Cisco EDR 85 System: Modules for Cisco GainMaker and GS7000

The Cisco® Enhanced Digital Return (EDR) 85 System expands the functionality of Cisco GS7000 and Cisco GainMaker® Nodes by increasing the performance, reach, and efficiency of the reverse path transmissions.

The Cisco EDR 85 System includes EDR Transmitter modules that install in GainMaker and GS7000 Nodes, and companion Cisco Prisma® high-density (HD) EDR PRX85 Receiver modules that install in a Prisma II or Prisma II XD chassis at the headend or hub. The transmitter and receiver use Small Form Factor Pluggable (SFP) optical pluggable modules (OPMs) for enhanced flexibility. The Cisco EDR 85 System operates over the 5-85 MHz range and supports all 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 1:1Transmitter 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 (Figure 1). The transmitter OPMs are available in either Coarse Wavelength Division Multiplexing (CWDM) 1270-1610 nm wavelengths or Dense Wavelength Division Multiplexing (DWDM) ITU channels (17-61 nm).

Figure 1. Cisco EDR Transmitter Modules

EDR 2:1 GS7000   EDR 2:1 GainMaker

EDR 1:1 GS7000   EDR 1:1 GainMaker

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. The EDR Receiver module is available in the High Density form factor. 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.

A single EDR Receiver module (Figure 2) occupies 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.

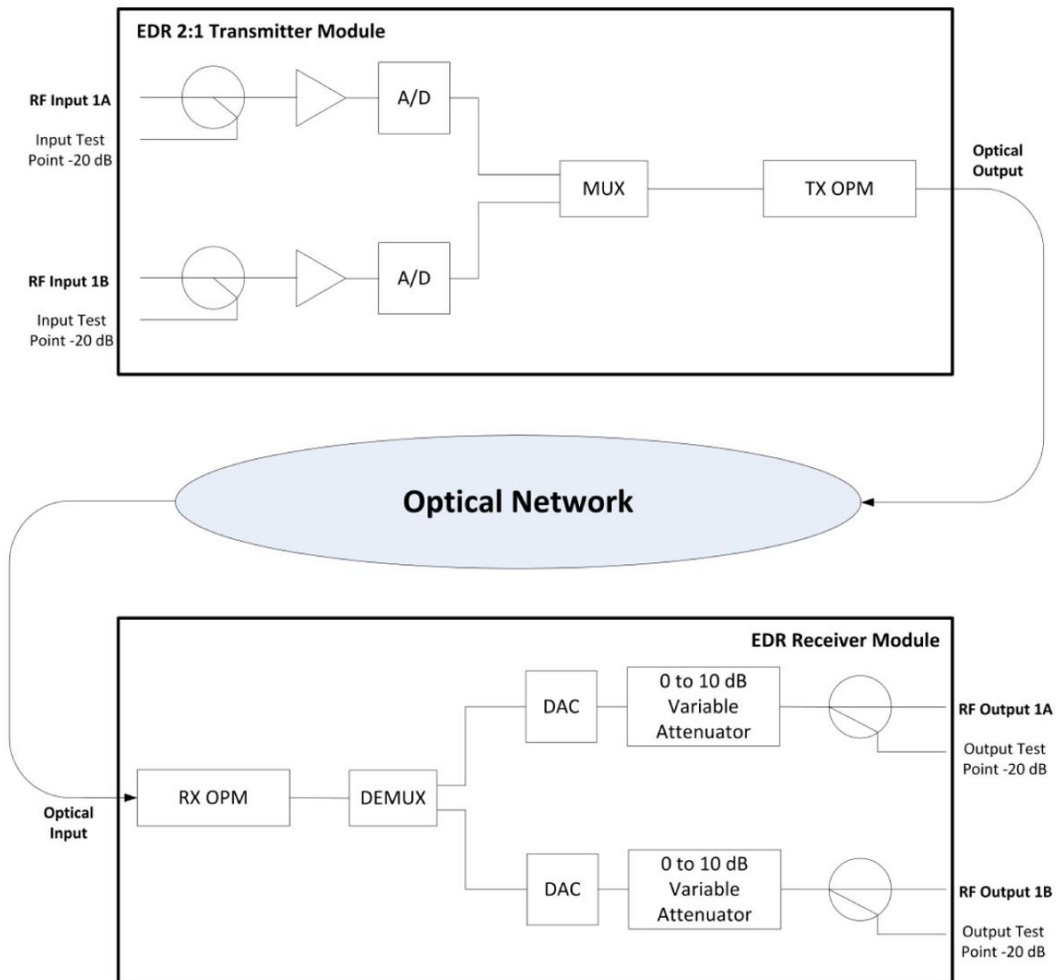**Figure 2.** Cisco EDR Receiver Module

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)
- Multiple operating modes in the EDR receiver that support the EDR transmitter and the older integrated 2:1 bdr node transmitter
- Optical pluggable modules 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
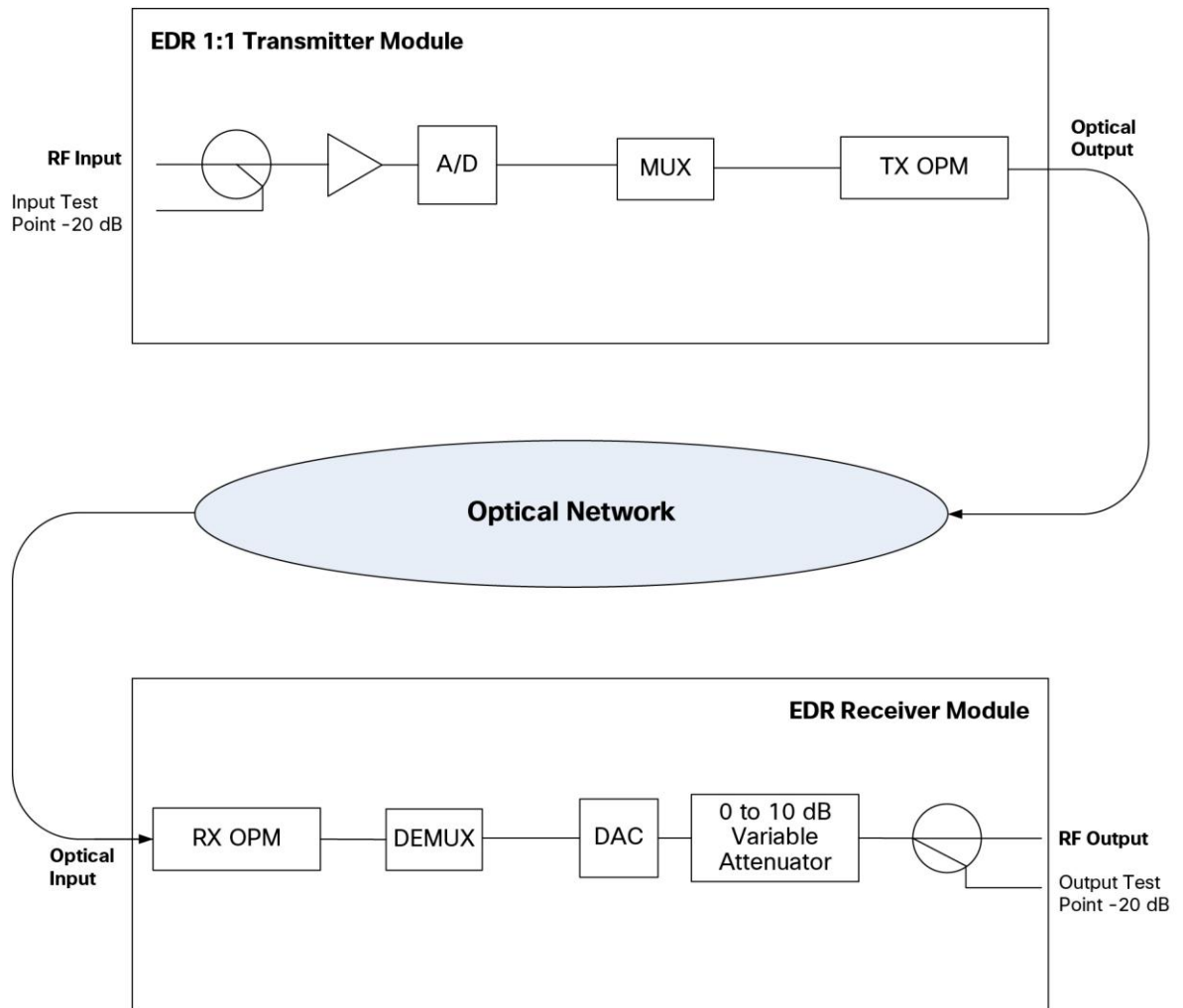
Block Diagrams

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

**Figure 3.**   Cisco EDR 85 System with 2:1 Transmitter

**Figure 4.** Cisco EDR 85 System with 1:1 Transmitter

EDR 1:1 Transmitter Module

RF Input

Input Test
Point –20 dB

A/D

MUX

TX OPM

Optical
Output

Optical Network

EDR Receiver Module

Optical
Input

RX OPM

DEMUX

DAC

0 to 10 dB
Variable
Attenuator

RF Output

Output Test
Point –20 dB

Figures 5 and 6 show block diagrams for EDR 2:1 and 1:1Transmitters in a GS7000 node. Figures 7 and 8 provide block diagrams for EDR 2:1 and 1:1 transmitters in a GainMaker node.
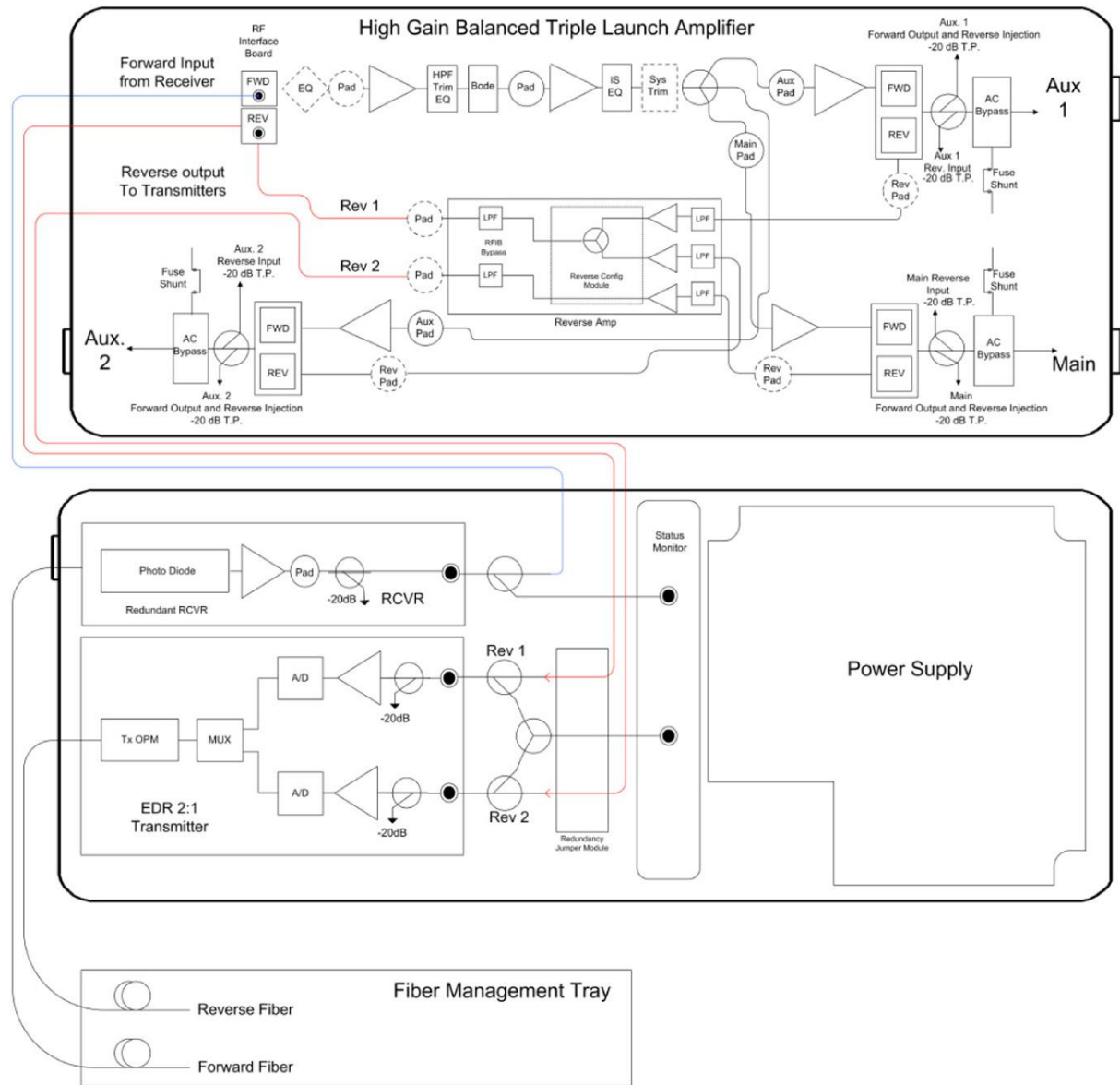
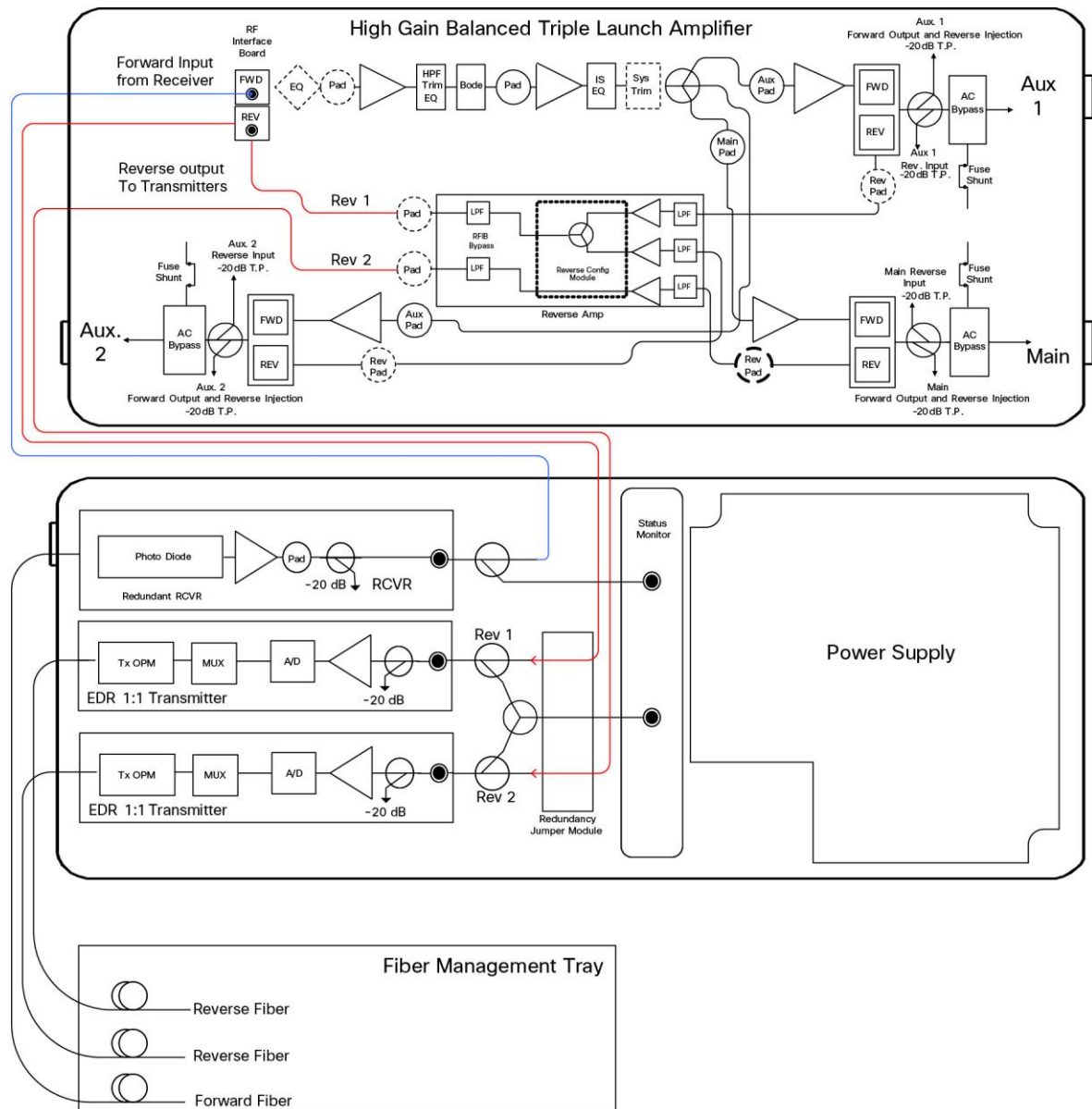**Figure 5.**   Cisco EDR 2:1 Transmitter Module in Cisco GS7000 Node
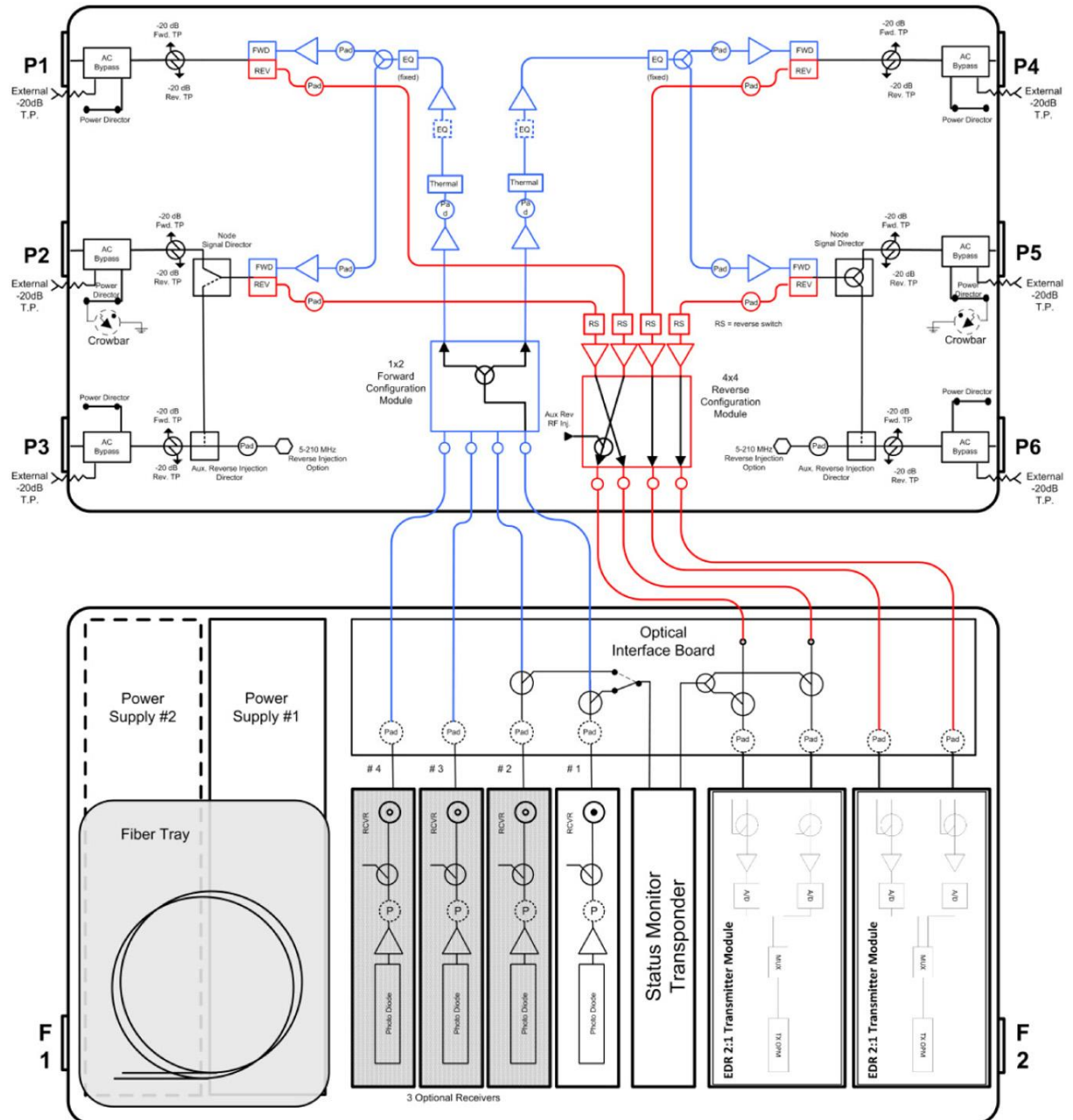
Figure 6. Cisco EDR 1:1 Transmitter Module in Cisco GS7000 Node
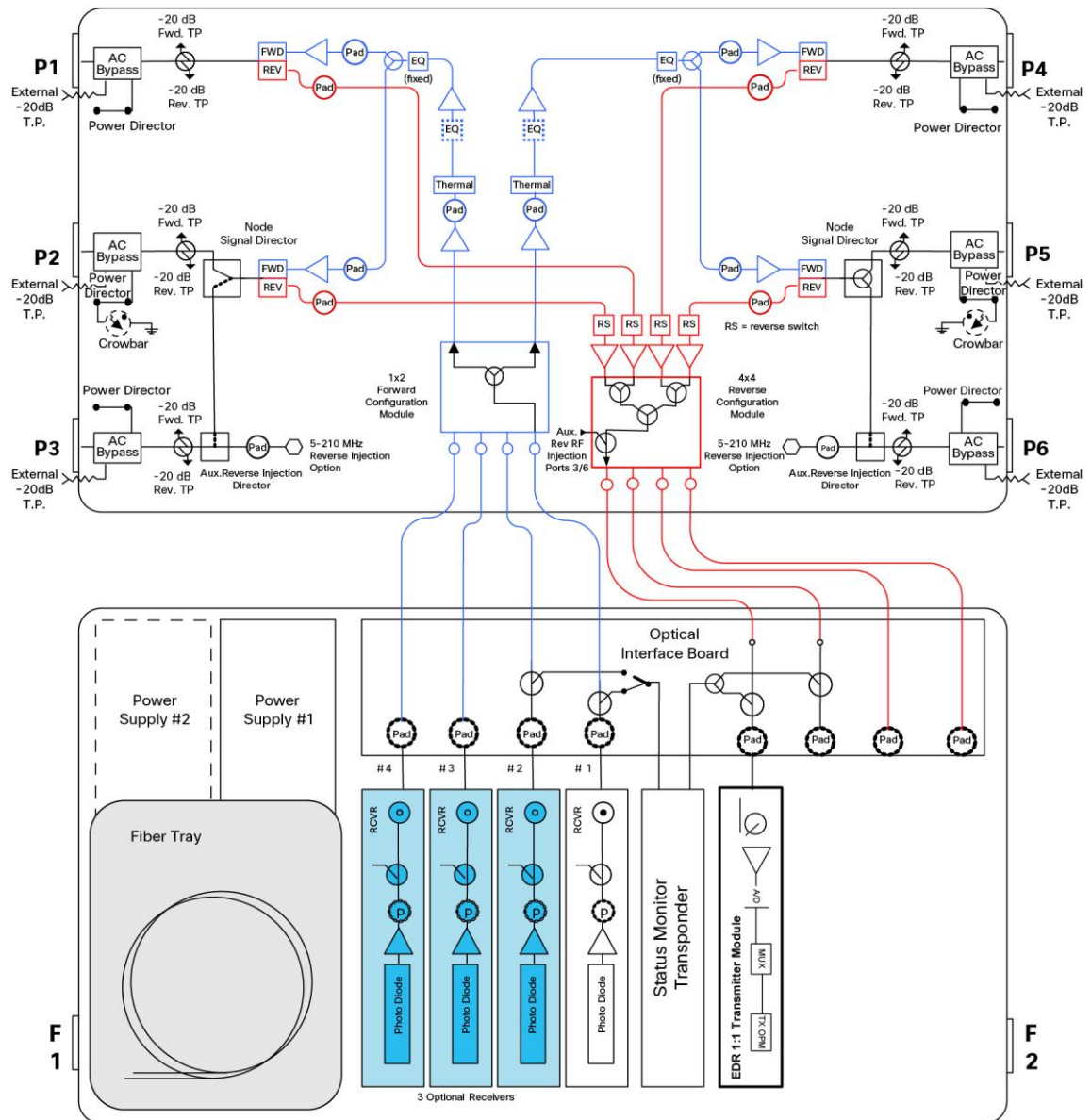
Figure 7. Cisco 2:1 EDR Transmitter Module in a Cisco GainMaker Node

Figure 8. Cisco 1:1 EDR Transmitter Module in a Cisco GainMaker Node

Product Specifications

Table 1 lists specifications for the EDR 85 Transmitter modules. Table 2 gives specifications for the EDR Receiver module. Table 3 lists RF link performance specifications.

Table 1.   Cisco EDR 85 Transmitter Modules

Specification	Units	Value
RF input level	dBmV/Hz	See Table 3
RF input test point	dB	-20 (± 1 dB)
Test point return loss (minimum)	dB	18
Power consumption (maximum)	W	< 4
Operating temperature range, node ambient	°C °F	-40 to +60 -40 to +131
Physical dimensions, GS1185 Module (L x W x H)	in. cm	5.75 x 1.45 x 3.90 14.50 x 3.68 x 9.91
Physical dimensions, GM1185 Module (L x W x H)	in. cm	5.75 x 1.45 x 1.40 14.50 x 3.68 x 3.56
Weight, GS1185 module	lb kg	0.8 0.36
Weight, GM1185 module	lb kg	0.5 0.23
Physical Dimensions, GS2185 Module (L x W x H)	in. cm	5.75 x 2.95 x 3.90 14.50 x 7.49 x 9.91
Physical Dimensions, GM2185 Module (L x W x H)	in. cm	5.75 x 2.95 x 1.40 14.50 x 7.49 x 3.56
Weight, GS2185 Module	Lb kg	1.5 0.68
Weight, GM2185 Module	Lb kg	1.0 0.45

Table 2.   Cisco EDR 85 PRX85 Receiver Module

Specification	Units	Value	Notes
RF output level	dBmV/Hz	See Table 3	
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	
RF output test point	dB	-20 (± 1 dB)	
RF output test point return loss	dB	18	
Operating temperature range	°C °F	0 to 50 32 to 122	1
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	

Note:

[1]. Recommended for use only in noncondensing environments.

Table 3.   RF Link Performance

General	Units	Value	Notes
Bandpass	MHz	5 - 85	
Full-scale single carrier wave (CW) carrier amplitude	dBmV	33	1, 2
Link gain	dB	15.5 (± 1.0 dB)	3, 4, 5
Response flatness	dB	± 0.5	

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 4 and 5 provide group delay and optical link specifications. Figure 9 shows noise power ratio (NPR) performance.

Table 4.   Group Delay, 1-MHz Bandwidth

Frequency (MHz)	Units	Value	Notes
5-10	ns	≤ 2.0	
11-85	ns	≤ 1.5	

Table 5.   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
Optical output power (modulated)	dBm	3 minimum (CWDM) 3 minimum (DWDM)	1
Optical input power (SR module)	dBm	-8 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 9.** Cisco EDR 85 Noise Power Ratio Performance: Input Power per Hz
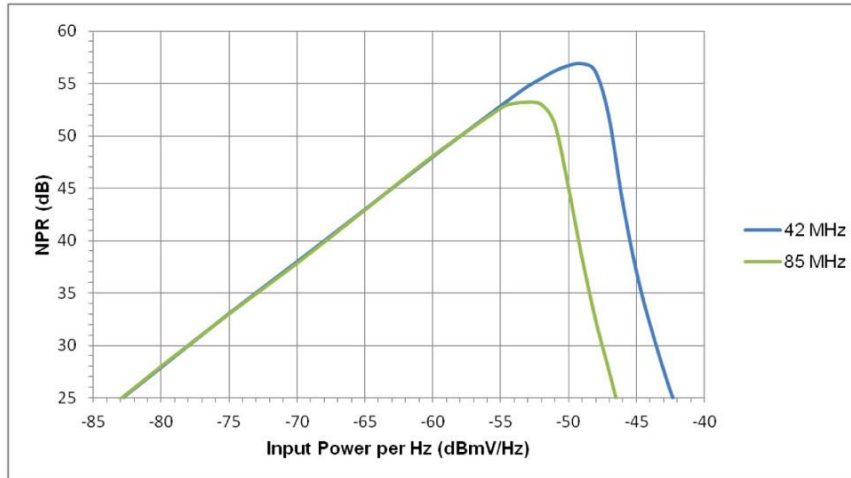
Notes:

[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.

Ordering Information

Figure 10 provides ordering matrixes for the Cisco EDR 85 System components. Tables 7, 8, and 9 list part numbers for Cisco Prisma EDR required equipment, additional required equipment, and accessories.
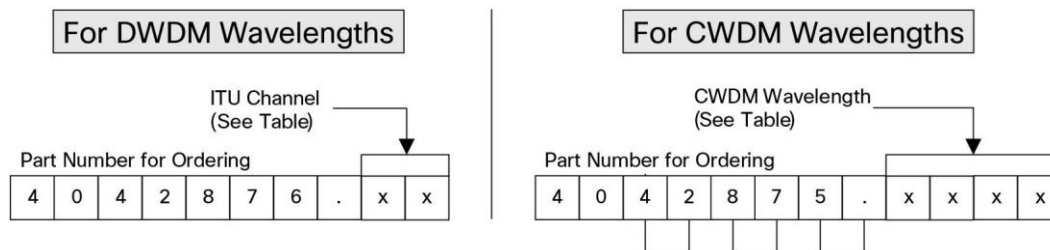
Figure 10. Ordering Matrixes for Cisco EDR 85 System
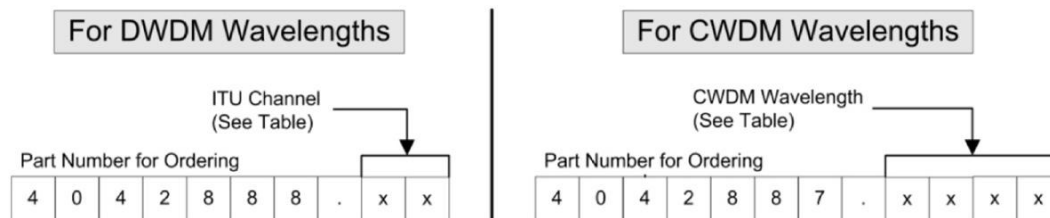
EDR GS2185 GS7000 2:1 Transmitters with OPM Order Matrix
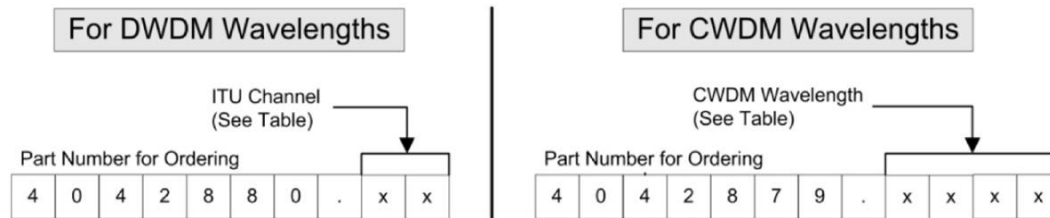
Note: Numbers above are for ordering purposes only. For field identification, the part number on the module is 4042877.
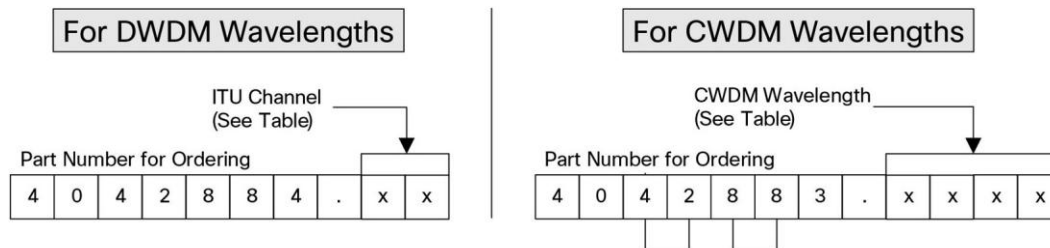
EDR GS2185 GS7000 1:1 Transmitters with OPM Order Matrix

Note: Numbers above are for ordering purposes only. For field identification, the part number on the module is 4042873.

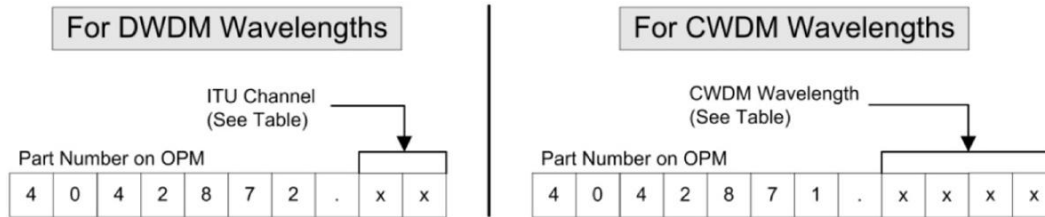**EDR GM2185 GainMaker 2:1 Transmitters with OPM Order Matrix**

Note: Numbers above are for ordering purposes only. For field identification, the part number on the module is 4042885.

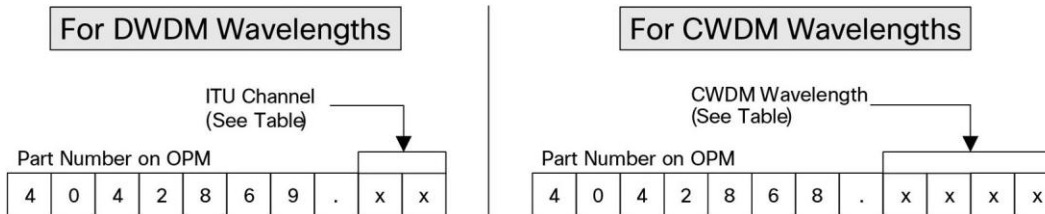**EDR GM2185 GainMaker 1:1 Transmitters with OPM Order Matrix**

Note: Numbers above are for ordering purposes only. For field identification, the part number on the module is 4042881.

Transmitter 2:1 Optical Pluggable Module (OPM) Order Matrix

For DWDM Wavelengths

ITU Channel (See Table)

Part Number on OPM

| 4 | 0 | 4 | 2 | 8 | 7 | 2 | . | x | x |

For CWDM Wavelengths

CWDM Wavelength (See Table)

Part Number on OPM

| 4 | 0 | 4 | 2 | 8 | 7 | 1 | . | x | x | x | x |

Transmitter 1:1 Optical Pluggable Module (OPM) Order Matrix

For DWDM Wavelengths

ITU Channel (See Table)

Part Number on OPM

| 4 | 0 | 4 | 2 | 8 | 6 | 9 | . | x | x |

For CWDM Wavelengths

CWDM Wavelength (See Table)

Part Number on OPM

| 4 | 0 | 4 | 2 | 8 | 6 | 8 | . | x | x | x | x |

Table 6. DWDM and CWDM Wavelengths

ITU Channel	DWDM Wavelengths, nm	ITU Channel	DWDM Wavelengths, nm	CDWM Wavelengths, nm
17	1563.86	40	1545.32	1270
18	1563.05	41	1544.53	1290
19	1562.23	42	1543.73	1310
20	1561.42	43	1542.94	1330
21	1560.61	44	1542.14	1350
22	1559.79	45	1541.35	1370
23	1558.98	46	1540.56	1390
24	1558.17	47	1539.77	1410
25	1557.36	48	1538.98	1430
26	1556.55	49	1538.19	1450
27	1555.75	50	1537.40	1470
28	1559.94	51	1536.61	1490
29	1554.13	52	1535.82	1510
30	1553.33	53	1535.04	1530
31	1552.52	54	1534.25	1550
32	1551.72	55	1533.47	1570
33	1550.92	56	1532.68	1590
34	1550.12	57	1531.90	1610
35	1549.32	58	1531.12	
36	1548.51	59	1530.33	
37	1547.72	60	1529.55	
38	1546.92	61	1528.77	
39	1546.12			

Table 7. Cisco Prisma EDR Required Equipment

Description	Part Number for Ordering	Part Number on Module	Part Number on OPM
EDR GS2185 Tx module	4042877	4042904	N/A
EDR GS1185 Tx module	4042873	4042188	N/A
EDR GM2185 Tx module	4042885	4041274	N/A
EDR GM1185 Tx module	4042881	4042187	N/A
EDR PRX85 Prisma HD Rx module	4041277	4041278	N/A
EDR PRX85 Prisma HD Rx w/SR OPM	4042748	4041278	4044008
EDR PRX85 Prisma HD Rx w/XR OPM	4042749	4041278	4044009
EDR Rx OPM SR	4042750	N/A	4044008
EDR Rx OPM XR	4042751	N/A	4044009

Table 8. Additional Required Equipment

Description	Part Number
GS7000 Optical Node	Refer to GS7000 data sheets
GainMaker Optical Nodes	Refer to GainMaker Node data sheets

Table 9. Accessories

Description	Part Number for Ordering	Part Number on Unit
EDR Tx Fiber Jumper GM and GS7K	4044313	4042940
Local Control Module (LCM) for EDR Interface	4044102	4044101

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