



# Cisco Remote PHY DS OFDM Channel Configuration

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This document provides information on how to configure DOCSIS 3.1 DS OFDM channel on Remote PHY systems.

## 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.

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## Hardware Compatibility Matrix for Cisco Remote PHY Device



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**Note** Unless otherwise specified, the hardware components introduced in a given Cisco Remote PHY Device Software Release are supported in all subsequent releases.

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Table 1: Hardware Compatibility Matrix for the Cisco Remote PHY Device

Cisco HFC Platform	Remote PHY Device
Cisco GS7000 Super High Output Node	<b>Cisco 1x2 / Compact Shelf RPD Software 2.1 and Later Releases</b> Cisco Remote PHY Device 1x2 <ul style="list-style-type: none"> <li>• PID—RPD-1X2=</li> </ul>
	<b>Cisco 1x2 / Compact Shelf RPD Software 2.1a and Later Releases</b> Cisco Remote PHY Device 1x2 <ul style="list-style-type: none"> <li>• PID—RPD-1X2-PKEY=</li> </ul>
Cisco GS7000 Super High Output Intelligent Node (iNode)	<b>Cisco 1x2 / Compact Shelf RPD Software 4.1 and Later Releases</b> Cisco Intelligent Remote PHY Device 1x2 <ul style="list-style-type: none"> <li>• PID—iRPD-1X2=</li> <li>• PID—iRPD-1X2-PKEY=</li> </ul>



**Note** The -PKEY suffix in the PID indicates units that enable the SCTE-55-2 Out-of-Band protocol support.

## Information About R-PHY DOCSIS 3.1 DS OFDM Channel

Cisco cBR routers support DS OFDM channels in an R-PHY system. The OFDM-channel-support includes one OFDM channel for each Remote PHY device (RPD) with a channel bandwidth up to 192 MHz and the modulation up to 4096 QAM.

Each OFDM channel supports a control profile, the NCP profile, and up to five data profiles. For a line card, a maximum of 16 DS OFDM channels are supported.

## Configure DS OFDM Channel



**Note** To know more about the commands referenced in this section, see the [Cisco IOS Master Command List](#).

## Configure OFDM Channel Profile

To configure the OFDM channel profile, run the following commands:

```

enable
configure terminal

cable downstream ofdm-chan-profile id
  description System Profile id
  cyclic-prefix value
  interleaver-depth value
  pilot-scaling value
  roll-off value
  subcarrier-spacing value
  profile-control {modulation-default mod_prof_id | modulation-profile mod_prof_id}
  profile-ncp modulation-default <mod_prof_id>
  profile-data channel_data_prof_id {modulation-default mod_prof_id | modulation-profile
mod_prof_id}

```

## Configure RPD Port/Controller and Channel

To configure the port or controller and channel, use the following commands.

```

enable
configure terminal
cable rpd <rpd_name_string>
  identifier <xxxx.xxxx.xxxx>
  core-interface Te slot/subslot/port
  principal
  rpd-ds <port> downstream-cable slot/subslot/port profile <ID>
  rpd-us <port> upstream-cable slot/subslot/port profile <ID>

cable downstream controller-profile <ID>
max-ofdm-spectrum value

rf-chan [id]
type DOCSIS
frequency value
  rf-output NORMAL
  qam-profile id
  docsis-channel-id id
rf-chan [id]
  docsis-channel-id id
  ofdm channel-profile id start-frequency value width value [plc value]

```

The OFDM channel IDs range from 158 to 162.

## Configure RF Channel Bandwidth in Wideband Interface

To add the RF channel to a wideband interface, and to specify the RF channel bandwidth allocated for the channel, use the following commands:



**Note** Cisco cBR router does not support Dynamic Bandwidth Sharing (DBS). Hence, the bandwidth-percentage value does not apply.

```

enable
configure terminal
interface Wideband-Cable{slot/subslot/port}:wideband-channel
  cable bundle id

```

```
cable rf-channels channel-list grouplist bandwidth-percent percentage-bandwidth
```

## Verify the Profile Ordering

To view the details of the profile downgrade ordering on a specific OFDM channel, run the following command:

```
Router#show controllers downstream-cable 7/0/0 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
```

## Verify OFDM Channel Profile

To view the details of an OFDM Channel Profile, run the following command:

```
Router# show controllers downstream-Cable 7/0/0 rf-channel 158 verbose
```

```
Chan State Admin Mod-Type Start      Width      PLC      Profile-ID dcid output
                Frequency
158  UP    UP    OFDM    807000000  192000000  963000000    20     162  NORMAL
Resource status: OK
License: granted <20:11:58 CST Jul 3 2017>
OFDM channel license spectrum width: 128200000
Config lock status: Open
OFDM config state: Configured
```

```
OFDM channel details: [7/0/0:158]
```

```
-----
OFDM channel frequency/subcarrier range      : 807000000[ 128] - 998999999[3967]
OFDM spectrum frequency/subcarrier range     : 800600000[  0] - 1005399999[4095]
Active spectrum frequency/subcarrier range    : 808900000[ 166] - 997049999[3929]
OFDM channel center frequency/subcarrier     : 903000000[2048]
PLC spectrum start frequency/subcarrier      : 963000000[3248]
PLC frequency/subcarrier                     : 965800000[3304]
Channel width                               : 192000000
Active Channel width                         : 128200000
OFDM Spectrum width                         : 204800000
Chan prof id                                : 20
Cyclic Prefix                               : 1024
Roll off                                     : 128
Interleave depth                             : 16
Spacing                                       : 50KHZ
Pilot Scaling                               : 48
Control modulation default                   : 1024
NCP modulation default                       : 16
Data modulation default                      : None
Data modulation profile                      : None
Lower guardband width in freq/subcarriers    : 1900000[38]
Upper guardband width in freq/subcarriers    : 1900000[38]
```

```
PLC spectrum frequencies [subcarriers]      :
963000000[3248] - 968999999[3367]
```

```
PLC channel frequencies [subcarriers]      :
965800000[3304] - 966199999[3311]   Size: 8 subcarriers
```

```

Excluded frequencies [subcarriers]                :
800600000[  0] - 808899999[ 165]    865000000[1288] - 924999999[2487]
997100000[3930] - 1005399999[4095]
Count: 1532

Pilot frequencies [subcarriers]                  :
*:PLC pilots
810150000[ 191]    812700000[ 242]    815250000[ 293]    817800000[ 344]
820350000[ 395]    822900000[ 446]    825450000[ 497]    828000000[ 548]
830550000[ 599]    833100000[ 650]    835650000[ 701]    838200000[ 752]
840750000[ 803]    843300000[ 854]    845850000[ 905]    848400000[ 956]
Count: 4

Active frequencies [subcarriers]                :
808900000[ 166] - 864999999[1287]    925000000[2488] - 997099999[3929]
Count: 2564

Data frequencies [subcarriers]                 :
808900000[ 166] - 810149999[ 190]    810200000[ 192] - 812699999[ 241]
812750000[ 243] - 815249999[ 292]    815300000[ 294] - 817799999[ 343]
817850000[ 345] - 820349999[ 394]    820400000[ 396] - 822899999[ 445]
822950000[ 447] - 825449999[ 496]    825500000[ 498] - 827999999[ 547]
..
Count: 2500

Profiles:
Number of profiles: 2
CTRL profile (Profile A): rate: 864000 kbps
Active frequencies [subcarriers]:
Modulation:Start-freq[start-subcarrier] - End-freq[end-subcarrier]
-----
1024 :808900000[ 166] - 810100000[ 190]    1024 :810200000[ 192] - 812650000[ 241]
1024 :812750000[ 243] - 815200000[ 292]    1024 :815300000[ 294] - 817750000[ 343]
1024 :817850000[ 345] - 820300000[ 394]    1024 :820400000[ 396] - 822850000[ 445]
1024 :822950000[ 447] - 825400000[ 496]    1024 :825500000[ 498] - 827950000[ 547]
...

Active subcarrier count: 2500, ZBL count: 0
Discontinuity time [days:hours:mins:secs]: 00:00:00:00

NCP profile:
Active frequencies [subcarriers]:
Modulation:Start-freq[start-subcarrier] - End-freq[end-subcarrier]
-----
16   :808900000[ 166] - 810100000[ 190]    16   :810200000[ 192] - 812650000[ 241]
16   :812750000[ 243] - 815200000[ 292]    16   :815300000[ 294] - 817750000[ 343]
16   :817850000[ 345] - 820300000[ 394]    16   :820400000[ 396] - 822850000[ 445]
16   :822950000[ 447] - 825400000[ 496]    16   :825500000[ 498] - 827950000[ 547]
...

Active subcarrier count: 2500, ZBL count: 0

CCCs:
OCD CCC: 1
DPD CCCs:
Control profile (Profile A) CCC: 1
NCP profile CCC: 1
Resource config time taken: 29 msecs
JIB channel number: 768
Chan Pr EnqQ Pipe RAF SyncTmr DqQ ChEn RAF Tun# SessionId Valid P/S XFI 0[TkbRt MaxP]
1[TkbRt MaxP]
768 0 384 0 308 0 384 1 5551 0 16778240 TRUE 0 0 479610000 4485120

```

```

383688000 4485120
768 1 384 0 4786 0 384 1 2190 0 16778240 TRUE 0 0 479610000 4485120
383688000 4485120
Encap Chan-id Data:0 PLC:5
Chan Qos-Hi Qos-Lo Med-Hi Med-Lo Low-Hi Low-Lo
768 24576 16384 24576 16384 40960 24576
Chan Med Low TB-neg Qos_Exc Med_Xof Low_Xof Qdrops(H-M-L) Pos Qlen(Hi-Med-lo) Fl Tgl_cnt
Rdy_sts
768 0 0 0 0 0 0 0 0 0 0 Y 0 0 0 0
0 ff
Chan Rate Neg Pos LastTS CurrCr Pos [PLC Rate Neg Pos]
768 10485750 65535 65535 123395759 268431360 Y [MM 86 128 1024][EM 87 128 6144][TR 2
9 3072]

```

## Verify OFDM Channel

To view the details of an OFDM channel, run the following command:

```
Router#show controllers downstream-Cable 7/0/0 counter ofdm-channel
```

Controller	Chan#	Profile/PLC	Packets	Bytes	MaxRate (Mbps)	Rate (Mbps)	Utilization (%)
7/0/0	158	Total	101694	9225522	-	0.015590	0.0
7/0/0	158	0	29216	2557604	864	0.004551	0.0
7/0/0	158	PLC-MMM	72474	6667608		0.011039	
7/0/0	158	PLC-EM	0	0		0.000000	
7/0/0	158	PLC-TR	0	0		0.000000	

## Verify OCD and DPD of MAC Domain

To display the MAC domain's OFDM Channel Descriptor (OCD) and Downstream Profile Descriptor (DPD) messages, use the **show cable mac-domain dpd | ocd** command in privileged EXEC mode.

```
Router# show cable mac-domain cable 7/0/0 ocd
```

```
DCID: 162 OFDM Controller:channel 7/0/0:158
```

```

OCD Message
MAC Header
  Frame Control          : 0xC2 (MAC specific, MAC msg, EHDR Off)
  MAC Parameters         : 0x0
  Length                 : 190
  Header Check Sequence  : 0x84A2 (33954)
MAC Management Header
?
  Destination MAC ADDR   : 01e0.2f00.0001
  Source MAC ADDR        : c414.3c17.3ead
  Length                 : 172
  Destination SAP        : 0
  Source SAP              : 0
  Control                 : 3
  Version                 : 5
  Type                   : 49
  Multipart               : 0 (Sequence number 0, Fragments 0)
OCD fields
  DCID                   : 162
  CCC                     : 1
  TLV 0 Spacing          : 50 KHz
  TLV 1 Cyclic Prefix    : 1024 samples

```

```

TLV 2 Rolloff                : 128 samples
TLV 3 Spectrum Location      : 800600000 Hz
TLV 4 Interleave Depth       : 16
TLV 5 Subcarrier Assignment   : Continuous Pilots (list)
    0191 0242 0293 0344 0395 0446 0497 0548 0599 0650
    0701 0752 0803 0854 0905 0956 1007 1058 1109 1160
    1211 1262 2513 2564 2615 2666 2717 2768 2819 2870
    2921 2972 3023 3074 3125 3176 3227 3257 3269 3280
    3289 3326 3335 3346 3358 3398 3449 3500 3551 3602
    3653 3704 3755 3806 3857 3908
TLV 5 Subcarrier Assignment   : Excluded Subcarriers (range)
                                : 0000 - 0165
TLV 5 Subcarrier Assignment   : Excluded Subcarriers (range)
                                : 1288 - 2487
TLV 5 Subcarrier Assignment   : Excluded Subcarriers (range)
                                : 3930 - 4095
TLV 5 Subcarrier Assignment   : PLC Subcarriers (range)
                                : 3304 - 3311
TLV 6 Primary Capable        : 0 (No)

```

---

## Verify Profile Management Data

To view the detailed profile management data associated with each cable modem.

```
Router#show cable modem c0c6.87ff.dabc prof-mgmt
```

```
Downstream Profile Management Data:
MAC Address       : c0c6.87ff.dcea
IP Address        : 60.11.0.12
IPv6 Address      : ---
```

```
RxMer Exempt Percent : 2
RxMer Margin qdB     : 0
Automatic Prof Dwngrd : Active
```

```
DCID                : 162
Configured Profile(s) : 0
Profile(s) in REG-RSP-MP : 0
Profile(s) in DBC-REQ   : N/A
Current profile       : 0 [1024-QAM]
Percentages of ideal BL vs Curr Prof : 96 (better) 3 (equal)
Downgrade profile     : 0
Recommend profile     : 0
Unfit profile(s)      : N/A
Recommend profile (Expired) : N/A
Unfit profile(s) (Expired) : N/A
```

```
Number of SubCarriers : 4096
1st Active SubCarrier : 166
# of Active SubCarriers: 3764
Tx Time               : 0h:15m:15s ago
Rx Time               : 0h:15m:15s ago
```

```
OFDM Profile Failure Rx: N/A
MER Poll Period (min): 60
Recommend Timeout (min): 120
Unfit Timeout (min): 60
Source               : OPT
```

```
Sub-   RxMER
Carrier
0x0000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
0x0020 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
0x0040 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
```

```

0x0060 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
0x0080 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
0x00A0 00000000 0000A5A3 A4A1A2A1 A5A3A39E A5A3A6A4 A6A1A6A2 A3A69FA2 A1A4A4A2
0x00C0 A2A0A4A4 A49EA7A6 A4A29EA4 A2A2A1A4 A3A1A1A4 A4A3A0A6 A4A1A4A6 A4A4A2A5
0x00E0 A5A2A3A5 A8A3A3A3 A6A1A1A0 A2A3A4A4 A3A2A19E A4A89FA3 A4A4A3A4 A4A4A5A2
0x0100 A5A3A1A1 A0A4A59E 9FA2A3A3 9F9FAAA4 A5A09FA4 A4A1A2A6 9DA1A1A0 A4A2A4A3
0x0120 A3A0A3A8 A29FA5A5 A3A6A1A0 A69EA1A2 A1A2A3A2 A1A2A3A5 9FA6A4A5 A1A7A4A4
0x0140 A5A4A5A1 A3A4A2A4 A2A2A4A3 A1A2A5A4 A19FA4A5 A1A0A5A4 9FA4A1A1 A6A2A59F
0x0160 A1A2A4A5 A3A5A4A1 A4A3A5A1 A3A3A5A0 A0A3A3A0 A2A3A3A3 A2A2A2A5 A5A4A4A3
0x0180 9EA4A3A1 A4A5A2A3 A29FA39F A6A1A0A2 A4A59FA3 A4A2A4A1 A2A4A3A3 A6A39DA2
0x01A0 A3A1A1A2 A3A2A2A1 A2A0A39F A7A39FA5 A1A4A4A1 A2A4A2A0 A6A49F9F A6A39D9F
0x01C0 9FA2A5A2 9BA1A1A0 A3A2A1A3 A39FA3A1 A19EA3A5 9DA1A0A0 A3A0A39F A0A3A2A1
0x01E0 A5A4A0A1 A0A39F9E A09FA2A4 9FA2A39F A2A3A49C A3A29FA0 A0A3A2A5 A3A0A1A1
... ..
Upstream Profile Management Data:

```

## Verify OCD and DPD Messages in RPD

To view OCD and DPD messages from RPD, run the following command. The output must be identical to the messages on Cisco cBR-8 routers.

```

RPD-config# show downstream ofdm configuration
OCD Message

OCD fields
  DCID                               : 0
  CCC                                 : 1
  TLV 0 Spacing                       : 50 KHz
  TLV 1 Cyclic Prefix                 : 1024 samples
  TLV 2 Rolloff                       : 128 samples
  TLV 3 Spectrum Location              : 800600000 Hz
  TLV 4 Interleave Depth              : 16
  TLV 5 Subcarrier Assignment         : Continuous Pilots (list)
    191 242 293 344 395 446 497 548 599 650
    701 752 803 854 905 956 1007 1058 1109 1160
    1211 1262 2513 2564 2615 2666 2717 2768 2819 2870
    2921 2972 3023 3074 3125 3176 3227 3257 3269 3280
    3289 3326 3335 3346 3358 3398 3449 3500 3551 3602
    3653 3704 3755 3806 3857 3908
  TLV 5 Subcarrier Assignment         : Excluded Subcarriers (range)
    : 0 - 165
  TLV 5 Subcarrier Assignment         : Excluded Subcarriers (range)
    : 1288 - 2487
  TLV 5 Subcarrier Assignment         : Excluded Subcarriers (range)
    : 3930 - 4095
  TLV 5 Subcarrier Assignment         : PLC Subcarriers (range)
    : 3304 - 3311
  TLV 6 Primary Capable               : 1 (Yes)

DPD Message
DPD fields
  DCID                               : 0
  Profile ID                          : 0
  CCC                                 : 1
  TLV 5 Subcarrier Range/List         : Range (continuous)
    Modulation                        : 1024 (default value)
    : 0 - 4095

DPD Message
DPD fields
  DCID                               : 0
  Profile ID                          : 255
  CCC                                 : 1

```



```

TLV 5 Subcarrier Range/List : Range (continuous)
Modulation                   : 16 (default value)
                             : 0 - 4095

```

## Verify per-Profile Counter on RPD

The following example shows how to verify the per-profile counter on RPD:

```
RPD-config# show downstream ofdm counter profile
```

Profile	Pkts	Sum-Pkts	Bytes	Sum-Bytes	Codewords	Sum-Codewords
0	7735	7735	677110	677110	4815	4815
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0

## Verify the Drop Counter in DPS

To verify the drop counter, especially in the DPS module, run the following command:

```

RPD-config#show downstream channel counter
----- Packets counter in TPMI -----

Level      Rx-pkts    Rx-sum-pkts
Node Rcv   32690704   32690704
Depi Pkt   32471383   32471383

Port Chan  Rx-pkts    Rx-sum-pkts
DS_0 0     3599407    3599407
DS_0 1     3605066    3605066

DS_0 5     3602293    3602293
DS_0 6     3596193    3596193
DS_0 7     3598393    3598393
DS_0 8     599        599
US_0 5     598656     598656

Port      Rx-pkts    Rx-sum-pkts Drop-pkts Drop-sum-pkts
DS_0     28998897   28998897   0         0
US_0     3602539    3602539    0         0
US_1     2244       2244       0         0

----- Packets counter in DPMI -----

```

## Configuration Example

```

Field          Pkts      Sum-pkts
Dpmi Ingress  28844845  28844845
Pkt Delete    0         0
Data Len Err  0         0

Chan Flow_id  Octets      Sum-octs  SeqErr-pkts  SeqErr-sum-pkts
0  0  374242      374242      1           1
0  1  710485      710485      1           1
0  2  218477141   218477141   1           1
0  3  0           0           0           0
1  0  379530      379530      1           1
1  1  700973      700973      1           1
1  2  218859695   218859695   1           1
1  3  0           0           0           0
2  0  372126      372126      1           1
2  1  695623      695623      1           1

31  2  0           0           0           0
31  3  0           0           0           0
158 0  0           0           0           0
158 1  682214      682214      1           1
158 2  0           0           0           0
158 3  0           0           1           1
163 0  0           0           0           0
163 1  0           0           1           1
163 2  0           0           0           0
163 3  1654620     1654620     1           1

```

----- Packets counter in DPS -----

```

Chan Tx-packets Tx-octets  Drop-pkts  Tx-sum-pkts  Tx-sum-octs  Drop-sum-pkts
0  3599803    219580072  0          3599803      219580072    0
1  3605466    219958582  0          3605466      219958582    0
2  3602414    219728291  0          3602414      219728291    0
3  3604543    219858566  0          3604543      219858566    0

31  599        20366      0          599          20366        0
158 7797       682524     0          7797         682524       0

```

## Configuration Example

The following example shows how to configure OFDM channel:

```

cable downstream ofdm-chan-profile 0
  description System Profile 0
  cyclic-prefix 1024
  interleaver-depth 16
  pilot-scaling 48
  roll-off 128
  subcarrier-spacing 50KHZ
  profile-control modulation-default 256-QAM
  profile-ncp modulation-default 16-QAM
  profile-data 1 modulation-default 1024-QAM

cable downstream controller-profile 100
  max-ofdm-spectrum 192000000
  rf-chan 0 7
  type DOCSIS

```

```

frequency 453000000
rf-output NORMAL
qam-profile 1
docsis-channel-id 1
rf-chan 158
docsis-channel-id 159
ofdm channel-profile 0 start-frequency 645000000 width 192000000 plc 651000000

cable rpd node_0873
identifier 0004.9f00.0873
core-interface Te7/1/0
principal
rpd-ds 0 downstream-cable 7/0/0 profile 100
rpd-us 0 upstream-cable 7/0/0 profile 1

```

## Feature Information for RPHY DS OFDM Channel Configuration

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](http://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 2: Feature Information for RPHY DS OFDM Channel Configuration**

Feature Name	Releases	Feature Information
Remote PHY DS OFDM Channel Configuration	Cisco 1x2 / Compact Shelf RPD Software 3.1	This feature was integrated into the Cisco Remote PHY Device.

