

SATA Host-IP Demo Instruction

Rev1.1 24-Nov-16

This document describes the instruction to run SATA Host-IP demo on FPGA development board and AB09-FMCRAID/AB12-HSMCRAID adapter board. The demo is designed to write/verify data with SATA-III device. User can control test operation through NiosII command shell.

1 Environment Requirement

To demo SATA Host-IP on Altera board, please prepare the following hardware/software.

- 1) Altera board: Altera ArriaV GX Starter board/Altera Arria10 SoC Development board
- 2) PC with QuartusII programmer and NiosII command shell software
- 3) AB09-FMCRAID for Arria10 SoC board or AB12-HSMCRAID for ArriaV GX Starter board
- 4) SATA-III device
- 5) Altera Power adapter and ATX power supply for SSD
- 6) A cable for programming FPGA and NiosII command shell connecting between FPGA board and PC,
 - USB Type-B cable in case of ArriaV GX Starter board
 - micro USB cable in case of Arria10 SoC Development board



Figure 1-1 SATA Host-IP Demo Environment Setup on ArriaV GX Starter Board







2 Demo setup

- 1) Power off system.
- 2) Setup board option.
 - a) For ArriaV GX Starter board only, set bit1 of SW4 to OFF position.



Figure 2-1 Set SW to select clock input for ArriaV GX Starter board

- 3) Setup RAID adapter board.
 - i. Connect AB09-FMCRAID/AB12-HSMCRAID to FMC#A/HSMC connector on Altera board.
 - ii. Connect SATA-III device to CN0 on AB09/AB12.
 - iii. Connect power to power connector on AB09/AB12



Figure 2-2 AB09/AB12 connection to FPGA board



4) Connect USB Type A or micro USB cable from FPGA board to PC for JTAG programming and JTAG UART.



- 5) Power on FPGA development board and power supply for SATA device.
- 6) Open "Clock Control" application to program 150 MHz clock for Altera board.
 - a) For ArriaV GX Starter board only, select 1st tab (U4), set CLK0 frequency = 150 MHz, and click "Set New Frequency" button.

\land Clock Contro	I			
	RA.			
F_vco	: 000MHz			
Registers		Fre	equency (MHz)	Disable all 📃
CLk0	-	CLK0	150.00	Disable CLK0 🥅
CLK1	-	CLK1	150.00	Disable CLK1 📃
CLK2	-	CLK2	150.00	Disable CLK2 📃
СГКЗ	-	CLK3	150.00	Disable CLK3 🥅
	read		Default	Set New Frequency
Messages				
/USB-Blas 22102) 1	sterII on lo SPM221002	calho:	st (USB-1)	/5M(1270ZF324
Figure 2	-1 Set clock	(frog	ioney for /	ArriaV GX board



7) Use QuartusII Programmer to program "HSataIPTest.sof" file, as shown in Figure 2-5.

	2						_
Hardware Setup	USB-Blasterli [USB-1]	Mode: JTAG		Progress:	100%	6 (Success	(ful)
Enable real-time ISP	to allow background programming wi	hen available					
Start Start	File	Device	Checksum	Usercode	Program/ Configure	Verify	Blan) Chec
B Stop	D:/SATA-IP/HostIP/HSataIPTest.sof	SAGXFB3H4F35	04979C38	04979C38			
Auto Detect	<none></none>	5M2210Z	00000000	<none></none>			
	100 T						
X Delete		111					
Add File Change File		m Andre Ra					
Change File Change File Save File Add Device Up Up Up Up Up Up							
				M Find.	Find Next	 a	
	TDI SAGXFB3H4F35 TDO Control Control Contro				🥂 Find Ne <u>x</u> i	<u> </u>	
Delete Add File Change File Save File Add Device Tup Down All O ZO9061	TDI SAGXFB3H4F35 TDO Message Ended Programmer opera	m	Oct 28 15:3	Eind (1:08 2016	💏 Find Neg	<u></u>	

Figure 2-5 Programmed by QuartusII Programmer

8) Open NiosII Command Shell and run nios2-terminal command. Boot message will be displayed.

"Waiting device ready" message is displayed during system initialization.

"SATA Gen3 Device Detect" shows SATA speed after complete SATA initialization. Main menu will be displayed to receive command from user.

++++ Start SATAHost-IP Te	est design [Ver = 1.2] ++++
Waiting device ready	Wait SATA Linkup
SATA Gen3 Device Detect	SATA Speed = Gen3
Main menu [Ver = 1.2] [0] : Identify Device [1] : Write SSD [2] : Read SSD [2] : Security Enace	Main menu to select operating command

Figure 2-6 NiosII Terminal



9) Check LED status on FPGA board. The description of LED is follows.

GPIO LED	ON	OFF
0	Normal operation	System is in reset condition
1	System is busy	Idle status
2	Error detect	Normal operation
3	Data verification fail	Normal operation

Table 1 LED Definition



Figure 2-7 4-bit LED Status for user output

After programming completely, LED[0] and LED[1] will be ON during SATA initialization process. Then, LED[1] will be OFF to show that SATA Host-IP completes initialization process and now system is ready to receive command from user.



Figure 2-8 LED status after program configuration file and SATA initialization complete



3 Test Menu

3.1 Identify Device

Select '0' to send Identify device command to SATA Device. When operation is completed, four information will be displayed on the console, i.e.

- 1) SSD Model number
- 2) Security feature set is supported or not. If not supported, user must not use menu 3 for the test.
- 3) Normal Erase Mode Time: This is estimation time to complete security erase command. Minimum valid value is 2 minutes. This information will be displayed when the device can support Security feature set.
- 4) SSD capacity which is output value from SATA Host-IP.



Figure 3-1 Result from Identify Device menu



3.2 Write SSD

Select '1' to send Write command to SATA device. Three inputs are required for this menu. 1) Start LBA: Input start address of SATA device in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.

2) Sector Count: Input total transfer size in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.

3) Test pattern: Select test pattern of test data for writing to SATA device. Four types can be used, i.e. 32-bit increment, 32-bit decrement, all 0, and all 1.

	*
++ Write data selected	+++
nter Start LBA : 0 - 0	x1DCF32AF => 0
nter Sector Count : 1 elected Pattern [Ø][nc]	-0x100F32B0 = > 0x1000000 32 [1]Dec32 [2]A]] 0 [3]A]] 1 = > 0
510.186 MB	
1.023 GB	1.1
Current t	ransfer size
7.181 GB	
7.694 GB	
8.207 GB	Output performance
otal = 8[GB] , Time = :	16[s] , Transfer speed = 513[MB/s]
Main menu [llew = 1 '	21
Main menu [Ver = 1.3 0] : Identify Device	21
Main menu [Ver = 1.3 0] : Identify Device 1] : Write SSD	21
Main menu [Ver = 1.3 0] : Identify Device 1] : Write SSD 2] : Read SSD	21
Main menu [Ver = 1.3 0] : Identify Device 1] : Write SSD 2] : Read SSD 3] : Security Erase	2]

Figure 3-2 Input and result of Write SSD menu

As shown in Figure 3-2, if all inputs are valid, the operation will be started. During writing data, current transfer size will be printed out to the console to show that system still be alive. Finally, test performance with the size and time usage will be displayed on the console.

Figure 3-3 – Figure 3-5 shows error message when user input is invalid. "Invalid input" message will be displayed on the console, and then return to main menu to receive new command.

Cygdrive/	:/altera/15.1		2
1 +++ Write Enter Star Invalid in Main m [0] : Iden [1] : Writ [2] : Read [3] : Secu	data selected +++ t LBA : Ø - Øx1DCF32AF => put Error message enu [Ver = 1.2] tify Device e SSD SSD rity Erase	Out-of-range LBA address Øx1dcf32b0	· · · ·
•		E E	14

Figure 3-3 Invalid Start LBA input









Figure 3-5 Invalid Test pattern input



3.3 Read SSD

Select '2' to send Read command to SATA Device. Three inputs are required for this menu. 1) Start LBA: Input start address of SATA Device in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.

2) Sector Count: Input total transfer size in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.

3) Test pattern: Select test pattern to verify data from SATA Device. Test pattern must be matched with write test. Four types can be used, i.e. 32-bit increment, 32-bit decrement, all 0, and all 1.

]	
++ Read data selected nter Start LBA : 0 - 0 nter Sector Count : 1 elected Pattern [0]Inc 559.907 MB 1.120 GB 1.681 GB	+++ x1DCF32AF => 0 - 0x1DCF32B0 => 0x1000000 Input from us 32 [1]Dec32 [2]AII_0 [3]AI1_1 => 0 transfer size
7.292 GB 7.853 GB 8.414 GB	Output performance
otal = 8[GB] , Time =	15[s] , Transfer speed = 560[MB/s]
Main menu [Ver = 1. 0] : Identify Device 1] : Write SSD	21
2] : Read SSD 3] : Security Erase	

Similar to write test if all inputs are valid, the operation will be started and test performance will be displayed when end of transfer. "Invalid input" will be displayed if any input value is out-of-range.



```
X
 /cygdrive/c/altera/15.1
2
                                                                                              .
+++ Read data selected +++
Enter Start LBA : \emptyset - \emptyset \times 1DCF32AF => \emptyset
Enter Sector Count : 1 - \emptyset \times 1DCF32B0 => \emptyset \times 1000000
Selected Pattern [0]Inc32 [1]Dec32 [2]A11_0 [3]A11_1 => 1
Verify fail
1st Error at Byte Addr = 0x00000000
                                     = Ø×FFFFFFFF
Expect Data
                                     = 0x00000000
Read Data
Press any key to cancel operation
559.912 MB
1.120 GB
1.681 GB
                                                       Verify fail without
                                                       cancel operation
   7.292 GB
7.853 GB
8.414 GB
Total = 8[GB] , Time = 15[s] , Transfer speed = 560[MB/s]
    - Main menu [Ver = 1.2] ----
[0] : Identify Device
[1] : Write SSD
[2] : Read SSD
[3] : Security Erase
 4
                                  111
```

Figure 3-7 Data verification is failed, but wait until read complete

2		
+++ Read data selected +++ Enter Start LBA : 0 - 0x1DCF32AF => Enter Sector Count : 1 - 0x1DCF32B0 Selected Pattern [0]Inc32 [1]Dec32 [0 => 0x1000000 2]All_0 [3]All_1	=> 1
Jerify fail 1st Error at Byte Addr = 0x00000000 Expect Data = 0xFFFFFFF	Verify fail with	
Read Data = 0x00000000 Press any key to cancel operation Operation is cancelled Please reset sustem before start new	cancel operation	. 1
Main menu [Ver = 1.2] [0] : Identify Device [1] : Write SSD		
[2] : Read SSD [3] : Security Erase		

Figure 3-8 Data verification is failed, and press key to cancel operation

Figure 3-7 and Figure 3-8 show the error message when data verification is failed. "Verify fail" message will be displayed with error address, expected data, and read data. User can press any key to cancel read operation or wait until all read process complete. "RESET" button should be pressed to restart the system before starting new test.



3.4 Security Erase

Select '3' to send Security Erase command to SATA Device. Please confirm that SATA device can support Security Erase feature firstly by using Identify device menu. The estimation of operation time to run security erase is also displayed in Identify device menu.

After selecting the menu, warning message will be displayed on the console. User can input 'y' or 'Y' to continue security erase operation or input other keys to cancel operation.

Number will be displayed on the console every second to show the status that system still run the command. After complete operation, total operation time will be displayed as shown in Figure 3-9.

Figure 3-10 shows the example when user inputs other keys to cancel the command.



Figure 3-9 Result from Security Erase command



Figure 3-10 Cancel Security Erase command



4 Revision History

Revision	Date	Description
1.0	28-Oct-16	Initial version release
1.1	24-Nov-16	Correct security erase menu