADSLLOT: Invalid slot [dec] in function [chars]

Explanation The cable interface line card received an invalid slot number as part of an interprocess communications message.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUFSM-1-CARD_LOADING: Card in slot ([dec]) booting: [chars], size [dec] bytes, version [hex], checksum [hex]

Explanation The indicated cable interface line card is loading and booting the indicated microcode software image. This typically should happen only during system initialization and during OIR of the card.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUFSM-3-ENQFAIL: Enqueue of message failed slot ([dec]), major event ([dec])

Explanation The indicated cable interface line card could not enqueue an OIR message to the proper event queue, typically because of insufficient memory resources.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUFSM-3-FSMEXECUTE: slot [dec]: fsm execution failed ([dec])

Explanation The finite state machine that operates on the indicated cable interface line card encountered the general failure that is indicated by the failure string.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUFSM-3-GENERAL: [chars]

Explanation The finite state machine operating in the software encountered the general failure indicated by the failure string.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUF3M-3-LOADEXIST: slot [dec]: previous download process

Explanation A previous download process exists on the indicated cable interface line card, and a new download cannot start until this previous process terminates.

Recommended Action Remove and reinsert the indicated cable interface line card. Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUF3M-3-OPENERR: slot [dec]: failed to open file [chars]

Explanation The cable interface line card failed to open the indicated microcode software file for download to the card.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

%MCUF3M-3-UNKNOWN: card type is unknown for slot ([dec]) in [chars]

Explanation The OIR finite state machine could not identify the card that is in the indicated slot.

Recommended Action Verify that you are running released software on the CMTS. Issue the **show tech-support** command to gather data that may help identify the nature of the error. If you cannot determine the nature of the error from the error message text or from the **show tech-support** command output, contact your Cisco technical support representative and provide the representative with the gathered information.

UBR7200

%UBR7200-3-L2VPNNOTSUPPORTED: L2 VPN ATM-VC mapping not currently supported on MC16U cards.

Explanation The Cisco uBR-MC16U/X cable interface line card does not support the Transparent LAN Service over Cable feature (which is enabled using the **cable l2-vpn-service atm-vc** command), but the **cable vc-map** command has been used to map traffic from a cable modem that is using the Cisco uBR-MC16U/X card.

Recommended Action Disable the Transparent LAN Service over Cable feature for all cable modems that are using the Cisco uBR-MC16U/X card, using the **no cable vc-map** command. If a later Cisco IOS Release is available for the Cisco uBR7246VXR router, check to see if this restriction has been removed, and if so, upgrade the Cisco IOS software on the router.

Additional References

For additional information related to the Cisco uBR-MC16U/X cable interface line card, refer to the following references:

Related Documents

| Related Topic | Document Title |
|--|---|
| CMTS Command Reference | <i>Cisco Broadband Cable Command Reference Guide</i> , at the following URL: http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html |
| Spectrum Management | <i>Spectrum Management for the Cisco CMTS</i> , at the following URL: http://www.cisco.com/en/US/docs/cable/cmts/feature/guide/ufg_spec.html |
| Cable Features Configuration Guide | <i>Cisco CMTS Feature Guide</i> , at the following URL: http://www.cisco.com/en/US/docs/cable/cmts/feature/guide/cmtsfg.html |
| Configuring an Extended Frequency Range | <i>Support for Extended Frequency Ranges</i> , at the following URL: http://www.cisco.com/en/US/docs/cable/cmts/feature/mclejfm.html |
| Hardware Installation Quick Start Guide | <i>Installing the Cisco uBR-MC16U/X Cable Interface Line Card, Quick Start Guide</i> , at the following URL: http://www.cisco.com/en/US/docs/interfaces_modules/cable/line_cards/ubr16u_x/quick/start/16u_xqsg.html |
| Cisco IOS Release 12.2 Command Reference | Cisco IOS Release 12.2 Configuration Guides and Command References, at the following URL: http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/prod_command_reference_list.html |

Standards

| Standards ¹ | Title |
|--|---|
| SP-RFIV1.1-I09-020830 | Data-over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 1.1 |
| SP-RFIV2.0-I03-021218 | Data-Over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 2.0 |
| SP-OSSIV2.0-I03-021218 | Data-Over-Cable Service Interface Specifications Operations Support System Interface Specification, version 2.0 |
| SP-BPI+-I09-020830 | Data-Over-Cable Service Interface Specifications Baseline Privacy Plus Interface Specification, version 2.0 |

1. Not all supported standards are listed.

MIBs

| MIBs ¹ | MIBs Link |
|--|---|
| <ul style="list-style-type: none"> • DOCS-BPI-PLUS-MIB • DOCS-CABLE-DEVICE-MIB (RFC 2669) • DOCS-CABLE-DEVICE-TRAP-MIB • DOCS-IF-EXT-MIB • DOCS-IF-MIB (RFC 2670) • DOCS-QOS-MIB • DOCS-SUBMGT-MIB • IGMP-STD-MIB (RFC 2933) | <p>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p>http://www.cisco.com/go/mibs</p> |

1. Not all supported MIBs are listed.

RFCs

| RFCs ¹ | Title |
|-------------------|-------------------------------------|
| RFC 2233 | DOCSIS OSSI Objects Support |
| RFC 2665 | DOCSIS Ethernet MIB Objects Support |
| RFC 2669 | Cable Device MIB |

1. Not all supported RFCs are listed.

Technical Assistance

| Description | Link |
|---|--|
| <p>Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.</p> | <p>http://www.cisco.com/cisco/web/support/index.html</p> |

Command Reference

The following commands were added or modified to support the Cisco uBR-MC16U/X card:

- **cable downstream frequency**
- **cable downstream rf-power**
- **cable downstream rf-shutdown**
- **cable modulation-profile**
- **cable upstream channel-width**
- **cable upstream docsis-mode**
- **cable upstream equalization-coefficient**
- **cable upstream ingress-noise-cancellation**
- **cable upstream maintain-psd**
- **cable upstream minislot-size**
- **cable upstream modulation-profile**
- **show cable logging**
- **show cable modulation-profile**
- **show interface cable mac-schedule**

In addition, the following commands have had minor enhancements or additions to support the Cisco uBR-MC16U/X card:

- **cable modem qos profile**—This command was changed so that it does not have any effect unless both the QoS profile specified by this command and the QoS profile specified for the CM in its DOCSIS configuration file are already created on the Cisco CMTS. This restriction did not exist in previous releases.
- **show cable modem phy**—Displays the primary SID and DOCSIS operating mode for each cable modem.
- **show cable modem verbose**—The output now includes the additional fields for DOCSIS 2.0 operation:
 - **Phy Operating Mode**—Displays the PHY-layer modulation mode for a particular cable modem (**tdma** or **atdma**).
 - **Enable DOCSIS 2.0 Mode**—Displays the value for the Enable DOCSIS 2.0 Mode field (TLV 39), if present, in the cable modem’s DOCSIS configuration file or Registration Request message.
- **show controllers cable**—The output for the Cisco uBR-MC16U/X card includes a count of “Null Modem RateLimit Dropped Pkts,” which counts the total number of packets that were dropped because they had a service flow ID (SFID) of 0. This typically means the packets were dropped because of rate-limiting on their original service flows.



Note

For a complete and current description of these commands, see the appropriate chapters in the *Cisco Broadband Cable Command Reference Guide*, at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

CCVP, the Cisco logo, and Welcome to the Human Network are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn is a service mark of Cisco Systems, Inc.; and Access Registrar, Aironet, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, LightStream, Linksys, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PIX, ProConnect, ScriptShare, SMARTnet, StackWise, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0711R)

