

Interoperability Demonstration

10GBASE-S

Serial 10Gbps 850 nm

IEEE P802.3ae 10 Gb/s Ethernet Task Force
Los Angeles Interim, September 2001

Participants

PMD suppliers

- Cielo
- Picolight

Fiber & Cable suppliers

- CDT/Optical Systems
- Lucent
- Corning

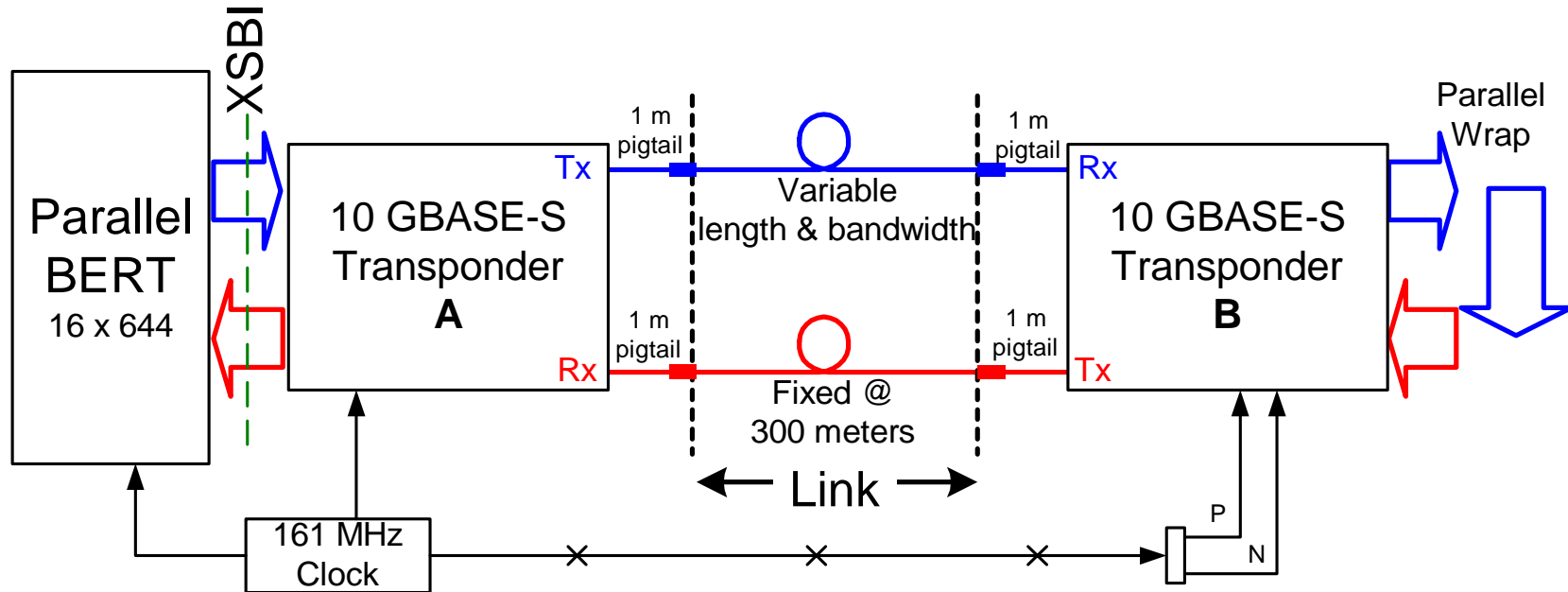


Site: Louisville, CO

10GBASE-S PMD

- 10 Gb/s Directly modulated 850 nm VCSEL
- PIN photodiode receiver
- XSBI electrical interface @ 644 Mbits per channel
- Targeted operating distances
 - 26 meters on 62.5 μm 160 MHz·km MMF
 - 33 meters on 62.5 μm 200 MHz·km MMF
 - 66 meters on 50 μm 400 MHz·km MMF
 - 82 meters on 50 μm 500 MHz·km MMF
 - 300 meters on 50 μm 2000 MHz·km MMF

Interoperability Test Configuration



Test Pattern: PRBS $2^{23}-1$ **Signal Speed:** 10.3125 GBd

Interoperation Testing Results

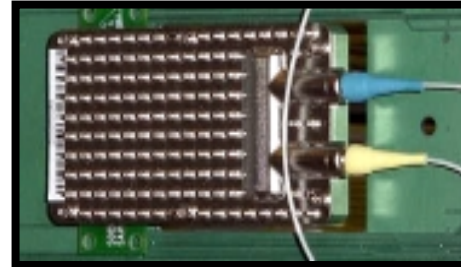
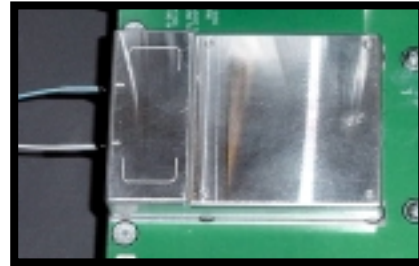
Cable label	Fiber type	Length	Connector	# ofmFibers	Jumpers	Results	Comments
A	2000 MHz-km	300	SC	2		8.00E-13	
	2000 MHz-km	300				0	
B	2000 MHz-km	300	SC	2		0	
	2000 MHz-km	300				0	
D	2000 MHz-km	300	LC	2	2 x FC to LC 1 m jumper (62.5 um receive, 50 um transmit)	0	
	2000 MHz-km	300			2 x FC to LC 1 m jumper (62.5 um receive, 50 um transmit)	3.00E-13	
F	50 um - 400 MHz-km	66	SC	1		0	Near worst case (+/- 50 MHz)
G	62.5 um - 160 MHz-km	26	SC	1	2 m SC-SC jumper added (tension relief)	0	Near worst case (+/- 50 MHz)
H	50 um - 500 MHz-km	82	SC	1	2 m SC-SC jumper added (tension relief)	0	Near worst case (+/- 50 MHz)
I	62.5 um - 200 MHz-km	33	SC	1	2 m SC-SC jumper added (tension relief)	0	Near worst case (+/- 50 MHz)
J	50 um	66	SC	2		0	
	50 um	66				0	
K	62.5 um	35	SC	2	2 m SC-SC jumper added (tension relief)	4.90E-13	
	62.5 um	35			2 m SC-SC jumper added (tension relief)	0	
L	2000 MHz-km	360	SC	2	DMD 0.118 (0-23 um)	4.00E-13	
	2000 MHz-km	360			DMD 0.282 (0-23 um)	<1E-12	
M	2000 MHz-km	450	SC	2	DMD 0.119 (0-23 um)	<1E-12	
	2000 MHz-km	450			DMD 0.145 (0-23 um)	<1E-12	

Testing Summary

Fiber Type/ Bandwidth	Distance	% of link length	BER
62.5 μm MMF 160 MHz·km	26	100%	$<10^{-12}$
62.5 μm MMF 200 MHz·km	33	100%	$<10^{-12}$
50 μm MMF 400 MHz·km	66	100%	$<10^{-12}$
50 μm MMF 500 MHz·km	82	100%	$<10^{-12}$
50 μm MMF 2000 MHz·km	450 m	150%	$<10^{-12}$

Conclusion

- The minimum of two independent vendors supplied Serial 10G 850nm transponders.



- All specified fiber types and link distances were successfully operated to less than 10^{-12} BER.
- 2000 MHz-km fibers were tested to 360m and 450m representing a 50% increase in link distance with a BER less than 10^{-12} .
- Initial analysis of the interoperability test link on the 10 Gb/s Link Budget Spreadsheet (Version 2.4.1) suggests the model is too conservative and that perhaps the values such as the k factor should be adjusted from 0.5 to 0.3
- These successful results demonstrate that the 10GBASE-S PMD is feasible.