Direct-Attach 4X and 12X Cable Assembly Test Summary

Test 343 Summary

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Samples Tested

Type	Wire size (awg)	Length (meters)	Equalized
4X	24	8.5	No
4X	26	7	No
4X	28	6	No
4X	28	0.5	No
4X	24	12.5	Yes
4X	26	9.5	Yes
4X	28	8.5	Yes
12X	28	6	No
4X Angled	28	6	No

Test Equipment

Tektronix CSA803C Digital Sampling Oscilloscope with SD24 TDR Sampling Heads
Anritsu MP1701B Pattern Generator
atSpeed's *Oculus eXtractor™* software for S-parameter extraction from TDT measurements
Meritec Test Boards #601192 Rev.B and C (2X trace risetime is 36psec)

Scope of Testing

The following time domain measurements were made:

Impedance, eye pattern, NEXT and FEXT

The following S-parameter measurements were made:

Insertion Loss, NEXT, MDNEXT, ELFEXT, MDELFEXT

Notes: all risetimes in this report are measured at 20 to 80%
"IB specs" refers to InfiniBand™ Trade Association Architecture specification requirements for copper cabling

Results

Impedance of male connector- 92 to 105 ohms @ 100 psec risetime
(IB specs: 90 to 110 ohms)

NEXT (worst case for all lengths and wire sizes)

Risetime (20-80%)	100ps (%)	40ps (%)
1st neighbor	0.60	1.30
2nd neighbor	0.09	0.50
3rd neighbor	0.05	0.35
4th neighbor	0.04	0.33
QAAAA	0.78	2.48
AAQAA	1.38	3.60

(IB specs: less than 4%, subject to change by IB committee)

FEXT @ 100 psec risetime

	½ meter	6 meter
	%	%
1st neighbor	0.50	0.12
2nd neighbor	0.12	0.05
3rd neighbor	0.07	0.03

(IB specs: none at present time)

Eye Pattern @ 2.5 Gb/s

	Height at 0.5 UI (mv)	Width (psec)
All unequalized samples	>316	>300
All equalized samples	>316	>350

(IB specs: min. height = 316mv; min width 300psec with 1 volt p-p source)

Jitter @ 2.5 Gb/s

	Width (psec)
All unequalized samples	<100
All equalized samples	<50

(IB specs: 100psec max.)

Attenuation @ 1.25 GHz

	Loss (dB)
All unequalized samples	<7.5
All equalized samples	<10

(IB specs: less than 10 dB)

CX4 S-Parameter data @1.5625 GHz

	CX4 Requires	½ meter 28 awg	6 meter 28 awg
	dB	dB	dB
Maximum insertion loss	16	0.92	7.8
Minimum return loss	12	No data	No data
Minimum NEXT	31.8	39.1	40.4
Minimum MDNEXT	29.8	39.0	40.3
Minimum ELFEXT	23.3	42.9	49.7
Minimum MDELFEXT	21.1	42.7	46.5

Note: CX4 does not allow equalization

A longer unequalized 28 awg CX4 cable is feasible (~12 meters)

Note: The S-parameter testing is referenced to specification IEEE Draft P802.3ak/D5.3, November 13, 2003: "Amendment: Physical Layer and Management Parameters for 10Gb/s Operation, Type 10GBASE-CX4".

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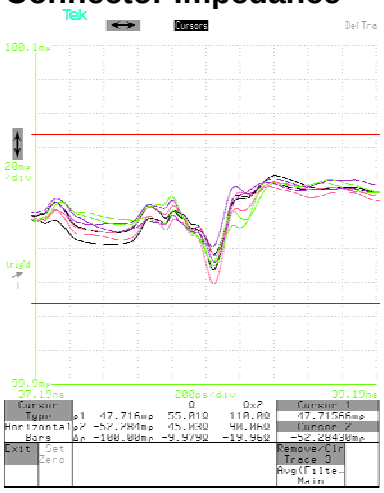
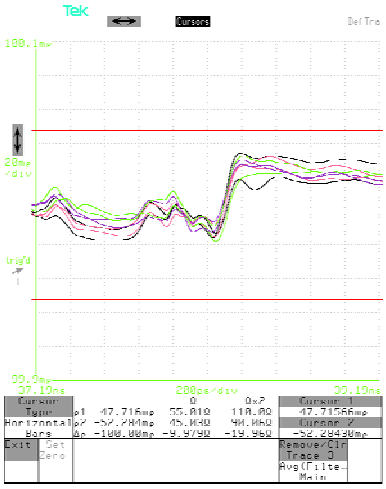
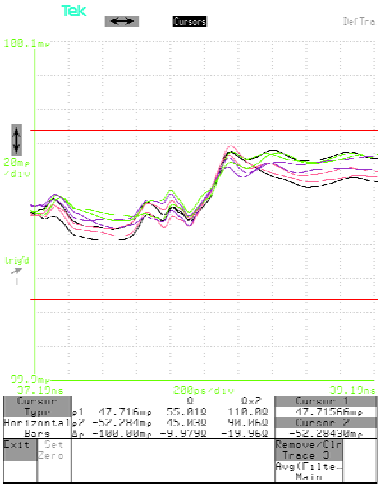
Connector Impedance



24 awg



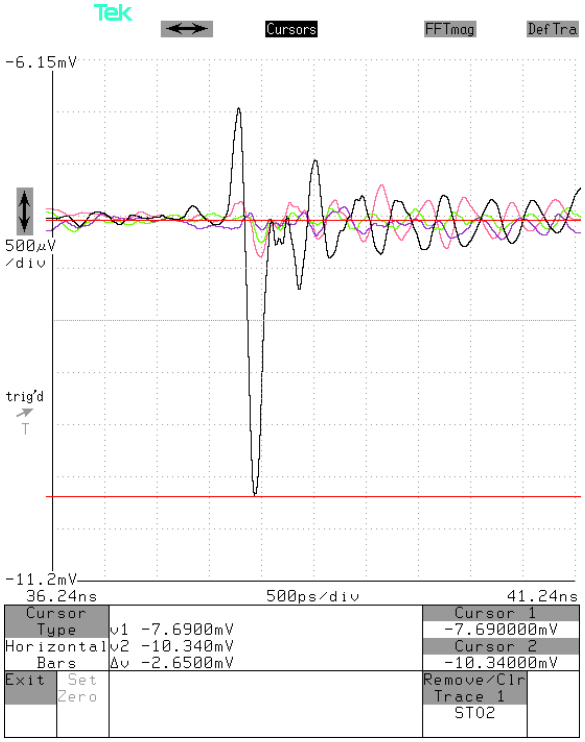
26awg



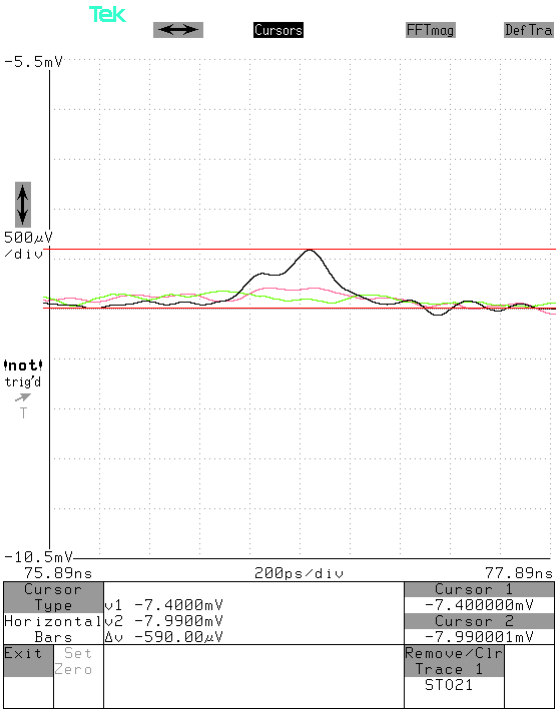
28 awg

Impedance of 8 pairs, unequalized ends - cursors at 90 and 110 ohms, filtered for 100psec risetime. Mated connector in center, SMA and test board to left, cable to right

Crosstalk



Typical NEXT, unequalized end,
100psec risetime, 500mv aggressor
Black trace – 1st neighbor 0.53%
Red trace – 2nd neighbor 0.07%
Green trace – 3rd neighbor 0.05%
Violet trace – 4th neighbor 0.04%



FEXT, unequalized end, 8.5 meter, 28 awg equalized assembly
100psec risetime, 500mv aggressor
Black trace – 1st neighbor 0.12%
Red trace – 2nd neighbor 0.05%
Green trace – 3rd neighbor 0.03%

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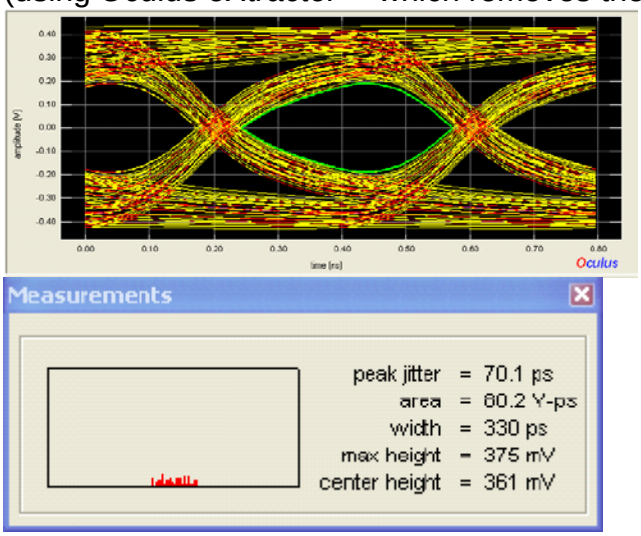
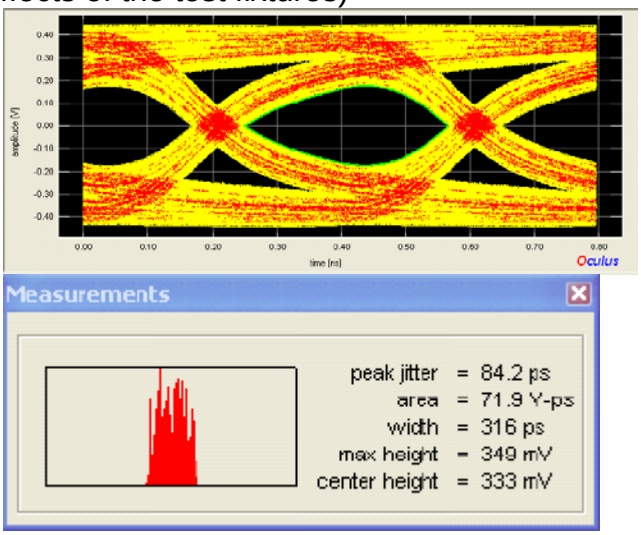
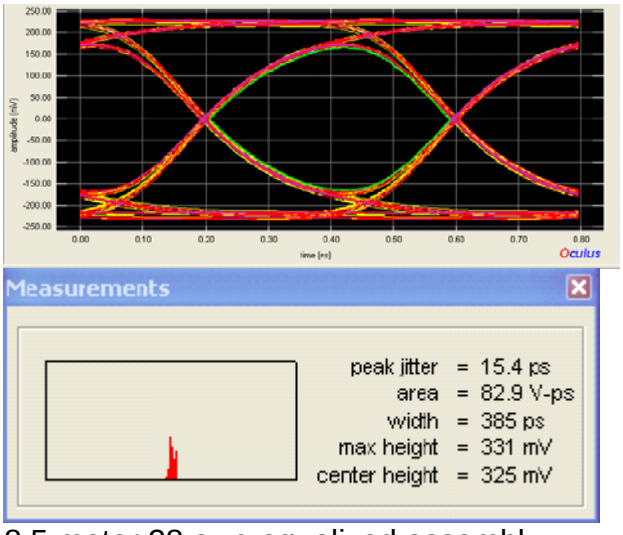
Typical Eye Pattern Diagrams @ 2.5 Gb/s and 100 psec risetimes based on S-Parameter Extractions
(using *Oculus eXtractor*™ which removes the effects of the test fixtures)



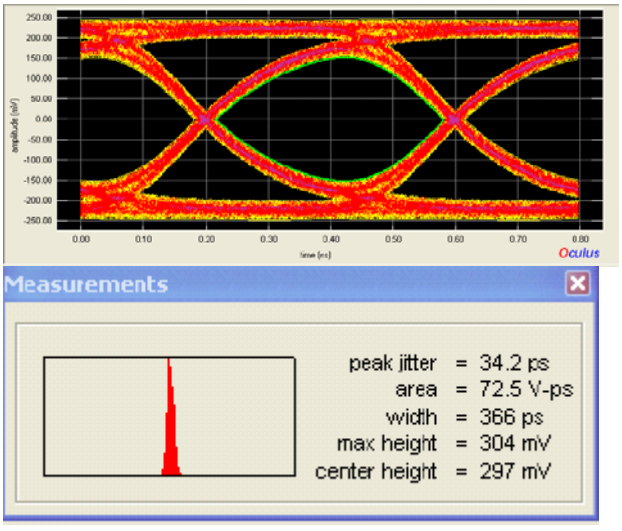
6 meter 28-awg unequalized assembly without crosstalk



6 meter 28-awg unequalized assembly with 4 near end aggressors on one side QAAAA



8.5 meter 28 awg equalized assembly without crosstalk



8.5 meter 28 awg equalized assembly with 4 near end aggressors on one side QAAAA

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