APPLICATION NOTE ON TESTING RADAR SYSTEM

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EEC 134

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I.Introduction

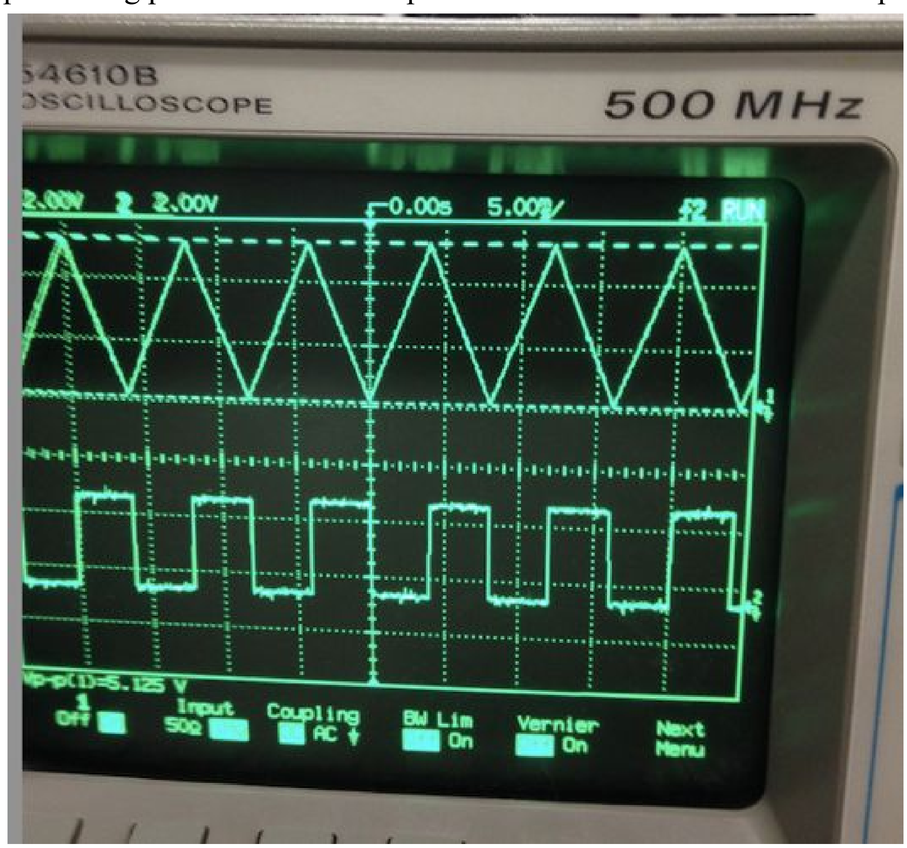
For this project I was given the role of writing the signal processing code and testing the radar printed circuit boards. However, for this particular application note, I would like to write about testing the system, since it is an extremely important step in building a functional system in a short period of time. Testing the system involve three steps: testing the baseband PCB board, testing the RF PCB board and testing the signal processing codes.

II.Testing the Baseband PCB

When testing the baseband PCB design, I choose to follow closely lab 1 procedure with a few adjustments for my group's designs.

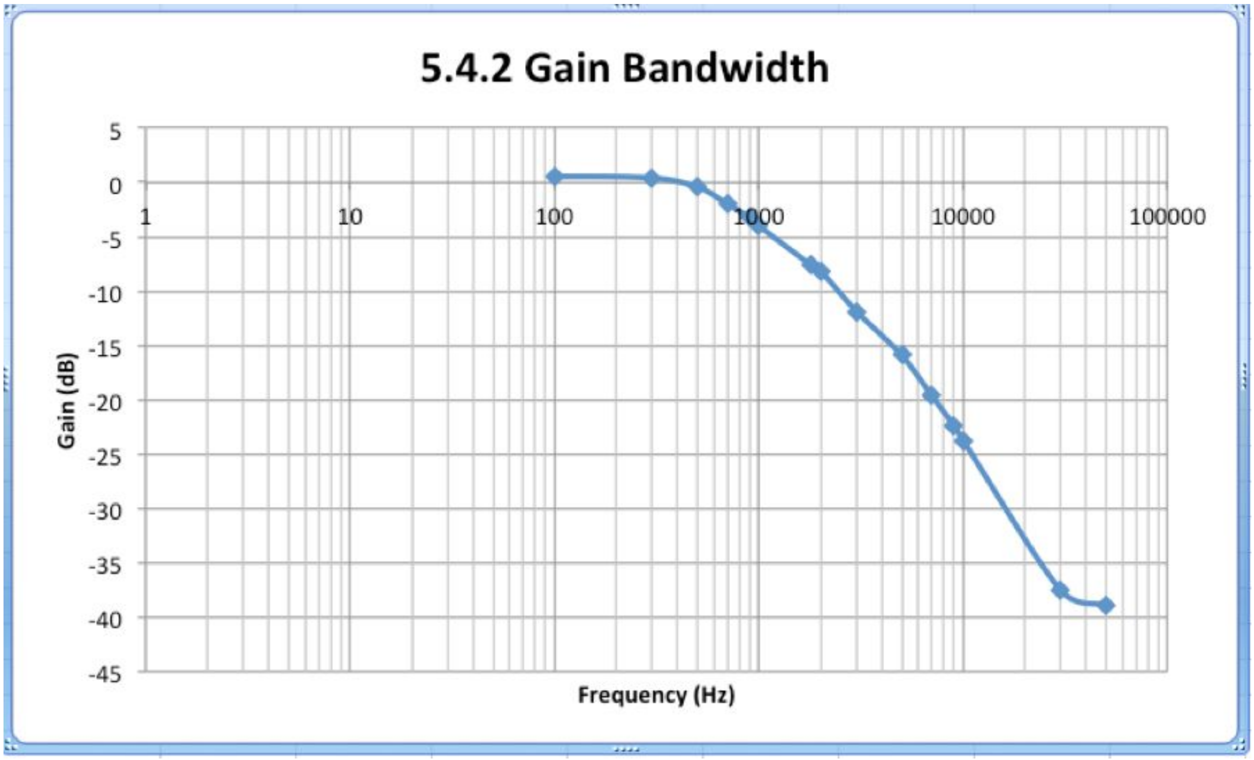
The first step is to test the power supply line by a multimeter. It is very important to insure that the ground and the power lines do not cross since this will burn Teensy chip immediately, which my team was in short supply.

After testing the power supply line, we next test the Teensy with the codes provided by the TA, to see if it can generate the sawtooth and square signals, which will be used in the signal processing part. Here are some pictures of the tests on the oscilloscopes:



To get this image, I use a piece of wire to poke around the Teensy pins or solder a wire at the bottom of the PCB board.

Using the same techniques, I test the gain and amplifier blocks thoroughly, checking each stage output and input. It is noticeable that the gain stage should be adjusted to maximum of three when testing to avoid damaging the operational amplifiers. Some of our data are taken as:



The last step is to check the output node which we have soldered on the board. In this entire process, it is important to note that the power supply pin must be checked at every stage.

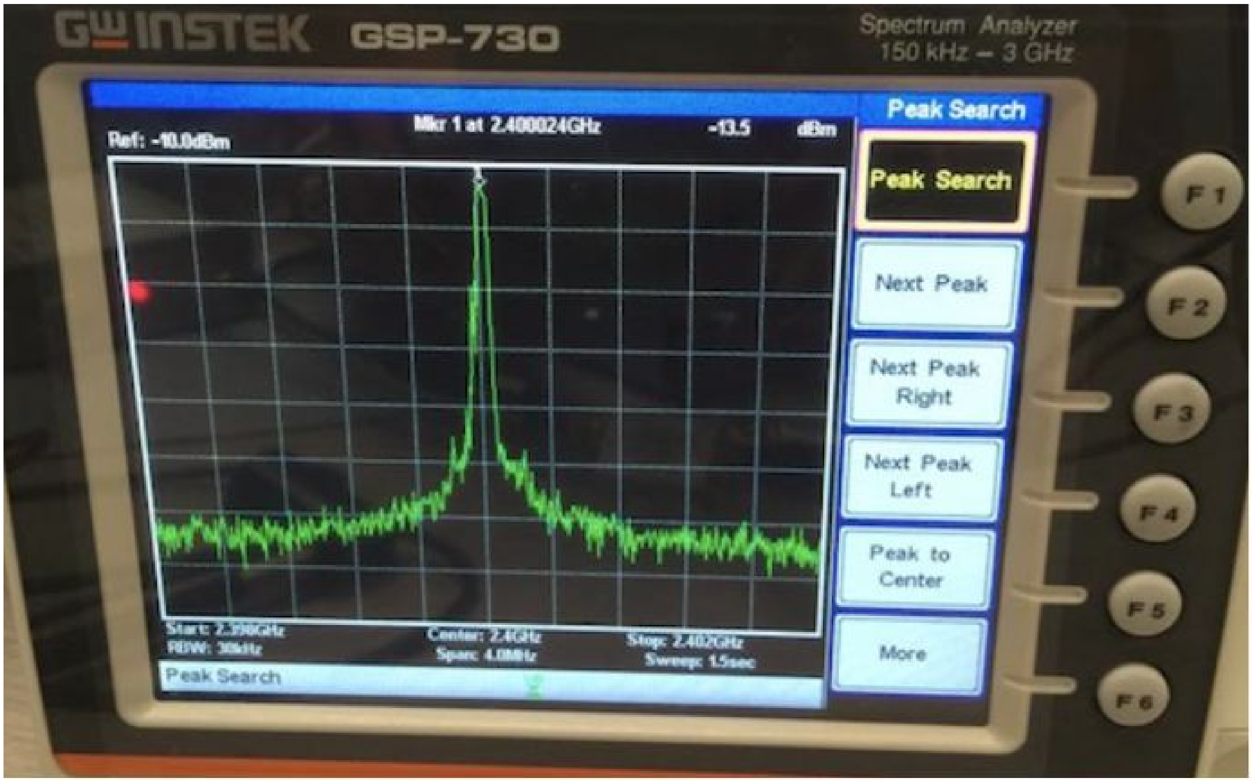
III.Testing the RF PCB

Testing the RF PCB follow a different principles from testing the baseband: instead of stage by stage careful examination of the power supply, the input and the output, I test a whole part of the system first and then each part later. There are many reasons for this, but chiefly is because I can make use of the cables and the spectrum analyzer. Since the RF PCB has very sensitive solder mark, so testing must be taken with great cares not to scratch them.

Since it is difficult to poke around the RF PCB, I follow instruction from the professor to strip the coaxial cable, which is connected to a spectrum analyzer, and use the center core to test the circuit. It is also important that the power generator has to be just right so that damage to the PCB is avoided.

Since my group use two LNAs from the same producers, it is likely that if one works, the other will work as well. Thus we perform only our test on one LNA.

First we test the transmitter by a examining the VCO - LNA - 3dB. Although lab 2 instruction suggest that the use a synthesizer to test it, I find it much better to apply directly the a power supply. Here is some pictures of the test we perform:



As you can see here the output is abnormally low, so I decide to test the VCO output instead, which happens to be normal. Thus, i decide that it is the fault of the LNA. After getting new parts and resoldering the LNAs back on, the testing continues with more success.

The same procedure is applied to the receiver, first the whole system and then the mixer. Both of these seems to be alright, so I move on to testing the codes.

III. Testing the Signal Processing Code

After writing the code, I tried different methods to get the best range resolution for the data. This involved changing the starting and ending frequency for the sweep so that I can get the best result possible.

- Acknowledgement: My team and I are much indebted to MIT can antenna radar system project for their codes, which help us greatly in our development of the radar system.

III. Lessons Learned during the Project

First and foremost, I have learned that testing a project takes a great deal of time and patience, for debugging can be difficult if no precise part is held responsible. Also, testing should be performed as soon as possible so that new parts can be bought and soldered immediately.

Secondly, it is important to ensure that the power supply is stable and functional. Many times the tests went wrong since the lab power supply just stop working entirely.

Last but not least, I do think that soldering the power and ground wire should always be done carefully, since the RF PCB is easier to be shorted.

IV. Suggestion for Future Students

Future students should follow the same principle described here for testing their circuits and consult the TA and the professor if they have any questions.