



# DOCSIS 3.0 Downstream Bonding for Bronze Certification

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The DOCSIS 3.0 Downstream Bonding for Bronze Certification feature helps cable operators offer new, more bandwidth-intensive services by adding one or more additional downstream quadrature amplitude modulation (QAM) channels to the standard broadband DOCSIS system.

## 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 see a list of the releases in which each feature is supported, see the [“Feature Information for DOCSIS 3.0 Downstream Bonding for Bronze Certification”](#) section on page 20.

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

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## Prerequisites for DOCSIS 3.0 Downstream Bonding for Bronze Certification

Table 1 shows the hardware compatibility prerequisites for the DOCSIS 3.0 Downstream Bonding for the Bronze Certification feature.



### Note

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

**Table 1** Cable Hardware Compatibility Matrix for Downstream Bonding

CMTS Platform	Processor Engine	Cable Interface Cards
Cisco uBR10012 Universal Broadband Router	<b>Cisco IOS Release 12.2(33)SCA and later</b> <ul style="list-style-type: none"> <li>• PRE2</li> </ul> <b>Cisco IOS Release 12.2(33)SCB and later</b> <ul style="list-style-type: none"> <li>• PRE4</li> </ul>	<b>Cisco IOS Release 12.2(33)SCB and later</b> <ul style="list-style-type: none"> <li>• Cisco uBR10-MC5X20U/H</li> </ul> <b>Cisco IOS Release 12.2(33)SCC and later</b> <ul style="list-style-type: none"> <li>• Cisco UBR-MC20X20V</li> </ul> <b>Cisco IOS Release 12.2(33)SCE and later</b> <ul style="list-style-type: none"> <li>• Cisco uBR-MC3GX60V<sup>1</sup></li> </ul>
Cisco uBR7246VXR Universal Broadband Router	<b>Cisco IOS Release 12.2(33)SCA and later</b> <ul style="list-style-type: none"> <li>• NPE-G1</li> <li>• NPE-G2</li> </ul>	<b>Cisco IOS Release 12.2(33)SCA and later</b> <ul style="list-style-type: none"> <li>• Cisco uBR-MC28U/X</li> </ul> <b>Cisco IOS Release 12.2(33)SCD and later</b> <ul style="list-style-type: none"> <li>• Cisco uBR-MC88V<sup>2</sup></li> </ul>
Cisco uBR7225VXR Universal Broadband Router	<b>Cisco IOS Release 12.2(33)SCA and later</b> <ul style="list-style-type: none"> <li>• NPE-G1</li> </ul> <b>Cisco IOS Release 12.2(33)SCB and later</b> <ul style="list-style-type: none"> <li>• NPE-G2</li> </ul>	<b>Cisco IOS Release 12.2(33)SCA and later</b> <ul style="list-style-type: none"> <li>• Cisco uBR-E-28U</li> <li>• Cisco uBR-E-16U</li> <li>• Cisco uBR-MC28U/X</li> </ul> <b>Cisco IOS Release 12.2(33)SCD and later</b> <ul style="list-style-type: none"> <li>• Cisco uBR-MC88V</li> </ul>

1. Cisco uBR3GX60V cable interface line card is not compatible with PRE2. You must use PRE4 with the Cisco uBR3GX60V cable interface line card.
2. 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 DOCSIS 3.0 Downstream Bonding for Bronze Certification

- Although verbose receive channel profile (RCP) reporting can be enabled on a given cable interface, this does not eliminate the need to define a receive channel configuration (RCC) template to support a non-standard RCP ID.
- An RCC template configuration cannot be modified or removed if it is associated to any MAC domain. The operator must remove the association first to make modifications to an existing RCC template.
- The CMTS does not create a new RCP or modify an existing RCP based on the verbose RCP report from a cable modem at run time. The operator should explicitly add an RCC template and the RCP ID association per RCP requirements.

## Information About DOCSIS 3.0 Downstream Bonding for Bronze Certification

The DOCSIS 3.0 Downstream Bonding for Bronze Certification enables high-speed broadband access and helps cable operators offer more bandwidth-intensive services by adding one or more additional downstream quadrature amplitude modulation (QAM) channels to the standard broadband DOCSIS system. This new set of downstream channels is grouped into one larger channel, known as a bonded channel.

Channel bonding combines several RF channels into one virtual channel. Data rates in this virtual channel range from hundreds of megabits to potentially gigabits per second, creating more available bandwidth in the network.

## Receive Channel Profile

An RCP is an encoding that represents the receive channels and receive modules of a cable modem. A cable modem communicates to the CMTS one or more RCP encodings within its registration request using either verbose description, which contains complete subtype encoding defined in DOCSIS 3.0, or simple description, which only contains RCP identifiers. The cable modem reporting method is controlled by the CMTS using a MAC Domain Descriptor (MDD).

## Receive Channel Configuration

A cable modem reports its ability to receive multiple channels with one or more RCP encodings in a REG-REQ or REG-REQ-MP message. Each receive channel profile describes a logical representation of the cable modem's downstream physical layer in terms of receive channels (RCs) and receive modules (RMs). The CMTS initially configures the cable modem's receive channels and receive modules with an RCC encoding in the registration response.

Beginning Cisco IOS Release 12.2(33)SCB, this feature supports any arbitrary RCP ID configuration and receive channel configuration on a Cisco uBR10012 universal broadband router and Cisco IOS Release 12.2(33)SCD provides this support on the Cisco uBR7225VXR and Cisco uBR7246VXR routers.

## RCC Template

You can configure one or more RCC templates for an RCP. An RCC template configures the physical layer components described by an RCP, including receive modules and receive channels to specific downstream frequencies. The template also specifies the interconnections among receive modules, or between a receive module and a receive channel. An RCC template can be associated only to the cable interface (MAC domain).

## Channel Assignment

The CMTS assigns a receive channel configuration encoding to a DOCSIS 3.0-certified cable modem operating in a Multiple Receive Channel (MRC) mode during cable modem registration. Prior to Cisco IOS Release 12.2(33)SCB, the channel assignment was based on a random selection from eligible bonding groups.

With the implementation of this feature, the DOCSIS 3.0-certified cable modem reports its receiving capabilities and characteristics using the receive channel profile type, length, value (TLV) list in the registration request message. Based on this report, the CMTS assigns an RCC encoding that is compatible with the reported RCP. Cable modems operating in an MRC mode are assigned an RCC encoding that is derived from an RCC template, which is associated with an RCP. An RCC encoding can also be derived from a wideband interface configuration if an RCC template is not configured and associated to the MAC domain of a particular cable modem.

## Downstream Traffic Forwarding

DOCSIS 3.0 introduces the concept of assigning service flows of cable modems, which are operating in an MRC mode, to downstream (DS) channels or bonding groups. Forwarding interfaces assigned to service flows (SFs) can be either DS channel interfaces (cable, integrated or modular cable interfaces) or bonding groups (wideband interfaces). These forwarding interfaces will override the default CMTS assignment of a service flow to a wideband interface.

**Note**

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Valid interfaces that are available for SF assignment must be a subset of the cable modem's assigned RCC encoding.

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## How to Configure an RCC Encoding

The following tasks describe how to configure a receive channel configuration encoding for a receive channel profile:

- [Configuring an RCC Template, page 5](#)
- [Configuring an RCC Encoding, page 5](#)
- [Assigning an RCC Template to a Cable Interface, page 8](#)
- [Verifying the RCC Configuration, page 9](#)
- [Verifying the MD-DS-SG Configuration, page 9](#)

## Configuring an RCC Template

You must configure an RCC template with a unique RCP ID for a particular CMTS. A valid RCC template consists of a configured RCP ID, RMs, and RCs.

### Prerequisites

To configure an RCC template, the verbose encoding of the corresponding RCP ID must be available.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable rcc-template** *index*

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>cable rcc-template</b> <i>index</i>  <b>Example:</b> Router(config)# cable rcc-template 1	Defines an RCC template. <ul style="list-style-type: none"> <li>• <i>index</i>—Specifies an RCC template ID in the range 1 to 255.</li> </ul>

## Configuring an RCC Encoding

You can configure an RCC encoding after defining an RCC template. The CMTS derives an RCC or RCCs from the RCC template for each MAC Domain Downstream Service Group (MD-DS-SG). Each RCC encoding contains all operational DS channels with their channel parameters, including the frequency match RC attribute specified in the RCC template. An RCC template specifies the intended receive channel assignment in the available DS spectrum.

The following information is required for RCC configuration:

- The RCC templates associated to the MAC domain
- DS channel physical parameters including frequency and connected-receive-module index
- DS channel primary capable indicator
- DS channel membership to the MD-DS-SG
- Cable modem membership to the MD-DS-SG

**Note**

If an RCC template is removed from a MAC domain through configuration, the CMTS removes all of the RCC encodings derived from the RCC template, and all cable modems assigned to the RCC encodings are marked offline.

## Prerequisites

At least one RC must be configured as a primary RC.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable rcc-template** *index*
4. **rcp-id** *rcp-id*
5. **receive-module** *index* **first-channel-center-frequency** *Hz* [**connected-receive-module** *index*]
6. **receive-channel** *index* **center-frequency** *Hz* **connected-receive-module** *index* [**primary**]

## DETAILED STEPS

<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>cable rcc-template</b> <i>index</i>  <b>Example:</b> Router(config)# cable rcc-template 1	Defines the RCC template. <ul style="list-style-type: none"> <li>• <i>index</i>—Specifies an RCC template ID in the range 1 to 255.</li> </ul>
<b>Step 4</b>	<b>rcp-id</b> <i>rcp-id</i>  <b>Example:</b> Router(config-rcc-template)# rcp-id 00 10 00 00 03	<ul style="list-style-type: none"> <li>• <i>rcp-id</i>—Specifies an RCP ID for the RCC template. The valid range is 00 00 00 00 00 to FF FF FF FF. By default the RCP ID is set to 00 00 00 00 00.</li> </ul>

<p><b>Step 5</b></p>	<pre>receive-module <i>index</i> first-channel-center-frequency <i>Hz</i> [connected-receive-module <i>index</i>]  <b>Example:</b> Router(config-rcc-template)# <b>receive-module 1</b> <b>first-channel-center-frequency 55500000</b> <b>connected-receive-module 1</b></pre>	<p>Specifies a receive module configuration for the selected RCP.</p> <ul style="list-style-type: none"> <li>• <i>index</i>—Specifies the index value for the receive module. The valid range is 1 to 10.</li> <li>• <b>first-channel-center-frequency</b>—Specifies the center frequency of the first channel of the receive module channel block. The first channel center frequency assignment defines a frequency within the minimum and maximum range of center frequencies configured for the RM.</li> <li>• <i>Hz</i>—Specifies the center frequency value in Hz. The valid range is from 55000000 to 1050000000.</li> <li>• <b>connected-receive-module</b>—(Optional) Specifies a nested receive module in the RCC template. Generally, only one receive module is configured for an RCC template.</li> <li>• <i>index</i>—(Optional) Specifies the index value for the connected receive module. The valid range is from 1 to 10.</li> </ul>
<p><b>Step 6</b></p>	<pre>receive-channel <i>index</i> <b>center-frequency</b> <i>Hz</i> connected-receive-module <i>index</i> [<b>primary</b>]  <b>Example:</b> Router(config-rcc-template)# <b>receive-channel 1</b> <b>center-frequency 555000000</b> <b>connected-receive-module 1 primary</b></pre>	<p>Specifies a receive channel configuration for the selected RCP.</p> <ul style="list-style-type: none"> <li>• <i>index</i>—Specifies the index value for the receive channel. The valid range is from 1 to 10.</li> <li>• <b>center-frequency</b>—Specifies the center frequency for the receive channel.</li> <li>• <i>Hz</i>—Specifies the center frequency value in Hz. The valid range is from 55000000 to 1050000000.</li> <li>• <b>connected-receive-module</b>—Specifies a nested receive module in the RCC template. Generally, only one receive module is configured for an RCC template.</li> <li>• <i>index</i>—Specifies the index value for the connected receive module. The valid range is from 1 to 10.</li> <li>• <b>Primary</b>—(Optional) Indicates that it is a primary channel and an RCC can be derived from this channel. At least one receive-channel must be configured as <b>primary</b>.</li> </ul>

## What to Do Next

After defining an RCC template, you must assign the template to a cable interface. See [Assigning an RCC Template to a Cable Interface, page 8](#).

## Assigning an RCC Template to a Cable Interface

This section describes how to assign an RCC template to a cable interface.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface cable** {*slot/port* | *slot/subslot/port*}
4. **cable rcc-template** *index*

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>interface cable</b> { <i>slot/port</i>   <i>slot/subslot/port</i> }  <b>Example:</b> Router(config)# interface cable7/0/0	Specifies the cable interface line card on a Cisco CMTS router: <ul style="list-style-type: none"> <li>• <i>slot</i>—Chassis slot number of the cable interface line card. Cisco uBR7246VXR router: The valid range is from 3 to 6. Cisco uBR7225VXR router: The valid range is from 1 to 2. Cisco uBR10012 router: The valid range is from 5 to 8.</li> <li>• <i>subslot</i>—(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1.</li> <li>• <i>port</i>—Downstream port number. Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid port value is 0 or 1. Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface).</li> </ul>
Step 4	<b>cable rcc-template</b> <i>index</i>  <b>Example:</b> Router(config-if)# cable rcc-template 1	Assigns the RCC template to the specified cable interface. <ul style="list-style-type: none"> <li>• <i>index</i>—Specifies the template you want to assign to the cable interface. The valid range is from 1 to 255.</li> </ul>



## Verifying the RCC Configuration

To verify the runtime RCCs on a cable interface, use the **show cable mac-domain rcc** command as shown in the following example:

### Cisco uBR10012 Router

```
Router# show cable mac-domain c8/0/0 rcc
```

RCC-ID	RCP	RCs	MD-DS-SG	CMs	WB/RCC-TMPL
1	00 00 00 00 00	2	0	0	WB (101)
2	00 10 00 00 03	3	2	0	RCC-TMPL (1)

### Cisco uBR7200 Series Routers

```
Router# show cable mac-domain cable 5/0 rcc
```

RCC-ID	RCP	RCs	MD-DS-SG	CMs	WB/RCC-TMPL
1	00 00 00 00 00	3	0	3	WB (25)

[Table 2](#) shows descriptions for the fields displayed by this command.

**Table 2** *show cable mac-domain rcc Field Descriptions*

Field	Description
RCC-ID	RCC index per MAC domain.
RCP	The receive channel profile associated with the RCC object.
RCs	Total number of DS channels.
MD-DS-SG	Indicates the MAC domain DS service group for which the RCC is configured.
CM	Total number of cable modems associated with the RCC object.
WB/RCC-TMPL	Indicates the wideband interface or the RCC template.



#### Note

A zero (0) value in the RCP or MD-DS-SG field indicates that the RCC encoding is configured directly through a wideband interface configuration and not through any RCC templates.

## Verifying the MD-DS-SG Configuration

To verify the MD-DS-SG on a cable interface, use the **show cable mac-domain downstream-service-group** command as shown in the following example:

```
Router# show cable mac-domain cable 5/0 downstream-service-group
```

Cable	MD-DS-SG	RF		
IF	Id	Resource	Chan	Primary Chan
C5/0	1	5/0	00-03	0

## How to Configure Attribute Masks

DOCSIS 3.0 introduces the concept of assigning service flows to channels or bonding groups based on binary attributes. The attribute masks configured on a cable, modular, integrated or wideband interface are called provisioned attribute masks.

The two types of attributes are as follows:

- Specification-defined attributes—Contain default values based on the characteristics of the channel or bonding group.
- Operator-defined attributes—Default to zero.

The operator can configure a provisioned attribute mask for each channel and provisioned bonding group to assign values to the operator-defined binary attributes. The operator can also assign new values to override the default values of the specification-defined attributes.

The operator can configure a required attribute mask and a forbidden attribute mask for a service flow in the cable modem configuration file. These required and forbidden attribute masks are optionally provided on the DOCSIS 3.0 service flows and are matched with the provisioned attribute masks of the interfaces.

Each service flow is optionally configured with the following TLV parameters:

- Service flow required attribute mask—To configure this, assign a service flow to a channel that has a 1-bit in all positions of its provisioned attribute mask corresponding to the 1-bit in the service flow required attribute mask.
- Service flow forbidden attribute mask—To configure this, assign a service flow to a channel that has a 0-bit in all positions of its provisioned attribute mask corresponding to the 1-bit in the service flow forbidden attribute mask.

Additionally, in a cable modem-initiated dynamic service request, the cable modem can include a required attribute mask and a forbidden attribute mask for a service flow. The CMTS assigns service flows to channels or bonding groups so that all required attributes are present and no forbidden attributes are present in the cable modem configuration file.

[Table 3](#) lists the supported binary attributes for channels and bonding groups.

**Table 3** Binary Attributes

Bit Position	Definition
Bit 0	Bonded—This bit is zero for all individual channel interfaces and one for all bonding groups.
Bit 1	Low latency—This bit is set when the interface can provide relatively low latency service. This bit is set to zero for all channels, and left up to the operator to define.
Bit 2	High availability—This bit is set to zero for all channels, and left up to the operator to define.
Bit 3:15	Reserved—Set to zero.
Bit 16:31	Operator defined—Set to zero by default.

You can configure provisioned attribute masks for cable, integrated cable, wideband cable, and modular cable interfaces.

- [Configuring Provisioned Attributes for a Cable Interface, page 11](#)
- [Configuring Provisioned Attributes for a Modular Cable Interface, page 12](#)
- [Configuring Provisioned Attributes for an Integrated Cable Interface, page 13](#)
- [Configuring Provisioned Attributes for a Wideband Cable Interface, page 14](#)

## Prerequisites

- To assign an interface to a wideband cable modem's service flow, the interface must be a subset of the cable modem's RCC.
- To assign a service flow to a modular shared port adapter (SPA) channel, the corresponding modular cable interface must be configured and operational.
- To assign a service flow to an integrated cable (IC) channel, the corresponding integrated cable interface must be configured and operational.

## Restrictions

- The dynamic bonding group is not supported.
- The service flow from a narrowband cable modem is always assigned to the primary interface of the cable modem. No attribute checking is performed in this case.

## Configuring Provisioned Attributes for a Cable Interface

The default provisioned attribute is zero for a cable interface.



### Note

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Provisioning the **cable downstream attribute-mask** command is not supported on the Cisco uBR7225VXR and Cisco uBR7246VXR routers.

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### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface cable** *slot/subslot/port*
4. **cable downstream attribute-mask** *mask*

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>interface cable</b> <i>slot/subslot/port</i>  <b>Example:</b> Router(config)# interface cable 7/0/0	Specifies the cable interface line card on a Cisco CMTS router: <ul style="list-style-type: none"> <li><i>slot</i>—Chassis slot number of the cable interface line card. Cisco uBR10012 router: The valid range is from 5 to 8.</li> <li><i>subslot</i>—(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1.</li> <li><i>port</i>—Downstream port number. Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface).</li> </ul>
Step 4	<b>cable downstream attribute-mask</b> <i>mask</i>  <b>Example:</b> Router(config-if)# cable downstream attribute-mask 800000ff	Specifies the mask for the interface.

## Configuring Provisioned Attributes for a Modular Cable Interface

This section describes how to configure the provisioned attributes for a modular cable interface on the Cisco uBR10012 universal broadband router. The default provisioned attribute is zero for a modular cable interface.

## SUMMARY STEPS

- enable**
- configure terminal**
- interface modular-cable** *slot/bay/port:nb-channel-number*
- cable attribute-mask** *mask*

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>interface modular-cable</b> <i>slot/bay/port:nb-channel-number</i>  <b>Example:</b> Router(config)# interface modular-cable 1/0/1:5	Specifies the modular cable interface and enters interface configuration mode. <ul style="list-style-type: none"> <li><i>slot</i>—The slot where a SIP resides. On the Cisco uBR10012 router, slots 1 and 3 can be used for SIPs.</li> <li><i>bay</i>—The bay in a SIP where a SPA is located. Valid values are 0 (upper bay) and 1 (lower bay).</li> <li><i>port</i>—Specifies the interface number on the SPA.</li> <li><i>nb-channel-number</i>—Specifies the narrowband channel number.</li> </ul>
Step 4	<b>cable attribute-mask</b> <i>mask</i>  <b>Example:</b> Router(config-if)# cable attribute-mask 800000ff	Specifies the mask for the modular-cable interface.

## Configuring Provisioned Attributes for an Integrated Cable Interface

The default provisioned attribute is zero for an integrated cable interface.

## SUMMARY STEPS

- enable**
- configure terminal**
- interface integrated-cable** {*slot/port* | *slot/subslot/port*};*rf-channel*
- cable attribute-mask** *mask*

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>enable</b></p> <p><b>Example:</b> Router&gt; enable</p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b> Router# configure terminal</p>	<p>Enters global configuration mode.</p>
Step 3	<p><b>interface integrated-cable</b> {slot/port   slot/subslot/port}:rf-channel</p> <p><b>Example:</b> Router(config)# interface integrated-cable 1/0:0</p>	<p>Specifies the cable interface line card on a Cisco CMTS router:</p> <ul style="list-style-type: none"> <li><i>slot</i>—Chassis slot number of the cable interface line card. Cisco uBR7246VXR router: The valid range is from 3 to 6. Cisco uBR7225VXR router: The valid range is from 1 to 2. Cisco uBR10012 router: The valid range is from 5 to 8.</li> <li><i>subslot</i>—(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1.</li> <li><i>port</i>—Downstream port number. Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid port value is 0 or 1. Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface).</li> <li><i>rf-channel</i>—RF channel number with a range of 0 to 3.</li> </ul>
Step 4	<p><b>cable attribute-mask</b> mask</p> <p><b>Example:</b> Router(config-if)# cable attribute-mask 800000ff</p>	<p>Specifies the mask for the interface.</p>

## Configuring Provisioned Attributes for a Wideband Cable Interface

The default provisioned attribute is 0x80000000 for a wideband cable interface, and the zero bit is automatically added to the wideband cable interface whenever an attribute is configured for that interface.

## SUMMARY STEPS

- enable
- configure terminal

3. **interface wideband-cable** {*slot/port* | *slot/subslot/port*}:*wideband-channel*
4. **cable downstream attribute-mask** *mask*

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>enable</b></p> <p><b>Example:</b> Router&gt; enable</p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b> Router# configure terminal</p>	<p>Enters global configuration mode.</p>
Step 3	<p><b>interface wideband-cable</b> {<i>slot/port</i>   <i>slot/subslot/port</i>}:<i>wideband-channel</i></p> <p><b>Example:</b> Router(config)# interface wideband-cable 1/0/1:4</p>	<p>Specifies the wideband cable interface and enters interface configuration mode:</p> <ul style="list-style-type: none"> <li>• <i>slot</i>—Chassis slot number of the cable interface line card or the SIP. Cisco uBR7246VXR router: The valid range is from 3 to 6. Cisco uBR7225VXR router: The valid range is from 1 to 2. Cisco uBR10012 router: The valid range is from 5 to 8 for the line cards and slots 1 and 3 can be used for SIPs.</li> <li>• <i>subslot</i>—(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1.</li> <li>• <i>port</i>—Downstream port number. Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid port value is 0 or 1. Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface).</li> <li>• <i>wideband-channel</i>—Specifies the wideband channel number. The valid range is 0 to 11. Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid range is from 0 to 5. Cisco uBR10012 router: The valid range is from 0 to 11.</li> </ul>
Step 4	<p><b>cable downstream attribute-mask</b> <i>mask</i></p> <p><b>Example:</b> Router(config-if)# cable downstream attribute-mask 800000ff</p>	<p>Specifies the mask for the interface.</p>

## Verifying the Attribute-Based Service Flow Assignments

To verify the attribute-based assignment of service flows on a cable interface, use the **show interface cable service-flow** or **show interface wideband-cable service-flow** command as shown in the following example:

```
Router# show interface cable 3/0 service-flow
```

Sfid	Sid	Mac Address	QoS	Param	Index	Type	Dir	Curr	Active	DS-ForwIf/
			Prov	Adm	Act			State	Time	US-BG/CH
17	4	001c.ea37.9aac	3	3	3	P	US	act	13h21m	CH 3
18	N/A	001c.ea37.9aac	4	4	4	P	DS	act	13h21m	Wi3/0:0
21	6	001c.ea37.9b5a	3	3	3	P	US	act	13h21m	CH 4
22	N/A	001c.ea37.9b5a	4	4	4	P	DS	act	13h21m	Wi3/0:0
23	7	0016.925e.654c	3	3	3	P	US	act	13h21m	CH 3
24	N/A	0016.925e.654c	4	4	4	P	DS	act	13h21m	In3/0:0

```
Router# show interface wideband-cable 5/1:0 service-flow
```

Sfid	Sid	Mac Address	QoS	Param	Index	Type	Dir	Curr	Active	DS-ForwIf/
			Prov	Adm	Act			State	Time	US-BG/CH
3	8193	ffff.ffff.ffff	3	3	3	S(s)	DS	act	2h06m	Wi5/1:0

Table 4 shows descriptions for the fields displayed by this command.

**Table 4** *show interface cable service-flow Field Descriptions*

Field	Description
Sfid	Identifies the service flow identification number. <b>Note</b> Primary service flow IDs are displayed even for offline cable modems because they are needed for modem re-registration.
Sid	Identifies the service identification number (upstream service flows only).
Mac Address	Identifies the MAC address for the cable modem.
QoS Parameter Index Prov	Identifies the QoS parameter index for the provisioned state of this flow.
QoS Parameter Index Adm	Identifies the QoS parameter index for the Admitted state of this flow.
QoS Parameter Index Act	Identifies the QoS parameter index for the Active state of this flow.
Type	Indicates if the service flow is the primary flow or a secondary service flow. Secondary service flows are identified by an "S" (created statically at the time of registration, using the DOCSIS configuration file) or "D" (created dynamically by the exchange of dynamic service messages between the cable modem and CMTS).
Dir	Indicates if this service flow is DS or US.
Curr State	Indicates the current run-time state of the service flow.
Active Time	Indicates the length of time this service flow has been active.
DS-ForwIf/US-BG/CH BG/DS	Indicates the bonding group ID or the downstream RFID of the forwarding interface assigned to the downstream service flow.



# Receive Channel Profile Verbose Reporting

A receive channel profile is an encoding that represents the receive channels and receive modules of a cable modem. A cable modem communicates to the CMTS one or more RCP encodings within its registration request using either verbose description, which contains complete subtype encodings defined in DOCSIS 3.0, or simple description, which only contains RCP identifiers.

## Enabling Verbose Reporting for Receive Channel Profiles

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface cable {slot/port | slot/subslot/port}`
4. `cable rcp-control verbose`

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code>  <b>Example:</b> Router> <code>enable</code>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<code>configure terminal</code>  <b>Example:</b> Router# <code>configure terminal</code>	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<p><b>interface cable</b> {<i>slot/port</i>   <i>slot/subslot/port</i>}</p> <p><b>Example:</b> Router(config)# interface cable7/0/0</p>	<p>Specifies the cable interface line card on a Cisco CMTS router:</p> <ul style="list-style-type: none"> <li><i>slot</i>—Chassis slot number of the cable interface line card. Cisco uBR7246VXR router: The valid range is from 3 to 6. Cisco uBR7225VXR router: The valid range is from 1 to 2. Cisco uBR10012 router: The valid range is from 5 to 8.</li> <li><i>subslot</i>—(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1.</li> <li><i>port</i>—Downstream port number. Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid port value is 0 or 1. Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface).</li> </ul>
Step 4	<p><b>cable rcp-control verbose</b></p> <p><b>Example:</b> Router(config-if)# cable rcp-control verbose</p>	<p>Enables RCP reporting with verbose description.</p>

## Configuration Example for an RCC Template

The following sample shows an RCC template configuration on a cable interface:

```

...
!
cable rcc-template 1
  rcp-id 00 10 00 00 03
  receive-module 1 first-center-frequency 555000000 connected-receive-module 1
  receive-channel 1 center-frequency 555000000 connected-receive-module 1 primary
  receive-channel 2 center-frequency 561000000 connected-receive-module 1
  receive-channel 3 center-frequency 567000000 connected-receive-module 1
!
...
!
interface Cable5/1
  downstream Integrated-Cable 5/1 rf-channel 0 upstream 0-3
  cable rcc-template 1
  cable rcp-control verbose
...

```

## Additional References

The following sections provide references related to the DOCSIS 3.0 Downstream Bonding for Bronze Certification feature.

### Related Documents

Related Topic	Document Title
Commands on the Cisco CMTS (universal broadband routers)	<i>Cisco IOS CMTS Cable Command Reference</i> <a href="http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html">http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html</a>
Cisco DOCSIS 3.0 Downstream Solution	<i>Cisco DOCSIS 3.0 Downstream Solution Design and Implementation Guide</i> <a href="http://www.cisco.com/en/US/docs/cable/cmts/wideband/solution/guide/release_2.0/ds_solu.html">http://www.cisco.com/en/US/docs/cable/cmts/wideband/solution/guide/release_2.0/ds_solu.html</a>
DOCSIS 3.0 Downstream Channel Bonding	<i>Cisco Cable Wideband Solution Design and Implementation Guide</i> <a href="http://www.cisco.com/en/US/docs/cable/cmts/wideband/solution/guide/release_1.0/wb_solu.html">http://www.cisco.com/en/US/docs/cable/cmts/wideband/solution/guide/release_1.0/wb_solu.html</a>

### Standards

Standard	Title
CM-SP-MULPIv3.0-I08-080522	MAC and Upper Layer Protocols Interface Specifications

### MIBs

MIB	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

## Technical Assistance

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

## Feature Information for DOCSIS 3.0 Downstream Bonding for Bronze Certification

Table 5 lists the features in this module and provides links to specific configuration information. Only features that were introduced or modified in Cisco IOS Release 12.2(33)SCB or a later release appear in the table.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

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



### Note

Table 5 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release. Unless noted otherwise, subsequent releases of that Cisco IOS software release also support that feature.

**Table 5**      **Feature Information for DOCSIS 3.0 Downstream Bonding for Bronze Certification**

Feature Name	Releases	Feature Information
DOCSIS 3.0 Downstream Bonding for Bronze Certification	12.2(33)SCB	<p>This feature was introduced to meet the Bronze requirements for the DOCSIS 3.0 downstream bonding. It also includes receive channel configuration for receive channel profiles.</p> <p>In Cisco IOS Release 12.2(33)SCB, this feature was introduced on the Cisco uBR10012 router.</p> <p>The following sections provide information about this feature:</p> <ul style="list-style-type: none"> <li>• <a href="#">How to Configure an RCC Encoding, page 4</a></li> <li>• <a href="#">How to Configure Attribute Masks, page 10</a></li> <li>• <a href="#">Receive Channel Profile Verbose Reporting, page 17</a></li> </ul> <p>The following commands were introduced or modified in this release:</p> <ul style="list-style-type: none"> <li>• <b>cable rcc-template</b></li> <li>• <b>cable rcp-control verbose</b></li> <li>• <b>rcp-id</b></li> <li>• <b>receive-module</b></li> <li>• <b>receive-channel</b></li> <li>• <b>show cable mac-domain rcc</b></li> <li>• <b>show interface cable service-flow</b></li> <li>• <b>show cable modem</b></li> </ul>
DOCSIS 3.0 Downstream Bonding for Bronze Certification	12.2(33)SCD	<p>In Cisco IOS Release 12.2(33)SCD, this feature was introduced on the Cisco uBR7225VXR and Cisco uBR7246VXR routers.</p> <p>The following commands were introduced or modified:</p> <ul style="list-style-type: none"> <li>• <b>interface cable</b></li> <li>• <b>show cable mac-domain rcc</b></li> <li>• <b>show cable mac-domain downstream-service-group</b></li> </ul>

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