



# HamShield: Kickstarting an amateur radio project

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# OUTLINE

- Motivations
- Design Goals
- Design and Testing
- Kickstarter
- Stretch Goals and RF Issues
- Manufacturing
- User Support

# ORIGINAL MOTIVATIONS

- Want a handy-talkie that we can automate
- Supports:
  - CW
  - CTCSS
- Enables Bluetooth connections

# FIRST STEPS

- Try to hack the handie-talkie we already have
- It's based around a single-chip transceiver!

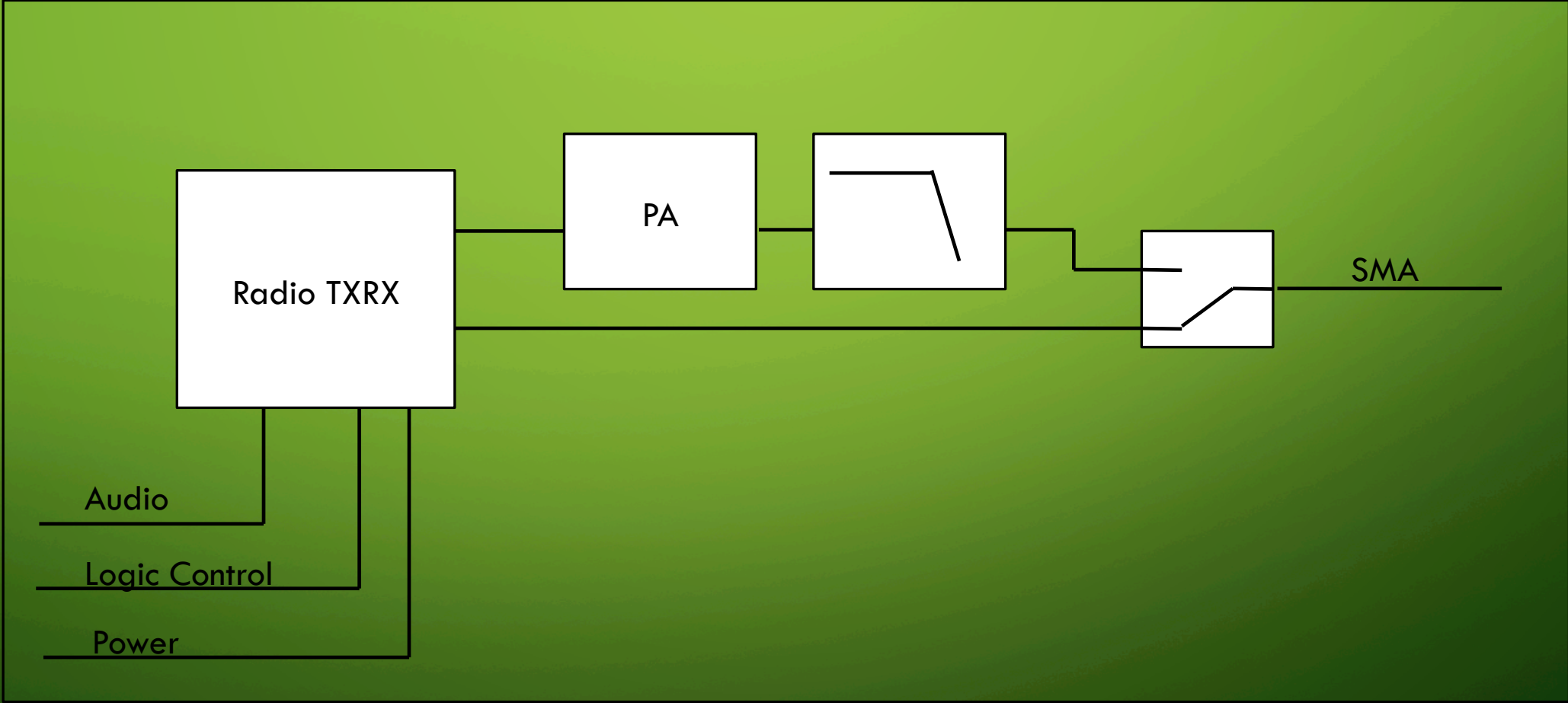
“What if we just build a board around that?”



# MINIMUM SATISFACTORY PRODUCT

- Make an Arduino shield
  - Easy to program
  - Easy to repurpose
- Use other shields to add functionality
  - BT could be supplied by secondary shield

# DESIRED DEVICE

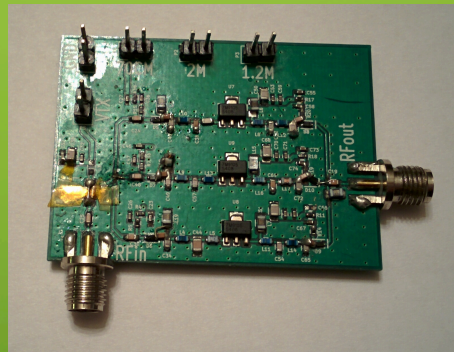
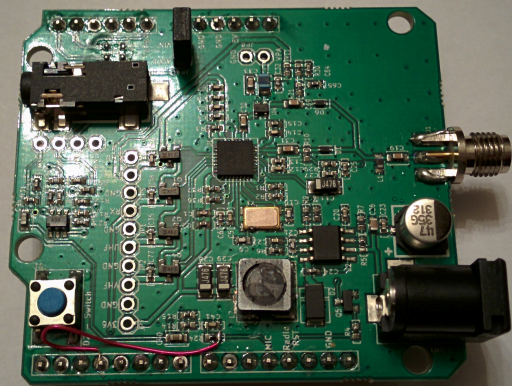


# DESIGN AND TESTING

- Separate test boards for each functional unit
  - AU1846 test board
  - PA test board
  - Filter test boards
- Lots of help and input from the community



# FIRST PROTOTYPE





# KICKSTARTER

- Best way to get people excited is to explain why we think it's exciting
- Don't be shy: ask for what it would actually take to get things started

# STRETCH GOALS

- Probably helped
  - but gave us a lot more work to do
- Back to the drawing board on PAs
- Caused some last minute headaches

# LAST MINUTE ISSUES

- First production prototype had sporadic I2C issues
  - Depending on transmit frequency and power, it could sometimes drop off the bus
  - Some boards just didn't respond on the I2C bus at all

# GROUND LOOPS

- Arduinos have ground pins on both sides
- During high power transmit, we draw a lot of current
  - This exacerbates the effect of a ground loop
- Easy to fix
  - Just leave digital ground pin unconnected on shield



# MARGINAL BUS CAPACITANCE

- 40pF bus capacitance limit for AU1846
  - By contrast: 400pF limit for ATmega328 on Arduino
- HamShield was pushing that limit
- More difficult to fix, because we didn't control what dev board people would use
- Solution: use alternative bus on AU1846
  - Requires bit-banging

# MANUFACTURING

- Manufacturing at Electronic Service Provider in Tukwila
- Can be cost effective to manufacture locally
  - Easy to fix issues that crop up
  - Fast turn-around time
  - No language barrier

# USER SUPPORT

- Instructional Videos
- Guides
- Lots of examples for the Arduino library



# HAMSHIELD

- Based on the AU1846
- 134-174MHz, 200-260MHz, 400-520MHz
- 10mW to 0.75W output
- Selectable channel bandwidth: 12.5kHz or 25kHz
- Software control of advanced features (subaudio, DTMF, etc.)

