Cable Modem Upstream RF Adaptation

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The Cable Modem Upstream RF Adaptation feature uses per cable modem physical layer statistics to identify and automatically move cable modems to another logical upstream channel within the same physical port. This is to prevent unnecessary channel-wide parameter changes, which reduces throughput, disrupts traffic flow for all modems, and makes some modems to go offline in extreme cases.

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 Cable Modem Upstream RF Adaptation

- Multiple logical channels must be configured.

- Logical channels should be enabled per upstream.

- Logical channel 0 is the preferred primary logical channel, and logical channel 1 is the preferred secondary logical channel. This increases interoperability with other CMTS applications such as load balancing and upstream channel bonding.

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

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

Table 1: Cable Hardware Compatibility Matrix for Cable Modem Upstream RF Adaptation

Platform	Processor Engine	Cable Interface Cards
Cisco uBR10012 Universal Broadband Router	Cisco IOS Release 12.2(33)SCF and later releases • PRE2 • PRE4 Cisco IOS Release 12.2(33)SCH and later releases • PRE5	Cisco IOS Release 12.2(33)SCF and later releases • Cisco uBR10-MC5X20H • Cisco UBR-MC20X20V[1] • Cisco uBR-MC3GX60V[2]
Cisco uBR7246VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCF and later releases • NPE-G2	Cisco IOS Release 12.2(33)SCF and later releases • Cisco uBR-MC88V[3]
Cisco uBR7225VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCF and later releases • NPE-G2	Cisco IOS Release 12.2(33)SCF and later releases • Cisco uBR-MC88V

[1] 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.

[2] The Cisco uBR-MC3GX60V line card is not compatible with PRE2.

[3] 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.

Restrictions for Cable Modem Upstream RF Adaptation

- Logical channel 1 cannot be part of an upstream bonding group.

- The Upstream Channel Bonding (USCB) feature coexists with the Cable Modem Upstream RF Adaptation feature; however, cable modems in the multiple transmits channel (MTC) mode are excluded.

- Cable modems that use the multiple receive channel (MRC) mode without MTC may participate in cable modem upstream RF adaptation because these cable modems can be moved using the dynamic channel change (DCC) method.

- Advanced spectrum management is not supported in multiple logical channel configurations.

- Dynamic channel-width configurations are not supported.

- A pair of logical upstream channels configured with a mix of DOCSIS modes (i.e. SCDMA on logical channel 0 and ATDMA on logical channel 1) is supported, however, the CMTS will request that the cable modem uses the initialization technique 1 for the DCC.

Information About Cable Modem Upstream RF Adaptation

The Cable Modem Upstream RF Adaptation feature moves a single cable modem or a group of cable modems to a more robust channel when a user-defined set of per cable modem PHY statistics does not meet a set of user-specified thresholds. Similarly, it releases a single cable modem or a group of cable modems from the secondary channel when the user-defined set of per cable modem PHY statistics exceeds a set of user-specified thresholds.

The following relocation methods are used while moving a cable modem to and from the secondary logical upstream channel:

- UCC for DOCSIS 1.0 cable modems.

- DCC initialization technique 2 for DOCSIS 1.1 and newer cable modems. Initialization technique 2 performs periodic ranging. The cable modem is kept online and allowed to start on the new channel with periodic ranging.

- DCC initialization technique 1 for any configuration where at least one logical channel uses the SCDMA DOCSIS mode. The initialization technique 1 broadcasts the initial ranging. The cable modem is kept online and re-registration is avoided, but this technique requires completion of initial ranging.

The following PHY statistics are used while moving a cable modem to and from the secondary logical upstream channel:

- Ranging burst Modulation Error Ratio (MER)

- Data burst MER for JIB3-based line cards

- Correctable and uncorrectable Forward Error Correction (FEC)

The cable modems to be relocated from the primary logical upstream channel to the secondary channel are marked as downgrade candidates. Similarly, the cable modems to be relocated from the secondary logical upstream channel to the primary channel are marked as upgrade candidates. Tracking individual cable modem

statistics prevents a cable modem or a small group of cable modems from lowering the available bandwidth for the larger population of cable modems.

Following are the step-by-step timer-based events that occur during RF adaptation:

1 General timer event—The PHY statistics of the cable modems on the RF adapt-enabled channel are checked. The cable modems that fail or exceed the set threshold are flagged as either downgrade or upgrade candidates.

2 Candidate timer event—The PHY statistics of the cable modems that are flagged as downgrade or upgrade candidates are checked again to verify if the impairment still exists.

3 Relocation timer event—The cable modems that continue to fail or exceed the threshold are relocated.

After a line card switchover, the cable modems remain online on either the primary or secondary logical upstream channel depending on the state of the cable modem prior to the switchover. The upgrade and downgrade candidate cable modems, and the cable modem movement history from primary to secondary logical upstream channel and vice versa are not retained after a line card switchover. The Cable Modem Upstream RF Adaptation feature is not affected by a PRE switchover and the candidate information and history is retained during a PRE switchover.

The Cable Modem Upstream RF Adaptation feature is disabled by default. For information about how to enable this feature, see How to Configure Cable Modem Upstream RF Adaptation, on page 5.

Related CMTS Software Features

The Cable Modem Upstream RF Adaptation feature via spectrum management integrates with and leverages from the following CMTS software features:

Multiple Logical Channels

The ability to use a multiple logical channel configuration to relocate cable modems with PHY impairments is a key capability of the Cable Modem Upstream RF Adaptation feature. In a cable modem upstream RF adaptation configuration, the logical channels are used as:

- Logical Channel 0—This is the default primary logical channel that cable modems registers on. The primary logical channel should be configured with performance options such as 64 QAM modulation profile irrespective of the index value.

- Logical Channel 1—This is the default secondary logical channel. The secondary logical channel should be configured with robust options, such as QPSK-based modulation profile irrespective of the index value.

You can configure the primary and secondary logical 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** *port logical-channel-index*, where *port* denotes the physical port number, and *logical-channel-index* denotes the logical channel index number.

The following logical channel-level configuration options have an impact on the Cable Modem Upstream RF Adaptation feature:

- DOCSIS mode. In the case of SCDMA, change in parameters like codes-per-minislot may also impact robustness.

- Modulation profile.

- Equalization-coefficient (that is pre-equalization).

For more details on the Multiple Logical Channel feature, see S-CDMA and Logical Channel Support on the Cisco CMTS Routers .

CMTS PHY Measurement

The CMTS PHY measurements collected on a per cable modem basis is used during RF adaptation. For a cable modem upstream RF adaptation, the MER (also referred to as Signal-to-noise Ratio [SNR]), and FEC (both correctable and uncorrectable) measurements provide an accurate indication about the effect of any PHY impairments on a single cable modem.

The Cable Modem Upstream RF Adaptation feature uses the following thresholds:

- rf-adapt—Sets the RF adaptation percentage threshold.

- snr-profiles—Specifies the MER (SNR) threshold in dB.

- hysteresis—Specifies the hysteresis value.

- corr-fec—Specifies the allowable number of correctable FEC errors for the upstream.

- uncorr-fec—Specifies the allowable number of uncorrectable FEC errors for the upstream.

Note   All the above thresholds are configured at the physical port level to ensure that the same collection of thresholds is used for both upgrade and downgrade.

How to Configure Cable Modem Upstream RF Adaptation

This section describes how to configure a physical upstream and its associated logical channels for cable modem upstream RF adaptation.

Before You Begin

Multiple logical channels must be configured.

Restriction   The cable modem upstream RF adaptation is not applicable for modems that are registered in MTC mode.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: Router> **enable**	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# **configure terminal**	Enters global configuration mode.
Step 3	**cable rf-adapt timer general** *time* **Example:** Router(config)# **cable rf-adapt timer general 1**	(Optional) Sets the timer for cable modem upstream RF adaptation. • **general** *time*—Specifies the period when the RF adaptation process examines the physical layer statistics of all modems on RF adaptation-enabled upstream channels. The valid range is from 1 to 300 seconds.
Step 4	**cable rf-adapt timer candidate** *time* **Example:** Router(config)# **cable rf-adapt timer candidate 2**	(Optional) Sets the timer for cable modem upstream RF adaptation. • **candidate** *time*—Specifies the period when the RF adaptation process examines the physical layer statistics of modems flagged as downgrade or upgrade candidates, or both. The valid range is from 1 to 300 seconds.
Step 5	**cable rf-adapt timer relocation** *time* **Example:** Router(config)# **cable rf-adapt timer relocation 300**	(Optional) Sets the timer for cable modem upstream RF adaptation. • **relocation** *time*—Specifies the period when the RF adaptation process performs a single relocation of a candidate modem from its current upstream channel to the appropriate destination. The valid range is from 1 to 300 seconds.

Step 6	**interface cable** {*slot*/*cable-interface-index* | *slot*/*subslot*/*cable-interface-index*}
	
	Example:
	Router(config)# **interface cable 8/0/0**
		Enters interface configuration mode.
		
		• *slot*—Slot where the line card resides.
		
		  ◦ Cisco uBR7225VXR router—The valid value is 1 or 2.
		
		  ◦ Cisco uBR7246VXR router—The valid range is from 3 to 6.
		
		  ◦ Cisco uBR10012 router—The valid range is from 5 to 8.
		
		• *subslot*—(Cisco uBR10012 only) Secondary slot number of the cable interface line card. The valid subslot is 0 or 1.
		
		• *cable-interface-index*—Downstream port of the Cisco uBR10-MC5X20 and Cisco uBR-MC88V line cards, or MAC domain index of the Cisco UBR-MC20X20V and Cisco uBR-MC3GX60V line cards.
		
		  ◦ Cisco uBR7225VXR and Cisco uBR7246VXR routers—The valid port value is 0 or 1.

	Command or Action	Purpose
		◦ Cisco uBR10012 router—The valid range for the Cisco UBR-MC20X20V and Cisco uBR-MC5X20 line cards is from 0 to 4. The valid range for the Cisco uBR-MC3GX60V line card is from 0 to 14.
Step 7	**cable upstream***port***max-logical-chans** *code* **Example:** Router(config-if)# **cable upstream 0 max-logical-chans 2**	Enables multiple logical channels on the physical upstream channel intended for RF adaptation. • *port* —Upstream port. The valid range is from 0 to 3. • *code* —Number of logical channels per port. The valid values are 1 and 2.
Step 8	**cable upstream** *port* **rf-adapt** **Example:** Router(config-if)# **cable upstream 0 rf-adapt**	Enables RF adaptation on the physical upstream channel. • *port*—Upstream port. The valid range is from 0 to 3.
Step 9	**cable upstream** *port* **threshold rf-adapt** *threshold1-in-percent* **Example:** Router(config-if)# **cable upstream 0 threshold rf-adapt 25**	(Optional) Sets the RF adaptation percentage threshold. • *port* —Upstream port. The valid range is from 0 to 3. • **rf-adapt**—Specifies the ratio of candidate cable modems to total number of upstream cable modems, which disables further RF adaptation. • *threshold1-in-percent*—RF adapt disable threshold in percentage. The valid range is from 1 to 50. **Note** You can bypass the RF adapt disable threshold by setting it to 0.
Step 10	**cable upstream***port***threshold****snr-profiles***snr-threshold1 snr-threshold2* **Example:** Router(config-if)# **cable upstream 0 threshold snr-profiles 25 0**	(Optional) Specifies the MER (SNR) threshold in dB. • *snr-threshold1*—MER (SNR) threshold for the primary modulation profile specified for the upstream. The valid range is from 5 to 35 dB, with a default value of 25 dB. **Note** You can bypass the primary MER (SNR) threshold (snr-threshold1-in-db) by setting it to 0. • *snr-threshold2*—MER (SNR) threshold for the secondary modulation profile specified for the upstream. The valid range is from 5 to 35 dB, with a default value of 25 dB. For the Cable Modem Upstream RF Adaptation feature, it is recommended to set this value to 0. **Note** *snr-threshold2* is ignored by the Cable Modem Upstream RF Adaptation feature.
Step 11	**cable upstream***port***threshold****hysteresis***hysteresis-value*	(Optional) Specifies the hysteresis value.

	Command or Action	Purpose
	Example: Router(config-if)# **cable upstream 0 threshold hysteresis 3**	• *hysteresis-value*—Hysteresis value. The valid range is from 0 to 10 dB, with a default value of 3 dB. **Note** You can bypass the hysteresis threshold by setting the value to 0.
Step 12	**cable upstream***port***threshold corr-fec***fec-corrected* **Example:** Router(config-if)# **cable upstream 0 threshold corr-fec 2**	(Optional) Specifies the allowable number of correctable FEC errors for the upstream. • *fec-corrected* —Allowable number of correctable FEC errors for the upstream, given as a percentage of total packets received on the upstream during the polling period. It is given as a percentage of total packets received on the upstream during the polling period. The valid range is from 1 to 30 percent, with a default value of 3 percent. **Note** You can bypass the corr-fec threshold by setting the value to 0.
Step 13	**cable upstream***port***threshold uncorr-fec***fec-uncorrected* **Example:** Router(config-if)# **cable upstream 0 threshold uncorr-fec 10**	(Optional) Specifies the allowable number of uncorrectable FEC errors for the upstream. • *fec-uncorrected* —Allowable number of uncorrectable FEC errors for the upstream, given as a percentage of total packets received on the upstream during the polling period. The valid range is from 1 to 30 percent of total packets, with a default of 1 percent. **Note** You can bypass the uncorr-fec threshold by setting the value to 0.
Step 14	**cable upstream** *port logical-channel-index* **rf-adapt** [**primary**	**secondary**] **Example:** Router(config-if)# **cable upstream 0 0 rf-adapt primary**	(Optional) Specifies the primary upstream logical channel and the secondary upstream logical channel. • *port* —Upstream port. The valid range is from 0 to 3. • *logical-channel-index* —Logical channel index. The valid values are 0 and 1. • **primary**—Sets the logical channel as primary for RF adaptation. By default, the logical channel 0 is primary. • **secondary**—Sets the logical channel as secondary for RF adaptation. By default, the logical channel 1 is secondary. **Note** When you set the primary channel, the secondary channel is automatically set.
Step 15	**no cable upstream** *portlogical-channel-index* **shutdown**	Performs a "no shutdown" on logical channel 1.

	Command or Action	Purpose
	Example: Router(config-if)# **no cable upstream 0 1 shutdown**	
Step 16	**end** **Example:** Router(config-if)# **end**	Exits the interface configuration mode and returns to privileged EXEC mode.

What to Do Next

If you want to customize multiple logical channels, see S-CDMA and Logical Channel Support on the Cisco CMTS Routers.

Troubleshooting Tips

Following are some scenarios that you may encounter while configuring or after configuring the Cable Modem Upstream RF Adaptation feature. Follow the recommended action to resolve these issue.

Cable Modem Does Not Downgrade to the Secondary Logical Channel

Problem A cable modem with PHY statistics less than the user-specified threshold is not downgraded to the secondary logical channel.

- **Possible Cause** The RF adaptation downgrade threshold has been met.

- **Possible Cause** The RF adaptation downgrade threshold is exceeded while the cable modem is still on the downgrade candidate list.

- **Possible Cause** The RF adaptation downgrade threshold is exceeded after a group of cable modems are moved to the secondary logical channel.

Solution Contact Cisco Technical Assistance Center (TAC).

Cable Modem Does Not Upgrade to the Primary Logical Channel

Problem A cable modem with PHY statistics greater than the user-specified threshold is not upgraded to the primary logical channel.

- **Possible Cause** The cable modem was upgraded or downgraded five times.

- **Possible Cause** The SNR has not improved beyond the threshold and the hysteresis value.

Solution You can delete the cable modem history from the CMTS database using the **clear cable modem delete** command.

Verifying Cable Modem Upstream RF Adaptation

Command	Purpose
show cable rf-adapt downgrade-candidates	To verify the downgrade candidate cable modems.
show cable rf-adapt upgrade-candidates	To verify the upgrade candidate cable modems.
show cable modem rf-adapt	To verify the RF adaptation history

Configuration Examples for Cable Modem Upstream RF Adaptation

This section provides configuration examples for the Cable Modem Upstream RF Adaptation feature:

Example: Configuring Cable Modem Upstream RF Adaptation on the Cisco uBR10012 Router

The following example shows how to configure the Cable Modem Upstream RF Adaptation feature on the Cisco uBR10012 router.

```
!
interface Cable8/0/0
 load-interval 30
 downstream Modular-Cable 1/1/0 rf-channel 0 upstream 0-3
 cable mtc-mode
 no cable packet-cache
 cable bundle 1
 cable upstream max-ports 4
 cable upstream bonding-group 700
  upstream 0
  upstream 1
  upstream 2
  upstream 3
  attributes A0000000
 cable upstream 0 connector 0
 cable upstream 0 frequency 13000000
 cable upstream 0 channel-width 6400000 6400000
 cable upstream 0 max-logical-chans 2
 cable upstream 0 threshold snr-profiles 20 0
 cable upstream 0 threshold corr-fec 0
 cable upstream 0 threshold uncorr-fec 0
 cable upstream 0 threshold rf-adapt 0
 cable upstream 0 rf-adapt
 cable upstream 0 0 docsis-mode scdma
 cable upstream 0 0 spreading-interval 16
 cable upstream 0 0 codes-per-minislot 16
```

```
cable upstream 0 0 active-codes 112
cable upstream 0 0 range-backoff 3 6
cable upstream 0 0 modulation-profile 321
cable upstream 0 0 attribute-mask 20000000
no cable upstream 0 0 shutdown
cable upstream 0 1 docsis-mode atdma
cable upstream 0 1 minislot-size 1
cable upstream 0 1 range-backoff 3 6
cable upstream 0 1 modulation-profile 223
cable upstream 0 1 attribute-mask 20000000
no cable upstream 0 1 shutdown
no cable upstream 0 shutdown
cable upstream 1 connector 1
cable upstream 1 frequency 20000000
cable upstream 1 channel-width 3200000 3200000
cable upstream 1 load-balance group 80
cable upstream 1 docsis-mode scdma
cable upstream 1 spreading-interval 16
cable upstream 1 codes-per-minislot 4
cable upstream 1 active-codes 112
cable upstream 1 range-backoff 3 6
cable upstream 1 modulation-profile 321
cable upstream 1 attribute-mask 20000000
no cable upstream 1 shutdown
cable upstream 2 connector 2
cable upstream 2 frequency 26400000
cable upstream 2 channel-width 3200000 3200000
cable upstream 2 power-level 1
cable upstream 2 load-balance group 80
cable upstream 2 docsis-mode scdma
cable upstream 2 spreading-interval 16
cable upstream 2 codes-per-minislot 4
cable upstream 2 active-codes 112
cable upstream 2 range-backoff 3 6
cable upstream 2 modulation-profile 321
cable upstream 2 attribute-mask 20000000
no cable upstream 2 shutdown
cable upstream 3 connector 3
cable upstream 3 frequency 32600000
cable upstream 3 channel-width 3200000 3200000
cable upstream 3 power-level 1
cable upstream 3 load-balance group 80
cable upstream 3 docsis-mode scdma
cable upstream 3 spreading-interval 16
cable upstream 3 codes-per-minislot 4
cable upstream 3 active-codes 112
cable upstream 3 range-backoff 3 6
cable upstream 3 modulation-profile 321
cable upstream 3 attribute-mask 20000000
no cable upstream 3 shutdown
cable sid-cluster-group num-of-cluster 2
cable sid-cluster-switching max-request 1
...
...
```

Example: Configuring Cable Modem Upstream RF Adaptation on the Cisco uBR7200 Router

The following example shows how to configure the Cable Modem Upstream RF Adaptation feature on the Cisco 7200 router.

```
!
interface Cable1/1
 load-interval 30
 downstream Integrated-Cable 1/1 rf-channel 0-3 upstream 0-3
 cable mtc-mode
 no cable packet-cache
```

```
cable bundle 2
cable upstream max-ports 4
cable upstream 0 connector 4
cable upstream 0 frequency 20000000
cable upstream 0 channel-width 6400000 6400000
cable upstream 0 max-logical-chans 2
cable upstream 0 threshold snr-profiles 26 0
cable upstream 0 threshold corr-fec 5
cable upstream 0 threshold uncorr-fec 2
cable upstream 0 threshold hysteresis 4
cable upstream 0 threshold rf-adapt 0
cable upstream 0 rf-adapt
cable upstream 0 0 docsis-mode atdma
cable upstream 0 0 minislot-size 4
cable upstream 0 0 range-backoff 3 6
cable upstream 0 0 modulation-profile 221
cable upstream 0 0 attribute-mask 20000000
no cable upstream 0 0 shutdown
cable upstream 0 1 docsis-mode atdma
cable upstream 0 1 minislot-size 4
cable upstream 0 1 range-backoff 3 6
cable upstream 0 1 modulation-profile 222
cable upstream 0 1 attribute-mask 20000000
no cable upstream 0 1 shutdown
no cable upstream 0 shutdown
cable upstream 1 connector 5
cable upstream 1 frequency 26600000
cable upstream 1 channel-width 3200000 3200000
cable upstream 1 docsis-mode atdma
cable upsteram 1 minislot-size 4
cable upstream 1 range-backoff 3 6
cable upstream 1 modulation-profile 321
cable upstream 1 attribute-mask 20000000
no cable upstream 1 shutdown
cable upstream 2 connector 6
cable upstream 2 frequency 30000000
cable upstream 2 channel-width 3200000 3200000
cable upstream 2 docsis-mode atdma
cable upsteram 2 minislot-size 4
cable upstream 2 range-backoff 3 6
cable upstream 2 modulation-profile 221
cable upstream 2 attribute-mask 20000000
no cable upstream 2 shutdown
cable upstream 3 connector 7
cable upstream 3 frequency 33500000
cable upstream 3 channel-width 3200000 3200000
cable upstream 3 docsis-mode atdma
cable upsteram 3 minislot-size 4
cable upstream 3 range-backoff 3 6
cable upstream 3 modulation-profile 221
cable upstream 3 attribute-mask 20000000
no cable upstream 3 shutdown
end
```

Example: Non-Default Timer Configuration

The following example shows how to configure non-default timer configuration.

```
Router# show running-config | in timer
cable rf-adapt timer general 60
cable rf-adapt timer candidate 15
cable rf-adapt timer relocation 5
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
CMTS cable commands	http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.htmlCisco IOS CMTS Cable Command Reference

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Cable Modem Upstream RF Adaptation

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 2: Feature Information for Cable Modem Upstream RF Adaptation

Feature Name	Releases	Feature Information
Cable Modem Upstream RF Adaptation	12.2(33)SCF	

Feature Name	Releases	Feature Information
		The Cable Modem Upstream RF Adaptation feature uses the per cable modem physical layer statistics to identify and automatically move cable modems to another logical upstream channel within the same physical port to prevent unnecessary channel-wide parameter changes.
		In Cisco IOS Release 12.2(33)SCF, this feature was introduced on the Cisco uBR10012 router and Cisco uBR7200 series routers.
		The following sections provide information about this feature:
		• Information About Cable Modem Upstream RF Adaptation, on page 3
		• How to Configure Cable Modem Upstream RF Adaptation, on page 5
		• Verifying Cable Modem Upstream RF Adaptation, on page 10
		• Configuration Examples for Cable Modem Upstream RF Adaptation, on page 10
		The following commands were introduced or modified: **cable rf-adapt timer, cable upstream rf-adapt(logical channel), cable upstream rf-adapt, cable upstream threshold rf-adapt, show cable modem rf-adapt, show cable rf-adapt, cable upstream threshold hysteresis, cable upstream threshold, show cable modem, show cable modem access-group, show cable modem calls, show cable modem connectivity, show cable modem counters, show cable modem docsis version, show cable modem domain-name, show cable modem errors, show cable**

Feature Name	Releases	Feature Information
		modem flap, show cable modem ipv6, show cable modem mac, show cable modem maintenance, show cable modem offline, show cable modem phy, show cable modem primary channel, show cable modem registered, show cable modem rogue, show cable modem summary, show cable modem type, show cable modem unregistered, show cable modem vendor, show cable modem wideband.