

# 4-Ch RAID0 (NVMeG3-IP) Demo Instruction

<u>Rev1.1 28-Jun-23</u>

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## 4-Ch RAID0 (NVMeG3-IP) Demo Instruction

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This document describes the instruction to run 4-ch RAID0 demo on FPGA development board by using the AB18-PCIeX16 board and Quad M.2 Card. The demo is designed to write/verify data with four M.2 NVMe SSDs for RAID0 operation. It is recommended to use the same SSD model for every channel. User controls test operation through Serial console.

## 1 Environment Requirement

To run the demo on FPGA development board, please prepare following environment.

- 1) FPGA Development board: VCU118
- 2) PC installing Xilinx programmer software (Vivado) and Serial console software such as TeraTerm.
- 3) AB18-PCIeX16 board
- 4) ATX power supply for AB18
- 5) Xilinx power adapter for FPGA board
- 6) ASROCK Ultra Quad M.2 Card, connecting B side (Device) of AB18. <u>https://www.asrock.com/mb/spec/product.asp?Model=ULTRA QUAD M.2 CARD</u>
- 7) Four M.2 NVMe SSDs.
- 8) Two micro USB cables for programming FPGA and Serial console, connecting between FPGA board and PC



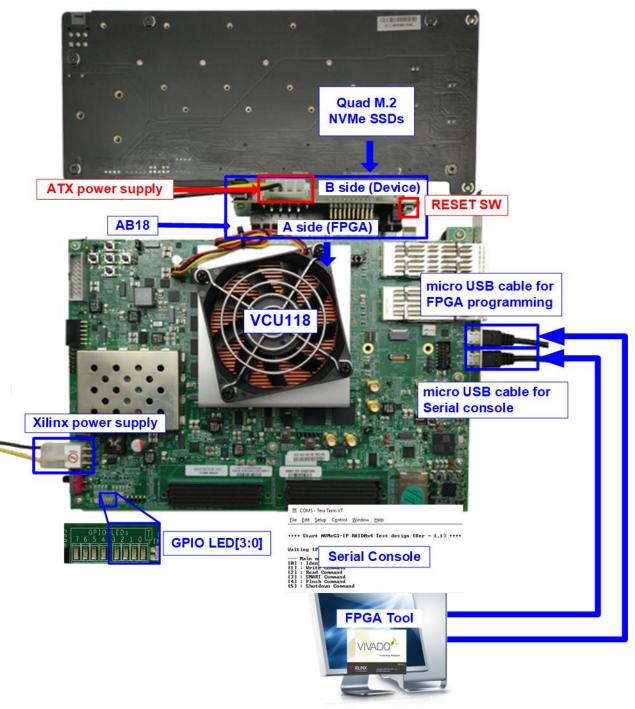


Figure 1-1 NVMeG3-IP RAID0 demo setup by AB18 on VCU118



#### 2 **Demo setup**

1) Power off system. Then, connect ATX power supply to AB18-PCIeX16 board and Xilinx power adapter to FPGA development board.

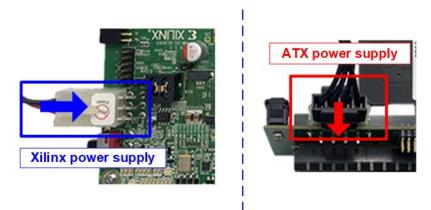


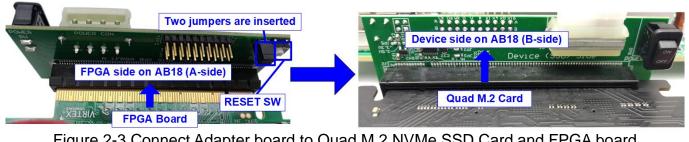
Figure 2-1 Power supply connection

2) Connect four M.2 NVMe SSDs to four connectors on Ultra Quad M.2 Card as shown in Figure 2-2.



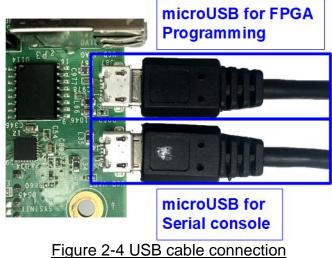
Figure 2-2 Four M.2 NVMe SSDs with Ultra Quad M.2 Card

3) Confirm that two mini jumpers are inserted at J5 connector on AB18. After that, connect FPGA Side (A-side) on AB18 to PCIe connector on FPGA board and connect Quad M.2 NVMe SSD Card to device side (B-Side) on AB18, as shown in Figure 2-3. Warning: Please confirm that the Quad M.2 Card is inserted in the correct side of AB18 (B-side, not A-side) before power on system.





4) Connect two micro USB cables between FPGA board and PC for FPGA programming and Serial console.



5) Power on FPGA development board, ATX power supply for AB18, and AB18 board, as shown in Figure 2-5.

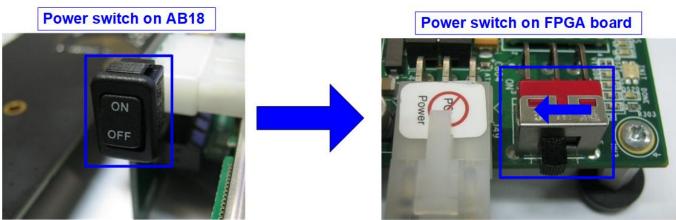


Figure 2-5 Turn on power switch on FPGA and adapter board



6) On PC, additional COM port is detected after connecting USB cables to FPGA board. More than one COM ports are detected.

In case of VCU118, select Standard COM port as shown in Figure 2-6.

On Serial console, the setting is as follows. Baud rate=115,200, Data=8-bit, Non-Parity, and Stop = 1.

| 🗄 Device Manager —  | Tera Term: Serial port  | erial setting   | ×   |
|---|---|---|---|
| Eile       Action       View       Help            ←          ←           ←           ←           ←             →           ←           ←           ←           ←               ←           ←           ←           ←               ←           ←           ←           ←               ←           ←           ←           ←               ←            ←            ←               ←            ←            ←   < | Port:<br>Sp <u>e</u> ed:<br>Data:<br>P <u>a</u> rity:<br>Stop bits:<br>ow control:<br>Transmit delay<br>0 msec/ | COM5       ~         115200       ~         8 bit       ~         none       ~         1 bit       ~         none       ~ | OK<br>Cancel<br>Help<br>sec <u>/l</u> ine |

Figure 2-6 Two COM ports from FPGA connection



7) Use Vivado tool to download configuration file, as shown in Figure 2-7.



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

#### Table 2-1 LED Definition

| GPIO LED | ON                     | OFF                    |
|----------|------------------------|------------------------|
| 0        | Normal operation       | SSD is not good status |
| 1        | System is busy         | Idle status            |
| 2        | IP Error detect        | Normal operation       |
| 3        | Data verification fail | Normal operation       |



9) After programming completely, LED[0] and LED[1] are ON during PCIe initialization process. Then, LED[1] changes to OFF after PCIe completes initialization process.



Figure 2-8 LED status after programming configuration file and finishing PCIe initialization

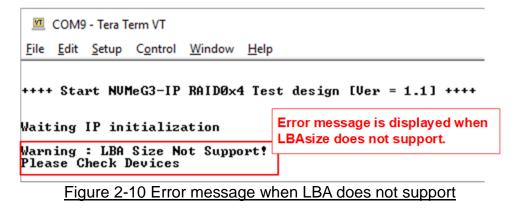
10)On the console, the message is displayed to show current status as follows.

- "Waiting IP initialization" is displayed after PCIe is linked up.
- After RAID0 finishes initialization, main menu to run six commands is shown on the console.

| 💆 COM5 - Tera Term VT   |  |
|---|--|
| <u>File Edit Setup Control Window H</u> e   | p  |
| ++++ Start NUMeG3-IP RAID0x4 Te<br>Waiting IP initialization<br>Waiting IP initialization<br>Wait R<br>Main menu [IPVer = 1.1]<br>[0] : Identify Command<br>[1] : Write Command<br>[2] : Read Command<br>[2] : Read Command<br>[3] : SMART Command<br>[4] : Flush Command<br>[5] : Shutdown Command | est design [Ver = 1.1] ++++<br>AID0 busy<br>Main menu to<br>select the command |

Figure 2-9 Main menu after RAID0 finishes initialization

When LBA size is 4 Kbyte, the error message is displayed on the console as shown in Figure 2-10





## 3 Test Menu

### 3.1 Identify Command

Select '0' to send Identify command to RAID0.

COM5 - Tera Term VT

 File
 Edit
 Setup
 Control
 Window
 Help

 \*++
 Identify
 Command
 selected
 +++

 Ch[0]Model
 Number
 :
 Samsung
 SSD
 960
 PRO
 512GB

 Ch[1]Model
 Number
 :
 Samsung
 SSD
 970
 PRO
 512GB

 Ch[2]Model
 Number
 :
 Samsung
 SSD
 970
 PRO
 512GB

 Ch[2]Model
 Number
 :
 Samsung
 SSD
 970
 PRO
 512GB

 Ch[3]Model
 Number
 :
 Samsung
 SSD
 970
 PRO
 512GB

 Ch[3]Model
 Number
 :
 Samsung
 SSD
 970
 PRO
 512GB

 Ch[3]Model
 Number
 :
 Samsung
 SSD
 970
 PRO
 512GB

 --- Main
 menu
 [IPUer = 1.1]
 Model
 name and and RAIDO capacity

 [0] :
 Identify
 Command
 [1] :
 Write
 Command

 [1] :
 Write
 Command
 [3] :
 Shutdown</

Figure 3-1 Test result when running Identify command

After finishing the operation, the SSD information output from Identify command is displayed. The console shows two values.

- 1) SSD model number: This value is decoded from Identify controller data.
- 2) RAID capacity: This value is calculated by multiplying device capacity in channel#0 by 4.



## 3.2 Write Command

Select '1' to send Write command to RAID0.

| COM5 - Tera Term VT   | Normal                       | Green: User input<br>Blue: Output to user |  |  |  |  |
|---|------------------------------|---|--|--|--|--|
| <u>File Edit Setup Control Window</u>   | Help                         |   |  |  |  |  |
| Input parameters         Input parameters |                              |   |  |  |  |  |
|   |                              | Output performance                        |  |  |  |  |
| Total = 103.079 [GB] , Time   | = 12383[ms] , Iransfer s     | peed = 8324LMB/sJ                         |  |  |  |  |
| Main menu [IPVer = 1.1]<br>[0] : Identify Command<br>[1] : Write Command<br>[2] : Read Command<br>[3] : SMART Command<br>[4] : Flush Command<br>[5] : Shutdown Command  |                              |   |  |  |  |  |
| Figure 3-2 Test r   | esult when running Write con | nmand                                     |  |  |  |  |

User sets three parameters as follows.

- 1) Start Address: Start address to write RAID0 as 512-byte unit. The input is decimal unit when the input is only digit number. User can add "0x" to be a prefix for hexadecimal unit.
- Transfer Length: Total transfer size as 512-byte unit. The input is decimal unit when the input is only digit number. User can add "0x" to be a prefix for hexadecimal unit.
- 3) Test pattern: Select test data pattern for writing RAID0. There are five patterns, i.e. 32-bit increment, 32-bit decrement, all 0, all 1, and 32-bit LFSR counter.

When all inputs are valid, the operation begins. During writing data, current transfer size is displayed on the console every second to show that system is still alive. Finally, total size, total time usage, and test speed are calculated and displayed on the console to be a test result.



| <u> </u> | hoodor | of | oach | sector-  |  |
|----------|--------|----|------|----------|--|
| C-04-DI  | neauer | 0  | each | 300101-7 |  |

| 48                                      | B-bit LBA Address = 0 0x0                    | 000 32-bit LFSR pattern                           | 48-bit LBA Address = 1   |
|---|--|---|--|
| Offset                                  | 0 1 2 3 4 5 6                                | 7 8 9 A B C D E F                                 | 0 1 2 3 4 5 6 7 8 9 A B C D E F  |
| 0000000000                              | 00 00 00 00 00 00 00                         | 00 FF FF 00 00 FF FF FF 00                        | 01 00 00 00 00 00 00 00 FE FF 00 00 FE FF FF 00  |
| 0000000010                              | 01 00 00 00 FF 01 00                         |   | 02 00 00 00 FC 01 00 00 FC FF 01 00 FD FF FF 01  |
| 0000000020                              | 02 00 00 00 FF 03 00                         | 00 FF FF 03 00 FD FF FF 03                        | 04 00 00 00 F9 03 00 00 F9 FF 03 00 FB FF FF 03  |
| 000000030                               | 04 00 00 00 FF 07 00                         | 00 FF FF 07 00 FB FF FF 07                        | 09 00 00 00 F2 07 00 00 F2 FF 07 00 F6 FF FF 07  |
| 0000000040                              | 09 00 00 00 FF 0F 00                         |   | 12 00 00 00 E4 0F 00 00 E4 FF 0F 00 ED FF FF 0F  |
| 0000000050                              | 12 00 00 00 FF 1F 00                         | 00 FF FF 1F 00 ED FF FF 1F                        | 24 00 00 00 C9 1F 00 00 C9 FF 1F 00 DB FF FF 1F  |
|   |  | SSD#0   | SSD#1  |
|   | 48-bit LBA Address = 4                       |   |  |
| 00000001A0                              | 9E 24 49 02 D9 F6 FF                         |   | 3C 49 92 04 7B 9B 24 F9 86 B4 2D F9 E7 FF 6F FB  |
| 00000001B0                              | 3C 49 92 04 B2 ED FF                         |   | 79 92 24 09 F7 36 49 F2 0C 69 5B F2 CF FF DF F6  |
| 00000001C0                              | 79 92 24 09 64 DB FF                         |   | F3 24 49 12 EE 6D 92 E4 18 D2 B6 E4 9E FF BF ED  |
| 00000001D0<br>00000001E0                | F3 24 49 12 C9 B6 FF<br>E7 49 92 24 92 6D FF |   | E7 49 92 24 DD DB 24 C9 31 A4 6D C9 3C FF 7F DB<br>CF 93 24 49 BA B7 49 92 62 48 DB 92 79 FE FF B6 |
|   | CF 93 24 49 24 DB FE                         |   | 9E 27 49 92 75 6F 93 24 C5 90 B6 25 F2 FC FF 6D  |
|   | 04 00 00 00 00 00 00                         |   | 05 00 00 00 00 00 00 00 FA FF 00 00 FA FF FF 00  |
|   | 09 00 00 00 F7 01 00                         |   | 0A 00 00 00 F4 01 00 00 F4 FF 01 00 F5 FF FF 01  |
|   |  |   |  |
|   | 48-bit LBA Address = 2                       |   | 48-bit LBA Address = 3   |
| Offset                                  | 0 1 2 3 4 5 6                                | 7 8 9 A B C D E F                                 | 0 1 2 3 4 5 6 7 8 9 A B C D E F  |
| 0000000000                              | 02 00 00 00 00 00 00                         |   | 03 00 00 00 00 00 00 00 FC FF 00 00 FC FF FF 00  |
| 0000000010                              | 04 00 00 00 FA 01 00                         |   | 07 00 00 00 F9 01 00 00 F9 FF 01 00 F8 FF FF 01  |
| 0000000020                              | 09 00 00 00 F4 03 00                         |   | OF 00 00 00 F2 03 00 00 F2 FF 03 00 F0 FF FF 03  |
| 000000030                               | 12 00 00 00 E9 07 00                         |   | 1F 00 00 00 E4 07 00 00 E4 FF 07 00 E0 FF FF 07  |
| 0000000040                              | 24 00 00 00 D2 OF 00<br>49 00 00 00 A4 1F 00 |   | 3F 00 00 00 C9 0F 00 00 C9 FF 0F 00 C0 FF FF 0F<br>7F 00 00 00 92 1F 00 00 92 FF 1F 00 80 FF FF 1F |
| 000000000000000000000000000000000000000 | 49 00 00 00 A4 IF 00                         | 00 A4 FF IF 00 B6 FF FF IF                        | 7F 00 00 00 92 1F 00 00 92 FF 1F 00 80 FF FF 1F  |
|   |  | SSD#2   | SSD#3  |
| 00000001A0                              | 79 92 24 09 3E 40 92                         | F4 C3 6F 9B F4 A2 24 D9 F6                        | DB FF FF 0F 9C 2D 49 F2 61 02 40 F2 00 49 02 F0  |
|   | F3 24 49 12 7D 80 24                         |   | B6 FF FF 1F 38 5B 92 E4 C3 04 80 E4 00 92 04 E0  |
| 00000001C0                              | E7 49 92 24 FA 00 49                         | D2 OC BF 6D D2 8A 92 64 DB                        | 6D FF FF 3F 70 B6 24 C9 86 09 00 C9 00 24 09 C0  |
| 00000001D0                              | CF 93 24 49 F5 01 92                         |   | DB FE FF 7F E1 6C 49 92 0D 13 00 92 00 48 12 80  |
| 00000001E0                              | 9E 27 49 92 EB 03 24                         |   | B6 FD FF FF C3 D9 92 24 1B 26 00 24 00 90 24 00  |
| 00000001F0                              | 3D 4F 92 24 D6 07 48                         |   | 6C FB FF FF 87 B3 25 49 37 4C 00 48 00 20 49 00  |
| 0000000200                              | 06 00 00 00 00 00 00                         |   | 07 00 00 00 00 00 00 00 F8 FF 00 00 F8 FF FF 00  |
| 0000000210                              | OC 00 00 00 F2 01 00                         | 00 F2 FF 01 00 F3 FF FF 01                        | OF 00 00 00 F1 01 00 00 F1 FF 01 00 F0 FF FF 01  |
| Figure 3                                | 3-3 Example Test of                          | data of the 1 <sup>st</sup> and 2 <sup>nd</sup> 5 | 12 byte of each SSD by using LFSR pattern  |

The stripe size in 4-ch RAID0 demo is 512-byte. For incremental, decremental, or LFSR pattern, each 512-byte data has unique 64-bit header which consists of 48-bit address (in 512-byte unit) and 16-bit zero value. The data after 64 bits header is the test pattern which is selected by user. The 1<sup>st</sup> stripe is mapped to the first 512-byte of SSD#0. The 2<sup>nd</sup> - the 4<sup>th</sup> stripe are mapped to the first 512-byte of SSD#1 - SSD#3 respectively, as shown in Figure 3-3. The unique header is not included when running all-0 or all-1 pattern.



Figure 3-4 shows the example when the input is not in the recommended range for each parameter. The console displays "Invalid input" and then the operation is cancelled.

| 🔟 COM5 - Tera Term VT  | Error inpu             | ıt                     |                       | _              |       |
|--|------------------------|------------------------|-----------------------|----------------|-------|
| <u>File Edit Setup Control Window</u>  | <u>H</u> elp           |                        |                       |                |       |
| +++ Write Command selected +   | • • •                  | Ou                     | t of range a          | addres         | S     |
| Enter Start Address (512 Byt<br>Invalid input  |                        | 0 – 0×EE7              | 84ABF =>              | Ø×FFF          | FFFFF |
| 🔟 COM5 - Tera Term VT  |                        |                        | -                     | - C            | C     |
| <u>File Edit Setup Control W</u> indow   | <u>H</u> elp           |                        |                       |                |       |
| +++ Write Command selected +<br>Enter Start Address (512 Byt<br>Enter Length (512 Byte)<br>Invalid input                                 | :e)                    | 0 - Øxee7<br>1 - Øxee7 |                       | 0×000          | 00000 |
| 🔟 COM5 - Tera Term VT  |                        |                        | _                     |                | ×     |
| <u>File Edit Setup Control W</u> indow   | <u>H</u> elp           |                        |                       |                |       |
| +++ Write Command selected +<br>Enter Start Address (512 Byt<br>Enter Length (512 Byte)<br>Selected Pattern [0]Inc32 [1<br>Invalid input | te) :<br>:<br>1Dec32 [ |                        | 84ACØ =><br>]All_1 [4 | 0×000<br>0×C00 | 0000  |
| <u>Figure 3-4 Error n</u>  | nessage f              | rom the inva           | alia input            |                |       |



## 3.3 Read Command

Select '2' to send Read command to RAID0.

| 💆 COM5 - Tera Term VT   | Normal –  |
|---|---|
| <u>File Edit Setup Control Window Hel</u>   | p   |
| +++ Read Command selected +++<br>Enter Start Address (512 Byte)<br>Enter Length (512 Byte)<br>Selected Pattern [Ø]Inc32 [1]De<br>12.803 [GB]<br>38.431 [GB]<br>51.249 [GB]<br>64.065 [GB]<br>76.879 [GB]<br>89.659 [GB]<br>102.409 [GB] | : 1 - 0xEE784AC0 => <u>0xC000000</u> <sup>2</sup><br>c32 [2]All_0 [3]All_1 [4]LFSR=> 4<br>3 |
| Total = 103.079 [GB] , Time =   | 8052[ms] , Transfer speed = 12801[MB/s]   |
| Main menu [IPVer = 1.1]<br>[0] : Identify Command<br>[1] : Write Command<br>[2] : Read Command<br>[3] : SMART Command<br>[4] : Flush Command<br>[5] : Shutdown Command  | -   |
| Figure 3-5 Input and  | result of Read Command menu   |

User inputs three parameters as follows.

- 1) Start Address: Start address to read SSD as 512-byte unit. The input is decimal unit when the input is only digit number. User can add "0x" to be a prefix for hexadecimal unit.
- 2) Transfer Length: Total transfer size as 512-byte unit. The input is decimal unit when the input is only digit number. User can add "0x" to be a prefix for hexadecimal unit
- Test pattern: Select test data pattern to verify data from RAID0. Test pattern must be matched with the pattern using in Write Command menu. There are five patterns, i.e. 32-bit incremental, 32-bit decremental, all-0, all-1, and 32-bit LFSR counter

Similar to Write command menu, test system starts reading data from RAID0 when all inputs are valid. During reading data, current transfer size is displayed on the console every second to show that system is still alive. Total size, total time usage, and test speed are calculated and displayed after finishing data transferring.



Figure 3-6 shows error message when data verification is failed. "Verify fail" is displayed with the information of the 1<sup>st</sup> failure data, i.e. the error byte address, the expected value, and the read value. User can press any key(s) to cancel read operation or wait until finishing Read command. Without cancelling the operation, the read operation runs until finish and displays the performance on the console as a test result.

When cancelling the operation, the read command still runs as the background process. So, the operation does not complete in the good sequence. It is recommended to power-off/on AB18/AB16 and then presses "RESET" button to restart system.

```
Verification error without cancellation
  🔟 COM5 - Tera Term VT
 File Edit Setup Control Window Help
+++ Read Command selected +++
                                               : 0 - 0xEE784ABF => 0x0000000
Enter Start Address (512 Byte)
Enter Length (512 Byte)
                                               : 1 - 0xEE784AC0 => 0xC000000 Wrong pattern
Selected Pattern [0]Inc32 [1]Dec32 [2]All_0 [3]All_1 [4]LFSR=> 1
                                     Message when verification is failed
Verify fail
1st Error at Byte Addr = 0x00000000
                              Expect Data[511:384]
Expect Data[383:256]
Expect Data[255:128]
Expect Data[127:0]
Read Data[511:384]
Read Data[383:256]
                               = 0x03FFFFFD_0003FFFF_000003FF_00000002
                               = 0x01FFFFFE_0001FFFF_000001FF_00000001
= 0x00FFFFFF_0000FFFF_0000000_00000000
Read Data[255:128]
Read Data[127:0]
Press any key to cancel operation
12.785 [GB]
  25.593 [GB]
  38.406 [GB]
 51.214 [GB]
 64.053 [GB]
  76.866 [GB]
 89.646 [GB]
 102.392 [GB]
                                                                    Output performance
Total = 103.079 [GB] , Time = 8053[ms] , Transfer speed = 12799[MB/s]
                         Verification error with cancellation
  🔟 COM5 - Tera Term
 File
      Edit Setup Control Window Help
+++ Read Command selected +++
                                                    : 0 - 0xEE784ABF => 0x0000000
: 1 - 0xEE784AC0 => 0xC000000 Wrong pattern
Enter Start Address (512 Byte) : 0 - 0xEE784ABF => 0x0000000
Enter Length (512 Byte) : 1 - 0xEE784ACO => 0xC000000
Selected Pattern [0]Inc32 [1]Dec32 [2]All_0 [3]All_1 [4]LFSR=> 1
                                               Message when verification is failed
Verify fail
1st Error at Byte Addr = 0x00000000
                                    0×67FFFFF6_FFFFF1_FFFFFF2_FFFFFF5
0×FFFFFF4_FFFFF5_FFFFF6_FFFFFF5
0×FFFFFFF8_FFFFF5_FFFFF6_FFFFFF
0×FFFFFFF8_FFFF9_FFFF6_6000000_0000000
0×07FFFFFF8_0007FFF_000007FF_0000000
0×03FFFFFB_0003FFFF_000003FF_00000000
0×03FFFFFB_0001FFF_000001FF_00000000
0×00FFFFFF_0000FFFF_00000000_00000000
Expect Data[511:384]
Expect Data[383:256]
Expect Data[255:128]
Expect Data[127:0]
                                  =
                                  =
                                  =
                                  =
Read Data[511:384]
Read Data[383:256]
                                  =
                                  =
Read Data[255:128]
                                  =
Read Data[127:0]
                                  =
Press any key to cancel operation
12.816 [GB]
25.638 [GB]
                                          User presses any keys to cancel the operation
Operation is cancelled
Please reset system before st<u>arting a new test</u>
                                            Message when operation is cancelled
  -- Main menu [IPVer = 1.1] -
[0] : Identify Command
[1] : Write Command
[2] : Read Command
                            Figure 3-6 Data verification is failed
```

Dec

dg\_nvmeg3ip\_raid0x4\_instruction\_xilinx\_en

## 3.4 SMART Command

Select '3' to send SMART command to RAID0.

🔟 COM5 - Tera Term VT File Edit Setup Control Window Help +++ SMART Command selected +++ Data output decoded from SMART command << SMART Log Information Ch[0] >> Temperature : 32 Degree Celsius 58341 GB Total Data Read Total Data Read (Raw data) 0x0000000\_0000000\_00000000\_06CA9C39 Total Data Written 61699 GB Total Data Written (Raw data) : 0x0000000\_0000000\_0000000\_072EAC8A Power On Cycles Power On Hours : 1813 Times : 122 Hours Unsafe Shutdowns : 1598 Times << SMART Log Information Ch[1] >> Temperature : 32 Degree Celsius 102749 GB Total Data Read Total Data Read (Raw data) Total Data Written 0x0000000\_0000000\_0000000\_0BF5F920 109708 GB : 0x0000000\_0000000\_0000000\_0CC55E34 Total Data Written (Raw data) Power On Cycles Power On Hours : 2675 Times : 216 Hours Unsafe Shutdowns : 2119 Times << SMART Log Information Ch[2] >> 32 Degree Celsius Temperature Total Data Read : 4709 GB Total Data Read (Raw data) Total Data Written 0x0000000 0000000 0000000 008C559F 5603 GB : 0×00000000\_00000000\_0000000\_00A6F917 Total Data Written (Raw data) Power On Cycles Power On Hours : 204 Times : 15 Hours : 135 Times Unsafe Shutdowns << SMART Log Information Ch[3] >> 30 Degree Celsius Temperature Total Data Read 6012 ĞB Total Data Read (Raw data) Total Data Written 0x0000000\_0000000\_0000000\_00B32A18 7210 GB : 0x0000000\_0000000\_0000000\_00D6E352 Total Data Written (Raw data) Power On Cycles Power On Hours : 155 Times : 17 Hours Unsafe Shutdowns : 75 Times SMART Command Complete

## Figure 3-7 Test result when running SMART command

When the operation is completed, SMART/Health Information (output from SMART command) is displayed as shown in Figure 3-7. The console shows six values from each SSD.

- 1) Temperature in °C unit.
- 2) Total Data Read decoded as GB/TB unit. Additionally, raw data without decoding is displayed in 128-bit hexadecimal unit. The unit size of raw data is 512,000 byte.
- 3) Total Data Written decoded as GB/TB unit. Additionally, raw data without decoding is displayed in 128-bit hexadecimal unit. The unit size of raw data is 512,000 byte.
- 4) Power On Cycles: Display the number of power cycles.
- 5) Power On Hours: Display period of time in hours to show how long the SSD has been powered on.
- 6) Unsafe Shutdowns: Display the number of unsafe shutdowns of SSD



## 3.5 Flush Command

Select '4' to send Flush command to RAID0.

| <u>vr</u>               | COMS                 | - Tera T         | erm VT                                |                |                                      |
|-------------------------|----------------------|------------------|---------------------------------------|----------------|--------------------------------------|
| <u>F</u> ile            | <u>E</u> dit         | <u>S</u> etup    | C <u>o</u> ntrol                      | <u>W</u> indow | <u>H</u> elp                         |
| +++                     | Flus                 | h Comr           | nand se                               | lected ·       |                                      |
| Flus                    | h Co                 | mmand            | Complet                               |                | essage after<br>ishing the operation |
| Main menu [IPVer = 1.1] |                      |                  |                                       |                |                                      |
| 101                     |                      |                  |                                       |                |                                      |
| [1]                     | : Wr                 | entify<br>ite Co | / Commai<br>mmand                     |                |                                      |
| [1]<br>[2]<br>[3]       | : Wr<br>: Re<br>: SM | entify           | y Commai<br>ommand<br>omand<br>ommand |                |                                      |

"Flush Command Complete" is displayed after finishing Flush operation.

## 3.6 Shutdown Command

Select '5' to send Shutdown command to RAID0.

|  | 5 - Tera Term   | VT                      |               |  |
|--|---|-------------------------|---------------|--|
| <u>F</u> ile <u>E</u> dit                                | <u>S</u> etup C <u>o</u>  | ntrol <u>W</u> indo     | w <u>H</u> el | p  |
| [0] : Id<br>[1] : Wr<br>[2] : Re<br>[3] : SM<br>[4] : F1 | menu []]<br>entify Co<br>ite Comma<br>ad Comma<br>ART Comma<br>ush Comma<br>utdown Co | and<br>nd<br>and<br>and | .]            |  |
|  |   | mand seled<br>want to s | LEU           | Confirmation massage                               |
|  | ' to con  |                         | Г             | Press 'y' to confirm                               |
| Shutdown<br>The devi                                     | command<br>ce has ti  | is comple<br>urned off  | Lastm         | nessage before NVMeG3-IP<br>SD are inactive status |
| —  | - · ·   |                         |               |  |

Figure 3-9 Message after Shutdown command is completed

The confirmation message is displayed on the console. User enters 'y' or 'Y' to confirm the operation or enters other keys to cancel the operation.

After finishing Shutdown operation, "Shutdown command is complete" is displayed on the console as the last message. Main menu is not displayed and user needs to power off/on the test system to start new test operation.



## 4 Revision History

| Revision | Date      | Description                          |
|----------|-----------|--------------------------------------|
| 1.0      | 17-Feb-20 | Initial version release              |
| 1.1      | 20-Apr-20 | Remove power adapter cable from AB18 |