



Configuring ADSL2/2+ Annex M and Routed Bridge Encapsulation over VC Bundles

This document describes the asymmetric digital subscriber line (ADSL) 2/2+ Annex M (product name: HWIC-1ADSL-M) feature in Cisco IOS Release 12.4(11)XJ. This feature provides enhanced functionality by increasing upstream data rates.

The Routed Bridge Encapsulation (RBE) over the Virtual Circuit (VC) Bundle feature is an existing feature, previously available on the Cisco IOS 12.4 (4)T release, that is now implemented on the Cisco 800 through 3800 platforms with the Cisco IOS 12.4(11)XJ release.

Two additional software features in this release are impulse noise protection (INP) and an enhancement to the DSL enable-training-log command. INP reduces the number of errors caused by impulse noise. No configuration is needed for the improved INP. The DSL enable-training-log command has been enhanced with an option to specify when to capture a log file. This allows the command to log the firmware debug messages.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the “[Feature Information for ADSL2/2+ Annex M and RBE over VC Bundles](#)” section on [page 23](#)”.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. An account on Cisco.com is not required.

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Restrictions for ADSL2/2+ Annex M and RBE Features

There are no known restrictions for implementing ADSL2/2+ Annex M or RBE.

When a permanent virtual circuit (PVC) bundle is configured (for RBE) based on a QoS group, PVC bundle member bumping and protection are not supported. For QoS-group-based PVC bundles, it is not required that each QoS group be assigned at least one bundle member.

Information About Using ADSL2/2+ Annex M , RBE, and INP Features

To configure ADSL2/2+ Annex M, you should understand the following concepts:

- ADSL
- RBE
- Impulse noise protection

ADSL

Unlike the symmetric high-data-rate digital subscriber line (SHDSL), which has the same maximum data transfer rates for both uploading and downloading data, the ADSL 2/2+ Annex M supports an upstream data rate of up to 3 Mbps and a downstream data rate of up to 24 Mbps. The increased Annex M (upstream) data rate is achieved by using some of the tones that were previously used in the downstream data rate in Annex A. As a result, downstream data rates are decreased in Annex M.

RBE

RBE over the VC bundle feature helps protect the router from some well-known problems involving permanent virtual circuits (PVCs), broadcast storms and some security issues. For more detailed information on RBE, see the following url:

http://www.cisco.com/en/US/products/ps6441/products_feature_guide09186a008055bc8e.html#wp1056973But.

Impulse Noise Protection

Impulse noise can be caused by various electronic devices, both inside and outside the network, and it can cause network errors. The ADSL standard for INP has several provisions to reduce the number of errors that are caused by impulse noise. The primary method of INP combines interleaving with forward error correction (FEC).

FEC adds extra bits to the data packet when it is sent. The receiving router uses an algorithm to check the incoming data for error bits. If the message has an error, FEC correction bits repair it. Interleaving then loads bits from each FEC block into rows and then sends them out by columns. This spreads an FEC error across multiple blocks, which usually makes the error correctable, since it affects just a small portion of the original blocks of data.

How to Configure ADSL2/2+ Annex M and RBE over VC Bundles

The following are configuration tasks typically done with ADSL2/2+ Annex M and RBE. This section contains the following tasks:

- [Configuring Annex M Operating Mode, page 3](#)
- [Configuring Multiple Options for DSL Operating Mode, page 4](#)
- [Configuring DSL Synchronization Mode Preference, page 5](#)
- [Configuring DSL Synchronization Interval, page 6](#)
- [Configuring the QoS Group-Based Method for Selecting of the PVC Bundle Members, page 8](#)
- [Configuring DSL Synchronization Interval, page 6](#)
- [Configuring when to Enable the Training Log, page 7](#)
- [Configuring RBE Using the QoS Selection Method, page 10](#)

Configuring Annex M Operating Mode

You need to configure Annex M as the DSL operating mode to be able to use the enhanced functionality of increased upstream data rates in the ADSL2/2+ lines. To configure Annex M operating mode, complete the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *interface number*
4. **dsl operating mode** *{adsl2 | adsl2+ [annex a | annex m]}*

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# conf t	Enters global configuration mode.
Step 3	interface atm <i>interface number</i> Example: Router(config) interface atm 0/1/0	Enters interface configuration mode.
Step 4	dsl operating-mode {adsl2 adsl2+ [annex a annex m]} Example: Router(config-if)# dsl operating-mode adsl2+ annex a or Router(config-if)# dsl operating-mode adsl2+ annex m	Sets Annex A or Annex M operating mode. If the annex mode is not specified, both Annex A and Annex M will be enabled. The final mode will be determined by negotiation with a digital subscriber line access multiplexer (DSLAM).

Configuring Multiple Options for DSL Operating Mode

To configure multiple options for DSL operating mode, use the **dsl operating-mode** command in the default auto mode with no options specified. If no options are specified, then all the supported modes are enabled.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm *interface number***
4. **dsl operating-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# conf t	Enters global configuration mode.
Step 3	interface atm <i>interface number</i> Example: Router(config)# interface 0/1/0	Enters interface configuration mode.
Step 4	dsl operating-mode Example: Router(config-if)# dsl operating mode	(Default auto mode) Selects the DSL operating mode that the customer premises equipment (CPE) can use while negotiating with the DSLAM. When this command is used, all of the modes will be used to negotiate synchronization with the DSLAM.

Configuring DSL Synchronization Mode Preference

To configure the preferred mode for digital subscriber line (DSL) synchronization, use the **dsl sync mode** command, beginning in interface configuration mode. The CPE tries to synchronize in ANSI and ITU modes and alternatively with the DSLAM. This command specifies which mode should be tried first. By default, ITU mode is tried first.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm *interface number***
4. **dsl sync mode**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	conf t Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface atm <i>interface number</i> Example: Router(config)# interface 0/1/0	Enters interface configuration mode.
Step 4	dsl sync mode Example: Router(config-if)# dsl sync mode ansi previous	Sets synchronization type preference for the CPE. The previous attribute tells the router to save the current trained mode and to try that mode first during the next synchronization

Configuring DSL Synchronization Interval

To configure the interval for DSL synchronization, use the **dsl sync interval** command, beginning in interface configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *interface number*
4. **dsl sync interval** *seconds*

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# conf t	Enters global configuration mode.
Step 3	interface atm <i>interface number</i> Example: Router(config)# interface 0/1/0	Enters interface configuration mode.
Step 4	dsl sync interval <i>seconds</i> Example: Router(config-if)# dsl sync interval 20	Sets the interval between ANSI and ITU synchronization. The default is 2 seconds.

Configuring when to Enable the Training Log

To configure the time when to capture a log file, enter the following command in interface configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *interface number*
4. **dsl enable-training-log** [*showtime* | *failure* | *ondemand*] [*delay* <*nseconds*>]

	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# conf t	Enters global configuration mode.

	Command or Action	Purpose
Step 3	interface atm <i>interface number</i>	Enters interface configuration mode.
	Example: Router(config)# 0/1/0	
Step 4	dsl enable-training-log [showtime failure ondemand] [delay <nseconds>]	(Optional—This command enables the training log to record the firmware debug messages.) The log can be retrieved from the ADSL chipset after the ADSL line goes into showtime mode, or after the ADSL comes out of showtime mode, or whenever the user enters the show dsl interface atm command. The delay option can be used to delay the retraining of the line after the log is retrieved from the chipset. Because only one log buffer is used to capture the log, the subsequent line state changes will overwrite the buffer. The delay option allows the user enough time to capture the log from the output of the show dsl interface atm command.
	Example: Router(config-if)# dsl enable-training-log delay 5	By default, the training log is disabled.

**Caution**

Enabling the training log takes 1 MB of memory. We recommend using the training log for debugging purposes only.

Configuring the QoS Group–Based Method for Selecting of the PVC Bundle Members

To configure PVC bundles with member selection based on quality of service (qos) group, enter the following commands, beginning in global configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *interfacenumber*
4. **Bundle** *bundle names*
5. **Selection-method qos group**
6. **pvc-bundle** *vpi/vci*
7. (Optional) **qos group** *group-numbers*

(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# config t	Enters global configuration mode.
Step 3	interface <i>interface number</i> Example: Router(config)#interface atm 0/1/0	Enters interface configuration mode.
Step 4	bundle <i>bundle name</i> Example: Router(config)#bundle cisco	Creates a bundle or modifies an existing bundle, and enters bundle configuration mode.
Step 5	selection-method <i>qos-group</i> Example: Router(config-if-atm-bundle)# selection-method qos group	Specifies QoS group as the method for selecting PVC bundle members.
Step 6	pvc-bundle <i>vpi/vci</i> Example: Router(config-if-atm-bundle)# pvc-bundle 1/32	Creates an ATM PVC and enters ATM VC bundle-member configuration mode.
Step 7	qos group <i>group-numbers</i> Example: Router(config-if-atm-member)# qos group 5	(Optional—This command applies to QoS selection method only) Configures which QoS groups will use RBE.

Configuring RBE Using the QoS Selection Method

The RBE PVC bundle–member selection is based on the QoS group.

When the PVC bundle is configured on the basis of a QoS group, the PVC bundle-member bumping and protections are not supported.

For the QoS group–based PVC bundles, it is not required that each QoS group be assigned at least one member.

To configure RBE using the QoS selection method, enter the following commands, beginning in global configuration mode.



Note

For more information about configuring ATM bundles, see the [Cisco IOS Quality of Service Solutions Configuration Guide](#).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *interface number*
4. **interface** *sub-interface number*
5. **bundle** *bundle name*
6. **selection-method** *qos group*
7. **pvc-bundle** *vpi/vci*
8. **qos group** *group numbers*
9. **inarp-vc**

	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# conf t	Enters global configuration mode.
Step 3	interface <i>interface number</i>	Enters interface configuration mode.
Step 4	interface <i>sub.interface number</i> selection-method <i>qos group</i> Example: Router(config-if-atm-member)# interface ATM 0/0/0.2	Enters subinterface configuration mode.

	Command or Action	Purpose
Step 5	bundle <i>bundle name</i> selection-method <i>qos group</i> Example: Router(config-subif)# bundle cisco	Creates a bundle or modifies an existing bundle and enters bundle configuration mode. The bundle name is the RBE PVC bundle member selection based on the QoS group.
Step 6	selection-method <i>qos group</i> Example: Router(config-if-atm-bundle)# selection-method qos group	Specifies the method for selection of PVC bundle member, based on the QoS group.
Step 7	pvc-bundle <i>vpi/vci</i> Example: Router(config-if-atm-bundle)# pvc-bundle 1/32	Creates an ATM PVC and enters the ATM PVC bundle member configuration mode.
Step 8	qos group <i>group-numbers</i> Example: Router(config-if-atm-member)# qos group 5	(Optional—applies to Qos selection method only). Configures which QoS groups will use RBE.
Step 9	inarp-vc Example: Router(config-if-atm-member)# inarp-vc	(Optional) Configures which Qos groups will be used by the PVC bundle member.

Configuration Examples

This section provides the following configuration examples:

- [ADSL2/2+ Annex M: Example, page 12](#)
- [PVC Bundle Member Selection Using QoS Group: Example, page 13](#)
- [RBE over PVC Bundle with QoS Group–Based PVC: Example, page 13](#)

ADSL2/2+ Annex M: Example

The following example shows how to set the CPE to negotiate ADSL2/2+ Annex M mode only with the DSLAM.



Note

Note that, with this configuration, the DSLAM needs to support ADSL2/2+ Annex M for the DSL line to enter showtime mode.

```
Router># conf t
<config-if># interface ATM 0/0/0
<config-if># no ip address
<config-if># load-interval 30
<config-if># no atm ilmi-keepalive
<config-if># dsl operating-mode adsl2+ annex M
<config-if># bridge-group 1
<config-if># pvc 0/35
<config-if-atm-vc># vbr-rt 120 120 1
<config-if-atm-vc># encapsulation aal5snap
<config-if-atm-vc>#!
<config-if-atm-vc># end
```



Note

The code following **<config-if># bridge-group 1** is optional.

ADSL Auto Operating Mode: Examples

The following example shows how to set the CPE and DSLAM to automatically negotiate the best mode.

```
Router# conf t
<config-if># interface ATM 0/0/0
<config-if># no ip address
<config-if># load-interval 30
<config-if># no atm ilmi-keepalive
<config-if># dsl operating-mode auto
<config-if># bridge-group 1
<config-if># pvc 0/35
<config-if-atm-vc># vbr-rt 120 120 1
<config-if-atm-vc># encapsulation aal5snap
<config-if>#!
<config-if># end
```

The following example shows how to configure the CPE to include ANSI and ADSL2/2+ Annex A and Annex M modes only while negotiating synchronization with the DSLAM, and how to configure the CPE to use ITU synchronization first with a synchronization interval of 10 seconds.

```
Router# conf t
<config-if># interface ATM 0/0/0
<config-if># interface ATM 0/0/0
<config-if># no ip address
<config-if># load-interval 30
<config-if># no atm ilmi-keepalive
<config-if># dsl operating-mode auto ansi adsl2+
<config-if># dsl sync mode itu previous
<config-if># dsl sync interval 10
```

```
<config-if># bridge-group 1
<config-if># pvc 0/35
<config-if-atm-vc># vbr-rt 120 120 1
<config-if-atm-vc># encapsulation aal5snap
<config-if-atm-vc># !
<config-if-atm-vc># end
```

PVC Bundle Member Selection Using QoS Group: Example

The following example shows how to configure the QoS group-based method for selection of ATM PVC bundle members.

```
Router# conf t
<config-if># interface ATM 0/0/0
<config-if># bundle b2
<config-if-atm-vc># selection-method qos-group
<config-if-atm-vc># pvc-bundle 10/100
<config-if-atm-vc># qos-group 0-10
<config-if-atm-vc># pvc-bundle 10/101
<config-if-atm-vc># qos 20-30
<config-if-atm-vc># pvc-bundle 10/102
<config-if-atm-vc># qos-group other
<config-if-atm-vc># end
```

RBE over PVC Bundle with QoS Group-Based PVC: Example

The following example shows how to configure the QoS group-based method for selecting PVC bundle members on an RBE over an ATM interface.

```
Router# conf t
<config-if># interface ATM 0/0/0
<config-if># interface ATM 0/0/0.2 [point-to-point]
<config-if># atm route-bridged ip
<config-if># bundle b2
<config-if-atm-vc># selection-method qos group
<config-if-atm-vc># pvc-bundle 10/100
<config-if-atm-vc># qos group 0-10
<config-if-atm-vc># pvc-bundle 10/101
<config-if-atm-vc># qos group 20-30
<config-if-atm-vc># pvc bundle 10/102
<config-if-atm-vc># qos group other
<config-if-atm-vc># end
```

Additional References

The following sections provide references related to the ADSL2/2+ Annex M and RBE over VC bundles features.

Related Documents

Related Topic	Document Title
ADSL command reference	<i>Cisco IOS Broadband Access Aggregation and DSL Command Reference</i>
ADSL configuration information	<i>Cisco IOS Broadband Access Aggregation and DSL Configuration Guide</i>
Cisco 800 hardware information	<i>Cisco 1800 Hardware Installation Guide</i>
HWIC-1ADSL-M hardware information	<i>Cisco Network Modules Hardware Installation Guide</i>
Routed Bridge Encapsulation (RBE) – (more configuration examples)	<i>Routed Bridge Encapsulation with ATM Virtual Circuit Bundles</i>

Standards

Related Topic	Document Title
Annex M	ADSL2/2+ Annex M is a variant of ADSL2/2+ Annex A (ADSL over POTS) that increases the number of upstream tones to allow a higher upstream bandwidth than is allowed by Annex A. Annex M refers to the Annex M sections of ITU G.992.3 and G.992.5 standards.

MIBs

Related Topic	Document Title
No new or modified RFCs are supported by this feature, and support for existing RFC's has not been modified by this feature.	—

Command Reference

This section documents only new and modified commands used by the ADSL 2/2+ Annex M feature.

New Commands

- **dsl sync interval**
- **dsl sync mode**

Modified Commands

- **dsl operating mode**
- **dsl enable-training-log**
- **qos group**

dsl enable-training-log

The **dsl enable-training-log** command is an optional command that enables the training log to record the firmware debug messages. This log can be retrieved from the asynchronous digital subscriber line (ADSL) chipset after the ADSL line goes into showtime or comes out of showtime, or whenever the user enters the **show dsl interface atm** command.

To enable the training log, enter the following command in interface configuration mode:

```
dsl enable-training-log {delay [nseconds] | failure | ondemand | showtime}
```



Caution

Enabling the training log takes 1 MB of memory. We recommend using the training log for debugging purposes only.

Syntax Description

{delay [nseconds] }	Delays the retraining of the line after the log is retrieved from the chipset. Because only one log buffer is used to capture the log, subsequent line state changes will overwrite the buffer. The delay option allows enough time to capture the log from the output of the show dsl interface atm command.
showtime	The training log is retrieved from the chipset after the ADSL line goes into showtime.
failure	The training log is retrieved from the chipset after the line comes out of showtime or when the line fails to synchronize with the Digital Subscriber Line Access Multiplexer (DSLAM).
ondemand	The training log is retrieved from the chipset when the show dsl atm command is executed.

Command Default

By default, the training log is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(11)XJ	This command modification was integrated into the Cisco IOS Release 12.4(11)XJ.

Examples

The following example shows: To enable the training log, enter the following command in interface configuration mode:

```
dsl enable-training-log showtime
```


Related Commands

Command	Description
show dsl int atm	displays the DSL line status and training log buffer.

dsl operating-mode

To configure the (DSL) operating mode, use the **dsl operating-mode** command in interface configuration mode on Annex A and Annex M interfaces.

dsl operating-mode {adsl2 [annex a | annex m] | adsl2+ [annex a | annex m] | ansi-dmt | auto | itu-dmt}

The router continues switching between modes, in sequence, until the router reaches the state showtime (which signifies that the connection attempt was successful) and connects using one of the modes. This switching process is designed specifically for expediting DSL performance.

Syntax Description		
adsl2		Configures operation in ADSL2 operating mode - ITU G.992.3 Annex A, Annex L, and Annex M. If an Annex operating mode is not chosen, Annex A, Annex L, and Annex M will all be enabled. The final mode will be decided by negotiation with the dsl access multiplexer (DSLAM).
adsl2+		Configures operation in ADSL2+ mode - ITU G.992.5 Annex A and AnnexM. If an Annex A operating mode isn't chosen, both Annex and Annex M will be enabled. The final mode will be decided by negotiation with DSLAM.
annex a, m		If the annex option is not specified, both Annex A and Annex M will be enabled. The final mode will be decided by negotiation with the Digital Synchronous Line Access Multiplexer (DSLAM).
ansi-dmt		Configures a router to operate in ANSI full-rate mode—ANSI T1.413.
auto		Default setting. Configures the router so that the DSLAM automatically picks the DSL operating mode, in the sequence described in the "Usage Guidelines" section. All supported modes are enabled.
itu-dmt		Configures operation in ITU G.992.1 Annex A full-rate mode.

Command Default	The default is auto mode.
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Command Modes	Interface configuration
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Command History	Release	Modification
	12.2(4)YA	This command was introduced.
	12.2(15)T	This command was implemented on the Cisco 820 series and the Cisco SOHO 70, 76, 77, and 77H platforms.
	12.4(11)XJ	This command modification was integrated into the Cisco IOS Release 12.4(11)XJ.

Usage Guidelines

In the default auto mode, a router first tries to connect using the configured ITU operating mode(s). If the connection fails, the router tries with ANSI/ETSI mode for the allowed number of seconds (2 seconds by default). This time can be modified with the **dsl sync interval** command. If this command fails, the router tries ITU mode again for the allotted number of seconds (2 seconds by default). The router can be forced to try connecting with ANSI mode first by using the **dsl sync mode ansi** command. If this also fails, the router tries ITU mode again for 3 seconds (or the interval specified by *dsl sync interval*). If even that fails, the router repeats the cycle mode, including any modes other than *ansi* mentioned above.

If the router is forced to connect in a mode other than auto, you must use DSL operating-mode with the attribute auto to put the router back to the default auto mode.

The router continues switching between modes, in sequence as described, until the router reaches the showtime state (which signifies that the connection attempt is successful) and connects, using one of the modes. This switching process is designed specifically for expediting DSL performance.

Examples

The following example shows how to configure Annex M operating mode, using the **dsl operating-mode** command and beginning in interface configuration mode:

```
Router(config-if)# dsl operating-mode adsl2+ annex m
```

dsl sync interval

To set the interval of time between ANSI synchronization and ITU synchronization, use the **dsl sync interval** command in interface configuration mode.

dsl sync interval *seconds*

Syntax Description

<i>seconds</i>	Number of seconds between ITU and ANSI synchronization. This number must be within the range from 2 to 360 seconds.
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Command Default

By default, the DSL synchronization interval is 2 seconds.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(11)XJ	This is a new command implemented on the Cisco IOS Release 12.4(11)XJ.

Examples

The following example sets the interval between ANSI and ITU synchronization. The default is 2 seconds.

```
Router(config-if)# dsl sync interval 20
```

Related Commands

Command	Description
dsl sync mode	Sets a preference for DSL synchronization mode

dsl sync mode

To set a preference for Digital Subscriber Line (DSL) synchronization mode, use the **dsl sync mode** command in interface configuration mode.

dsl sync mode [ansi | itu] [previous]

Syntax Description		
ansi		Sets a preference for ANSI over ITU.
itu		Sets a preference for ITU over ANSI.
previous		Tells the router to save the current trained mode and to try that mode during the next synchronization.

Command Default This command is disabled by default.

Command Modes Interface configuration

Command History	Release	Modification
	12.4(11)XJ	This is a new command implemented on the Cisco IOS Release 12.4(11)XJ.

Examples The following example shows the DSL synchronization mode set to ANSI:

```
Router(config-is-atm-bundle)# dsl sync mode ansi
```

Related Commands	Command	Description
	dsl sync interval	Sets the interval of time between ANSI synchronization and ITU synchronization.

qos-group

To associate a quality of service (QoS) group with a private virtual circuit (PVC) bundle member, use the **qos-group** command in PVC bundle member configuration mode. To remove a QoS group from a PVC bundle member, use the **no** form of this command.

qos-group *group number*

no qos-group *group number*

Syntax Description	<i>group number <0-99></i> Associates a QoS group with a PVC bundle member. You can associate one QoS group with a PVC bundle member. You can associate a range or set of ranges of QoS groups with a PVC bundle member. When a range of QoS groups is associated with a PVC bundle, only the starting and ending QoS group numbers need to be listed, separated by a hyphen. For example, 1-5. When multiple noncontiguous QoS groups or noncontiguous ranges of QoS groups are associated with a PVC bundle, separate the groups. For example: 1, 3, 8-10, 12-14. When a QoS group is associated with a bundle member, use a number from 0 to 99. When a QoS group is not associated with a PVC bundle, use numbers 100 and greater. <i>other</i> All nonconfigured QoS groups.
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Command Default	By default, QoS groups are not associated with PVC bundle members.
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Command Modes	PVC bundle-member configuration
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Command History	<table><tr><th>Release</th><th>Modification</th></tr><tr><td>12.4(11)XJ</td><td>This is a new command implemented on the Cisco IOS Release 12.4(11)XJ.</td></tr></table>	Release	Modification	12.4(11)XJ	This is a new command implemented on the Cisco IOS Release 12.4(11)XJ.
Release	Modification				
12.4(11)XJ	This is a new command implemented on the Cisco IOS Release 12.4(11)XJ.				

Examples	The following example shows the configuration of which QoS group will use (RBE): <pre>Router(config-if-atm-member)# qos group 5</pre>
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Feature Information for ADSL2/2+ Annex M and RBE over VC Bundles

Table 1 lists the release history for this feature.

Feature Name	Releases	Feature Information
ADSL2/2+ Annex M	12.4(11)XJ	ADSL2/2+ Annex M supports an upstream data rate of up to 3 Mbps and a downstream data rate of up to 24 Mbps. This functionality was added to Cisco 877 router, Cisco 1801 router and the one-port ADSL HWIC. It is supported on Cisco 870 series routers, Cisco 1800 series routers, and Cisco 2800 series routers.
RBE	12.4(4)T 12.4(11)XJ	Routed Bridge Encapsulation (RBE) over PVC bundle functionality was added to Cisco 870 series routers, Cisco 1800 series routers, and Cisco 2800 series routers. RBE over VC bundle functionality was implemented on Cisco 3800 series routers for the first time.
INP	12.4(11)XJ	Impulse noise protection (IMP) has been added to this release on Cisco 870 series routers, Cisco 1800 series routers, and Cisco 2800 series routers.

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