SATA Host-IP Demo Instruction

Rev1.6 15-Jan-18

This document describes the instruction to run SATA Host-IP demo on FPGA development board and AB09-FMCRAID board. The demo is designed to write/verify data with SATA-II/III device (except KCU105 and ZCU102 which supports only SATA-III device). User can control test operation through Serial console.

1 Environment Setup

To demo SATA Host-IP on FPGA development board, please prepare following hardware.

1) Supported FPGA Development board: AC701/KC705/VC707/VC709/ZC706/KCU105/ ZCU102/Zynq Mini-ITX
2) PC with Xilinx programmer software (Vivado) and Serial console software
3) SATA cable for Zynq Mini ITX or AB09-FMCRAID board for other FPGA boards
4) SATA-II/III device
   Note: KCU105/ZCU102 board supports only SATA-III device
5) Xilinx Power adapter for Xilinx board or ATX power supply for Zynq Mini-ITX board
6) micro USB cable for programming FPGA between FPGA Development board and PC
7) mini/micro USB cable for Serial console connecting between FPGA board and PC
8) For AC701 board only, connect CLKSMA board to the board.

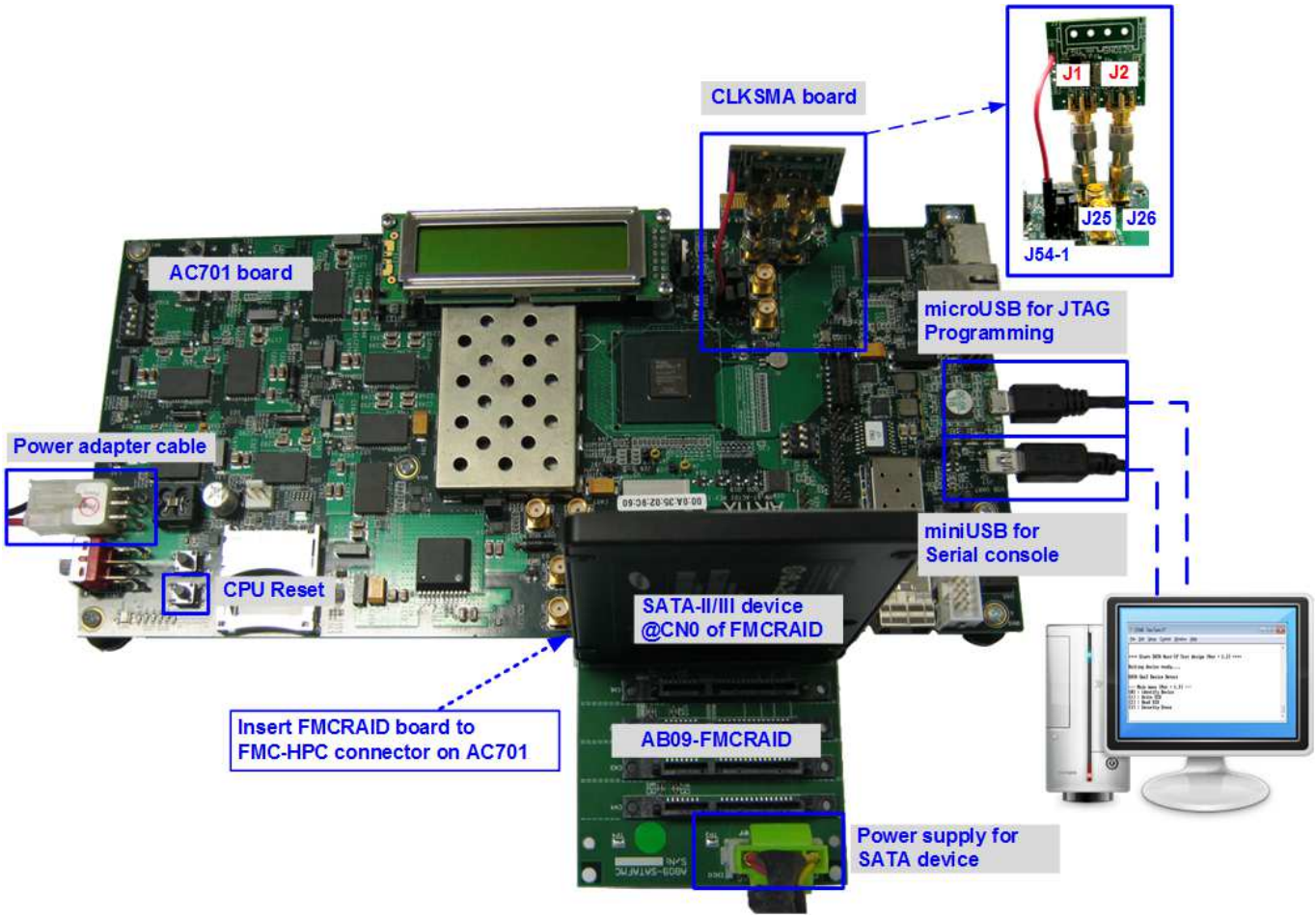

Figure 1-1 SATA Host-IP Demo Environment Setup on AC701

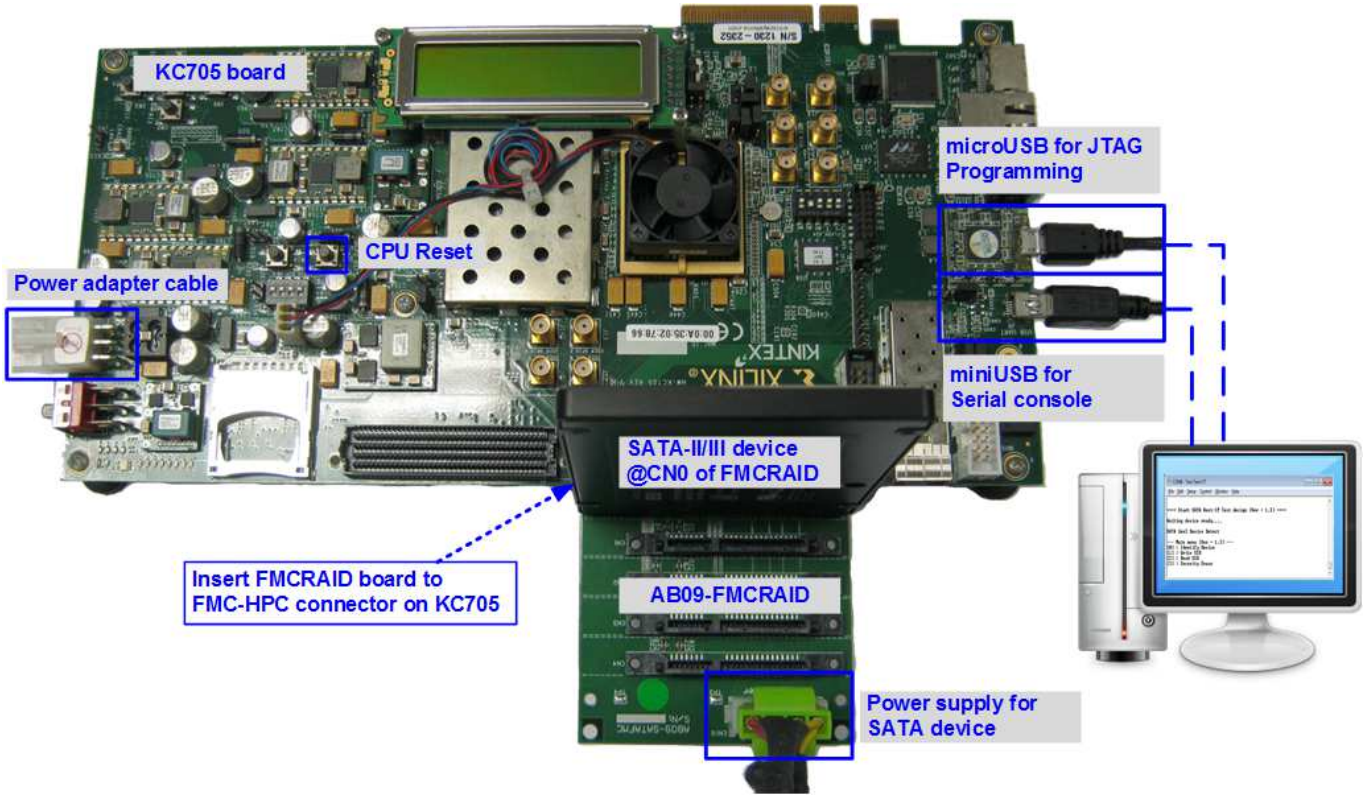

Figure 1-2 SATA Host-IP Demo Environment Setup on KC705

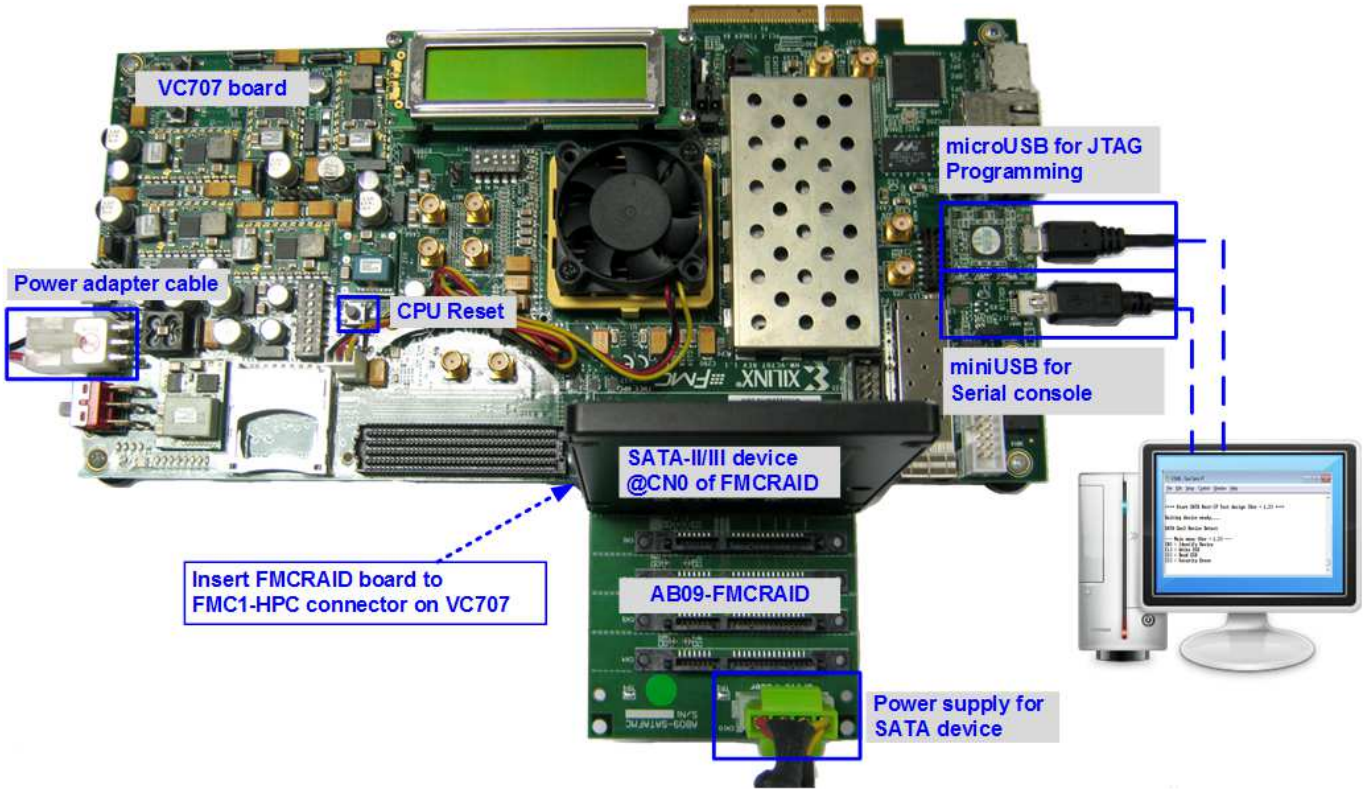

Figure 1-3 SATA Host-IP Demo Environment Setup on VC707

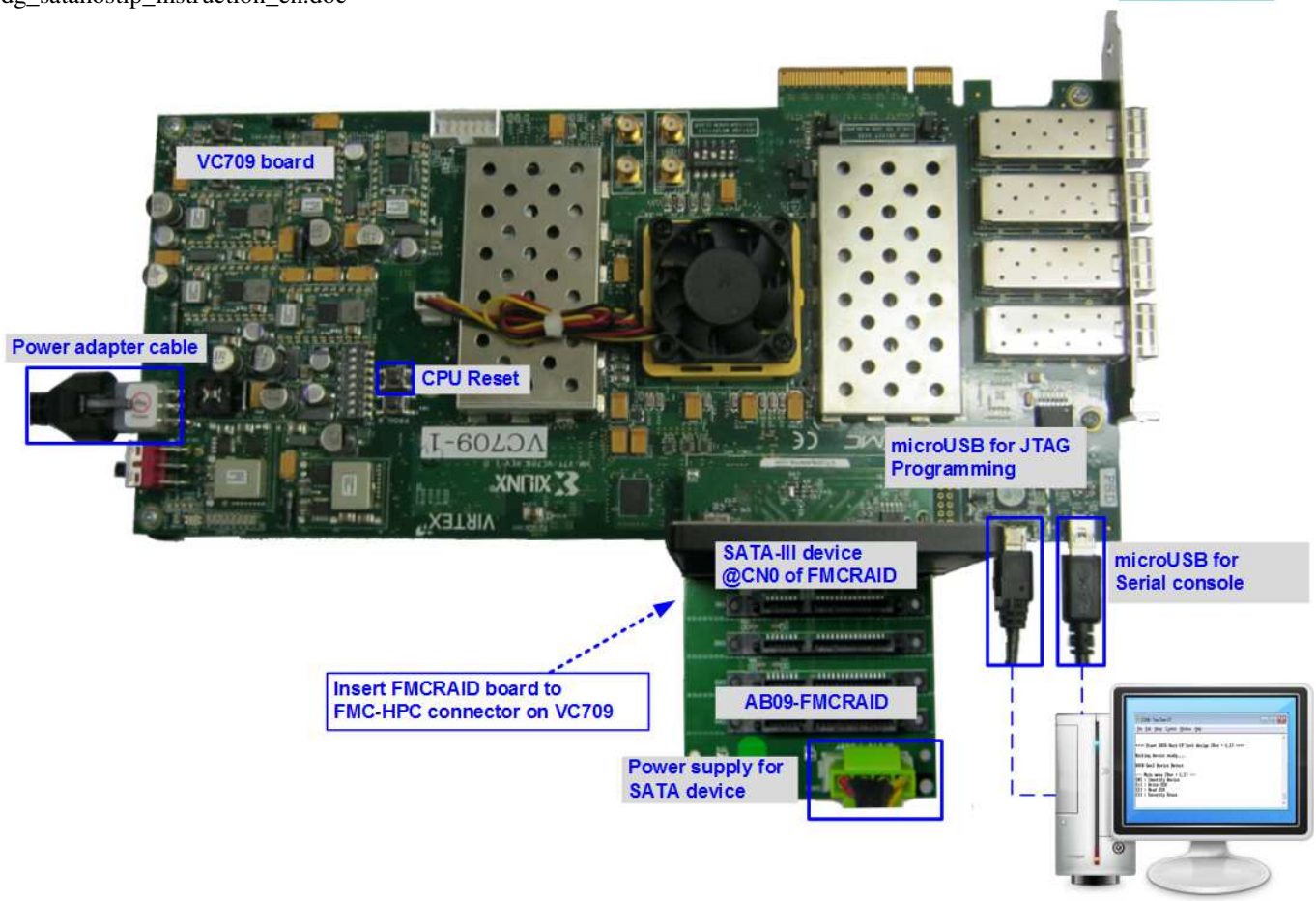

Figure 1-4 SATA Host-IP Demo Environment Setup on VC709

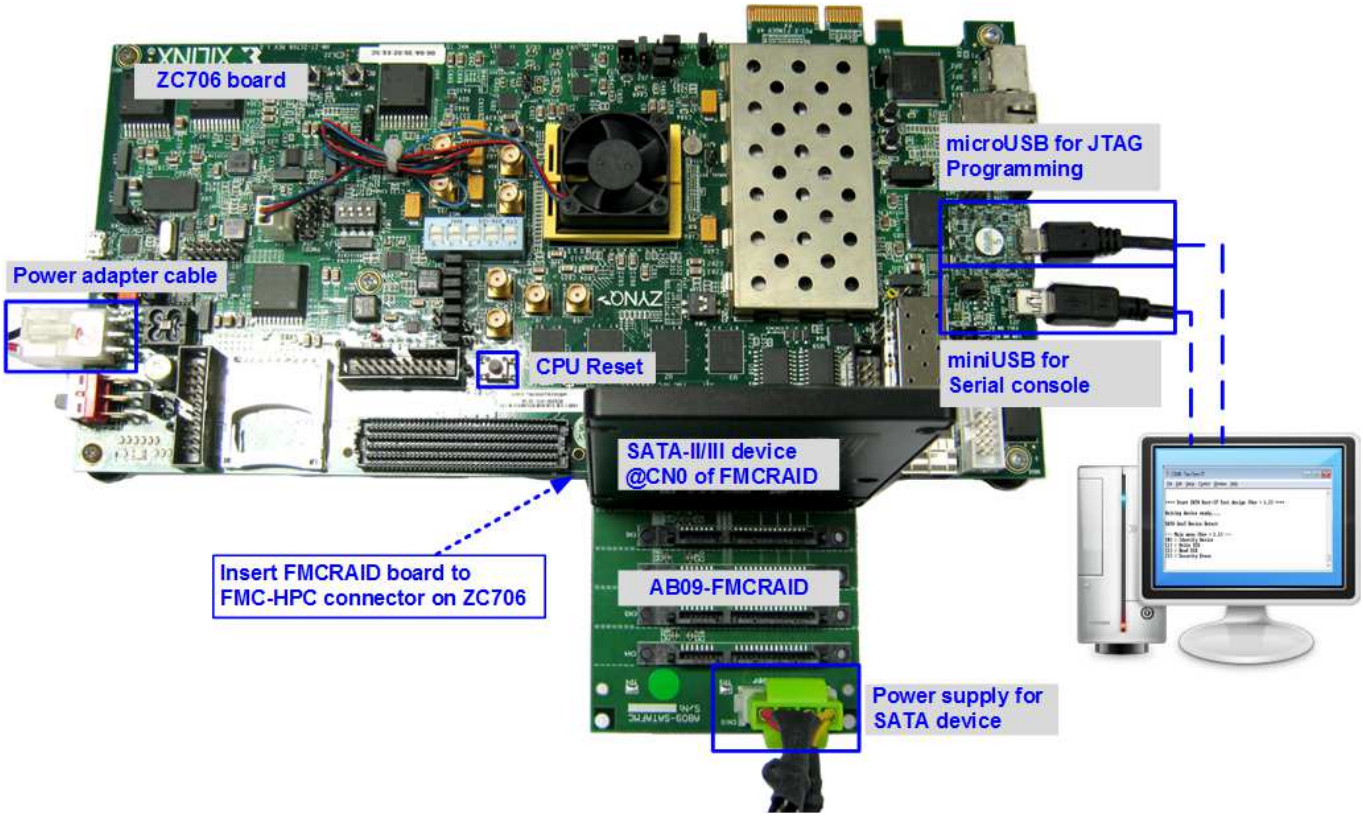

Figure 1-5 SATA Host-IP Demo Environment Setup on ZC706

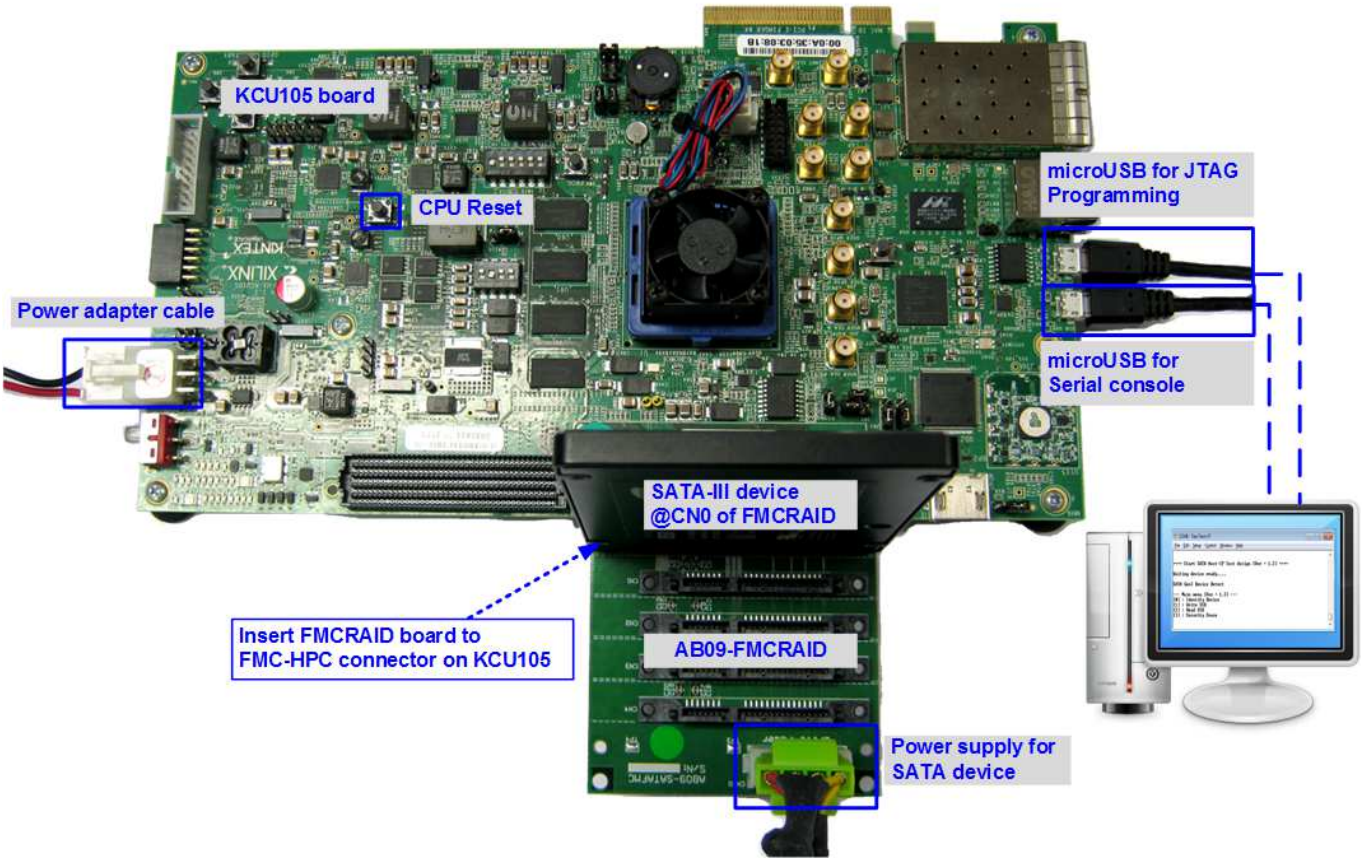

Figure 1-6 SATA Host-IP Demo Environment Setup on KCU105

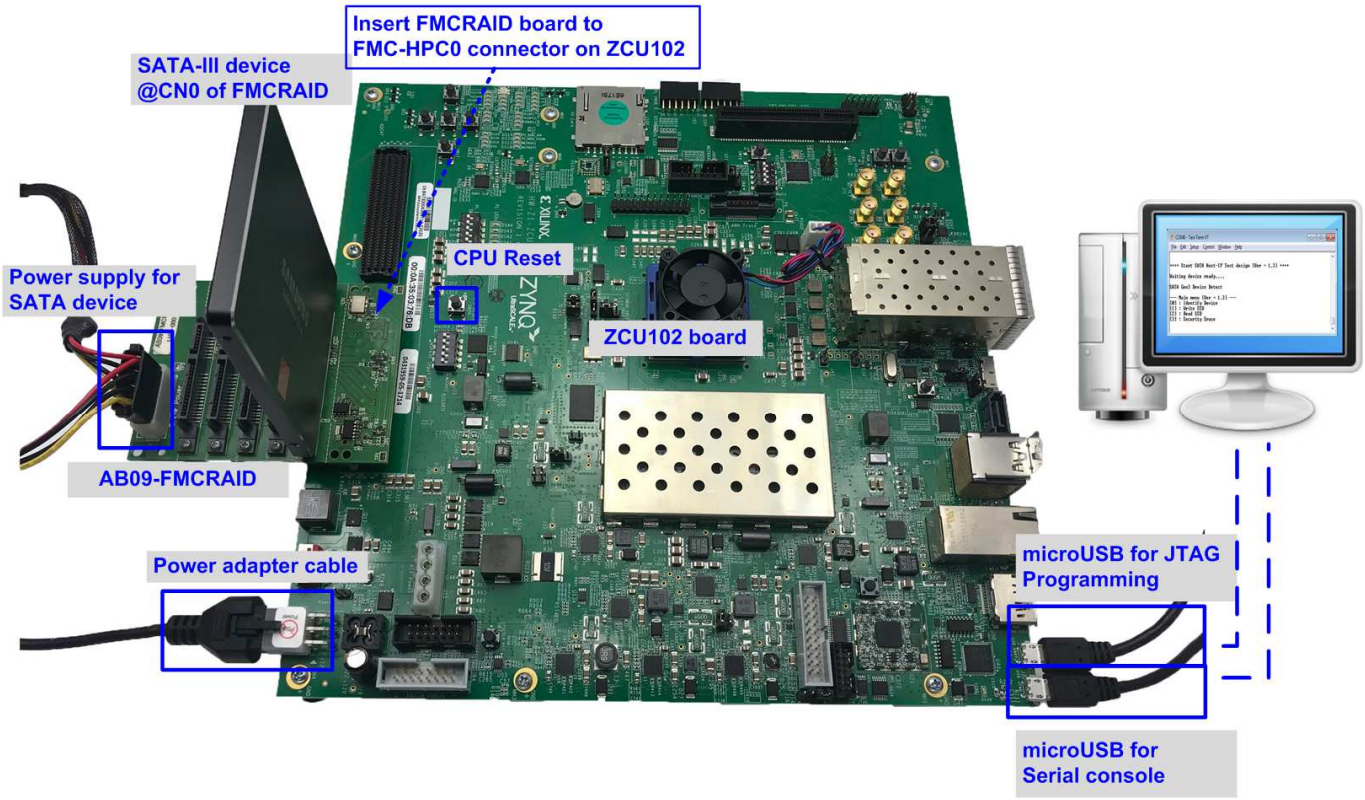

Figure 1-7 SATA Host-IP Demo Environment Setup on ZCU102

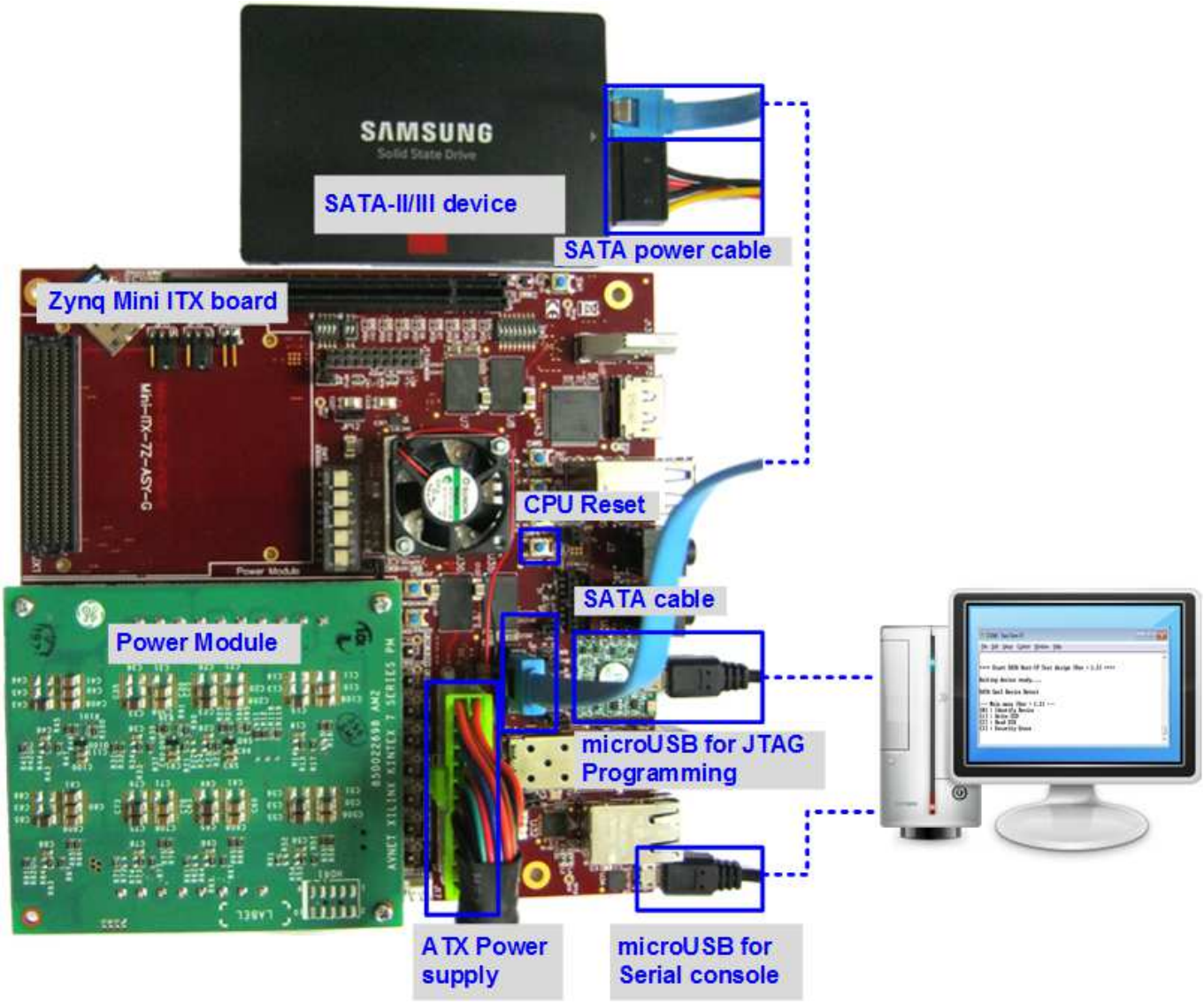

Figure 1-8 SATA Host-IP Demo Environment Setup on Zynq Mini ITX

2 Demo setup

1) Power off system.
2) Set up board option.
   a) For AC701 board only, connect CLKSMA board to the board.

Figure 2-1 Connect CLKSMA board to AC701

b) For ZC706 board only,
   i. Set SW11="00000" to configure PS from JTAG, as shown in Figure 2-2.
   ii. Det SW4="01" to connect JTAG with USB-to-JTAG interface, as shown in Figure 2-3.

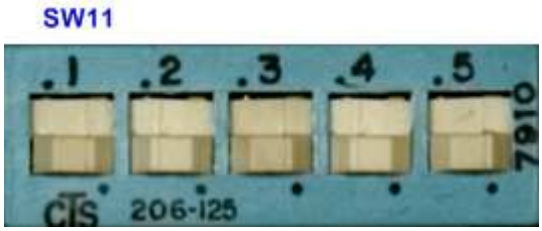

Figure 2-2 SW11 setting to configure PS from JTAG on ZC706 board

Figure 2-3 SW4 setting to use USB-to-JTAG on ZC706 board

c) For Zynq Mini-ITX board only,

i. Set SW7="00000" to configure PS from JTAG, as shown in Figure 2-4.

ii. As shown in Figure 2-5, install a jumper on JP1 pins 1-2 to enable JTAG chain, install the power module onto the board via J8, J9, J10 connectors, and connect ATX power cable to FPGA board via P2 connector.

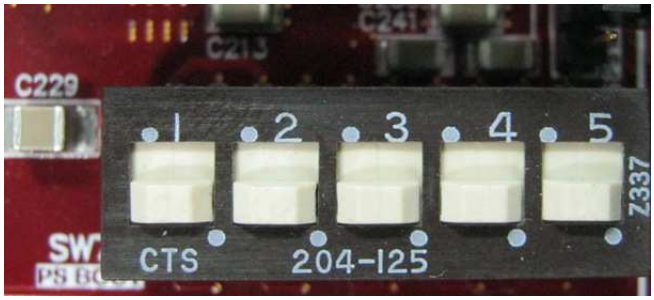

Figure 2-4 SW7 setting to configure PS from JTAG on Zynq Mini-ITX

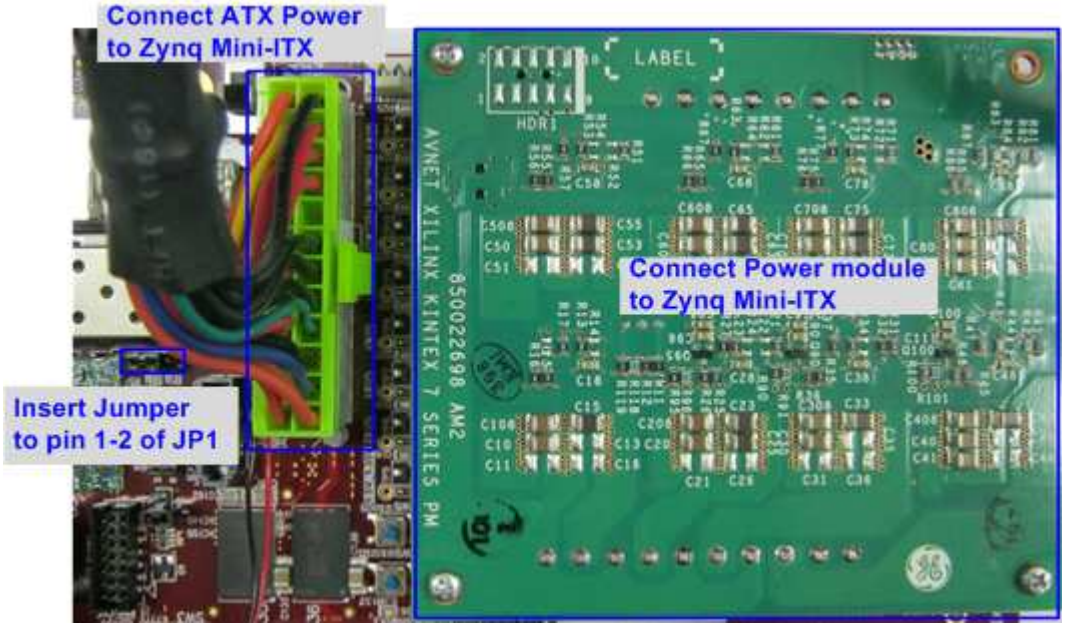

Figure 2-5 The power module installed onto the board

d) For ZCU102 only, set SW6="0000" (SW = ON) to configure PS from JTAG, as shown in Figure 2-6.

Figure 2-6 SW6 setting to configure PS from JTAG on ZCU102

3) Connect the SATA-II/III device to the board by the following steps.
   a) For Xilinx board,
      i. Connect AB09-FMCRAID board to FMC-HPC, FMC1-HPC, or FMC-HPC0 connector on Xilinx development board.
      ii. Connect SATA-II/III device to CN0 on FMCRAID board.
      Note: KCU105/ZCU102 supports only SATA-III device.
      iii. Connect power to power connector on FMCRAID board.
   The connections are shown in Figure 2-7.

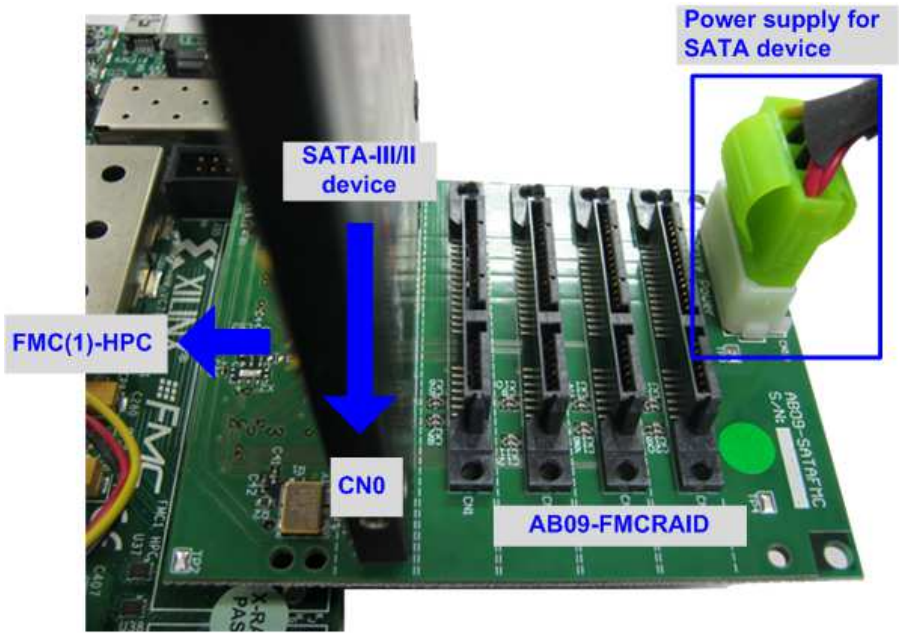

Figure 2-7 AB09-FMCRAID connection

   b) For Zynq Mini ITX board,
      i. Connect the device to the SATA connector (J12) on the board using SATA cable.
      ii. Connect SATA Power cable to the device.
   The connections are shown in Figure 2-8.

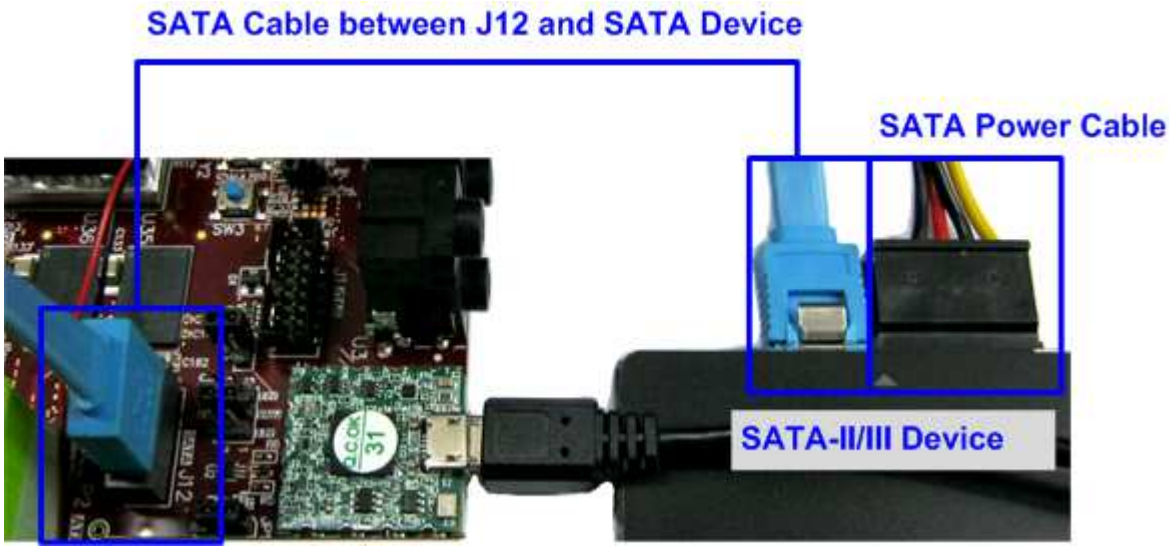

Figure 2-8 SATA-II/III device connection for Zynq Mini ITX

4) Connect micro USB cable from FPGA development board to PC for JTAG programming
5) Connect mini/micro USB cable from FPGA board to PC for Serial console.

Figure 2-9 USB cable connection

6) Power on FPGA development board and power supply for SATA device.
7) Open Serial console such as TeraTerm, HyperTerminal and set Buad rate=115,200 Data=8 bit Non-Parity Stop=1.
8) a) For Zynq Mini ITX/ZC706 board, open Vivado TCL shell, change current directory to ready_for_download. Next, run XXX_HSataIPTest.bat as shown in Figure 2-10. For example, type zc706_HSataIPTest.bat, zcu102_HSataIPTest.bat, MiniITX_7z045(or 7z100)_HSataIPTest.bat.

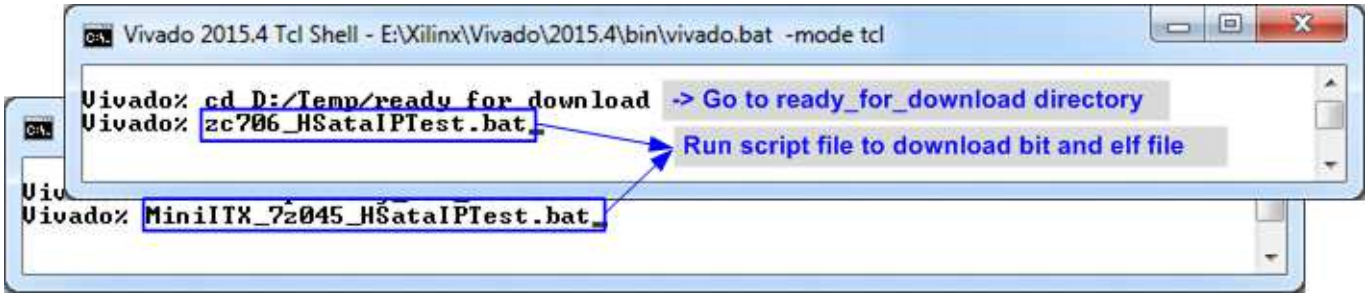

Figure 2-10 Command script for download demo file on Mini ITX/ZC706

b) For AC701/KC705/VC707/VC709/KCU105 board, use Vivado tool to program bit file, as shown in Figure 2-11.

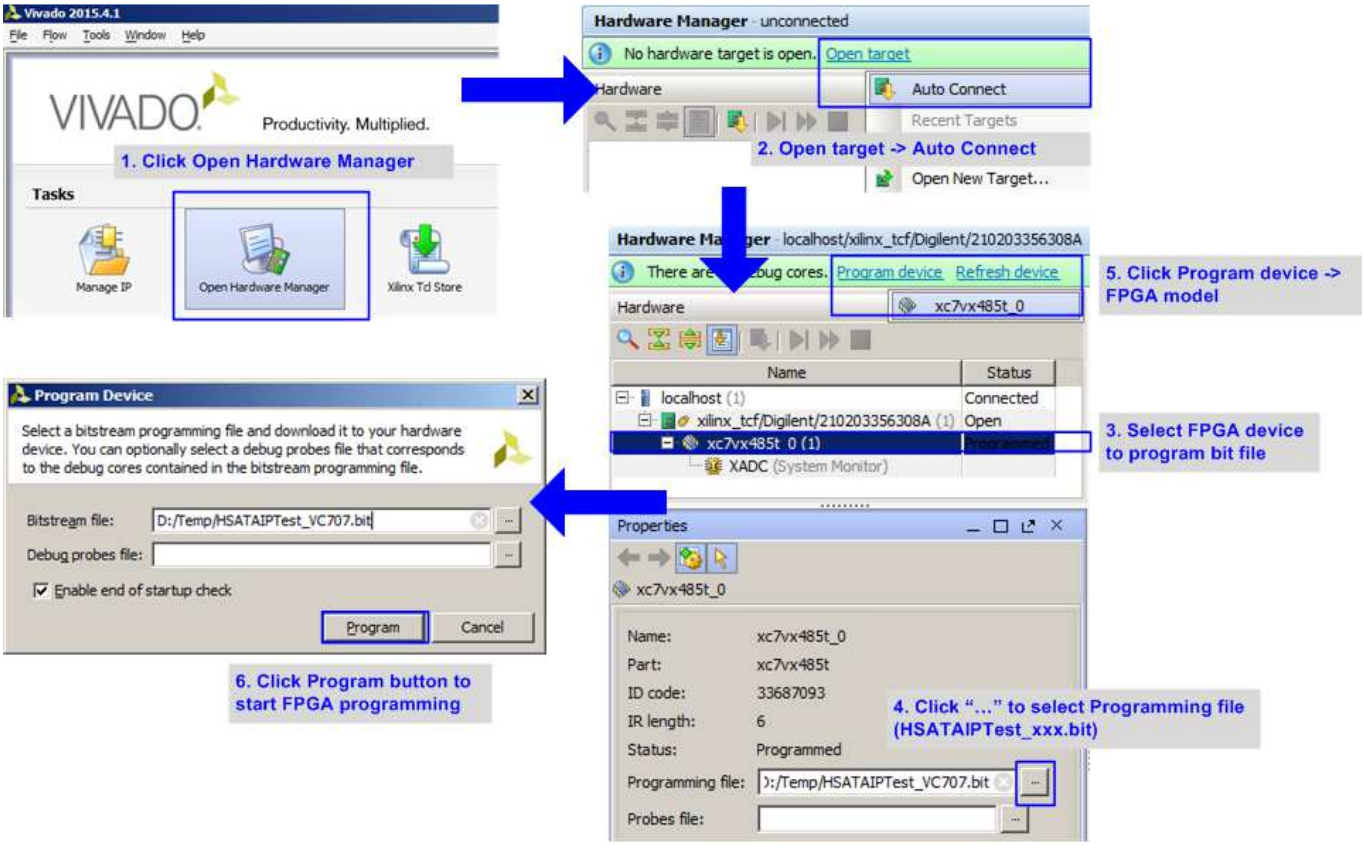

Figure 2-11 Programmed by Vivado

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

Table 1 LED Definition

GPIO LED	ON	OFF
0/D4	Normal operation	System is in reset condition
1/R/D5	System is busy	Idle status
2/C/D6	Error detect	Normal operation
3/L/D7	Data verification fail	Normal operation

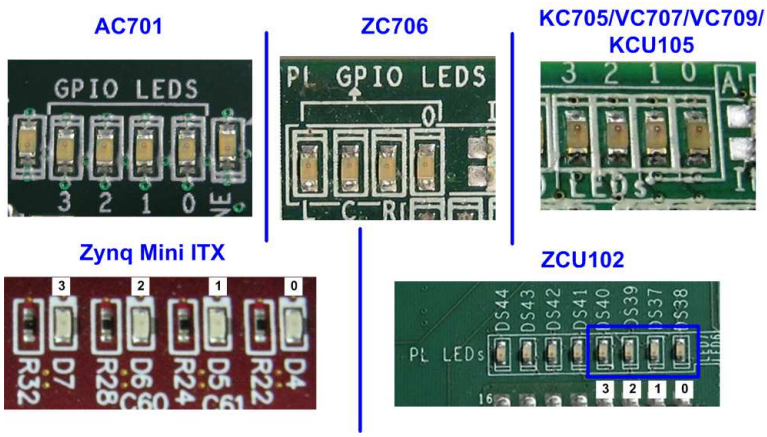

Figure 2-12 4-bit LED Status for user output

10) After programming completely, LED[0] and LED[1] are ON for initializing SATA device. LED[1] is OFF when SATA Host-IP completes initialization process. Now system is ready to receive command from user. SATA speed is displayed on the console before Main menu, as shown in Figure 2-14.

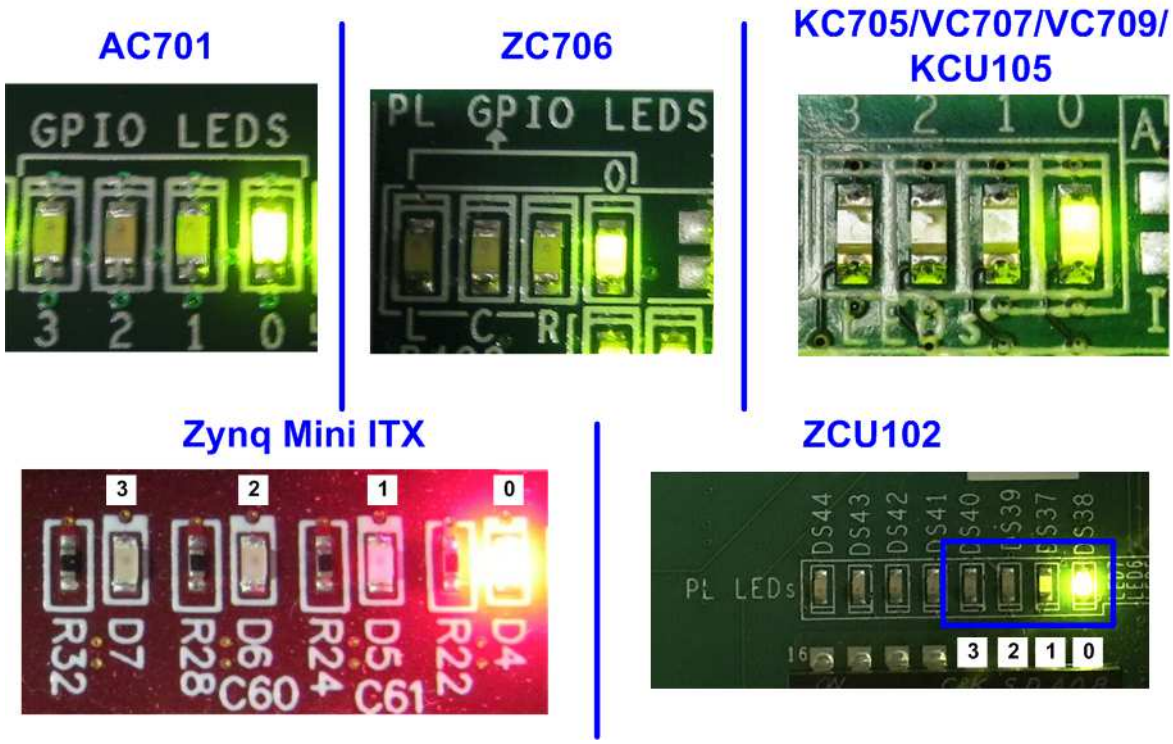

Figure 2-13 LED status after program configuration file and SATA initialization complete

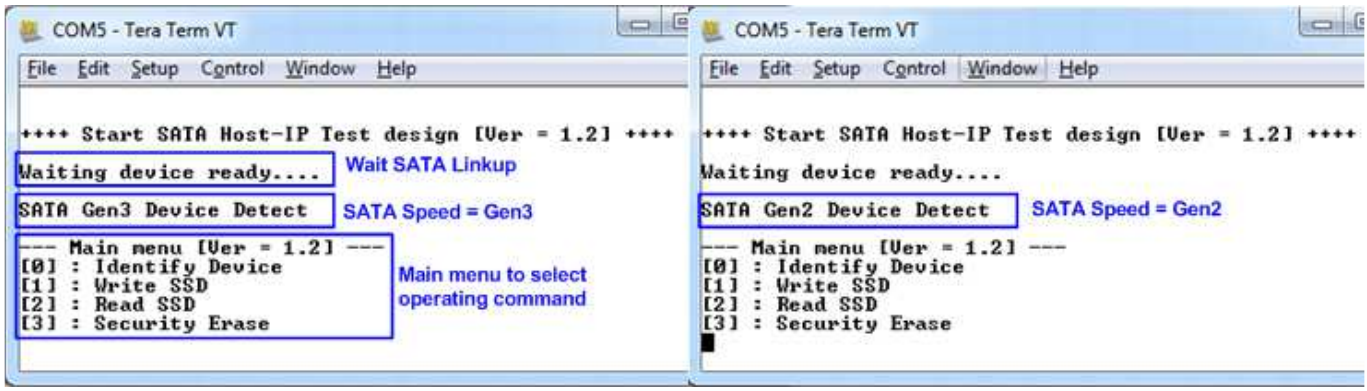

Figure 2-14 Main menu after program configuration file and SATA initialization complete

3 Test Menu

3.1 Identify Device

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

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

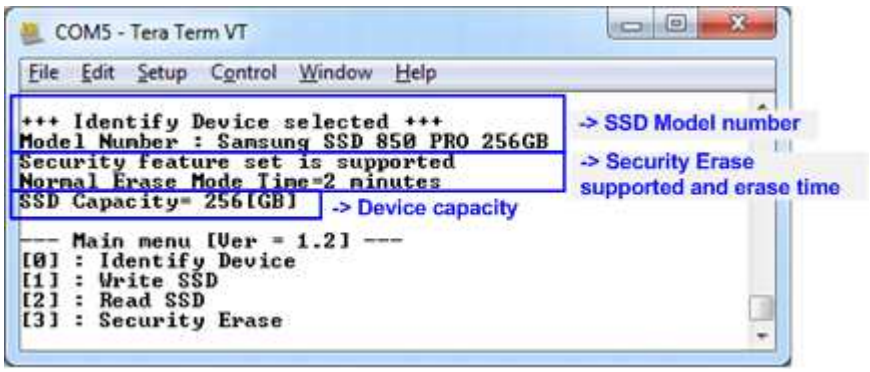

Figure 3-1 Result from Identify Device menu

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 "0x" as a prefix for hexadecimal unit.
2) Sector Count: Input total transfer size in sector unit. The input can be decimal unit or add "0x" as a prefix for hexadecimal unit.
3) Test pattern: Select test pattern of test data for writing to SATA device. Five types can be selected, i.e. 32-bit increment, 32-bit decrement, all 0, all 1, and 32-bit LFSR counter.

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

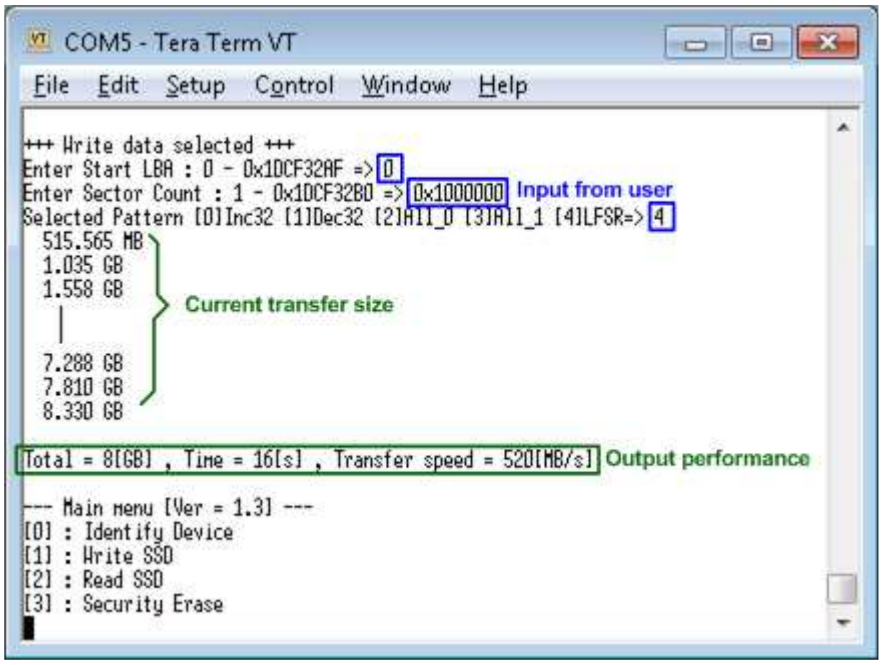

Figure 3-2 Input and result of Write SSD menu

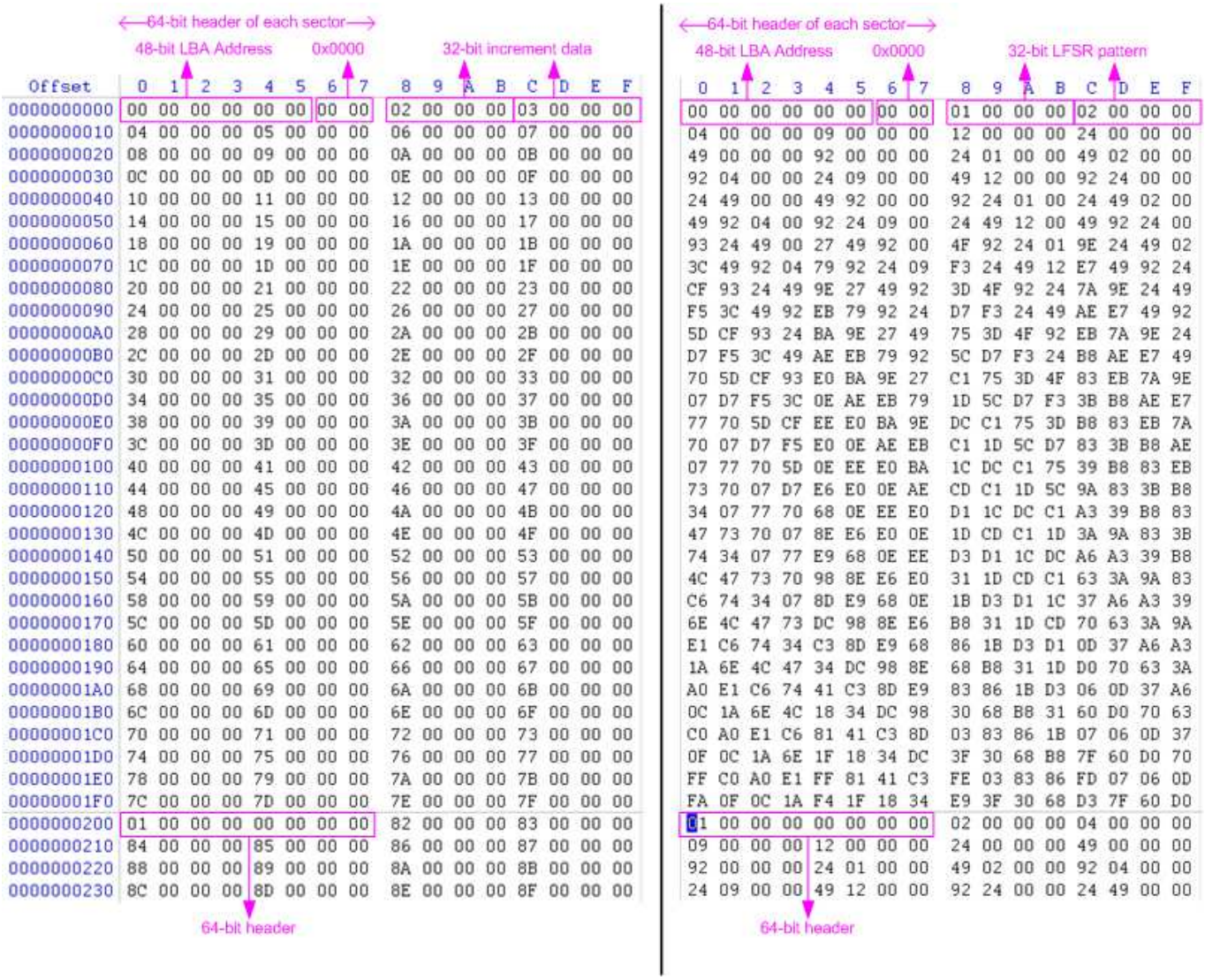

Figure 3-3 Example Test data in sector#0/#1 by increment/LFSR pattern

Test data of each sector has different 64-bit header which consists of 48-bit LBA address and 16-bit all 0 value. 48-bit LBA address is unique value for each sector. After that, the test pattern is filled following user selection such as 32-bit increment pattern (left window of Figure 3-3), 32-bit LFSR pattern (right window of Figure 3-3).

Figure 3-4 – Figure 3-6 show error message when user input is invalid. “Invalid input” message is displayed on the console. Then, it returns to main menu to receive new command.

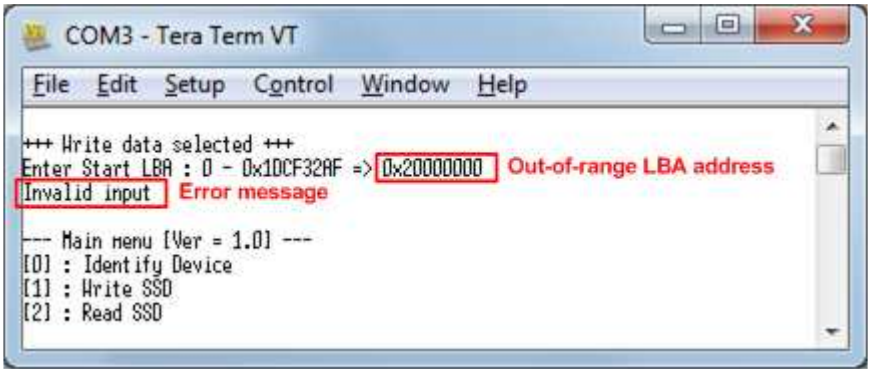

Figure 3-4 Invalid Start LBA input

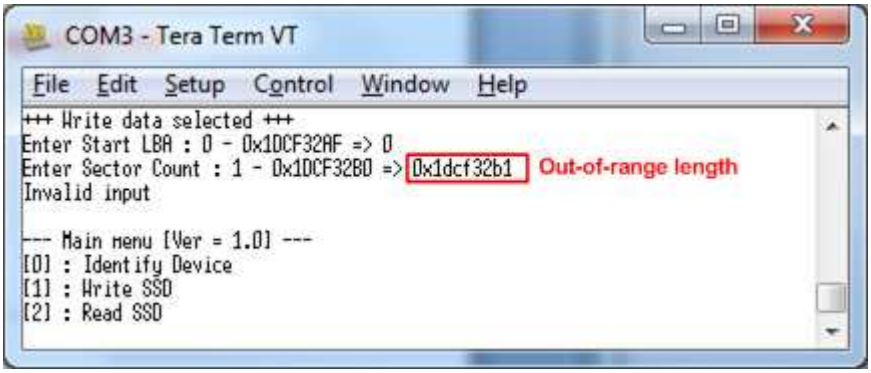

Figure 3-5 Invalid Sector count input

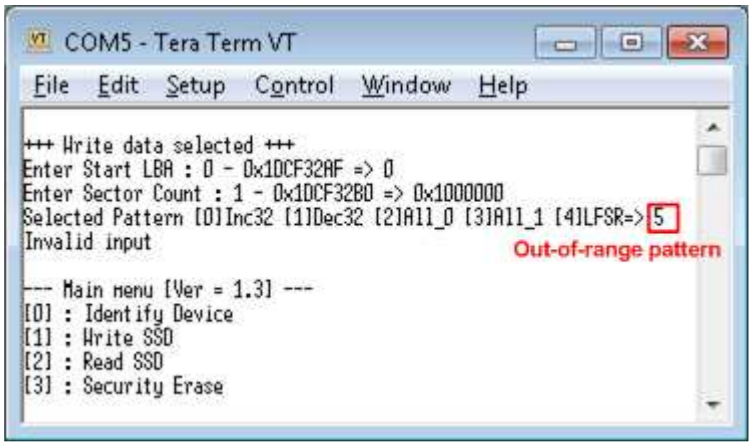

Figure 3-6 Invalid Test pattern input

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 "0x" as a prefix for hexadecimal unit.
2) Sector Count: Input total transfer size in sector unit. The input can be decimal unit or add "0x" as a prefix for hexadecimal unit.
3) Test pattern: Select test pattern to verify data from SATA Device. Test pattern must be matched with the test pattern which is used during write test. Five types can be selected, i.e. 32-bit increment, 32-bit decrement, all 0, all 1, and 32-bit LFSR counter.

Similar to write test if all inputs are valid, test system will read data from SATA device. Test performance, total size, and total time usage are displayed after end of transfer. "Invalid input" will be displayed if some inputs are out-of-range.

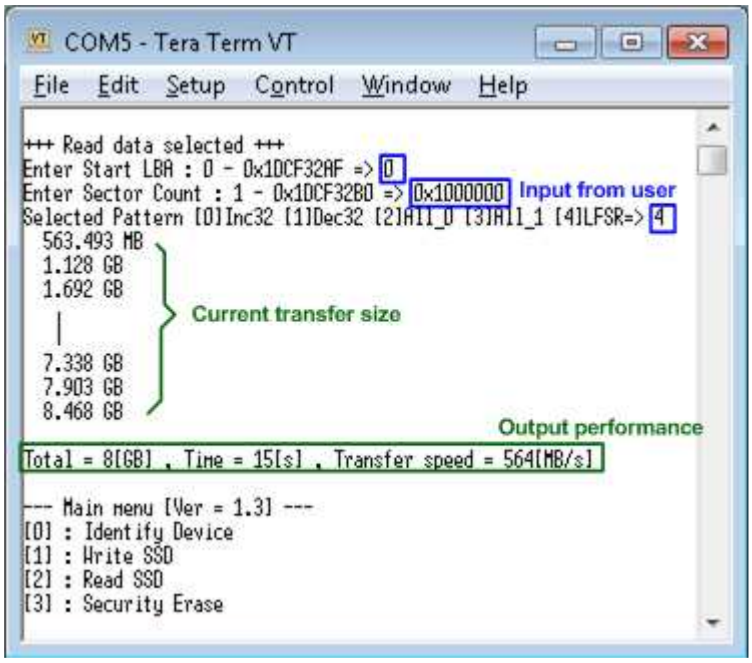

Figure 3-7 Input and result of Read SSD menu

Figure 3-8 and Figure 3-9 shows the error message when data verification is failed. “Verify fail” message is 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 must be pressed to restart the system when user cancels the operation.

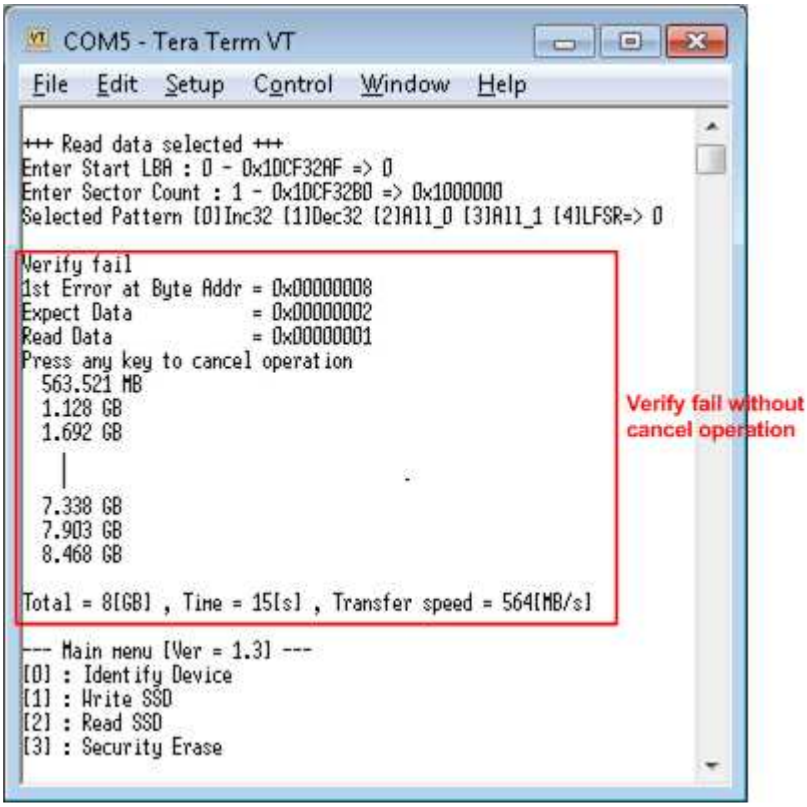

Figure 3-8 Data verification is failed, but wait until read complete

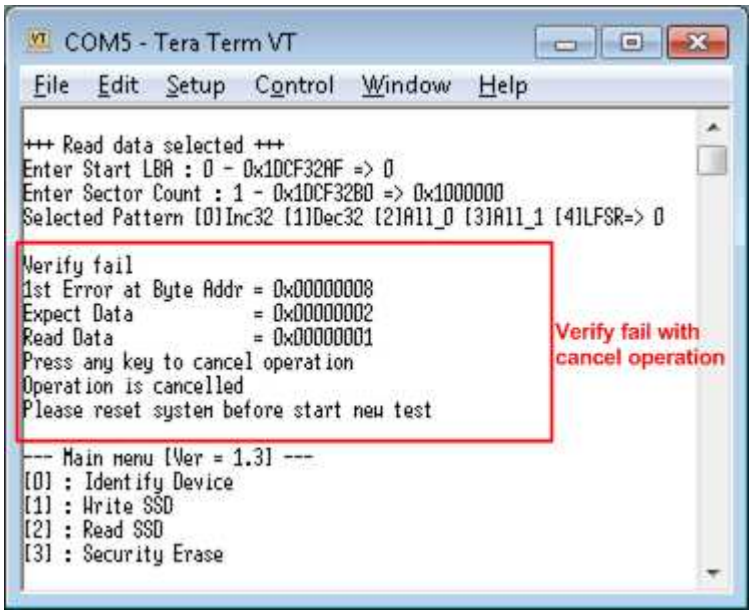

Figure 3-9 Data verification is failed, and input any keys to cancel operation

3.4 Security erase

Select '3' to send Security Erase command to SATA Device. Please confirm that SATA device supports Security Erase feature 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 is displayed on the console. User input 'y' or 'Y' to continue security erase operation or input other keys to cancel operation.

Number 0-9 is displayed on the console every second to show that system still be alive. Finally, total time usage is displayed as shown in Figure 3-10.

Figure 3-11 shows the example when user inputs other keys to cancel the command.

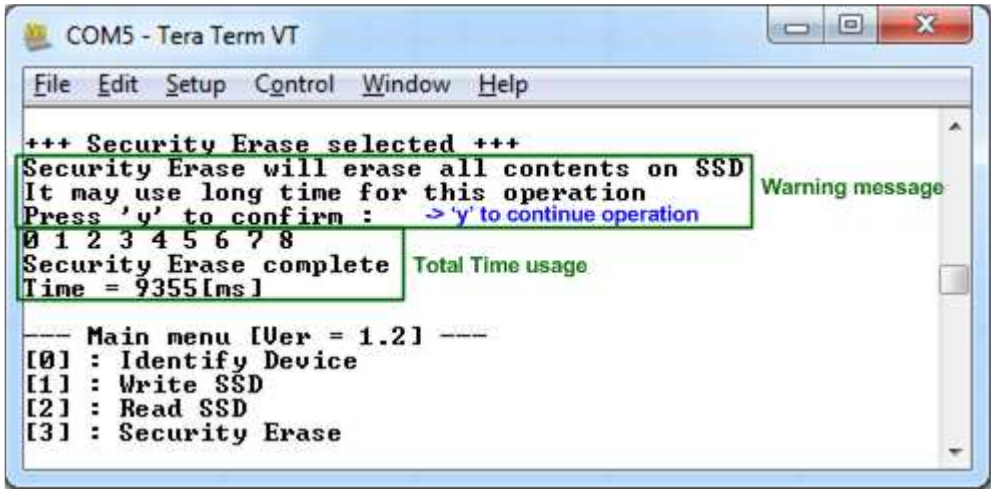

Figure 3-10 Result from Security Erase command

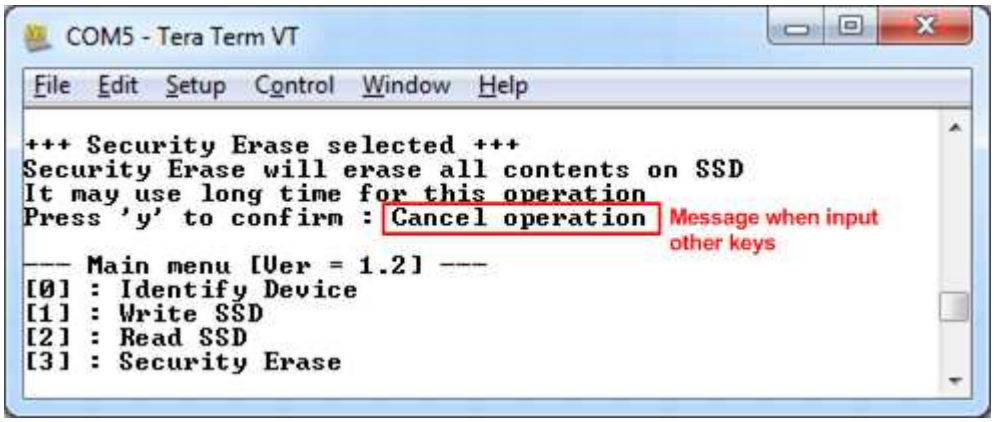

Figure 3-11 Cancel Security Erase command

4 Revision History

Revision	Date	Description
1.0	15-Oct-14	Initial version release
1.1	3-Apr-15	Add ZC706 support
1.2	30-Aug-16	Add CPU and support KCU105 board
1.3	29-Sep-16	Add Zynq Mini ITX support
1.4	9-Nov-16	Add Security erase command and VC709 support
1.5	1-Aug-17	Add LFSR pattern
1.6	15-Jan-18	Add ZCU102 support