Application Report
SLAA752–September 2017

Automated Data Transfer Between TSW40RF8x and TSW14J56 using MATLAB

ABSTRACT

Interfacing multiple FPGA evaluation modules (EVM) simultaneously has many applications when testing high speed analog-to-digital (ADC) and digital-to-analog (DAC) converters. This document demonstrates how the use of two TSW14J56 evaluation platforms can be automated in HSDC Pro with the use of MATLAB scripting for RX/TX (Ping-Pong) type applications. An example using two TSW40RF82 EVMs is provided in order to establish a baseline for application specific needs.

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1 Introduction

Since only one instance of HSDC Pro can be running at a given time, running two FPGA Capture Cards simultaneously is not possible. This application note provides a path forward by automating the capture and reproduction of data by managing HSDC Pro active connections. MATLAB is used to automate functions in HSDC Pro which can be used as a ping-pong (capture data from ADC, send data to DAC) loop.

The TSW40RF8x is an RF sampling solution board that houses a dual 9-GSPS DAC (DAC38RF80) and a dual, 14-bit, 3-GSPS ADC (ADC32RF45). The example provided uses two TSW14J56s and TSW40RF82s, but can be easily modified to use any evaluation module that is supported by HSDC Pro.

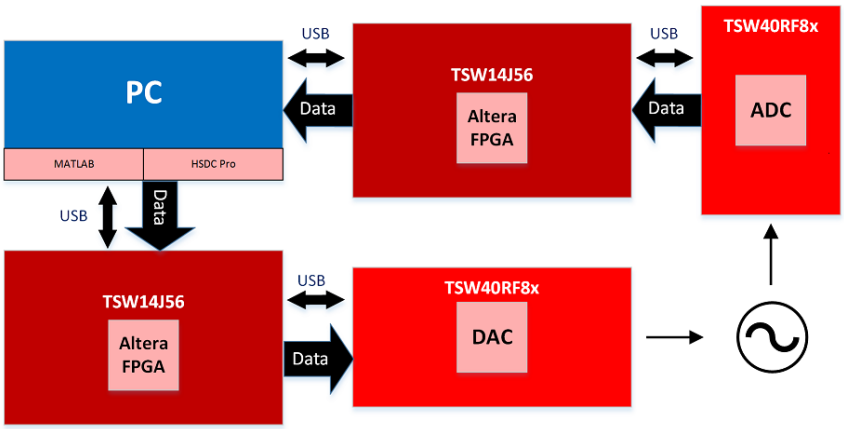

Figure 1. Block Diagram of Setup

2 Hardware Setup

This example requires two TSW14J56s, and TSW40RF8xs, and a PC (with HSDC Pro and TSW40RF8x EVM GUI installed), as shown in Figure 2.

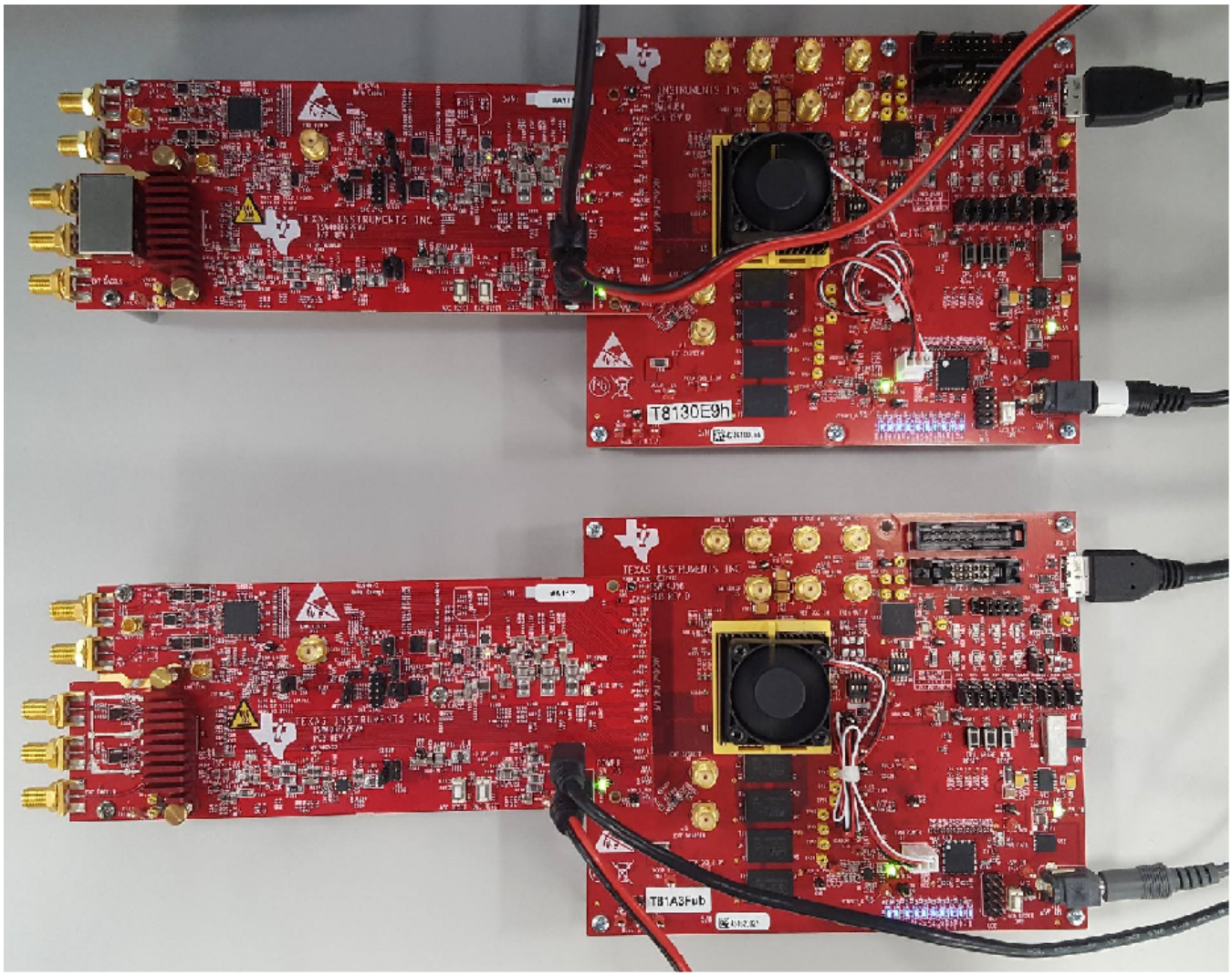

Figure 2. TSW40RF82 and TSW14J56 Setup

Before using HSDC Pro, the TSW40RF82s must be configured to their default state using the TSW40RF8x EVM GUI by clicking the “LOAD DEFAULT” button, as shown in Figure 3.

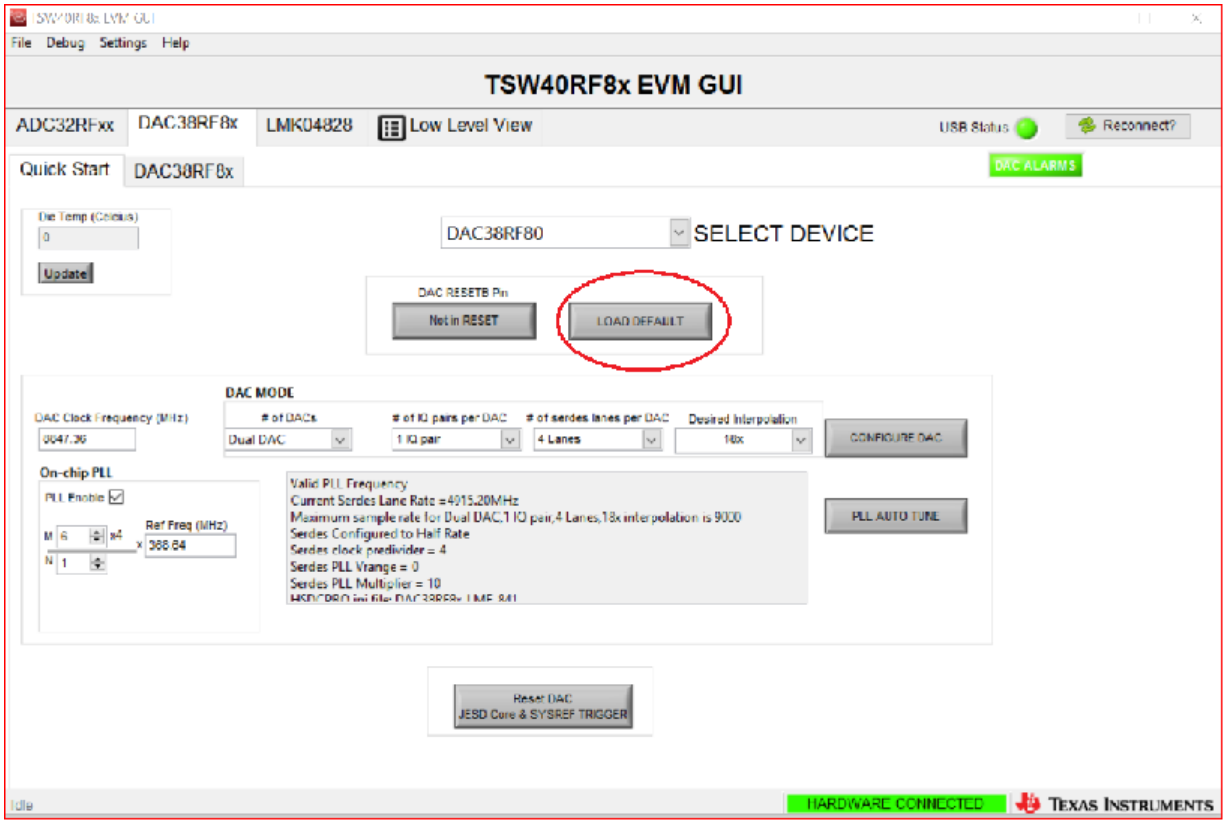

Figure 3. TSW40RF8x EVM GUI

3 Example Code

HSDC Pro includes an automation dll (Dynamic Library) that can be accessed by different programing and scripting languages. By using this dll, HSDC Pro functions are called by MATLAB that directly control the program’s operation. For instance, this example code requires the use of the dll function “Pass_Capture_Event” to capture data from the ADC. When using the HSDC Pro GUI, clicking the button “Capture” calls the “Pass_Capture_Event”; however, by using MATLAB, there is no need to interact with the HSDC Pro GUI, so operating and switching EVMs is done autonomously.

3.1 Before Starting

Download and install the HSDC Pro Dual Capture Automation install file from www.ti.com/tool/DATACONVERTERPRO-SW/ . In order to more closely follow the proceding steps, install the software to the default location "C:\Program Files (x86)\Texas Instruments\HSDC Pro Matlab Automation\Source Code\HSDC Pro Dual Capture Automation". Launch MATLAB, and set the directory where the user installed HSDC Pro Dual Capture Automation on their computer as the MATLAB working directory.

NOTE: Installation of the Labview 2014 Runtime Engine (32 or 64 bit) is required in order to use the automation dll.

http://www.ni.com/download/labview-run-time-engine-2014/4887/en/(32-bit)

http://www.ni.com/download/labview-run-time-engine-2014/4889/en/(64-bit)

3.2 Setting Up the Example Code

Before the program can perform any useful actions, it must first know where its resources reside. This is done by adding the folder path (your MATLAB working directory) at the beginning of the code. (Currently, all files should be residing in this folder. If not, refer back to *Before Starting* .)

```
% Add folder into path that contains the Automation DLL
addpath(genpath('C:\Program Files (x86)\Texas Instruments\HSDC Pro Dual Capture Automation\Source
Code\HSDC Pro Matlab Automation'));
% Load the Automation DLL
if ~libisloaded('HSDCProAutomation_64Bit')     [notfound,warnings]=loadlibrary('C:\Program Files
(x86)\Texas Instruments\HSDC Pro Dual Capture Automation\Source Code\HSDC Pro Matlab
Automation\HSDCProAutomation_64Bit.dll', @HSDCProAutomationHeader);
end
```

After this point, the program can be considered to be in two sections: declaring variables and function calling. Function calling does not require any modification since the functions are executed in the same order for all HSDC Pro devices, so only Declaring Variables are looked at further.

3.2.1 Declaring Variables

In this section, all of the settings and selections that are available on HSDC Pro (Firmware, Data Rate, Window Type, etc…) are determined. Each variable name corresponds to its identical counter-part in HSDC Pro.

There are three critical parameters that must be entered in order for HSDC Pro to make a connection to an ADC or DAC EVM. The following code shows the three parameters for the ADC, but the DAC has the same parameters as well.

```
            % Board Serial Number with board typ separted by hyphen. Eg: TIVHIV9Z-TSW1400
BoardSerialNumberADC = 'T81A3Fub-TSW14J56revD';
% Firmware file path which needs to be loaded to the board.
FirmwareFilePath = 'C:/Program Files (x86)/Texas Instruments/High Speed Data Converter
Pro/14J56revD

              Details/Firmware/TSW14J56REVD_FIRMWARE.rbf';
ADCDevice = 'ADC32RF80_LMF_8821';
```

BoardSerialNumberADC is a device specific USB address for the TSW14J56. “FirmwareFilePath” loads the TSW14J56 with its respective firmware. “ADCDevice” selects what ADC EVM the user is connecting to and its data transmission configuration (LMF), so this name corresponds directly with the ADC drop down selection box.

All parameters after these are used to set RX/TX preferences for the ADC and DAC, and have functional, preset values assigned, but can be freely modified in accordance with the limits of the ADC and HSDC Pro.

3.2.2 Running the Example Code

After all variables have their desired values, the example code can be run. For each function that is called, an error code status is provided. If no errors are detected, the error code status will be “0”. If any other number is present in the error code status, look up that error code number in the document “Automation DLL Error Codes.csv”to determine the specific error (located here C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro\HSDCPro Automation DLL\) . While running the example code, the HSDC Pro GUI can be seen carrying out the commands.

NOTE: Ensure that there are not any dialogue boxes open in HSDC Pro before running the example code. This causes HSDC Pro to ignore any commands coming from MATLAB, so the program will not run successfully.

4 Additional Considerations

The ADC sample size is directly connected to the time required to save the ADC samples. To increase the overall speed of the example code execution time, and if the application needs allow, it is recommended to reduce the number of ADC samples taken.

5 Summary

This application note illustrates how users can automate data transfer between ADC and DAC EVMs using MATLAB scripting. The TSW14J56 capture card serves as the development platform and interface for the EVMs and the PC. Procedures and steps are thoroughly described in order to provide a working example that can be easily modified to fit the user's needs.

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