Downstream Resiliency Bonding Group

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With more wideband (WB) modems being deployed in cable plants, WB modem resiliency is an important feature. The Wideband Modem Resiliency feature works well when a large number of WB modems experience an RF impairment. However, if a comparatively smaller number of cable modems (CMs) observe an impairment on an RF channel, then all CMs using that RF channel are shut down irrespective of whether they are affected or not. Instead, the solution should be to communicate with the affected CMs using the good RF channel, without affecting the other CMs.

In the Wideband Modem Resiliency feature, CMs with multiple impaired RF channels are moved to a single primary RF channel. Because the CMs are moved to a narrowband (NB) interface, this scenario may cause performance issues.

Starting with Cisco IOS Release 12.2(33)SCG, the Downstream Resiliency Bonding Group feature allows CMs with multiple impaired RF channels to be allocated to a dynamically-created wideband interface, which ensures that the performance of the wideband CMs is not drastically affected.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

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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.

Table 1: Downstream Resiliency Bonding Group – Hardware Compatibility Matrix

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

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

[2] This feature is supported on the Cisco uBR7246VXR and Cisco uBR7225VXR routers only in Cisco IOS Release 12.2(33)SCG1 and later releases.

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.

- In Cisco IOS Release 12.2(33)SCG, a CM 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.

- The Cisco CMTS prevents configuration changes on a protect line card. Therefore, RBGs are not added or removed on a protect line card. Impaired SFs are moved only to a WB, NB, or existing RBGs on the protect line card.

- When the WB interface is in standby mode and after a line card switchover, if a cable modem experiences an RF channel impairment, and after impairment if there are no preexisting RBG that matches the new set of channels, in such case, the Cisco CMTS does not create a new Downstream Resiliency Bonding Group and channels are not assigned to it and the cable modem is moved to a Narrow Band state.

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:

- Dynamic service flows that require a committed information rate (CIR), 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

In releases earlier than Cisco IOS Release 12.2 (33)SCG, bonding groups were static and created manually from the command line interface. The Cisco CMTS utilized the unused bonding groups for the Wideband Modem Resiliency feature.

However, starting with Cisco IOS Release 12.2 (33)SCG, 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.

For more information about NB mode, see Wideband Modem Resiliency.

How to Configure Downstream Resiliency Bonding Group

This section contains the following:

Enabling Downstream Resiliency Bonding Group

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# 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.
		
		   • **percent** *value*—Indicates the percentage of cable modems that must report a particular non-primary RF channel is down before that channel is removed from the bonding group. The valid range is 1 to 100. The default value is 0.
		
		   • **count** *number*—Specifies the number of cable modems reporting an impairment for a non-primary downstream channel. The default value is 0.
		
		   • **secondary**—(Optional) Configures the Cisco CMTS to move the unicast secondary service flows to the primary channel interface, when the

	Command or Action	Purpose
		number of cable modems reporting RF channel impairment is less than the configured (percent or count) threshold.
		Note Only those unicast secondary service flows, which share the same wideband interface as the primary interface, are moved to the primary channel interface. By default, the **secondary** keyword is not configured.
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 Table 2: Wideband Modem Resiliency Versus Downstream Resiliency - Scenario 1 , on page 8 and Table 3: Wideband Modem Resiliency Versus Downstream Resiliency - Scenario 2 , on page 10. For more information, see Wideband Modem Resiliency .

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.

DETAILED STEPS

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

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface wideband-cable** *slot*/{*subslot* | *bay*}/*port:wideband-channel* **Example:** `Router(config)# interface wideband-cable 1/0/0:7`	Configures a wideband cable interface. • *slot*—Slot where the cable line card resides. • *subslot*—Subslot where the cable line card resides. • *port*—Port number on the WB interface. • *wideband-channel*—WB interface on the router.
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
------------     ----  --------------  ----- --------------  ----------
Wi1/2/0:10       10    Free
Wi1/2/0:20       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
```

Wideband Modem Resiliency Versus Downstream Resiliency

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: Wideband Modem Resiliency Versus Downstream Resiliency - Scenario 1

Effect on	Using only cable rf-change-trigger command (Wideband Modem Resiliency)		Using cable rf-change-trigger command with cable resiliency ds-bonding (Downstream Resiliency Bonding Group)	
	Below Threshold	**Above Threshold**	**Below Threshold**	**Above Threshold**
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 the cable modem 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: Wideband Modem Resiliency Versus Downstream Resiliency - Scenario 2

Effect on	Using only cable rf-change-trigger secondary command (Wideband Modem Resiliency)		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 rf-status**

- **show cable modem summary wb-rfs**

Configuration Examples of the Downstream Resiliency Bonding Group Feature

The following is an example of the configuration of the Downstream Resiliency Bonding Group feature on a Cisco UBR-MC20X20V line card:

```
controller Integrated-Cable 5/0/0
rf-channel 0 frequency 387000000 annex B modulation 256qam interleave 32
 rf-channel 0 rf-power 52.0
 no rf-channel 0 rf-shutdown
rf-channel 1 frequency 393000000 annex B modulation 256qam interleave 32
 rf-channel 1 rf-power 52.0
 no rf-channel 1 rf-shutdown
rf-channel 2 frequency 399000000 annex B modulation 256qam interleave 32
 rf-channel 2 rf-power 52.0
 no rf-channel 2 rf-shutdown
rf-channel 3 frequency 405000000 annex B modulation 256qam interleave 32
 rf-channel 3 rf-power 52.0
 no rf-channel 3 rf-shutdown
interface Cable5/0/0
 downstream Integrated-Cable 5/0/0 rf-channel 0
 cable mtc-mode
 cable bundle 1
  cable upstream bonding-group 510
 upstream 0
 upstream 1
 upstream 2
 upstream 3
 attributes 80000000
 cable upstream 0 connector 0
 cable upstream 0 frequency 17000000
 cable upstream 0 channel-width 6400000 6400000
 cable upstream 0 docsis-mode atdma
 cable upstream 0 minislot-size 1
 cable upstream 0 range-backoff 3 6
 cable upstream 0 modulation-profile 221
 no cable upstream 0 shutdown
 cable upstream 1 connector 1
 cable upstream 1 frequency 24000000
 cable upstream 1 channel-width 6400000 6400000
 cable upstream 1 docsis-mode atdma
 cable upstream 1 minislot-size 1
 cable upstream 1 range-backoff 3 6
 cable upstream 1 modulation-profile 221
 no cable upstream 1 shutdown
 cable upstream 2 connector 2
 cable upstream 2 frequency 31000000
 cable upstream 2 channel-width 6400000 6400000
 cable upstream 2 docsis-mode atdma
 cable upstream 2 minislot-size 1
 cable upstream 2 range-backoff 3 6
 cable upstream 2 modulation-profile 221
 no cable upstream 2 shutdown
 cable upstream 3 connector 3
 cable upstream 3 frequency 38000000
 cable upstream 3 channel-width 6400000 6400000
 cable upstream 3 docsis-mode atdma
 cable upstream 3 minislot-size 1
 cable upstream 3 range-backoff 3 6
 cable upstream 3 modulation-profile 221
 no cable upstream 3 shutdown
interface Integrated-Cable5/0/0:0
 cable bundle 1
 cable rf-bandwidth-percent 10
 !
interface Wideband-Cable5/0/0:0
```

```
cable bundle 1
 cable rf-channel 0 bandwidth-percent 10
 cable rf-channel 1 bandwidth-percent 10
 cable rf-channel 2 bandwidth-percent 10
 cable rf-channel 3 bandwidth-percent 10
 cable rf-channel controller 1 channel 0 bandwidth-percent 10
 cable rf-channel controller 1 channel 1 bandwidth-percent 10
 cable rf-channel controller 1 channel 2 bandwidth-percent 10
 cable rf-channel controller 1 channel 3 bandwidth-percent 10
!
interface Wideband-Cable5/0/0:1
 cable bundle 1
 cable rf-channel 0 bandwidth-percent 10
 cable rf-channel 1 bandwidth-percent 10
 cable rf-channel 2 bandwidth-percent 10
 cable rf-channel 3 bandwidth-percent 10
!
interface Wideband-Cable5/0/0:2
 cable ds-resiliency
!
interface Wideband-Cable5/0/0:3
 cable ds-resiliency
!
interface Wideband-Cable5/0/0:4
 cable ds-resiliency
!
interface Wideband-Cable5/0/0:5
 cable ds-resiliency

cable fiber-node 50
 downstream Integrated-Cable 5/0/0 rf-channel 0-3
 downstream Integrated-Cable 5/0/1 rf-channel 0-3
 upstream Cable 5/0 connector 0-3
```

The following is an example of the configuration of the Downstream Resiliency Bonding Group feature with multiple Cisco UBR-MC20X20V line cards:

- Primary bonding group on the Cisco UBR-MC20X20V line card in slot 7/1

- Another bonding group on the Cisco UBR-MC20X20V line card in slot 8/1

- Resiliency Bonding Group is set aside on the Cisco UBR-MC20X20V line card in slot 7/1

```
interface Wideband-Cable7/1/0:0
 cable bundle 2
 cable rf-channel 0 bandwidth-percent 10
 cable rf-channel 1 bandwidth-percent 10
 cable rf-channel 2 bandwidth-percent 10
 cable rf-channel 3 bandwidth-percent 10
!
interface Wideband-Cable8/1/3:0
 cable bundle 2
 cable rf-channel 0 bandwidth-percent 10
 cable rf-channel 1 bandwidth-percent 10
 cable rf-channel 2 bandwidth-percent 10
 cable rf-channel 3 bandwidth-percent 10
!
interface Wideband-Cable7/1/0:3
cable ds-resiliency
!
interface Wideband-Cable7/1/0:4
cable ds-resiliency
interface Wideband-Cable8/1/3:3
cable ds-resiliency
!
interface Wideband-Cable8/1/3:4
cable ds-resiliency
```

The following is an example of the cross-controller configuration of the Downstream Resiliency Bonding Group feature with the Cisco UBR-MC20X20 line card:

```
interface Wideband-Cable8/1/3:2
 cable bundle 3
 cable rf-channel controller 1 channel 0 bandwidth-percent 10
 cable rf-channel controller 1 channel 1 bandwidth-percent 10
 cable rf-channel controller 1 channel 2 bandwidth-percent 10
 cable rf-channel controller 1 channel 3 bandwidth-percent 10
 cable rf-channel 0 bandwidth-percent 10
 cable rf-channel 1 bandwidth-percent 10
 cable rf-channel 2 bandwidth-percent 10
 cable rf-channel 3 bandwidth-percent 10
!
!
interface Wideband-Cable8/1/3:3
 cable ds-resiliency
!
interface Wideband-Cable8/1/3:4
 cable ds-resiliency
!
```

The following is an example of the configuration of the Downstream Resiliency Bonding Group feature with a shared port adapter (SPA):

```
interface Wideband-Cable1/2/0:0
 cable bundle 1
 cable rf-channel 0 bandwidth-percent 25
 cable rf-channel 1 bandwidth-percent 25
 cable rf-channel 2 bandwidth-percent 25
 cable rf-channel 3 bandwidth-percent 25
!
interface Wideband-Cable1/2/0:3
 cable ds-resiliency
!
interface Wideband-Cable1/2/0:4
 cable ds-resiliency
|
```

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

```
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 the CM is in downstream partial service mode.

When the impaired CMs have recovered, the **show cable modem** command displays the following output:

```
Router# show cable modem
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  0.50   1057   0   N
0022.3a30.9fc0 10.1.11.47    C5/0/0/UB    w-online    926  -0.50  1055   0   N
001a.c3ff.e3d4 10.1.11.39    C5/0/0/UB    w-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    w-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    w-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    w-online    936  0.00   1057   0   N
0022.ce97.8268 10.1.11.31    C5/0/0/UB    w-online    937  -1.00  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  -0.50  1306   0   N
001a.c3ff.e50a 10.1.11.59    C5/0/0/UB    w-online    944  -0.50  1304   0   N
001a.c3ff.e3f8 10.1.11.57    C5/0/0/UB    w-online    945  0.50   1306   0   N
001e.6bfb.1a14 10.1.11.37    C5/0/0/UB    w-online    946  0.00   1305   0   N
```

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

```
Router# show cable modem
                                                                        D
MAC Address     IP Address     I/F          MAC         Prim RxPwr  Timing Num I
                                            State        Sid  (dBmv) Offset CPE P
4458.294a.f3cc 10.1.11.27    C5/0/0/U3    init(o)     1020 0.00   1053   0   N
001e.6bfb.1964 10.1.11.63    C5/0/0/UB    w-online    1021 0.00   1305   0   N
0022.3a30.9fc0 10.1.11.47    C5/0/0/UB    p-online    1022 -0.50  1056   0   N
001a.c3ff.e3f8 10.1.11.57    C5/0/0/UB    p-online    1023 0.00   1305   0   N
0025.2ecf.f190 10.1.11.55    C5/0/0/UB    p-online    1027 0.00   1056   0   N
001a.c3ff.e4ce 10.1.11.44    C5/0/0/UB    p-online    1031 -0.50  1306   0   N
0022.ce9c.8398 10.1.11.33    C5/0/0/UB    p-online    1032 -0.50  1305   0   N
0025.2ecf.f04e 10.1.11.54    C5/0/0/UB    p-online    1039 -1.00  1056   0   N
0022.3a30.9fbc 10.1.11.60    C5/0/0/UB    w-online    1040 0.00   1055   0   N
001a.c3ff.e3d4 10.1.11.39    C5/0/0/UB    w-online    1041 0.00   1305   0   N
0025.2ecf.f196 10.1.11.29    C5/0/0/UB    p-online    1042 -1.00  1058   0   N
0025.2ecf.f19c 10.1.11.53    C5/0/0/UB    p-online    1043 0.00   1058   0   N
0022.3a30.9fd0 10.1.11.52    C5/0/0/UB    w-online    1047 -0.50  1059   0   N
0023.be83.1c8c 10.1.11.38    C5/0/0/UB    p-online    1051 0.00   1057   0   N
0022.3a30.9fc8 10.1.11.43    C5/0/0/UB    p-online    1061 -0.50  1056   0   N
0023.be83.1c9e 10.1.11.46    C5/0/0/UB    p-online    1065 0.00   1060   0   N
0023.be83.1caa 10.1.11.28    C5/0/0/UB    p-online    1069 0.00   1049   0   N
001a.c3ff.e50a 10.1.11.59    C5/0/0/UB    p-online    1070 -0.50  1306   0   N
0023.be83.1c9a 10.1.11.61    C5/0/0/UB    p-online    1071 0.00   1056   0   N
0022.ce9c.839e 10.1.11.32    C5/0/0/UB    p-online    1078 -1.00  1305   0   N
0022.cea3.e768 10.1.11.41    C5/0/0/UB    p-online    1079 0.00   1306   0   N
001e.6bfb.1a14 10.1.11.37    C5/0/0/UB    p-online    1089 0.00   1304   0   N
0022.ce97.8268 10.1.11.31    C5/0/0/UB    p-online    1102 -0.50  1058   0   N
0022.ce97.8281 10.1.11.25    C5/0/0/UB    p-online    1103 0.00   1056   0   N
```

The following is a sample of output for the **show cable resiliency** command that displays that resiliency bonding groups are free:

```
Router# show cable resiliency
              BG    Resil BG                              RF
Resil BG I/F  ID    State           Count Time            Ctrl  Num
------------- ----  -------------- ----- --------------- ----------
Wi5/0/0:2     2     Free            9     Mar 30 17:18:21
Wi5/0/0:3     3     Free            9     Mar 30 16:22:21
Wi5/0/0:4     4     Free            2     Mar 30 15:53:58
Wi5/0/0:5     5     Free            3     Mar 30 16:24:12
```

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 an RBG and the RF bandwidth does not exceed 100 percent.

In the following example:

- Parent WB interface—wideband-cable 1/2/0:0

- RBGs—wideband-cable1/2/0:3, wideband-cable1/2/0:4, and wideband-cable1/2/0:5

```
!
interface Wideband-Cable1/2/0:0
 cable bundle 1
 cable rf-channel 0 bandwidth-percent 25
 cable rf-channel 1 bandwidth-percent 25
 cable rf-channel 2 bandwidth-percent 25
 cable rf-channel 3 bandwidth-percent 25
end
!
interface Wideband-Cable1/2/0:3
 cable ds-resiliency
end
!
interface Wideband-Cable1/2/0:4
 cable ds-resiliency
end
!
interface Wideband-Cable1/2/0:5
 cable ds-resiliency
end


Router# show cable resiliency

              BG    Resil BG                              RF
Resil BG I/F  ID    State           Count Time            Ctrl  Num
------------- ----  -------------- ----- --------------- ----------
Wi1/2/0:3     3     Free            1     May 24 09:58:35
Wi1/2/0:4     4     Free            0
Wi1/2/0:5     5     Free            0
Router# show cable modem resiliency

                              Orig BG               Curr BG
I/F     MAC Address    ID   I/F            RFs ID   I/F            RFs
------- -------------- ---------------------- ----------------------
Router# show cable modem c7/0/0
                                                                    D
MAC Address    IP Address    I/F          MAC        Prim RxPwr Timing Num I
                                          State      Sid  (dBmv) Offset CPE P
001e.6bfc.d732 80.66.0.16    C7/0/0/U0    w-online   1    0.00   1989   0   N
0025.2e2d.74cc 80.66.0.14    C7/0/0/U1    w-online   5    0.00   1592   1   N
0025.2ebf.29dd 80.66.0.3     C7/0/0/U0    w-online   10   0.50   1591   0   N
0015.d176.5b9d 80.66.0.15    C7/0/0/U0    w-online   17   0.75   1990   0   N
```

In the following example, CM1 reports RF 1 failure, CM2 reports RF 2 failure, and CM3 reports RF 3 failure. In this case, three RBGs are created:

```
Router# show cable resiliency
            BG   Resil BG                              RF
Resil BG I/F ID   State          Count Time            Ctrl  Num
------------- ---- -------------- ----- --------------- ----------
Wi1/2/0:3    3    Assigned       2     May 24 10:39:42 2     0
                                                             2
                                                             3
Wi1/2/0:4    4    Assigned       1     May 24 10:39:42 2     0
                                                             1
                                                             3
Wi1/2/0:5    5    Assigned       1     May 24 10:39:42 2     0
                                                             1
                                                             2

Router# show cable modem resiliency
                              Orig BG            Curr BG
I/F     MAC Address    ID   I/F            RFs ID  I/F            RFs
------- -------------- ---- ---------------------- ----------------------
C7/0/0  001e.6bfc.d732 65   Wi1/2/0:0      4   68  Wi1/2/0:3      3
C7/0/0  0025.2e2d.74cc 65   Wi1/2/0:0      4   69  Wi1/2/0:4      3
C7/0/0  0025.2ebf.29dd 65   Wi1/2/0:0      4   70  Wi1/2/0:5      3
!
interface Wideband-Cable1/2/0:3
 cable bundle 1
 cable ds-resiliency
 cable rf-channel 0 bandwidth-percent 1
 cable rf-channel 2 bandwidth-percent 1
 cable rf-channel 3 bandwidth-percent 1
end
!
interface Wideband-Cable1/2/0:4
 cable bundle 1
 cable ds-resiliency
 cable rf-channel 0 bandwidth-percent 1
 cable rf-channel 1 bandwidth-percent 1
 cable rf-channel 3 bandwidth-percent 1
end
!
interface Wideband-Cable1/2/0:5
 cable bundle 1
 cable ds-resiliency
 cable rf-channel 0 bandwidth-percent 1
 cable rf-channel 1 bandwidth-percent 1
 cable rf-channel 2 bandwidth-percent 1
end
```

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_ref.html
Wideband Modem Resiliency	http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/ ubr_wm_resiliency.html

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 platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

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

Table 4: Feature Information for Downstream Resiliency Bonding Group

Feature Name	Releases	Feature Information
Downstream Resiliency Bonding Group	12.2(33)SCG	This feature was introduced. The following commands were introduced: • **cable resiliency ds-bonding** • **cable ds-resiliency** • **show cable modem resiliency** • **show cable resiliency**