



S-CDMA and Logical Channel Support on the Cisco CMTS Routers

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Cisco IOS Release 12.2(33)SCC introduces the S-CDMA and Logical Channel Support feature, which provides support for Synchronous Code Division Multiple Access (S-CDMA) upstream modulation profiles and logical channels on the Cisco cable modem termination systems (CMTS) routers.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <http://tools.cisco.com/ITDIT/CFN/>. An account on <http://www.cisco.com/> is not required.

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Prerequisites for S-CDMA and Logical Channel Support

The table below shows the hardware compatibility prerequisites for this feature.

Table 1: S-CDMA and Logical Channel Support for the Cisco CMTS Routers Hardware Compatibility Matrix

CMTS Platform	Processor Engine	Cable Interface Cards
Cisco uBR10012 Universal Broadband Router	Cisco IOS Release 12.2(33)SCA and later releases <ul style="list-style-type: none"> • PRE2 Cisco IOS Release 12.2(33)SCB and later releases <ul style="list-style-type: none"> • PRE4 Cisco IOS Release 12.2(33)SCH and later releases <ul style="list-style-type: none"> • PRE5 	Cisco IOS Release 12.2(33)SCC and later releases <ul style="list-style-type: none"> • Cisco uBR10-MC5X20H¹ • Cisco UBR-MC20X20V² Cisco IOS Release 12.2(33)SCE and later releases <ul style="list-style-type: none"> • Cisco uBR-MC3GX60V³
Cisco uBR7246VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • NPE-G2 	Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • Cisco uBR-MC88V⁴
Cisco uBR7225VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • NPE-G2 	Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • Cisco uBR-MC88V⁵

¹ The S-CDMA feature is not supported on the Cisco uBR10-MC5X20H cable interface line card.

² The Cisco UBR-MC20X20V cable interface line card has three variants: Cisco UBR-MC20X20V-0D, Cisco UBR-MC20X20V-5D, and Cisco UBR-MC20X20V-20D. The Cisco UBR-MC20X20V-0D line card supports 20 upstreams and zero (no) downstreams. The Cisco UBR-MC20X20V-5D line card supports 20 upstreams and 5 downstreams, and the Cisco UBR-MC20X20V-20D line card supports 20 upstreams and 20 downstreams.

³ Cisco uBR3GX60V cable interface line card is not compatible with PRE2. You must use PRE4 with the Cisco uBR3GX60V cable interface line card.

⁴ The Cisco uBR-MC88V cable interface line card is not compatible with NPE-G1. You must use NPE-G2 with the Cisco uBR-MC88V cable interface line card.

⁵ The Cisco uBR-MC88V cable interface line card is not compatible with NPE-G1. You must use NPE-G2 with the Cisco uBR-MC88V cable interface line card.



Note

Any reference to the Cisco UBR-MC20X20V cable interface line card used in this document is also applicable to its three variants—Cisco UBR-MC20X20V-0D, Cisco UBR-MC20X20V-5D, and Cisco UBR-MC20X20V-20D.

- The cable physical plant must be capable of supporting the higher bandwidth S-CDMA modulation profiles.

- DOCSIS 2.0 compliant cable modems (CMs).
- DOCSIS 1.0 or DOCSIS 1.1 provisioned DOCSIS configuration file.
- Upstream configured for DOCSIS 2.0 S-CDMA or DOCSIS 3.0 S-CDMA mode.
- Complete a basic configuration of the 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 Wide Area Network (WAN) adapter to provide backbone connectivity.
- Determine a channel plan for your router and all of its cable interfaces.
- Verify that your headend site includes all necessary servers to support DOCSIS and Internet connectivity, including Dynamic Host Configuration Protocol (DHCP), Time of Day (ToD), and Trivial File Transfer Protocol (TFTP) servers.
- The system clock on the router should be set to the current date and time to ensure that the system logs have the proper timestamp and the Baseline Privacy Interface Plus (BPI+) subsystem uses the correct timestamp for verifying cable modem digital certificates.

Restrictions for S-CDMA and Logical Channel Support

The S-CDMA feature has the following restrictions and limitations:

- The S-CDMA feature is not supported on the Cisco uBR10-MC5X20H cable interface line card.
- DOCSIS 1.0 provisioned CM configuration file is not recommended or allowed for cable modems on the S-CDMA channel.
- The Cisco IOS Release 12.2(33)SCC supports a maximum of 10 modulation profiles for each of the DOCSIS 2.0 A-TDMA and S-CDMA modes. However, if you enable the global modulation profile there is no restriction on the number of modulation profiles you can use, and can assign any modulation profile number to any DOCSIS mode.
- Advanced hardware-based spectrum management features (such as guided frequency hopping, dynamic upstream modulation, and proactive carrier-to-noise ratio [CNR] based frequency hopping and channel width changes) are not supported for S-CDMA upstreams.
- 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.
- For the S-CDMA high availability, there should be timestamp, minislot, and frame counters synchronization between the working and the protect line cards.
- The DOCSIS 3.0 option scdma-d3 (4SR) is available only when the CMTS is configured to operate in the global modulation profile format.
- If you revert to the legacy modulation profile from the global modulation profile, all the modulation profiles that are outside of the legacy number space range are lost.

The Logical Channel Support feature has the following restrictions and limitations:

- The CMTS must support the logical channel types 3S and 4SR individually on the Cisco uBR-MC88V cable interface line card.
- The Cisco uBR10-MC5X20H, Cisco UBR-MC20X20V, and Cisco uBR-MC88V cable interface line cards can only support up to two logical channels per physical port.
- The upstream bonding at the logical channel level is supported with the following limitations:
 - The upstream bonding of the logical channels from the same physical port (on the same radio frequency spectrum) is not allowed.
 - The upstream bonding is available only to the first logical channel on each physical port.
- Admission control policy cannot be configured at the logical channel level.
- Load balancing is restricted only to the first logical channel. However, the secondary logical channel can be selected as the source channel and not the target channel. That is, load balancing can only move modems from the secondary logical channel, and not to the secondary logical channel.

Information About S-CDMA and Logical Channel Support

The following sections describe the S-CDMA and Logical Channel Support feature:

S-CDMA Services

S-CDMA provides a number of advanced physical layer (PHY) capabilities as per the new DOCSIS 3.0 specifications, which improves the maximum upstream bandwidth on cable networks.

The S-CDMA feature allows the same physical RF upstream channel to receive multiple bursts simultaneously. It uses a two-dimensional (time and code) data transmission technique where multiple modems can simultaneously send their data, each using their own codes, in the same time slot. The codes are orthogonal in nature and do not interfere with each other.

Data is sent over an array of up to 128 spreading codes and all modems are required to transmit their data at precisely the same time. This means that the CMTS and modems have to be synchronized at the symbol clock level (known as synchronous CDMA).

A burst from a particular cable modem may be transmitted on two or more codes (out of the available 128 codes) in one or more frames. A frame can contain bursts transmitted simultaneously from multiple CMs (each on a separate subset of codes) defined as per MAP messages.

The S-CDMA feature allows cable system operators to utilize parts of the upstream below 20 MHz that was previously unusable due to noise conditions. This type of noise cannot be removed with the ingress noise cancellation technology available as part of the DOCSIS 2.0 standard.

The S-CDMA feature incorporates the following advantages and improvements on DOCSIS 3.0 networks:

- Upstreams can be configured for two different modes to support different mixes of cable modems:
 - S-CDMA mode to support DOCSIS 2.0 cable modems.
 - S-CDMA-d3 mode to support DOCSIS 3.0 cable modems.

- S-CDMA-d3 mode allows DOCSIS 3.0 modems to use all data interval usage codes (IUC) like IUC 5, 6, 9, 10, and 11 for data bursts.
- S-CDMA mode of operation provides higher bandwidth on the upstream using 64-QAM, 32-QAM, 16-QAM, 8-QAM, and QPSK modulation profiles.

The table below shows the maximum data rates supported on S-CDMA.

Table 2: Maximum S-CDMA Data Rates

Upstream Channel Width	Modulation Scheme	Baud Rate Sym/sec	Maximum Raw Bit Rate Mbit/sec
6.4 MHz	64-QAM	5.12 M	30.72
	32-QAM		25.60
	16-QAM		20.48
	8-QAM		15.36
	QPSK		10.24
3.2 MHz	64-QAM	2.56 M	15.36
	32-QAM		12.80
	16-QAM		10.24
	8-QAM		7.68
	QPSK		5.12
1.6 MHz	64-QAM	1.28 M	7.68
	32-QAM		6.40
	16-QAM		5.12
	8-QAM		3.84
	QPSK		2.56

Modulation Profiles

To simplify the administration of Advanced Time Division Multiple Access (A-TDMA) and S-CDMA modulation profiles, the S-CDMA 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 (321 and 381) cannot be deleted.

A new global modulation profile is introduced in Cisco IOS Release 12.2(33)SCC, which allows you to assign any modulation profile number to any DOCSIS mode.

The table below lists the valid modulation profile ranges according to the cable interface and modulation type:

Table 3: Allowable Ranges for Modulation Profiles

Cable Interface	DOCSIS 2.0 (S-CDMA)	DOCSIS 3.0 (S-CDMA)
Cisco UBR-MC20X20V	321 to 330 (default is 321)	1 to 400 (default is 381)
Cisco uBR-MC88V	321 to 330 (default is 321)	1 to 400 (default is 381)

Global Modulation Profile

Cisco IOS Release 12.2(33)SCC introduces the global modulation profile scheme, which allows you to assign any modulation profile number to any DOCSIS mode up to 400. It eliminates the number space restriction and increases the number of modulation profiles that can be created per DOCSIS mode. Currently, there is a restriction of 10 modulation profiles per DOCSIS mode.

In global modulation profile scheme, you can assign any number between 1 to 400 to any modulation profiles. The global modulation profile mode allows you to create and configure DOCSIS 3.0 channel type 4SR (scdma-d3). When the DOCSIS mode of an upstream is changed into scdma-d3, it is initially assigned to the system created default modulation profile as shown in [Table 3: Allowable Ranges for Modulation Profiles](#), on page 6.



Note

Though you can assign any number between 1 to 400 to any modulation profile, the default modulation profile number assigned to an upstream channel for a given channel type will remain the same. That is, modulation profile numbers 21, 121, 221, 321, and 381 will be applicable for TDMA, mixed, A-TDMA, S-CDMA, and DOCSIS 3.0 S-CDMA channel types.

All the existing and previously defined modulation profiles are converted to the new format. However, all the newly created modulation profiles, which are outside of the legacy number space range, will be lost when you revert to the legacy modulation profile.

The new global modulation profile scheme is enabled using the cable modulation-profile global-scheme command. For more details on this command, refer to the [Cisco IOS CMTS Cable Command Reference](#).

Benefits

The S-CDMA feature provides the following benefits:

- Provides full compatibility with DOCSIS 2.0 and DOCSIS 3.0 cable modems (CMs) and cable modem termination systems (CMTS).
- Increases protection against electronic impairments that occur in cable systems, allowing for a more robust operating environment.
- Supports S-CDMA ingress noise cancellation technology that provide more knobs for fine tuning.
- Supports all existing upstream bonding capabilities for Time Division Multiple Access (TDMA) and A-TDMA channels under S-CDMA.
- Supports up to two logical channel combinations for the Cisco UBR-MC20X20V and Cisco uBR-MC8X8V cable interface line cards.
- Supports the In-Service Software Upgrade (ISSU) feature.

Logical Channels

The concept of a logical channel refers to time-division multiplexing (TDM) of the same radio frequency (RF) spectrum allocated to one physical upstream port. All logical upstream channels defined within the physical upstream port share the same upstream RF spectrum or the bandwidth. The MAC-scheduler is responsible for managing how that common bandwidth is shared or distributed.

Using the Logical Channel Support feature, cable system operators can segment and time-multiplex one spectrum for supporting the legacy modems, near and far modems, and newer DOCSIS 3.0 modems with various service levels.

The Logical Channel Support feature provides the following benefits to cable service providers and their partners and customers:

- Switchovers between the same cable interface line cards at the logical channel level, as part of high availability (HA). For example, switchover from Cisco uBR10-MC5X20H line card to Cisco uBR10-MC5X20H line card is supported.
- Support for the In-Service Software Upgrade (ISSU) feature.

Each logical channel has its own Upstream Channel ID, upstream channel descriptor (UCD) messages, and Mini-slot Allocation Packet (MAP) messages. The logical channels on their own must satisfy the ranging and UCD change requirements that are imposed on a legacy standalone upstream channel.

The Cisco uBR10-MC5X20H and Cisco UBR-MC20X20V cable interface line cards support two logical channel combinations per physical port.

When two logical channels are configured through the **cable upstream max-logical-chans** command, both logical channels are mapped to the same physical port specified and the physical upstream bandwidth is shared between the two logical channels. However, from the cable modem perspective, each logical channel appears as an independent upstream channel.

When multiple logical channels are configured, the upstream-related commands are categorized into physical port level and logical channel level groups. Logical channel level commands use the format of **cable upstream *n m***, where *n* denotes the physical port number, and *m* denotes the logical channel index number.

For more details on the **cable upstream max-logical-chans** command, refer to the [Cisco IOS CMTS Cable Command Reference](#).

Spectrum Management on Logical Channels

Spectrum management allows you to prevent long-term service interruptions caused by upstream noise events in the cable plant. Spectrum management is also used for fault management and troubleshooting the cable network.

The Logical Channel Support feature supports all the basic spectrum management features. Some spectrum management features operate on the physical port level while others operate at the logical channel level.

The spectrum group assignment feature operates at the physical port level, and the Dynamic Upstream Modulation feature using Signal-to-Noise Ratio (SNR) operates at the logical channel level.

For more information on spectrum management, refer to the *Spectrum Management and Advanced Spectrum Management for the Cisco CMTS Routers* document at the following location: http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/cmts_spcrm_mgt.html

Load Balancing on Logical Channels

The Load Balancing (LB) feature allows cable system operators to distribute cable modems across RF downstream and upstream channels on the same cable interface line card, or across multiple cable interface line cards in some circumstances. Load balancing maximizes bandwidth and usage of the cable plant.

Load balancing is supported on logical channels using a two-tiered approach—the first level uses the traditional load balancing to move modems between the physical channels, and the second level moves modems amongst the logical channels.

The first level of load balancing (known as Cisco LB implementation) moves the modems amongst the physical upstream channels, identified in the load balancing group. It uses the aggregate upstream channel utilization statistics of a physical channel, including that of all logical channels, to perform load balancing.

The second level of load balancing moves modems among the logical channels defined within a physical channel (no outside moves). It is referred to as “per CM spectrum management” as it is strictly based on the physical channel parameters or conditions, or the physical layer capabilities of the CM.

For more information on the LB feature, refer to the *Load Balancing and Dynamic Channel Change on the Cisco CMTS Routers* document at the following location: http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/ubr_load-bal_dcc.html

How to Configure S-CDMA and Logical Channel Support

This section describes the following tasks that are required to implement S-CDMA and Logical Channel Support:

Creating Modulation Profiles

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

**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.

Creating a DOCSIS 2.0 S-CDMA Modulation Profile

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	cable modulation-profile <i>profile</i> qam-16 Example: Router(config)# cable modulation-profile 322 qam-16	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> —Modulation profile number. The valid range is from 321 to 330. The system creates profile 321 as the default modulation profile. • qam-16—Default 16-QAM profile.
Step 4	exit Example: Router(config)# exit	Exits global configuration mode and returns to privileged EXEC mode.

Configuring a Global Modulation Profile

This section describes how to enable or configure a global modulation profile. The global modulation profile scheme eliminates the number space restriction associated with the legacy mode allowing you to assign any number between 1 to 400 to any modulation profiles.

**Note**

When you configure a global modulation profile, all the previous modulation profiles are automatically converted. However, when you revert back to the legacy mode, all the profiles that are outside of the legacy number space range are lost.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	cable modulation-profile global-scheme Example: Router(config)# cable modulation-profile global-scheme	Activates the global modulation profile scheme, where you can assign any number between 1 to 400 to any modulation profile.
Step 4	exit Example: Router(config)# exit	Exits global configuration mode and returns to privileged EXEC mode.

Creating a DOCSIS 3.0 S-CDMA Modulation Profile

This section describes how to create a modulation profile for the DOCSIS 3.0 S-CDMA mode of operation, using one of the preconfigured modulation profiles.



Note

The **scdma-d3** option is available only after configuring the CMTS to operate in the global modulation profile mode. This option is not available in the default mode.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	cable modulation-profile <i>profile</i> scdma-d3 qam-16 Example: Router(config)# cable modulation-profile 382 scdma-d3 qam-16	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>—Modulation profile number. The valid range is from 1 to 400. The system creates profile 381 as the default modulation profile. scdma-d3—Configures the upstream only for DOCSIS 3.0 S-CDMA modulation profiles.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • qam-16—Default 16-QAM profile.
Step 4	exit Example: Router(config)# exit	Exits global configuration mode and returns to privileged EXEC 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.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface cable {slot/port slot/subslot/port} Example: Router(config)# interface cable 5/0/0	Enters interface configuration mode for the indicated cable downstream interface. <ul style="list-style-type: none"> • On the Cisco uBR7246VXR router, the valid values are: <ul style="list-style-type: none"> ◦ <i>slot</i>—3 to 6 ◦ <i>port</i>—0 or 1 (depending on the cable interface) • On the Cisco uBR7225VXR router, the valid values are: <ul style="list-style-type: none"> ◦ <i>slot</i>—1 and 2 ◦ <i>port</i>—0 or 1 (depending on the cable interface) • On the Cisco uBR10012 router, the valid values are: <ul style="list-style-type: none"> ◦ <i>slot</i>—5 to 8 ◦ <i>subslot</i>—0 or 1 ◦ <i>port</i>—0 to 4 (depending on the cable interface)

	Command or Action	Purpose
Step 4	<p>cable upstream <i>n</i> docsis-mode {atdma scdma scdma-d3 tdma tdma-atdma}</p> <p>Example: Router(config-if)# cable upstream 0 docsis-mode atdma</p>	<p>Configures the upstream for the desired DOCSIS mode of operation:</p> <ul style="list-style-type: none"> • <i>n</i>—Upstream port number. Valid values are 0 to 3 by default, but can be increased to a maximum of 7 using the cable upstream max-ports command. • atdma—Configures the upstream only for DOCSIS 2.0 A-TDMA modulation profiles. • scdma—Configures the upstream only for DOCSIS 2.0 S-CDMA modulation profiles. • scdma-d3—Configures the upstream only for DOCSIS 3.0 S-CDMA modulation profiles. • tdma—Configures the upstream only for DOCSIS 1.X TDMA modulation profiles. • tdma-atdma—Configures the upstream for both, A-TDMA, and TDMA operations (mixed mode). <p>Note The scdma-d3 mode is available only when the global modulation profile is used.</p>
Step 5	<p>cable upstream <i>n</i> modulation-profile <i>profile</i> [<i>profile2</i>] [<i>profile3</i>]</p> <p>Example: Router(config-if)# cable upstream 0 modulation-profile 241</p>	<p>Assigns the particular modulation profile to this upstream.</p> <ul style="list-style-type: none"> • <i>profile</i>—Modulation profile 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 2.0 S-CDMA, the valid range is from 321 to 330. ◦ If the upstream is configured for DOCSIS 3.0 S-CDMA mode, the valid range is from 1 to 400. • <i>profile2</i> —(Optional) 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 than the primary profile to cope with the noise.) • <i>profile3</i> —(Optional) Tertiary modulation profile that the interface uses when noise on the upstream increases to the point that the secondary modulation profile can no longer be used. <p>Note The tertiary modulation profile is available only for the basic dynamic modulation. You cannot use the tertiary modulation profile when a spectrum group is defined for the upstream.</p> <p>Note The type of modulation profiles must match the DOCSIS mode configured (using the cable upstream docsis-mode command) for the upstream.</p>

	Command or Action	Purpose
Step 6	cable upstream <i>n</i> active-codes <i>active-codes</i> Example: Router(config-if)# cable upstream 0 active-codes 64	(Optional) Configures the number of active codes on an upstream channel. <ul style="list-style-type: none"> <i>active-codes</i>—Number of active codes. The valid values range from 64 to 128. The active-codes have a default value of 112, when ingress noise cancellation is enabled; and a default value of 128, when ingress noise cancellation is disabled.
Step 7	cable upstream <i>n</i> channel-width <i>first-choice-width</i> Example: Router(config-if)# cable upstream 0 channel-width 3200000	(Optional) Specifies an upstream channel width for an upstream port. <ul style="list-style-type: none"> <i>first-choice-width</i>—Upstream channel width in hertz (Hz). For valid values refer to the cable upstream channel-width command.
Step 8	cable upstream <i>n</i> codes-per-minislot <i>minislot-code</i> Example: Router(config-if)# cable upstream 0 codes-per-minislot 8	(Optional) Specifies the number of codes-per-minislot allowed on an upstream channel. <ul style="list-style-type: none"> <i>minislot-code</i>—Number of codes-per-minislot. The valid values range from 2 to 32.
Step 9	cable upstream <i>n</i> max-codes-per-subframe <i>subframe-codes</i> Example: Router(config-if)# cable upstream 0 max-codes-per-subframe 128	(Optional) Specifies the upper limit that overrides the maximum value of codes-per-subframe defined in the individual modulation profile setting for an upstream channel. <ul style="list-style-type: none"> <i>subframe-codes</i>—Number of codes-per-subframe. The valid values range from 1 to 128, with a default value of 2.
Step 10	cable upstream <i>n</i> spreading-interval <i>spreading-interval</i> Example: Router(config-if)# cable upstream 0 spreading-interval 32	(Optional) Specifies the spreading interval for S-CDMA channels on an upstream channel. <ul style="list-style-type: none"> <i>spreading-interval</i>—Spreading interval for S-CDMA channels. The valid values range from 1 to 32, with a default value of 16.
Step 11	cable upstream <i>n</i> equalization-coefficient Example: Router(config-if)# cable upstream 0 equalization-coefficient	(Optional) Enables the use of a DOCSIS preequalization coefficient on an upstream.
Step 12	cable upstream <i>n</i> ingress-noise-cancellation <i>interval</i> Example: Router(config-if)# cable upstream 0 ingress-noise-cancellation 400	(Optional) Configures, in milliseconds, how often the cable interface line card should sample the signal on an upstream to correct any ingress noise that has appeared on that upstream. <ul style="list-style-type: none"> <i>interval</i>—Sample interval. The valid range is from 10 to 3000 milliseconds, with a default value of 200 milliseconds. <p>Note The ingress noise cancellation has to be disabled to use a default value of 128 for active-codes. When ingress noise cancellation is enabled, the active-codes has a default value of 112.</p>

	Command or Action	Purpose
		Note Repeat Step 3, on page 11 through Step 12, on page 13 for each cable interface and upstream to be configured.
Step 13	end Example: Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring the Logical Channel Support

This section describes how to configure logical channels for the Cisco uBR10-MC5X20H and Cisco UBR-MC20X20V cable interface line cards.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface cable {slot/port slot/subslot/port} Example: Router(config)# interface cable 5/0/0	Enters interface configuration mode for the indicated cable downstream interface. <ul style="list-style-type: none"> On the Cisco uBR7246VXR router, the valid values are: <ul style="list-style-type: none"> ° <i>slot</i>—3 to 6 ° <i>port</i>—0 or 1 (depending on the cable interface) On the Cisco uBR7225VXR router, the valid values are: <ul style="list-style-type: none"> ° <i>slot</i>—1 and 2 ° <i>port</i>—0 or 1 (depending on the cable interface) On the Cisco uBR10012 router, the valid values are: <ul style="list-style-type: none"> ° <i>slot</i>—5 to 8 ° <i>subslot</i>—0 or 1 ° <i>port</i>—0 to 4 (depending on the cable interface)

	Command or Action	Purpose
Step 4	cable upstream <i>n</i> max-logical-chans <i>num-of-logical-channels</i> Example: Router(config-if)# cable upstream 0 max-logical-chans 2	Creates the specified number of logical channels per port on an upstream channel. <ul style="list-style-type: none"> • <i>n</i>—Upstream port. Valid values start with 0 for the first upstream port on the cable interface line card, but can be increased to a maximum of 7. • <i>num-of-logical-channels</i>—Number of logical channels per port.
Step 5	end Example: Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Monitoring the S-CDMA and Logical Channel Support

To monitor the S-CDMA and Logical Channel Support feature, use the following procedures:

Displaying Modulation Profiles

To display the modulation profiles that are currently defined on the CMTS, use the **show running-config** command as shown in the example:

```
Router# show running-config | begin cable modulation-profile

cable modulation-profile global-scheme
cable modulation-profile 222 atdma request 0 16 0 22 qpsk scrambler 152 no-diff8
cable modulation-profile 222 atdma initial 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 222 atdma station 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 222 atdma a-short 6 76 6 22 64qam scrambler 152 no-dif8
cable modulation-profile 222 atdma a-long 9 232 0 22 64qam scrambler 152 no-dif8
cable modulation-profile 222 atdma a-ugs 9 232 0 22 64qam scrambler 152 no-diff8
cable modulation-profile 223 atdma request 0 16 0 22 qpsk scrambler 152 no-diff8
cable modulation-profile 223 atdma initial 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 223 atdma station 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 223 atdma a-short 6 76 6 22 64qam scrambler 152 no-dif8
cable modulation-profile 223 atdma a-long 14 220 0 22 64qam scrambler 152 no-di8
cable modulation-profile 223 atdma a-ugs 14 220 0 22 64qam scrambler 152 no-dif8
cable modulation-profile 400 scdma-d3 request 0 16 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 initial 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 station 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 short 3 76 12 64qam scrambler 152 no-diffm
cable modulation-profile 400 scdma-d3 long 9 232 0 64qam scrambler 152 no-diff m
cable modulation-profile 400 scdma-d3 a-short 6 76 6 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 a-long 9 232 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 a-ugs 9 232 0 64qam scrambler 152 no-diffm
--More--
```

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

```
Router# show cable modulation-profile 381
```

Mod	IUC	Type	Pre len	Diff enco	FEC T	FEC k	Scramb seed	Max B	Guard time	Last CW	Scramb	Pre offst	Pre Type	RS
					BYTE	BYTE		siz	size	short				
381	request	qpsk	64	no	0x0	0x10	0x152	0	0	no	yes	0	qpsk0	n
381	initial	qpsk	98	no	0x5	0x22	0x152	0	0	no	yes	0	qpsk0	n
381	station	qpsk	98	no	0x5	0x22	0x152	0	0	no	yes	0	qpsk0	n
381	short	qpsk	64	no	0x3	0x4C	0x152	12	0	yes	yes	0	qpsk0	n
381	long	qpsk	64	no	0x9	0xE8	0x152	0	0	yes	yes	0	qpsk0	n
381	a-short	64qam	64	no	0x6	0x4C	0x152	6	0	yes	yes	0	qpsk1	n
381	a-long	64qam	64	no	0x9	0xE8	0x152	0	0	yes	yes	0	qpsk1	n
381	a-ugs	64qam	64	no	0x9	0xE8	0x152	0	0	yes	yes	0	qpsk1	n

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 State	Prim Sid	Ver	QoS Prov	Frag	Concat	PHS	Priv	DS	US
0014.bfbe.4fc3	offline	1	DOC1.0	DOC1.0	no	no	yes		15	16
0014.bfbe.4f59	offline	2	DOC1.0	DOC1.0	no	no	yes		15	16
0018.6830.2813	offline	3	DOC1.0	DOC1.0	no	no	yes		15	16
001a.c3ff.d208	online	4	DOC2.0	DOC1.1	yes	no	yes		24	8
0014.bfbe.4fbb	w-online	7	DOC3.0	DOC1.1	yes	yes	yes		15	16
0014.bfbe.4f9b	w-online	8	DOC3.0	DOC1.1	yes	yes	yes		15	16
0014.bfbe.4efd	init(t)	9	DOC1.0	DOC1.0	no	yes	yes		15	16
0018.684a.3f46	online	10	DOC2.0	DOC1.1	yes	yes	yes		15	16
0014.bfbe.4086	init(t)	11	DOC1.0	DOC1.0	no	yes	yes		15	16
001a.c3ff.d53a	w-online	12	DOC3.0	DOC1.1	no	no	yes		24	8

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

```
Router# show cable modem mac summary
```

Cable Modem Summary									

Interface	Total	Mac Version				QoS Provision Mode			
		DOC3.0	DOC2.0	DOC1.1	DOC1.0	Reg/Online	DOC1.1	DOC1.0	DOC1.1
Cable7/1/0/U0	4	0	1	0	3	1	1	0	0
Cable8/0/0/UB	1	1	0	0	0	1	1	0	0
Cable8/0/0/U0.0	2	0	1	0	1	1	1	0	0
Cable8/0/0/U2	1	0	1	0	0	1	1	0	0
Cable8/0/0/U3	1	0	1	0	0	1	1	0	0
Cable8/0/0/U0.1	1	0	0	0	1	0	0	0	0

Displaying the Logical Channel Support

To display the logical channels within the physical upstream port, use the **show cable modem** command without any options:

```
Router# show cable modem
```

MAC Address	IP Address	I/F	MAC State	Prim Sid	RxPwr (dBmv)	Timing Offset	Num CPE	B D P I
0014.bfbe.4f9b	1.60.0.6	C5/0/0/U0.0	online	1	1.00	1406	0	N N


```
0014.bfbc.4efd 1.60.0.2      C5/0/0/U0.1 online      637   1.00   1409   0   N   N
0014.bfbc.4efa 1.60.0.3      C5/0/0/U1  online      635   1.00   1409   0   N   N
```

The following example shows a typical output of the **show controllers cable** command for a cable interface line card that is configured with multiple logical channels:

```
Router# show controllers cable 7/1/0 upstream 0
Cable7/1/0 Upstream 0 is up
Frequency 10.000 MHz, Channel Width 6.400 MHz, Symbol Rate 5.120 Msps
Modulations - A-short 64-QAM, A-long 64-QAM, A-ugs 64-QAM
This upstream is mapped to physical port 0
Spectrum Group is overridden
US phy MER(SNR) estimate for good packets - 23.4731 dB
Nominal Input Power Level 3 dBmV, Tx Timing Offset 1645
Ranging Backoff Start 3, Ranging Backoff End 6
US timing offset adjustment type 0, value 0
Ranging Insertion Interval automatic (60 ms)
US throttling off
Tx Backoff Start 3, Tx Backoff End 5
Modulation Profile Group 322
Concatenation is enabled
Fragmentation is enabled
part_id=0x3140, rev_id=0x03, 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 = 1
Minislot Size in Symbols = 32
Bandwidth Requests = 0x31
Piggyback Requests = 0x0
Invalid BW Requests= 0x0
Minislots Requested= 0x22C
Minislots Granted = 0x31
Minislot Size in Bytes = 24
Map Advance (Dynamic) : 2465 usecs
Map Count = 17393154
Remote Map Counts: (none)
UCD Count = 17875
Remote UCD Counts: (none)
SCDMA mode enabled
PHY: us errors 0 us recoveries 0
MAC PHY TSS: tss error start 0 tss error end 0
MAC PHY Status: bcm3140 status 0 lookout status 0
MAP/UCD Replication Instructions:
```

To display the modulation profile of a single logical channel, for default and legacy cable interface line cards, use the **show cable modulation** command:

```
Router# show cable modulation cable 5/0/0 upstream 0
```

Mod	IUC	Type	Pre len	Diff enco	FEC T	FEC k	ScrmB seed	Max B	Guard time	Last CW	ScrmB short	Pre offst	Pre Type	RS
381	request	qpsk	64	no	0x0	0x10	0x152	0	0	no	yes	400	qpsk0	n
381	initial	qpsk	384	no	0x5	0x22	0x152	0	0	no	yes	6	qpsk0	n
381	station	qpsk	384	no	0x5	0x22	0x152	0	0	no	yes	6	qpsk0	n
381	short	qpsk	64	no	0x3	0x4C	0x152	12	0	yes	yes	400	qpsk0	n
381	long	qpsk	64	no	0x9	0xE8	0x152	136	0	yes	yes	400	qpsk0	n
381	a-short	64qam	64	no	0x6	0x4C	0x152	6	0	yes	yes	400	qpsk1	n
381	a-long	64qam	64	no	0x9	0xE8	0x152	46	0	yes	yes	400	qpsk1	n
381	a-ugs	64qam	64	no	0x9	0xE8	0x152	35	0	yes	yes	400	qpsk1	n

The following example shows a typical output of the **show interface cable** command when multiple logical channels are configured on the indicated cable interface:

```
Router# show interface cable 7/1/0 mac-scheduler 0
DOCSIS 1.1 MAC scheduler for Cable7/1/0/U0: rate 26880000
wfg:None
Queue[Rng Polls] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 1
Queue[CIR Grants] 0/256, 0 drops, flows 0 fs_demand_ms 0, max 0
```

```

Queue[BE(7) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
Queue[BE(6) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
Queue[BE(5) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
Queue[BE(4) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
Queue[BE(3) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
Queue[BE(2) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
Queue[BE(1) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
Queue[BE(0) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 1
Req Slots 17301958, Req/Data Slots 1440804
Init Mtn Slots 498660, Stn Mtn Slots 28134
Short Grant Slots 0, Long Grant Slots 0
Adv Phy Short Grant Slots 26, Adv Phy Long Grant Slots 23
Adv Phy UGS Grant Slots 0
Awacs Slots 0
Fragmentation count 0
Fragmentation test disabled
Avg upstream channel utilization : 0%
Avg percent contention slots : 97%
Avg percent initial ranging slots : 3%
Avg percent minislots lost on late MAPs : 0%
Sched Table Rsv-state: Grants 0, Reqpolls 0
Sched Table Adm-State: Grants 0, Reqpolls 0, Util 0%
UGS      : 0 SIDs, Reservation-level in bps 0
UGS-AD   : 0 SIDs, Reservation-level in bps 0
RTPS     : 0 SIDs, Reservation-level in bps 0
NRTPS    : 0 SIDs, Reservation-level in bps 0
BE       : 3 SIDs, Reservation-level in bps 0
MAP TSS: lch_state 11, init_retries 0
         late_initial_maps 0, late_ucd_maps 0
         mac-phy tss errors 0
Router#

```

Configuration Examples for S-CDMA and Logical Channel Support

This section lists the following sample configurations for the S-CDMA and Logical Channel Support feature on a Cisco CMTS router:

Creating Modulation Profiles Examples

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

Example: DOCSIS 2.0 S-CDMA Modulation Profiles

The following sample configuration shows typical modulation profiles for the DOCSIS 2.0 S-CDMA mode of operation:

- Profile 321 is the default profile for S-CDMA operations that is automatically created on the router for the cable interface line card.
- Profiles 321 through 330 can be used to create S-CDMA modulation profiles.
- Profiles 1 through 400 can be used to create S-CDMA mode modulation profiles, while using the global configuration.

```

cable modulation-profile 321 scdma request 1 16 0 qpsk scrambler 152 no-diff 64m
cable modulation-profile 321 scdma initial 5 34 0 qpsk scrambler 152 no-diff 98m

```

```

cable modulation-profile 321 scdma station 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 321 scdma a-short 5 131 6 32qam scrambler 152 no-diff m
cable modulation-profile 321 scdma a-long 5 131 0 32qam scrambler 152 no-diff 6m
cable modulation-profile 321 scdma a-ugs 9 232 0 64qam scrambler 152 no-diff 64m
cable modulation-profile 322 scdma request 0 16 0 qpsk scrambler 152 no-diff 64m
cable modulation-profile 322 scdma initial 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 322 scdma station 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 322 scdma a-short 6 76 6 64qam scrambler 152 no-diff 6m
cable modulation-profile 322 scdma a-long 9 232 0 64qam scrambler 152 no-diff 6m
cable modulation-profile 322 scdma a-ugs 9 232 0 64qam scrambler 152 no-diff 64m
cable modulation-profile 333 scdma request 0 16 0 qpsk scrambler 152 no-diff 64m
cable modulation-profile 333 scdma initial 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 333 scdma station 5 34 0 qpsk scrambler 152 no-diff 98m
--More--

```

Example: Global Modulation Profiles

The following sample configuration shows typical modulation profiles for the global mode of operation. Profiles 1 through 400 can be used to create any modulation profile in global modulation profile mode.

```

cable modulation-profile global-scheme
cable modulation-profile 222 atdma request 0 16 0 22 qpsk scrambler 152 no-diff8
cable modulation-profile 222 atdma initial 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 222 atdma station 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 222 atdma a-short 6 76 6 22 64qam scrambler 152 no-dif8
cable modulation-profile 222 atdma a-long 9 232 0 22 64qam scrambler 152 no-dif8
cable modulation-profile 222 atdma a-ugs 9 232 0 22 64qam scrambler 152 no-diff8
cable modulation-profile 223 atdma request 0 16 0 22 qpsk scrambler 152 no-diff8
cable modulation-profile 223 atdma initial 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 223 atdma station 5 34 0 48 qpsk scrambler 152 no-diff8
cable modulation-profile 223 atdma a-short 6 76 6 22 64qam scrambler 152 no-dif8
cable modulation-profile 223 atdma a-long 14 220 0 22 64qam scrambler 152 no-di8
cable modulation-profile 223 atdma a-ugs 14 220 0 22 64qam scrambler 152 no-dif8
cable modulation-profile 321 scdma request 1 16 0 qpsk scrambler 152 no-diff 64m
cable modulation-profile 321 scdma initial 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 321 scdma station 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 321 scdma a-short 5 131 6 32qam scrambler 152 no-diff m
cable modulation-profile 321 scdma a-long 5 131 0 32qam scrambler 152 no-diff 6m
cable modulation-profile 321 scdma a-ugs 9 232 0 64qam scrambler 152 no-diff 64m
cable modulation-profile 322 scdma request 0 16 0 qpsk scrambler 152 no-diff 64m
cable modulation-profile 322 scdma initial 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 322 scdma station 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 322 scdma a-short 6 76 6 64qam scrambler 152 no-diff 6m
cable modulation-profile 322 scdma a-long 9 232 0 64qam scrambler 152 no-diff 6m
cable modulation-profile 322 scdma a-ugs 9 232 0 64qam scrambler 152 no-diff 64m
cable modulation-profile 333 scdma request 0 16 0 qpsk scrambler 152 no-diff 64m
cable modulation-profile 333 scdma initial 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 333 scdma station 5 34 0 qpsk scrambler 152 no-diff 98m
cable modulation-profile 333 scdma a-short 6 76 6 64qam scrambler 152 no-diff 6m
cable modulation-profile 333 scdma a-long 9 232 0 64qam scrambler 152 no-diff 6m
cable modulation-profile 333 scdma a-ugs 9 232 0 64qam scrambler 152 no-diff 64m
cable modulation-profile 400 scdma-d3 request 0 16 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 initial 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 station 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 short 3 76 12 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 long 9 232 0 64qam scrambler 152 no-diff m
cable modulation-profile 400 scdma-d3 a-short 6 76 6 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 a-long 9 232 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 a-ugs 9 232 0 64qam scrambler 152 no-difm
cable service class 1 name def_sclass
--More--

```

Example: DOCSIS 3.0 S-CDMA Modulation Profiles

The following sample configuration shows typical modulation profiles for the DOCSIS 3.0 S-CDMA mode of operation:

- Profile 381 is the default profile for DOCSIS 3.0 S-CDMA mode operations that is automatically created on the router.
- Profiles 1 through 400 can be used to create DOCSIS 3.0 S-CDMA mode modulation profiles, while using the global configuration.

```

cable modulation-profile 381 scdma-d3 request 0 16 0 64qam scrambler 152 no-difm
cable modulation-profile 381 scdma-d3 initial 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 381 scdma-d3 station 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 381 scdma-d3 short 3 76 12 64qam scrambler 152 no-difm
cable modulation-profile 381 scdma-d3 long 9 232 0 64qam scrambler 152 no-diff m
cable modulation-profile 381 scdma-d3 a-short 6 76 6 64qam scrambler 152 no-difm
cable modulation-profile 381 scdma-d3 a-long 9 232 0 64qam scrambler 152 no-difm
cable modulation-profile 381 scdma-d3 a-ugs 9 232 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 request 0 16 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 initial 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 station 5 34 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 short 3 76 12 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 long 9 232 0 64qam scrambler 152 no-diff m
cable modulation-profile 400 scdma-d3 a-short 6 76 6 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 a-long 9 232 0 64qam scrambler 152 no-difm
cable modulation-profile 400 scdma-d3 a-ugs 9 232 0 64qam scrambler 152 no-difm
--More--

```

Assigning Modulation Profiles to Upstreams Examples

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

Example: Assigning DOCSIS 2.0 S-CDMA Modulation Profiles

The following sample configuration shows DOCSIS 2.0 S-CDMA modulation profiles being assigned to the upstreams on two cable interfaces. The default S-CDMA modulation profile (profile 321) is assigned to the upstreams on cable interface 7/1/0, and custom modulation profile 322 is assigned to the upstreams on cable interface 7/1/1.

```

interface Cable7/1/0
 cable init-channel-timeout 160
 no cable mtc-mode
 cable cm-status enable 1-5
 no cable packet-cache
 cable bundle 1
 cable downstream channel-id 13
 cable downstream annex B
 cable downstream modulation 256qam
 cable downstream interleave-depth 32
 cable downstream frequency 459000000
 no cable downstream rf-shutdown
 cable upstream max-ports 4
 cable upstream ranging-poll interval 25000
 cable upstream 0 connector 0
 cable upstream 0 frequency 10000000
 cable upstream 0 channel-width 3200000
 cable upstream 0 power-level 3
 cable upstream 0 docsis-mode scdma
 cable upstream 0 spreading-interval 16
 cable upstream 0 codes-per-minislot 4
 cable upstream 0 active-codes 112
 cable upstream 0 range-backoff 3 6
 cable upstream 0 modulation-profile 321
 no cable upstream 0 shutdown
interface Cable7/1/1
 shutdown

```

```

cable cm-status enable 1-5
no cable packet-cache
cable downstream channel-id 180
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream rf-shutdown
cable upstream max-ports 4
cable upstream 0 connector 4
cable upstream 0 frequency 10000000
cable upstream 0 channel-width 1600000
cable upstream 0 docsis-mode scdma
cable upstream 0 spreading-interval 16
cable upstream 0 codes-per-minislot 4
cable upstream 0 active-codes 112
cable upstream 0 range-backoff 3 6
cable upstream 0 modulation-profile 322
no cable upstream 3 shutdown
!

```

Example: Assigning Global Modulation Profiles

The following sample configuration shows user-defined DOCSIS 3.0 S-CDMA modulation profiles being assigned to the upstreams on two cable interfaces. Only the first upstream on cable interface 7/1/0 is enabled for A-TDMA mode and assigned an A-TDMA profile. The other two upstreams on cable interface (7/1/1 and 7/1/2) are enabled for custom-defined DOCSIS 3.0 S-CDMA modulation profiles.

```

interface Cable7/1/0
cable init-channel-timeout 160
no cable mtc-mode
cable cm-status enable 1-5
no cable packet-cache
cable bundle 1
cable downstream channel-id 13
cable downstream annex B
cable downstream modulation 256qam
cable downstream interleave-depth 32
cable downstream frequency 459000000
no cable downstream rf-shutdown
cable upstream max-ports 4
cable upstream ranging-poll interval 25000
cable upstream 0 connector 0
cable upstream 0 frequency 10000000
cable upstream 0 channel-width 3200000
cable upstream 0 ingress-noise-cancellation 112
cable upstream 0 power-level 3
cable upstream 0 docsis-mode atdma
cable upstream 0 range-backoff 3 6
cable upstream 0 modulation-profile 221
cable upstream 0 equalization-coefficient
no cable upstream 0 shutdown
!
interface Cable7/1/1
shutdown
cable cm-status enable 1-5
no cable packet-cache
cable downstream channel-id 180
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream rf-shutdown
cable upstream max-ports 4
cable upstream 0 connector 4
cable upstream 0 frequency 10000000
cable upstream 0 channel-width 1600000
cable upstream 0 docsis-mode tdma
cable upstream 0 minislot-size 4
cable upstream 0 range-backoff 3 6
cable upstream 0 modulation-profile 21

```

```

no cable upstream 0 shutdown
cable upstream 1 connector 5
cable upstream 1 frequency 18000000
cable upstream 1 channel-width 3200000
cable upstream 1 ingress-noise-cancellation 112
cable upstream 1 docsis-mode scdma-d3
cable upstream 1 spreading-interval 16
cable upstream 1 codes-per-minislot 4
cable upstream 1 active-codes 64
cable upstream 1 max-codes-per-subframe 128
cable upstream 1 range-backoff 3 6
cable upstream 1 modulation-profile 382
cable upstream 1 equalization-coefficient
no cable upstream 1 shutdown
cable upstream 2 connector 6
cable upstream 2 frequency 25000000
cable upstream 2 channel-width 1600000 1600000
cable upstream 2 docsis-mode tdma
cable upstream 2 minislot-size 4
cable upstream 2 range-backoff 3 6
cable upstream 2 modulation-profile 21
no cable upstream 2 shutdown
cable upstream 3 connector 7
cable upstream 3 frequency 32000000
cable upstream 3 channel-width 1600000 1600000
cable upstream 3 docsis-mode tdma
cable upstream 3 minislot-size 4
cable upstream 3 range-backoff 3 6
cable upstream 3 modulation-profile 21
no cable upstream 3 shutdown
!
interface Cable7/1/2
shutdown
cable cm-status enable 1-5
no cable packet-cache
cable downstream channel-id 181
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream rf-shutdown
cable upstream max-ports 4
cable upstream 0 connector 8
cable upstream 0 frequency 20000000
cable upstream 0 channel-width 1600000
cable upstream 0 docsis-mode tdma
cable upstream 0 minislot-size 4
cable upstream 0 range-backoff 3 6
cable upstream 0 modulation-profile 21
no cable upstream 0 shutdown
cable upstream 1 connector 9
cable upstream 1 channel-width 1600000
cable upstream 1 docsis-mode tdma
cable upstream 1 minislot-size 4
cable upstream 1 range-backoff 3 6
cable upstream 1 modulation-profile 21
no cable upstream 1 shutdown
cable upstream 2 connector 10
cable upstream 2 channel-width 3200000
cable upstream 2 ingress-noise-cancellation 112
cable upstream 2 docsis-mode scdma-d3
cable upstream 2 spreading-interval 16
cable upstream 2 codes-per-minislot 4
cable upstream 2 active-codes 64
cable upstream 2 max-codes-per-subframe 128
cable upstream 2 range-backoff 3 6
cable upstream 2 modulation-profile 382
cable upstream 2 equalization-coefficient
!
```

Example: Assigning DOCSIS 3.0 S-CDMA Modulation Profiles

The following sample configuration shows DOCSIS 3.0 S-CDMA modulation profiles being assigned to the upstreams on two cable interfaces. The default DOCSIS 3.0 S-CDMA modulation profile (profile 381) is assigned to the upstreams on cable interface 7/1/0, and custom modulation profile 382 is assigned to the upstreams on cable interface 7/1/1.

```
interface Cable7/1/0
 cable init-channel-timeout 160
 no cable mtc-mode
 cable cm-status enable 1-5
 no cable packet-cache
 cable bundle 1
 cable downstream channel-id 13
 cable downstream annex B
 cable downstream modulation 256qam
 cable downstream interleave-depth 32
 cable downstream frequency 459000000
 no cable downstream rf-shutdown
 cable upstream max-ports 4
 cable upstream ranging-poll interval 25000
 cable upstream 0 connector 0
 cable upstream 0 frequency 10000000
 cable upstream 0 channel-width 3200000
 cable upstream 0 power-level 3
 cable upstream 0 docsis-mode scdma-d3
 cable upstream 0 spreading-interval 16
 cable upstream 0 codes-per-minislot 4
 cable upstream 0 active-codes 64
 cable upstream 0 range-backoff 3 6
 cable upstream 0 modulation-profile 381
 cable upstream 0 equalization-coefficient
 no cable upstream 0 shutdown
!
interface Cable7/1/1
 shutdown
 cable cm-status enable 1-5
 no cable packet-cache
 cable downstream channel-id 180
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream rf-shutdown
 cable upstream max-ports 4
 cable upstream ranging-poll interval 25000
 cable upstream 0 connector 0
 cable upstream 0 frequency 10000000
 cable upstream 0 channel-width 3200000
 cable upstream 0 power-level 3
 cable upstream 0 docsis-mode scdma-d3
 cable upstream 0 spreading-interval 16
 cable upstream 0 codes-per-minislot 4
 cable upstream 0 active-codes 64
 cable upstream 0 range-backoff 3 6
 cable upstream 0 modulation-profile 382
 cable upstream 0 equalization-coefficient
 no cable upstream 0 shutdown
```

Example: Creating Logical Channels

The following example shows the configuration of an interface that has two of four physical ports configured to have two logical channels per physical port:

```
interface Cable5/0/0
 no cable packet-cache
```

```

cable downstream channel-id 167
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 453000000
no cable downstream rf-shutdown
cable upstream max-ports 4
cable upstream 0 connector 0
cable upstream 0 frequency 10000000
cable upstream 0 channel-width 1600000 1600000
cable upstream 0 max-logical-chans 2
cable upstream 0 load-balance group 1
cable upstream 0 0 docsis-mode atdma
cable upstream 0 0 minislots-size 4
cable upstream 0 0 power-adjust continue 3
cable upstream 0 0 range-backoff 3 6
cable upstream 0 0 modulation-profile 21
no cable upstream 0 0 shutdown
cable upstream 0 1 docsis-mode tdma
cable upstream 0 1 minislots-size 2
cable upstream 0 1 power-adjust continue 6
cable upstream 0 1 range-backoff 3 6
cable upstream 0 1 modulation-profile 221
no cable upstream 0 1 shutdown
no cable upstream 0 shutdown
cable upstream 1 connector 1
cable upstream 1 spectrum-group 1
cable upstream 1 channel-width 1600000 1600000
cable upstream 1 max-logical-chans 2
cable upstream 1 0 docsis-mode atdma
cable upstream 1 0 minislots-size 4
cable upstream 1 0 range-backoff 3 6
cable upstream 1 0 modulation-profile 21
no cable upstream 1 0 shutdown
cable upstream 1 1 docsis-mode tdma
cable upstream 1 1 minislots-size 2
cable upstream 1 1 range-backoff 3 6
cable upstream 1 1 modulation-profile 221
cable upstream 1 1 equalization-coefficient
no cable upstream 1 1 shutdown
no cable upstream 1 shutdown
cable upstream 2 connector 2
cable upstream 2 docsis-mode scdma
cable upstream 2 frequency 10000000
cable upstream 2 channel-width 1600000 1600000
cable upstream 2 range-backoff 3 6
cable upstream 2 modulation-profile 322
no cable upstream 2 shutdown
cable upstream 3 connector 3
cable upstream 3 docsis-mode scdma
cable upstream 3 spectrum-group 2
cable upstream 3 channel-width 1600000 1600000
cable upstream 3 range-backoff 3 6
cable upstream 3 modulation-profile 321
no cable upstream 3 shutdown
end

```

Additional References

The following sections provide references related to the S-CDMA and Logical Channel Support feature.

Related Documents

Related Topic	Document Title
CMTS commands	Cisco IOS CMTS Cable Command Reference

Related Topic	Document Title
Spectrum Management and Advanced Spectrum Management	Spectrum Management and Advanced Spectrum Management for the Cisco CMTS Routers
Load Balancing and Dynamic Channel Change	Load Balancing and Dynamic Channel Change on the Cisco CMTS Routers

Standards and RFCs

Standards	Title
CM-SP-SECv3.0-I09-090121	Data-over-Cable Service Interface Specifications Security Specification, version 3.0
CM-SP-CMCv3.0-I01-080320	Data-over-Cable Service Interface Specifications Cable Modem to Customer Premise Equipment Interface Specification, version 3.0
CM-SP-PHYv3.0-I08-090121	Data-over-Cable Service Interface Specifications Physical Layer Specification, version 3.0
CM-SP-MULPv3.0-I09-090121	Data-over-Cable Service Interface Specifications MAC and Upper Layer Protocols Interface Specification, version 3.0
CM-SP-OSSv3.0-I08-090121	Data-over-Cable Service Interface Specifications Operations Support System Interface Specification, version 3.0
RFC 2233	DOCSIS OSSI Objects Support
RFC 2665	DOCSIS Ethernet MIB Objects Support
RFC 2669	Cable Device MIB

MIBs

MIBs	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 • IF-MIB • DOCS-IF-MIB (RFC 2670) 	<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>

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/support</p>

Feature Information for S-CDMA and Logical Channel Support on the Cisco CMTS Routers

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on [Cisco.com](http://www.cisco.com) is not required.

**Note**

The table below lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 4: Feature Information for S-CDMA and Logical Channel Support on the Cisco CMTS Routers

Feature Name	Releases	Feature Information
S-CDMA and Logical Channel Support on the Cisco CMTS Routers	12.2(33)SCC	<p>This feature was introduced for the Cisco uBR10012 router.</p> <p>The following commands are new or modified:</p> <ul style="list-style-type: none"> • cable upstream active-codes • cable upstream channel-width • cable upstream codes-per-minislot • cable upstream docsis-mode • cable upstream max-codes-per-subframe • cable upstream max-interleave-step • cable upstream max-logical-chans • cable upstream spreading-interval • cable upstream modulation-profile • cable upstream modulation-profile global-scheme • show controllers cable • show interface cable mac-scheduler
S-CDMA and Logical Channel Support on the Cisco CMTS Routers	12.2(33)SCD	<p>Support was added for the Cisco uBR7246VXR and Cisco uBR7225VXR routers.</p>

