Team: System Solutions

Multiple Board Communication Test

Board Communication Test 1

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Revision History

Name	Date	Revision Made	Version Number
Alexis Wilson	02/07/2020	Creation of Document	1.0

Purpose of Test:

The purpose of this test is to verify that multiple boards are able to pass signals from one to the another. This test will demonstrate how signals will be modified and behave from the output of each board to the input of the other board. It will also aid in the understanding of the irregularities of each board.

Requirements:

To perform this test, one will need two STEMLab 125-14 Field Programmable Gate Arrays (FPGAs) and two power cables and two Ethernet cables. One will also need a switch/hub, an Ethernet cable, and a laptop/computer. No internet or outside source will be required to send signals from one board to another. Knowledge of signals and external noise on a system may help with interpreting any irregularities in the input signal coming from the output of the other board.

NOTE: This test can be run with more than 2 boards, it will just require more repetitions at certain steps.

CAUTION: Before touching the STEMLab 125-14 board, make sure to ground oneself by touching metal or wearing an ESD strap so that no electric discharge can cause harm to the components on the board.

Test Implementation:

Setup:

1. Take the first STEMLab 125-14 board out of the box and plug in the FPGA to an outlet.
    a. The power plug in is on the left side of the board far left of the ethernet cable.
2. Repeat step 1 with board 2
3. Take an ethernet cable and plug it back into ethernet slot on the first FPGA.
4. Take the other end of the ethernet cable and plug it into a LAN slot of the network switch/hub.
5. Repeat steps three and four for the second FPGA
6. Take the third Ethernet cable and plug it into the next LAN spot on the network switch/hub
7. Take the other end of the Ethernet cable and plug it into the Ethernet port of the computer/laptop.
8. Once the boards are on and link light is coming from the switch for all three Ethernet connections, use an internet browser to connect to the board through Ethernet

    a. Type rp-xxxxxx.local/ and press enter (The xxxxxx is the 6 Hexadecimal value on the Ethernet port of each FPGA)
    b. Repeat for the second FPGA
9. If the setup was done correctly, your setup should mimic Figure 1 below:
    a. In picture below, the yellow cable is only required if a SATA connection is in use to synchronize the clock signals between boards

Figure 1: Multiple Boards Linked to Machine Set Up

10. Once one can access both boards interfaces, attach SMA-SMA cables from the output of board one to the input of board two
    a. Take one end of the SMA-SMA cable and gently screw it into the Fast Analog Input of the first board
        i. Farthest left SMA connector on FPGA
    b. Take the other end of that SMA-SMA cable and attach it the First Fast Analog Output of the second board
        i. This pin is the second to the right or third to the left SMA connector on the FPGA
11. On board 1 open up the Oscilloscope and Function Generator
    a. This board will be utilizing the built-in Oscilloscope
12. On board 2 open up the Oscilloscope and Function Generator
    a. This board will be utilizing the built-in Function Generator
13. Once this is loaded, setup is complete

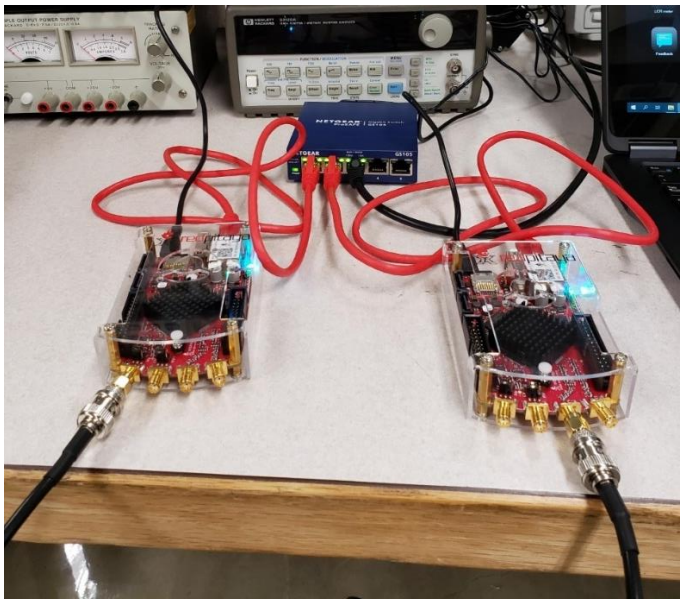

Figure 2: Multiple Board Communication Test Final Set Up

Procedure:

1. On board 2, use the Function Generator capabilities to push an output signal of 1V
    a. Generate by clicking the OUT1 settings icon
        i. Press Show
        ii. Set the Amplitude to 1 V
        iii. Set the frequency to 1000 Hz
        iv. Set trigger to internal
2. One board 1, just the Oscilloscope capabilities to read the Fast Analog Input
    a. Click the IN1 settings icon
    b. Click Show
3. Back on board 2's Function Generator, Click Run on the top right-hand side of the screen

Results:

1. At the end of step 1, the output from board 1 is shown in Figure 3 below:
    a. Note this signal is shown at 1 V/div

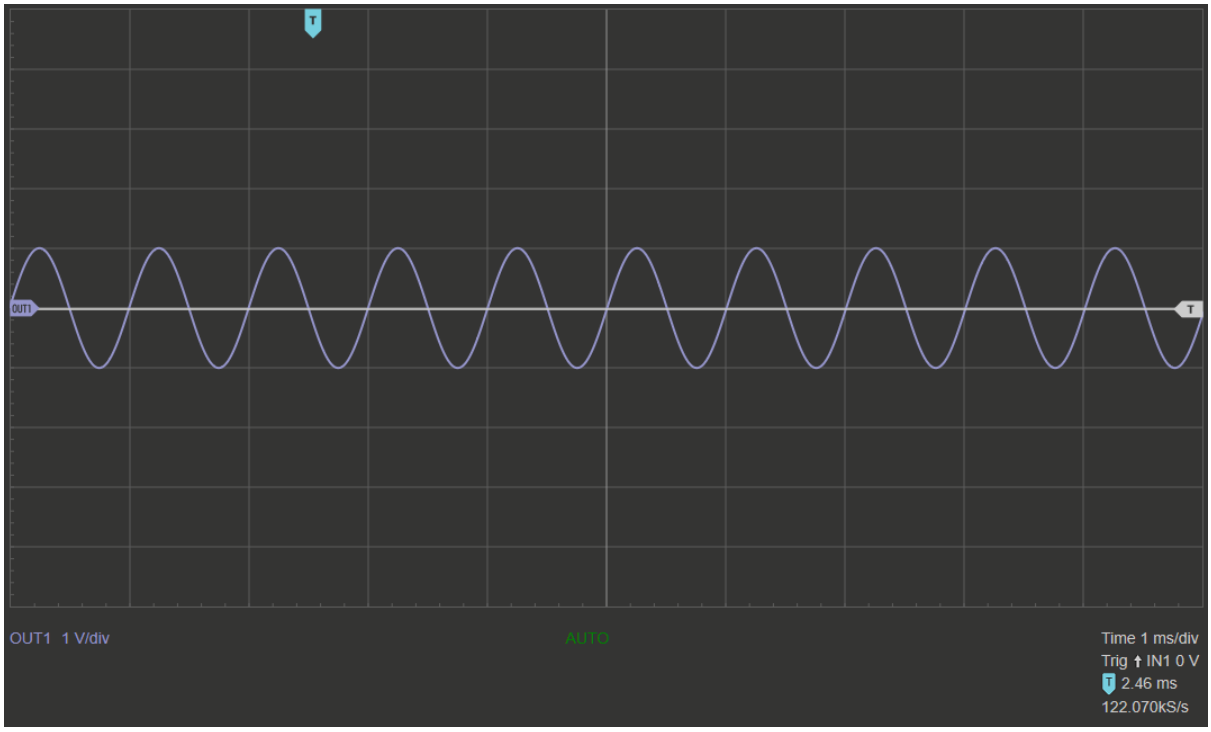

Figure 3: Output from Board 1

2. After step 3, the input from board 2 on board 1 is shown in Figure 4 below:
    a. Note the signal is zoomed in at 20mV/div vs the 1 V/div shown in Figure 3

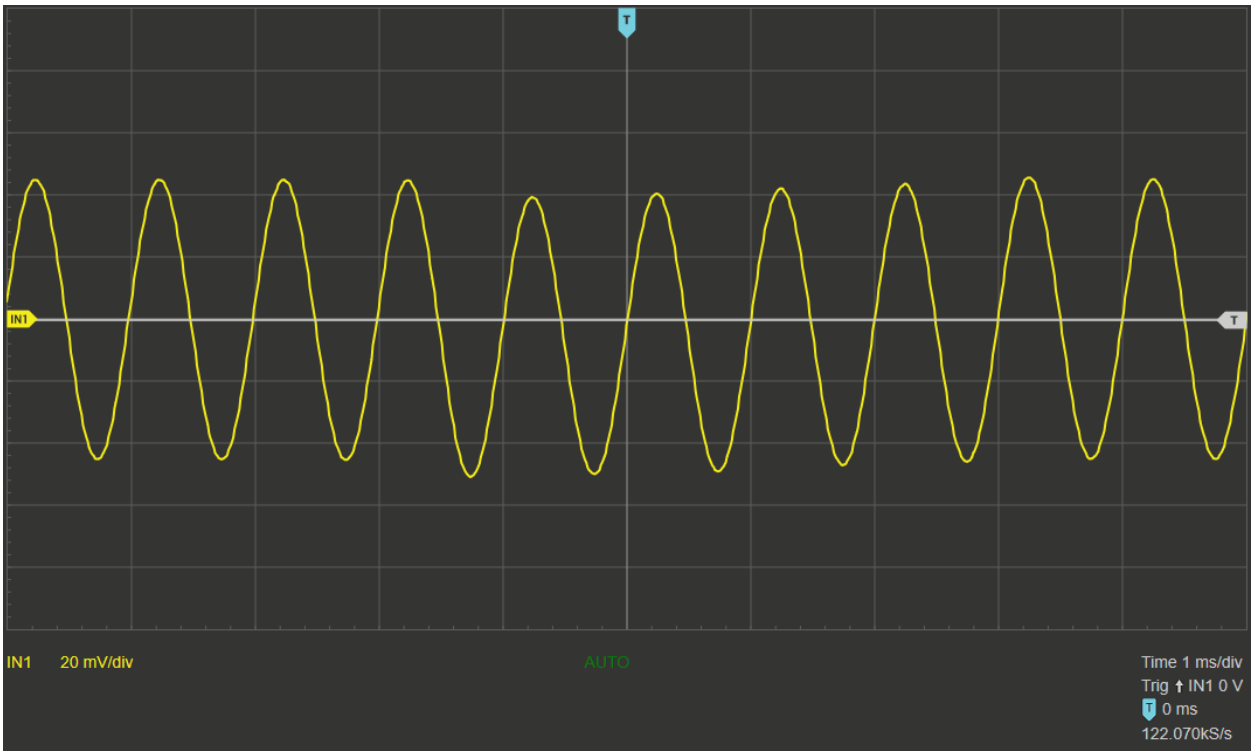

Figure 4: Input from Board 1 on Board 2

Conclusion:

The purpose of this test was to see if passing data from one board to the other was possible and see how the signals behave from one board to the other. The other reason we performed this test was so we can see if there are any irregularities when taking inputs and pushing outputs from the Red Pitaya Systems. This test verifies that it is possible to pass data from one board to another accurately.