

# Quick Start Guide for testing the AD6649 IF Diversity Receiver Customer Evaluation Board Using the FPGA based Capture Board HSC-ADC- EVALCZ

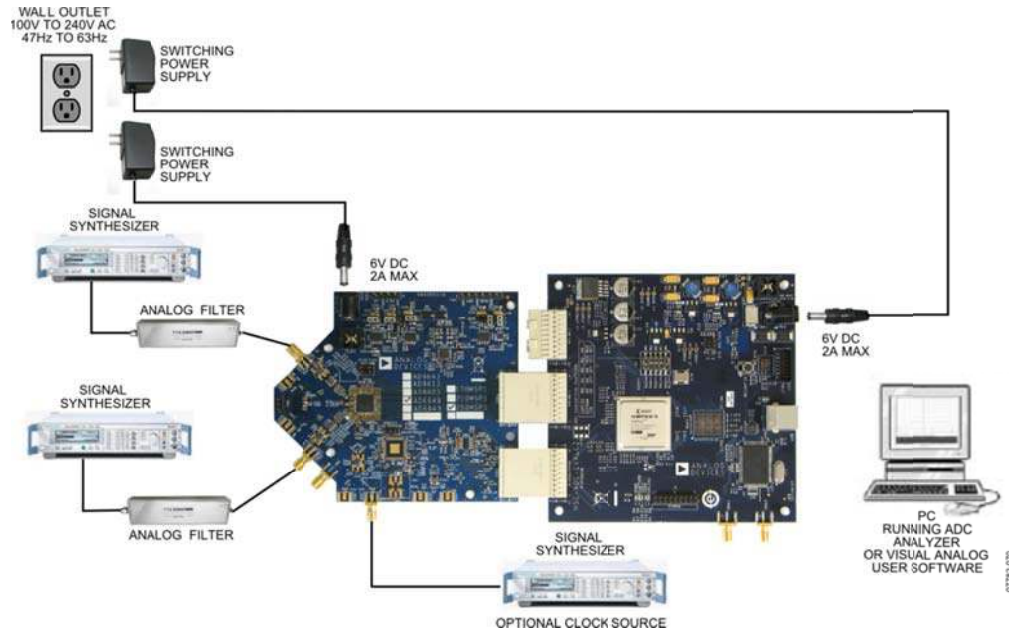


Figure 1: AD6649 Evaluation Board with HSC-ADC\_EVALCZ Data Capture Board

## ***Equipment Needed***

- ▶ Analog signal source and anti-aliasing filter
- ▶ Analog Clock Source
- ▶ PC
- ▶ USB 2.0 port recommended (USB 1.1-compatible)
- ▶ AD6649 evaluation board
- ▶ HSC-ADC-EVALCZ FPGA Based Data Capture Board

## ***Documents Needed***

- ▶ AD6649 Datasheet
- ▶ VisualAnalog Converter Evaluation Tool User Manual, AN-905
- ▶ High Speed ADC SPI Control Software User Manual, AN-878
- ▶ Interfacing to High Speed ADCs via SPI, AN-877

## ***Software Needed***

- ▶ VisualAnalog
- ▶ SPIController


All documents and software are available at <http://www.analog.com/fifo>.  
For any questions please send an email to [highspeed.converters@analog.com](mailto:highspeed.converters@analog.com).

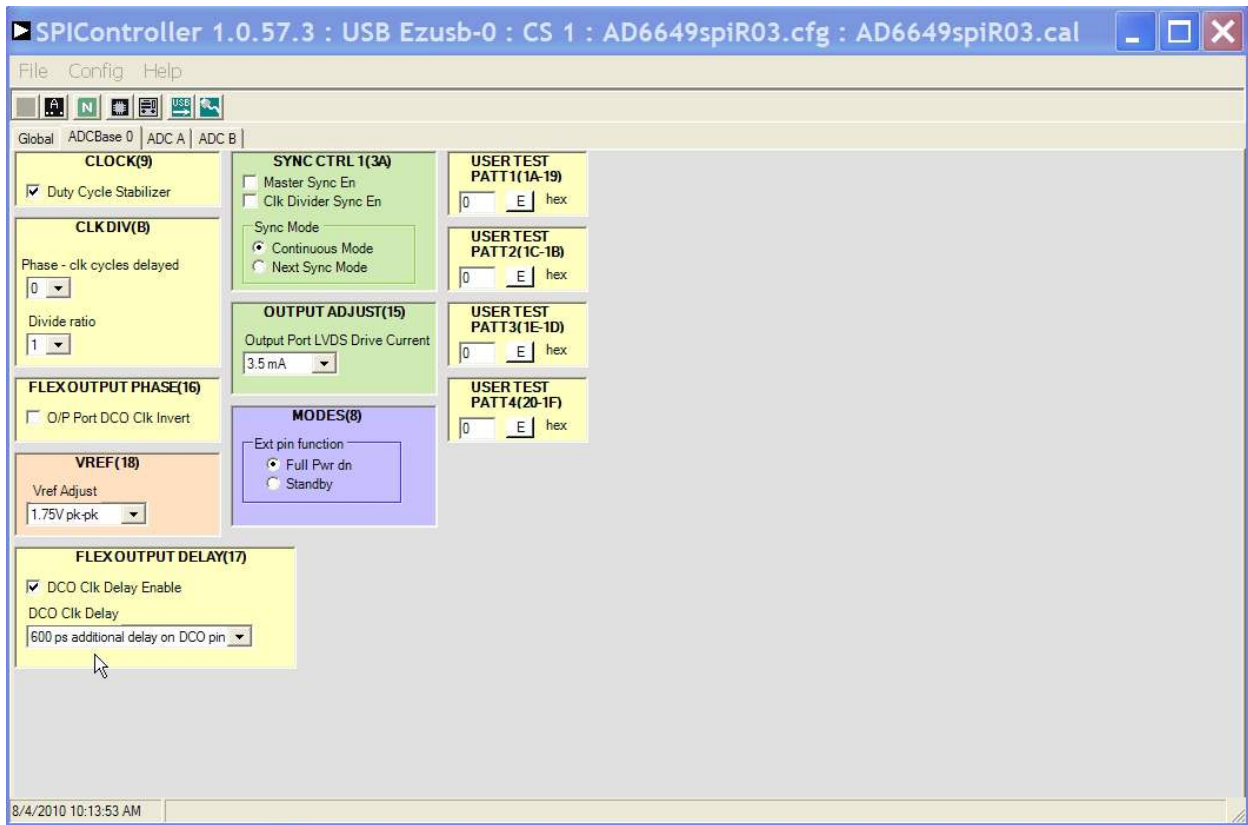
### ***AD6649 Filter Modes***

The AD6649 IF diversity receiver supports 2 different filter modes. The first mode supports a 95MHz output bandwidth at 245.76MSPS with the fixed-frequency NCO and low latency FIR filter. The second mode supports a 100MHz output bandwidth at 245.76MSPS with a tunable NCO and high performance FIR filter. The evaluation platform supports both of these modes.

### ***Testing***

1. Connect the AD6649 evaluation board and the HSC-ADC-EVALCZ board together as shown in Figure 1.
2. Connect one 6V, 2A switching power supply (such as the CUI EPS060250UH-PHP-SZ supplied) to the AD6649 board.
3. Make sure a jumper is installed on header J9 at the 2.5V position on the HSC-ADC-EVALCZ evaluation board to set the FPGA I/O voltage to 2.5V. Connect one 6V, 2A switching power supply (such as the CUI EPS060250UH-PHP-SZ supplied) to the HSC-ADC-EVALCZ board.
4. Connect the HSC-ADC-EVALCZ board to the PC with a USB cable. (Connect to J6.)
5. On the ADC evaluation board, make sure that jumpers are installed on headers P105, P108, P104, P107, P110, and P103 for the default setup.
6. On the ADC evaluation board, provide a clean, low jitter clock source to connector J506 at the desired ADC conversion rate. If the AD6649 input clock divider is used provide a clock into connector J506 at the appropriate rate which will be divided to your desired clock rate. The input clock level should be between 10dBm and 14dBm.
7. On the ADC evaluation board, use a clean signal generator with low phase noise to provide an input signal to the analog input at connector J301 (Channel A) and/or J303 (Channel B). Use a 1 m, shielded, RG-58, 50  $\Omega$  coaxial cable to connect the signal generator. For best results use a narrow-band, band-pass filter with 50  $\Omega$  terminations and an appropriate center frequency. (ADI uses TTE, Allen Avionics, and K&L band-pass filters.) In order for the input level to be near the ADC's full scale, the generator level should be set to 8dBm to 12dBm – this level depends on the input frequency and any losses in bandpass filters.
8. Open VisualAnalog on the PC. "AD6649" should be listed in the status bar of the "New Canvas" window. Select the template that corresponds to the type of testing that you are performing. Select 'Yes' when VisualAnalog prompts for programming the FPGA. The 'DONE' LED should illuminate on the HSC-ADC-EVALCZ board indicating that the FPGA has been correctly programmed. (If Visual Analog does not prompt for programming the FPGA select the ADC Data Capture Settings window and click on the 'Capture Board' tab. In the FPGA box select program to configure the FPGA.)

9. Next open the SPI Controller software. If prompted for a configuration file, select the file titled AD6649spiR03.cfg. If not, check the title bar of the window to see which configuration is loaded. If necessary, choose “Cfg Open” from the “File” menu and select the configuration file named above. Note that the CHIP ID(1) field may be filled whether the correct SPI Controller configuration file is loaded or not.
10. Click the New DUT button (  ) in SPI Controller.
11. Set the DCO Clk Delay Enable checkbox in the FLEXOUTPUT DELAY(17) panel on the ADCBase0 tab as shown below. In addition, set the DCO Clk Delay register to the ‘600ps additional delay on DCO pin’. These settings align the output timing with the input timing on the capture FPGA.



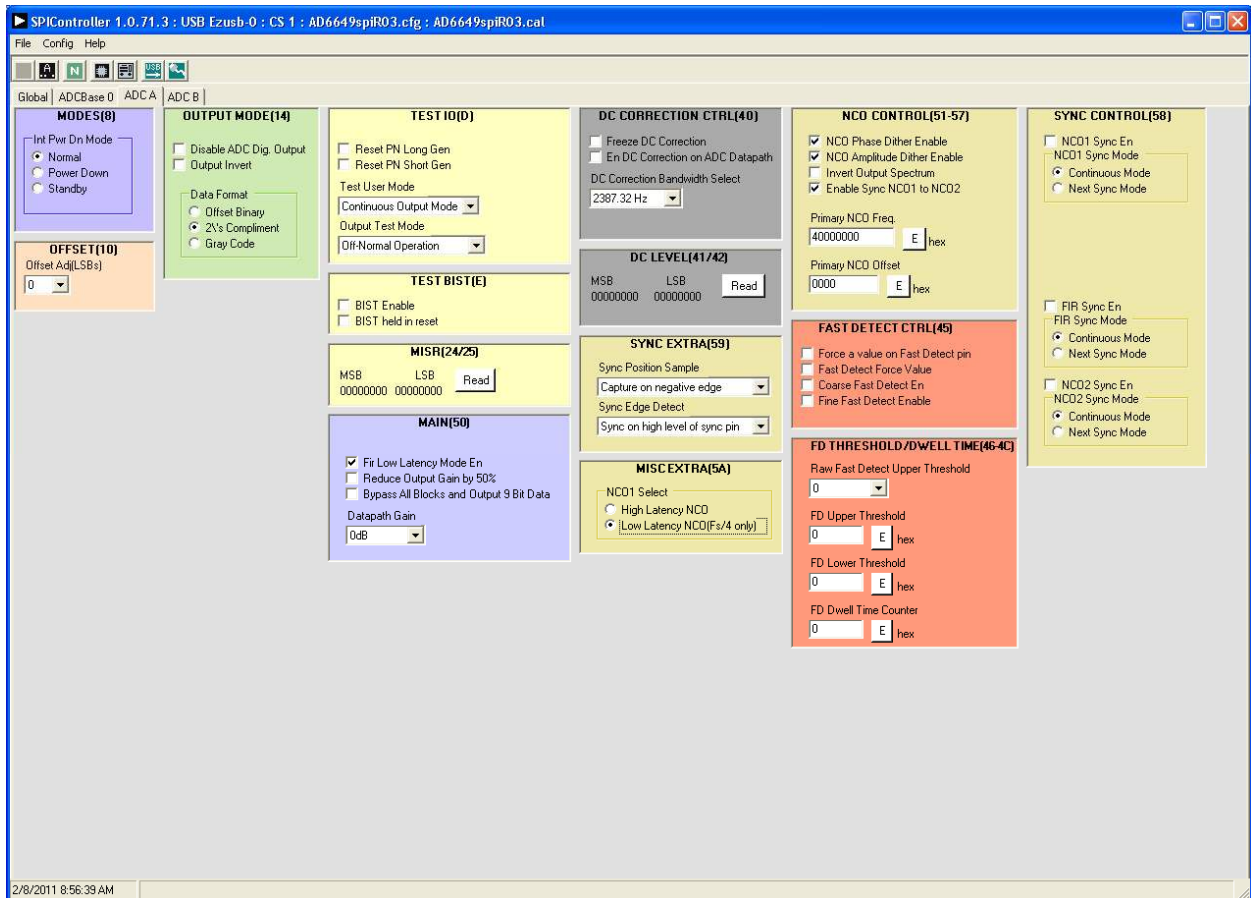
12. The AD6649 defaults to the fixed frequency NCO and low latency FIR filter. To place the part in this mode the SPI settings for the ADC A and ADC B tabs should be set as shown below. For this mode the following checkboxes should be checked:

KANAS MAIN(50) 'Fir Low Latency Mode En'

NCO CONTROL(51-57) 'NCO Phase Dither Enable', 'NCO Amplitude Dither Enable', 'Enable Sync NCO1 to NCO2'

The NCO frequency should be set to '40000000'

MISC EXTRA (5A) 'Low Latency NCO (Fs/4 only)'

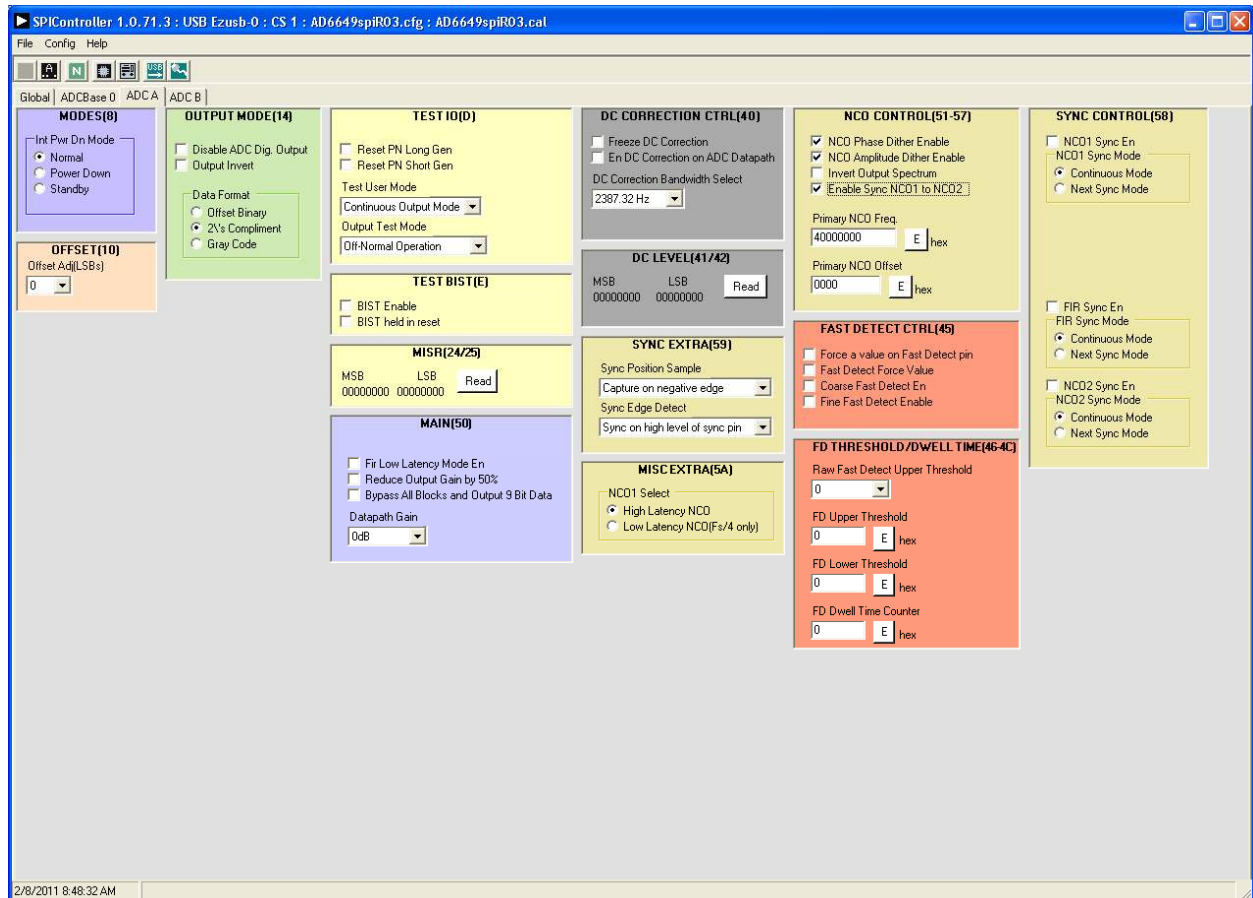


13. To place the AD6649 in the mode that uses the tunable NCO and high performance FIR filter, the SPI settings for the ADC A and ADC B tabs should be set as shown below. For this mode the following checkboxes should be checked:

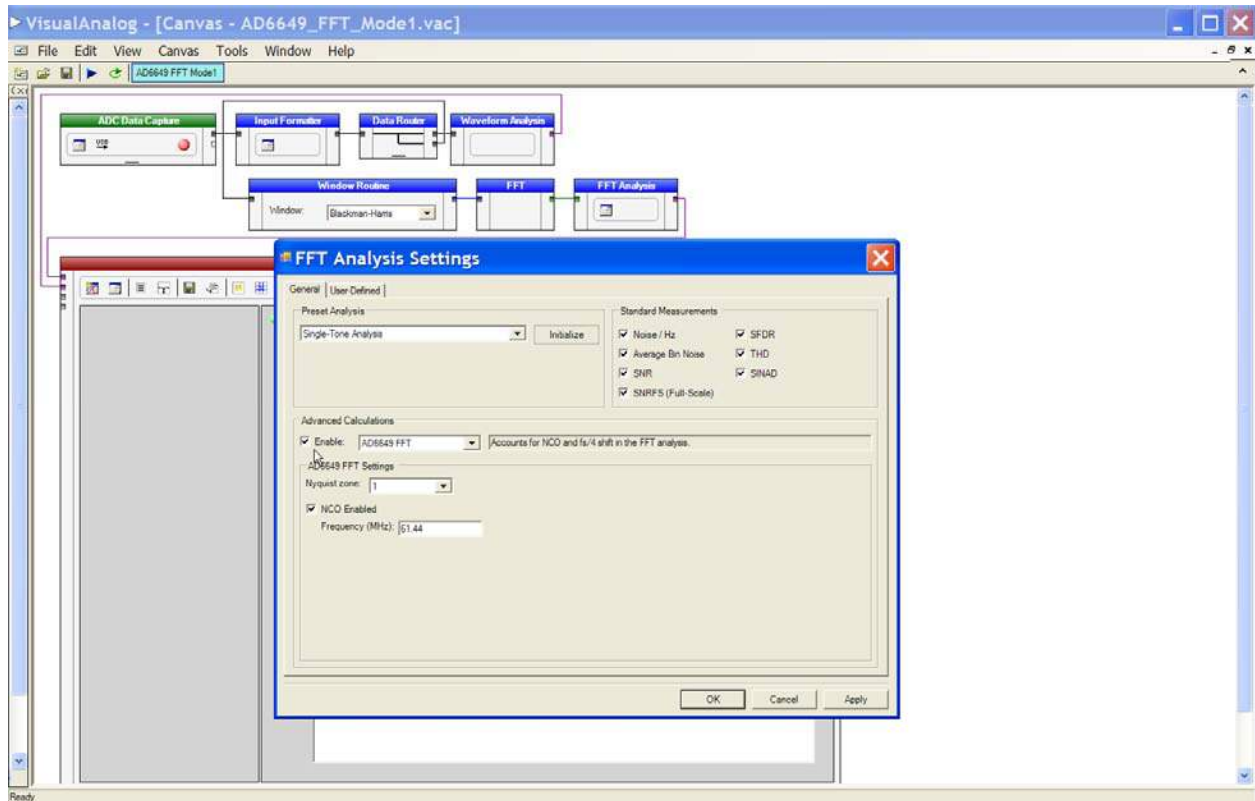
NCO CONTROL(51-57) ‘NCO Phase Dither Enable’, ‘NCO Amplitude Dither Enable’, ‘Enable Sync NCO1 to NCO2’

The NCO frequency should be set to ‘40000000’

MISC EXTRA (5A) ‘High Latency NCO’



14. If the NCO is set to a value other than ‘4000000’ (fs/4) then Visual Analog allows input of the Nyquist zone and NCO frequency in order to find the output signal harmonics correctly after the AD6649 frequency conversion. To enable this mode click on the ‘FFT Analysis Settings’ button and enable the Advanced calculations feature for the AD6649. Enter the Nyquist zone of the input signal and the NCO frequency – Visual Analog can then accurately find the signal harmonics in the FFT spectrum. (Images are noted with an ‘I’).



15. Click the Run button (▶) in VisualAnalog.
16. Adjust the amplitude of the input signal so that the fundamental is at the desired level. (Examine the “Fund Power” reading in the left panel of the VisualAnalog FFT window.)
17. If desired, click on File>Save Form as in the FFT window to save the FFT plot.

## ***Troubleshooting***

- ▶ *The FFT plot appears abnormal...*
  - ✓ If you see a normal noise floor when you disconnect the signal generator from the analog input, be sure you are not overdriving the ADC. Reduce input level if necessary.
  - ✓ In VisualAnalog, Click on the Settings button in the “Input Formatter” block. Check that “Number Format” is set to the correct encoding (2’s compliment by default).
  
- ▶ *The FFT plot appears normal, but performance is poor.*
  - ✓ Make sure you are using an appropriate filter on the analog input.
  - ✓ Make sure the signal generators for the clock and the analog input are clean (low phase noise).
  - ✓ If you are using non-coherent sampling, change the analog input frequency slightly.
  - ✓ Make sure the SPI config file matches the product being evaluated.
  
- ▶ *The FFT window remains blank after the Run button is clicked.*
  - ✓ Make sure the evaluation board is securely connected to the HSC-ADC-EVALCZ board
  - ✓ Repeat steps 8 through 12.
  - ✓ Make sure the FPGA has been programmed by verifying that the ‘D6’ LED is illuminated on the HSC-ADC-EVALCZ board.
  - ✓ Make sure the correct FPGA program was installed.
  
- ▶ *VisualAnalog indicates that the “FIFO capture timed out.”*
  - ✓ Make sure all power and USB connections are secure.
  - ✓ Repeat steps 11 through 16.
  - ✓ Double check that the encode clock source is present at connector J506.

Revision: 0 July 26, 2010

Revision: A December 14, 2010

Revision: B February 8, 2011

Revision: C October 24, 2013