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1310nm Wavelength Specs for 10x10 MSA

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10x10 MSA Meeting



Supporter

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Outline

Based on the open discussion at the January 25th 10x10 MSA face-to-face meeting, the following information is provided regarding the 1310nm window specs:

- A clear need to develop 1310nm specs for the 10x10 MSA
- Better wavelength compatibility to LAN-WDM lane assignments and IEEE standard
- Solutions towards high LD performance and reduced power consumption
- Technical & economical feasibility will fulfill the requirements of major customers (especially the Chinese carriers).

10x10 MSA - WDM lane assignments

Table 1 Wavelength-division-multiplexed lane assignments					
	CURRENT LR10		PROPOSED 1310nm LR10		
Description	Center wavelength (1550nm window)	Wavelength range (1550nm window)	Center wavelength (1310nm window)	Wavelength range (1310nm window)	Module electrical lane
L0	1523 nm	1521 to 1525 nm	1286.66 nm	1285.63 to 1287.69 nm	Tx0, Rx0
L1	1531 nm	1529 to 1533 nm	1291.10 nm	1290.07 to 1292.13 nm	Tx1, Rx1
L2	1539 nm	1537 to 1541 nm	1295.56 nm	1294.53 to 1296.59 nm	Tx2, Rx2
L3	1547 nm	1545 to 1549 nm	1300.05 nm	1299.02 to 1301.09 nm	Tx3, Rx3
L4	1555 nm	1553 to 1557 nm	1304.58 nm	1303.54 to 1305.63 nm	Tx4, Rx4
L5	1563 nm	1561 to 1565 nm	1309.14 nm	1308.09 to 1310.19 nm	Tx5, Rx5
L6	1571 nm	1569 to 1573 nm	1313.73 nm	1312.70 to 1314.76 nm	Tx6, Rx6
L7	1579 nm	1577 to 1581 nm	1318.35 nm	1317.32 to 1319.38 nm	Tx7, Rx7
L8	1587 nm	1585 to 1589 nm	1323.00 nm	1321.97 to 1324.03 nm	Tx8, Rx8
L9	1595 nm	1593 to 1597 nm	1327.69 nm	1326.66 to 1328.72 nm	Tx9, Rx9

IEEE 802.3.ba ←

- **1310nm spec is compatible to IEEE 802.3ba.**
- **10x10 has larger link budget than 4x25**
 - Max Tx launch power per lane of 10x10G is lower than 4x25G by 4dB;
 - ROSA sensitivity per lane of 10G is >4.5dB better than 25G.

Under discussion

Performance of 1.3um versus 1.55um Directly Modulated Lasers (DMLs)

- 1.3um DMLs are approx. 30% more efficient than DMLs at 1.5um reducing the power consumption of the 100GBASE-LR10 CFP module to less than 12.5W.
- The optical module in client side will greatly benefits from a 1.3um DML solution to achieve extended temperature performance.
- 1.3um lasers are lower cost as they leverage the manufacturing expertise from the high volume ONU FTTX market.

Performance at 85degC

Wavelength/um	Slope (W/A)	Threshold Current in (mA) max	Modulation Current in (mA) @ 4dBm
DML 1.55	0.16	38	31
DML 1.3	0.24	26	21

Source: CyOptics Inc.

Technical feasibility and standards



IEEE 802.3-2008: 10GBASE-L PMDs defined on 1310nm window

Table 52-12—10GBASE-L transmit characteristics

Description	10GBASE-LW	10GBASE-LR	Unit
Signaling speed (nominal)	9.95328	10.3125	GBd
Signaling speed variation from nominal (max)	± 20	± 100	ppm
Center wavelength (range)	1260 to 1355		nm

IEEE 802.3-2008: 10GBASE-L PMDs defined on 1310nm window

Table 87-7—40GBASE-LR4 transmit characteristics

Description	Value	Unit
Signaling rate, each lane (range)	10.3125 ± 100 ppm	GBd
Lane wavelengths (range)	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm

- Based on the standards, the 1310nm-band is the preferred window in client side modules.
- The industry chain of 1310nm products is mature!

Summary

- A clear demand to develop 1310nm specs for 10x10 MSA.
- Proposing the following changes in the latest version of the tech specs MSA (see next pages)
 - 1) Insert 1310nm specs in page 6-11:
 - section 4.3 Wavelength-division-multiplexed lane assignments
 - section 4.4 Optical specifications
 - 2) Update the Table 8-9 for optical fiber and cable characteristics

10x10 MSA - WDM lane assignments

Table 1 Wavelength-division-multiplexed lane assignments

Description	Center wavelength (1550nm window)	Wavelength range (1550nm window)	Center wavelength (1310nm window)	Wavelength range (1310nm window)	Module electrical lane
L0	1523 nm	1521 to 1525 nm	1286.66 nm	1285.63 to 1287.69 nm	Tx0, Rx0
L1	1531 nm	1529 to 1533 nm	1291.10 nm	1290.07 to 1292.13 nm	Tx1, Rx1
L2	1539 nm	1537 to 1541 nm	1295.56 nm	1294.53 to 1296.59 nm	Tx2, Rx2
L3	1547 nm	1545 to 1549 nm	1300.05 nm	1299.02 to 1301.09 nm	Tx3, Rx3
L4	1555 nm	1553 to 1557 nm	1304.58 nm	1303.54 to 1305.63 nm	Tx4, Rx4
L5	1563 nm	1561 to 1565 nm	1309.14 nm	1308.09 to 1310.19 nm	Tx5, Rx5
L6	1571 nm	1569 to 1573 nm	1313.73 nm	1312.70 to 1314.76 nm	Tx6, Rx6
L7	1579 nm	1577 to 1581 nm	1318.35 nm	1317.32 to 1319.38 nm	Tx7, Rx7
L8	1587 nm	1585 to 1589 nm	1323.00 nm	1321.97 to 1324.03 nm	Tx8, Rx8
L9	1595 nm	1593 to 1597 nm	1327.69 nm	1326.66 to 1328.72 nm	Tx9, Rx9

Under discussion

10x10 MSA - 2km transmit characteristics

Table 3 10x10 MSA - 2km transmit characteristics			
Description	Value (1550nm window)	Value (1310nm window)	Unit
Signaling rate, each lane (range) 100GE	10.3125 ± 100 ppm	10.3125 ± 100 ppm	GBd
Signaling rate, each lane (range) OTU4	11.22 ± 20 ppm	11.22 ± 20 ppm	GBd
Line wavelengths (range)	1521 to 1525	1285.63 to 1287.69 nm	nm
	1529 to 1533	1290.07 to 1292.13 nm	
	1537 to 1541	1294.53 to 1296.59 nm	
	1545 to 1549	1299.02 to 1301.09 nm	
	1553 to 1557	1303.54 to 1305.63 nm	
	1561 to 1565	1308.09 to 1310.19 nm	
	1569 to 1573	1312.70 to 1314.76 nm	
	1577 to 1581	1317.32 to 1319.38 nm	
	1585 to 1589	1321.97 to 1324.03 nm	
1593 to 1597	1326.66 to 1328.72 nm		
Side-mode suppression ratio (SMSR), (min)	30	35	dB
Total average launch power (max)	13	10.5	dBm
Average launch power, each lane (max)	3	0.5	dBm
Average launch power, each lane (min)	-6.9	-8	dBm
Optical Modulation Amplitude (OMA), each lane (max)	2.5	0	dBm
Optical Modulation Amplitude (OMA), each lane (min)	-3.9	-5	dBm
Difference in launch power between any two lanes (OMA) (max)	4	4	dB
Launch power in OMA minus TDP, each lane (min)	-4.9	-6	dBm
Transmitter and dispersion penalty (TDP), each lane (max)	2.5	2.6	dB
Average launch power of OFF transmitter, each lane (max)	-30	-30	dBm
Extinction ratio (min)	2.5	5.5	dB
RIN20OMA (max)	-130	-120	dB/Hz
Optical return loss tolerance (max)	20	20	dB
Transmitter reflectance (max)	-12	-12	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}	

Under discussion

10x10 MSA - 2km receive characteristics

Table 4 10x10 MSA - 2km receive characteristics			
Description	Value (1550nm window)	Value (1310nm window)	Unit
Signaling rate, each lane (range) 100GE	10.3125 ± 100 ppm	10.3125 ± 100 ppm	GBd
Signaling rate, each lane (range) OTU4	11.22 ± 20 ppm	11.22 ± 20 ppm	GBd
Line wavelengths (range)	1521 to 1525	1285.63 to 1287.69 nm	nm
	1529 to 1533	1290.07 to 1292.13 nm	
	1537 to 1541	1294.53 to 1296.59 nm	
	1545 to 1549	1299.02 to 1301.09 nm	
	1553 to 1557	1303.54 to 1305.63 nm	
	1561 to 1565	1308.09 to 1310.19 nm	
	1569 to 1573	1312.70 to 1314.76 nm	
	1577 to 1581	1317.32 to 1319.38 nm	
	1585 to 1589	1321.97 to 1324.03 nm	
1593 to 1597	1326.66 to 1328.72 nm		
Damage threshold, each lane (min)	4	4	dBm
Average receive power, each lane (max)	3	0.5	dBm
Average receive power, each lane (min)	-9.5	-11.2	dBm
Receive power, each lane (OMA) (max)	2.5	5.5	dBm
Difference in receive power between any two lanes (OMA) (max)	5.5	5.5	dB
Receiver reflectance (max)	-26	-26	dB
Receiver sensitivity (OMA), each lane (max)	-7.5	-8.9	dBm
Receiver 3 dB electrical upper cutoff frequency, each lane (max)	12.3	12.3	GHz
Stressed receiver sensitivity (OMA), each lane (max)	-6	-7.3	dBm
Conditions of stressed receiver sensitivity test:			
Vertical eye closure penalty, each lane	2	1.9	dB
Stressed eye J2 Jitter, each lane	0.3	0.3	UI
Stressed eye J9 Jitter, each lane	0.47	0.47	UI

Under discussion

10x10 MSA - 2km illustrative power budget

Table 5 10x10 MSA - 2km illustrative power budget			
Description	Value (1550nm window)	Value (1310nm window)	Unit
Power budget (for max TDP)	5.1	5.5	dB
Operating distance	2	2	km
Channel insertion loss	2.6	2.9	dB
Fiber attenuation, max	0.6	0.9	dB
Connector loss, max	2	2	dB
Maximum discrete reflectance	-26	-26	dB
Allocation for penalties (for max TDP)	2.5	2.6	dB
Additional insertion loss allowed	0	0	dB

Under discussion

Thank you

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