

## GS7000 and GainMaker Reverse Segmentable Node bdr Digital Reverse 2:1 Multiplexing System

The bdr™ Digital Reverse 2:1 Multiplexing System expands the functionality of the GS7000 and GainMaker® Reverse Segmentable (GM-RS) Nodes by increasing the performance, reach, and efficiency of the reverse path transmissions.

At the node (transmit) end of the system, the 5 to 42 MHz reverse path RF input signals from each of the node's four ports are routed to a bdr Integrated Reverse Optical Transmitter Module in the housing lid. There, two pairs of RF inputs are separately combined to produce two discrete 5 to 42 MHz RF signals. The Transmitter Module also converts each signal to a baseband digital data stream and time division multiplexes the two streams into a single data stream. The baseband data stream is converted to an optical signal for transmission back to the headend or hub at standard 1310 nm or 1550 nm wavelengths, Coarse Wave Division Multiplexing (CWDM) 1470 - 1610 nm wavelengths, or Dense Wave Division Multiplexing (DWDM) ITU grid wavelengths.

On the receive end, typically in a large hub or headend, the bdr Dual Receiver Module receives the optical signal, performs conversion back to the baseband data stream, demultiplexes the data stream and converts the two resultant data streams back to analog reverse path signals for routing to termination equipment. The bdr Dual Receiver Module contains two independent receivers, each with its own optical input and pair of RF outputs, integrated into one module. This equipment is housed in the Prisma II™ Chassis, the industry's first carrier-class platform – providing critical network reliability, equipment density, and high performance functionality.

**Figure 1.** 2:1 bdr Transmitter Module



**Figure 2.** 2:1 bdr Dual Receiver Module

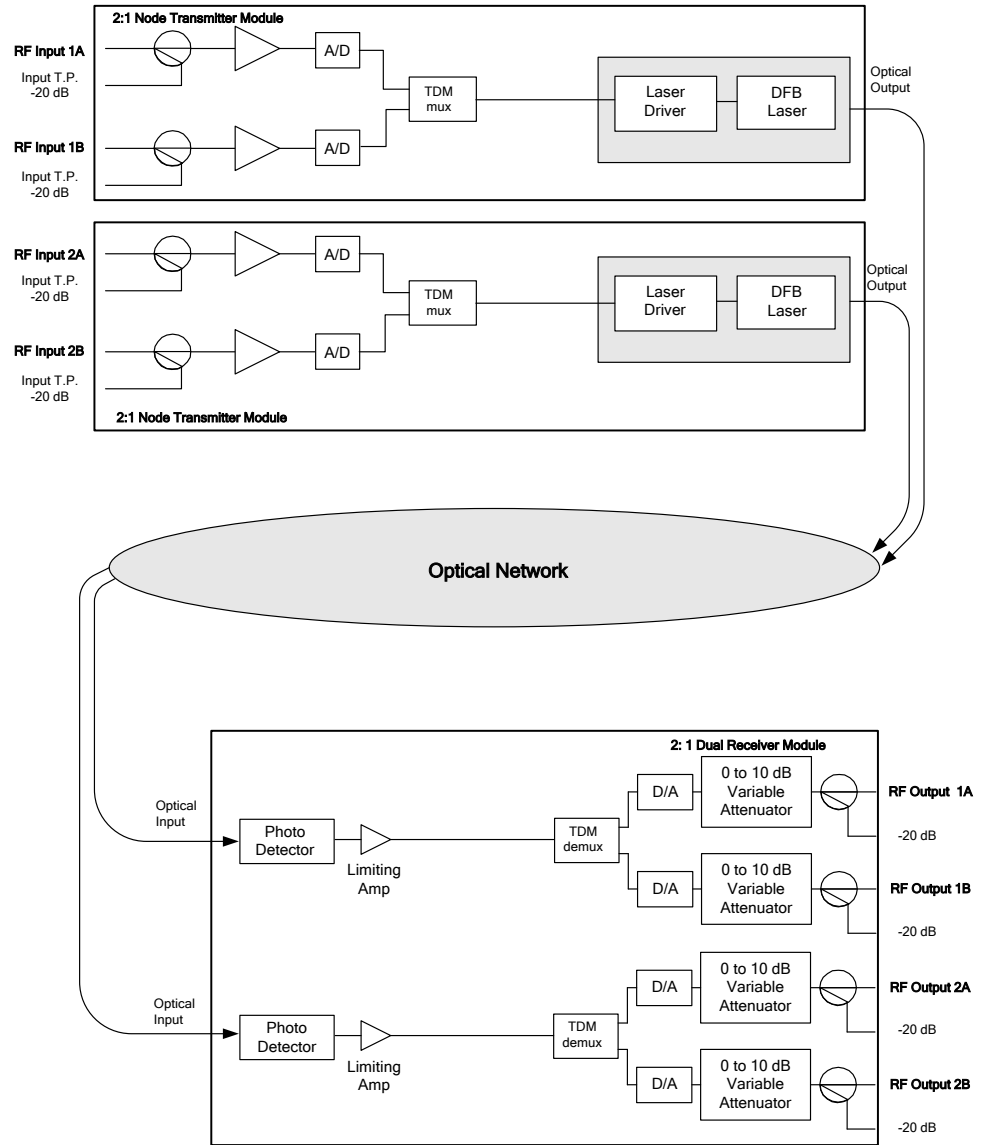


### Features

- High-performance bdr digital reverse technology, 12 bit encoding enables transmission of analog video and high-order digital modulation signals (e.g., 16 QAM, 64 QAM, and 256 QAM)
- 2:1 time division multiplexing reduces requirements for costly 1550 nm ITU transmitters by 50%
- Long reach transmission capabilities eliminate need for optical amplifiers reducing cost and space requirements
- Capable of sending 48 individual 5-42 MHz reverse signals over a single fiber
  - leverages 2:1 time division multiplexing for doubling fiber usage
  - compatible with Cisco's 24 wavelength DWDM system
- Modular configuration provides for cost-effective upgrade to 4:1 multiplexing receiver without requiring the cost associated with replacing Laser Modules
- Flexible RF combining enables balancing of the reverse traffic from each of the four node ports
- Simplified setup reduces installation time and expertise requirements
- Distance and temperature independent link performance simplifies engineering and maintenance requirements

- Space-saving, high-density deployment in Prisma II platform increases deployment cost efficiency
- High-speed remote control and monitoring via ROSA®

**Block Diagram**



## Product Specifications

**Table 1.** Product Specifications

Bdr 2:1 Digital Transmitter	Units		Notes
RF Input Level Requirements	dBmV/Hz	See Link Performance	
Power Consumption (maximum)	W	13.7	
Operating Temperature Range, node ambient	°C	-40 to +60	
	°F	-40 to +140	
RF Input test point	dB	-20 (±0.5)	
Optical Wavelength	nm	1550 ITU grid 200 GHz spacing CWDM 1310 nm	
Optical Output Power (modulated)	dBm	6 (1550 nm ITU )	
		3 (CWDM)	
		3 (1310 nm)	
Optical Interface		SC/APC Connector	
Module Width	in	3.0	
	cm	7.6	

Bdr 2:1 Dual Receiver Module	Units		Notes
Data Input from Transmitter	Gbps	2.5	
RF Output Level	dBmV/Hz	See Link Performance	
RF Output Return Loss	dB	16	
Output RF Variable Gain Control Range	dB	0 to -10	
Power Consumption (maximum)	W	13	
RF Output Test Point	dB	-20 (±0.5 dB)	
Optical Input Power Range : (SR module)	dBm	0 to -21	
Optical Input Power Range : (ER module)	dBm	-5 to -28	
Optical Interface		SC/APC connector	

Mechanical – bdr Modules	Units		Notes
Operating Temperature Range (ambient)	°C	-40 to +65	1
Physical Dimensions Receive processor with 2 receiver modules	°F	-40 to +149	
Depth	In.	9.8	
	cm	24.9	
Width	In.	1.0	
	cm	2.5	
Height	In	7.6	
	cm	19.3	
Weight	Lb	2.25	
	kg	1.0	

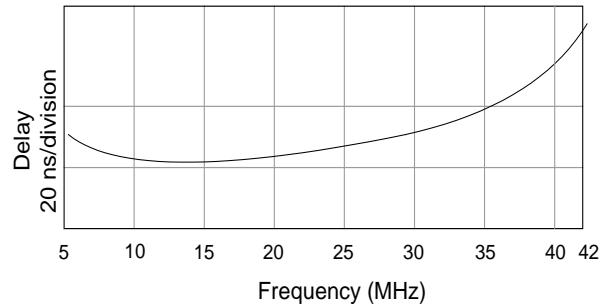
**Note:**

1. Recommended for use only in non-condensing environments.

**Table 2.** Link Performance

General	Units		Notes
Bandpass	MHz	5-42	
Full Scale Single CW Carrier Amplitude	dBmV	33	1, 2
Noise Floor Amplitude	dBmV/Hz	-98	1
Link Gain (± 1.0 dB)	dB	32	3, 4, 5, 6
Response Flatness	dB	± 0.5	
Transit Delay	µs	5	6

## Group Delay

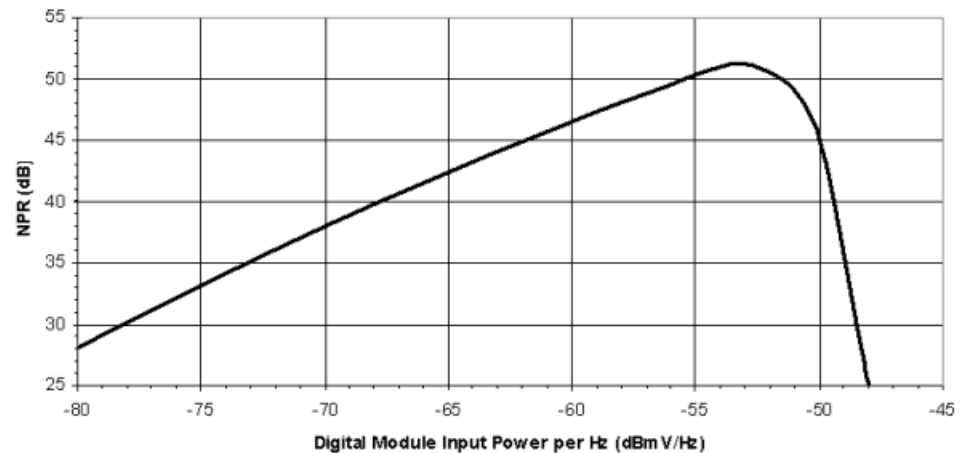


## Notes:

1. With respect to the input port on 2:1 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 2:1 Dual Receiver Module set to 0 dB.
4. Add Link Gain (dB) to Transmitter Module RF input level to determine Dual Receiver Module RF output level.
5. At cold and high temperature extremes, link gain of  $\pm 1.5$  dB relative to 29 dB may occur.
6. Time delay from RF input to RF output of bdr system. Does not include additional transit delay associated with fiber optic cable.

## Noise Power Ratio (NPR) Performance

(Applies to Constant Power / Hz Loading over 35 MHz band)



## Notes:

1. Input power is specified with respect to the input port of the 2:1 Transmitter Module.
2. Variable Gain Control on the Dual 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 GM-RS Nodes and the Prisma II 2:1 Dual Receiver Module Specifications are for the optical link only measured from the input to the GS7000 and GM-RS Nodes 2:1 Transmitter Module to the output of the Prisma II 2:1 Dual Receiver Module. Refer to the GS7000 and GM-RS Node data sheets for other node related specifications.

## Ordering Information

**Table 3.** bdr Integrated Reverse Optical Transmitters (used standalone)

ITU Channel I	Wavelength	GS 7000	GMRS and GM4P
17	1563.86	4018949.17	4018915.17
18	1563.05	4018949.18	4018915.18
19	1562.23	4018949.19	4018915.19
20	1561.42	4018949.20	4018915.20
21	1560.61	4018949.21	4018915.21
22	1560.61	4018949.22	4018915.22
23	1558.98	4018949.23	4018915.23
24	1558.17	4018949.24	4018915.24
25	1557.36	4018949.25	4018915.25
26	1556.55	4018949.26	4018915.26
27	1555.75	4018949.27	4018915.27
28	1559.94	4018949.28	4018915.28
29	1554.13	4018949.29	4018915.29
30	1553.33	4018949.30	4018915.30
31	1552.52	4018949.31	4018915.31
32	1551.72	4018949.32	4018915.32
33	1550.92	4018949.33	4018915.33
34	1550.12	4018949.34	4018915.34
35	1549.32	4018949.35	4018915.35
36	1548.51	4018949.36	4018915.36
37	1547.72	4018949.37	4018915.37
38	1546.92	4018949.38	4018915.38
39	1546.12	4018949.39	4018915.39
40	1545.32	4018949.40	4018915.40
41	1544.53	4018949.41	4018915.41
42	1543.73	4018949.42	4018915.42
43	1542.94	4018949.43	4018915.43
44	1542.14	4018949.44	4018915.44
45	1541.35	4018949.45	4018915.45
46	1540.56	4018949.46	4018915.46
47	1539.77	4018949.47	4018915.47
48	1538.98	4018949.48	4018915.48
49	1538.19	4018949.49	4018915.49
50	1537.40	4018949.50	4018915.50
51	1536.61	4018949.51	4018915.51
52	1535.82	4018949.52	4018915.52
53	1535.04	4018949.53	4018915.53
54	1534.25	4018949.54	4018915.54
55	1533.47	4018949.55	4018915.55
56	1532.68	4018949.56	4018915.56
57	1531.90	4018949.57	4018915.57
58	1531.12	4018949.58	4018915.58
59	1530.33	4018949.59	4018915.59

CWDM/1310	Wavelength (nm)	GS7000	GMRS and GM4P
-	1310	4018949.1310	4018915.1310
-	1470	4018949.1470	4018915.1470
-	1490	4018949.1490	4018915.1490
-	1510	4018949.1510	4018915.1510
-	1530	4018949.1530	4018915.1530
-	1550	4018949.1550	4018915.1550
-	1570	4018949.1570	4018915.1570
-	1590	4018949.1590	4018915.1590
-	1610	4018949.1610	4018915.1610

Note: Wavelengths ITU #21 through #35 are primary wavelengths used in 8 channel DWDM systems. The remaining wavelengths are incremental for greater DWDM efficiency requirements.

**Table 4.** Required Equipment

Prisma II bdr Required Equipment	Part Number
Prisma II bdr 2;1 Dual Receiver Module (Standard Range with SC/APC connectors)	4018935
Prisma II bdr 2;1 Dual Receiver Module (Extended Range with SC/APC connectors)	4018938
<b>Additional Required Equipment</b>	
GS7000 Optical Node	Refer to GS7000 Data Sheet
GainMaker Reverse Segmentable (GM-RS) Optical Node	Refer to GM-RS Data Sheet
GainMaker 4-Port Node	Refer to GainMaker 4-Port Node Data Sheet



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Part Number 7012808 Rev C  
March 2011