QRP Transceiver Projects

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Evolution of 40 Meter CW Transceiver

- **R1** high performance direct conversion receiver
- **Rockmite 40** – performance left something to be desired
- Goal: Build a *real* homebrew transceiver for 40 CW, consisting of:
  - **R1** DC receiver and a proven VFO circuit
  - 3 stage **MKII** 5W+ transmitter
  - **Universal VFO –** Suitable for **R1** and its successor, the **Mini-R2**
  - **Norcal Keyer**
  - Upgrade to **Mini-R2** receiver

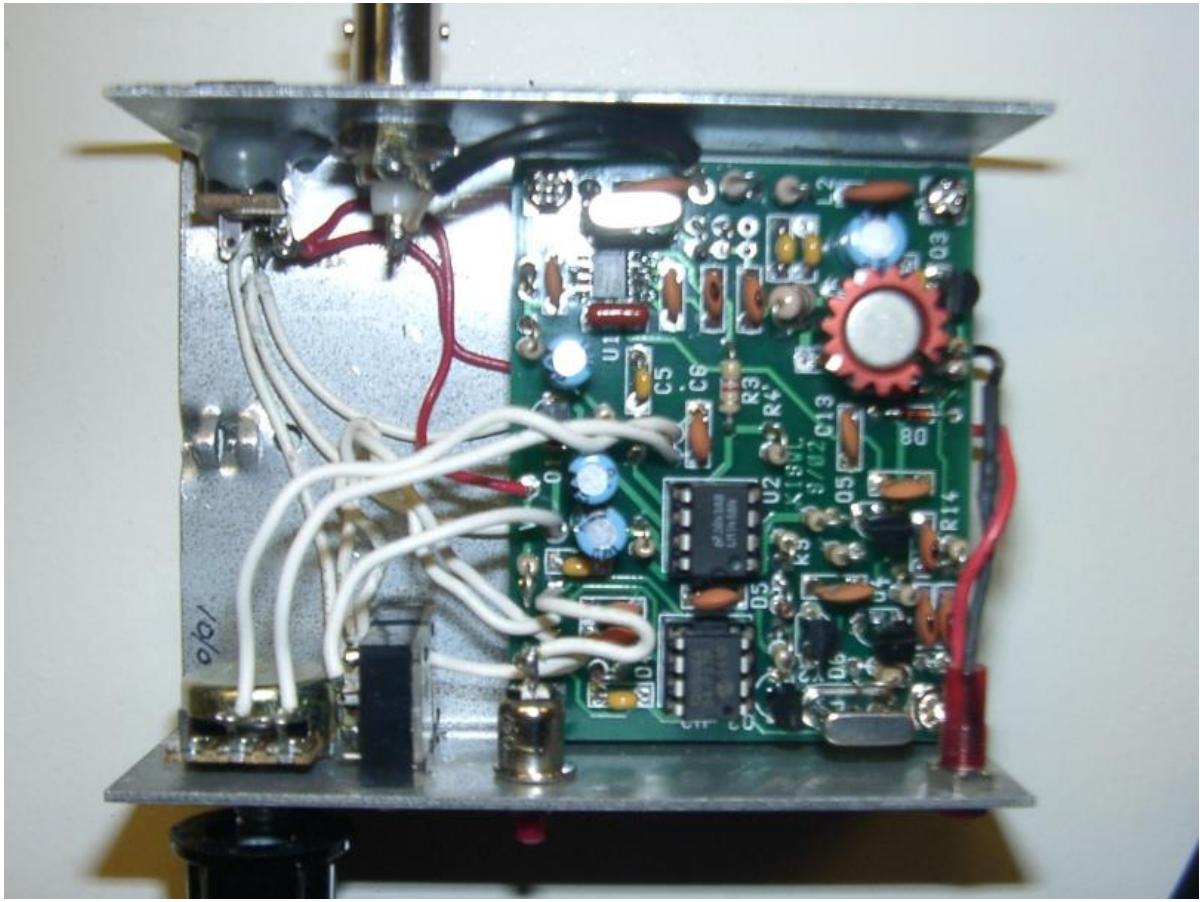
Receiver (R1)

- Good performance
- Very low distortion audio amp
- Built with 3Khz filter
- No provision for removing audio image/opposite sideband
- No AGC

"High-Performance Direct-Conversion Receivers" by Rick Campbell, KK7B, QST, August 1992

Rockmite 40 Meter Transceiver

- Crystal controlled DC Receiver
- 8-pin PIC microcontroller, built in keyer
- Pushbutton reverses offset to yield a second oper. frequency.
- Introduced in 2002 by K1SWL



http://www.smallwonderlabs.com/Rockmite.htm

Some Desired Features

- 40 meter CW band
- 5+ watts output
- Smooth T/R switching/semi break-in keying
- Built-in keyer
- Receiver incremental tuning (RIT)
- Good performance (not too worried about parts count or DC power consumption)
- Enough audio output for small speaker
- Portable

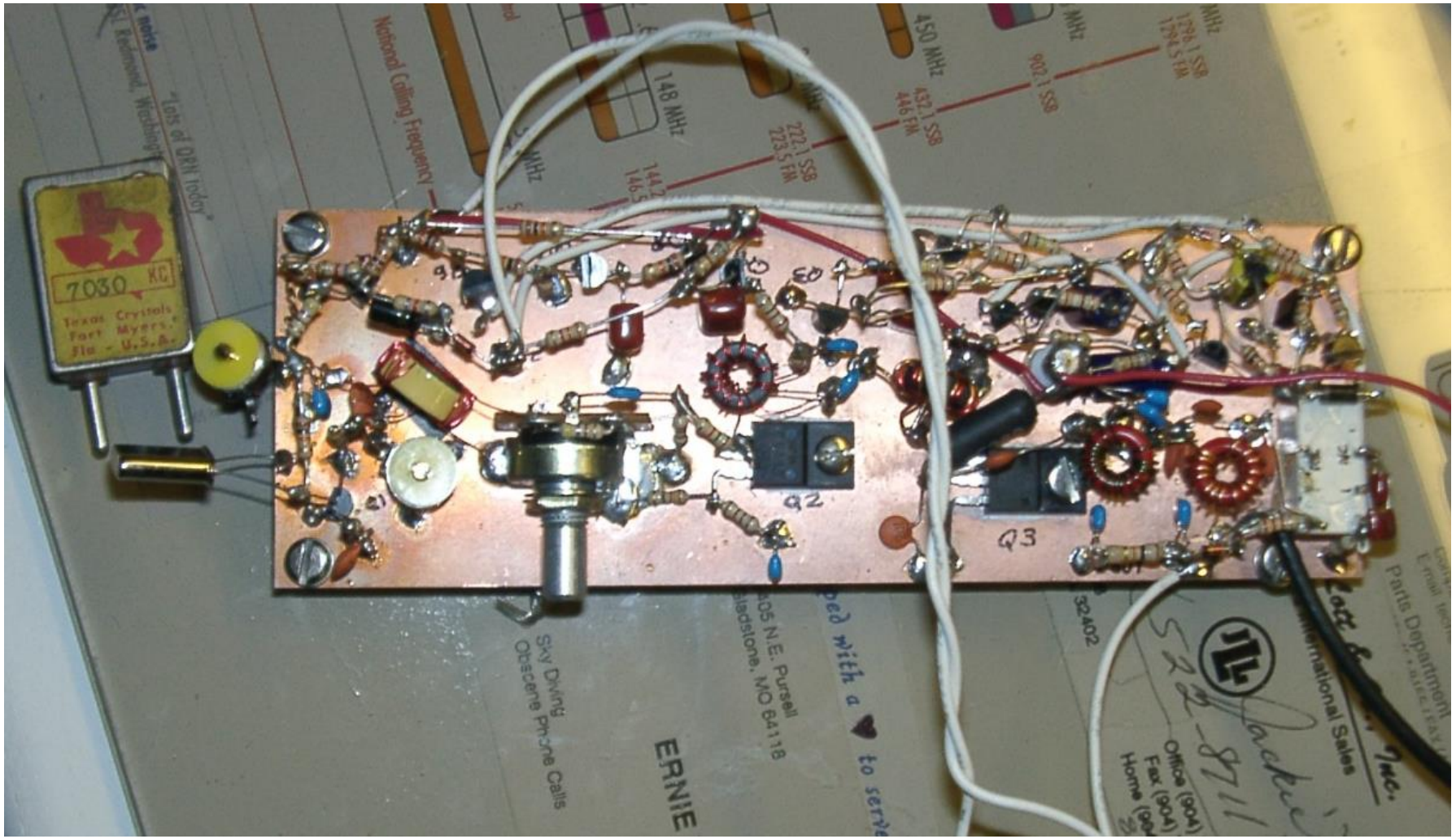
MKII Transmitter

- 3 stage design, up to ~7.5 watts output if desired (or a bit more?), depending on supply voltage and drive setting
- Automatic T/R switching for use with a receiver
- Side tone oscillator
- Spot circuit
- 2N3904 crystal oscillator/VXO, inexpensive 2SC5739* driver and power amp
- Common parts for T/R switching and side-tone oscillator
- See Wes' website for notes on MKII transmitter http://w7zoi.net/mark2.html

"An Updated Universal QRP Transmitter" by Wes Hayward, W7ZOI, QST, April 2006

*Obsolete, check with Bill Kelsey, N8ET at http://www.kangaus.com/

Transmitter



"An Updated Universal QRP Transmitter" by Wes Hayward, W7ZOI, QST, April 2006

“Ugly” Construction

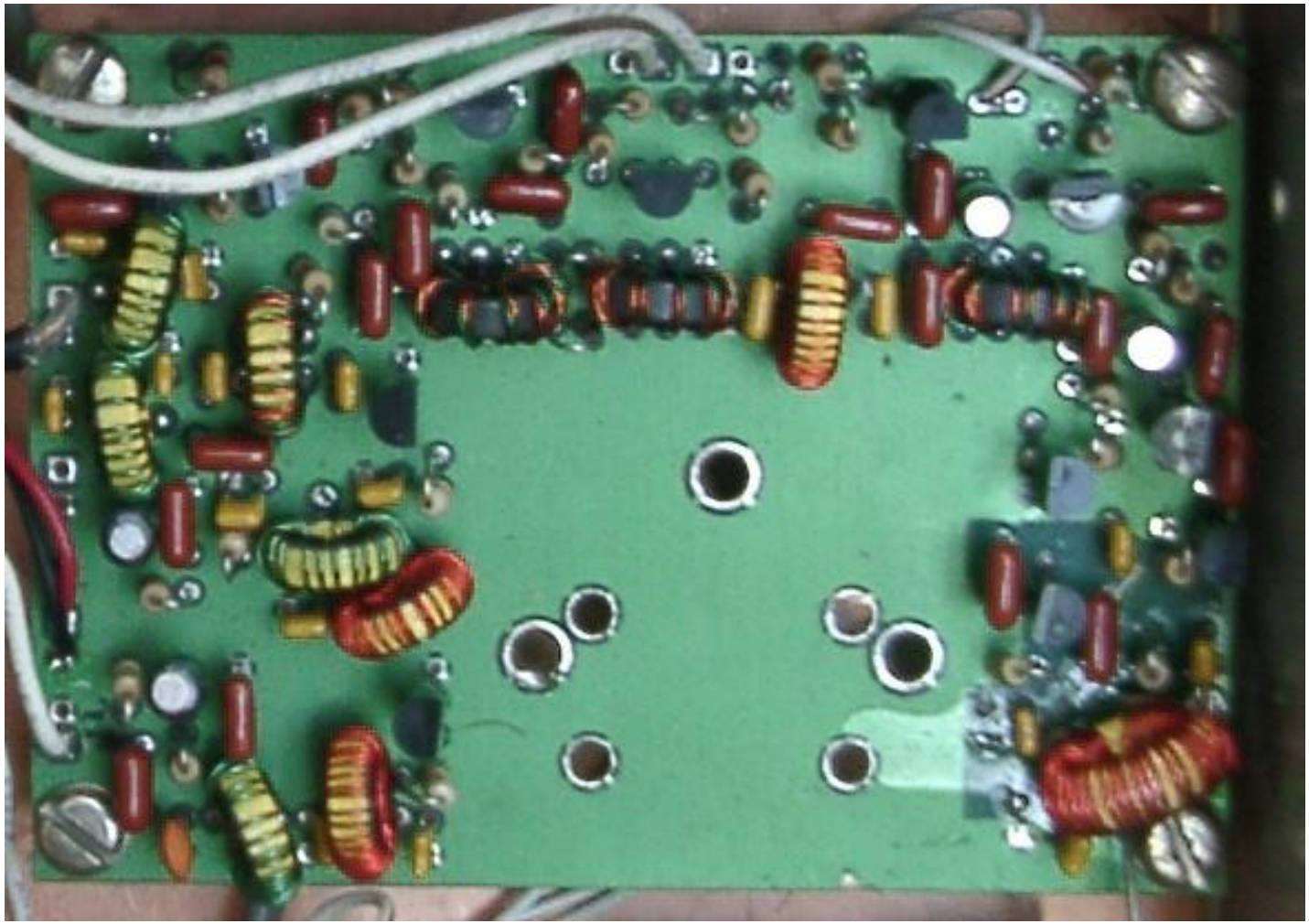
- Ugly Construction involves building circuits on top of a double or single-sided copper clad board
- The copper ground-plane provides a low impedance ground and mechanically supports the parts
- Stand-offs: high value resistors (10 Megohm or greater), terminal strips/posts, or small copper islands glued onto the copper.

Variable Frequency Oscillator (VFO)

- Universal VFO (UVFO) design (KK7B)
- ~60Khz tuning range (bottom end of 40M)
- I and Q outputs for a receiver
- Single output provided to drive a transmitter.
- RIT built in.
- Variable capacitor with reduction drive

http://www.kangaus.com/

Variable Frequency Oscillator (VFO)



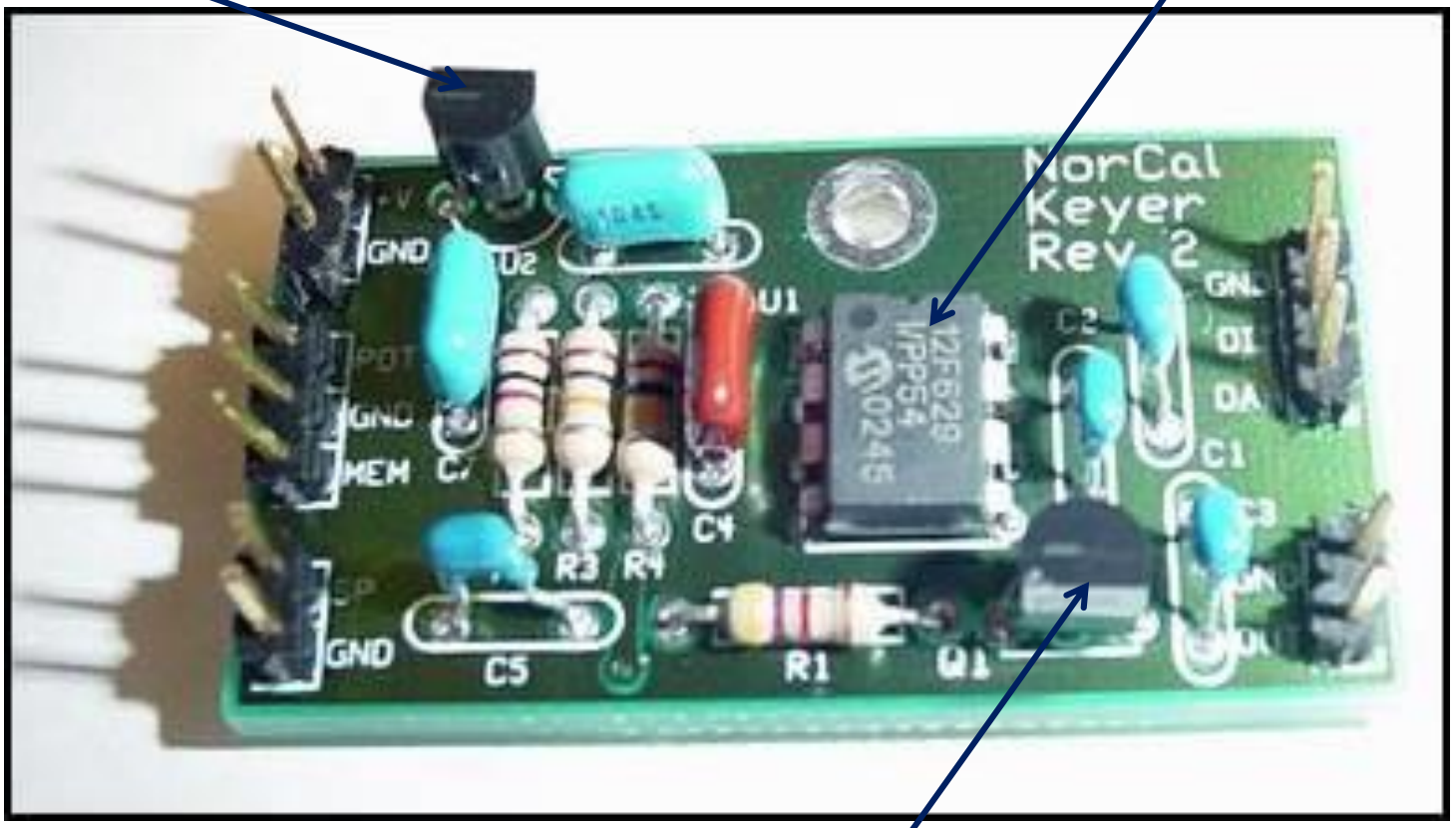
Norcal Memory Keyer

- PIC12F6293 microcontroller (pre-programmed)
- Three 40-character memories
- Iambic, straight key and bug mode; beacon modes
- Variable speed control via paddles (option for potentiometer control if desired).
- 7-to-18 volt input power range with 5V regulator built in
- Side-tone from keyer is injected into the audio circuit
- “FB” sent by the keyer at power up through the sidetone if functioning correctly.

http://www.norcalqrp.org/nckeyer.htm (now retired)

5V Reg.

Keyer Chip



Output Transistor (to key rig)

Keys Used	**PAR** (press and release)	**PAH** (press and hold)
Mem switch	Send memory 3	Record memory 3, O? Beacons: BE and BA
Mem + dit	Send speed	Paddle set of speed, pot options, main menu
Mem + dah	Send memory 2	Record memory 2: M?
Mem + both	Send memory 1	Record memory 1: T?

CW	**Menu Item**	**Pressing a dit**	**Pressing a dah**
Memory + Dit Menu (PAR mem to advance to the next menu)			
S	Speed set from paddle	Increase speed 1 wpm	Decrease speed 1 wpm
P	Pot / paddle speed control	Selects pot speed control	Selects paddle speed control
C	Calibrate pot speed control	Enters the calibration routine	Restores default pot calibration
B	Bug / straight key mode	Enables bug mode (dah = key)	Disables bug mode (default)
A	Iambic mode A or B	Enables iambic mode A	Enables mode B (default)
R	Reverse paddle mode	Reverse dit and dah switches	Returns dit and dah to normal
AU	Autospace on / off	Turns on character autospace	Turns off autospace (default)
Memory + Dah Menu (PAR mem to exit)			
M?	Record memory 2	Records a dit	Records a dah
Memory Switch Menu (PAR mem to advance to next menu)			
O?	Record memory 3	Records a dit	Records a dah
BE	Beacon mode - sends mem 1	Starts the beacon going	Exits the menu
BA	Beacon alternate mode	Selects alternate beacon sends of mem 1 and mem 2	Selects send of mem 1 only (default)
ST	Side tone on/off	Turns off the side tone	Turns the side tone on
Memory + Both Menu (PAR mem to exit)			
T?	Record memory 1	Records a dit	Records a dah

Transceiver Enclosure

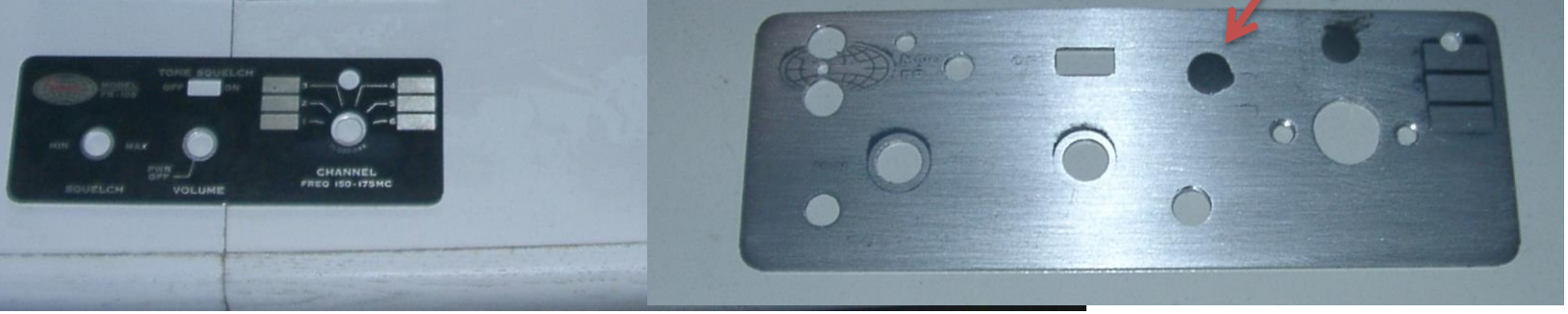
SONAR FR-104 VHF Monitor

Enclosure

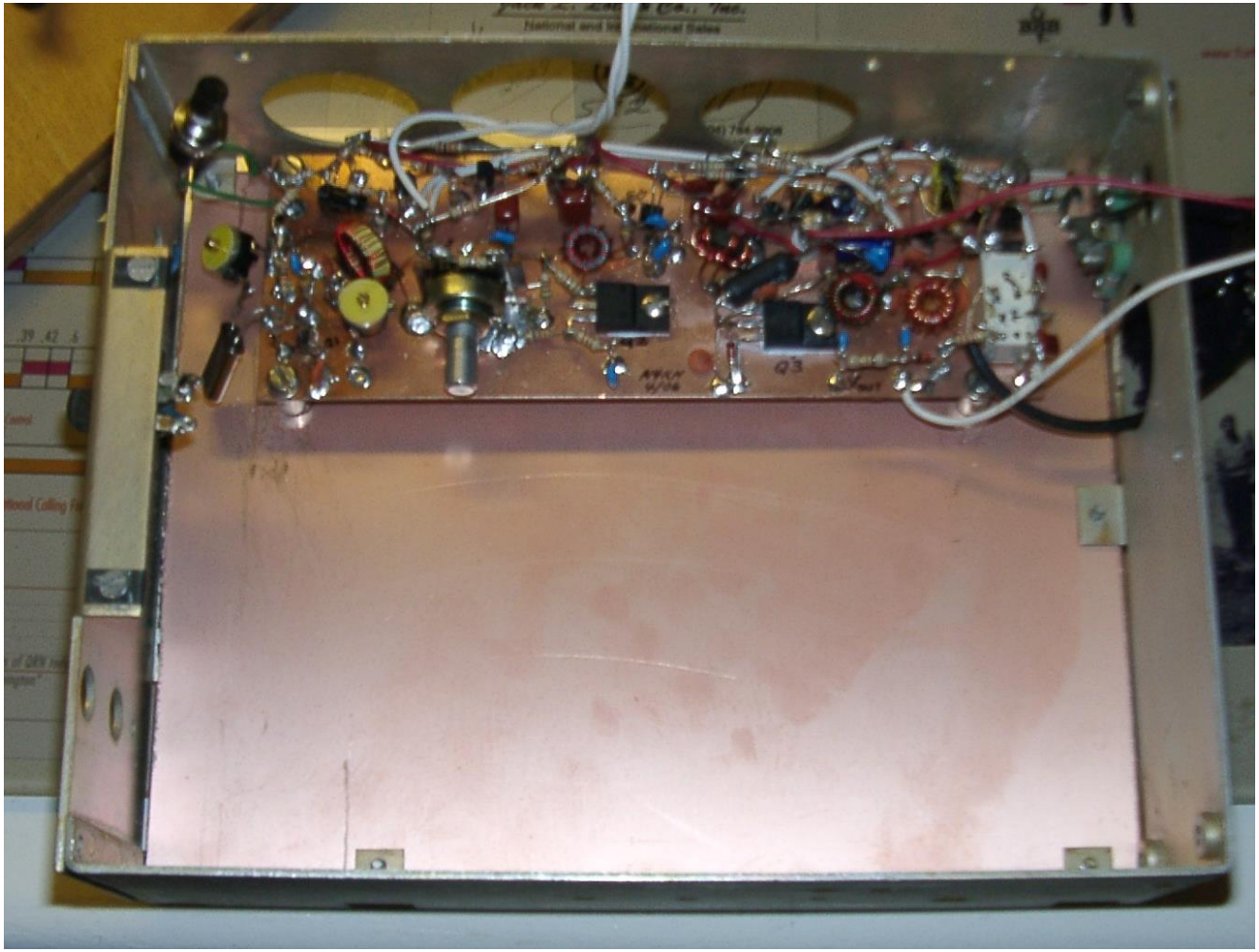
Re-Purposed
SONAR Case

Unwanted holes filled with “J. B. Weld”

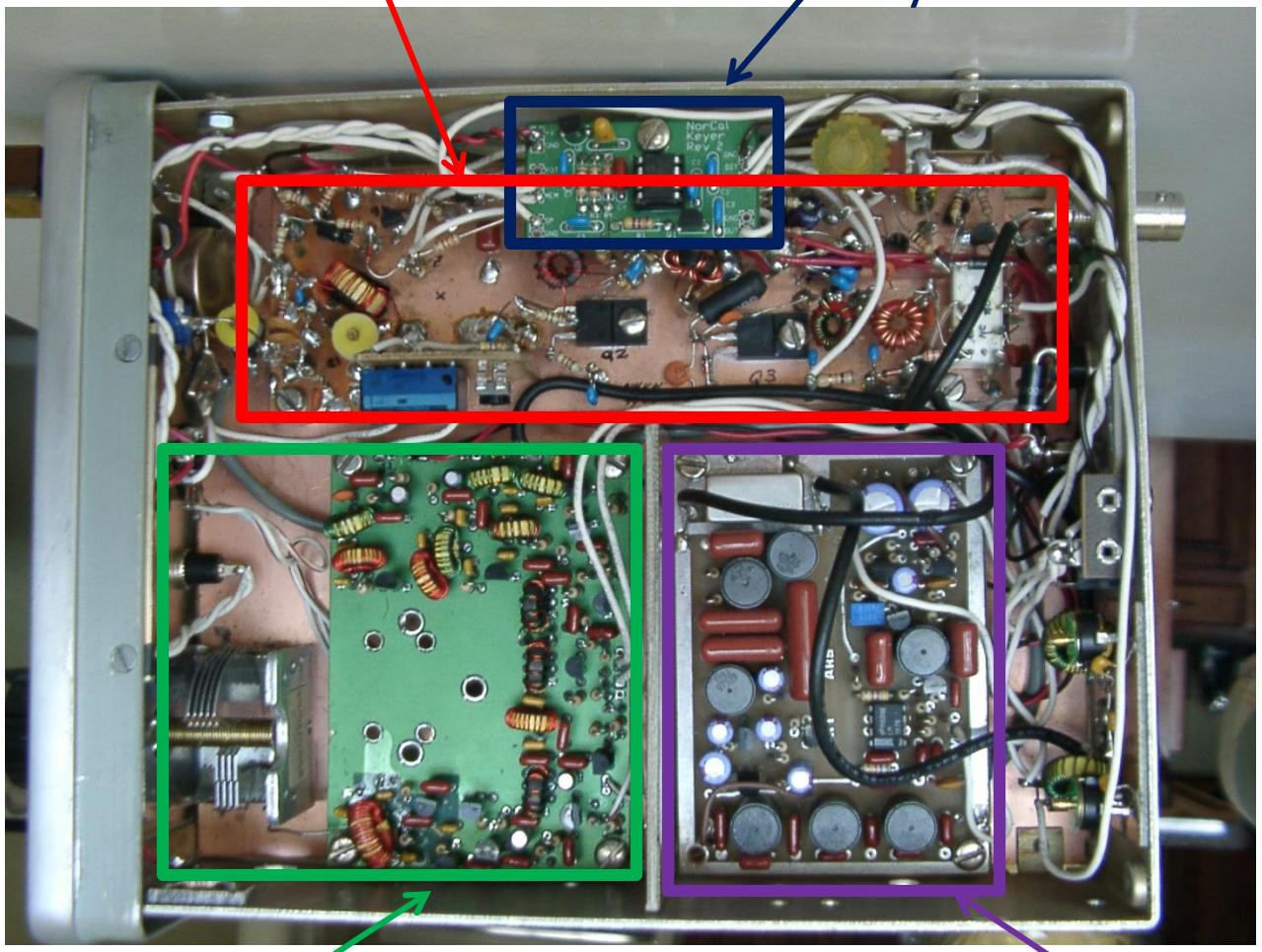
Front Panel Overlay



Construction



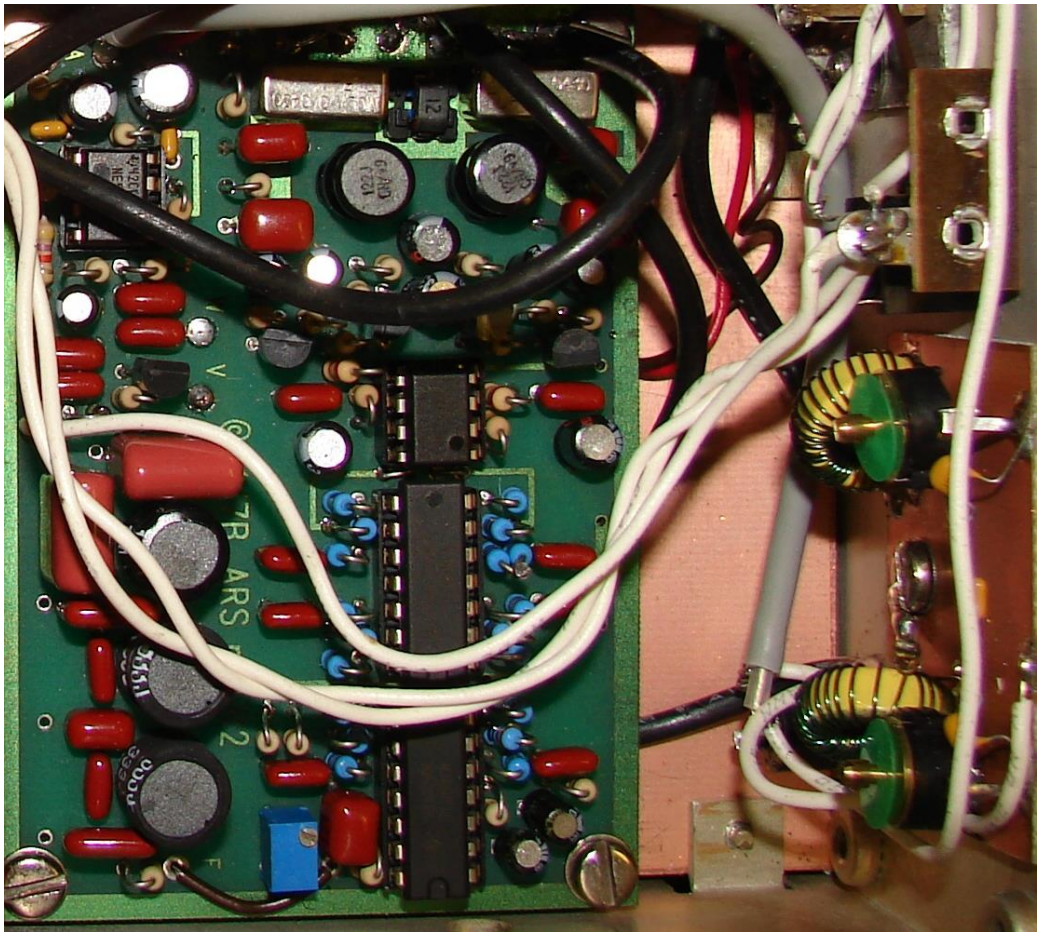
Internal Layout



Front Panel

Receiver Mini-R2

- DC Phasing Receiver (single signal)
- Based on R1, successor to original R2
- Audio sufficient for headphones or small speaker
- Slightly better performance than R2 and R1



"A Small High Performance CW Transceiver" by Rick Campbell, QST, November 1995

On The Air

- Contacts
  - V31WA Belize
  - SC8N Sweden
  - CS95A Madeira Is.
  - P40ADI Aruba
  - OK5W Czech Rep.
  - OM2VL Slovak Rep.
  - HB9LCW Switzerland
  - Numerous states (incl. FL, CA, WA, CA)

Possible Improvements

- Adjustable T-R delay
- Selectable bandwidth audio filter (Wide/Narrow)
- Switch for second tuning range
- Internal speaker
- Louder spot signal
- 30, 20 or 15 Meter version
- ??

Build Something!

- Not as difficult as you think!
- Many excellent published designs (QST, CQ, ARRL Handbook, Web)
- “Bag” kits avoid gathering of parts
- Larger projects (e.g. receiver, transceiver) can usually be broken down into modules
- Learn by doing
- Loads of fun to put it to work in your station