Summary - Zipper RX

Name	zipper_rx
Worker Type	Frontend Interface (Proxy)
Version	v1.3
Release Date	February 2018
Component Library	ocpi.assets.devices
Workers	zipper_rx.rcc
Tested Platforms	Zedboard, ML605, ALST4
Slave Worker	Multiple

Functionality

This worker is used to control the RX portion the Zipper RF daughter card. Each property has a max, min, and step value associated with it. These associated properties are available to be used by application developers for reading back information about the functionality of the interface during runtime if necessary.

This worker implements a common interface that is intended to be used across multiple platforms. All platforms will have the same property interface to allow applications to be ported seamlessly to other platforms. It is also intended to be a simple interface that encompasses functionality that all RX interfaces will have but not any specialty functionality that only some RX interfaces will have.

There are two known limitations when using this worker:

1) When used in addtion to the TX frontend interface, there must be a 1 MHz offset between the TX and RX center frequencies, due to a limitation with the Lime transceiver device on the Zipper RF daughter card.

2) Due to a limitation of the framework, this component must appear after the RX control proxies in an application XML.

Worker Implementation Details

This worker controls the filtering, gain, tuning frequency, and the sample rate of the Zipper RF daughter card. Each of these are described below in their own section.

Filtering

In the RF section of the receiver, there are no filtering elements.

The baseband section has a variable low pass filter that is located in the LMS6002D transceiver.

Gain

In the RF section of the receiver, there is one element that has adjustable gain: an LNA in the LMS6002D Transceiver. The baseband section has two VGA devices which are both located in the LMS6002D transceiver.

Tuning

The LMS6002D transceiver converts the signal from RF to baseband using one mixing phase.

Sample Rate

The sampling clock domain originates from the CLK2 and CLK3 output of a SI5338 clock generator. CLK2 is connected directly to the Zynq FPGA and used as the sampling clock in the FPGA. CLK3 is expected to be set to the same value as CLK 2 and this is routed to the LMS6002D as a sampling clock.
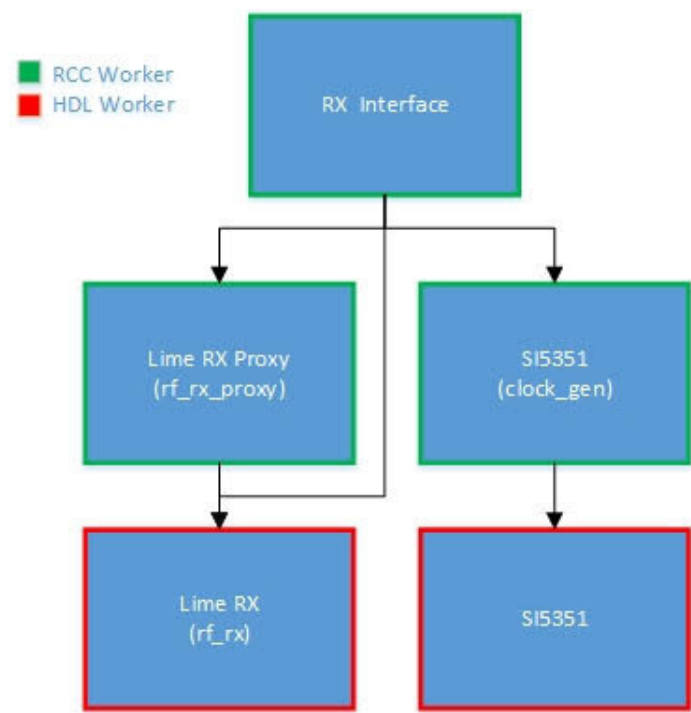
Block Diagrams

Top level

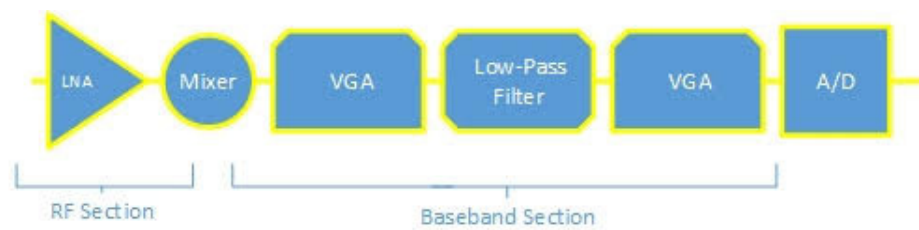Figure 1: Top Level Block Diagram

RX Hardware

Figure 2: Hardware Block Diagram

Source Dependencies

- ocpi.assets/hdl/devices/zipper_rx.rcc/zipper_rx.cc

Component Spec Properties

Name	Type	Sequence Length	Array Dimensions	Accessibility	Valid Range	Default	Usage
rf_gain_dB	double	-	-	Readable, Writable	-	0	The value of the RF gain stage of the receiver
rf_gain_max_dB	double	-	-	Volatile, Writable	-	0	Maximum valid value for RF gain
rf_gain_min_dB	double	-	-	Volatile, Writable	-	0	Minimum valid value for RF gain
rf_gain_step_dB	double	-	-	Volatile, Writable	-	0	Minimum granularity for changes in RF gain
bb_gain_dB	double	-	-	Readable, Writable	-	0	The value of the baseband gain stage of the receiver
bb_gain_max_dB	double	-	-	Volatile, Writable	-	0	Maximum valid value for baseband gain
bb_gain_min_dB	double	-	-	Volatile, Writable	-	0	Minimum valid value for baseband gain
bb_gain_step_dB	double	-	-	Volatile, Writable	-	0	Minimum granularity for changes in baseband gain
frequency_MHz	double	-	-	Readable, Writable	-	0	The value for the tuned center frequency of the incoming RF samples
frequency_max_MHz	double	-	-	Volatile, Writable	-	0	Maximum valid value for frequency
frequency_min_MHz	double	-	-	Volatile, Writable	-	0	Minimum valid value for frequency
frequency_step_MHz	double	-	-	Volatile, Writable	-	0	Minimum granularity for changes in frequency
sample_rate_MHz	double	-	-	Readable, Writable	-	0	Sample rate of the incoming RF samples
sample_rate_max_MHz	double	-	-	Volatile, Writable	-	0	Maximum valid value for sample rate
sample_rate_min_MHz	double	-	-	Volatile, Writable	-	0	Minimum valid value for sample rate
sample_rate_step_MHz	double	-	-	Volatile, Writable	-	0	Minimum granularity for changes in sample rate
rf_cutoff_frequency_MHz	double	-	-	Readable, Writable	-	0	The effective cutoff frequency, i.e. half of the bandwidth, for all filtering that is done in the RF stage of the receiver.
rf_cutoff_frequency_max_MHz	double	-	-	Volatile, Writable	-	0	Maximum valid value for RF cutoff frequency
rf_cutoff_frequency_min_MHz	double	-	-	Volatile, Writable	-	0	Minimum valid value for RF cutoff frequency
rf_cutoff_frequency_step_MHz	double	-	-	Volatile, Writable	-	0	Minimum granularity for changes in RF cutoff frequency
bb_cutoff_frequency_MHz	double	-	-	Readable, Writable	-	0	The effective cutoff frequency, i.e. half of the bandwidth, for all filtering that is done in the baseband stage of the receiver.
bb_cutoff_frequency_max_MHz	double	-	-	Volatile, Writable	-	0	Maximum valid value for baseband cutoff frequency
bb_cutoff_frequency_min_MHz	double	-	-	Volatile, Writable	-	0	Minimum valid value for baseband cutoff frequency
bb_cutoff_frequency_step_MHz	double	-	-	Volatile, Writable	-	0	Minimum granularity for changes in baseband cutoff frequency

Worker Properties

zipper_rx.rcc

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/ Advanced	Valid Range	Default	Usage
SpecProperty	rf_gain_dB	-	-	-	WriteSync	-6 - 6	0	The value of the RF gain stage of the receiver
SpecProperty	rf_gain_max_dB	-	-	-	-	6	6	Maximum valid value for RF gain
SpecProperty	rf_gain_min_dB	-	-	-	-	-6	-6	Minimum valid value for RF gain
SpecProperty	rf_gain_step_dB	-	-	-	-	6	6	Minimum granularity for changes in RF gain
SpecProperty	bb_gain_dB	-	-	-	WriteSync	5-60	5	The value of the baseband gain stage of the receiver
SpecProperty	bb_gain_max_dB	-	-	-	-	60	60	Maximum valid value for baseband gain
SpecProperty	bb_gain_min_dB	-	-	-	-	5	5	Minimum valid value for baseband gain
SpecProperty	bb_gain_step_dB	-	-	-	-	1	1	Minimum granularity for changes in baseband gain
SpecProperty	frequency_MHz	-	-	-	WriteSync	232.5 - 3720	500	The value for the tuned center frequency of the incoming RF samples
SpecProperty	frequency_max_MHz	-	-	-	-	3720	3720	Maximum valid value for frequency
SpecProperty	frequency_min_MHz	-	-	-	-	232.5	232.5	Minimum valid value for frequency
SpecProperty	frequency_step_MHz	-	-	-	-	0.1	0.1	Minimum granularity for changes in frequency
SpecProperty	sample_rate_MHz	-	-	-	WriteSync	0.5 - 40	0.5	Sample rate of the incoming RF samples
SpecProperty	sample_rate_max_MHz	-	-	-	-	40	40	Maximum valid value for sample rate
SpecProperty	sample_rate_min_MHz	-	-	-	-	0.5	0.5	Minimum valid value for sample rate
SpecProperty	sample_rate_step_MHz	-	-	-	-	1	1	Minimum granularity for changes in sample rate
SpecProperty	rf_cutoff_frequency_max_MHz	-	-	-	-	-1	-1	Maximum valid value for RF cutoff frequency. -1 means that no settings exist to change for RF cutoff frequency.
SpecProperty	rf_cutoff_frequency_min_MHz	-	-	-	-	-1	-1	Minimum valid value for RF cutoff frequency. -1 means that no settings exist to change for RF cutoff frequency
SpecProperty	rf_cutoff_frequency_step_MHz	-	-	-	-	-1	-1	Minimum granularity for changes in RF cutoff frequency. -1 means that no settings exist to change for RF cutoff frequency
SpecProperty	bb_cutoff_frequency_MHz	-	-	-	WriteSync	0-14	10	The effective cutoff frequency, i.e. half of the bandwidth, for all filtering that is done in the baseband stage of the receiver.
SpecProperty	bb_cutoff_frequency_max_MHz	-	-	-	-	14	14	Maximum valid value for baseband cutoff frequency
SpecProperty	bb_cutoff_frequency_min_MHz	-	-	-	-	0	0	Minimum valid value for baseband cutoff frequency
SpecProperty	bb_cutoff_frequency_step_MHz	-	-	-	-	0.125	0.125	Minimum granularity for changes in baseband cutoff frequency

Performance and Resource Utilization

zipper_rx.rcc

Processor Type	Processor Frequency	Run Function Time
TBD	TBD	TBD

References

1) LMS6002D Datasheet, www.limemicro.com