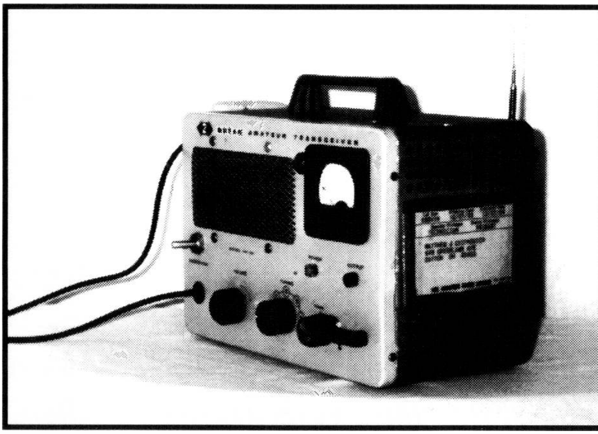
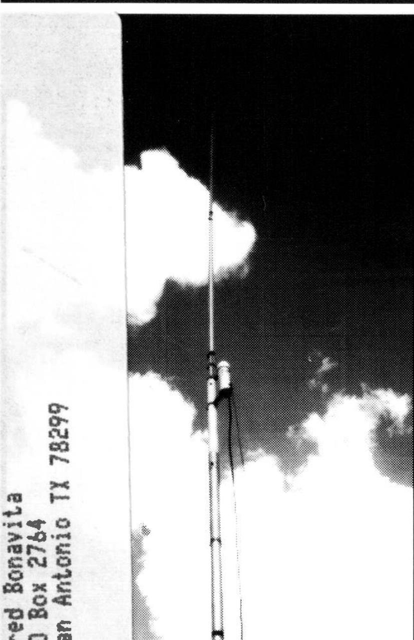
hambrew

FOR AMATEUR RADIO DESIGNERS AND BUILDERS





KB8TPT's Benton Harbor Revisited

N7KSB: A Simple Multi-Band Vertical

The *hambrew* Gallery

SPRING 1997

PERIODICALS POSTAGE PAID AT DENVER, COLORADO

• In Appreciation •

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• Contents •

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FOR AMATEUR RADIO DESIGNERS AND BUILDERS

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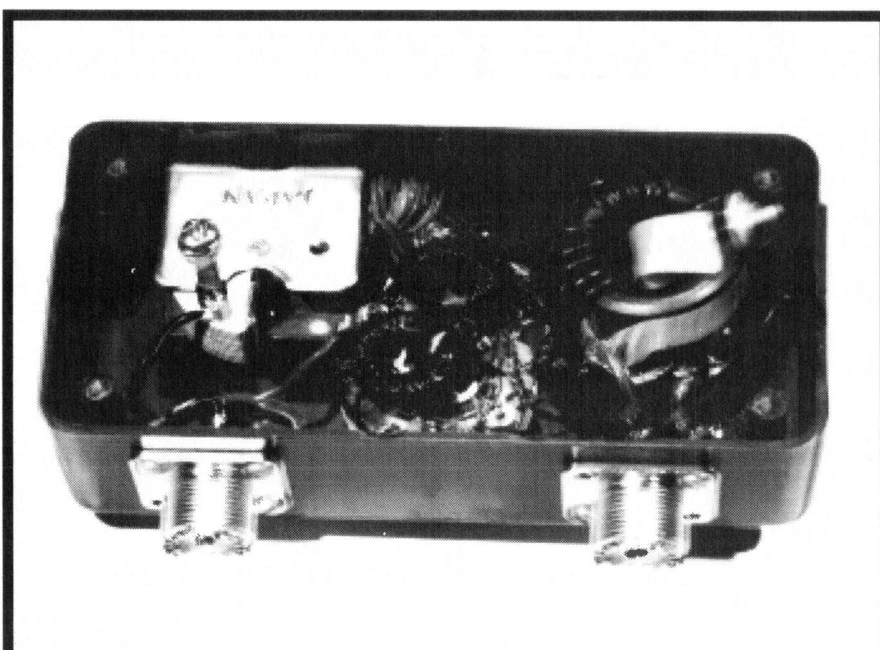
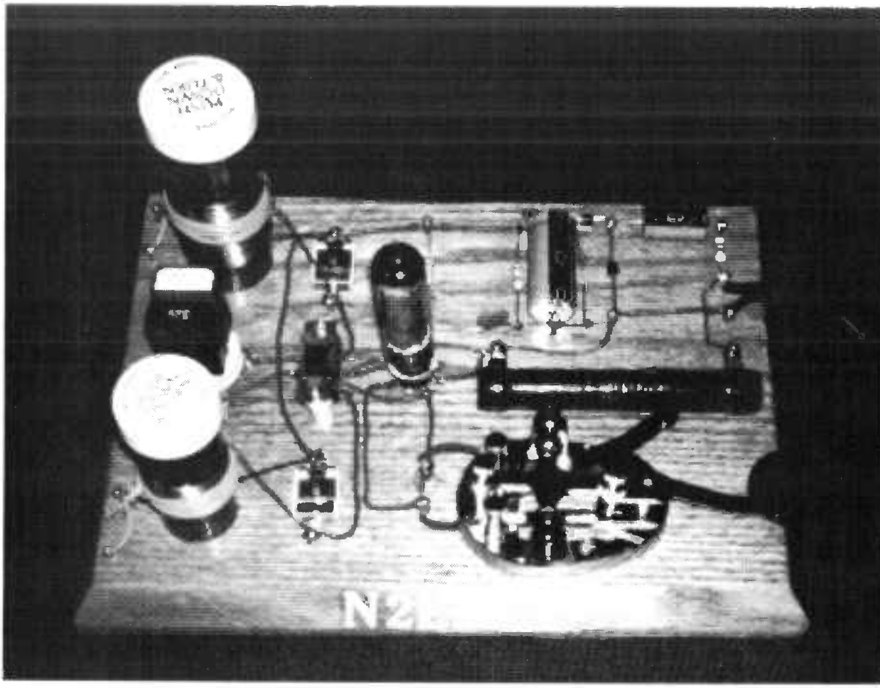
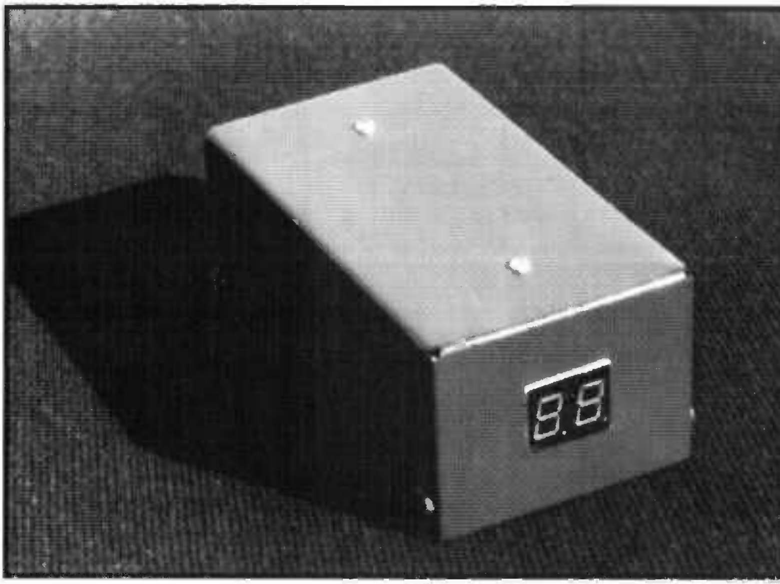
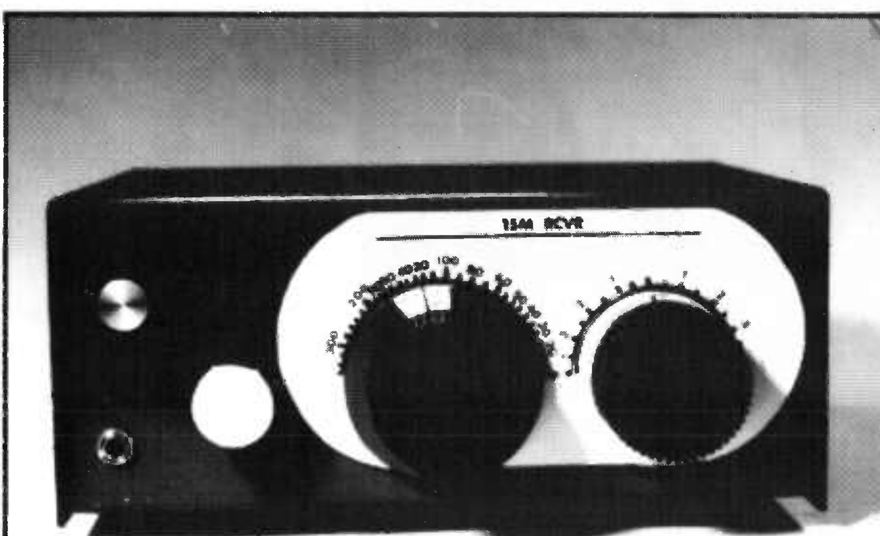


WØLK Tuner
(photo: Bob Seymour, WØLK)

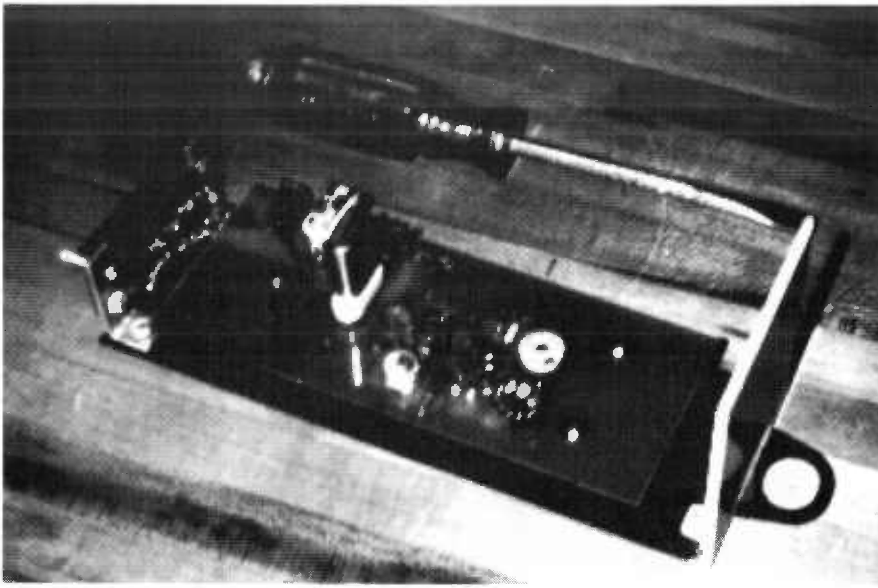


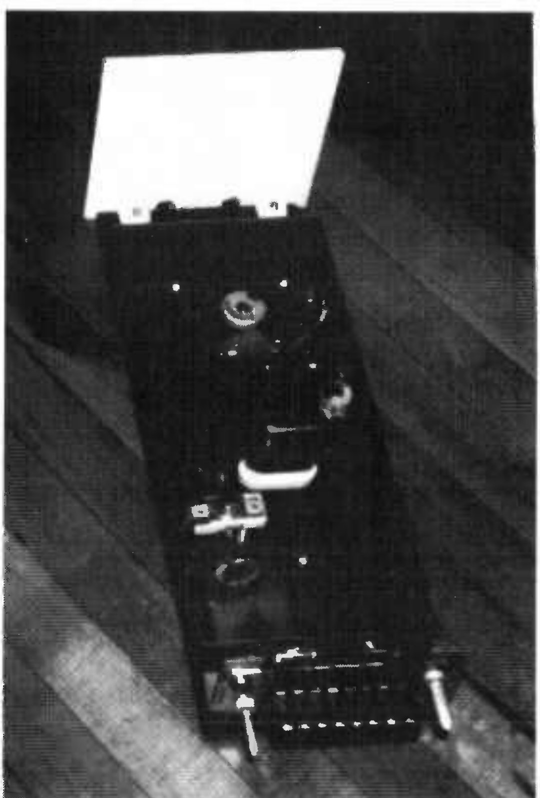
Top: The N2EDF 2-band tube transmitter (photo: Bob Shelton, N2EDF)
Bottom: VE3GQD transceiver combo (photo: Reg Tremblay, VE3GQD)



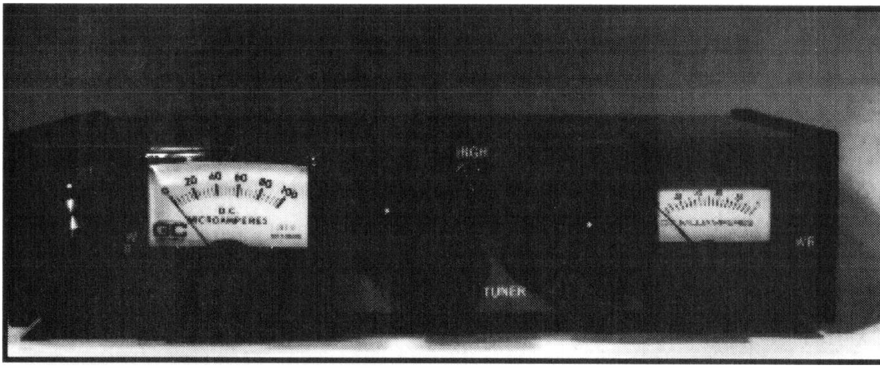


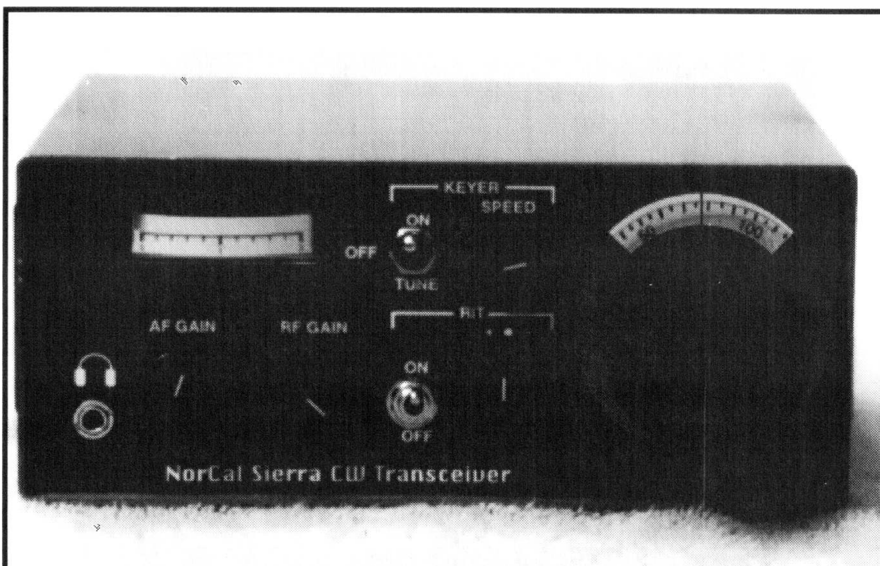
Top: N7KSB Frequency Counter (photo: Lew Smith, N7KSB)
Bottom: Hambrew's 15 Meter Receiver, based on a Neophyte "tunable IF" and a crystal oscillator receive converter (photo: hambrew)





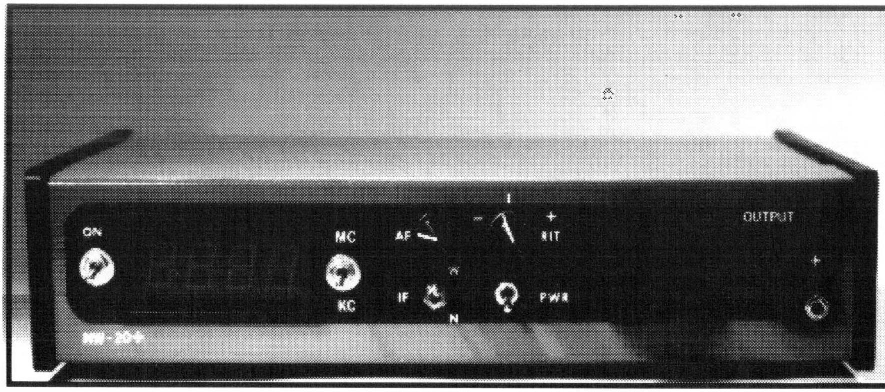
Top, Bottom: W5NOE Transmitter (photo: Dave Anthony, W5NOE)





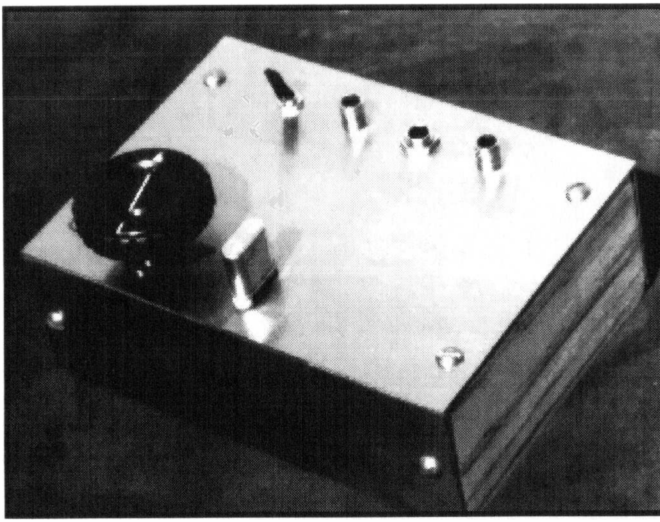
Top: W6EMT Z-Match
(hambrew photo)

Bottom: Norcal Sierra Transceiver
(photo: Stan Cooper, K4DRD)

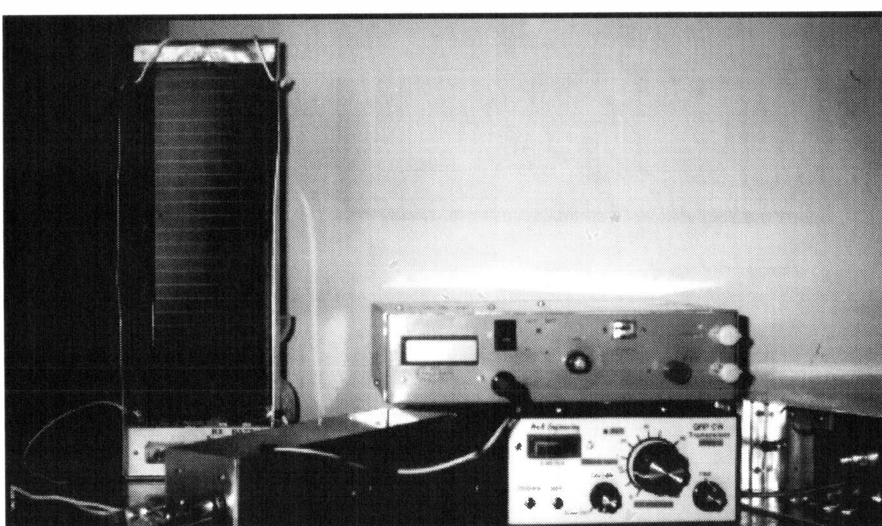


Top: NWQRP's Xcvr designed by Roy Gregson, W6EMT, with digital frequency counter added (hambrew photo)

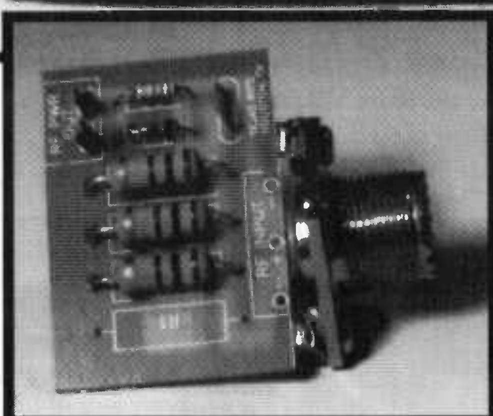
Bottom: Roger Wagner, K6LMN 30 meter superhet receiver, bandspread added (hambrew photo)



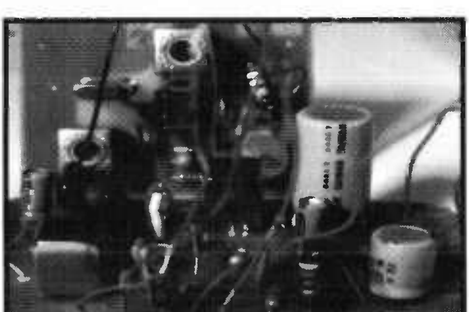
N7KSB Transmitter
(photo: Lew Smith, N7KSB)



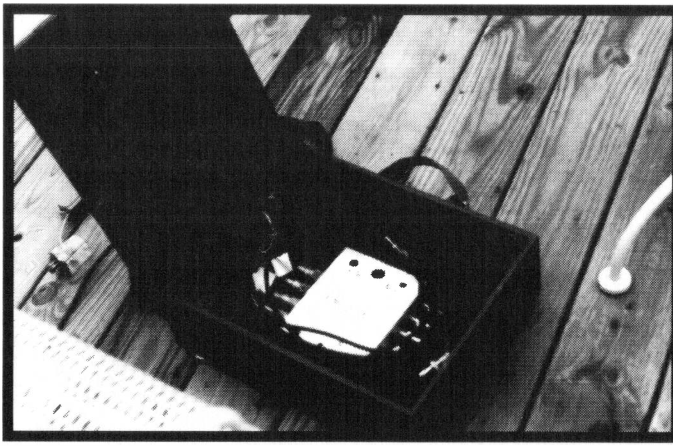
Jorn Nielsen's shack with solar panel
(photo: Jorn Nielsen, SM5IFO)



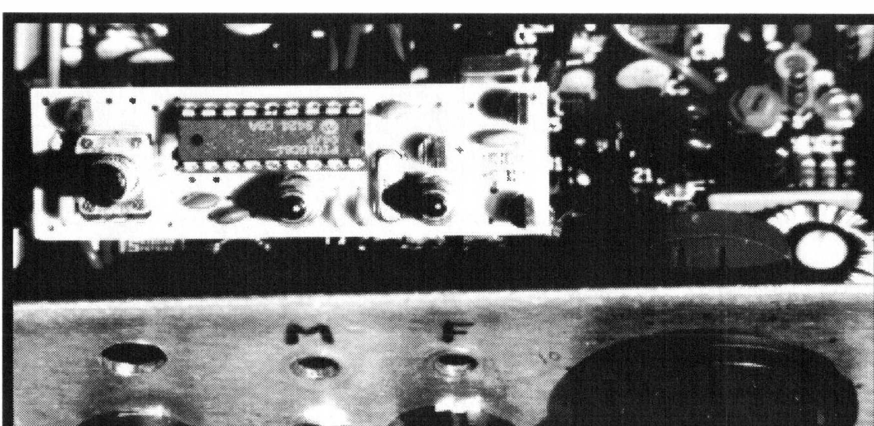
Above: Tejas Kit's SWR Bridge, designed by Bill Hickox, K5BDZ
Left: Tejas dummy load
(hambrew photos)



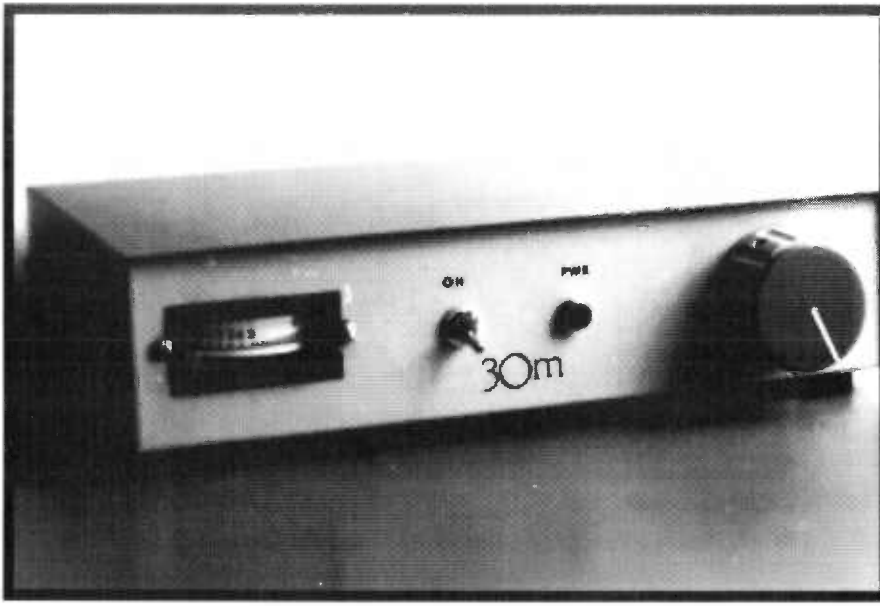
Left: Hambrew's Three Band Receiver Interior (6, 28, 50 MHz). (hambrew photo)



Mike Branca, W3IRZ designed a 9-Band antenna matching system for his loop antenna. This is the relay box and cable storage for the device. (Photo: Mike Branca W3IRZ)



The Wilderness KC-1 Keyer and Frequency Counter was reviewed by Stan Cooper in the Autumn, '95 issue. (Photo: Stan Cooper, K4DRD)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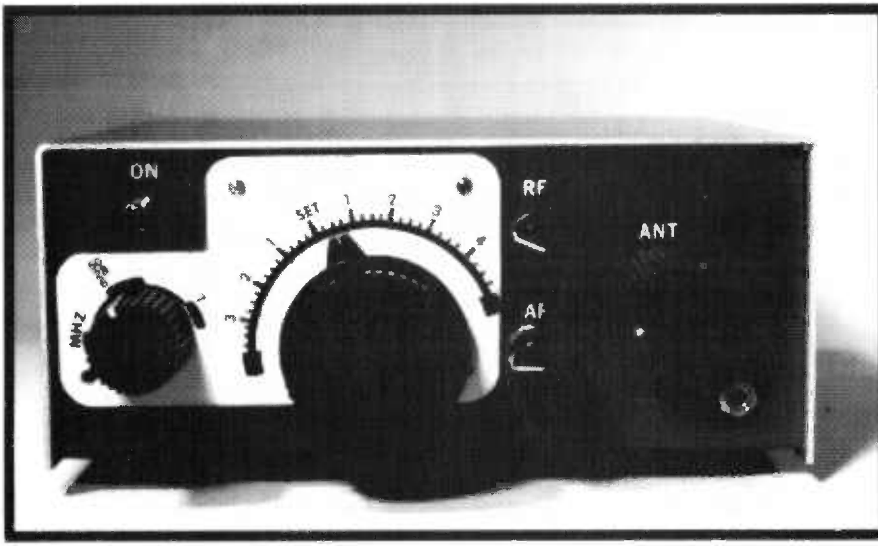
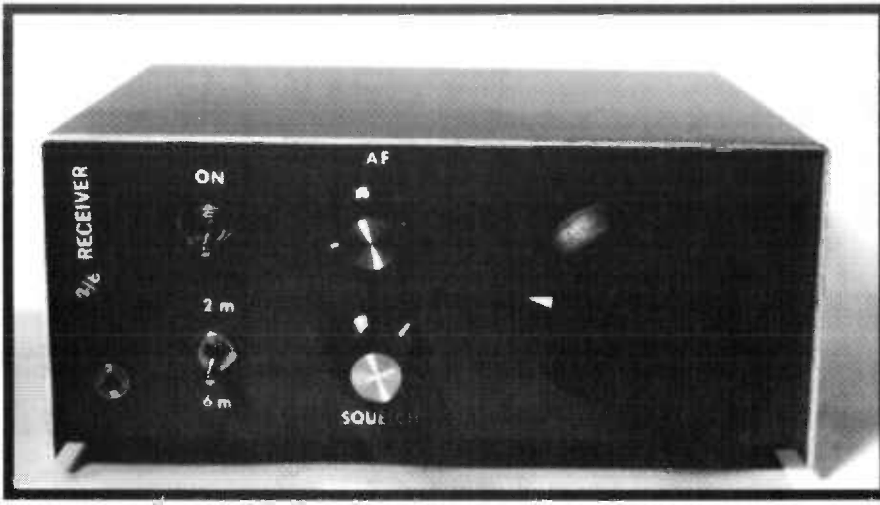
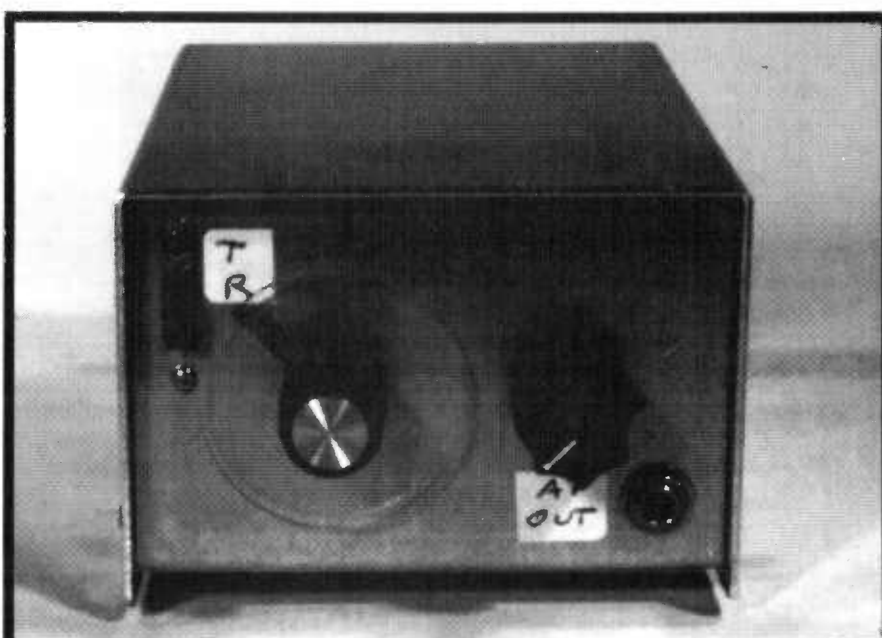
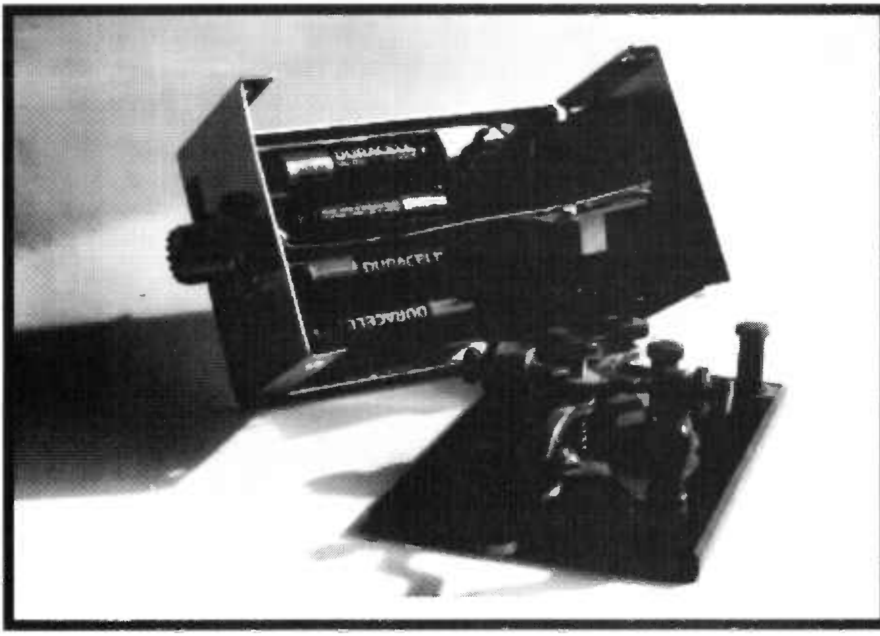


Opposite Page (top): Hambrew-built 30 Meter Ramsey transmitter kit with power meter added from used CB rig.
Opposite Page (bottom): Code practice oscillator and utility audio amp by Charles S. Fitch, W2IPI. (Photo: W2IPI)
This Page (top): 3-band receiver with two switchable receive converters. Receives 6m, 10m and the lower end of 40m. (hambrew photo)
Bottom: Longwire Antenna tuner based on the W6EMT design. (hambrew photo)



Above: The Elenco 6m/2m Receiver kit
Below: WA6IVC's Emergenceiver (both photos: hambrew)
Opposite Page (top): The "Fireball" QRP trasmitter was reviewed by Roger Wendell, WBØJNR (hambrew photo).
Opposite Page (bottom): A very workable and useful antenna tuner designed and built by legendary designer Roy Gregson, W6EMT (hambrew photo).

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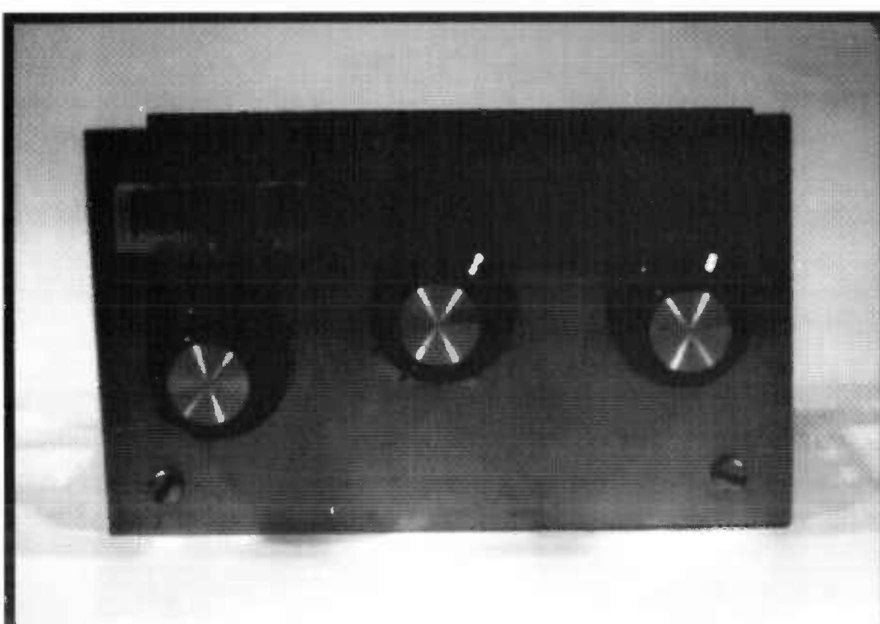
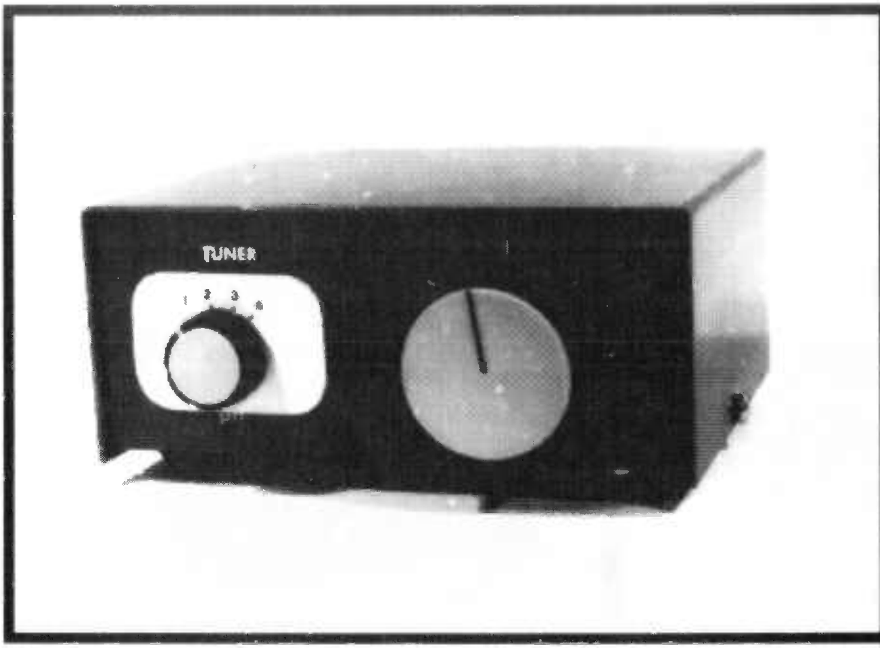
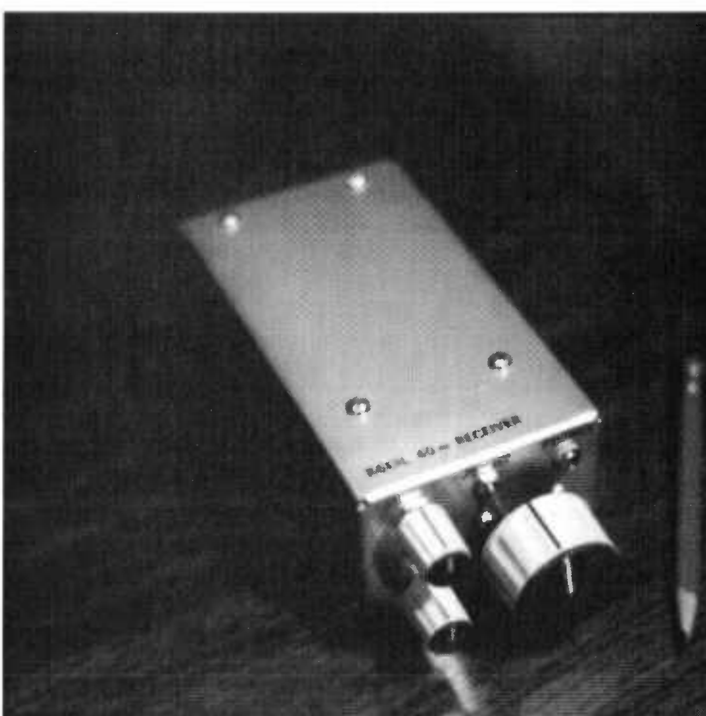
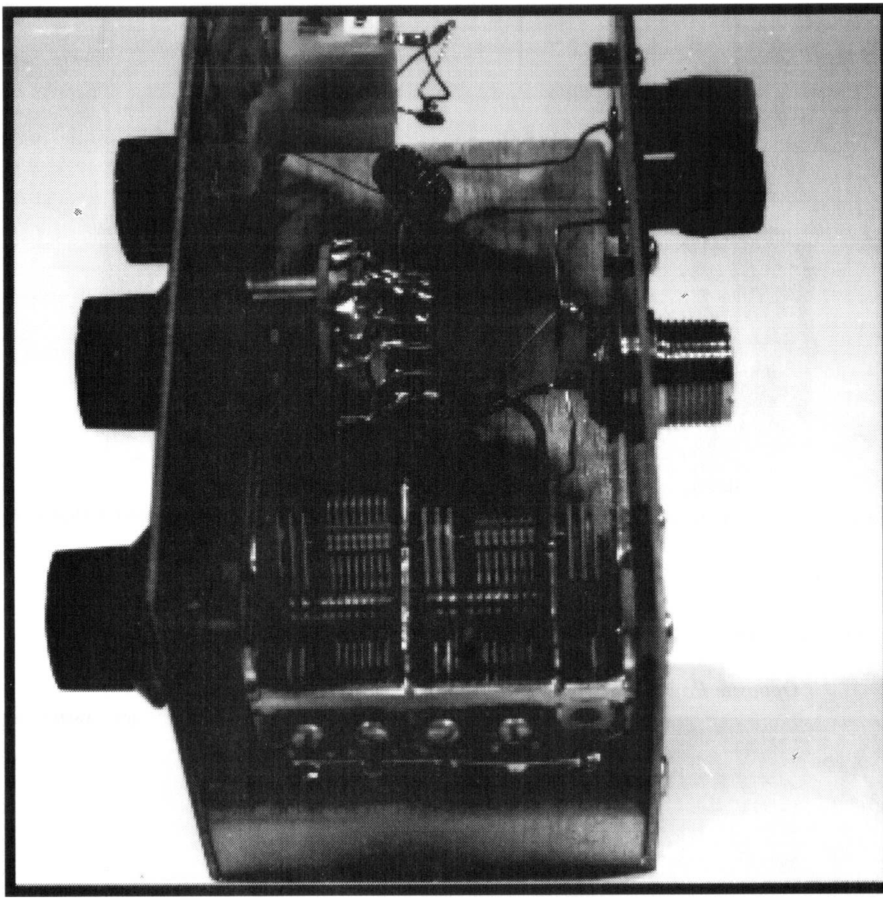



TUNER

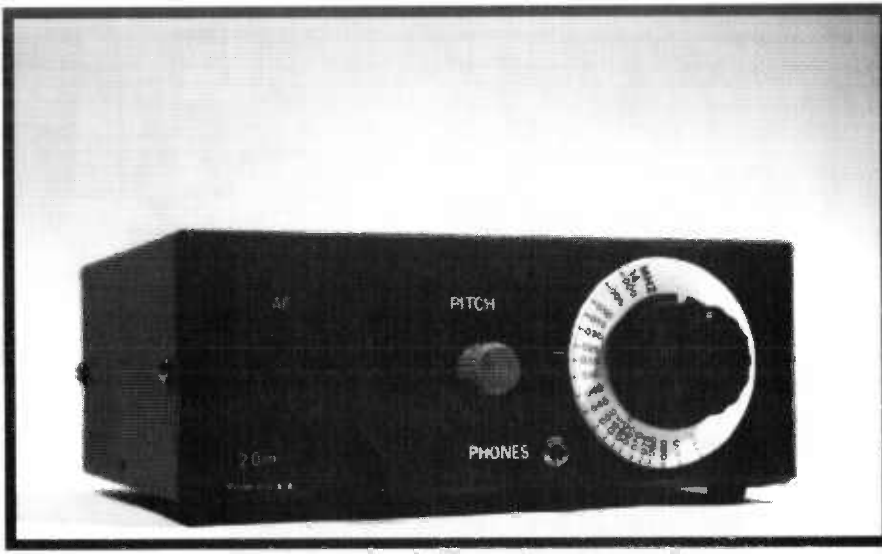




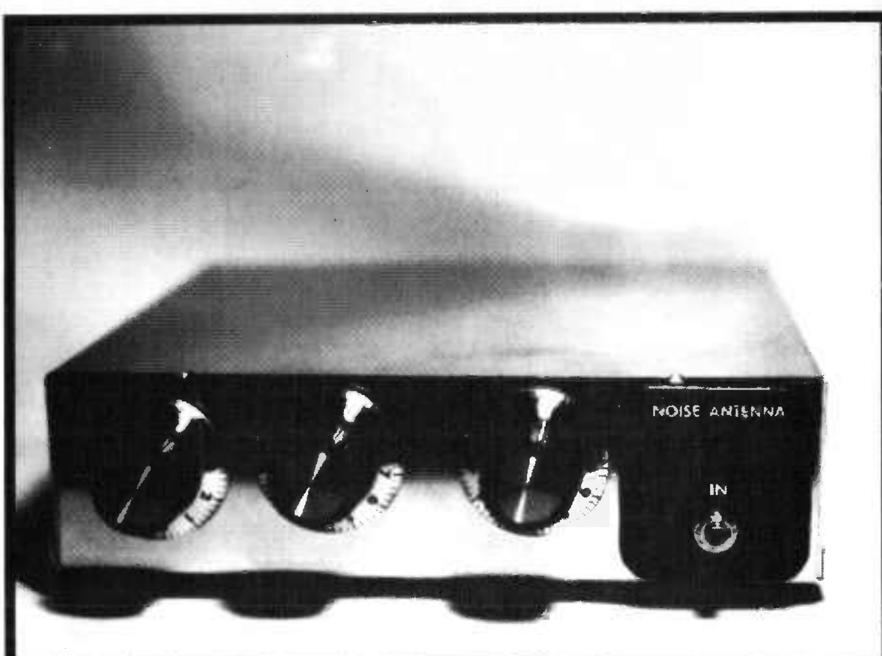
Opposite Page (top): Another "L"-type antenna tuner (hambrew photo).

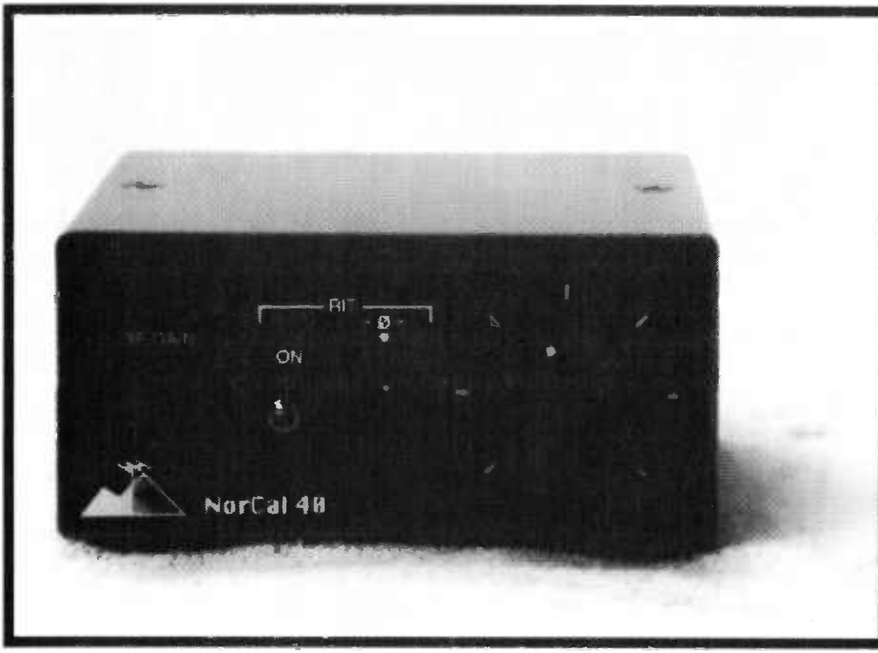
Opposite page (bottom): Wes Baden's great "Improved Neophyte Receiver" (photo: Wes Baden, K6EIL)

This page (top): Interior of the W6EMT antenna tuner seen on page 17, this issue.



Above: The MXM Transceiver, 20M version.
Below: A workable "Noise Antenna", also known as a modified Jones Noise Cancelling Circuit (hambrew photos)
Opposite page (top): The famous NorCal 40 workhorse NorCal kit (photo: Stan Cooper, K4DRD).
Opposite Page (bottom): Interior of a T-type transmatch (hambrew photo).

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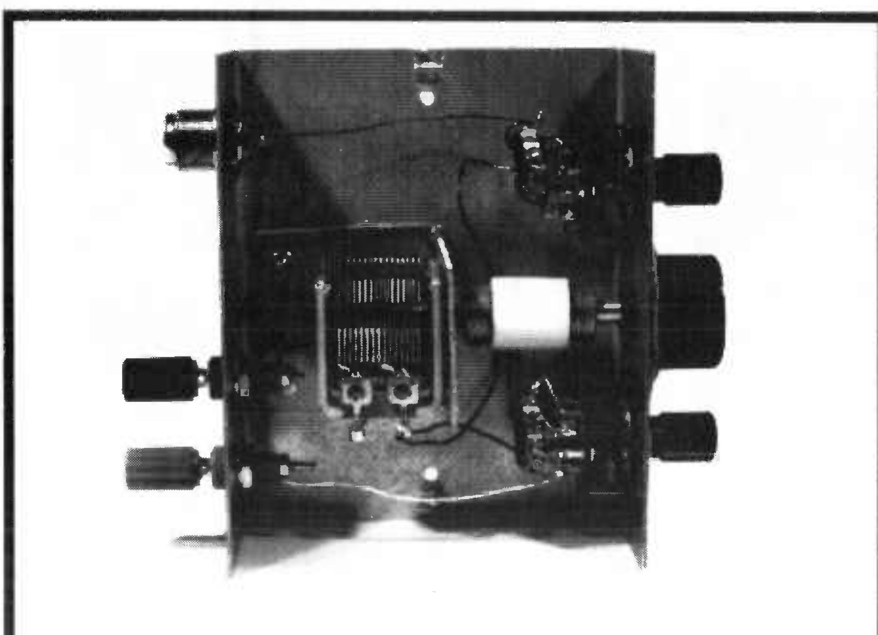
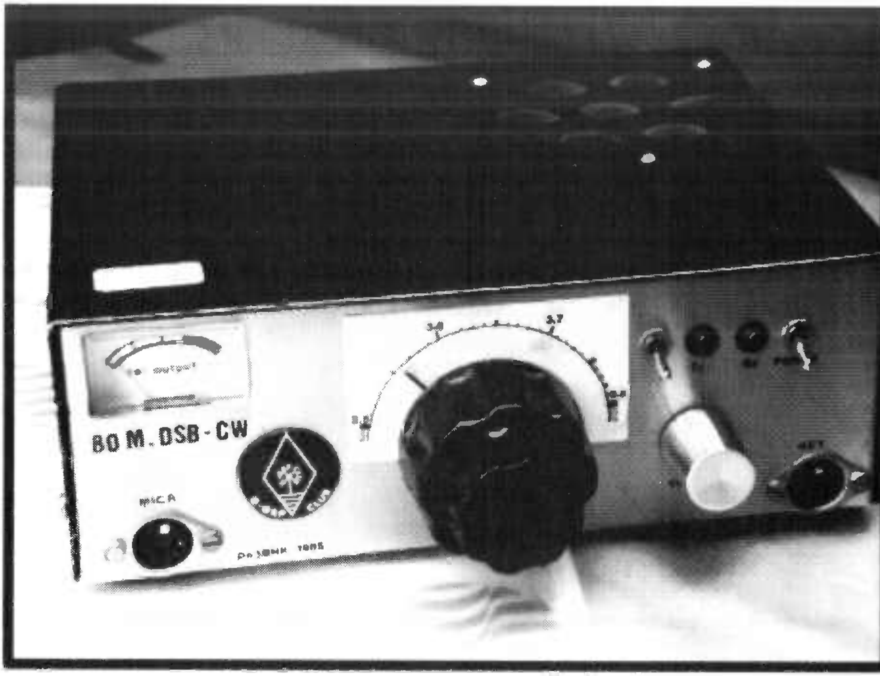
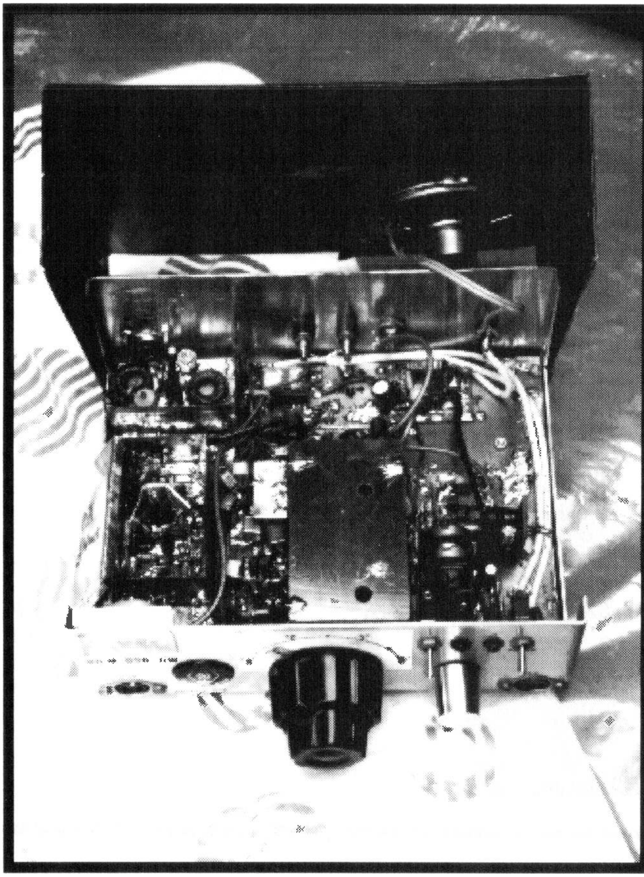
NorCal 40



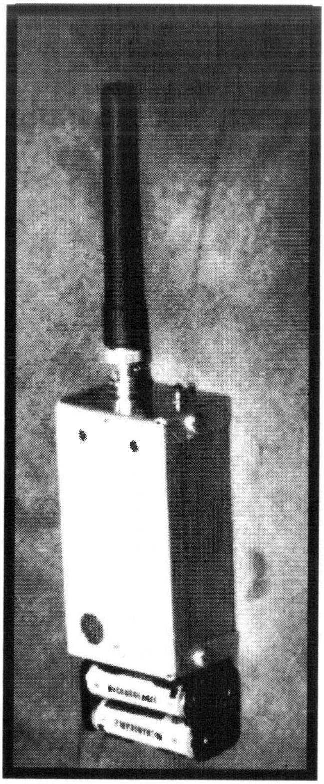

80 M. DSB - CW
MIC A


INDUCTANCE
ANT
NOISE ANTENNA
BANDPASS FILTER



Opposite page (top) and this page: PA3BHK 's gorgeous Simple DSB & CW Transceiver for 80 Meters. A beautivul rig - well built! (photos: Robert van der Zaal, PA3BHK)

Opposite page (bottom): hambrew's "Shack in a Box" featured the "Pixie" transceiver (250 Mw) and included an audio filter, antenna tuner in a drawer, and a noise antenna. Perfect for portable QRP on 40m. (hambrew photo)



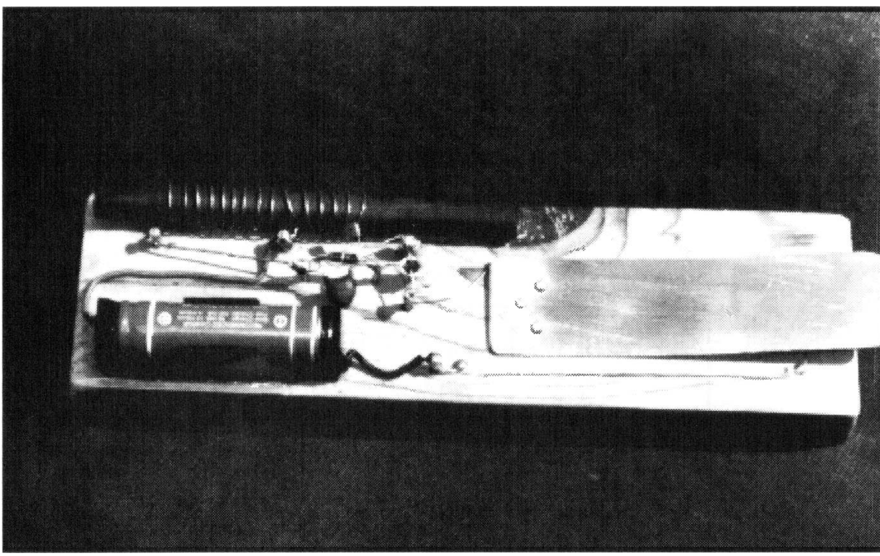
Left: The N7KSB 2-meter hand held transmitter - a real beaut! (photo: Lew Smith, N7KSB)

Below: Tejas kits produced a very compact two-stage audio filter that worked very well to eliminate QRM. (hambrew photo)

A Code Practice Transmitter

Lew Smith, N7KSB

4176 N. Soldier Trail
Tucson, AZ 85749



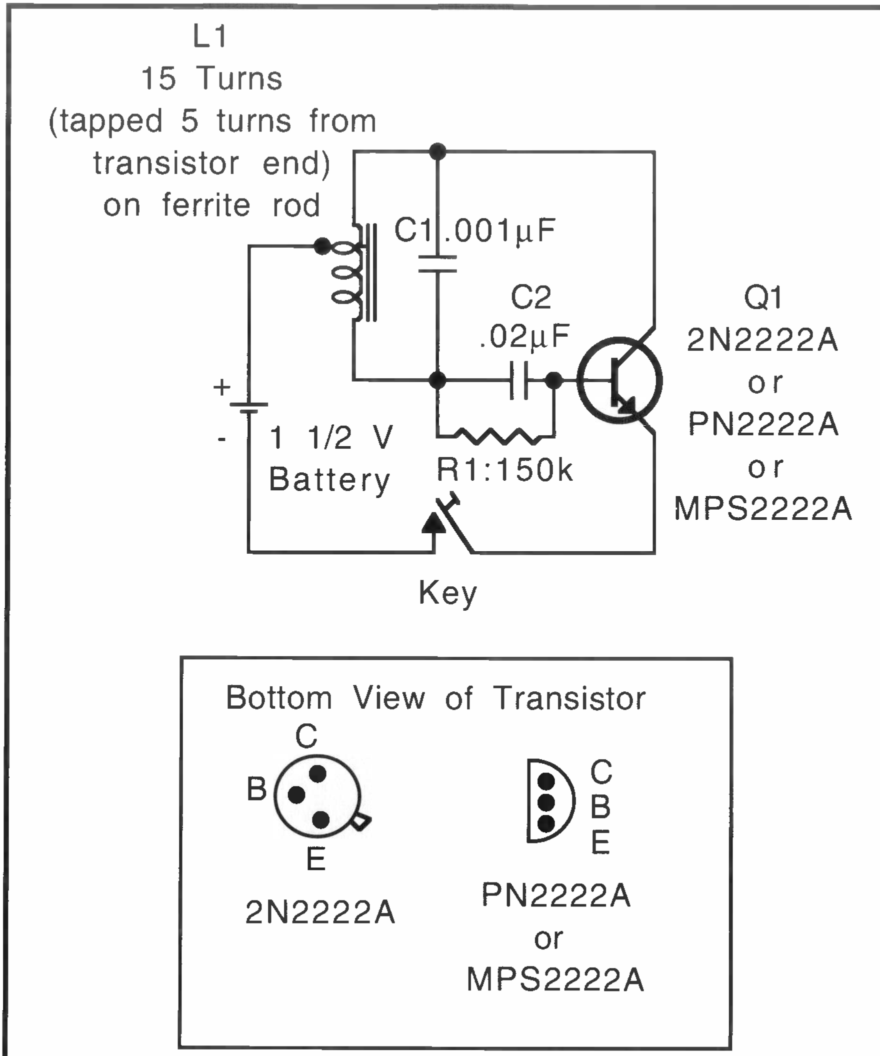
Mounted on a piece of wood by the author, this mighty mite slings CW up to a whopping 10 to 12 feet away! (photo by N7KSB)

Here is a project that could spark a youngster's interest in ham radio. The code practice transmitter is a superregenerative oscillator that transmits a modulated RF signal on the AM broadcast hand.

Superregenerative action occurs when oscillator feedback is far in excess of that required for normal operation. This results in an oscillator that produces bursts of RF. The code practice transmitter sends 1 MHz RF bursts at an audio rate.

The code practice transmitter can be received on a nearby AM broadcast receiver. Maximum DX is 10 or 12 feet. The superregenerative action results in a signal that peaks in the middle of the AM broadcast band but is detectable all over the dial.

The circuit was built on a piece of 1" by 3" wood. Brass nails (3/4", #16 escutcheon pins) were used as solder terminals. Although the connections were soldered in this project, it is possible to avoid solder



by wrapping wires around a nail and then hammering it down all the way. If the solderless method is used, be sure to space the components at least an inch from each other.

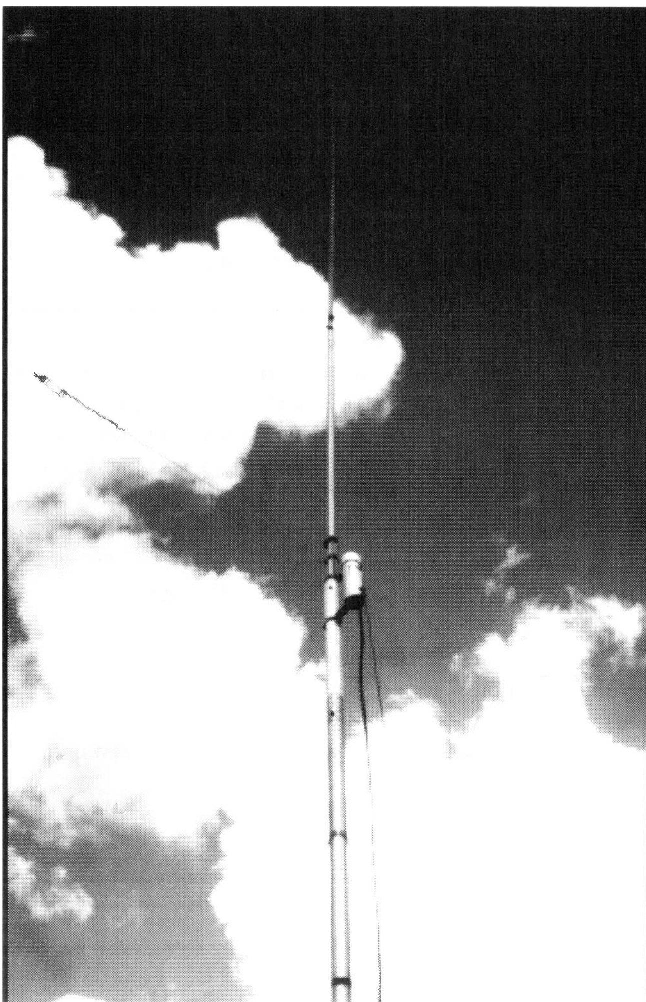
The key was made from a piece of 1/32" PCB material. A piece of hobby brass could be substituted. A brass screw was used for the stationary key contact.

The coil was made by wrapping 15 turns of wire around a ferrite rod. I used a 5/16" x 4" ferrite rod from my junkbox. A ferrite rod or bar salvaged from an AM radio's antenna pickup coil ("loopstick") will work. Glue was used to fasten the coil to the wood base. If a ferrite rod cannot be found, the coil can be a 10" x 10" square 15-turn loop. Two wooden dowels can be used to support the loop.

A Simple Five Band Vertical

Lew Smith, N7KSB

4176 N. Soldier Trail
Tucson, AZ 85749



Here is a nice looking antenna that puts out a good signal on the 10, 12, 15, 17, and 20 meter DX bands. It is a simple, no trap, broadband design. Most of the materials can be purchased from local hardware stores.

As shown in figure 1, the antenna consists of a 20 foot vertical section of aluminum tubing, two 8 1/2 foot wire radials, a 4:1 impedence ratio transformer, and a balun. Data from broadcast station towers[1] shows that a 1/2 wave end fed antenna with a large diameter to length ratio will have an SWR of 3:1 or less into 200 ohms over a 2:1 frequency range. Although a 3:1 SWR is still too high for most transmitters (I

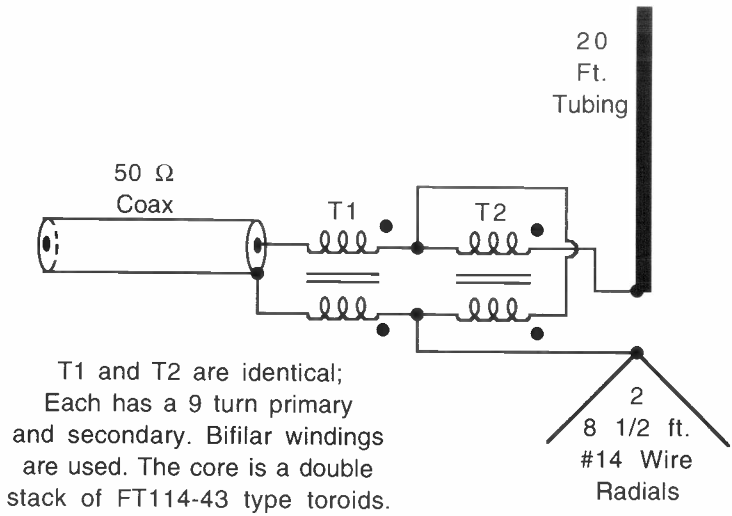


Figure 1: 5-Band Elevated Vertical Antenna

will deal with that later), it is low enough to avoid significant SWR-induced losses. Transformer T2 is used to reduce the antenna's average 200 ohm impedence to 50 ohms.

Two sloping radials are used as a ground plane. The radials are tuned to 10 meters. On 20 and 17 meters the capacitive reactance of the short radials tends to cancel the inductance of the vertical. Balun T1 is used to reduce the feedline radiation that could result on frequencies where the radials are non-resonant.

Construction

The main vertical section can be constructed out of telescoping pieces of 1 1/4, 1 1/8, 1, 7/8, and 3/4 inch aluininum tubing. Since the key to good broadband performance is a large diameter to length ratio, avoid smaller diameter tubing. My local hardware store did not stock 1 1/8 inch tubing, so I slit a 10 inch piece of 1 1/4 inch tubing and squeezed it down to a 1 1/8 inch diameter. This was then used to couple the 1 1/4 and 1 inch pieces of tubing.

Several sections of PVC pipe were used to insulate the vertical from the mast. The outside pipe should be the thick-wall type. If necessary, a shim can be made out of aluminum sheet to obtain a good fit between the 1 1/4 aluminum tubing and the PVC pipe.

I used a 12 foot long piece of 2 inch aluminum tubing from a wrecked ultralight aircraft as a mast. The PVC pipe had to be sanded before it would slide into the mast.

The transformer and the balun are

identical. They are hooked up differently to do their separate jobs. Both use a double stack of FT114-43 ferrite cores[2]. These cores should handle 300 watts. FT240-43 cores should be used for higher power. Both T1 and T2 used a 9 turn bifilar winding. I used two lengths of 16 gauge hookup wire for each transformer.

A 2 inch PVC pipe and a PVC end cap were used to house T1 and T2. This housing was also used to support the wire radials.

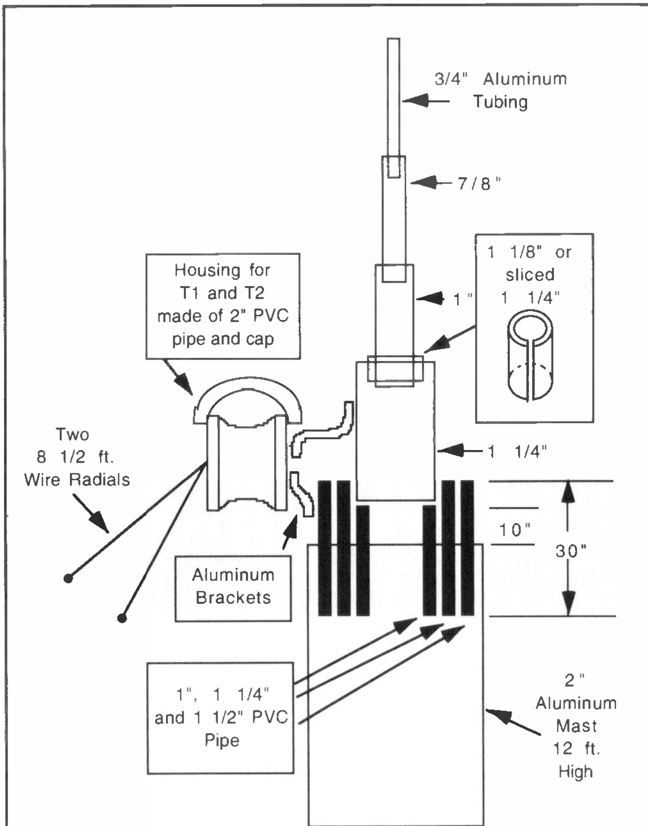


Figure 2: Mechanical Details

Adjustment

If possible, temporarily mount the antenna and check the SWR. The SWR can be tweaked to favor either 10 or 20 meters. Lengthening the vertical section by a foot decreases 20 meter SWR at the expense of the 10 meter SWR. Likewise, shortening the antenna favors the

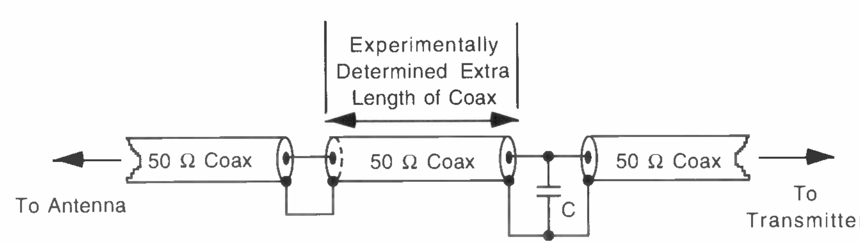
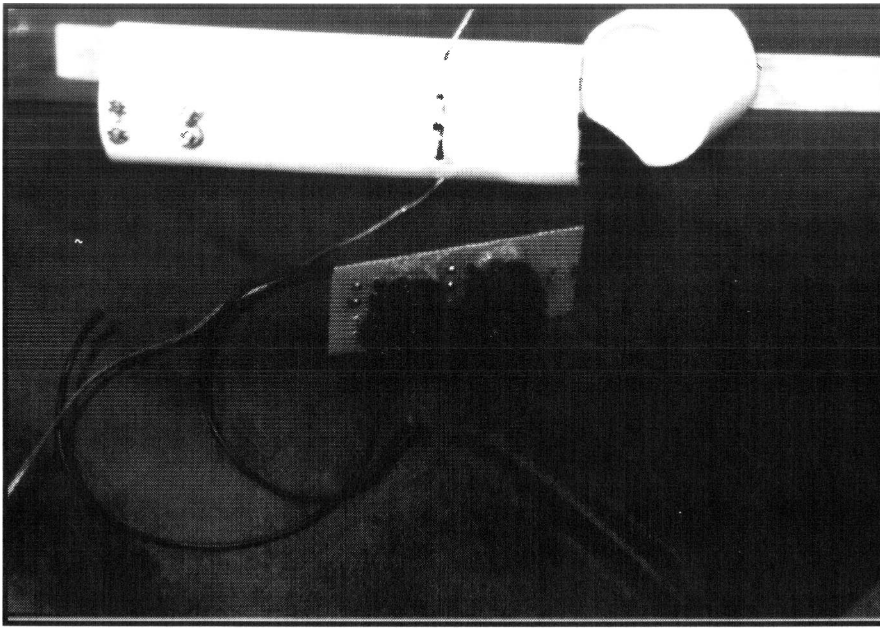


Figure 3: Stubless Tuner



10 meter SWR at the expense of the 20 meter SWR.

A Stubless Tuner

Although a conventional antenna tuner could be used to match this antenna to a transmitter, I prefer to use a "stubless" tuner. The stubless tuner is similar to a classical stub tuner[3] except that the stub is replaced by a capacitor. As shown in figure 3, the stubless tuner consists of a mica capacitor and an experimentally determined extra length of coax inserted between the capacitor and the antenna feedline. The coax can be coiled up and fastened with plastic ties. One of these coax and capacitor networks is needed for each band.

A perfect match can be obtained by using the following formula:

C _ 3183 (5-1) where C = capacitor value in pf
f = frequency in MHz
S = SWR to be corrected

A less than perfect, but still acceptable match is possible using the following capacitor values: 220 pf for 20 meters, 150 pf for 17 meters, and 120 pf for 15, 12, and 10 meters. Mica capacitors should handle up to 50 watts. Higher power will require transmitting capacitors capable of tolerating large RF currents. Alternately, the capacitor can be replaced by an open-ended coax stub[3].

The extra length of coax will be between 0 and 11.5 feet on 10 meters and twice that on 20. Coax with foam insulation will be 20% longer. It helps if 1/2, 1., 2, 4, 8, and 16 foot cables - with a male connector on one end and a female connector on the other end - are assembled and used in various combinations to determine the correct length for minimum SWR. Be aware that if feedline radiation is present, coiling the coax may change the required length somewhat.

Results

I have used various roof mounted versions of this antenna for 20 years. It is a very good DX antenna. The SWR on this version ranged from 2.0 : 1 on 15 meters to 2.8 : 1 on 20 meters. SWR at the transmitter after using the stubless tuner was less than 1.2 : 1.

Notes

1 Chamberlain and Lodge, "The Broadcast Antenna": *Proceedings of the IRE* vol 24, pp 11-35, Jan 1936——The data is also shown in figure 20.42, page 20.20 of the *1996 ARRL Handbook*

2 Ferrite cores can be obtained from Amidon Associates, P0 box 25867, Santa Ana, CA 92799

3 See discussion of "matching stubs" in any edition of the *ARRL Antenna Handbook*.. This antenna can be matched by replacing the capacitor with an open ended coax stub. Use a 6 foot stub on 20 meters, 4 feet on 17, and 3 feet on 15, 12, and 10 meters.

Benton Harbor Revisited

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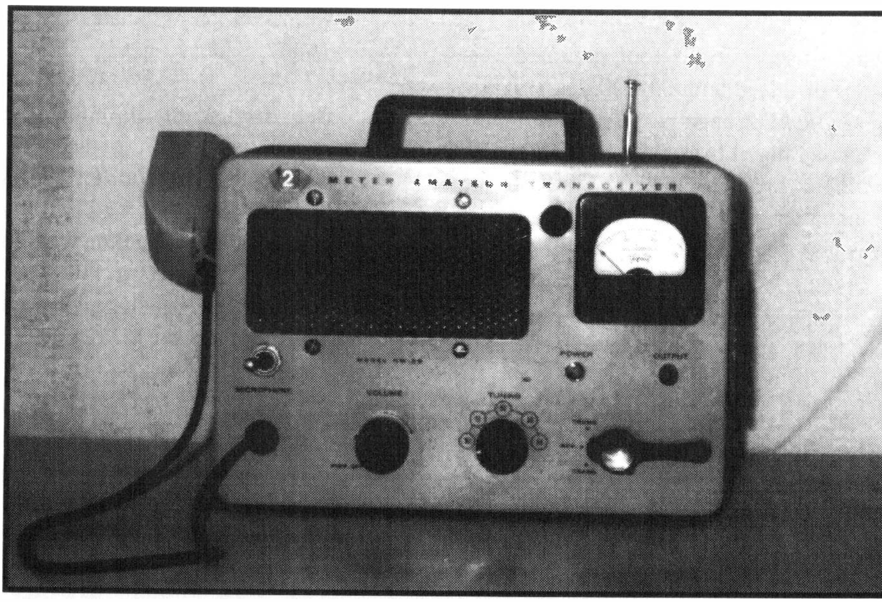
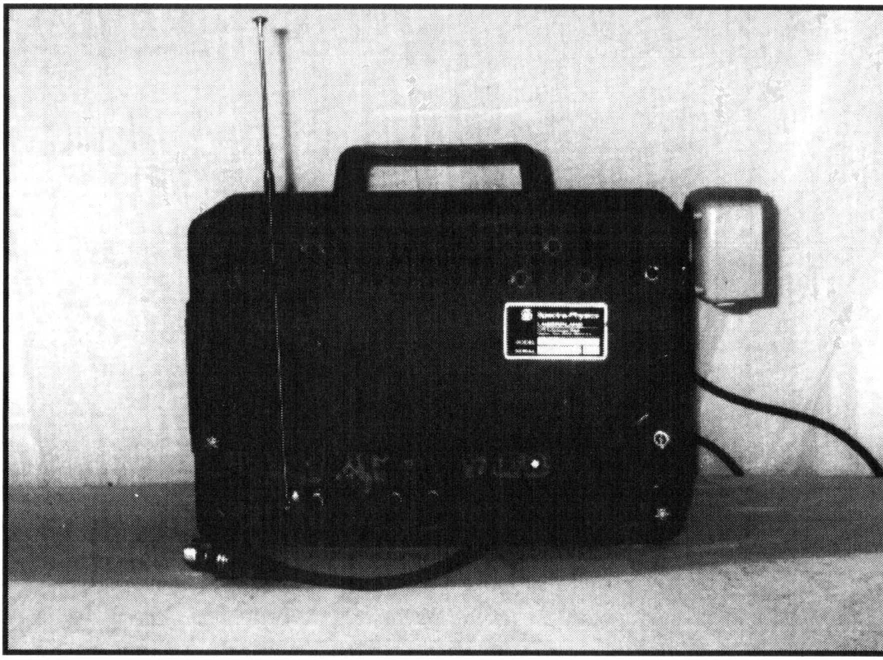


A "2" sticker is placed over the original "6" on the face panel. The meter, toggle switch and the indicator lamp next to the meter were added by the previous owner and currently serve no function. All original controls and lamps work as they did decades ago.
(All photos this article by Matthew Cvitkovich, KB8VVK)

Imagine you're at a hamfest looking at an old outdated radio. You may wonder or try to remember how it was in the days gone by. As your mind travels back in time you flirt with the idea of having a QSO on such a primitive radio.

In the summer of '94 I bought such a jewel: a Heathkit 6 meter Benton Harbor Lunchbox. These AM transceivers were available in 2,6,10 and 11 meters, and were offered with only one transmit frequency and a variable receiver.

I had no idea what I was going to do with it, but just owning a piece of history did not sound like a bad idea. After realizing the radio was not functioning properly, I used it in the shack as a bookend. With the desire to homebrew a 2 meter rig, I decided to build into the lunchbox a functioning transmitter and receiver using the original control locations on the Heathkit.

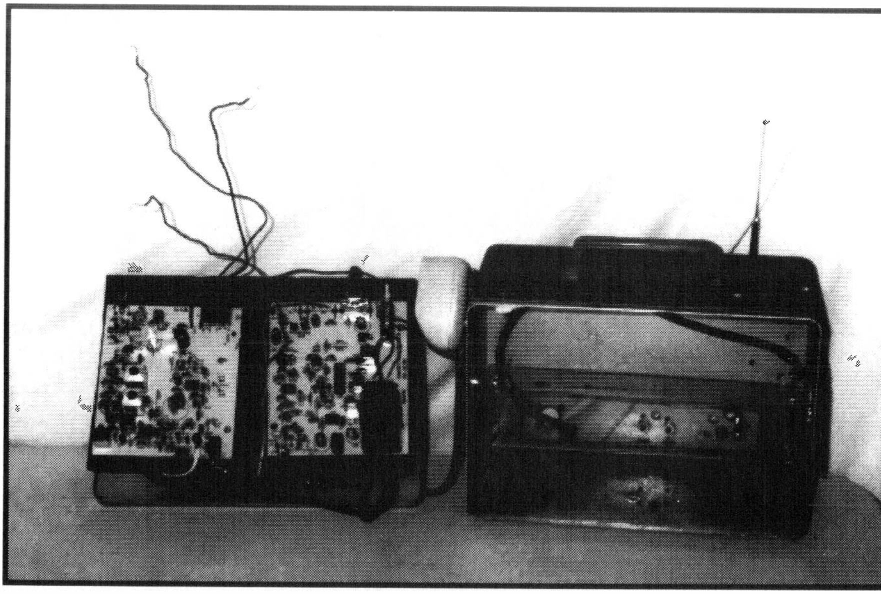


Rear view shows receive antenna, transmitter power terminals and coax for transmit antenna.

To simulate the original transmitting characteristics I chose a Ramsey FT 146. This kit offers 5 watts output with one crystal-controlled transmit frequency. For the receiver I chose a Ramsey FR 146. This receiver is capable of tuning the entire 2 meter band, so combined with the transmitter, this would simulate the Lunchbox of decades past.

Following the step by step instructions for assembling tbe transmitter and receiver was fun and informative. After the transmitter and receiver boards were assembled, I mounted them on plywood. Here they were tested for proper operation. The receiver worked flawlessly and required no antenna to receive the local repeater. With a little telescopic whip I can receive simplex and repeaters from the surrounding counties. The transmitter had an intermittent problem that I could not solve myself. The transmitter board was shipped to Ramsey for service and fine tuning. The lesson learned was to solder all parts as close to the board as possible and clip the leads on the solder side of the board as close to the solder as you can, using a file to smooth the lead to the solder.

Now that the boards were working properly it was time to wire them into the lunchbox. But first I had to remove the Heathkit chassis out of the box, leaving the speaker and indicator light sockets intact. I mounted a sheet of plexiglas on the back of the speaker casing. The



The interior of the lunchbox. To the left are the Ramsey kit receive and transmit boards.

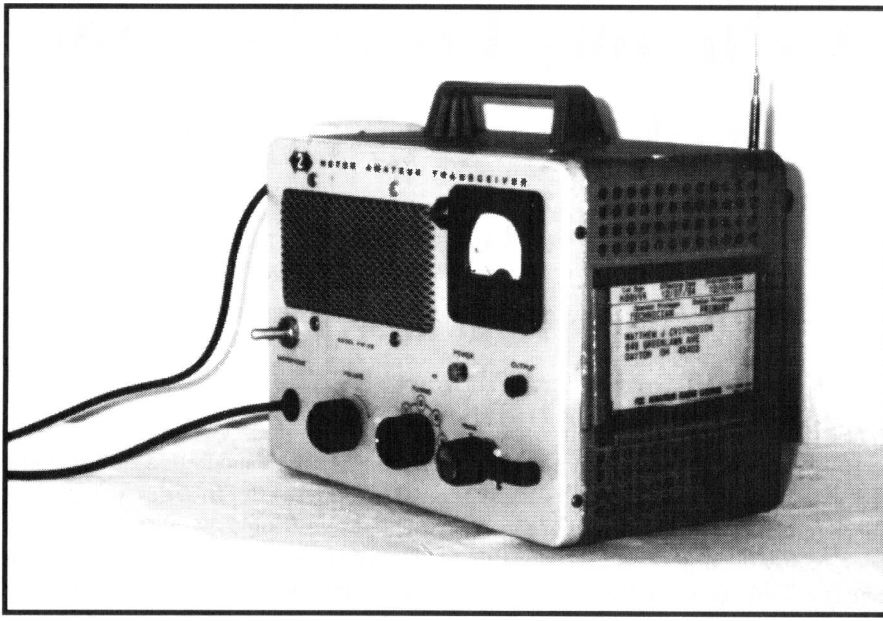
plexiglas is used to mount the transmitter and receiver boards.

A 10k pot with an on/off switch was mounted to the Heathkit face panel for on/off-volume, and a 10k multi-turn pot was mounted to the panel for easy tuning. A three rosition switch was mounted at the transmit/receive position on the face panel.

After de-soldering the volume and tune pots from the receiver board, a wire harness was improvised to connect the pots on the face panel to the receiver board. The on/off power switch is wired to simply shift the power off from the 9volt battery hot wire. An LED to indicate power-on was wired from the receiver board to the face panel indicator socket. The speaker wires were soldered to the original Heathkit speaker, and the squelch control left on the board set to OFF position to hear distant signals and to simulate the noisy Heathkit regenerated receiver.

The transmitter board was much easier to hook up, since nothing needed to be desoldered. The power wires were sent to the back of the lunchbox to the power terminals. A foot of coax extrudes from the rear of the box for the transmit antenna. Inside, the coax is plugged into the board using a standard jack. I wired an LED from the board to the power output indicator on the Heathkit's face panel, and plugged a microphone into the standard microhone jack. Also, I wired switching into the three position switch to simulate old time keying. Recomended microphone innards were transplanted to an old Heathkit microphone case.

A telescopic whip was installed at the rear of the box. Since the receiver runs off



The license is held on the side of the box. An internal LED glows to give the illusion of hot tubes.

of an internal 9v. battery, the lunchbox can be carried around as a portable receiver. To transmit you need 12v at 1 amp and a tuned antenna. I made one out of a couple telescopic whips and can hang it on a wall and operate just about anvwhere in the house.

While sitting in front of the two-er I tend to forget that the year 2000 is just around the corner. Turn the on/off volume control on and the green diode lights the power-on indicator. Crackling and static is heard. You may have flashbacks of the regen-receiver days. Turning the tuning control to a station quiets the receiver background with pleasant FM audio.

After a moment or two vou realize you can't break into this QSO. This radio was built to simulate the original Heathkit Two-er, and you have but one transmit frecuency. Finding that frequency on the receiver proves to be a challenge at first, but you soon get used to it.

Flip the transmit/receive switch on the face panel, the red diode lights the transmit indicator, the receiver is shut off and you are on the air. After a friendly QSO, you sign off and stare at the lunchbox,noticing a funny grin is on your face.

The Ramsey FT146 comes with a 146.520 transmit crystal. After proving out the lunchbox arrangement, I changed the transmit frequency to 146.340 to operate on the Dayton Amateur Radio Association Repeater.

Operating on the repeater is much less challenging but more practical. The repeater's courtesy beep reminds me that this is the nineties!

A Dummy Load for Low-Voltage DC Power Supplies

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How many times have you needed to test a power supply under load? Here is a piece of test equipment that I have never seen in any catalog. You can adjust the current load from short to open, and anywhere in between.

I found some DC regulator boards that came out of old main frame computers. They can be found at electronic junkyards or some times at hamfests. The one I used had 6 power germanium transistors (marked Motorola 2471,8140,7439) mounted on a black, finned aluminum heat sink and strapped in parallel. Any similar type unit can be tried.

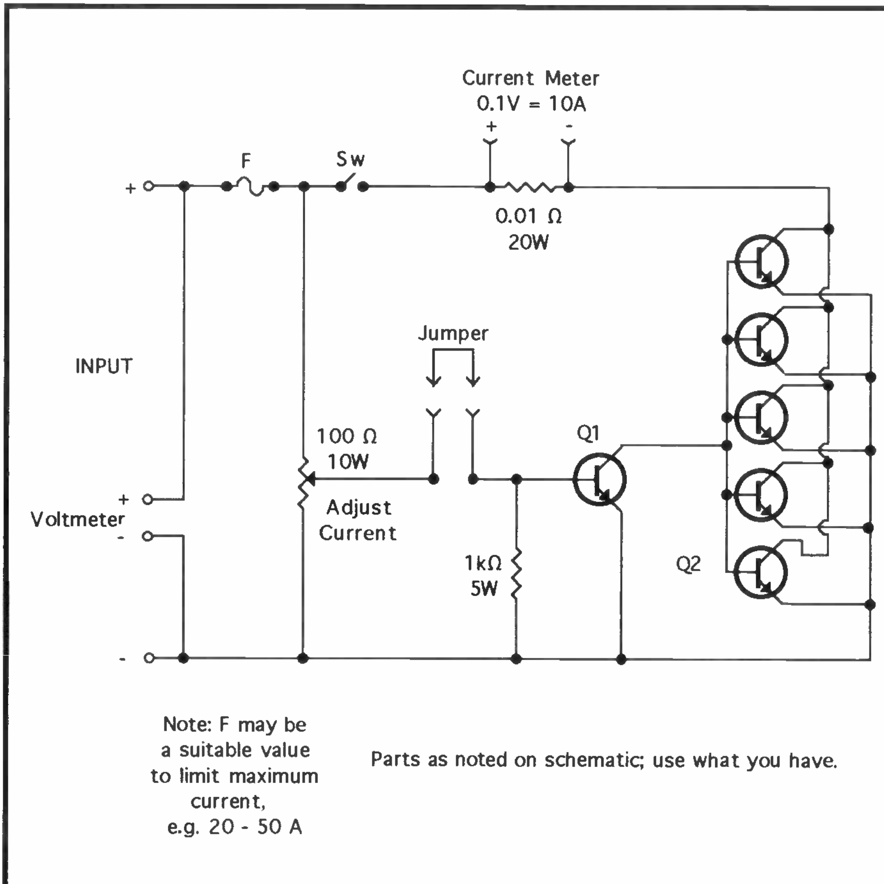
I cut one transistor out of the bank and connected it as a driver for the other parallel five. Then I used a 100 ohm ww power pot (rheostat) across the input to adjust the bias and conduction of the driver transistor which controls the bank of five connected across the input voltage as a variable, controllable load. Thus one can vary the load resistance and current drawn by varying the bias on the driver transistor. The bank of load transistors will handle better than 50A for a few seconds.

See the schematic for details. I included a 0.01 ohm resistor in series with the load bank. Measuring the voltage drop across this resistor is a convenient way to measure large currents with a small VM (0.1 v = 10 a). I fused it for safety and included a switch to isolate the bank whenever necessary.

This unit lets me quickly test any low voltage (1 - 50v) power source for regulation or drop under load. Vary the load current and watch the input voltage vary. The less voltage change the better the regulation.

Another trick is to wire the adjust pot so you can either have the DC input volts across it or put a pair of jacks so you can put a signal generator output across the driver base and watch the dynamic regulation as the load follows the signal. This shows some odd results sometimes. My load tester worked throughout the audio range acceptably, even though I could see distortion at higher frequencies (depends on the response of the transistors).

Try this unusual piece of test equipment.



Play with it. Not only is it helpful in testing power sources, it is also a valuable design and teaching tool. Have fun and learn just how good these low voltage power supplies you put together regulate or stand varying loads.

An interesting project is to plot the output voltage of plug-in power packs against load current. Is the "hamfest special" plug-in adequate for your project? How much does the voltage vary from zero to rated load (how much current you need)?

Another use for these surplus resistor banks is as regulators in your own power supply projects. Experiment and enjoy.

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