

Optical Loop Back Test for ODMB7 Preproduction

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Hardware Connections



Firmware compatible with ODMB7 is here: https://github.com/wsicheng/ODMBDevelopment/tree/master/SingleTestFWs/optical ibert gth

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Conceptual Diagram

from Hualin









IBERT Test on ODMB7

- Overview for IBERT test
 - * An automated Bit Error Rate test, simple to implement
 - * Same config need to be applied to each quad
- Firmware goals
 - * Test that all optical transmitter lines are working properly
 - * All the ports need to be config to the same speed
 - * Compiled IBERT firmware in 12.48 Gb/s and 4.0 Gb/s
 - 4.0 Gb/s motivated as Finisar for the SPY channel only support up to 4.0 Gb/s nominally
 - Both firmware versions have all TXs and RXs activated
 - Can set SPY_TX_P/N to low power mode (effectively switch off) as a protection in the 12.48 Gb/s version, this need to be done by Tcl script/manual after firmware loaded to the FPGA
 - Automated Eye Scan + Bit Error Rate test by Tcl script
 runScan.tcl

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Auto IBERT Procedure

- Step 1: Preparation
- Connect to board and load firmware *
- Edit the constants at the top of runScans.tcl
- Step 2: Run script from the Tcl console *
- > source runScans.tcl
- Step 3: Evaluate results from "Serial I/O Links"
 - Verify that the Link status are good
 - Verify that the Error count is stable at one
 - Look at the IBERT scans plots (next slide)

Firmware and the automated script can be found at: http://hep.ucsb.edu/cms/odmb_noCVS/firmware/odmb7/preproduction/optical_loopback_ibert/



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	S Link 1	MGT_X0Y13/TX	MGT_X0Y13/R	(10.000 Gbps	4.16E14	1E0	2.404E-15	Reset	PRBS 7-bi				
	S Link 2	MGT_X0Y14/TX	MGT_X0Y14/R	(10.000 Gbps	4.16E14	1E0	2.404E-15	Reset	PRBS 7-bi				
	N Link 3	MGT_X0Y15/TX	MGT_X0Y15/R	(10.008 Gbps	4.16E14	1E0	2.404E-15	Reset	PRBS 7-bi				
	N LINK 4	MGT_X0Y16/TX	MGT_X0Y16/R		4.16E14	1E0	2.404E-15	Reset	PRBS 7-bi				
	N LINK 5	MGT_X0Y17/TX	MGT_X0Y17/R	9.995 Gbps	4.16E14	1E0	2.404E-15	Reset	PRBS 7-bi				

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IBERT Eye Scan

- The scans will pop up one by one during the script running
- The Open area should be the main indicator on link quality

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			Ended:	2020-Nov-05 15	07:09			Vertical increm	nent:	8					
<								Vertical range	:	100%					
General Propertie	es														
Tcl Console Mess	sages Serial I/	Olinks Se	rial I/O Scans	×											2 0 6
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Scan 2 Link	2		2d_full_eye	Done 🗾	100%	6400	77.78	8	~	-0.500 UI to 0.500 UI 👻	8 🗸	100%	~	BER	∨ 1e-
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Running eye scan will create errors to the link, so it's normal to see error count increase during running of the eye scan, and the link shall be reset afterward



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More Details on the Script

- Configurable constants
 - FPGA name
 - The PRBS pattern sent and checked by TX/RX
 - Auto load firmware with the script (need to specify filename)
 - Disable the SPY_TX_P/N channels
 - Set to 1 for the 12.48 Gb/s version, 0 for the 4.0 Gb/s version
 - Tag: suffix to the log file
- Steps performed by the script
 - Make a link between each available txs and rxs
 - Reset all good links and inject 1 error
- Config and run Eye Scans on each good link
- The open area, open percentage, horizontal percentage and vertical percentage will be written to a log file
- Reset again and inject 1 error
- Loop to fetch the BER values in certain time period
- Write total bits received, error count, bit error rate (BER), RX pattern each turn into file for later plotting/analysis

* https://github.com/wsicheng/ODMBDevelopment/blob/master/SingleTestFWs/optical_ibert_gth/scripts/runScans.tcl



- set DEVICE_NAME {xcku040_0} 8
- set PRBS_PATTERN {PRBS 31-bit} 9
- set programfpga 0 17
- set bitfilename {} 18
- set disable_spy_tx 0 19
- set tag "test2" 20

