

# Stratix4 GX SATA3 RAID Demo Instruction

Rev1.0 31-Oct-12

This document describes the instruction to run 4-ch RAID0 of SATA3-IP demo on Stratix IV GX development board.

## 1 Environment Setup

To run RAID demo, HSMCRAID board, provided by Design Gateway, is required to connect Stratix IV GX development board with 4 SATA-III HDD/SSD, as shown in Figure 1.

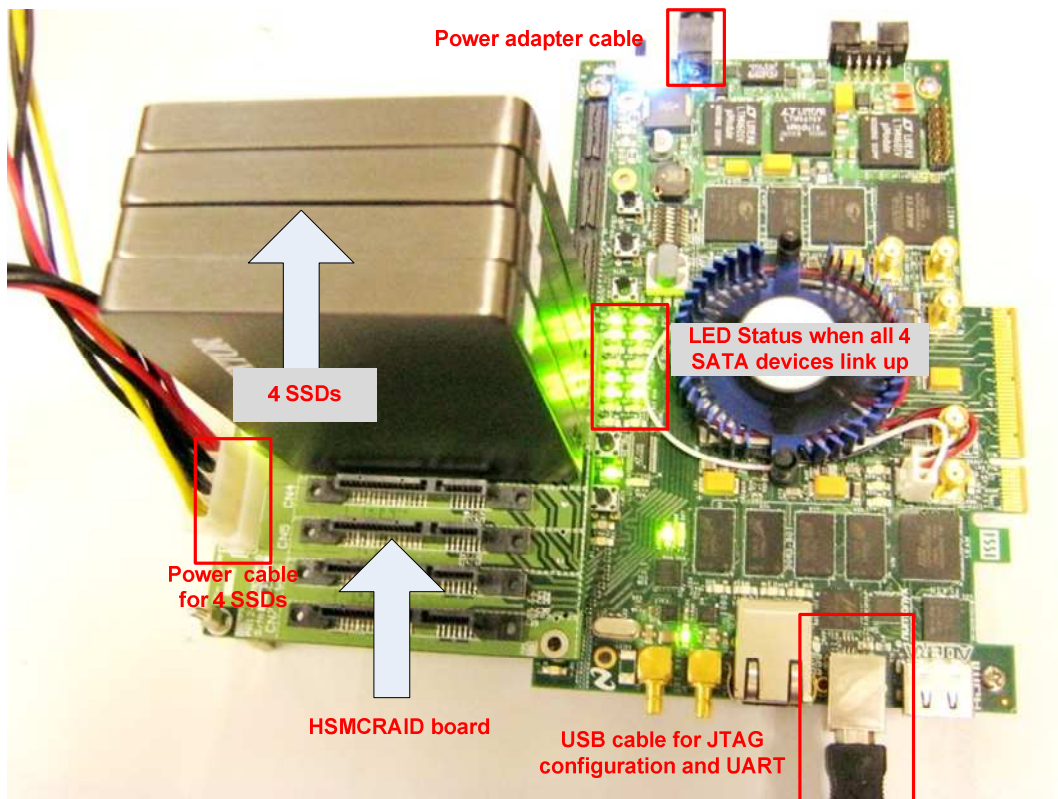


Figure 1 RAID Demo Environment Setup



Figure 2 HSMCRAID board by Design Gateway

Following step is setup procedure for running demo.

- Connect HSMCRAID board to HSMC connector Port A on Stratix IV GX development board
- Connect 4x2.5" SATA-III HDD/SSD to CN0 – CN3 on HSMCRAID board, as shown in Figure 1.
- Connect ATX power cable to HSMCRAID board.
- Connect Power adapter cable to Stratix IV GX development board
- Connect USB A-B cable from Stratix IV GX board to PC.
- Power on Stratix IV GX board and SATA-III HDD/SSD
- Open Quartus Programmer and download "nios\_sata3.sof" to Stratix IV GX board, as shown in Figure 3.

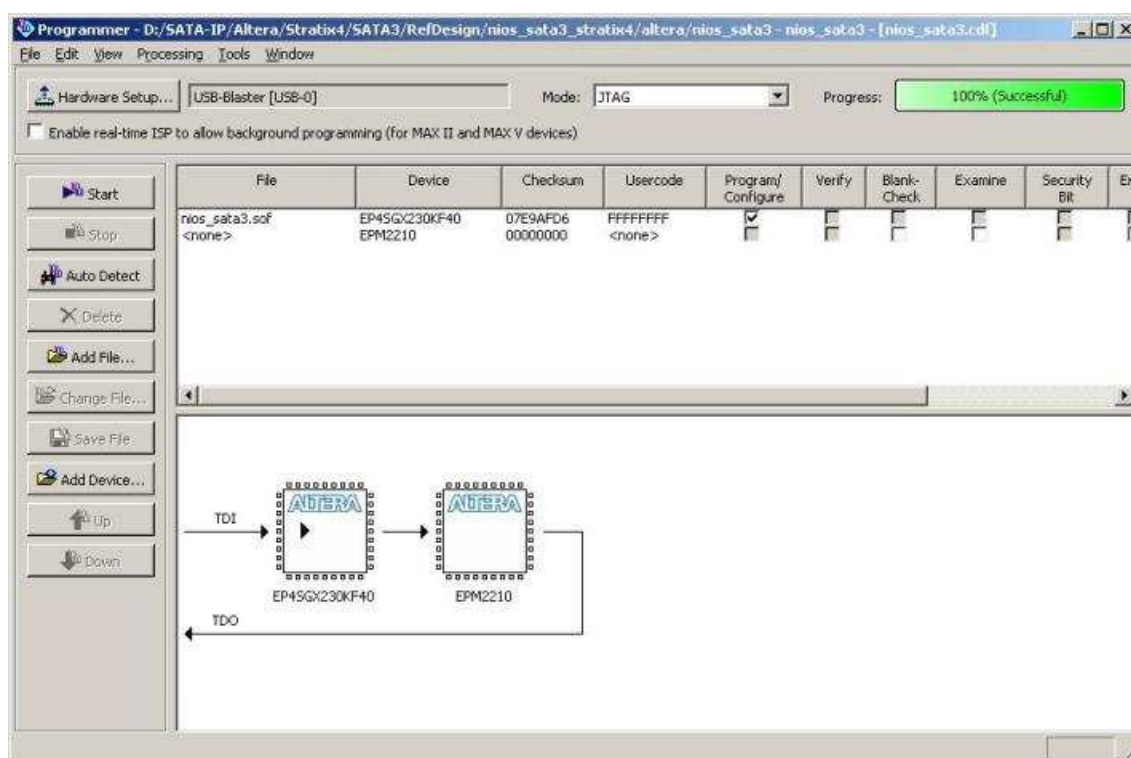


Figure 3 Programmer Environment

- Check LED status on Stratix IV GX board now and LED0-1, LED4-5, LED8-9, and LED12-13 should be turn-on, as shown in Figure 4.

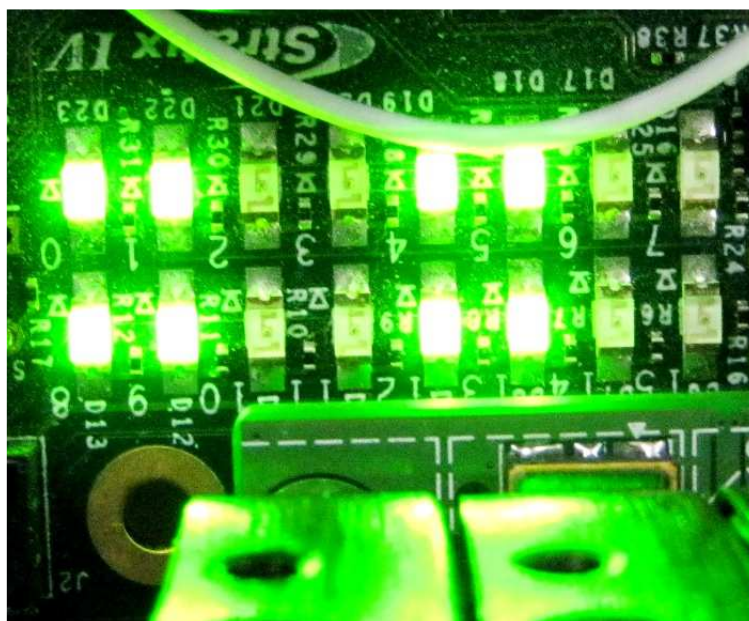
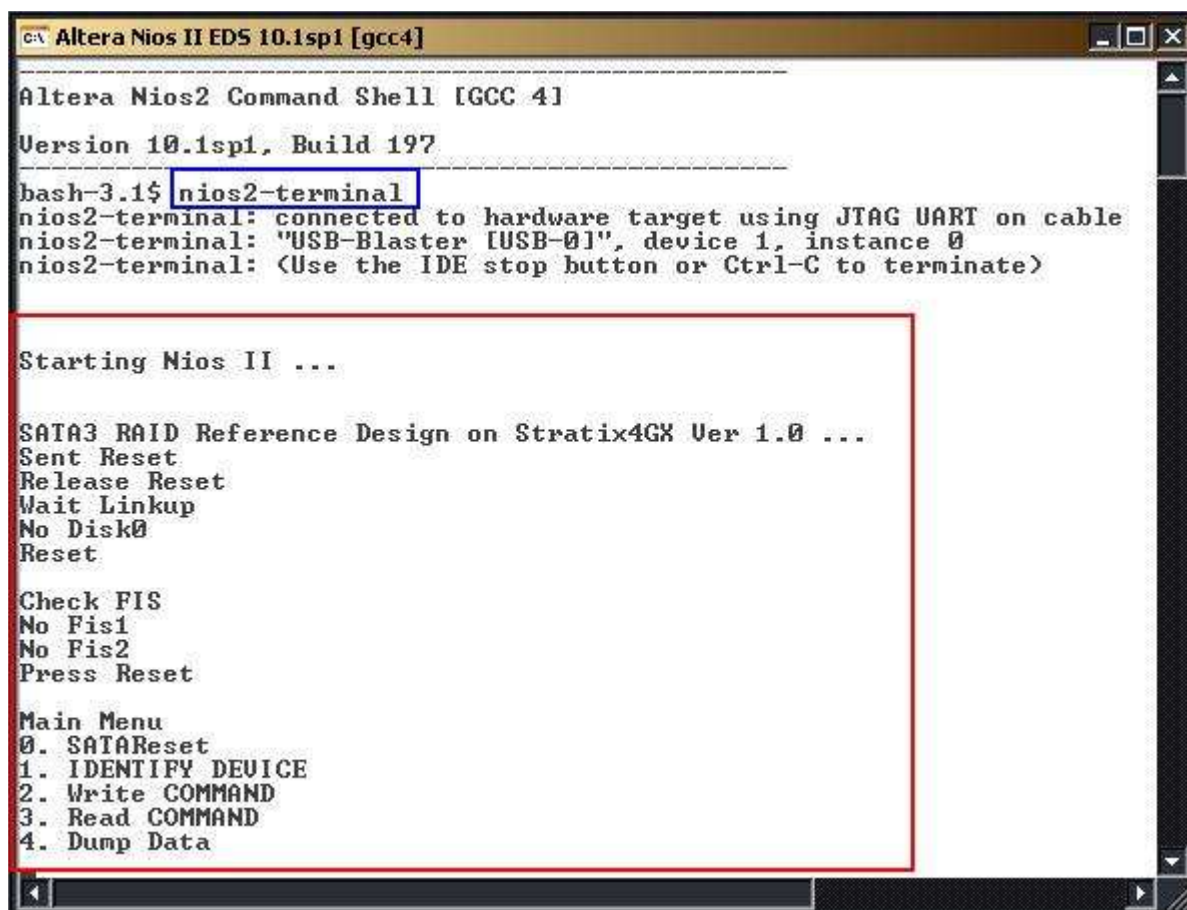


Figure 4 Normal operation LED Status

LED	SATA	ON	OFF	BLINK
LED0	CN0	OK	SATA-IP cannot detect SATA device. Please check SATA@CN0 connection.	SATA ERROR
LED1		OK	Internal PLL is not LOCK.	SATA ERROR
LED2		SATA device @CN0 is in writing process.	Idle Status	-
LED3		SATA device @CN0 is in reading process.	Idle Status	-
LED4-7	CN1	Same with LED0-3 for SATA device at CN1 status		
LED8-11	CN2	Same with LED0-3 for SATA device at CN2 status		
LED12-15	CN3	Same with LED0-3 for SATA device at CN3 status		

Table 1 LED Status of RAID reference design on Stratix-IV GX board

- Open NiosII 10.1 Command Shell.
- Type “nios2-terminal” and then Main menu for running SATA RAID demo is displayed, as shown in Figure 5. More details about each Menu are described in next topic.



```

C:\ Altera Nios II ED5 10.1sp1 [gcc4]
-----
Altera Nios2 Command Shell [GCC 4]
Version 10.1sp1, Build 197
-----
bash-3.1$ nios2-terminal
nios2-terminal: connected to hardware target using JTAG UART on cable
nios2-terminal: "USB-Blaster [USB-0]", device 1, instance 0
nios2-terminal: <Use the IDE stop button or Ctrl-C to terminate>

Starting Nios II ...

SATA3 RAID Reference Design on Stratix4GX Ver 1.0 ...
Sent Reset
Release Reset
Wait Linkup
No Disk0
Reset

Check FIS
No Fis1
No Fis2
Press Reset

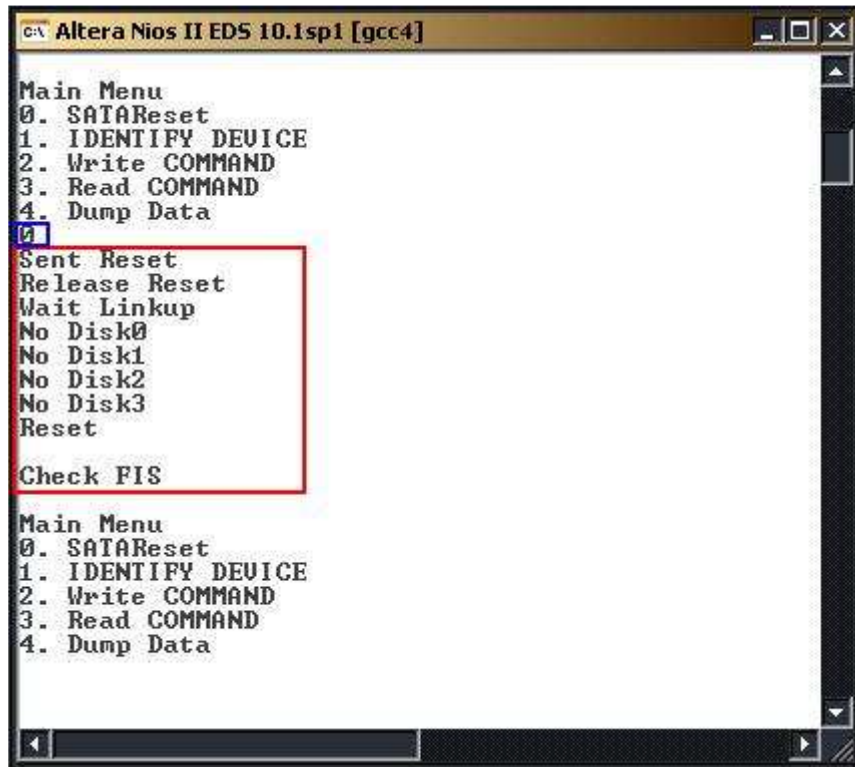
Main Menu
0. SATAReset
1. IDENTIFY DEVICE
2. Write COMMAND
3. Read COMMAND
4. Dump Data
  
```

Figure 5 Run NIOSII Terminal

## 2 Main Menu

### 2.1 SATA RESET

Select '0' for sending hardware reset signal to SATA-IP. Hardware reset is designed to reset all 4 SATA-IP and SATA-PHY module. All initialize process will be rerun by this menu, as shown in Figure 7.

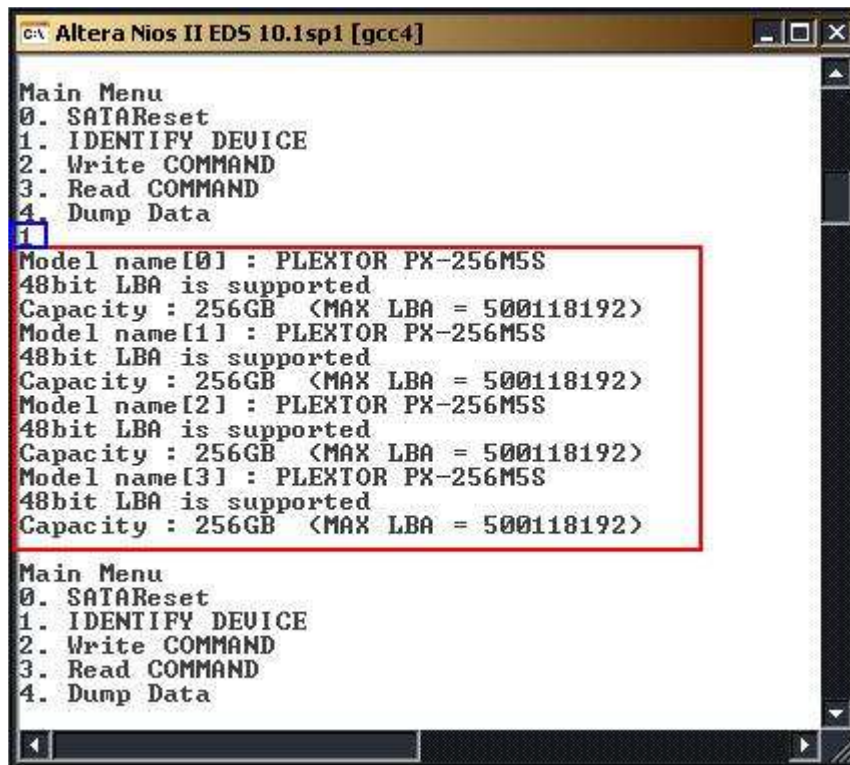


```
c:\ Altera Nios II EDS 10.1sp1 [gcc4]
Main Menu
0. SATAReset
1. IDENTIFY DEVICE
2. Write COMMAND
3. Read COMMAND
4. Dump Data
0
Sent Reset
Release Reset
Wait Linkup
No Disk0
No Disk1
No Disk2
No Disk3
Reset
Check FIS
Main Menu
0. SATAReset
1. IDENTIFY DEVICE
2. Write COMMAND
3. Read COMMAND
4. Dump Data
```

Figure 6 RESET Menu

## 2.2 IDENTIFY DEVICE

Select '1' for sending "IDENTIFY DEVICE" command to 4 HDD/SSD. Disk information (Model name, 48-bit LBA supported, disk capacity) of all four SATA devices will be displayed by using this menu, as shown in Figure 7. RAID0 system capacity in this demo will be calculated and equal to 4 times of one SATA device capacity. The lowest capacity of SATA device will be used for calculating RAID0 capacity if each SATA device has different capacity.



```
c:\ Altera Nios II EDS 10.1sp1 [gcc4]
Main Menu
0. SATAReset
1. IDENTIFY DEVICE
2. Write COMMAND
3. Read COMMAND
4. Dump Data
1
Model name[0] : PLEXTOR PX-256M5S
48bit LBA is supported
Capacity : 256GB (MAX LBA = 500118192)
Model name[1] : PLEXTOR PX-256M5S
48bit LBA is supported
Capacity : 256GB (MAX LBA = 500118192)
Model name[2] : PLEXTOR PX-256M5S
48bit LBA is supported
Capacity : 256GB (MAX LBA = 500118192)
Model name[3] : PLEXTOR PX-256M5S
48bit LBA is supported
Capacity : 256GB (MAX LBA = 500118192)
Main Menu
0. SATAReset
1. IDENTIFY DEVICE
2. Write COMMAND
3. Read COMMAND
4. Dump Data
```

Figure 7 IDENTIFY DEVICE Menu

## 2.3 WRITE COMMAND

Select '2' for sending "WRITE DMA (EXT)" command to HDD/SSD. Input parameter is received as decimal unit by default. 0x is used to be prefix for input as heximal unit. Three inputs are required for this menu, i.e.

- Start LBA: this value, divided by 4, is used to be the sector number of HDD/SSD to start write data to it.
- Sector Count: this value, divided by 4, is used to be total transfer size in sector unit (512 byte) to write HDD/SSD. If this value is more than 262144, data written to HDD/SSD will be duplicated every 262144 sectors from write buffer limitation. From hardware limitation, sector size of each channel must be aligned to 2 sectors.
- Write Pattern: this value is used to select test pattern to write to buffer and HDD/SSD. There are 5 test patterns in this demo, i.e. 32-bit increment pattern[0], 32-bit decrement pattern[1], 00000000H[2], FFFFFFFFH[3], and 32-bit LFSR[4].

After Software receives all inputs correctly,

- "Prepare data" will be displayed during CPU writing test pattern data to write buffer.
- Transfer speed will be displayed after write operation complete.

The example to use "WRITE COMMAND" menu is shown in Figure 8. Write operation will be cancelled when user input is out-of-range value, as shown in Figure 9.

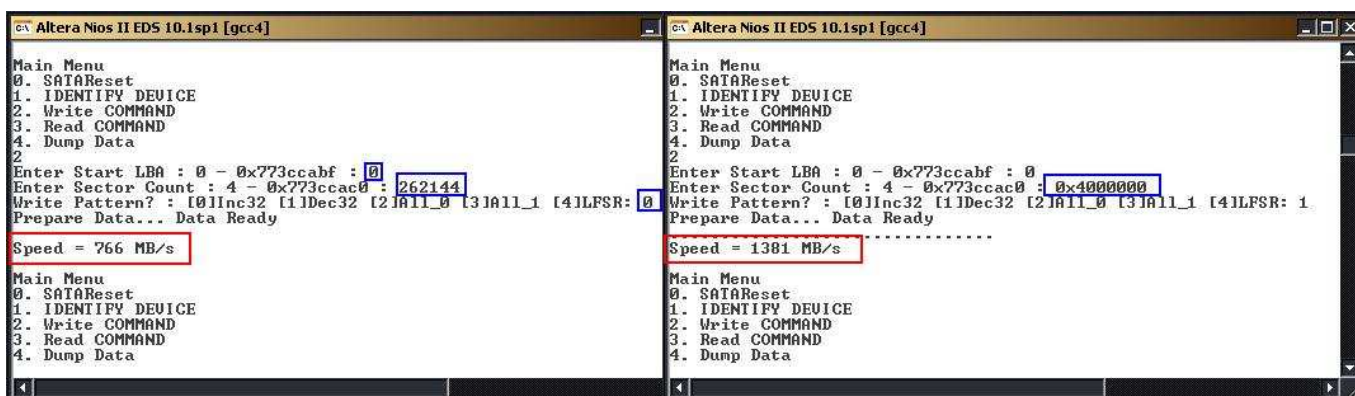


Figure 8 WRITE COMMAND Menu

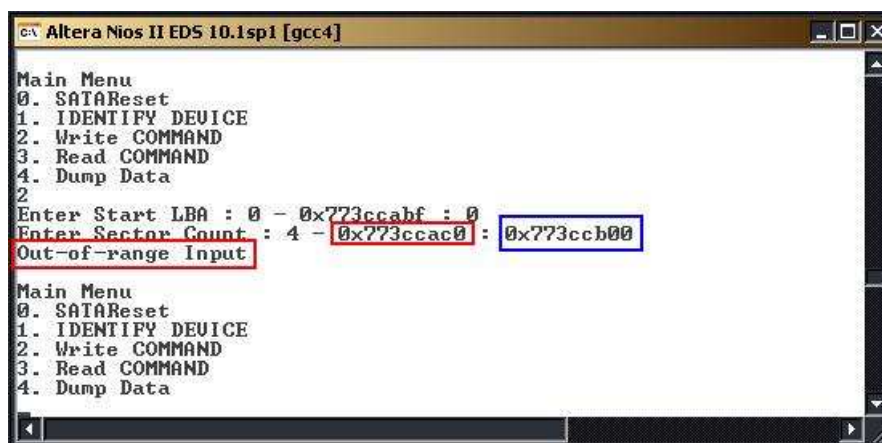


Figure 9 Write operation cancelled from error input

## 2.4 READ COMMAND

Select '3' for sending "READ DMA (EXT)" command to HDD/SSD. Input parameter is received as decimal unit by default. 0x is used to be prefix for input as heximal unit. Two or three inputs are required for this menu, i.e.

- Start LBA: this value, divided by 4, is used to be the sector number of HDD/SSD to start read data from it.
- Sector Count: this value, divided by 4, is used to be total transfer size in sector unit (512 byte) to read HDD/SSD. If this value is more than 262144 which is read buffer size value, transfer speed will be displayed as output without verify, as shown in Figure 10. From hardware limitation, sector size of each channel must be aligned to 2 sectors.
- Verify Pattern: this menu will be displayed if Sector Count value is not more than 262144. 5 verify patterns can be selected, like in WRITE COMMAND menu. "Verify Data ... Success" will be displayed if all data in read buffer is equal to check pattern, as shown in left window of Figure 11. But "Data Mismatch with failure value" will be displayed instead if data is not equal, as shown in right window of Figure 11

Similar to WRITE COMMAND menu, read operation will be cancelled if receiving error input value, as shown in Figure 12.

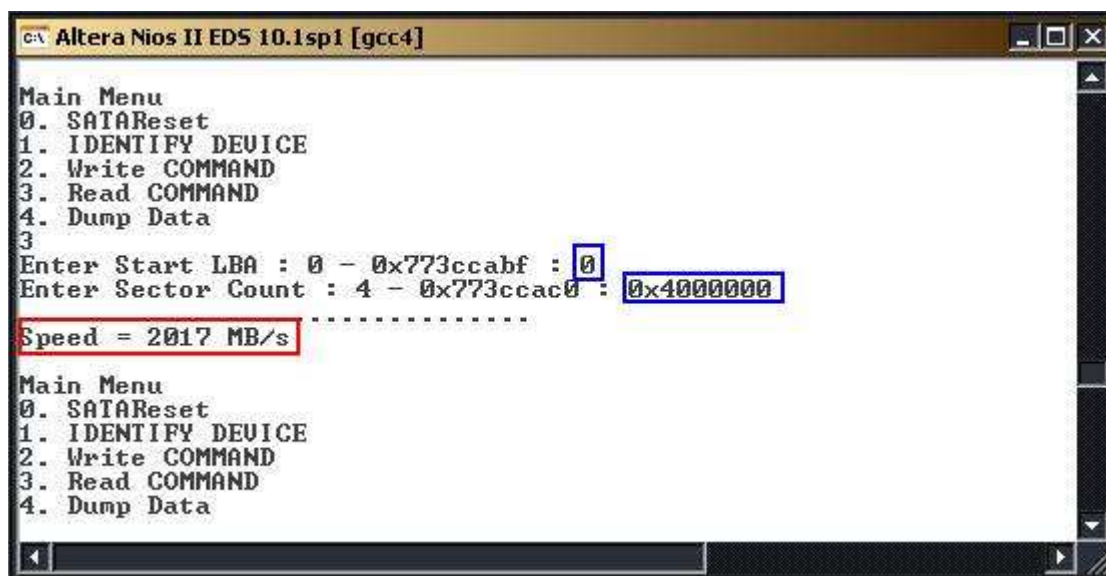


Figure 10 READ COMMAND without Verify

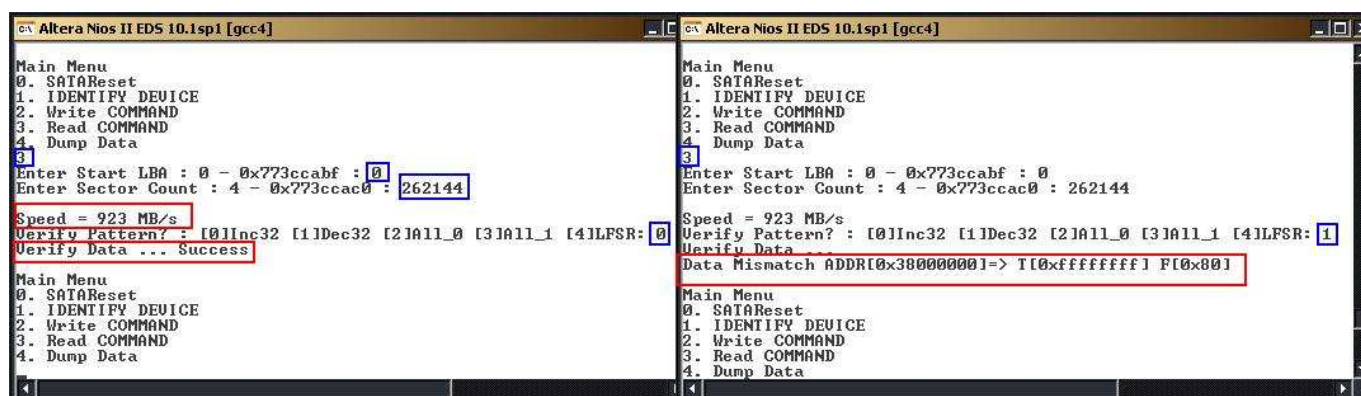


Figure 11 READ COMMAND with verify



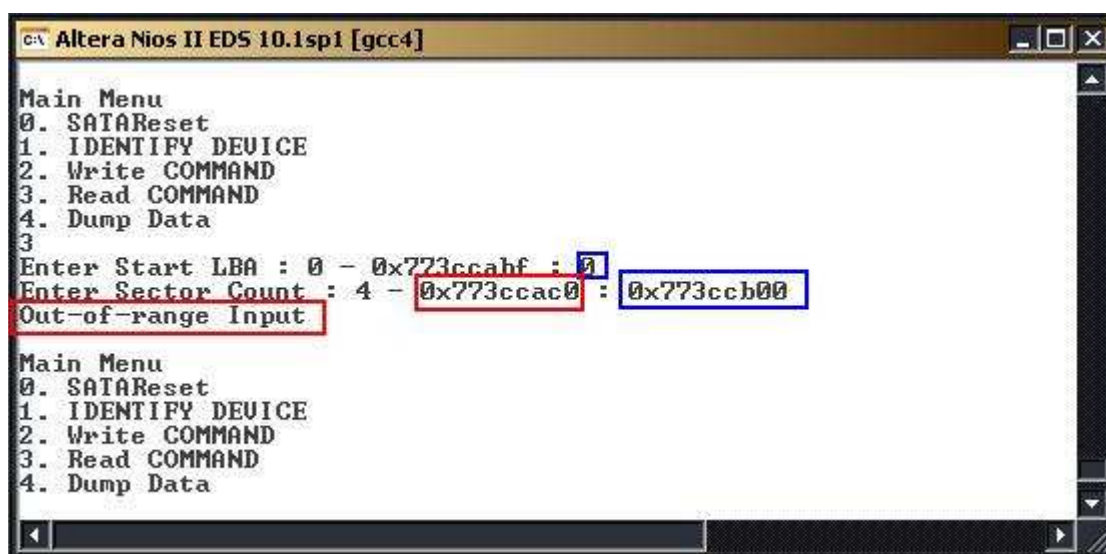


Figure 12 Read operation cancelled from error input

## 2.5 DUMP DATA

Select '4' to read data from DDR3 to check real value or read control register inside Avalon2SATA module. Two inputs are required for this menu, i.e.

- Start address: Heximal value can be input by adding prefix "0x". Memory map of this reference design is displayed in Table 2.
- Byte length: Input read length in byte unit.

After setting all inputs, all read values will be displayed on console, as shown in Figure 13.

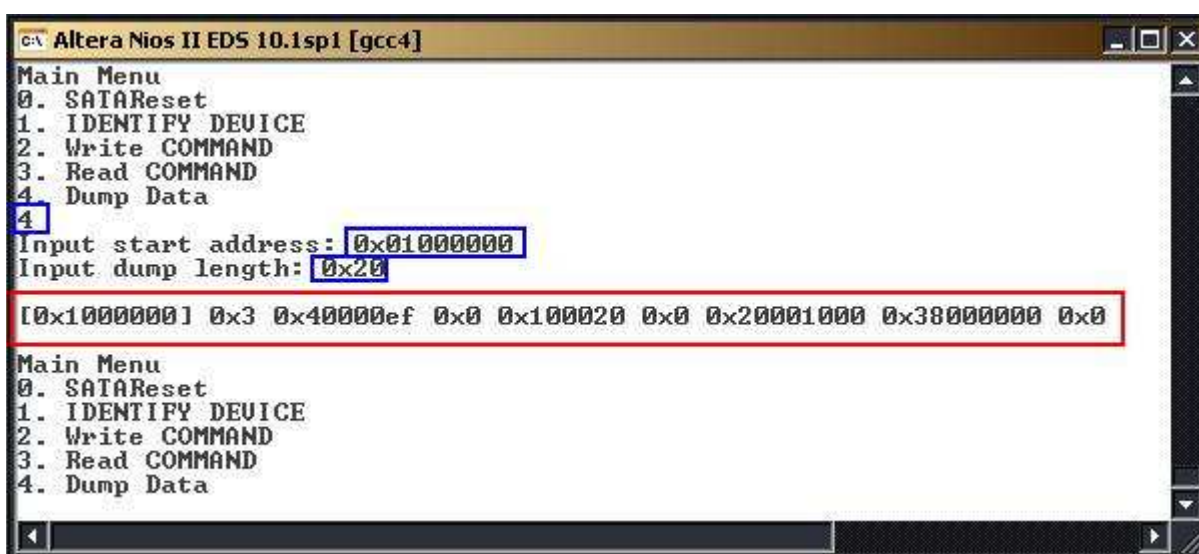


Figure 13 DUMP DATA Menu

Address	Memory map
0x01000000-0x0100001F	Avalon2SATA register area for SATA@CN0
0x01000020-0x0100003F	Avalon2SATA register area for SATA@CN1
0x01000040-0x0100005F	Avalon2SATA register area for SATA@CN2
0x01000060-0x0100007F	Avalon2SATA register area for SATA@CN3
0x20000000-0x3FFFFFFF	DDR3 memory area
- 0x20000000-0x20000FFF	TX FIS area
- 0x20001000-0x20001FFF	RX FIS area for SATA@CN0
- 0x20002000-0x20002FFF	RX FIS area for SATA@CN1
- 0x20003000-0x20003FFF	RX FIS area for SATA@CN2
- 0x20004000-0x20004FFF	RX FIS area for SATA@CN3
- 0x30000000-0x31FFFFFF	TX DATA FIS area for SATA@CN0
- 0x32000000-0x33FFFFFF	TX DATA FIS area for SATA@CN1
- 0x34000000-0x35FFFFFF	TX DATA FIS area for SATA@CN2
- 0x36000000-0x37FFFFFF	TX DATA FIS area for SATA@CN3
- 0x38000000-0x39FFFFFF	RX DATA FIS area for SATA@CN0
- 0x3A000000-0x3BFFFFFF	RX DATA FIS area for SATA@CN1
- 0x3C000000-0x3DFFFFFF	RX DATA FIS area for SATA@CN2
- 0x3E000000-0x3FFFFFFF	RX DATA FIS area for SATA@CN3

Table 2 Memory map in NIOSII system

### 3 Revision History

Revision	Date	Description
1.0	31-Oct-12	Initial version release