TE USB Reference Design Test

Introduction

The reference architecture can be tested in two ways:

- USB communication tests + DMA tests
- full test (USB communication tests + DMA tests + other tests)

JTAG and USB connections

Two types of connections are available:

- USB connection (USB (host computer) USB (TE USB FX2 module))
- JTAG connection (normally a JTAG adapter cable; we recommend using the Xilinx Platform Cable USB (USB (host computer) JTAG (TE USB FX2 module)) ;

Xilinx EDK/SDK and iMPACT (or equivalent XMD console commands) could be used to develop/generate an FPGA bitstream (with MicroBlaze's processor and software "merged" into an FPGA bitstream). When the FPGA bitstream is ready, either the USB or JTAG connection could be used to write the SPI Flash memory of the TE USB FX2 module (i.e. download the FPGA bitstream into the SPI Flash memory).

The JTAG connection could also be used to directly download the FPGA bitstream into the FPGA without the need of a reset.

The JTAG connection could be used with Xilinx EDK and SDK GUIs for development and debug purposes; XMD console could also be used.

The USB connection CANNOT be used with Xilinx EDK and SDK GUIs for development and debug purposes. The USB connection should be used after the development and debug process.

With a JTAG connection, the development and debug phases are easier.
Without a JTAG connection, the user/developer should create/use custom functions/programs for the debug phase but some JTAG debug features may not be easily replicated through a USB connection.

USB communication tests + DMA tests only

> Use of JTAG connection is NOT necessary.

To test the USB communication in the Reference Architecture case is necessary:

- to download the correct reference bitstream file in the FPGA and/or SPI Flash;
- the USB FX2 microcontroller on the TE USB FX2 module should contain valid firmware;
- the host computer should have a specific driver installed;
- a USB cable should be used to connect the PC and the FPGA module (USB communication tests and/or power supply);
- run the C# or C++ Reference Project test.

For an example see here.

Full test

> Use of JTAG connection is necessary.

To completely test the Reference Architecture is necessary:

- to download the bitstream file (that create the Microblaze system) and the demo.elf file or to be certain that this two are already downloaded before;

- the USB FX2 microcontroller on the TE USB FX2 module should contain valid firmware;
- the host computer should have a specific driver installed;
- the host computer should have Xilinx EDK installed;
- a JTAG adapter cable. We recommend using the Xilinx Platform Cable USB (USB JTAG) ;
- a USB cable should be used to connect the PC and the FPGA module (USB communication tests and/or power supply);
- run the C# or C++ Reference Project test (USB communication tests + DMA tests).

The procedures are the following (a TE0300 board case is described).

<table>
<tr><th>.bit or .mcs direct download

iMPACT, OpenFut or OpenFutNet</th><th>Procedure SDK: opening and update SDK project only
('updated' SW on 'NOT updated' HW)

Compile and link time less than 1 minute.</th><th>Procedure XPS+SDK: opening and update both XPS and SDK projects
('updated' SW on 'updated' HW')

Resynthesis of reference HW could take from 10 minutes to 1 hour(1)</th></tr>
<tr><td>Skip.</td><td colspan="2">Copy IP Cores and drivers used in TE reference projects</td></tr>
<tr><td>Skip.</td><td>Skip.</td><td>Update XPS project from an old version to a new one</td></tr>
<tr><td>Skip.</td><td>Skip.</td><td>Export the HW design to SDK</td></tr>
<tr><td>Skip.</td><td>Open SDK project and (if needed) update the SDK project from an old version to a new one</td><td>Recreate SDK project using the new exported HW project</td></tr>
<tr><td>Skip.</td><td colspan="2">Generate a new link script</td></tr>
<tr><td>Download the reference bitstream to the FPGA using iMPACT, Open_FUT or OpenFutNet</td><td colspan="2">Download the reference bitstream to the FPGA using SDK</td></tr>
<tr><td>Skip.</td><td colspan="2">Run the demo project to run on board tests</td></tr>
<tr><td colspan="3">Check the fiirmware of FX2 microcontroler</td></tr>
<tr><td colspan="3">USB communication tests + DMA tests</td></tr>
</table>

(1) It depends on which computer is used (workstation, regular PC or low-end PC).

> For old version of Xilinx EDK with older version of Project Reference (they do no longer exist on GitHub) the procedure is the folowing
>
> - Open the project by double-clicking on the *system.xmp* file. The Xilinx Platform Studio is opened.
> - If you open the project with a new version of Xilinx XPS, the tool will try to update all the components of MicroBlaze system. In some case it is not possible to refuse the update.
> - To compile the project press the "Download Bitstream to the FPGA" button.
> - If the HDL design was successfully implemented and downloaded to the TE USB FX2 module, you can proceed to compile the MB software. Press the "build all user applications" button.

Copy IP Cores and drivers used in TE reference projects

To use the "demo" application contained in TE0xxx-Reference-Designs\reference-TE0xxx\SDK\SDK_Workspace, you should (1) copy GitHub's "TE-EDK-IP" folder (from https://github.com/Trenz-Electronic/TE-EDK-IP) to the folder that contains the folder "reference-TE0xxx":

1. C:\XilinxProject, if you have copied the folder "TE0xxx-Reference-Designs\reference-TE0xxx" to "C:\XilinxProject" ("C:\XilinxProject\reference-TE0xxx" and "C:\XilinxProject\TE-EDK-IP");
2. otherwise you must copy the contents of GitHub's 'TE-EDK-IP' folder inside the already existent empty folder "TE0xxx-Reference-Designs\TE-EDK-IP".

> You should not alter folder nesting (double nesting) because is a Xilinx Platform Studio requirements.

✓ **Choice assumed in this step and in the following ones.**

From now on, the choice (1) is assumed.

Check the firmware of FX2 microcontroler

The FX2 microcontroller on the TE USB FX2 module should contain valid firmware before proceeding.

- If the FX2 microcontroller has not been programmed before, please follow the instructions here and here. You can use Cypress, Python OpenFut or C# OpenFutNet programs.
- If you are sure that the FX2 microcontroller is properly connected, you can connect to the TE USB FX2 module with a JTAG adapter cable. We recommend using the Xilinx Platform Cable USB.
- Then connect the TE USB FX2 module to a USB cable.