Cisco Prisma II Quad Optical Input Enhanced Digital Return (EDR) Receiver for GainMaker and GS7000 Nodes

The Cisco® Quad Optical Input Enhanced Digital Return (Q-EDR) 85 Receiver expands the Cisco PII EDR Receiver product line. This new Q-EDR receiver offers the superior performance of our dual EDR receiver and enables doubling the PII receiver density in digital return systems.

As with our Cisco Prisma® II Dual EDR Receiver, the Q-EDR receiver module works within the Cisco EDR 85 System. The Cisco EDR 85 System includes the existing EDR transmitter modules that install in GainMaker® and GS7000 nodes. It also includes the existing Cisco Prisma high-density (HD) Dual EDR PRX85 Receiver modules. Both the dual and quad optical input EDR receivers install in a Prisma II or Prisma II XD chassis at the headend or hub. The Q-EDR receiver uses the same Small Form-Factor Pluggable (SFP) optical pluggable modules (OPMs) as the dual EDR receivers. The Cisco EDR 85 System operates over the 5–85 MHz range and supports the standard reverse frequency bandwidths at 40, 42, 55, 65, and 85 MHz.

At the transmit (node) end of the system, reverse-path RF input signals from each node port are routed to an EDR 2:1 or EDR 1:1 transmitter module in the housing lid. The transmitter module converts each signal to a baseband digital data stream and combines the signals into a serial data stream using time-division multiplexing (TDM). The baseband data stream is then converted to an optical signal for transmission to the headend or hub. The double-wide (2:1) transmitter modules occupy two transmitter slots, and the 1:1 modules occupy one slot. The EDR 2:1 transmitter is available for the GS7000 and GainMaker 4-Port or Reverse Segmentable platforms (Figure 1). The EDR 1:1 transmitter is available for the GS7000 and all GainMaker node platforms. The transmitter OPMs are available in either coarse wavelength-division multiplexing (CWDM) 1270–1610 nm wavelengths or dense wavelength-division multiplexing (DWDM) channels (ITU 17–ITU 61).

Figure 1. Cisco EDR Transmitter Modules

At the receive end, typically in a large hub or headend, the EDR receiver module receives the optical signal and performs the conversion back to the baseband data stream. The resulting data streams are converted back to analog reverse path signals for routing to termination equipment. With the Q-EDR receiver, up to 4 optical inputs can be combined and routed to the 2 RF outputs of the module in a variety of ways. For example, all 4 optical inputs can be combined onto a single RF output or reconfigured with a simple software command to be split between the 2 RF outputs. This software-controlled reconfiguration capability of the Q-EDR Rx allows for maximum network flexibility with minimal hardware investment. The receiver OPMs are available in Standard Range (SR) and Extended Range (XR) configurations. Both configurations feature a dual LC/PC optical input connector that feeds two independent reverse optical receivers, each with its own RF output port.

Both the Dual and Quad Input EDR Receiver modules (Figure 2) occupy one slot in a Cisco Prisma II XD chassis. Two EDR HD receiver modules can be vertically stacked in an associated Prisma II host module that occupies a single-wide slot in the Prisma II standard chassis. Up to 26 HD modules can operate in a standard 6–rack unit (6RU) chassis (the 56-connector version of the chassis is required to make use of both receivers in one chassis slot). Up to 16 HD modules can operate in the Prisma II XD chassis. The ability to mix EDR receiver modules with other Prisma II HD modules in the same chassis greatly enhances the flexibility of the platform.

Figure 2. Cisco EDR Receiver Module

Features

- High-performance digital reverse technology:
  - 12-bit encoding that enables transmission of analog video in the reverse band
  - High-order digital modulation signals (for example, 16 quadrature amplitude modulation [QAM], 64 QAM, and 256 QAM)
- Common optical pluggable modules with the Dual EDR receiver that provide flexible inventory management
- Long-reach transmission capabilities that eliminate the need for optical amplifiers, reducing cost and space requirements
- Capability to send 90 individual 5–85 MHz reverse signals over a single fiber:
  - Use of 2:1 multiplexing to reduce fiber usage
  - Compatibility with Cisco's 45-wavelength DWDM system
- Support for independent balancing of reverse traffic at EDR receiver RF ports
- Simplified setup that reduces installation time and expertise requirements
- Distance- and temperature-independent link performance that simplifies engineering and maintenance requirements
- Space-saving, high-density deployment in Prisma II or Prisma II XD chassis to increase deployment cost efficiency
- Optional monitoring of node (GS7000) and transmitter (GS7000 and GainMaker) parameters available at the receiver

Block Diagrams

Figures 3 and 4 provide block diagrams of the EDR systems for 2:1 transmission, and Figures 5 and 6 provide block diagrams of the EDR systems for 1:1 transmission.

Figure 3. Cisco Q-EDR 85 System with 2:1 Transmitters Using 2 RF Output Ports

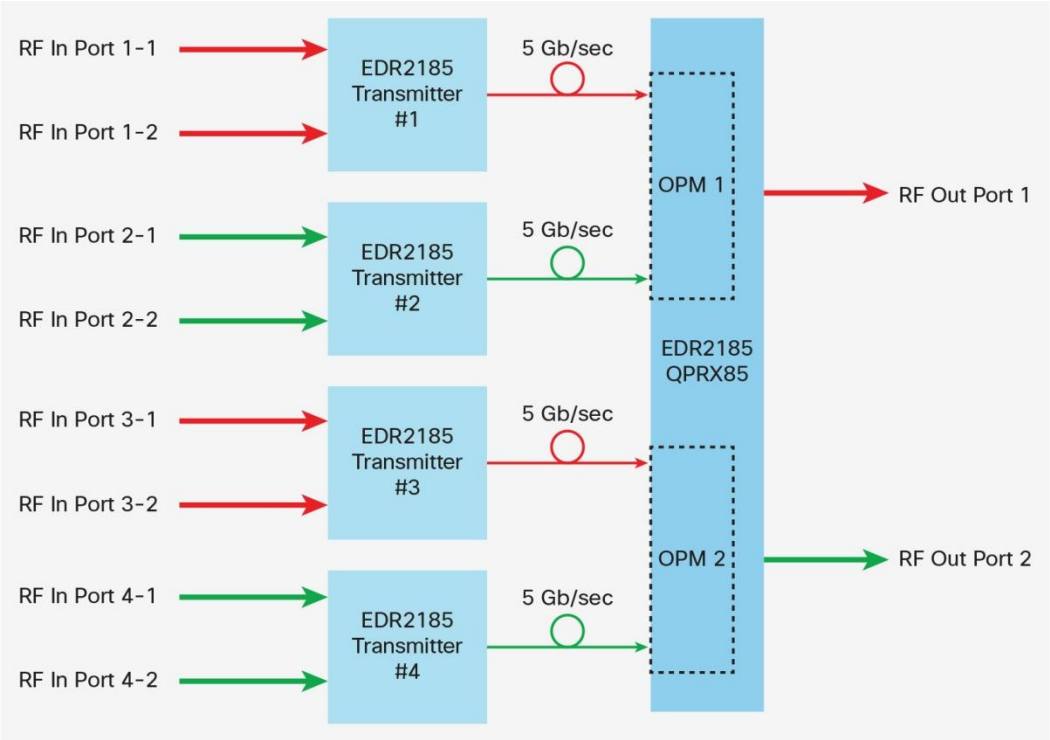


Figure 4. Cisco Q-EDR 85 System with 2:1 Transmitters Using 1 RF Output Port

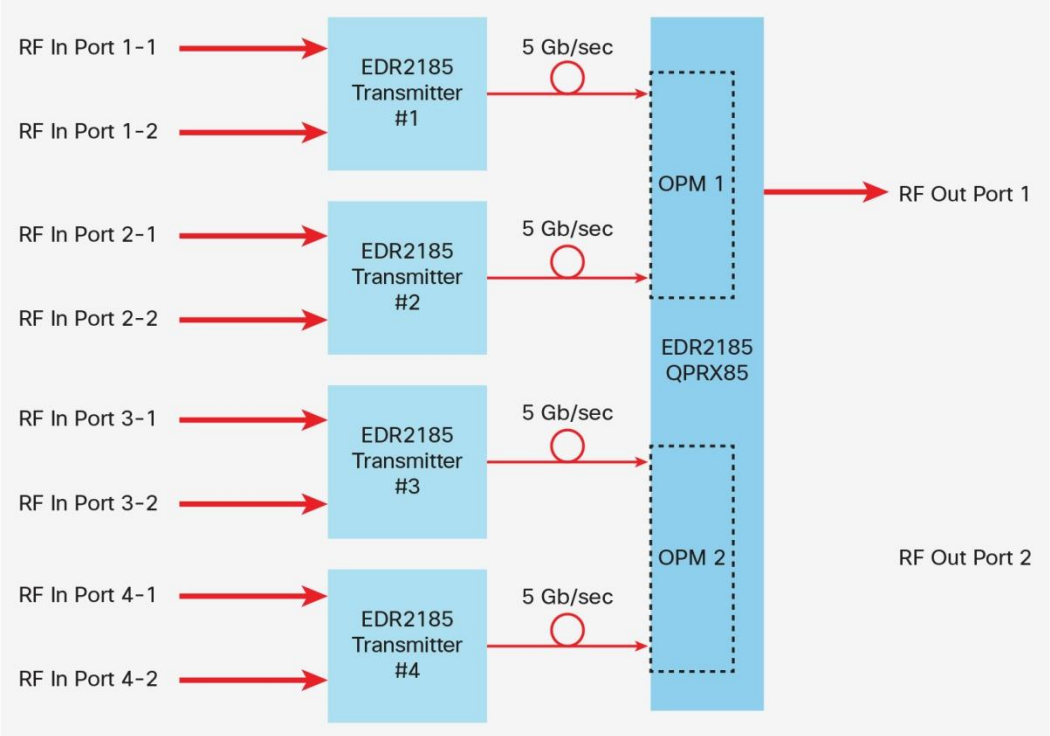


Figure 5. Cisco Q-EDR 85 System with 1:1 Transmitters Using 2 RF Output Ports

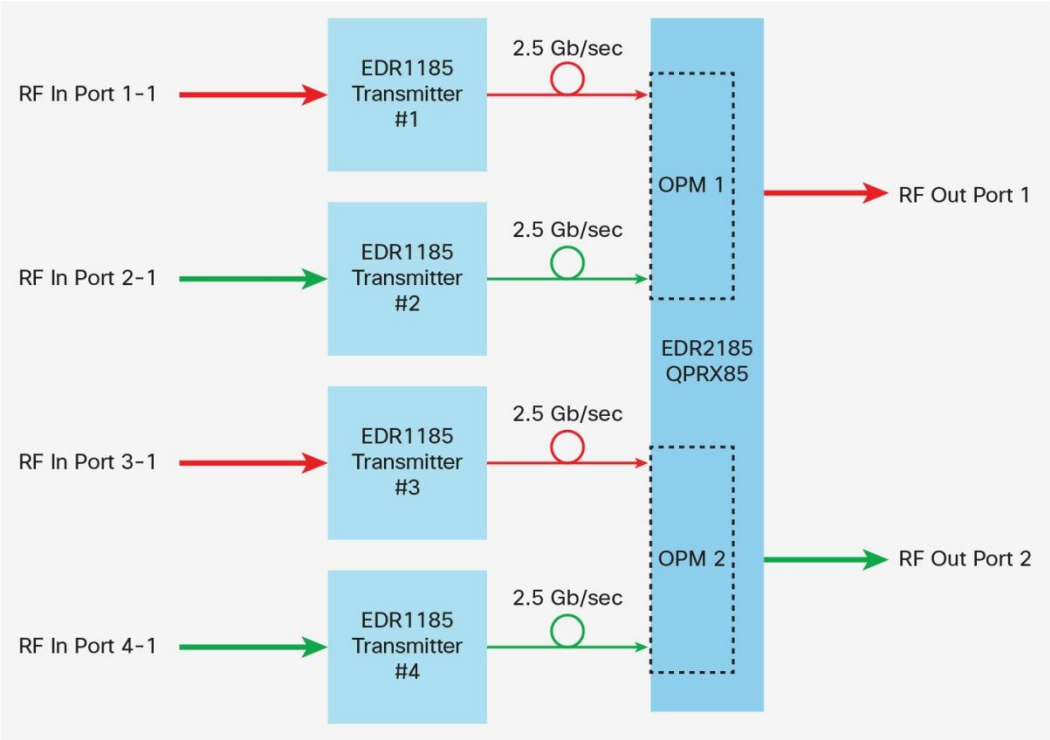
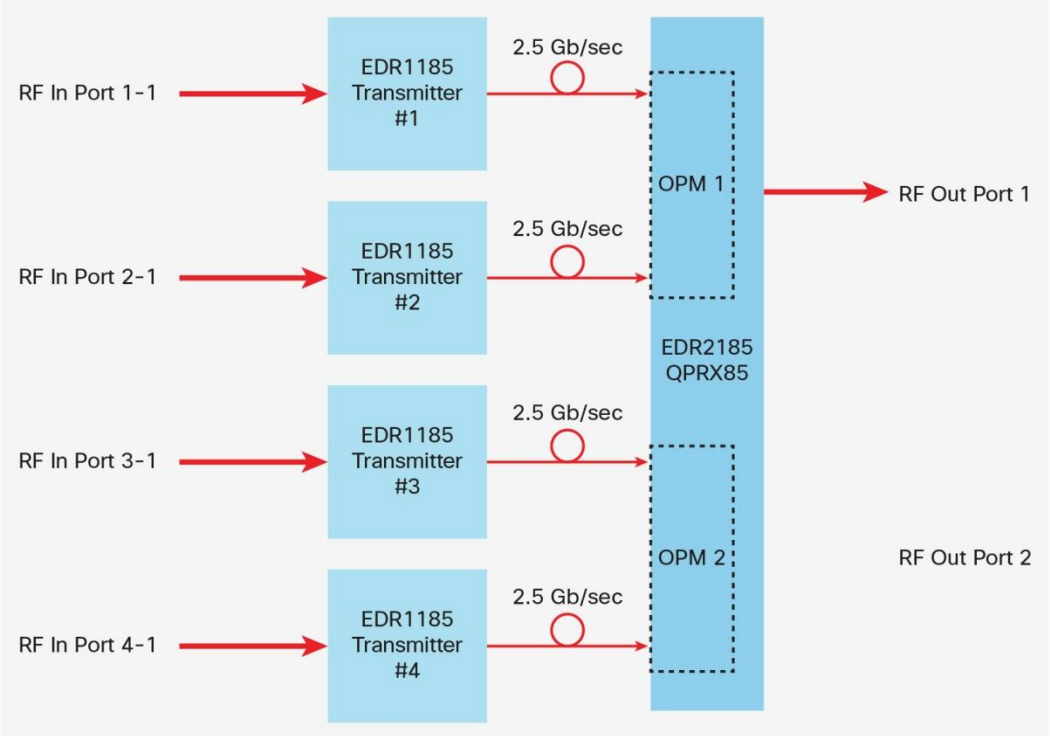


Figure 6. Cisco Q-EDR 85 System with 1:1 Transmitters Using 1 RF Output Port



Product Specifications

Table 1 gives specifications for the Q-EDR receiver module. Table 2 lists RF link performance specifications when combined with EDR transmitter modules specified on the Cisco Prisma II System EDR 85 data sheet.

Table 1. Cisco Q-EDR 85 PRX85 Receiver Module

Specification	Units	Value	Notes
RF output level	dBmV/Hz	See Table 2, note 4	
RF output return loss (minimum)	dB	18	
Output RF variable gain control range	dB	0 to –10 (0.5 dB increments)	
Power consumption (maximum)	W	< 9.5	
RF output test point	dB	–20 (± 1 dB)	
Operating temperature range	°C °F	0 to 50 32 to 122	1
Operating humidity	%	5–95 noncondensing	
Physical dimensions (D x W x H)	in. cm	8.8 x 1.0 x 3.5 22.35 x 2.54 x 8.89	
Weight	lb kg	0.9 0.4	

Table 2. RF Link Performance

General	Units	Value	Notes
Bandpass	MHz	5–85	
Full-scale single continuous wave (CW) carrier amplitude	dBmV	33	1, 2
Link gain	dB	12 (± 1.0 dB) for dual output mode 9 (± 1.0 dB) for single output mode	3, 4, 5
Response flatness	dB	± 0.75	

Notes:

[1] With respect to the input port on the EDR transmitter module.

[2] A CW carrier of this amplitude applied to the RF input will exercise the full-scale range of the A/D converter. Full scale is analogous to 100% OMI for analog lasers.

[3] Variable gain control on EDR receiver module set to 0 dB.

[4] Add link gain (dB) to EDR transmitter module RF input level to determine EDR receiver module RF output level.

[5] At low and high temperature extremes.

Tables 3 and 4 provide group delay and optical link specifications. Figure 7 shows noise power ratio (NPR) performance.

Table 3. Group Delay, 1-MHz Bandwidth

Frequency (MHz)	Units	Value	Notes
5–10	ns	≤ 3.0	
11–85	ns	≤ 1.5	

Table 4. Optical Link Characteristics

General	Units	Value	Notes
Link budget	dB	21 (SR Rx) 28 (XR Rx)	
Optical wavelength	nm	1270–1610 (CWDM) 1563.86–1528.77 (DWDM)	1

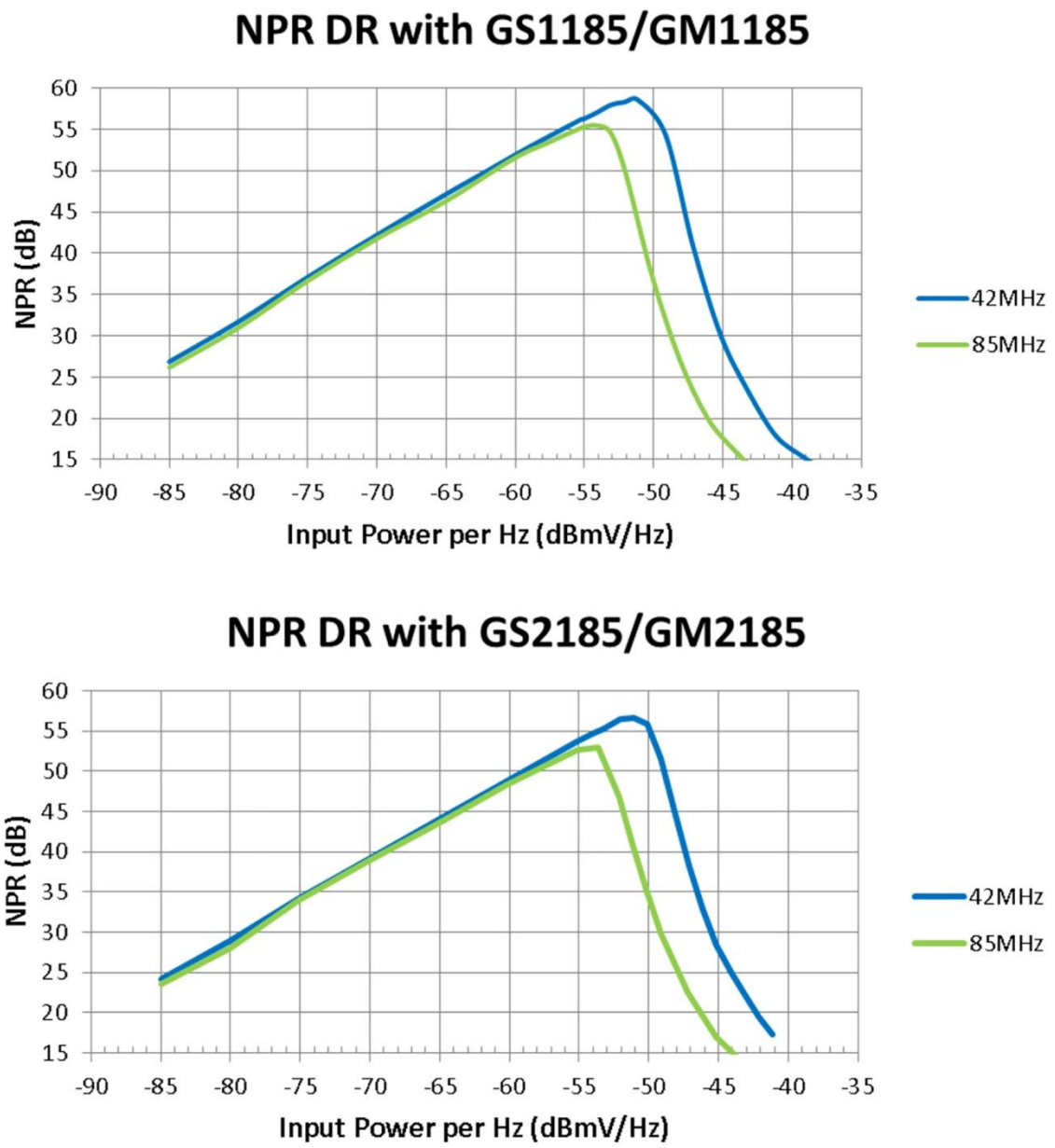
General	Units	Value	Notes
Optical output power (modulated)	dBm	5 minimum (CWDM) 5 minimum (DWDM)	1
Optical input power (SR module)	dBm	0 to –18	2
Optical Input power (XR module)	dBm	–8 to –25	2
Optical interface		LC/PC connector	

Notes:

[1] Applies to transmitter module only.

[2] Applies to receiver module only.

Figure 7. Cisco EDR 85 Noise Power Ratio Performance: Input Power per Hz (Note 4)



Notes:

[1] Input power is specified with respect to the input port of the EDR transmitter module.

[2] Variable gain control on the EDR receiver module set to 0 dB.

[3] Unless otherwise stated, all link performance specifications shown reflect minimum performance over the specified operating temperature range of the GS7000 and relevant GainMaker nodes. The EDR receiver module specifications are for the optical link only, measured from the input to the GS7000 or GainMaker node EDR transmitter module to the output of the receiver module. Refer to the relevant node data sheets for other node-related specifications.

[4] Optical input power –25 dBm, 80 km fiber.

Ordering Information

Table 5 lists part numbers for Cisco Prisma Q-EDR transmitter module and associated OPM modules.

Table 5. Cisco Prisma Q-EDR Products

Description	Part Number for Ordering	Part Number on Module
EDR PRX85 Prisma HD Quad EDR Rx Module	P2-HD-QEDR-RX	800-102707-01
EDR Rx OPM SR	4042750	800-4073801-01
EDR Rx OPM XR	4042751	800-4073802-01

Table 6. Accessories

Description	Part Number for Ordering
Test Port Adapter Cable	CAB-TSTADPT-MCX-F=

Service and Support

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