5 Testing

Testing is an **extremely** important component of most projects, whether it involves a circuit, a process, power system, or software.

The testing plan should connect the requirements and the design to the adopted test strategy and instruments. In this overarching introduction, give an overview of the testing strategy and your team's overall testing philosophy. Emphasize any unique challenges to testing for your system/design.

In the sections below, describe specific methods for testing. You may include additional types of testing, if applicable to your design. If a particular type of testing is not applicable to your project, you must justify why you are not including it.

When writing your testing planning consider a few guidelines:

- Is our testing plan unique to our project? (It should be)
- Are you testing related to all requirements? For requirements you're not testing (e.g., cost related requirements) can you justify their exclusion?
- Is your testing plan comprehensive?
- When should you be testing? (In most cases, it's early and often, not at the end of the project)

5.1 Unit Testing

What units are being tested? How? Tools?

In this senior design project, the ADC, display , and wi-fi transmission are being tested. Since all of the above are exclusively software, the "testing" is more along the lines of "does it work?". If yes, then the component has been successfully tested and can be potentially improved upon, depending on any issues with the present version. The ADC being slightly more involved uses a sinusoidal voltage wave input with a DC offset, with the only thing really being tested is a primitive form of the display to show that the ADC is receiving a signal and converting it to a graphable form. The display will be developed in more depth once the wi-fi is able to successfully pass the signal to a separate monitor. We test the WiFi by seeing if the display receives the signal transmission.

5.2 Interface Testing

What are the interfaces in your design? Discuss how the composition of two or more units (interfaces) are being tested. Tools?

The interfacing with our section of our project is mainly one section. This interface is the display that comes over the wifi and into the user's computer. This interface testing will be moved between the group, focusing on ease of use, user friendliness and ability to display properly. We will be working with a known input to be displayed upon the device in the graphing format and then have the person who is using the interface to try and graph the data correctly. We will have another person switch the input to see if the data correctly shows up upon the interface. Another way we are going to test our interface is to have the person utilizing the interface not know the input, be able to see if they can accurately describe the input into the system. We will be using a multimeter and a voltage source to give data into the system and then a computer to receive the data and display it.

5.3 Integration Testing

What are the critical integration paths in your design? Justification for criticality may come from your requirements. How will they be tested? Tools?

The critical integration paths in this design are between the ADC and the display, and the wi-fi and the monitoring device. Since the ADC has no explicit evidence of functionality, it is critical that it must be integrated with the display. This integration will be tested in the same way that the ADC and the display will be tested- does the signal get displayed? If the ADC is not working there won't be a visible signal, and if the display is not working there won't be anything to show the signal. The other major integration path is the wi-fi and the monitoring device. In this case, the wi-fi must be able to be connected to some form of monitor with a compatible graphing function (in the case of this project, LabView will suffice as the function). No wi-fi chip means nothing to transmit, and no monitor means nothing to view the transmission on.

System Testing

We have multiple test units we are using prior to using the devices that will be placed within the circuit. We are testing each chip out individually, specifically using the STM Blue pill before using the STM 32H750 chip so that we can catch any issues that may occur before using the more expensive and unique device. We will be testing things in order of how they would connect within the system, checking each chip as we move onto the next. We will be having breaks within the system when connecting the devices together to make sure we don't override the system with power or data. Focusing on our part of the project, we will have to make sure that each of our three chips are able to work alone before connecting the parts together. We will have test two parts together before adding the third as well as moving past into adding other parts of the project.

5.4 Regression Testing

How are you ensuring that any new additions do not break the old functionality? What implemented critical features do you need to ensure do not break? Is it driven by requirements? Tools?

Physically, our design is pretty well thought out and likely won't need to be changed. Also considering the fact we need to maintain our ability to take a signal, amplify it, convert it and then transmit it, removing any of our components is likely not possible. One thing we will likely be revising frequently that we need to ensure not to break is the code for the STM (which is the microcontroller that does the ADC). We need to ensure that the code is still sampling at a specific rate and then placing that data into a file. So, ensuring that the code still accomplishes all of this will have to be something we check on frequently when making changes to the code.

5.5 Acceptance Testing

How will you demonstrate that the design requirements, both functional and non-functional are being met? How would you involve your client in the acceptance testing?

The final display shows our signal, so since we will know the signal we are inputting we can just look at the display to see if the shape and magnitude of the waveform is accurate based on our input. If we wanted to look at a specific part to see if the amplifier or another part was functioning properly, then we could just use a normal oscilloscope to analyze the signal at a certain point in the system. Since we control the input then we can tell if/where an issue is occurring. We would involve our client in our acceptance testing by first testing basic signals from a waveform generator (or similar device) to prove that it is in fact accurately depicting signals. Then we would replace this input signal with the ones that come from the ultrasound devices they use in the ultrasound lab to ensure it is compatible with what it will actually be used for.

5.6 Results

What are the results of your testing thus far? Include any numerical, graphical, or qualitative testing results here? How do they demonstrate compliance with the requirements or addressing user needs? Use a summary narrative to discuss what you've learned and what next steps need to be taken.

At present, the ADC and a primitive version of the display have been tested. The display shows that the ADC is functioning, and the display needs to be adjusted to show more data and give a more useful image of the ADC output signal. The axes on the graph of the display are too short right now, so the output signal only appears to be a straight line while updating the range of the vertical output rapidly. This shows the ADC is detecting and outputting a sinusoidal voltage signal, but the limited axes prevent this information from being shown in any useful manner.