Evaluating 10GBASE-SX CWDM

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53 Individuals - 29 Companies

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10GBASE-SX CWDM

- Meets all five criteria
  - Broad market potential
  - Technical feasibility
  - Compatibility
  - Distinct identity
  - Economic feasibility

10GBASE-SX CWDM

- Meets both MMF distance objectives
  - –100m on installed fiber
  - –300m on MMF
- Ability to meet the IEEE 802.3ae schedule

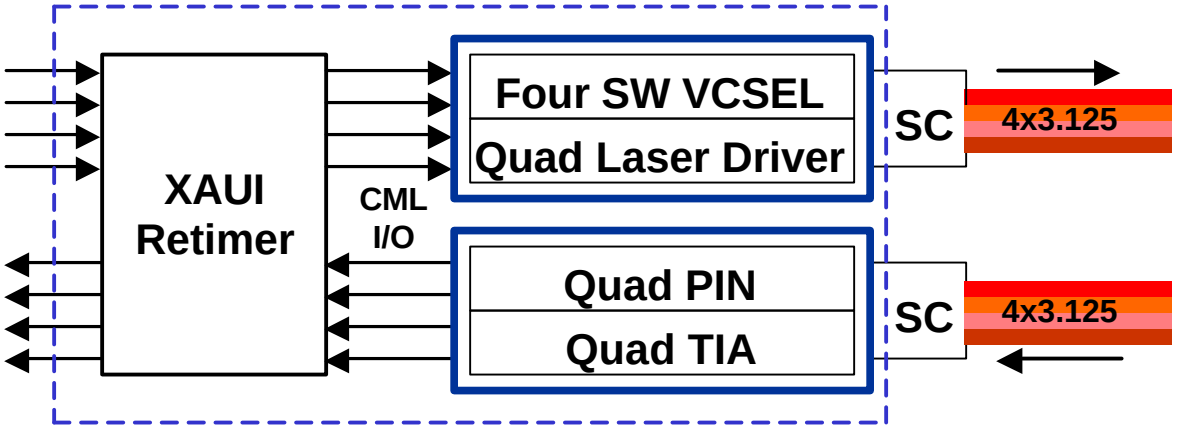
10GBASE-SX CWDM

- Addresses largest market segment
- Lowest EMI solution
- Lowest power solution
- Early availability
- Multi-vendor support
- Lowest cost solution

Broad Market Appeal

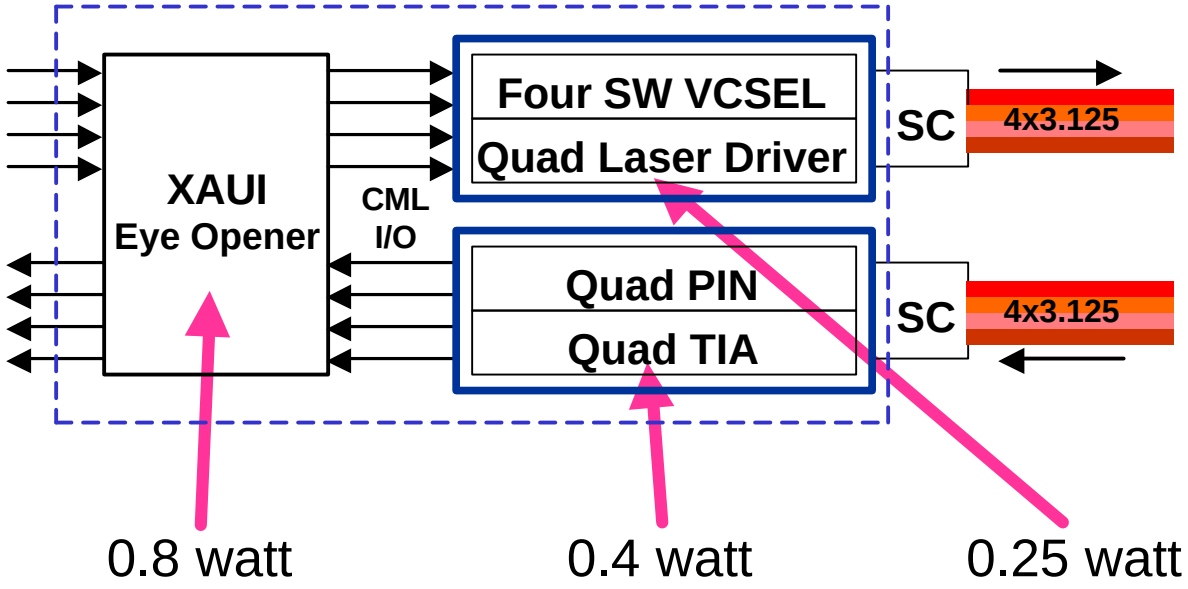
- 50% of target market is <100 meter multimode
- At a minimum this task force should standardize the optimal solution for the largest market segment
- It is not in the best interests of our real customers to require them to use a sub-optimal solution for half of their applications
- By not including an optimized solution for half the market addressed by the IEEE 802.3ae standard, customer adoption of 10 Gigabit Ethernet solutions will be slowed

Functional Blocks



- No single mode alignments
- Injection molded plastic optics for multiplexer and demultiplexer
- Low power, low cost VCSELs
- Simple low power and low cost electronics

Lowest power solution



- Low power solutions enable high density applications
- Small form factors, plugables

Lowest EMI solution

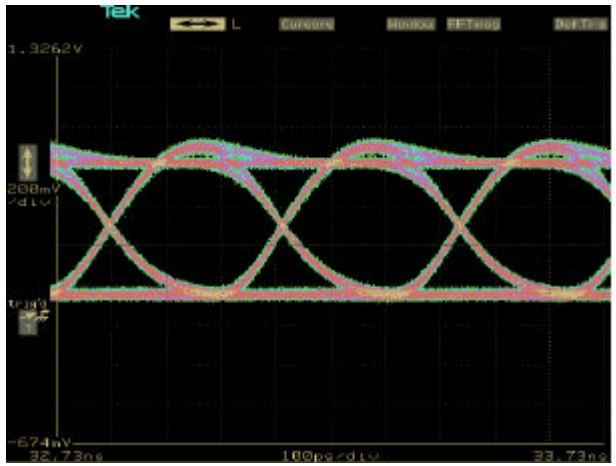
- Low power = low radiation
- Highest Fundamental - 3.125 GHz
- No internal recoding minimizes generated EMI
- EMI of incoming 8B/10B idle sequence being addressed in MAC

Multi-mode Construction

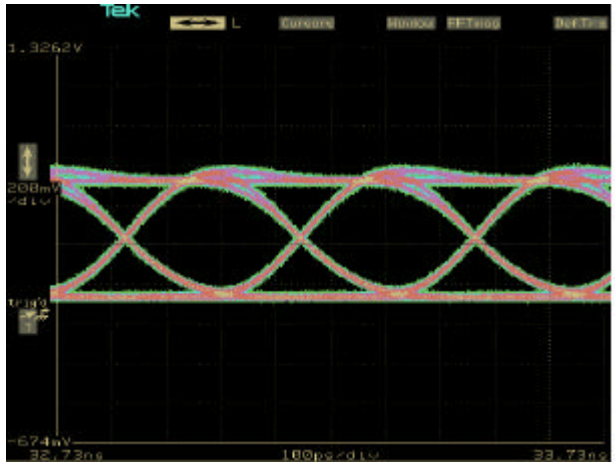
- **Uses inexpensive multi-mode optics & lasers**
  - plastic optics
  - low cost multi-mode sources
  - no temperature control
  - fast and easy assembly
  - multiple suppliers

Performance at 3.125 Gbps

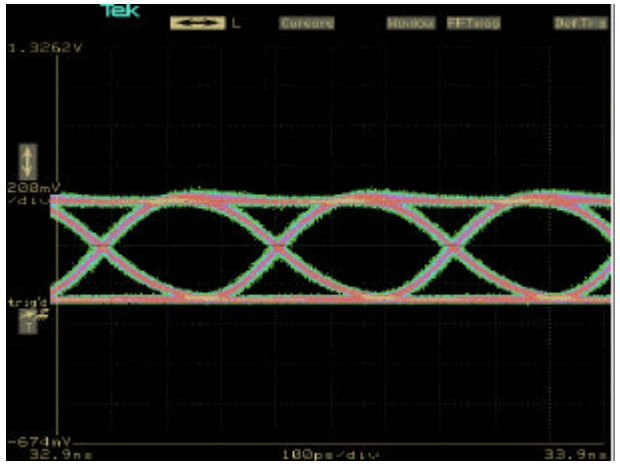
2 m



100 m



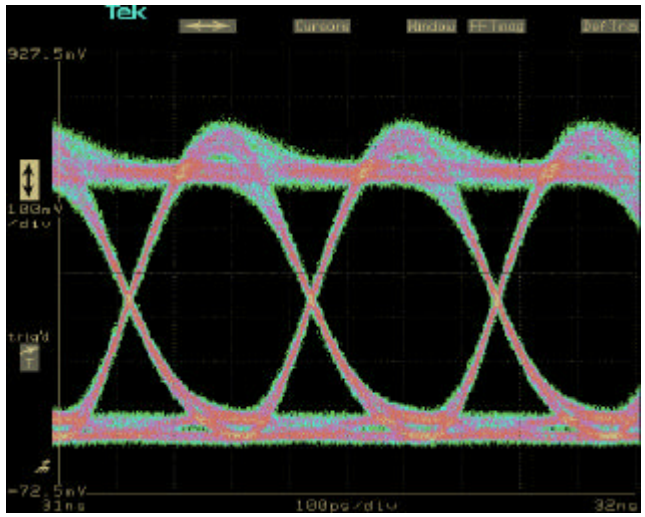
62.5 µm Fiber



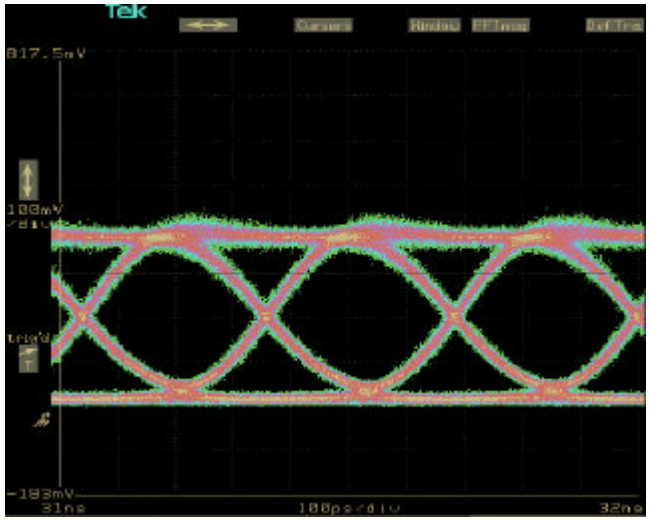
300 m

Performance at 3.125 Gbps

50 μm Fiber



2 m



300 m

Early Availability

- Lasers Summer 2000
- XAUI retimer Summer 2000
- Laser drivers Summer 2000
- TIAs Summer 2000

- **Complete transceiver - Q4 2000**

Table 38-2* Operating Range

Fiber type	Modal bandwidth @ 850nm (MHz*km)	Minimum range (meters)
62.5µm MMF	160	2-100
50.0 µm MMF	500	2-300
50.0 µm MMF (new)	2200	2-550
10µm SMF	N/A	Not supported

* Equivalent for 10GBASE-SX CWDM

Table 38-3* Transmit

Description	62.5 μm MMF 50 μm MMF 50 μm MMF (new)	Unit
Transmitter Type	Shortwave Laser	
Signaling speed per channel (range)	3.125 ± 100 ppm	GBd
Wavelength (range), four channels	800 to 870	nm
Channel center wavelengths	805, 825, 845, 865 ± 5.0 nm	nm
Channel separation	20.0	nm
Trise/Tfall (max. 20-80% response time)	85	ps
RMS spectral width (max)	0.5	nm
Average launch power, four channels (max)	+4.7	dBm
Average launch power per channel (max)	-1.3	dBm
Average launch power per channel (min)	-5.5	dBm
Extinction ratio, (min)	7	dB
RIN (max)	-120	dB/Hz

* Equivalent for 10GBASE-SX CWDM

Table 38-4* Receive

Description	62.5mm MMF	50.0 mm MMF	50.0 mm MMF (new)	Unit
Signaling speed per channel (range)	3.125 ± 100 ppm			Gbd
Wavelength (range), four channels	800 to 870			nm
Channel center wavelengths	805, 825, 845, 865 ± 5.0 nm			nm
Channel separation	20.0			nm
Avg receive power, four channels (max)	+4.7			dBm
Avg receive power, per channel (max)	-1.3			dBm
Return loss	12			dB
Receive electrical 3 dB upper cutoff freq (max)	3750			MHz
Receive sensitivity	-13.5	-13.5	-13.5	dBm
Stressed receive sensitivity	-7.8	-8.7	-9.7	dBm
Vertical eye closure penalty	3.6	3.4	0.9	dB

* Equivalent for 10GBASE-SX CWDM

Table 38-5* Link Power Budget

Parameter	62.5mm MMF	50.0 mm MMF		Unit
Modal bandwidth as measured at 850nm (min overfilled launch)	160	500	2200	MHz*km
Link power budget	8.0	8.0	8.0	dB
Operating distance	100	300	550	m
Wavelength	800 - 870			nm
Channel insertion loss	1.9	2.7	3.8	dB
Link power penalties	4.3	4.3	1.6	dB
Unallocated margin in link power budget	1.8	1.0	2.6	dB

* Equivalent for 10GBASE-SX CWDM

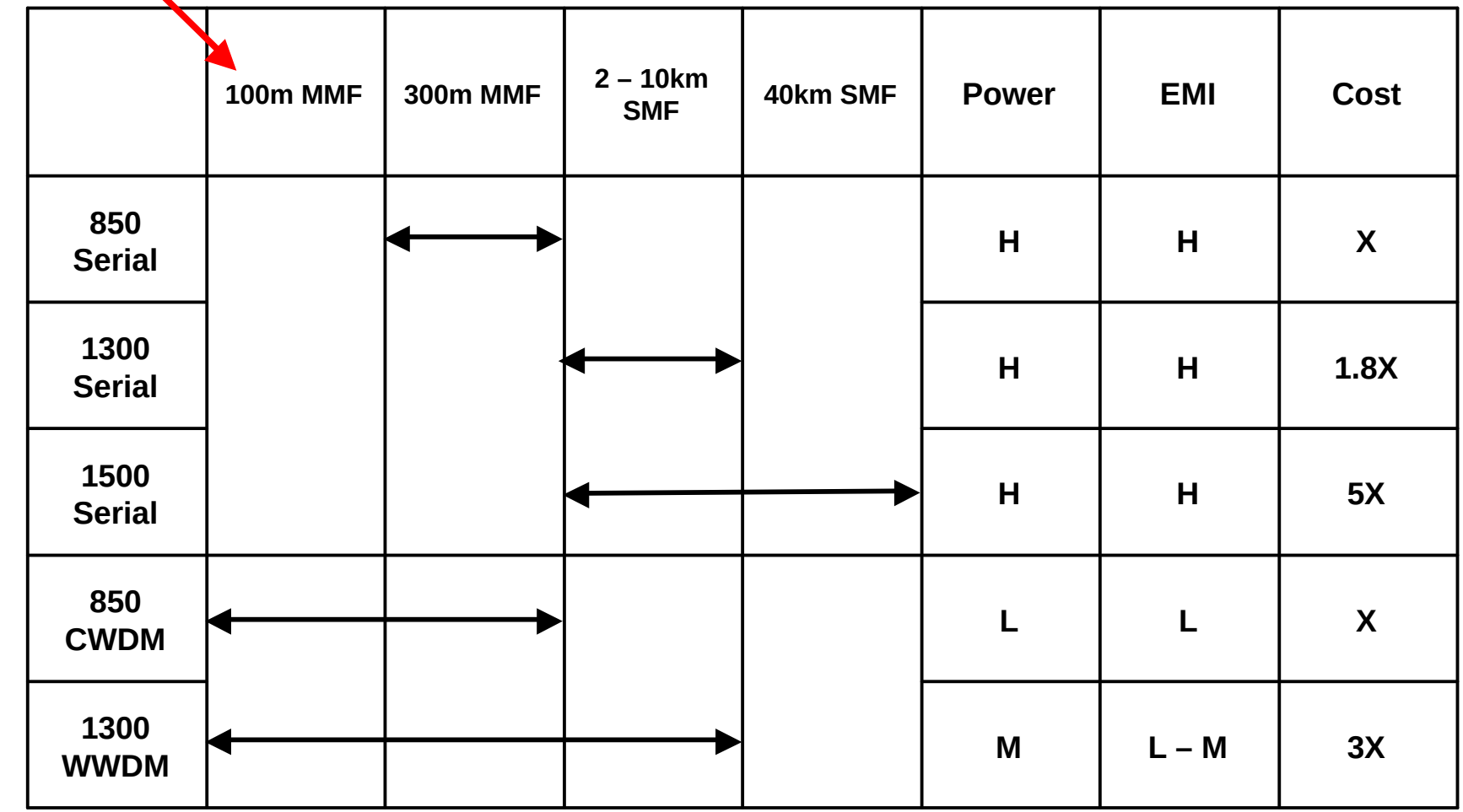
Table 38-10* Equivalent Jitter

Compliance point	Total Jitter		Deterministic Jitter	
	UI	ps	UI	ps
TP1	0.240	76.8	0.100	32.0
TP1 to TP2	0.284	90.9	0.100	32.0
TP2	0.431	138.0	0.200	64.0
TP2 to TP3	0.170	54.4	0.050	16.0
TP3	0.510	163.4	0.250	80.0
TP3 to TP4	0.332	106.2	0.212	67.8
TP4	0.749	239.6	0.462	147.8

* Equivalent for 10GBASE-SX CWDM

PMD Selections

54% of 10G target market



	100m MMF	300m MMF	2 – 10km SMF	40km SMF	Power	EMI	Cost
850 Serial		←	→		H	H	X
1300 Serial			←	→	H	H	1.8X
1500 Serial			←	→	H	H	5X
850 CWDM	←	→			L	L	X
1300 WWDM	←	→	→		M	L – M	3X

Final Thoughts

Ethernet has been successful because it has always been the most cost effective solution in the networking market space

This committee must standardize on an optimal solution for the largest market segment