Downstream Resiliency Bonding Group

With more wideband (WB) modems being deployed in cable plants, WB modem resiliency is an important feature. When a comparatively smaller number of cable modems (CMs) observe an impairment on an RF channel, that RF channel stops working. It impacts all the CM using that RF channel, irrespective of whether they reported the impairment on that RF channel. Instead, the solution should be to communicate with the affected cable modems using the good RF channel, without affecting the other cable modems.

The Downstream Resiliency Bonding Group feature allows cable modems with multiple impaired RF channels to be allocated to a dynamically-created wideband interface, which ensures that the performance of the wideband cable modems is not drastically affected.

Finding Feature Information

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

Contents

Hardware Compatibility Matrix for the Cisco cBR Series Routers

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

Table 1: Hardware Compatibility Matrix for the Cisco cBR Series Routers

Cisco CMTS Platform	Processor Engine	Interface Cards
Cisco cBR-8 Converged Broadband Router	**Cisco IOS-XE Release 16.5.1 and Later Releases** Cisco cBR-8 Supervisor: • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G • PID—CBR-CCAP-SUP-60G • PID—CBR-SUP-8X10G-PIC	**Cisco IOS-XE Release 16.5.1 and Later Releases** Cisco cBR-8 CCAP Line Cards: • PID—CBR-LC-8D30-16U30 • PID—CBR-LC-8D31-16U30 • PID—CBR-RF-PIC • PID—CBR-RF-PROT-PIC • PID—CBR-CCAP-LC-40G • PID—CBR-CCAP-LC-40G-R Cisco cBR-8 Downstream PHY Modules: • PID—CBR-D30-DS-MOD • PID—CBR-D31-DS-MOD Cisco cBR-8 Upstream PHY Modules: • PID—CBR-D30-US-MOD • PID—CBR-D31-US-MOD

Prerequisites for Downstream Resiliency Bonding Group

• Set aside WB interfaces so that new WB interfaces can be dynamically created from the reserved list of WB interfaces.

• Free up RF bandwidth so that those RF channels can be added to a resiliency bonding group (RBG).

• Remove all existing RBG configuration from the WB interface.

Restrictions for the Downstream Resiliency Bonding Group

• If an existing wideband interface is reserved as a Resiliency Bonding Group (RBG) and later the RBG is removed (through the **no cable ds-resiliency** command), the modems using this RBG go offline and the RBG configuration itself is deleted. Therefore, it is highly recommended that users should not configure an existing BG as an RBG.

- This feature is enabled only when the number of cable modems observing an RF channel impairment is *below* the resiliency threshold. If the number of cable modems on an impaired RF channel is above the resiliency threshold, the impaired RF channel is temporarily removed from the bonding group.

- A cable modem is assigned to an RBG on a first-come-first-served basis. To handle this feature optimally, it is recommended to set aside more WB interfaces and RF channel bandwidth.

- The Cisco CMTS controls the freeing of unused RBGs, when there is no modem using the RGB. The freeing of the unused RGB may take some time and the RGB, which is not completely free cannot be used by the modems. Irrespective of the number of configured RBGs, if all the old RBGs are not completely set free and if the Cisco CMTS tries to move the cable modem to a new RBG, the Cisco CMTS moves the cable modem to the primary DS channel instead of RBG.

- Only SFs on the WB interface associated with the primary SF are moved to an RBG. SFs on other interfaces will not be moved.

- Static SFs are assigned to an RBG on a best effort quality of service (QoS).

- If the **resiliency rf-change-trigger** setting does not have the **secondary** keyword set, only the primary SF is moved to the RBG or a NB interface.

- If the Downstream Resiliency Bonding Group feature is not enabled to use an RBG, only cable modems with impairments on the primary WB interface are moved to the NB interface.

- SFs carrying multicast traffic are not moved.

There may not be enough reserved bonding groups to support all modems facing an impairment at any given time thus the following restrictions must be considered:

- Each RBG has at least two RF channels.

- RBG RF assignments are always a subset of the RF channel assignment of the parent WB interface.

- If an RBG is unavailable for a cable modem, the SF of the CM is moved to a NB interface.

- If a high percentage of cable modems experience an RF impairment and there are no more available bonding group IDs, the impaired RF itself may be removed from the bonding group. Removal of an impaired RF from a parent bonding group is also reflected in the RBG. If an RBG drops to a single RF, all SFs are moved to the NB interface.

The Downstream Resiliency Bonding Group feature has the following cross-functional restrictions:

- All Dynamic service flows, whether they require a committed information rate (CIR) or not, typically voice flows, are created on the NB interface when an RF channel is impaired. Because all SFs assigned to an RBG are best effort only, voice calls may report a quality issue.

- Cable modems participating in the resiliency mode do not take part in load balancing.

- The Downstream Resiliency Bonding Group feature is only supported in the Dynamic Bandwidth Sharing (DBS) mode.

Information About Downstream Resiliency Bonding Group

You can set aside unused bonding groups as RBGs. Ensure that each RF channel is assigned at least 1% of the available bandwidth. Use the **cable rf-channel bandwidth-percent** command to configure the RF channel bandwidth.

Note   If the bandwidth-percent is set to 100, the Cisco CMTS does not add any RFs to the RBG. In other words, this feature will not be enabled.

The Cisco CMTS controls the assignment and freeing of unused RBGs. If an RF channel is removed from a WB interface, it is also removed from any associated RBGs.

Note   If the wideband interface is in standby mode, the Cisco CMTS does not assign or free up the unused downstream bonding group.

A suspended RF channel is restored for all affected wideband interfaces when a specified number of cable modems report (via CM-STATUS) that the channel connectivity is restored. The Wideband Modem Resiliency feature defines the specified number of cable modems as half of the configured count or percentage of rf-change-trigger, or both. For example, if the count is 20 and the percent is 10, then the number of cable modems reporting recovery should reduce the count to 10 and the percent to 5 for the suspended RF channel to be restored.

Finding a Best-Fit RBG for the Cable Modem

A bonding group is a list of channels that provide a means to identify the channels that are bonded together. The Cisco CMTS assigns a service flow (SF) to an RBG based on the attributes of the SF and the attributes of the individual channels of the bonding group.

In the Downstream Resiliency Bonding Group feature, when a line card receives a CM-STATUS message from the cable modem informing the line card that there is an RF channel impairment, the line card checks for the number of good RF channels and:

- Moves the cable modem to narrowband mode if there is only one available RF channel.

- Moves the cable modem to wideband mode if the cable modem reports all RF channels are in good state.

- Moves the cable modem to an RBG if there are two or more good RF channels, with at least one RF channel impaired, and if the Downstream Resiliency Bonding Group feature is enabled.

When the Cisco CMTS receives a message from the line card to move a cable modem to an RBG, the Cisco CMTS attempts to find an existing RBG or creates an RBG that satisfies the impairment.

Note   If two or more RBGs are reserved for the same wideband controller, the Cisco CMTS creates one RBG for each cable modem.

| Note | The Cisco CMTS creates more than one RBG from a parent WB interface if the user has set aside more than one WB interface as the RBG and the RF bandwidth does not exceed 100%. |

If a matching RBG is not found or cannot be created, the Cisco CMTS looks for an RBG with a subset of the required RF channels and if available, the cable modem is assigned to such an RBG.

However, if no such RBG exists, the Cisco CMTS instructs the line card to move the cable modem to NB mode.

How to Configure Downstream Resiliency Bonding Group

This section contains the following:

Enabling Downstream Resiliency Bonding Group

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> **enable**	Enables privileged EXEC mode. 　• Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# **configure terminal**	Enters global configuration mode.
Step 3	**cable rf-change-trigger** {**percent** *value* | **count** *number*} [**secondary**] **Example:** Router(config)# **cable rf-change-trigger percent 50 count 1 secondary**	Specifies the amount of time an event must persist before it triggers an action for the reporting CM.
Step 4	**cable resiliency ds-bonding** **Example:** Router(config)# **cable resiliency ds-bonding**	Enables the downstream resiliency bonding group.
Step 5	**exit** **Example:** Router(config)# **exit**	Returns to the global configuration mode.

What to do next

Note The result of using the **cable rf-change-trigger** command with the **cable resiliency ds-bonding** command is different from using only the **cable rf-change-trigger** command. For more information, see Downstream Resiliency Narrowband Mode Versus Resiliency Bonding Group, on page 7.

Reserving a Resiliency Bonding Group for a Line Card

This section describes reserving a bonding group or a wideband interface for a line card per controller.

Restriction When you reserve a resiliency bonding group using the cable ds-resiliency command, the existing bundle and RF channel configurations on the wideband interface will be removed automatically. Other configurations like admission control, should be removed manually.

After downstream resiliency bonding group is configured, avoid other manual configurations.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> **enable**	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# **configure terminal**	Enters global configuration mode.
Step 3	**interface wideband-cable** *slot/subslot/port:wideband-channel* **Example:** Router(config)# **interface wideband-cable 1/0/0:7**	Configures a wideband cable interface.
Step 4	**cable ds-resiliency** **Example:** Router(config-if)# **cable ds-resiliency**	Reserves an individual bonding group or WB interface for usage on a line card, on a per controller basis.
Step 5	**exit** **Example:** Router(config-if)# **exit**	Returns to the global configuration mode.

Verifying Downstream Resiliency Bonding Group Configuration

This section contains the following:

Verifying the Downstream Resiliency Bonding Group

To verify if the Downstream Resiliency Bonding Group feature is enabled, use the **show cable modem resiliency** command as shown in the following example:

```
Router# show cable modem resiliency
                               Orig BG             Curr BG
I/F     MAC Address    ID   I/F           RFs ID   I/F            RFs
------- -------------- ---- -------------------- ---------------------
C7/0/0  0025.2eaf.843e 897  Wi7/0/0:0     4   898  Wi7/0/0:1     3
C7/0/0  0025.2eaf.8356 897  Wi7/0/0:0     4   899  Wi7/0/0:2     3
C7/0/0  0015.d176.5199 897  Wi7/0/0:0     4   720  In7/0/0:0
```

The **Current BG I/F** field indicates whether Downstream Resiliency Bonding Group feature is enabled and if the cable modems are assigned to a WB interface.

Verifying a Reserved Resiliency Bonding Group

To verify if a BG is reserved for a line card, use the **show cable resiliency** command as shown in the following example:

```
Router# show cable resiliency
              BG   Resil BG                               RF
Resil BG I/F  ID   State         Count Time          Ctrl  Num
------------- ---- -------------- ----- --------------- ----------
Wi1/0/0:10    10   Free
Wi1/0/0:20    20   Free
Wi7/0/0:1     1    Assigned      3     Nov 3  09:55:49 0    0
                                                            1
                                                            2
Wi7/0/0:2     2    Assigned      3     Nov 3  09:57:09 0    0
                                                            1
                                                            3
```

Downstream Resiliency Narrowband Mode Versus Resiliency Bonding Group

This section provides the sample outputs when using the **cable rf-change-trigger** command with the **cable resiliency ds-bonding** command and using only the **cable rf-change-trigger** command.

Table 2: Downstream Resiliency Narrowband Mode Versus Resiliency Bonding Group - Scenario 1

Effect on	Using only cable rf-change-trigger command (Downstream Resiliency NB Mode)		Using cable rf-change-trigger command with cable resiliency ds-bonding (Downstream Resiliency Bonding Group)	
	Below Threshold	**Above Threshold**	**Below Threshold**	**Above Threshold**

Effect on	Using only cable rf-change-trigger command (Downstream Resiliency NB Mode)		Using cable rf-change-trigger command with cable resiliency ds-bonding (Downstream Resiliency Bonding Group)	
Primary Service Flow	Moves to the primary channel.	Remains on the original bonding group while the impaired downstream channels are not used and are reported as DOWN.	Moves to dynamic bonding group.	Remains on the original bonding group while the impaired downstream channels are not used and are reported as DOWN.
Secondary Service Flows	Remain on the original WB interface.	Remains on the original bonding group while the impaired downstream channels are not used and are reported as DOWN.	Remains on the original bonding group.	Remains on the original bonding group while the impaired downstream channels are not used and are reported as DOWN.

The following is a sample output for a cable modem when the **cable rf-change-trigger** command is used with the **cable resiliency ds-bonding** command and the number of cable modems observing an RF channel impairment is *below* the resiliency threshold:

```
Router# show cable modem

                                                                      D
MAC Address     IP Address      I/F           MAC         Prim RxPwr  Timing Num I
                                              State        Sid  (dBmv) Offset CPE P
0023.be83.1c9e  10.1.11.46      C5/0/0/UB     w-online     922  -0.50  1055   0   N
0023.be83.1caa  10.1.11.28      C5/0/0/UB     w-online     923  0.00   1043   0   N
0025.2ecf.f19c  10.1.11.53      C5/0/0/UB     w-online     925  0.00   1057   0   N
0022.3a30.9fc0  10.1.11.47      C5/0/0/UB     w-online     926  0.00   1055   0   N
001a.c3ff.e3d4  10.1.11.39      C5/0/0/UB     p-online     927  0.00   1307   0   N
0023.be83.1c9a  10.1.11.61      C5/0/0/UB     w-online     928  0.00   1057   0   N
0022.3a30.9fbc  10.1.11.60      C5/0/0/UB     p-online     929  -0.50  1055   0   N
0023.be83.1c8c  10.1.11.38      C5/0/0/UB     w-online     930  0.00   1061   0   N
001e.6bfb.1964  10.1.11.63      C5/0/0/UB     p-online     931  0.50   1305   0   N
0025.2ecf.f196  10.1.11.29      C5/0/0/UB     w-online     932  0.00   1057   0   N
0025.2ecf.f04e  10.1.11.54      C5/0/0/UB     w-online     933  0.00   1054   0   N
0022.3a30.9fc8  10.1.11.43      C5/0/0/UB     w-online     934  0.00   1056   0   N
0025.2ecf.f190  10.1.11.55      C5/0/0/UB     w-online     935  0.00   1059   0   N
0022.3a30.9fd0  10.1.11.52      C5/0/0/UB     p-online     936  0.00   1057   0   N
0022.ce97.8268  10.1.11.31      C5/0/0/UB     w-online     937  -0.50  1056   0   N
0022.ce97.8281  10.1.11.25      C5/0/0/UB     w-online     938  0.00   1058   0   N
001a.c3ff.e4ce  10.1.11.44      C5/0/0/UB     w-online     940  -0.50  1304   0   N
0022.ce9c.839e  10.1.11.32      C5/0/0/UB     w-online     941  -0.50  1305   0   N
0022.cea3.e768  10.1.11.41      C5/0/0/UB     w-online     942  -1.00  1305   0   N
0022.ce9c.8398  10.1.11.33      C5/0/0/UB     w-online     943  0.00   1306   0   N
001a.c3ff.e50a  10.1.11.59      C5/0/0/UB     w-online     944  0.00   1304   0   N
001a.c3ff.e3f8  10.1.11.57      C5/0/0/UB     w-online     945  -1.00  1306   0   N
001e.6bfb.1a14  10.1.11.37      C5/0/0/UB     w-online     946  0.00   1305   0   N
```

Note   p-online indicates that cable modem has reported NP RF failure and it is in downstream partial service mode.

```
Router# show cable resiliency

              BG    Resil BG                          RF
Resil BG I/F  ID    State          Count Time         Ctrl  Num
```

```
------------ ---- ------------- ----- -------------- ----------
Wi5/0/0:2    2    Assigned      1     Mar 30 14:46:43 0    0
                                                           1
                                                           2
Wi5/0/0:3    3    Assigned      1     Mar 30 14:46:43 0    0
                                                           1
                                                           2
                                                      1    0
                                                           1
                                                           2
                                                           3
Wi5/0/0:4    4    Free          0
Wi5/0/0:5    5    Free          0

Router# show cable modem resiliency
                            Orig BG              Curr BG
I/F     MAC Address    ID   I/F           RFs ID  I/F             RFs
------- -------------- ---- -------------------- --------------------
C5/0/0  001a.c3ff.e3d4 258  Wi5/0/0:1      4   259 Wi5/0/0:2        3 <- Dynamic Bonding Group
C5/0/0  0022.3a30.9fbc 257  Wi5/0/0:0      8   260 Wi5/0/0:3        7 <- Dynamic Bonding Group
C5/0/0  001e.6bfb.1964 258  Wi5/0/0:1      4   259 Wi5/0/0:2        3 <- Dynamic Bonding Group
C5/0/0  0022.3a30.9fd0 257  Wi5/0/0:0      8   260 Wi5/0/0:3        7 <- Dynamic Bonding Group
```

The following is a sample output for a cable modem under the following conditions:

- **cable rf-change-trigger** command is used with the **cable resiliency ds-bonding** command

- Number of cable modems observing an RF channel impairment is *below* the resiliency threshold

- There is no available WB interface for the resiliency bonding group:

```
Router# show cable modem
 0025.2ecf.f196 service-flow version

SUMMARY:
MAC Address    IP Address     Host         MAC         Prim Num Primary  DS
                              Interface    State       Sid  CPE Downstream RfId
0025.2ecf.f196 10.1.11.29     C5/0/0/UB    p-online
      932   0   In5/0/0:0    240
Sfid Dir Curr Sid  Sched Prio MaxSusRate  MaxBrst    MinRsvRate  Throughput
         State      Type
1867 US  act  932  BE    0    0           10000      0           294
1868 DS  act  N/A  N/A   0    0           3044       0           154

Router# show cable resiliency
            BG   Resil BG                            RF
Resil BG I/F ID  State         Count Time           Ctrl Num
------------- ---- -------------- ----- --------------- ----------
Wi5/0/0:2    2    Assigned      6     Mar 30 15:57:09 0    0
                                                           1
                                                           2
                                                           3
                                                      1    0
                                                           2
                                                           3
Wi5/0/0:3    3    Assigned      8     Mar 30 15:53:58 0    0
                                                           1
                                                           2
                                                      1    1
                                                           2
                                                           3
```

```
        Wi5/0/0:4    4    Assigned    2    Mar 30 15:53:58 0    0
                                                                1
                                                                2
                                                                3
                                                           1    1
                                                                2
                                                                3
        Wi5/0/0:5    5    Assigned    2    Mar 30 15:58:35 0    0
                                                                1
                                                                2
                                                                3
                                                           1    0
                                                                1
                                                                3


    Router# show cable modem resiliency

                                    Orig BG              Curr BG
    I/F     MAC Address     ID   I/F          RFs ID   I/F          RFs
    ------- -------------- ---------------------- ----------------------
    C5/0/0  0025.2ecf.f19c 257  Wi5/0/0:0     8   259  Wi5/0/0:2    7
    C5/0/0  0025.2ecf.f196 257  Wi5/0/0:0     8   240  In5/0/0:0    <-- move NB for no available
     WB interface
    C5/0/0  0025.2ecf.f04e 257  Wi5/0/0:0     8   262  Wi5/0/0:5    7
    C5/0/0  0022.3a30.9fbc 257  Wi5/0/0:0     8   260  Wi5/0/0:3    6
    C5/0/0  0022.3a30.9fd0 257  Wi5/0/0:0     8   261  Wi5/0/0:4    7
```

Table 3: Downstream Resiliency Narrowband Mode Versus Resiliency Bonding Group - Scenario 2

Effect on	Using only cable rf-change-trigger secondary command (Downstream Resiliency NB Mode)		Using cable rf-change-trigger secondary command with cable resiliency ds-bonding (Downstream Resiliency Bonding Group)	
	Below Threshold	**Above Threshold**	**Below Threshold**	**Above Threshold**
Primary Service Flow	Moves all service flows to the primary channel.	Remains on the original bonding group while the impaired downstream channels are not used and are reported as DOWN.	Moves all service flows to a dynamic bonding group.	Remains on the original bonding group while the impaired downstream channels are not used and are reported as DOWN.
Secondary Service Flows				

The following is a sample output for a cable modem when the **cable rf-change-trigger secondary** command is used with the **cable resiliency ds-bonding** command and the number of cable modems observing an RF channel impairment is *below* the resiliency threshold:

```
    Router# show cable modem 0025.2ecf.f196 service-flow

    SUMMARY:
    MAC Address     IP Address      Host        MAC        Prim  Num Primary    DS
                                    Interface   State      Sid   CPE Downstream RfId
    0025.2ecf.f196 10.1.11.29       C5/0/0/UB   p-online   955   0   In5/0/0:0  240
    Sfid  Dir Curr Sid   Sched  Prio MaxSusRate  MaxBrst    MinRsvRate  Throughput
             State       Type
    1913  US  act  955   BE     0    10000000    10000      0           425
    1915  US  act  956   RTPS   7    0           3044       100000      0
    1916  US  act  957   BE     0    0           3044       50000       0
    1917  US  act  958   BE     4    0           3044       0           0
```

```
     1914  DS  act   N/A   N/A    0   100000000   20000        0           0          <-- Primary
Service-Flow
     1918  DS  act   N/A   N/A    0   0           3044         0           0          <-- Secondary
 Service-Flow
     1919  DS  act   N/A   N/A    0   0           3044         0           0          <-- Secondary
 Service-Flow
     1920  DS  act   N/A   N/A    4   4500000     3044         0           0          <-- Secondary
 Service-Flow
UPSTREAM SERVICE FLOW DETAIL:
SFID   SID    Requests    Polls      Grants      Delayed    Dropped    Packets
                                                 Grants     Grants
1913   955    83          0          83          0          0          92
1915   956    0           0          0           0          0          0
1916   957    0           0          0           0          0          0
1917   958    0           0          0           0          0          0
DOWNSTREAM SERVICE FLOW DETAIL:
SFID   RP_SFID QID    Flg Policer                Scheduler            FrwdIF
                          Xmits       Drops      Xmits      Drops
1914   33210   131555     90          0          6          0          Wi5/0/0:3 <-- Dynamic
 Bonding Group
1918   33211   131556     0           0          0          0          Wi5/0/0:3
1919   33212   131557     0           0          0          0          Wi5/0/0:3
1920   33213   131558     0           0          0          0          Wi5/0/0:3
```

Troubleshooting the Downstream Resiliency Bonding Group Configuration

Use the following commands to get information on the WB interface, number of CMs in an impaired state, resiliency bonding groups, their associated bonding groups, available RF channels, and the number of CMS and service flows assigned to them:

- **debug cable wbcmts resiliency**
- **debug cable wbcmts resiliency report**
- **show cable resiliency**
- **show cable modem resiliency**
- **show cable modem wideband rcs-status**
- **show cable modem service-flow verbose**
- **show cable resil-rf-status**
- **show cable modem summary wb-rfs**

Configuration Examples for the Downstream Resiliency Bonding Group

The following is an example of the configuration of the Downstream Resiliency Bonding Group feature:

```
cable rf-change-trigger count 10 secondary
cable resiliency ds-bonding
!
controller Upstream-Cable 9/0/1
us-channel 0 frequency 13200000
us-channel 0 channel-width 6400000 6400000
us-channel 0 power-level -1
```

```
us-channel 0 docsis-mode atdma
us-channel 0 minislot-size 8
us-channel 0 modulation-profile 221
no us-channel 0 shutdown
us-channel 1 frequency 19600000
us-channel 1 channel-width 6400000 6400000
us-channel 1 power-level -1
us-channel 1 docsis-mode atdma
us-channel 1 minislot-size 8
us-channel 1 modulation-profile 221
no us-channel 1 shutdown
us-channel 2 frequency 26000000
us-channel 2 channel-width 6400000 6400000
us-channel 2 power-level -1
us-channel 2 docsis-mode atdma
us-channel 2 minislot-size 8
us-channel 2 modulation-profile 221
no us-channel 2 shutdown
us-channel 3 frequency 32400000
us-channel 3 channel-width 6400000 6400000
us-channel 3 power-level -1
us-channel 3 docsis-mode atdma
us-channel 3 minislot-size 8
us-channel 3 modulation-profile 221
no us-channel 3 shutdown
!
controller Integrated-Cable 9/0/1
max-carrier 128
base-channel-power 34
rf-chan 0
  type DOCSIS
  frequency 381000000
  rf-output NORMAL
  power-adjust -2
  docsis-channel-id 1
  qam-profile 1
rf-chan 1 3
  type DOCSIS
  frequency 387000000
  rf-output NORMAL
  power-adjust 0
  docsis-channel-id 2
  qam-profile 1
rf-chan 32 35
  type DOCSIS
  frequency 477000000
  rf-output NORMAL
  power-adjust 0
  docsis-channel-id 33
  qam-profile 1
rf-chan 64 67
  type DOCSIS
  frequency 501000000
  rf-output NORMAL
  power-adjust 0
  docsis-channel-id 65
  qam-profile 1
rf-chan 96 99
  type DOCSIS
  frequency 669000000
  rf-output NORMAL
  power-adjust 0
  docsis-channel-id 97
  qam-profile 1
```

```
!
interface Cable9/0/1
downstream Integrated-Cable 9/0/1 rf-channel 0-3
downstream Integrated-Cable 9/0/1 rf-channel 32-35
upstream 0 Upstream-Cable 9/0/1 us-channel 0
upstream 1 Upstream-Cable 9/0/1 us-channel 1
upstream 2 Upstream-Cable 9/0/1 us-channel 2
upstream 3 Upstream-Cable 9/0/1 us-channel 3
cable upstream bonding-group 1
  upstream 0
  upstream 1
  upstream 2
  attributes 80000000
cable upstream bonding-group 2
  upstream 0
  upstream 1
  attributes 80000000
cable upstream bonding-group 3
  upstream 1
  upstream 2
  attributes 80000000
cable upstream bonding-group 4
  upstream 0
  upstream 2
  attributes 80000000
cable upstream bonding-group 5
  attributes 80000000
cable bundle 1
no cable mtc-mode
cable privacy accept-self-signed-certificate
end
!
interface Integrated-Cable9/0/1:0
cable bundle 1
cable rf-bandwidth-percent 65
!
interface Wideband-Cable9/0/1:0
cable bundle 1
cable privacy accept-self-signed-certificate
cable rf-channels channel-list 0-3 bandwidth-percent 20
!
interface Integrated-Cable9/0/1:1
cable bundle 1
cable rf-bandwidth-percent 65
!
interface Wideband-Cable9/0/1:1
cable bundle 1
cable privacy accept-self-signed-certificate
cable rf-channels channel-list 32-35 bandwidth-percent 20
!
!
interface Wideband-Cable9/0/1:60
cable ds-resiliency
!
interface Wideband-Cable9/0/1:61
cable ds-resiliency
!
interface Wideband-Cable9/0/1:62
cable ds-resiliency
!
```

The following is a sample output for the **show cable modem** command to display impaired cable modems below the resiliency threshold value:

```
Router# show cable modem

MAC Address     IP Address      I/F          MAC       Prim  RxPwr  Timing Num I
                                             State     Sid   (dBmv) Offset CPE P
e448.c70c.96d5 80.17.150.6     C9/0/1/U2    p-online  1     0.00   1784   0   N
e448.c70c.96f3 80.17.150.14    C9/0/1/U1    w-online  2     -1.00  1797   0   N
68ee.9633.0699 80.17.150.31    C9/0/1/U0    w-online  3     -1.00  2088   1   N
e448.c70c.96e7 80.17.150.29    C9/0/1/U3    p-online  4     -0.50  1785   0   N
e448.c70c.982b 80.17.150.18    C9/0/1/U2    w-online  5     0.00   1780   0   N
e448.c70c.9804 80.17.150.13    C9/0/1/U3    w-online  6     -0.50  1788   0   N
e448.c70c.9819 80.17.150.30    C9/0/1/U0    w-online  7     -1.00  1782   0   N
e448.c70c.980d 80.17.150.17    C9/0/1/U0    w-online  8     -1.00  1787   0   N
```

Note p-online indicates that the cable modem has reported NP RF failure and it is in downstream partial service mode.

The following is a sample output when RBGs are created:

```
Router# show cable resiliency

                BG    Resil BG                        RF
Resil BG I/F    ID    State          Count Time       Ctrl  Num
-------------  -----  --------------  ----- ---------------  ----------
Wi9/0/1:60     28989  Assigned        1     Jan 9  07:35:08  1     0
                                                                   1
                                                                   2
Wi9/0/1:61     28990  Assigned        1     Jan 9  07:36:54  1     0
                                                                   1
                                                                   3
Wi9/0/1:62     28991  Free            0
```

The following is a sample output when cable modems service flows are assigned to RBGs:

```
Router# show cable modem resiliency

                              Orig BG              Curr BG
I/F     MAC Address     ID    I/F         RFs ID   I/F          RFs
------- --------------  ----- ----------------------- -----------------------
C9/0/1  e448.c70c.96d5 28929 Wi9/0/1:0    4   28989 Wi9/0/1:60   3
C9/0/1  e448.c70c.96e7 28929 Wi9/0/1:0    4   28990 Wi9/0/1:61   3
```

The following is a sample output of the **show cable modem** command when the impaired cable modems have recovered:

```
Router# show cable modem

MAC Address     IP Address      I/F          MAC       Prim  RxPwr  Timing Num I
                                             State     Sid   (dBmv) Offset CPE P
e448.c70c.96d5 80.17.150.6     C9/0/1/U2    w-online  1     0.00   1784   0   N
e448.c70c.96f3 80.17.150.14    C9/0/1/U1    w-online  2     -1.00  1797   0   N
68ee.9633.0699 80.17.150.31    C9/0/1/U0    w-online  3     -1.00  2088   1   N
e448.c70c.96e7 80.17.150.29    C9/0/1/U3    w-online  4     -0.50  1785   0   N
e448.c70c.982b 80.17.150.18    C9/0/1/U2    w-online  5     0.00   1780   0   N
e448.c70c.9804 80.17.150.13    C9/0/1/U3    w-online  6     -0.50  1788   0   N
e448.c70c.9819 80.17.150.30    C9/0/1/U0    w-online  7     -1.00  1782   0   N
e448.c70c.980d 80.17.150.17    C9/0/1/U0    w-online  8     -1.00  1787   0   N
```

The following is a sample output of the **show cable resiliency** command when the impaired cable modems have recovered:

```
Router# show cable resiliency

              BG    Resil BG                          RF
Resil BG I/F  ID    State         Count Time          Ctrl  Num
------------- ----- ------------- ----- -------------- ----------
Wi9/0/1:60    28989 Free          1     Jan 9  07:35:08
Wi9/0/1:61    28990 Free          1     Jan 9  07:36:54
Wi9/0/1:62    28991 Free          0
```

Additional References

Related Documents

Related Topic	Document Title
Cisco CMTS Command Reference	http://www.cisco.com/c/en/us/td/docs/cable/cmts/cmd_ref/b_cmts_cable_cmd_re

Technical Assistance

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

Feature Information for Downstream Resiliency Bonding Group

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

Note   The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 4: Feature Information for Downstream Resiliency Bonding Group

Feature Name	Releases	Feature Information
Downstream Resiliency Bonding Group	Cisco IOS XE Fuji 16.7.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.