



Demo

Group 5: Field Radio

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Specifications

Transmission Delay	< 5 Seconds
Transmission Shutdown Delay	< 5 Seconds
Receive Delay	< 2.5 Seconds
Receive Shutdown Delay	< 2.5 Seconds
Output Power	5 Watts FM; 3 Watts AM
Repeater Functionality	CTCSS standard subaudible tones (88-200hz)
Battery Life	3 hrs FM standby
Manufacturing Price	< \$600
Controls	Touch Screen



Raspberry Pi



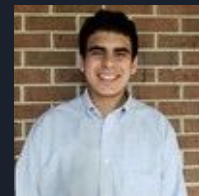
- Provide control and modulation to the Lime SDR over USB
- Provides control signals to the main PCB for RF switches and Power Mosfets
- Provides GUI through





LimeSDR

- Main software defined radio
- Used for RF synthesis for TX from modulated I/Q samples provided by pi
- Also Used for RF RX by sending modulated I/Q to PI for demodulation
- Powered with 6-12v
- Connects to Power Amplifier on transmit port
- Connects to RF switch on receiver port





Main PCB (Top) and replacement voltage regulator (Bottom)

Main PCB contains :

- RF switches
- 5v and 3v3 regulator
- Power control mosfets

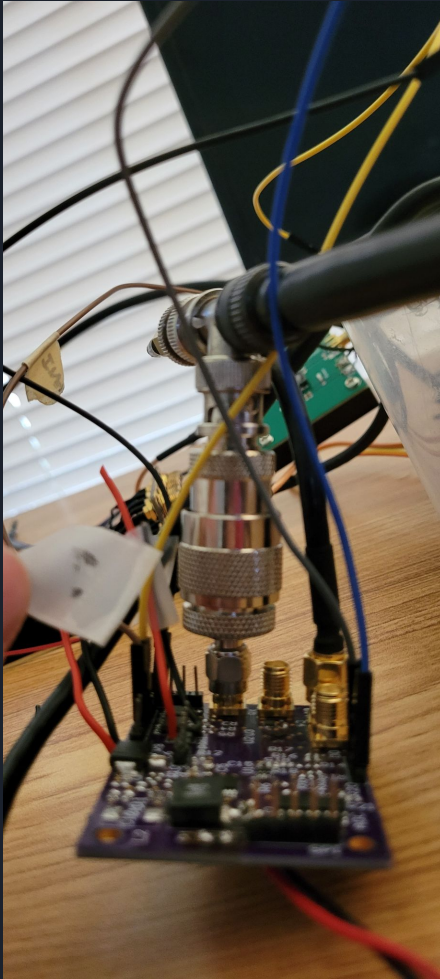
Replacement regulator:

- Replaces out of stock TPS63070
- Provides 5-7.2v to the power amplifiers through the control Mosfets

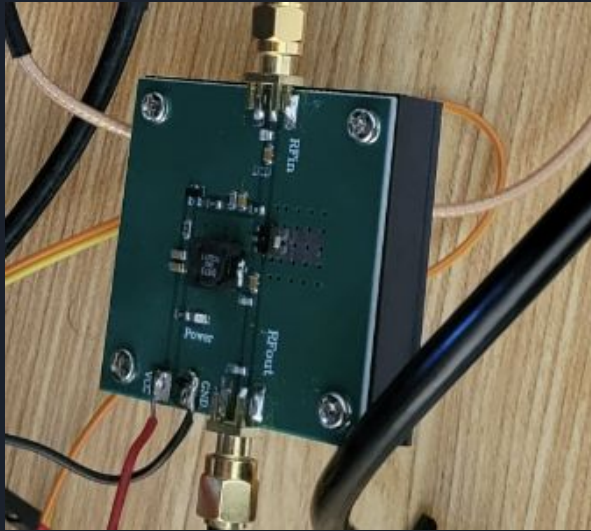


Antenna T

- Combination of SMA connectors
- Allows us to connect the RX switch and the TX amplifier to the same antenna



Power Amplifier



- Amplifies SDR output to 2-5W depending on input voltage between 5-7.2v
- Each band 2m, 70cm, 900MHz, has its own filters amplifier module like the one on the left





RF Switch

- The RF switch allows for half duplex operation with the RX and TX channels connected to the same antenna
- This works by blocking the 5W (16v) RF from reaching RX port when in transmit mode protecting the SDR
- And by allowing RF to pass through the switch to the RX channel in RX mode
- The RF switch is controlled by a 3v3 logic from the pi, but because you cannot see logic voltage change we just connect a 3v3 power supply to simulate a logic signal





Repeater Functionality

Our system supports CTCSS (Continuous Tone-Coded Squelch System) which allows us to use repeaters





Frequency Changing

Our system supports changing frequencies while transmitting



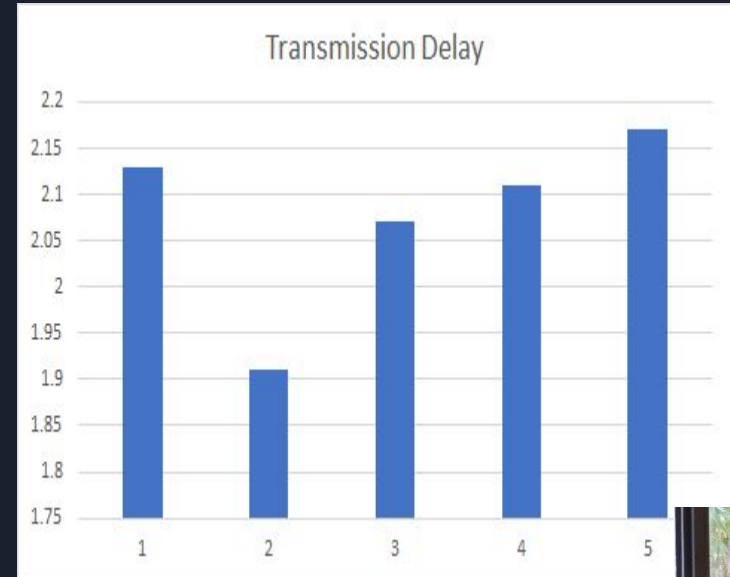
Transmission Delay

There is a delay when transmitting. Part of this delay is due to us using a second SDR to receive the signal. We ran 10 tests which resulted in the following metrics:

Mean: 2.01 Seconds

Median: 2.11 Seconds

Std Dev: 0.10 Seconds



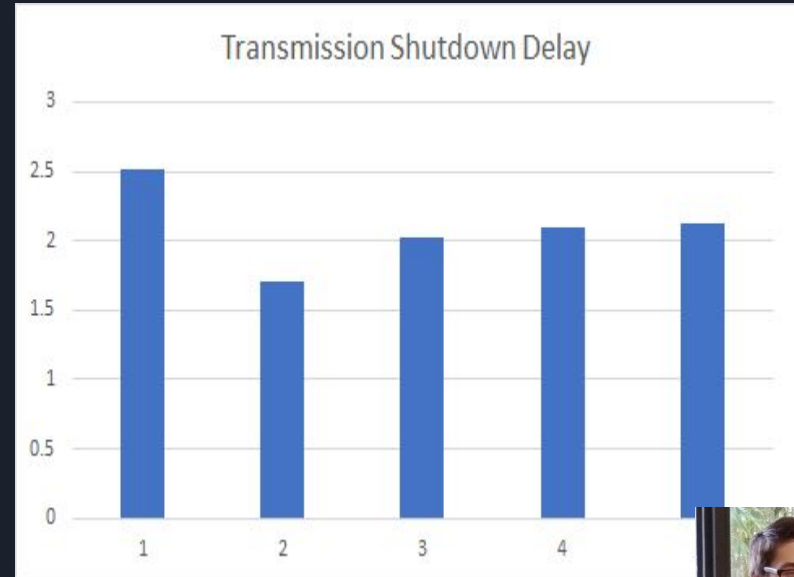
Transmission Shutdown Delay

There is a delay when we end transmitting. This is due to the LimeSDR needing to finish clearing out its transfer buffer. We ran 10 tests which resulted in the following metrics:

Mean: 2.01 Seconds

Median: 2.1 Seconds

Variance: 0.29 Seconds



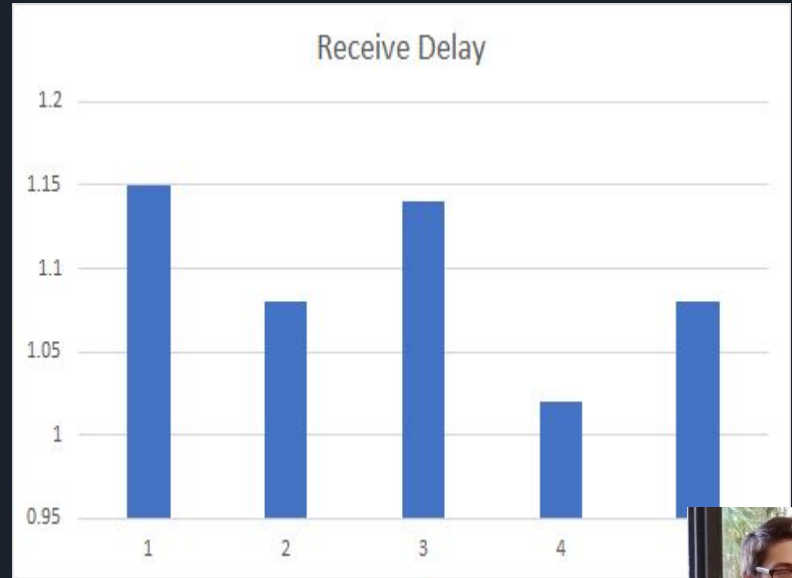
Receive Delay

There is a delay when we begin receiving. We ran 10 tests which resulted in the following metrics:

Mean: 1.09 Seconds

Median: 1.08 Seconds

Variance: 0.06 Seconds



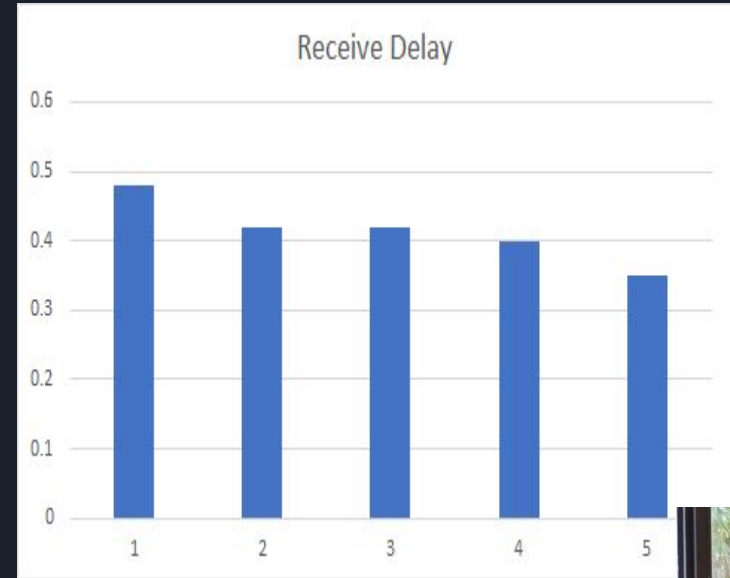
Receive Shutdown Delay

There is a delay when we end receiving. We ran 10 tests which resulted in the following metrics:

Mean: 0.42 Seconds

Median: 0.42 Seconds

Variance: 0.05 Seconds





Software Successes and Challenges

Successes

- Serial Data Communication
- TX/RX/FM Communication
- Audio I/O
- Finalizing Final Presentation Website
- Basic Testing Completed

Challenges

- GUI Library/Framework Redesign
- Resource Management
- Complex DIY Integration to LIMESDR



Hardware Successes and Challenges

Successes

- PCB completion
- Successful Amplifier Test
- Successful Speaker Test
- Successful FM and AM
- Successful RF switch test
- Demodulation Test
- Working amplifier switching

Challenges

- TPS63070 Out of stock
- Issues with JLC PCB - had to switch to OSH park
- Power regulation
- RF Switch control line mismatch





Thank you!

We will now open the floor for questions.

