Deprecation Notice:

Beginning with OpenCPI Version 1.5, support for Lime Microsystems' Zipper card is now deprecated. This document will not be updated any further.

Important Note: The Zipper Carrier Card is no longer being produced by the manufacturer. The card is Open Source so you are able to fabricate one yourself.

Required Modifications for Myriad-RF 1 and Zipper Daughtercards

To support OpenCPI RF applications on the Zedboard (zed), Xilinx Virtex6 (ml605), and Altera Stratix 4 (alst4) development kits, 2 daughtercards are required:

1) Myriad-RF 1 board

2) Zipper FMC/HSMC carrier card for Myriad-RF 1

Figure 1: Myriad-RF 1 Board

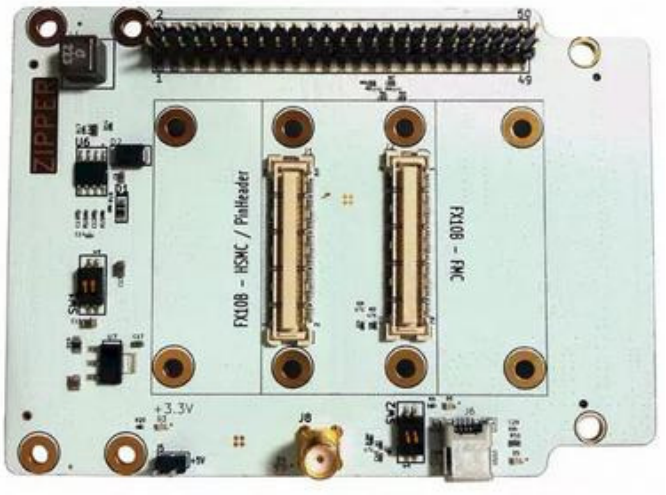

Figure 2: Zipper FMC/HSMC carrier card for Myriad-RF 1

The Myriad-RF 1 is a transmit/receive digital-to-RF module based on the Lime Microsystems LMS6002D transceiver IC. The Zipper carrier card provides an adapter for the Myriad-RF 1 ADC/DAC interface to both FMC and HSMC connectors. Both daughtercards are commercially available from DigiKey. For additional information on the daughtercards as of October 2016, see the Reference Documentation section of this document and Table 1.

Purpose of this Document

Before using the daughtercards with OpenCPI on the zed, ml605 and alst4 platforms, a number of hardware modifications are required. The below sections describe the modifications in detail for Version 1 Revision 1 (v1 r1) of Myriad-RF 1 and Version 2 Revision 1 or 3 (v2 r1 or v2 r3) of the Zipper carrier card. The schematic for any other revision should be verified prior to making these changes.

Daughtercard	Version	Revision	Digikey Part Number	Price
Myriad-RF 1	1	1	1434-1001-ND	$299
Zipper Carrier Card	2	1 or 3	1434-1002-ND	$199

Table 1: Daughtercard Version & Part Numbers

Zipper: Known Issues

The HSMC and FMC slot specifications include card presence pins which allow an FPGA host board to determine the presence of an HSMC/FMC mezzanine card via the mezzanine card shorting these pins to ground. Note that the Zipper Board v.2 r.1 does not short the FMC H2 PRSNT_M2C_L pin to ground. This has the side effect of OpenCPI assemblies erroneously reporting their slotCardIsPresent properties as false for the zed and ml605 platform workers even when a card is present.

Zipper: Configure SW1 for power up

On the Zipper, SW1 is a manual slider switch that powers on to the Zipper and Myriad cards when power is applied to the Zedboard. Configuring SW1 for 'always on', allows the Zedboard power switch to act as the system power switch.

Configure slider switch 1 of SW1 to be in the 'ON' position, as shown in Figure 3. Note: slider switch 2 is not connected in the schematic.

Once the system is powered on, two green LEDs (Zipper(D3) and Myriad(LD1)) will illuminate.

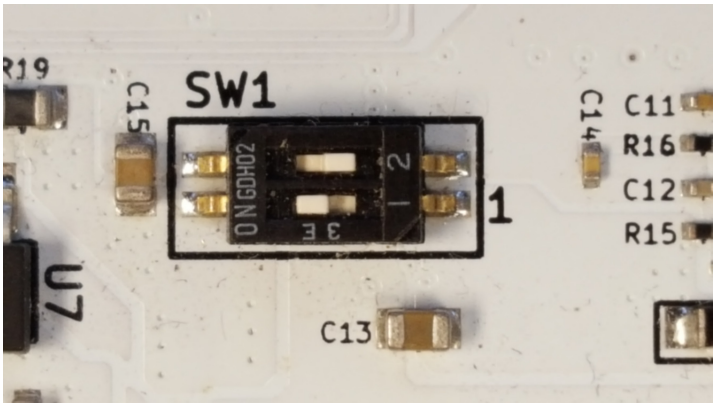

Figure 3: Configured Zipper SW1: slider switch 1 is 'ON'

Zipper: Modify voltage divider to set FMC/HSMC IO voltage to 2.5 V

The input-output (IO) voltage on the Zipper carrier card FMC and HSMC connectors is configurable. A study of the supported OpenCPI platforms was conducted to determine if there was a common I/O voltage that could be used for the FMC/HSMC interfaces. Table 2 lists the supported IO voltages of the OpenCPI platforms. Given this information, 2.5 V is the logical choice because all the platforms support this IO voltage.

Platform	Connector Type	Supported IO Voltages
zed	FMC	1.8 V, 2.5 V, 3.3 V
ml605	FMC	2.5 V
alst4	HSMC	2.5 V

Table 2: OpenCPI Platform IO Voltages

On the Zipper carrier card, the IO voltage is determined via a voltage divider circuit, and can be adjusted by replacing one resistor. The default IO voltage is 3.3 V. Figure 4 shows the voltage divider circuit from page 6 of the Zipper schematic [1]. To set the IO voltage to 2.5 V, replace R82 with a resistor of value 150 ohms.

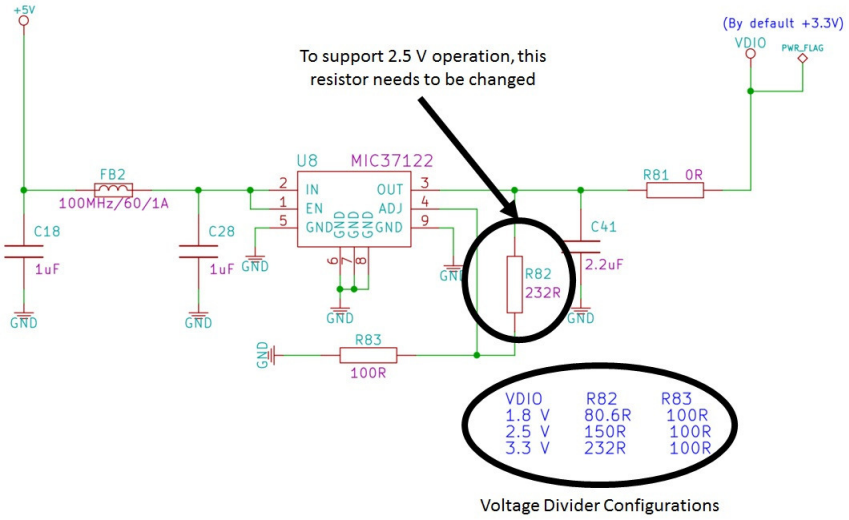

Figure 4: Zipper IO Voltage Divider Circuit

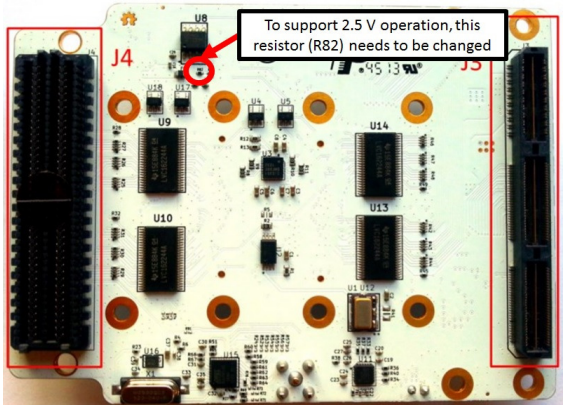

Figure 5: Zipper IO Voltage Divider Layout

Zipper: Connect I2C, SPI, and GPIO buses to FMC/HSMC connectors

The default mode of operation for control of the Zipper and Myriad-RF 1 is via USB (J6) on the Zipper carrier card. The USB port connects to a microcontroller (U15) which implements the I2C, SPI, and GPIO buses.

The OpenCPI mode of operation controls the Zipper and Myriad-RF 1 through HDL device workers on the FPGA and RCC proxy workers, all of which are located on the OpenCPI enabled platform. Therefore, hardware modifications are made to the Zipper to reroute the I2C, SPI and GPIO signals from the microcontroller to the FMC/HSMC connectors which interface to the FPGA. Note: The Zipper has a PLL Frequency Synthesizer (ADF4002) which is currently not supported by AV and these modifications do not support access to the SPI interface of this device.

The layout of the Zipper carrier card has traces for both USB and FMC/HSMC control with 0 ohm resistors that can be placed or removed depending on which interface is being used. Figures 6 and Figures 7 and Table 3 specify which resistors need to be removed and which ones need to be placed to use the Zipper carrier card on OpenCPI platforms.

Description	Resistor to remove (default is placed)	Resistor to place (default is removed)
I2C SDA	R76	R74
I2C SCL	R77	R75
SPI RESET	R60	R24
SPI MISO	R61	R54
SPI MOSI	R62	R55
SPI CLK	R63	R56
SPI CS	R64	R57
GPIO0	R68	R71
GPIO1	R69	R72
GPIO2	R70	R73
GPIO3	R80	R90

Table 3: Required Resistor Modifications for Zipper Carrier Card

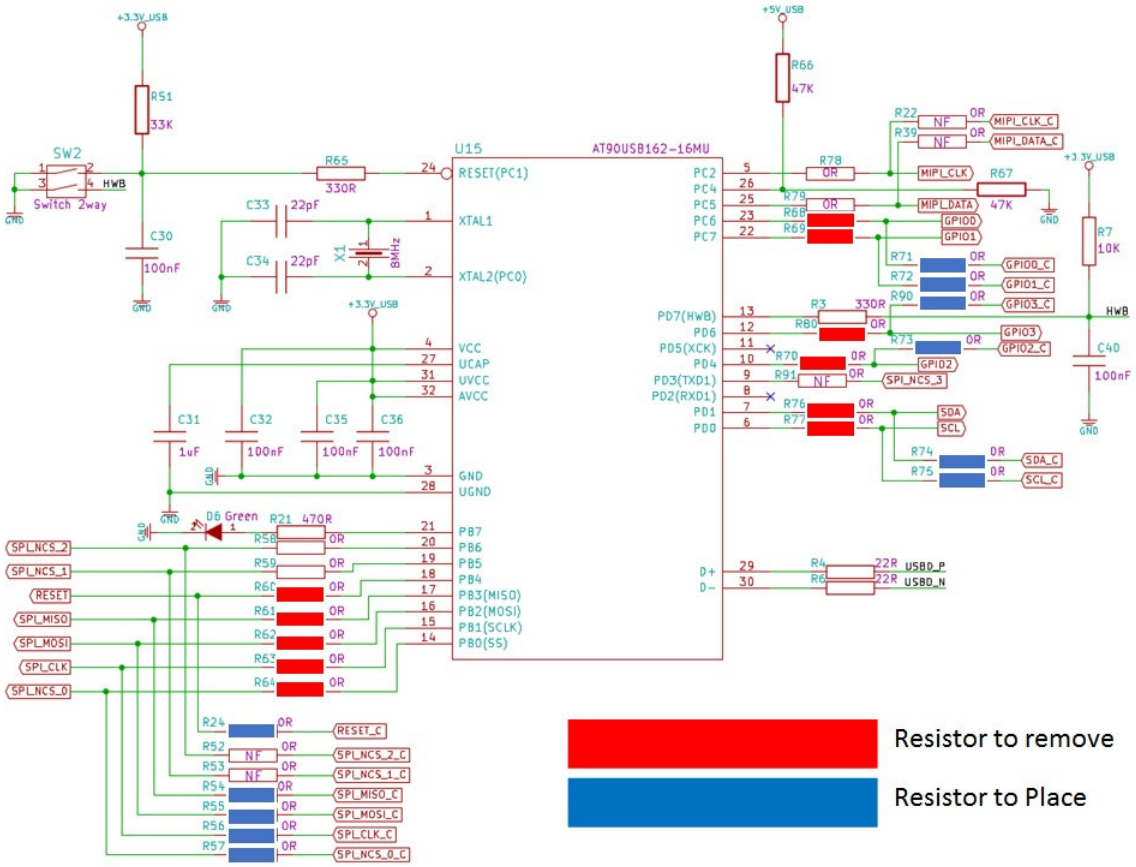

Figure 6: Schematic of Zipper I2C, SPI, and GPIO buses

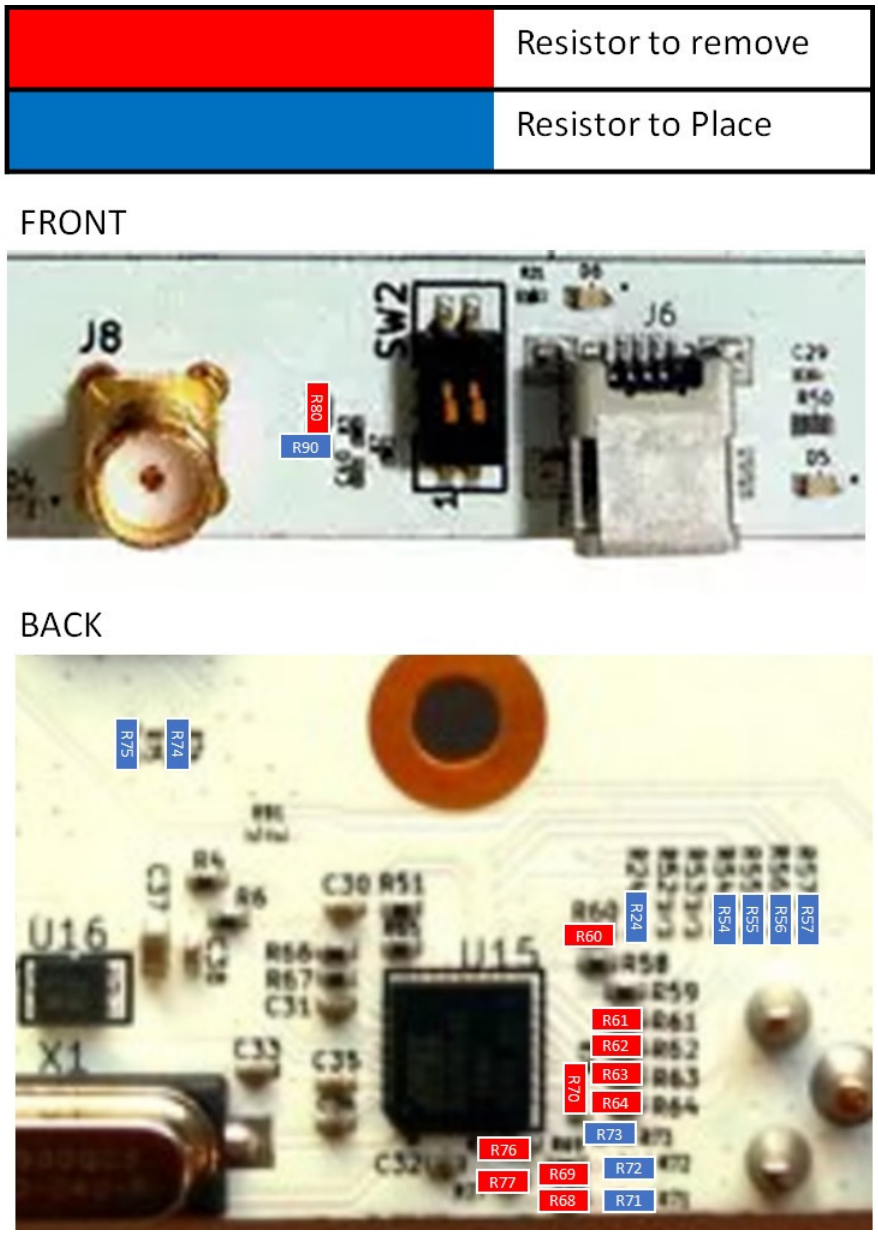

Figure 7: Layout of Zipper I2C, SPI, and GPIO buses

Zipper: Add jumper to enable I2C over HSMC

Note: This modification only applies to use with platforms with HSMC connectors (alst4)

There is a known layout error in version v1 r1 of the Zipper carrier card which impacts the I2C interface over the HSMC connector. The I2C SDA signal is connected to pin 111 of the HSMC connector, which corresponds to +3.3V on the alst4 (per the HSMC spec). The recommended modification avoids this error, while maintaining support for both FMC and HSMC connections.

A diagram of the required modifications including instructions can be seen in Figure 7. In summary, a 3 pin header is added to the design to switch between the existing working FMC connection and an unused HSMC pin.

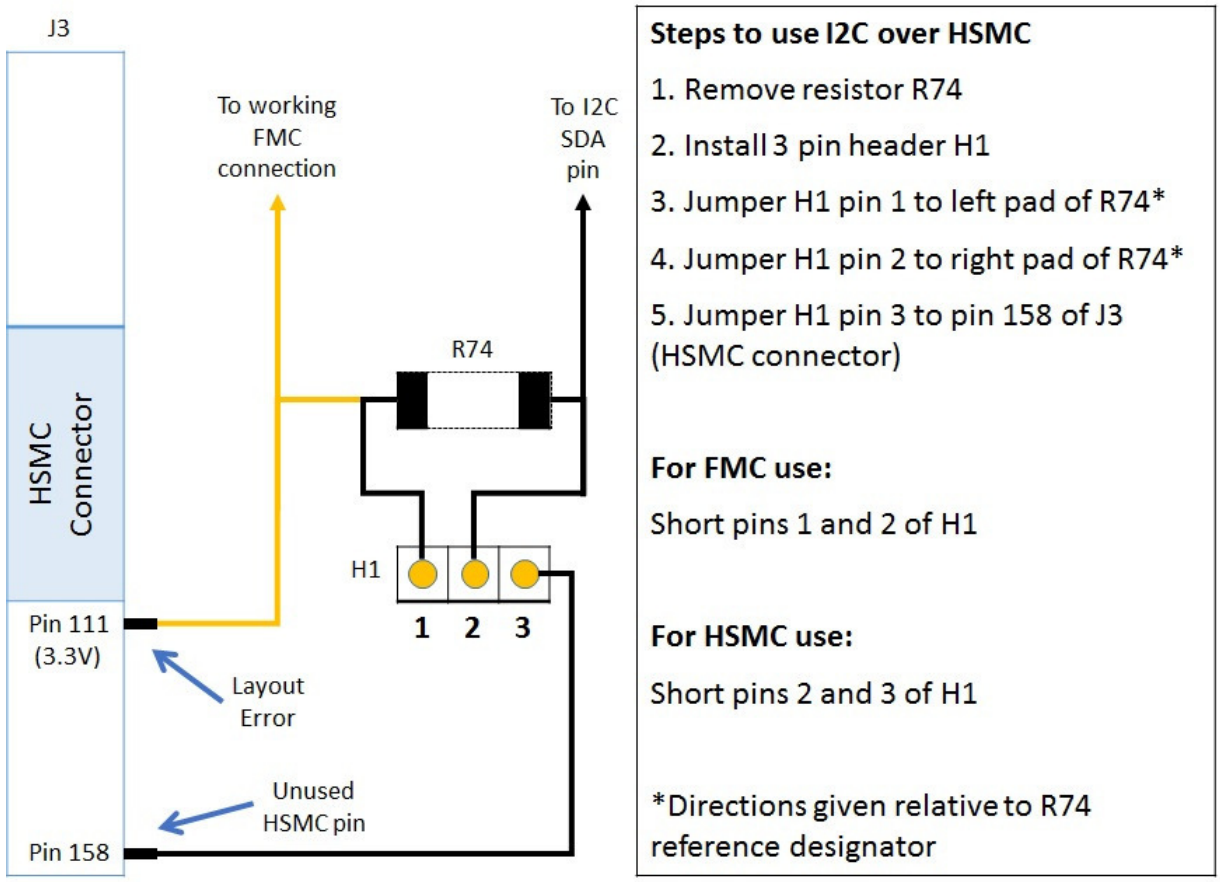

Figure 8: Diagram and instructions for enabling I2C over HSMC with Zipper carrier card

Connecting the Myriad-RF 1 to the Zipper

As mentioned above, the Zipper can be connected to platforms via FMC *or* HSMC connectors. Make sure Myriad-RF 1 is connected to the Zipper using the same connection type. So, for example when connecting the Zipper to the alst4 platform via HSMC, make sure the Myriad-RF 1 is connected to the Zipper via HSMC as well.

References

[1] Zipper v2 r1 Schematic
Zipper_v.2_Schematics_r.1.pdf (included in this directory)

[2] Zipper & Myriad-RF 1 Development Kit Manual
https://github.com/myriadrf/reference-development-kit/blob/master/zipper/docs/
Zipper Development Kit_1 0r5.pdf

[3] Zipper v2 r1 Layout Drawing
Zipper_v.2_Layout_r.1.pdf (included in this directory)

[4] Myriad-RF 1 Schematic
https://github.com/myriadrf/reference-development-kit/blob/c09ccdbac996ebbbbd2ea3c8fd5f02affb97e6ff/
rfmodule/v1/VIA_OFF_PAD/PDF/MYRIAD_RF_Schematics.pdf

[5] Lime Microsystems LMS6002D Datasheet
http://www.limemicro.com/download/LMS6002Dr2-DataSheet-1.2r0.pdf