
# Implementing and Configuring the Solution

This chapter provides implementation and configuration information for the Cisco DOCSIS 3.0 Downstream Solution, for Cisco IOS Release 12.3(23)BC and Cisco IOS Release 12.2(33)SCB (and later releases), and contains the following topics:



## Wideband CMTS Configuration

This section provides an overview of the wideband CMTS configuration tasks:



This section also lists documents where you can find the detailed information needed to configure the Cisco IOS Software for the Cisco uBR10012 router components, including the components needed for the Cisco DOCSIS 3.0 Downstream Solution.

### Configuring Base CMTS Components

The base CMTS is the Cisco uBR10012 router with the components needed for DOCSIS 1.x, DOCSIS 2.0 and DOCSIS 3.0 operations. Wideband cable components can be added to the Cisco uBR10012 base system so that it can be used as a wideband CMTS. For wideband cable operation, the configuration tasks for the base CMTS components are similar to the configuration tasks used for DOCSIS 1.x, DOCSIS 2.0 and DOCSIS 3.0 operations. The base CMTS can be used as a DOCSIS 1.x, DOCSIS 2.0 and DOCSIS 3.0 CMTS.

All wideband channels used on a fiber node and all associated primary downstream channels on Cisco uBR10-MC5X20 cable interface line cards must be configured to belong to the same virtual bundle interface. For detailed information on this configuration task, see the “Configuring a Virtual Bundle” section in the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide*.

Table 6-1 provides a list of the software configuration documents that are likely to be useful for configuring the Cisco DOCSIS 3.0 Downstream Solution, base CMTS components.

***Table 6-1 Base CMTS Components Configuration—Where to Find Information***

| Solution Component | Where to Find Information |
|---|---|
| Cisco uBR10012 router (general and feature-specific configuration) | Release Notes for Cisco uBR10012 Universal Broadband Router for Cisco IOS Release 12.3 BC (which includes information on Cisco IOS Release 12.3(21)BC)<br><br>Cisco uBR10012 Universal Broadband Router Software Configuration Guide<br><br>Cisco Cable Modem Termination System Feature Guide |
| PRE2, PRE4, and PRE5 | *Route Processor Redundancy Plus for the Cisco uBR10012 Universal Broadband Router*<br><br>*Cisco uBR10012 Universal Broadband Router Performance Routing Engine Module*<br><br>*Cisco Performance Routing Engine 5 Hardware Installation Guide* |
| Cisco uBR10-MC5X20,<br>Cisco UBR-MC20X20V, and<br>Cisco uBR-MC3GX60V line cards | *Configuring the Cisco uBR10-MC5X20U/H Broadband Processing Engine*<br><br>*Configuring the Cisco UBR-MC20X20V Cable Interface Line Card*<br><br>*Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card*<br><br>Chapter 3, "Configuring Cable Interface Features for the Cisco uBR10012 Router," in the *Cisco uBR10012 Universal Broadband Router Software Configuration Guide*<br><br>"Cable Interface Bundling and Virtual Interface Bundling for the Cisco CMTS" in the *Cisco Cable Modem Termination System Feature Guide*<br><br>"N+1 Redundancy for the Cisco Cable Modem Termination System" in the *Cisco Cable Modem Termination System Feature Guide* |
| Gigabit Ethernet SPA | *Cisco uBR10012 Universal Broadband Router SIP and SPA Hardware Installation Guide*<br><br>*Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide* |
| Half-Height Gigabit Ethernet (HHGE) network uplink line cards | Configuring the Half-Height Gigabit Ethernet Line Card for the Cisco uBR10012 Universal Broadband Router |

The technical documentation set for the Cisco uBR10012 router includes many documents not shown in Table 6-1 that are useful for configuring the CMTS. The Cisco uBR10012 documentation set can be accessed from this URL:

http://www.cisco.com/en/US/products/hw/cable/ps2209/tsd_products_support_series_home.html

# Configuring Wideband CMTS Components

The wideband CMTS components are added to the base CMTS components to make the CMTS wideband-capable. This section provides overview information on configuring the wideband CMTS components, which includes the components that are based on the integrated downstream RF channels, and the components based on the M-CMTS architecture.

- Configuring a Wideband Capable Line Card, page 6-71—This section is applicable to both DOCSIS 3.0 M-CMTS and DOCSIS3.0 I-CMTS downstream solution architecture.
- Configuring M-CMTS Components, page 6-73—This section is applicable only to DOCSIS 3.0 M-CMTS downstream solution architecture.

## Configuring a Wideband Capable Line Card

All Cisco wideband capable line cards follow a uniform procedure for enabling wideband services. The following sections describe the procedure to configure wideband services on the Wideband SPA, Cisco uBR-MC3GX60V, Cisco uBR-MC20X20 and Cisco uBR-MC8X8V cable interface line cards:

- Pre-Provisioning Configuration with the Card Command, page 6-71
- Configuring Controllers, page 6-71
- Configuring Primary-Capable Channel, page 6-72
- Configuring Modular-Cable or Integrated-Cable Interfaces, page 6-72
- Configuring Wideband Interfaces, page 6-72
- Configuring Fiber Nodes, page 6-73

### Pre-Provisioning Configuration with the Card Command

The line card can be preprovisioned with the **card** command, without the line card being present in the chassis. This allows you to configure your network topology for wideband deployment without the having the line card present. The configuration is applied to the line card when the online insertion and removal (OIR) of the card is performed.

**Note** The **card** command is not applicable to the Cisco uBR-MC8X8 cable interface line card. This line card exists on the Cisco uBR7200 router series platform, which does not support the **card** command.

For more information on the **card** command, see the *Cisco IOS CMTS Cable Command Reference* at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

### Configuring Controllers

All Cisco wideband-capable line cards have a configuration for channel parameters grouped into one or more controllers:

- Each wideband SPA has 1 controller with 24 channels.
- Each Cisco UBR-MC20X20V card has 5 controllers with 4 channels each.
- Each Cisco uBR-MC8X8 card has 2 controllers with 4 channels each.
- Each Cisco uBR-MC3GX60V card has 3 controllers with 24 channels each.

The following channel attributes are specified by the controller configuration:

- Frequency
- Annex—Annex A or Annex B
- Modulation—64 QAM or 256 QAM
- Interleaver

For the M-CMTS compliant line cards, apart from the channel attributes specified above, the DEPI channel attributes are also specified in the controller configuration.

For more information on the controller configuration, see the specific cable interface line card configuration guide.

### Configuring Primary-Capable Channel

The set of primary-capable channels must be identified and configured with the CGD configuration line (or lines), in the related MAC domains. This step must be performed irrespective of whether the wideband services are deployed or not, and the cable plant supports only DOCSIS2.0 cable modems. The configuration is applied within the context of the individual MAC domains supported on each line card. Table 6-2 lists the supported number of MAC domains for each cable interface line card.

*Table 6-2 Supported Number of MAC Domains for cable interface line cards*

| Cable Interface Line Card | Number of Supported MAC Domains |
|---|---|
| Cisco uBR-MC8X8 | 2 |
| Cisco UBR-MC20X20V | 5 |
| Cisco uBR-MC3GX60V | 15 |

The **interface cable** and **downstream** commands are used to configure the primary-capable channel. This configuration binds a particular downstream RF channels to the MAC domain and optionally binds specific upstream channels in the MAC domain to specific downstream RF channels. The downstream channel are primary-capable, providing DOCSIS SYNC, MAP, and UCD signaling. For more information on primary-capable downstream channels, see section "Primary-Capable Downstream Channels" section on page 5-51

For more information on the CGD command, see the *Cisco Command Reference Guide* at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

### Configuring Modular-Cable or Integrated-Cable Interfaces

Modular-cable interfaces and Integrated-cable interfaces must be configured to use at least 1 percent bandwidth of their underlying channel, to become protocol up and functional for use by the MAC domain. The interface will inherit the bundle ID from the parent MAC domain interface.

### Configuring Wideband Interfaces

Wideband interfaces are configured to match the types of modems used in the cable plant in terms of the number of receive RF channels on those modems.

To utilize all the three channels, a Scientific Atlanta DPC2505 cable modem requires 3-channel wideband interfaces. Similarly, a 4-channel Scientific Atlanta DPC3000 cable modem requires 4-channel wideband interfaces, and a Scientific Atlanta DPC3010 cable modem requires 8-channel wideband interfaces. However, an N-channel cable modem may generally use a wideband interface smaller than N if that is a plant requirement. For example, a Scientific Atlanta DPC3010 cable modem can utilize a 4-channel wideband interface, but its maximum downstream bandwidth is then limited to four channels, not eight.

Wideband interfaces can be configured to overlap the RF channels in order to maximize DS channel usage. For example, a fiber node may support a cable plant with three, four, and eight channel wideband modems. A specific RF channel, say RF channel 0, may be included in all three wideband interfaces.The Cisco CMTS spreads the load on the overlapped channels in the wideband interfaces depending on the per RF channel load.

### Configuring Fiber Nodes

The Cisco CMTS fiber node configuration provides the CMTS with topology information needed to generate the correct DOCSIS signaling and is mandatory for wideband operation. More specifically, a cable plant may have hundreds or thousands of fiber nodes serviced by multiple CMTSs. A specific Cisco CMTS may service up to 255 fiber nodes at one time. A specific fiber node is assigned to a geographic area, and the downstream channels (in CMTS controllers) and the upstream connector used on that fiber node are configured for service. The CMTS then generates the correct DOCSIS service group signaling in the MDD messages, for the cable modems to understand which channels are available for use. The cable modem in turn uses the MDD message content to pick a MAC domain service group as part of the modem registration.

For information on the preceding configuration tasks and for reference information on the Cisco IOS commands, see the following configuration guides:

- Wideband SIP, SIP-600, and Wideband SPA configuration, see the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide.*
- For Cisco UBR-MC20X20V configuration, see the *Configuring the Cisco UBR-MC20X20V Cable Interface Line Card Guide*
- For Cisco uBR-MC8X8 configuration, see the *Configuring the Cisco uBR-MC88V Cable Interface Line Card*
- For Cisco uBR-MC3GX60V configuration, see the *Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card*

## Configuring M-CMTS Components

Figure 5-1 on page 5-42 ispecifies the wideband components required in the M-CMTS deployments when the Cisco uBR-MC3GX60V line card is used. This section provides overview information on how to configure these wideband components in M-CMTS deployments:

- Configuring the DOCSIS Timing and Control Card, page 6-74
- Configuring the Edge QAM Device, page 6-74
- Configuring the Gigabit Ethernet Switch, page 6-76
- Configuring the DTI Server, page 6-76

### Configuring the DOCSIS Timing and Control Card

The DOCSIS Timing and Control Card (DTCC), which acts as the DTI client, provides the interface to the DTI server for the Cisco CMTS. By default, the DTCC runs in a standalone mode and does not synchronize its timing to the external DTI server. The DTCC must be configured to operate as a DTI client. For information on configuring the DTCC to operate as a DTI Client, see the *Cisco uBR10012 Universal Broadband Router DTCC* documentation.

### Configuring the Edge QAM Device

Edge QAM (EQAM) device configuration is device-specific and implementation-specific. The Cisco CMTS DOCSIS 3.0 Wideband Solution is compatible with the Cisco RF Gateway 1, Cisco RF Gateway 10 and Harmonic NSG 9000. For more information on how to configure EQAM, see the specific device documentation.

Regardless of the EQAM device or implementation, these items are used for Wideband configuration and must be configured on each EQAM device:

- For the edge QAM device:
  - IP address of the EQAM device Gigabit Ethernet interface (input port)
  - MAC address of the EQAM device Gigabit Ethernet interface (input port)
  - DEPI remote ID of the QAM output
- For each of the EQAM device QAM outputs that will be used for a DS channel:
  - Center frequency of the QAM output
  - Annex type, Annex A or Annex B
  - Modulation—64 QAM or 256 QAM
  - Interleaver—Interleaver settings can enhance downstream error correction capabilities

The IP address, MAC address, frequency, and DEPI ID configured on the edge QAM device are specified when configuring RF channels on the CMTS. Be certain to verify that the RF channel values set with the **rf-channel** (issued on the CMTS) command match the values configured on the edge QAM device.

**Note** If a Layer 2 Gigabit Ethernet switch is used to connect the Wideband SPA to the EQAM device, the MAC address specified in the **rf-channel** command is the MAC address of the Gigabit Ethernet interface of the switch.

**Note** The EQAM device may also require configuration to connect to a DTI server. For information on configuring the EQAM device, refer to the vendor EQAM device documentation.

For the Cisco IOS Release 12.2(33)SCE, the Cisco CMTS and Cisco RFGW 10 EQAM support a feature called Control Plane DEPI, which intelligently links the devices with two-way communication for the DEPI protocol. The protocol running on the Cisco CMTS side is capable of detecting EQAM control plane failure and activating redundancy functionality if configured. Moreover, the EQAM can be placed in learn mode, which allows it to learn the per-QAM configuration from the Cisco CMTS. This greatly decreases the chance of a misconfiguration between the Cisco CMTS and EQAM which might cause plant failure.

For information on the control plane DEPI feature, see the *M-CMTS DEPI Control Plane* Guide at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/m-cmts_depi_control_plane_ps2209_TSD_Products_Configuration_Guide_Chapter.html

An RF channel and EQAM configuration worksheet such as the one shown in Table 6-3 may be useful for coordinating Wideband RF channel and EQAM device configuration. A wideband controller for M-CMTS line cards supports either 18 or 24 RF channels depending on channels that are configured for Annex A or B. For more information, see the description of the **rf-channel** command in *Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card* or *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide*.

***Table 6-3 RF Channel and EQAM Configuration Worksheet***

| | EQAM Device | | QAM Output | | | |
|---|---|---|---|---|---|---|
| **Wideband RF Channel** | **GE Input IP Address** | **GE Input MAC Address** | **QAM Module** | **Frequency** | **Annex type** | **DEPI Remote ID** |
| 0 | | | | | | |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
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| 20 | | | | | | |
| 21 | | | | | | |
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## Configuring the Gigabit Ethernet Switch

A Gigabit Ethernet (GE) switch linking the Cisco Wideband line card and the edge QAM (EQAM) devices is optional but may enhance the wideband deployment in one or more of the following situations:

- When more than two EQAM devices are required for two or more Wideband controllers
- When VoD traffic and RF channels for wideband channels are mixed on the same EQAM device.
- When N+1 line card redundancy or line card port redundancy is configured. All the redundant ports may be connected to a switch which in turn is connected to the EQAM

**Note** Beginning with Cisco IOS Release 12.2(33)SCE1, the N+1 redundancy feature including DEPI redundancy is supported on the Cisco uBR-MC3GX60V cable interface line card. For more information on redundancy schemes and configurations, see *Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card* Guide.

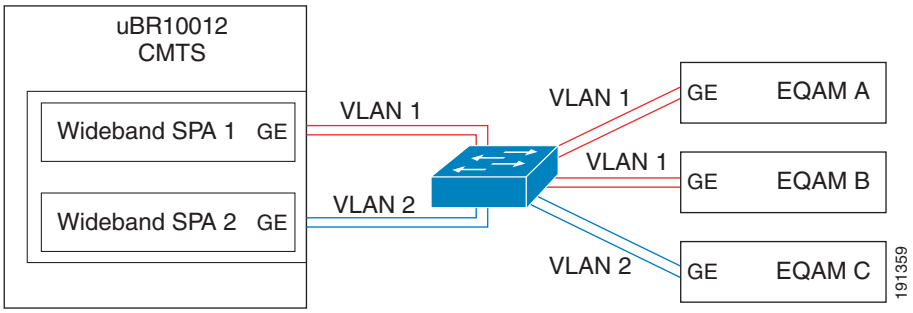
The configuration of the Gigabit Ethernet switch is device-specific and implementation-specific, but it is recommended that virtual LANs (VLANs) be used to create separate broadcast domains for the traffic of each wideband controller.

Figure 6-1 shows an example of VLAN usage in a Wideband SPA deployment. Wideband SPA 1 uses the QAM outputs on EQAM A and EQAM B. Wideband SPA 2 uses the QAM outputs on EQAM C.

- VLAN 1 carries traffic for Wideband SPA 1.
- VLAN 2 carries traffic for Wideband SPA 2.

Both the Wideband SPAs and EQAM devices have redundant Gigabit Ethernet links that are members of the appropriate VLANs.

***Figure 6-1 VLANs for Wideband Traffic***




## Configuring the DTI Server

The DTI server provides the DOCSIS time stamp and frequency to the DTI clients. The DTI server mode and Time Of Day (ToD) services are configurable. The ToD services can be configured to be the internal Real Time Clock (RTC) or it can updated from the Global Positioning System (GPS). For information on configuring the DTI server, see the vendor DTI server device documentation.

Use the **cable clock dti** command to configure the Cisco CMTS to be used along with a DTI server.

# Wideband Cable Modem Behavior

This section provides information on the wideband cable modems and their interactions with the CMTS. The following topics are discussed:



## Cisco DPC3010

The DPC3010 wideband modem is DOCSIS 3.0-compliant and is capable of bonding eight downstream channels and four upstream channels. The modem contains two tuners with four channels each. Each tuner has a frequency window of 32 MHz, therefore the channels received by each tuner must be consecutive. If the fifth channel's frequency is not immediately after the fourth channel's frequency, then a CMTS RCC template must be configured. For more information on RCC Template configuration, see *Cisco IOS CMTS Cable Software Configuration Guide, Release 12.2SC* Guide at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/VDOC_dbc_feature_support_TSD_Island_of_Content_Chapter.html

## Cisco DPC3000

The DPC3000 wideband modem is DOCSIS 3.0-compliant on its four downstream channels. It has one upstream channel. The tuner has a frequency window of 82 MHz, therefore the four channels do not need to be consecutive.

## Linksys WCM300-NA, WCM300-EURO, and WCM300-JP Modems

With the Linksys WCM300-NA, WCM300-EURO, and WCM300-JP wideband cable modems, the Cisco DOCSIS 3.0 Downstream Solution supports downstream data service to the cable modem on multiple bonded downstream channels. The Linksys WCM300 wideband cable modem supports the receiving of up to three wideband downstream channels:

- One primary-bonded channel
- Up to two secondary bonded channels

The primary-bonded channel is the wideband channel where the wideband cable modem receives all of its unicast traffic and some multicast traffic. The cable modem may identify the primary-bonded channel and any secondary-bonded channels to the CMTS at cable modem registration time. The DOCSIS configuration file may define the primary-bonded channel for the CMTS to assign to the cable modem.

Secondary-bonded channels are the wideband channels where the wideband cable modem receives additional multicast data streams. The DOCSIS configuration file defines the secondary-bonded channels for the modem to pass to the CMTS. Secondary-bonded channels are intended to receive multicast traffic such as broadcast video that is not available on the primary-bonded channel.

When the wideband cable modem registers with one primary and one or more secondary wideband channels, it accepts multicast packets from all associated wideband channels. The CMTS ensures that a multicast packet is not forwarded on the primary and secondary wideband channels simultaneously.

A primary-bonded channel cannot also be configured as a secondary-bonded channel, and vice versa. Secondary-bonded channels can be configured on the CMTS with the **cable bonding-group-secondary** command and with the DOCSIS configuration file using TLVs (primary bonding group ID and secondary-bonding group ID).

The Linksys WCM300 wideband cable modem implements a subset of the DOCSIS 3.0 protocol for channel bonding. Channel bonding is accomplished by the use of a per-packet sequence number to enable the wideband cable modem to deliver, in order, the packets from multiple RF channels that are destined to the CPE device. The Linksys WCM300 modem supports up to 16 independent resequencing engines for the receiving of bonded unicast traffic and bonded multicast traffic over its three bonded channels.

## DOCSIS Configuration File for Wideband on Linksys WCM300 Modems

The Linksys WCM300 wideband cable modem obtains a DOCSIS configuration file as it does in DOCSIS 3.0. For wideband operation, the file may contain three wideband-related TLV encodings:

- Primary bonding group ID
- Bonded channel enable
- Secondary bonding group ID

**Note** The preceding TLVs can be optionally specified in the DOCSIS configuration file. These TLVs *are not required* for the Linksys WCM300 modem to operate in wideband mode (w-online).

All three TLVs are encoded as vendor-specific options (type 43) to facilitate interoperability and reduce future compatibility issues.

### Primary Bonding Group ID

The primary bonding group ID option is encoded as subtype 14:

- Type.Subtype—43.14
- Length—2
- Value—primary bonding group ID

The primary bonding group ID option allows the provisioning system to force the wideband cable modem to use a particular primary bonded downstream channel. The modem can use a single primary bonded channel for unicast and multicast traffic. When the primary bonding group ID value is present, the CMTS assigns the wideband cable modem to the wideband-channel interface identified by the configured bonding group ID. If the CMTS is unable to assign the wideband cable modem to the wideband-channel interface specified by the configured bonding group ID, the CMTS causes the wideband cable modem to fail registration.

Only a single occurrence of the primary bonding channel ID option may be specified in the DOCSIS configuration file. The total of the RF channels in the primary and secondary bonded channels must comply with the 50-MHz capture-window limitation of the Linksys WCM300 modem.

**Note** Cisco IOS Release 12.2(33)SCE onwards, the wideband interface bonding group IDs on the CMTS are no longer configurable. The IDs are created by the CMTS and assigned at bootup. The **show controller <modular-cable | integrated-cable> wideband-channel** command can be used to display the IDs

**Note** When a wideband channel is specified as a primary bonded channel in the DOCSIS configuration file, the channel must be identically specified as a primary bonded channel in the CMTS active, running configuration file. The **cable bonding-group-secondary** command specifies if a bonding group is a secondary bonding group. For information on this command, see the *Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card* or the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide*.

### Bonded Channel Enable

The bonded channel enable option is encoded as subtype 15:

- Type.Subtype—43.15
- Length—1
- Value—0 equals Disable, and 1 equals Enable

The bonded channel enable option allows the provisioning system to require that a wideband cable modem operate in DOCSIS 2.0 mode. When the bonded channel enable option has a value of 0 (disable), the CMTS ensures that a wideband-channel interface is not assigned to the wideband cable modem at registration time.

Only a single occurrence of the bonded channel enable option may be specified in the DOCSIS configuration file.

### Secondary Bonding Group ID

The secondary bonding group ID option is encoded as subtype 16:

- Type.Subtype—43.16
- Length—2
- Value—secondary bonding group ID

The secondary bonding group ID option allows the provisioning system to specify secondary bonded downstream channels for the wideband cable modem to use. The modem can use one or two secondary bonded channels for multicast traffic. If the configured secondary bonding group ID is not valid, the CMTS causes the wideband cable modem to fail registration.

Up to two secondary bonding group IDs can be specified in the DOCSIS configuration file. The total of the RF channels in the primary and secondary bonded channels must comply with the 50-MHz capture-window limitation of the Linksys WCM300 modem.

**Note** When a wideband channel is specified as a secondary bonded channel in the DOCSIS configuration file, the channel must be identically specified as a secondary bonded channel in the CMTS active, running configuration file. The **cable bonding-group-secondary** command specifies if a bonding group is a secondary bonding group. For information on this command, see *Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card or* the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide*.

# Scientific Atlanta DPC2505 and EPC2505 Wideband Cable Modems

**Note** All interactions and behaviors described in this section for the Scientific Atlanta DPC2505 wideband cable modem are also applicable to the Scientific Atlanta EPC2505 wideband cable modem.

The Scientific Atlanta DPC2505 (EPC2505 for EuroDOCSIS) wideband cable modem makes use of the Broadcom Corporation BCM93381 cable modem chip. The BCM93381 chip provides three tuners, allowing the three downstream receivers to be independently tuned to any frequency. The M-CMTS and the Scientific Atlanta DPC2505 wideband cable modem use three downstream RF channels from the CMTS controller (one of which is the primary downstream channel) to form a wideband channel. The primary downstream channel is used for SYNCs, MAP, and other MAC management messages.

The Scientific Atlanta DPC2505 wideband cable modem uses a selected subset of the DOCSIS 3.0 protocol for channel bonding. Channel bonding is the transmission of a stream of packets across multiple RF channels with the use of sequence numbers to ensure the modem receiver delivers packets in the proper order to the CPE. The Scientific Atlanta DPC2505 wideband cable modem filters packets on a Destination Address and Security Association Identifier (SAID). The Scientific Atlanta DPC2505 modem supports up to 16 independent resequencing contexts.

The Scientific Atlanta DPC2505 wideband cable modem does not support multicast traffic on the wideband channel. Multicast service flows that the modem sees on the bonded downstream channel are discarded.

The configuration file used for the Scientific Atlanta DPC2505 wideband cable modem is identical to a DOCSIS 3.0 configuration file. DOCSIS 3.0 configuration file tools like the Cisco Broadband Configurator can be used to create configuration files for this modem.

# CMTS Interactions with Wideband Modems

For the wideband-capable cable modems, this section provides information on the following:


- Registration for Wideband Modems, page 6-80
- Automatic Adjustments During Registration, page 6-81
- Registration Load Balancing for Wideband Modems, page 6-81


## Registration for Wideband Modems

A wideband modem will scan downstream channel frequencies, stopping to analyze a channel if it has SYNC messages present, which is the first sign that the channel is primary-capable. Next the modem will analyze the channel for UCD messages, which describe upstream modulation details. The modem will then analyze for MDD messages, the contents of which will describe other channels available within the MAC domain service groups. A wideband modem will then send a B-INIT-RNG-REQ message in an upstream channel, notifying the CMTS of its presence. After the wideband cable modem completes the initialization process on the primary downstream channel, the CMTS uses the REG-RSP message to enable multiple downstream RF channel operations (wideband channel operation) and to assign channels to the cable modem.

Consistent with DOCSIS 3.0, the assignment of multiple channels takes place at two layers. The lower layer is that of physical receiver configuration, or the Receive Channel Set, of the cable modem. The CMTS uses a specific subset of DOCSIS 3.0 Receive Channel Configuration (RCC) encodings to inform the wideband cable modem what center frequencies to use for its primary downstream channel receiver and its two non-primary downstream channel receivers.

With a wideband cable modem as per DOCSIS 3.0, bonding and sequencing of traffic can take place across all channels of a Receive Channel Set of a cable modem, or across any subset of these channels. A second, higher layer of channel assignment deals with bonding and resequencing. This higher layer is handled by assignment of a Downstream Service Identifier (DSID) for each independent sequence number space. In the REG-RSP message, the CMTS uses a subset of DOCSIS 3.0 DSID encodings to inform the cable modem the DSID values to recognize, and the channels and resequencing timeouts that are associated with each DSID.

## Automatic Adjustments During Registration

On receiving the REG-RSP message, the wideband modem first checks for presence and correctness of the various encodings.

- If any encodings are incorrectly formatted or exceed the capabilities of modem, the wideband cable modem may detect this and immediately send a REG-ACK message with a confirmation code indicating failure. The confirmation code will be reject-bad-rcc(208) if the RCC encoding is bad, or reject-other(1) if some other problem is found.
- If encodings appear to be valid, the wideband cable modem attempts to tune its non-primary receivers to the non-primary downstream channels specified in the RCC. The RCC may specify zero, one, or two non-primary downstream channels. If the cable modem fails to tune to the designated non-primary downstream channels, it will send a REG-ACK message with confirmation code reject-bad-rcc(208).

In the case of wideband channels overlapping on some sets of QAM channels, the wideband modem rejects the registration with confirmation code of reject-bad-rcc(208), which implies that something is wrong— either an incorrect plant topology configuration or a bad tuner in the cable modem. The CMTS records this occurrence. When the same cable modem tries to register again, the CMTS chooses different wideband channels preferably residing on different sets of QAM channels.

The process continues until the wideband cable modem successfully registers on a wideband channel or all choices of wideband channels are exhausted. If all choices are exhausted, the modem operates as a narrowband modem on its next attempt to register.

A timeout value of 24 hours is defined for the CMTS to clear the bad QAM status recorded for each cable modem. Therefore, the wideband cable modem is allowed to retry the bad set of QAM channels in the future.

## Registration Load Balancing for Wideband Modems

If multiple wideband channels are available on the same fiber node, and the wideband cable modem comes online with one of the wideband channels, the CMTS has the choice of assigning it to a different wideband channel. In this case, a simple random load balancing algorithm distributes the cable modems on the fiber node across the multiple wideband channels.

If the CMTS has a choice between a wideband channel consisting of one RF channel and another channel consisting of two RF channels, the CMTS uses a weighted random load-balancing algorithm to determine the wideband channel that the wideband cable modem will use. The wideband channel with two RF channels is weighted so that it has two-thirds of a chance of being chosen while the wideband channel with one RF channel has one-third of a chance.

For more information on load balancing, see *Load Balancing and Dynamic Channel Change on the Cisco CMTS Routers* or *the Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide*.

# Cisco SIP-600 and Gigabit Ethernet SPA Configuration

This section mentions the configuration tasks related to the Cisco SIP-600 and Gigabit Ethernet SPA:


- Configuring the Cisco SIP-600, page 6-82
- Configuring the Gigabit Ethernet SPAs, page 6-82


## Configuring the Cisco SIP-600

The Cisco 10000 Series SPA Interface Processor-600 (referred to as the Cisco SIP-600) can support up to four Cisco Wideband SPAs. Two SIP-600s can support up to six Cisco Wideband SPAs plus Gigabit Ethernet SPAs. For more configuration information, see the chapter "Configuring a SIP" in the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide.*

## Configuring the Gigabit Ethernet SPAs

The following Gigabit Ethernet SPAs are supported on the Cisco 10000 SIP-600 on the Cisco uBR10012 router in the Cisco IOS Release 12.2(33)SCB and later releases:

- 1 port 10-Gigabit Ethernet Shared Port Adapter, Version 2
- 5 port Gigabit Ethernet Shared Port Adapter, Version 2

**Note** The 1 port 10-Gigabit Ethernet Shared Port Adapter is supported only on a PRE4 chassis.

For more configuration information on Gigabit Ethernet SPAs, see the chapter "Configuring Gigabit Ethernet SPAs" in the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide.*

# Supported MIBs

The following MIBs are supported in Cisco IOS Release 12.3(23)BC and later releases for the Cisco uBR10012 router and the Cisco Wideband SIP and Wideband SPA:

The following MIBS have been added since Cisco IOS Release 12.3(23)BC:

- CLAB-TOPO-MIB
- DOCS-DIAG-MIB
- DOCS-DRF-MIB
- DOCS-IETF-CABLE-DEVICE-NOTIFICATION-MIB
- DOCS-IETF-QOS-MIB
- DOCS-IF3-MIB

- DOCS-IFEXT2-MIB
- DOCS-IF-M-CMTS-MIB
- DOCS-LOADBAL3-MIB
- DOCS-LOADBALANCING-MIB
- DOCS-MCAST-AUTH-MIB
- DOCS-MCAST-MIB
- DOCS-QOS3-MIB
- DOCS-SEC-MIB
- DOCS-SUBMGT3-MIB
- DOCS-TEST-MIB
- ENTITY-SENSOR-MIB

The following MIBS have been modified since Cisco IOS Release 12.3(23)BC:

- CISCO-CABLE-METERING-MIB
- CLAB-DEF-MIB
- DOCS-CABLE-DEVICE-MIB
- DOCS-CABLE-DEVICE-TRAP-MIB
- DOCS-DSG-IF-MIB
- DOCS-IETF-BPI2-MIB
- DOCS-IF-EXT-MIB
- DOCS-IF-MIB
- DOCS-QOS-MIB
- DOCS-SUBMGT-MIB

The following MIBS continue to be supported in Cisco IOS Release12.3(23)BC:

- CISCO-CABLE-WIDEBAND-MIB
- CISCO-VENDORTYPE-OID-MIB

For information about MIBs associated with edge QAM devices or wideband cable modems, refer to the vendor documentation.

The following MIBs are supported by the Gigabit Ethernet SPAs on the Cisco uBR10012 router:

- ENTITY-MIB (RFC 2737)
- CISCO-ENTITY-ASSET-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-ALARM-MIB
- CISCO-ENTITY-EXT-MIB
- CISCO-ENTITY-SENSOR-MIB
- IF-MIB
- ETHERLIKE-MIB (RFC 2665)
- Remote Monitoring (RMON)-MIB (RFC 1757)
- CISCO-CLASS-BASED-QOS-MIB

- Ethernet MIB/RMON

The following MIBs are supported by the Cisco SIP-600 on the Cisco uBR10012 router:

- IF-MIB
- ENTITY-MIB

For more information on supported MIBs for the Cisco SIP-600 and Gigabit Ethernet SPAs, see the respective chapters "Overview of Cisco uBR10012 Router SIPs" and "Overview of Gigabit Ethernet SPAs" in the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide*.

For more information about MIB support on a Cisco uBR10012 router, refer to the *Cisco CMTS Universal Broadband Router MIB Specifications Guide.*

# Known Restrictions

## Cisco Wideband SPA Restrictions

The following restrictions apply to the *Cisco Wideband SPA* for Cisco IOS Release 12.3(23)BC:

- Voice call service flows are configurable only on wideband interfaces.
- Full DOCSIS QoS, including CIR support and downstream low latency service flows for voice, are configurable only on wideband interfaces.
- Dynamic services are configurable only on wideband interfaces.
- A wideband interface can only use RF channels from the same SPA.
- Scientific Atlanta DPC2505 and EPC2505 wideband cable modems support multicast traffic on the primary downstream channel only. These modems do not support multicast traffic on wideband downstream channels.

## Cisco SIP-600 Restrictions

The following restrictions apply to the Cisco SIP-600 for Cisco IOS Release 12.2(33)SCB.

- The Cisco Wideband SIP (2 SPA bays) and the Cisco SIP-600 (4 SPA bays) cannot coexist on a Cisco uBR10012 router.
- The Cisco SIP-600 can be configured in Slot 1 and Slot 3 only, of the Cisco uBR10012 router.
- For a PRE4 setup, all SPAs share a 11.2Gbps ironbus connection.
- A PRE2 setup allows the typical ironbus connection in which Bay 0 and Bay 2 share a 2.8 Gbps ironbus connection and Bay 1 and Bay 3 also share a 2.8 Gbps ironbus connection.

For information on restrictions relevant to the Cisco SIP-600, see the section "Cisco SIP-600 Restrictions" and "WAN Slot Restrictions", in the *Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide.*

## Gigabit Ethernet SPA Restrictions

The following restrictions apply to the *Gigabit Ethernet SPAs* for Cisco IOS Release 12.2(33)SCB:

- When used as an uplink interface, the Cisco 1-port 10-Gigabit Ethernet SPA supports from one to ten VLANs with priority queues and class-based weighted-fair queues, based on QoS configuration and test scenarios. When QoS is applied at multiple VLAN 10-Gigabit Ethernet interfaces other than the main 10-Gigabit Ethernet interface, unexpected drops with nonpriority class queues may occur.
- As an access interface, the Cisco 1-port 10-Gigabit Ethernet SPA does not support oversubscription at the VLAN level when using QoS Model F.
- You cannot configure more than two active ports for sending and receiving packets on the Cisco 5 port Gigabit Ethernet SPA.
- The following features are not supported:
  - IEEE 802.1 Q-in-Q VLAN tag switching
  - Bridge protocol data units (BPDU) filtering

# Cisco uBR-MC3GX60V Line Card Restrictions

The following restrictions apply to the Cisco uBR-MC3GX60V cable interface line card:

- All channels of a bonding group must come from the same controller.
- Cisco uBR-MC3GX60 MAC domains cannot use Wideband SPA downstream channels in Cisco IOS Release 12.2(33)SCF and earlier.

**Note** Starting with Cisco IOS Release 12.2(33)SCG, Cisco uBR-MC3GX60V cable interface line cards and the Cisco Wideband SPA can coexist on a single chassis and share downstream channels. MAC domains hosted on the Cisco uBR-MC3GX60V line card can include downstream channels from the Cisco Wideband SPA.

For more information on the Cisco uBR-MC3GX60V line card restrictions, see *Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card* at the following URL:

http://www.cisco.com/en/US/docs/interfaces_modules/cable/broadband_processing_engines/ubr_mc3gx60v/configuration/guide/mc3g60_cfg.html