

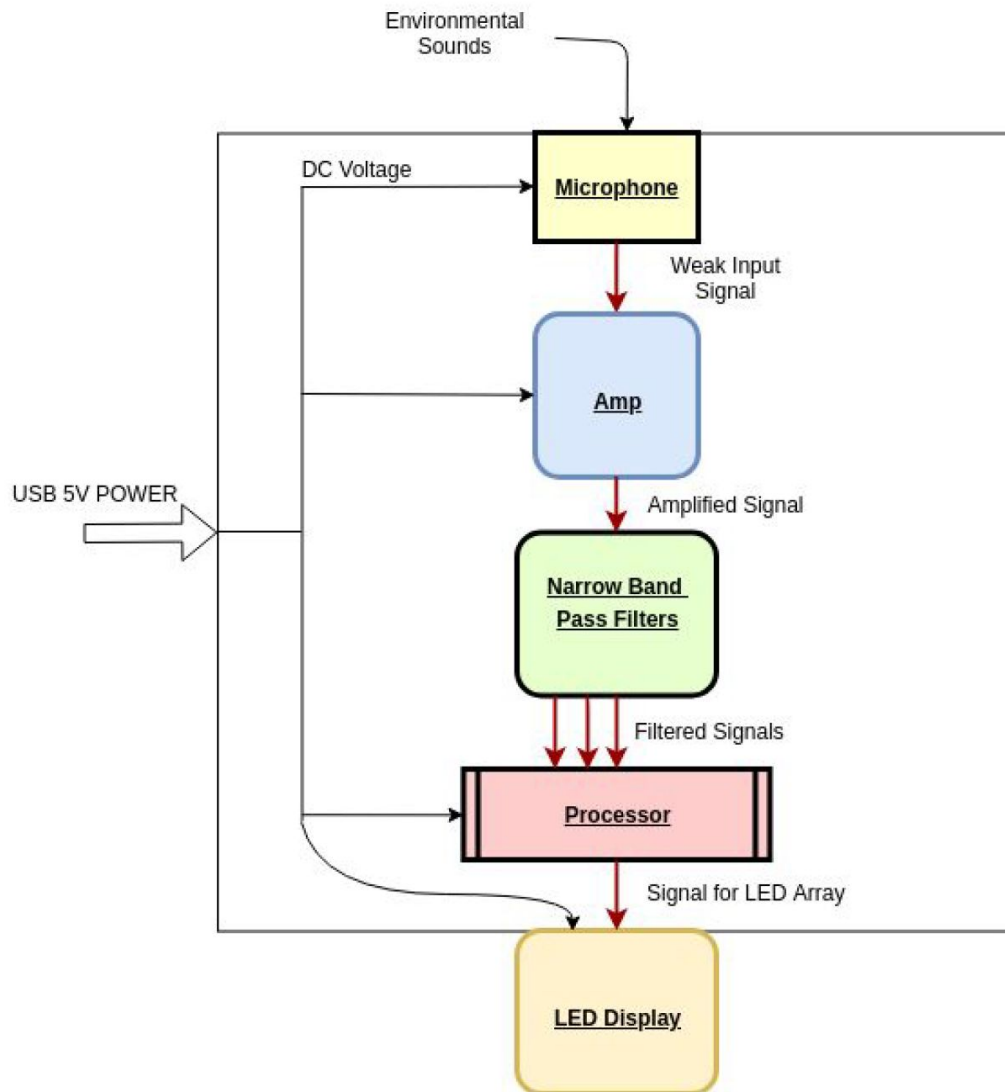
Homework 7 - Audio Spectrum Visualizer: System Test Plan  
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## Introduction

The Audio Spectrum Visualizer is a device that takes in audio input and displays the frequency bands with their related signal strength on an LED matrix. Each frequency band is associated with a certain color. Below is a block diagram that illustrates the Audio Spectrum Visualizer on an abstract level.



## Reference Documentation

Below are links to all of the documents needed to thoroughly test the Audio Spectrum Visualizer.

### Product Design Specifications (PDS)

[Product Design Specifications](#)

### Board Schematic & Layout

[Ver1.3 Schematic](#)

[Ver1.3 Layout](#)

### Datasheets

[Microphone Preamplifier](#)

[MSGEQ7 - Seven Band Graphic Equalizer](#)

[SK6812 - Programmable LED](#)

[Atmel ATmega32U4 - 8-bit microcontroller](#)

[WS2812B - Intelligent Control LED](#)

## Test Objectives

### Unit Testing:

Testing each individual module using the module's specification as a description of desired behavior helps to ensure that each individual system is working correctly prior to integration.

The systems that need to work according to their datasheet prior to integration are:

- MSGEQ7 7 band bandpass filter
- Microphone
- Microphone Preamplifier
- Atmel Atmega32U4 8-bit microcontroller

Once these units have been thoroughly tested and meet the specifications of their respective datasheets, we can confidently move onto integration testing.

### Integration Testing:

The purpose of integration testing is to ensure that the modules interact correctly when connected to one another. Each interface needs to be exercised prior to the entire system being put together. Once integration testing has been thoroughly completed, we can confidently assemble the Audio Spectrum Visualizer and move into acceptance testing.

### Acceptance Testing:

The purpose for acceptance testing in our project is to make sure our product design specifications (PDS) are met. This involves both functional and performance testing. Once these tests pass, the project is finalized.

## System Tests

### Acceptance Test Example:

Test Writers: Nicholas Long, Marcus Chalona, Ian Taylor, Ali Saad			
Test Case Name:	Frequency to LED Mapping	Test ID #:	ACC-01
Description:	Verify each frequency is displayed on the correct row of an 8x8 LED matrix with their associated color.	Type:	Black Box Testing
Tester Information			
	Name of Tester:	Computer Engineering / Electrical Engineering Student/ Graduate	Date:
Hardware Version:		1.3	Time:
Equipment Needed:	Audio Spectrum Visualizer (device being tested), Arbitrary Waveform Generator, BNC Speaker		
Setup:	Power on the Audio Spectrum Visualizer. Make sure the system is reset and all LEDs have no input. Set the arbitrary waveform generator to a frequency sweep from 50 Hz - 16 kHz. Using a BNC Female - Male cable, connect the arbitrary waveform generator to a speaker. Make sure the volume is up on the speaker and within 1 foot of the Audio Spectrum Visualizer. Start the frequency sweep on the waveform generator.		

Step:	Action: Audio Input Frequency	Expected Result	Pass	Fail	N/A	Comments
1	Minimum 63 Hz - Maximum 159 Hz	Column 1: LED should light up red with related power level.				
2	Minimum 160 Hz - Maximum 399 Hz	Column 2: LED should light up green with related power level.				
3	Minimum 400 Hz - Maximum 999 Hz	Column 3: LED should light up blue with related power level.				
4	Minimum 1.0 kHz - Maximum 2.4 kHz	Column 4: LED should light up yellow with related power level.				
5	Minimum 2.5 kHz - Maximum 6.2 kHz	Column 5: LED should light up purple with related power level.				
6	Minimum 6.25 kHz - Maximum 15.9 kHz	Column 6: LED should light up white with related power level.				

7	16.0 kHz	Column 7: LED should light up Aqua with related power level.				
Overall Test Result:						



Unit Test Example:

Test Writers: Nicholas Long, Marcus Chalona, Ian Taylor, Ali Saad						
Test Case Name:		Matrix Array Signal		Test ID #:		ATM-01
Description:		Custom communication protocol for WS2812b LED Array is in the correct frequency range to control LEDs. Frequency must be greater than 400 Hz as per the WS2812B data sheet. This is a white box test as we know the program that is uploaded on the microprocessor.		Type:		White Box Testing
Tester Information						
	Name of Tester:	Level I Technician, Electrical Engineering Senior Student/Graduate		Date:		
Hardware Version:		1.3		Time:		
Equipment Needed:		Atmel ATmega32U4, Oscilloscope, BNC Female - Male Cable, Computer w/ Arduino software installed, Micro USB cable				
Setup:		Attach USB Power and wait 5 seconds for bootloader to initialize. Hook up BNC Female - Male cable from the oscilloscope to the output pin PE6 of the ATmega32U4. This pin can be seen on the Ver1.3 Schematic.				
Step:	Action	Expected Output	Pass	Fail	N/A	Comments
1	Upload Neopixel LED Matrix "HOWDY" example program from the Adafruit Neopixel library	Frequencies read on oscilloscope are greater than 400 Hz and less than 800 Hz.				
Overall Test Result:						

Integration Test:

Test Writers: Nicholas Long, Marcus Chalona, Ian Taylor, Ali Saad						
Test Case Name:		Signal to LED Matrix		Test ID #:		STG3-01
Description:		LED Matrix Array responds to the signal that was developed in the unit test ATM-01 above.		Type:		White Box Testing
Tester Information						
	Name of Tester:	Level I Technician, Electrical Engineering Senior Student/Graduate		Date:		
Hardware Version:		1.3		Time:		
Equipment Needed:		Atmel ATmega32U4, 8x8 LED Neopixel Matrix Array, Computer with Arduino software installed, Micro USB cable				
Setup:		Attach USB Power and wait 5 seconds for bootloader to initialize. Make sure the LED Matrix Array is attached to pin PE6 of the ATmega32U4. This pin can be seen on the Ver1.3 Schematic.				
Step:	Action	Expected Output	Pass	Fail	N/A	Comments
1	Upload Neopixel LED Matrix "HOWDY" example program from the Adafruit Neopixel library	"HOWDY" displays on 8x8 LED Neopixel Matrix Array				
Overall Test Result:						