Mercury Test Plan - Revision v0.5 - 10 December 2008

This Document describes the methodology for testing the HPSDR Mercury Project Receiver board.

1 Test Fixture Description

There are two test fixtures, one for each of the two tests performed on the Mercury Board.

1.1 Test #1a Fixture Description

The JTAG test fixture consists of an empty Atlas Backplane (no loopback cable). Power is supplied to the board under test via the Atlas Backplane through an ATX connector by a PicoPSU-60-WI 60W. The PicoPSU is an ATX style power supply that receives its power from a nominal 12VDC source. The PicoPSU power supply can be purchased at http://www.mini-box.com/

A PC is used to run Altera Quartus II that uses a USB Blaster to load the FPGA in JTAG mode.

The on-board LEDs are used as pass/fail indicators for all tests.

1.2 Test #1b Fixture Description

The Loopback test fixture consists of an Atlas Backplane populated with a loopback cable. Power is supplied to the board under test via the Atlas Backplane through an ATX connector by a PicoPSU-60-WI 60W. The PicoPSU is an ATX style power supply that receives its power from a nominal 12VDC source. The PicoPSU power supply can be purchased at http://www.mini-box.com/

A PC is used to run Altera Quartus II that uses a USB Blaster to load the serial PROM in Active Serial mode.

The on-board LEDs are used as pass/fail indicators for all tests.

1.3 Test #2 Fixture Description

The RF/Codec test fixture consists of an Atlas Backplane populated with Ozy and Mercury boards. Power is supplied to the individual boards via the Atlas Backplane through an ATX connector by a PicoPSU-60-WI 60W. The PicoPSU is an ATX style power supply that receives its power from a nominal 12VDC source. The PicoPSU power supply can be purchased at http://www.mini-box.com/

A PC is used to run a Windows batch file (Initozy11a.bat) that loads initialization commands to the Ozy board. The same PC starts an instance of the Flex-Radio PowerSDR console that has been modified for use with the Mercury board.

The PowerSDR console is required to command the Mercury board.

2 Test Fixture Hardware

2.1 Test Fixture 1a

Test fixture #1a uses the following additional hardware:

- An Altera USB Blaster to program the FPGA on the Mercury board.

2.2 Test Fixture 1b

Test fixture #1b uses the following additional hardware:

- An Altera USB Blaster to program the serial PROM on the Mercury board.

- An Atlas loopback cable. (This is the same cable that is used for Ozy testing.)
- A 5-pin loopback cable for J1.
- A 20-pin ribbon loopback cable for J5.
- A 10-pin ribbon loopback cable for J6.

2.3 Test Fixture #2

Test fixture #2 uses the following additional hardware:

- A USB cable to connect the Ozy board to the PC running the PowerSDR console.
- An Elecraft XG1 signal generator and BNC M/M adapter.
- Two sets of earphones to test the line and headphone outputs.

3 Test Software

In order to perform testing it is necessary to download and install the following software.

3.1 USBIO or libusb-win32

The libusb-win32 driver set is preferred and is available from the www.sourceforge.net website. USBIO is available for download from www.flex-radio.com.

3.2 A Mercury enabled PowerSDR folder

PowerSDR is not automatically "installed" in Windows. Instead a folder with a Mercury enabled version of PowerSDR.exe and all other required files is copied into Windows. PowerSDR.exe is then run from that folder. A special version (**21Aug2008 -- 1.10.4+ BaseSVN 2025**) of PowerSDR is required for testing Mercury. This version of the PowerSDR file folder is available at www.hpsdr.org in the SVN repository.

After the software installation, create desktop shortcuts to the initozy11a.bat and PowerSDR.exe files and place them on the PC Desktop. Modify the PowerSDR shortcut by adding the expression:

 "--ignore-pp-ppt"

after the "/$PATH$/PowerSDR.exe" in the properties pane of the shortcut. This statement will keep the absence of an Ozy to SDR-1000 parallel port connection from turning on the external PTT function.

If it is present, delete the PowerSDR.mdb file from the PowerSDR folder. This will cause the Initial Configuration Wizard in PowerSDR to generate a new database file the first time the console is opened.

3.3 PowerSDR Files

The PowerSDR files that are required to configure and run Ozy and Mercury are listed below:

ADODB.dll

CATStructs.xml

DttSP.dll

fftw_wisdom.exe

wisdom

HPSDR_USB_LIB_V1.1.dll

Initozy11a.bat*

Interop.ADOX.dll

JanusAudio.dll

msadox.dll

Ozy_Janus.rbf

ozyfw-sdr1k.hex

PA19.dll

PortTalk.dll

porttalk.sys

power.csv

PowerSDR.exe

PowerSDR.mdb

libfftw3f-3.dll	pthreadVC.dll
libusb0.dll	sleep.exe
load_firmwareV1.1.exe	upload_fpgaV1.1.exe
morsedef.txt	write_I2cV1.1.exe

*The current version is Initozy11a.bat

4 Hardware Setup

4.1 Test Fixture #1a

Connect the USB Blaster to a USB port on the computer and Mercury connector J7 (JTAG).

Connect an ATX power supply connector to the Atlas backplane.

4.2 Test Fixture #1b

Plug the Atlas loopback cable into Atlas connectors J1 (connector with few wires) and J3 (connector with many wires).

Plug loopback cables into Mercury connectors J1, J5 and J6.

Connect the USB Blaster to a USB port on the computer and Mercury connector J4 (PROM).

Connect an ATX power supply connector to the Atlas backplane.

4.3 Test Fixture #2

Connect a USB cable from the PC to the USB connector on the Ozy board.

Attach the XG1 signal generator to the RF Connector on the Mercury board.

Connect an ATX power supply connector to the Atlas backplane.

5 Software Setup

5.1 libusb-win32 or USBIO Installation

Download and install libusb-win32 per its included readme file. If you have ever used the PowerSDR USB Adapter cable you may already have the required files installed on your PC.

5.2 Power SDR Initialization and Configuration

Double-Click on the PowerSDR Shortcut on the Desktop. The Startup Wizard will ask a number of questions. In response:

- Model: SDR-1000
- RFE Expansion Board: No
- External Clock Option: No
- USB to Parallel Adapter: No
- Sound Card: HPSDR Janus/Ozy (USB2)

Verify that the top panel of the PowerSDR console shows the message ***PP PTT disabled*** on it.

From the main drop down menu in PowerSDR open the HPSDR Setup Window (Setup ->General->HPSDR). In the "HPSDR Hardware Present" frame check the box "Mercury". In the "10 MHz Clock Source" frame click the "Mercury" radio button. In the "122.8 MHz Clock Source" frame click the "Mercury" radio button. Close the menu by clicking the OK button.

Set the frequency of the PowerSDR console to 7.040 MHz. This is setting matches the XG1 output frequency. Set the Display Mode to Scope. Shut down PowerSDR.

6   Mercury Testing

6.1   Mercury Test #1a and #1b Summary

1. Power/Config LEDs (no test required):
    a. D14 (3P3VA_LT2208)
    b. D15 (3P3VA)
    c. D16 (2P5VA)
    d. D17 (3P3VD)
    e. D3 (DONE)
2. LED D4 (122.88MHz Osc)
3. LED D5-D11 (rotate when all tests pass)
4. U9 FPGA serial EPROM
    a. program through J4
    b. load FPGA using active serial mode
5. Load FPGA through JTAG header J7
6. External clock buffer test: J1
7. 122.88MHz PLL test
8. PIO test: J5 (17 GPIO lines)
9. PIO Test: J6 (4 SPI lines)
10. PIO test: relay
11. JTAG interface: TMS, TCK, TDO, TDI
12. Atlas Bus interface
    a. A[2:22], A[31]
    b. C[2:25], C[27], C[29], C[31]

6.2   Mercury Test #2 Summary

1. LEDs D14 – D17 (Power)
2. LED D3 (FPGA Code Loaded)
3. J2 (RF in)
4. FL1/T1/U6/U5 (front end through ADC)
5. K1 (attenuator)
6. U11 (FPGA)
7. Atlas bus interface, U11/bus and bus/U16
8. U16 (Codec)
9. J10 (line out)
10. J11 (phones out)

6.3   Mercury Test Procedure #1a

1. Inspect PCB and serial number label
2. Install jumpers
   a. JP1 short pins 1-2 (top) (clk select)
   b. JP2 short pins 2-3 (bottom) (MSEL2)
   c. JP3 short pins 1-2 (top) (MSEL1)
   d. JP4 short pins 2-3 (bottom) (MSEL0)
   e. JP8 short pins 1-2 (10MHz osc pwr)
   f. JP9 short pins 1-2 (122.88MHz osc pwr)
3. Plug Mercury into Atlas backplane between loopback connectors
4. Plug loopback plugs onto J1, J5 and J6
5. Plug byte blaster onto J7 and power up Atlas backplane
6. Load MercuryProdTest.sof using JTAG and verify that LED D3 is on, LEDs D4-10 rotate and LED D11 blinks
7. Power down Atlas backplane and remove loopbacks from J1, J5 and J6
8. Move jumper from JP1 pins 1-2 (top) to JP1 pins 2-3 (bottom)

6.4   Mercury Test Procedure #1b

1. Plug Mercury into Atlas backplane between loopback connectors
2. Plug byte blaster onto J4 and power up Atlas backplane
3. Load Mercury.pof using AS, remove the programmer and verify that LEDs D3, D9 and D10 are lit
4. Power down Atlas backplane

6.5   Mercury Test Procedure #2

1. Verify Jumpers:
   a. JP1 short pins 2-3 (bottom) (clk select)
   b. JP2 short pins 2-3 (bottom) (MSEL2)
   c. JP3 short pins 1-2 (top) (MSEL1)
   d. JP4 short pins 2-3 (bottom) (MSEL0)
   e. JP8 short pins 1-2 (19MHz osc pwr)
   f. JP9 short pins 1-2 (122.88MHz osc pwr)
2. Plug the Mercury board into the Atlas backplane
3. Connect headphones to J10.
4. Power up the Atlas backplane
5. Verify LED's D3, D9 and D10 on Mercury are lit
6. Double-click on the Initozy11a.bat shortcut on the PC desktop
7. Verify that on the Ozy board LEDs D5-D8 and D12 are lit, LEDs D9 and D10 are alternately flashing, and LED D1 is rapidly flashing.

8. Start the PowerSDR Console and verify that LED D1 stays on solid..

9. Connect the XG1 signal generator to J2, set it to 50uV output level and turn it on

10. Verify that the display window on the PowerSDR console is showing a signal at 7040kHz at about -73dBm.

11. Engage the attenuator in PowerSDR (Setup->HPSDR->Uncheck Preamp On Box) and verify that the signal level is now about -93dBm.

12. Check for audio from the headphones (from J10).

13. Remove the headphone plug from J10, insert it into J11 and check for audio in the headphones.

14. Power down Atlas backplane.

6.6 Package PCB for Shipment

Place the board in an antistatic bag and seal.