

Compact Reverse Transmitters with DFB or CWDM Lasers

Cisco® Compact Nodes can be configured with a variety of optical reverse transmitters to provide flexibility for use in multiple applications. These reverse transmitters are plug-in modules that deliver a cost-effective, user-friendly solution for upstream transmission. The Compact Reverse Transmitters (Figure 1) are available with distributed feedback (DFB) or Coarse Wavelength Division Multiplexing (CWDM) lasers.

All transmitters feature a built-in microprocessor and pilot tone for easy set-up of the reverse path. The pilot tone does not take up any reverse bandwidth as it is placed at 5 MHz. Moreover, placing the pilot tone at 5 MHz also makes the reverse transmitter interoperable with virtually all reverse receivers in the marketplace. If there is no modulation, the pilot tone serves as a quieting tone, which reduces spurious noise and improves overall noise performance with up to 15 dB. All reverse transmitters have increased gain, which allows low reverse input levels at the node.

The reverse transmitter can also run in burst mode which makes it possible to deploy Cisco Compact Nodes in a radio frequency over glass (RFOG) network.

Reverse Transmitters and CWDM

The reverse transmitters (Figure 2) are an integral part of the CWDM transport system making it possible for each fiber in a hybrid fiber-coaxial (HFC) network to support a sixteen-fold increase in the number of wavelengths available. The CWDM lasers offer two output powers, 3 dBm and 6 dBm.

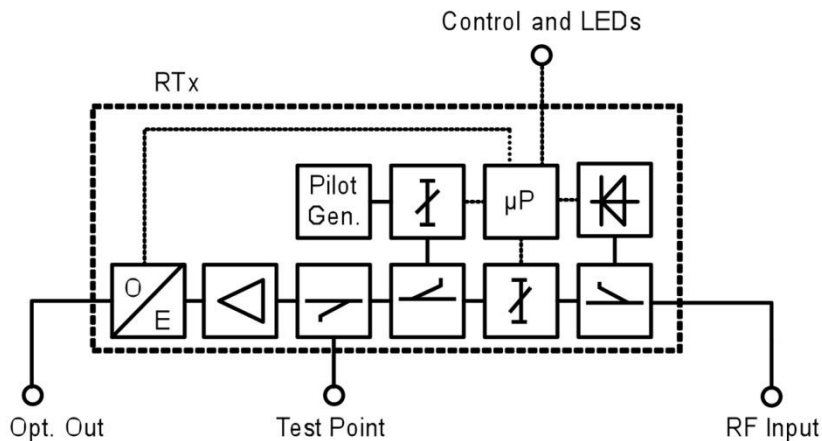
Figure 1. Reverse Transmitter



General Features

- Designed to operate within the Cisco Compact Nodes (A90100/A90300, A90200, A90201)
- Variable modulation depth (RF drive level) promotes superior link optimization
- RF input test point
- 5-MHz pilot tone for easy setup
- Multiple setup and control options
 - Local control with front panel or Cisco Handheld Programmer Terminal Model 91200
 - Advanced element management (status monitoring and control) interface
- Nonvolatile storage of preset operating parameters
- Remote optical modulation index (OMI) setting, when supported by node
- Burst mode for interoperability in RFoG
- 0 dBm DFB
- 3 dBm and 6 dBm, DFB available in 16 CWDM wavelengths
- Uncooled DFB lasers with Isolator for exceptional performance and low power consumption

Figure 2. Reverse Transmitter Block Diagram



Noise Power Ratio (NPR) Performance

Figures 3 through 5 show the NPR performance of the Compact Reverse Transmitter.

Test condition: Prisma[®] II Reverse Optical Receiver (part number: P2-RRX-STD), 10 dB optic link (20 km glass, plus passive loss), Cisco Compact EGC Fiber Deep Node A90100 in default setting, with reverse transmitter attenuator at 10dB and room temperature.

Figure 3. NPR Performance for 5 to 65 MHz in Normal Mode

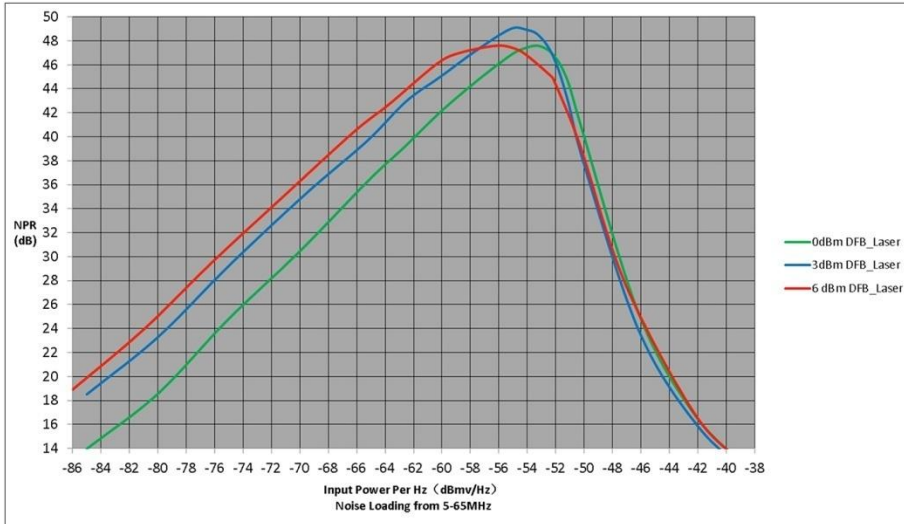


Figure 4. NPR Performance for 5 to 204 MHz in Normal Mode

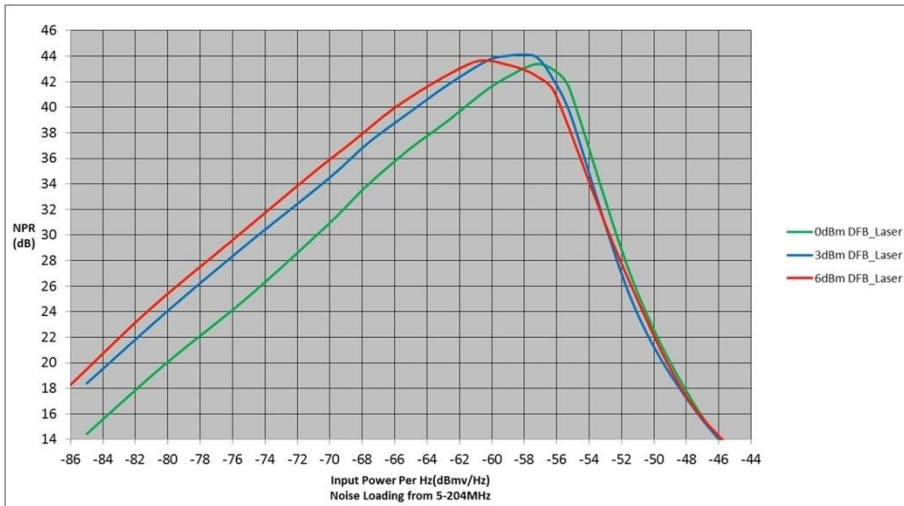
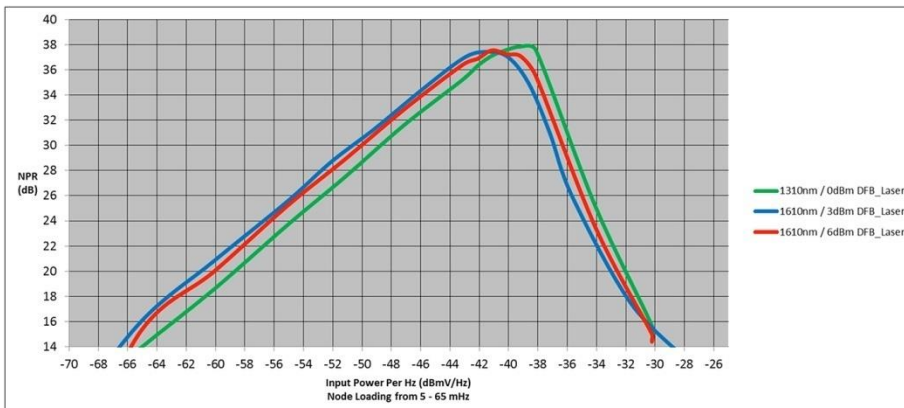


Figure 5. NPR Performance for 5 to 65 MHz in Burst Mode



Node Correction Factor

A Cisco A90100 Node is used in the NPR tests in figures 3 through 5. For the nodes listed in Table 1, the X-axis in the three figures, which indicates input power per hertz, must move to the left by the correction factor also listed in Table 1. The node is set to its default configuration and tested with a reverse jumper in the diplexer slot.

Table 1. Node Correction Factor

Cisco Node	Correction Factor (dB)
A90201	1 (gain)
A90100/A90300	0
A90200	-2.2 (loss)

Example: Node type A90200 has a correction factor of -2.2 dB. From the NPR-curve (Figure 3), a 0 dBm DFB laser (part number: CMPT-RTX-0-13) will have the best NPR performance (47.5dB) at an input of -53 dBmV/Hz. For Node type A90200 the required input power at the port will need to increase to -50.8 dBmV/Hz (= -53 - (-2.2)) to achieve the best NPR performance.

NPR Performance Descriptions

The NPR performance plots contained in this document depict the NPR performance on a reference 10 dB fiber optic link.

With other link losses, the following items vary from that shown on the reference 10 dB link plots.

- NPR dynamic range for a given minimum NPR performance (Carrier to Noise ratio)
- NPR value for a given transmitter RF input level

To determine an NPR dynamic range for a different link loss: Add (or subtract) the correction factor from Table 2. Associated with the desired link loss to (or from) the dynamic range shown on the reference 10 dB link NPR plots. Note that the associated increase (or decrease) in dynamic range affects only the left side of the NPR curve (minimum RF input side), since that is the portion of the curve affected by changes to the traditional noise sources associated with optical link.

To determine an NPR value for a different link loss: Add (or subtract) the correction factor from Table 2 associated with the desired link loss to (or from) the NPR value shown on the 10 dB link NPR plot for a given RF input level. Again, only the NPR values on the left side of the NPR curve (prepeak values) are to be adjusted. The NPR values and slope associated with the right side of the NPR curve (post peak values) are primarily due to laser clipping at high RF input levels. Therefore, they do not vary appreciably with link loss, but only with the channel load.

Table 2 lists link loss correction factors.

Table 2. Link Loss Correction Factors for 5 to 65 MHz

Optical Link loss (dB)	Fiber Length (km)	Loss Correction Factor (dB)		
		0dBm DFB	3dBm DFB/CWDM	6dBm CWDM
2	0	6	3.25	N/A
6	12.5	1	1	1
8	12.5	0.5	0.5	0.9
9	20	0	0	0

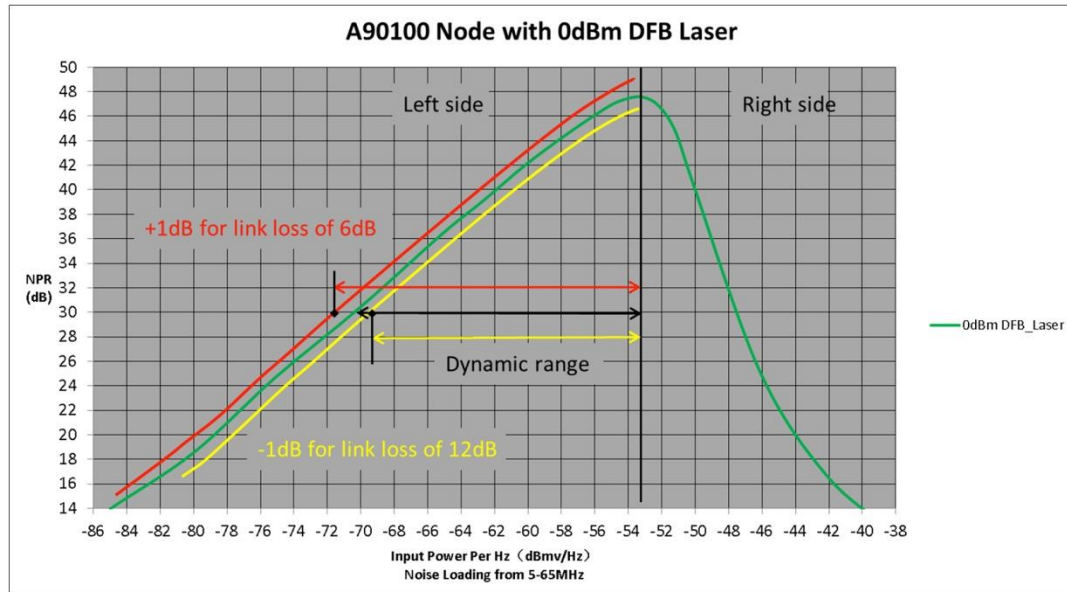
Optical Link loss (dB)	Fiber Length (km)	Loss Correction Factor (dB)		
		0dBm DFB	3dBm DFB/CWDM	6dBm CWDM
10	20	0	0	0
12	20	-1	-1	-1
15	20	-3.5	-3	-1.6
18	20	-8	-7	-4.5
20	20	N/A	-10	-6.5

Table 3. Link Loss Correction Factors for 5 to 204 MHz

Optical Link loss (dB)	Fiber Length (km)	Loss Correction Factor (dB)		
		0dBm DFB	3dBm DFB/CWDM	6dBm CWDM
2	0	5	2,4	NA
6	12.5	3	1	1, 5
8	12.5	2, 5	0, 5	1
9	20	0	0	0
10	20	0	0	0
12	20	-1	-1, 5	-0, 5
15	20	-3	-3, 5	-2
18	20	-6	-6	-3, 5
20	20	-8, 5	-8	-5, 5

Example: Figure 6 shows how dynamic range (for NPR of 30 dB) of a 0 dBm DFB-laser will be influenced for 6 dB link loss and 15 dB link loss for 5 to 65 MHz.

Figure 6. Example of NPR Performance



Product Specifications

This section lists product specifications for.

Table 4. Specifications

Optical Performance	Unit	DFB laser	CWDM laser 3 dBm	CWDM laser 6 dBm	Note
Wavelength	nm	1310 ±30	1270, 1290, 1310, 1330, 1350, 1370, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 Tolerance: ±3 (CWDM)	1270, 1290, 1310, 1330, 1350, 1370, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 Tolerance: ±3 (CWDM)	At 25°C ambient temperature
Connector options	See Ordering Information				
Output power	dBm/dB	0 ±0.5 or 3 ±0.5	3 ±0.5	6 ±0.5	
Electrical Performance					
Frequency range	MHz	5 to 300			
Input level (normal mode)	dBμV	60 to 70			At module input @ 10% OMI
Test point	dB	-10			
Input Return Loss					
5–300 MHz	dB	≤ -20			At 40 MHz decreasing with 1.5 dB/octave and module on
Spurious Noise Level					
Carrier on/pilot on	dBc	-50	-55	-60	
Carrier off/pilot on	dBc	-50	-55	-55	
Carrier off/pilot off	dBc	-33	-33	-33	
Flatness for 5–204 MHz	dB	≤ ±0.5			≤ ±0.7 for 5 to 300 MHz
Power consumption	W	≤ 2.25	≤ 2.25	≤ 2.50	Measured in node
Burst Mode					
Standard		ANSI/SCTE 174			
Transmitter input level (burst mode)	dBμV	≥ 82			For 10% OMI with 10 dB internal attenuation; recommended symbol rate = 5.12 MS/s
Laser rise time	μs	< 1.3			
Laser fall time	μs	< 1.6			
Pilot tone					
Frequency	MHz	5			
Level	dBμV	35 to 45			
Environmental					
Node operating Temperature range	°C	-15 to +55			
Mechanical					
Dimensions (H x W x D)	mm	22 x 69 x 77			
Weight	g	105			

Optical Performance	Unit	DFB laser	CWDM laser 3 dBm	CWDM laser 6 dBm	Note
Element Management Parameters - Alarms					
<ul style="list-style-type: none"> • Alarms from reverse transmitter <ul style="list-style-type: none"> ◦ Module OK ◦ Laser aging ◦ Laser failure 					
Element Management Parameters – Status information (depending on node)					
<ul style="list-style-type: none"> • Factory data <ul style="list-style-type: none"> ◦ Wavelength ◦ Output power ◦ Frequency range • Laser bias current 					
Element Management Parameters - Settings					
<ul style="list-style-type: none"> • OMI setting (internal attenuator 0 – 10dB) • Pilot tone level • Transmitter on/off • Pilot tone on/off 					

Ordering Information

Table 5 lists ordering information for reverse transmitters. Table 6 provides ordering information for **required** accessories, which must be ordered separately.

To place an order, visit the [Cisco Ordering Home Page](#).

Table 5. Ordering Information

Reverse DFB Transmitters	Part Number
0 dBm, 1310 nm, DFB laser, pigtail with SA/APC connector	CMPT-RTX-0-13
3 dBm, 1310 nm, DFB laser, pigtail SA/APC connector	CMPT-RTX-3-13
Reverse CWDM Transmitters	Part Number
3 dBm, 1270 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1270
3 dBm, 1290 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1290
3 dBm, 1310 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1310
3 dBm, 1330 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1330
3 dBm, 1350 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1350
3 dBm, 1370 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1370
3 dBm, 1430 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1430
3 dBm, 1450 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1450
3 dBm, 1470 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1470
3 dBm, 1490 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1490
3 dBm, 1510 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1510
3 dBm, 1530 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1530
3 dBm, 1550 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1550
3 dBm, 1570 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1570
3 dBm, 1590 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1590
3 dBm, 1610 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-3-1610
6 dBm, 1270 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1270
6 dBm, 1290 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1290

6 dBm, 1310 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1310
6 dBm, 1330 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1330
6 dBm, 1350 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1350
6 dBm, 1370 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1370
6 dBm, 1430 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1430
6 dBm, 1450 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1450
6 dBm, 1470 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1470
6 dBm, 1490 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1490
6 dBm, 1510 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1510
6 dBm, 1530 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1530
6 dBm, 1550 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1550
6 dBm, 1570 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1570
6 dBm, 1590 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1590
6 dBm, 1610 nm, CWDM laser, pigtail SA/APC connector	CMPT-RTX-6-1610

Table 6. Required Accessories

Accessories	Part Number
<p>One adapter is required for each optical connection.</p> <p>Optical connector on the reverse transmitter module is SC/APC.</p> <ul style="list-style-type: none"> Adapter SC/APC to SC/APC 	A90540.1088

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For More Information

To learn more about Cisco Compact Reverse Transmitters, visit:

<http://www.cisco.com/c/en/us/products/video/compact-nodes/index.html>



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