GrAPE

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**Interface Control Document**

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Interface Control Document

for

Project Name Here

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# Overview

This document will cover the input and output interfaces for the planned design of the GrAPE, a graphic portable analog equalizer.

Exterior interfaces are those inputs that the user of the device interacts with. The external interfaces are as follows: A main power on/off switch, an input auxiliary connection location, an output auxiliary connection location, a wireless Bluetooth input connection, a wireless Bluetooth output connection, 10 frequency gain sliders, 2 stereo-audio gain sliders, 1 main gain slider, a bluetooth input on/off switch, a bluetooth output on/off switch, an output LCD, an input selection panel corresponding to the LCD, 4 output battery indicator LEDs, and a charger input connection port.

Internal interfaces are those involved in the exchange of data/information or power in a way that the user does not immediately interact with. The internal interfaces are as follows: a battery that provides power to all internal systems, a Bluetooth receiver, a Bluetooth transmitter, and a main signal PCB for left and right audio. Note that interfaces that the user interacts with are excluded from the internal interfaces because they are considered external interfaces.

# References and Definitions

## References

**ANSI S1.11-2004**

**Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters**

15 June 2009

## Definitions

CCA Circuit Card Assembly

mA Milliamp

mW Milliwatt

MHz Megahertz (1,000,000 Hz)

TBD To Be Determined

TTL Transistor-Transistor Logic

VME VERSA-Module Europe

# Physical Interface

## Weight

## Overall

| **Component** | **Weight** |
| --- | --- |
| GrAPE | up to 15 lbs |

Table 1: Overall Weight

## Internals

| **Component** | **Weight** | **Number of Items** | **Total Weight** |
| --- | --- | --- | --- |
| ESP32-WROVER-E  Bluetooth module | Estimated 7.74g | 2 | 15.5g |
| NHD-C12832A1Z-FSW-FBW-3V3 LCD | Estimated 1.2g | 1 | 1.2g |
| L37A26-1-0-3WA3  Rechargeable Battery | 56.7g | 1 | 56.7g |
| Main Signal PCB | TBD | 1 | TBD |
| SAM4S Series  DAC | Estimated 800mg | 1 | 800mg |

Table 2: Main Console Weight

* + 1. **Externals**

| **Component** | **Weight** | **Number of Items** | **Total Weight** |
| --- | --- | --- | --- |
| USB to TBD charger | TBD | 1 | TBD |

Table 3: External Weight

## Dimensions

### Overall Dimensions

| **Component** | **Length** | **Width** | **Height** |
| --- | --- | --- | --- |
| External Case | up to 18’’ | up to 9’’ | up to 4’’ |

Tabel 4: External Case Dimensions

### Main Signal Manipulation

| **Component** | **Length** | **Width** | **Height** |
| --- | --- | --- | --- |
| Main Signal PCB | TBD | TBD | TBD |

Table 5: Main Signal Manipulation Dimensions

* + 1. **Display and Power Supply**

| **Component** | **Diameter** | **Length** | **Width** | **Height** |
| --- | --- | --- | --- | --- |
| NHD-C12832A1Z-FSW-FBW-3V3 LCD | N/A | 41.4mm | 4.9mm | 24.3mm |
| L37A26-1-0-3WA3  Rechargeable Battery | 17.8mm | N/A | N/A | 68.6mm |

Table 6: Display and Power Supply Dimensions

* + 1. **Bluetooth Input/Output**

| Component | Length | Width | Height |
| --- | --- | --- | --- |
| ESP32-WROVER-E Bluetooth Module | 3 cm | 1.8 cm | 0.3 cm |
| SAM4S Series  DAC | 1.2 cm | 1.2 cm | 0.1 cm |

Table 7: Bluetooth Input/Output Dimensions

## Mounting Locations

The components of the GrAPE will be mounted on PCBs and attached to a 3D printed case. The GrAPE will be portable and also contain a battery that will be chargeable. Therefore, the equalizer will be able to be used anywhere and will not require a mount of any kind. The GrAPE will sit on a flat surface and work from any location.

# Thermal Interface

The GrAPE may not use a heat sink as most of its devices will not perform complex computations. However, the GrAPE will be designed to have wiggle room for its lithium-ion rechargeable battery. This is to prevent the battery from compressing and potentially breaking inside the device.

# Electrical Interface

## Primary Input Power

## Primary Power for Subsystems

The GrAPE will be powered by a 3.7V and 2700mAh rechargeable lithium-ion battery. The battery will supply power to both bluetooth modules, the DAC, the main signal manipulation system, as well as the display of the GrAPE. The voltage will be regulated by a buck converter to provide acceptable voltages for devices in the GrAPE which cannot use 3.7V.

## Voltage and Current Levels

The values on Table 6 show the voltage, current and power levels of the main components of the GrAPE. As seen from the table the total power consumption from our current voltage and current levels yield 5W. Note that the main signal manipulation currently does not have voltage or current values therefore it is expected that the power consumption of the GrAPE might be larger than 5W.

Table 6: Maximum Values

| **Component** | **Voltage [V]** | **Current [mA]** | **Power [W]** |
| --- | --- | --- | --- |
| ESP32-WROVER-E (x2)  Bluetooth Module | 3.6 (3.3 TYP) | 1000 | 3.6W |
| SAM4S Series  DAC | 3.6 (3.3 TYP) | 400 | 1.44W |
| NHD-C12832A1Z-FSW-FBW-3V LCD | 3.3 (3.0 TYP) | 1 | 0.0033W |
| Main Signal Manipulation | TBD | TBD | TBD |

## Signal Interfaces

## Bluetooth Modules

The GrAPE will utilize two Bluetooth modules to receive and transmit Bluetooth signals to a specific device. The Bluetooth module selected, the ESP32-WROVER-E, utilizes its integrated ADC to communicate to the desired receiver and effectively transmit the Bluetooth audio signal to said receiver.

## User Interface

The user control interface will consist of a display and a control pad. The display will show on an LCD a menu with all the available Bluetooth devices nearby. The user will then be able to use the control pad to select the Bluetooth device they want to connect to.

# Communications / Device Interface Protocols

## Bluetooth

The GrAPE has two built-in Bluetooth modules using IEEE 802.11 ac standards. This Bluetooth will allow for wireless transfer of an audio signal to and from the GrAPE.

## Auxiliary

The audio signal will have the ability to come out of an auxiliary output and should have the ability to go into an auxiliary input connection.

## Wired Battery Charging

The battery will be charged by wire using IEEE Std 946 standards. This battery will supply power to all subsystems throughout the GrAPE.