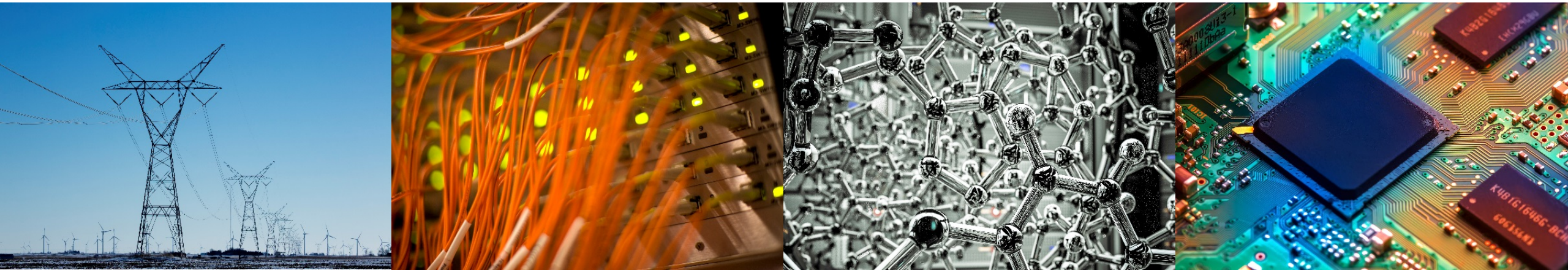


WSSS: Wireless Speaker Sharing System

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ECE445 Senior Design Fall 2020



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Electrical & Computer Engineering

GRAINGER COLLEGE OF ENGINEERING

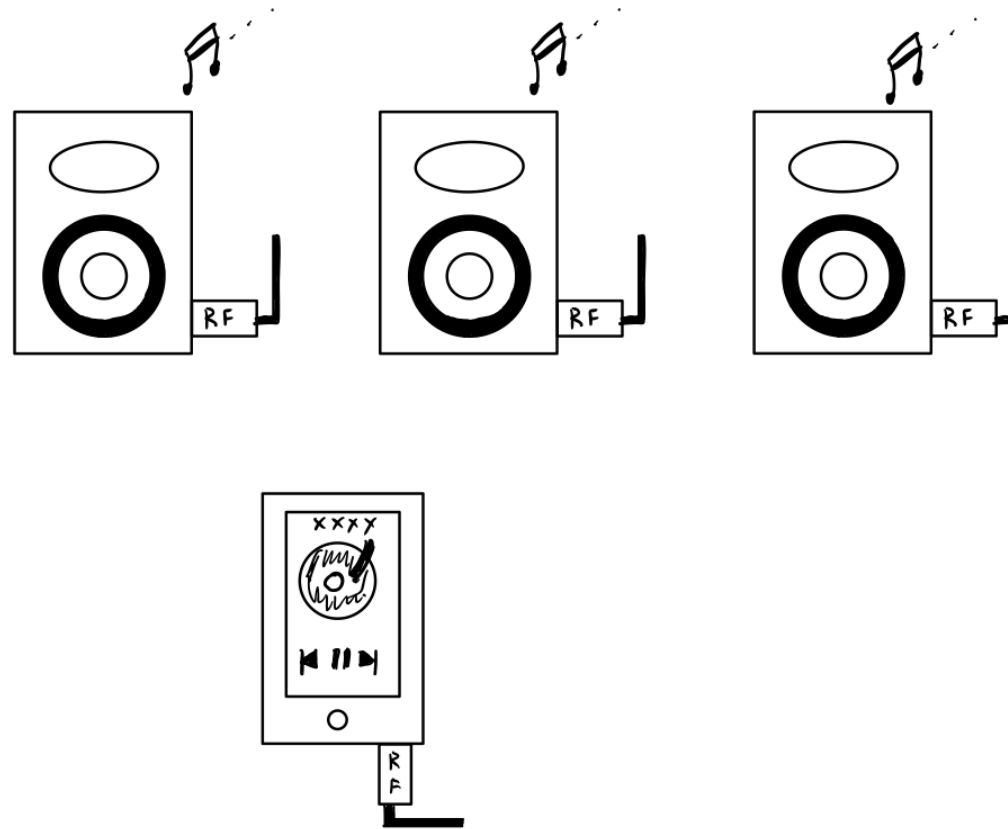
Introduction

- Inspired by the uncomfortable experience with a single speaker at parties
- Easy setup
 - No pairing, sign-up or network needed
 - Plug-and-play: a wireless AUX "cable"
- Broadcasting to multiple speakers
- Transmit over radio frequency (2.4GHz)

Objective

- Interface with the 3.5 mm audio jack
- A plug-and-play device
- Audio playback in sync (latency < 15 ms)
- Works anywhere within 10 meters radius

Typical Use Case



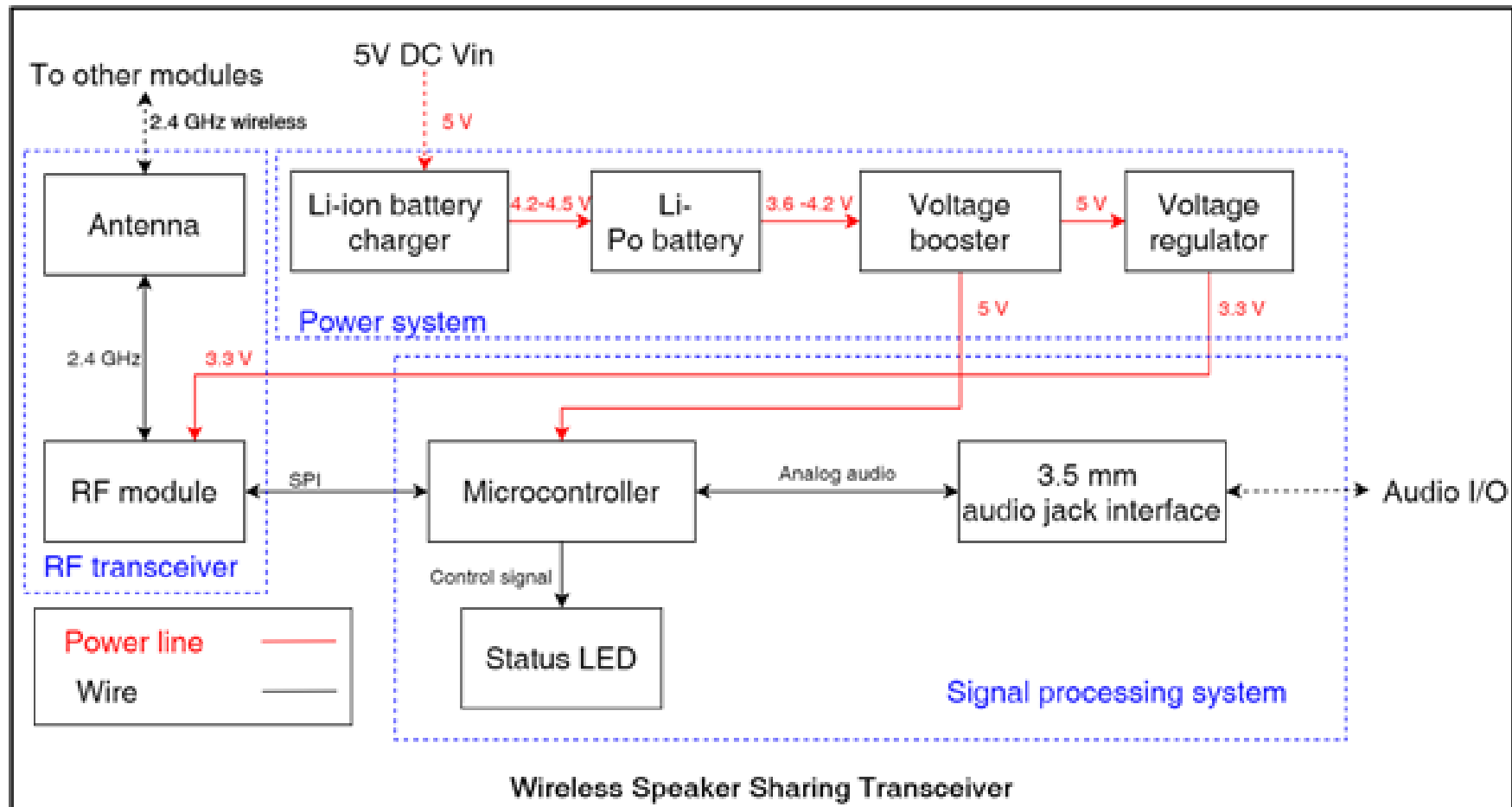
Typical Use Case



Design

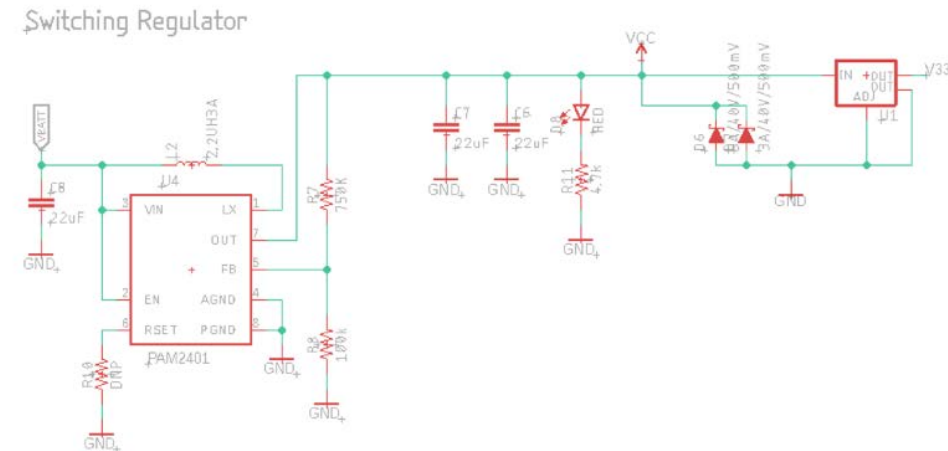
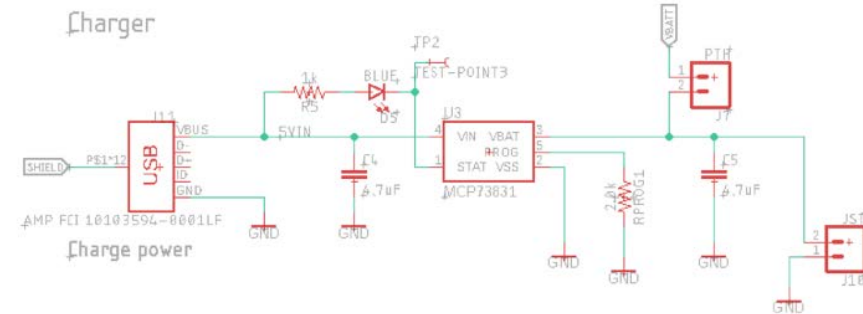
- Power Subsystem
- Signal Processing Subsystem
- RF Transceiver Subsystem

Block Diagram



Power Supply

- Voltage booster: boost 3.7V battery output to 5V (microcontroller)
- Voltage regulator: down-step 5V to 3.3V (RF module)
- Charging circuit with overcharge protection



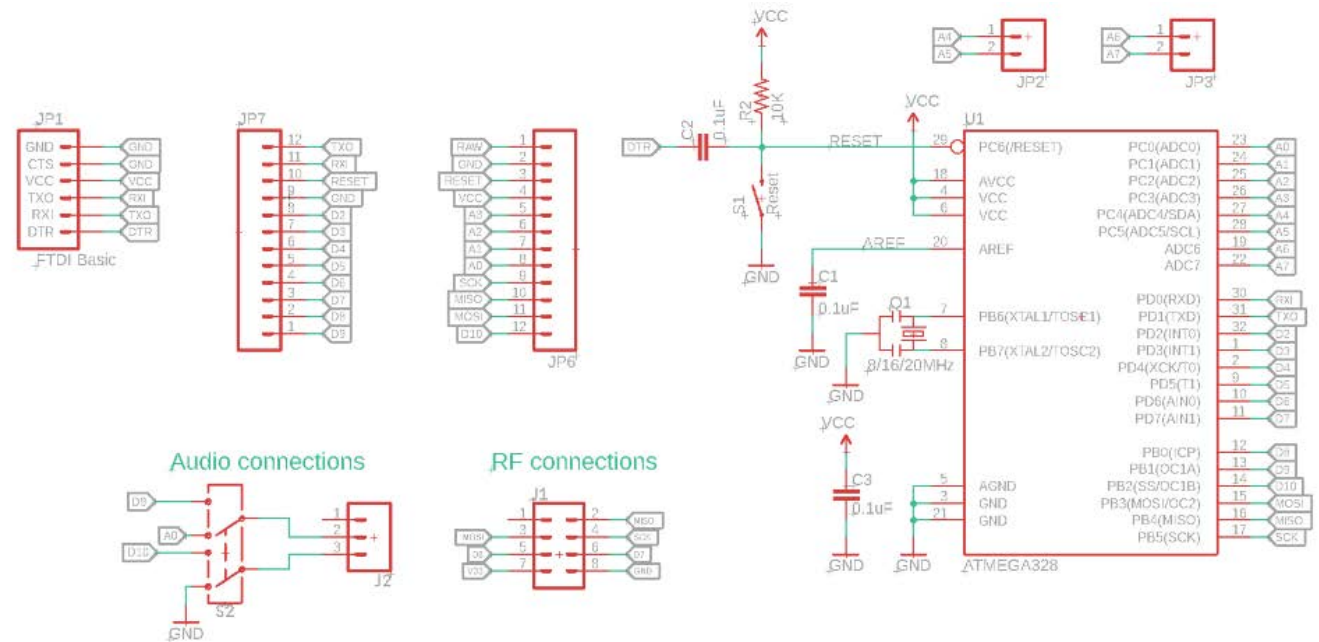
Power Supply R&V

- Supplying 5V to the microcontroller
- Supplying 3.3V to the RF chip
- Charge the battery at 4.2V

Measurement Point	Expected Value	Measured Value
V_{33}	$3.3V \pm 0.1V$	3.28V
V_{cc}	$5.0V \pm 0.1V$	5.08V
V_{charge}	$4.2V \pm 0.1V$	4.19V

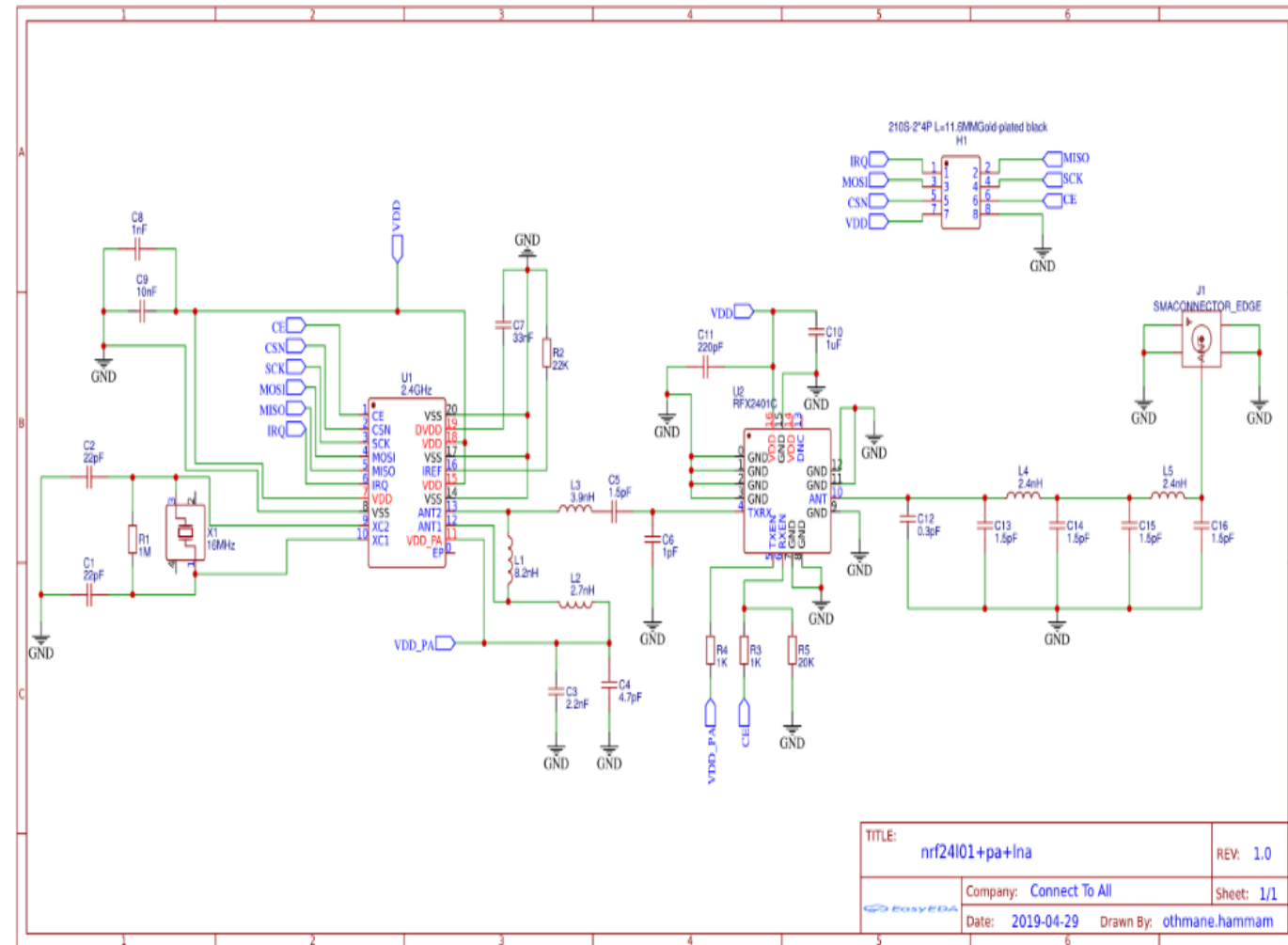
Microcontroller Schematics

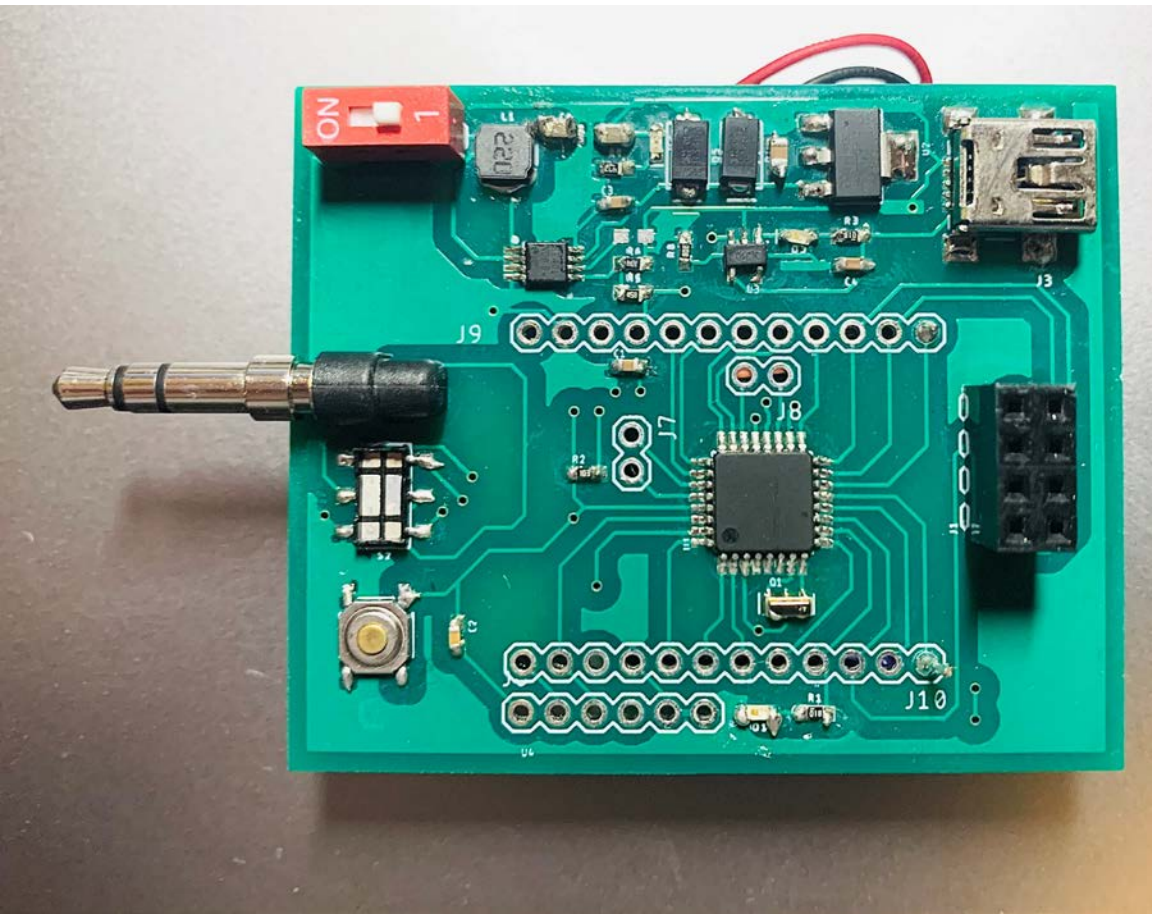
- Transmitter and receiver share same board design
 - 2-to-4 switch for switching between the two



RF Transceiver R&V

- Requirements
 - Range: 10 meters
 - Omnidirectional





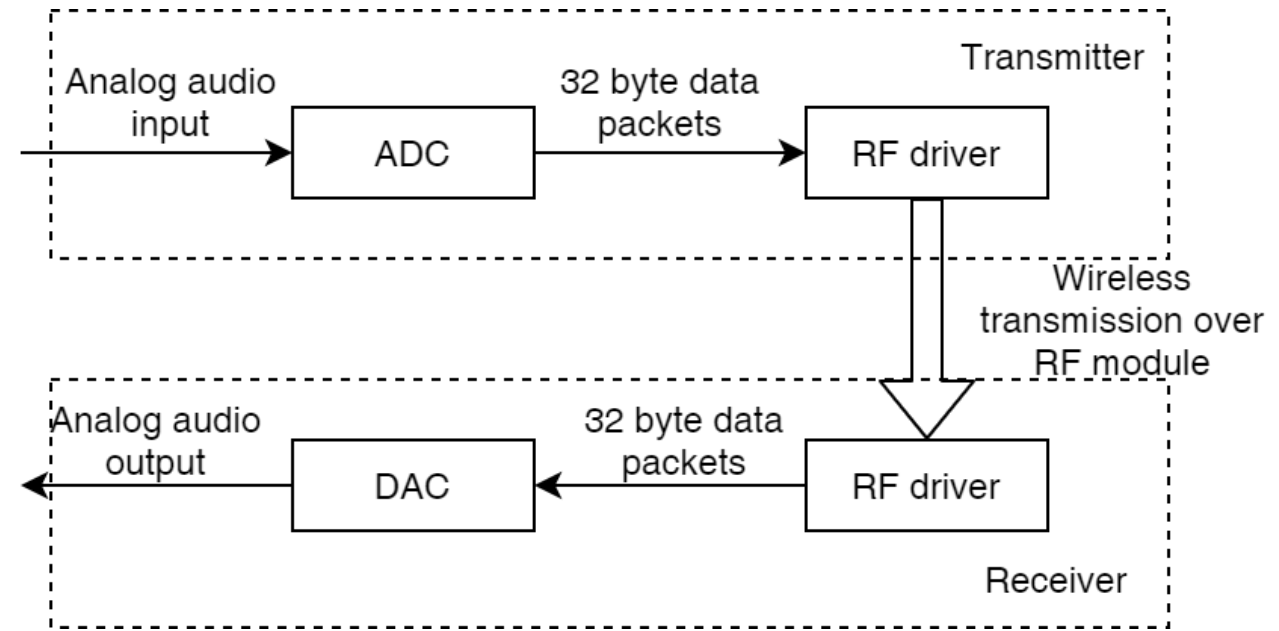
Physical Design

- Sturdy audio jack able to hold the weight of the design
- Socket for RF chip replacement



Software Design

- Transmitter program periodically samples audio input and send using RF driver
- Receiver program periodically checks for available packets and recreate the audio



Crosstalk Prevention

- Assigning unique, immutable RF address
- Receivers only pickup signals addressed for them
- Devices in a set are pre-paired

Future Improvements

- Use analog-to-digital converter with higher resolution
- Incorporate a digital-to-analog IC chip
- Smart channel selection to avoid crowded ones