

Cisco Compact Reverse Transmitters 9008x with FP, DFB or CWDM Lasers

Compact nodes can be configured with a variety of optical reverse transmitters to provide flexibility for use in multiple applications. The reverse transmitters are plug-in modules that deliver a cost-effective, user-friendly solution for upstream transmission. The Cisco[®] Compact Reverse Transmitters 9008x are available with Fabry-Perot (FP), distributed feedback (DFB), or Coarse Wavelength Division Multiplexing (CWDM) lasers.

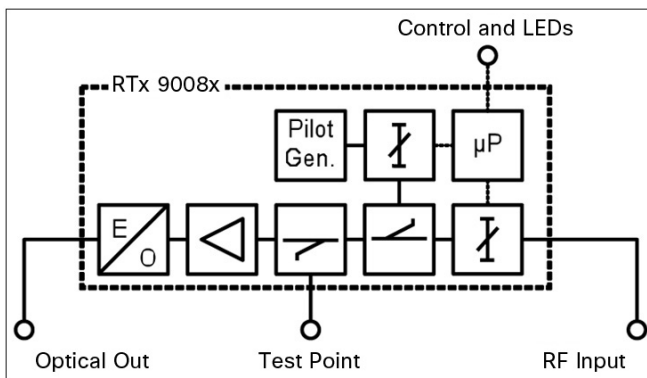
All reverse transmitters feature a built-in microprocessor and pilot tone for easy setup of the reverse path. The pilot tone does not take up any reverse bandwidth, as it is placed at 5 MHz. Placing the pilot tone at 5 MHz also makes the reverse transmitter interoperable with almost all reverse receivers in the marketplace. In the event of 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. Figure 1 shows the 90080 model.

Figure 1. Cisco Compact Reverse Transmitter 90080



Figure 2 provides a block diagram for the reverse transmitters.

Figure 2. Cisco Compact Reverse Transmitter 9008x Block Diagram



General Features

- Designed to operate within the compact platform of optical nodes
- Variable modulation depth (RF drive level) supports superior link optimization
- RF input test point
- 5 MHz pilot tone for easy setup
- Multiple setup and control options:
 - Local control through front panel or Cisco Handheld Programmer Terminal 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)

Additional Features Type 90080

- Uncooled high-performance FP lasers

Additional Features Type 90083 and 90086

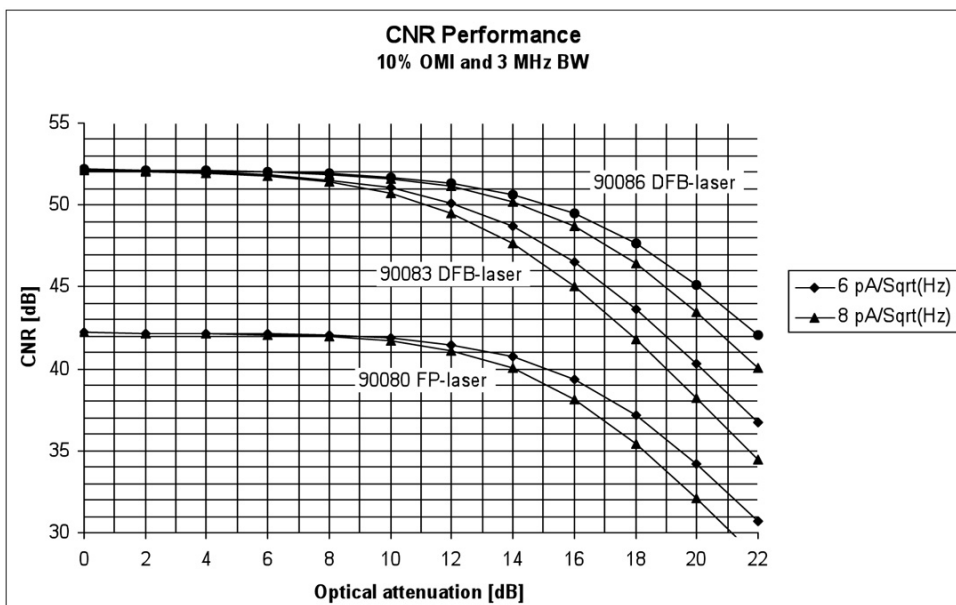
The 90083 and 90086 reverse transmitters are an integral part of the CWDM transport system enabling each fiber in a hybrid fiber-coaxial (HFC) network to support a 16-fold increase in the number of wavelengths available.

- 90083: 3 dBm, 1310 nm DFB available in 16 CWDM wavelengths
- 90086: 6 dBm, 1550 nm DFB available in 16 CWDM wavelengths
- Uncooled DFB lasers with isolator for exceptional performance and low power consumption

Carrier-to-Noise Ratio Performance

Figure 3 shows carrier-to-noise ratio (CNR) performance data.

Figure 3. CNR Performance

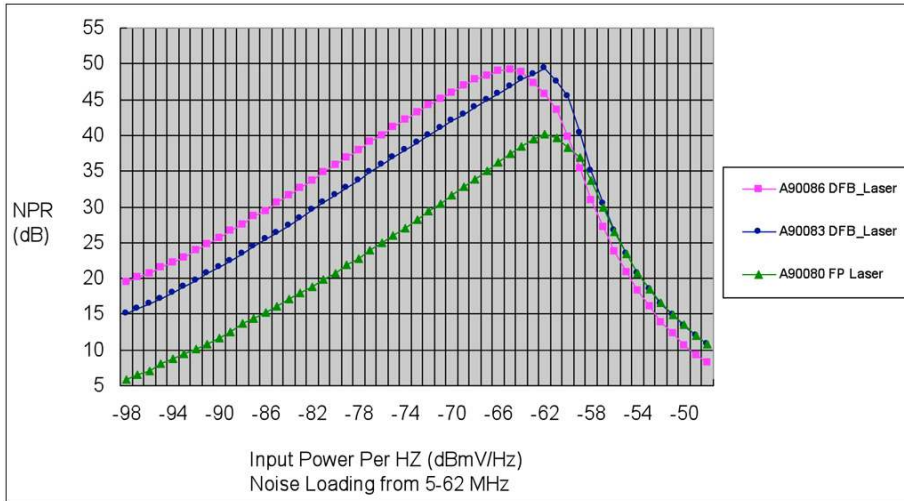


NPR Performance Descriptions

NPR Performance Type 9008x Reverse Transmitter

The test condition shown in Figure 4 is: Cisco Prisma® II Reverse Optical Receiver, 10 dB Optic Link (20 km glass, plus passive loss), node A90090 in default setting, and room temperature.

Figure 4. NPR Performance



Node Correction Factor

An A90090 Node is used in the above NPR tests. For other nodes as listed in Table 1, the X axis, which presents input power per Hertz must move to the left by a correction factor (node with default configuration and test with a reverse jumper).

Table 1. Node Correction Factor

Node	Correction Factor (dB)
A90090/A90093	0
A90201 (preliminary)	0.5
A90100/A90300	1.5
A90200	3.7
A90285/A90286	6.5
A90075/A90275	6.5

Example: Node type A90200 has a correction factor of 3.7 dB. From the NPR curve in Figure 4, a FP laser (A90080) will have the best NPR performance (40dB) at an input of -62dB/Hz. For Node type A90200 the required input power/Hz will need to increase to -58.3 dB/Hz (= -62+ 3.7) to achieve the best NPR performance.

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 (C/N) performance
- 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 associated with the desired link loss to (or from) the dynamic range shown on the reference 10 dB link NPR plot. 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 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 (pre-peak 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 the high RF input levels, and therefore do not vary appreciably with link loss.

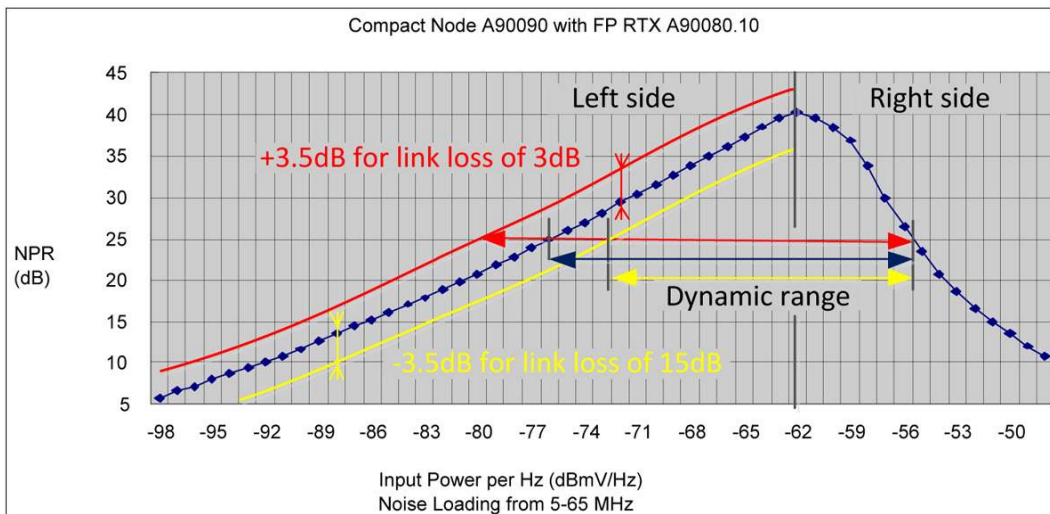
Table 2 lists link loss correction factors.

Table 2. Link Loss Correction Factors

Optical Link Loss (dB)	Fiber Length (km)	Loss Correction Factor (dB)		
		A90080	A90083	A90086
2	0	6	3.25	N/A
3	5	3.5	1.8	1.5
6	12.5	1	1	1
8	12.5	0.5	0.5	0.9
9	20	0	0	0
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

Example: Figure 5 shows how dynamic range (for NPR of 25 dB) of a FP-laser (A90080.10) will be influenced for 3 dB link loss and 15 dB link loss.

Figure 5. Example of NPR Performance



Product Specifications

Table 3 lists the product specifications.

Table 3. Specifications

Optical Performance	Unit	90080	90083	90086	Note
Wavelength	nm	1310 ±30	1310 ±20 (DFB) 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 section				
Output power	dBm/dB	0 ±0.5	3 ±0.5	6 ±0.5	
Electrical Performance					
Frequency range	MHz	5-200			
Input level	dBµV	60-70			At module input 10% OMI
Input Level Return Loss					
At 5-200 MHz	dB		≤ -20		At 40 MHz decreasing with 1.5 dB per octave and module on
Spurious Noise Level					
Carrier off/pilot on	dBc	-	-50	-55	
Carrier off/pilot on	dBc	-	-55	-60	
Carrier off/pilot off	dBc	-	-33	-33	
Flatness at 5-200 MHz	dB	≤ ±0.5			For 90086 ±1 dB at 100-200 MHz
Power consumption	W	≤ 1.75	≤ 2.25	≤ 2.50	Measured in node
Environmental					
Node operating temperature range	°C	-15 to +55			
Mechanical					
Dimensions (H x W x D)	mm	22 x 69 x 77			
Weight	g	65			
Element Management Monitorable Parameters					
<ul style="list-style-type: none"> • Alarms from reverse transmitter: <ul style="list-style-type: none"> ◦ Module OK ◦ Laser aging ◦ Laser failure 					
Element Management Monitorable Parameters (depending on node)					
<ul style="list-style-type: none"> • Factory data: <ul style="list-style-type: none"> ◦ Wavelength ◦ Output power ◦ Frequency range • Laser bias 					
Element Management Controllable Parameters (depending on node)					
<ul style="list-style-type: none"> • OMI setting • Pilot tone level • Transmitter on or off • Pilot tone on or off 					

Ordering Information

Table 4 lists the product ordering information.

Table 4. Ordering Information

Reverse Transmitters with Pilot Tone	Part Number
0 dBm, 1310 nm, FP without adapter	A90080.10
3 dBm, 1310 nm, DFB without adapter	A90083.1013
Reverse CWDM Transmitters with Pilot Tone	Part Number
3 dBm, xxxx nm, DFB without adapter (where xxxx is the wavelength in nm)	A90083.10xxxx
6 dBm, xxxx nm, DFB without adapter (where xxxx is the wavelength in nm)	A90086.10xxxx

The following **required accessories** must be ordered separately (Table 5).

Table 5. Required Accessories

Required Accessories	Part Number
One adapter is required for each optical connection forward and reverse. Internal optical connector is SC/APC.	
• Adapter SC/APC to E2108	A90540.1048
• Adapter SC/APC to FC/APC	A90540.1058
• Adapter SC/APC to SC/APC	A90540.1088
For more information about housings, see Compact Housing data sheet (Part Number: A541442).	



Americas Headquarters
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