QRP Quarterly

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What's Inside This Quarter:

From the President

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It was very nice to meet with the BOD and officers who attended Dayton this year. I feel that the business meeting we had was very useful and a good start in renewing the Club.

For those of you who could not make it I shall try to fill you in. During the last month that I have been president I have had to take care of club business on a day to day basis. I am in hope that we can get down to the some long overdue projects that are required.

As president I am going to require the board to share in the responsibility of running QRP ARCI. I will call upon each of you to research and suggest issues regarding policy and other club business. I am going to ask several of you to act as a team in drafting policys. I must also ask each of you to complete your work in a very timely manner. The Quarterly will be a big priority, and I have already had Myron begin working on it. I shall atempt to mail a presidential newsletter every month to allow each of you [the directors and officers] the very latest information.

Dayton meeting

1) A discussion concerning the Quarterly was the primary topic. Mr. Koyle made a report after voicing his concerns that we were paying too much to have the QQ printed. His report indicated he could save as much as $1,000 per issue if we were to change printers. Even Luke Dodds had made comment to Myron that something was wrong with our account with the current printer. Complete details can be gotten from Mr. Koyle.

It was decided to change printers, and have the new printer start by the July QQ if possible.

2) Mr. Koyle passed out a treasurer's report.

3) Rich Arland's report concerning the creation of a scholarship and technicial excellence award was discussed. There was a lot of comments made, all positive. It was decided to table these items for a month or two and concentrate on getting the QQ on time, etc.

4) There was discussion to provide funding for a QRP trophy for a major contest. This is an old issue and many years ago it was decided it should be done. Mr. Koyle was instructed to fund the project.

5) Director Bruce Milne asked the possibility of purchasing several small club banners and printed material to be used at smaller hamfests. Mr. Milne was directed to collect information and report to the president.

5) Acting President Les Shattuck gave the board members and the officers present an overview of his acceptance of the office of president and what he feels it will take to get the club back on its feet. He hopes the current board will bear with him and realize that to keep the club running he will be making some executive decisions if board members cannot be reached. It is hoped that a renewal of interest in the club will attract members interested in running for office. Mr. Shattuck told the board and officers of their responsibility to help in the operation of the club.

7) Appointment of a new director: Doug Hendricks KI6DS was appointed a director to fill a vacant slot that no one ran for last year. We welcome Mr. Hendricks and thank him for volunteering his time to help QRP ARCI. Mr. Hendricks is the editor of the NorCal QRPp.

As discussed earlier to get the work required to keep the club going I must make assignments to the directors and officers. Beginning today I am making these assignments. If you as a director feel you cannot or are uncomfortable with an assignment, please contact me ASAP. On the other hand, if you wish to have an idea investigated and approved by the board, please send it to me and I will see to it all board members know of your idea. I am your point of contact for every thing, it may sound like a dictatorship but for now it will get things done.

Assignments:

•Club banners: Bruce Milne

•Technician excellence award research how, what, where and when so it could be implemented in 1994. Report to me ASAP for presentation to board. Rich Arland and Bob Hajdak will get together on this.

•We have to see how ARCI and the other QRP clubs can work together for the mutual benefit of all. A master plan and resolution of cooperation must be researched to present to the general membership. Jim Fitton and Doug Hendricks.

•A complete officers and board of directors list must be compiled ASAP. It should tell name, address , phone nr., and when term of office expires. Myron Koyle

QRP Show and Tell,

Washington DC/Baltimore area

There will be a QRP Show and Tell, the first in several years, on the first Saturday in August at Maryland Radio Center in Laurel, MD, halfway between Baltimore and Washington. The store opens at 10 a.m., and there will be QRPers there until they close at 3 p.m.

There's nothing formal–just come and leave whenever you like, and bring something to show off if you wish. Even if you have nothing to bring, there will be several QRPers covering the tables in the ham radio library room with goodies. At a minimum, WA8MCQ, K3TKS and KD3S will be there.

As always, MRC has free donuts and coffee on Saturday (but donations gladly accepted!). If you need instructions on finding the store, call them at 301-725-1212; hours during the week are 10 a.m. to 5 p.m.

Dayton 1995 Rooms

Myron Koyle is again handling QRP rooms for Dayton 1995. As of the end of May, 45 of the 60 rooms blocked are already spoken for.

To get your room reserved, send Myron two #10 (business size) self-addressed and stamped envelopes. Also include the following information: number of rooms wanted, nights wanted, names and calls of those staying in the rooms, and a home telephone number (this last piece of information is an absolute must).

Mail to Myron Koyle, N8DHT; 1101 Miles Ave. SW; Canton, OH 44710-1241.

A Portable "Invisible" Loop Antenna

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A year ago I came to the realization that I was not using my ham license to its full advantage. I travel frequently to Europe and more recently, to Russia, where I would be DX! Instead of having to struggle to make a contact, I would have the "horrifying" chore of struggling to fight off the hordes trying to contact ME!

Since I would be the desirable DX station, high power was no longer a requirement. To keep things small and simple I opted for the Oak Hills Research "Spirit" transceiver. This rig is a 5-watt 20 meter CW transceiver with built-in keyer circuit. I next considered the type and size of the antenna. My requirements for the antenna were many:

- *Transportable in a standard suitcase*
- *Not a problem w/ Airport Security*
- *Invisible to airport X-Ray machines*
- *Lightweight and rugged*
- *Easily installed in hotel rooms*
- *Readily tuned*

All this, and I didn't want the resulting creation to worry hotel personnel into contacting the local gendarmes! After much reflection, experimentation, and construction, I fashioned a small loop antenna which satisfies all the requirements listed above.

Description:

The loop is made from 4.5 feet of number 14-18 AWG clear-covered lamp cord separated into two separate wires. The wire is strung on the ends of four 3/8", 24-inch long wooden dowels. One end of each wire is connected to a tuning capacitor which is mounted at the top of the loop. The other end of each wire is connected to a matching coil located at the bottom of the loop as shown in Figure 1.

Design:

Using the "Minimec"[1] computer program it was found that for a square loop with a 0.1 wavelength circumference, the input impedance is:

$$Zin = 0.015 + j(305-4f)\ \text{Ohms}\ (f\ \textit{in Mhz})$$

The 0.015 radiation resistance value is very close to the 0.018 value obtained using Anderson's, W9PNE's, equations[2]. The inductive reactance at 14.050 Mhz is 249 ohms (from the formula above).

The capacitor value is calculated using the formula from the ARRL handbook, rearranged by suitable mathematical manipulation. For resonance the capacitance reactance must cancel the inductive reactance:

$$C = 10^6 / (2\pi f X) = 46\ \text{pF}$$

$$(f = 14.05\ \text{Mhz})$$
$$(X = 249\Omega)$$

The radiation resistance, as shown before, is 0.015, and the loss resistance is 0.745 ohms (see W9PNE's work). The Q of this loop is:

$$Q = X/R = 326$$

where $R = 0.015 + 0.745 = 0.763\Omega$. This equates to a bandwidth of:

$$BW = f/Q = 43\ \text{Khz}$$

The voltage rating on the capacitor must exceed:

$$Vc = (P * X * Q)^{.5} = 637\ \text{Volts (approx)}$$

Where P = 5 Watts. To ensure reliability, use a 2000 volt rating. I formed my own capacitor from a piece of sheet Plexiglass® using the following formula:

$$C = (0.224 * K * A * (n-1)) / s$$

where K = dielectric constant
A = area in square inches
n= number of plates
s = plate spacing in inches

For the capacitance value I required, a capacitor of 4.6 square inches was needed.

Materials:

2- PVC 3/8" diam. T connectors
4- 18" 3/8" diam. wooden dowels
1- 4.5 foot clear plastic-covered lamp cord
2- 0.5" long 3/8" diam. wood plugs
1- 3/4" long 1.75" I.D. PVC pipe
1- 8-32 x 3" bolt, 2 washers, butterfly nut
3- 8-32 x 1/2" copper bolts, washers, nuts
1- 4' #20-22AWG covered hookup wire
1- phono plug (RS 274-319)
1- phon socket (RS 274-332)
1- RF connector
1- RG-58 or RG-174 (length to suit)
4- Radio Shack "Bullet" connectors, (RS 64-3047) *
1- Qty. Ring terminals (RS 64-3032)
1- piece clear 1/16" plexiglass (2.5" x 3")*
1- piece clear 1/16" plexiglass* (0.5" x 2.75")
1- piece copper or aluminum foil (2.5" x 6")
1- tube Krazy Glue® or equiv.
1- Knob

*- See text

Construction:

Insert the two 3/8"-diameter wood plugs in each of the vertical branches of each Tee. Using a #18 drill (.01695"), drill a hole lengthwise through each plug and through the top of the Tee. Place the two Tees back-to-back, then pass the 3" bolt through the combination with two washers in position. Tighten the butterfly nut to hold the two Tees so that the remaining four holes are at right angles to each other.

The loop frame is constructed from four 18" lengths of 3/8" diameter dowel. Notch each dowel at one end to hold the wire in place when fully assembled. The dowels are held in an "X" position at the loop's center by being inserted in the two PVC Tees previously assembled.

Construct the impedance matching coil as follows: Drill a 3/32" hole near each end of the 3/4"-long 1.75" ID PVC pipe. Wind a 5-turn coil between the two holes, leaving three-inch connection leads sticking out the ends. Tap the coil at 1, 3, 4 and 5 turns with three-inch leads. Solder a "bullet" connector at the end of taps 3, 4 and 5. I made my "connectors" from 3 female pins from an old surplus connector. Solder the coil's "low " end to one of the female phono sockets' outer shell. Solder tap 1 to the shell connection on the other phono socket. Note that the two sockets are electrically isolated from each other. Bend the connection tab over this second socket to prevent its use. Solder the male pin to the socket 1 connection tab with a short pigtail wire.

Since this is supposed to be a low-cost homebrew project, I decided to fabricate the variable capacitor. I chose 1/16" (.062) plexiglass for its high dialectric strength and ready availability.

Drill holes in 3 of the 4 corners of the 2.5" x 3" plexiglass piece to clear an 8-32 bolt (or your favorite), as shown in figure 3. I used copper foil and hard. Using the foil shapes shown at the bottom of Figure 3, glue the foil pieces to opposing sides of the plexiglass. With the two holes on the 3-inch side oriented upward, affix the foil from the left side of the plexiglass. Flip the piece over and repeat for the bottom foil piece. If correctly placed, each of the two holes is covered with only one foil on opposing sides. Insert and tighten appropriate hardware to form the capacitor connections (see Figure 3). The trimmer is constructed as shown in the sketch, with one side covered in foil. A pigtail lead connects the trimmer to the main portion of the capacitor, and hardware with a fiber or rubber washer provides a friction-fit means of holding the trimmer in place. (*Double-sided PC board, with corners stripped or etched away, would serve the same function- NN1G*)

Separate the lamp cord into two 4.5 foot pieces. Using an approporiate ring terminal at the end of each of the two wires, fasten these wires to the 2 capacitor terminals.

Position the capacitor at the top center of the loop. Strin the wires over the dowel ends to form the loop. Trim the wires to length so that they are taut when connected to the coil. Solder one end of the loop's wire to the coil "Low" connection onthe phon jack, and the other loop end to "Tap 1" as shown in Figure 2. Pass each end through mounting holes in the dual phono socket strip to provide mechanical strength.

Prepare the coax cable by installing a suitable RF connector at the rig end and a phono plug at the loop antenna end.

Tuning:

Insert the male pin (see Figure 3) into one of the 3 female pins and rotate the trim capacitor for lowest indicated SWR. I've found that by using tap 4 I can easily obtain an SWR of 1.4:1 or less in most instances. For operating over the 14.0 to 14.1 frequency range, retuning will be necessary. If you find it necessary to change the capacitor value, it's possible to score a narrow (0.1") strip of the foil material, and peel it back until adjustment is possible. The peeled-back portions may be cut off.

Conclusion:

I've carried this antenna around the U.S. and to Europe without having to open my suitcase for inspection. Even Room Service folks in Europe seems unperturbed by this little antenna! It's light weight (20 oz) including 8 feet of RG-174, fits within a suitcase, and operates just about anywhere. Give it a try!

References:

1. Antenna Optimizers AO 6.0, (Minimec), Brian Beezley, K6STI, 507-1/2 Taylor, Vista, CA 92084

2. Bryce Anderson, W9PNE, "Single and Multi-Turn Loop Antennas", QRP Quarterly, October 1993.

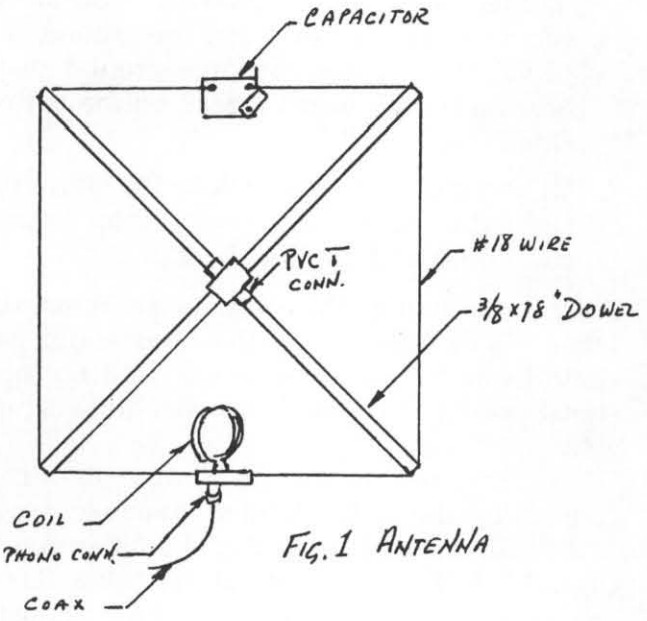


FIG. 1 ANTENNA

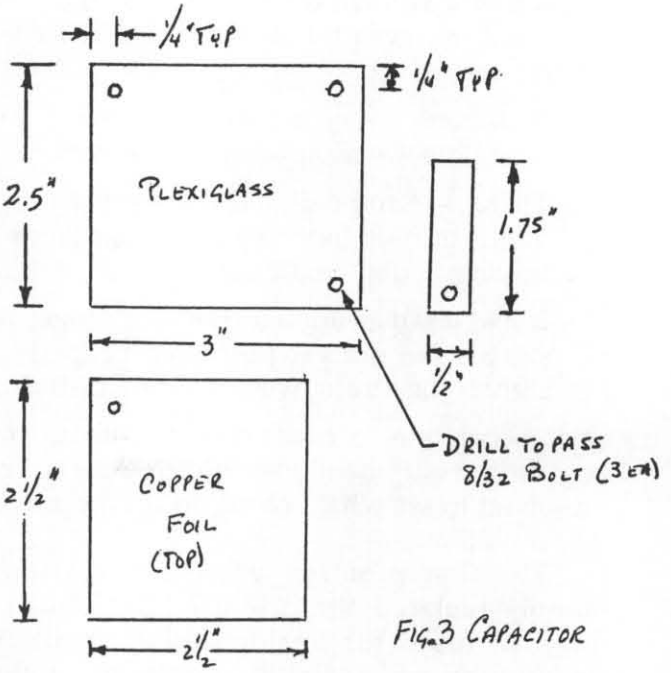
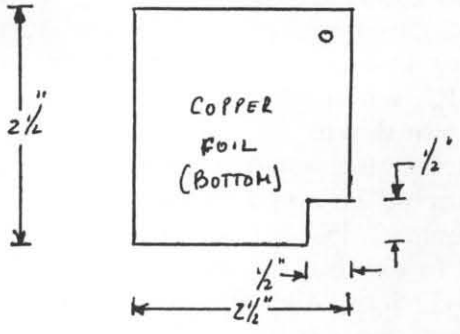


FIG. 3 CAPACITOR



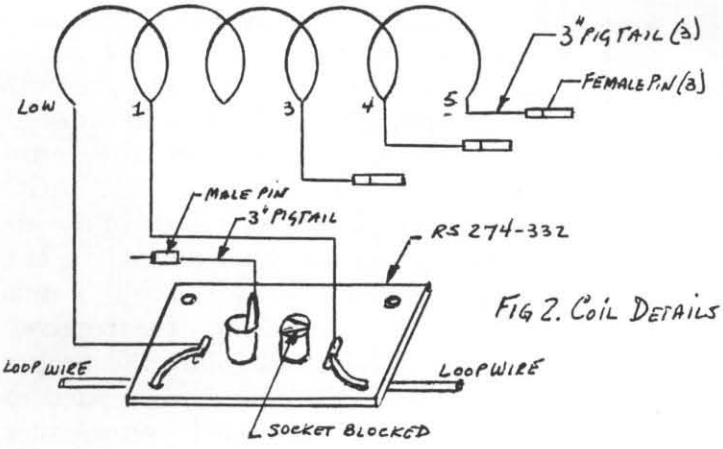


FIG 2. COIL DETAILS

Improvements for the W9GR DSP Audio Filter

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Idaho Falls, ID 83401

I've been intrigued for some time with the use of digital signal processing to enhance receiver performance, but have had neither the time nor spare cash required to pursue development work in this area. I was therefore very interested in W9GR's QST article[1] describing a DSP filter of his design available as a kit[2]. I purchased the kit, and after a long wait (apparently there was much greater demand than expected and problems in obtaining parts) it arrived and I set about assembling it. Although it worked quite well (first time it was powered-up, even!), it did have a few irritating characteristics:

- It emitted a very annoying "screech" every time power was applied or removed.
- There was some digital noise present in the audio output (not excessive, but some noticeable "pops" and hiss).
- It had a rather limited dynamic range; weak signals did not get processed properly and signals too strong were severely distorted.

Not being one to resist mucking about inside my radio equipment, even new pieces of gear, I set about to see what I could do the improve on the situation.

The first problem was easily corrected: I simply replaced the original LF347 quad op-amp IC (used for analog audio conditioning before and after digital processing) with an LM348 IC. It appears that some sort of momentary instability was occurring in the original IC when the supply voltage was ramped up or down.

The noise problem was a little harder to solve. It should be noted that the kit I received had a revised PC board layout that was supposed to eliminate noise problems present in earlier versions. Also, bypass capacitors were installed on power input, audio input, speaker and headphone output connectors, and the unit was built in a metal box as suggested in the kit instructions. Although the noise was not excessive, I still found it annoying; particularly when using one of the CW filter modes with no (or very little) input audio present. I was finally able to reduce the noise to a very low level by making the following simple modifications:

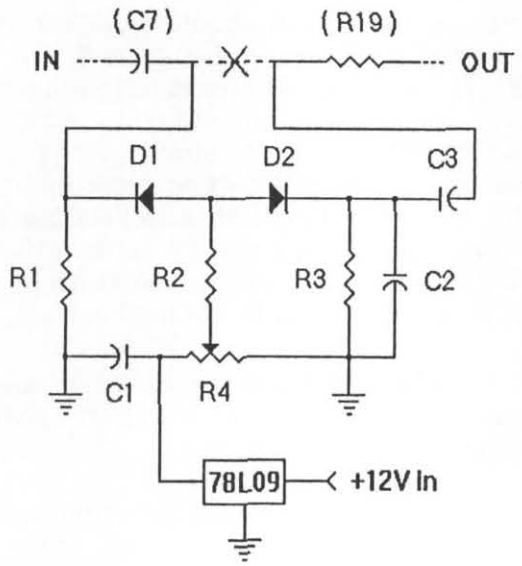
1. I added a 1.0 µF ceramic capacitor between pins 1 and 24 of U2 (AD7569 A/D and D/A converter), directly between the IC socket pins on the bottom side of the PC board.
2. A 1.0 µF cap was added between IC socket pins 4 and 11 of U8 (the quad op-amp mentioned above).
3. A short ground strap made from a piece of "solder wick" insulated with heat-shrink tubing was added between the ground side of C3 and the nearest large ground plane area on the PC board (again, on the bottom side of the board).
4. R1 was changed from 100K to 100 Ohm; this seemed to eliminate a ground-loop between my FT-301 and the DSP filter unit.

After these mods, the only noise remaining was a slight "hiss" when the filter audio gain control was turned to maximum with no input signal present. I decided this was quite acceptable.

A few words are perhaps in order concerning the unit's limited dynamic range: first of all, it is due to the use of 8-bit analog-to-digital (A/D) and digital-to-analog (D/A) conversion for the sake of economy.[1] As noted in the instructions included with the kit, it is important that the input audio level be kept in the upper portion of this 8-bit range in order to keep the A/D and D/A conversion precision high and quantizing noise low. If the audio level is too high, the A/D will "wrap around" resulting is severely distorted audio. In order to maintain the proper input level, the radio feeding the filter needs to have a "flat" AGC characteristic. Well, fancy new state-of-the-art supper whiz-bang rigs may have flat AGC's, but my QRP rigs and old FT-301 don't! I was therefore continually "diddling" the receiver audio output in order to maintain the proper audio level into the DSP unit. This tended to distract from the otherwise great performance of the unit; the CW filters are absolutely "brick wall" with no ringing, and the automatic notch

and noise filter modes actually makes 40m SSB bearable at night!

I finally solved the problem by adding a simple series limiter ahead of the analog-to-digital converter, as shown in Fig. 1. In the following description, part numbers enclosed in parentheses refer to original DSP parts; other part numbers refer to the limiter circuit. This simple circuit limits the amplitude of the audio signal to the A/D, thereby eliminating distortion due to A/D "wrap around". The clipping level is set by R4; diodes D1 and D2 should be well matched so that positive and negative signal peaks are limited at the same level. Matching can also be accomplished by selecting the value of R3 (and/or R1) to produce equal DC voltage drops across the two diodes (should be matched to within 0.05V). The 78L09 regulator provides a fixed reference voltage for the limiter eliminating the necessity to reset the limit point if the supply voltage should change. The regulator can be eliminated and R4 connected directly to +12V if the filter will always be used with the same regulated power source. I built the limiter on a small piece of perf-board and mounted it "spider web" style above (U2). A miniature trim-pot and small 25V ceramic caps were used to keep size to a minimum. Connections were made without modifying the PC board by unsoldering the end of (R19) originally connected to (C7), and connecting it to C3 on the perf-board. A short jumper was then connected from the junction of D1 and R1 on the perf-board to the solder pad on the PC board from which the end of (R19) was lifted. A ground connection can be made to a ground trace on the top of the PC board near (U2), and +12V can be obtained by soldering a jumper to the end of (L2) nearest the front of the PC board.



Parts List:

C1, C3-	1.0 µF
C2-	.01 µF
D1,D2-	Matched small-signal diodes (1N914, 1N4148, etc)
R1,R3,R4-	10K
R2-	6.8K

Figure 1

Series limiter added between input analog filter and A-to-D converter. (C7) and (R19) refer to original W9GR DSP filter components.

The limiter is adjusted as follows:

1. Select the DSP filter mode that you use most, connect it to your receiver, and tune in a good strong signal.
2. With R4 set to supply maximum voltage to the anodes of D1 and D2, increase the audio input to the filter until the A/D "wraps" (you can tell when this happens by the severe distortion produced).
3. Adjust R4 to eliminate the overload distortion. The top indicator on the LED signal strength bar graph should still light on signal peaks; if it doesn't, back off R4 slightly.

That's all there is to it! You can now set the receiver audio output so that "normal" signals will cause the top LED signal strength indicator to flash on audio peaks without worrying about stronger signals overloading the unit.

This simple limiter circuit can, of course, be used with other DSP units that do not have built-in protection against A/D overload.

References and Notes

1. Dave Herschberger, "Low-Cost Digital Signal Processing for the Radio Amateur", QST, September 1992, p. 43.
2. Available from QUANTICS, P.O. Box 2163, Nevada City, CA 95959.
3. Some "deluxe" DSP units apparently use 16-bit conversion, but most available units use 8-bit in order to keep costs reasonable.

Another Use for the MFJ SWR Analyzer

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Brooklawn, NJ 08030

Here's another use for that great MFJ-249 SWR Analyzer you bought last year. You didn't get one yet? Perhaps you could convince your local club to get one and set up a "loaner" program for members in good standing. You'll wonder how you ever got along without it!

In addition to being a super antenna test gadget, the analyzer's inernal frequency counter and tunable signal generator make it handy for other projects in the shack. I've even used it as a QRP transceiver tester.

A year or so ago, I built an OHR 20 meter transceiver. It went together pretty easily, but alignment was more difficult than expected. It has a crystal oscillator that needs to be precisely tuned to set the transmit/receive offset. The alignment instructions tell you what frequency to adjust it to, but frequency pulling when a counter is connected makes it difficult to get a good final result.

Another alignment step that rig's manual suggested was to use your "big rig" to inject a transmit signal of known frequency to set the receiver, then transmit and note the frequency in the big rig's receiver. Fine, but what if your big rig doesn't have a fancy digital dial?

The MFJ-249 can come to your rescue here! You can use its internal oscillator set with frequency-counter accuracy to zero-beat the receiver, then feed the transmitter to the -249 counter (through an attenuator) to measure the offset. Naturally, it will work equally well with any other HF or VHF transceiver.

My setup is detailed in Figures 1 and 2. The tunable -249 output is taken from the antenna test port. The level at this point is about 0.5 volt into an open circuit or 0.25 volt into a 50Ω load. The attenuator reduces the high-level -249 output so you don't damage the transceiver input (*If you're interested, see the ARRL Handbook for representative circuits- the attentuation accuarcy is non-critical in this application. Fortunate, since you won't realize 80 dB without careful attention to shielding- NN1G).* You can also just lay the coax from the transceiver near the -249 and rely on stray pickup if you don't have an attenuator.

The transmitter output must also be reduced to acceptable levels for the -249's frequency counter input. The rated minimum input level is 600 mV RMS. Its maximum level is not specified, but MFJ says it will withstand 5V RMS without damage. The resistor network shown in Figure 2 reduces the transmitter output to roughly 1 volt RMS. The values shown here should work for any transmitter power level between 1 and 5 watts. The same attenuator is left in-line for receiver testing. I recommend using good ol' carbon composition resistors in the the attenuator. Newer film-type resistors may exhibit excessive inductance depending on their manufacturer. (I always scout for Allen-Bradley carbon- comp resistors at hamfests to use in RF attenuators and dummy loads.)

Here's a summary of some prudent precautions when you're using the MFJ Analyzer:

- Don't feed the MFJ Test Antenna input directly to the transceiver input. Be sure to reduce signal levels using an attenuator to preclude damaging the receiver front-end.
- Don't hook a transceiver output directly up to the analyzer input directly- use an attentuator here as well.
- If you're using the analyzer's signal source, recheck the frequency readings occasionally. Although the counter seems stable and accurate, the tunable oscillator tends to drift over time.

This is only one possible non-antenna use for the -249. I'm sure we QRPers can find many more uses for a wide range tunable oscillator and a VHF frequency counter. Good luck!

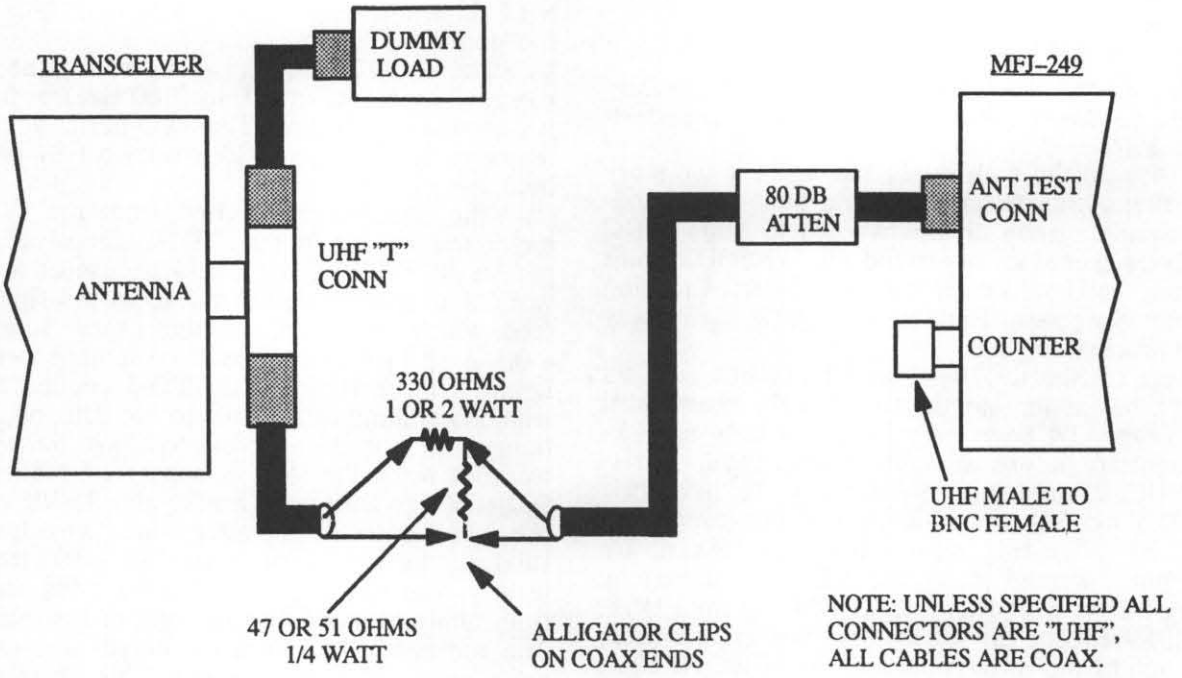

FIGURE 1 – RECEIVER SETUP CONNECTIONS

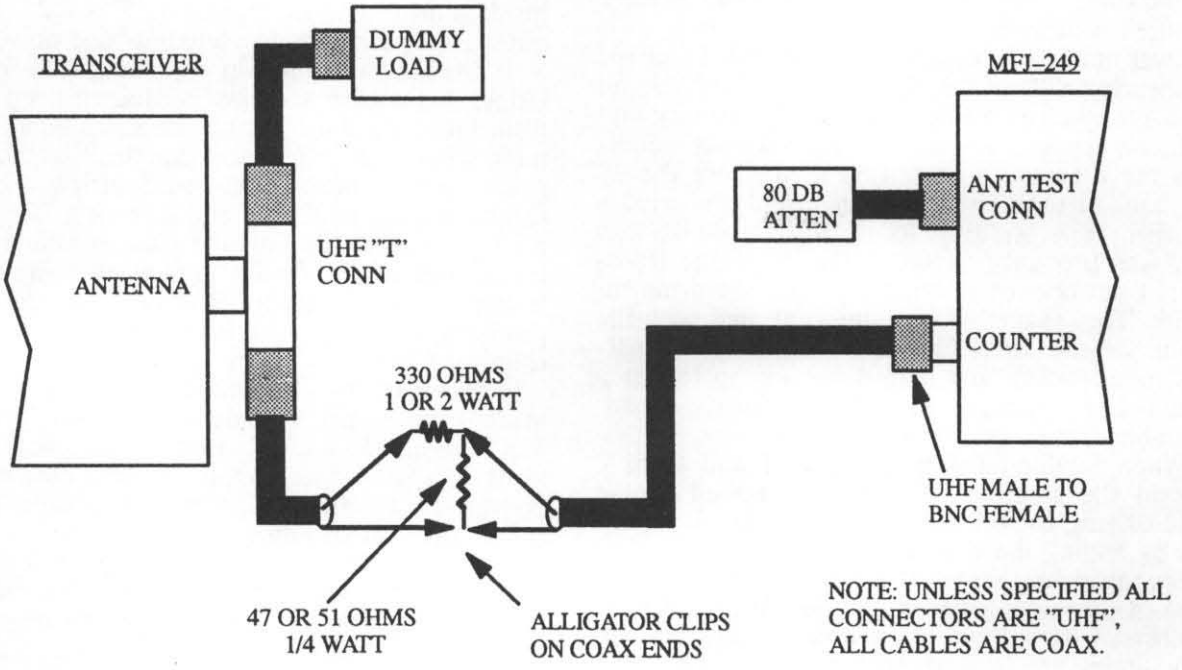

FIGURE 2 – TRANSMITTER SETUP CONNECTIONS

A 40M Transceiver from Handbook Circuits

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(editor's note: This article is reprinted from QRPp, the Journal of the Northern California QRP Club, with the author's consent- NN1G)

I thought the club might like to hear the story of my first complete homebrew rig built from handbook circuits. I had always wanted to build a DC transceiver ever since my friend Ed, WA6ODR, built one from the Handbook in the 70's. I started reading the QRP Notebook, Handbook projects, and every related article in sight!

I sent for the KK7B R2 and T2 boards and lots of parts, but as the months wore on the boards still didn't come. I'd been promising my kids a backpacking trip before summer ended (both Chris- KD6WUC, 9, and Lauralee- KD6WIV, 11, have their Techs). I needed something small but capable. I know the diode-ring double-balanced mixers are best , but I wanted to try the NE602. I started by making the receiver from the KH6CP rig from QST, Oct. 1989 except for 40 meters. The circuit takes advantage of the differential outputs of the NE602 , and has an active audio low-pass filter, FET mute, and "plenty of headphone drive". The headphone drive was dismal! I use lightweight 'Walkman' phones. With both 32-ohm elements in parallel, that's 16 ohms. As a result, I put the LM386 for a few more dB of gain.

I was amazed how well it worked until I realized I was hearing SSB in the Novice band! Even though I had a pretty clean VFO, I was hearing twenty meters! Later, at night, I heard broadcast signals rectifying in the detector. I identified them from the 39 meter band. I took out the input toroid and tried a few other coils, settling for a tiny ferrite IF can which was probably a 10.7 MHz interstage transformer. I cut out the internal cap and added the input link. This shaped it up somewhat, and with the addition of the final low-pass and coupling networks, overloading and harmonics are no longer a problem. Even at night with the Shortwave broadcasts in-band, the receiver works well.

When I added the transmitter, I had terrible clicks in the sidetone. These were traced to the NE602 driving the op-amp into saturation. This was cured by adding the diodes in the feedback path of the second op-amp stage. The Hartley oscillator is a variant of those published by W1FB, W7EL, KK7B and others. I started with a fixed cap across the tank and the tuning cap in series with a small-value cap to reduce its value to a fraction of the fixed cap value for the proper tuning range. This resulted in very non-linear tuning. It would be very nearly linear if the series cap and the combination of the tuning and padding caps were about equal. I found a toroid inconvenient so I changed to a slug-tuned form for the VFO tank. I had quite a time compensating drift out of the VFO. Early versions were pretty stable, but I think the oriental NPO caps I got later weren't too good.

The RIT/CW offset works well. The control moves the receiver from 0 to 1300 Hz, and the offset is removed for transmit. The VFO buffer amp works, but is power-hungry. I'd like to try a FET or MMIC here.

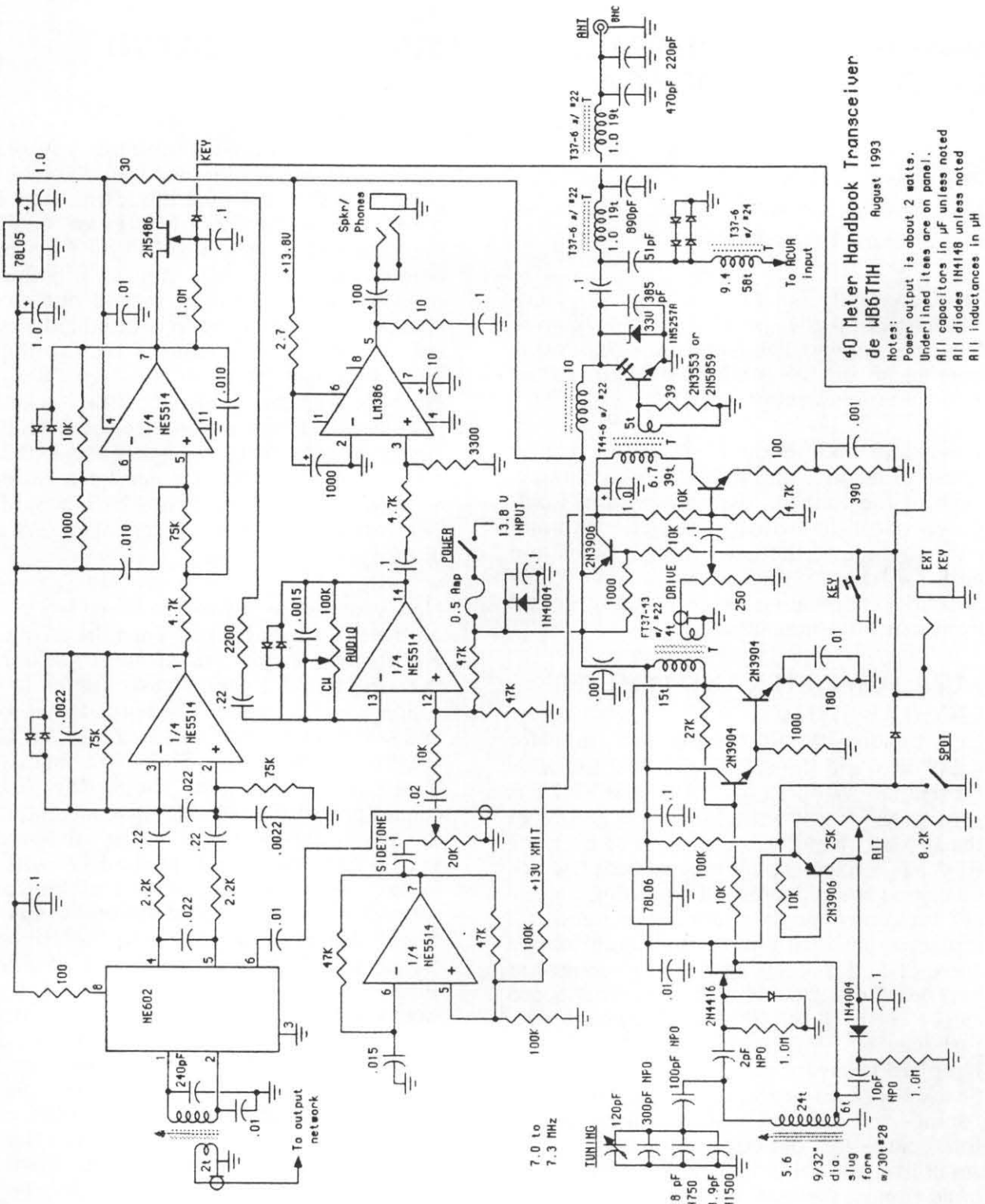
The transmitter is lifted from the W7EL 40 meter transceiver in the '92 Handbook. The drive pot stays at 100%, but could be useful for QRPp work. I used a miniature choke in the final power feed, which works fine now that I made sure to keep a 0.5 Amp fuse in the line! Accidental shorts of the large "hat" heatsink on the TO-5 cooked a choke, which later allowed the final to oscillate, popping the transistor! The 33 volt over-voltage zener gets a workout when the load disappears. I moved to the 500 mW size with good results after losing a smaller one, but it can still pop after a long 'key-down'. The final seems to accept other TO-5 RF transistors readily. The two watt output looks good on a spectrum analyser thanks to the output low-pass filter. The additional 220 pF at the output was needed to get a good match to 50 ohms. This rig is all 'ugly' constructed on 2 un-etched PC boards and spacers, one of which also serves as the panel. Only the ICs and final transistor got sockets, mounted in holes drilled through the inside board. It all gets stuffed inside a meter box measuring 3.75" x 6.25" x 2", requiring only headphones, antenna, and power.

The rig has a built-in key made from PC-board strips. A lot of work was needed to keep the key from vibrating the VFO on the same board. Only a minimum of shielding was practical due to lack of space and planning. PC-board strips and solder served as both stiffening and shielding. Tin foil was used on part of the Bakelite case to eliminate hand capacitance effects on the VFO when using the built-in key. It sounds much better on an external key- I probably won't try a built-in key again with a mechanical VFO.

Many hours of work later, and a few QSOs made from home, I made an inverted Vee out of #28 wire and RG-174, loaded up the packs, and we hit the trails. We set up the Vee in a clearing in the bottom of a canyon and worked skeds home, a couple of hundred miles, with no problem.

This isn't intended as a "how-to-build-it" article, but as an example of the process of building a transceiver from 'scratch'. If you are new to construction and electronics, try to follow one published plan closely, using the specified parts, or just stick to kits. But if you enjoy a challenge...

Now wouldn't it be nice to set up a PLL and 68HC11 uP for a VFO and frequency display for that R2 and T2?- they finally came! Then, that NN1G rig looks neat and easy, too. (*Hi- it's me again. Neat-yes. Easy-maybe! Not for the rank beginner. -ed*) Long live homebrewing!



A 40 Meter Transceiver from Handbook Circuits WB6TMH

YAESU FT-7 MODIFICATIONS TURN A GOOD RADIO INTO A GREAT QRP RADIO (Part 2 of 2)

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(I inadvertently ran Figures 1 and 2 for this installment in part 1 (Jan. '94 issue) . To prove that "two wrongs don't make a right", we're running the part 1 illustrations right here in part 2. Color me embarrassed! - NN1G)

This article modifies the FT-7 to add a number of useful features and makes it a great radio. Each of the changes uses an existing front-panel control to switch these options in and out, eliminating the need to drill holes and add switches. Flip-flops provide click-on/click-off operation- an easy way to extend front-panel functionality.

AUDIO CW FILTER AND 10 METER CRYSTAL SWITCH

Unfortunately, the FT-7 has no provisions for a CW filter and the SSB filter is just too wide for serious CW operating. Also, the FT-7 has provisions for only a single 500 Khz portion of the 10 Meter band. Fortunately, however, the FT-7 has a fixed crystal plug-in board which gives you the capability of operating on one crystal controlled frequency per band. I replaced that board with one made from a piece of Radio Shack 44-pin edge connector perf board (RS 276-154 @ $3.49). This board can be cut to fit the FT-7 fixed crystal board. Just use the FT-7 fixed crystal board as a template to create an outline on the Radio Shack board and carefully cut it out with a coping- or band-saw. After you've cut out this board, tin the edge connector using a small iron and minimal solder. Use copper braid (from a piece of coax) to wick off excess solder.

The complete circuit is shown in Figure 1 and the component layout I used is shown in Figure 2 (*see the Jan '94 issue*). This is a popular 2-pole bandpass filter with a 200 Hz bandwidth that has been published previously in some ARRL publications. I replaced the fixed 24K frequency-determining resistors in the original article with the two 50K multi-turn pots to be able to adjust the filter center (TX offset) frequency. This is 700 Hz for the FT-7. The active filter uses a TL084 JFET op-amp. One section of the 4013 dual D flip flop is used to switch the filter in and out of the circuit with the help of the 4016 quad analog switch. The other section of the flip flop is used to select between the two 10-meter crystals. For the HC-25U crystal sockets, I just removed two sockets from the original "fixed" board. Also, instead of the 43.0 Mhz crystal for the "high" 10 meter band, I used a 42.8 Mhz crystal to cover 28.3-28.8 Mhz. This provides me with one crystal for CW and one for phone.

Now you need to re-wire the "fixed" connector on the FT-7 main board. Turn the FT-7 over and remove the bottom cover. Unsolder all the wires from the band switch that go to this connector. Find a source of regulated +8 volts and solder a wire from this source to pin 11 of the "fixed" connector. There is a small sub-board mounted just above the "fixed" connector that has +8 volts available on it all the time (right-most post on the sub-board as you look at the bottom of the FT7 with the front panel on the right). Pin 14 of the "fixed" connector is the pin closest to you. Connect a shielded wire from pin 13 to the 10 meter crystal socket on the main board. Solder a shielded wire from pin 9 and a shielded wire from pin 5 (shields soldered to ground) that are long enough to reach pin 11 of the audio board. Disconnect the red wire currently soldered to pin 11 of the audio board. Solder the center conductor of the shielded cable coming from "fixed" connector pin 5 to the red wire just unsoldered from the audio board pin 11. Solder the center conductor of the shielded cable from "fixed" connector pin 9 to the audio board pin 11 and solder the shields to an adjacent ground.

To actually do the switching, I wired the filter's flip flop input to the USB/LSB/CW switch such that I go to a +8 volt input to the flip flop when switching from LSB to USB. I

wired the Noise Blanker/Off switch to the crystal flip flop input such that I get a +8 volt input when switching from OFF to NOISE BLANKER. To do this, move the wire from the FIX front panel switch (which goes to pin 3 of the "fixed" connector) to the NB switch (move the wire one solder terminal over - use a voltmeter to make sure you have the right switch connection). Add a wire from the USB/LSB/CW switch to the "fixed" connector pin 10. The switch terminal is the second from the bottom closest to the side of the radio. Again, use a voltmeter to make sure you are on the right switch position. Now you can toggle the CW filter in and out with the USB/LSB switch, and change 10 meter crystals with the NB/OFF switch. I also drilled a small hole in the front panel of the FT-7 and installed a red LED by the 10 meter position. The LED is lit when the switch is in the 10 meter "high" frequency position. You can easily hear when the audio filter is in or out so I didn't include an indicator for the filter. The radio will turn on with the CW filter out if the USB/LSB/CW switch is in the LSB or CW position. Also, the crystal plugged into the non-LED socket will be selected when the radio is turned on.

CURRENT REDUCTION

The FT-7 draws around 500 ma in receive. About 250 mA of this is just in the dial and meter lamps! I added 27 ohm resistors (1/2 watt required) in series with the Meter and Dial lamps, and 47 ohm resistors in series with the Clarifier and FIX lamps and saved 40 ma. This should also significantly increase the life of the lamps. Reducing the current much more than this caused the meter and dial to be difficult to read. Since I run off batteries during portable operation, I decided that a means to switch off the dial lamps would also be worthwhile. Turning off these lamps reduces the receive drain to about 250 ma. In order to do this, I built another flip-flop controlled circuit (see Figure 3). Because I didn't have any more room on the "fixed" board, I used a 1-1/2" X 1-1/2" piece of perf board. I mounted this board to the chassis wall on the bottom side of the radio near the "fixed" connector with double sided sticky tape plus a blob of hot glue to ensure it wouldn't come loose. Next I unsoldered the ground pins and wires on the dial and meter lamps and attached the transistor output to these points. I connected the flip flop input to the "FIX" switch such that when you switch to the "FIX" position, you'll get +8 volts on this line. When wired as shown, the radio comes on with the lamps on. If you want it the other way, move the 4.7K TIP-120 base resistor from pin 1 to pin 2 of the 4013. Now you can toggle the lamps on and off by switching to the "FIX" position and back.

CONCLUSION

There you have it! With these modifications, you can turn the Yaesu FT-7 into an excellent CW QRP rig. It was already an great SSB rig. Adding crystal switching to give you the first 1 Mhz coverage of 10 meters also gives you most of the 10 meter action. Finally, you don't have to add obvious add-on switches to be able to add these features. I hope you can find an FT-7 before all their present owners read this article. Once someone installs these modifications in their FT-7, I doubt if they'll ever want to part with it!

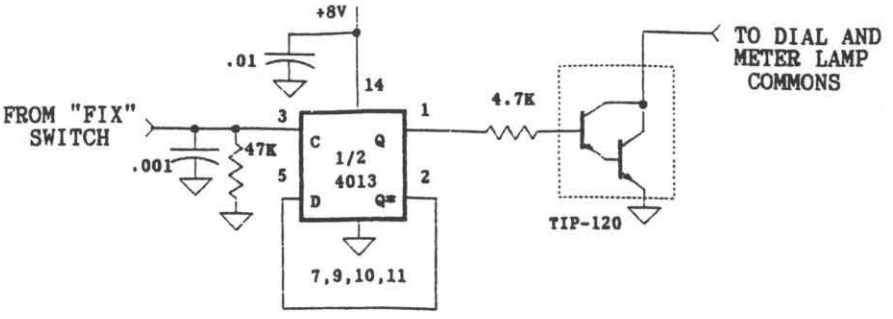

FIGURE 3
LAMP SWITCHER CIRCUIT

(Here are Figures 1 and 2 which should have accompanied part 1 of Phil's article in the January '94 Quarterly.)

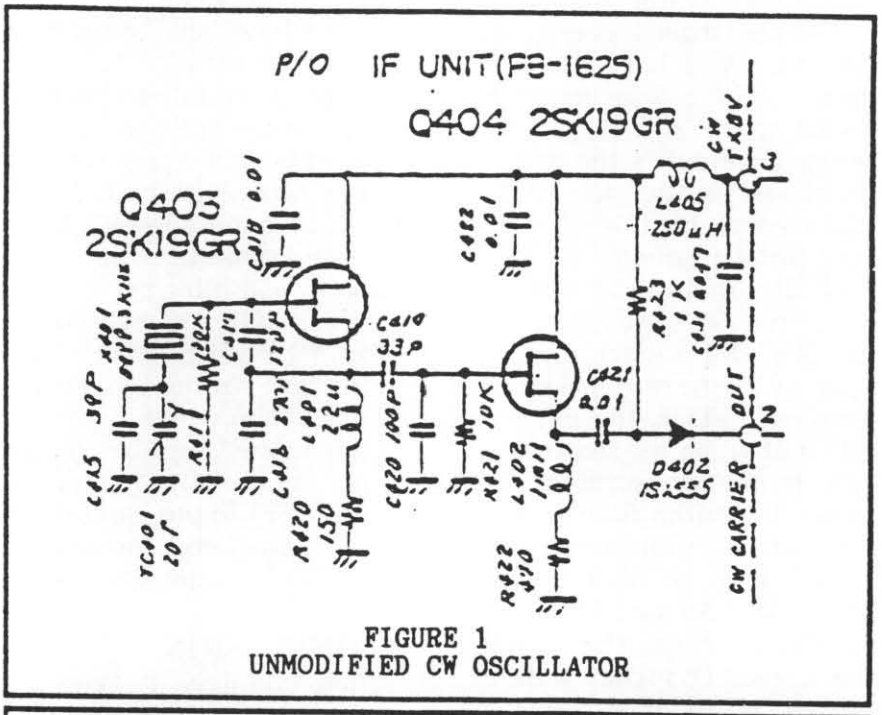

FIGURE 1
UNMODIFIED CW OSCILLATOR

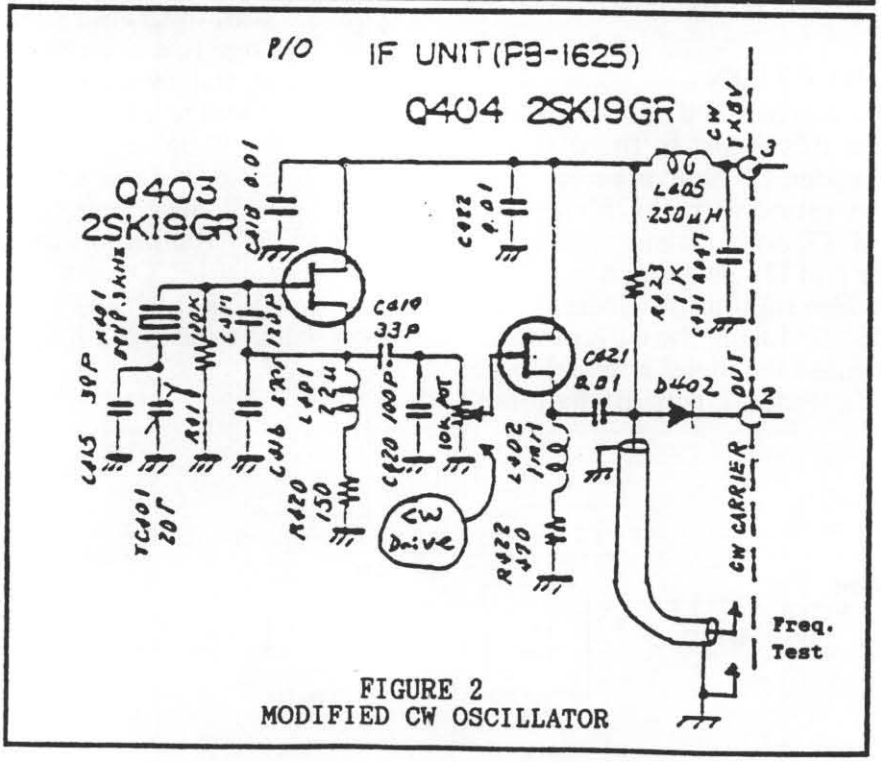

FIGURE 2
MODIFIED CW OSCILLATOR

Contests

by Cam Hartford, N6GA
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It seems that someone has been trying to fool Mother Nature. Her revenge came in the form of lousy atmospheric conditions, both for our Spring '94 QSO Party and at Dayton. Which was worse?

QRP Contesters will contend that the bands were about as lousy as they can possibly get. How many different ways can you describe foul propagation conditions? Read the Soapbox comments for a comprehensive overview.

Dayton Hamvention attendees will contend that the continuous rainfall followed by Sunday's 39 degrees with a 15 knot breeze were among the worst conditions in recent memory, but then that is what one expects from Ohio in April.

But none of this seemed to diminish the crowds. Dayton was packed, and more importantly, packed with QRPers. And the Spring QSO Party netted logs from 92 hardy contestants.

My inaugural trip to Dayton was a real mind-boggler. Best part was meeting many of the QRPers I have worked, read about, or otherwise crossed paths with over the last 20 years. Most encouraging is the current level of interest in building and operating QRP gear, along with the growing number of offerings from both kit and complete-rig manufacturers. I got to lay my hands on the new ARK-4 from S&S, the Index labs Do-Everything-in-a Small-Box radio, the next edition from NorCal dubbed "Sierra" (something to do with many peaks), a whole bunch of really nicely built Homebrew items, and (a personal high point for me) the original W7EL and its maker, Roy. Maybe next year will be a good one for the Flea market...

Additions and Corrections:

The combined Postal services of Ecuador and the US conspired to delay the entry of Kris Merschrod, HC1CK, well past the deadline for entries into the 94 Winter Fireside SSB Sprint. Kris should have been listed as having amassed 9282 points from far-away Quito, an excellent effort for QRP SSB. (His QRP ARCI number must be a big help - #7272!) Another miscue, this one attributable to me, was the omission of the team entry of the Mississippi QRP Society into the Fall '93 QRP Party. Team members included KI5FW, N5NRG, WD5HLD, and N5ODV. They captured the Team Category with a score of 115,444 points, and if there was a team QSL competition, they'd probably win that, too.

Upcoming Events:

Please note elsewhere in this issue the announcements for the Summer Daze SSB Sprint and the Fall QSO Party. Hopefully the solar flares will have let up by then and we can re-commence contesting. New on the scene are the Michigan Labor Day Sprint, which will give you a reason to slip away from all those relatives, and QRP Afield-1994, sponsored by the QRP Club of New England. This is a six hour mini field day, and looks like a fine opportunity to gather your QRP friends for a day in the wilds with your radios. Another excellent opportunity for some additional wallpaper is the Maryland-DC QSO Party, Aug. 20-21, which will award a certificate to the highest-scoring QRP station from each state.

Included in this Quarter's report are three older contests which have as yet to be reported–the Hootowl, Summer Homebrew, and Summer Daze SSB sprints from 1993. This leaves only the Spring 93 QSO Party, which should show up in the October QQ, at which time we should once again be current.

One final note. I received much needed input regarding the contest program while in Dayton. There is a strong sentiment toward encouraging and rewarding homebrewing, so we will be exploring ways to include points for homebrewing without penalizing those who use commercial gear. As usual, your comments will be greatly appreciated.

1994 Spring QRP ARCI QSO Party

TOP TEN

1	KØFRP	589,120
2	N4ROA	279,888
3	KB5YVT	219,905
4	W8MVN	212,667
5	WA4VQD	201,096
6	KN4QV	178,451
7	HP1AC	177,422
8	W1MK	168,868
9	NZ8J	165,900
10	KB2JE	137,886

SINGLE BAND

20M	NN9K	14,875
40M	W8MVN	212,667
80M	KA1TQM	7,420

HI/LO BAND

HI-B	NONE!	
LO-B	N4ROA	279,888

TEAM COMPETITION

INTERNET#1	KU7Y, WA4VQD, NR3Z	225,764
INTERNET #2	AC4HF, K5FO, KD4YRN	61,394

A comparison of the results of this contest with those of the Fall '93 tells the tale: top score less than half of the previous contest; no 15m Single Band entry; no High Band entry; only two 20M entries; average score of the top ten stations was 233,120 points, versus 754,945 for the Fall Party!

How bad was it? Let me count the ways: Minor geomagnetic storm (NØIBT). Poor band condx, but a lot of fun anyway (N2JOC). Nice way to spend a rainy weekend Hi! (N2TWW). Stinko conditions (K1BV). Prop sucked (K7YHA). Hearing aids make lousy CW filters! (K3TKS) Never got a chance to try out my 10M Module (N2MNN). Band was un-terrific (N6KM). Miserable condx–good practice for the future? (N8CQA) QRN, QSB, Poor Propagation, Weak Signals, Thunderstorms (NØIZZ). Worst condx yet for an ARCI test. Used WB2QAP Logger, it was great (NZ8J). The scenery made up for the poor band condx (W1FMR). Most horrible band condx I can remember (W2JEK). Conditions so poor, signals so weak, and my choice of antenna so bad! (W6JHQ) Well, condx were awful (W6SIY). Who was in charge of propagation for this contest? I'd like to file a complaint (W6TOY). Condx verry verry poor (WA3GYW). Hats off to all those who struggled with the condx (WA8RJF). I thought my S-meter had failed–WAØRPI, where were you (Hi Hi)! (WA9PWP) Could only put in two hours due to nice wx and golf... (WDØT) Not a lot of time to spend... I didn't miss much (WO7T). Worst I have experienced. Went fishing Saturday (WX7R).

SPRING QSO PARTY 1994

CALL	SCORE	POINTS	SPC	POWER	BANDS	TIME	RIG	ANTENNA
ARKANSAS								
KI5EZ	6,930	90	11	5.0	40M	4	ARGOSY II	VERTICAL
ARIZONA								
WO7T	1,911	39	7	4.0	A-2	1	INDEX QRP-PLUS	SLOPER / LOG PERIODIC
CALIFORNIA								
N6BXU	44,940	214	30	5.0	A-2	5	HB TX	CRUDE DIPOLES
W6JHQ	25,872	154	24	4.0	A-2	18	ARGOSY 2	HORIZONTAL LOOP
N6GA	4,760	68	10	2.0	A-2	4	ARGO 515 / NORCAL 40	YAGI / DIPOLE
N6KM	1,519	31	7	5.0	40M	1	IC 735	3 BAND DIPOLE
W6SIY	340	17	2	0.3	40M	2	TUNA TIN 2 / HB RX	DIPOLE
COLORADO								
KØFRP	589,120	1052	80	5.0	A-2	13	TS 850	20 - 4EL / 40 - 2 EL
W2CRS	67,270	217	31	0.9	A-3	4	HW-8	YAGI / VERTICAL
WOØQ	51,695	211	35	5.0	A-2	10	FT 1000	QUAD / VERT
NØIBT	30,758	169	26	5.0	A-2	11	TS 830	DIPOLE
CONNECTICUT								
KH6CP/1	134,505	427	45	4.0	A-5	22	ARGO 515 / HW-9	LOOP / DIPOLE / VERT
NN1G	15,300	102	15	0.9	L-2	2	MYSTERIOUS PROTOTYPE	WINDOM
KA1TQM	7,420	106	10	4.0	80M	8	HW-9	DIPOLE
FLORIDA								
WA4VQD	201,096	513	56	5.0	A-3	11	TS 440S	YAGI / LOOP / VERT
GEORGIA								
KN4QV	178,451	481	53	5.0	A-3	11	?	LOOP
KE2WB	39,494	182	31	5.0	A-3	?	HW-9 / HB TCVR	G5RV
ILLINOIS								
N4OGW	105,105	385	39	5.0	A-3	7	R-4C / T-4XC	DIPOLE / LAZY H
KB9FKO	19,110	130	21	4.0	A-2	6	HW-9	DIPOLES
NN9K	14,875	125	17	4.0	20M	9	MFJ 9020	YAGI
W9CUN	9,464	90	13	5.0	40M	3.5	DELTA 580	HORIZONTAL LOOP
N9JCV	3,717	59	9	2.5	40M	3	HW-8	DIPOLE
INDIANA								
WD9CTB	66,045	255	37	2.0	A-3	9	IC 730	ZEPP / VERTICAL
KANSAS								
WBØSMZ	4,277	47	13	5.0	A-3	4	ROCK BENDER / TS 140	80 M DIPOLE

LOUISIANA								
W5TVW	37,352	184	29	4.0	A-4	5	HW-8 / MFJ 9040	LONG WIRE / VERTICAL
MASSACHUSETTS								
W1MK	168,868	572	42	5.0	L-2	10.5	IC 740 / IC 765	4 EL 6P 80 / 4 EL 6P 40
NX1K	20,160	126	16	0.8	40M	7	NORCAL 40	WINDOM
WT1M	19,684	148	19	5.0	A-3	5	IC 745 / HW-9	160M RECT LOOP
KAØIQT	17,766	141	18	4.0	A-2	12.5	ARK 40 / K9AY	VERT/ATTIC DIPOLE
MARYLAND								
K3TKS	117,290	317	37	0.9	L-2	10	ARGO 509	AOG LOOP
W6TOY	1,666	34	7	5.0	40M	7	TS 130V / MXM TCVR	DIPOLE @ 5 FT UP
WA3GYW	882	21	6	2.0	L-2	1	HW-8	DIPOLES
MICHIGAN								
N8CQA	46,738	198	33	4.0	A-3	6	TS 830S	160M INVERTED L
WB8BHP	21,420	153	20	5.0	L-2	3.5	ARGOSY I	80M DIPOLE
WB8RUQ	17,556	132	19	5.0	40M	2.5	DRAKE TR5	GROUND PLANE
N8HSC	6,930	90	11	5.0	80M	2	IC 735	DIPOLE
MISSOURI								
KE4CBB	48,741	211	33	5.0	A-3	?	TS 430S	DIPOLE
WØGWT	33,075	175	27	5.0	A-2	9	IC 735	RANDOM WIRE / VERT
NØIZZ	5,544	66	12	5.0	A-2	3	TS 520	DIPOLE AT 8'
NOTH CAROLINA								
KD4YRN	6,237	81	11	5.0	L-2	6	TS 450S	DIPOLE
NORTH DAKOTA								
WAØRPI	113,365	395	41	5.0	A-3	15	IC 735	LOOP / KITE LONGWIRE
NEWFOUNDLAND								
VO1DRB	4,690	67	10	5.0	20M	5	ARGOSY	ISOLOOP ON BALCONY
NEW HAMPSHIRE								
K1BV	91,385	373	35	5.0	A-3	6	FT 990	?
W1FMR	32,319	171	27	3.0	A-3	8.5	NORCAL 40 / 509	VERTICAL, LONG WIRE
NEW JERSEY								
KB2JE	137,886	402	49	4.0	A-3	10.5	IC 765	G5RV
K2JT	65,604	284	33	5.0	A-4	5	OMNI-A	G5RV
N2MNN	55,986	258	31	5.0	A-3	8	TEN TEC SCOUT	40M LOOP
W2JEK	9,120	76	12	0.9	A-4	4.5	ARGO 505	DIPOLE / GP / HERTZ
N2JOC	2,800	50	8	2.0	40M	4	OMNI VI	DIPOLE
NEVADA								
KU7Y	15,750	150	15	5.0	40M	10.5	TS130S	G5RV 15' UP
NW YORK								
W2QYA	49,880	172	29	0.9	A-3	15	HW-8	100M MARCONI
N2TWW	21,420	153	20	5.0	A-3	6	ARGO 509	DIPOLE / G5RV
WA2IPZ	9,620	74	13	0.9	A-3	6	ARGOSY	DIPOLE / LOOP / YAGI
KF2JH	3,059	161	19	?	A-2	?	?	?
OHIO								
W8MVN	212,667	779	39	4.0	40M	23	ARK 40	DELTA LOOPS @ 60'
NZ8J	165,900	474	50	4.0	A-3	16	OMNI 5	YAGI / ZEPP
WA8RJF	42,175	241	25	4.5	40M	10	IC 735	LONG WIRE @ 20 FEET
WBØIQK	15,162	114	19	4.0	A-2	7.5	ARGO 556	VERTICAL
KB8GAE	14,385	137	15	5.0	40M	4.5	K9AY	160M WINDOM
OKLAHOMA								
W7BD	64,498	271	34	4.0	A-2	10	DELTA	TRAP VEE DIPOLE

ONTARIO								
VE3NBE	16,240	116	20	5.0	40M	7.5	TS 850S	DIPOLE
OREGON								
WX7R	34,713	171	29	4.0	A-2	5.5	IC 735	LONG WIRES
AA7KF	19,320	184	15	5.0	40M	2	TS 940S	SLOPER
AA7QU	12,096	96	18	5.0	A-2	4	ARGO II	WINDOM
WB4TPW	4,284	68	9	2.5	40M	6	HW-8	INV VEE
PENNSYLVANIA								
W3TS	71,680	256	28	0.1	A-3	8	HB TCVR	YAGI / VEE
WA3SRE	28,980	180	23	5.0	L-2	10	ARGO 515	LOOP / VERT
KA3WTF	25,760	184	20	5.0	40M	15	WINDOM	
K7YHA	23,520	160	21	5.0	A-2	6	TS 130V	DIPOLES / VERTICAL
NR3Z	8,918	91	14	5.0	40M	3	ARGOSY	VERTICAL
KT3A	1,092	26	6	2.0	40M	1	NORCAL 40	HAMSTICK ON ROOF
N3CZB	532	19	4	4.0	40M	10	CENTURY 21	INDOOR LOOP
PANAMA								
HP1AC	177,422	437	58	5.0	A-3	15	K9AY/K1BQT/TS430	YAGI / LONG WIRE
QUEBEC								
VE2ATD	840	24	5	5.0	A-2	2	?	?
RHODE ISLAND								
WA1OFT	55,769	257	31	4.0	A-3	16	HW-9	DIPOLES, VERTICAL
KA9HAO	3,780	63	6	0.8	40M	7	ARGO 515	INVERTED G5RV
SOUTH CAROLINA								
K4ADI	48,391	223	31	5.0	A-3	6	CORSAIR II	YAGI / DIPOLES
WN2V	16,310	110	21	4.0	40M	2	TRITON	VERTICAL
SOUTH DAKOTA								
WDØT	9,912	118	12	4.0	40M	2	TS 940	2 EL YAGI (40M)
TENNESSEE								
N4AOX	52,780	290	26	4.0	40M	18.5	TR7	DIPOLE
AC4HF	45,927	243	27	4.0	A-3	12.5	HW-9 / ARGO II	VERTICAL
TEXAS								
KB5YVT	219,905	515	61	5.0	A-2	12	?	?
W5TFB	64,750	250	37	5.0	L-2	5.5	TRITON / ARGOSY	LW / VERT ARRAY
KB5ZMH	27,930	103	30	5.0	A-2	?	?	?
KC5DRB	18,340	131	20	3.0	A-3	4	HW-8	G5RV
K5FO	9,230	71	13	0.9	40M	1.5	MXM TCVR	LONG WIRE
VIRGINIA								
N4ROA	279,888	714	56	5.0	L-2	18	OMNI	270 FT INVERTED "L"
K4JM	101,920	364	40	5.0	A-3	8	CORSAIR II	DIPOLE / 135' END FED
AC4QO	6,944	62	16	4.0	A-2	5	HW-9 / FT 890	SLOPER / VERTICAL
WISCONSIN								
WA9PWP	119,070	405	42	5.0	A-2	10.5	ARGO II	YAGI / VERTICAL
W9MSE	74,725	305	35	5.0	A-3	6	TS 440S	VERTICAL
W9CBE	41,825	239	25	5.0	L-2	4.5	ARGOSY	?
CHECK LOG - W6RCL								

HOOTOWL SPRINT 1993

STATE	CALL	SCORE	POINTS	SPC	POWER	BANDS	TIME	RIG	ANTENNA
ALL-BAND STATIONS									
NY	WA2VEZ	23,828	148	23	2	A-3	4	ARGO 509	ZEPP / VERT / QUAD
OK	W7BD	23,520	140	24	4	A-2	4	DELTA / MFJ-20	DIPOLE
PA	W3TS	19,000	40	8	.9 B	A-3	1	HB TCVR	YAGI / INV VEE
NJ	W2JEK	17,266	37	7	4 B	A-3	1	OHR / 2 FERS	GP, DIPOLE, HERTZ
40 METER STATIONS									
CA	KI6SN	7,100	42	4	.9 B	40M	2	HB SPIDER	DIPOLE
NY	WB2QAP	6,300	70	9	0.9	40M	1.5	ARGO II	INV VEE
CA	W6SIY	5,150	15	1	0.25	40M	2	TUNA TIN / HB RX	DIPOLE
CA	W6SKQ	2,971	37	3	1 B	40M	1	HB TX	SKELTON CONE
EQ	HC1CK	476	17	4	?	40M	4	?	?
20 METER STATIONS									
FL	N4FNG	24,255	165	21	4	20M	3	ARGO II	YAGI
CT	NM1J	7,100	71	10	1	20M	4	ARGO 515	YAGI
WY	AA7QV	3,386	43	9	4 B	20M	1.5	MFJ 9020	VERTICAL
OK	KA5J	140	10	2	5	20M	19M	ICOM 735	VERTICAL

SUMMER DAZE SSB SPRINT 1993

STATE	CALL	SCORE	POINTS	SPC	POWER	BANDS	TIME	RIG	ANTENNA
NY	KG2H	770	22	5	10PEP	80M	2	TS 690	DIPOLE
CT	WM1U	476	17	4	10PEP	80M	?	IC 735	G5RV
QUE	VE2XLT	473	15	3	10PEP	80/40	4	IC 728	LOOP / DIPOLE
7Z2	7Z2AB	28	4	1	10PEP	20M	1.5	IC 725	YAGI

SUMMER HOMEBREW SPRINT 1993

STATE	CALL	SCORE	POINTS	SPC	POWER	BANDS	TIME	RIG	ANTENNA
PR	KP4DDB	26,945	132	19	3.0	20M	4	K9AY TCVR	YAGI
OK	WD5GLO	16,718	93	18	3.0	A-2	2.5	HW-9/ HB TX, RX	YAGI / LOOP
WV	WF8X	8,190	78	15	4.0	20M	4	TS 120V	VERTICAL
MO	WAØOUI	7,450	35	8	4.0	20M	3	HB VXO TX/RX	80 M ZEPP
CA	N6WMF	3,010	43	10	?	20M	1.5	?	?
7X2 !	7Z2AB	1,344	32	6	5.0	20M	1.5	IC 725	YAGI (KBØEVM, OP)

CONTEST RULES

FALL QRP ARCI CW QSO PARTY

Date/time:
Oct. 15, 1994-1200Z through Oct. 16, 1994-2400Z

Exchange:
Member - RST, State/Province/Country, ARCI Number
Non-Member - RST, State/Province/Country, Power Out

QSO Points:
Member = 5 Points
Non-Member, Different Continent = 4 Points
Non-Member, Same Continent = 2 Points
Multiplier - SPC (State/Province/Country) Total all bands.

The same station may be worked on more than one band for QSO Points and SPC credit.

Team Competition:

Team competition of teams consisting of 2 to 5 members will be a separate category apart from individual entries. Team members will be listed as individuals and the team score will be the total of the member's scores. Team entry will be all-band only. The team captain must send a list of its members to the contest manager postmarked at least one day prior to the QSO party. Certificate awarded to the highest scoring team

Power Multiplier:
Ø-1 watt out = x 10; 1-5 watts out = x 7

Suggested Frequencies:

	CW	Novice
160 M	1810 kHz	
80 M	3560 kHz	3710 kHz
40 M	7040 kHz	7110 kHz
20 M	14060 kHz	
15 M	21060 kHz	21110 kHz
10 M	28060 kHz	28110 kHz
6 M	50060 kHz	

CALLING:
"CQ QRP, CQ QRP, CQ QRP DE N6GA, N6GA, QRP TEST K"

SCORE = POINTS * SPC * POWER MULTIPLIER

Entry may be an all-band, a single band, "HI-band" (20m, 15M, l0M, AND 6M) or as a "LO-band" (160M, 80M, AND 40M). All entries will compete against other entries in their own class of entry only. Certificates to the top 10 scores and to the top score in each single band, LO-band, and HI-band.

Certificates for the top score in each class in each SPC. The contest manager reserves the right to recognize special significant entries with a certificate award.

Entry includes a copy of the logs and a separate summary sheet. Include duplicate check sheets with entries of 100 QSO's or more. Indicate the total time-on-air, including time spent listening. All entries must include a complete, legible, name, call, and address. All entries must be received within 30 days following the contest. Late entries will be counted as check logs. Members indicate their QRP ARCI member number on all logs. Members and non-members indicate their input or output power for each entry and band. The highest power level used will determine the power multiplier. Output power is considered as 1/2 of the input power. During the QSO party, a maximum of 24 hours may be operated within the 36 hour time period.

Include a description of homebrew equipment, commercial equipment, and antennas used with each entry. A summary sheet and sample log sheets are available from the contest manager for an SASE with one unit of postage. Include an SASE with one unit of postage in the entry for a copy of the contest results. Results will be published in the next available issue of the QRP ARCI Quarterly. The final decision on all matters concerning the contests rests with the contest manager.

Send Entries To:
Cam Hartford N6GA
1959 Bridgeport Ave.
Claremont, CA 91711

QRP AFIELD-1994

QRP Afield–1994 is sponsored by the QRP Club of New England and is designed to encourage QRP enthusiasts to fieldtest their radio equipment using temporary antennas and non-commercial power sources.

Date/Time: Saturday, Sept. 17, 1994, from 1600Z to 2200Z
Exchange: QRP-NE Members: RST,
State/Province/Country, QRP-NE #
Non-Members: RST, State/Province/Country, Power Output
Definitions:
- Permanent Location: Any location using commercial power and/or permanently installed antennas.
- Field Location: Any location using battery/solar/natural power AND temporary antennas.
- Low Power QRP: Less than one watt output.
- High Power QRP: to 5 watts output.

Scoring (CW Only)
1 point for each contact from a permanent location using high power QRP.
2 points for each contact from a permanent location using low power QRP.
4 points for each contact from a field location using high power QRP.
8 points for each contact from a field location using low power QRP.
Note: All contest contacts MUST be made using the same location and power output.

Multipliers: Each State/Province/Country worked counts for one point. Multipliers may be counted only once regardless of band worked.

Awards and Results: Certificates will be awarded to the ten stations with the highest point totals. Complete results will be printed in 72 magazine. Results will also be available by enclosing a #10 SASE with the contest submission.

Address
Chester (Chet) Bowles, AA1EX
RFD 2, Box 335L
Sharon, NH 03458

MICHIGAN QRP CLUB
1994 LABOR DAY CW SPRINT

CW only. 160 thru 6 Meters (no WARC bands). The contest is open to all amateurs and all are eligible for awards.

DATE: 0000Z to 0400Z 5 September 1994. (2000EST Sun. 09/04/94 to 2400EST Sun. 09/04/94)

CLASSES: A - 250 milliwatts or less output.
B - One watt to 250 milliwatts output.
C - Five watts to one watt output.
D - Over five watts output.

EXCHANGE: RST, QTH (State/Province/Country) and MI-QRP Membership Number (non-members send *Power-output*).

FREQUENCIES: 1810, 3560, 7040, 14060, 21060, 28060, 50060 KHz.
Novice: 3710, 7110, 21110, 28110 KHz.

SCORING: Stations may be worked once per band for QSO points. All member contacts are 5 points. Non-member contacts in W & VE are one point. Non-member contacts outside W & VE are 4 points.

Multiply total QSO Points, on all bands, by the number of States/Provinces/Countries worked on *all* bands for total points. U.S. & Canada ***do not*** count as countries.

BONUS POINTS: Total points may be multiplied by 1.25 for homebrew RX or TX w/commercial RX or TX combinations. Multiply by 1.5 for a total homebrew station (HW-7/8/9 not eligible).

(Those using homebrew gear on some, but not all bands, may claim credit by listing the proper bonus points in each band's "BPts" column on the score sheet, adding them up and dividing by the number of bands used. Enter the average (round to two decimal places) in the "Totals" row, under the "BPts" column. I'll do this for you if you give me adequate rig info on each band).

AWARDS: Certificates awarded by class for each State/Province/ Country.

A legible, chronological log is required. Please include your name, call, address, equipment description and *POWER OUTPUT.*

Logs must be received by 5 October 1994. Please send an SASE for a copy of the results. Final decision on any contest matters rest with the contest manager.

All logs to: L. T. Switzer, N8CQA
654 Georgia Ave.
Marysville MI 48040-1243

Log and entry sheets available for an SASE to the above.

QRP ARCI SUMMER DAZE SSB SPRINT

Date/Time:
August 7, 1994; 2000 - 2400 Z

EXCHANGE:
Member - RS, State/Province/Country, ARCI Number
Non-Member - RS, State/Province/Country, Power Out

QSO POINTS: Member = 5 Points
Non-Member, Different Continent = 4 Points
Non-Member, Same Continent = 2 Points

Multiplier:
SPC (State/Province/Country) Total All Bands.
The Same Station May Be Worked On More Than One Band For QSO Points And SPC Credit.

Bonus Points:(homebrew equipment used any band worked)
BONUS: +2,000 HB TRANSMITTER USED
+3,000 HB RECEIVER USED
+5,000 HB TRANCEIVER USED

Power Supply Multiplier: (bonus multiplier)
x 1.00 - commercial power
x 1.25 - solar, natural, battery charged by natural

Power Multiplier:
Ø-1 watt out (0-2 watts PEP SSB) = x 10
1-5 watts out (2-10 watts PEP SSB) = x 7

Suggested SSB Frequencies:

160 M	1810 kHz	15 M	21385 kHz
80 M	3985 kHz	10 M	28385 kHz
40 M	7285 kHz	6 M	50885 kHz
20 M	14285 kHz		

CALLING: "CQ QRP, CQ QRP, CQ QRP DE N6GA, N6GA, QRP TEST K".

SCORE = POINTS * SPC * POWER MULT * POWER SUPPLY MULT + BONUS.

Entry may be an all-band, a single band, "HI-band" (20M, 15M, l0M, and 6M) or as a "LO-band" (160M, 80M, and 40M). All entries will compete against other entries in their own class of entry only. Certificates to the top 10 scores for the QSO certificates to the top 3 scores for the sprint. Certificates to the top score in each single band, LO-band, and HI-band. Certificates for the top score in each class in each SPC. The contest manager reserves the right to recognize special significant entries with a certificate award.

Entry includes a copy of the logs and a separate summary sheet. Include duplicate check sheets with entries of 100 QSO's or more. Indicate the total time-on-air, including time spent listening. All entries must include a complete, legible, name, call, and address. All entries must be received within 30 days following the contest. Late entries will be counted as check logs.

Members indicate their QRP ARCI member number on all logs. Members and non-members indicate their input or output power for each entry and band. The highest power level used will determine the power multiplier. Output power is considered as 1/2 of the input power.

Include a description of homebrew equipment, commercial equipment, and antennas used with each entry. Homebrew bonus points may not be claimed if a description is not included with the entry.

A summary sheet and sample log sheets are available from the contest manager for an SASE with one unit of postage. Include an SASE with one unit of postage in the entry for a copy of the contest results. Results will be published in the next available issue of the QRP ARCI Quarterly.

The final decision on all matters concerning the contests rests with the contest manager.

Send Entries To: Cam Hartford N6GA

QRP ARCI History, Purpose and Policies:

The QRP ARCI was founded in 1961 by the late Harry Blomquist, K6JSS, with the aim of reducing QRM on the air, by members voluntarily limiting their power to 100 watts or less at all times. Due to increasing interest in true low power operation, and through the leadership of then-president Tom Davis, K8IF, the Club voted in the late 1970's to redefine its purpose in that direction, and adopted the generally accepted definition of QRP as 5 watts output CW and 10 watts PEP SSB.

The voluntary 100 watt power limit was later abolished; members may run any legal amount of power necessary at any time, for any purpose, although the 5 watt limit should be observed when claiming to be operating QRP. Club awards and activities are geared to the 5 watt and under level. The QRP ARCI does not advocate the reduction of the legal power limits of amateurs in any country, and serves only to provide a forum for those who enjoy the thrills and challenges of building and operating with low power equipment. The QRP ARCI is a member of the World QRP Federation and maintains ties with various other QRP organizations.

The QRP ARCI publishes the QRP Quarterly in January, April, July and October. All contributions are welcome and should be directed to the appropriate editor or columnist. (No payment is made for material published. Unless expressly requested, manuscripts, drawings, pictures and diskettes will not be returned.) Except for those items with a copyright indication, material may be reprinted elsewhere if proper credit is given to the author and the QRP Quarterly. The products, projects, features and fantasies described are intended solely for the enjoyment of our readers. No testing has been done unless explicitly stated, and no warranties are intended nor implied. The QRP ARCI and QRP Quarterly in no way warrant any commercial or private offers herein unless expressly stated.

To promote on the air QRP operation, the QRP ARCI promotes the use of designated QRP calling frequencies, regular QRP nets, and a program of QRP operating awards and contests. Information on these is found in the QRP Quarterly from time to time. Detailed information on the awards program is available from the Awards Chairman. To join the QRP ARCI or renew your subscription to the QRP Quarterly, see the form inside the back cover.

Members' News

Richard Fisher, KI6SN
1940 Wetherly St.
Riverside, CA 92506

Winds of change for QRP ARCI

It seems that those of us who trek through The World of QRP get a collective shot of adrenaline as the last person shuts out the lights in the QRP Hospitality Suite at Dayton. People fortunate enough to have attended — and those of us who would have liked to — seem to get a little bit more pumped up about low power operation after the late-April/early-May gathering.

KI6SN
. . .Richard Fisher

QRP Big Guns and lesser-knowns alike carry a renewed enthusiasm for low power operation away from Ohio. And that energy is parceled out to the legions of other QRPers who couldn't make it to Dayton.

This year, with major changes in leadership at the highest levels of QRP Amateur Radio Club International, and with lots of people talking about new directions and more activity in the club, never has it been more important to get involved in this organization.

Winds of change are blowing across QRP ARCI, and the more voices heard during this pivotal period, the better. With fully more than a dozen active QRP groups across the country and beyond, QRP ARCI is in a period of healthy soul-searching.

If you've got a vision for a better QRP ARCI, let your ideas be known. A listing of the board of directors, officers and QRP Quarterly staff members are regularly carried in these pages. Letting them know what you're thinking is one way of assuring that a good and highly respected organization get *even better.*

— R. E. F.

Good things in small QRP packages

Dean Hemphill, KC5NG, of Lake Dallas, Tex., has news of his success with a small transceiver.

"It's based on a **Dave Benson, NN1G,** 20 meter transceiver (See QRP Quarterly, Jan. 1993), which I built from a **Danny Stevig, KA7QJY,** kit. I added a Curtis keyer, an op-amp audio filter (a copy of my MFJ-9020's optional unit), and a relative RF output meter from a junked HyGain CB radio using a simple diode detector.

"Maximum RF output is about 1.5 watts. The front panel is made from thin sheet aluminum, and the enclosure is a steel 3-inch by 5-inch file card box with a flip-top lid.

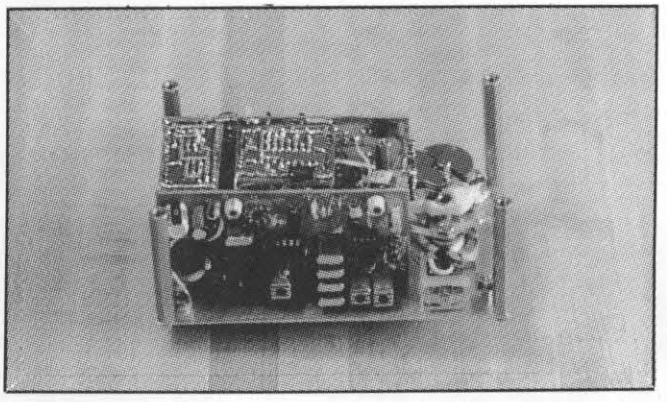
"The NN1G rig is easy to operate and performs very well. The QSK is great, and the sine-wave sidetone is easy on the ears. The VFO (as I have set it up) tunes from 7.010 to 7.070 MHz, and dial calibration is surprisingly linear.

"The receiver is quiet, sensitive, and selective, and the LM-386 audio amp provides plenty of volume for speaker and headphone use. Power consumption is very low, so the set will run for hours on a small 12-volt battery pack.

"It's perfect for portable operation. In fact, I often use it 'portable' from my easy chair. I connect a 50 foot extension to my antenna feedline, then carry the transceiver, battery pack, Bencher paddle and logbook to the living room, plug it all together and work 20 meter CW in reclined comfort.

"I'm very happy with the operating results. Using my ground-mounted Butternut HF-6V vertical antenna, I've worked stations all over the continental United States, Hawaii and Canada — plus DX stations in Europe, South America, and the Caribbean. I consistently receive good tone and clean keying reports from everyone.

A label on a 20 meter CW transceiver, top, built by Dean Hemphill, KC5NG, of Lake Dallas, Tex., tells the story succinctly: "BIG FUN COMES IN SMALL BOXES." The card box enclosure houses, below, an NN1G transceiver, a Curtis keyer, an op-amp audio filter, and a relative RF output meter.



"Just for fun, I took the rig with me to the monthly outdoor hamfest a few months ago in Forth Worth. I had it sitting in the back of my truck (to show it off). Many folks passing by my tailgate — especially the newer hams — had never seen a tiny home-built rig like this before.

"The oldtimers and newcomers alike were quite impressed when I plugged the rig into the cigar lighter and my bumper-mounted Hustler antenna, answered the first CQ that I tuned across, and ended up having a nice chat with a W4 station near Atlanta.

"Many of the newer hams had no idea that any modern hams still build their own equipment — 'They used to do it back in the *old days,* didn't they?' And the oldtimers were glad to see that some of us still do.

"A few of the newer hams had never heard of QRP. They couldn't imagine anyone using less than 100 watts on HF.

"To my great surprise, one brand new codeless technician didn't know that United States hams are *allowed* to build their own equipment! This was incredible. Who in the heck was *this* guy's 'Elmer?'

"I do have two complaints that I must mention. First, the

VFO drifts quite a bit from a cold start. It eventually stabilizes after about a half hour warm up. Second, WWV bleeds through the 10 MHz IF and is audible in the background. It doesn't interfere with reception — it's just a bit annoying.

"KA7QJY's kit costs $59.95, plus shipping. It includes the two PC boards, all board-mounted parts, a volume pot, a VFO tuning capacitor, and a nice Jackson drive.

"The enclose and connectors are 'builder's choice.' The high quality PC boards are plated, pre-drilled, and silk screened. Unfortunately, the documentation is really weak, which could make it difficult for the beginner to build the kit."

Milliwatting the QRP nets

Mike Czuhajewski, WA8MCQ, of Severn, Md., writes that he continues "to have fun checking into the Saturday morning QRP net on 7.040 MHz with *real* QRP, under 100 milliwatts — usually *way* under.

"A check of the log for 1993 shows that I checked in with net control **WA1JXR** (Louis Algieri of Lancaster, Mass.) nine times with 55 milliwatts and less. In fact, six of those were with 11 milliwatts and under, as low as 3 milliwatts. I've been doing this for several years.

"In the first two months of 1994 I've checked in with 15, 3, 3, 2 and 1.6 milliwatts. In fact, on one of those 3 milliwatt mornings nearby **WO3B, Bob White,** (of Pasadena, Md.) checked in with 11 milliwatts with his HW-9 cranked all down all the way. After my milliwatt-preaching, he's looking into buying some attenuators to go even lower.

"Greg is 350 miles away. Over the years we've qualified for the 1,000 Miles Per Watt Award at least two dozen times with my QRP check-ins.

"Remember, it's given for receiving as well as transmitting. The most fun is doing it with under 10 milliwatts, and sometimes I almost feel cheap and dirty if I have to go much higher to make it!

"I've also checked in with similar powers to other net control stations between here and Greg's QTH.

"I've always contended that while anyone can crank down the rig, and even slap attenuators on the output — which I do — it takes skill, as well as good equipment and antennas, for the other person to hear it. The other guy does the real work!

"As always, the QRP nets are a good place to have some fun with milliwatts, where people *expect* puny signals!"

QRPp on Top Band

Leighton Smart, GW0LBI, writes from Trelewis, Wales, that he's "been quite busy here as far as radio is concerned, getting back to milliwatting on Top Band (160 meters) again.

"I have increased the earthing system here quite considerably, with buried radials, tuned ¼ wave counterpoise, etc., and I have been having great fun on 160 meters with just one watt, and less.

"I worked LX (Luxembourg) last night for my 16th QRP DXCC country on Top Band in just a couple of months," Leighton says. "I have been working with both SSB and CW at one watt output, and I'm pleased with the results so far.

"In fact, with one watt SSB I have found very little difference in my reports when I have gone QRO up to the full 5 watts. I hooked up a new microphone to the FT747G to get better talk power.

"Actually, it's just a power amplified mike which I took off a CB rig, but with it I have found that I can run very low power on sideband, and still get a good level of audio out at the same time, even down as low as 100 milliwatts PEP. The standard mike I had with the rig was useless in this respect.

"On a number of occasions I've received 58 reports at the one watt level on 20 meters — and good ragchews, too. Not quick rubber stamp contacts, which is one thing I dislike about amateur radio.

"So, that's the answer to QRP SSB — get a decent microphone!

"I'm rather fond of QRP SSB as you have probably guessed, and would like to see — or hear — more of it on the bands.

"My total score for Top Band QRP with up to five watts is now 42 DXCC countries. I guess I'll never get 100 DXCC, so I'll be happy when I get to a half century.

"One last thing, though. I have noticed an increase in the number of stations using QRP on Top Band this winter. It's good that they are coming on the band at last. Over here in Europe they all seem to be 80 meter-only stations. So I must admit it's nice to hear some QRPers venturing onto Top Band. I hope it's a sign of things to come!"

Going mobile for the Fall QSO Party

Jim Fitton, W1FMR, of Salem, N.H., says that he "had a ball in the ARCI QSO Party operating from the car.

"I grabbed an ancient Butternut vertical and headed for a spot scoped out the previous fall. Located on a salt tide river on the Massachusetts/New Hampshire border, it is a brackish basin about 1,500 feet across, facing west.

"I set the vertical in an open fence post and could hardly hold it because of high winds, but I got lucky and it went up without incident.

"Six various lengths of radials were attached and the feedline was fed through the open car window. I tried to run the Nor-Cal-40 using lantern batteries, but the audio was low and wind noise and QRN so high I could barely hear stations.

"After switching to the Argo 509 and a gel cell, was able to copy stations easily on the rig speaker."

Jim writes that it "was beautiful, peaceful and cozy, sitting in the sun-warmed car, looking across the river inlet at the white-caps whipped up from the wind and following the flight of seagulls hovering and diving at invisible carrion on the river.

"The mystical and weird shapes of the Seabrook Nuclear Plant buildings looked especially calm, and I wondered if the QRN was due to internal atomic explosions occurring within the plant.

"Stations were worked at the rate of about five-per-hour — not too shabby considering the portable location and miserable band conditions. The only Internet QRP club stations worked were **Jan Heise, WA4VQD,** (of Indiatlantic, FL) and **Bill Kelsey, N8ET,** (of Findlay, OH).

"Bill and I made a sked for 80 meters, but I needed time to put a matching coil on the vertical for 80 and after that the SWR was horrible.

"I heard and called Bill but could not get him. About the same time, a ham, seeing the Butternut flailing around in the gale, wandered by and we introduced ourselves. **Jim Hatch, AA1FR,** (of Manchester, NH) helped my put up a long, low wire for 80 meters. By that time N8ET had disappeared, but I worked three stations on 80.

"Since Jim and I now were spending more time chatting in the car than operating, I decided to dismantle the station and head for the Blarney Stone Tavern for a couple of Murphy stouts, and call it a night.

"All in all, a memorable time, and just enough stations were contacted."

Log of W1FMR

Location: Hampton, N.H., outdoors near a fishing village.

Power: 3 watts, battery

Rigs: Argonaut 509, NorCal-40

Antennas: Butternut vertical, end fed wire

Operating time: 8.5 hours, Saturday 11:30 a.m. to 8 p.m. EST.

Stations worked: 39 (26 with QRP ARCI members)

Best DX: Wyoming, North Dakota

Bands: 80, 40, 20

SPC: 21

The Bantam
1-Watter takes centerstage against the backdrop of a vintage Hallicrafters SX-25 receiver in the QRP shack of Tom Calantonio, WB3HLH, of Rockville, Md.

'The Bantam 1-Watter' revisited

Tom Calantonio, WB3HLH, writes from Rockville, Md., that "while reading the Members' News in the July 1993 'QRP Quarterly,' I noticed a familiar circuit — 'A Bantam 1-Watter' from the January 1948 QST.

"This circuit also appears in 'History of QRP in the U.S., 1924-1960' by **Adrian Weiss, W0RSP,** which is where I discovered it.

"In March 1992 I built the circuit on a small craft board. I use it mainly on 40 meters and have worked 21 states and VE3 on this band.

Tom says his best DX has been California. "**WB6CZJ** (Paul Rink of Cloverdale, CA) gave a report of 449." He earned the 1,000-Mile-Per-Watt Award (No. 1412) as a result of the contact.

"Battery voltage on the 1S4 plate is 112 volts," Tom writes. "Antenna used is a ground-mounted Butternut HF2V vertical. Power output to the antenna is about 750 milliwatts.

"This little transmitter is used mainly with my Hallicrafters SX-25 receiver — something has to heat the shack! The 1S4 tube can't!"

Tom says that "casual and relaxed operation is the key to success with flea power transmitters. Hats off to **W4BIW** for a good circuit!"

Goodie Giveaway

This quarter's Goodie Giveaway features **a set of matched 12 MHz crystals,** suitable for an IF filter. They're matched to within 25 Hz and come compliments of **Pat Bunn, N4LTA,** of 624 Kits in Spartanburg, S.C., and a great friend to QRP homebrewers.

The winner? It's **Dean Hemphill, KC5NG,** of Lake Dallas, Tex. A tip of the QRP hat and a sincere "72" to him for his submission.

Here's hoping lots of Quarterly readers will take a moment to drop a card, letter or photograph to MN for the next issue.

You'll automatically be in the running for next quarter's Giveaway.

Items for the Members' News column should be sent to Richard Fisher, KI6SN, 1940 Wetherly St., Riverside, CA 92506. Photographs — either black and white or color — are welcomed. Please include a self addressed, stamped envelope if you would like pictures returned.

Keeping in QRP contact

Part of the fun and fascination of QRP comes in hearing of the experiences, challenges and success of others. And telling your story is part of that natural process.

Why not drop a card, letter or photograph to Members' News? Jotting down a few lines takes only a few minutes. Putting it in the mail is painless, and the camaraderie it invokes in the QRP community is a substantial payback.

Here's the only mailing address you need:

Richard Fisher, KI6SN
Quarterly Members' News
1940 Wetherly St.
Riverside, CA 92506

IDEA EXCHANGE

Technical Tidbits for the QRPer

by Michael A. Czuhajewski WA8MCQ
7945 Citadel Drive
Severn, MD 21144

In this edition of the Idea Exchange:
Good Idea: Try Nor-Cal QRP, WA8MCQ
Eating Half a Crow on the HW-8 Key Jack, WA8MCQ
Better Bandspread for Ramsey Receivers, N9JCV
BewareE "Yellow" Cores in Power Supplies, WA8MCQ
Receiver Potpourri–Hiss, AGC, Mute, WU2J
Ramsey QRP-20 Moves to 15 and 17 Meters, KJ5TF
Setting VFO Tuning Ranges, KE2WB
More MFJ 90XX Info, AA8HV
Joe's Quickie #10: Ground Plane Antenna, N2CX
More Useful Old Test Equipment: Tektronix 130 L/C Meter, WA8MCQ

GOOD IDEA: TRY NOR-CAL QRP

Not exactly a technical tidbit, but still a VERY good idea for you–check out the Northern California QRP Club. It was started in June 93 by **Doug Hendricks, KI6DS** (who does the QRP Quarterly reprints) and **Jim Cates, WA6GER.** They were soon joined by **Wayne Burdick, N6KR,** as their technical guru. Those of you on the packet BBS system have probably seen some of the bulletins they've put out.

I finally got around to signing up for their quarterly, QRPp, and I was quite impressed with it. It's about the same size as SPRAT–an 8 1/2 X 11 sheet of paper folded in half. The March 94 issue is the largest yet, at 70 pages, or 35 sheets of paper–and the type isn't that big, either. It's stuffed! What I'd heard was true–there's a lot of good QRP info here.

The March index lists 59 articles, ranging from long to very short. They cover operating, reviews, technical, of which some (but not much) has appeared in other QRP magazines, some simply letters from members, and most of it pretty good. How's their growth? They were formed in June 1993, and my member number 10 months later is 387! This looks like it might be one of the regional QRP groups to keep an eye on, and it's definitely worth looking into.

At the moment, they want only $5 a year–that's an attempt to break even. These folks aren't in it for the money, that's for sure, and some day they'll have to raise it, but even when they do it will still be a really good value. If interested, you can write to Jim Cates, WA6GER, at 3241 Eastwood Rd, Sacramento CA 95821 (include an SASE), or just go ahead and send the $5. (And Doug offers photocopies of the first three issues for $10 postpaid–write to him at 862 Frank Ave, Dos Palos, CA 93620.)

–DE WA8MCQ

Correction

Revenge of the Old Printer? In the April Idea Exchange the "u" somehow got deleted from every uF, uH and uV, throughout the entire column. Don't know how it happened, but the typesetter will pay better attention in the future.

EATING HALF A CROW ON THE HW-8 KEY JACK

From me, WA8MCQ–In the last column I said that the HW-8 key jack is reversed, that they tell you to wire it like that and that the schematic shows it that way. I was half right, so I'll take half a helping of crow. The schematic does show it the way I said, but they don't necessarily tell you to wire it like that. I looked at the assembly instructions, and they have you wire it one way or the other, depending on what type of keyer you use. They also note that it can be used either way with a straight key. The bottom line: check your HW-8 key jack, and rewire it if you deem necessary.

–DE WA8MCQ

BETTER BANDSPREAD FOR RAMSEY RECEIVERS

From **Bruce Williams, N9JCV** of Lake Villa, IL–I built a Ramsey 40M receiver but was unhappy because of the bandspread. I modified the value of C4 as the manual states so I could decrease it. If you build it according to specs, it tunes approximately 300 KHz. By changing C4 I was able to decrease that to about 60 KHz, but that was still too much for one turn of the pot for me to comfortably tune in QRP CW. My idea was to replace R2, the tuning control, with a ten turn pot. Bingo–now I have 60 KHz over 10 turns and can really fine tune stations.

–DE N9JCV

BEWARE "YELLOW" CORES IN POWER SUPPLIES

From me, WA8MCQ–Switching power supplies have been with us for quite a few years now, and a lot of them are showing up in junk piles and at hamfests. You might get excited if you spot one and see a yellow toroid on it–that's a type 6 powdered iron, and in great demand for homebrewing. Unfortunately, that "yellow" core is probably something entirely different. Look it over very carefully–I can almost guarantee that while the core is yellow on one side and around the edge, the other side probably has a white ring on it. That's type 26, with ui of 75 and a low-Q material. It's intended use is for things like DC chokes and AC line filters, and mostly unsuited for QRP building. In all my years of scrounging I've yet to see a "true" yellow core (type 6) on a switching supply.

–DE WA8MCQ

RECEIVER POTPOURRI–HISS, AGC, MUTE

From a Frequent Contributor, **Byron Weaver, WU2J** of Palm Bay, FL, a variety of receiver topics.

1. Hiss-Hiss. [Regarding earlier discussion of hissy amplifiers] Investigation indicates that the hiss does not come from the LM386 audio amp IC. LM380s were compared and if the gain were the same the hiss is present in the same abundance. David Limmer's Quiet Audio Amp for DC Receivers (SPRAT #66) was also built and compared. Using 3 transistors and a bunch of other components, gain is about the same as the simpler LM386 chip and his circuitry limits the high frequencies (thru feedback), promoting the lows.

Little is gained as the same approach to the LM386 yields equal or better results. My simpler approach for SSB reception uses less parts than the N6KR method (Hints & Kinks, QST for November 91) without reducing gain as much. (Always send signals to the LM386 on pin 2, the inverting input.)

2. Frequent flyers might consider the higher impedance headphones used by the airlines. Rewired in parallel, an impedance of 130 ohms is obtained on a nicely cushioned pair of AA earphones. For the same audio output level (loudness), the hiss is very much down. (AA is not Eastern Airlines.)

3. The RX board for the NN1G superhet transceiver (FAR, as well as Dan's Small Parts & Kits) is a good general purpose board for homebrewers. Used in an SSB XCVR the following AGC changes were appreciated. AC4RU (XYL, a former nurse) always notices how many senior citizen hams have hearing aids and recommends this one to save your (& hers) hearing.

Diode D1–select a 1N34 for lowest voltage drop using minimum voltage for test (minimum current). Some DMMs (like the Heath 2372) provide too much current in comparison to, say, a Krista 30B-130. Simpler to use a battery, pot and fixed resistor and measure voltage drop across the diode. British CV 5853 germanium diodes worked much better than the 1N34s from Radio Shack (they have lower voltage drop). Silicon Schottkys drop too much voltage.

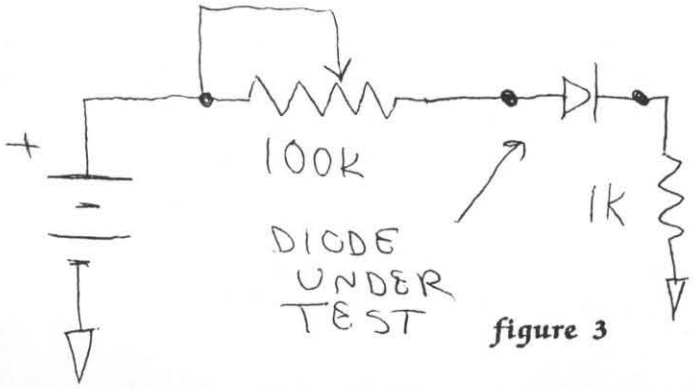


figure 3

4. MC1350 Mute Circuit (Used when a crystal filter is shared by TX and RX). You'll notice there is no hiss when the MC1350 is muted, no thump either, hence the LM386 is not the culprit! The emitter resistor of 75 ohms gives approximately 14 mA at 13.3V (assuming 13.8V supply) to the MC1350. (That's right, the mute cuts the voltage to pin 2, the VCC pin.)

5. Mizuho Mute for LM386 uses a positive voltage. I tried this one with +7V and 2.2M in series with 4.7M and although V was around +1.6V initially with only 2.2M, added megohms brought it down to 0.5V or less and no thump. (A parts count reducer.)

6. Mizuho attenuator mod–Change the small 10K resistor (it's overkill and even promotes breakthrough) to 2.7K, or something between 1.5K and 3K. It's equivalent to about 12 dB attenuation of the incoming signal.

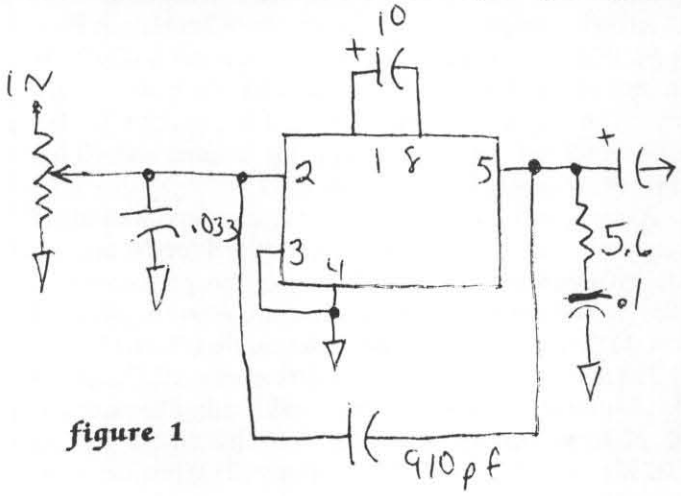


figure 1

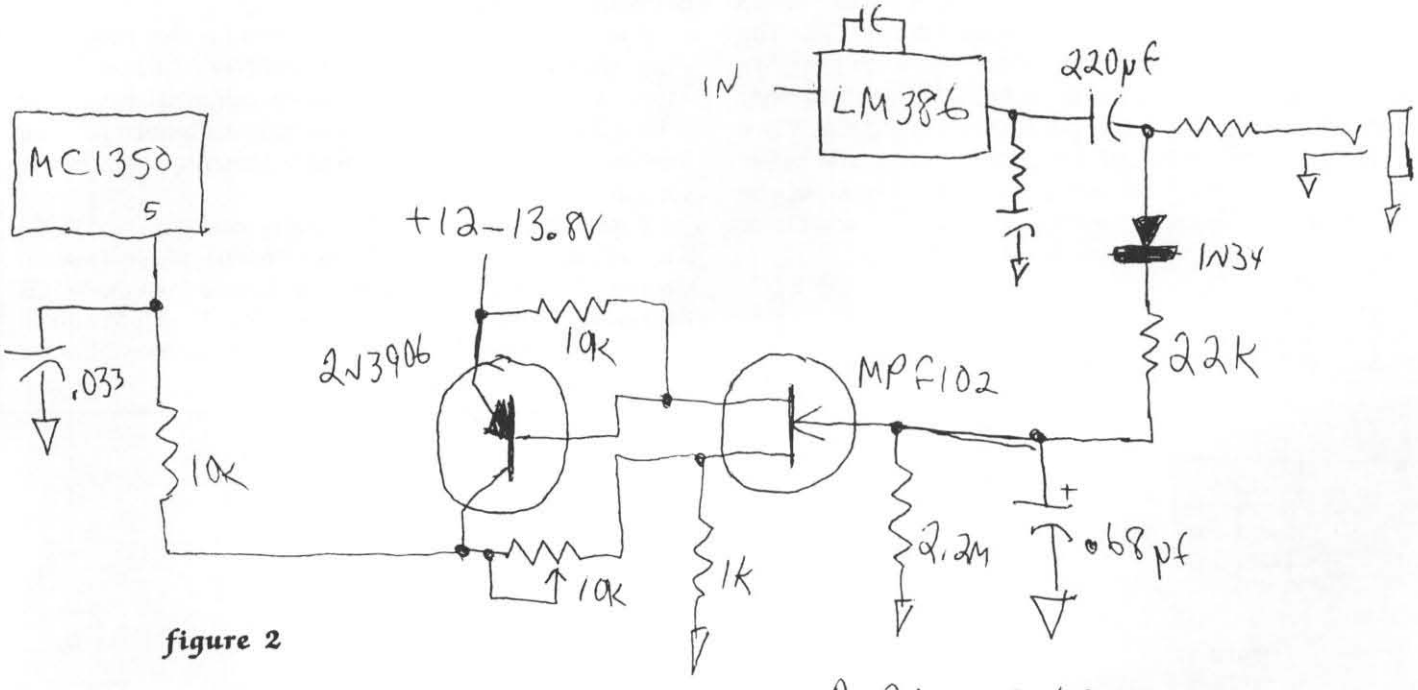


figure 2

2.2M & 0.68NF SETS TIME CONSTANTS; YOUR CHOICE

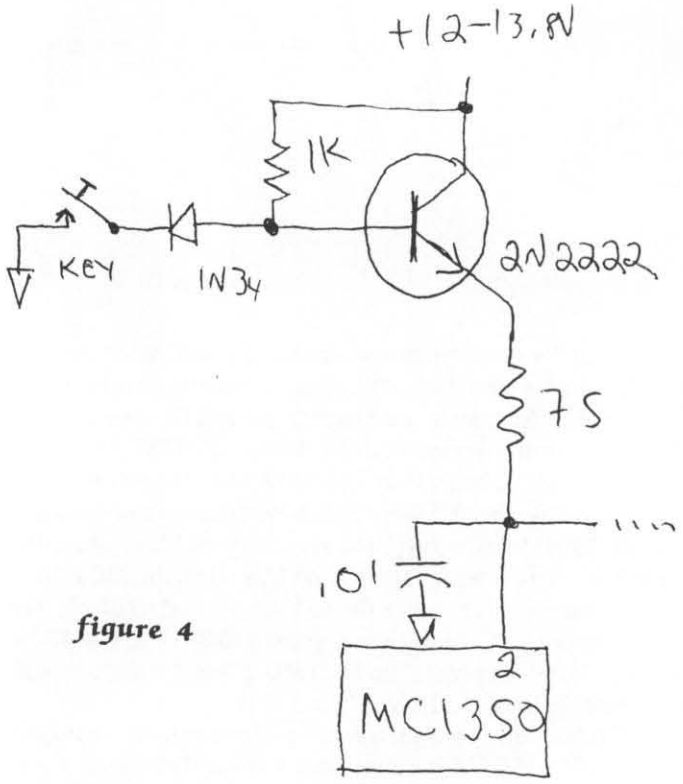


figure 4

7. A correction: In the 3rd paragraph on page 22, October 1993 Quarterly, in my "Tips on VFO Stability," it should be 47 ohms, not 47K, across the output coupling capacitor.

8. Final Thoughts: The LM386 is a high gain, wide bandwidth audio amp and while the LM380 can be filtered easier, it lacks the gain to amplify the hiss. I'd rather have the gain. If you turn off the BFO the hiss disappears, the same as turning off the MC1350. You lack one of the signals needed by the second conversion stage. We must filter after a product detector or limit the high frequency response of the audio amp if it's a good 'un with high gain. With a 10K audio pot, I prefer a 0.22 uF capacitor to ground at the output of the second NE602 on pin 4 rather than a 0.1. There's plenty of gain in the system so nothing is lost on the weakest signals except some hiss.

–DE WU2J

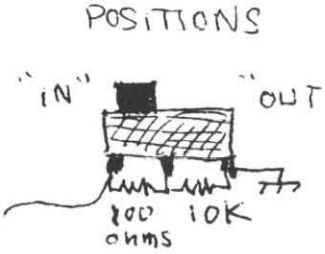


figure 6

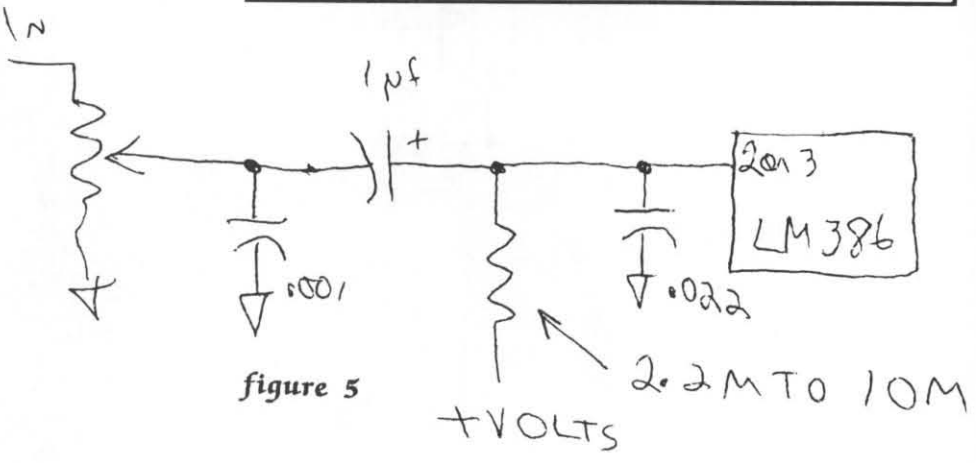
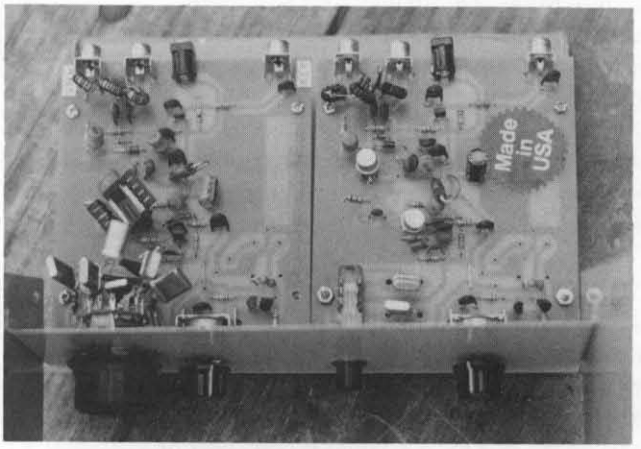


figure 5



RAMSEY QRP-20 MOVES TO 15 and 17 METERS

A continuing QRP modification saga from **Jim Hale, KJ5TF** (ex-N5WSZ) of Kingston, AR–I bought a Ramsey QRP-20 CW transmitter kit and put it on 15 meters with help from VE7DJI. Why? A Novice needs a good HF band to practice CW. Ten meters is all but gone, 80 needs a big antenna and 40 has drawbacks from megawatt AM stations.

A frugal new ham comes across the Ramsey line, with 80 and 40 meters, but no 15M available. I got on 40 and got CW practice while having a blast, but contacts were only a couple states away. A Novice can have even more fun working CW on 15, which has the best DX, and requires smaller antennas than 80 and 40.

Just replace the 220 pF output filter capacitors C17 and C18 with 150 pF and remove some turns from L6 in the filter. It comes with 22 turns; remove all but 13. We replaced Q3 with an ECG295 or MRF472. You will have to order 21 MHz fundamental crystals, of course.

I'm on 21.110 and 21.140. Ever wonder what you can do with less than a watt? I had a nice chat with NH6JC in Hawaii with an output of about 750 milliwatts into my 2 element quad. I'd like to have suggestions from folks who have had similar fun with Ramsey kits. How can it be improved or dressed up? For now I've got it in a plastic VHS tape box.

Later: bought another QRP-20 and ordered 18080 and 18090 KHz crystals from JAN. I used a 2N3866 final, and built a seven element 17M filter. Component values came from the W1FB Design Notebook, chosen between those for 15 and 20M. I called CQ and minutes later I had two QSOs, the second one with a ham in Costa Rica! *(continued on next page.)*

[Ramsey rig continued...]

How can I improve the other stages for best efficiency and output for 15 and 17M? Has anyone put a VFO on a Ramsey QRP transmitter? I would enjoy hearing from others who have done any mods on Ramsey QRP transmitters and HR receivers.

Still later: Other options for the output transistor are 2SC1017 CB radio output transistor, and the NTE299, although the latter didn't have the power when asked to work on 15/17M. The overall winner is the 2N3866. It may also be better than the stock 2N3053 if you actually use your QRP-20 on 20M.

My latest project was a two band Ramsey 15/17M transmitter. One socket has a 21.120 crystal and the other 18.090. The seven element 15M output filter takes care of harmonics above 21.4 MHz. Operating the two bander is really a blast! The JAN crystals cover about 12 KHz on 17 and 16 KHz on 15M. This is not like 30 or 40M with only 3 or 4 KHz swing.

My little Ramseys are tucked away in Radio Shack metal cases now, with knobs and looking pretty good. I've worked Hawaii, France, South and Central America, Antarctica, Hungary, Bahamas, Cuba and Alaska with my one watt, two band Ramsey. If you hear me on the air, you might notice a minor frequency variation. I'm $30,000 away from power poles and running on batteries. The voltage can change some if a cloud passes by and the solar array is eclipsed!

–DE KJ5TF

SETTING VFO TUNING RANGES

From **John Jarvis, KE2WB** of Augusta, GA–

A sometimes vexing problem in building a VFO is getting it to tune the desired frequency range. Setting the frequency at one end of the tuning range is easy enough. Setting the desired frequency spread is somewhat more difficult. The change in capacity, ΔC, of the main tuning cap is a given; if it's range is not stated in a catalog, it can be measured. Here is a simple procedure for choosing the VFO inductor and minimum capacitance so the given change in capacity will tune between Fmin and Fmax.

First, calculate the value of A, here the square of the ever-present constants in the resonant frequency formula chosen so the units are MHz, pF and μH.

$$A = 10^6 / (4\pi^2)$$

Then the required inductance and total minimum capacitance are calculated:

$$L = (A/\Delta C)(1/Fmin^2 - 1/Fmax^2)$$

$$Cmin = A/(L*Fmax^2)$$

As an example, I had a capacitor with a range of 4-18 pF giving a ΔC of 14 pF. I wanted the VFO to tune the CW portion of the 40M band: Fmin = 7.00 MHz and Fmax = 7.15 MHz. The calculation gives l = 1.53 μH and Cmin = 324 pF. I wound 13 turns of #28 wire, tapped at 5 turns, on an Amidon L57-6 coil form and added 250 pF of NPO caps in parallel with the VFO tuning cap and a trimmer. The VFO adjusted to the desired tuning range.

If the tuning range is too small, decrease the trimmer and adjust the inductor to bring the VFO frequency down to the desired value. Obviously, if the tuning range is too large, reverse this procedure.

These formulas will give answers for any combination of the frequencies and ΔC. Before constructing your VFO be sure the resulting values are reasonable.

These formulas are obtained from the standard resonant frequency formula. Two equations are written, both using the same value of L. In the first equation, Fmax and Cmin are used. In the second equation Fmin and Cmin + ΔC are used. This is a classical case of two equations containing two unknowns (L, Cmin) which are solved using ordinary algebra. Since ΔC is fixed and there are two frequencies that must be matched, it is necessary to determine both L and Cmin simultaneously.

–DE KE2WB

MORE MFJ 90XX INFO

Joseph Falcone, AA8HV of Southfield, MI, publishes the MFJ NINETIES newsletter, with info for those radios. Here are the mods from the January 1994 issue, which he credits to **Stan Kozlowitz, AA5XO,** MFJ's Customer Service Rep–

Revisions for MFJ 9040 to prevent frequency drift–these mods apply to Rev 1 through Rev 4 boards, and the mods are included in recently sold 9040s. a) Replace C33 and C34 with multilayer types (330 pf). It is the polystyrene type in older 9040's. b) Place a 10K resistor in parallel with L4 and L5. (Lowers the Q factor of the coils.) c) Short the Y6 crystal to TX1 (can to can).

Revisions to raise transmit level of all 90 series transceivers: a) Replace C23 with 0.1 uF ceramic disc capacitor (was 0.01 uF). b) Replace C24, C25, C26 and C64 with silver mica capacitors. For 9040 use 470 pF, 9030 use 330 pF, 9020 use 220 pF, 9017 use 180 pF, 9015 use 150 pF. This raises the TX output by 1/4 to 1/3 watt (varies with transceiver).

Revisions to raise audio level on all 90 series transceivers: Replace R27 with jumper. This revision does not require retuning of the RX IF coils, and should increase volume a considerable amount.

–DE AA8HV

JOE'S QUICKIE #10: GROUND PLANE ANTENNA

From **Joe Everhart, N2CX** of Brooklawn, NJ, the second-most prolific contributor to the Idea Exchange–Here's a Quickie that's been an Old Reliable for most of my hamming since the early 60's. It's a simple, cheap and surprisingly effective VHF ground plane antenna. Made from readily available material, it can be one of the lowest cost ways of improving the performance of a 146, 220 or 440 MHz HT. (Of course we QRPers don't need anything more than an HT–do we?) It's worlds better than the usual rubber duck, and I'll tell you how to make it even more effective later.

I've used it lots over the years, but not much lately. It came to mind recently while teaching an antenna course at work. The first part was the usual theory business, but I wanted some hands-on to get the students involved. A GP antenna was a sure bet for something simple to build, use and measure.

The ground plane antenna is a handy vehicle for demonstrating a number of practical antenna issues. After paper design, we modeled it using ELNEC. Its impedance and SWR were calculated around the design frequency. This allowed demonstration of the VSWR bandwidth of the antenna and the fact that the SWR is lowest at resonance. With the model, element lengths were then tweaked from the design values to get resonance at the desired frequency. The antenna was first modeled as a vertical element with a horizontal ground plane. Since this is kind of a half dipole the impedance is about 36 ohms, half the dipole value. Next the radials in the model were bent downward, making a vertical dipole. This resulted in a feed impedance of 72 ohms. Finally, the angle of the radials was adjusted between these two extremes. At about 45 degrees, the antenna is a good match to 50 ohm cable! In other sessions, the real antennas were built and adjusted while measuring SWR.

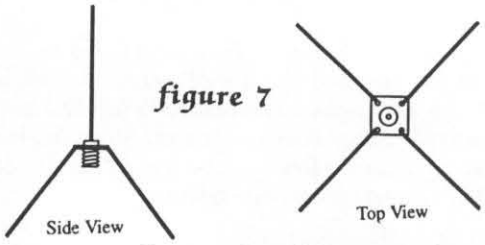


figure 7

Back to our antenna. Construction of the antenna is very simple. First get the materials. They are nothing more than some ordinary 12 gauge soft-drawn electrical wire and a chassis mount UHF female connector–also called an SO-239. You may have the wire around the shack, or can get it for a few bucks at most. The connector is available from Radio Shack if your junk box is lacking (RS 278-201). *[Try a local hardware store for the wire–buy a few feet of 12 ga. electrical cable. -WA8MCQ]*

Figure 1 shows its makeup. The SO-239 is turned upside down and the radiating element is soldered to the center conductor solder cup. Four radials are used to establish the ground plane. They can be soldered directly into the mounting holes of the connector. Or, for an antenna that can be "broken down," solder each radial to a lug and connect the lugs to the SO-239 holes with machine screws and bolts. An even more sophisticated incarnation is to mount the SO-239 on a stiff brass L bracket for mounting to a mast. The radials can then be soldered directly to the mounting bracket.

The radiating element and each radial is a quarter wavelength long. 12 gauge wire is (barely) stiff enough for two meters and fine for higher frequency bands. The old standby rule of thumb I use is L = 2808/F, where L is the length in inches and F is the desired frequency [in MHz]. This makes the elements slightly long so that they can be cut to frequency. Cut the elements to this length AFTER they are mounted. I measure the length from the closest metal of the connector to the end of the element.

Dimensions are surprisingly non-critical. Computer modeling using ELNEC gives a 2:1 SWR bandwidth of about 10%. This is about 14 MHz at two meters! If you want to get the lowest possible SWR follow the following process.

First find the resonant frequency. This is where the SWR is the lowest. Don't worry if it's not 1:1 at the low point–we'll fix that later. Next cut each element slightly to raise the frequency. At two meters cut off no more than a quarter of an inch at a time. Repeat until you are close enough to your operating frequency. Remember that the darned thing is about three times a wide as the 2M band! Finally, adjust the vertical angle of the radials to get the absolute lowest SWR. With patience you can probably get 1:1, but anything below 1.5 is fine.

PS–one interesting fallout came from the lab exercise. Some of the antennas showed SWR bandwidths of almost 20%. Careful plotting of the curves showed that they were not smooth curves, but showed ripple. Physical measurements revealed that the radial lengths varied slightly. This causes a kind of stagger tuning of the antenna. Heaven knows what this does to performance, but it keeps the SWR low.

The simple ground plane isn't a gain antenna by any stretch of the imagination, but it is quite a few dB better than the rubber duckie on your HT. To make the antenna even more effective, put it up in the air 15 or 20 feet. The additional line of sight distance can give your low power rig far more range than you'll get with the duckie. One boy scout leader friend of mine carries his ground plane folded up in his back-pack along with 20 feet of RG-58 and some fishing line. When he sets up camp he unfolds the antenna, loops the fishing line over a high tree branch and raises the quickie ground plane. It helps him keep in touch with the home repeater much more easily.

One final wrinkle–you can use the antenna with your dual bander HT! Since the 440 MHz band is about the 3rd harmonic of the two meter band, the antenna will work as a quarter wave on two meters and as three quarter waves on 440. Since it is so broad band you can probably find a compromise length that gives pretty good SWR on both bands. The loss of gain over a quarter wave antenna is compensated by the convenience of not needing another antenna.

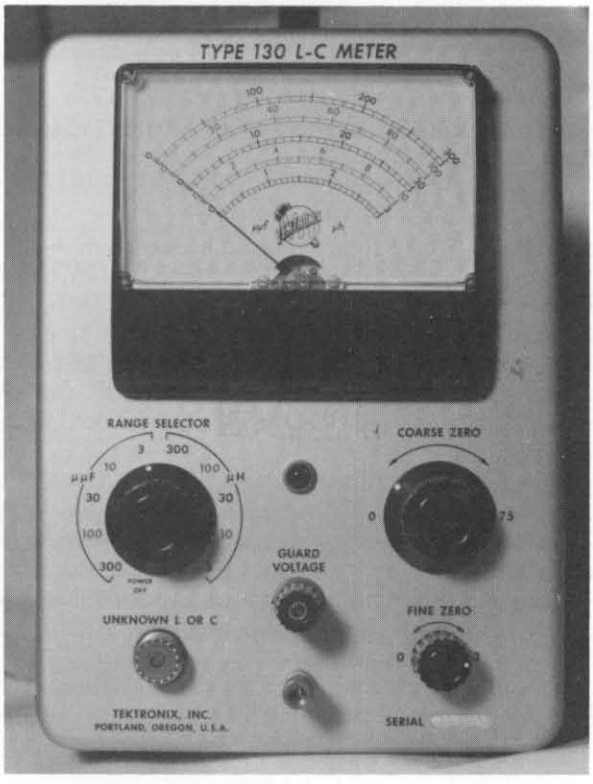
–DE N2CX

MORE USEFUL OLD TEST EQUIPMENT: TEKTRONIX 130 L/C METER

From me, WA8MCQ–Here's another in my occasional series of bits about old test equipment you might find useful at home. There's still a lot of older, tube type equipment out there at the hamfests, etc., which isn't as modern and doesn't have all the digital bells and whistles but is still quite usable. The Tek model 130 is about the size of an old VTVM (now there's a dated reference!), full of tubes and measures low values of capacitance and inductance on an analog meter.

Although the range is rather limited, it's still useful for homebrewing. Capacitance can be measured up to 300 pF, and inductance up to 300 uH. These are good for most of the things we use at HF, although a little more capacitance range would be helpful. (There's a way around that, which I'll get into later.)

Some devices measure with audio frequencies, others (such as the Boonton 260A Q meter) measure with RF, but the 130 uses a different method. The component under test is part of a resonant circuit operating somewhere between 125 and 140 KHz, and it's compared to a 140 KHz reference oscillator. The meter indicates the frequency difference, but is calibrated in uH and pF (although it actually says uuF, an indication of its age). The ranges, whether in uH or pF, are 3, 10, 30, 100 and 300.



The unit uses ten tubes, most of which are well known types to us oldtimers: 6U8 (five of them), plus one each 6BE6, 6DJ8, 6BH6, 6X4 and OA2. Power can be either 110 or 220 volts.

The unknown unit is connected to a regular SO-239 ("UHF") socket. You can make a little jig with clips on the end of a PL-259 plug, or a piece of shielded cable a foot or two long (such as the P93C probe shown in the manual). The front panel has a pair of knobs for zeroing the meter with whatever test connection is used (open connection for capacitance, and shorted for inductance).

How to measure capacitors larger than 300 pF? Simply put a known value capacitor in series with your unknown cap, the closer to 300 pF the better–270 pF is a good bet. If the unknown cap is considerably larger than 270, you will read close to 270. As the unknown gets smaller, so will the reading on the meter. The formula for finding the net capacitance of two caps in series is basically the same as two resistors in parallel, and is

$$C1 \times C2 \quad Ctotal = \frac{}{} \quad C1 + C2$$

Ctotal is the net value of the pair, and what we read on the meter. If we know Ctotal and C1, then we can find C2 with

$$C1 \times Ctotal \quad C2 = \frac{}{} \quad C1 - Ctotal$$

If you can get one of these in working condition for just a few dollars, it could be a good investment and a handy tool. The usual bargaining techniques apply: when negotiating the price, be sure to point out these true facts–it's old, full of increasingly rare tubes, expensive to fix if the power transformer goes out, of very limited range, power hungry, and that for only about a hundred dollars you can buy a new digital, handheld unit powered by a 9V battery covering ranges several orders of magnitude larger.

–DE WA8MCQ

THE FINE PRINT

At a recent hamfest I ran into **Mike Michael, W3TS,** who wrote this column several years ago. I mentioned that I live a "paycheck to paycheck" existence, having just enough material much of the time to fill it up, with little excess, and he said it was like that when he had it, too. Fortunately, a few weeks after each issue hits the streets the material starts rolling in again–although lots of people are now writing for the various regional QRP journals there are still enough inputs to keep the Idea Exchange going. How about sending YOUR technical tidbits to Severn?

Problems, Questions, Comments?

Who To Contact—*PLEASE include an SASE of an appropriate size if you expect a response.*

- **Subscriptions, dues, membership problems:** Mike Bryce, WB8VGE; 2225 Mayflower, N.W.; Massilon, Ohio 44647
- **Technical articles:** Dave Benson, NN1G, 80 East Robbins Ave., Newington, Conn. 06111
- **Idea Exchange:** Mike Czuhajewski, WA8MCQ, 7945 Citadel Drive, Severn, Maryland 21144
- **QRP Contests:** Cam Hartford, N6GA; 1959 Bridgeport Ave.; Claremont, California 91711
- **Member News:** Richard Fisher, KI6SN, 1940 Wetherly St. Riverside, CA 92506
- **Nets:** Danny Gingell, K3TKS; 3052 Fairland Road; Silver Spring, Maryland 20904
- **Awards:** Chuck Adams, K5FO; 830 Waite Drive; Copper Canyon, Texas 75067
- **Club Operations:** Les Shattuck, WN2V, 7878 Mill Creek Road, Surfside Beach, SC 29575
- **Club Information packets** (include $2): Mike Bryce, WB8VGE; 2225 Mayflower, N.W.; Massilon, Ohio 44647

New Member/Renewal Data Sheet

Full Name_____ Call_____ QRP #_____

Mailing Address_____

City_____State/Country_____ Post Code_____

❑ New Address? ❑ New Call?

USA

❑ New Member, $12 (DX: $14)
❑ Renewal, $10 (DX: $12)
Amount enclosed in U.S. funds____
Check or MO in U.S. funds
payable to "QRP-ARCI".
Do not send cash.
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