



Configuring Upstream Cable Interface Features on the Cisco CMTS Routers

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Note

Cisco IOS Release 12.2(33)SCA and later releases integrate support for this feature on the Cisco CMTS routers. This feature is also supported in Cisco IOS Release 12.3BC, and this document contains information that references many legacy documents related to Cisco IOS 12.3BC. In general, any references to Cisco IOS Release 12.3BC also apply to Cisco IOS Release 12.2SC.

The cable interface in the Cisco universal broadband router supports downstream and upstream signals, and serves as the cable TV radio frequency (RF) interface. The downstream signal is output as an intermediate-frequency (IF) signal suitable for use with an external upconverter. Your cable plant, combined with your planned and installed subscriber base, service offering, and external network connections, determines the combination of cable interfaces, network uplink line cards, and other components that you should use.

The Cisco IOS software command-line interface (CLI) can be used to configure the Cisco cable interface line card for correct operation on the hybrid fiber-coaxial (HFC) cable network. This chapter provides a configuration summary for the various upstream cable interface features available on a Cisco CMTS router. Details about some of these features can be found in other chapters of this book.



Note

The configuration commands and examples in this chapter may show slot numbering or references to either Cisco uBR7200 series or Cisco uBR10012 Universal Broadband Routers. However, the features can be configured on either platform. Use the slot numbering appropriate for your CMTS router configuration.

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.

Contents

- [Prerequisites for Configuring Upstream Cable Interfaces on the Cisco CMTS Routers, page 2](#)
- [Prioritizing Upstream Traffic to Initialize Cable Modems, page 3](#)
- [Activating the Upstream Minimum Reserved Traffic Rate Plus Excess Traffic Rate, page 5](#)
- [Activating Upstream Admission Control, page 6](#)
- [Activating Upstream Differential Encoding, page 7](#)
- [Activating Upstream Forward Error Correction, page 8](#)
- [Activating the Upstream Ports, page 9](#)
- [Activating Upstream Power Adjustment, page 10](#)
- [Activating the Upstream Scrambler, page 11](#)
- [Activating Upstream Timing Adjustment, page 12](#)
- [Traffic Shaping, page 13](#)
- [Configuring Upstream Rate Limiting and Traffic Shaping, page 15](#)
- [Setting Upstream Backoff Values, page 16](#)
- [Setting the Upstream Channel Width, page 17](#)
- [Setting the Upstream Frequency, page 19](#)
- [Setting the Upstream Input Power Level, page 21](#)
- [Specifying Upstream Minislot Size, page 23](#)
- [Setting Upstream Traffic Shaping, page 24](#)
- [Configuring Upstream Drop Classifier, page 26](#)
- [Setting Upstream Buffer Control Parameters, page 27](#)

Prerequisites for Configuring Upstream Cable Interfaces on the Cisco CMTS Routers

The configuration of upstream cable interface features is supported on the Cisco CMTS routers in Cisco IOS Release 12.3BC and Cisco IOS Release 12.2SC. The table below shows the hardware compatibility prerequisites for this feature.



Note

The hardware components introduced in a given Cisco IOS Release will be supported in all subsequent releases unless otherwise specified.

Table 1: Configuring Upstream Cable Interfaces on the Cisco CMTS Routers Hardware Compatibility Matrix

Cisco CMTS Platform	Processor Engine	Cable Interface Cards
Cisco uBR10012 Universal Broadband Router	Cisco IOS Release 12.2(33)SCA <ul style="list-style-type: none"> • PRE2 Cisco IOS Release 12.2(33)SCC <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)SCB and later releases <ul style="list-style-type: none"> • Cisco uBR10-MC5X20U/H Cisco IOS Release 12.2(33)SCC and later releases <ul style="list-style-type: none"> • Cisco UBR-MC20X20V Cisco IOS Release 12.2(33)SCE and later releases <ul style="list-style-type: none"> • Cisco uBR-MC3GX60V ¹
Cisco uBR7246VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCA <ul style="list-style-type: none"> • NPE-G1 • NPE-G2 Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • NPE-G2 	Cisco IOS Release 12.2(33)SCA <ul style="list-style-type: none"> • Cisco uBR-MC28U/X • Cisco uBR-MC16U/X Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • Cisco uBR-MC88V²
Cisco uBR7225VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCA <ul style="list-style-type: none"> • NPE-G1 Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • NPE-G2 	Cisco IOS Release 12.2(33)SCA <ul style="list-style-type: none"> • Cisco uBR-E-28U • Cisco uBR-E-16U • Cisco uBR-MC28U/X • Cisco uBR-MC16U/X Cisco IOS Release 12.2(33)SCD and later releases <ul style="list-style-type: none"> • Cisco uBR-MC88V

¹ Cisco uBR-MC3GX60V cable interface line card is not compatible with PRE2.

² Cisco uBR-MC88V cable interface line card is compatible only with NPE-G2.

Prioritizing Upstream Traffic to Initialize Cable Modems

When the Cisco CMTS is busy servicing data and bandwidth requests from a large number of online cable modems, it may deny new registration requests from offline cable modems. This denial of service occurs

because when a cable modem first begins initializing, its default upstream service flow is assigned a quality of service (QoS) profile-2 with a priority of zero. Zero is the lowest priority that can be scheduled. Depending on the priority and rate of bandwidth requests from other online cable modems, the priority-zero queue can either overflow or get ignored.

To ensure that the initializing cable modems can get online when a large number of online cable modems are actively transmitting data, the Cisco CMTS must allow the bandwidth request from an initializing cable modem to get priority over those requests from online cable modems.

In Cisco IOS Release 12.2(33)SCD2 and later releases, an operator can configure the priority of QoS profile-2 to a higher value.

Configuring the Priority of the QoS Profile

This configuration is optional. This section describes how you can manually configure a non-zero value for the QoS profile-2 priority to ensure that initialization requests from offline cable modems are serviced.



Note It is up to the cable operator to determine the appropriate new priority value.

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 qos pre-registration us-priority <i>priority-value</i> Example: Router(config)# cable qos pre-registration us-priority 2	Sets the priority of the QoS profile-2 of the initializing cable modem. Note The valid priority value range is 0 to 7 where 0 is the default value. <ul style="list-style-type: none"> • us-priority—Specifies the upstream priority to be assigned to the pre-registration traffic. • <i>priority-value</i>—User-defined priority value for the QoS profile-2.
Step 4	end Example: Router(config)# end	Exits global configuration mode.

After a cable modem has successfully completed registration, the QoS profile of the default upstream service flow is changed from QoS profile-2 to the QoS indicated through the DOCSIS configuration file.

What to Do Next

To determine if the priority of the QoS profile-2 is configured, enter the **show cable qos profile** command in privileged EXEC mode.

```
Router# show cable qos profile
```

```

ID  Prio Max          Guarantee Max          Max  TOS  TOS  Create  B  IP  prec.
      upstream upstream  downstream tx  AND  OR  by  priv rate
      bandwidth bandwidth bandwidth burst mask mask  cmts(r) enab enab
1    0    0              0              0      0  0xFF 0x0  cmts(r) no  no
2    2   64000         0              1000000  0  0xFF 0x0  cmts(r) no  no
3    7   31200         31200         0        0  0xFF 0x0  cmts   yes no
4    7   87200         87200         0        0  0xFF 0x0  cmts   yes no
Router#
```

The **Prio** column in the **ID 2** displays the user-defined value of the QoS profile-2.

Activating the Upstream Minimum Reserved Traffic Rate Plus Excess Traffic Rate

This configuration is optional. Each service flow (SF) carries traffic based on certain defined parameters. One of them is the minimum reserved traffic rate.

The minimum reserved traffic rate specifies the minimum traffic rate, in bits/sec, reserved for a service flow. The value of minimum reserved traffic rate is calculated from the byte following the MAC header check sequence (HCS) to the end of the cyclic redundancy check (CRC), including every protocol data unit (PDU) in a concatenated MAC frame. If this parameter is omitted, then it defaults to a value of 0 bits/sec (that is, no bandwidth is reserved for the flow by default).

The Cisco CMTS schedules forwarding traffic of all service flows such that each flow receives at least its minimum reserved traffic rate when transmitting packets with the assumed minimum reserved rate packet size. If the service flow requests less bandwidth than its minimum reserved traffic rate, the Cisco CMTS reallocates the excess reserved bandwidth for other purposes. All best effort service flows with or without their minimum reserved traffic rate configured, share the excess bandwidth.

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.

	Command or Action	Purpose
Step 3	cable rate-limit-algorithm min-plus-excess Example: Router(config)# cable rate-limit-algorithm min-plus-excess	Enables a service flow to receive its configured minimum reserved traffic rate plus the expected excess traffic rate bandwidth.
Step 4	end Example: Router(config)# end	Exits global configuration mode.

What to Do Next

To verify if the upstream min-plus-excess parameter is configured and activated, run the **show interface cable mac-scheduler** and the **show interface cable service flow** commands in privileged EXEC mode.

```
Router# show interface cable 8/0/0 mac-scheduler 0 |include rate
DOCSIS 1.1 MAC scheduler for Cable8/0/0/U0: rate 10240000
Router# show interface cable 8/0/0 service-flow qos us
Sfid  Dir  Curr  Sid  Sched  Prio  MaxSusRate  MaxBrst  MinRsvRate  Through
      State
7     US  act   1    BE     0    2000000     28000    500000      856051
134   US  act   120  BE     0    2000000     11000    0            403840
9     US  act   2    BE     0    2000000     28000    500000      856176
129   US  act   115  BE     0    2000000     11000    0            402647
11    US  act   3    BE     0    2000000     28000    500000      856019
132   US  act   118  BE     0    2000000     11000    0            402751
13    US  act   4    BE     0    2000000     28000    500000      856394
131   US  act   117  BE     0    2000000     11000    0            402754
15    US  act   5    BE     0    2000000     28000    500000      855977
135   US  act   121  BE     0    2000000     11000    0            403808
17    US  act   6    BE     0    2000000     28000    500000      685510
133   US  act   119  BE     0    2000000     11000    0            341456
25    US  act   13   BE     0    2000000     28000    500000      855598
130   US  act   116  BE     0    2000000     11000    0            403870
Router#
```

Activating Upstream Admission Control

Upstream admission control tallies up the total amount of guaranteed minimum upstream throughput reserved by CMs on an upstream interface. When the total exceeds an allowable level, no more CMs requiring a guaranteed minimum upstream rate are allowed online on that upstream port.

The Cisco CMTS upstream admission control is turned off by default and must be activated. To set the upstream admission control as a percentage of the upstream channel capacity, use the following command in cable interface configuration mode. The admission control is set as a percentage of the specified upstream channel capacity. The acceptable range is from 10 to 1000 percent.

```
Router(config-if)# cable upstream usport admission-control percentage
```

For example:

```
Router(config-if)# cable upstream 0 admission-control ?
Max Reservation Limit As Percentage of Raw Channel Capacity
```



Note

If *percentage* is left blank or set to 100%, the Cisco CMTS will only allow the total of the actual available upstream bandwidth to be guaranteed. If *percentage* is set to its maximum of 1000, then up to 10 times of the actual interface bandwidth may be “guaranteed”.

Verifying Upstream Admission Control

To determine if upstream admission control is configured and activated, enter the **show running-config** command in privileged EXEC mode and look for the cable interface configuration information. If upstream admission control is configured and enabled, an admission control entry appears in the **show running-config** command output, indicating the user-defined percentage of upstream channel capacity allowable. If upstream admission control is disabled, no admission control entry appears in the output.

Perform these steps if you are having difficulty with verification:

-
- Step 1** Ensure that the cable connections are not loose or disconnected.
 - Step 2** Ensure that the cable interface line card is firmly seated in its chassis slot.
 - Step 3** Ensure that the captive installation screws are tight.
 - Step 4** Verify that you have entered the correct slot and port numbers.
 - Step 5** Verify that you selected a valid frequency for your router.
-

Activating Upstream Differential Encoding

Differential encoding on the upstream is a digital encoding technique whereby a binary value is denoted by a signal change rather than a particular signal level. To enable differential encoding on upstream traffic to a specified cable interface, use the following command in cable interface configuration mode. Upstream differential encoding is enabled by default.

```
Router(config-if)# cable upstream usport differential-encoding
```

Verifying Upstream Differential Encoding

To determine if upstream differential encoding is activated, enter the **show running-config** command and look for the cable interface configuration information. If upstream differential encoding is enabled, a differential encoding entry appears in the **show running-config** output. If upstream differential encoding is disabled, no differential encoding entry appears in the output.

Perform these steps if you are having difficulty with verification:

-
- Step 1** Ensure that the cable connections are not loose or disconnected.
 - Step 2** Ensure that the cable interface line card is firmly seated in its chassis slot.
 - Step 3** Ensure that the captive installation screws are tight.
 - Step 4** Verify that you have entered the correct slot and port numbers.
 - Step 5** Verify that you selected a valid frequency for your router.
-

Activating Upstream Forward Error Correction

The Cisco uBR7200 series CMTS uses forward error correction (FEC) to attempt to correct any upstream data that might have been corrupted. When FEC is activated, all CMs on the network also activate FEC.



Note Although upstream FEC is an option, it is recommended that you use upstream FEC. FEC is activated by default and should not be disabled.

To activate the upstream forward error correction and to enable FEC, use the following command in cable interface configuration mode.

```
Router(config-if)# cable upstream usport fec
```

Verifying Upstream FEC

To verify whether FEC is activated or deactivated, enter the **more system:running-config** command and look for the cable interface configuration information. If FEC is enabled, an FEC entry appears in the **show running-config** command output. If FEC is disabled, no FEC entry appears in the output.

Perform these steps if you are having difficulty with verification:

-
- Step 1** Ensure that the cable connections are not loose or disconnected.
 - Step 2** Ensure that the cable interface line card is firmly seated in its chassis slot.
 - Step 3** Ensure that the captive installation screws are tight.
 - Step 4** Verify that you have entered the correct slot and port numbers.
 - Step 5** Verify that you selected a valid frequency for your router.
-

Activating the Upstream Ports

Each upstream port must be activated to enable upstream data transmission from the CMs on the HFC network to the Cisco uBR7200 series CMTS.



Note The upstream cable interface does not operate until you either set a fixed upstream frequency or create and configure a spectrum group. For more information, see the [Setting the Upstream Frequency](#), on page 19.

To activate the upstream ports, perform the following steps:

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 Example: Router(config)# interface cable 5/0	Specifies a cable interface and enters cable interface configuration mode.
Step 4	no cable upstream usport shutdown Example: Router(config-if)# no cable upstream 0 shutdown	Enables upstream data traffic.

What to Do Next

To determine if the upstream ports are activated or deactivated, enter the **show interface cable** command for the upstream port just configured:

```
Router# show interface cable5/0
```

```
Cable5/0 is up, line protocol is up
Hardware is BCM3210 FPGA, address is 00e0.1e5f.7a60 (bia 00e0.1e5f.7a60)
Internet address is 1.1.1.3/24
MTU 1500 bytes, BW 27000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
Encapsulation, loopback not set, keepalive not set
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:25, output 00:00:00, output hang never
Last clearing of "show interface" counters never
Queuing strategy: fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sea, 0 packets/sec
```

```

5 minute output rate 0 bits/sec, 0 packets/sec
 10878 packets input, 853740 bytes, 0 no buffer
 Received 3679 broadcasts, 0 runts, 0 giants, 0 throttles
 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
 5401 packets output, 645885 bytes, 0 underruns
 0 output errors, 0 collisions, 9 interface resets
 0 output buffer failures, 0 output buffers swapped out

```

Activating Upstream Power Adjustment

To enable upstream power adjustment for a specified cable interface, use one of the following commands in cable interface configuration mode.

Command	Purpose
Router(config-if)# cable upstream power-adjust continue <i>pwr-level</i>	Sets the minimum power adjustment in dB that allows continued ranging status. Valid values are 2 to 15 dB. Default = 4 dB.
Router(config-if)# cable upstream usport power-adjust noise <i>perc-pwr-adj</i>	Sets the minimum number (percentage) of power-adjustment packets required to justify changing the upstream power rating. Valid values are 10 to 100 percent. The default is 30 percent.
Router(config-if)# cable upstream 0 power-adjust threshold <i>value</i>	Sets the power-adjustment threshold in dB. Valid values are 0 to 2 dB. The default is 1 dB.
Router(config-if)# end Router#	Returns to enable (privileged EXEC) mode.

To return the automatic upstream power-adjustment ranging value to the default of 4 dB, enter the following command in cable interface configuration mode:

```
Router(config-if)# no cable upstream n power-adjust continue
```

To return the automatic upstream power-adjustment noise value to the default of 30 percent, enter the following command in cable interface configuration mode:

```
Router(config-if)# no cable upstream n power-adjust noise
```

To return the upstream power-adjustment threshold value to the default of 1 dB, enter the following command in cable interface configuration mode:

```
Router(config-if)# no cable upstream n power-adjust threshold
```

What to Do Next

To determine if upstream power adjustment is configured and activated, enter the **show running-config** command and look for the cable interface configuration information. If upstream power adjustment is enabled, any or all three of the continue, noise, and threshold power-adjustment entries appear in the **show running-config** command output. If all three upstream power adjustments are disabled, no power-adjustment entry appears in the **show running-config** command output.

Activating the Upstream Scrambler

The scrambler on the upstream RF carrier enables CMs on the HFC network to use built-in scrambler circuitry for upstream data transmissions. The scrambler circuitry improves reliability of the upstream receiver on the cable interface line card.



Caution

The upstream scrambler is activated by default and should not be disabled under normal circumstances. Disabling it can result in corrupted packets. Disable it only for prototype modems that do not support the upstream scrambler.

To activate the upstream scrambler, use the following command in cable interface configuration mode. The upstream scrambler is enabled by default.

```
Router(config-if)#  cable upstream usport scrambler
```

Verifying the Upstream Scrambler

To determine if the upstream scrambler is activated, enter the **more system:running-config** command and look for the cable interface configuration information. Perform these steps if you are having difficulty with verification:

-
- Step 1** Ensure that the cable connections are not loose or disconnected.
 - Step 2** Ensure that the cable interface line card is firmly seated in its chassis slot.
 - Step 3** Ensure that the captive installation screws are tight.
 - Step 4** Verify that you have entered the correct slot and port numbers.
 - Step 5** Verify that you selected a valid frequency for your router.
-

Activating Upstream Timing Adjustment

To enable upstream timing adjustment for a specified cable interface, use one of the following commands in cable interface configuration mode.

Command	Purpose
Router(config-if)# cable upstream <i>usport</i> time-adjust continue <i>seconds</i>	Sets the minimum timing adjustment that allows continued ranging status. Valid second values are 2 to 64 seconds. The default is 2 seconds.
Router(config-if)# cable upstream <i>usport</i> time-adjust threshold <i>seconds</i>	Sets the timing adjustment threshold value in seconds. Valid second values are 1 to 32 seconds. The default is 1 second.
Router(config-if)# end Router#	Returns to enable (privileged EXEC) mode.

To return the upstream time-adjustment ranging value to the default of 2 seconds, enter the following command in cable interface configuration mode:

```
Router(config-if)# no cable upstream usport time-adjust continue
```

To return the upstream time adjustment threshold value to the default of 1 second, enter the following command in cable interface configuration mode:

```
Router(config-if)# no cable upstream usport time-adjust threshold
```

Verifying Upstream Timing Adjustment

To determine if upstream timing adjustment is configured and activated, enter the **show running-config** command and look for the cable interface configuration information. If upstream timing adjustment is enabled, either or both of the continue and threshold timing-adjustment entries appear in the **show running-config** command output. If both the continue and threshold upstream timing adjustments are disabled, no timing adjustment entry appears in the **show running-config** command output.

Perform the following steps if you are having difficulty with verification:

-
- Step 1** Verify that the cable connections are not loose or disconnected.
 - Step 2** Verify that the cable interface line card is firmly seated in its chassis slot
 - Step 3** Verify that the captive installation screws are tight.
 - Step 4** Confirm that you have entered the correct slot and port numbers.
-

Traffic Shaping

Traffic shaping basically uses queues to limit data surges that can congest a network. The data is buffered and then sent into the network in regulated amounts to ensure that the traffic fits within the expected traffic envelope for the particular connection.

Traffic shaping reduces the chance of retransmitting information to hosts on the cable plant. When cable modems (CMs) have rate limits established, the CMTS typically drops bandwidth requests to enforce the rate limit. This causes the CM to retransmit the request, thereby putting additional latency in packet transmission. If both the hosts sending and requesting information are on the same cable plant, the upstream bandwidth is wasted as well.

On the DOCSIS downstream and upstream channels, traffic shaping allows the CMTS to perform downstream rate limiting and bandwidth request shaping allows the CMTS to perform upstream rate limiting. Rate limiting restricts the data rate to and from a CM; the MAC scheduler supports shaping capabilities for downstream and upstream traffic. Rate limiting ensures that no single CM consumes all of the channel bandwidth and allows a CMTS administrator to configure different maximum data rates for different subscribers. Subscribers requiring higher sustained rates and willing to pay for higher rates can be configured with higher sustained rate limits in their CM DOCSIS configuration file over regular subscribers, who pay less and get lower rate limits.

Each time a packet belonging to a flow is transmitted on an output channel, the token-bucket policer function checks the rate limit status of the flow, parsing the following parameters:

- Token bucket maximum sustained rate in bits per millisecond.
- Token bucket depth (maximum transmit burst) in bits.
- Length of current packet to be sent in bits.
- Pointer to the token bucket of the flow.
- Pointer to the flow's token bucket last update time stamp.
- Variable to return the milliseconds buffering delay in case the packet needs to be shaped.
- Maximum buffering delay that the subsequent traffic shaper can handle in milliseconds.

Every flow has its own shaping buffer where rate-exceeded packets are typically held back in first-in/first-out (FIFO) order for later releases transmission.

**Tip**

Token bucket policing with shaping is the per-upstream default rate limiting setting at the CMTS. Shaping can be enabled or disabled for the token-bucket algorithm.

Upstream Traffic Shaping

Upstream traffic shaping allows the CMTS to perform rate limiting on a DOCSIS upstream channel. The upstream traffic shaping feature delays the scheduling of the upstream packet, which in turn, causes the packet to be buffered on the cable modem device. This allows the user TCP/IP stack to pace the application traffic appropriately and approach throughput commensurate with the subscriber's defined quality of service (QoS)

levels. Upstream traffic shaping enables the CMTS to enforce the peak upstream rate for each CM without degrading overall TCP performance for the subscriber CMs.

When you do not enable the shaping option for upstream rate limiting, the CMTS upstream-rate-policing code drops bandwidth requests from cable modems that are found to have exceeded their configured-peak-upstream rate (using different local drop policies). The effect of bandwidth requests (eventually upstream packets) being dropped causes degraded throughput performance of window-based protocols (like TCP) for these rate-exceeded modems.

Upstream grant shaping is on a per-CM (service identifier-SID) basis. The grant shaping feature is a configurable option for the current upstream token-bucket rate-limiting algorithm.

A traffic shaping feature is restricted QoS class assignment, which allows a CMTS administrator to override the class of service provisioned for a CM. When this feature is enabled, the user-defined QoS profile is enforced on the CM attempting to register with the CMTS, regardless of the CM's provisioned class of service. Use the **cable qos profile** command to configure a QoS profile.


Note

The restricted QoS class assignment feature is added to address instances where a cable operator implemented rate limiting incorrectly. The feature allows an administrator to override the statically provisioned QoS parameters of the CM and force the CM to use a specific QoS profile defined at the CMTS.

Upstream Buffer Control for Maximum Queue Depth

Upstream traffic shaping uses queues to control the upstream data flow. The data packets are buffered in a queue on the CM to regulate traffic and avoid network congestion. Starting with Cisco IOS Release 12.2(33)SCF2, the Upstream Buffer Control feature enables the Cisco CMTS to control the size of this queue (or buffer) by controlling the amount of data that can be enqueued for transmission at any point of time.

The Upstream Buffer Control feature supports buffer control TLVs, which allows the user to configure the buffer size control parameters. These parameters are used to create buffer for each service flow on the CM. The buffer control parameters comprise of three values—minimum buffer, maximum buffer, and target buffer. The minimum buffer and maximum buffer parameters provide a range for the size of the service flow buffer, and the target buffer parameter indicates a desired size of the buffer. The Upstream Buffer Control feature supports the following sub-TLVs in the service flow TLV (24.35), to control these buffer parameters:

Table 2: Supported Upstream Buffer Control TLVs

TLV	TLV Description
24.35.1	Upstream minimum buffer.
24.35.2	Upstream target buffer
24.35.3	Upstream maximum buffer

The CM sends the buffer control TLVs in the registration request or in dynamic service add (or change) request to the Cisco CMTS. The Cisco CMTS stores the value of the buffer control TLVs and sends its response. On receiving the response CM creates a buffer for US service flow based on the TLVs.

The buffer control parameters can be configured in the CM configuration file, or by using the cable service class command in global configuration mode. For more information on how to configure upstream buffer control parameters, see [Setting Upstream Buffer Control Parameters](#), on page 27.

Configuring Upstream Rate Limiting and Traffic Shaping

You can configure rate limiting and traffic shaping on a DOCSIS upstream channel. This delays the scheduling of the upstream packet, which in turn causes the packet to be buffered on the cable CPE device. This allows the user's TCP/IP stack to pace the application traffic appropriately and approach throughput commensurate with the subscriber's defined QoS levels.

To configure this, use the following command in cable interface configuration mode.

Command	Purpose
Router(config-if)# [no] cable upstream <n1> rate-limit [token-bucket]	Enables or disables DOCSIS rate limiting or shaping on an upstream channel. <n1> depends on the number of upstream channels on the specific cable interface line card.

Using Cisco IOS Release 12.0(5)T1 or higher, the software supports:

- Generic calendar queuing routines
- New token bucket policing function
- Grant shaping application of the calendar queues
- Upstream rate shaping option to the token-bucket keyword
- A default state change from 1 second burst policing to token-bucket with shaping



Tip

Upstream grant shaping is per CM (SID). Shaping can be enabled or disabled for the token-bucket algorithm.



Note

Before the introduction of this feature, the CMTS would drop bandwidth requests from a CM it detected as exceeding its configured peak upstream rate. Such request dropping affects the throughput performance of IP-based protocols such as FTP, TCP, and SMTP. With this feature, the CMTS can shape (buffer) the grants for a CM that is exceeding its upstream rate, rather than dropping the bandwidth requests.

```
Router# show interface cable 3/0 sid 1 counters
```

```
Sid   Inpackets  Inoctets   Outpackets  Outoctets  Ratelimit  Ratelimit
      67859     99158800  67570      98734862  BWReqDrop  DSPktDrop
      2579     0
```

Setting Upstream Backoff Values

The DOCSIS-specified method of contention resolution for CMs wanting to transmit data or requests on the upstream channel is a truncated binary exponential backoff value, with the initial backoff window and the maximum backoff window controlled by the CMTS. The Cisco uBR7200 series CMTS specifies backoff window values for both data and initial ranging, and sends these values downstream as part of the Bandwidth Allocation Map (MAP) MAC message.

The values are configurable on the Cisco uBR7200 series software and are power-of-two values. For example, a value of 4 indicates a window between 0 and 15; a value of 10 indicates a window between 0 and 1023. You can set fixed start and end values for data backoff on the upstream ports, or you can set the upstream ports for automatic data backoff. You have the same options for ranging backoff. For both backoff windows, the default start value is 0; the default end value is 4. Valid values are from 0 to 15.



Note It is not recommended that you adjust default values, but that you enable the automatic dynamic backoff algorithm.

To set data or ranging backoff values for an upstream port, use one or more of the following commands in cable interface configuration mode.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Enter one of the following commands: <ul style="list-style-type: none"> • Router(config-if)#cable upstream usport data-backoff start end • Router(config-if)#cable upstream usport data-backoff automatic 	Optimizes the automatic setting for as many as 250 cable interfaces per upstream port. Sets manual values for data backoff windows only when operating with more than 250 cable interfaces per upstream port. Configures the default backoff window values of 0 and 4.
Step 2	Enter one of the following commands: <ul style="list-style-type: none"> • Router(config-if)#cable upstream usport range start end • Router(config-if)#cable upstream usport range automatic 	Optimizes the automatic setting for as many as 250 cable interfaces per upstream port. Sets manual values for data backoff windows only when operating with more than 250 cable interfaces per upstream port. Configures the default backoff window values of 0 and 4.

When considering whether to adjust backoff values, keep the following considerations in mind:

- The cable interface reconnection time after a power outage is related to the following factors:
 - DHCP, ToD, and TFTP servers often operate well below 1 percent load under normal situations, but can jump to over 100 percent after an outage.

- Adjusting the backoffs to larger numbers slows cable interface reconnection and reduces server load.
 - Backoffs that are too small result in cable interfaces failing to range the upstream RF levels correctly and cycling to maximum power, thus increasing connection time and reducing network performance.
 - Backoffs that are too large result in increased recovery time after a large service outage.
 - There is significant variation in cable interface performance (brand to brand) in cable interface restart time.
- All cable interfaces should recover in 0 to 10 minutes after all services are restored (Cisco uBR7200 series, RF transport, DHCP, TFTP, and ToD servers). A CM that takes longer than 10 minutes could be experiencing a problem with the modem itself, a problem with CMTS settings, or a problem in the DOCSIS provisioning servers.

**Note**

Upstream segments serving a relatively large number of cable interfaces (for example, more than 1600) might suffer recovery times greater than 10 minutes.

What to Do Next

To verify backoff window settings, enter the **show controllers cable** command for the upstream port you configured:

```
Router# show controllers cable5/0 upstream 0

Cable5/0 Upstream 0 is up
Frequency 24.016 MHz, Channel Width 1.600 MHz, QPSK Symbol Rate 1.280 Msp/s
Spectrum Group is overridden
SNR 33.2560 dB
Nominal Input Power Level 0 dBmV, Tx Timing Offset 2288
Ranging Backoff automatic (Start 0, End 3)
Ranging Insertion Interval automatic (60 ms)
Tx Backoff Start 0, Tx Backoff End 4
Modulation Profile Group 1
part_id=0x3137, rev_id=0x03, rev2_id=0xFF
nb_agc_thr=0x0000, nb_agc_nom=0x0000
Range Load Reg Size=0x58
Request Load Reg Size=0x0E
Minislot Size in number of Timebase Ticks is = 8
Minislot Size in Symbols = 64
Bandwidth Requests = 0xFE
Piggyback Requests = 0xD
Invalid BW Requests= 0x2
Minislots Requested= 0x2963
Minislots Granted = 0x2963
Minislot Size in Bytes = 16
Map Advance = 4000 usecs
UCD Count = 32964
DES Ctrl Reg#0 = C000C043, Reg#1 = 0
```

Setting the Upstream Channel Width

Use the commands below to enter the upstream channel width in hertz (Hz). For NTSC operations, valid values are 200,000 Hz (160 kilo symbols per second [ksp/s]), 400,000 Hz (320 ksp/s), 800,000 Hz (640 ksp/s), 1,600,000 Hz (1280 ksp/s), and 3,200,000 Hz (2560 ksp/s). The default is 1,600,000 Hz.

If no acceptable channels of the specified width are found, the spectrum management card automatically begins to scan the upstream spectrum for the next largest available channel width; for example, if the spectrum management card is unable to find a usable 1.6 MHz upstream channel, it automatically begins searching for usable 800 kHz channels.

**Caution**

Higher symbol rates are more susceptible to RF noise and interference. If you use a symbol rate or modulation format beyond the capabilities of your HFC network, you might experience packet loss or loss of cable interface connectivity.

**Note**

For QAM-16 channel widths of 400 kHz (320 ksps) or greater, Cisco recommends that you use QAM-16 modulation for long and short data, and that you use QPSK for request, initial, and station communications. For QAM-16 channel widths of 200 kHz (160 ksps), all communication must be able to use QAM-16. That is, 160 ksps with QAM-16 requires an exceptional signal-to-noise ratio (SNR) in your upstream channels. When you use QAM-16 for request, initial, and station maintenance messages with channel widths greater than 400 kHz, the QAM-16 preamble and message data take longer to transmit than the QPSK format.

To set the upstream channel width, use the following commands in cable interface configuration mode:

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config-if)# cable upstream <i>usport</i> channel-width <i>width</i>	Enters the channel width for your upstream RF carrier in Hz.
Step 2	Router(config-if)# no cable upstream <i>usport</i> channel-width	Returns the channel width to its default setting of 1,600,000 Hz.

For additional information about channel width and minislots size, refer to the [Cable Radio Frequency \(RF\) FAQs](#) on Cisco.com.

Verifying Upstream Channel Width

To verify the current value of the upstream channel width, enter the **show controllers cable** command for the upstream port you configured:

```
Router# show controllers cable5/0 upstream 0

Cable5/0 Upstream 0 is up
  Frequency 24.016 MHz, Channel Width 0.800 MHz, QPSK Symbol Rate 0.640 Msps
  Spectrum Group is overridden
  SNR 33.2560 dB
  Nominal Input Power Level 0 dBmV, Tx Timing Offset 2288
  Ranging Backoff automatic (Start 0, End 3)
  Ranging Insertion Interval automatic (60 ms)
  Tx Backoff Start 0, Tx Backoff End 4
  Modulation Profile Group 1
```

Perform these steps if you are having difficulty with verification:

-
- Step 1** Use a valid combination of modulation format (QPSK and QAM-16), minislot size, frequency, and the **no shutdown** command.
- Step 2** Use a recommended or previously tested modulation profile. It is not uncommon to create a modulation profile that does not allow cable interface-to-headend communication. Because each message type is individually specified, some messages might not work.
- Step 3** Verify using IP ping packets of varying lengths (64 to 1500 bytes). Ping from the headend to the cable interface.
- Step 4** Verify with your cable interface vendor that your CM software is fully certified or compatible with DOCSIS 1.0 and extensions, as appropriate.
-

Copy and Paste Support for TDMA to A-TDMA Upgrade

When configuration is copied from Method of Procedure (MOP) document and pasted, with 6400 kHz specified as channel width (as last-choice-width or first-choice-width or both) and the DOCSIS mode set to TDMA or mixed TDMA/A-TDMA mode, the 6400 kHz channel width is rejected. If the configuration is pasted twice, the 6400 kHz channel width is accepted.

To have the 6400 kHz accepted by pasting the configuration only once, Cisco IOS Release 12.2(33)SCG2 introduces the Copy and Paste Support for TDMA to A-TDMA Upgrade feature. If 6400 kHz is set as channel width in TDMA mode or mixed TDMA/A-TDMA mode, DOCSIS mode automatically changes to A-TDMA-only (DOCSIS 2.0) mode. The command interface displays a message to show the change in the DOCSIS mode.

The automatic change to the DOCSIS mode applies to logical upstream channels configured for a physical

**Note**

Only A-TDMA and SCDMA modes support 6400 kHz channel width. To configure 6400 kHz channel width with SCDMA mode, use manual configuration. The 6400 kHz channel width is hidden in CLI Interactive Help output for TDMA and mixed TDMA/A-TDMA modes.

Setting the Upstream Frequency

The upstream channel frequency of your RF output must be set to comply with the expected input frequency of your Cisco cable interface line card. To configure upstream channel frequencies, perform one of the following tasks:

- Configure a fixed frequency from 5 to 42 MHz for NTSC operations, then enable the upstream port.
- Create a global spectrum group, assign the interface to it, and enable the upstream port.

**Note**

You can also select a default that does not set a specific fixed value.



Note The upstream port is frequency agile. If you define spectrum groups, the frequency can change while the interface is up and carrying traffic.

A modulation profile consists of a table of physical layer characteristics for the different types of upstream bursts; for example, initial maintenance, long grant, request/data, request, short grant, and station maintenance.



Note The upstream cable interface does not operate until you either set a fixed upstream frequency or create and configure a spectrum group. If you are setting a fixed upstream frequency, make sure that the frequency selected does not interfere with the frequencies used for any other upstream applications running on the cable plant.

To set a fixed upstream frequency, use the following commands in cable interface configuration mode.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config-if)# cable upstream <i>usport</i> frequency <i>up-freq-hz</i>	Enters the fixed center frequency for your upstream RF carrier in Hz.
Step 2	Router(config-if)# no cable upstream <i>usport</i> shutdown	Places the upstream port in the "admin up" state.



Tip For National Television Standards Committee (NTSC) operations, valid ranges are 5000000 to 42000000 Hz.



Caution Some cable systems cannot reliably transport frequencies near these band edges. The wider the upstream channel (in MHz), the more difficulty you might have. Enter a center frequency between 20 and 38 MHz if you have difficulty.



Note You can also select a default that does not set a specific fixed value. The Cisco uBR7200 series software instructs the cable interfaces to use this frequency as the center frequency.



Note After the spectrum-band is changed, the spectrum management does not rearrange the frequency for each US channel if the previous frequency belongs to the range of new spectrum-band, which means that the US frequency will not be changed; if the previous frequency is out of range of new spectrum-band, those US channels will not get frequencies.

Verifying the Upstream Frequency

To verify the current value of the upstream frequency, enter the **show controllers cable** command for the upstream port you configured:

```
Router# show controllers cable5/0 upstream 0

Cable5/0 Upstream 0 is up
Frequency 24.016 MHz, Channel Width 1.600 MHz, QPSK Symbol Rate 1.280 Msps
Spectrum Group is overridden
SNR 33.2560 dB
Nominal Input Power Level 0 dBmV, Tx Timing Offset 2288
Ranging Backoff automatic (Start 0, End 3)
Ranging Insertion Interval automatic (60 ms)
Tx Backoff Start 0, Tx Backoff End 4
Modulation Profile Group 1
```

**Note**

The upstream frequency displayed in the **show controllers cable** command output might not match the frequency that you entered when you set the upstream frequency. The Cisco uBR7200 series CMTS might select an upstream frequency close to the frequency you entered that offers better performance. The Cisco uBR7200 series CMTS selects the closest frequency available.

Perform these steps if you are having difficulty with verification:

-
- Step 1** Ensure that the cable connections are not loose or disconnected
 - Step 2** Ensure that the cable interface line card is firmly seated in its chassis slot.
 - Step 3** Ensure that the captive installation screws are tight.
 - Step 4** Verify that you have entered the correct slot and port numbers.
 - Step 5** Verify that you have selected a valid frequency for your router.
-

Setting the Upstream Input Power Level

The Cisco uBR7200 series CMTS controls the output power levels of CMs to meet the desired upstream input power level. The nominal input power level for the upstream RF carrier is specified in decibels per millivolt (dBmV). The default setting of 0 dBmV is the optimal setting for the upstream power level.

The valid range for the input power level depends on the data rate. At 1.6 MHz, the valid range is -10 to 25 dBmV. If your power levels operate at greater than the maximum valid level, use an inline attenuator to bring the power level to within the valid range.

**Caution**

If you increase the input power level, CMs on your HFC network increase their transmit power level. This increases the carrier-to-noise ratio (C/N) on the network, but also increases distortion products. Composite Second Order Beat (CSO) and Composite Triple Beat (CTB) values worsen by 2 dB for every 1 dB-increased C/N. The return path laser immediately enters a nonlinear mode called clipping, and all communication becomes unreliable. Many return lasers send short bursts above the clipping thresholds and fail on longer or successive bursts.

You should not adjust your input power level by more than 5 dB in a 30-second interval. If you increase the power level by more than 5 dB within 30 seconds, cable interface service on your network is disrupted. If you decrease the power level by more than 5 dB within 30 seconds, cable interfaces on your network are forced offline.

**Note**

When you run the **cable upstream 0 power-level** command, Cisco recommends that the adjacent channel not have a large variation. The recommended maximum input power variance is 5 to 6 dBmV.

To set the upstream input power level in dBmV, use the following command in cable interface configuration mode. The default is 0 dBmV.

```
Router(config-if)# cable upstream usport power-level dbmv
```

Verifying the Upstream Input Power Level

To verify the current value of the upstream input power level, enter the **show controllers cable** command for the upstream port you configured:

```
Router# show controllers cable5/0 upstream 0

Cable5/0 Upstream 0 is up
  Frequency 24.016 MHz, Channel Width 0.800 MHz, QPSK Symbol Rate 0.640 Msps
  Spectrum Group is overridden
  SNR 33.2560 dB
  Nominal Input Power Level 0 dBmV, Tx Timing Offset 2288
  Ranging Backoff automatic (Start 0, End 3)
  Ranging Insertion Interval automatic (60 ms)
  Tx Backoff Start 0, Tx Backoff End 4
  Modulation Profile Group 1
```

Perform these steps if you are having difficulty with verification:

-
- Step 1** Verify that the upstream amplitude of an optimal RF carrier (injected at the fiber node reference input point) reaches the cable interface line card input point at a consistent level (node-to-node and port-to-port).
- Step 2** Verify that this absolute level, as installed, matches both the design and software settings on the Cisco uBR7200 series CMTS.
-

**Note**

Software adjustments of 1 to 3 dB can be used to adjust for minor variations in measurement or setup and port-to-port calibration differences. These adjustments can significantly improve cable interface performance, especially in marginal situations. Larger adjustments should be made in conjunction with spectrum analyzer support at the headend or distribution hub.

Specifying Upstream Minislot Size

To specify the minislot size (in ticks) for specific upstream cable interfaces, use the following command in cable interface configuration mode. Acceptable values are 2, 4, 8, 16, 32, 64, and 128. The default is 8.

```
Router(config-if)# cable upstream usport minislot-size size
```

For additional information about channel width and minislot size, refer to the [Cable Radio Frequency \(RF\) FAQs](#) on Cisco.com.

Verifying Upstream Minislot Size

To verify upstream minislot size, enter the **show controllers cable** command for the upstream port you configured:

```
Router# show controllers cable5/0 upstream 0

Cable5/0 Upstream 0 is up
Frequency 24.016 MHz, Channel Width 1.600 MHz, QPSK Symbol Rate 1.280 Msps
Spectrum Group is overridden
SNR 33.2560 dB
Nominal Input Power Level 0 dBmV, Tx Timing Offset 2288
Ranging Backoff automatic (Start 0, End 3)
Ranging Insertion Interval automatic (60 ms)
Tx Backoff Start 0, Tx Backoff End 4
Modulation Profile Group 1
part_id=0xFFFF, rev_id=0xFF, rev2_id=0xFF
nb_agc_thr=0x0000, nb_agc_nom=0x0000
Range Load Reg Size=0x58
Request Load Reg Size=0x0E
Minislot Size in number of Timebase Ticks is = 8
Minislot Size in Symbols = 64
Bandwidth Requests = 0xFE
Piggyback Requests = 0xD
Invalid BW Requests= 0x2
Minislots Requested= 0x2963
Minislots Granted = 0x2963
Minislot Size in Bytes = 16
Map Advance = 4000 usecs
UCD Count = 32964
DES Ctrl Reg#0 = C000C043, Reg#1 = 0
```

Perform these steps if you are having difficulty with verification:

-
- Step 1** Ensure that the cable connections are not loose or disconnected.
 - Step 2** Ensure that the cable interface line card is firmly seated in its chassis slot.
 - Step 3** Ensure that the captive installation screws are tight.
 - Step 4** Verify that you have entered the correct slot and port numbers.
 - Step 5** Verify that you selected a valid frequency for your router.
-

Setting Upstream Traffic Shaping

Upstream traffic shaping, available on the DOCSIS upstream channel, delays the scheduling of the upstream packet, which in turn causes the packet to be buffered on the cable customer premises equipment (CPE) device. This allows the user's TCP/IP stack to pace the application traffic appropriately and approach throughput commensurate with the subscriber's defined quality of service (QoS) levels.

The bandwidth requests are buffered without incurring DOCSIS-related timeouts and retransmits. This enables the CMTS to enforce the peak upstream rate for each CM, without degrading overall TCP performance for the subscriber CPEs. Upstream grant shaping is per cable interface (per service ID (SID)).

Token-bucket policing with shaping is the per-upstream default rate-limiting setting at the CMTS. Shaping can be enabled or disabled for the token-bucket algorithm.

To enable upstream shaping for an upstream port on a Cisco cable interface line card, use one of the following commands in cable interface configuration mode.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Enter the following commands: Example: Router(config-if)# cable upstream usport rate-limit Router(config-if)# cable upstream usport rate-limit token-bucket Router(config-if)# cable upstream usport rate-limit token-bucket shaping	Enables traffic shaping for the specified upstream cable interface. Enables traffic shaping for the upstream cable interface employing the token-bucket policing algorithm. Enables traffic shaping for the upstream cable interface employing the token-bucket policing algorithm with traffic shaping.
Step 2	end Example: Router(config-if)# end	Exits back to the EXEC mode so that you can verify upstream traffic shaping.

To disable upstream traffic shaping for an upstream port, enter the following command in cable interface configuration mode:

```
Router(config-if)# no cable upstream usport rate-limit
```

The software supports:

- Generic calendar queuing routines
- New token-bucket policing function
- Grant shaping application of the calendar queues
- Upstream rate-shaping option to the token-bucket keyword
- A default state change from 1-second burst policing to token bucket with shaping



Tip Upstream grant shaping is per CM (per service ID (SID)). Shaping can be enabled or disabled for the token-bucket algorithm.



Note Before the introduction of this feature, the CMTS would drop bandwidth requests from a CM it detected as exceeding its configured peak upstream rate. Such request dropping affects the throughput performance of IP-based protocols such as FTP, TCP, and Simple Network Management Protocol (SNMP). With this feature, the CMTS can shape (buffer) the grants for a CM that is exceeding its upstream rate, rather than dropping the bandwidth requests.

```
Router# show interface cable 5/0 sid 1 counters
```

```
00:02:23: %ENV3-3-LASTENV: Cannot save environmental data
Sid  Req-polls  BW-reqs  Grants  Packets  Frag  Concatpkts
      issued    received  issued  received complete  received
1      0          22       22      22       0       0
2      0           3        3       2       0       0
3      0           0        0       0       0       0
```

Verifying Upstream Bandwidth Request Shaping

To determine if upstream bandwidth request shaping is configured and activated, enter the **show running-config** command and look for the cable interface configuration information. If upstream bandwidth request shaping is configured and enabled, a shaping entry appears in the **show running-config** output. If upstream bandwidth request shaping is disabled, **no cable upstream rate-limit** appears in the output.

You can also perform the following tasks to verify that bandwidth request shaping is enabled on the upstream channel:

- Step 1** Configure a low-peak upstream rate limit for the CM in its QoS profile. Either use the CLI to modify the QoS profile of the modem, or edit the TFTP configuration file of the modem. For more information, see the [DOCSIS 1.1 for the Cisco uBR7200 Series Universal Broadband Routers](#) feature.
- Step 2** Use a regular rate-limiting algorithm on the upstream without rate shaping, and note the drops of the excess bandwidth requests from this CM when it exceeds its peak upstream rate.

Use the **show interface cx/y sid counters verbose** command to see the bandwidth request drops. Verify that the upstream rate received by that modem is less than its configured peak rate, due to the timeouts and backoffs produced by the drop in bandwidth requests. Enter the **show interface cx/y service flow qos** command to see the input rate at CMTS in bps.

Step 3 Enable grant shaping on the upstream channel by using the new **shaping** keyword extension to the token-bucket algorithm CLI command.

Step 4 Make the CM exceed its peak upstream rate by generating upstream traffic, and note the effect of grant buffering (shaping) at the CMTS. If you use CM-to-CMTS pings, there is a perceivable decrease in the frequency of the pings.

Let the pings run long enough to allow the averages at the CMTS to settle; then view the upstream rate received by this single modem. Use the **show interface cx/y** command and see the input rate in bps. This value should be close to the modem's peak upstream rate. Also note the drop counts for the modem's SID by using the **show interface sid counters** command, and verify that the CMTS no longer drops the bandwidth requests from the CM.

The bandwidth request drop count (from the previous nonshaping test) remains unchanged when upstream rate shaping is used, indicating that the CMTS is actually shaping (buffering) the grants for the modem. Verify that the input rate at the CMTS (from the single rate-exceeded CM) stabilizes close to the configured peak rate of 128 Kbps.

Troubleshooting Tips

Perform these steps if you are having difficulty with verification:

-
- Step 1** Ensure that the cable connections are not loose or disconnected.
 - Step 2** Ensure that the cable interface line card is firmly seated in its chassis slot.
 - Step 3** Ensure that the captive installation screws are tight.
 - Step 4** Verify that you have entered the correct slot and port numbers.
 - Step 5** Verify that you selected a valid frequency for your router.
-

Configuring Upstream Drop Classifier

This configuration is optional. A set of matching criteria is applied by the cable modems to packets to determine if a packet should be dropped. This set of matching criteria when applied to upstream traffic, is called the Upstream Drop Classifier (UDC).

The CMTS enables the UDC feature on the cable modems. The UDC configuration is done by the cable modem using a configuration file.

Effective with Cisco IOS Release 12.2(33)SCG5, the UDC feature can be enabled for all cable modems on any interface of a Cisco CMTS by using the **cable udc-capability** command in interface configuration 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	interface cable slot/subslot/port Example: Router(config)# interface cable 7/1/0	Enters the interface configuration mode
Step 4	cable udc-capability Example: Router(config-if)# cable udc-capability	Enables the UDC feature on cable modems.
Step 5	end Example: Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

What to Do Next

To verify that the UDC feature is enabled on a specified cable modem, use the **show cable modem *H.H.H* verbose** command (where *H.H.H* represents the MAC address of the cable modem) in privilege EXEC mode. The following example displays the output of the show command using the **|** and **section** keyword to show only the “UDC Enabled” field.

```
Router# show cable modem 4458.2945.3004 verbose | s UDC
UDC Enabled                : Y
Router#
```

If the UDC feature is not enabled, this field shows ‘N’ to denote that the cable modems have not configured UDC.

Setting Upstream Buffer Control Parameters

This configuration is optional. To configure the upstream buffer control parameters for the CM queue using the service class name, use the cable service class command in global configuration 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 service class class-index max-buff-size min-buff-size tar-buff-size Example: Router(config)# cable service class 10 min-buff-size 1000	Configures the following buffer control parameters. • <i>class-index</i> —The class ID for the class to be modified. • max-buff-size —Maximum CM buffer size. • min-buff-size —Minimum CM buffer size. • tar-buff-size —Target CM buffer size.
Step 4	end Example: Router(config)# end	Exits global configuration mode and returns to privileged EXEC mode.

Verifying Upstream Buffer Control Parameters

To verify the current values of the upstream buffer control parameters for a particular service class, use the **show cable service-class verbose** command in privilege EXEC mode. The following is a sample output of the **show cable service-class verbose** command for a service class with class-index 10:

```
Router# show cable service-class 10 verbose

Index:                10
Name:                 REG-US
Direction:           Upstream
Traffic Priority:     0
Maximum Sustained Rate: 0 bits/sec
Max Burst:           3044 bytes
Minimum Reserved Rate: 0 bits/sec
Minimum Packet Size  0 bytes
Peak Rate            0 bits/sec
Admitted QoS Timeout 200 seconds
Active QoS Timeout   0 seconds
Maximum Concatenated Burst: 1522 bytes
Scheduling Type:     Best Effort
Request/Transmission Policy: 0x0
IP ToS Overwrite [AND-mask,OR-mask]: 0xFF,0x0
Parameter Presence Bitfield: {0x8, 0x0}
!Upstream Buffer Control Parameters
Minimum Buffer Size:  1000 bytes
Target Buffer Size:  1500 bytes
```

Maximum Buffer Size: 2000 bytes

To verify if the upstream buffer control parameters have been correctly propagated to the CM, use the **show cable modem service-flow verbose** command, in privilege EXEC mode. The following is a sample output of the **show cable modem service-flow verbose** command for a particular CM:

```
Router# show cable modem 0022.cea5.02ba service-flow verbose

SUMMARY:
MAC Address      IP Address      Host          MAC          Prim Num Primary
DS
0022.cea5.02ba 5.60.122.132   C7/1/0/UB    w-online     10   0   Downstrea  RfId
                               In7/1/0:0    840
Sfid Dir Curr Sid Sched Prio MaxSusRate MaxBrst MinRsvRate Throughp
      State Type
29   US act 10   BE    0    100000    3044    0          0
30   DS act  N/A  BE    0    200000    3044    0          0

CfrId SFID      CM Mac Address Direction State Priority Matches
Reg Info Requests Tx      : 2
Reg Info TLV len          : 152

UPSTREAM SERVICE FLOW DETAIL:
Sfid                : 29
Mac Address         : 0022.cea5.02ba
Type                : Primary
Direction           : Upstream
Current State       : Active
Current QoS Indexes [Prov, Adm, Act] : [3, 4, 4]
Active Time         : 03:45
Required Attributes : 0x00000000
Forbidden Attributes : 0x00000000
Aggregate Attributes : 0x00000000
Sid                 : 10
Service Class Name  : REG-US
Traffic Priority     : 0
Maximum Sustained rate : 100000 bits/sec
Maximum Burst       : 3044 bytes
Minimum Reserved Rate : 0 bits/sec
Minimum Packet Size : 0 bytes

!Upstream Buffer Control Parameters
Minimum Buffer Size : 1000 bytes
Target Buffer Size  : 1500 bytes
Maximum Buffer Size : 2000 bytes
Peak Rate          : 0 bits/sec
Admitted QoS Timeout : 200 seconds
Active QoS Timeout : 0 seconds
Packets            : 3
Bytes              : 1020
Rate Limit Delayed Grants : 0
Rate Limit Dropped Grants : 0
Current Throughput : 0 bits/sec, 0 packets/sec
Application Priority : 0
US Bonded          : YES
Upstream Bonding Group : UBG-1
Transmit Channel Set : 0x6
Sid Cluster        : SC-0, Sid [ 10 10 ]
Segments Valid     : 3
Segments Discarded : 0
Segments Lost      : 0
SID Cluster Switching Information
Total Bytes Requested : 0
Total Time          : 0
Outstanding Bytes    : 0
Max Requests        : 1
Classifiers: NONE
Sid                 : 10
Request polls issued : 0
BWReqs {Cont,Pigg,RPoll,Other} : 4, 0, 0, 0
No grant buf BW request drops : 0, where:0
Rate exceeded BW request drops : 0
```

```

Grants issued : 4
Packets received : 4
Bytes received : 1488
rate-adapt : Disabled
rate-adapt {rcvd, Consec-PB} : 0, 0
Fragment reassembly completed : 0
Fragment reassembly incomplete : 0
Concatenated packets received : 0
Queue-indicator bit statistics : 0 set, 0 granted
Good Codewords rx : 8
Corrected Codewords rx : 0
Uncorrectable Codewords rx : 0
Concatenated headers received : 0
Fragmentation headers received : 0
Fragmentation headers discarded : 0
ARP Requests Received : 2

```

Additional References

MIBs

MIB	MIBs Link
DOCS-IF3-MIB	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

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>	http://www.cisco.com/support

Feature Information for Configuring Upstream Cable Interface Features 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://tools.cisco.com/ITDIT/CFN/>. An account on <http://www.cisco.com/> is not required.



Note

The below table 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 3: Feature Information for Configuring Upstream Cable Interface Features on the Cisco CMTS Routers

Feature Name	Releases	Feature Information
Configuring Upstream Cable Interface Features on the Cisco CMTS Routers	12.2(33)SCA	This feature was introduced on the 12.2(33)SC release train.
Configuring Upstream Cable Interface Features on the Cisco CMTS Routers	12.2(33)SCD5	The Upstream Minimum Reserved Traffic Rate Plus Excess Traffic Rate feature was introduced.
Upstream Buffer Control for Maximum Queue Depth	12.2(33)SCF2	This feature enables the Cisco CMTS to control the size of the upstream service-flow queue (or buffer) on a CM. The following commands were modified: <ul style="list-style-type: none"> • cable service class • show cable modem service-flow • show cable service-class
Copy and Paste Support for TDMA to A-TDMA Upgrade	12.2(33)SCG2	This feature automatically sets the DOCSIS mode to A-TDMA-only (DOCSIS 2.0) mode. The following command was modified: <ul style="list-style-type: none"> • cable upstream channel-width, cable upstream docsis-mode

Feature Name	Releases	Feature Information
Upstream Drop Classifier (UDC)	12.2(33)SCG5	<p>This feature enables the upstream drop classifier feature on the cable modems on a specific interface.</p> <p>The following commands were introduced or modified:</p> <p>cable udc-capability, show cable modem verbose</p>