DOCSIS 3.1 Downstream Profile Selection

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DOCSIS 3.1 introduces the concept of downstream profiles for OFDM channels.

Contents

- Hardware Compatibility Matrix for the Cisco cBR Series Routers, on page 1
- Information about Downstream Profiles, on page 3
- How to Configure Profiles, on page 9
- Additional References, on page 17
- Feature Information for Downstream Profile Selection, on page 17

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	**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 • PID—CBR-CCAP-LC-G2-R • PID—CBR-SUP-8X10G-PIC • PID—CBR-2X100G-PIC Digital PICs: • PID—CBR-DPIC-8X10G • PID—CBR-DPIC-2X100G Cisco cBR-8 Downstream PHY Module: • PID—CBR-D31-DS-MOD Cisco cBR-8 Upstream PHY Modules: • PID—CBR-D31-US-MOD

Note Do not use DPICs (8X10G and 2x100G) to forward IP traffic, as it may cause buffer exhaustion, leading to line card reload.

The only allowed traffic on a DPIC interface is DEPI, UEPI, and GCP traffic from the Cisco cBR-8 router to Remote PHY devices. Other traffic such as DHCP, SSH, and UTSC should flow via another router, since DPICs cannot be used for normal routing.

Information about Downstream Profiles

A profile is a list of modulation orders that are defined for each of the subcarriers within an OFDM channel. The CMTS can define multiple profiles for use in an OFDM channel, where the profiles differ in the modulation orders assigned to each subcarrier. The CMTS can assign different profiles for different groups of CMs.

Default Data Profile

The first time a CM registers, it is assigned a default data profile. The default data profile is "profile-data 1". If "profile-data 1" is not configured, "profile-control" is assigned to the CM.

Note Profile A, with profile ID 0, is also referred to as the control profile.

Recommended Profile

Based on the Receive Modulation Error Ratio (RxMER) values collected from a modem, the CMTS finds among the existing profiles the one that may provide the highest speed, and yet at the same time may have sufficient Signal to Noise Ratio (SNR) margin for the modem to receive code words with acceptable error. This profile is called the recommended profile for that CM. The **show cable modem phy ofdm-profile** command displays the recommended profile for each CM. Recommended Profile will take effect when the CM is reset by the operator. When the CM comes back online, recommended profile is assigned to it.

Internal PMA is enabled by default on the cBR-8. If external PMA is enabled, internal PMA is disabled and can be enabled by running the following config command on the cBR-8:

```
no cable downstream ofdm-prof-mgmt prof-upgrade-pma
```

In external PMA, the cBR-8 does not automatically upgrade a CM's profile to the recommended profile. In internal PMA, the profile can be upgraded to the recommended profile in the next OFDM Profile Test (OPT) cycle.

A user configurable age is associated with each recommended profile, which can be configured as follows:

```
Router (config)#cable downstream ofdm-prof-mgmt recommend-profile-age age-in-minutes
```

If the recommended profile exceeds this age, it is no longer valid for that CM.

Unfit Profile

When a Cable Modem reports an OFDM profile failure (CM-STATUS Event 16 message) for a profile, the OFDM Profile management module on CMTS moves this profile to the **Unfit** profile list. Later, CMTS may remove the same profile from the cable modem by sending a Dynamic Bonding Change Request (DBC-REQ) message.

The profiles remain in the unfit profile list until

- a CM-STATUS Event 24 message is received
- the **unfit-profile-age** timer expires.

You can configure the maximum age that is associated with each unfit profile, using the following command:

```
Router (config)#cable downstream ofdm-prof-mgmt unfit-profile-age age-in-minutes
```

If the unfit profile for a modem exceeds this age, the profile is no longer unfit and cleared from the unfit list.

CMTS device does not clear the profiles from the unfit list while processing a Dynamic Bonding Change Response (DBC-RSP) message received from the cable modem.

Unfit profiles are unusable as long as they are present in the unfit list.

The following example shows the *partial* output of the **show cable modem** *XXXX.XXXX.XXXX* **prof-mgmt downstream verbose**.

```
router# show cable modem XXXX.XXXX.XXXX prof-mgmt downstream verbose
.
.
.
  DCID                                 : 159
  Configured Profile(s)                : 0 1 2 3 4 5 6
  Profile(s) in REG-RSP-MP             : 0 1 2 3
  Profile(s) in DBC-REQ                : N/A
  Current profile                      : 1  [4096-QAM]
  Percentages of ideal BL vs Curr Prof : 0 (better)  99 (equal)
  External Profile Management  (PMA)   : Inactive
  Downgrade profile                    : 2
  Recommend profile                    : 1
  Unfit profile(s)                     : N/A
  Recommend profile (Expired)          : N/A
  Unfit profile(s)  (Expired)          : N/A
  Flow to Profile override             : Inactive
.
.
.
```

In this output, the DBC-REQ and Unfit profile list is empty as indicated by the lines highlighted in bold.

The following example shows the *partial* output of the **show cable modem** *XXXX.XXXX.XXXX* **prof-mgmt downstream verbose** after the CM status event 16 for the current profile **1** is generated.

```
router# show cable modem XXXX.XXXX.XXXX prof-mgmt downstream verbose
.
.
.
  DCID                                 : 159
  Configured Profile(s)                : 0 1 2 3 4 5 6
  Profile(s) in REG-RSP-MP             : 0 1 2 3
  Profile(s) in DBC-REQ                : N/A
  Current profile                      : 2  [2048-QAM]
  Percentages of ideal BL vs Curr Prof : 99 (better)  0 (equal)
  External Profile Management  (PMA)   : Inactive
  Downgrade profile                    : 4
  Recommend profile                    : 1
  Unfit profile(s)                     : 1
  Recommend profile (Expired)          : N/A
  Unfit profile(s)  (Expired)          : N/A
  Flow to Profile override             : Inactive

.
.
.
```

In this output, profile **1** moves to the Unfit profile list and profile **2** moves as a current profile. As profile **2** is already on a cable modem so DBC-REQ isn't triggered.

Implementing Hysteresis Timer for Profile Recovery

Table 2: Feature History

Feature Name	Release Information	Feature Description
Implementing hysteresis timer for profile recovery	Cisco IOS XE Dublin 17.12.1z	CMTS can implement a hysteresis function or timer for profile recovery starting with this release. This timer uses the OPT process to check RxMER values at the CM before recovery or upgrading to the profile.

Starting with Cisco IOS XE Dublin 17.12.1z, CMTS can implement a hysteresis function or timer for profile recovery without having to wait for the next regularly scheduled rx-mer poll. To recover a Unfit profile more quickly after the CMTS receives cm-status event 24 (profile recovery) from the CM, the profile recovery has been introduced.

You can control the configuration for the regular RxMER poll timer for profile recovery with the following command:

```
Router (config)#cable downstream ofdm-prof-mgmt rxmer-poll-interval interval
```

The following command is used to set a time from profile recovery to On-Demand RxMER Polling where interval is set in range 10 to 3600 seconds:

```
Router (config)#cable downstream ofdm-prof-mgmt unfit-profile-hysteresis interval
```

The following example shows the output of the **show cable modem** *mac address* **prof-mgmt downstream** configuration

```
router# show cable modem 206a.9454.30a4 prof-mgmt downstream
Downstream Profile Management Data:
MAC Address            : 206a.9454.30a4
IP Address             : 9.32.0.43
IPv6 Address           : ---
RxMer Exempt Percent   : 2
RxMer Margin qDB       : 0
Automatic Prof Dwngrd  : Active
Internal PMA           : Active
Unfit Profile Aging    : Active
DCID                                  : 159
  Configured Profile(s)               : 0 1 2
  Profile(s) in REG-RSP-MP            : 0 1 2
  Profile(s) in DBC-REQ               : N/A
  Current profile                     : 0  [1024-QAM]
  Percentages of ideal BL vs Curr Prof : 99 (better)  0 (equal)
  External Profile Management  (PMA)  : Inactive
  Downgrade profile                   : 0
  Recommend profile                   : 1
  Unfit profile(s)                    : N/A
  Recommend profile (Expired)         : N/A
  Unfit profile(s)  (Expired)         : N/A
  Flow to Profile override            : Inactive
Number of SubCarriers  : 4096
1st Active SubCarrier  : 1126
# of Active SubCarriers: 1844
Tx Time                : 0h:30m:22s ago   (Jun 24 11:57:18.000)
```

```
Rx Time                : 0h:30m:22s ago   (Jun 24 11:57:18.000)
OFDM Profile Failure Rx: 0h:14m:48s ago   (Jun 24 12:12:52.000)
OFDM Profile Recover Rx: 0h:14m:45s ago   (Jun 24 12:12:55.000)
MER Poll Period   (min): 60
Recommend Timeout (min): 120
Unfit Timeout     (min): 60
Unfit Profile Hysteresis(sec): Disabled
Source              : OPT
Sub-    RxMER
```

Moving OFDM Profiles Out Of Unfit Profile List

There are two ways to move a profile out of the unfit profile list:

- When the CMTS receives a profile-specific **CM-STATUS Event 24** (profile recovery) message from the cable modem, the profile is automatically moved out of the unfit profile list.
- When the **cable downstream ofdm-prof-mgmt unfit-profile-age** *age* timer configuration expires and an OFDM Profile Test (OPT) is successful, the profile is moved out of the unfit profile list.

  If you configure this command, a good profile remains in the unfit profile list and wait for the timer to expire. Even if the profile qualifies to be moved out of the unfit list as there is no FEC error, it is still stuck in the unfit list due to this timer.

A cBR-8 router sends a **CM-STATUS Event 24** message to the CMTS to indicate that there is no FEC error for a particular unfit profile and the same profile can be moved out of the unfit list.

Disabling OFDM Unfit Profile Aging

Table 3: Feature History

Feature Name	Release Information	Feature Description
Disabling OFDM Unfit Profile Aging	Cisco IOS XE Dublin 17.12.1z	With this release, you can disable the OFDM unfit profile aging functionality. As a result, a profile automatically moves out of the unfit profile list, only when the CMTS receives a profile-specific **CM-STATUS Event 24** message from the cable modem. Disabling OFDM Unfit Profile aging allows good profiles to move out of the unfit profile list. Good profiles do not need to wait for the timer to expire to move out of the unfit profile list. **Command Added**: **cable downstream ofdm-prof-mgmt unfit-profile-age disable**.

Profiles are eligible to move out of the unfit list when a cBR-8 router sends a **CM-STATUS Event 24** message to the CMTS. However if an unfit profile timer is configured, then the profile remains in the unfit list even though the profile qualifies to be moved out of the unfit as there is no FEC error.

You can completely disable the OFDM unfit profile aging functionality. The profile does not have to wait for a timeout and instead only depends on the CMTS receiving a **CM-STATUS Event 24** message, to move out of the unfit list.

Use the **cable downstream ofdm-prof-mgmt unfit-profile-age disable** command to disable unfit profile aging.

Clearing OFDM Unfit Profile List

Table 4: Feature History

Feature Name	Release Information	Feature Description
Clearing OFDM Unfit Profile List	Cisco IOS XE Dublin 17.12.1z	CMTS devices clear all the profiles from the unfit profile list upon receiving a Dynamic Bonding Change Response (DBC-RSP) message from the cable modem.. The profiles are cleared as long as they are not present in the Dynamic Bonding Change Request (DBC-REQ) list of Profiles. This feature ensures that good profiles do not remain in the unfit list for a longer duration.

When a cBR-8 router reports an OFDM profile failure (CM-STATUS event 16) for a profile, the OFDM profile management module on CMTS moves the faulty profile to the unfit list.

When CMTS sends a Dynamic Bonding Change Request (DBC-REQ) message to update the list of profiles on the cBR-8 router, the cBR-8 router sends the Dynamic Bonding Change Response (DBC-RSP) message in response. The DBC messages are system defined MAC management messages which handle changing of channel assignments and Downstream Service Identifiers (DSID).

CMTS clears the profiles from the unfit profile list, after receiving a Dynamic Bonding Change Response (DBC-RSP) message as long as they are not present in the list of profiles in Dynamic Bonding Change Request (DBC-REQ) message.

The unfit profile list does not have to meet either of these conditions to be cleared:

- The **unfit-profile-age** timer to expire.
- CMTS receiving a CM-STATUS Event 24 from the cable modem.

Use the **show cable modem [ip-address | mac-address] prof-mgmt downstream** command to verify if the **unfit** profile list is clear.

This feature ensures that good profiles don't remain in the unfit list and ensures timely clearing up of the unfit list.

The following example shows the *partial* output of the **show cable modem** *XXXX.XXXX.XXXX* **prof-mgmt downstream verbose** after the CM status event 16 for the current profile **2** is generated in releases before Cisco IOS XE Dublin 17.12.1z:

```
router# show cable modem XXXX.XXXX.XXXX prof-mgmt downstream verbose
.
.
.
  DCID                                : 159
  Configured Profile(s)               : 0 1 2 3 4 5 6
  Profile(s) in REG-RSP-MP            : 0 1 2 3
  Profile(s) in DBC-REQ               : 0 3 4 5
  Current profile                     : 4  [512-QAM..2048-QAM]
  Percentages of ideal BL vs Curr Prof : 99 (better)  0 (equal)
```

```
  External Profile Management  (PMA)   : Inactive
  Downgrade profile                    : 0
  Recommend profile                    : 1
  unfit profile(s)                     : 1 2
  Recommend profile (Expired)          : N/A
  unfit profile(s)  (Expired)          : N/A
  Flow to Profile override             : Inactive
.
.
.
```

In this output, profile **2** moves to the unfit profile list and profile **4** moves to the current profile. As profile **4** isn't on a cable modem, DBC-REQ is triggered. The unfit profile list currently has profiles **1** and **2** and the DBC-REQ list has profiles **0**, **3**, **4** and **5**.

The unfit profiles **1** and **2** in this case remain in the unfit profile list until the unfit timer expires or until CM status event 24 is received from the cable modem. These Profiles can't be used by the cable modem until they are cleared from the unfit profile list.

The following example shows the *partial* output of the **show cable modem** *XXXX.XXXX.XXXX* **prof-mgmt downstream verbose** after the CM status event 16 for the current profile **2** is generated in Cisco IOS XE Dublin 17.12.1z and later.

```
router# show cable modem XXXX.XXXX.XXXX prof-mgmt downstream verbose
.
.
.
  DCID                                 : 159
  Configured Profile(s)                : 0 1 2 3 4 5 6
  Profile(s) in REG-RSP-MP             : 0 1 2 3
  Profile(s) in DBC-REQ                : 0 3 4 5
  Current profile                      : 4  [512-QAM..2048-QAM]
  Percentages of ideal BL vs Curr Prof : 99 (better)  0 (equal)
  External Profile Management  (PMA)   : Inactive
  Downgrade profile                    : 0
  Recommend profile                    : 1
  unfit profile(s)                     : N/A
  Recommend profile (Expired)          : N/A
  unfit profile(s)  (Expired)          : N/A
  Flow to Profile override             : Inactive
.
.
.
```

In this output, profile **2** moves to the unfit profile list and profile **4** moves to the current profile. As profile **4** isn't on a cable modem, DBC-REQ is triggered. Profile **1** and **2** are cleared from the unfit profile list since profiles **1** and **2** aren't in the DBC-REQ list, so CMTS is able to select those profiles again sometime in the future.

Unlike the previous example, the unfit profile list is clear.

How to Configure Profiles

OFDM Profile Downgrade

A cBR-8 router sends a CM-STATUS event 16 message to indicate a downstream OFDM profile failure. When CMTS recieves this message, it takes immediate action to downgrade the router to a lower profile, as per the pre-configured profile ordering.

Events Triggering an OFDM Profile Downgrade

The following table, extracted from [DOCSIS 3.1 MULPI], lists the CM-Status events that trigger a profile downgrade:

Table 5: Table: CM-Status Events for Profile Downgrade

Event Type	Event Condition	Status Report Events		Parameters reported by CM	
		Trigger event to "on"	Trigger event to "off"	DCID	Profile ID
16	DS OFDM profile failure	Loss of FEC lock on one of the assigned downstream OFDM profiles of a channel	Re-establishment of FEC lock for that OFDM profile; OR Removal of the channel from the active channel list in the primary channel MDD; OR Removal of the channel from the CM's Receive Channel set via DBC-REQ	Yes	Yes

Configuring Automatic OFDM Profile Downgrade

To configure automatic profile downgrade, use the following command in global configuration mode:

```
Router (config)#cable downstream ofdm-prof-mgmt prof-dwngrd-auto
```

This command is enabled by default.

To disable the automatic profile downgrade, use the following command in global configuration mode:

```
Router (config)#no cable downstream ofdm-prof-mgmt prof-dwngrd-auto
```

For more information see cable downstream ofdm-prof-mgmt prof-dwngrd-auto

Viewing the OFDM Profile Downgrade Order

To view information about the profile downgrade ordering on a given OFDM channel in global configuration mode:

```
Router# show controllers integrated-Cable 2/0/3 rf-channel 158 prof-order
```

Here is a sample output of the command:

```
Router# show controllers integrated-Cable 2/0/3 rf-channel 158 prof-order
OFDM channel data profile order: [2/0/3:158]
-----------------------------------------------
Data Profile:       Downgrade Profile:
 Profile 1     ->    Profile 0
 Profile 2     ->    Profile 1
 Profile 3     ->    Profile 2
```

For more information see, show controller integrated-cable

Types of OFDM Profile Downgrade

There are two types of OFDM profile downgrade:

- Bit Loading Based OFDM Profile Downgrade
- Capacity Based OFDM Profile Downgrade

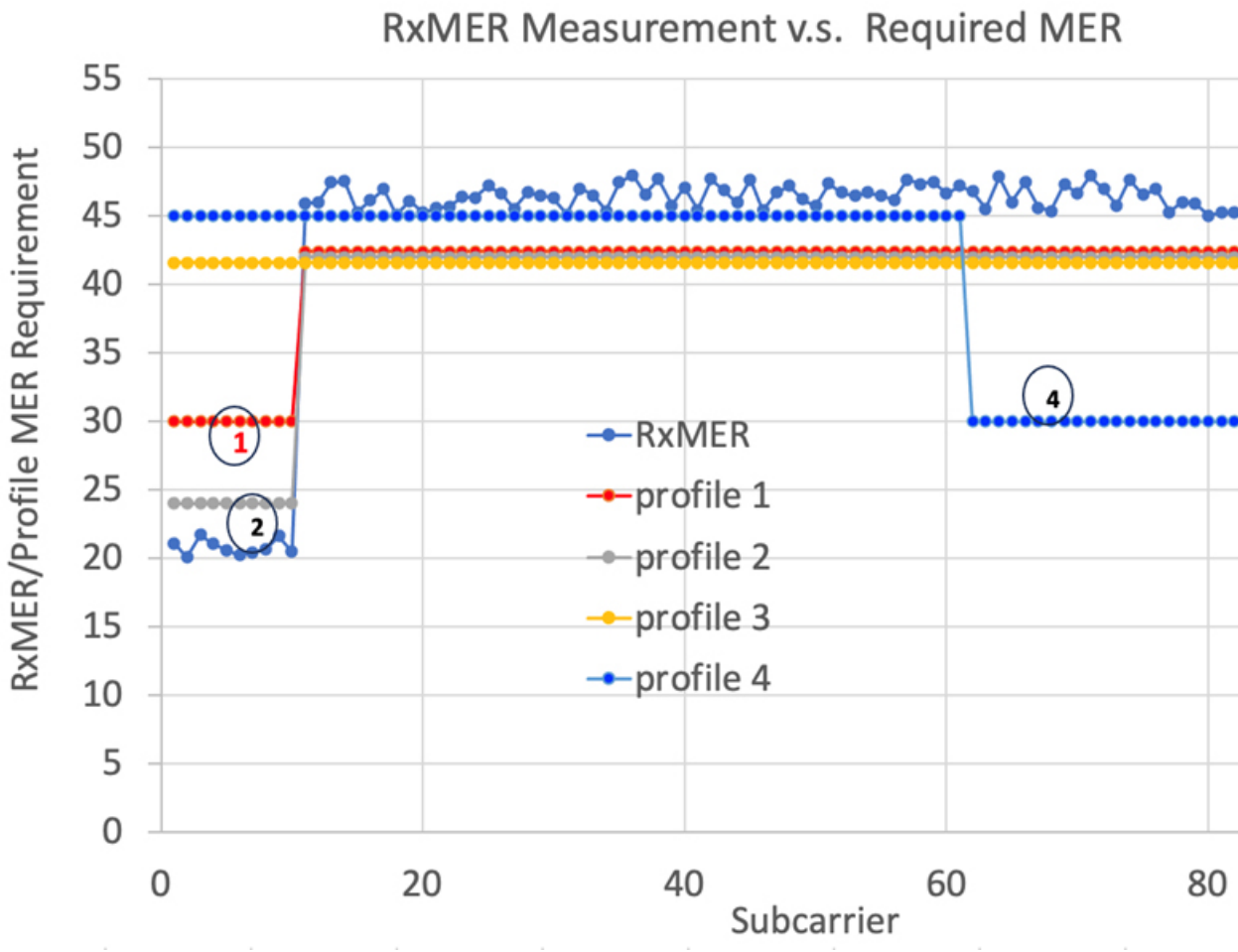
Bit Loading Based OFDM Profile Downgrade

When the CMTS must perform a downgrade, the profile is selected based on the RxMER margin. The profile with the next lowest margin is selected. Profiles with an equal or higher margin are not considered even if it is a good profile.

RxMER margin is the measurement in profile selection as part of the profile downgrade. The recommended profile must be a suitable profile, and its required MER should be closest to the actual RxMER. It may not be the suitable profile with the highest rate.

In this illustration, Profile 1 is the in-use profile and we assume a 10% MER margin. Capacity order from high to low is: 1 -> 4 -> 3 -> 2. However, only profile 2 and profile 3 are lower that profile 1 with a 10% MER margin, and profile 3 has a higher rate that profile 2. If the bit loading method is configured, then the downgrade order is: 1 -> 3 -> 2.

Figure 1: RxMER Measurement Against the Required MER



CMTS may eliminate good profiles that the cable modem didn't report as failed (CM-STATUS event 16). This profile could have a higher or equal capacity compared with the selected profile (such as profile 4 in the illustration). It is only skipped because of the rules of the bit loading method.

CMTS also performs a profile downgrade if it receives a CM-STATUS event 16 message for the current in-use profile, when the bit loading method is used.

Configuring Bit Loading Based OFDM Profile Downgrade

Use the **cable downstream ofdm-prof-mgmt prof-order-method bit-loading** command to enable the bit loading method of downgrading profiles. This command is configured by default.

Also, if you configure the **no cable downstream ofdm-prof-mgmt prof-order-method** command, it enables the default option which is the bit loading method of downgrading profiles.

Capacity Based OFDM Profile Downgrade

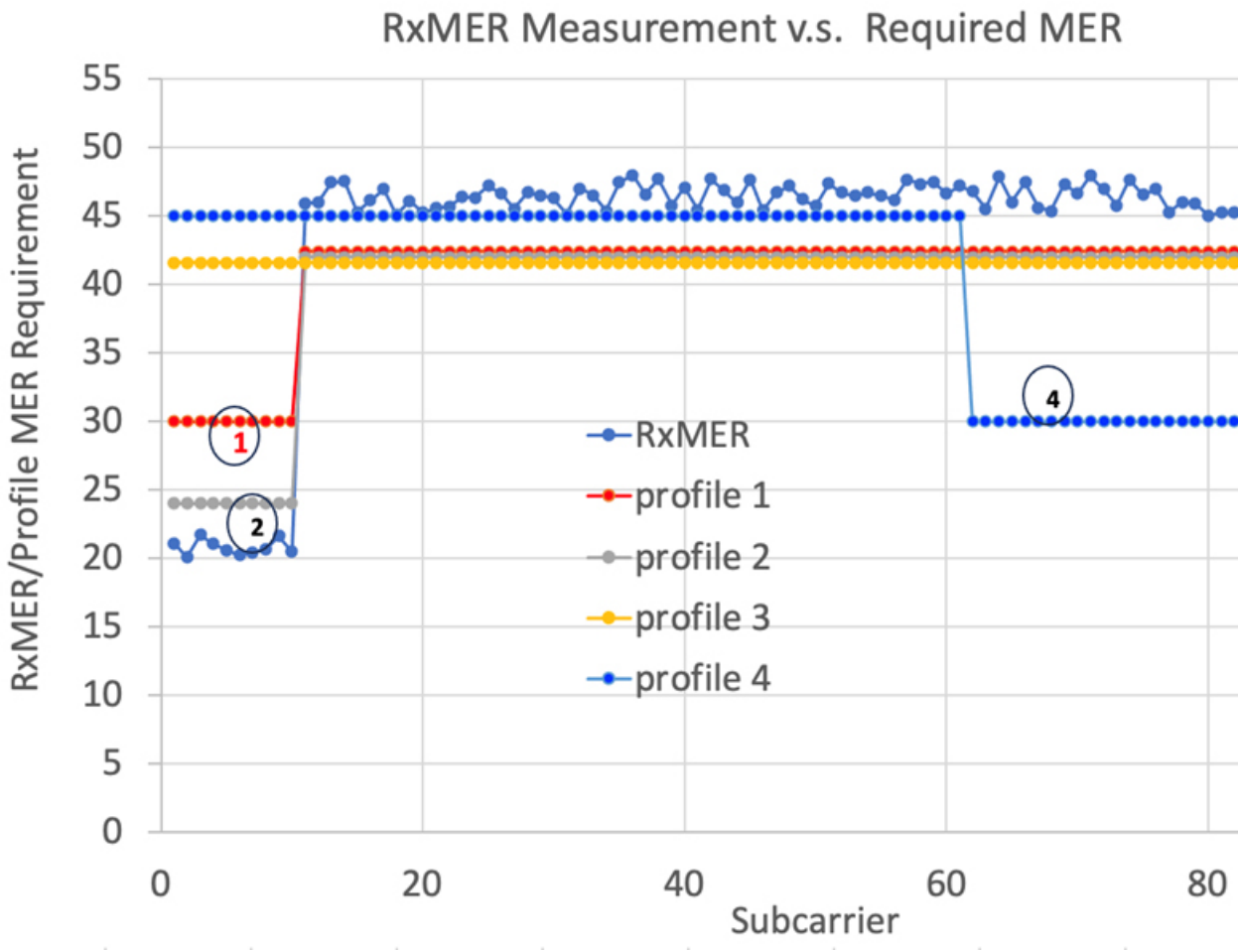
Table 6: Feature History

Feature Name	Release Information	Feature Description
Optimizing OFDM Profile Downgrade	Cisco IOS XE Dublin 17.12.1z	The process of downgrading an OFDM profile to is optimized to ensure that the best available profile is selected. Use the capacity based profile ordering method to ensure that the profile with the highest capacity is selected and a good profile is not skipped. Here, capacity refers to the pre-configured data transfer rate in Kbps for a profile. As part of this feature, CMTS always skips a profile downgrade if CM-STATUS event 16 is not on the current profile, regardless of profile order method configuration. **Command Added**: **cable downstream ofdm-prof-mgmt prof-order-method capacity**

CMTS selects a profile to downgrade, when a cable modem sends a CM-STATUS event 16 to CMTS, on a profile which is currently used. To ensure that a good profile is not skipped, we have added a capacity-based profile ordering method. Here, capacity refers to the pre-configured data transfer rate in Kbps for a profile. This method selects the downgrade profile only based on the actual capacity. The profile with the highest capacity is selected.

If you configure the **capacity** order method, the downgrade order for this illustration is 1 -> 4 -> 3 -> 2. This time Profile 4 which has the highest capacity is not skipped, and is only considered, as capacity based ordering method is configured.

Figure 2: RxMER Measurement Against the Required MER



Configuring Capacity Based OFDM Profile Downgrade Method

Use the **cable downstream ofdm-prof-mgmt prof-order-method capacity** to configure the downgrade of the profile to be based on the capacity. Here is a sample configuration:

```
Router(config)# cable downstream ofdm-prof-mgmt prof-order-method capacity
```

Verifying OFDM Profile Downgrade Method

To verify the configuration, use the **show controllers downstream-cable** *slot/subslot/port* **rf-channel** *rf-channel* **prof-order**. Here is a sample output of the command:

```
Router# show controllers downstream-cable 8/0/0 rf-channel 160 prof-order
OFDM channel data profile order: [8/0/0:160]
Ordering method  : Capacity
RxMER Subcarrier Difference Tolerance: 2%
-----------------------------------------------
Data Profile:       Downgrade Profile:
 Profile 1     ->    Profile 2
 Profile 2     ->    Profile 3
 Profile 3     ->    Profile 4
 Profile 4     ->    Profile 0
```

This command output also displays the type of OFDM profile downgrade method. In this case **Ordering method: Capacity** indicates capacity based OFDM profile downgrade method.

Configuring RxMER to Bit Loading Mapping

There are many ways to map the RxMER values to bit loading values. We use the following mapping recommended in [DOCSIS 3.1 OSSI], as our baseline mapping:

RxMER (in ¼ DB)	QAM	Bit Loading
60	16	4
84	64	6
96	128	7
108	256	8
122	512	9
136	1024	10
148	2048	11
164	4096	12
184	8192	13
208	16384	14

- To configure a margin to adjust the RxMER to bit loading mapping, use the following command:

  ```
  Router(config)# cable downstream ofdm-prof-mgmt mer-margin-qdb quarter-DB
  ```

  This configured value (*quarter-DB*) is added to the RxMER values collected by CMTS before using the above mapping table, thus giving a user more control in selecting the recommended profiles.
- To specify the percentage of subcarriers that can be ignored in the recommended profile calculation, use the following command:

  ```
  Router(config)# cable downstream ofdm-prof-mgmt exempt-sc-pct percent
  ```

  This provides a way to specify the extent that the outliers can be ignored.

Hitless OFDM Profile Changes

Cisco cBR supports Hitless OFDM Profile from Cisco IOS XE Everest 16.12.1x, as a Profile Management Application (PMA) tool.

The operation is as follows:

1. PMA determines if the modulation order of a data profile in an OFDM channel can be upgraded or downgraded. This decision is based on the MER data that is received from cable modems that uses the profile.
2. Poll cBR for all modems with active profiles to identify inactive ones.

3. Move modems to a temporary data profile if all are in use. Note that this is not control profile.
4. Delete any unused OFDM profile. The PMA repeats step 2 and step 3 to avoid race conditions.
5. Add (or Delete) a new OFDM profile with the desired modulation order to the OFDM channel.
6. Define the new profile list for the modems (DBC sent to modems by cBR).
7. Move modems to the new profile.

Ephemeral Profile to Cable Modem Assignment

Cisco cBR supports Ephemeral Profile to Cable Modem Assignment from Cisco IOS XE Everest 16.12.1x, as a Profile Management Application (PMA) tool.

If the modem is not listening to the desired profile, you can submit up to 4 data profiles. The PMA wants to be active for that cable modem before issuing the profile assignment command. The control profile zero (0) is always included by default.

The following commands are supported:

- **cable modem <mac> ofdm-set-profiles chan <n> profiles <profile list>**

  This command initiates a DBC to the cable modem with the specified profile list. The profile list order defines the downgrade profile in case the CM-STATUS is 16.

- **cable downstream ofdm-flow-to-profile interface <integrated-Cable x/y/z:n> profile-data <n> mac-address <mac>**

  This command enables the CMTS to start forwarding all traffic to the cable modem using the specified profile. Ensure that you use the accompanying **cable modem mac-address mac opt0** command for the changes to take effect immediately.

  Move the cable modems traffic to one of the profiles that it is listening to. DBC is not necessary. If the profile is not active on the cable modem, then the CLI reports error. If the CMTS receives a CM-STATUS 16 for that profile, the CMTS downgrades the profile automatically.

  The CM-STATUS does not reset when moving to another profile.

Display the Cable Modem Count per Profile

Feature History

Table 7: Feature History

Feature Name	Release Information	Feature Description
Display CM counts per US IUC and DS profile	Cisco IOS XE Bengaluru 17.6.1x	This feature introduces new commands **show cable modem phy ofdm downstream prof-count** and **show cable modem phy ofdm upstream iuc-count**, it helps tracking and reporting number of Cable Modems being in use per Upstream IUC and Downstream Profile on each controller separately. These counters are indicative of health of the RF plant.

To display the CM count per downstream channel and profile, use the **show cable modem phy ofdm downstream prof-count** command as shown in the examples below:

```
Router#show cable modem phy ofdm downstream prof-count
                      |<---------------------------- CM Count per profile
-------------------------->|
Channel       IF-INDX  P-0  P-1  P-2  P-3  P-4  P-5  P-6  P-7  P-8  P-9 P-10 P-11 P-12 P-13
 P-14 P-15
------------- -------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
 ---- ----
In0/0/0:158   264134     0    0    0    3    0    0    -    -    -    0    -    -    -
-    -    -
In0/0/0:159   264135     0    0    0    3    0    0    -    -    -    0    -    -    -
-    -    -
Do9/0/0:158   321478     1    0    0    0    4    0    -    -    -    0    -    -    -
-    -    -
```

Or use the command in the example below:

```
Router#show controllers downstream-cable 9/0/0 rf-channel 158 prof-status

Profile status:
------------------------------------------------------
Control profile: Oper state: UP, Modem count: 1
    Modem list: 4800.33ef.3aea
Data profile  1: Oper state: UP, Modem count: 0
Data profile  2: Oper state: UP, Modem count: 0
Data profile  3: Oper state: UP, Modem count: 0
Data profile  4: Oper state: UP, Modem count: 4
    Modem list: 4800.33ef.06ca 4800.33ef.0d1a 4800.33ea.716a 4800.33ef.3c52

Data profile  5: Oper state: UP, Modem count: 0
```

Additional References

Technical Assistance

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

Feature Information for Downstream Profile Selection

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 8: Feature Information for Downstream Profile Selection

Feature Name	Releases	Feature Information
Downstream Profile Selection	Cisco IOS XE Everest 16.6.1	This feature was integrated into Cisco IOS XE Everest 16.6.1 on the Cisco cBR Series Converged Broadband Routers.