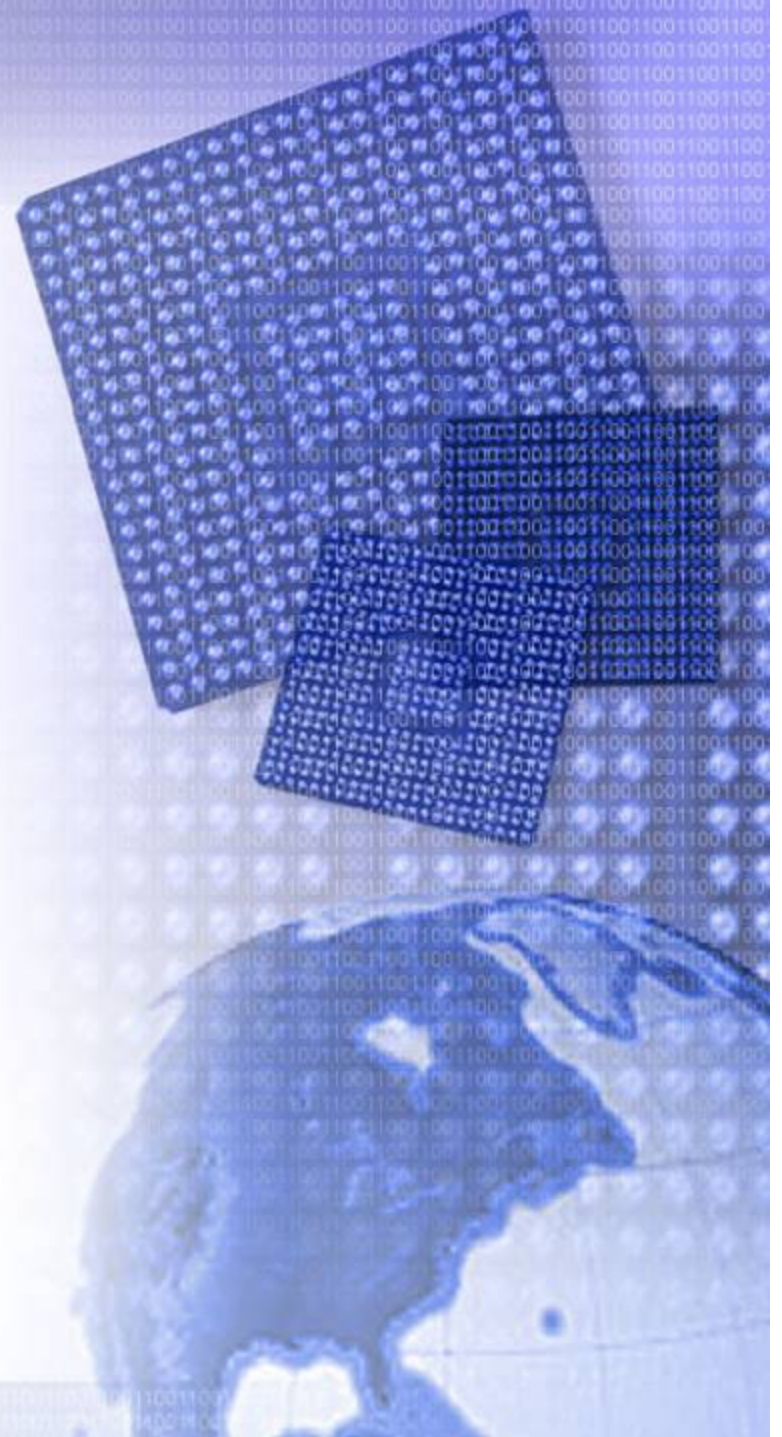




CX4 Cable Testing @ 3, 6 and 10Gbps

Tim Hemken

August 8, 2005



Test Objective

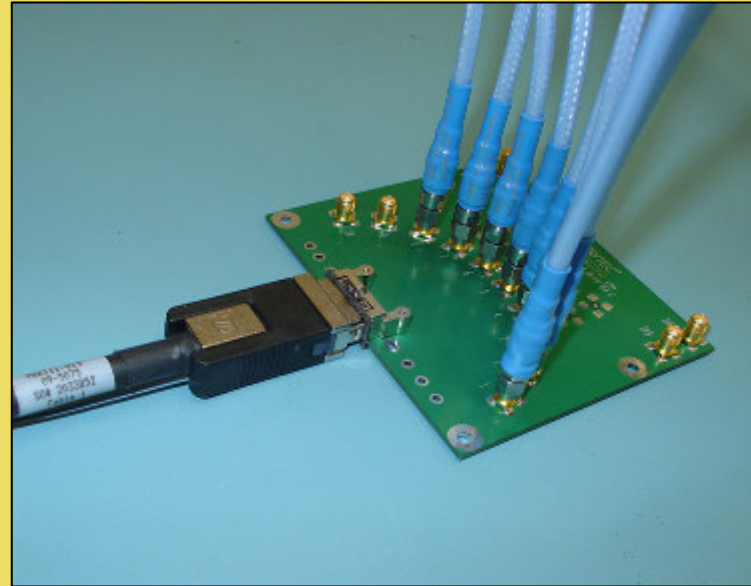
- Analyze CX4 cabling performance with Industry standard components: Xilinx FPGA and Meritec CX4 cables
- Cables used cover both IEEE802.3ak (CX4) & InfiniBand X4 industry standards
- Analyzed 2 cables with 4 MGTs operating simultaneously
 - 6 meter cable @ 10Gbps (40Gbps cumulative data rate)
 - 15 meter cable @ 6.25Gbps (25Gbps cumulative data rate)
- Channels run in alternate directions through cable: TX-RX-TX-RX, done to maximize the effects of cross-talk
- Both IEEE CX4 and InfiniBand specify 8b10b: so PRBS 2⁷ was used due to similarity of the data patterns
- All testing was done with a Xilinx XC4VFX60-10FF672CES2

Equipment

- ML421 Eval Board with XBERT
- Meritec cables and test cards
 - <http://www.meritec.com/Pages/products/cca/4x12xdirectattach.html>

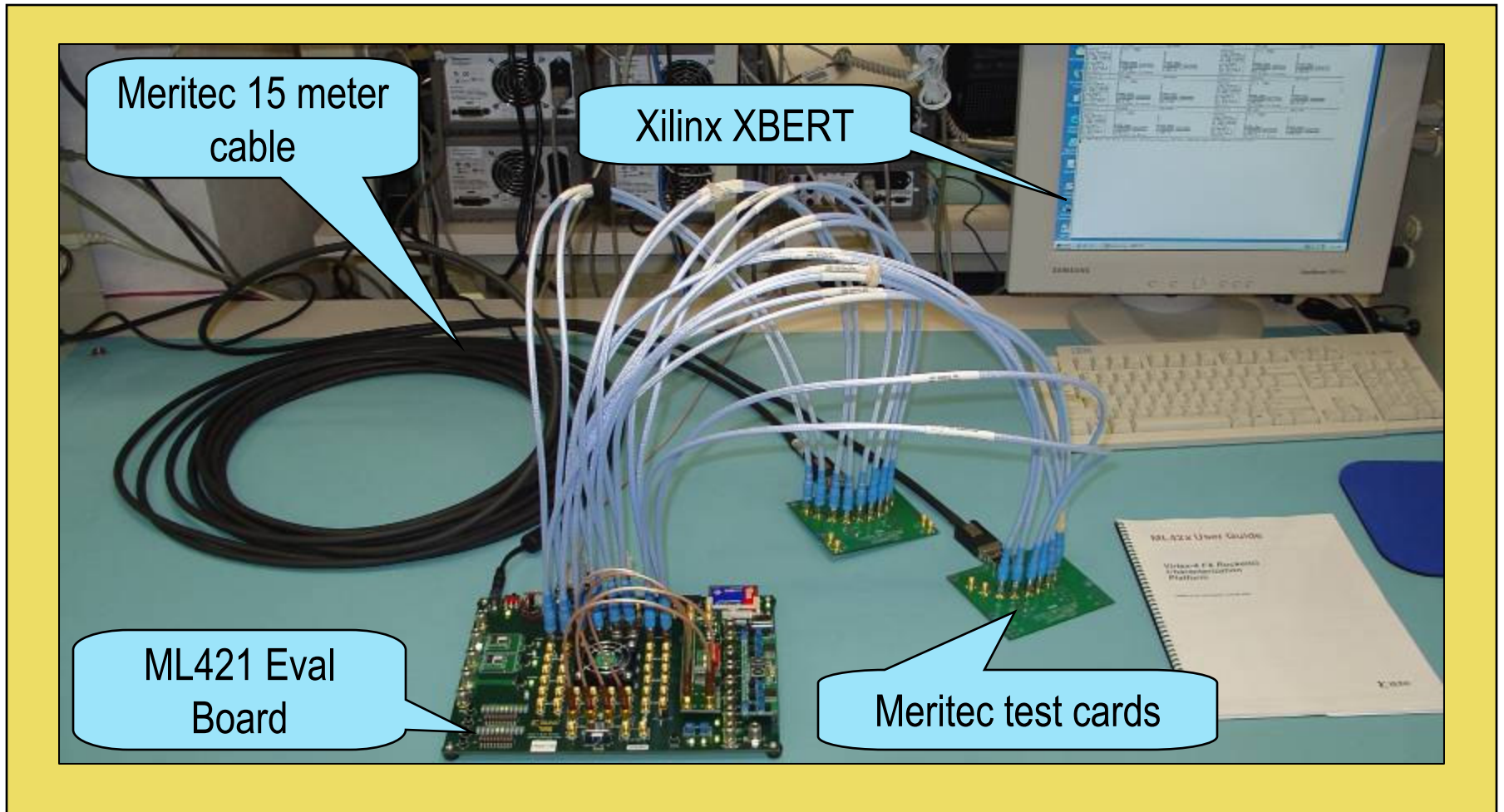


ML421



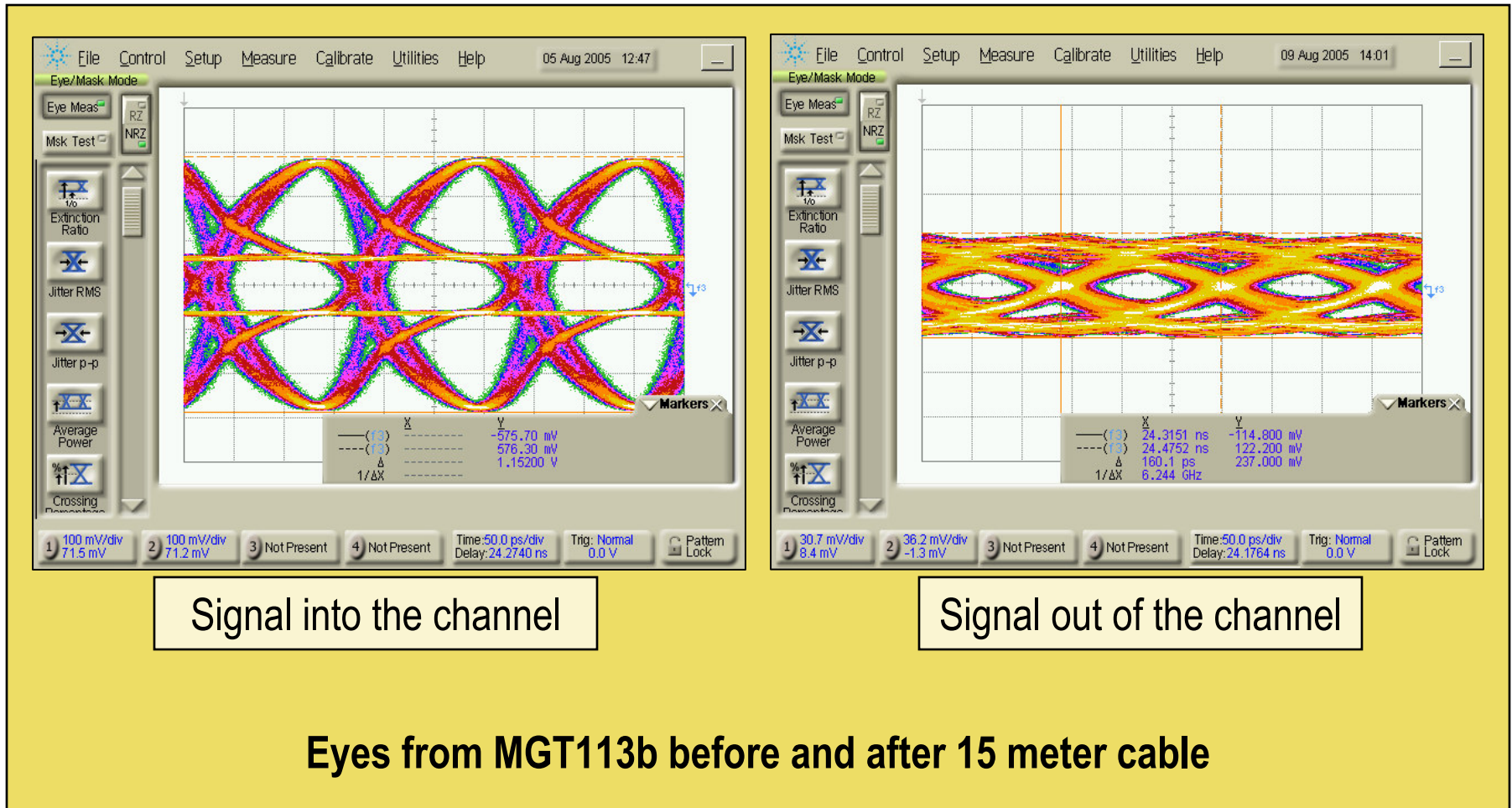
Meritec Cable & Cards

Test Setup



Note: 10Gbps 6 meter test set up is identical, just different cable

6.25Gbps Eye Diagrams



6.25G BERT Results

XBERT: Bit Error Rate Test Console (Device: V4FX60)

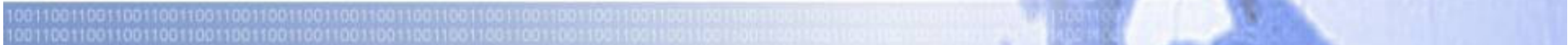
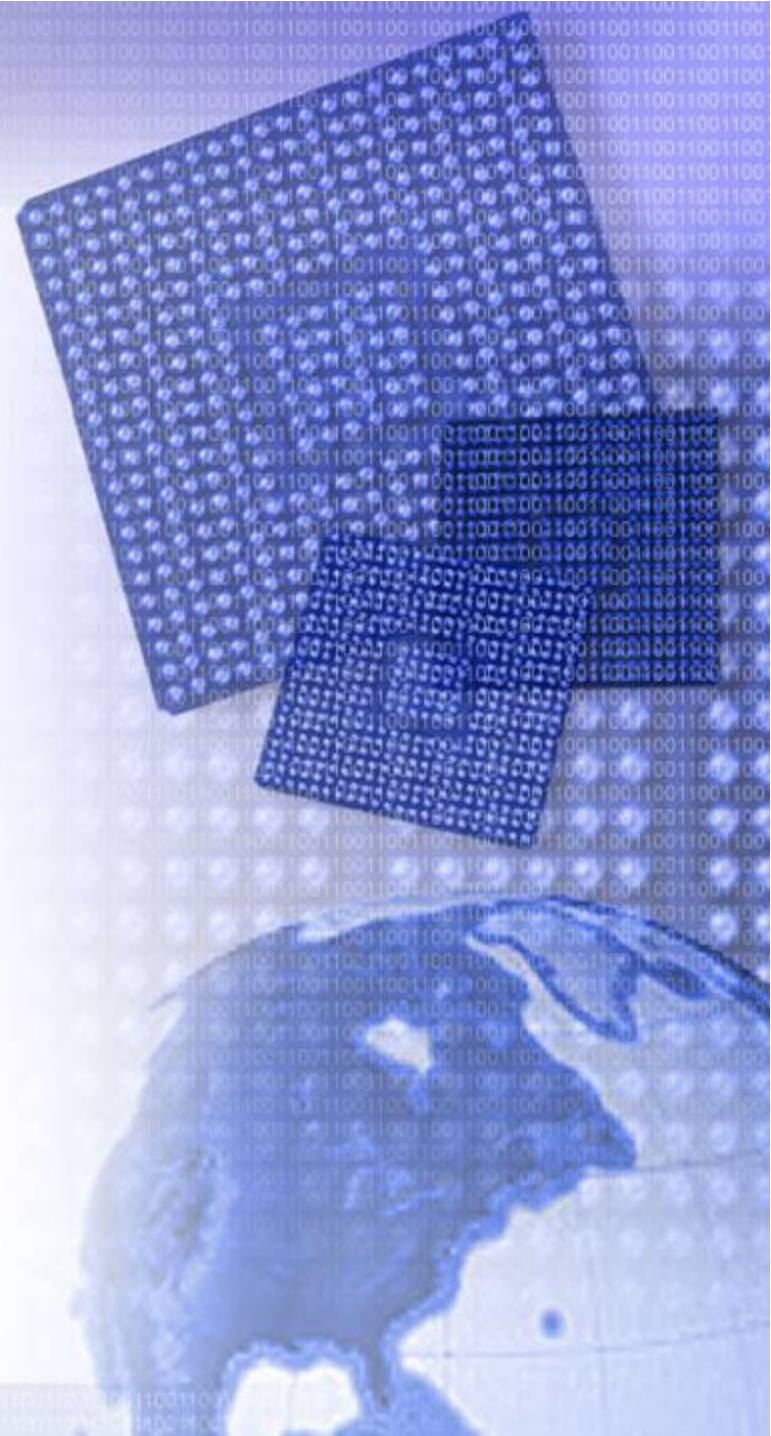
Test Duration: 64hrs+

Channel 4	MGT102A	MGT102B
Pattern	2 ⁷ -1 PRBS	
Link Status	1	1
Tx PMA Locked	1	1
Rx PMA Locked	1	1
Line Rate	6250 Mbps	6250 Mbps
Rx Words #	0x00002100_637B27D9	0x00002100_637C3B5E
Bit Errors #	0x00000000_00000000	0x00000000_00000000
Bit Err Rate	6.88E-16	6.88E-16
Channel 5	MGT113A	MGT113B
Pattern	2 ⁷ -1 PRBS	
Link Status	1	1
Tx PMA Locked	1	1
Rx PMA Locked	1	1
Line Rate	6250 Mbps	6250 Mbps
Rx Words #	0x00002100_637DB8A4	0x00002100_637ECC20
Bit Errors #	0x00000000_00000000	0x00000000_00000000
Bit Err Rate	6.88E-16	6.88E-16

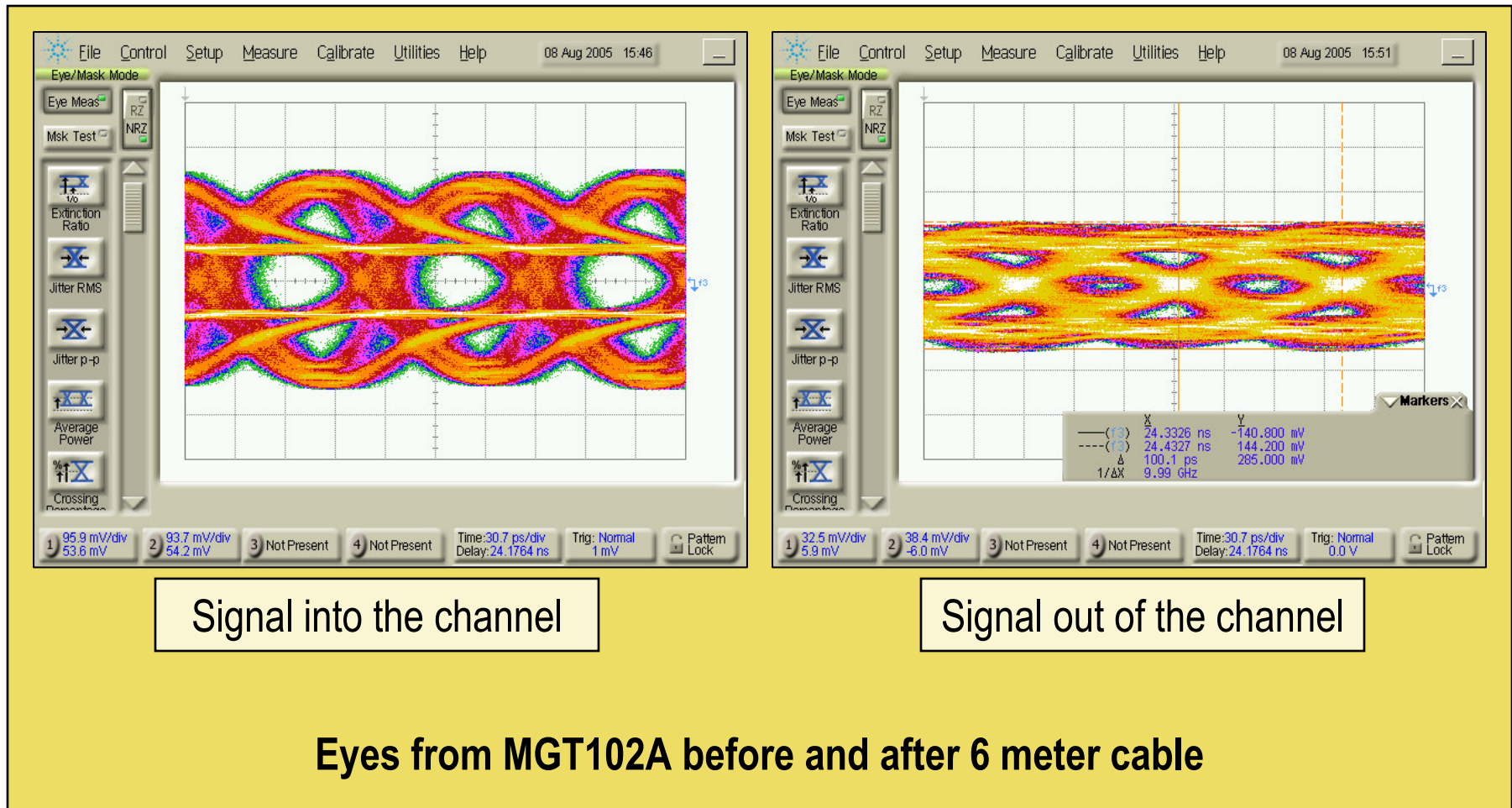
Note: The "Bit Error Rates" are calculated assuming 1 error, since no error were recorded the RocketIO's performance easily exceeds the rate shown



10Gbps Analysis: 6m Cable



10Gbps Eye Diagrams



Signal into the channel

Signal out of the channel

Eyes from MGT102A before and after 6 meter cable

10G BERT Results

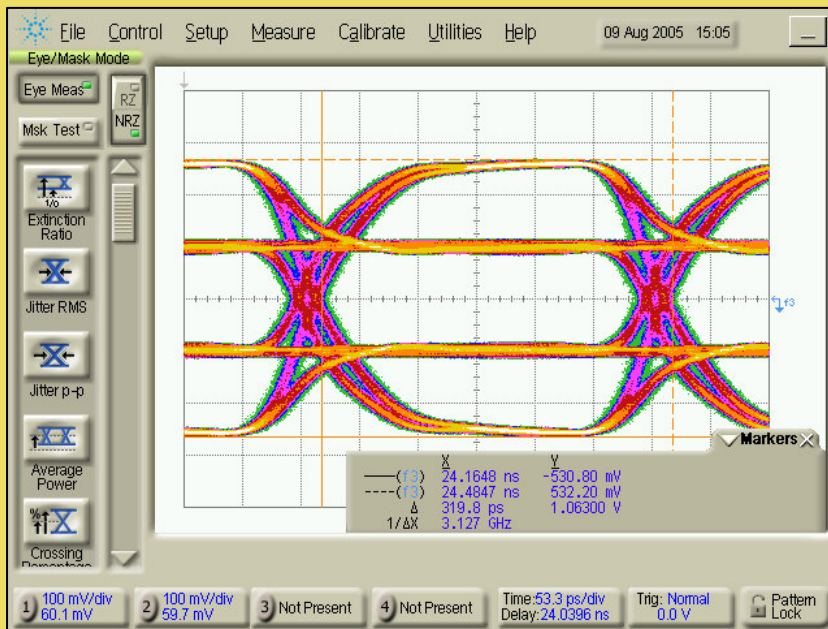
XBERT: Bit Error Rate Test Console (Device: V4FX60)

Test Duration: ~17hrs

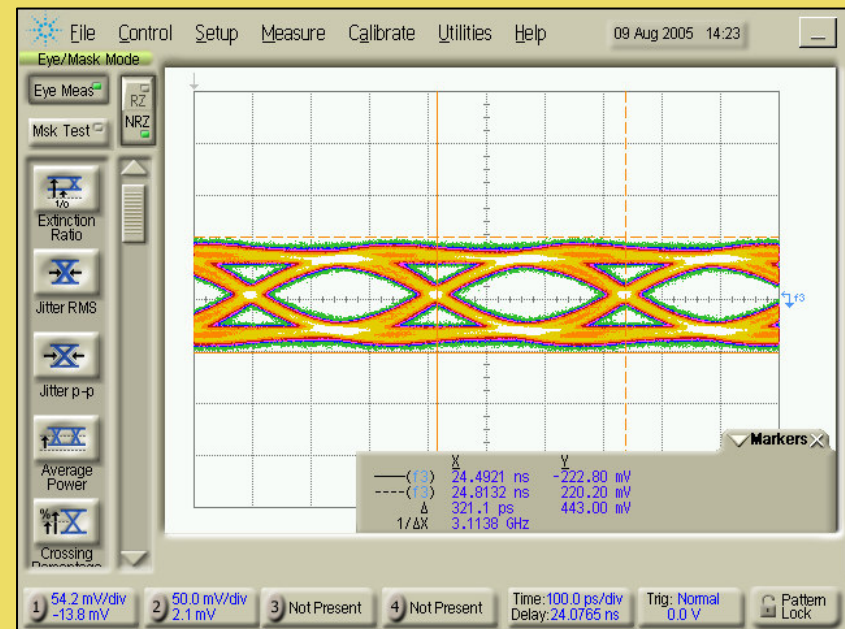
Channel 4	MGT102A	MGT102B
Pattern	2^7-1 PRBS	
Link Status	1	1
Tx PMA Locked	1	1
Rx PMA Locked	1	1
Line Rate	10000 Mbps	10000 Mbps
Rx Words #	0x00000DCE_1C940252	0x00000DCE_1C95A75E
Bit Errors #	0x00000000_00000000	0x00000000_00000000
Bit Err Rate	1.64E-15	1.64E-15
Channel 5	MGT113A	MGT113B
Pattern	2^7-1 PRBS	
Link Status	1	1
Tx PMA Locked	1	1
Rx PMA Locked	1	1
Line Rate	10000 Mbps	10000 Mbps
Rx Words #	0x00000DCE_1B06FA1D	0x00000DCE_1B089F3A
Bit Errors #	0x00000000_00000000	0x00000000_00000000
Bit Err Rate	1.64E-15	1.64E-15

Note: The "Bit Error Rates" are calculated assuming 1 error, since no error were recorded the RocketIO's performance easily exceeds the rate shown

3.125Gbps Eye Diagrams



Signal into the channel



Signal out of the channel

Eyes from MGT113b before and after 15 meter cable

3.125G BERT Results

XBERT: Bit Error Rate Test Console (Device: V4FX60)		Test Duration: ~17hrs
Channel 4	MGT102A	MGT102B
Pattern	2^31-1 PRBS	
Link Status	1	1
Tx PMA Locked	1	1
Rx PMA Locked	1	1
Line Rate	3125 Mbps	3125 Mbps
Rx Words #	0x0000046C_8E3DCC5A	0x0000046C_8E3E5102
Bit Errors #	0x00000000_00000000	0x00000000_00000000
Bit Err Rate	5.13E-15	5.13E-15
Channel 5	MGT113A	MGT113B
Pattern	2^31-1 PRBS	
Link Status	1	1
Tx PMA Locked	1	1
Rx PMA Locked	1	1
Line Rate	3125 Mbps	3125 Mbps
Rx Words #	0x0000046C_8E3F0A25	0x0000046C_8E3F8ECB
Bit Errors #	0x00000000_00000000	0x00000000_00000000
Bit Err Rate	5.13E-15	5.13E-15

Note: The "Bit Error Rates" are calculated assuming 1 error, since no error were recorded the RocketIO's performance easily exceeds the rate shown

Wrap-up

- These channels easily ran error free at both 6.25Gbps & 3.125Gbps with industry standard components
- 10Gbps operation over 6 meters required optimizing the TX & RX PMA settings for each channel
- TX and RX equalization setting are easily managed thru Xilinx XBERT tool