From: Microelectronics Support Centre [MicroelectronicsCentre@stfc.ac.uk]
Sent: Tuesday, May 28, 2013 3:26 PM
To: Vanco B. Litovski
Subject: EUROPRACTICE/Lime Microsystems Partnership; Introducing a highly flexible, programmable RF platform for research and teaching of wireless technology

Dear Vanco Litovski,

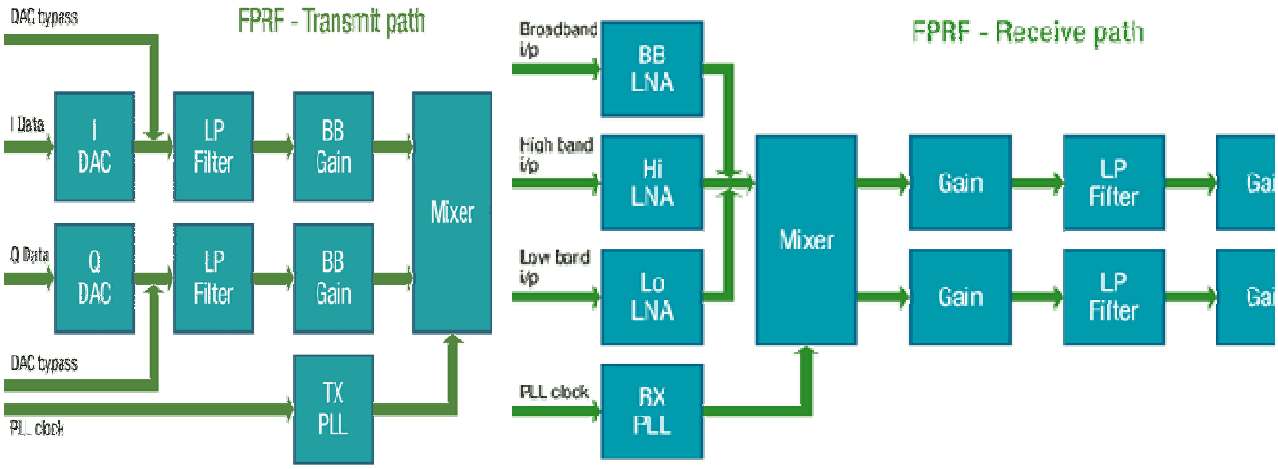
EUROPRACTICE / LIME MICROSYSTEMS PARTNERSHIP

Introducing a highly flexible, programmable RF platform for research and teaching of wireless technology

Lime Microsystems (www.limemicro.com) has developed a highly flexible, programmable RF single-chip wireless transceiver. EUROPRACTICE is pleased to make its members aware of this field programmable RF (FPRF) device and how to access low-cost development boards containing this FPRF device via an open-source web site. The FPRF development board can be optionally connected to FPGA development boards to enable highly complex configurable systems to be developed.

The Lime Microsystems LMS6002D programmable RF IC covers the frequency range from 300 MHz to 3.8 GHz. This spans all the cellular phone frequencies used around the world, as well as unlicensed bands such as “white space”. The RF chip is highly programmable by the user. At the highest level of abstraction, the FPRF transmitter takes a digital data stream and converts it into RF signals, while the receiver does the reverse function allowing implementation of many digital modulation schemes, or wireless standards. Added to this is the capability to program key parameters like the RF frequency, gain and bandwidth, which form the essential ingredients of a FPRF platform.

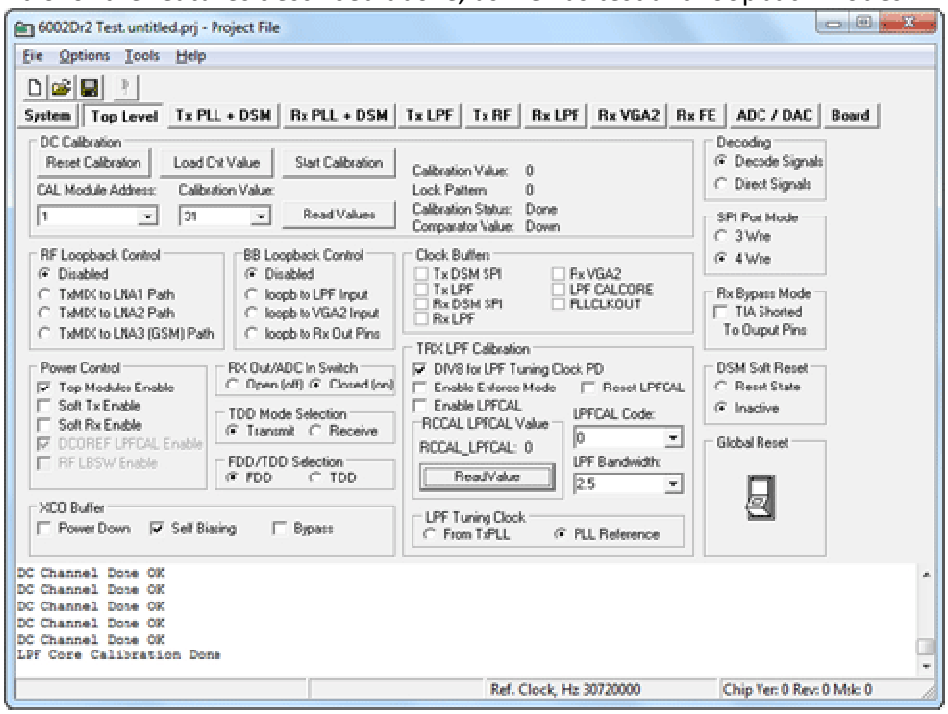
Wireless transmission uses a range of different modulation schemes, and the chip accepts data as in-phase (I Data) and quadrature (Q Data) words. The transmit path applies the data to a pair of on-chip DACs to convert it into two analog signals. User can choose to bypass the DACs and inject analog signals directly into the device or monitor the DAC outputs. The low pass filter is programmed by the user to one of 16 different bandwidths ranging from 1.5 to 28 MHz at RF. The filtering restricts the signals to the selected bandwidth, and attenuates any out-of-band noise or aliasing from the DAC.



The filter can boost the signal by 6dB, and is followed by a programmable baseband gain stage that can be adjusted to give up to 31dB of gain in 1dB increments. The TX PLL synthesiser multiplies up the input PLL clock by a programmable ratio, and generates a stable frequency with a tight accuracy. The programmable RF gain stage provides the final signal boost that is output from the FPRF device. The transmit power level is sufficient for short range communications (tens of meters), without any further amplification. For a given application external amplification could be used to increase the range.

The receiver path is also highly programmable. The FPRF device offers a choice of three low noise amplifiers (LNAs). A general broadband input stage is designed to handle RF inputs across the spectrum from 300 MHz to 3.8 GHz. Two further LNAs are optimised for enhanced performance for signals in the range 300 MHz to 2.8 GHz (Lo LNA) and 1.5 to 3.8 GHz (Hi LNA). The mixer in the receive path uses the same PLL clock input as the transmitter, but has a different synthesiser to provide full duplex and direct down conversion. Programmable gain stages and filtering are applied, before the analog signal is digitised and output as I&Q data streams.

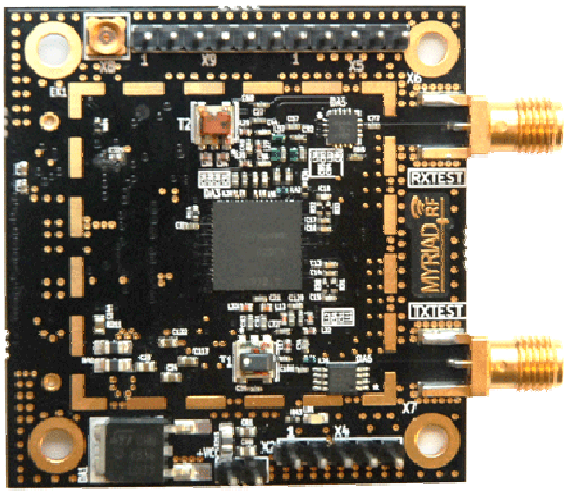
Configuration of all the different elements is done via a simple SPI interface into the control logic. Each element is programmed by loading a 16-bit word that can be static, or for more sophisticated applications, the parameters can be changed on the fly. The configuration is set up using a simple GUI that allows control of the features described above, as well as test and loopback modes.



The FPRF device was designed to be highly flexible; one of the original applications was for cellular femto and pico cells. These units act as local base stations for cell phones, and link into the internet to provide fast connectivity inside the home or small office. The chip's flexibility, however, also made it ideal for many other applications such as "white space".

Lime has launched the Myriad-RF board, manufactured by their strategic partner Azio Electronics, and supplied through well established distribution channels. The board can be connected to an Altera DE0-Nano board or an FPGA Mezzanine Card (FMC) to connect to Xilinx boards. Further information on the Myriad-RF board and associated interface boards are available through the Myriad-RF website.

http://myriadrf.org/



For further details of the FPRF device and example applications, please visit the Lime Microsystems website http://www.limemicro.com

Regards,

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