To: Trey German and Advisors

From: Team 04

Date: 1/20/2015

Subject: System Level Test Plans, AFE v2

For the black box testing we wanted to confirm the input requirements to the scope. This includes features like how high frequency of a signal can be inputted to the scope, and how large of a signal. This testing revolved around the front end because that is what takes the input signal and delivers it to the ADC for sampling.

For the setup of this testing the final board was made so a scope probe can take an inputted signal and there were testing wires soldered to the output of the analog front end right before the ADC. This allows us to see when a certain signal is inputted that the signal gets to the ADC correctly to be sampled. Here we are mostly looking for shape because depending on the settings of the programmable gain amplifier the true amplitude is unknown and is only known to the microcontroller which provide the correct gain factor to the samples. For the sake of this testing the lowest settings of gain were used for the programmable gain amplifier.

To start testing the functionality was confirmed with a 50mV input which is reality simulates a .5 V input because of the 10x probes (probes used were set at 1X). At 50 mV a sine wave was put through at 1kHz, 100kHz, 1MHz, and 10 MHz in addition to a square wave at 1MHz and a ramp wave at 200kHz. Again here we want to confirm the correct shape going into the ADC.

These test address the requirements of BBDI-1 and BBDI-2 which both describe characteristics of the input signal.

Here are the results of the first round of testing. (Yellow – Input, Green – Output)

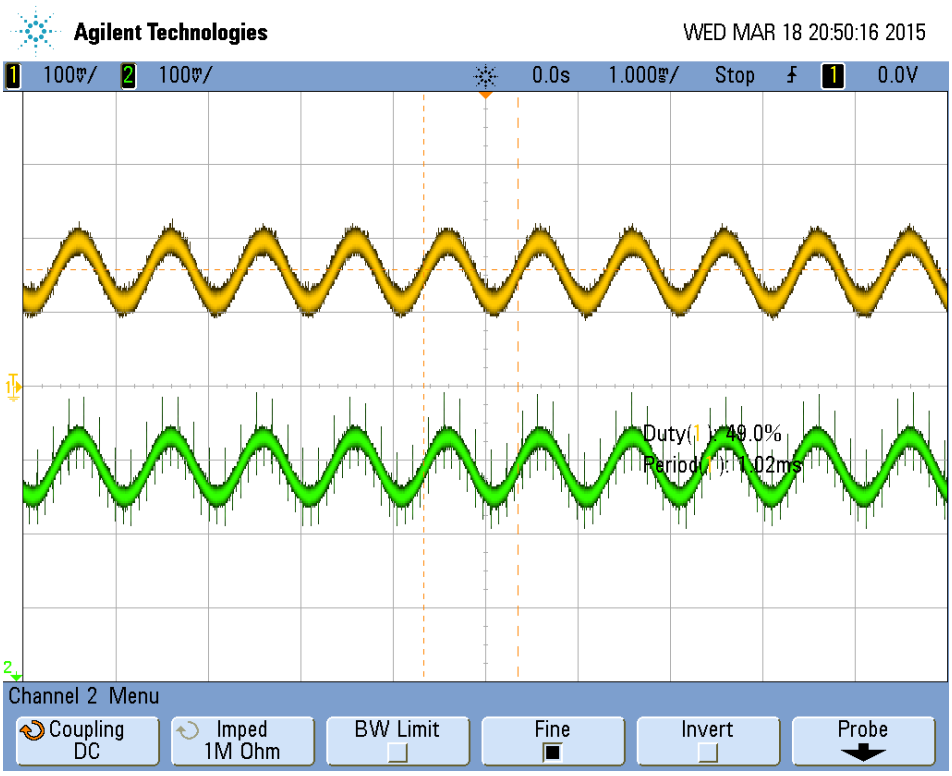

Figure 1. 50 mV Sine at 1kHz

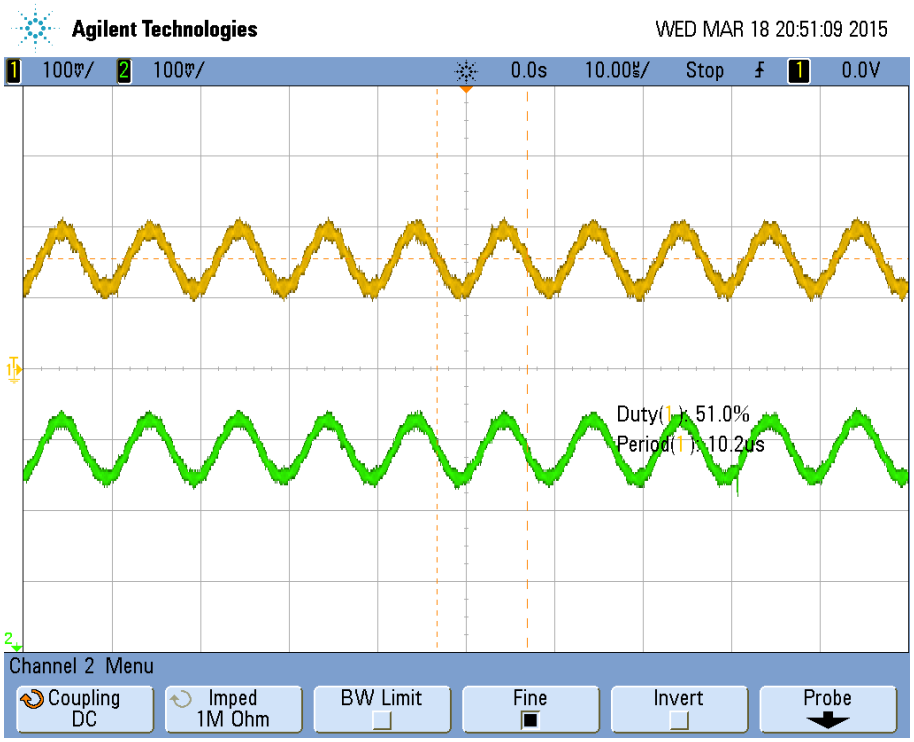

Figure 2. 50mV sine at 100kHz

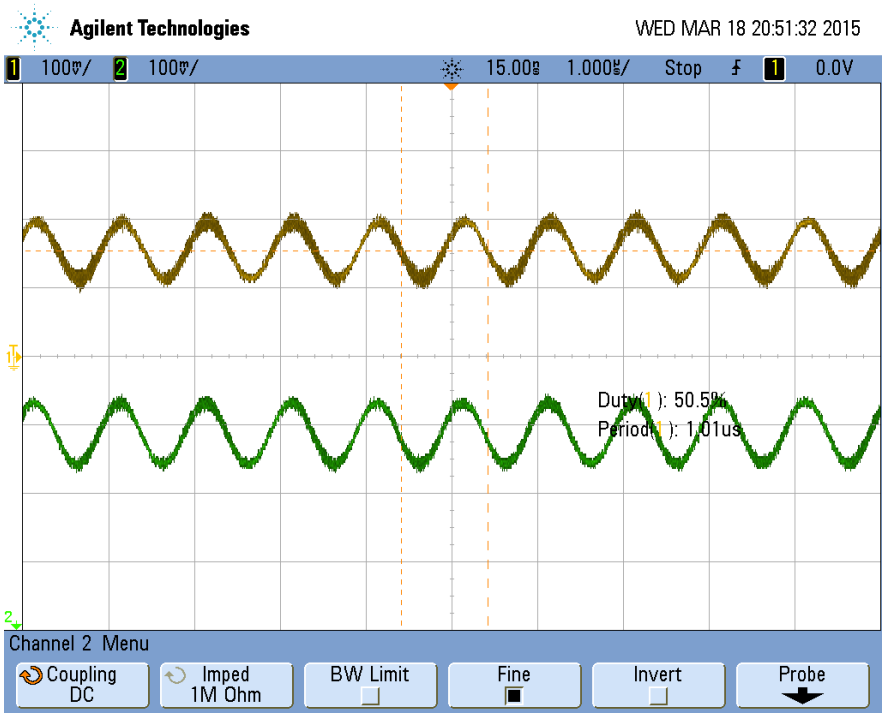

Figure 3. 50mV sine at 1Mhz

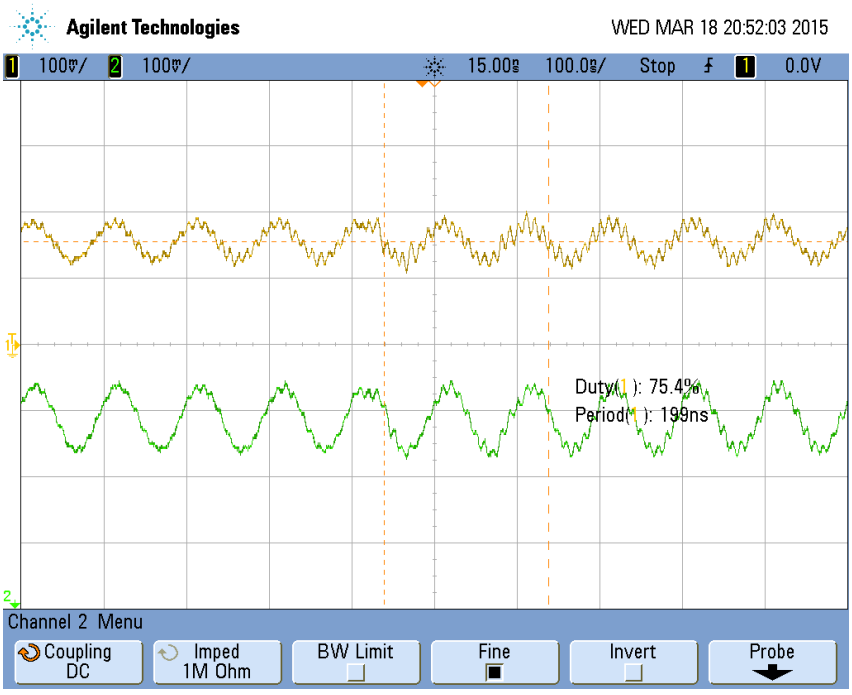

Figure 4. 50mV sine at 10MHz

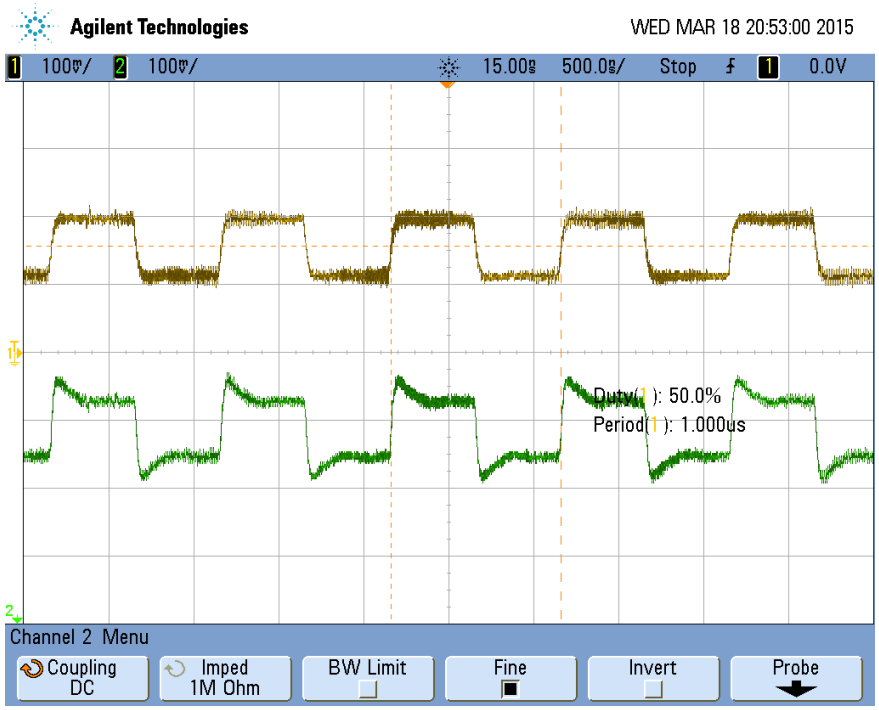

Figure 5. Square Wave at 1MHz

Figure 6. Ramp Wave at 200kHz

The second round of testing includes an input signal of 1.4V simulating a 14V input on 10x probes. 1.5V was tried but the signals saturated failing the 15V goal. However the behavior still should be tested at the max input level. The same tests were performed as before. The only change was the input level of the signal.

Here are the results (Yellow – Input, Green – Output):

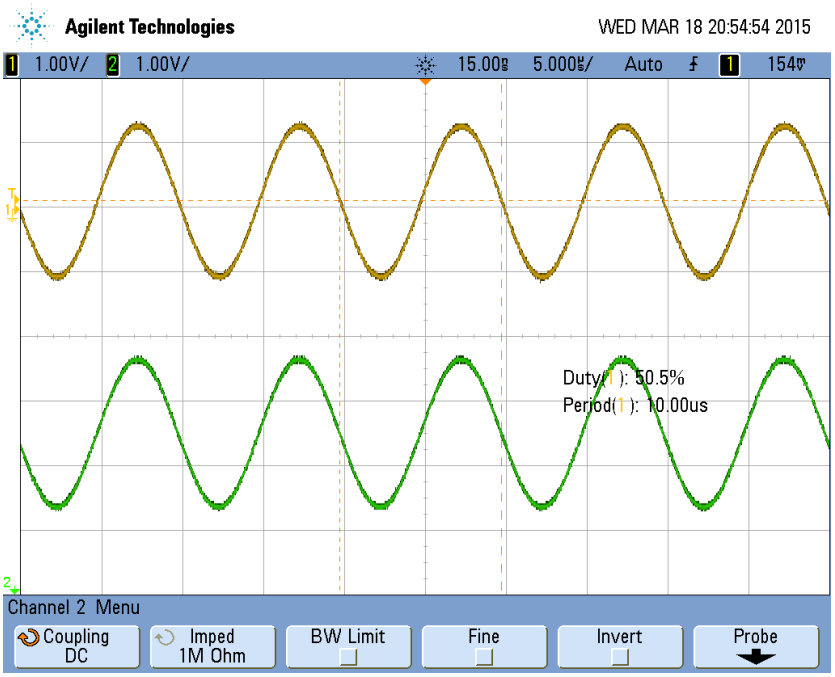

Figure 7. 1.4V Sine at 100KHz

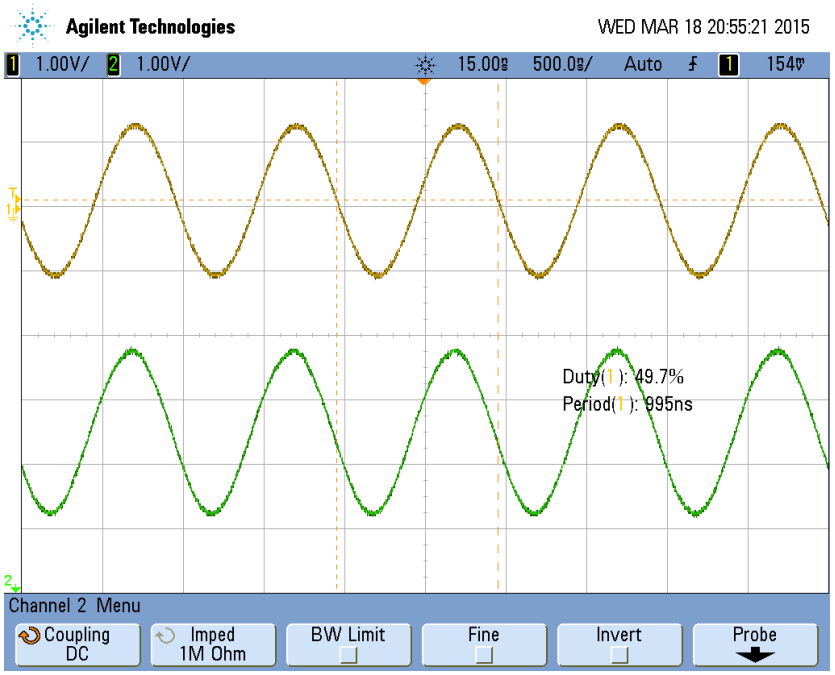

Figure 8. 1.4V Sine wave at 1MHz

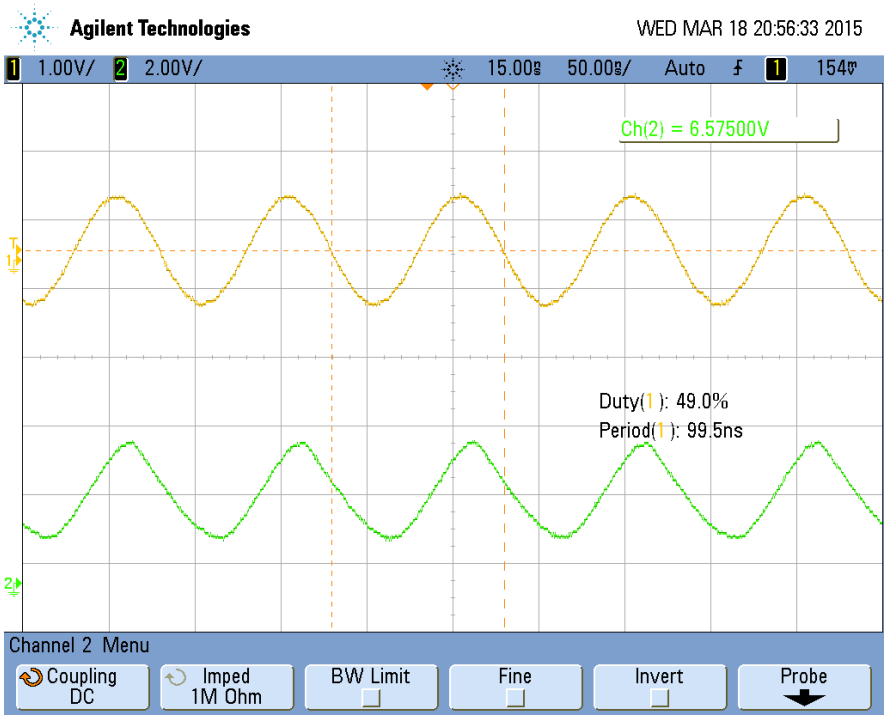

Figure 9. 1.4V Sine wave at 10MHz

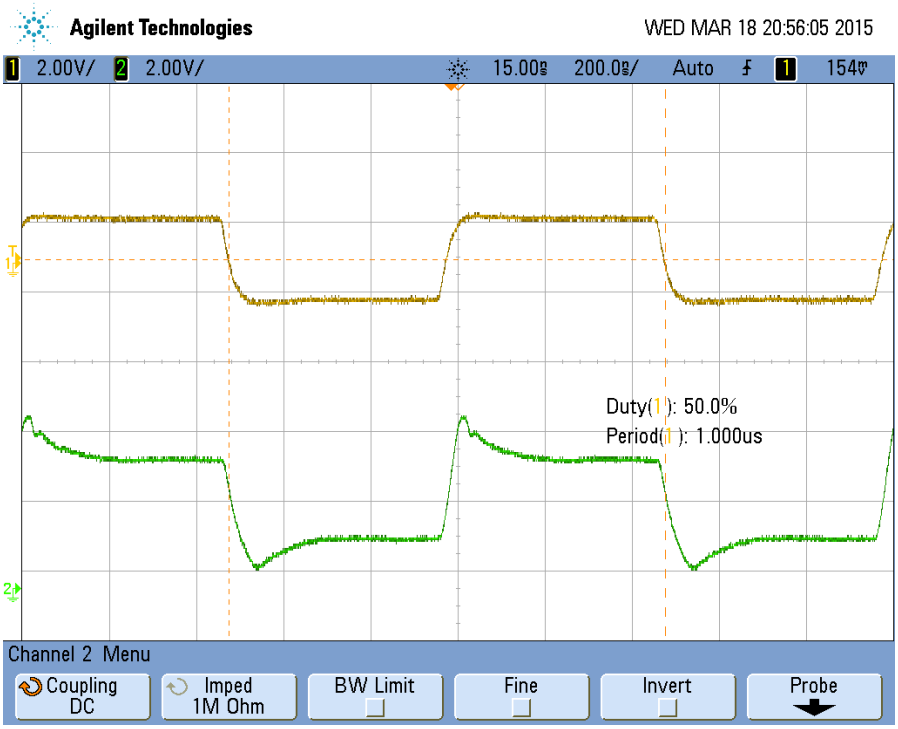

Figure 10.1.4V Square wave at 1MHz

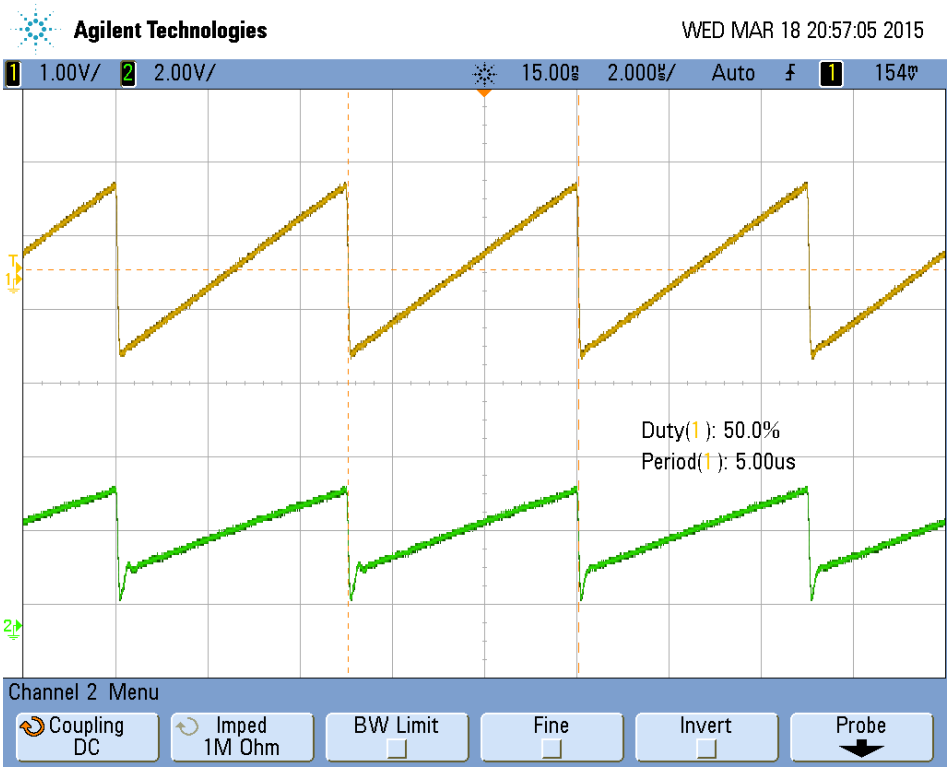

Figure 11. 1.4V Ramp at 200kHz

Conclusions:

For the first round of testing all the signals were able to be put through. When the frequencies were increased to 10MHz the tests were approaching the limits of the signal generator which can be seen in the input signal causing distortion on the output signal. These tests also show the low pass filter has to be looked at to get rid of some of the noise on the inputted signal.

For the second round of testing where the amplitude was increased the signals became much clearer and more defined. In general a lot better results were seen in terms of the shape of the original signal. This shows us at smaller signals the gain settings may have to be increased to get the optimal shape of the output signal.

Overall the requirements were not met perfectly, but with fixes to the low pass filter, using the correct gain settings, and putting a small divider on the front this system can achieve its requirements.