N5022 Optical Node

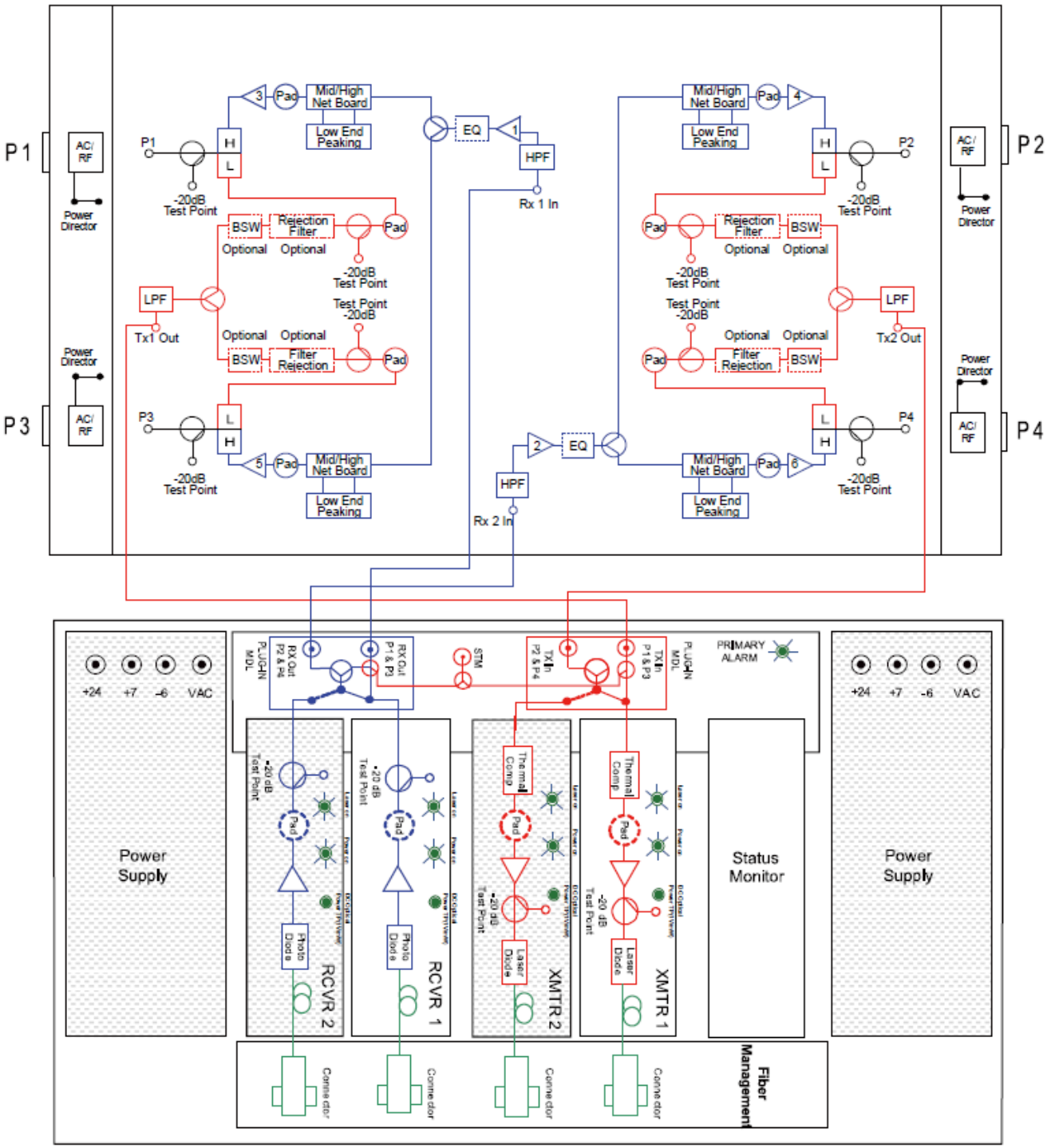
2x2 Fully Segmentable

The ACI Communications N5022 1.2GHz is a 4-output 2x2 fully segmentable optical node that is capable of providing up to 59.1 dBmV output at 1218 MHz with an optical input range from -8 dBm to +2 dBm. The node can have up to two optical receivers and two optical transmitters. Replacing conventional analog optical modules, a Remote PHY module can be integrated into the node to provide high speed full digital optical link for better RF signal quality to meet high-order QAM modulation and data transmission rate as required by DOCSIS 3.1 standard.

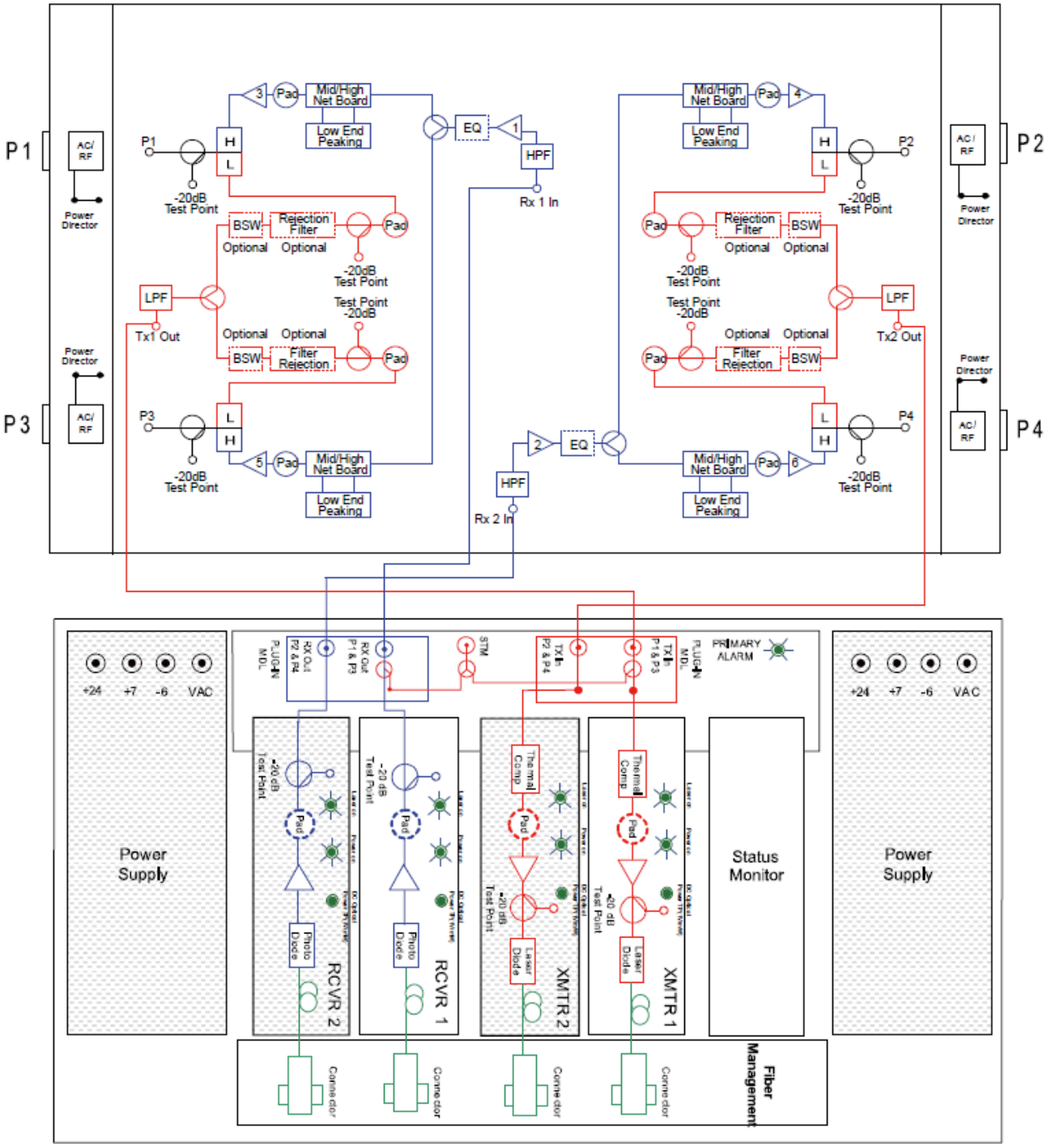
Features

- Four driven output ports
- Compact size for a 2x2 segmentable node
- -20.0 dB directional coupler test points
- 15 amp power passing
- Plug-in bridger switching for managing the reverse path @ 0, -3.0, -6.0, -12.0 dB and open with active status monitoring (optional)
- Standard push on “F” connectors can be used on all test points
- FP, DFB, CWDM, DWDM & Digital return transmitters available
- Redundant receiver & Transmitter (optional 1:4 only)
- Plug-in forward and reverse configuration modules allows for easy field reconfiguration to add or remove segmentation as needed
- 85% efficient 40/90 VAC switch-mode power supply with built-in Triac surge protection

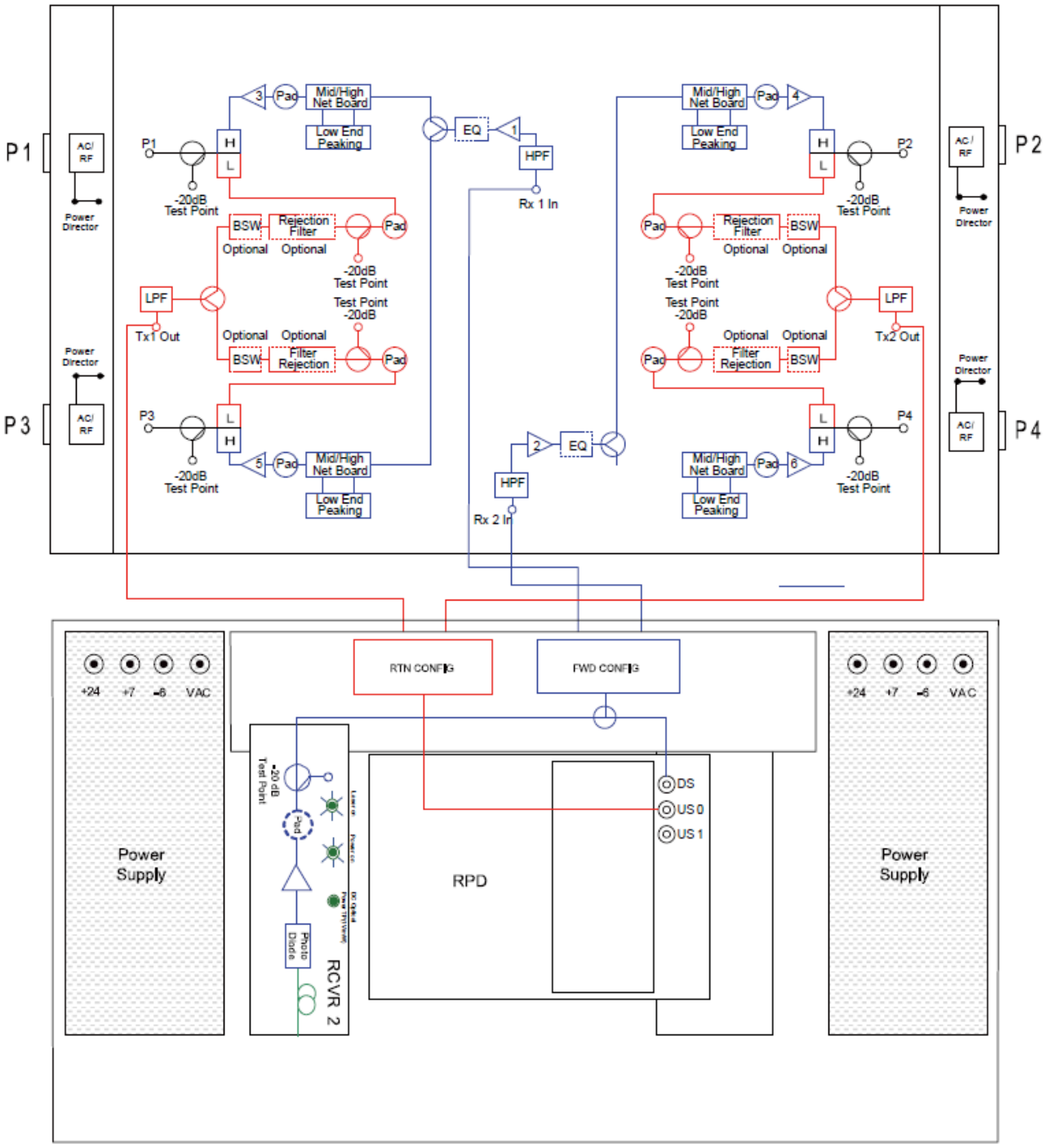
Block Diagrams



N5022 Block Diagram (Non-Segmented Optical Node 1218MHz)

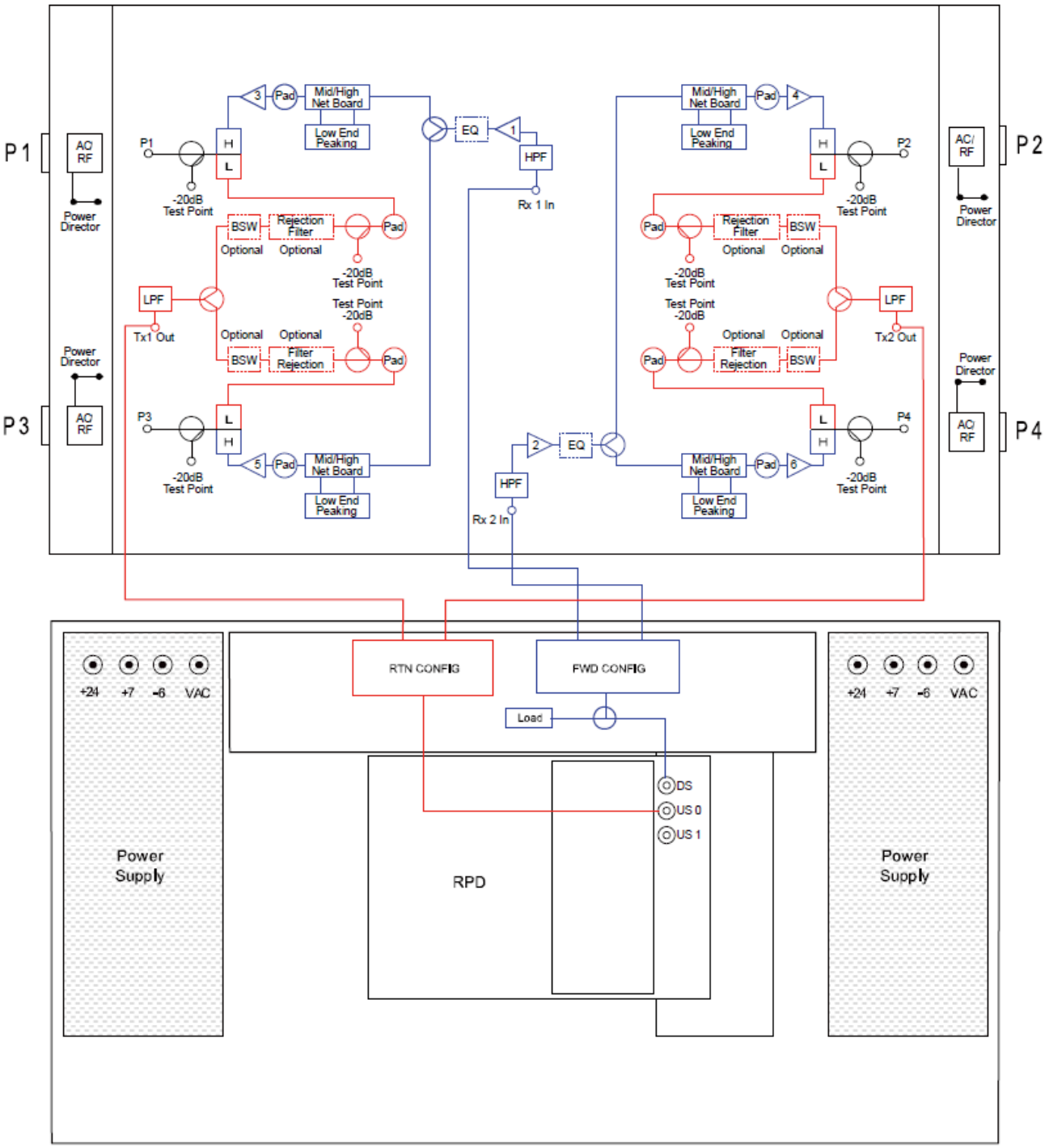


N5022 Block Diagram (Forward and Reverse Segmented Optical Node 1218 MHz)

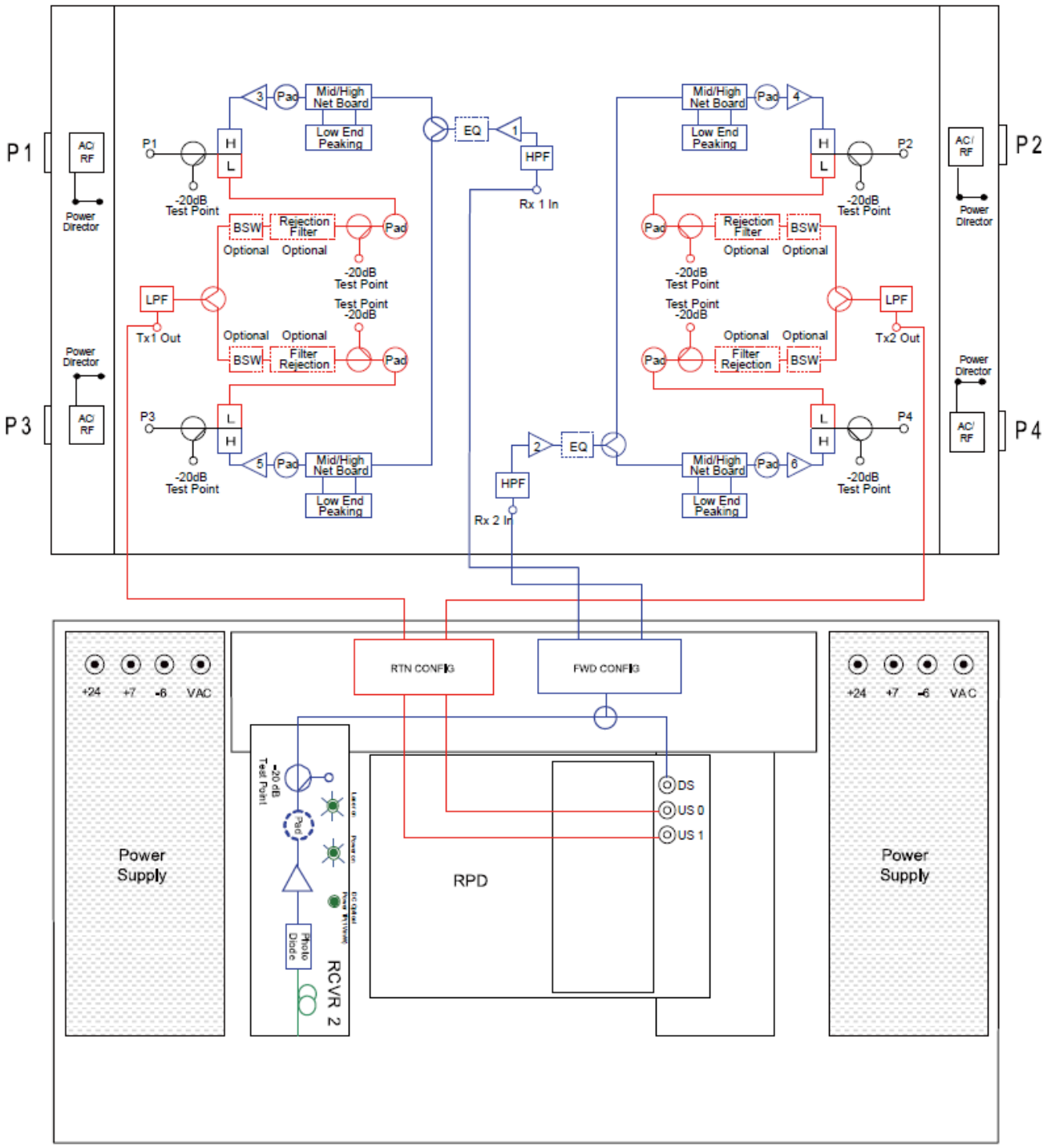


N5022 Block Diagram with Remote PHY module

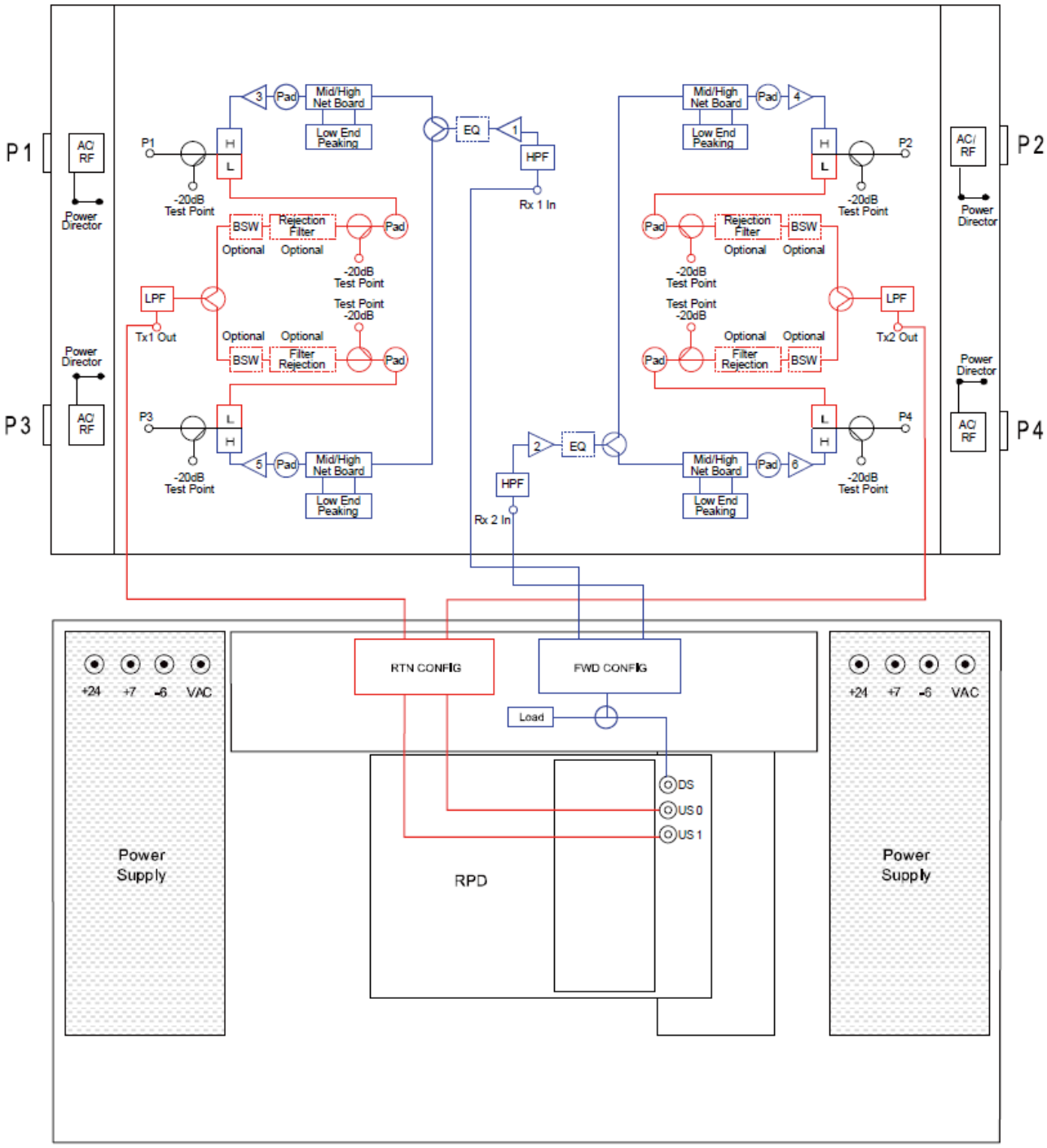
(4x1 Upstream and 1x4 Downstream Option with ORx Overlay)



N5022 Block Diagram with Remote PHY module
(4x1 Upstream and 1x4 Downstream Option without ORx Overlay)



N5022 Block Diagram with Remote PHY module
(2x2 Upstream and 1x4 Downstream Option with ORx Overlay)



N5022 Block Diagram with Remote PHY module
(2x2 Upstream and 1x4 Downstream Option without ORx Overlay)

Specifications

ACI			N5022 4-Output Forward and Reverse 2x2 Segmentable Optical Node 1218 MHz				
STATION PARAMETERS							
	CONDITIONS	UNITS	SPECIFICATION				NOTES
Housing passband		MHz	5 to 1218				
Input current capacity	Any port, worst case	Amperes	15				
Frequency range		MHz	5 - 10	11-750	751-1002	1003-1218	
Hum modulation	Time domain @ rated current above	-dBc	55	70	65	60	
Station passband		MHz	53 to 1218				
Return loss- Ports 1 to 4	Worst case	-dB	16.5				Typical 18.0
Frequency range		MHz	53-870	871-1002		1003-1218	
Port to Port Isolation	Typical	-dB	70	60		50	
Test Points							
Test point type	Directional coupler	N / A	DC				
Test point level(s)		-dB	20.0				
Test point accuracy	Forward TP	±dB	0.5				
Frequency range	Reverse TP	MHz	5 to 83				
Test point accuracy	Reverse TP	±dB	0.5				
Frequency Range							
Station passband		MHz	53 to 1218				
Station flatness - feeder out		±dB	0.75				
Station Gain							
			Minimum		Minimum		
Configuration			1:4		1:2 (X2)		
Gain - feeder	@ 1218 MHz	dB	30		33		
Gain control type		N / A	Plug-in pads				
Gain control range		dB	15.0				
Gain control steps	Pad value steps	dB	0.5				
Station Slope							
Slope control type	Linear equalizers	N / A	Plug-in Equalizers				
Slope control range		dB	-12.0 to 13.0				
Slope control steps	Equalizer value steps	dB	1.0 linear steps				
Operational Specifications							
Operational level - feeders	@ 1218 MHz	dBmV	59.1				
Operational slope	@53 / 550 / 750 / 870 / 1002 / 1218 MHz	dB	0 / 8.4 / 12.2 / 14.5 / 17 / 21.1				
Operational optical input range		dBm	-8 to +2				Recommended optical input level 0 dBm
Station Output Levels with a -3 dBm optical input							
Distribution out	@53 / 550 / 750 / 870 / 1002 / 1218 MHz	dBmV	38.1 / 46.5 / 50.3 / 52.6 / 55.1 / 59.1				
Station Noise Figure - values for RF portion of node only. Complete values dependent on optical link.							
			* No slope		21.0 dB slope		* LEQ1= 0 dB
Noise figure (NF)	@ 53 MHz	dB	9.5		16.0		
Noise figure (NF)	@ 550 MHz	dB	9.5		11.0		
Noise figure (NF)	@ 1002 MHz	dB	9.5		11.0		
Noise figure (NF)	@ 1218 MHz	dB	9.5		11.0		
Station Distortions - values for RF Portion of node only. Complete values dependent on optical link.							
550 MHz analog channel loading, 79 channels + 660 MHz digital channel loading 256 QAM at -6 dBc relative to its associated visual carrier							
Reference levels	@53 / 550 / 750 / 870 / 1002 / 1218 MHz	dBmV	38.1 / 46.5 / 50.3 / 52.6 / 55.1 / 59.1				
		N / A	Worst Case		Typical		
Composite Triple Beat (CTB)		-dBc	70		72		
Cross Modulation (XMOD)		-dBc	64		66		
Composite Second Order (CSO -)	(Vc +0.75 & -1.25 MHz only)	-dBc	69		71		
Composite Second Order (CSO +)	(Vc +1.25 MHz only)	-dBc	69		71		
CIN		-dBc	65		67		
Station Group Delay							
Group delay	Channel 2 (std)	nSec / 3.58 MHz	30				Typical 25
Group delay	Channel 3	nSec / 3.58 MHz	16				
Group delay	Channel 4	nSec / 3.58 MHz	10				
Group delay	Channel 5 & >	nSec / 3.58 MHz	3				

REVERSE SPECTRUM:

	CONDITIONS	UNITS	SPECIFICATIONS		NOTES
Reverse - General					
Station passband		MHz	5 to 42		
Station flatness		±dB	1.0		
Bridger switch control (optional)		-dB	0, 3.0, 6.0, 12.0 & open		
Port to Port Isolation	Typical	-dB	65		
Reverse - Station Gain (RF section only)					
Configuration			4:1	2:1 (X2)	
Gain	Minimum	dB	*5.0	2.0	*for one TX Configuration
Gain control type		N / A	Plug-in pads		
Gain control steps	Pad value steps	dB	0.5		
Reverse - Station Input Levels					
RF station input to node for 40 dBmV @ Laser TP	Minimum	dBmV	17		
Reverse - Noise Figure					
Configuration			4:1	2:1 (X2)	
Station Noise Figure (w/ EQ)		dB	16.5	12.0	
Reverse - Station Distortions @ 23 dBmV					
Composite Second Order (CSO)	6 NTSC channel loading	-dBc	75		
Composite Triple Beat (CTB)	6 NTSC channel loading	-dBc	80		
Cross Modulation (XMOD)	6 NTSC channel loading	-dBc	80		
Noise-to-Power Ratio (NPR)	Noise loading	dB	Typical >40.0 / 13.0		@ 10.0 dB optical loss (6.0 dB fiber +4.0 dB flat loss) @ -51 dBmV/Hz
Reverse - Station Group Delay					
Group delay	5 MHz	nSec / 1.5 MHz	36		
Group delay	7 MHz	nSec / 1.5 MHz	16		
Group delay	10 MHz	nSec / 1.5 MHz	4		
Group delay	35 MHz	nSec / 1.5 MHz	10		
Group delay	38.5 MHz	nSec / 1.5 MHz	25		
Power Requirements:					
Station configuration (Over temperature range of -40°F to +140°F (-40°C to +60°C) @ 90 VAC)			1X4 (1RX & 1TX)	2X2 (2RX & 2TX)	
Power requirements	Worst case	W	67.8	87.5	
AC Voltage					
Input ranges		VAC	40 - 90		
Current Draw					
@ 40 VAC	Maximum	A	1.9	2.1	
@ 50 VAC	Maximum	A	1.6	1.9	
@ 60 VAC	Maximum	A	1.4	1.6	
@ 70 VAC	Maximum	A	1.3	1. 5	
@ 80 VAC	Maximum	A	1.1	1.4	
@ 90 VAC	Maximum	A	1.0	1.2	
Environmental					
Operating temperature		°F (°C)	-40 to +140 (-40 to +60)		
RF output stability over temperature		±dB	0.5		
Physical					
Dimensions (H X W X D)		In. (cm)	9.56 x 16.39 x 9.59 (24.28 x 41.62 x 24.35)		
Weight		lbs. (kg)	22.0 (10.00)		

REMOTE PHY MODULE (OPTIONAL)

	CONDITIONS	UNITS	SPECIFICATIONS			NOTES
General Requirements			Min.	Typical	Max.	
Specification Support			PHY3.1, DRFI Annex D, MHAv2			
Number of RF ports			1xDS, 2x US			
DS:US SG ratio			1:1 or 1:2			
RF ports impedance		Ohm	75			
Number of RF channels						
DOCSIS 3.0 DS channels						
Annex A (8 MHz channel)		Channel			120	
Annex B/C (6 MHz channel)		Channel			158	
DOCSIS 3.0 US channels/port		Channel			12	
ATDMA		Channel			12	
SCDMA		Channel			4	
ATDMA+SCDMA		Channel			8+4	
DOCSIS 3.1 DS channels (OFDM)	Bandwidth of 24 MHz to 192 MHz per channel	Channel			6	
DOCSIS 3.1 US channels (OFDMA)/port	Bandwidth of 6.4 MHz to 96 MHz per channel	Channel			2	
DS RF Performances						
DS Spectrum Range for SC-QAM		MHz	54		1006	
DS Spectrum Range for OFDM		MHz	108		1218	
Carrier frequency resolution		Hz			312.5	
DS RF port Return Loss		dB	16			
DS RF Power Level	For 158 SC-QAMs loaded, +22dB for composite power level	dBmV/ 6MHz	20	22	24	
For less than 158 SC-QAM		dBmV/ 6MHz	PLa158+ceil(3*LOG2(158/N'))			PL^{a}_{158} – Power level per channel - 158 loaded D3.0 SC-QAM channels for active RF chain
Flatness over entire DS spectrum range		dB			1 dB	From min to max power
D3.0 and D3.1 DS channels location	Over DS spectrum including SC- QAM inside OFDM		Flexible, Programmable			Annex A and Annex B
US RF Performances / per port						
US Spectrum Range for SC-QAM		MHz	5		85	
US Spectrum Range for OFDMA		MHz	5		204	
US Input RF Power Level	For 6.4MHz channel	dBmV/ch	-2		23	
US attenuation control	Programmable	dB	0		31.5	
Average US Composite Signal Power		dB			15	
Instantaneous US Composite Power		dB			20	
US Flatness 5-204MHz		dB			2	
US RF port Return Loss (15 MHz – 204 MHz)		dB	16			Min 12dB from 5 to 15MHz
DS to US Isolation		dB	60			
Physical / Powering						
Power consumption	2 US ports, no SFP modules	W			26	
Dimensions (D x W x H)		mm	184x115x45			

Part Number Ordering Matrix

N5022 Configuration Sheet

Customer: _____

Created By: _____ Order Date: _____

ORDERING MATRIX **September 26, 2019**

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
PART NUMBER	3	H																			

3 [ ] **BASIC CONFIGURATION**

A = FWD 1:4 REV 4:1 nonsegmented
1 Transmitter installed, 1 Receiver installed
TX and RX redundancy capable

B = FWD 1:4 REV 2:1 (X2) Reverse segmented
2 Analog or 1 Digital Dual Transmitter installed, 1 Receiver installed
RX redundancy capable

C = FWD 1:2 (X2) REV 4:1 Forward segmented
1 Transmitter installed, 2 Receivers installed
TX redundancy capable

D = FWD 1:2 (2X) REV 2:1 (X2) Forward & Return segmented
2 Analog or 1 Digital Dual Transmitter installed, 2 Receivers installed
Not TX or RX redundancy capable

4 [ ] **DIPLEX FREQUENCY SPLIT**

Connector / Split	SC/APC	SC/UPC	FC/APC	FC/UPC
	4 = 42/53	A = 42/53	F = 42/53	L = 42/53
	5 = 55/70	B = 55/70	G = 55/70	M = 55/70
	6 = 65/85	C = 65/85	H = 65/85	N = 65/85
	8 = 85/105	D = 85/105	J = 85/105	P = 85/105
	2 = 204/258	E = 204/258	K = 204/258	Q = 204/258

5 & 6 [ ][ ] **ANALOG TRANSMITTER 1 - Primary 4:1 or Ports 1 & 3 for 2:1 (X2)**
DIGITAL TRANSMITTER ENTER "DR" FOR POSTIONS 5&6
REMOTE PHY MODULE ENTER "RP" FOR POSITIONS 5&6

7 & 8 [ ][ ] **ANALOG TRANSMITTER 2 - Secondary 4:1 or Ports 2 & 4 for 2:1 (X2)**
DIGITAL TRANSMITTER DUAL MODULE
REMOTE PHY MODULE CONFIGURATIONS

TYPE FP & DFB
00 = None
D0 = Uncooled 1310 nm 1.0 mW FP
H0 = Uncooled 1310 nm 2.0 mW FP W/ISOLATOR
J0 = Uncooled 1310 nm 1.0 mW DFB
R0 = Uncooled 1310 nm 2.0 mW DFB
B0 = Uncooled 1310 nm 3.0 mW DFB
C0 = Uncooled 1550 nm 2.0 mW DFB
Z0 = Uncooled 1550 nm 4.0 mW DFB

TYPE DFB CWDM 2.0 mW
A2 = Uncooled 1471 nm DFB CWDM (2.0 mW)
G2 = Uncooled 1491 nm DFB CWDM (2.0 mW)
V2 = Uncooled 1511 nm DFB CWDM (2.0 mW)
L2 = Uncooled 1531 nm DFB CWDM (2.0 mW)
W2 = Uncooled 1551 nm DFB CWDM (2.0 mW)
M2 = Uncooled 1571 nm DFB CWDM (2.0 mW)
N2 = Uncooled 1591 nm DFB CWDM (2.0 mW)
T2 = Uncooled 1611 nm DFB CWDM (2.0 mW)

TYPE DFB CWDM 3.0 mW
A3 = Uncooled 1471 nm DFB CWDM (3.0 mW)
G3 = Uncooled 1491 nm DFB CWDM (3.0 mW)
W3 = Uncooled 1551 nm DFB CWDM (3.0 mW)
N3 = Uncooled 1591 nm DFB CWDM (3.0 mW)
T3 = Uncooled 1611 nm DFB CWDM (3.0 mW)

TYPE DFB CWDM 4.0, 5.0 & 6.0 mW
W4 = Uncooled 1551 nm DFB CWDM (4.0 mW)
W5 = Uncooled 1551 nm DFB CWDM (5.0 mW)
N5 = Uncooled 1591 nm DFB CWDM (5.0 mW)
T5 = Uncooled 1611 nm DFB CWDM (5.0 mW)
A6 = Uncooled 1471 nm DFB CWDM (6.0 mW)
G6 = Uncooled 1491 nm DFB CWDM (6.0 mW)

TYPE DWDM: ITU Grid: C-Band, 100 GHz Spacing (10.0 mW)

19 =	Channel 19 - 1562.23nm	42 =	Channel 42 - 1543.73nm
20 =	Channel 20 - 1561.42nm	43 =	Channel 42 - 1542.94nm
21 =	Channel 21 - 1560.61nm	44 =	Channel 44 - 1542.14nm
22 =	Channel 22 - 1559.79nm	45 =	Channel 45 - 1541.35nm
23 =	Channel 23 - 1558.98nm	46 =	Channel 46 - 1540.56nm
24 =	Channel 24 - 1558.17nm	47 =	Channel 47 - 1539.77nm
25 =	Channel 25 - 1557.36nm	48 =	Channel 48 - 1538.98nm
26 =	Channel 26 - 1556.56nm	49 =	Channel 49 - 1538.19nm
27 =	Channel 27 - 1555.75nm	50 =	Channel 50 - 1537.40nm
28 =	Channel 28 - 1554.94nm	51 =	Channel 51 - 1536.61nm
29 =	Channel 29 - 1554.13nm	52 =	Channel 52 - 1535.82nm
30 =	Channel 30 - 1553.33nm	53 =	Channel 53 - 1535.04nm
31 =	Channel 31 - 1552.52nm	54 =	Channel 54 - 1534.25nm
32 =	Channel 32 - 1551.72nm	55 =	Channel 55 - 1533.47nm
33 =	Channel 33 - 1550.92nm	56 =	Channel 56 - 1532.68nm
34 =	Channel 34 - 1550.12nm	57 =	Channel 57 - 1531.90nm
35 =	Channel 35 - 1549.32nm	58 =	Channel 58 - 1531.12nm
36 =	Channel 36 - 1548.52nm	59 =	Channel 59 - 1530.33nm
37 =	Channel 37 - 1547.72nm	60 =	Channel 60 - 1529.55nm
38 =	Channel 38 - 1546.92nm	61 =	Channel 61 - 1528.77nm
39 =	Channel 39 - 1546.12nm	62 =	Channel 62 - 1527.99nm
40 =	Channel 40 - 1545.32nm	63 =	Channel 63 - 1527.22nm
41 =	Channel 41 - 1544.53nm	64 =	Channel 64 - 1526.44nm

TYPE DIGITAL RETURN TRANSMITTER MODULE
00 = No Digital Return Transmitter

45 MHz
AA = Single RF, Single 1310 nm DFB, 40 km
AB = Single RF, Single 1471 nm CWDM, 80 km
AC = Single RF, Single 1491 nm CWDM, 80 km
AD = Single RF, Single 1511 nm CWDM, 80 km
AE = Single RF, Single 1531 nm CWDM, 80 km
AF = Single RF, Single 1551 nm CWDM, 80 km
AG = Single RF, Single 1571 nm CWDM, 80 km
AH = Single RF, Single 1591 nm CWDM, 80 km
AJ = Single RF, Single 1611 nm CWDM, 80 km
AK = Dual RF, Single 1591 nm CWDM, 80 km
AL = Dual RF, Single 1310 nm DFB, 40 km

85 MHz
EA = Single RF, Single 1310 nm DFB, 40 km
EB = Single RF, Single 1471 nm CWDM, 80 km
EC = Single RF, Single 1491 nm CWDM, 80 km
ED = Single RF, Single 1511 nm CWDM, 80 km
EE = Single RF, Single 1531 nm CWDM, 80 km
EF = Single RF, Single 1551 nm CWDM, 80 km
EG = Single RF, Single 1571 nm CWDM, 80 km
EH = Single RF, Single 1591 nm CWDM, 80 km
EJ = Single RF, Single 1611 nm CWDM, 80 km

TYPE REMOTE PHY MODULE CONFIGURATIONS
00= No Remote PHY Module
11= 1 Down Stream + 1 Up Stream
12= 1 Down Stream + 2 Up Stream
22= 2 Down Stream + 2 UP Stream

9 [ ] **RECEIVER REDUNDANCY (Basic configuration A or B only)**
0 = None
1 = Not redundant
2 = RX Redundant

10 [ ] **STATION SLOPE**
K = 21.0 dB @1218 MHz (Standard)

Ordering Matrix (Continued)

11 & 12	
13 & 14	
15 & 16	
17 & 18	

CWDM/DWDM Mux/DeMux or WDM
(For a 1X2 Mux or WDM use positions 13 & 15)
CWDM or DWDM DeMux Downstream Wavelength # 1
CWDM or DWDM DeMux Downstream Wavelength # 2
CWDM or DWDM Mux Upstream Wavelength #1
CWDM or DWDM Mux Upstream Wavelength #2

00 = None	AF = 1371 nm	AM = 1491 nm	AV = 1611 nm
AA = 1271 nm	AG = 1391 nm	AN = 1511 nm	AW = 1310 nm
AB = 1291 nm	AH = 1411 nm	AP = 1531 nm	AY = 1550 nm
AC = 1311 nm	AJ = 1431 nm	AR = 1551 nm	
AD = 1331 nm	AK = 1451 nm	AT = 1571 nm	
AE = 1351 nm	AL = 1471 nm	AU = 1591 nm	

DWDM O-Band: 1270nm to 1370nm (Downstream Only)

Z3 = 1290 nm	Z4 = 1291 nm	Z5 = 1293 nm	Z6 = 1295 nm

DWDM: ITU Grid: C-Band, 100 GHz Spacing (10.0 mW)

19 =	Channel 19 - 1562.23nm	42 =	Channel 42 - 1543.73nm
20 =	Channel 20 - 1561.42nm	43 =	Channel 42 - 1542.94nm
21 =	Channel 21 - 1560.61nm	44 =	Channel 44 - 1542.14nm
22 =	Channel 22 - 1559.79nm	45 =	Channel 45 - 1541.35nm
23 =	Channel 23 - 1558.98nm	46 =	Channel 46 - 1540.56nm
24 =	Channel 24 - 1558.17nm	47 =	Channel 47 - 1539.77nm
25 =	Channel 25 - 1557.36nm	48 =	Channel 48 - 1538.98nm
26 =	Channel 26 - 1556.56nm	49 =	Channel 49 - 1538.19nm
27 =	Channel 27 - 1555.75nm	50 =	Channel 50 - 1537.40nm
28 =	Channel 28 - 1554.94nm	51 =	Channel 51 - 1536.61nm
29 =	Channel 29 - 1554.13nm	52 =	Channel 52 - 1535.82nm
30 =	Channel 30 - 1553.33nm	53 =	Channel 53 - 1535.04nm
31 =	Channel 31 - 1552.52nm	54 =	Channel 54 - 1534.25nm
32 =	Channel 32 - 1551.72nm	55 =	Channel 55 - 1533.47nm
33 =	Channel 33 - 1550.92nm	56 =	Channel 56 - 1532.68nm
34 =	Channel 34 - 1550.12nm	57 =	Channel 57 - 1531.90nm
35 =	Channel 35 - 1549.32nm	58 =	Channel 58 - 1531.12nm
36 =	Channel 36 - 1548.52nm	59 =	Channel 59 - 1530.33nm
37 =	Channel 37 - 1547.72nm	60 =	Channel 60 - 1529.55nm
38 =	Channel 38 - 1546.92nm	61 =	Channel 61 - 1528.77nm
39 =	Channel 39 - 1546.12nm	62 =	Channel 62 - 1527.99nm
40 =	Channel 40 - 1545.32nm	63 =	Channel 63 - 1527.22nm
41 =	Channel 41 - 1544.53nm	64 =	Channel 64 - 1526.44nm

19 [ ] **HOUSING TYPE**
P = Powder Coated

20 [ ] **STATUS MONITORING**
0 = None
D = Docsis HMS Transponder

21 [ ] **CUSTOM SPECIAL REQUEST**
0 = None
X = Determined by Product Management

NOTES:

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