Getting Started

SMP FMC Card

Revision

B

2017/10/23

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Contents

1. Read This First

1.1 Important Information

READ FIRST:
- Before using this card, be sure to read this Getting Started manual.
- Keep this Getting Started manual so you can refer to it when necessary.
- You should sufficiently understand the card's configuration before you use it.

Card Application:
- This card is an FPGA Mezzanine Connector (hereafter FMC) daughter card that can be connected to and used with any FMC that complies with FMC ALTERA LPC+ standard. Combining with an FPGA evaluation board (hereafter Evaluation board), this card supports the development and verification of software and hardware for SMP I/O interfaces. Use this card correctly in line with the application.

People Who Are Expected to Use This Card:
- Only people who carefully read and understood this manual and the Reference Manual should use this card. You need a fundamental understanding of FPGA, logic circuits, electronic circuits, and micro-computers to use this card.

Precautions When Using This Card:
- This card is a development support card used for the purpose of your hardware and software development and evaluation. This card cannot be used in your mass production products. Furthermore, when you want to use the card's sample designs for your products, please be sure to confirm if it withstands practical use at your own risk by doing necessary and sufficient tests and evaluations.
- Macnica Incorporated (hereafter Macnica Inc.) has no liability for any results arising from the use of the card.
- Macnica Inc. will attempt to provide either free or paid support to handle repair of faults or workarounds for faults with the card. This does not mean, however, that Macnica Inc. guarantees to provide a workaround or fix under all circumstances.
- Macnica Inc. cannot anticipate every possible circumstance that might involve a potential hazard. The warnings and precautions in this Getting Started manual and on the card are therefore not all-inclusive. You are responsible for using the card correctly and safely.
- Even if there are faults with devices that are mounted on the card, Macnica Inc. will not replace it with a fault-fixed device.
- Each interface is not guaranteed to connect with all products.
- The card will not be replaced if you damaged or modified the card.
- The card uses lead-free parts.
- The rights to the trademarks and registered trademarks of the vendors noted in this manual belong to their respective vendors.

Improvement Policy:

- Macnica Inc. pursues a policy of continuous improvement in design, performance, and safety of the product.
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Warranty:

- Macnica Inc. offers to exchange this card free of charge only in case of initial malfunction noticed by you within 30 days from the delivery.
  Macnica Inc. cannot exchange cards in cases where the malfunction is caused by the following reasons:
  (1) Misuse, abuse of the card or use under abnormal conditions
  (2) Remodeling or repair
  (3) A fire, earthquake, fall or other accidents

Figures:

- Some figures in this manual may differ from your purchased card.

1.2　Developer Information

The Developer of this card is:
Macnica Inc.
1-6-3 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8561 JAPAN

1.3　Inquiries

In case you have any inquiries about the use of this card, please contact sales office you purchased or make inquiries through the contact form on the following web site.

Inquiries page:
　　http://www.m-pression.com/contact/inquiry
Inquiries to:
　　Macnica Inc.
　　Sales and Planning Advanced Technology
　　1-5-5 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8563 JAPAN
　　TEL: +81-45-470-9838

2. For Ensuring Safe Use

Be sure to follow the instructions given in this Manual which are intended to prevent harm to the user and others as well as material damage.

2.1 Legend

⚠	**Danger**	Indicates an imminent hazardous situation which if not avoided will result in death or serious injury.
⚠	**Warning**	Indicates a potentially hazardous situation which if not avoided could result in death or serious injury.
⚠	**Caution**	Indicates a potentially hazardous situation which if not avoided may result in minor or moderate injury or in property damage.

2.2 Cautions

⚠	**Danger**	If an AC adapter is needed, be sure to use the AC adapter provided in the package or one that meets the specifications described in this manual. Using an AC adapter not meeting the specifications described in this manual may cause the card to emit heat, explode, or ignite.
⚠	**Warning**	Do not apply strong impacts or blows to the card. Doing so may cause the card to emit heat, explode, or ignite, or the equipment in the card to fail or malfunction. This may also cause fire.
		Do not put this card or the AC adapter in cooking appliances such as microwave ovens, or high-pressure containers. Doing so might cause this card or AC adapter to emit heat, explode, ignite, or emit smoke, or its parts to break or warp.
		Do not cover or wrap this card that is in use with cloth or other materials that are likely to allow heat to build up inside the wrapping. This will cause heat to build up inside the wrapping which may cause this card to ignite or malfunction.
		When disposing of this card, do not dispose of it along with general household waste. Throwing this card into fire may cause it to explode. Dispose of this card following the laws, regulations, and ordinances governing waste disposal.
		Do not pull the power supply cable with excessive force or place heavy items on it. Do not damage, break, bundle, or tamper with the power supply cable. Damaged parts of the power supply cable might cause a short circuit resulting in fire or accidents involving electrical shock.
		Do not plug or unplug the power plug with wet or moist hands. This might cause injuries or equipment malfunctions or failures due to electrical shock.

⚠️ **Warning** (Continued from previous page)		Plug the power plug securely into the outlet. If the power plug is not securely plugged into the outlet, it may cause accidents involving electrical shock or fire due to heat emitted.
		Do not connect many electrical cords to a single socket or connect an AC adapter to an outlet that is not rated for the specified voltage. Doing so may cause the equipment to malfunction or fail, or lead to accidents involving electrical shock or fire due to heat emitted.
		Periodically remove any dust accumulated on the power plug and around the outlet (socket). Do not use a power plug with dust accumulated on it because doing so will lead to insulation failure due to moisture which may lead to fire. Remove any dust on the power plug and around the outlet with a dry cloth.
		Do not place any containers, such as cups or vases, filled with water or other liquids on the card. If the card is exposed to water or other liquids, it will cause a malfunction or electric shock. If you spilled water or other liquid on this card, immediately stop using the card, turn off the power, and unplug the power plug. If you have any requests for repairs or technical consultation, please contact sales office you purchased or Mpression inquiry URL.
		Keep the card and accessories out of the reach of children. Failure to do so may lead to injuries.
⚠️ **Caution**		Do not place the card on unstable places such as shaky stands or tilted locations. Doing so may cause injuries or cause this card to malfunction if the card should fall.
		Do not attempt to use or leave the card in places subject to strong direct sunlight or other places subject to high temperatures such as in cars in hot weather. Doing so might cause the card to emit heat, break, ignite, run out of control, warp, or malfunction. Also, some parts of the equipment might emit heat, causing burn injuries.
		Do not use the card in places subject to extremely high or low temperatures or severe temperature changes. Doing so may cause the card to fail or to malfunction. Always be sure to use the card within a temperature range of 5°C to 35°C and a humidity range of 0% to 85%.
		Unplug the power supply when doing maintenance on equipment in which the card is embedded. Failure to do so may lead to accidents involving electrical shock.
		Do not place the card in locations where excessive force might be applied to it. Doing so may cause the printed circuit board to warp, leading to breakage of the printed circuit board, missing parts or malfunctioning parts.

Caution (Continued from previous page)	When using the card together with expansion boards or other peripheral equipment, be sure to carefully read each of their manuals and to use them correctly. Developer does not guarantee the operation of specific expansion boards or peripheral devices when used in conjunction with this card unless they are specifically mentioned in this Manual or their successful operation with this card has been confirmed in separate documents.
	Turn off the power switch when moving or connecting the card. Failure to do so may cause this card to fail or lead to accidents involving electrical shock.
	Do not clean this card by using a rag containing chemicals such as benzine or thinner. Doing so could degrade the card. When using a chemically treated cloth, comply with its directions and warnings.
	Do not immediately turn on the power if you find that moisture has condensed onto this card after removing it from the box. Condensation may form if the card is cold when moved from the box into a warm room. Turning on the power while there is moisture on the card may cause it to malfunction or shorten the service life of the parts. Allow the card to reach room temperature when you first take it out of the box. If condensation or moisture has occurred on this card, first wait for the moisture to fully evaporate before installing or connecting the card to other equipment.
	Operation of the card cannot be guaranteed if it has been disassembled, dismantled, altered, modified, or rebuilt.

3. Advance Preparation

3.1 About This Manual

This manual describes how to use the reference design that this card is used in. The following information is also included.

- Basic specifications of the card
- Executions of sample designs based on the combination of the card and the Altera's Arria® 10 GX FPGA development kit

3.2 Advance Preparation

A. Preparation of reference design

The following items are included in the reference design that is provided.

- Reference Design (sof file)
- Board information

The following items are included in the board information.

➢ Circuit diagram

To download these files, go to the URL noted on the "Packing List and Precautions".

B. Preparation of materials

Prepare the following materials to execute all of the functions of this design.

- This card: 1
- Altera Arria® 10 GX FPGA development kit: 1
- SMP-SMP cable: 1 pair

C. Preparation of tools

Prepare the following tools before operating this design.

- Altera Quartus Prime 16.0.1 Standard Edition

* The transceiver toolkit used for the reference design requires a subscription license.

4. Reference Design

4.1 About Reference Design

4.1.1 Loopback Test using Transceiver Toolkit

Using Altera Quartus Prime 16.0 Transceiver Toolkit, you can test 10.3125 Gbps loopback between transceivers in Arria 10 GX.
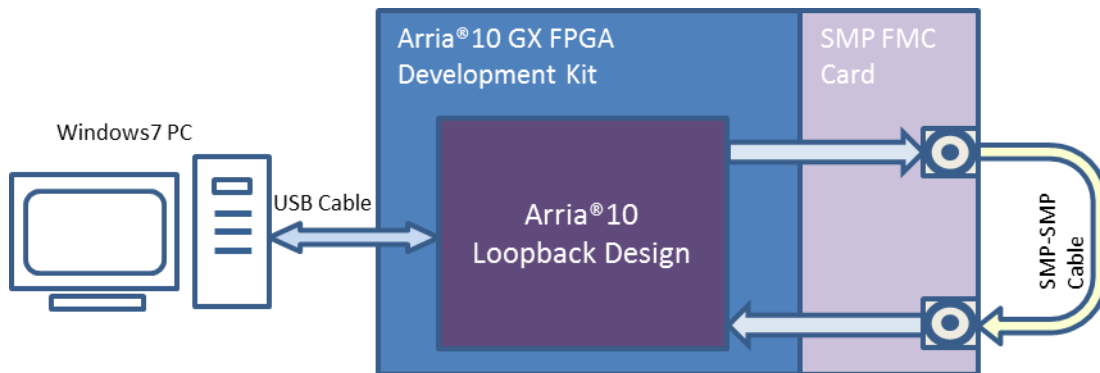

Figure 4-1 SMP FMC Card Transceiver Toolkit Loopback Design Block Diagram

Table 4-1 SMP FMC Card Loopback Test

sof file name	Loopback test target
sample_top_ch0.sof	Channel 0
sample_top_ch1.sof	Channel 1
sample_top_ch2.sof	Channel 2
sample_top_ch3.sof	Channel 3
sample_top_ch4.sof	Channel 4
sample_top_ch5.sof	Channel 5
sample_top_ch6.sof	Channel 6
sample_top_ch7.sof	Channel 7
sample_top_ch8.sof	Channel 8
sample_top_ch9.sof	Channel 9

5.   Setup

5.1   Card Layout

This section explains the card layout and major components.
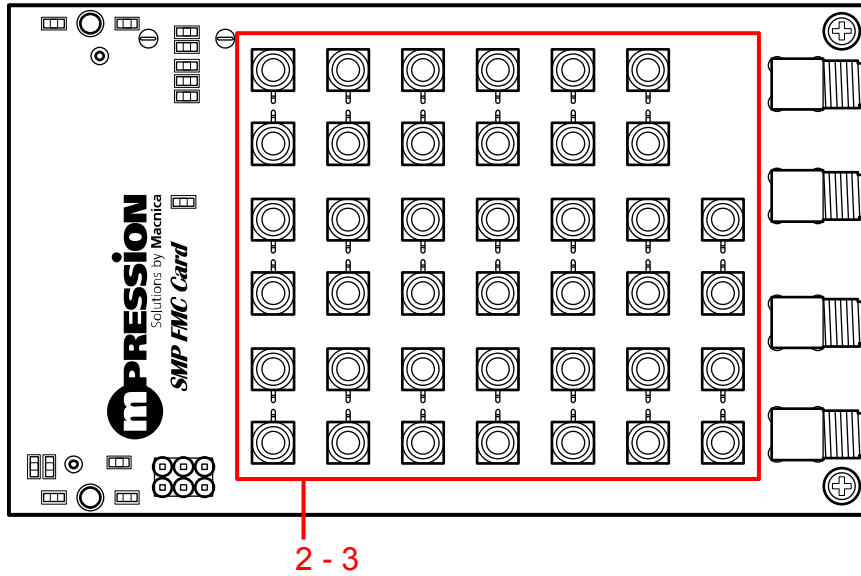Figure 5-1 and Figure 5-2 show the layout of the card.
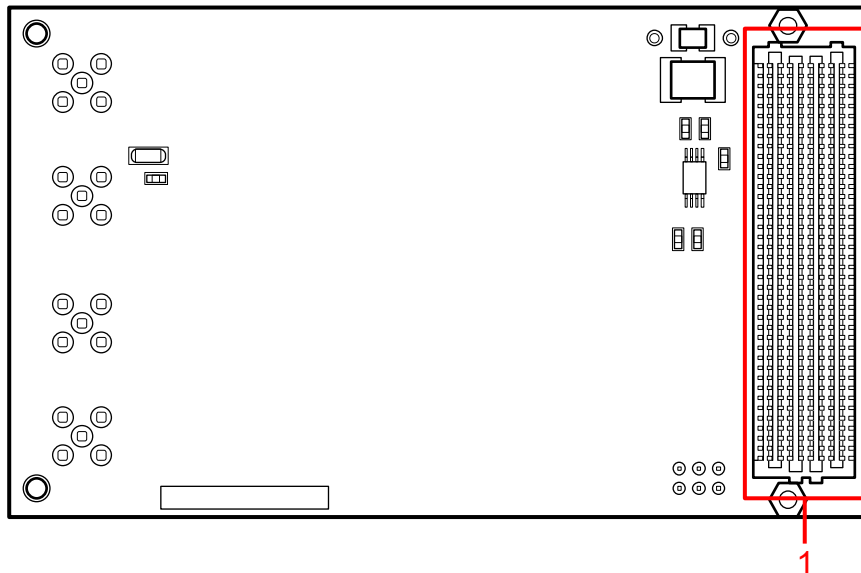

Figure 5-1 Layout (Top View)

Figure 5-2 Layout (Bottom View)

Table 5-1 SMP FMC Card Connectors

	Reference	Functions	Details
1	CN1	FMC	ALTERA FPGA Development Board Interface (FMC ALTERA LPC+)
2	CN2-CN21	SMP pairs for Input	Mezzanine to Carrier High-Speed Differential Signals
3	CN22-CN41	SMP pairs for Output	Carrier to Mezzanine High-Speed Differential Signals

Table 5-2 FMC Transceiver Channel and SMP Connector Correspondence Table

FMC Transceiver Channel	Signal Name (C2M)	SMP CN# (P/N)		Signal Name (M2C)	SMP CN# (P/N)
DP0	C2M_10_p/_n	CN22 / CN23		M2C_08_p/_n	CN2 / CN3
DP1	C2M_07_p/_n	CN24 / CN25		M2C_05_p/_n	CN4 / CN5
DP2	C2M_09_p/_n	CN26 / CN27		M2C_07_p/_n	CN6 / CN7
DP3	C2M_02_p/_n	CN28 / CN29		M2C_10_p/_n	CN8 / CN9
DP4	C2M_04_p/_n	CN30 / CN31		M2C_02_p/_n	CN10 / CN11
DP5	C2M_06_p/_n	CN32 / CN33		M2C_04_p/_n	CN12 / CN13
DP6	C2M_05_p/_n	CN34 / CN35		M2C_03_p/_n	CN14 / CN15
DP7	C2M_03_p/_n	CN36 / CN37		M2C_01_p/_n	CN16 / CN17
DP8	C2M_01_p/_n	CN38 / CN39		M2C_09_p/_n	CN18 / CN19
DP9	C2M_08_p/_n	CN40 / CN41		M2C_06_p/_n	CN20 / CN21

5.2   Card Setup and Loopback Test

Before starting up the card, set up the Evaluation board and the card as shown below. The setup and loopback test method are shown below.

1) Confirm that the FMCB voltage (VADJ voltage of FMCB) in the Arria® 10 GX FPGA development kit is set to 1.8 V. (Confirm that a 0 Ω resistor is mounted at R1081, and that the resistors at R1082 and R1083 are not mounted.)
2) Connect the card to the FMC port (FMCB) on the Arria® 10 GX FPGA development kit.
3) Testing channel 0, choose the SMP CN#s corresponding to channel 0 in Table 5-3 and connect cables between those CN#s as illustrated in Figure 5-3.

Table 5-3 Cable Connections by Channel

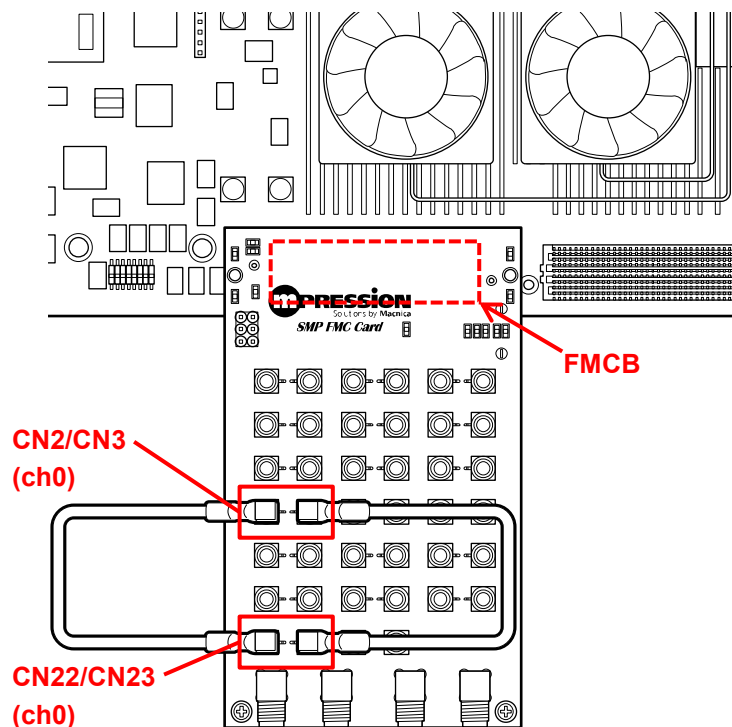| ch#	SMP CN# (P/N)		SMP CN# (P/N)
0	CN22 / CN23	-	CN2 / CN3
1	CN24 / CN25	-	CN4 / CN5
2	CN26 / CN27	-	CN6 / CN7
3	CN28 / CN29	-	CN8 / CN9
4	CN30 / CN31	-	CN10 / CN11
5	CN32 / CN33	-	CN12 / CN13
6	CN34 / CN35	-	CN14 / CN15
7	CN36 / CN37	-	CN16 / CN17
8	CN38 / CN39	-	CN18 / CN19
9	CN40 / CN41	-	CN20 / CN21

Figure 5-3 Arria® 10 GX FPGA Development Kit Assembly

4) Connect the AC adapter to the DC jack on the Arria® 10 GX FPGA development kit.
5) Connect the USB cable to the J3 (On-Board USB Blaster) on the Arria® 10 GX FPGA development kit.
6) Turn on the power to the Arria® 10 GX FPGA development kit.
7) Start up Quartus Prime.

8) Using Quartus Prime Programmer, select sample_top_ch0.sof from the folder in which the sof files listed in Table 4-1 are stored, and write it to the FPGA.
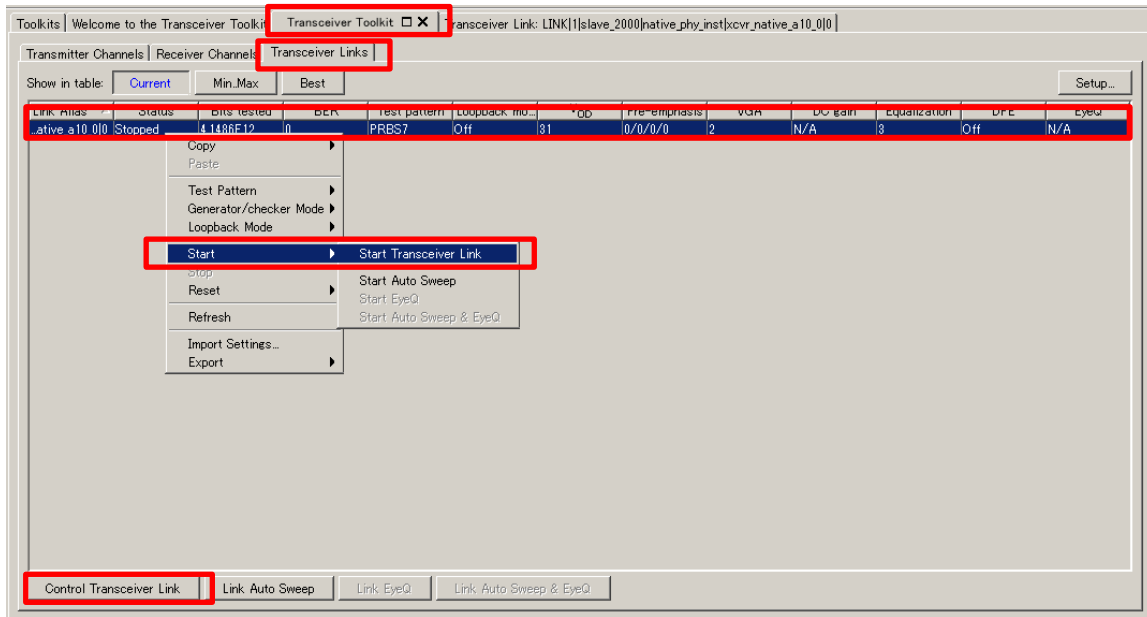
9) Start up the Transceiver Toolkit in Quartus Prime.

Figure 5-4 Transceiver Toolkit Operation Window

10) After starting up the Transceiver Toolkit, wait a short time for the window in Figure 5-4 to appear. Select the "Transceiver Toolkit" → "Transceiver Links" tabs, and then highlight the link that is shown in the list in Figure 5-4.
If you want to change the sof file, or if the window in Figure 5-4 does not open, select the same sof file as the file written to the FPGA previously by selecting "File" → "Load Design..." as shown in Figure 5-5.
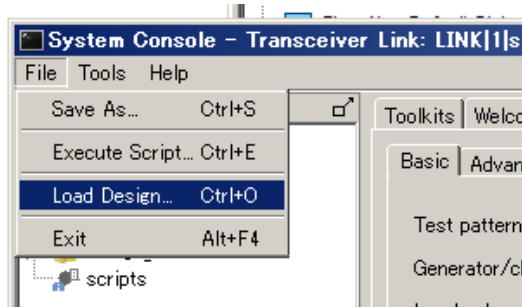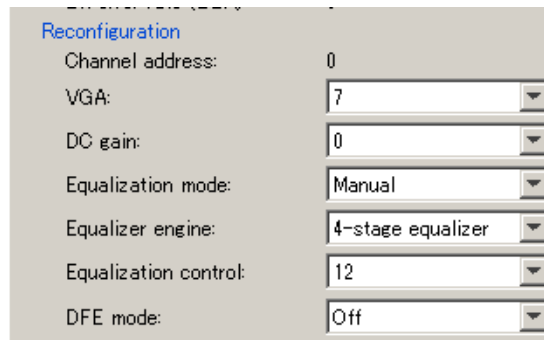

Figure 5-5 Loading sof File

11) Click "Control Transceiver Link" at the lower left.
12) Set the parameters of the Receiver as shown in Figure 5-6.

Figure 5-6 Receiver Settings

13) Click the Transceiver Toolkit tab at the top of the screen to reopen the Figure 5-4 screen. Right-click in the highlighted list to open a context menu. At this point, click "Start" → "Start Transceiver Link" to start the test. If the status on the receiver channel side is green and the bit error rate is 0, as shown in Figure 5-7, then that means the loopback operation is running normally.
(Immediately after starting the test, a few errors may occur. Do Start → Reset to clear the errors.)
If the status is yellow or the BER (Bit Error Rate) does not reach 0, even after resetting, then the result of the loopback test is not good.

Figure 5-7 Loopback Test Results (OK)

Figure 5-8 Loopback Test Results
(Examples of Not Good: Status Is Yellow or BER Is Not 0)

14) When the test is complete, click the Stop button to stop the Transceiver Toolkit, and then turn off the power to the Arria® 10 GX FPGA development kit.
15) To continue testing other channels, refer to Table 5-3 and change the cable connections. Next, close and then restart the Transceiver Toolkit. Then, select the corresponding sof file from Table 4-1, and then do operations from step 6.

6. Reference Information

- Arria® 10 GX FPGA Development Kit
  https://www.altera.com/products/boards_and_kits/dev-kits/altera/kit-a10-gx-fpga.html

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7. Document Revision History

Date	Revision	Changes
January 27, 2017	A	• First Edition
October 23, 2017	B	• Change URL
		•