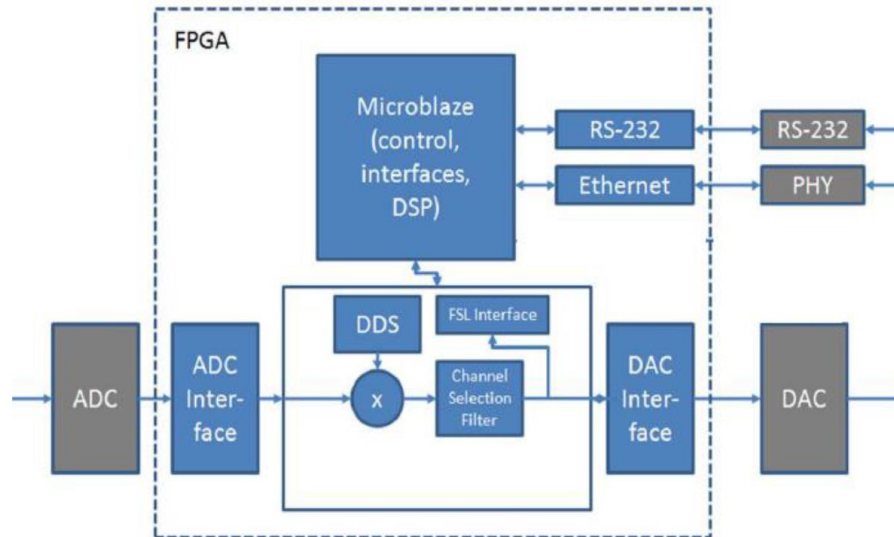


## Project 5: Full Microprocessor-controlled Digital Downconverter



### Goals

1. Fully integrate the DSP chain of the software defined radio (SDR)
2. Signal processing block which can tune to any 36kHz wide segment of spectrum between 0 and 62.5 MHz, convert it to baseband, and play it out of the audio DAC.

*An on-chip DDS will simulate an A/D converter in this project (125MHz sample rate). This DDS, will be referred to as the “fake ADC”*

- Data from the fake ADC is mixed with the output of a tunable DDS so that any section of the digitized bandwidth can be moved to baseband (DC)
- Data from the mixer is then passed to a channel selection filter, which will filter out all but a narrow band around DC, and decimate by 2560 to a sample rate of approximately 48.8kHz
- Data from the output of the filter should be scaled correctly, and sent to the DAC interface.

### Requirements

- The microblaze accepts commands to change the frequency of the fake ADC. ('F', 'u', 'U', 'd', 'D').
- Additionally, the microblaze should accept a new command 'T', which will tune the radio. This will accept a desired tune frequency from the user, and it will use that input to correctly set that phase increment of the tuner DDS such that the tune frequency is shifted to 0 (DC).
- The microblaze should accept tuning commands over the serial port in the format listed below. It should respond to these commands by tuning the receiver to the specified frequency (in other words, a signal injected into the analog input at that frequency should

show up at DC in your output data path). Frequencies from at least the range of 1MHz to 60MHz should be supported.

- "T11250000" (tunes to 11.25 MHz)

- "T2000000" (tunes to 2 MHz)

- Data from the signal processing section should always be coming out of the DAC such that "Q" (the imaginary part of the sample) is on the Left Channel, and "I" (the real part) is on the Right channel
- The microblaze should accept volume control commands ('+', '-'). These will be used to increase and decrease the volume of the data at the DAC. There should be 10 settings, 0-9 (8 as the initial level). Each step is 6dB. This volume control can be achieved by changing registers 2 and 3 of the CODEC