CHAPTER 8

DOCSIS 2.0 A-TDMA Modulation Profiles for the Cisco CMTS

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This document describes the DOCSIS 2.0 A-TDMA services feature, which provides support for DOCSIS 2.0 Advanced Time Division Multiple Access (A-TDMA) upstream modulation profiles on the Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20S/U Broadband Processing Engine (BPE) cable interface line cards. This feature supplements the existing support for DOCSIS 1.0 and DOCSIS 1.1 Time Division Multiple Access (TDMA) modulation profiles.

Feature Specifications for DOCSIS 2.0 A-TDMA services

Feature History	
Release	**Modification**
Release 12.2(15)CX	This feature was introduced for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cable interface line cards on the Cisco uBR7246VXR router.
Release 12.2(15)BC2	This feature was supported on the Cisco uBR-MC5X20S/U cable interface line cards on the Cisco uBR10012 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.

Contents

This document includes the following major sections:

Prerequisites for DOCSIS 2.0 A-TDMA Services

The DOCSIS 2.0 A-TDMA services feature has the following prerequisites:

- DOCSIS 2.0 A-TDMA-only and TDMA/A-TDMA mixed modes of operation are supported only on the following cable interface line cards and platforms:
  - Cisco uBR-MC16U/X on a Cisco uBR7246VXR router using Cisco IOS Release 12.2(15)CX, Cisco IOS Release 12.2(15)BC2, or later release
  - Cisco uBR-MC28U/X on a Cisco uBR7246VXR router using Cisco IOS Release 12.2(15)CX, Cisco IOS Release 12.2(15)BC2, or later release
  - Cisco uBR-MC5X20S/U on a Cisco uBR10012 router using Cisco IOS Release 12.2(15)BC2 or later release
- The cable physical plant must be capable of supporting the higher-bandwidth DOCSIS 2.0 A-TDMA modulation profiles.
- 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/A-TDMA mode, upgrade the modem software to a DOCSIS-compliant version.
- The following are required to support the DOCSIS 2.0 A-TDMA features:
  - Cable modems must be DOCSIS 2.0 capable.
  - The DOCSIS configuration file for a DOCSIS 2.0 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 A-TDMA-only or mixed TDMA/A-TDMA mode. To use the 6.4 MHz channel width, the upstream must be configured for A-TDMA-only mode.
- Complete a basic configuration of the Cisco uBR7246VXR or Cisco uBR10012 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 or Cisco uBR10012 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 or Cisco uBR10012 router should be set to a current date and time to ensure that system logs have the proper timestamp and to ensure that the BPI+ subsystem uses the correct timestamp for verifying cable modem digital certificates.

Restrictions for DOCSIS 2.0 A-TDMA Services

The DOCSIS 2.0 A-TDMA services feature has the following restrictions and limitations:

- Does not support virtual channels, as described in DOCSIS 2.0 specification.
- Does not support Synchronous Code Division Multiple Access (S-CDMA) channels.
- Cisco IOS Release 12.2(15)CX, Release 12.2(15)BC2, and later releases 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.
- Advanced hardware-based 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 and EuroDOCSIS 1.X upstreams. You cannot use these features on channels configured for mixed mode or DOCSIS 2.0 A-TDMA mode. Advanced hardware-based spectrum management for A-TDMA operations is scheduled to be supported in a future release of the Cisco IOS software.
- 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.

Information About DOCSIS 2.0 A-TDMA services

This section describes the DOCSIS 2.0 A-TDMA services feature:

Feature Overview

DOCSIS 2.0 A-TDMA services improve 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. In Cisco IOS Release 12.2(15)BC2, DOCSIS 2.0 A-TDMA services are supported on the Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20S/U Broadband Processing Engine (BPE) cable interface line cards.

DOCSIS 2.0 A-TDMA services incorporate 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 for special applications.
- Supports a minislot size of 1 tick for A-TDMA operations.
- Increases channel widths to 6.4 MHz (5.12 Msymbol rate) for A-TDMA operations.
- 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 to 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.

Note Cisco IOS Release 12.2(15)BC2 does not support the Synchronous Code Division Multiple Access (S-CDMA) modulation technique that is also specified in the DOCSIS 2.0 specification.

Modes of Operation

Depending on the configuration, the DOCSIS 2.0 A-TDMA Service feature 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.

  Cisco IOS Release 12.2(15)BC2 also supports an extended frequency range for DOCSIS cable networks, in which the upstream channel widths can range from 5 to 55 MHz.
- 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 difference between DOCSIS and EuroDOCSIS is at the physical layer. To support a DOCSIS or EuroDOCSIS network requires the correct configuration of the DOCSIS 2.0 A-TDMA Service card, as well as upconverters, diplex filters, and other equipment that supports the network type.

When using Cisco IOS Release 12.2(15)BC2, the Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco uBR-MC5X20S/U cards support all DOCSIS 1.1-specified and all DOCSIS 2.0-specified A-TDMA radio frequency (RF) data rates, channel widths, and modulation schemes. Table 8-1 shows the maximum supported DOCSIS 1.1 data rates, and Table 8-2 shows the maximum supported DOCSIS 2.0 (A-TDMA-mode) data rates.

Table 8-1 Maximum DOCSIS 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 8-2 Maximum DOCSIS 2.0 (A-TDMA-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	30.72 25.60 20.48 15.36 10.24
3.2 MHz	64-QAM 32-QAM 16-QAM 8-QAM QPSK	2.56 M	15.36 12.80 10.24 7.68 5.12
1.6 MHz	64-QAM 32-QAM 16-QAM 8-QAM QPSK	1.28 M	7.68 6.40 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 8-2 Maximum DOCSIS 2.0 (A-TDMA-mode) Data Rates (continued)

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

Modulation Profiles

To simplify the administration of A-TDMA and mixed TDMA/A-TDMA modulation profiles, the DOCSIS 2.0 A-TDMA Service feature provides a number of preconfigured modulation profiles that are optimized for different modulation schemes. We recommend using these preconfigured 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. These default modulation profiles (1, 21, 41, 101, 121, 141, 201, 221, and 241, depending on the cable interface line cards that are installed) cannot be deleted.

The valid range for modulation profiles depends on the cable interface being used and the type of modulation profile being created. Table 8-3 lists the valid ranges according to cable interface and modulation type:

Table 8-3 Allowable Ranges for Modulation Profiles

Cable Interface	DOCSIS 1.X (TDMA)	Mixed DOCSIS 1.X/2.0	DOCSIS 2.0 (A-TDMA)
Cisco uBR7100 series	1 to 10 (default is 1)	N/A	N/A
Cisco uBR-MC16C	1 to 10 (default is 1)	N/A	N/A
Cisco uBR-MC16S	1 to 10 (default is 1)	N/A	N/A
Cisco uBR-MC28C	1 to 10 (default is 1)	N/A	N/A
Cisco uBR-MC5X20S/U	21 to 30 (default is 21)	121 to 130 (default is 121)	221 to 230 (default is 221)
Cisco uBR-MC16U/X, Cisco uBR-MC28U/X	41 to 50 (default is 41)	141 to 150 (default is 141)	241 to 250 (default is 241)

Benefits

The DOCSIS 2.0 A-TDMA Service feature provides the following benefits to cable service providers and their partners and customers:

- 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.

How to Configure DOCSIS 2.0 DOCSIS 2.0 A-TDMA Services

This section describes the following tasks that are required to implement DOCSIS 2.0 A-TDMA services:

- Creating Modulation Profiles, page 8-9
- Configuring the DOCSIS Mode and Profile on an Upstream, page 8-14

Note For a complete description of the commands listed in these procedures, see the documentation listed in the "Additional References" section on page 8-25.

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 8-9
- Creating a Mixed Mode Modulation Profile, page 8-10
- Creating an A-TDMA Modulation Profile, page 8-12

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.

	Command or Action	Purpose

Step 3	**cable modulation-profile** *profile* {**mix** | **qam-16** | **qpsk** | **robust-mix**}
	
	Example:
	`Router(config)# cable modulation-profile 3 mix`
	`Router(config)# cable modulation-profile 4 qpsk`
		Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:
		• *profile* = Specifies the modulation profile number. The valid range depends on the cable interface line card:
		– For the Cisco uBR-MC5X20S/U card, the valid range is 21 to 30. The system creates profile 21 as a default TDMA-only modulation profile.
		– For the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X card, the valid range is 41 to 50. The system creates profile 41 as a default TDMA-only modulation profile.
		– For all other cable interface line cards, the valid range is 1 to 10. The system creates profile 1 as a default TDMA-only modulation profile.
		• The following preconfigured profiles are available:
		– **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.

	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. We recommend using the preconfigured default modulation profiles for most cable plants.	

Step 4	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

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

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** *profile* {**mix-high** | **mix-low** | **mix-mid** | **mix-qam** | **qam-16** | **qpsk** | **robust-mix-high** | **robust-mix-mid** | **robust-mix-qam**}
	
	Example:
	`Router(config)# cable modulation-profile 143 mix-medium`
	`Router(config)# cable modulation-profile 144 mix-high`
		Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:
		• *profile* = Specifies the modulation profile number. The valid range depends on the cable interface line card:
		– For the Cisco uBR-MC5X20S/U card, the valid range is 121 to 130. The system creates profile 121 as a default mixed mode modulation profile.
		– For the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cards, 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:
		– **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.
		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.

	Command or Action	Purpose
	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. We recommend using the preconfigured default modulation profiles for most cable plants.	

Step 4	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

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	**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.

	Command or Action	Purpose

Step 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**}
	
	Example:
	`Router(config)# cable modulation-profile 242 qam-32`
	`Router(config)# cable modulation-profile 243 qam-64`
		Creates a preconfigured modulation profile, where the burst parameters are set to their default values for each burst type:
		• *profile* = Specifies the modulation profile number. The valid range depends on the cable interface line card:
		– For the Cisco uBR-MC5X20S/U card, the valid range is 221 to 230. The system creates profile 221 as a default DOCSIS 2.0 A-TDMA mode modulation profile.
		– For the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X cards, the valid range is 241 to 250. The system creates profile 241 as a default DOCSIS 2.0 A-TDMA mode modulation profile.
		• The following preconfigured profiles are available:
		– **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.
		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.

	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. We recommend using the preconfigured default modulation profiles for most cable plants.	

Step 4	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

Configuring the DOCSIS Mode and Profile on an Upstream

This section describes how to configure an upstream for a DOCSIS mode of operation, and then to assign a particular modulation profile to that upstream.

Note By default, all upstreams are configured for DOCSIS 1.0/DOCSIS 1.1 TDMA-only mode, using the default modulation profile of 1, 21, or 41, depending on the cable interface line card.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface cable** *x/y/z*
4. **cable upstream** *n* **docsis-mode** {**atdma** | **tdma** | **tdma-atdma**}
5. **cable upstream** *n* **modulation-profile** *profile* [*profile2*]
6. **cable upstream** *n* **ingress-noise-cancellation** *interval*
7. **cable upstream** *n* **equalization-coefficient**
8. **cable upstream** *n* **maintain-psd**
9. **end**

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/z*
	
	Example:
	`Router(config)# interface cable c5/1/1`
	`Router(config-if)#`
		Enters interface configuration mode for the indicated cable downstream interface.

	Command or Action	Purpose

Step 4	**cable upstream** *n* **docsis-mode** {**atdma** | **tdma** | **tdma-atdma**}
	
	Example:
	`Router(config-if)# cable upstream 0 docsis-mode atdma`
	`Router(config-if)# cable upstream 1 docsis-mode tdma-atdma`
	`Router(config-if)#`
		Configures the upstream for the desired DOCSIS mode of operation:
		• *n* = Specifies the upstream port. Valid values start with 0 for the first upstream port on the cable interface line card.
		• **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 5	**cable upstream** *n* **modulation-profile** *profile* [*profile2*]
	
	Example:
	`Router(config-if)# cable upstream 0 modulation-profile 241`
	`Router(config-if)# cable upstream 1 modulation-profile 131`
		Assigns the particular modulation profile to this upstream.
		• *n* = Specifies the upstream port. Valid values start with 0 for the first upstream port on the cable interface line card.
		• *profile* = Specifies the modulation profile to be used on this upstream. The valid range for the *profile* parameter depends on the current DOCSIS mode:
		– If the upstream is configured for DOCSIS 1.0 and DOCSIS 1.1 mode, the valid range is 21 to 30 for the Cisco uBR-MC5X20S, and 41 to 50 for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X. The valid range is 1 to 10 for all other cards.
		– If the upstream is configured for DOCSIS 1.X and DOCSIS 2.0 mixed mode, the valid range is 121 to 130 for the Cisco uBR-MC5X20S, and 141 to 150 for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X.
		– If the upstream is configured for DOCSIS 2.0 A-TDMA mode, the valid range is 221 to 230 for the Cisco uBR-MC5X20S, and 241 to 250 for the Cisco uBR-MC16U/X and Cisco uBR-MC28U/X.
		• *profile2* = (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.)
		Note The type of modulation profiles must match the DOCSIS mode configured for the upstream, using the **cable upstream docsis-mode** command.

	Command or Action	Purpose

Step 6	**cable upstream** *n* **equalization-coefficient**
	
	Example:
	`Router(config-if)# cable upstream 0 equalization-coefficient`
	`Router(config-if)#`
		(Optional) Enables the use of a DOCSIS pre-equalization coefficient on an upstream.
		• *n* = Upstream port. Valid values start with 0 for the first upstream port on the cable interface line card.

Step 7	**cable upstream** *n* **ingress-noise-cancellation** *interval*
	
	Example:
	`Router(config-if)# cable upstream 0 ingress-noise-cancellation 400`
	`Router(config-if)#`
		(Optional) Configures how often, in milliseconds, the line card should sample the signal on an upstream to correct any ingress noise that has appeared on that upstream.
		• *n* = Upstream port. Valid values start with 0 for the first upstream port on the cable interface line card.
		• interval = Sample interval. Valid range is 10 to 3000 milliseconds, with a default value of 200 milliseconds.

Step 8	**cable upstream** *n* **maintain-psd**
	
	Example:
	`Router(config-if)# cable upstream 0 maintain-psd`
	`Router(config-if)#`
		(Optional) Requires DOCSIS 2.0 cable modems that are operating on an ATDMA-only upstream to maintain a constant power spectral density (PSD) after a modulation rate change.
		• *n* = Upstream port. Valid values start with 0 for the first upstream port on the cable interface line card.

	Note Repeat Step 3 through Step 8 for each cable interface and upstream to be configured.	

Step 9	**end**
	
	Example:
	`Router(config-if)# end`
	`Router#`
		Exits interface configuration mode and returns to privileged EXEC mode.

How to Monitor the DOCSIS 2.0 A-TDMA services Feature

To monitor the DOCSIS 2.0 A-TDMA services feature, use the following procedures:

- Displaying Modulation Profiles, page 8-17
- Displaying Cable Modem Capabilities and Provisioning, page 8-18

Displaying 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 Diff FEC    FEC   Scrambl Max  Guard Last Scrambl Preamb
                  length enco T      k     seed    B    time  CW           offset
                                BYTES  BYTES         size size  short
21  request qpsk  64     no   0x0    0x10  0x152   0    8     no   yes     0
21  initial qpsk  128    no   0x5    0x22  0x152   0    48    no   yes     0
21  station qpsk  128    no   0x5    0x22  0x152   0    48    no   yes     0
21  short   qpsk  72     no   0x5    0x4B  0x152   6    8     yes  yes     0
21  long    qpsk  80     no   0x8    0xDC  0x152   0    8     yes  yes     0
121 request qpsk  64     no   0x0    0x10  0x152   0    8     no   yes     0
121 initial qpsk  128    no   0x5    0x22  0x152   0    48    no   yes     0
121 station qpsk  128    no   0x5    0x22  0x152   0    48    no   yes     0
121 short   qpsk  72     no   0x5    0x4B  0x152   6    8     yes  yes     0
121 long    qpsk  80     no   0x8    0xDC  0x152   0    8     yes  yes     0
121 a-short 64qam 128    no   0x5    0x63  0x152   10   8     yes  yes     0
121 a-long  64qam 128    no   0xF    0xC8  0x152   0    8     yes  yes     0
221 request qpsk  64     no   0x0    0x10  0x152   0    8     no   yes     0
221 initial qpsk  128    no   0x5    0x22  0x152   0    48    no   yes     0
221 station qpsk  128    no   0x5    0x22  0x152   0    48    no   yes     0
221 short   qpsk  72     no   0x5    0x4B  0x152   6    8     yes  yes     0
221 long    qpsk  80     no   0x8    0xDC  0x152   0    8     yes  yes     0
221 a-short 64qam 128    no   0x5    0x63  0x152   10   8     yes  yes     0
221 a-long  64qam 128    no   0xF    0xC8  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 221

Mod IUC     Type  Pre  Diff FEC  FEC  Scrmb Max Guard Last Scrmb Pre   Pre   RS
                 len  enco T    k    seed  B   time  CW         offst Type
                           BYTE BYTE       siz size  short
221 request qpsk  68   no   0x0  0x10 0x152 0   8     no   yes   0     qpsk0 no
221 initial qpsk  2    no   0x0  0x10 0x0   0   0     no   no    0     qpsk1 no
221 station qpsk  128  no   0x5  0x22 0x152 0   48    no   yes   0     qpsk0 no
221 a-short 32qam 160  no   0x9  0x4C 0x152 6   8     yes  yes   0     qpsk1 no
221 a-long  64qam 132  no   0xC  0xE7 0x152 0   8     yes  yes   0     qpsk1 no
221 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                                        Saids Sids
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
Cable3/1/U0     1       0       1       0        1            0        0        1
Cable3/1/U1     1       0       0       1        1            0        0        1
Cable3/1/U2     3       0       1       2        3            0        1        2
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 DOCSIS 2.0 A-TDMA services

This section lists the following sample configurations for the DOCSIS 2.0 A-TDMA services feature on a Cisco CMTS router:

Creating Modulation Profiles Examples

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

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 when using the Cisco uBR-MC5X20S/U cable interface line card:

- Profile 1 is the default profile for TDMA operations that is automatically created on the router for legacy cable interface line cards.
- Profile 21 is the default profile for TDMA operations that is automatically created on the router for the Cisco uBR-MC5X20S/U card.
- Profiles 24 and 25 use the preconfigured 16-QAM and QPSK modulation profiles.
- Profile 26 is a typical QPSK modulation profile using some customized burst parameters.

```
cable modulation-profile 1 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed uw8
cable modulation-profile 1 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 1 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 1 short 4 76 12 8 qpsk scrambler 152 no-diff 72 shortened uw8
cable modulation-profile 1 long 9 236 0 8 qpsk scrambler 152 no-diff 80 shortened uw8

cable modulation-profile 24 qam-16
cable modulation-profile 25 qpsk

cable modulation-profile 26 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 26 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 26 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 26 short 4 76 12 8 qpsk scrambler 152 no-diff 80 shortened
cable modulation-profile 26 long 8 236 0 8 qpsk scrambler 152 no-diff 80 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:

- Profile 121 is the default profile for mixed mode operations that is automatically created on the router for the Cisco uBR-MC5X20S/U card.
- Profiles 122 through 126 use the preconfigured mixed mode modulation profiles.

- Profile 127 is a typical mixed mode modulation profile some customized burst parameters.

```
cable modulation-profile 121 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed uw8
cable modulation-profile 121 initial 5 34 0 48 qpsk scrambler 152 no-diff 32 fixed uw16
cable modulation-profile 121 station 5 34 0 48 qpsk scrambler 152 no-diff 32 fixed uw16
cable modulation-profile 121 short 5 75 6 8 qpsk scrambler 152 no-diff 72 shortened uw8
cable modulation-profile 121 long 8 220 0 8 qpsk scrambler 152 no-diff 80 shortened uw8
cable modulation-profile 121 a-short qpsk0 0 18 5 99 10 8 64qam scrambler 152 no-diff 128
shortened uw8
cable modulation-profile 121 a-long qpsk0 0 18 15 200 0 8 64qam scrambler 152 no-diff 128
shortened uw8

cable modulation-profile 122 mix-high
cable modulation-profile 123 mix-low
cable modulation-profile 124 mix-medium
cable modulation-profile 125 qam-16
cable modulation-profile 126 qpsk

cable modulation-profile 127 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed
cable modulation-profile 127 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 127 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed
cable modulation-profile 127 short 6 76 7 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 127 long 8 231 0 8 16qam scrambler 152 no-diff 160 shortened
cable modulation-profile 127 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened
qpsk1 1 2048
cable modulation-profile 127 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:

- Profile 221 is the default profile for A-TDMA mode operations that is automatically created on the router.
- Profiles 222 through 226 use the preconfigured A-TDMA mode modulation profiles.
- Profile 227 is a typical A-TDMA mode modulation profile customized burst parameters.

```
cable modulation-profile 221 request qpsk0 0 0 0 16 0 8 qpsk scrambler 152 no-diff 64
fixed uw8
cable modulation-profile 221 initial qpsk0 0 0 5 34 0 48 qpsk scrambler 152 no-diff 32
fixed uw16
cable modulation-profile 221 station qpsk0 0 0 5 34 0 48 qpsk scrambler 152 no-diff 32
fixed uw16
cable modulation-profile 221 short qpsk0 0 0 5 75 6 8 qpsk scrambler 152 no-diff 72
shortened uw8
cable modulation-profile 221 long qpsk0 0 0 8 220 0 8 qpsk scrambler 152 no-diff 80
shortened uw8
cable modulation-profile 221 a-short qpsk0 0 18 5 99 10 8 64qam scrambler 152 no-diff 128
shortened uw8
cable modulation-profile 221 a-long qpsk0 0 18 15 200 0 8 64qam scrambler 152 no-diff 128
shortened uw8

cable modulation-profile 222 qam-8
cable modulation-profile 223 qam-16
cable modulation-profile 224 qam-32
cable modulation-profile 225 qam-64
cable modulation-profile 226 qpsk

cable modulation-profile 227 request 0 16 0 8 qpsk scrambler 152 no-diff 68 fixed qpsk0 1
2048
```

```
cable modulation-profile 227 initial 0 16 0 0 qpsk no-scrambler no-diff 2 fixed qpsk1 0 18
cable modulation-profile 227 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed qpsk0
1 2048
cable modulation-profile 227 a-short 9 76 6 8 32qam scrambler 152 no-diff 160 shortened
qpsk1 1 2048
cable modulation-profile 227 a-long 12 231 0 8 64qam scrambler 152 no-diff 132 shortened
qpsk1 1 2048
cable modulation-profile 227 a-ugs 3 231 0 8 16qam scrambler 152 no-diff 80 shortened
qpsk1 1 2048
```

Assigning Modulation Profiles to Upstreams Examples

This section lists sample configurations for assigning the following types of modulation profiles to upstreams:

- Assigning DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles, page 8-21
- Assigning Mixed TDMA/A-TDMA Modulation Profiles, page 8-22
- Assigning DOCSIS 2.0 A-TDMA Modulation Profiles, page 8-23

Assigning DOCSIS 1.0/DOCSIS 1.1 TDMA Modulation Profiles

The following sample configuration shows DOCSIS 1.0/DOCSIS 1.1 TDMA modulation profiles being assigned to the upstreams on two cable interfaces on the Cisco uBR-MC5X20S/U cable interface line card. The default TDMA modulation profile (profile 21) is assigned to the upstreams on cable interface 5/1/0, and modulation profile 22 is assigned to the upstreams on cable interface 5/1/1.

Note The **cable upstream docsis-mode tdma** command is the default configuration for upstreams, so this command is not shown in these sample configurations.

```
interface Cable5/1/0
 ip address 22.0.0.1 255.0.0.0
 ip helper-address 10.10.0.4
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream channel-id 2
 cable upstream 0 frequency 30000000
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 1600000
 cable upstream 0 minislot-size 4
 cable upstream 0 modulation-profile 21
 no cable upstream 0 shutdown
 cable upstream 1 channel-width 1600000
 cable upstream 1 minislot-size 4
 cable upstream 1 modulation-profile 21
 cable upstream 1 shutdown
 cable upstream 2 channel-width 1600000
 cable upstream 2 minislot-size 4
 cable upstream 2 modulation-profile 21
 cable upstream 2 shutdown
 cable upstream 3 channel-width 1600000
 cable upstream 3 minislot-size 4
 cable upstream 3 modulation-profile 21
 cable upstream 3 shutdown
 cable upstream 4 channel-width 1600000
 cable upstream 4 minislot-size 4
```

```
 cable upstream 4 modulation-profile 21
 cable upstream 4 shutdown
 cable upstream 5 channel-width 1600000
 cable upstream 5 minislot-size 4
 cable upstream 5 modulation-profile 21
 cable upstream 5 shutdown
!
interface Cable5/1/1
 ip address 21.0.0.1 255.0.0.0
 ip helper-address 10.10.0.4
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream channel-id 2
 cable upstream 0 frequency 30000000
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 1600000 1600000
 cable upstream 0 minislot-size 4
 cable upstream 0 modulation-profile 22
 no cable upstream 0 shutdown
 cable upstream 1 channel-width 1600000 1600000
 cable upstream 1 minislot-size 4
 cable upstream 1 modulation-profile 22
 cable upstream 1 shutdown
 cable upstream 2 channel-width 1600000 1600000
 cable upstream 2 minislot-size 4
 cable upstream 2 modulation-profile 22
 cable upstream 2 shutdown
 cable upstream 3 channel-width 1600000 1600000
 cable upstream 3 minislot-size 4
 cable upstream 3 modulation-profile 22
 cable upstream 3 shutdown
```

Assigning Mixed TDMA/A-TDMA Modulation Profiles

The following sample configuration shows mixed mode TDMA/A-TDMA modulation profiles being assigned to the upstreams on a cable interface on the Cisco uBR-MC5X20S/U cable interface line card. All upstreams are configured for mixed mode and profile 121 is assigned to them, but only the first upstream is enabled.

```
interface Cable5/1/2
 ip address 21.0.0.1 255.0.0.0
 ip helper-address 10.10.0.4
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream channel-id 2
 cable upstream 0 frequency 30000000
 cable upstream 0 docsis-mode tdma-atdma
 cable upstream 0 power-level 0
 cable upstream 0 channel-width 1600000 1600000
 cable upstream 0 minislot-size 4
 cable upstream 0 modulation-profile 121
 no cable upstream 0 shutdown
 cable upstream 1 docsis-mode tdma-atdma
 cable upstream 1 channel-width 1600000 1600000
 cable upstream 1 minislot-size 4
 cable upstream 1 modulation-profile 121
 cable upstream 1 shutdown
 cable upstream 2 docsis-mode tdma-atdma
 cable upstream 2 channel-width 1600000 1600000
 cable upstream 2 minislot-size 4
```

```
 cable upstream 2 modulation-profile 121
 cable upstream 2 shutdown
 cable upstream 3 docsis-mode tdma-atdma
 cable upstream 3 channel-width 1600000 1600000
 cable upstream 3 minislot-size 4
 cable upstream 3 modulation-profile 121
 cable upstream 3 shutdown
```

Assigning DOCSIS 2.0 A-TDMA Modulation Profiles

The following sample configuration shows DOCSIS 2.0 A-TDMA modulation profiles being assigned to the upstreams on two cable interfaces on the Cisco uBR-MC5X20S/U cable interface line card. Only the first upstream on cable interface c7/1/1 is enabled for A-TDMA mode and assigned an A-TDMA profile. The first three upstreams on cable interface c7/1/2 are enabled for A-TDMA mode, and they are using the default A-TDMA modulation profile of 221.

```
interface Cable7/1/1
 ip address 20.0.0.1 255.0.0.0
 ip helper-address 10.10.0.4
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream channel-id 1
 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 minislot-size 1
 cable upstream 0 modulation-profile 221
 no cable upstream 0 shutdown
 cable upstream 1 channel-width 1600000 1600000
 cable upstream 1 minislot-size 4
 cable upstream 1 modulation-profile 41
 cable upstream 1 shutdown
 cable upstream 2 channel-width 1600000 1600000
 cable upstream 2 minislot-size 4
 cable upstream 2 modulation-profile 41
 cable upstream 2 shutdown
 cable upstream 3 channel-width 1600000 1600000
 cable upstream 3 minislot-size 4
 cable upstream 3 modulation-profile 41
 cable upstream 3 shutdown
!
interface Cable7/1/2
 ip address 71.2.1.1 255.255.255.0 secondary
 ip address 71.72.71.1 255.255.255.0
 load-interval 30
 no keepalive
 cable map-advance static
 cable downstream annex B
 cable downstream modulation 256qam
 cable downstream interleave-depth 32
 cable downstream frequency 459000000
 cable downstream channel-id 2
 no cable downstream rf-shutdown
 cable upstream 0 frequency 30000000
 cable upstream 0 docsis-mode atdma
 cable upstream 0 power-level 0
 no cable upstream 0 concatenation
 no cable upstream 0 fragmentation
 cable upstream 0 modulation-profile 221
 no cable upstream 0 shutdown
```

```
cable upstream 1 frequency 5104000
cable upstream 1 docsis-mode atdma
cable upstream 1 power-level 6
cable upstream 1 channel-width 200000
cable upstream 1 minislot-size 32
cable upstream 1 modulation-profile 221
cable upstream 1 shutdown
cable upstream 2 frequency 38800000
cable upstream 2 power-level 0
cable upstream 2 channel-width 800000
cable upstream 2 minislot-size 32
cable upstream 2 modulation-profile 221
cable upstream 2 shutdown
cable upstream 3 docsis-mode atdma
cable upstream 3 frequency 14000000
cable upstream 3 power-level -6
cable upstream 3 channel-width 400000
cable upstream 3 minislot-size 32
cable upstream 3 modulation-profile 221
cable upstream 3 shutdown
```

Additional References

For additional information related to configuring the Cisco uBR10012 router for DOCSIS 2.0 A-TDMA services, see the following references:

Related Documents

Related Topic	Document Title
CMTS Command Reference	*Cisco Broadband Cable Command Reference Guide,* at the following URL: http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.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/products_installation_and_configuration_guides_list.html http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/prod_command_reference_list.html
Configuring the Cisco uBR-MC16U/X Card	*Configuring the Cisco uBR-MC16U/MC16X Cable Interface Line Card*, at the following URL: http://www.cisco.com/en/US/docs/interfaces_modules/cable/line_cards/ubr16u_x/configuration/guide/mc16uxfm.html
Configuring the Cisco uBR-MC28U/X Card	*Configuring the Cisco uBR-MC28U/MC28X Cable Interface Line Card*, at the following URL: http://www.cisco.com/en/US/docs/interfaces_modules/cable/line_cards/ubr28u_x/configuration/guide/mc28uxfm.html
Configuring the Cisco uBR-MC5X20S Card	*Configuring the Cisco uBR10-MC5X20S Cable Interface Line Card*, at the following URL: http://www.cisco.com/en/US/partner/docs/interfaces_modules/cable/broadband_processing_engines/ubr10_mc5x20s_u_h/feature/guide/mc5x20s.html
Configuring the Cisco uBR-MC5X20U Card	*Configuring the Cisco uBR10-MC5X20U Cable Interface Line Card*, at the following URL: http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122bc/122bc_15/mc5x20u.htm

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
• 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)	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

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
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.	http://www.cisco.com/cisco/web/support/index.html

Command Reference

The following commands were added or modified to support the DOCSIS 2.0 A-TDMA services feature.

- **cable modulation-profile**
- **cable upstream channel-width**
- **cable upstream docsis-mode**
- **cable upstream equalization-coefficient**
- **cable upstream maintain-psd**
- **cable upstream minislot-size**
- **cable upstream modulation-profile**
- **show cable modulation-profile**
- **show interface cable mac-schedule**

In addition, the following commands have had minor enhancements or additions to support the DOCSIS 2.0 A-TDMA services feature:

- **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 cable modem phy**—Displays the primary SID and DOCSIS operating mode for each cable modem.
- **show controllers cable**—The output for the Cisco uBR-MC5X20S/U 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.

For complete and current information about these commands, see 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