

E2.08: Team Echo: Wireless Speaker System

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Project Description

- Our project is a wireless speaker system that has:
- Audio output of 80 dB at 1 meter
 - Capable of being used in a 10 x 10 ft room
 - Recharging capabilities
 - Utilizes an analog crossover for filtering the input signal to the subwoofer & the speakers

Project Motivation

- Experience with analog circuit design & system integration
- Offers a high quality & low cost wireless speaker system

Subsystems & Responsibilities



Haley Hirschfield

- Rechargeable Power Subsystem**
- 4-Hour Maximum Recharge Time
 - 10-Hour Minimum Battery Life



Sergio Morales

- Analog Crossover Subsystem**
- Linkwitz-Riley Filter
 - 12 dB/Octave Fall-Off Rate
 - 200 Hz Cut-Off Frequency



Mason Killingsworth

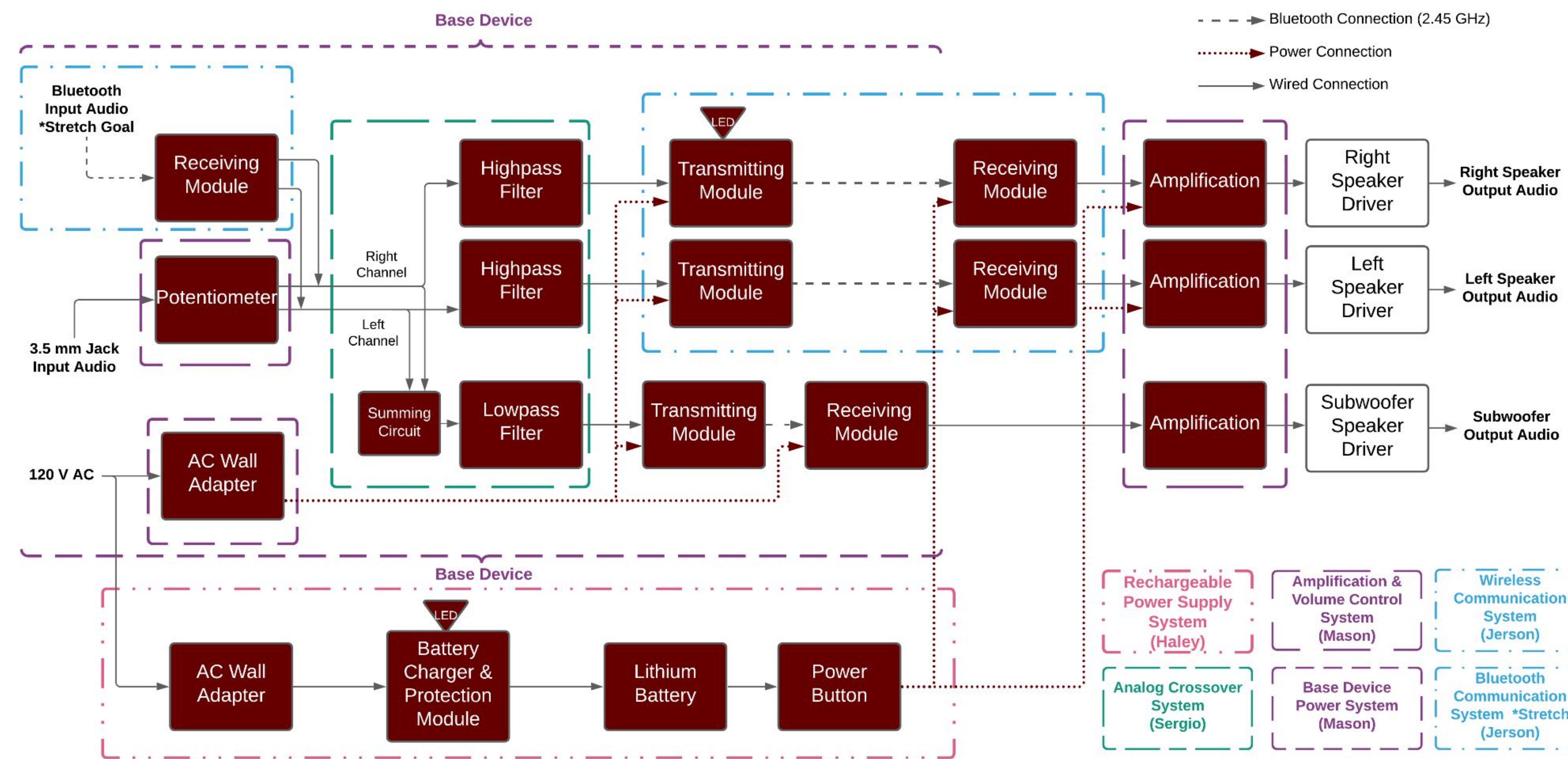
- Amplification & Volume Control Subsystem**
- Audio Output of 80 dB at 1 m
- Base Device & Power Subsystem**



Jerson Quispe

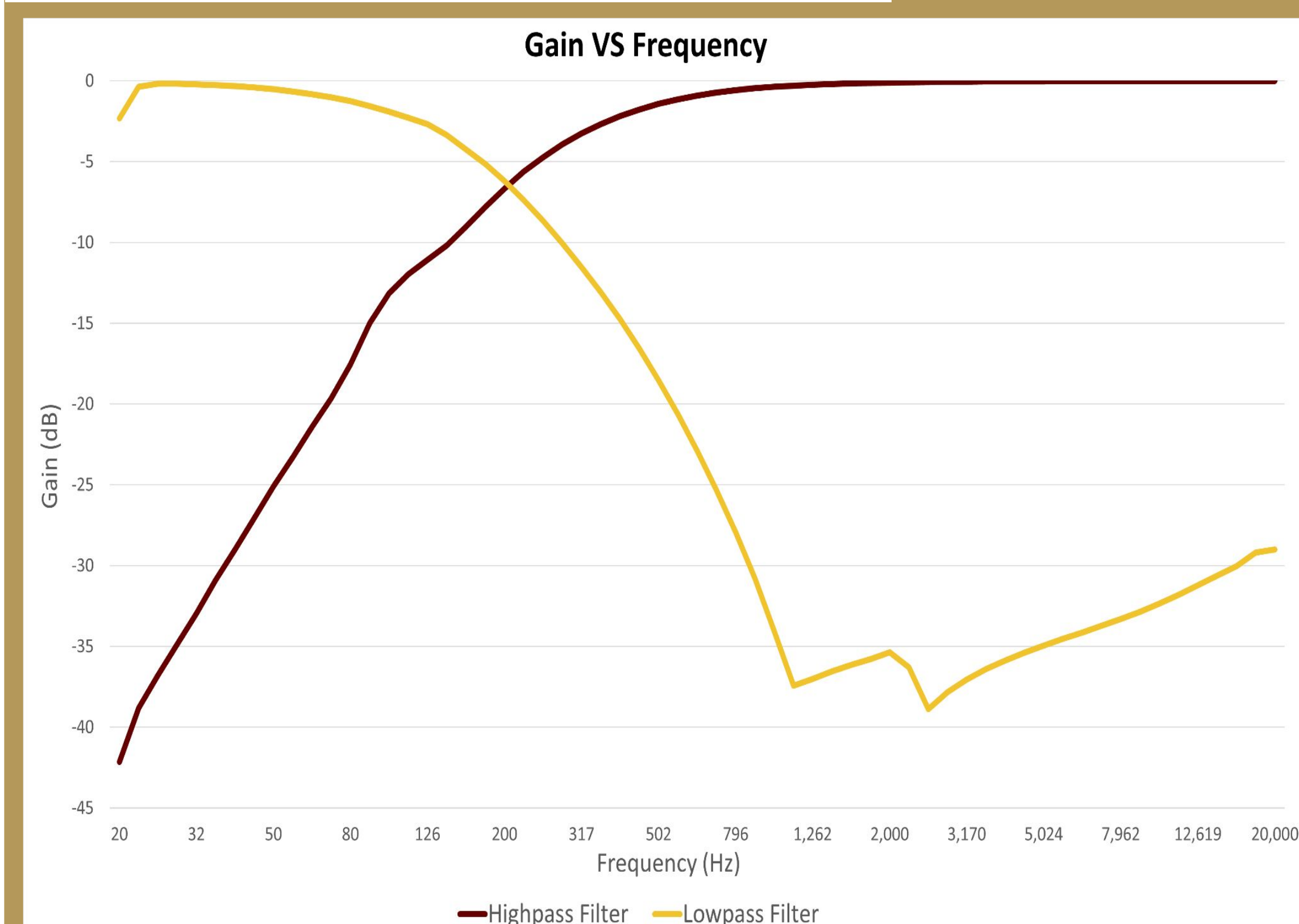
- Wireless Communication Subsystem**
- 10'x10' Connection Range
- Bluetooth Communication Subsystem**

Project Design

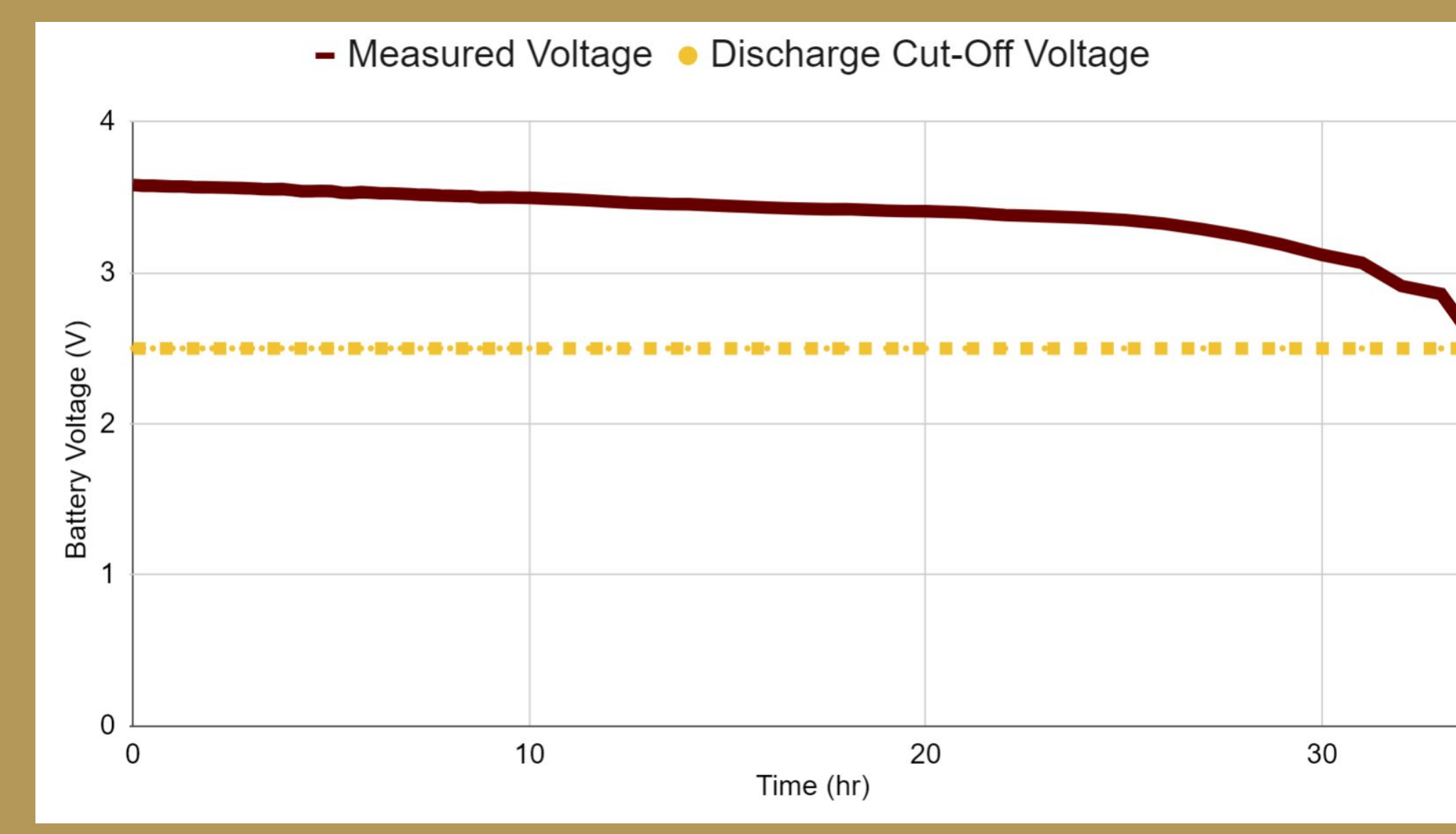


Data

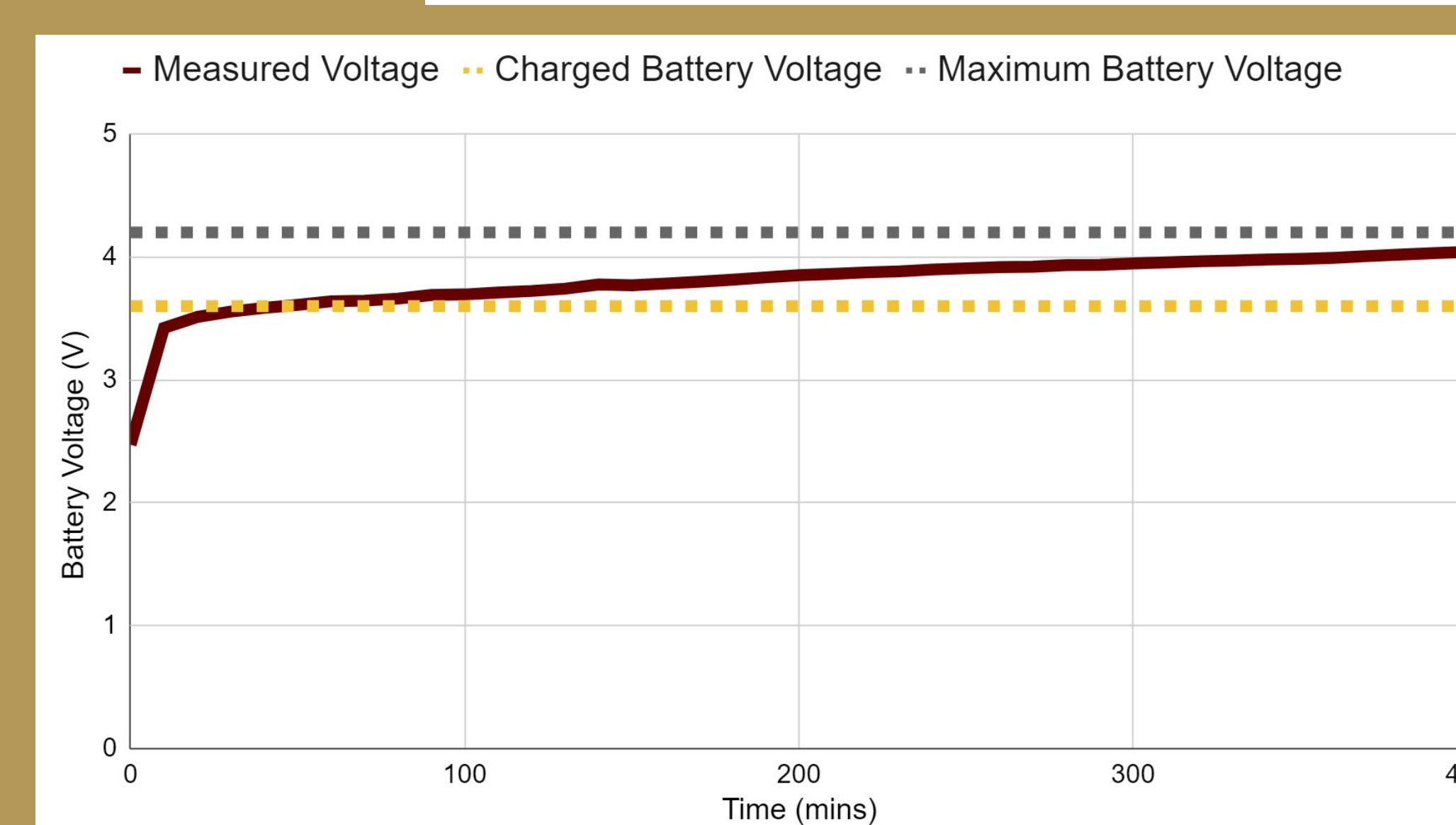
Analog Crossover Bode Plot



Battery Discharge Voltage Plot



Battery Recharge Voltage Plot



Acknowledgments

Sponsor: Mark Welker
Faculty Advisor: Dr. Harold Stern
Dr. Richard Compeau & Daniel Lewis
OptimallyMark, LLC

Requirements & Testing

| Requirement | Result |
|---|--|
| Transmission in a 10'x10' room | PASS 30 ft Maximum |
| Cutoff Frequency of 200 Hz | PASS ~185 Hz (High Pass) ~217 Hz (Low Pass) |
| -12 dB/octave Fall-Off Rate | PASS ~11.58 dB (High Pass) ~12.94 dB (Low Pass) |
| 80 dB SPL at 1 m (Speakers) | PASS 88 dB at 1 m |
| 80 dB SPL at 1 m (Subwoofer) | PASS 81 dB at 1 m |
| Minimum Battery Life of 10 Hours | PASS 34 Hours |
| Maximum Recharge Time of 4 Hours | PASS 0.83 Hours (Nominal Voltage) |
| <\$50 Budget (Without Enclosures & Drivers) | FAIL* \$52.41 \$49.38 (Excluding Stretch Goal) |

Budget Breakdown

| Subsystem | Subsystem Price |
|--|-----------------|
| Wireless Communication | \$20.19 |
| Rechargeable Power | \$16.42 |
| Amplification & Volume Control | \$7.00 |
| Base Device & Power | \$4.14 |
| Analog Crossover | \$2.01 |
| Total System Cost (Excluding Drivers & Enclosures) | \$49.76 |