Opti Max™ 41xx Series Fully-Segmentable Nodes

OM4100 1 GHz 4 x 4 Segmentable Node

ARRIS 6-Port Wide-Body Housing

General Node Specifications

- 42/54 MHz
- 55/70 MHz
- 65/85 MHz
- 85/105 MHz
- Broadcast/Narrowcast Combiner

Receivers and Transmitters

- 1500209 Series Standard Gain Forward Optical Receiver
- 1500209 Series High Gain Forward Optical Receiver
- 1500239 Series 1310 nm DFB Analog Return Transmitter
- 152220 Series 1550 nm DFB Analog Return Transmitter
- Analog CWDM Return Transmitter
- Analog DWDM Return Transmitter
- CWDM 2:1 TDM Digital Return Transmitter (Double-width)
- DWDM 2:1 TDM Digital Return Transmitter (Double-width)
- Flexible Digital Return Processing Module (Single-width)

EDFA

- OM4-EDFA

Power Supply and Housing

- Power Supply
- ARRIS 6-Port Wide-Body Housing Dimensions

Technical Specification

42/54 MHz Split General Node Specifications

Characteristics	Specifications	
Number of Active RF/AC Ports	4	
Number of AC Only Ports	2	
Housing Passband, MHz	1002	
Port Impedance, Ω	75	
AC Current Passing, A (All Ports)	15	
Operating Temperature Range, °C	–40 to 60	
Operating/Storage Humidity Range	5 to 95%, non-condensing	
Forward Path Optical		
Optical Input Wavelength, nm	1290 to 1600	
Optical Input Range, dBm[1]	–3 to 3	
Equivalent Input Noise (HG Rx), pA/Hz$^{0.5}$	5.0	
Forward Path RF		
Operating Passband, MHz[2]	54 to 1002	
Output Level @ 1002 MHz,	**Std Rx@**	**High Gain Rx @ –6 dBm input**
>3% OMI, dBmV, min.[3]	**–3 dBm input**	
GaAs RF Module	53.5	53.5 Max. output 56.5 dBmV @ 1 GHz analog equiv.
GaN RF Module	54.5	54.5 Max. output 58 dBmV @ 1 GHz analog equiv.
Enhanced GaN RF Module	53.5	53.5 Max. output 60 dBmV @ 1 GHz analog equiv.
Level Stability, dB, max.	± 1.5	
Gain Slope, dB[4]	17.0 ± 1.0	
Flatness @ Gain Slope[2]	± 1.5	
Return Loss, dB, min. (All RF Ports)	16.0	
Port to Port Isolation, dB, typ.	70/60 (870/1002 MHz)	
Testpoints		
Forward Output, dB	–20 ± 0. 5 (54 to 550 MHz), –20 ± 0.75 (551 to 1002 MHz)	
Receiver Input Optical Level	1V/mW ± 10%	
79 NTSC Channel Performance[5,6]	**GaAs**	**GaN**
Frequency, MHz	1002/870/550/54	1002/870/550/54
Output Level, dBmV[3]	53.5/51.2/45.4/36.5	56/53.5/48/39
Carrier to Noise Ratio, 4 MHz, 75 Ω, dB	58.5, 0 dBm input	60, 0 dBm input
Composite Triple Beat, –dBc	73	73
Composite 2IM, –dBc	67	70
Cross Modulation, per NCTA std., –dB	70	67
Composite Intermodulation Noise (CIN), dB[7]	62.5	60
Composite Intermodulation Noise (CIN), dB[8]	68.5	65
30 NTSC Channel Performance[9]	**GaAs**	**GaN**
Frequency, MHz	1002/870/247/54	1002/870/247/54
Output Level, dBmV[3]	53.5/51.2/40/36.5	56/53.5/42.5/39
Carrier to Noise Ratio, 4 MHz, 75 Ω, dB	58.5, 0 dBm input	60, 0 dBm input
Composite Triple Beat, –dBc	80	80
Composite 2IM, –dBc	79	80
Composite Intermodulation Noise, dB[10]	60	58
154 256-QAM Channel Performance[11]	**GaAs**	**GaN**
Frequency, MHz	1002/870/550/54	1002/870/550/54
Output Level, dBmV[3]	53.5/51.2/45.4/36.5	56/53.5/48/39
Carrier to Noise Ratio, 4 MHz, 75 Ω, dB	58.5, 0 dBm input	60, 0 dBm input
Digital Output, dBmV	47.5/45.2/39.4/30.5	50/47.5/42/33
Composite Intermodulation Noise (CIN), dB[12]	59	58

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42/54 MHz Split General Node Specifications (Continued)

Characteristics	Specifications
Chrominance to Luminance Delay	
Channel 2, ns max./3.58 MHz	15
Channel 3, ns max./3.58 MHz	10
Channel 4, ns max./3.58 MHz	7
Channel 5, ns max./3.58 MHz	4
Hum Modulation (Time Domain @ 15 A)	
54 to 750 MHz, dB	60
751 to 1002 MHz, dB	55
Gain Control, plug-in PADs	NPB-000 to NPB-200 (0–20 dB)
Equalization, 1 GHz and 870 MHz	GEQL-000 (0 dB), GEQL-020 to GEQL-130 (2–13 dB)
Return Path RF	
Operating Passband, MHz	5 to 42
Optimum RF Input Level, dBmV/6 MHz	12
Gain Slope, dB	± 1.0
Flatness @ Gain Slope, dB	± 1.0
Return Loss, dB (All RF Ports)	16.0
Port to Port Isolation, dB, typ.	70
Testpoints	–20 ± 0.5
RF Input, Directional, dB	1V/mW ± 10%
Transmitter Output Optical Power	62
Group Delay	20
5.5 to 7 MHz, ns, max.	
38.5 to 40 MHz, ns, max.	50
Hum Modulation (Time Domain @ 15 A)	60
5 to 10 MHz, dB	NPB-000 to NPB-200 (0–20 dB)
11 to 42 MHz, dB	
Gain Control, plug-in PADs	

Specification Document Number 1500166 Rev R, 1507099 Rev E, 1508405 Rev B

NOTES:

1. Circuit resiliency to 5 dBm.
2. Maximum Roll-off of 1 dB at 51.5 MHz.
3. At the specified operational tilt, the maximum GaAs/GaN/Enhanced GaN output level for 870 MHz or 1002 MHz loading is 56.5/58.0/60.0 dBmV at the highest frequency.
4. 11dB EQ typically installed at each RF port at the factory to achieve 17.0 dB of tilt.
5. The distortion values listed are for the Node only. To obtain a particular link performance, combine the listed Node performance values with the applicable transmitter performance values.
6. Analog channels occupying the 54 to 550 MHz frequency range with digitally compressed channels or equivalent broadband noise to 1002 MHz at levels 6dB below equivalent video channels.
7. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 54-550 MHz frequency spectrum.
8. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 870MHz at levels 6dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 54-550MHz frequency spectrum.
9. Analog channels occupying the 54 to 250 MHz frequency range with 256-QAM channels to 1002 MHz at –6 dBc below equivalent video channels.
10. Systems operating with digitally compressed channels from 250 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 54-250 MHz frequency spectrum.
11. 256-QAM channels occupy 54 to 1002 MHz with 3 channels replaced by analog channels for CCNR measurement.
12. Systems operating with digitally compressed channels from 54 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise relative to any remaining analog channels.

55/70 MHz Split General Node Specifications

Characteristics	Specifications	
Number of Active RF/AC Ports	4	
Number of AC Only Ports	2	
Housing Passband, MHz	1002	
Port Impedance, Ω	75	
AC Current Passing, A (All Ports)	15	
Operating Temperature Range, °C	–40 to 60	
Operating/Storage Humidity Range	5 to 95%, non-condensing	
Forward Path Optical		
Optical Input Wavelength, nm	1290 to 1600	
Optical Input Range, dBm[1]	–3 to 3	
Forward RF		
Operating Passband, MHz	70 to 1002	
Output Level @ 1002 MHz,	**Std Rx@**	**High Gain Rx @ –6 dBm input**
>3% OMI, dBmV, min.	**–3 dBm input**	
GaAs RF Module	53.5	53.5 Max. output 56.5 dBmV @ 1 GHz analog equiv.
GaN RF Module	54.5	54.5 Max. output 58 dBmV @ 1 GHz analog equiv.
Enhanced GaN RF Module	53.5	53.5 Max. output 60 dBmV @ 1 GHz analog equiv.
Level Stability, dB, max.	± 1.5	
Gain Slope, dB[2]	16.7 ± 1.0	
Flatness @ Gain Slope	± 1.5	
Return Loss, dB, min. (All RF Ports)	16.0	
Port to Port Isolation, dB, typ.	70/60 (870/1002 MHz)	
Testpoints		
Forward Output, dB	–20 ± 0. 5 (70 to 550 MHz), –20 ± 0.75 (551 to 1002 MHz)	
Receiver Input Optical Level	1V/mW ± 10%	
76 NTSC Channel Performance[3,4]		
Frequency, MHz	1002/870/550/70	
Output Level, dBmV	53.5/51.2/45.4/36.8	
Carrier to Noise Ratio, 4 MHz, 75 Ω, dB	58.5, 0 dBm input	
Composite Triple Beat, –dBc	70	
Composite 2IM, –dBc	67	
Cross Modulation, per NCTA std., –dB	65	
Composite Intermodulation Noise CIN, dB[5]	62	
Chrominance to Luminance Delay		
Channel 5, ns max./3.58 MHz	7	
Channel 6, ns max./3.58 MHz	4	
Hum Modulation (Time Domain @ 15 A)		
70 to 750 MHz, dB	60	
751 to 1002 MHz, dB	55	
Gain Control, plug-in PADs	NPB-000 to NPB-200 (0–20 dB)	
Equalization, 1 GHz and 870 MHz	GEQL-000 (0 dB), GEQL-020 to GEQL-130 (2–13 dB)	

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55/70 MHz Split General Node Specifications

Characteristics	Specifications
Return Path RF	
Operating Passband, MHz	5 to 55
Optimum RF Input Level, dBmV/6 MHz	12
Gain Slope, dB	± 1.0
Flatness @ Gain Slope, dB	± 1.0
RF Stability, dB	± 2.5
Return Loss, dB (All RF Ports)	16.0
Port to Port Isolation, dB, typ.	70
Testpoints	
RF Input, Directional, dB	–20 ± 0.5
Transmitter Output Optical Power	1V/mW ± 10%
Group Delay	
5.5 to 7 MHz, ns, max.	62
10 to 11.5 MHz, ns, max.	4
52 to 53.5 MHz, ns, max.	13
53.5 to 55 MHz, ns, max.	20
Hum Modulation (Time Domain @ 15 A)	
5 to 10 MHz, dB	50
11 to 55 MHz, dB	60
Gain Control, plug-in PADs	NPB-000 to NPB-200 (0–20 dB)

Specification Document Number 1501153 Rev G

NOTES:

1. Circuit resiliency to 5 dBm.
2. 11dB EQ typically installed at each RF port at the factory to achieve 16.7 dB of tilt.
3. The distortion values listed are for the Node only. To obtain a particular link performance, combine the listed Node performance values with the applicable transmitter performance values.
4. Analog channels occupying the 70 to 550 MHz frequency range with digitally compressed channels or equivalent broadband noise to 1002 MHz at levels 6dB below equivalent video channels.
5. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 70-550 MHz frequency spectrum.

65/85 MHz Split General Node Specifications

Characteristics	Specifications		
Number of Active RF/AC Ports	4		
Number of AC Only Ports	2		
Housing Passband, MHz	1006		
Port Impedance, Ω	75		
AC Current Passing, A (All Ports)	15		
Operating Temperature Range, °C	–40 to 60		
Operating/Storage Humidity Range	5 to 95%, non-condensing		
Forward Path Optical			
Optical Input Wavelength, nm	1290 to 1600 GaAs, 1290 to 1610 GaN		
Optical Input Range, dBm[1]	–3 to 3		
Equivalent Input Noise (HG Rx), pA/Hz$^{0.5}$	5.0		
Forward Path RF			
Operating Passband, MHz	85 to 1006		
Output Level @ 1002 MHz,	**Std Rx@**	**High Gain Rx @ –6 dBm input**	
>3% OMI, dBmV, min.[2]	**–3 dBm input**		
GaAs RF Module	53.5	53.5	Max. output 56.5 dBmV @ 1 GHz analog equiv.
GaN RF Module	54.5	54.5	Max. output 58 dBmV @ 1 GHz analog equiv.
Enhanced GaN RF Module	53.5	53.5	Max. output 60 dBmV @ 1 GHz analog equiv.
Level Stability, dB, max.	± 1.5		
Gain Slope, dB[3]	16.4 ± 1.0 GaAs, 16.5 ± 1.0 GaN		
Flatness @ Gain Slope	± 1.5		
Return Loss, dB, min. (All RF Ports)	16.0		
Port to Port Isolation, dB, typ.	70 @ 870 MHz/60 @ 1002 MHz		
Testpoints			
Forward Output, Directional, dB	–20 ± 0. 5 (85 to 550 MHz), –20 ± 0.75 (551 to 1006 MHz)		
Receiver Input Optical Level	1V/mW ± 10%		
60 PAL Channel Performance[4,5]	**GaAs**		**GaN**
Frequency, MHz	1002/600/119		1002/600/119
Output Level, dBmV[2]	53.5/46/37		56/48/39
Carrier to Noise Ratio, 5 MHz, 75 Ω, dB	57.5, 0 dBm input		58, 0 dBm input
Composite Triple Beat, –dBc	71		75
Composite 2IM, –dBc	69		70
Cross Modulation, per NCTA std., –dB	61		—
Composite Intermodulation Noise CIN, dB[6]	62		64
42 CENELEC Channel Performance[4]	**GaAs**		**GaN**
Frequency, MHz	870/600/85		870/119
Output Level, dBmV	51.2/46.3/37.1		57/49
Carrier to Noise Ratio, 5 MHz, 75 Ω, dB	57.5, 0 dBm input		58, 0 dBm input
Composite Triple Beat, –dBc	67		60
Composite 2IM, –dBc	65		60
Cross Modulation, per NCTA std., –dB	60		—
Chrominance to Luminance Delay			
112.25, ns max./4.43 MHz	3		
119.25, ns max./4.43 MHz	3		
Hum Modulation (Time Domain @ 15 A)			
85 to 750 MHz, dB	60		
751 to 1002 MHz, dB	55		
Plug-ins			
Gain Control PADs	NPB-000 to NPB-200 (0–20 dB)		
Equalizers for Alternate Equalization	GEQL-000 (0 dB), GEQL-020 to GEQL-130 (2 – 13 dB)		

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65/85 MHz Split General Node Specifications (Continued)

Characteristics	Specifications
Return Path RF	
Operating Passband, MHz	5 to 65
Optimum RF Input Level, dBmV/6 MHz	10
Gain Slope, dB	± 1.0
Flatness @ Gain Slope, dB	± 1.0
RF Level Stability, dB	± 2.5
Return Loss, dB (All RF Ports)	16.0
Port to Port Isolation, dB, typ.	70
Testpoints	
RF Input, Directional, dB	–20 ± 0.5
Transmitter Output Optical Power Level	1V/mW ± 10%
Group Delay	
7 to 9 MHz, ns, max.	28
61 to 63 MHz, ns, max.	10
Hum Modulation (Time Domain @ 15 A)	
5 to 10 MHz, dB	50
11 to 65 MHz, dB	60
Gain Control, plug-in PADs	NPB-000 to NPB-200 (0–20 dB)

Specification Document Number 1501149 Rev G, 1507596 Rev B, 1508407 Rev A

NOTES:

1. Circuit resiliency to 5 dBm.
2. At the specified operational tilt, the maximum GaAs/GaN/Enhanced GaN output level for 870 MHz or 1002 MHz loading is 56.5/58.0/60.0 dBmV at the highest frequency.
3. 11dB EQ typically installed at each RF port at the factory to achieve 16.4 dB of tilt using the GaAs RF module or 16.5 dB of tilt using the GaN RF module.
4. The distortion values listed are for the Node only. To obtain a particular link performance, combine the listed Node performance values with the applicable transmitter performance values.
5. PAL B/G video channel plan occupying the 85 to 600 MHz forward spectrum (based on the Spanish Law channel plan) with digitally compressed channels or equivalent broadband noise from 600 to 1002 MHz at levels 6dB below equivalent video channels.
6. Systems operating with digitally compressed channels or equivalent broadband noise from 600 to 1002 MHz at levels 6dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 85-600 MHz frequency spectrum.

85/105 MHz Split General Node Specifications

Characteristics	Specifications	
Number of Active RF/AC Ports	4	
Number of AC Only Ports	2	
Housing Passband, MHz	1002	
Port Impedance, Ω	75	
AC Current Passing, A (All Ports)	15	
Operating Temperature Range, °C	–40 to 60	
Operating/Storage Humidity Range	5 to 95%, non-condensing	
Forward Path Optical		
Optical Input Wavelength, nm	1290 to 1600	
Optical Input Range, dBm[1]	–3 to 3	
Equivalent Input Noise, pA/Hz[0.5]	5.0 (using High Gain Rx)	
Forward Path RF		
Operating Passband, MHz[2]	105 to 1002	
Output Level @ 1002 MHz,	**Std Rx@**	**High Gain Rx @ –6 dBm input**
>3% OMI, dBmV, min.[3]	**–3 dBm input**	
GaAs RF Module	53.5	53.5 Max. output 56.5 dBmV @ 1 GHz analog equiv.
GaN RF Module	54.5	54.5 Max. output 58 dBmV @ 1 GHz analog equiv.
Enhanced GaN RF Module	53.5	53.5 Max. output 60 dBmV @ 1 GHz analog equiv.
Level Stability, dB, max.	± 1.5	
Gain Slope, dB[4]	16.1 ± 1.0 GaAs, 16.0 ± 1.0 GaN	
Flatness @ Gain Slope[2]	± 1.5	
Return Loss, dB, min. (All RF Ports)	16.0	
Port to Port Isolation, dB	70 @ 870 MHz/60 @ 1002 MHz	
Testpoints		
Forward Output, Directional, dB	–20 ± 0. 5 (105 to 550 MHz), –20 ± 0.75 (551 to 1002 MHz)	
Receiver Input Optical Level	1V/mW ± 10%	
71 NTSC Channel Performance[5,6]	**GaAs**	**GaN**
Frequency, MHz	1002/870/550/105	1002/870/550/105
Output Level, dBmV[3]	53.5/51.2/45.4/37.4	56/53.5/48/40
Carrier to Noise Ratio, 4 MHz, 75 Ω, dB	58.5, 0 dBm input	60, 0 dBm input
Composite Triple Beat, –dBc	73	73
Composite 2IM, –dBc	67	70
Cross Modulation (per NCTA standard), –dB	70	67
Composite Intermodulation Noise, dB[7]	62.5	60
Composite Intermodulation Noise, dB[8]	68.5	65
22 NTSC Channel Performance[5,9]	**GaAs**	**GaN**
Frequency, MHz	1002/870/247/105	1002/870/247/105
Output Level, dBmV[3]	53.5/51.2/40/37.4	56/53.5/42.5/40
Carrier to Noise Ratio, 4 MHz, 75 Ω, dB	58.5, 0 dBm input	60, 0 dBm input
Composite Triple Beat, –dBc	80	80
Composite 2IM, –dBc	79	80
Composite Intermodulation Noise, dB[10]	60	58
146 256-QAM Channel Performance[5,11]	**GaAs**	**GaN**
Frequency, MHz	1002/870/550/105	1002/870/550/105
Analog Output Level, dBmV[3]	53.5/51.2/45.4/37.4	56/53.5/48/40
Carrier to Noise Ratio, 4 MHz, 75 Ω, dB	58.5, 0 dBm input	60, 0 dBm input
Digital Output Level, dBmV	47.5/45.2/39.4/31.4	50/47.5/42/34
Composite Intermodulation Noise (CIN), dB[12]	59	58
Chrominance to Luminance Delay[2]		
Channel 98, ns max./3.58 MHz	7	
Channel 99, ns max./3.58 MHz	5	

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85/105 MHz Split General Node Specifications (Continued)

Characteristics	Specifications
Hum Modulation (Time Domain @ 15 A)	
105 to 750 MHz, dB	60
751 to 1002 MHz, dB	55
Plug-ins	
Gain Control PADs	NPB-000 to NPB-200 (0–20 dB)
Equalizers for Alternate Equalization	GEQL-000 (0 dB), GEQL-020 to GEQL-130 (2 – 13 dB)
Return Path RF	
Operating Passband, MHz	5 to 85
Optimum RF Input Level, dBmV/6 MHz	9
Gain Slope, dB	± 1.0
Flatness @ Gain Slope, dB	± 1.0
Return Loss, dB (All RF Ports)	16.0
Port to Port Isolation, dB, typical	70
Testpoint Specifications	
RF Input, Directional, dB	–20 ± 0.5
Transmitter Output Optical Power Level Testpoint	1V/mW ± 10%
Group Delay[2]	
5.5 to 7 MHz, ns, max.	62
10 to 11.5 MHz, ns, max.	10
82 to 83.5 MHz, ns, max.	15
83.5 to 85 MHz, ns, max.	20
Hum Modulation (Time Domain @ 15 A)	
5 to 10 MHz, dB	50
11 to 85 MHz, dB	60
Gain Control, plug-in PADs	NPB-000 to NPB-200 (0–20 dB)

Specification Document Number 1504564 Rev G, 1508409 Rev B, 1508410 Rev B

1. Circuit resiliency to 5 dBm.
2. Roll-off from 105 MHz to 102 MHz is < 1.0 dB. Group delay from 103.25 MHz to 105.25 MHz is < 10 ns.
3. At the specified operational tilt, the maximum GaAs/GaN/Enhanced GaN output level for 870 MHz or 1002 MHz loading is 56.5/58.0/60.0 dBmV at the highest frequency
4. 11 dB EQ typically installed at each RF port at the factory to achieve 16.1 dB of tilt using the GaAs RF module or 16.0 dB of tilt using the GaN RF module.
5. The distortion values listed are for the Node only. To obtain a particular link performance, combine the listed Node performance values with the applicable transmitter performance values.
6. Analog channels occupying the 105 to 550 MHz frequency range with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6dB below equivalent video channels.
7. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 105-550 MHz frequency spectrum.
8. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 870 MHz at levels 6dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 105-550 MHz frequency spectrum.
9. Analog channels occupying the 105 to 250 MHz frequency range with 256-QAM channels to 1002 MHz at –6 dBc below equivalent video channels.
10. Systems operating with digitally compressed channels from 250 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 105 to 250 MHz frequency spectrum.
11. 256-QAM channels occupy 105 to 1002 MHz with 3 channels replaced by analog channels for CCNR measurement.
12. Systems operating with digitally compressed channels from 105 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise relative to any remaining analog channels.

Broadcast/Narrowcast Combiner Specifications

Characteristics	Specifications
RF Specifications[1]	
Frequency Range, Broadcast, MHz	54 to 550
Frequency Range, Narrowcast, MHz	568 to 1002
Insertion Loss, 54 to 544 MHz, max., dB	2.8
Insertion Loss, 573 to 1002 MHz, max., dB	2.8
Flatness, dB[1,2]	± 0.25
Slope/Rolloff, Broadcast Band, 544 to 550 MHz, dB	1.0
Slope/Rolloff, Narrowcast Band, 568 to 574 MHz, dB	1.0
Frequency, 3 dB Down, typ., MHz	559
Impedance, Ohms, (all ports)	75
Return Loss, min./typ. (all ports), dB[3]	16/18
Isolation, 54 to 500 MHz, min., dB[3]	–22
Isolation, 600 to 1002 MHz, min., dB[3]	–25
Isolation, Filter to Filter, min., dB[3]	–50
Isolation in Crossover @ 550/568 MHz, typ., dB	11
Group Delay, 541 to 547 MHz, max., ns	5
Group Delay, 568 to 574 MHz, max., ns	5
Connectors	mini SMB
Pull Force Required to Disengage, typ., lbs.	6.0

Specification Document Number 1504174 Rev A

NOTES:
1. Specifications reflect just BC/NC module. Node output levels should be calculated accordingly.
2. Does not include rolloff.
3. Specification excludes the filter crossover region.

1500209-001 through -004 Series Standard Gain Forward Optical Receiver Specifications

Characteristics	Specifications
Optical Specifications	
Optical Wavelength, nm	1290 to 1600
Optical Input Return Loss, dB, min.	45
Equivalent Noise Input, pA/Hz $^{0.5}$	8.5
Optical Input Range, dBm[1]	–3 to 3
Optical Power Threshold Alarm Limits, dBm	User-settable: –13 to 2
RF Specifications	
Impedance, Ohms	75
Frequency Range, MHz	40 to 1002
Slope, dB[2]	8 ± 0.5
Flatness, dB[3]	± 0.5
Return Loss, dB min.	16.0
RF Output Level, dBmV, min.[4]	37.0
Thermal Stability, dB[5]	± 1.5
Testpoint Specifications	
Output RF Testpoint, dB	–20 ± 0.75
Optical Power Monitor	1V/mW ± 10%
Optical Threshold Testpoint	1V/mW
79 NTSC Channel Performance Specifications @ Recommended Levels, typ.[6, 7]	
Frequency, MHz	1002/870/550/54
Output Level, dBmV	37.0/36.0/33.2/29.0
Carrier to Noise Ratio, 4 MHz, 75 Ohm, dB	59
Composite Triple Beat, –dBc	80
Cross Modulation, per NCTA std., –dB	75
Composite 2IM, –dBc	70
Composite Intermodulation Noise CIN, dB[7]	73
LED Indicators	
On/Off	Green: RF output on Off: RF output off
Optical Power Threshold	Green: optical input above threshold Off: optical input below threshold
DC Power	Green: DC power good Off: DC power failure
Powering Requirements	
Supply Voltages, VDC	24/5
DC Current, mA, max.	510/<5
Power Consumption, W, max.	12.25
Environmental Specifications	
Operating Temperature, ° C[5]	–20 to 85
Storage Temperature, ° C	–40 to 85
Relative Operating Humidity, %, non-condensing	95
Gain Control	
Plug-in PADs	NPB-000 to NPB-200 (0–20 dB)

Specification Document Number 1500422 Rev D

NOTES:

1. Circuit resiliency to +5 dBm.
2. Slope is linear and measured from 54 to 1002 MHz.
3. Flatness is measured with respect to slope.
4. RF output level is 37.0 dBmV minimum @ 1002 MHz with a –3.0 dBm received power, transmitter OMI of 3%, and an NPB-000 attenuator installed.
5. The receiver module is designed to operate in a node application with external ambient temperature ranging from –40 to 60° C.
6. The distortion values listed are for the receiver only. To obtain a particular link performance, combine the listed receiver performance values with the applicable transmitter performance values.
7. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 54 to 550 MHz frequency spectrum.

1500209-005 through -008 Series High Gain Forward Optical Receiver Specifications

Characteristics	Specifications
Optical Specifications	
Optical Wavelength, nm	1270 to 1610
Optical Input Return Loss, dB min.	45
Equivalent Noise Input, pA/ $Hz^{0.5}$	5.0
Optical Input Range, dBm[1]	–3 to +3 and –6 to 0 dBm
Optical AGC Options	–3 to +3 dBm, –6 to 0 dBm, or TLC
Optical Power Threshold Alarm Limits min., dBm	User Settable –11 to 1
RF Specifications	
Impedance, Ohms	75
Frequency Range, MHz	54-1006
Band Edge Roll off, dB max. (50 to 54 MHz)	0.5
Slope, dB	+8.0 dB, ± 0.5
Flatness, dB[2]	± 0.5
Return Loss, dB min.	16.0
RF Output Level, dBmV min.[3]	43
Stability, dB[4]	± 1.5
Low Frequency Isolation, dB typ. (5 to 42 MHz)	15
Testpoint Specifications	
Output RF Testpoint, dB	–20 ± 1
Optical Power Monitor	1V/mW ± 10%
Optical Threshold Testpoint	1V/mW
Performance Characteristics @ Recommended Levels, Typical[5]	
Channels, Number of NTSC[6]	79
Frequency, MHz	1002/870/550/54
Output Level, dBmV	43/42/39.2/35
Carrier to Noise Ratio, 4 MHz, 75 ohm, dB	59
Composite Triple Beat, -dBc	80
Cross Modulation (per NCTA std.), –dB	75
Composite 2IM, –dBc	70
Composite Intermodulation Noise CIN, dB[6]	70
LED Indicators	
OPT PWR (Optical Power)	Green – Optical power within acceptable input range; above threshold setting and below maximum input of: • 0 dBm (–6 to 0 dBm Optical AGC) • 3 dBm (–3 to 3 dBm Optical AGC) • 3 dBm (Thermal Level Control, TLC) Red – Optical power below the threshold level or above the maximum input of either 0 or 3 dBm. Amber – Optical power is within 10% of either the minimum or maximum level.
RF OUT[7]	Green – RF output is enabled Red – RF output is disabled by either A/B switch or by user control. Blinking Amber – Maximum attenuation value exceeded.
Powering Requirements	
Supply Voltages, V_{DC}	24 / 12 / 5
DC Current, mA max.	270 / 10 / 415
Power Consumption, W max.	8.7

continue to next page

High Gain Forward Optical Receiver (Continued)

Characteristics	Specifications
Environmental Specification	
Operating Temperature, °C[4]	–20 to +85
Storage Temperature, °C	–40 to +85
Relative Operating Humidity, % Non-condensing	95%
GAIN CONTROL	
Plug-in-PAD[8]	NPB-xxx

Specification Document Number 1507347 Rev D

NOTES:

1. Circuit resiliency to +5 dBm.
2. Flatness is measured with respect to slope.
3. RF output level is minimum @ 1006 MHz with a -3.0 dBm received power, transmitter OMI of 3.0%.
4. Combines AGC (if selected), thermal stability, and overall attenuation when used in a node application with external ambient temperature ranging from -40°C to +60°C.
5. The distortion values listed are for the receiver only. To obtain a particular link performance, combine the listed receiver performance values with the applicable transmitter performance values.
6. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1006 MHz at levels 6dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 54-550 MHz frequency spectrum. Distortion values are typical with an input of 0dBm @ 3.5% OMI.
7. Blinking amber indicates excessive attenuation between attenuator and AGC setting. Balance receiver at a higher output, or use an optical attenuator to lower the overall attenuation.
8. Plug-in-PAD provides service interruption protection. Attenuation will change after a new value of PAD is installed. For optimum performance while in AGC mode, do not exceed 6 dB of plug-in attenuation.

1500239 Series 1310 nm DFB Analog Return Transmitter Specifications

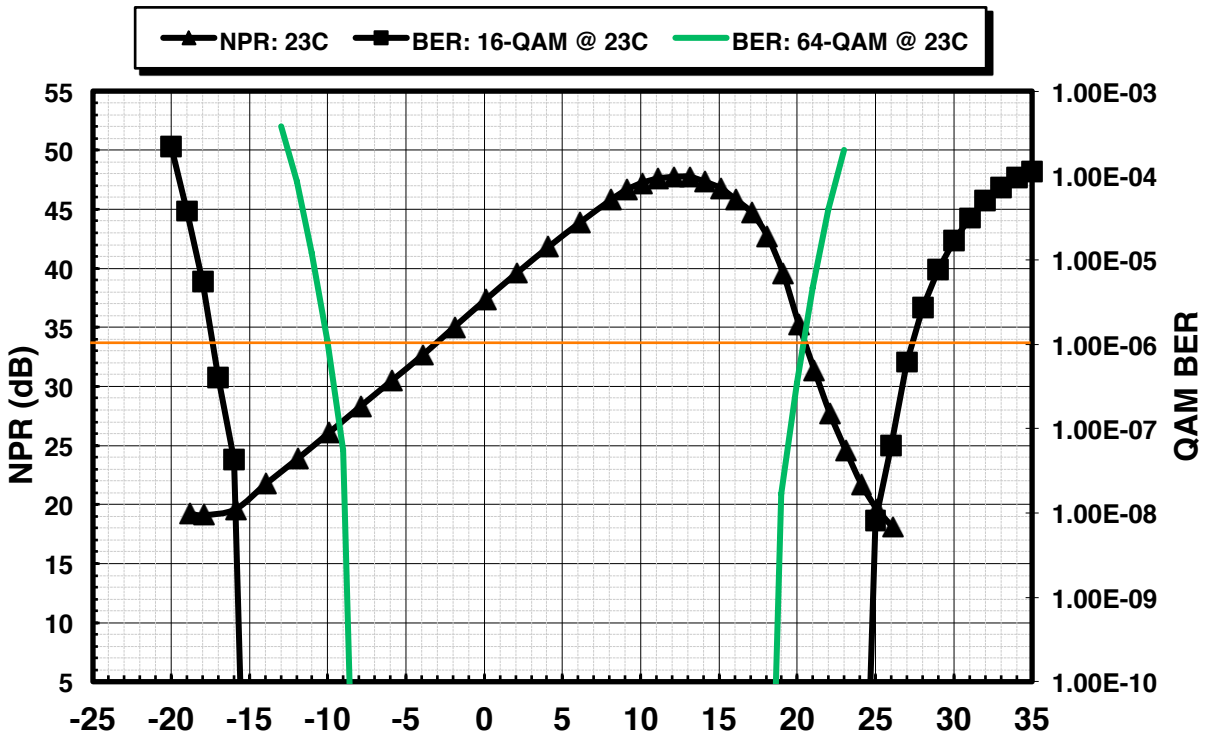
Characteristics	Specifications			
Optical Specifications				
Output Power, dBm[1]	3 ± 1			
Transmitted Wavelength, nm	1310 ± 20			
Laser Type	Isolated Uncooled DFB			
Optical Power Voltage Testpoint	1 mW/V ± 10%			
Optical Connector Types	SC/APC, FC/APC, SC/UPC, FC/UPC			
LED Indicators				
Optical Power	Green: ≥ 1.5 mW output; Off: <1.5 mW output			
DC Power	Green: DC Power good; Off: DC power not available			
RF Specifications (PRN with 37 MHz Loading)				
Impedance, Ohms	75			
RF Bandpass, MHz	5 to 200			
Return Loss, dB[2]	–18			
RF Monitor Point Insertion Loss, dB[3]	0 ± 0.5			
Flatness, dB, max.[4]	± 0.5			
Gain Slope, dB, max.[5]	± 0.5			
Level Stability Over Temp., dB	± 2.5			
Operating Temperature, °C[6]	–20 to 85			
Powering Specifications				
Supply Voltage, VDC	24/12/5 ± 0.5			
Current Draw, mA, max.	40/220/5			
Performance	**42/54 MHz Split**	**55/70 MHz Split**	**65/85 MHz Split**	**85/105 MHz Split**
Optimum Transmitter Input Level, dBmV/6 MHz[7]	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Optimum RF Monitor Point Level, dBmV/6 MHz	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Pseudo Random Noise (PRN) Loading, MHz	37	37	60	80
Optical Modulation Index (OMI), % per channel, typ.[8]	10	10	7.9	7.1
Link Level Stability, dB	± 2.5	± 2.5	± 2.5	± 2.5
NPR/Dynamic Range, dB[9]	41/12	41/11	41/10	41/8
BER Dynamic Range, 16-QAM/64-QAM, dB[9,10]	35/25	34/24	33/23	31/21

Specification Document Number 1500166 Rev T, 1507099 Rev E, 1501153 Rev G, 1507596 Rev B, 1501149 Rev G, 1504564 Rev G,1500237 Rev C

NOTES:

1. Measured at output of bulkhead connector.
2. Return loss is –16 dB from 160 to 200 MHz.
3. RF monitor point is 0 dB referenced to the transmitter input with a 0 dB pad installed in the transmitter.
4. Flatness is measured with respect to gain slope.
5. Gain slope is measured as a straight line from 5 to 200 MHz.
6. Denotes transmitter temperature. Product must operate in a node from –40 to 60° C.
7. Optimum transmitter input for 5 to 200 MHz loading is 5 dBmV/6 MHz.
8. OMI/channel measurement obtained using specified CW per channel loading.
9. Measured over 15 km fiber link using the specified pseudo random noise (PRN) loading. All measurements are typical and taken at room temperature.
10. BER performance is measured with QAM loading over 15 km pure fiber link for a Bit Error Rate of $1E^{-06}$. All measurements are typical.

OM4100 NPR/BER 16-QAM and 64-QAM Curves with 1500239 Series 1310 nm DFB Transmitters



Node Input Level (dBmV/6 MHz)
(to convert dBmV/6 MHz to dBmV/Hz, subtract 67.78)

*1500239 Series 1310nm DFB transmitter installed in OM4100 node with ≈6 dB optical link

152220 Series 1550 nm DFB Analog Return Transmitter Specifications

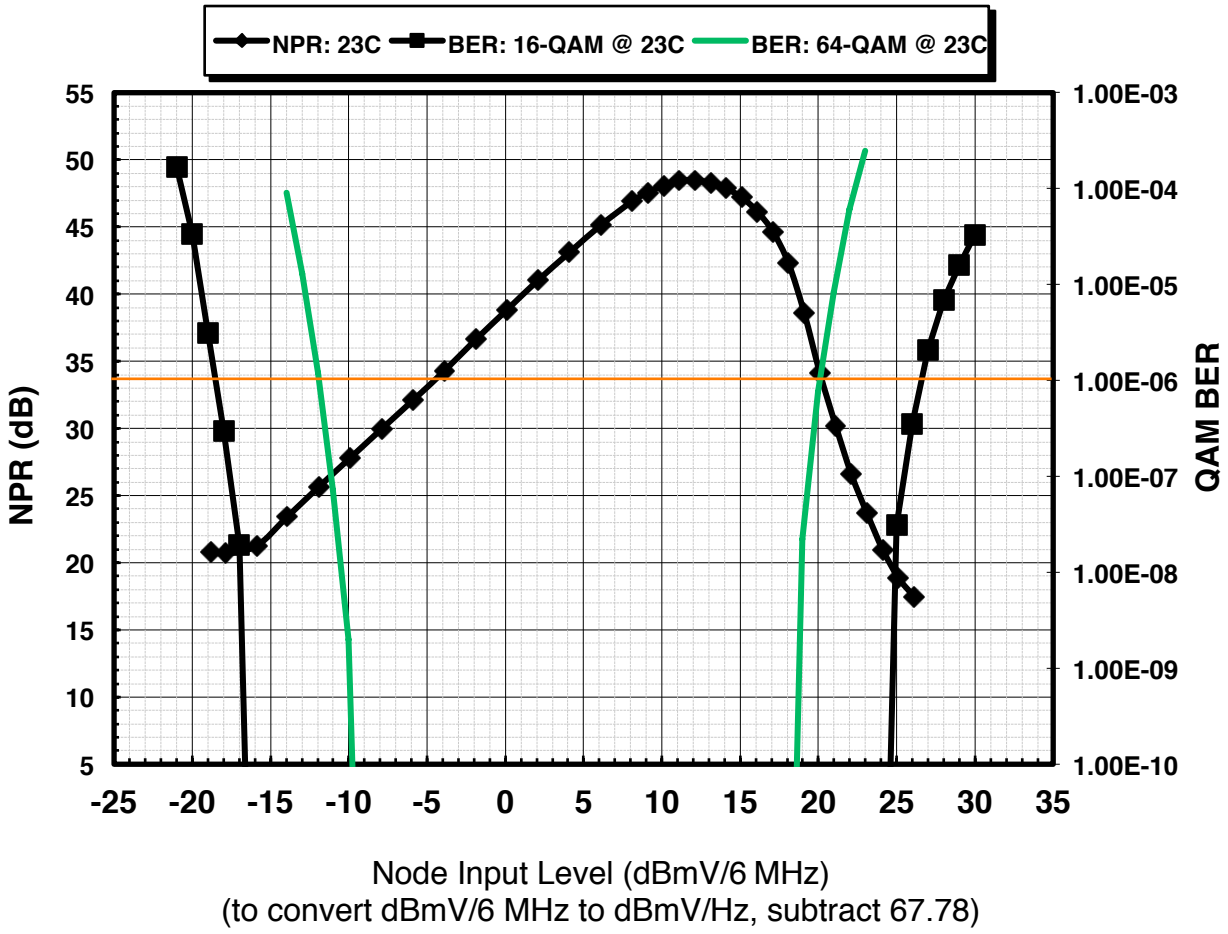
Characteristics	Specifications			
Optical Specifications				
Output Power, dBm[1]	3 ± 1			
Transmitted Wavelength, nm	1550 ± 25			
Laser Type	Isolated Uncooled DFB			
Optical Power Testpoint	1 mW/V ± 10%			
Optical Connector Types	SC/APC, FC/APC, SC/UPC, FC/UPC			
LED Indicators				
Optical Power	Green: Š≥1.5 mW output; Off: <1.5 mW output			
DC Power	Green: DC Power OK; Off: DC power not available			
RF Specifications (PRN with 37 MHz Loading)				
Impedance, Ohms	75			
RF Bandpass, MHz	5 to 200			
Return Loss, dB[2]	–18			
RF Monitor Point Insertion Loss, dB[3]	0 ± 0.5			
Flatness, dB, max.[4]	± 0.5			
Gain Slope, dB, max.[5]	± 0.5			
Level Stability Over Temp., dB	± 2.5			
Operating Temperature, °C[6]	–20 to 85			
Powering Specifications				
Supply Voltage, VDC	24/12/5 ± 0.5			
Current Draw, mA, max.	40/220/5			
Performance	**42/54 MHz Split**	**55/70 MHz Split**	**65/85 MHz Split**	**85/105 MHz Split**
Optimum Transmitter Input Level, dBmV/6 MHz[7]	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Optimum RF Monitor Point Level, dBmV/6 MHz	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Pseudo Random Noise (PRN) Loading, MHz	37	37	60	80
Optical Modulation Index (OMI), % per channel, typ.[8]	10	10	7.9	7.1
Link Level Stability, dB	± 2.5	± 2.5	± 2.5	± 2.5
NPR/Dynamic Range, dB[9]	41/12	41/11	41/10	41/8
BER Dynamic Range, 16-QAM/64-QAM, dB[9,10]	35/25	34/24	33/23	31/21

Specification Document Number 1500166 Rev T, 1507099 Rev E, 1501153 Rev G, 1507596 Rev B, 1501149 Rev G, 1504564 Rev G, 601241 Rev H

NOTES:

1. Measured at output of bulkhead connector.
2. Return loss is –16 dB from 160 to 200 MHz.
3. RF monitor point is 0 dB referenced to the transmitter input with a 0 dB PAD installed in the transmitter.
4. Flatness is measured with respect to gain slope.
5. Gain slope is measured as a straight line from 5 to 200 MHz.
6. Denotes transmitter temperature. Product must operate in a node from –40 to 60° C.
7. Optimum transmitter input for 5 to 200 MHz loading is 5 dBmV/6 MHz.
8. OMI/channel measurement obtained using specified CW per channel loading.
9. Measured over 25 km fiber link using the specified pseudo random noise (PRN) loading. All measurements are typical and taken at room temperature.
10. BER performance is measured with QAM loading over 25 km pure fiber link for a Bit Error Rate of $1E^{-06}$. All measurements are typical.

OM4100 NPR/BER 16-QAM and 64-QAM Curves with 152220 Series 1550 nm DFB Transmitters



*152220 Series 1550nm DFB transmitter installed in OM4100 node with ≈6 dB optical link

Analog CWDM Return Transmitter Specifications

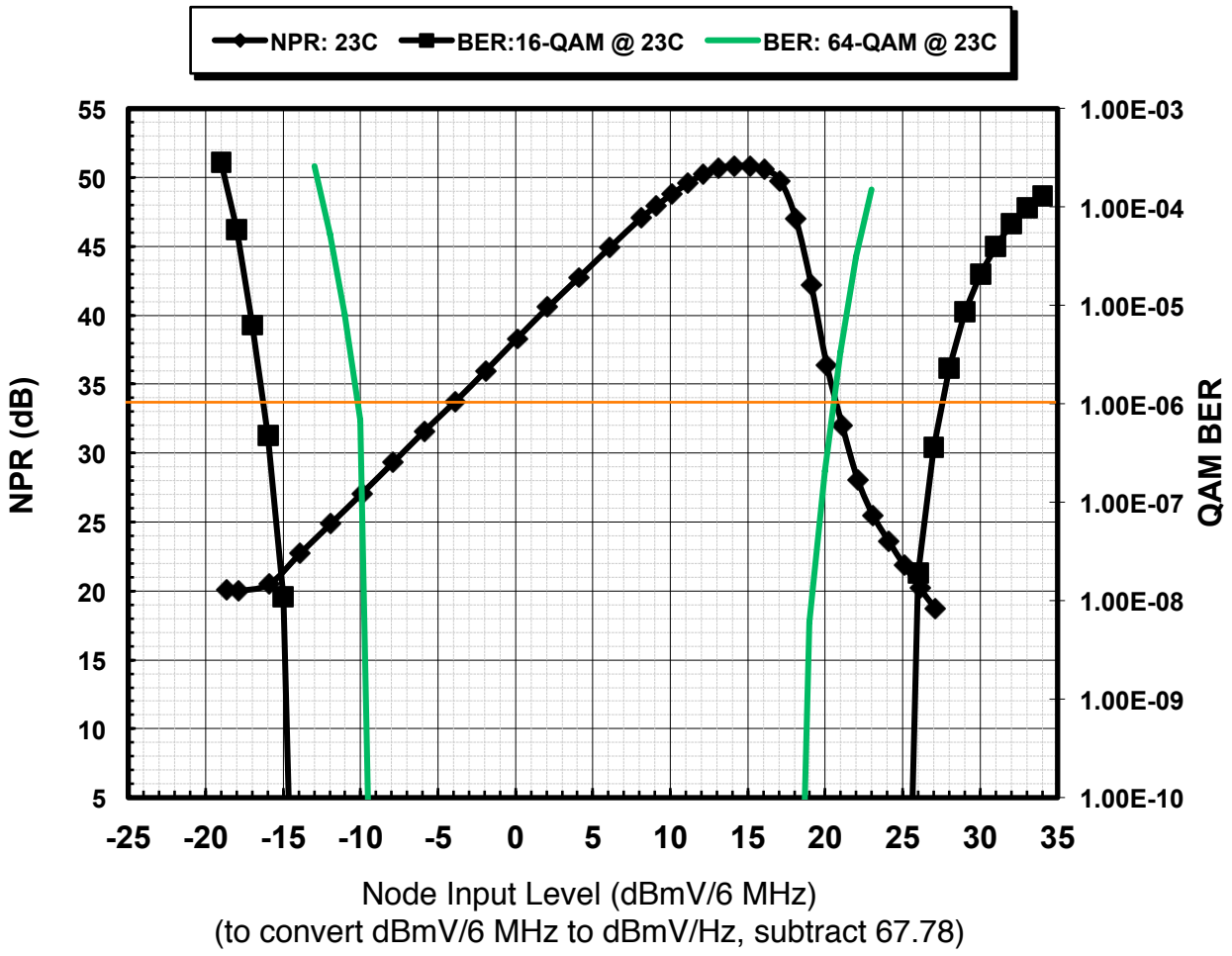
Characteristics	Specifications			
Optical Specifications				
Output Power, dBm[1]	3 ± 1			
Transmitted Wavelength, nm	1271 to 1611 ± 6.5 nm (18 CWDM channels, 20 nm spacing)			
Laser Type	Isolated Uncooled DFB			
Optical Power Testpoint	1 mW/V ± 10%			
Optical Connector Types	SC/APC, FC/APC, SC/UPC, FC/UPC			
LED Indicators				
Optical Power	Green: Š≥1.5 mW output; Off: <1.5 mW output			
DC Power	Green: DC Power OK; Off: DC power not available			
RF Specifications (PRN with 37 MHz Loading)				
Impedance, Ohms	75			
RF Bandpass, MHz	5 to 200			
Return Loss, dB[2]	–18			
RF Monitor Point Insertion Loss, dB[3]	0 ± 0.5			
Frequency Flatness, dB, max.[4]	± 0.5			
Gain Slope, dB, max.[5]	± 0.5			
Level Stability Over Temp., dB	± 2.5			
Reverse Spurious, dBc	< –60			
Operating Temperature, °C[6]	–30 to 85			
Powering Specifications				
Supply Voltage, VDC	24/12/5 (± 0.5)			
Current Draw, mA, max.	240/220/5			
Performance	**42/54 MHz Split**	**55/70 MHz Split**	**65/85 MHz Split**	**85/105 MHz Split**
Optimum Transmitter Input Level, dBmV/6 MHz[7]	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Optimum RF Monitor Point Level, dBmV/6 MHz	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Pseudo Random Noise (PRN) Loading, MHz	37	37	60	80
Optical Modulation Index (OMI), % per channel, typ.[8]	10	10	7.9	7.1
Link Level Stability, dB	± 2.5	± 2.5	± 2.5	± 2.5
NPR/Dynamic Range, dB[9]	35/15	35/14	35/13	35/11
BER Dynamic Range, 16-QAM/64-QAM, dB[9,10]	34/25	33/24	32/23	30/21
EMS Monitor Status				
Laser Shut Down				
Enabled, V	5 ± 0.25			
Disabled, V	0 ± 0.25			

Specification Document Number 1500166 Rev T, 1507099 Rev E, 1501153 Rev G, 1507596 Rev B, 1501149 Rev G, 1504564 Rev G,1500893 Rev G

NOTES:

1. Measured at output of bulkhead connector.
2. Return loss is –16 dB from 160 to 200 MHz.
3. RF monitor point is 0 dB referenced to the transmitter input with a 0 dB PAD installed in the transmitter. RF monitor point is 0 ± 1.0 dB from 170 to 200 MHz.
4. Flatness is measured with respect to gain slope.
5. Gain slope is measured as a straight line from 5 to 200 MHz.
6. Denotes transmitter temperature. Product must operate in a node from –40 to 60° C.
7. Optimum transmitter input for 5 to 200 MHz loading is 5 dBmV/6 MHz.
8. OMI/channel measurement obtained using specified CW per channel loading.
9. Measured over 6 dB fiber link using the specified pseudo random noise (PRN) loading. All measurements are typical and taken at room temperature.
10. BER performance is measured with QAM loading over 6 dB pure fiber link for a Bit Error Rate of 1E–06. All measurements are typical.

OM4100 NPR, 16-QAM & 64-QAM BER Performance with Analog CWDM Transmitters



*Analog CWDM DFB transmitter installed in OM4100 node with ≈6 dB optical link

Analog DWDM Return Transmitter Specifications

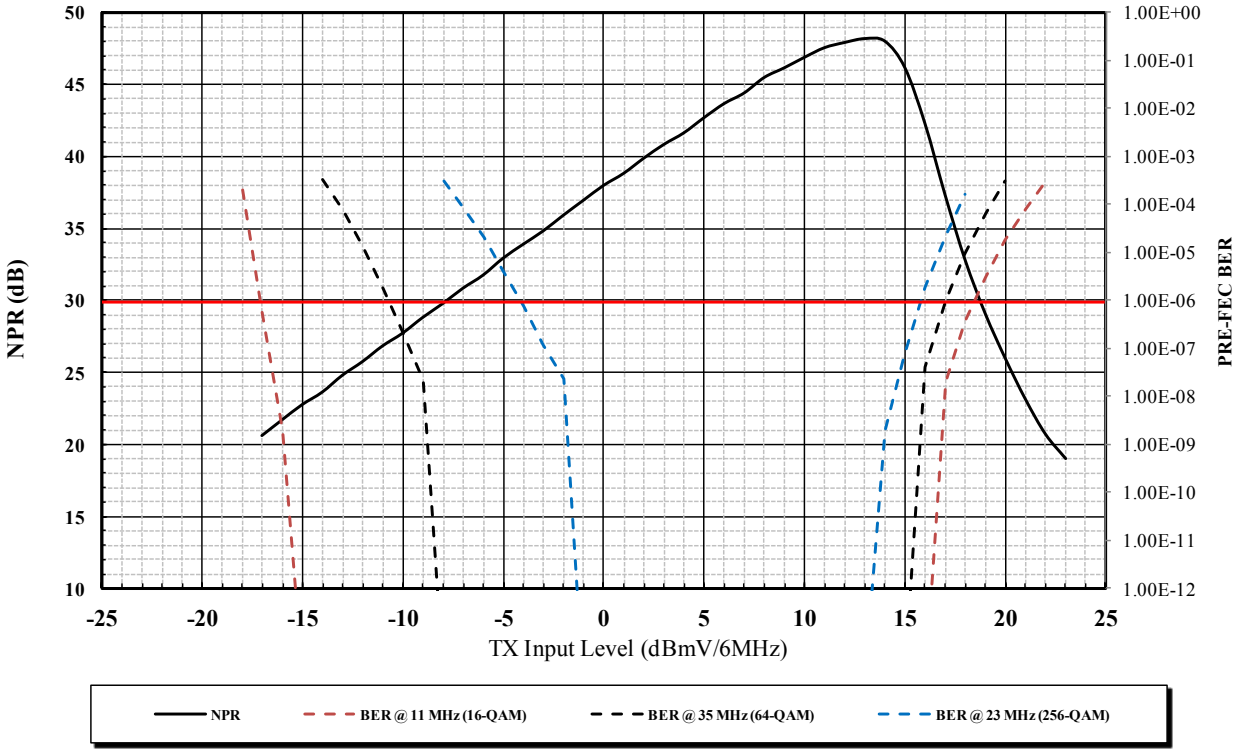
Characteristics	Specifications			
Optical				
Output Power, dBm[1]	8 ± 1			
Transmitted Wavelength	100 GHz spacing, ITU CH 19-63			
Wavelength Tolerance	± 0.11 nm			
Laser Type	Isolated Thermal Electric Cooled DFB			
Optical Output Power Testpoint	1 mW/V ± 10%			
Optical Connector Type	SC/APC, SC/UPC, FC/APC, FC/UPC			
LED Indicators				
DC Power	Green: DC Power OK; Off: DC Power Not Available			
Optical Output Power	Green: ≥ 7dBm output; Off < 7dBm output			
RF Characteristics				
Impedance, Ohms	75			
RF Bandpass, MHz	5 to 200			
Return Loss, dB	–20 (5 to 100 MHz); –16 (100 to 200 MHz)			
RF Monitor Point Insertion Loss, dB[2]	0 ± 0.5			
Frequency Flatness , dB maximum[3]	± 0.5			
Gain Slope , dB maximum[4]	± 0.5			
Level Stability Over Temperature, dB	± 1.5			
ID Tone @ 2.08 MHz, dBc[5]	–10			
Reverse Spurious, dBc	< –60			
Operating Temperature, °C[6]	–30 to +85 (–22 to 185°F)			
Powering Specifications				
Supply Voltage, VDC	24 ± 0.5/12 ± 0.5/5 ± 0.5			
Current Draw, mA maximum	200/100/600			
Total DC Power, W maximum	9			
Performance	**42/54 MHz Split**	**55/70 MHz Split**	**65/85 MHz Split**	**85/105 MHz Split**
Optimum Transmitter Input Level, dBmV/6 MHz[7]	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Optimum RF Monitor Point Level, dBmV/6 MHz	12 (–56 dBmV/Hz)	12 (–56 dBmV/Hz)	10 (–58 dBmV/Hz)	9 (–59 dBmV/Hz)
Pseudo Random Noise (PRN) Loading, MHz	37	37	60	80
Optical Modulation Index (OMI), % per channel, typ.[8]	10	10	7.9	7.1
Link Level Stability, dB	± 2.5	± 2.5	± 2.5	± 2.5
NPR/Dynamic Range, dB[9]	35/15	35/14	35/13	35/11
BER Dynamic Range, 16-QAM/64-QAM, dB[9,10]	34/25	33/24	32/23	30/21

Specification Document Number 1500166 Rev T, 1507099 Rev E, 1501153 Rev G, 1507596 Rev B, 1501149 Rev G, 1504564 Rev G,1507187 Rev G

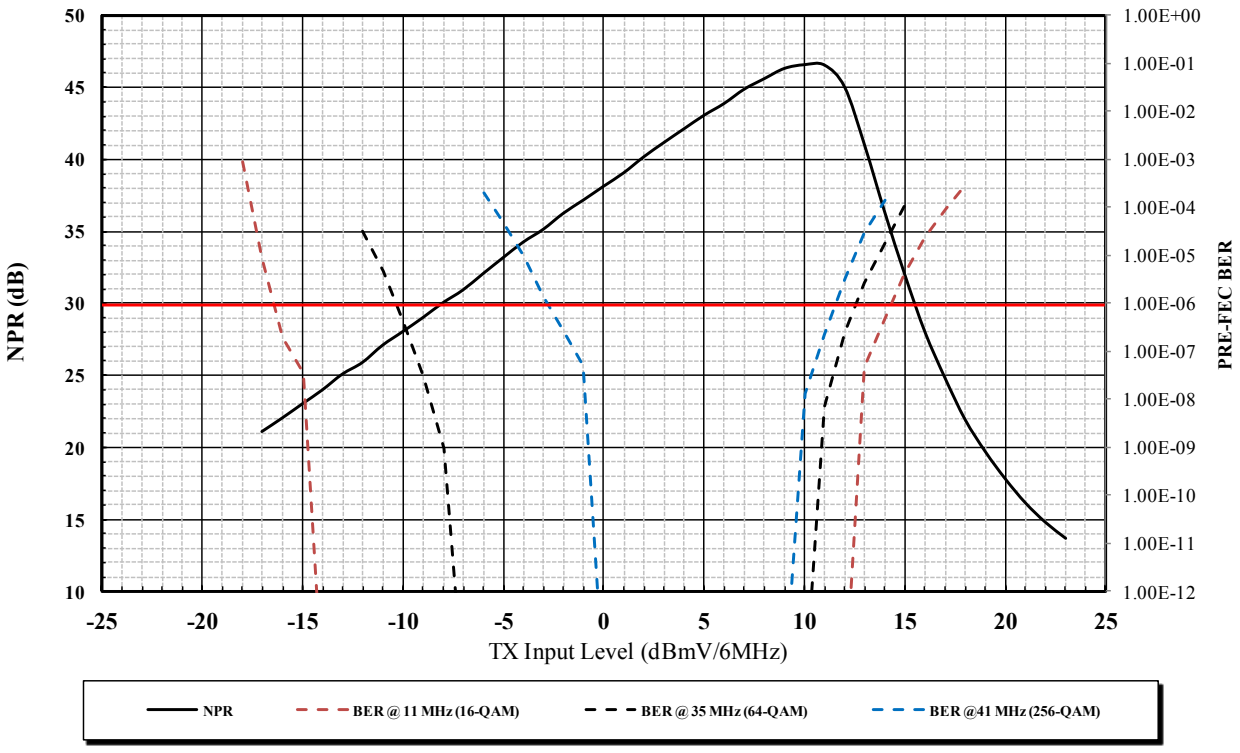
NOTES:

1. Measured at output of bulkhead connector.
2. RF Testpoint is 0 dB referenced to transmitter input with a 0 dB PAD installed in the **CONFIG PAD** location.
3. Flatness is measured with respect to gain slope.
4. Gain Slope is measured using least squares method.
5. The ID tone is factory-set to be 10 dB lower than an input carrier at 12 dBmV/6 MHz.
6. Denotes transmitter temperature. Product must operate in a node from -40 to +60°C.
7. Optimum transmitter input for 5 to 200 MHz loading is 5 dBmV/6 MHz.
8. OMI/channel measurement obtained using specified CW per channel loading.
9. Measured over 40 km fiber link using the specified pseudo random noise (PRN) loading. All measurements are typical and taken at room temperature.
10. BER performance is measured with QAM loading over 40 km pure fiber link for a Bit Error Rate of $1E^{-06}$. All measurements are typical.

OM4100 DWDM TX Typical NPR
NPR 37 MHz Loading, BER 64-QAM & 256-QAM
40 km Fiber and Passive Atten. w/ CHP-R2RR @ -8 dBm Optical I/P



OM4100 DWDM TX Typical NPR
NPR 80 MHz Loading, BER 64-QAM & 256-QAM
40 km Fiber and Passive Atten. w/ CHP-R2RR @ -8 dBm Optical I/P



CWDM 2:1 TDM Digital Return Transmitter (Double-width) Specifications

Characteristics	Specifications	
Optical Specifications		
Output Power, mW[1]	2.0 ± 0.5 (1.76 to 4.0 dBm)	
Wavelength, nm, (8 CWDM channels, 20 nm spacing), 25° C	1471 to 1611 +2.5/–6 nm	
Wavelength Drift Over Oper. Temp. Range, nm, typ.	1471 to 1611 ± 6.0 nm	
Laser Type	CWDM, Isolated DFB	
Optical Power Voltage Testpoint	1 V/mW ± 10%	
Optical Connector Type	SC/APC	
RF Specifications, each channel		
RF Bandpass, MHz	5 to 42	
Flatness, dB[2]	± 0.5	
Gain Slope, dB[3]	0 ± 0.25	
Gain Stability Over Temp., dB	± 1.0	
Input and Testpoint Impedance, Ohms	75	
Input and Testpoint Return Loss, dB	16	
RF Testpoint from Transmitter Input (PAD = 0 dB), dB[4]	–20 ± 0.5	
CW Input Level at Peak NPR, dBmV/6 MHz, min.	12, with 0 dB attenuation	
LED Indicators	**Channel A LED**	**Channel B LED**
No Laser Installed/Laser Failure	solid red	solid red
Channel A RF Overdrive	flashing red	—
Channel B RF Overdrive	—	flashing red
Laser Power and RF OK	solid green	solid green
Powering Specifications		
Power Consumption, W, typ. [5]	10	
Temperature Range		
Operating Temperature, °C[6]	–20 to 85 (–4 to 185°F)	
System Specifications[7]		
NPR @ 12 dBmV TX input, dB, typ.	50, with 0 dB attenuation	
NPR Peak, dB, min.	48	
Dynamic Range @ ≥ 40 dB NPR, dB, typ./min.	18/16	
BER Dynamic Range @ < 10^{-6} BER, dB, 4-QAM/64-QAM, typ.	45/30	
Link Gain, dB[8]	32, with 0 dB input attenuation @ Tx, max gain @ Rx	
Link Flatness, dB, typ./max.	± 0.75/±1.00	

Specification Document Number 1500166 Rev T, 1500189 Rev H

NOTES:

1. Measured at output of bulkhead connector through a low loss (< 0.3 dB) 1-meter (or less) fiber jumper at 25° C.
2. Flatness is measured with respect to gain slope.
3. Gain slope is measured as a straight line from 5 to 42 MHz.
4. The transmitter testpoints are 20 dB plus the corresponding **REV PAD** value lower than the port input level.
5. DC current draw requirements for 2:1 TDM digital CWDM transmitters: add 1.5 A @ 5 V and 130 mA @ 12 V for each additional transmitter.
6. Denotes transmitter temperature. Temperature range when installed in node must be –40 to 60° C, ambient.
7. System specifications with up 100 km fiber link.
8. With 0 dB input attenuation at transmitter and maximum gain at receiver.

DWDM 2:1 TDM Digital Return Transmitter (Double-width) Specifications

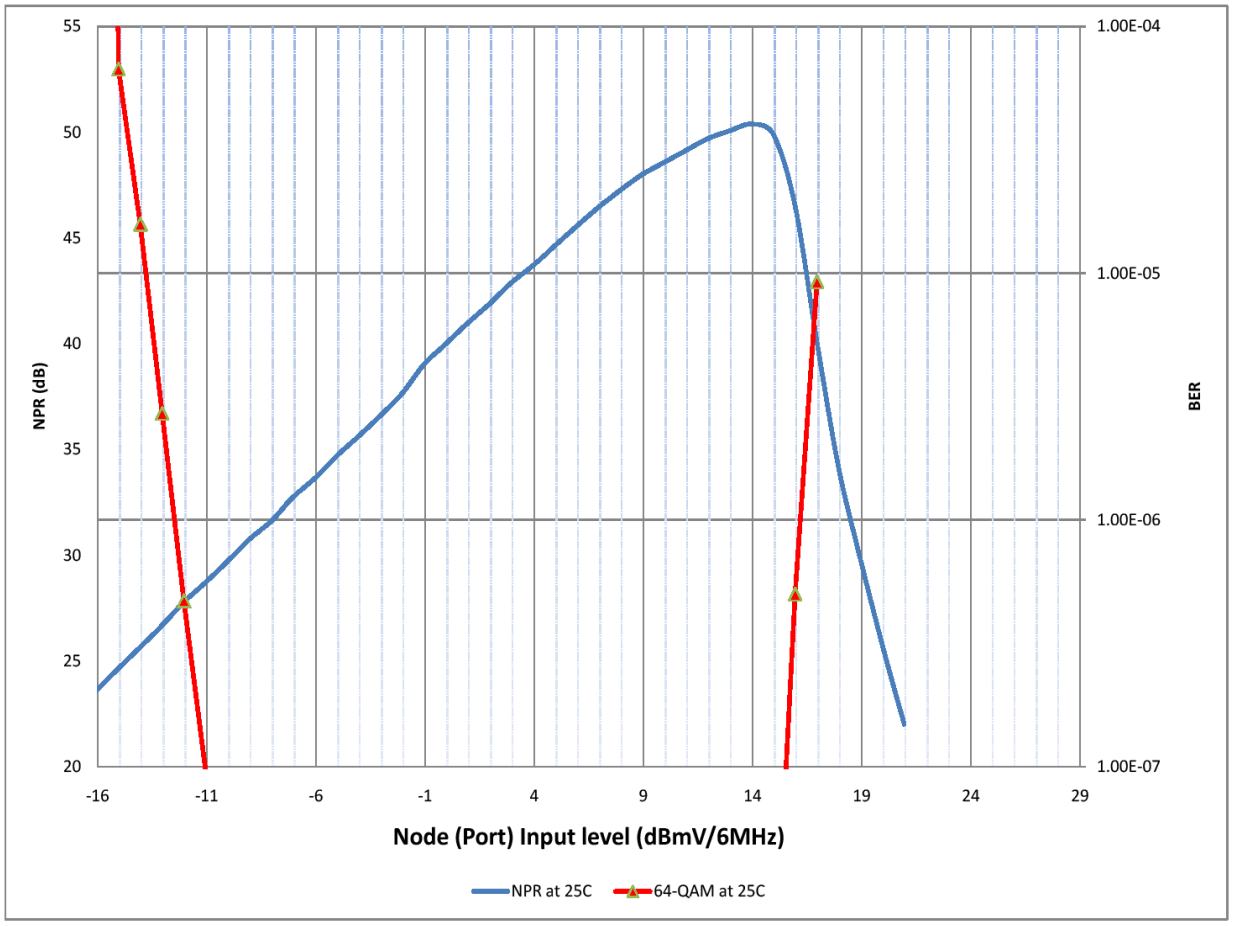
Characteristics	Specifications	
Optical Specifications		
Output Power, dBm[1]	4.25 ± 0.25	
Wavelength, nm, (45 DWDM channels, 100 GHz spacing, ITU channels 17 through 61, 25° C)	1528.77 nm (ITU channel 61) through 1563.86 nm (ITU channel 17)	
Wavelength Drift Over Oper. Temp. Range, nm, typ.	± 0.1 nm	
Laser Type	DWDM, Isolated DFB	
Optical Power Voltage Testpoint	1 V/mW ± 10%	
Optical Connector Type	SC/APC	
RF Specifications, each channel		
RF Bandpass, MHz	5 to 42	
Flatness, dB[2]	± 0.50	
Gain Slope, dB[3]	0 ± 0.25	
RF Gain Stability Over Temperature, dB	± 1.0	
Input and Testpoint Impedance, Ohms	75	
Input and Testpoint Return Loss, dB, min.	16	
RF Testpoint from Transmitter Input (PAD = 0 dB), dB[4]	–20 ± 0.5	
CW Input Level at Peak NPR, dBmV/6 MHz, min.	12, with 0 dB attenuation	
LED Indicators	**Channel A LED**	**Channel B LED**
No Laser Installed/Laser Failure	solid red	solid red
Channel A RF Overdrive	flashing red	—
Channel B RF Overdrive	—	flashing red
Laser Power and RF OK	solid green	solid green
Powering Specifications		
Power Consumption, W, typ.	10	
Temperature Range		
Operating Temperature, °C[5]	–20 to 85 (–4 to 185°F)	
System Specifications[6]		
NPR @ 12 dBmV TX input, dB, typ.	50, with 0 dB attenuation	
NPR Peak, dB, min.	48	
Dynamic Range @ ≥ 40 dB NPR, dB, typ./min.	16.5/15	
BER Dynamic Range @ < 10^{-6} BER, dB	28 (64-QAM), 34 (16-QAM), 45 (QPSK)	
Link Gain, dB[7]	32	
Link Flatness, dB, typ./max.	± 0.75/±1.00	

Specification Document Number 1504919 Rev C

NOTES:

1. Measured at output of bulkhead connector through a low loss (< 0.3 dB) 1-meter (or less) fiber jumper at 25° C.
2. Flatness is measured with respect to gain slope.
3. Gain slope is measured as a straight line from 5 to 42 MHz.
4. The transmitter testpoints are 20 dB plus the corresponding **REV PAD** value lower than the port input level.
5. Denotes transmitter temperature. Temperature range when installed in node must be –40 to 60° C, ambient.
6. System specifications with up 100 km fiber link.
7. With 0 dB input attenuation at transmitter and maximum gain at receiver.

OM4100 NPR/BER 64-QAM Curve with 2:1 Double-width Digital Return Transmitter

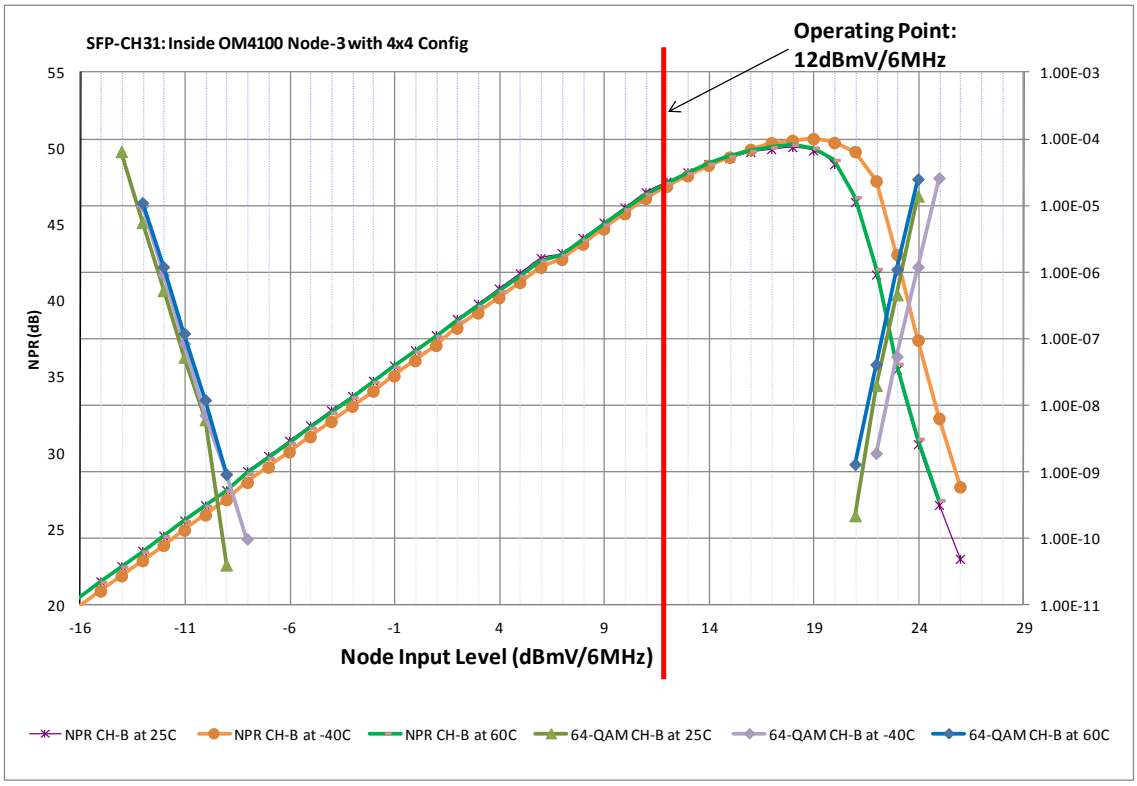


NPR/BER Curve Obtained Using a 2:1 TDM Digital Return Transmitter (Double-width) Installed in an OM4100 Node with 100 km SMF, and fully loaded from 5 to 42 MHz with six 64-QAM Channels

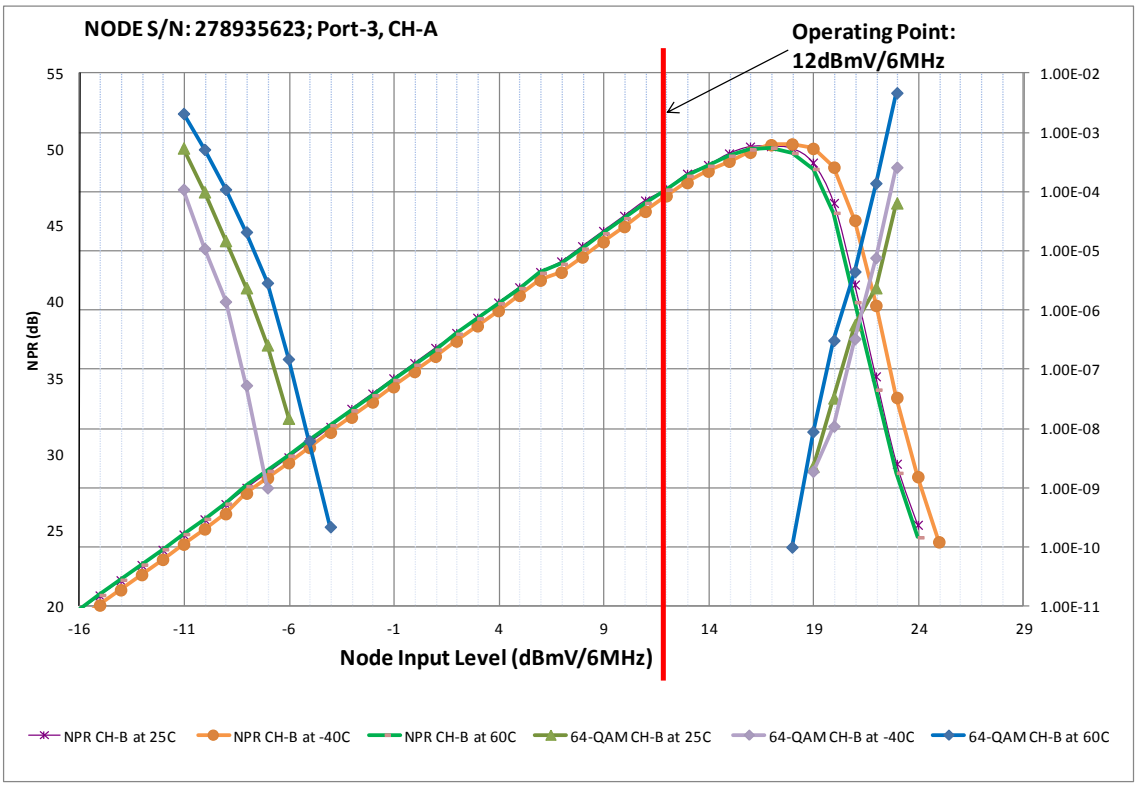
Flexible Digital Return Processing Module (Single-width) Specifications

Characteristics	Specifications		
Optical Specifications	**5 to 42 MHz**	**5 to 65 MHz**	**5 to 85 MHz**
A standard, industrial temperature range DWDM, CWDM, 1310 nm, or 1550 nm SFP with a data rate of 2.488 Gb/s or higher (5 to 42 MHz or 5 to 85 MHz) or 3.73 Gbps (5 to 65 MHz) must be plugged into an OM4100 digital processing module.			
RF Specifications, each channel			
RF Bandpass, MHz	5 to 42	5 to 65	5 to 85
RF Digitizing Resolution	10 (12 companded)	10 (12 companded)	10 (12 companded)
RF to Optical Ratio	2:1	2:1	1:1
Data Rate, Gb/s	2.488	3.73	2.488
Flatness, dB	± 0.50	± 0.50	± 0.50
Recommended Operational Input Testpoint Level, dBmV/Ch	–8	–8	–8
RF Gain Stability Over Temperature, dB	± 1.0	± 1.0	± 1.0
Input and Testpoint Impedance, Ohms	75	75	75
Input and Testpoint Return Loss, dB, min.	16	16	16
Attenuation from port input to Digital Processing module RF Testpoint, dB	–20 ± 0.5	–20 ± 0.5	–20 ± 0.5
LED Indicators	**LED State**		
SFP not installed	TX 1 & 2 = Red	TX 1 & 2 = Red	TX = Red
SFP fault or other system error — bottom SFP	TX 1 & 2 = Red 1 blink repeating sequence		TX = Red 1 blink repeating sequence
SFP fault — top SFP	TX 1 & 2 = Red 2 blink repeating sequence		TX = Red 2 blink repeating sequence
SFP fault — top and bottom SFPs	TX 1 & 2 = Red 3 blink repeating sequence		TX = Red 3 blink repeating sequence
No optical input signal detected since SFP has been installed	RX 1 = Off	LED not active	No LED
Optical input signal detected and lost since SFP was installed or optical input signal detected but receiver not locked since SFP has been installed	RX1 = Solid Red	LED not active	No LED
Optical input signal detected, receiver locked to incoming signal, bit errors detected	RX1 = Red 1 blink repeating sequence	LED not active	No LED
RF input Ch A Over Drive (ADC Clipping)	Ch A = Flashing Red	Ch A = Flashing Red	RF = Flashing Red
RF input Ch B Over Drive (ADC Clipping)	Ch B = Flashing Red	Ch B = Flashing Red	—
No alarms	TX 1 & 2, RF Ch A, RF Ch B, RX1 = green		TX & RF = green
Powering Specifications			
Power Consumption, W, typ./max.[1]	7.2/7.9	7.2/7.9	7.2/7.9
Temperature Range			
Digital Processing module Operating Temperature, °C (°F)	–40 to 60 (–40 to 140°F)		
System Specifications[2]			
NPR Peak, dB, typ./min.	50/48	50/48	50/48
Dynamic Range @ ≥ 40 dB NPR, dB, typ./min.	18/16	17/15	17/15
BER Dynamic Range @ < 10^{-6} BER, dB	28 (64-QAM), 34 (16-QAM), 45 (QPSK)	26 (64-QAM), 32 (16-QAM), 43 (QPSK)	26 (64-QAM), 32 (16-QAM), 43 (QPSK)
Link Gain, dB[3]	32	32	30
Link Flatness, dB, typ./max.	± 0.75/±1.00	± 0.75/±1.00	± 0.75/±1.00

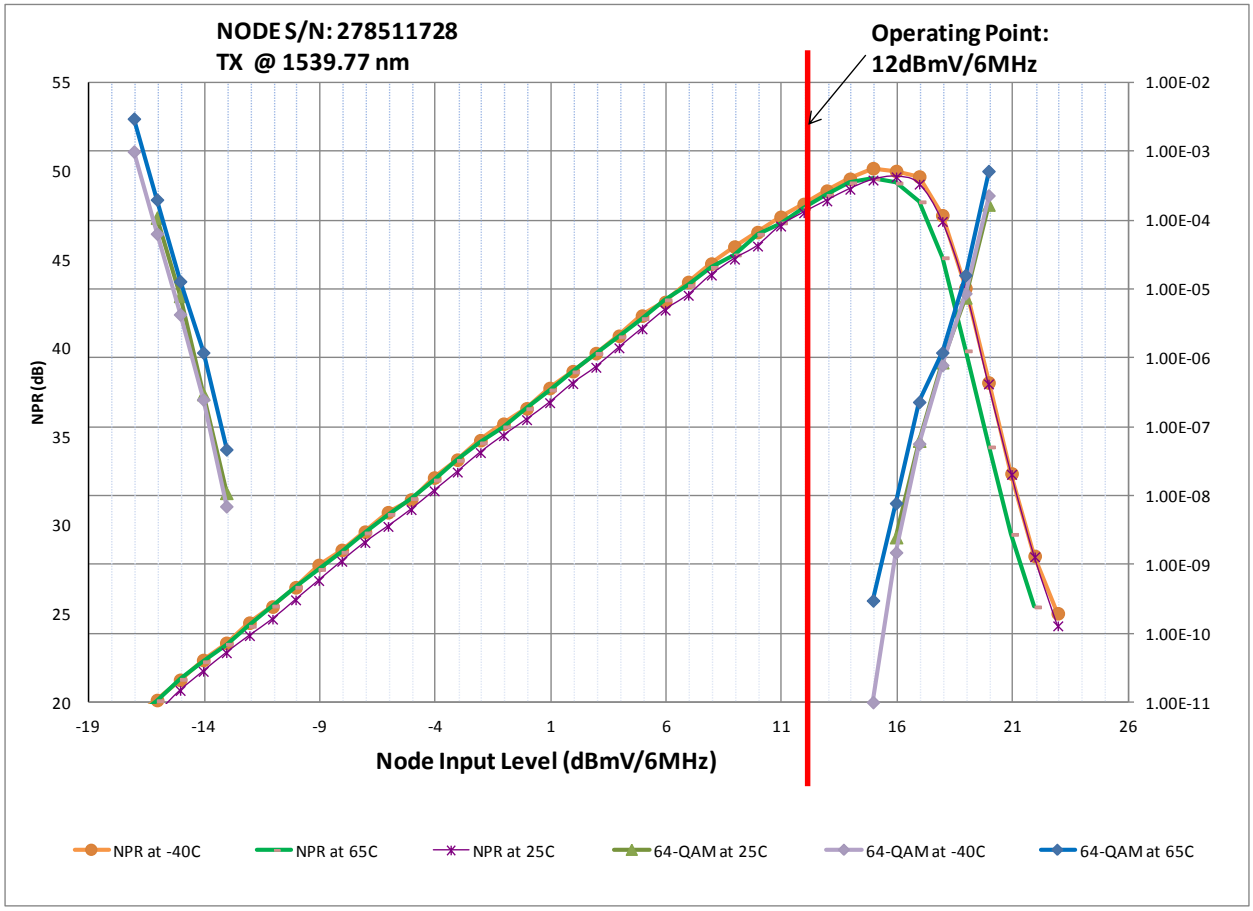
NOTES:
1. When a CWDM, DWDM, 1310 nm, or 1550 nm SFP is installed.
2. System specifications with up 100 km fiber link for the 5 to 42 MHz or 5 to 85 MHz transmitter and up to 75 km fiber link for the 5 to 65 MHz transmitter.
3. With rotary switch set to **R4x1** position on digital processing module and maximum gain at receiver.



NPR/BER Curve Obtained Using a Flexible 2:1 TDM Digital Return Processing Module (Single-width) Installed in an OM4100 Node with a SFP through a 100 km SMF, and fully loaded from 5 to 42 MHz with six 64-QAM channels



NPR/BER Curve Obtained Using a Flexible 2:1 TDM Digital Return Processing Module (Single-width) Installed in an OM4100 Node with an SFP through a 75 km SMF, and fully loaded from 5 to 65 MHz with ten 64-QAM channels



NPR/BER Curve Obtained Using a Flexible 2:1 TDM Digital Return Processing Module (Single-width) Installed in an OM4100 Node with a SFP through a 75 km SMF, and fully loaded from 5 to 85 MHz with (13) thirteen 64-QAM Channels

OM4-EDFA Specifications

	OM4-EDFA-						
Characteristics	**17-1-S-N**	**21-1-S-N**	**19-2-S-N**	**17-8-M-N**	**20-4-M-N**	**20-1-S-H**	**23-1-S-K**
Optical Input Power[1]							
Constant Gain Mode, dBm[2]	–10 to 12	–10 to 12	NA	NA	NA	0 to 14.5	–2 to 15
Constant Power Mode, dBm[3, 4]	–3 to 12	–3 to 12	–3 to 12	0 to 12	0 to 12	NA	7 to 17
Wavelength Range, nm	1530 to 1562			1534 to 1562		1527 to 1562	
Optical Output Power							
Minimum Output Power per Port, dBm[5]	17.0	21.0	19.0	17.0	20.0	20.5	23.5
Number of Output Ports	1	1	2	8	4	1	1
Maximum Output Power Variation, dB[6]				± 0.5			
Maximum Gain Variation, dB[7]				± 0.5			
Power per Port Tolerance, dB	NA	NA	+0.5/-0.0	+1.0/-0.0	+1.0/-0.0	NA	NA
Residual Pump Power, dBm				–35			
ASE Noise Figure							
–10dBm to 0dBm in 1550 ± 5 nm, dB (Typ/Max)	4.5/4.8	4.5/4.8	4.5/4.8	NA	NA	NA	NA
–10dBm to 0dBm in 1530-1562 nm, dB (Max)	5.5	5.5	5.5	NA	NA	NA	NA
0dBm to 6dBm in 1550 ± 5 nm, dB (Typ/Max)	5.5/6.0	5.5/6.0	5.5/6.0	6.0/6.5	6.0/6.5	NA	NA
0dBm to 6dBm in 1530 to 1562 nm, dB (Typ/Max)	6.5	6.5	6.5	NA	NA	NA	NA
0dBm to 6dBm in 1534 to 1562 nm, dB (Typ/Max)	NA	NA	NA	8.0	8.0	NA	NA
> 6 dBm in 1550 ± 5 nm, dB (Typ/Max)	5.5/6	5.5/6	5.5/6	7.0/7.5	7.0/7.5	NA	NA
> 6 dBm in 1530-1562 nm, dB (Max)	8.0	8.0	8.0	NA	NA	NA	NA
> 6 dBm in 1534-1562 nm, dB (Max)	NA	NA	NA	10.0	10.0	NA	NA
2dBm to 13.5 dBm in 1540-1562nm, dB (Typ/Max)	NA	NA	NA	NA	NA	5.0/6.0	5.0/5.5
2dBm to 13.5 dBm in 1528-1562nm, dB (Typ/Max)	NA	NA	NA	NA	NA	6.0/7.0	6.0/6.5
Gain Flatness							
Optimum Gain, dB	11.0	14.0	NA	NA	NA	8.0	10.0
Minimum Settable Gain, dB	7.0	10.0	NA	NA	NA	6.0	8.5
Maximum Settable Gain, dB	15.0	18.0	NA	NA	NA	10.0	11.5
1535-1560nm, dB	± 1.5	± 1.5	NA	NA	NA	NA	NA
1525-1562nm, dB	± 3.0	± 3.0	NA	NA	NA	1.5 (pk-pk)	3.5 (pk-pk)
1540-1562nm, dB	NA	NA	NA	NA	NA	1.2 (pk-pk)	1.1 (pk-pk)
Dynamic Gain Tilt from 1540-1562 nm, dB	NA	NA	NA	NA	NA	0.5	0.3
Dynamic Gain Tilt from 1525-1562 nm, dB	NA	NA	NA	NA	NA	0.9	1.0

continue to next page

OM4-EDFA Specifications (Continued)

	OM4-EDFA-						
Characteristics	**17-1-S-N**	**21-1-S-N**	**19-2-S-N**	**17-8-M-N**	**20-4-M-N**	**20-1-S-H**	**23-1-S-K**
General							
Input/ Output Isolation, dB				30.0			
Input / Output Return Loss, dB				–55			
Polarization Mode Dispersion, dB				0.5			
Polarization Dependant Loss, ps				0.3			
Transient Response, ms				10.0			
Powering Requirements, Max.							
DC Current, mA @ 24 VDC	425	425	425	510	510	425	425
DC Current, mA @ 12 VDC	150	150	150	150	150	150	150
DC Current, mA @ 5 VDC	30	30	30	30	30	30	30
Environmental							
Operational Temperature Range, °C[8]				–30 to 75			
Storage Temperature Range, °C				–40 to 85			
Optical Connector, Input/Output (all are APC except for the MPO)	SC/SC	SC/SC	SC/SC	SC/MPO	SC/MPO	SC/SC	SC/SC

Specification Document Number 1505218 Rev E

NOTES:

1. Laser emissions shall turn off when the input power is:
   <–2 dBm for OM4-EDFA-23-1-S-x (AGC)
   <6.5 dBm for OM4-EDFA-23-1-S-x (APC)
   <–4 dBm for OM4-EDFA-20-1-S-H, OM4-EDFA-17-8-M-N, and OM4-EDFA-20-4-M-N
   Laser emissions shall turn on when the input power is:
   >1 dBm for OM4-EDFA-23-1-S-x (AGC)
   >7 dBm for OM4-EDFA-23-1-S-x (APC)
   > –1 dBm for OM4-EDFA-20-1-S-H, OM4-EDFA-17-8-M-N, and OM4-EDFA-20-4-M-N
   > –7 dBm for all other models
2. When operating in Constant Gain Mode, the sum of the input power and the gain set-point should not exceed the nominal output power or the high output power shutdown may be triggered.
3. EDFA's operating in Constant Power Mode will meet output power specifications with input power levels >–3 dBm. At input power levels between –10 and –3 dBm, the EDFA will attempt to maintain the set point output power but it may be less than specifications.
4. OM4-EDFA-17-8 and OM4-EDFA-20-4 will meet optical output power specifications with input power levels >0 dBm. At input power levels between –4 and 0 dBm, the EDFA will attempt to maintain the set point output power but it may be less than specifications.
5. OM4-EDFA-23-1-S-K: when operating in APC mode, the maximum output power is a function of input power level and maximum gain limit allowed by the EDFA, which is equal to 13.5 dB. Thus, the maximum allowed output power is set by following equation: Pout_MAX (dBm) = Pin (dBm) + 13.5 dB.
6. Variation of optical power over specified temperature, wavelength, and all polarization states.
7. Gain will not vary more than ± 0.5 dB when adding or subtracting wavelengths in AGC mode.
8. Representative of the OM4100 internal temperature range when the node is operating in an external temperature range of –40°C to 60°C.

Power Supply (1500358-001) Specifications[1]

Characteristics	Specifications		
Input Frequency	50/60 Hz		
Output Voltages	24 ± 0.5 VDC		
	12 ± 0.5 VDC		
	5 ±0.2 VDC		
Output Voltage Ripple	10 mVrms, all supply voltages		
Output Currents	@ Nominal DC Loading	@ Maximum DC Loading	
@ 24.0 VDC	4.0 ADC	5.0 ADC	
@ 12.0 VDC	1.0 ADC	2.0 ADC	
@ 5.0 VDC[2]	2.0 ADC	5.0 ADC	
Efficiency	83% (typ.)		
Short Circuit Current			
@ 24.0 VDC	8.0 ADC (typ.)		
@ 12.0 VDC	8.0 ADC (typ.)		
@ 5.0 VDC	12.0 ADC (typ.)		
Output Voltage Protection			
@ 24.0 VDC	31.5 VDC (max.)		
@ 12.0 VDC	18.5 VDC (max.)		
@ 5.0 VDC	7.98 VDC (max.)		
Operating Temperature[3]	–40 to 60° C		
Hold-up Time[4]	@ Nominal DC Loading	@ Maximum DC Loading	
	40 V	45 V	20 ms (min.)
	90 V	90 V	100 ms (min.)
Start-up Voltage	38 Vrms (typ.)		
Cutoff Voltage	34 Vrms (typ.)		
Agent Capable	Yes		

Specification Document Number 1500481 Rev C

NOTES:
1. As tested in accordance with IEEE C62.41-1991. See Power Curve specification 1500795 for more information.
2. For node configurations that require 5.0 ADC from the 5.0 VDC bus, the 24 VDC bus should not be loaded more than the specified nominal DC loading (4.0 ADC).
3. The operating temperature represents the outside ambient temperature of the die-cast housing in which power supply is installed. (Housing Ambient Temp.).
4. Operation of power supply at maximum DC Loading under 45 VAC input voltage will decrease holdup time.

Powering Requirements[1,2]	DC Curr. (mA, max.)			DC Pwr	AC I/P Curr.	AC I/P Pwr
	5 V	12 V	24 V	(W)	@60/90 V (A)	@60/90 V (W)
1 x 4 w/ 1310/1550 IDFB TX	15	905	2190	63.4	1.360/1.020	74.0/75.0
1 x 4R w/ 1310/1550 IDFB TX	20	1125	2230	67.0	1.410/1.060	78.0/80.0
2 x 2 w/ 1310/1550 IDFB TX	20	1640	2700	84.5	1.790/1.250	100.0/100.0
2 x 2R w/ 1310/1550 IDFB TX	30	2080	2780	91.7	1.960/1.360	110.0/109.0
4 x 4 w/ 1310/1550 IDFB TX	30	1050	3720	101.9	2.150/1.490	122.0/122.0
2 x 2R or 4 x 4 w/ 2:1 TDM TX	4610	1300	3630	125.8	2.770/1.850	148.0/148.0

Specification Document Number 1504564 Rev G

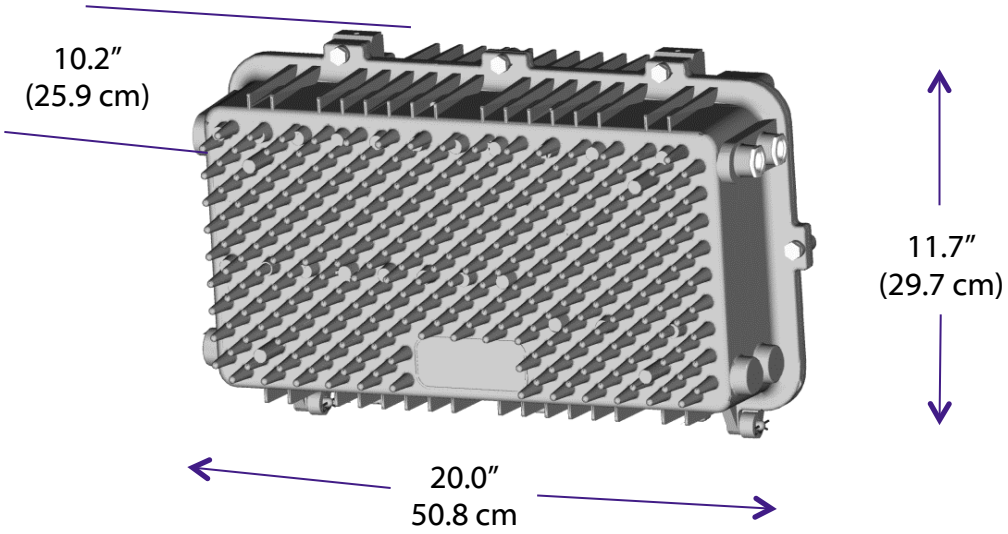
NOTES:
1. DC current draw requirements for analog CWDM transmitters: Add 200 mA @ 24V for each additional transmitter. DC current draw requirements for 2:1 TDM digital CWDM transmitters: add 1.5 A @ 5 V and 130 mA @ 12 V for each additional transmitter.
2. Value Max transponder installed: add 300 ma @ 5 V and 125 mA @ 24 V.

ARRIS 6-Port Wide-Body Housing Dimensions

Characteristics	Uncrated Measurements	Crated Measurements
Width	20.0 inches (50.8 cm)	23.25 inches (59.1 cm)
Height	11.7 inches (29.7 cm)	15.3 inches (38.9 cm)
Depth	10.2 inches (25.9 cm)	13.63 inches (34.6 cm)
Weight[1]	43 pounds (19.5 kg)	45 pounds (20.4)

NOTES:

1. Approximate weight for a fully-configured node built with four forward receivers, four return transmitters, two power supplies, a transponder, and appropriate accessories.



Ordering Information

To configure a product that meets your specific needs, or for any questions, please contact your ARRIS Sales Professional. You may also use our Product Wizard, located at **support.arrisi.com** (User ID and password required). If you do not have a user ID and password or have forgotten your password, please use the Sign In Help section indicated.