µBITX: HF For Less

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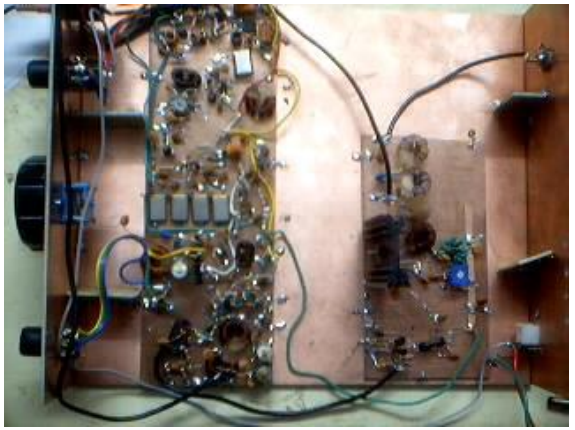
Outline

- What is μBITX?
- Microcontroller and Firmware
- Hardware
- Construction
- Testing
- Results
- Demo

BITX

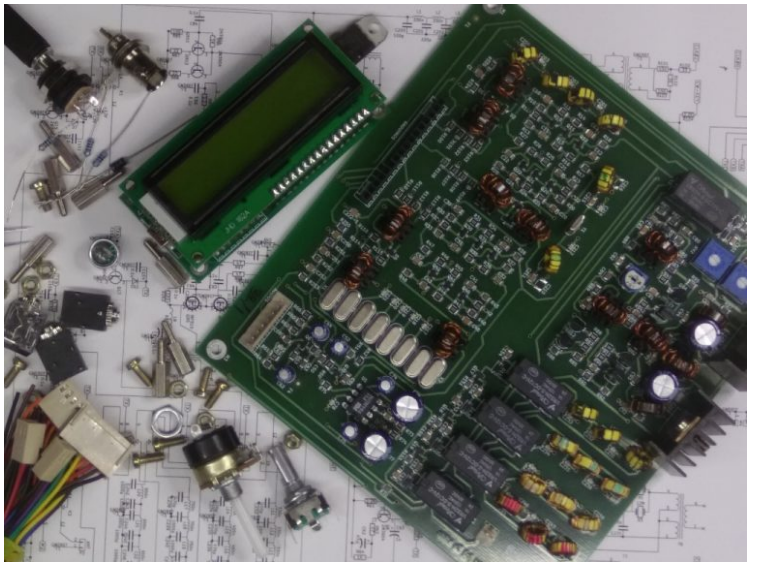


- BITX single-band (20M) low cost, QRP SSB radio created in 2003 by Ashhar Farhan VU2ESE

  www.phonestack.com/farhan/

- Bidirectional design saves $$$ by using the same hardware for receive and transmit
- Homebrewers quickly adapted the design for other bands including multi band rigs
- How do you pronounce it?

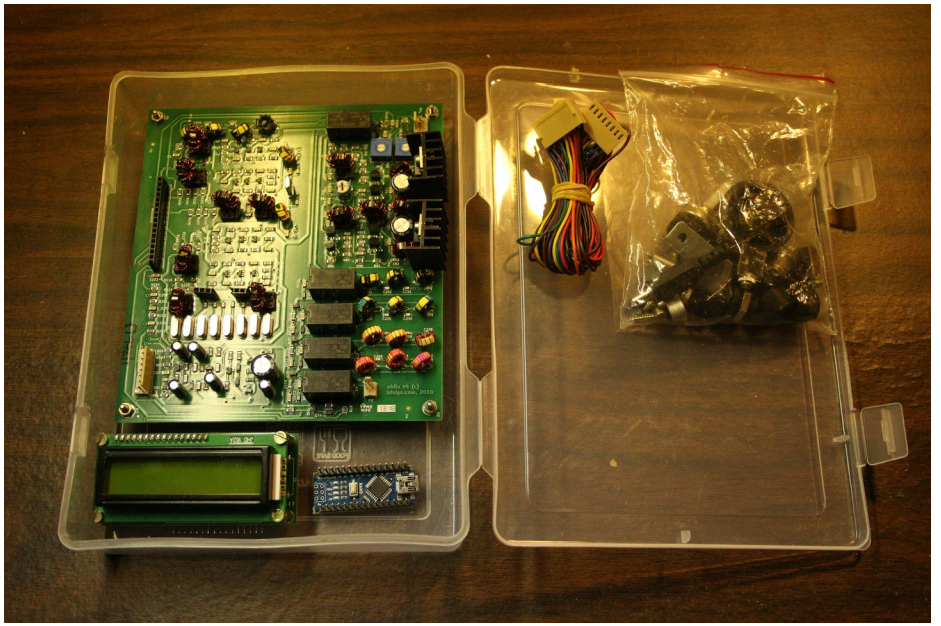
µBITX



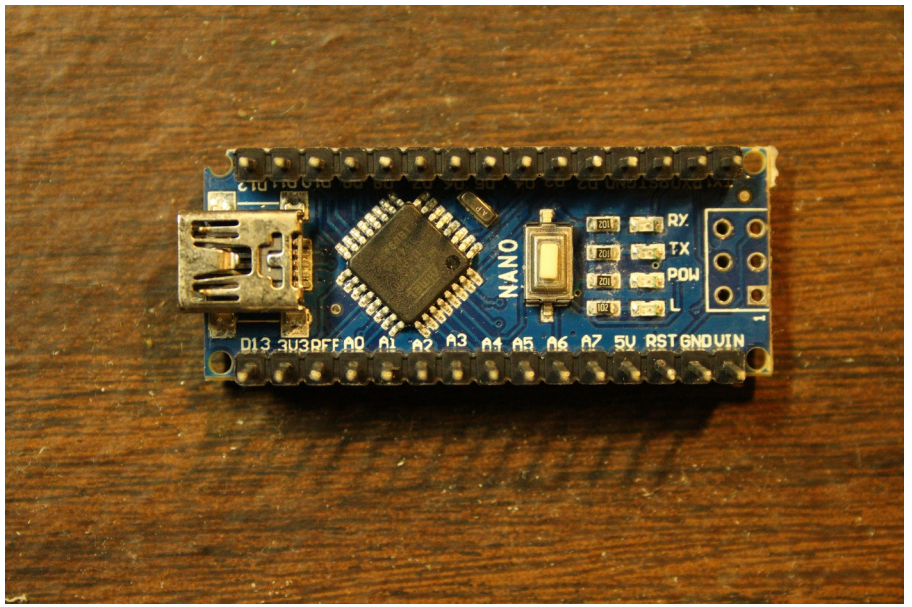
- BITX-based design by HF Signals
  (Ashhar Farhan VU2ESE, founder)
- Full HF coverage from 3MHz-30MHz
- Output >10 watts under 10MHz,
  <5 watts on 28MHz
- SSB and CW operation
- All radio functions controlled by built-in
  microcontroller
- Accurate, stable tuning from SI5351 oscillator chip
- Tuning knob encoder/button and 16x2 display for easy menu-based operations and minimal interface
- Designed for low cost and easy experimentation
- Build from scratch or buy a kit from www.hfsignals.com

The Kit

- $129 incl. shipping from India
- Assembled, calibrated µBITX PCB
- Raduino board w/Arduino and display
- Panel controls, connectors, wires, microphone element
- You provide your own enclosure, microphone case, headphones, antenna, 12V supply, and USB Mini B cable (for programming)



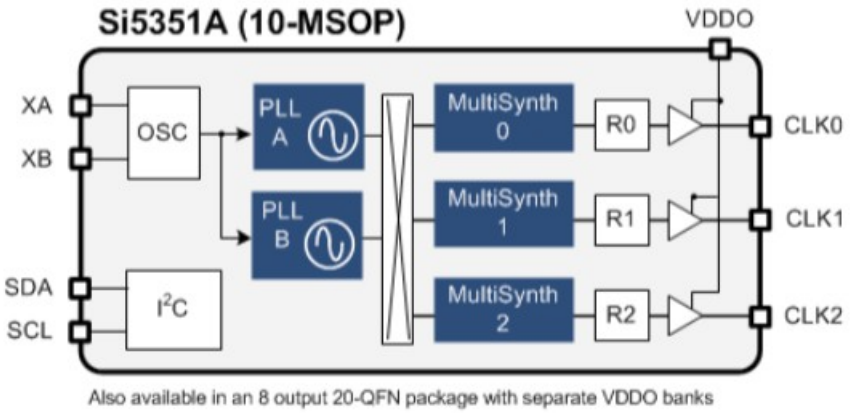
Arduino



- Popular open-source microcontroller platform
- Large user group = good support
- Many different variants; µBITX uses Arduino Nano
- Programmed over USB from a PC, using C-like language and free IDE

www.arduino.cc

Raduino



- Arduino + SI5351 + LCD Display = Raduino
- Silicon Labs SI5351A accurately generates 3 frequencies up to 200MHz - 3 VFOs on a $1 chip
- Controlled by Arduino Nano via I²C 2-wire serial interface

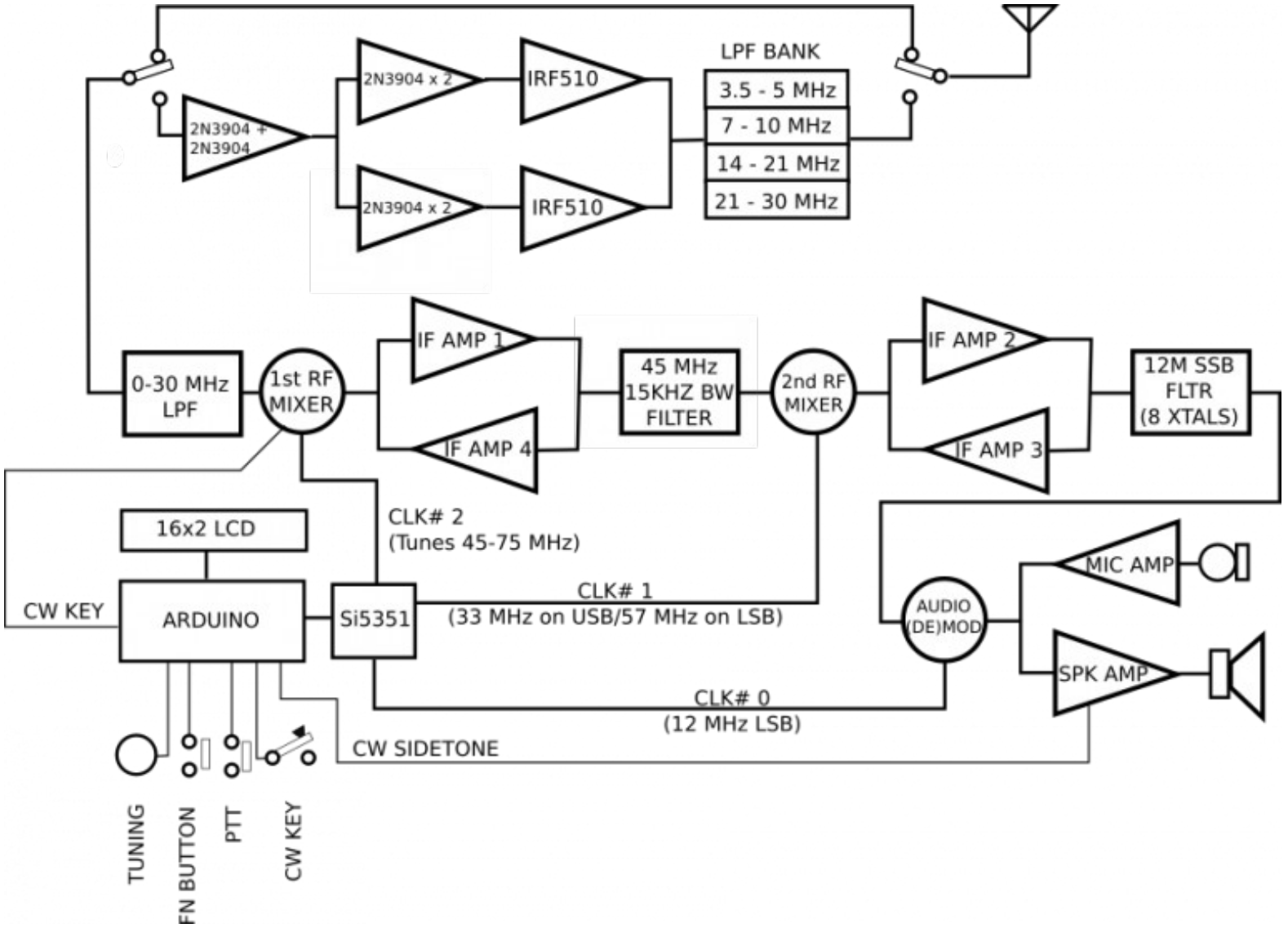
The µBITX Firmware

- GNU open source, on GitHub at https://github.com/afarhan/ubitx_v5
- Firmware features are operated using the main tuning encoder/button with a menu system
- Includes dual frequency memory with split operation, RIT, automatic sideband select (can be overridden), CW keyer, CW sidetone adjust, speed sensitive tuning, fast tuning mode for changing bands, BFO adjust, CAT control via USB
- Onscreen S-Meter under development
- Modify or add features with a few lines of C code

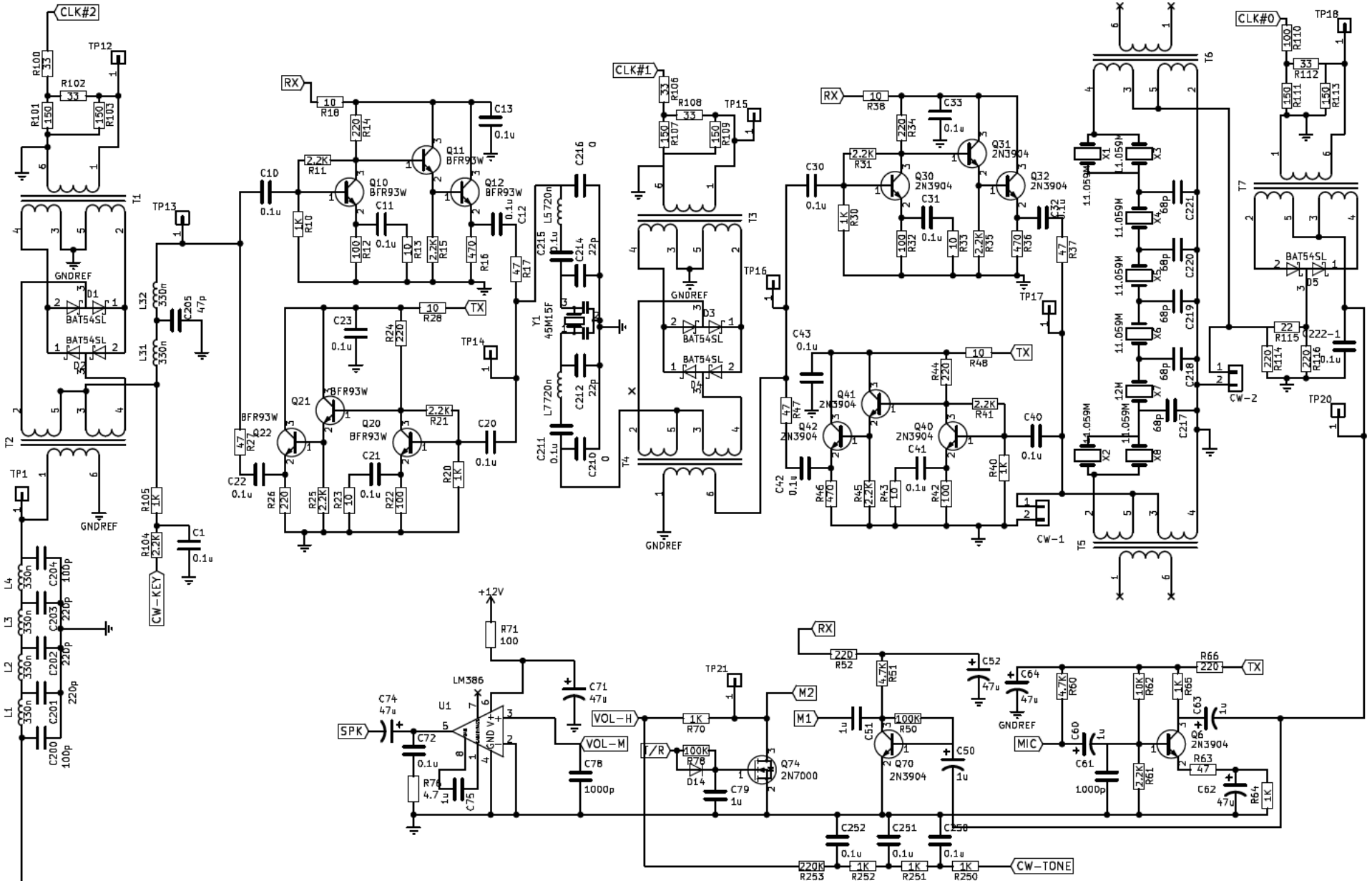
Hardware Design

- Superhet with IF’s at 45MHz and 12MHz
- SI5351A drives two conversion oscillators and BFO
- Bidirectional design uses the same filters and modulators for both TX and RX
- Amplifier blocks have separate circuits for TX and RX that are switched on and off electronically as necessary
- TX power amplifier and front end filters are switched by relays

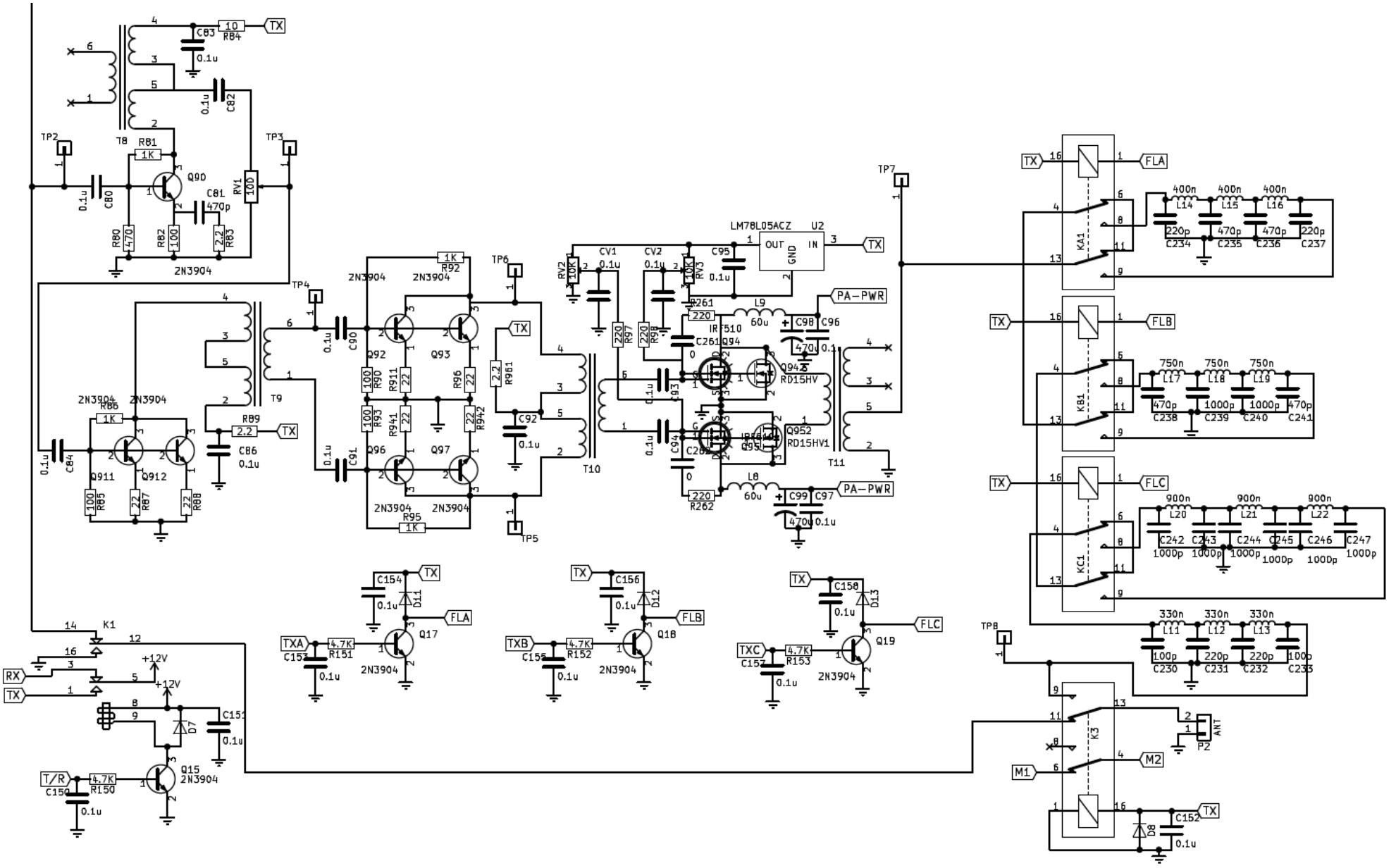
Hardware Block Diagram



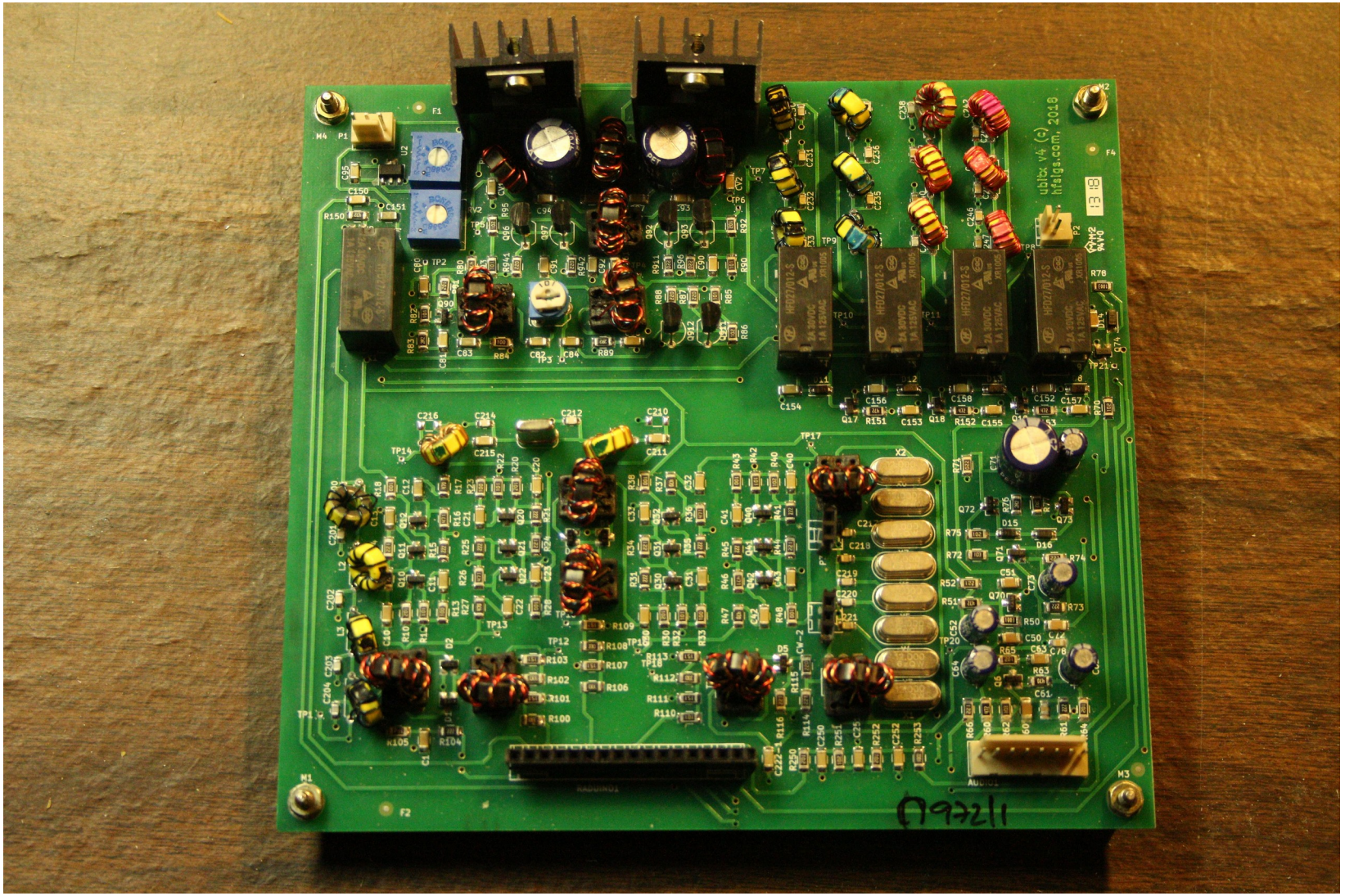
Schematic (Modulation)



Schematic (PA/Front End)



Construction



Construction

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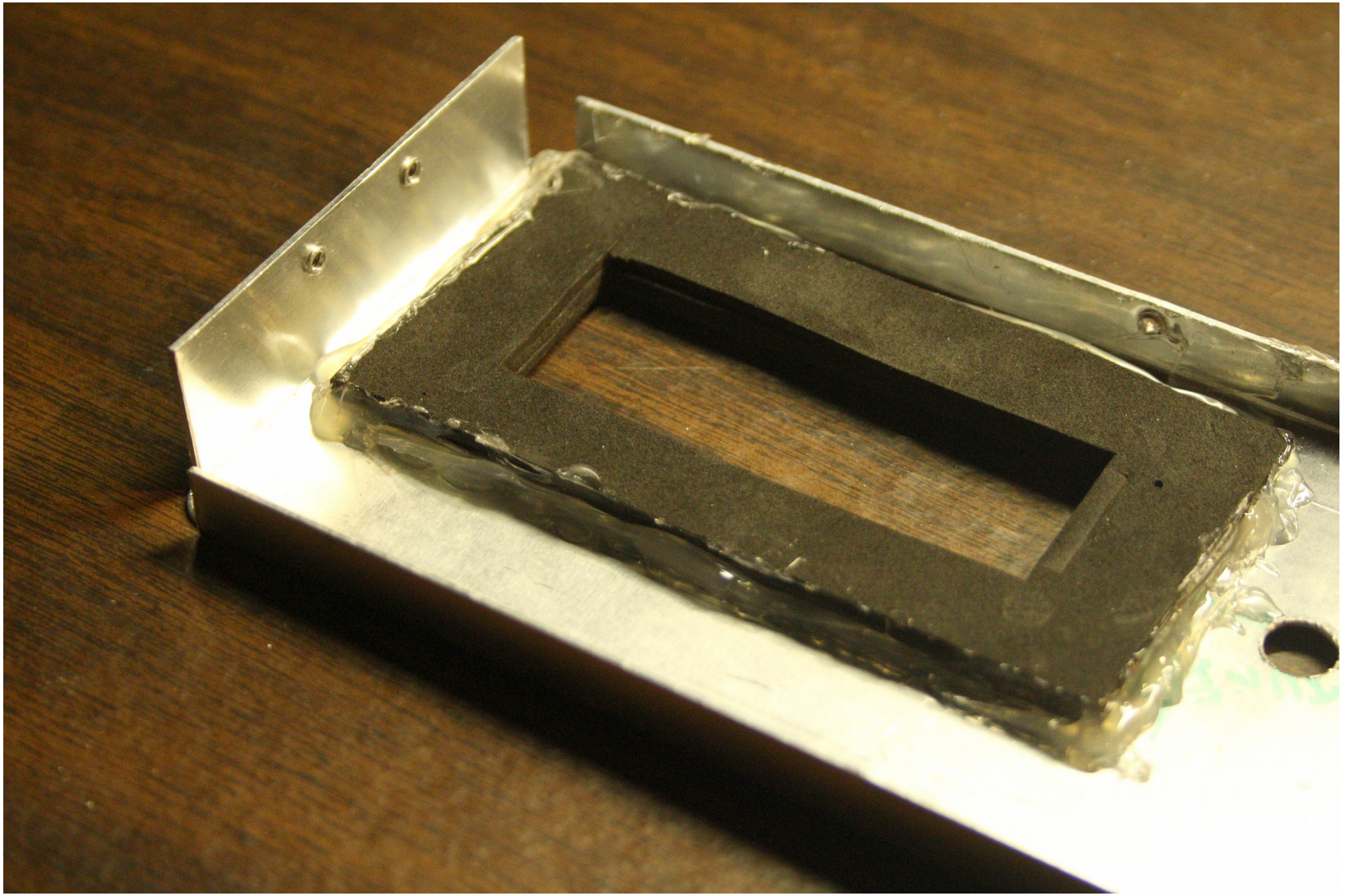

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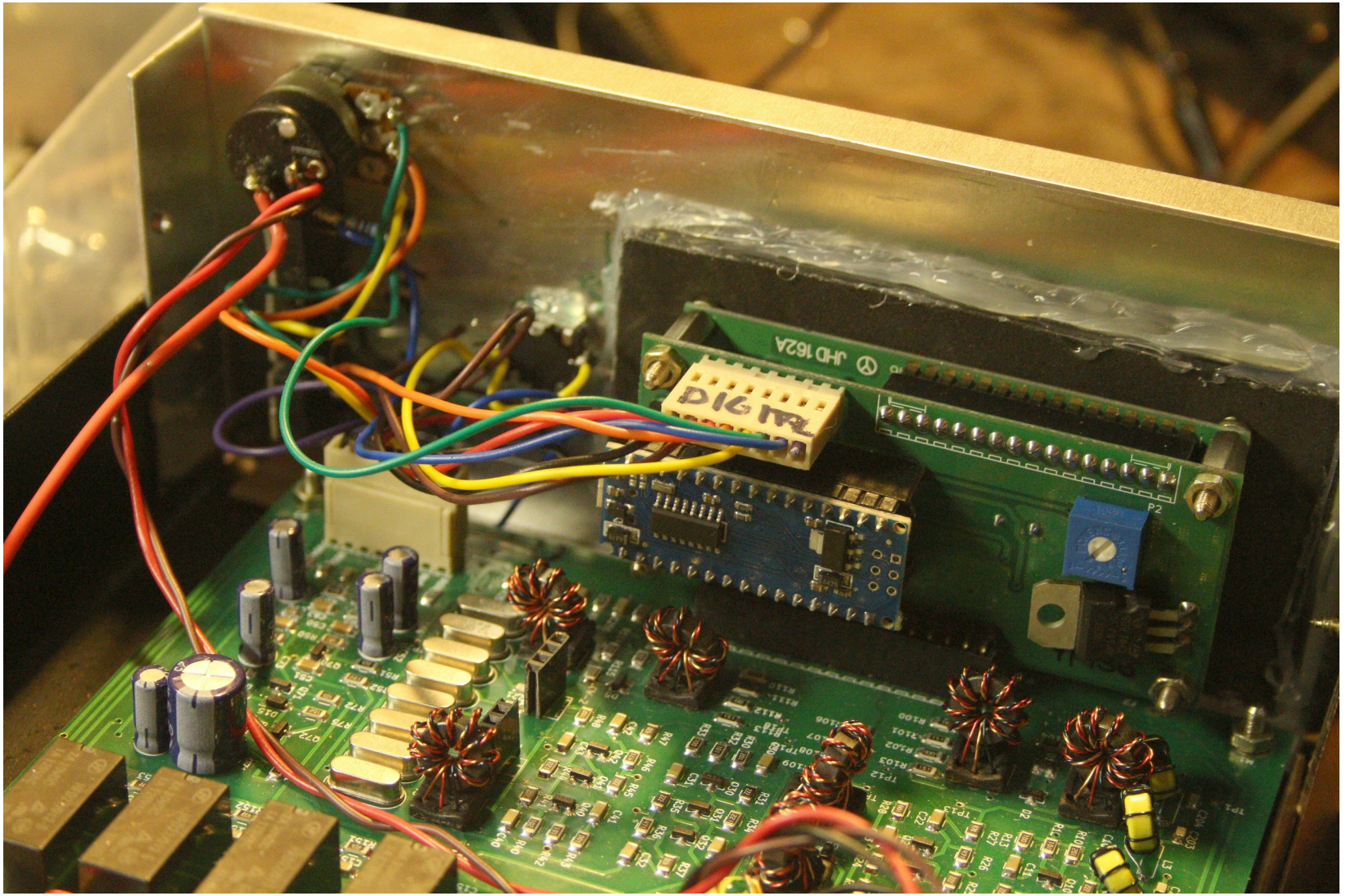

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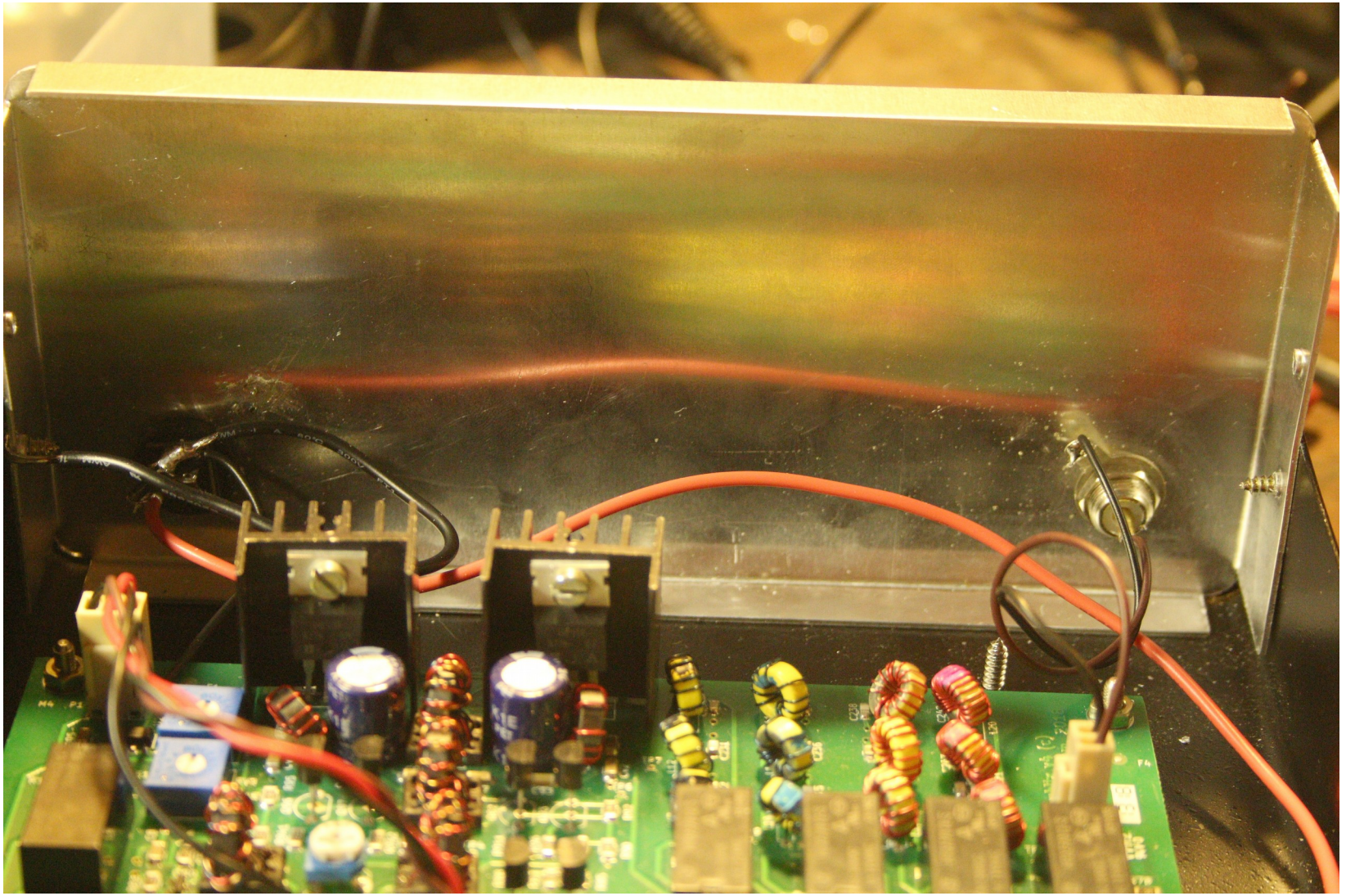


Construction

Construction

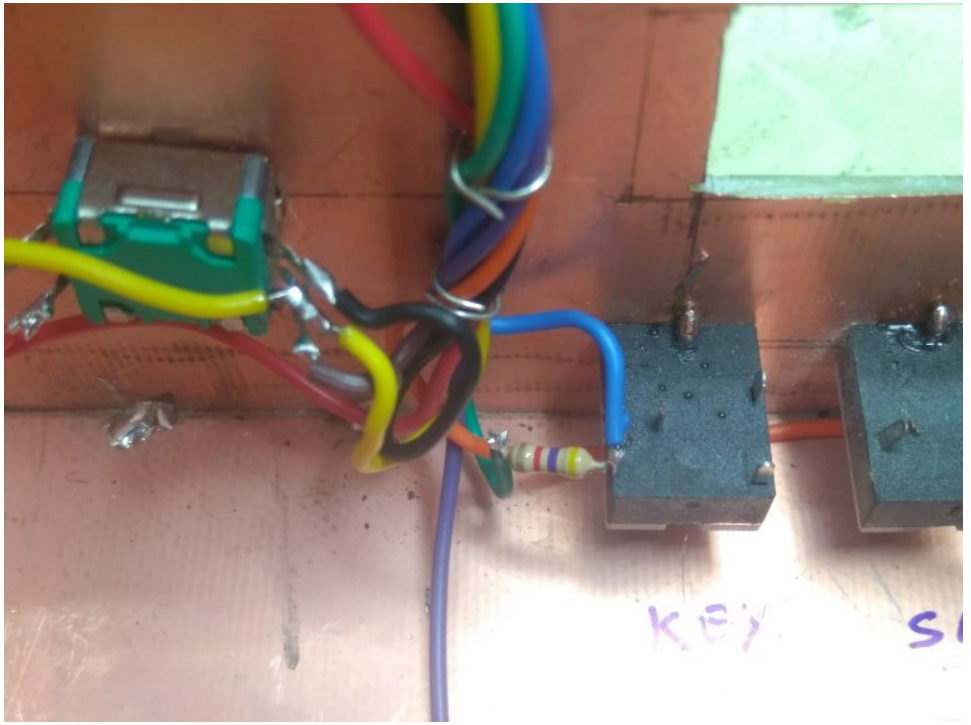
Testing with Buddipole

Thanks to KA3IAX

Results

- Tested using indoor and outdoor long wire antennas and a backyard buddipole
- SSB and CW signals were clearly heard on 20, 40, and 80 meter bands, including from the USA, UK, Spain, and Bulgaria
- SSB TX operation confirmed with another radio, but no QSOs yet
- CW power output agrees with specs

Other Tweaks



- Discovered and fixed a wiring error in the CW key connector (not my fault!)
- Changed firmware tuning response and startup message

µBITX: The FT-818 Killer?

Well, no, probably not:

- Not plug and play
- Not necessarily bug-free
- Currently lacks high end features such as an S-Meter, channel memories, tuner, band limits etc. – although users are encouraged to work on their own implementations

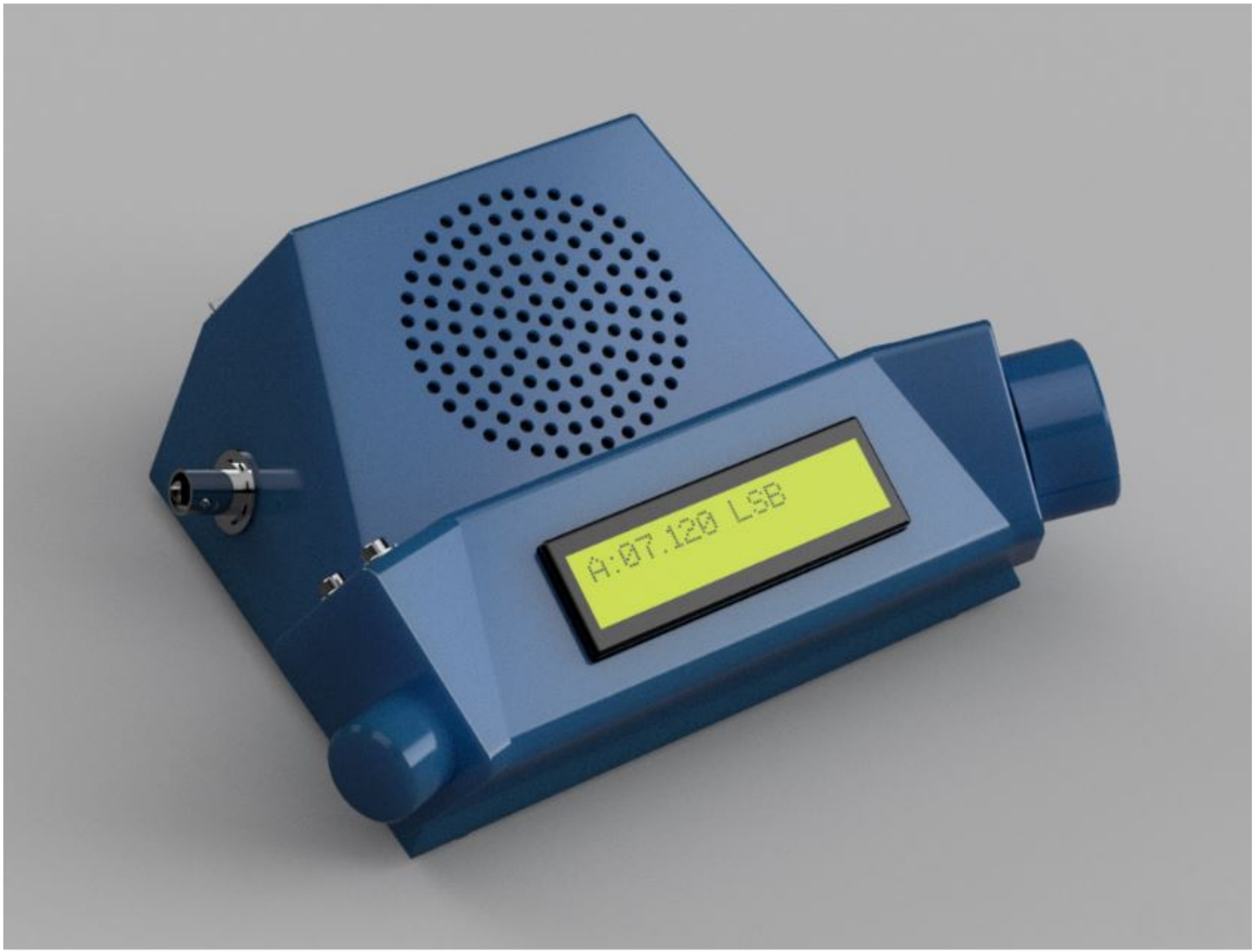
BUT:

- Similarly suited for portable QRP operation on HF bands
- Only ¼ the price (or less)
- Fun and educational build, especially for homebrew beginners
- Also good as a general purpose, highly modifiable radio for more advanced experimenters and programmers

Some Other Builds
Blue Screen by N8QW

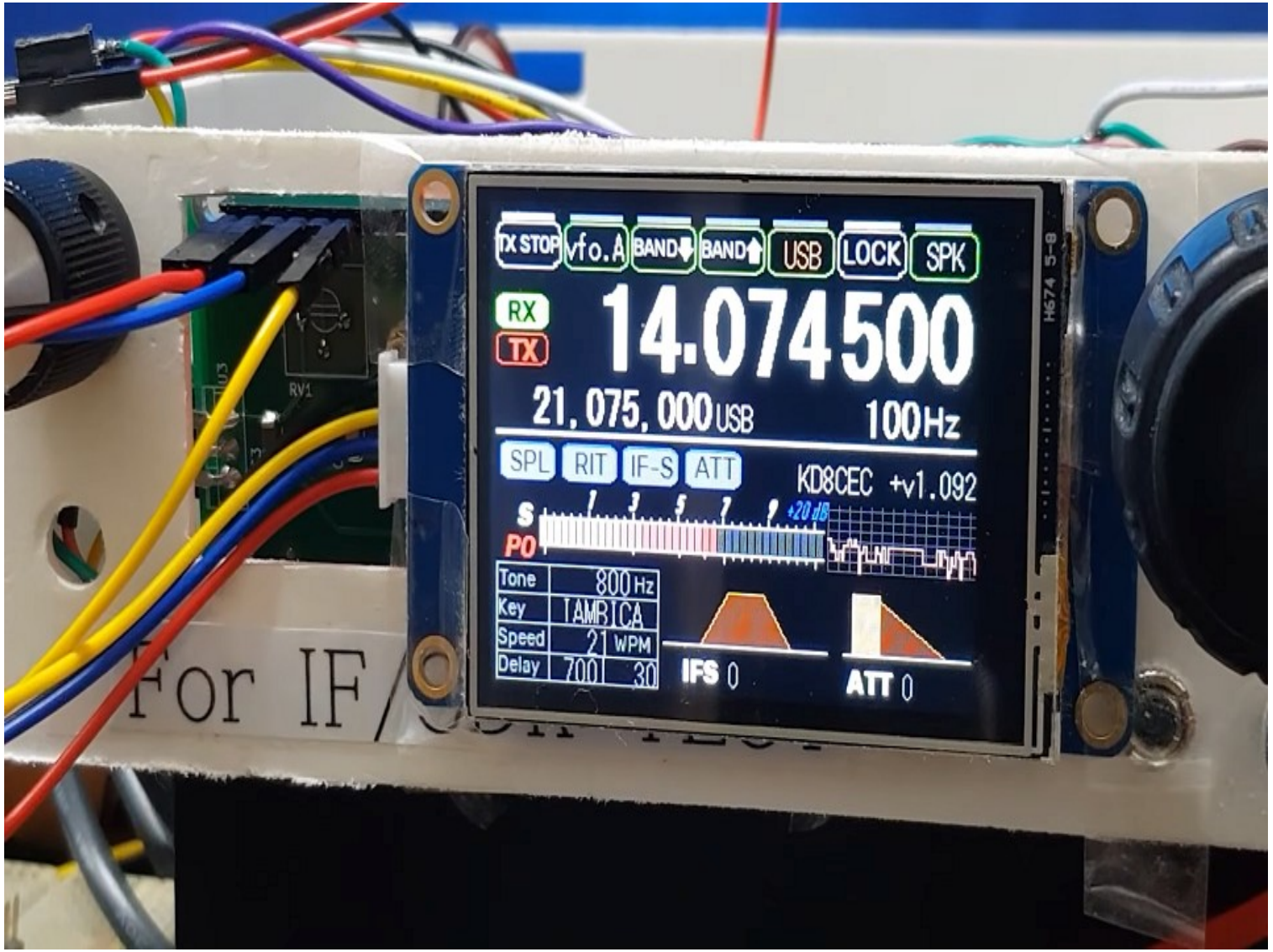
Some Other Builds
Cake Pan by KC8WBK

Some Other Builds – 3D Printed Ergonomic Case by VE1LEB



Some Other Builds
Recycled HW22 by KC5RT

Some Other Builds
Touchscreen LCD by KD8CEC



Demo & Links

- Original BITX www.phonestack.com/farhan/
- HF Signals (µBITX and BITX40 kits/info)

  www.hfsignals.com
- Arduino microcontrollers www.arduino.cc
- µBITX firmware repository (v5)
  https://github.com/afarhan/ubitx_v5