IOWA STATE UNIVERSITY
College of Engineering

Lightning Talk 4
Millimeter-Wave Imaging Radar

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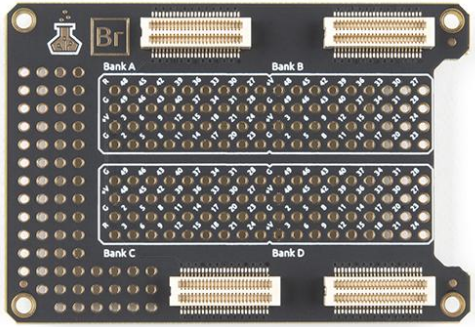
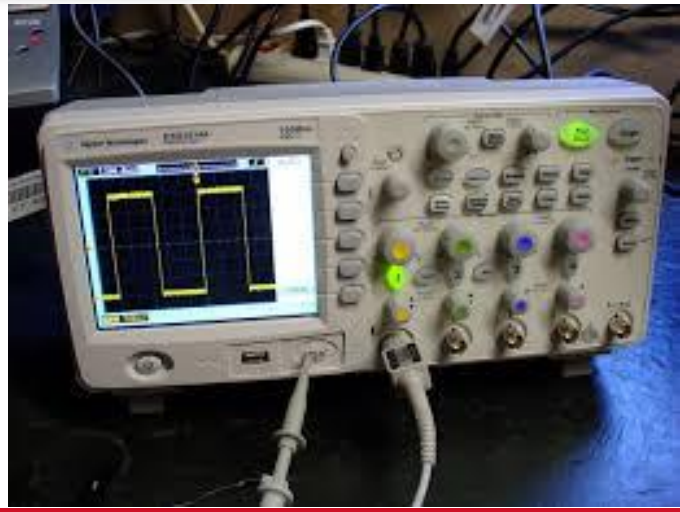
Problem Statement

Researchers and students at Iowa State University need a method to analyze materials, beyond the surface of those materials. The researchers and students are working in CNDE at Iowa State University, but this is not a problem specific to people at Iowa State University, there are likely people working around the world on similar projects. The problem may occur at any point in an items lifecycle, requiring regular analysis of the material. The importance of this is crucial to ensure safe operation, where a material analysis of the inside of a material is required. Finally, we will design a product that will analyze a material to check for defects and communicate that to the analyzer.

4.1:Unit Testing

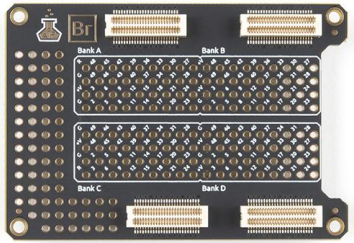
Test	Tools Required
Signal Generation SPI	Vivado, Oscilloscope probe attached to our PCB breakout board pins.
Signal Processing	Vivado, PC code to return these signals to ensure that complex signals are separated properly.
PC code for reading Processed Data	Visual Studio code, the breakout board PCB, test scripts with data configured similar to what can be expected from the FPGA.



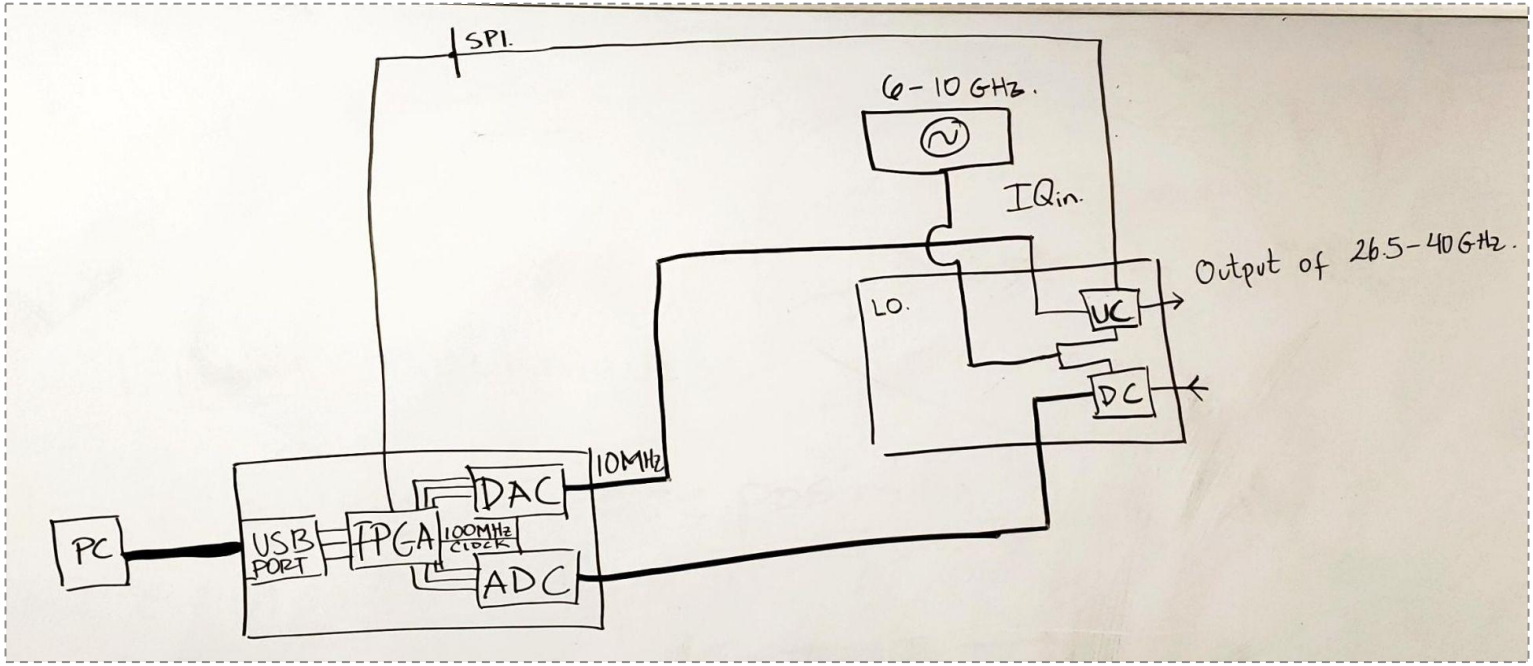


4.2: Interface Testing

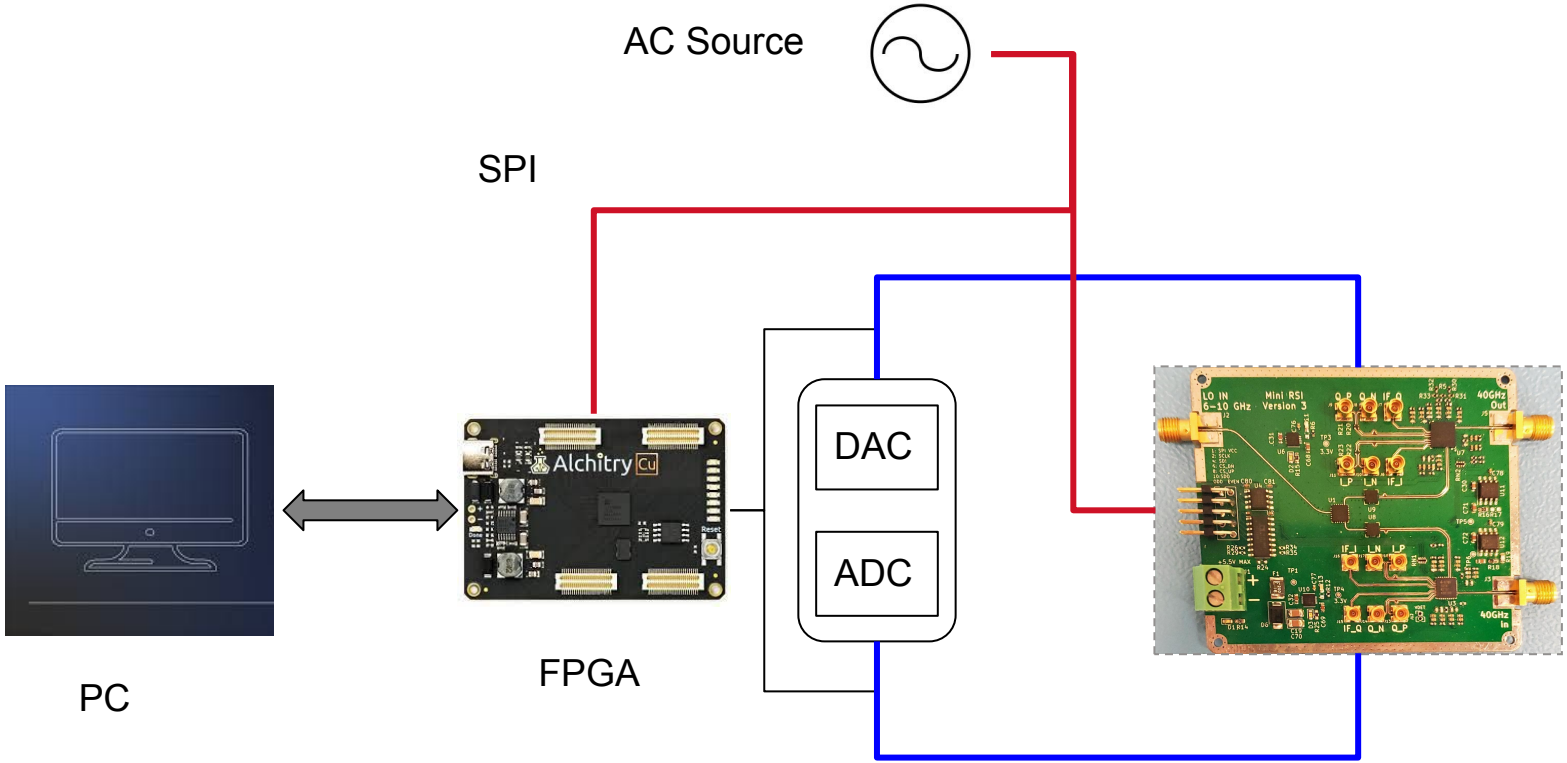
Test	Tools Required
GUI Button/Text box function	Manual test, can only be tested using the GUI itself.
Read/Write to pin functionality	Oscilloscope probe to breakout board or use the FPGA to connect a pin to an onboard LED.
USB connection	USB type C cable, and the final product.



4.3: Integration Testing



4.4: System Testing



4.5: Regression Testing

- Waterfall Organization Structure
- Fully integrated tests for every added component
- Thorough testing of individual components
- Priority components in order of implementation
  - Hardware
  - SPI
  - DSP
  - Interface

4.6: Acceptance Testing

- Clear and detailed to-do lists
- Intercommunication between team members and between the client
  - Weekly in-person meetings for team members
  - Bi-weekly in-person meetings with the client
  - Shared GIT/ message group chat

4.8: Results

Even though we have not completed testing yet we can look at what our device should be capable of…

- Confirming the FPGA is programming the correct SPI registers
- Analysis to confirm we are outputting and receiving the correct signals (DACs, ADCs, USB phy, ect.)
- Measuring a known material and comparing results to what we expect

Example of Final Results