IIO-Oscilloscope (OSC)

As a prerequisite for these labs you should have already installed OSC, if not please install it from the Release Page here.

Launch OSC, and you should be greeted by a connection window similar to Figure 9.

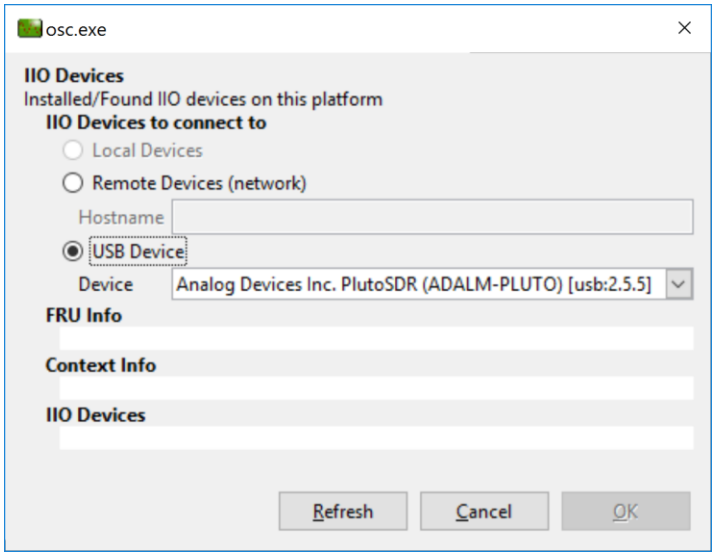


Figure 9

Next, select the USB device, and the PlutoSDR. Click the refresh button, and then OK. Next the main window should appear with the necessary control tabs.

Explore IIO oscilloscope, and the control tabs. These tabs let you control the high to the low levels of the device and visualize the signals that are going in/out of the device. Some specific parts to look at are shown in Figure 10.

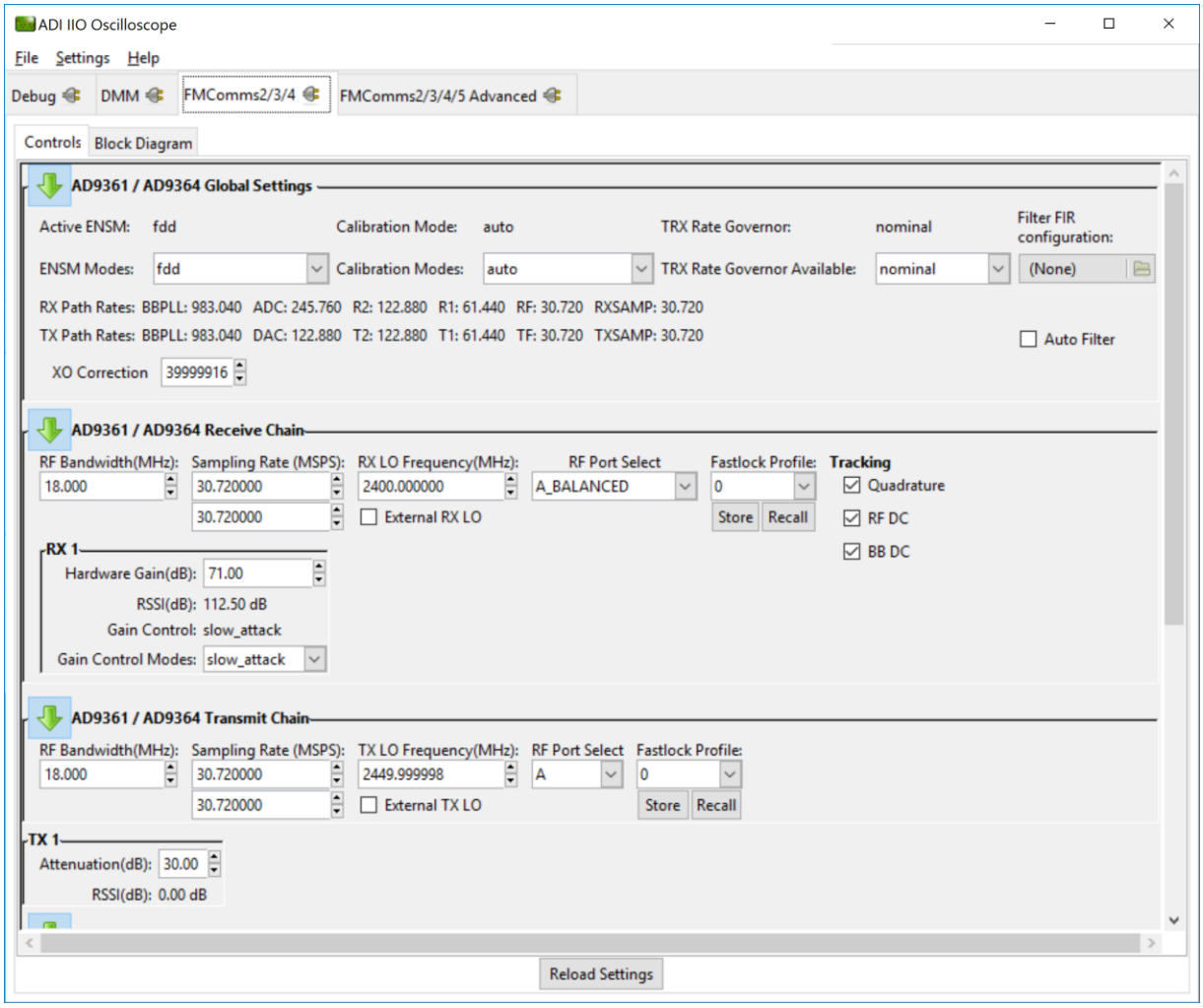
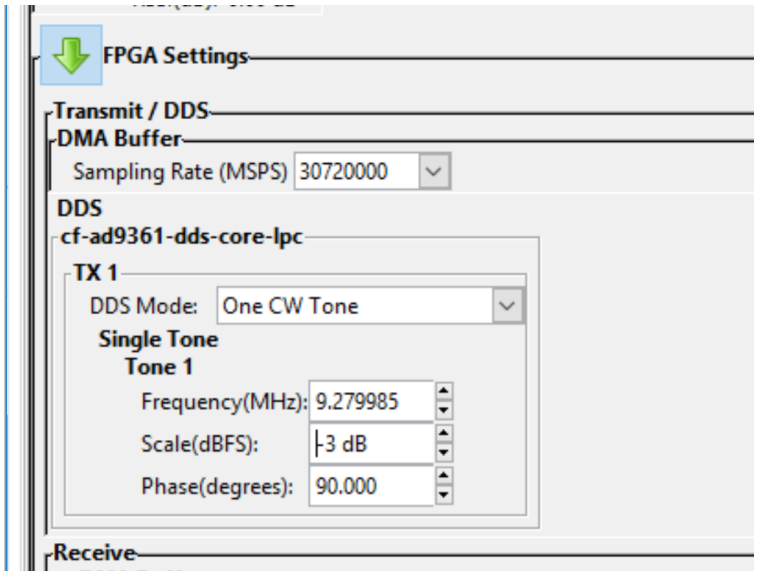


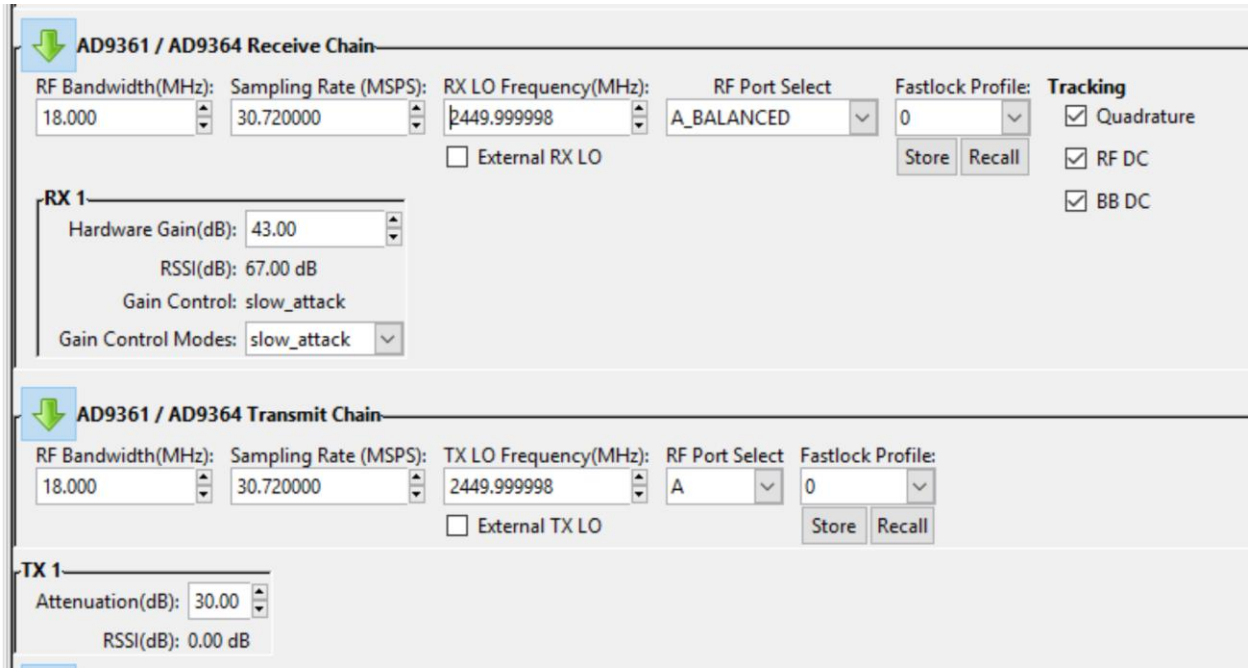
Figure 10

From the “FMComms2/3/4” tab shown in Figure 10, you can examine and change the RF bandwidth, the DAC sample rate, the Tx LO Frequency, and the signals that are being sent from the FPGA to the AD9363 inside the ADALM-PLUTO SDR. This tab, as the name define is shared among a few SDR that proceeded PlutoSDR, specifically FMComms2/3/4.

Using the controls in the “FMComms2/3/4” tab, set the DDS in the “FPGA Settings” to a single tone at -3dB scale.



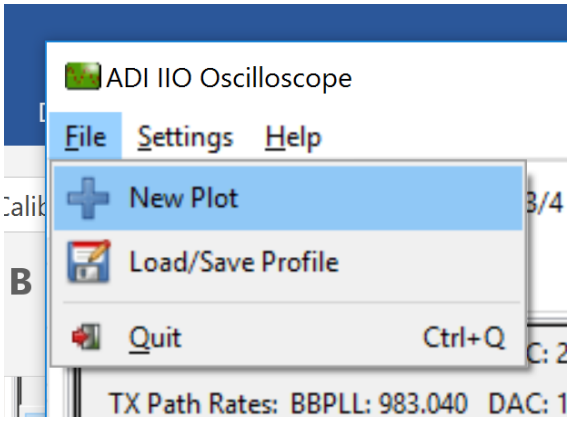
In the Receive and Transmit Chain panels, set the Sample Rate to 30.72 MSPS, with a 18 MHz RF Bandwidth, at a TX and RX LO of 2450 MHz.



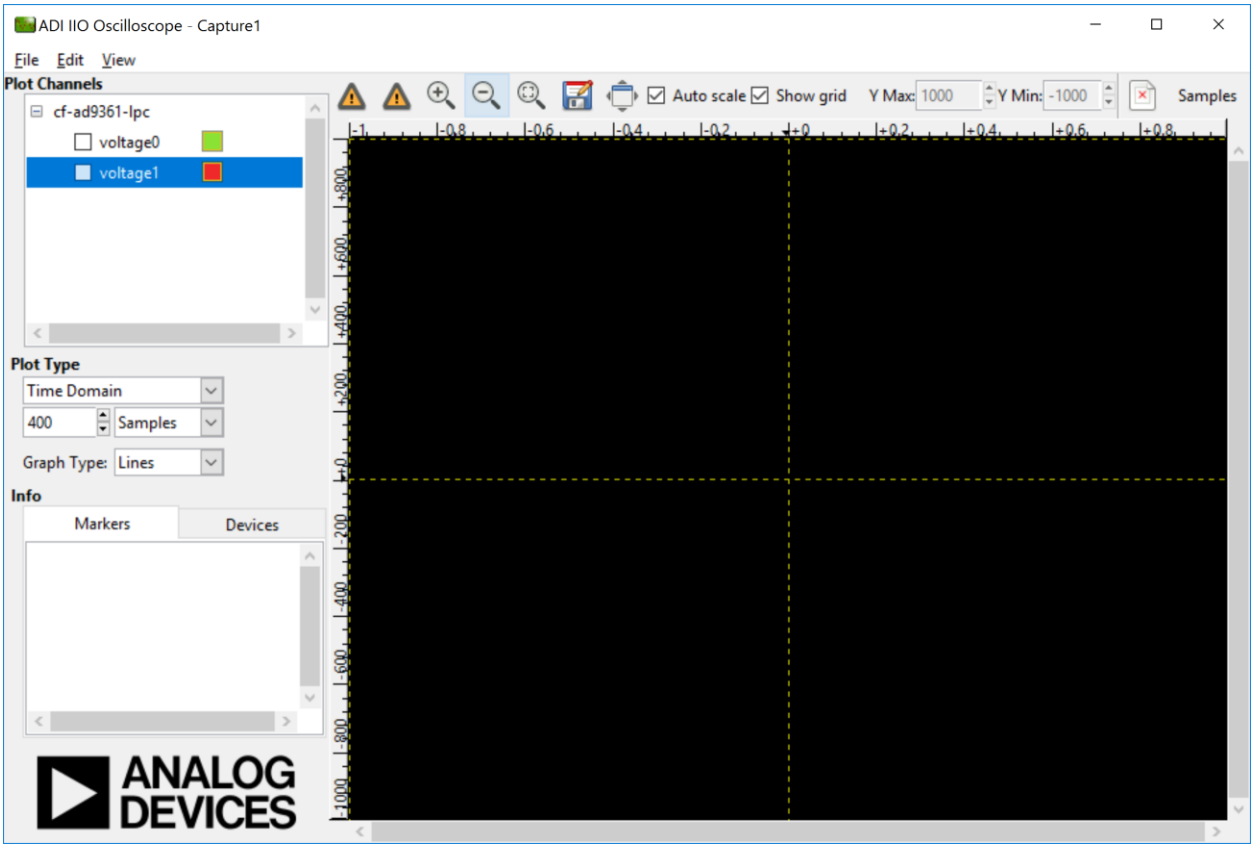
OSC also visualization capabilities, which we will explore next.

Visualizations

Create a new plot window from the file menu.



These plot, or capture, windows provide real-time visualization with time domain plots, frequency domain plots, cross-correlation, and constellation diagrams. Enable some of the voltage channels and play with the scopes a bit to get a feeling for them. Once you are done, move on to the next section.



For now, enable both voltage channels, “voltage0” and voltage1, and select the constellation diagram plot. Then press the play button to start capturing data.

Next, we will setup the transmitter to send some useful data. Back in the “FMComms2/3/4” tab, in the FPGA Settings panel. As show in Figure 11, select “DAC Buffer Output” as the DDS Mode and load the file “qpsknofilt_30M.txt” for voltage0 and voltage1. Make sure to hit load. This will set the transmitter to continuously repeat a buffer of data, which are just some QPSK symbols.

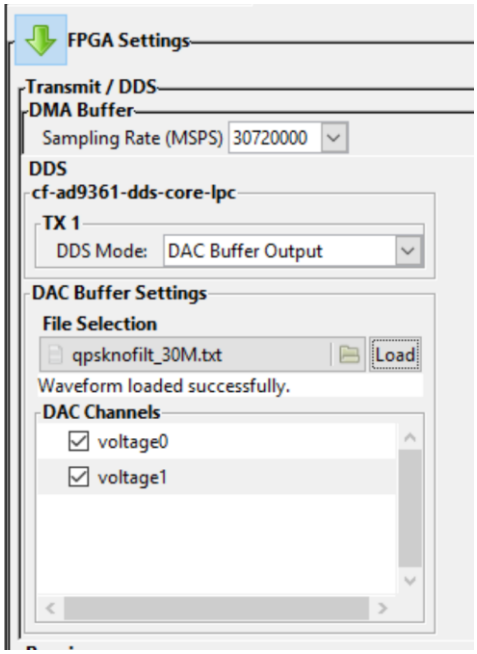


Figure 11

Back on the constellation diagram, you should observe something similar to Figure 12. Since there is a fractional delay between the antennas we are observing some inter-symbol interference. This will be random for each user and each radio initialization.

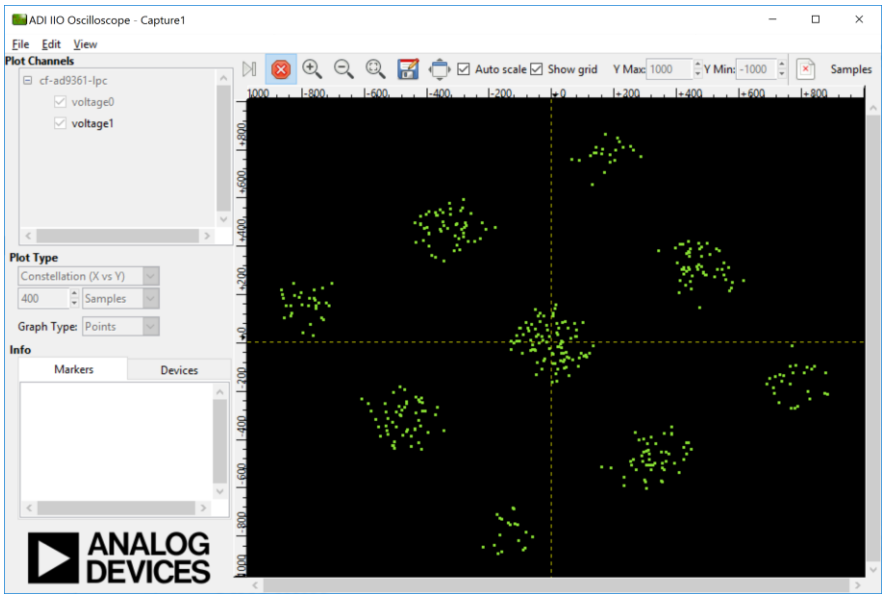


Figure 12

Now for debugging it can be useful to view digitally looped back data, which has not gone out to the RF. To enable this loopback go to the “FMComms2/3/4/5 Advanced” tab, the BIST subtab, and select “Digital TX -> Digital RX” as the Loopback mode as in Figure 13.

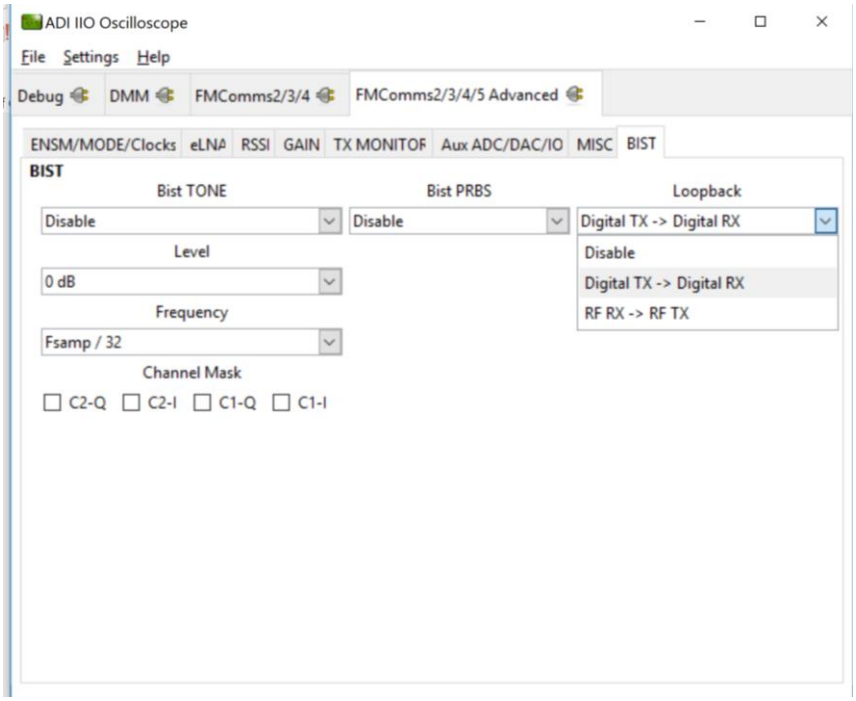


Figure 13

Going back to the constellation diagram, enabling lines instead of points, we should observe a perfect constellation with perfect crossing in the middle as in Figure 14.

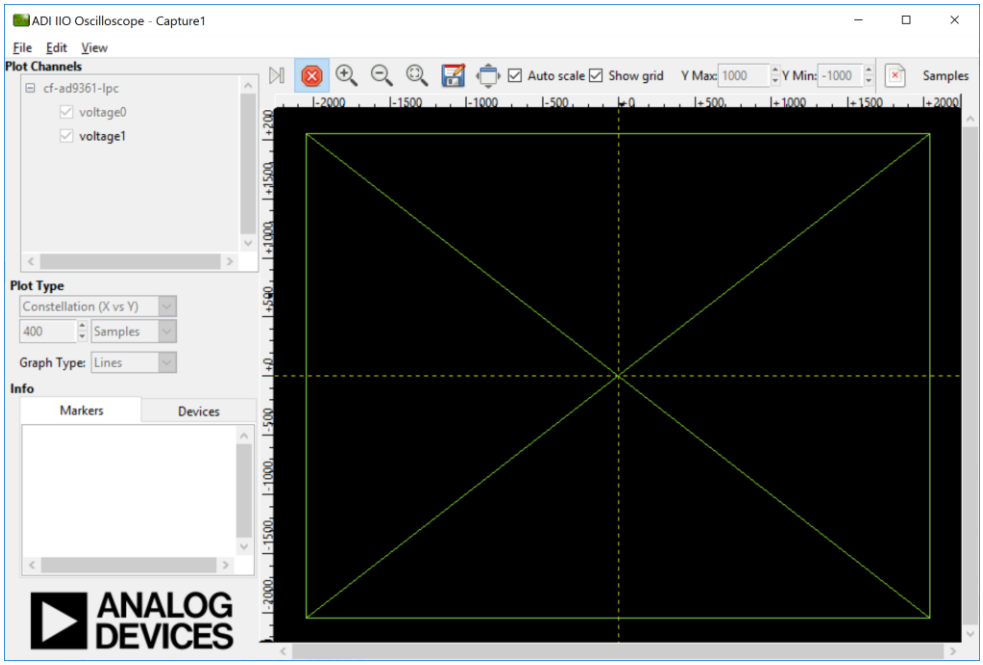


Figure 14

With free time remaining before the next lecture section explore OSC on your own and play with all the knobs if you wish.