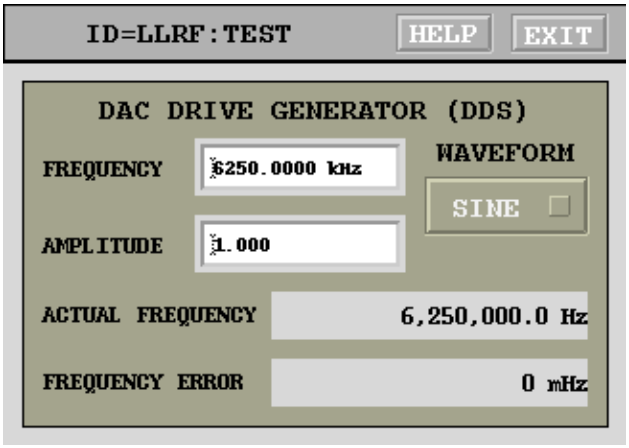

DAC Familiarization

Dmitry Teytelman and Dan Van Winkle

RF and Digital Signal Processing
US Particle Accelerator School
15–19 June, 2009

Student name: _____

June 16, 2009

Contents

1 Introduction

In this lab we will spend some time generating signals with the LLRF4 board. You should have the "LLRF4 Evaluation Board: USPAS Lab Reference" document handy — we will refer to it quite often.

Our basic setup will use a N5181A signal generator and a N9010A spectrum analyzer. The generator will be used as the 250 MHz clock source (shared with the ADC lab). You do not need to adjust that generator.

Set things up as described in Section 1.1 of the LLRF4 reference. Connect 250 MHz clock (the cable will be labeled as such) to the clock input.

2 Exercises

2.1 Generating a Sinewave

Connect digital-to-analog converter (DAC)1 output to the spectrum analyzer and enable the DACs. Set DAC0 and DAC1 source to direct digital synthesis (DDS). Open the DDS control window. Set the amplitude to 1 (full-scale) and the frequency to 10 MHz. Locate the signal on the spectrum analyzer and record measured frequency and power:

2.2 Checking DAC1 frequency response

Set the DDS frequency to several points (5–10, uniformly spaced) across the output range of DC to 125 MHz and record the magnitude measured on the spectrum analyzer:

2.3 Checking DAC0 frequency response

Repeat the above measurement with DAC0 (J18).

2.3.1 After Dinner Questions

- Is DAC1 response consistent with the theoretical zero-order hold output[1]?

- Is DAC0 response consistent with the theoretical zero-order hold output?

2.3.2 Extra Credit

Estimate DAC0 output filter bandwidth.

[1]Hint: normalize zero-order hold (ZOH) response to the low-frequency power out of the DAC

3 Glossary

Glossary

digital-to-analog converter (DAC)

A hardware device to convert a sequence of digital codes to corresponding analog voltages or currents. 2–4

direct digital synthesis (DDS)

A technique for generating arbitrary frequencies and waveforms from a fixed-frequency clock source. 2

zero-order hold (ZOH)

A method of converting discrete-time signals to continuous-time by holding constant sample value for one sample interval. 4