



DOCSIS3.1 Downstream Zero Bit Loading

This document describes how to configure DOCSIS3.1 Downstream Zero Bit Loading on the Cisco cBR Series Converged Broadband Router.

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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	<p>Cisco IOS-XE Release 16.5.1 and Later Releases</p> <p>Cisco cBR-8 Supervisor:</p> <ul style="list-style-type: none"> • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G 	<p>Cisco IOS-XE Release 16.5.1 and Later Releases</p> <p>Cisco cBR-8 CCAP Line Cards:</p> <ul style="list-style-type: none"> • 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 <p>Digital PICs:</p> <ul style="list-style-type: none"> • PID—CBR-DPIC-8X10G • PID—CBR-DPIC-2X100G <p>Cisco cBR-8 Downstream PHY Module:</p> <ul style="list-style-type: none"> • PID—CBR-D31-DS-MOD <p>Cisco cBR-8 Upstream PHY Modules:</p> <ul style="list-style-type: none"> • 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 DOCSIS3.1 Downstream Zero Bit Loading

Zero Bit Loading (ZBL) is a subcarrier in an OFDM channel, it has power but does not carry any user data. ZBL can be used if the user wants to bypass one or more subcarrier because, for example, cable modem reports that Modulation Error Ratio (MER) is too low on these subcarriers.

Unlike the excluded subcarrier which is defined per RF port and applied to all modulation profiles used on that port's OFDM channels, ZBL is defined per profile and applied to individual OFDM channel.

ZBL is modulated using PRBS (Pseudo Randomness Binary Sequence), it can not be used for other purpose. Excluded subcarrier is not modulated, and does not have power, so it can be used for other purposes, such as video.

For more information about the OFDM, see [DOCSIS 3.1 OFDM Channel Configuration](#).

How to Configure DOCSIS3.1 Downstream Zero Bit Loading

Configuring Downstream Zero Bit Loading

To configure downstream ZBL, follow these steps:

1. Configure ZBL for the data/control profile and the NCP profile.
2. Apply the modulation profiles to a channel profile.
3. Apply the channel profile to an OFDM channel.

Run the following commands as an example to configure ZBL:

```
Router# configure terminal
Router(config)# cable downstream ofdm-modulation-profile 159
Router(config-ofdm-mod-prof)# description an example of ZBL starting at 10MHZ for 1MHZ
Router(config-ofdm-mod-prof)# subcarrier-spacing 50KHZ
Router(config-ofdm-mod-prof)# width 96000000
Router(config-ofdm-mod-prof)# assign modulation-default 1024-QAM
Router(config-ofdm-mod-prof)# assign modulation zero-bit-load range-subcarriers freq-offset
10000000 width 1000000
```

```
Router# configure terminal
Router(config)# cable downstream ofdm-modulation-profile 160
Router(config-ofdm-mod-prof)# description an example for ZBL on NCP profile for one SC
starting 14MHZ
Router(config-ofdm-mod-prof)# subcarrier-spacing 50KHZ
Router(config-ofdm-mod-prof)# width 96000000
Router(config-ofdm-mod-prof)# assign modulation-default 16-QAM
Router(config-ofdm-mod-prof)# assign modulation zero-bit-load list-subcarriers freq-offset
14000000
```

```
Router# configure terminal
Router(config)# cable downstream ofdm-chan-profile 159
Router(config-ofdm-chan-prof)# cyclic-prefix 1024
Router(config-ofdm-chan-prof)# interleaver-depth 16
Router(config-ofdm-chan-prof)# pilot-scaling 48
```

```

Router(config-ofdm-chan-prof)# roll-off 128
Router(config-ofdm-chan-prof)# subcarrier-spacing 50KHZ
Router(config-ofdm-chan-prof)# profile-control modulation-profile 159
Router(config-ofdm-chan-prof)# profile-ncp modulation-profile 160

Router# configure terminal
Router(config)# controller Integrated-Cable 1/0/0
Router(config-controller)# max-ofdm-spectrum 192000000
Router(config-controller)# max-carrier 32
Router(config-controller)# base-channel-power 37
Router(config-controller)# rf-chan 0 3
Router(config-rf-chan)# type DOCSIS
Router(config-rf-chan)# frequency 261000000
Router(config-rf-chan)# rf-output NORMAL
Router(config-rf-chan)# power-adjust 0.0
Router(config-rf-chan)# qam-profile 1
Router(config-rf-chan)# docsis-channel-id 1
Router(config-rf-chan)# exit
Router(config-controller)# rf-chan 158
Router(config-rf-chan)# power-adjust 0.0
Router(config-rf-chan)# docsis-channel-id 159
Router(config-rf-chan)# ofdm channel-profile 159 start-frequency 627000000 width 96000000
plc 648000000

```

Verifying Downstream Zero Bit Loading

To check if the ZBL is taking effect, use **show controllers verbose** command as shown in the example below:

```

router# show controllers integrated-Cable 1/0/0 rf-channel 158 verbose | in ZBL
1024 :634350000[1235] - 636950000[1287]      ZBL :637000000[1288] - 637850000[1305]
      ZBL :637950000[1307] - 637950000[1307]      1024 :638000000[1308] - 641450000[1377]
Active subcarrier count: 1804, ZBL count: 19
      ZBL :641000000[1368] - 641000000[1368]      16  :641050000[1369] - 641450000[1377]
Active subcarrier count: 1804, ZBL count: 1

```

User can also check DPD messages as shown in the example below:

```

router# show cable mac-domain c1/0/0 dpd integrated-Cable 1/0/0 158
DPD Message
  MAC Header
    Frame Control           : 0xC2      (MAC specific, MAC msg, EHDR Off)
    MAC Parameters         : 0x0
    Length                  : 41
    Header Check Sequence   : 0xB242 (45634)
  MAC Management Header
    Destination MAC ADDR    : 01e0.2f00.0001
    Source MAC ADDR         : d42c.447c.2ce9
    Length                  : 23
    Destination SAP         : 0
    Source SAP              : 0
    Control                 : 3
    Version                 : 5
    Type                    : 50
    Multipart               : 0      (Sequence number 0, Fragments 0)
  DPD fields
    DCID                   : 159
    Profile ID              : 0
    CCC                     : 4
    TLV 5 Subcarrier Range/List : Range (continuous)
      Modulation            : 1024 (default value)
      : 0000 - 4095
    TLV 5 Subcarrier Range/List : Range (continuous)

```

```

Modulation                : Zero
                          : 1288 - 1307
DPD Message
MAC Header
  Frame Control           : 0xC2    (MAC specific, MAC msg, EHDR Off)
  MAC Parameters          : 0x0
  Length                  : 39
  Header Check Sequence   : 0xCCAB (52395)
MAC Management Header
  Destination MAC ADDR    : 01e0.2f00.0001
  Source MAC ADDR        : d42c.447c.2ce9
  Length                  : 21
  Destination SAP        : 0
  Source SAP              : 0
  Control                 : 3
  Version                 : 5
  Type                    : 50
  Multipart               : 0      (Sequence number 0, Fragments 0)
DPD fields
  DCID                    : 159
  Profile ID              : 255
  CCC                     : 4
  TLV 5 Subcarrier Range/List
    Modulation            : Range (continuous)
                          : 16 (default value)
                          : 0000 - 4095
  TLV 5 Subcarrier Range/List
    Modulation            : List
                          : Zero
                          : 1368

```

Feature Information for DOCSIS3.1 Downstream Zero Bit Loading

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 <https://cfng.cisco.com/> 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 2: Feature Information for DOCSIS3.1 Downstream Zero Bit Loading

Feature Name	Releases	Feature Information
DOCSIS3.1 Downstream Zero Bit Loading	Cisco IOS XE Fuji 16.8.1	This feature was introduced into the Cisco cBR Series Converged Broadband Routers.

