

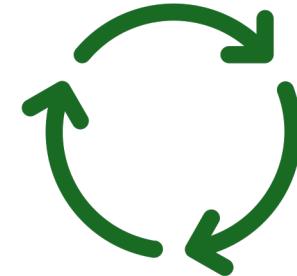
QRP CW Transceiver Update

Chris Maughan, G7LQX

Disclaimer



I like to build things

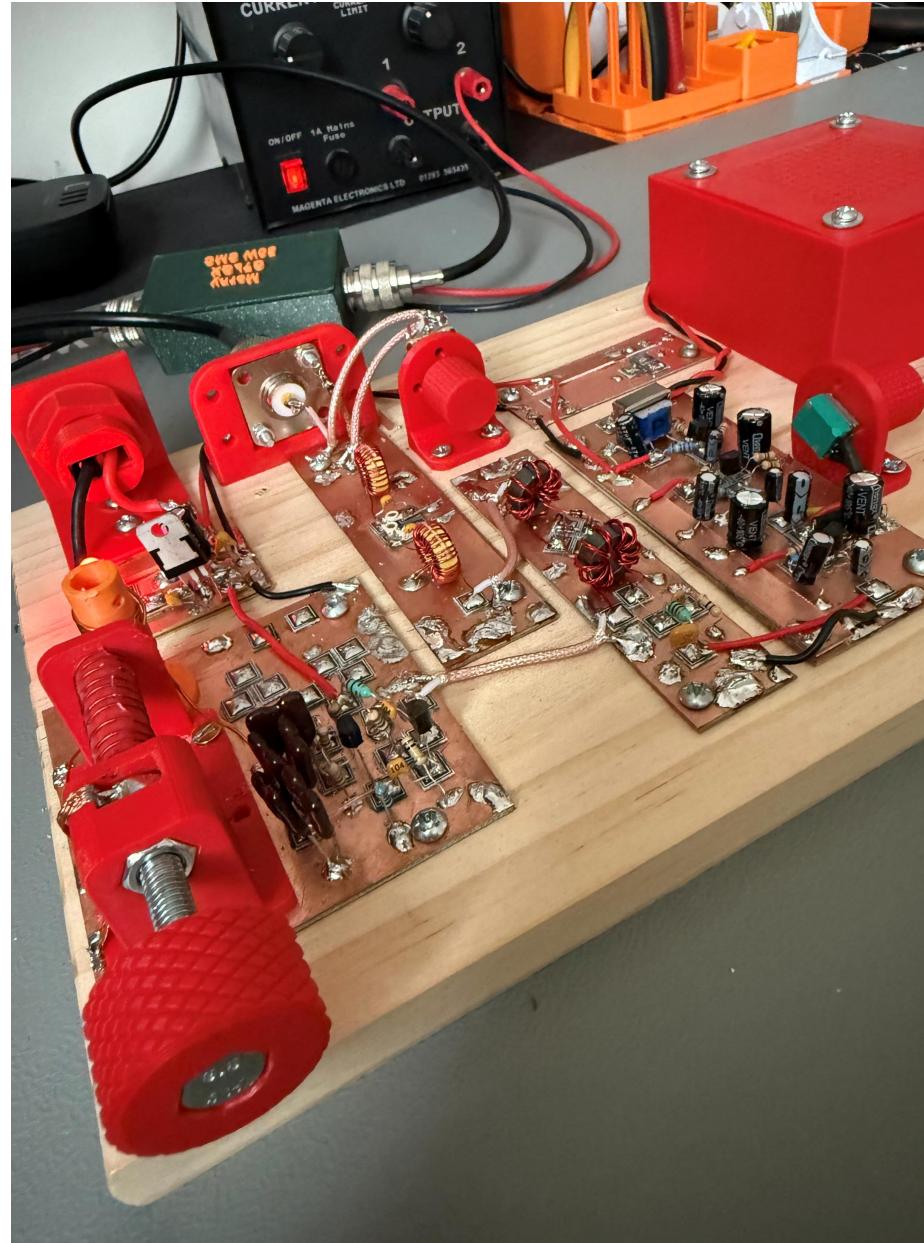


Understanding comes later; or
not at all!

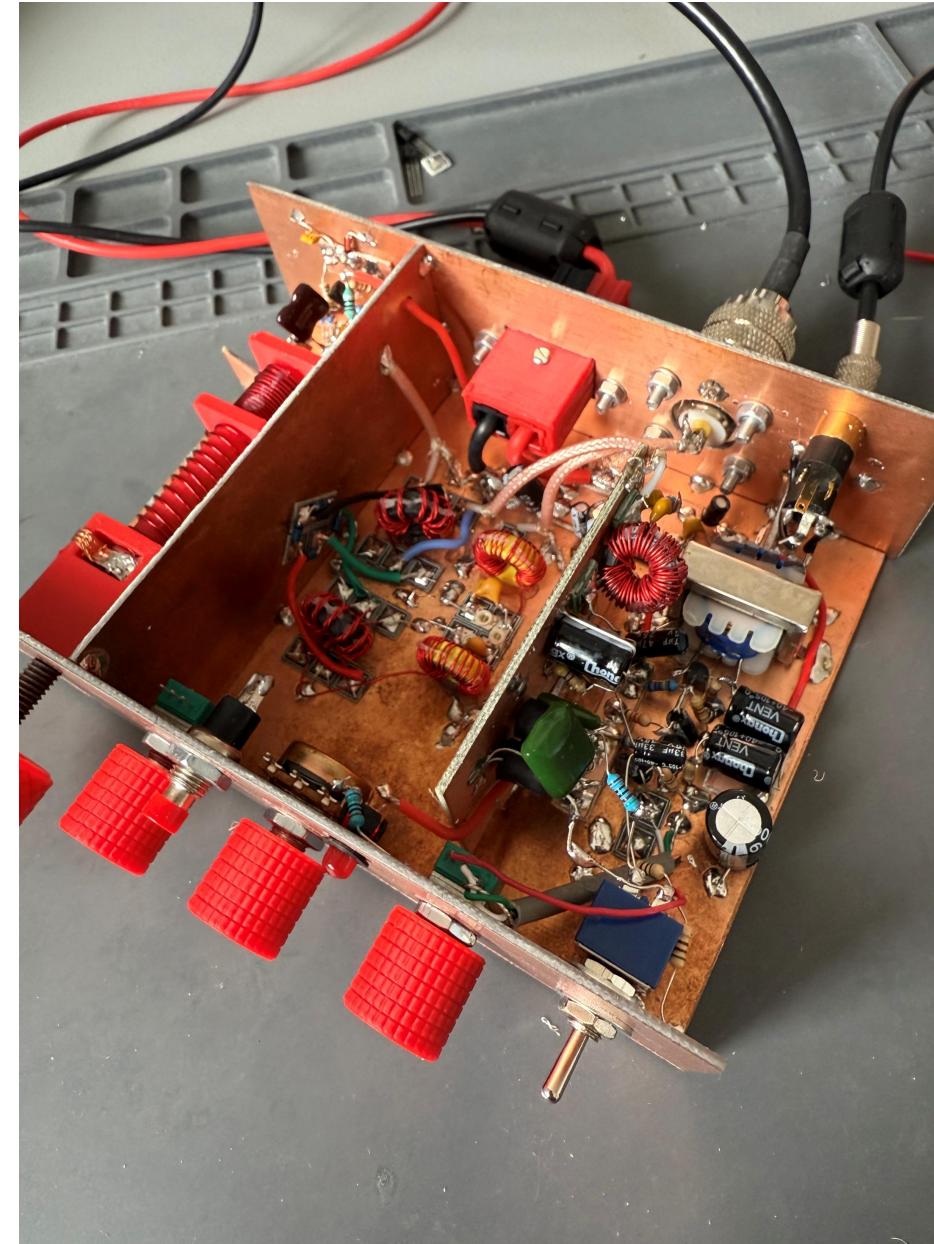
The Shack



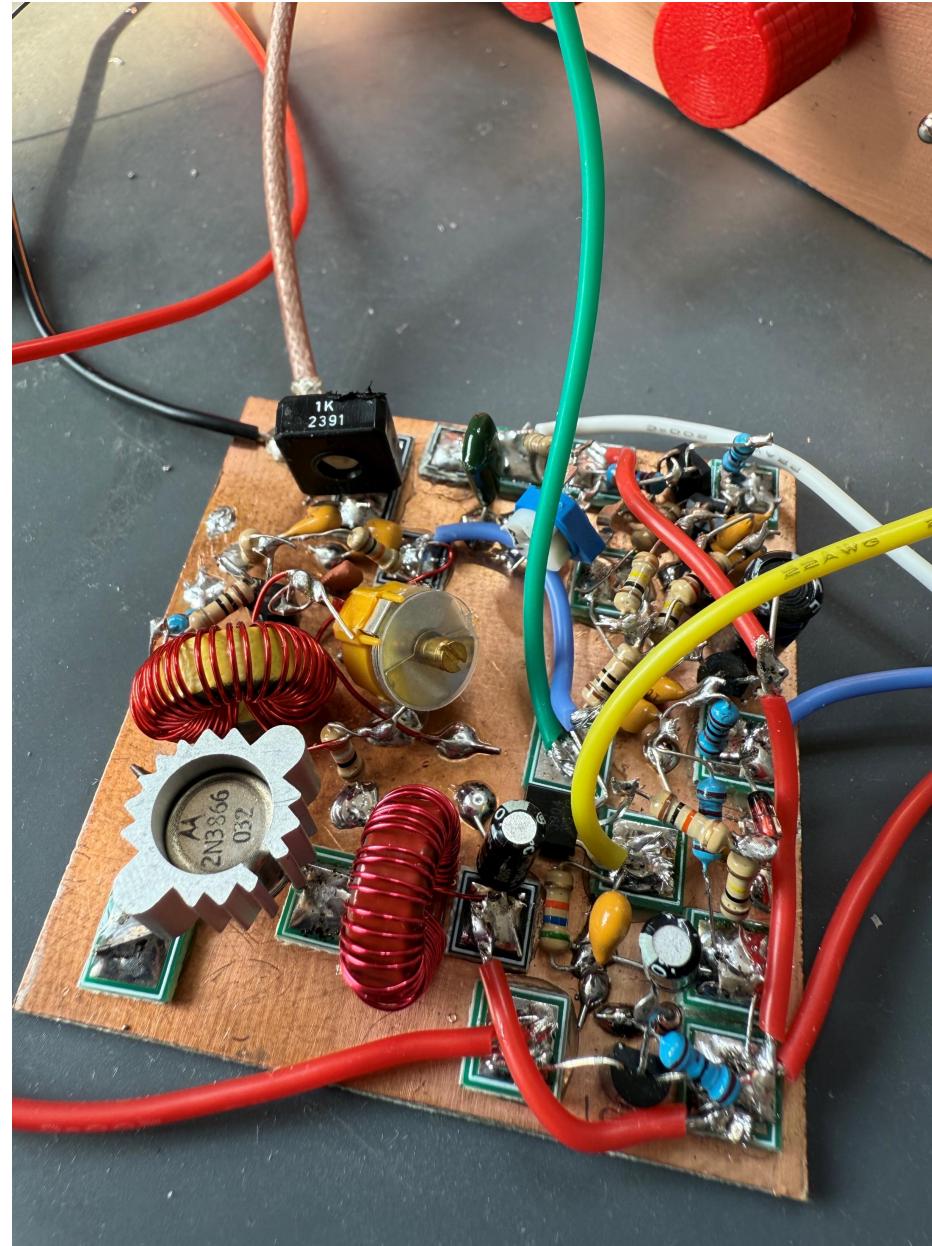
Mark 1: Soldersmoke Receiver (where we left off...)

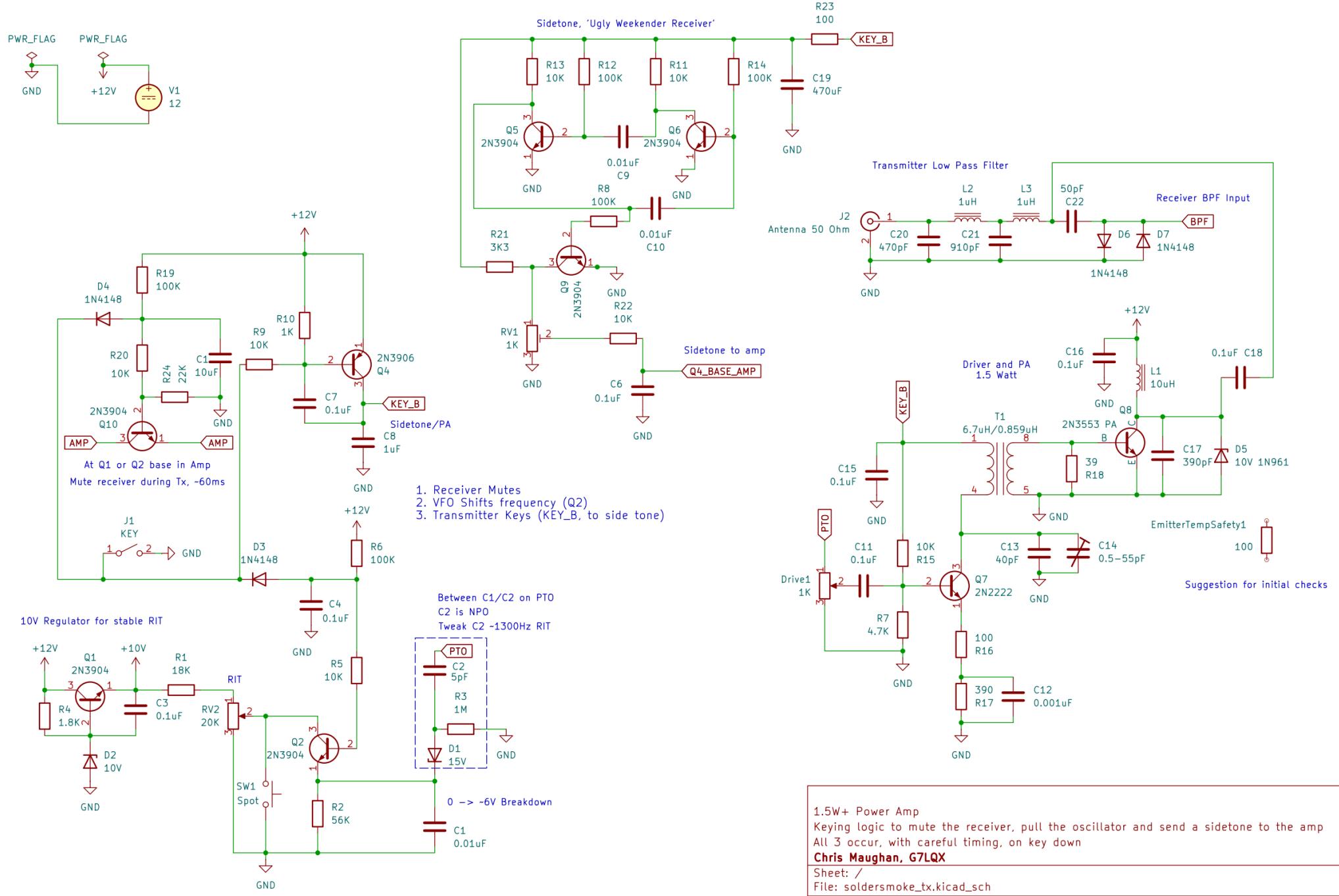


Mark 1: Soldersmoke Receiver



Mark 1: Transmitter





1.5W+ Power Amp

Keying logic to mute the receiver, pull the oscillator and send a sidetone to the amp
All 3 occur with careful timing on key down

Chris Maunhan G7IQR

Sheet: /

File: soldersmoke_tx.kicad_sch

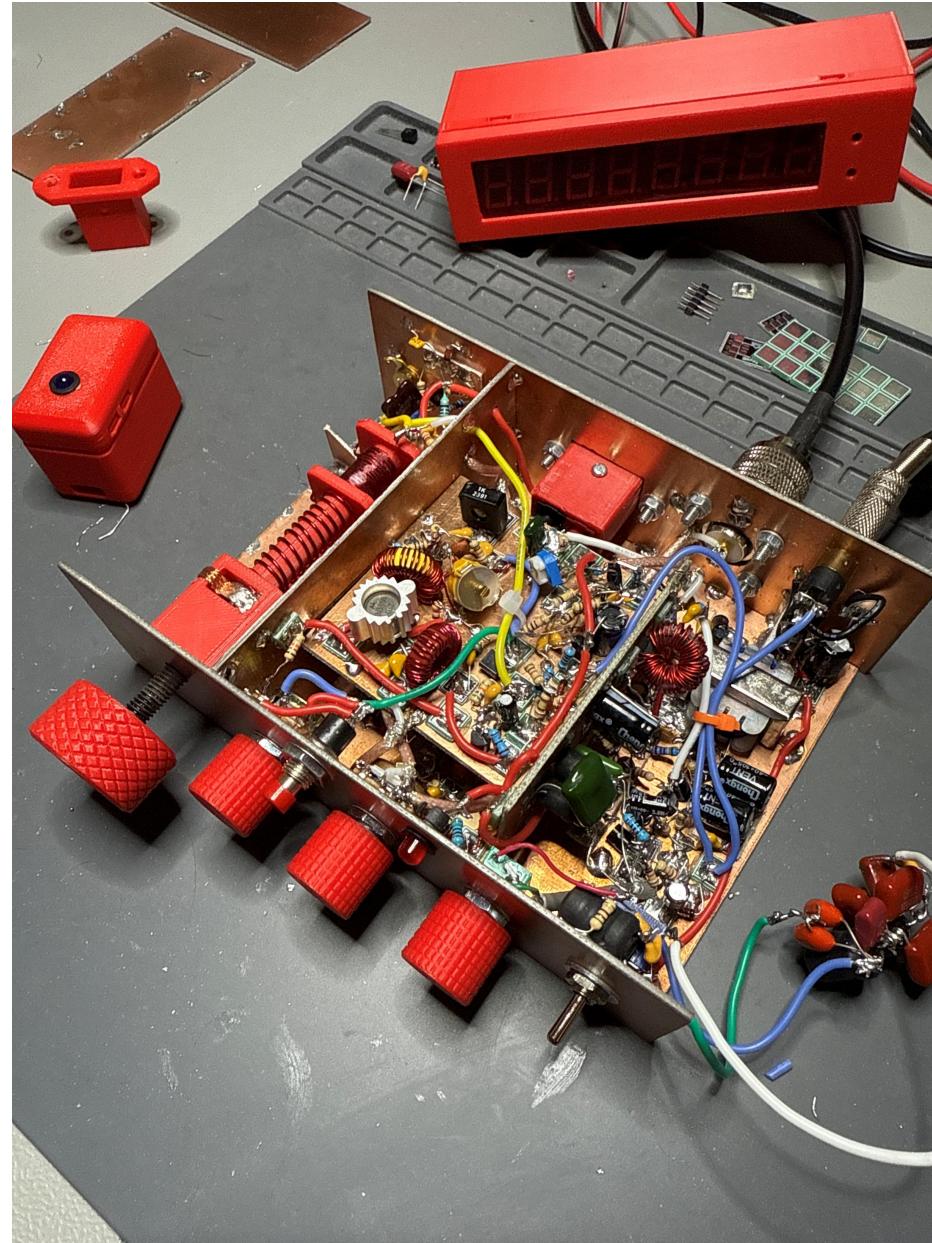
Title: SolderSmoke

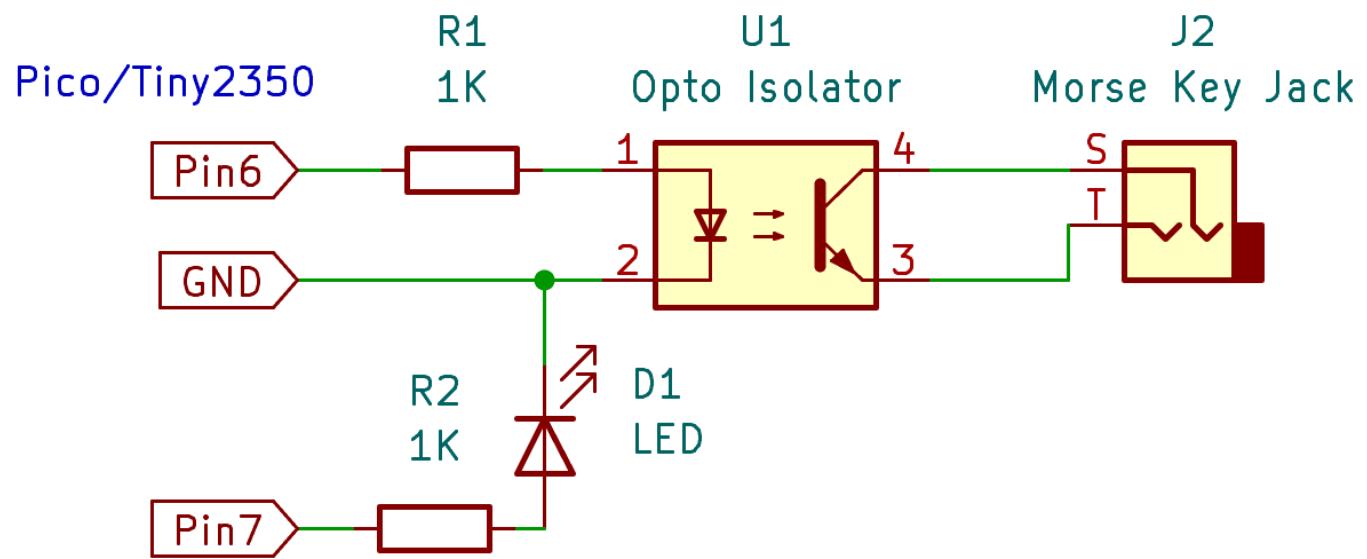
KiCad EDA 9.0.3

P-187

Rev: 1.23

Mark 1: Transmitter





Beacon

```

from machine import Pin          cmaughan/MorseBeacon
import time

# ----- USER SETTINGS -----
GPIO_PIN_A = 7                  # Pico GPIO pin driving LED
GPIO_PIN_B = 6                  # Pico GPIO pin driving Opto Isolator
WPM = 15                         # Words per minute (12-15 recommended)

# Beacon text (G7LQX @ IO93KX, 800 mW, EFHW 40m)
MSG1 = "TEST TEST TEST DE G7LQX/B G7LQX/B G7LQX/B G7LQX/B"
#MSG3 = "QTH IO93KX PWR 800MW ANT EFHW 40M"
#MSG4 = "DE G7LQX/B"

PAUSE1 = 2 # seconds
PAUSE2 = 2
PAUSE3 = 5
PAUSE4 = 10
# ----- 

# Setup GPIO (active_low: 0 = key up, 1 = key down)
keyA = Pin(GPIO_PIN_A, Pin.OUT)
keyA.value(0)
keyB = Pin(GPIO_PIN_B, Pin.OUT)
keyB.value(0)

# Morse timings (PARIS standard)
DIT = 1.2 / WPM
DAH = 3 * DIT
INTRA = DIT
INTER_CHAR = 3 * DIT
INTER_WORD = 7 * DIT

MORSE = {
    'A': ".-", 'B': "-...", 'C': "-.-.", 'D': "-..", 'E': ".",
    'F': "..-.", 'G': "--.", 'H': "...", 'I': "...", 'J': ".---",
    'K': "-.-", 'L': "-..", 'M': "--", 'N': "-.", 'O': "----",
    'P': ".--.", 'Q': "---", 'R': "-.", 'S': "...", 'T': "-",
    'U': "..-", 'V': "...-", 'W': ".--", 'X': "-..-", 'Y': "-.--",
    'Z': "--..",
}

```

```

def key_down() -> None:
    keyA.value(1)
    keyB.value(1)

def key_up() -> None:
    keyA.value(0)
    keyB.value(0)

def send_element(symbol) -> None:
    key_down()
    time.sleep(DIT if symbol == '.' else DAH)
    key_up()
    time.sleep(INTRA)

def send_char(ch) -> None:
    if ch == ' ':
        time.sleep(INTER_WORD); return
    pat: str | None = MORSE.get(ch.upper())
    if not pat: return
    for s in pat:
        send_element(s)
    time.sleep(INTER_CHAR - INTRA)

def send_string(msg) -> None:
    for ch in msg:
        send_char(ch)

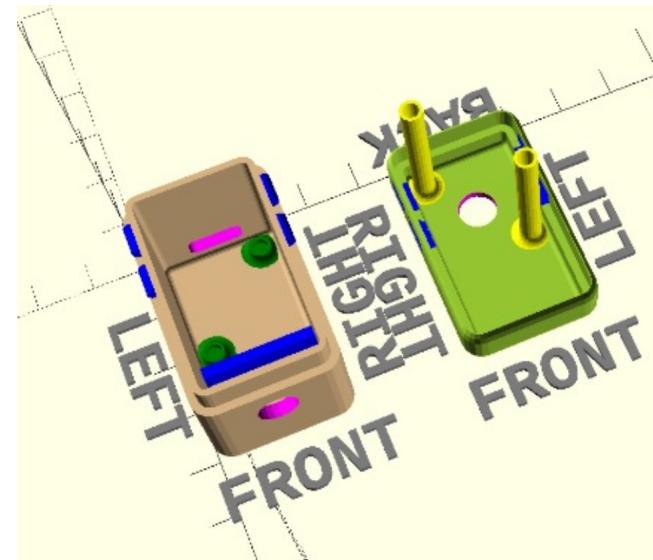
time.sleep(2)

# Beacon loop
while True:
    send_string(MSG1); time.sleep(PAUSE4)

```

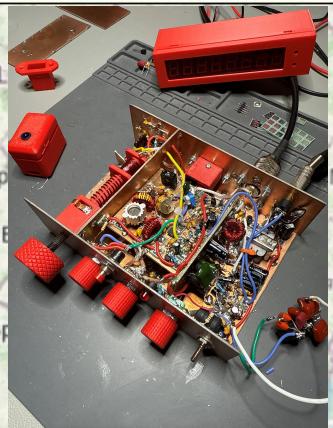
mrWheel/YAPP_Box:
Yet Another Parametric
Projectbox Box

Beacon



Boxed Modules





630m 160m 80m 60m 40m 30m 20m 17m 15m 12m 10m 6m 4m 2m

cw rtty psk31 psk63

CQ DX BCN /B NCDXF

Consider supporting the RBN!

Donate

Max rows: 10 Max age: 10 Hours

Unfreeze

Show Spotters Advanced

CW Speed: Min all M

Copy URL to Cli

● Spotted (dx)

● Spotter (de)

callsign	spotter-callsign	G7LQX/B
● spotter	● spotted	
DF2CK	+ G7LQX/B	669 mi 7001.7 CW BCN 4 dB 12 wpm 1234z 19 Aug 18 minutes ago

< 1 Watt, 1000 km!

Version: v2.2.6



DF2CK 'Shack'

Mark 1 Problems!

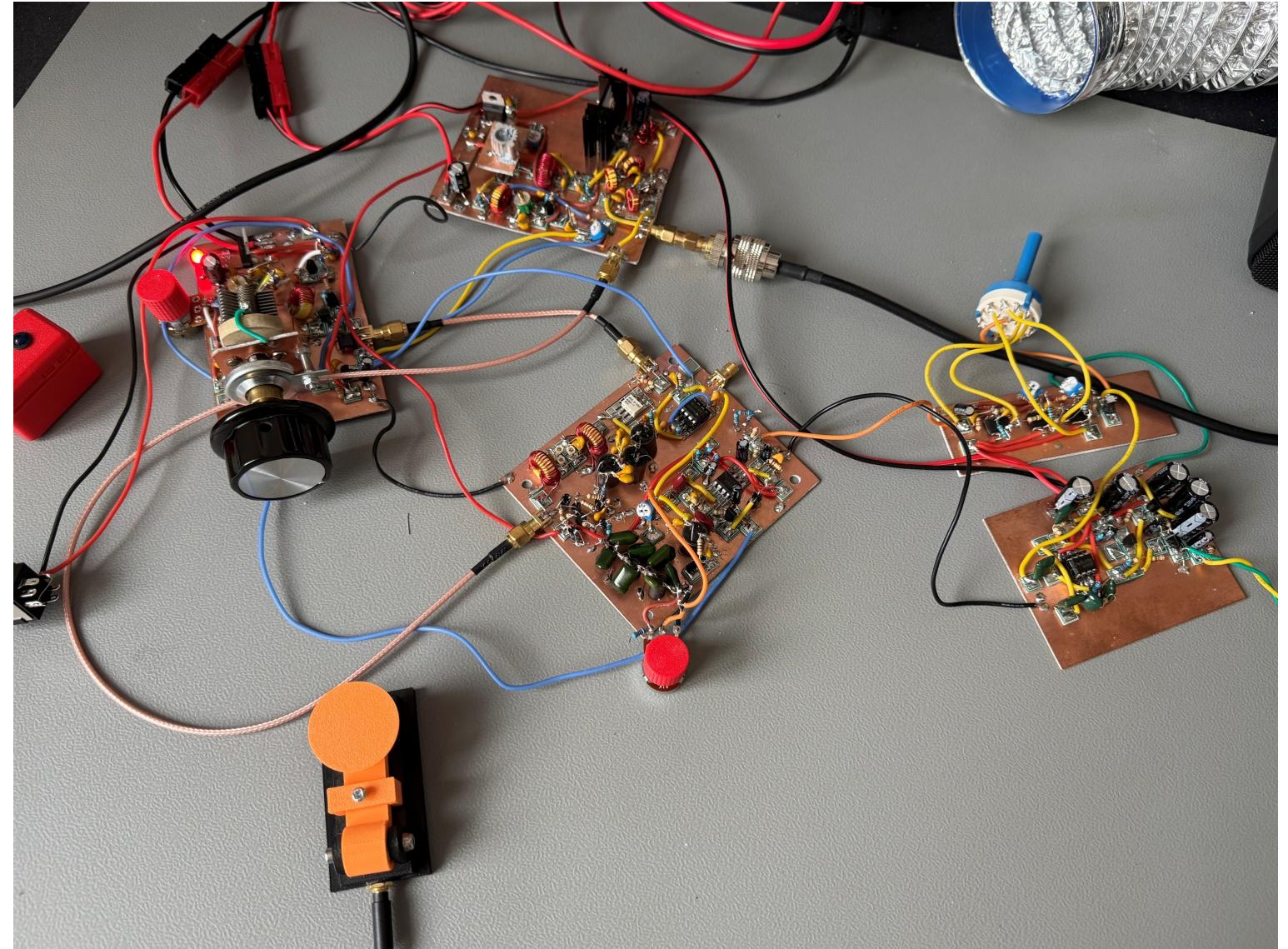
- Frequency was ‘variable’
 - PTO / Hand Effect + Drive
- Power Transistor got too hot (blew)
- Switching logic transistor blew
- Non Linear RIT (Zener)
- A steep learning curve
- The ship of Theseus?
- Cramped, difficult!

Begin Again...

“The thing that gets us to the
next thing...”
- Halt and Catch Fire



A New Transceiver



Spec

QRP, CW, Direct Conversion, Full Break-in, 5W

Separate Boards – divide and conquer

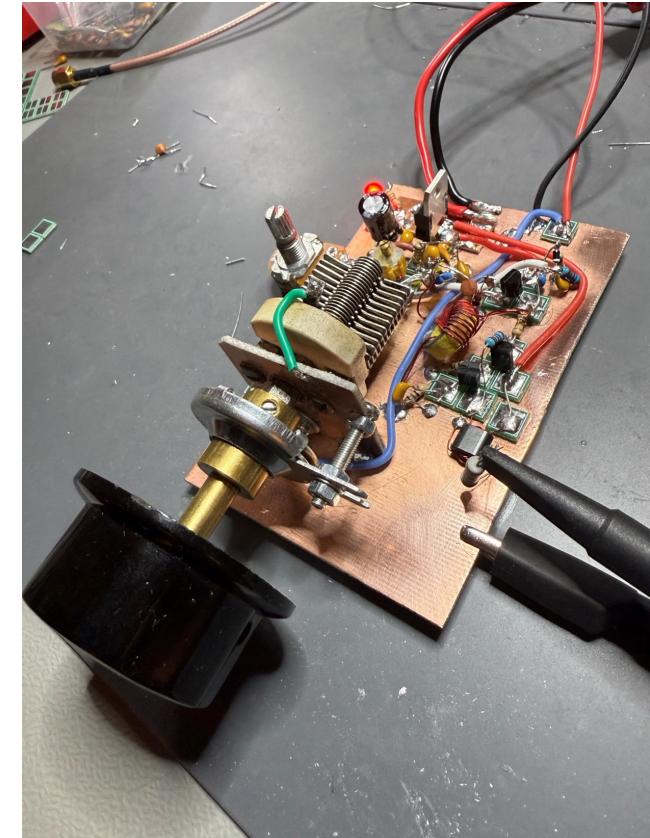
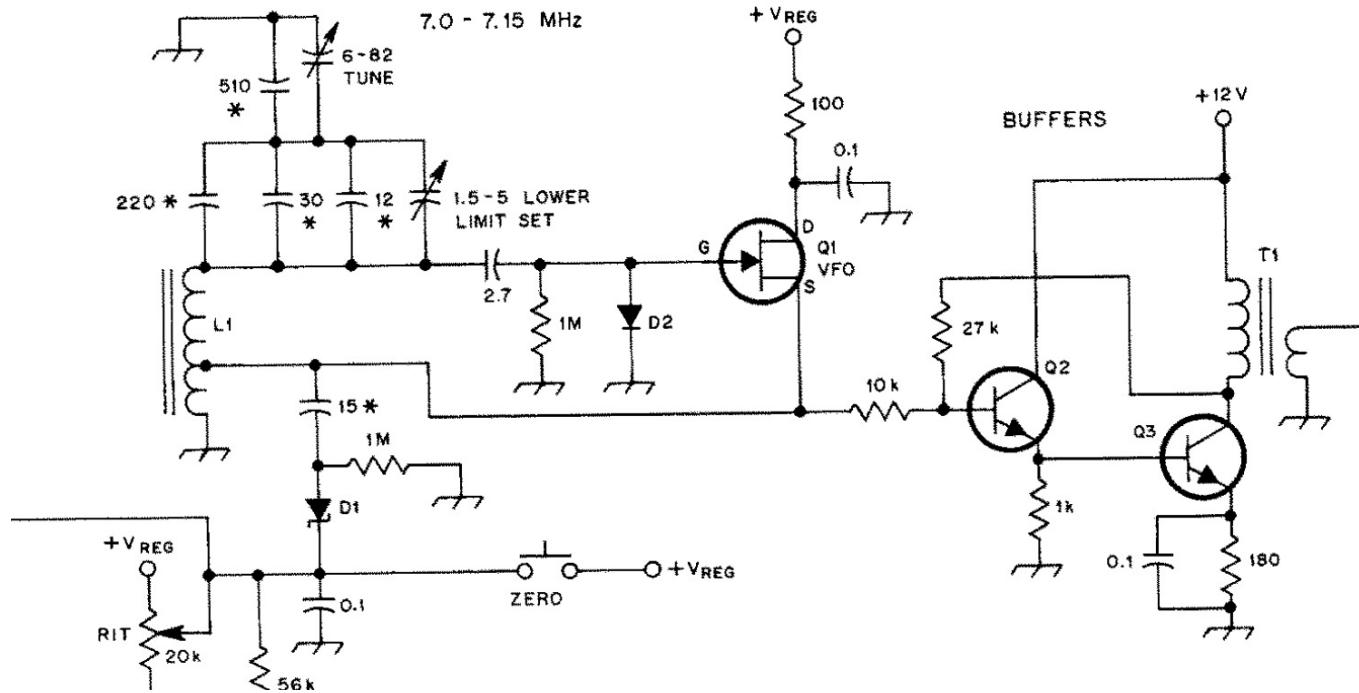
Some ICs (OpAmp, 555 timer, Regulators)

Stable Oscillator with more drive

Better CW filters

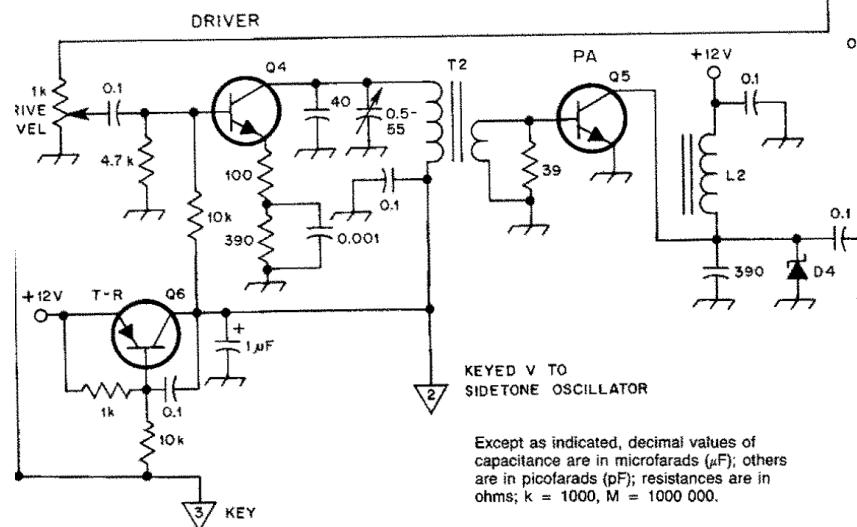
Use best in class Direct Conversion designs

'W7EL' Hartley Oscillator



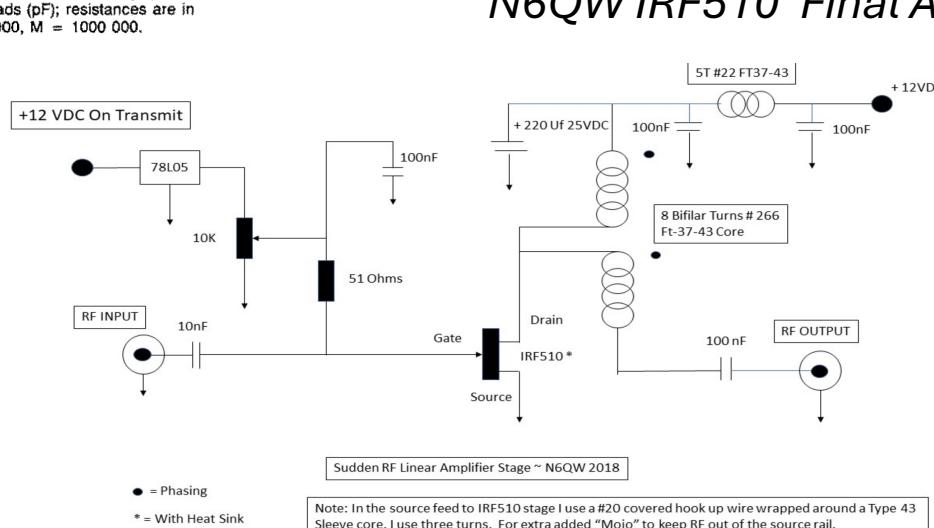
- 4v Pk-Pk, RIT, Varactor, Darlington Pair
- RIT drops the frequency

5 W QRP Transmitter

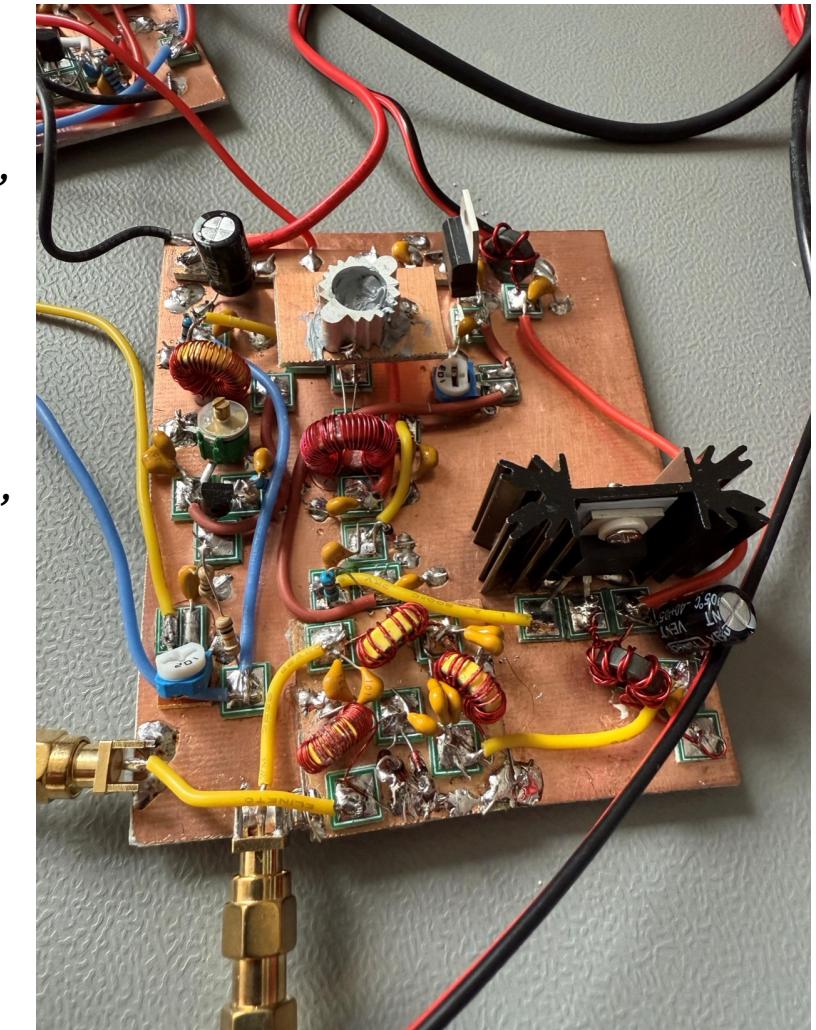


W7EL ‘Optimized QRP Transceiver’

- Output ~45v pk-pk, 5W
- When the PSU isn't limiting it!



N6QW IRF510 ‘Final Amp’



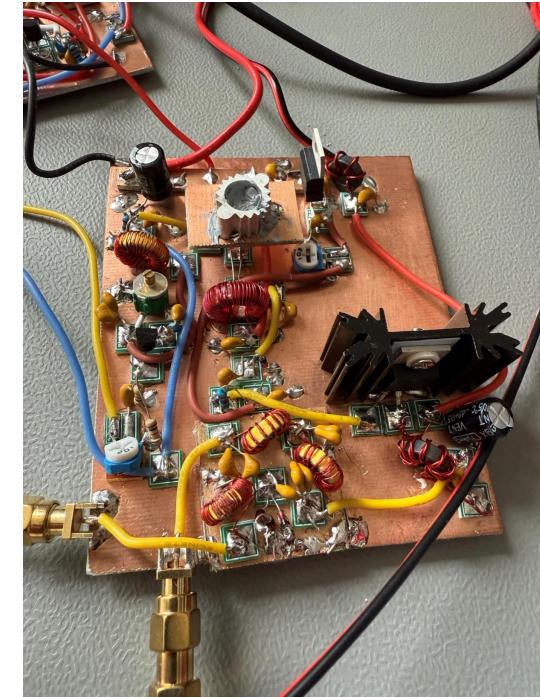
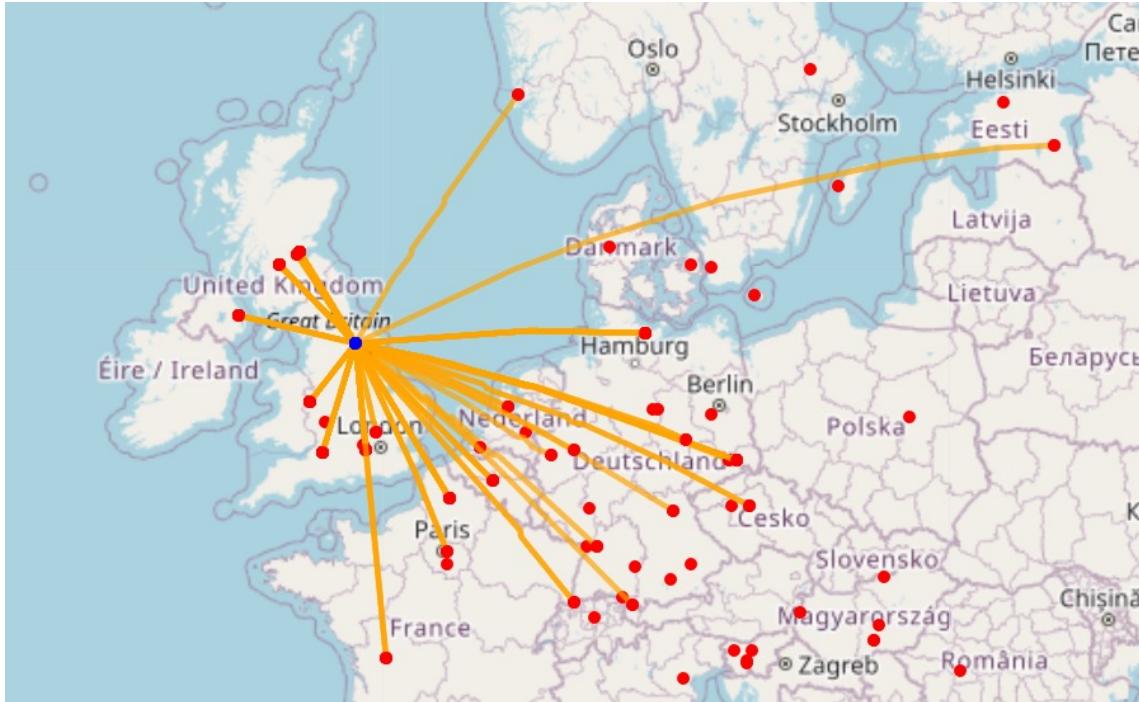




Beacon Demo

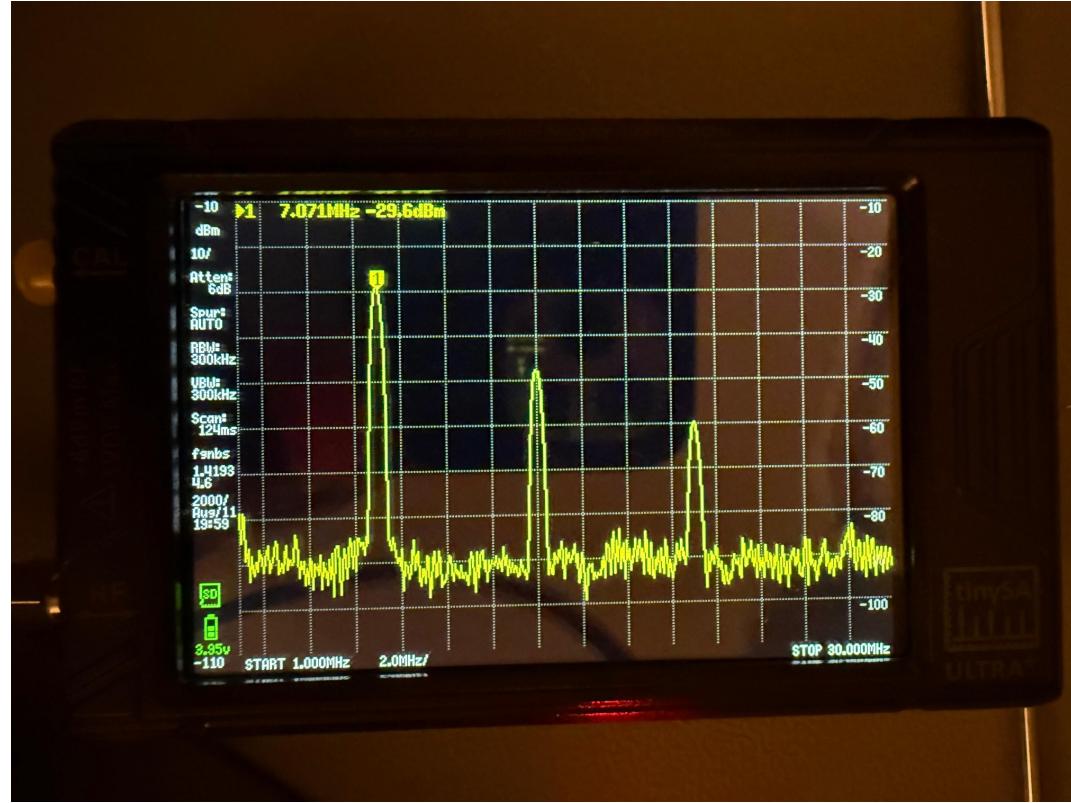
[https://youtu.be/yxxH_-
4BMM4?si=vgu9jTTf7pEDNo5m&t=46](https://youtu.be/yxxH_-4BMM4?si=vgu9jTTf7pEDNo5m&t=46)

Beacon Test, 5W



Most distant Spot – Estonia, 1772km, 3dB

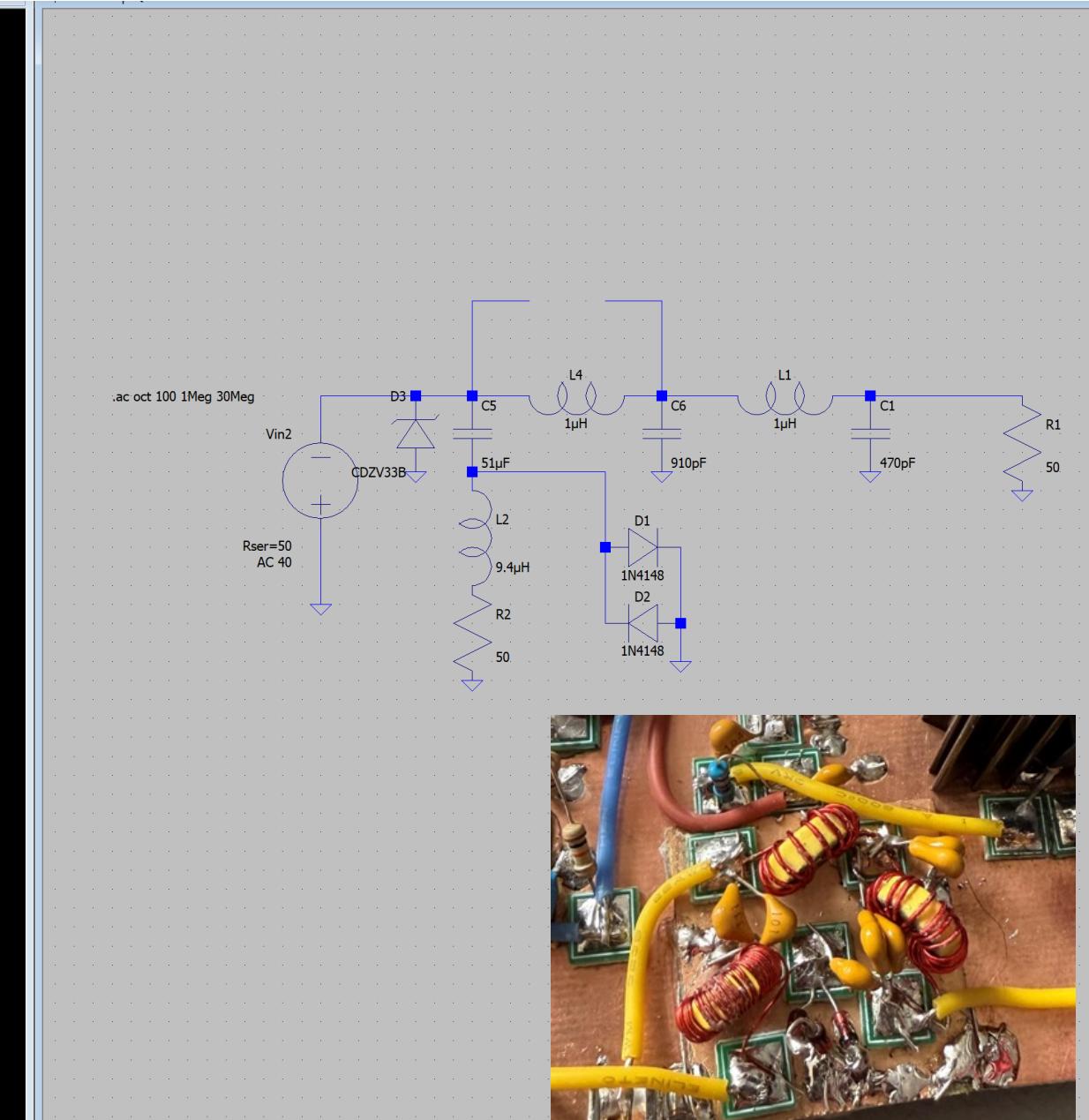
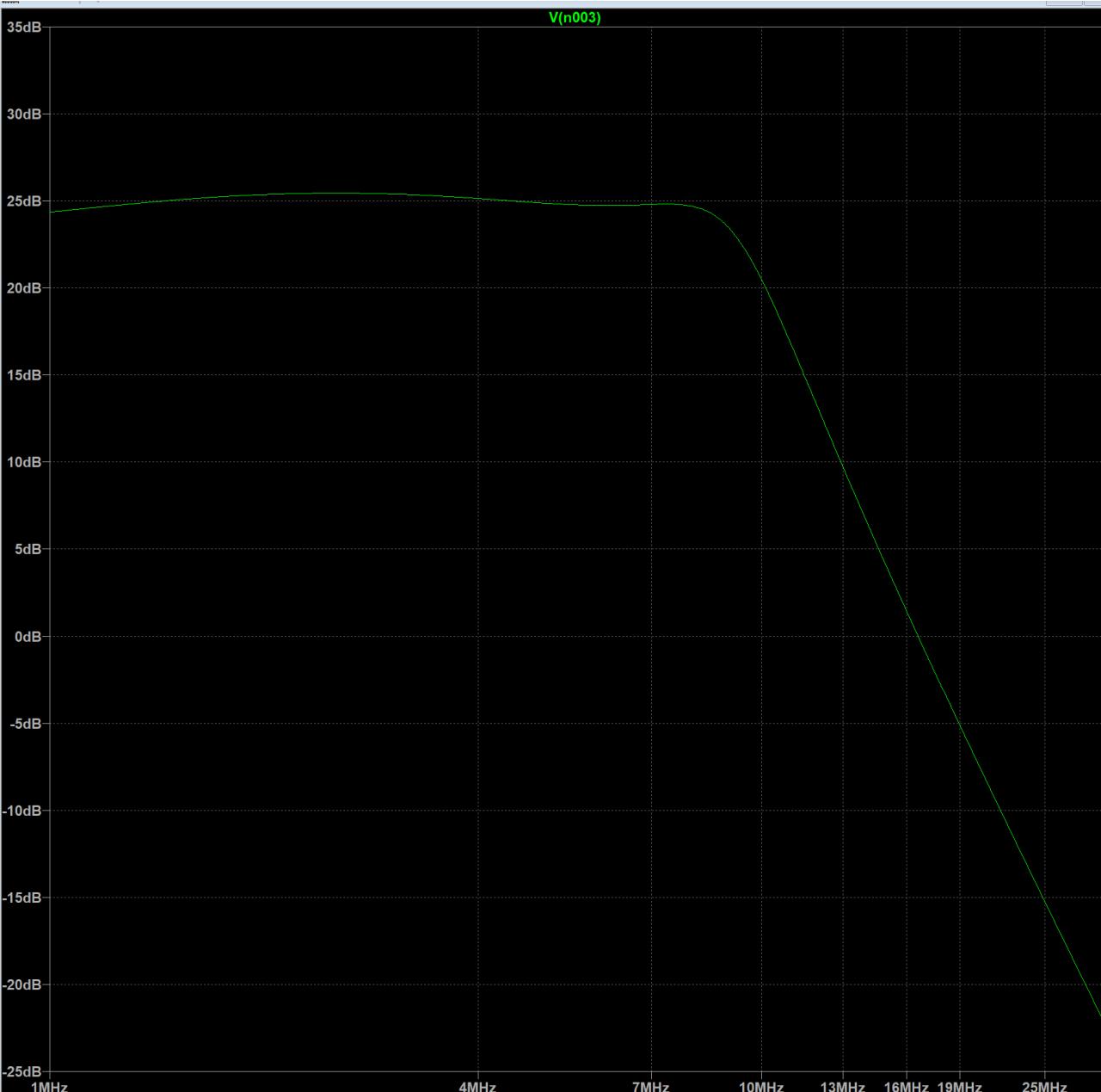
A problem...



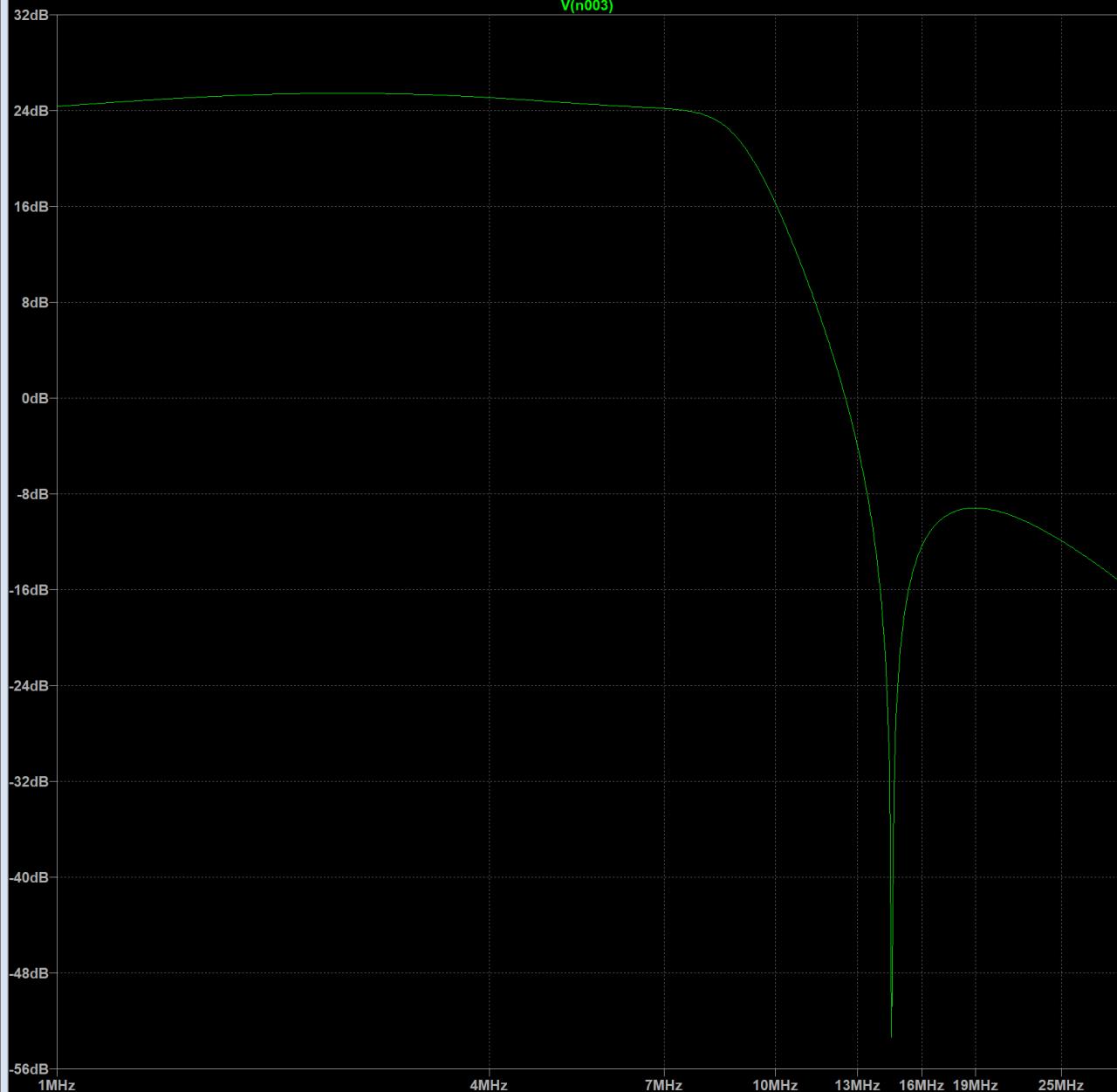
OK1HRA	G7LQX/B	1114 km	14008.8	CW	BCN	5 dB	15 wpm	1829z 21 Sep	6 minutes ago
--------	---------	---------	---------	----	-----	------	--------	--------------	---------------

- 2nd Harmonic, ~20dB (100x less power) 50mW! QPRp?!
- Licence conditions: ~40dB (10,000x less power)

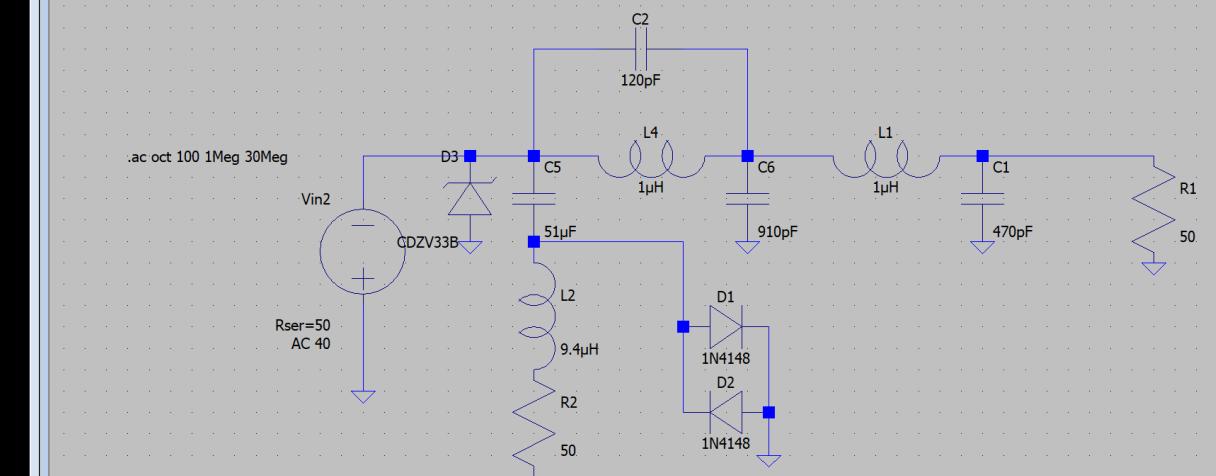
“the apparatus shall be designed, constructed, maintained and used only so as to avoid undue interference.”



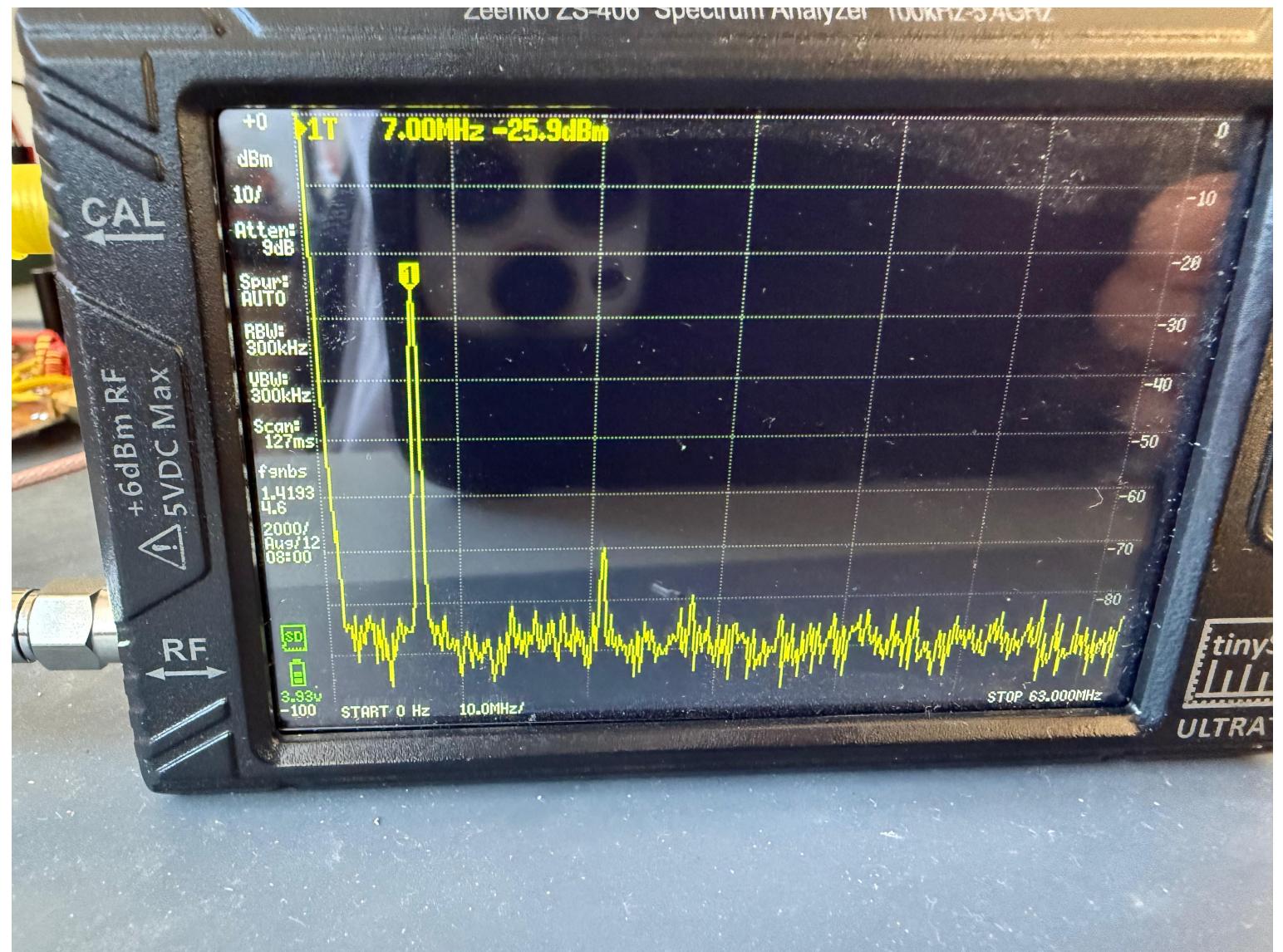
LowPassOptQRP.asc



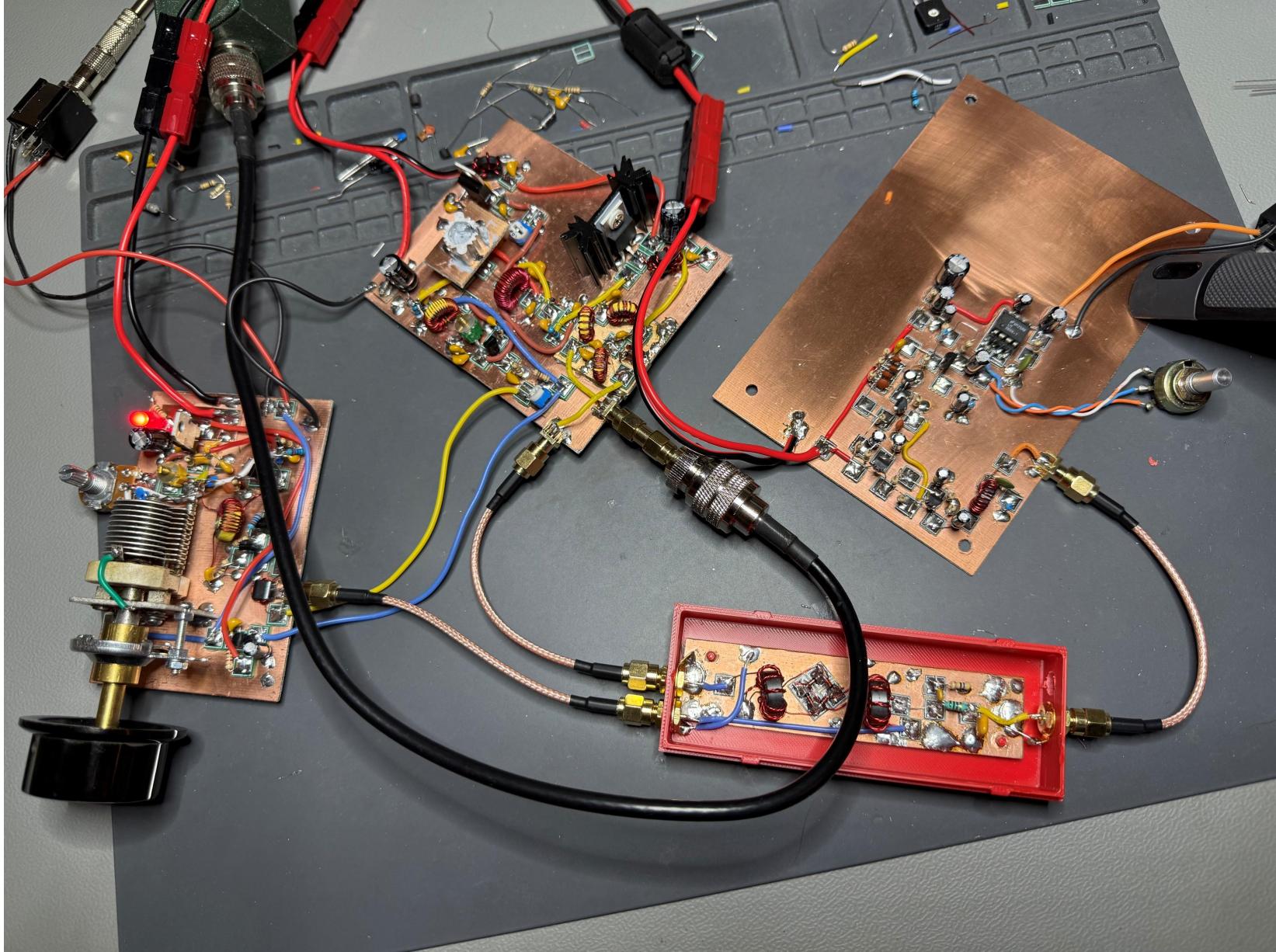
LowPassOptQRP.asc



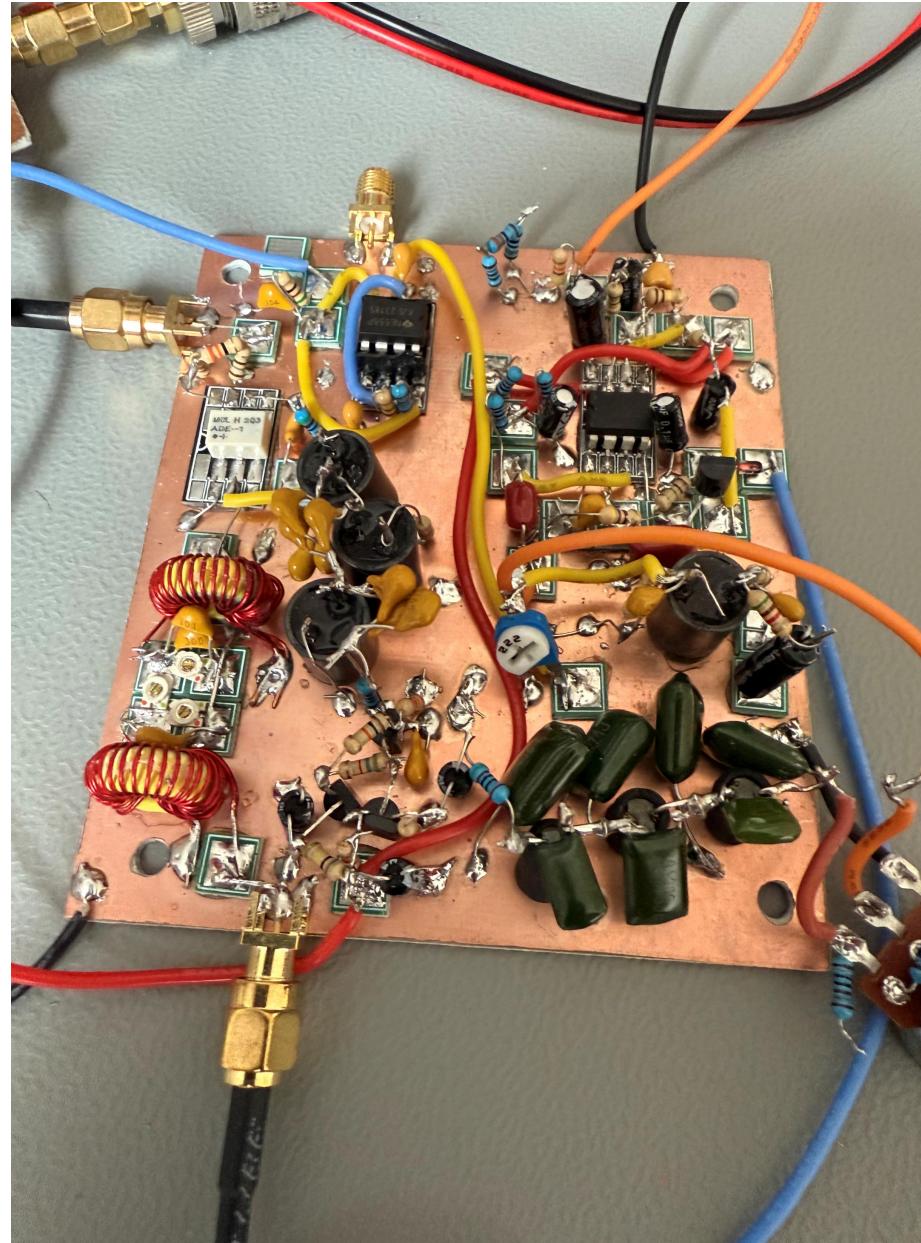
Solution!



Testing Receive/Transmit



Receiver



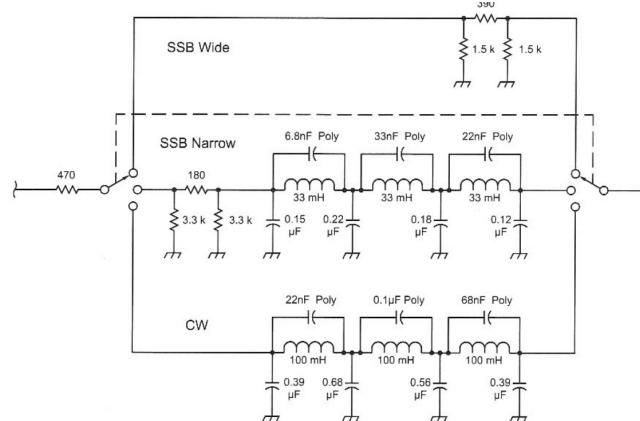
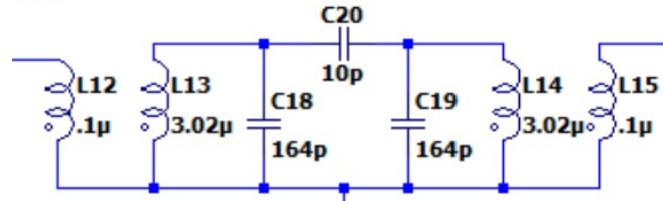
- SolderSmoke 7Mhz BPF
- ADE 1+ Mixer (with Pad)
- 555 Timer sidetone + filter
- KK7B Diplexer (50ohm)
- KK7B Pre-Amp
- EMRFD 3Khz 7th Order Filter
- EMRFD Pre-Amp
- W7EL FET Mute

... Space Weather!

Receiver Schematics

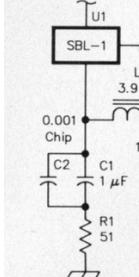
2 are for
station only
TALL

40M Band Pass Filter



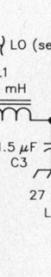
Except as indicated, decimal values of capacitance are in microfarads (μF); others are in picofarads (pF); resistances are in ohms; $k=1,000$, $M=1,000,000$.
 * Omit for headphone-only operation.
 ** Optional networks to reduce high frequency hiss.

RF (see text)

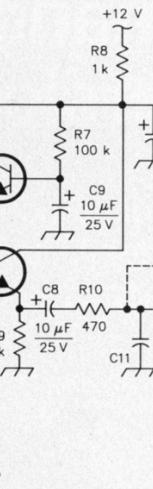


Mixer
 $G = -6 \text{ dB}$

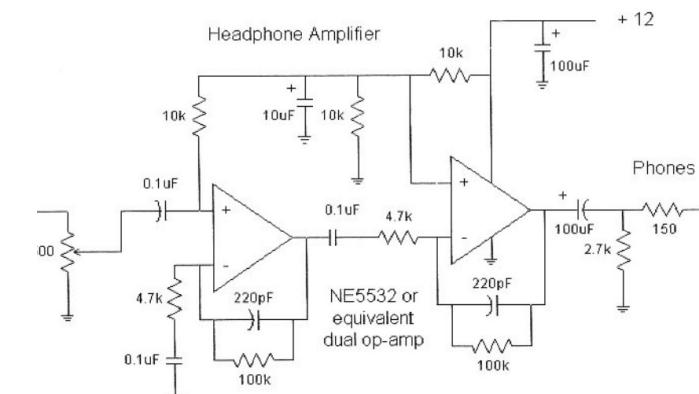
LO (see text)



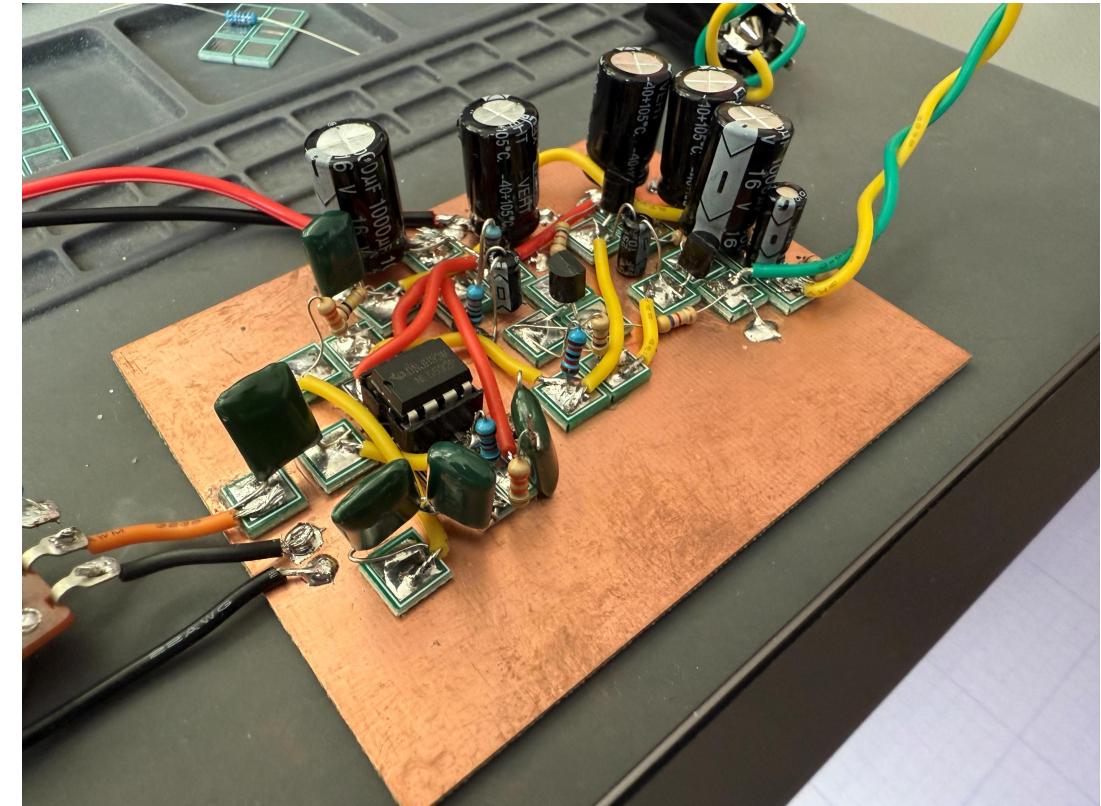
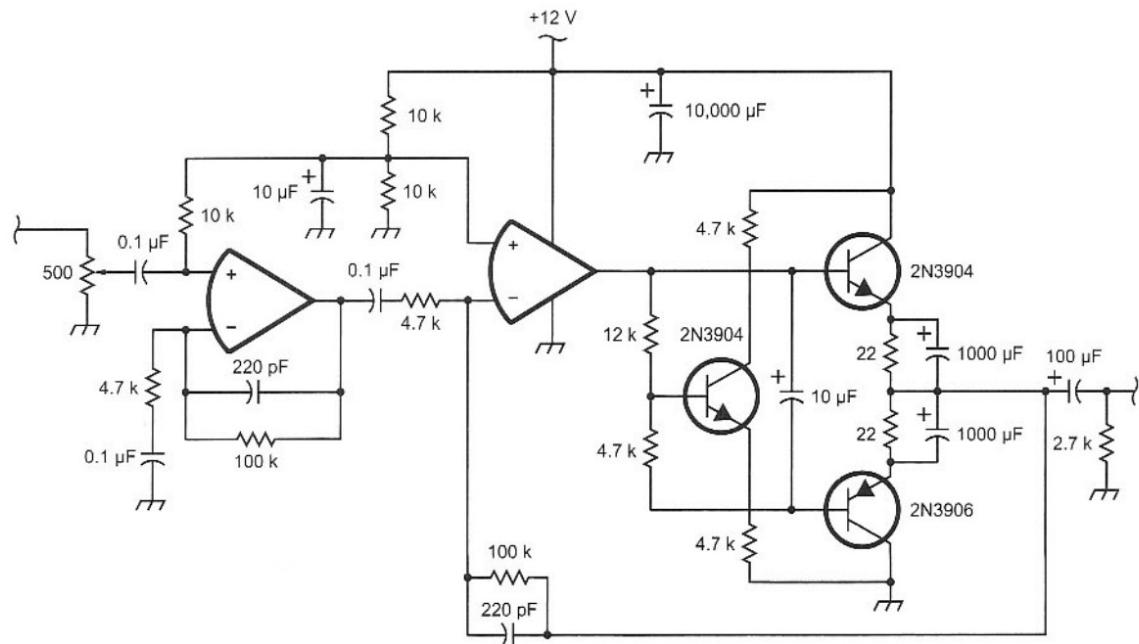
Band-pass Diplexer
 $G = -2 \text{ dB}$



50- Ω Audio Preamp
 $G = 40 \text{ dB}$

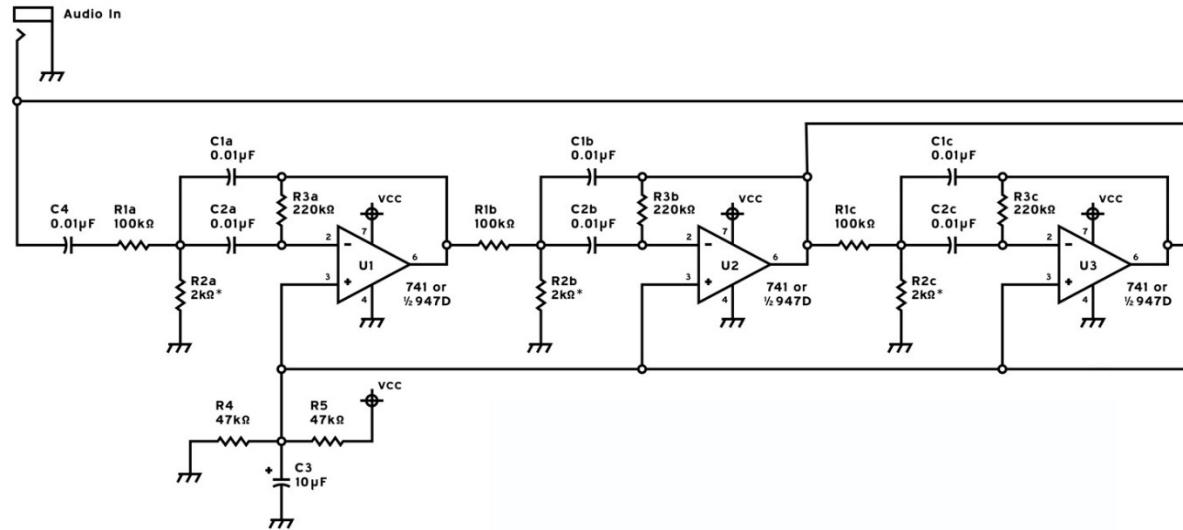


EMRFD NE5532 Amplifier

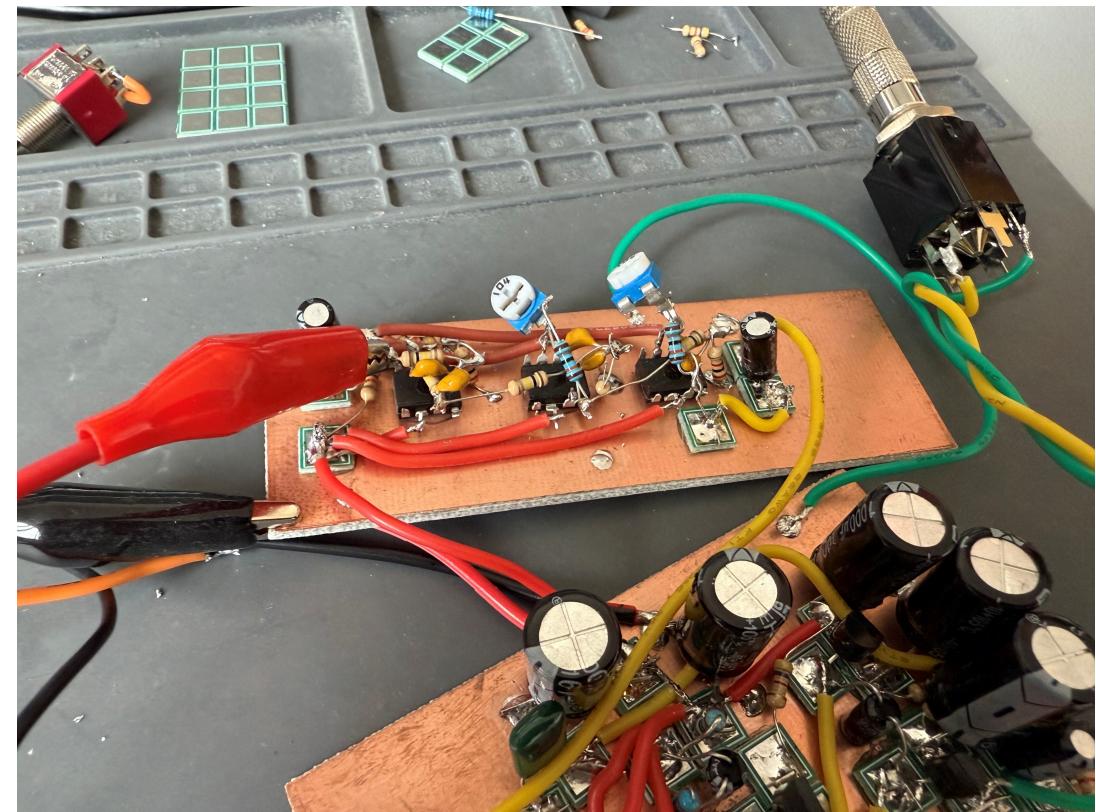


- 46dB gain (x1000), 7Khz Roll Off
- Low Impedance Speaker
- Quiet as a mouse, then howled like a Banshee!

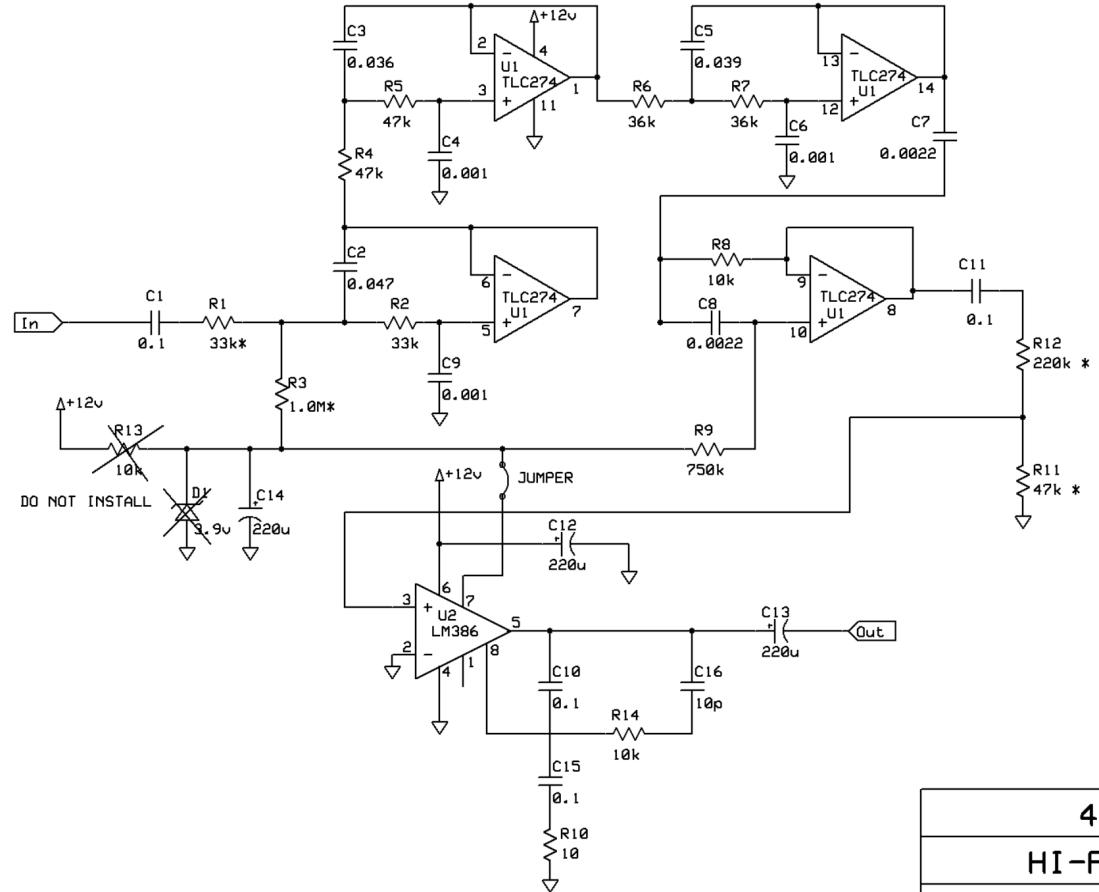
K4ICY CW Filter



- 3 equal stages (in theory...)
- 100Hz, ~750Hz center CW Filter
- Rings like Big Ben



Next...



4SQRP/NMOS	
HI-PER-MITE Filter	
David Cripe	Rev 1.0 1/30/2012
Page #1 of 1	

YouTube

<https://www.youtube.com/@mornymakes>

Morny Makes
@mornymakes · he/him · 39 subscribers · 18 videos
A channel for my projects. ...more

Customise channel Manage videos

Home Videos Shorts Posts

Latest Popular Oldest

The channel page displays 18 video thumbnails arranged in three rows of six. Each thumbnail includes the video title, view count, and upload date. The titles are: "QRP CW Transceiver 11: CW Filter Tuning" (23 views, 20 hours ago), "QRP CW Transceiver 10: The EMRFD Audio Power Amp Part 2" (60 views, 1 day ago), "QRP CW Transceiver 9: The EMRFD Audio Power Amp: Part 1" (190 views, 2 days ago), "QRP CW Transceiver 8: Beacon demo" (104 views, 5 days ago), "QRP CW Transceiver 7: Sidetone" (126 views, 5 days ago), "QRP CW Transceiver 6: A CW Active Filter" (263 views, 6 days ago), "QRP CW Transceiver 5: Receiver Demo" (75 views, 7 days ago), "QRP CW Transceiver 4: Low Pass and Receive fix" (51 views, 2 weeks ago), and three additional thumbnails at the bottom.

QRP CW Transceiver 11: CW Filter Tuning 23 views • 20 hours ago

QRP CW Transceiver 10: The EMRFD Audio Power Amp Part 2 60 views • 1 day ago

QRP CW Transceiver 9: The EMRFD Audio Power Amp: Part 1 190 views • 2 days ago

QRP CW Transceiver 8: Beacon demo 104 views • 5 days ago

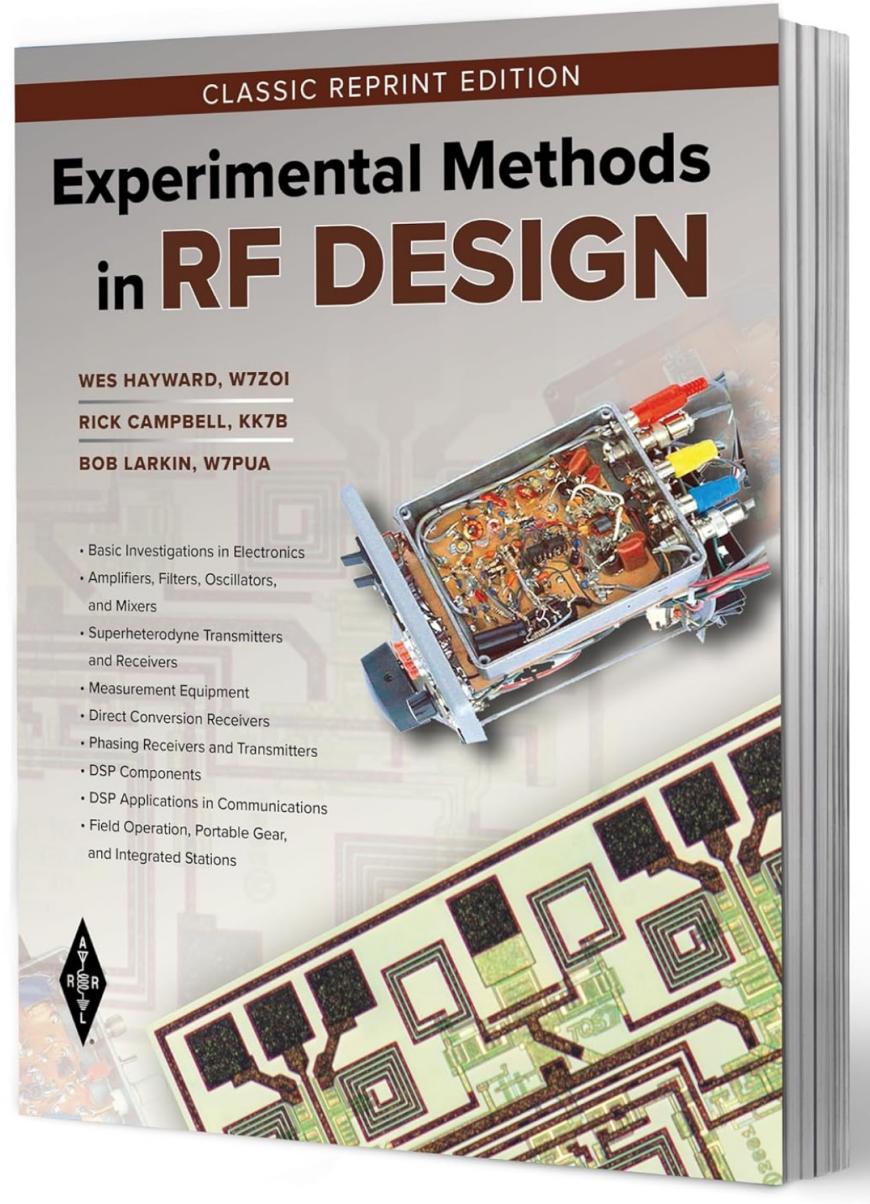
QRP CW Transceiver 7: Sidetone 126 views • 5 days ago

QRP CW Transceiver 6: A CW Active Filter 263 views • 6 days ago

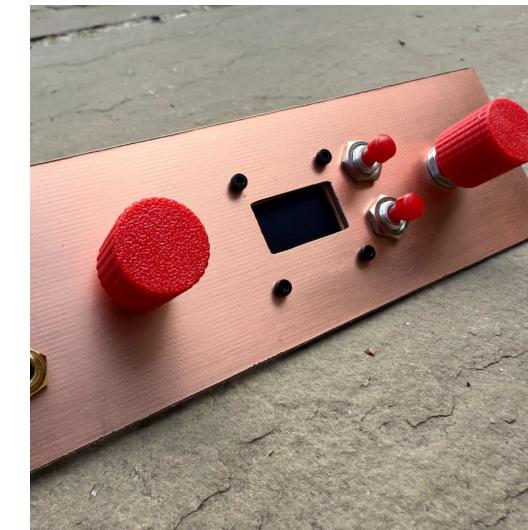
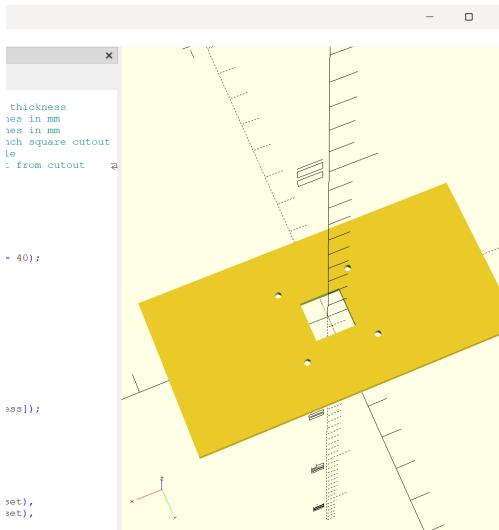
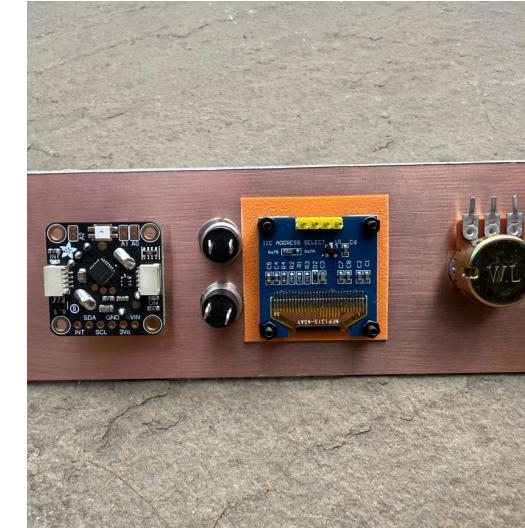
QRP CW Transceiver 5: Receiver Demo 75 views • 7 days ago

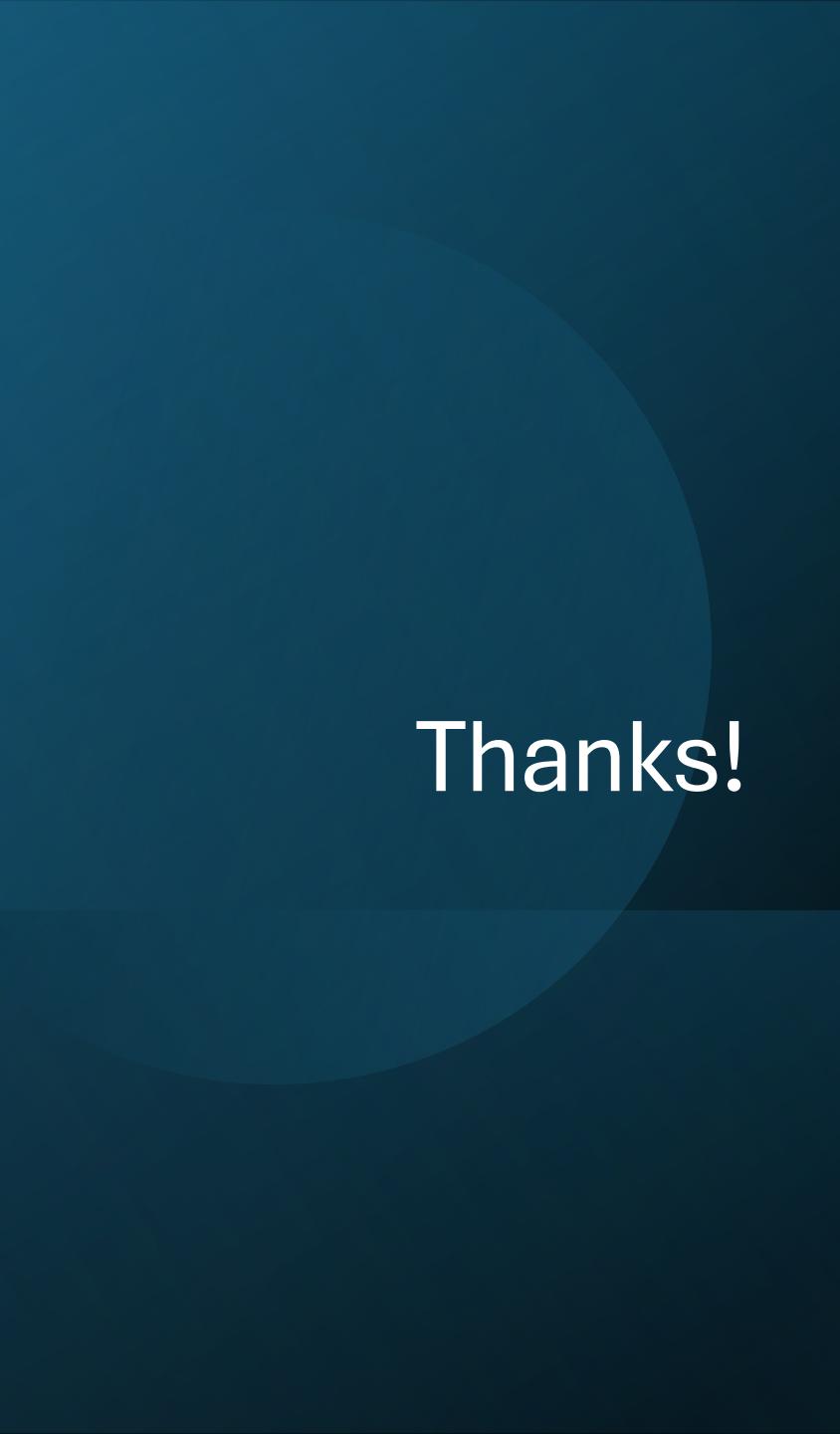
QRP CW Transceiver 4: Low Pass and Receive fix 51 views • 2 weeks ago

The only
book you
need...



Making Boxes





Thanks!

- mornymorny@gmail.com