April 2000
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QRP Quarterly

Journal of the QRP Amateur Radio Club, International

April 2000 Volume XXXIV Number 2

TEN-TEC POWER MITE LINE FROM THE PAUL R. VALKO, W8KC COLLECTION

Also inside this issue is an article by John Marranca, Jr., KB2HSH detailing the Pomermite. Thanks to both for their generous contributions.

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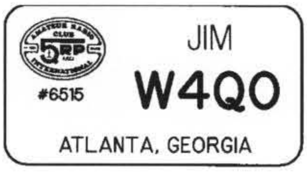

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Jim Stafford, W4QO, QRP ARCI Webmeister

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QRP QUARTERLY

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From the Editor's Desk

Mary Cherry, NA6E

8383 Sierra Sunset Drive, Sacramento, CA 95828-5304 email: na6e@arrl.net

The year 2000 has been real exciting here at the NA6E shack. Due to Ron, KU7Y getting ready to go "permanently portable", I've become the keeper of a lot of QRP and other goodies. The DSW-30 that Ron built is now boxed and on the air. What a great little rig. I also have one of the original Norcal 40's and a CMOS III keyer to play with... speak about a little bit of history. The next projects on the bench are an OHR Sprint and the10 meter minipig. This OHR kit was given to me by Ron. It seems he won it at Dayton, but hadn't had the opportunity to build it yet. What a fantastic kit it is too. I'm still collecting the parts to build the minipig and it will be my first endeavor at building something that wasn't "kitted". But with the generosity of Dieter (DIZ) Gentzow - WB8QYY in setting up a user's group I think it will be a lot of fun.

And speaking about changes. There have been a few changes here at QRP ARCI. The QRP Quarterly has a new Technical Editor Ed Tanton, N4XY. We are very happy to have him on the staff. And Larry, W1HUE, is still with us as Features Editor. I'm not sure how he managed to wear both the Technical Editor and Features Editor hats for the past few issues, but I know there would have been no QQ without his efforts. There are also new members of the Board of Directors and you can read more about that further on in this issue. Les Shattuck, K4NK is back with us doing his Historical Notes and we have a new Membership Chairman, Dale Hollaway, K4EQ and Mark Milburn, KQ0I will be maintaining the membership data base and processing the subs and renewals.

I've noticed a lot of the articles lately have made references to information on the Internet. If someone doesn't have Internet access and would like copies of the information, I'd be happy to help. I would appreciate a legal sized sase though. Thanks go out to all the members for their supportive notes and for being patient with all the changes that have been taking place.

72 de NA6E

One task I never did avoid,
Was to wind a good old solenoid.
I always thought it rather fun;
I've wound a thousand--if I've ever wound one!

But then there came this "cyber age",
To fill our lives with anxious rage;
If homebrew gear is on your mind,
Then these darn toroids you must wind.

You grab the wire and the form;
You'd think you held a squirming worm!
Now stick that wire through the hole--
My gosh! It's tangled! Durn it's soul!

No matter with what care you strive,
The wire wiggles, as if alive!
One wonders, when the coil is done,
How ANYONE could call this ":fun!"

When you've wound a dozen turns or so,
The wire kinks--oh, weary woe!
You think you've nearly beat this rap!
But watch out brother, here comes that tap!

Oh brother, when you're feelin' tough,
Tackle a toroid, that's enough,
To turn your boast into a gulp,
And beat your ego to a pulp!

It seems the toroids here to stay,
Like taxes, death and Judgment Day.
So, if winding makes your finger sore,
Then BUY your gear from the radio store!

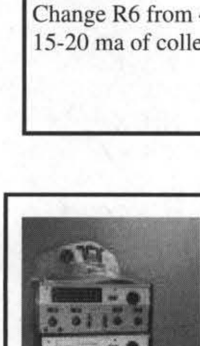
C. F. Rockey, W9SCH (aka Rock)
Box 171, Albany WI 53502

CORRECTIONS

For anyone trying to build the "Power Altoids" 10W linear amp from the Jan 2000 QQ, I made a mistake in a couple of resistor values for setting the collector current. With the values shown in the schematic, the transistors aren't biased on.

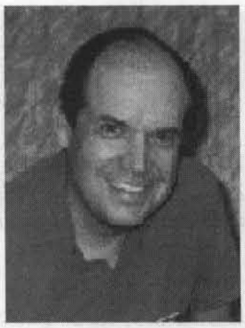
Change R6 from 470 ohms to 220 ohms and change R7 from 100 ohms to 39 ohms. The value of R7 might have to be tweaked a tad lower to get 15-20 ma of collector current. (Parallel a 1K to 2.2K resistor across R7 to get the current in the right range).

72, Steve, KD1JV



ABOUT THE COVER: At the top is the original PM1 circa 1970, under that is a "white" version of a PM-2B. At the bottom is the final Power Mite, the PM3A. To the right of the PM3 aer the matching accessories, an AC5 tuner and the AC4 SWR meter. For more classic QRP Ten-Tecs, visit W8KC's virtual Ten-Tec Museum at:

www.acs.oakland.edu/~pvalko



Base Current—

Jim Stafford, W4QO
Club President
email: w4qo@arrl.net

The thrill is back! We continue to see all kinds of exciting activities associated with the club right now and most of them are covered elsewhere in this issue, but let me mention a few. At the top of my list is our Membership Drive. As you can tell if you enter a contest, we have member numbers in the 10,000+ range. Unfortunately, only about 1400 are actually paid up. Why you ask? Well, the club is 30 years old now and for the first dozen or so years, it was an entirely different kind of club. If you are not familiar with the club's history, go to the web site and check out the history button. Still that won't account for the low number of actual paid members. We get a lot of new folks "in the front door" but then we lose them "out the back door!" Renewals are not high and we want to change that. You can keep up by checking the envelope that your Quarterly comes in to see when your membership expires and remember if you can to renew at least one month ahead of the next issue. For example, Oct 01 means October 2001.. How can you help except to be sure you renew?

2k in 2k Drive - Simply put we'd like to hit the 2000 level during this calendar year! We can do that if every other member will recruit one new member or find an old one to renew. Sounds simple enough. We are putting a spot on the membership form now for SPONSOR NAME/NR/CALL. By putting your info there you will be entered in a contest at the end of the year. Two ways to win - either be the one who signs up the most members (better figure on at least one hamfest table, don't you think?) or we will draw out a name from the has where you get one "ticket" for each person you sponsor. If the person has been a member, then they must have been inactive during the whole year of 1999. We hope to have the members listed on the web site shortly, but do the best you can in the meantime.

FDIM 2000 - The orders for tickets and rooms are rolling in they tell me and this is exciting. The QRP hotel (it's not all that small actually) has filled up but my experience tells me that many folks on the waiting list will eventually get a room. And guess what - it is now the Ramada Inn and all the rooms have their own A/C! There will be prizes galore so don't wait too long to get your order in and while you're at it, order one of our commemorative tee shirts!

Q.R.P. - The Quality Recognition Program is alive and well. We need more nominees to make this work. Steve Pituch, W2MY, our program administrator tells me he doesn't get many nominations. Why not take a minute and think of someone in QRP that should get a very nice certificate recognizing some action they have taken or accomplished. It's all on the web site under RECOGNITION.

QRP-Cub™ Program - The club has arranged to make bulk purchases of the new MFJ Cub transceiver. I am also excited that part of the program is a "mailing list" for the Cub owners. This kit is a great one for new kit builders. Although it is small, about 2/3 of the parts are already mounted making an easy transceiver to build. Designed by QRP ARCI Hall of Famer, Rich Littlefield, K1BQT, these little one banders will make great "trail" radios. Even if you don't own the transceiver, you might want to join the list for a while. The kit lends itself to certain customization - the instruction manual even tells you some other final transistors you might want to substitute! By the time you read this at least one "batch" will have been ordered and maybe several.

QRP_ARCI Personnel changes - You can read about it in more detail in this issue, but our Membership Chairman for the past 2+ years, **David Johnson, WA4NID**, has handed over the reigns of the database to Mark Milburn who will keep it along with his Sec/Treasurer duties. I want to thank Dave for the great job he did on this. This is one of those really tough jobs that don't get a lot of "glory" but it is very necessary. Our Q.R.P. guy (W2MY) is handling the new member certificates. So I guess it took two people to replace Dave! In any event, thanks Dave.

New Directors - Three new directors are coming on board April 1. As I write this, I don't know who they are because we are trying to leave the balloting open until the very last minute! I am sure they will be good ones - all the candidates were top notch. Let the directors know what you want for the club, and then they let me know what to do - hi hi.

Action Team - My call for members of the club Action Team in the last issue was well heeded by at least 2 dozen folks. Several of them are already working on projects that needed to be done. Everything from a member QSL to brochures to use at hamfests are products of the Action Team. You sign up by going to the web site and checking the Action Team page. You then put yourself on the list where you can hear about all these wonderful opportunities. We can always use a more volunteers.

Some personal activities - I attended the Jackson, MS hamfest in February and Ev Catlin, N5MZX, and Ben McKinney, K5HQV, had all the details worked out when I arrived. We had a nice QRP table (it wasn't all that small) and a forum attended by 24 folks including Mr. MFJ himself where he showed off the QRP-Cub™. Martin has been a QRPer himself for many years and many of his company's products have been QRP related. After the hamfest, my wife and I visited the MFJ "factory" in Starkville and it is a site to behold. One of the more successful ham manufacturers around, we saw where all those items are made. We were simply amazed by the breadth of work detail that they do at the facilities there. The metal bending, stamping, and painting operations were impressive in themselves. One thing that makes a meeting with Martin worthwhile - he is always asking "what else could we be making?" That makes you feel good and also indicates that he feels there is more out there to be done. During the visit, we worked out many details of support for our club. Look for more of MFJ at our evening activities at Dayton this year! Thanks, Martin. And thanks to all the volunteers who make QRP ARCI work. Keep it up!

De Jim, W4QO

IDEA EXCHANGE

Technical tidbits for the QRPer

Mike Czuhajewski WA8MCQ 7945 Citadel Drive, Severn, MD 21144 wa8mcq@erols.

IN THIS EDITION OF THE IDEA EXCHANGE

JOE'S QUICKIE #33—PC BOARD BOXES

With the possible exception of me, WA8MCQ, ***Joe Everhart, N2CX*** *of Brooklawn, NJ is the most prolific and long running contributor to the Idea Exchange. (And I don't count since it's my column.) Years ago he told me he could produce an endless series of his Technical Quickies, and he's put his keyboard where is mouth is. In the beginning he submitted one every now and then, but soon started doing them every issue. That's 4 per year, and this one is Joe's Quickie #33—you do the math!*

The NJQRP Product Design Team has been busy lately coming up with yet another club kit. A convenient enclosure will be available as an accessory to the SOP Receiver. For those who want to roll their own, this Quickie discusses a couple of techniques I find handy in making rig cases by soldering together pieces of unetched copper-clad glass-epoxy printed circuit board.

Cutting the board stock

This isn't too tough but you quickly find that the darned stuff is quite abrasive. Some report success with large paper cutters. If you try this use somebody *else's* cutter so you don't dull yours... Seriously, it probably will work if you don't do too much and you may find that the blades need more frequent replacement than when the cutter is used for paper!

Chuck, K7QO reported on QRP-L that mail-order supplier Harbor Freight sells a combination shear and metal bending brake. I don't own one but have seen one in action and it is quite good. However it is rather costly and heavy.

My own experience for the last 30 years has been with a good pair of tin snips (Wiss, I believe). The pair I bought back in the 60's is still in good condition. Get a good quality heavy duty pair and you will not be disappointed. Expect to pay between 10 and 15 dollars.

Layout

Layout is best done using a combination square and a sharp scribe to mark the material. Combination squares can be found in all hardware megastores ranging from $4 plastic cheapies to good quality steel ones for under $20. Again, I have been using a good quality Starrett for years.

Maintaining straight sides and square corners helps ensure good fit along seams and corners. The combination square is imperative. And a trick I learned from one of my elmers is to use a known straight edge and square corner on to start with. And a file is often necessary on cuts you make with the tin snips since it's almost impossible to cut absolutely straight lines by hand. Another trick to make things line up is to design cabinet sides with symmetry. If you do this, then when you cut, for example two identical sides, you can clamp them together and use your file to make them exactly identical.

Another precaution to keep in mind is the material thickness. I usually use 0.062 (1/16 inch) material so when I make a box, the layout dimensions include (or subtract) this thickness on mating edges. Normally it is best to maintain outside panels with hidden seams for appearance sake.

Cleanliness is Next to Solderliness

After laying out and cutting the enclosure pieces it's a good idea to clean the copper surface completely before soldering. Even a little copper oxide or finger oil can make soldering uneven. Conversely, clean copper surfaces are a joy to solder!

If the copper is relatively bright and unoxidized it is sufficient to scour the pieces a bit with dry Scotchbrite (tm) and remove finger oil with rubbing alcohol then dry with a clean soft cloth (remember cotton diapers?) or a paper towel. If the copper is corroded, all evidence of corrosion should be scoured off with sandpaper or some wet cleanser then washed with dish detergent and dried completely.

In extreme cases (or if you are lazy) a little liquid flux may aid in soldering. Clean up afterwards though, or the activating agent in the solder will eventually cause corrosion.

Soldering

Soldering PC board enclosures is a balancing act between providing enough heat to overcome the copper's excellent heat conductivity and not heating the joints so much that the copper delaminates from the board. Soldering guns are "not" appropriate. I've the most luck with a flat-tipped 35 watt iron though a 50-watter is usable with care.

Fixturing

Before you can accurately solder your enclosure it is necessary to do some fixturing to ensure that pieces to be soldered are butted securely against each other in the proper position.

I've used two very simple methods, depending on the type of joint being made - both use ordinary cigar boxes and gravity. The cigar box sides and bottom are reasonable "square" and when the box is tilted at a 45 degree or so angle, gravity holds the work pieces in alignment. (You can use whatever politically correct type of box you find at hand.)

Figure 1 shows the tilted cigar box propped to the proper angle by a block of wood underneath. In the box are two large pieces of PC board that are to be soldered at the edge. The pieces are "tacked" several places to hold them securely then removed from the box for final soldering. Check the alignment for squareness (using the combination square) and make final adjustments while heating the tack joints. After final alignment this way, you can run a solder bead along the length of the joint.

For smaller pieces it is easiest to use a clamp of some sort to hold the pieces while doing the preliminary tacks. Figure 2 shows two common wooden spring-type clothespins holding the work pieces in the cigar box. Final alignment and soldering is done the same as for larger pieces.

One precaution is in order for lengths of more than a couple of inches.They tend to warp a little when being cut and during soldering. Note this during the final alignment and bend them straight as appropriate.

Figure 1

Getting it All Together

One of the biggest challenges in making PC board boxes is attaching top and bottom covers. ARRL publications show brass nuts soldered in box corners and common machine screw used to attach covers - but I'm too much of a klutz to do that repeatably.

Dave Benson, NN1G used a different technique in a "72" article some years back for similar enclosures - he threaded and tapped square stock that fitted into box corners - but that needs either a very steady hand or a drill press to do properly. [Now out of print, "72" was the journal of the New England QRP Club several years ago. —WA8MCQ]

Figure 2

I have two "tricks" that have proved successful. Both use #4 or #6 sheet metal screws (which are self-tapping) with an undersized hole drilled in glass-epoxy PC board.

The first way replaces corner screws with triangular or square scraps of pc board stock soldered in place. See Figure 3. The box frame is set flat on a piece of cardboard or wood for protection then the corner piece is set in a corner on the protective surface. (It is probably a good idea to not have the box solder bead run all the way to the edge of the box sides until the corner piece is installed.) Now the piece is soldered in place (only) on the inside edge of the box. This puts the top of the corner piece flush with the box top (or bottom).

The second method is only slightly more complex. One half inch high rails are soldered at the sides of the box to the box bottom and front and rear panels. See Figure 4. They are flush with the edge of the bottom panel so that side pieces can be attached with sheet metal screws.

So there you have it! I've purposely not included any suggested box designs here. I've done a number of them that have the same shape factor as old Heathkits like the HW-8, some "nested U's" and even some boxes with rectangular frames with separate tops bottoms. And be sure to check out the soon-to-be-announced NJQRP SOP box for a neat layout with a sloping front shadow box effect.

—DE N2CX

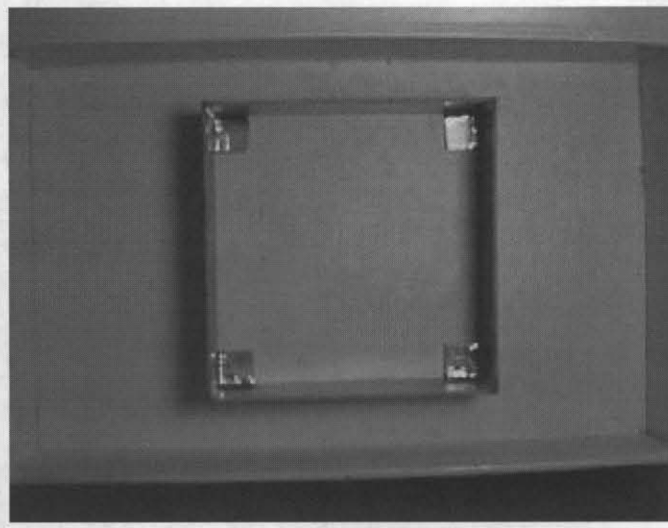


Figure 3

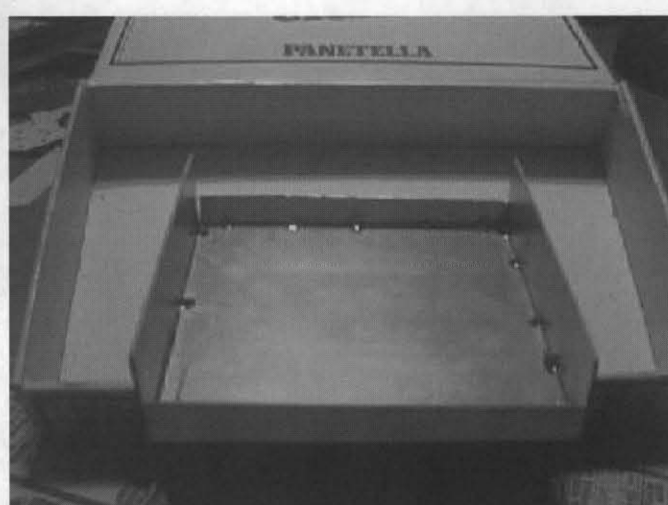


Figure 4

NIGHT VISION FOR THE TEN-TEC ARGOSY I

From ***Wes Spence, AC5K*** *(ac5k@ih2000.net)—*

My Argosy 1 is my main rig for CW Mobile and general QRP work. I became increasingly frustrated over the years at not being able to see the frequency at night, especially while mobile. Step 1: I installed the Blue Sky Engineering (K1MG) frequency counter kit in the radio. Note-- this is a VERY tight fit and the CW/SSB/Tune board had to be relocated to the top of the rig.

Step 2: I used super bright LEDs all around the counter to illuminate the readout and also replaced the incandescent lamp behind the meter with one. After cutting the front panel of the rig up to accommodate the counter and LEDs, I rebuilt it using counter top samples from the local home supply cut to size and glued in place. (See Figure 5 for details). This is NOT an easy weekend project, but I am very happy with the ease of using the rig at night now.

—DE AC5K

Figure 5

CHEAPER REPLACEMENT FOR 2N3553

Harry Hurst, WA3PTG *(WA3PTG@aol.com), posted this to QRP-L a while back*--While browsing around the web this morning, I noticed that the final transistor in the Ten Tec QRP rigs, the 2SC2166, is a fairly cheap device for QRP transmitters. It's rated for 6 watts at 27 MHz, and sells for $1.30 at RF Parts.

It sounds like a good substitute for the 2N3553. The '53 is getting expensive, and the '2166 will put out 2-3 watts for half the price. I haven't seen it used in any homebrew designs. Maybe it's because we're all familiar with the 2N parts.

[WA8MCQ comments: I just checked the RF Parts web site, which is at ***www.rfparts.com****. (Don't add a dash; www.rf-parts.com is something completely different.) I haven't priced the 2N3553 in several years, and it was a case of sticker shock—they list it at $5.50! They have a $25 minimum order as well as some rather hefty shipping charges, but you can get quite a few more 2SC2166s than 2N3553s for the same money. For some reason Japanese RF transistors have not been all that popular in the QRP community in this country, but they do appear every now and then in articles. And don't forget to look for cheap, old CB radios at hamfests, flea markets, etc. They are designed to run 5 watts at 27 MHz, and the final amp transistor is perfect for QRP rigs. They have other useful parts as well, such as a small meter. If you can get one for just a few dollars, it's quite a bargain.]*

—DE WA3PTG

VARMINTS EATING WIRES AND CABLES

Adrian Weiss, W0RSP *(aweiss@sunflowr.usd.edu) reported an interesting problem with his radials on QRP-L--*

I've been using two kinds of computer ribbon cable for radials for over two years. While it's junk in any feedline or radiator application, it is perfectly OK for ground radials.

Every so often, I'd notice that one of the two or three conductor ribbons had been sliced at a 45-deg angle. I figured it was due to a bend that had been stepped upon or some such logical inference. But not so! Late yesterday, I found two neat slices, so I did the usual repair--burn off the insulation, steel-wool the strands, splice, and tape.

This afternoon, I was amazed to find that the two specific ribbons had once again been sliced, but, in addition there were four sliced pieces of the gray kind, and three sliced pieces of the rainbow kind. Ahah! No normal kind of bending and stomping could have done this -- especially since no one had walked in the vicinity in the meantime. So, I examined the sliced pieces under a magnifying glass, and sure enough, teeth-marks appeared about 1/16" to 1/8" from the actual slice on half of the pieces -- evidence of an initial bite positioning which was abandoned before the real bite sliced off the piece!

There are two options, rabbits and squirrels. This fall is atypical; it still gets up to 75 degrees on many days, so there is no shortage of food. Any biologists out there with a clue to which would be biting off chunks of my radials?

Don Bullard, WA4IML *(dbullard@negia.net) replied--*

The squirrels were definitely the guilty party that chewed away the insulation on the coax going to my dipole. At a recent hamfest I discussed this with the Wireman [a vendor of wire and cable] and he said he was working on something to repel squirrels. I'm not sure exactly what he had in mind but if he succeeds he will be a millionaire.

And from ***Steven "Melt Solder" Weber, KD1JV*** *(kd1jv@moose.ncia.net)--*

Lots of critters like to chew on plastic. Porcupines love tires, fan belts and brake lines. I know the phone line going to the ranger station in the Adirrondacks of New York had to be armor shielded to keep the porcupines from chewing through the cable.

I don't know what you'd do to protect the coax, but for the radials, bare copper wire would be the obvious solution there. Or put that sling shot to good use.

WA8MCQ *comment*--I've read for years that people burying cables commercially, such as power, telephone, etc, have similar problems. It's not just the animals that live above ground that like to chew on things, and gophers are definitely a problem, too. They don't see very well, but sure do have sharp teeth! If you have buried radials or coax and notice gopher trails start showing up, you might eventually have a problem.

SOME ANTENNA COMMENTS

Paul Kranz, W1CFI *(w1cfi@switch.capecod.ampr.org) sent along some comments on his antennas, which he hopes might encourage others to try a scheme like this one when the available trees are short and space limited.--*

I always read your "Idea Exchange" with great interest but especially this time when I noticed the note entitled "Variations on G5RV Type Antennas". This was probably due to the fact that I just finished putting up my old center fed Zepp antenna here at my condo on Cape Cod in about the same configuration that Stuart, K5KVH, did.

The problem with living in a condo on Cape Cod is that first, antennas are supposed to be invisible, and second the trees are very short! So I've been using a Marconi antenna, 100 feet long using no. 22 gage wire with a tuner for 80 through 10 meters. This antenna worked very well for 30 meters and above but poorly on 80 and 40 meters. One particular annoying problem with this antenna is that there was so much RF in the shack that occasionally I'd set off the fire alarm in our neighbors condo.

I got thinking about how to keep the RF out of the shack by using a coax fed multiband antenna such as a G5RV. Louis Varney use a low loss coax balun at the junction of the coax and the open wire feeding his antenna which keeps RF off the outside of the shield and out of the shack. Also, the G5RV looked a lot like my old center fed Zepp I'd used at a former location. What I wound up with, using the Zepp, is very similar to a G5RV hung up in our short Cape Cod trees at 20 feet high, having the 450 ohm feed line run off the antenna at right angles, parallel to the ground then over to the coax balun. I used bungee cord connected to some nearby trees to support the center feed point and the balun where it joins the coax.

The results have been spectacular on 80 and 40 meters with recent QRP DX worked including: HB9ACC, IK0YUT, F9KP, HA3HH, OZ2UN, RK3AZ. On receive the new antenna provides a much lower background noise level and at least two "S" units more in signal strength than the Marconi. The RF in the shack measures ten times less on this antenna as compared to the Marconi antenna and the SWR is 4:1 or less on all bands. I'm not using a tuner with it and my QRP rigs. The Marconi does outperform the new antenna on 30 through 10 meters, however.

—DE W1CFI

REHASH AND UPDATE ON THE BOONTON 260A

Here's some old info from years ago, but which is still of interest. I originally talked about the Boonton 260A Q meter in this column in October 1991, with an update in April 1992. In 1996 someone asked about Q meters on QRP-L and I had some comments there. After someone recently asked me again, I realized it was time to share this with those who have never seen it before.

First, my QRP-L post from 6 July, 1996:

From a posting on 27 June 1996, from John Young, WA8KNE--"I picked up an old Heath Q-meter at a hamfest for $3.... Having never used a Q-meter I played with it for a few hours and traced the basic circuit but still have no idea how to use it. A copy of the manual or other information or references on Q-meters would be appreciated...."

I've had a Boonton model 260A Q meter since 1990, and found it to be an extremely useful instrument. I saw the Heath Q meter once, and though it's a Cadillac/Chevrolet comparison in many respects, with the Boonton being the Cadillac, the basic principles are the same.

One of the most useful things a Q meter will do is measure inductance and capacitance. The basic instrument consists of a variable oscillator and a variable capacitor, both with calibrated dials, and some sort of resonance indicator. Remember the old trick of using a dip meter and capacitor to measure inductance? A Q meter does basically the same thing but with much greater precision and ease. You set the dial for some frequency, connect your inductor, and tune the capacitor until resonance is indicated. (On the Boonton, it's a meter.)

You can read the capacitance off the dial and use that plus the frequency to calculate the inductance. If you set the frequency to certain specified points, you can read the inductance directly off a separate scale on the variable capacitor dial (at least on the 260A--I don't know about the Heath). If you don't get resonance at any settings of the capacitor dial, you need either more or less capacitance than it has; change the frequency and try again.

To measure capacitance, within limits, you take some arbitrary coil and set the variable cap for maximum capacitance, then vary the frequency for resonance. You then connect your unknown capacitor in parallel with the variable cap, which knocks it out of resonance, and reduce the capacitance until you see resonance again; the amount of capacitance removed, which you read off the dial, is the amount the unknown cap added. This only permits relatively small caps to be measured, limited by the size of the variable cap in the Q meter.

In the case of the Boonton 260A, the cap is 30 to 460 pF, so the largest you could measure directly is 460 minus 30, or 430 pF. But you can extend that by measuring a cap in that range, then connecting that known cap in parallel with the internal cap, vary the frequency until you have resonance again, then add your unknown cap and repeat. That way, by removing both the known cap along with a certain amount of capacitance on the variable cap, you can measure capacitors larger than 430 pF.

There was a qrp-l posting a couple of weeks back [in 1996] from w0rw@kktv.com advertising a Boonton 260A for $75, I think. (Why would anyone part with such a useful thing? He also has the solid state version they came out with later!) I don't know if he sold it or not, but I certainly hope so--it's an incredibly useful tool for a homebrewer. And if anyone reading this did buy his Boonton and wants more info on it, I can copy some of what I have--that includes the manual as well as several related articles from the old Boonton Radio Notebook series (the latter passed to me by St. Louis QRPer Andy Becker, W0NVM).

THE Q-METER, THE HOMEBREWERS FRIEND

[from the October 1991 QRP Quarterly, Idea Exchange column; this was also attached to the QRP-L post]

Please forgive the hokey title, but anyone who really knows and understands these devices knows how useful they can be. There are many fine, modern digital Q meters available but you'd have to postpone purchase of your next car to get one, and you don't really need such accuracy and bells and whistles at home anyhow. On the other hand, there's nothing wrong with an older, analog unit, such as the Boonton 160A and 260A.

I acquired a 260A last year [1990], and found it to be extremely useful and versatile (although also extremely large and heavy). What can you do with one? Measure inductance of coils at the frequency they will be used at, measure their Q (quality factor), and measure capacitance. (Actually, it measures the apparent inductance, which is the true inductance as modified by the distributed capacitance of the coil, another characteristic you can measure.) It also functions as a calibrated 30-460 pF variable capacitor, with resolution to much better than 0.1 pF on the +/- 3 pF fine tuning cap, and includes a wide range variable frequency oscillator, covering 50 kHz to 50 MHz.

The basic idea is to apply some RF to a coil, resonate it with a variable capacitor and observe the voltage rise at resonance. From this you can determine Q by reading the meter, and find inductance, either directly from scales on the unit (260A only) or by plugging values into a formula. You can also measure capacitance. Connect a coil, set the capacitor near maximum, vary the frequency until you have resonance. Now connect the unknown capacitor, which throws the circuit out of tune. Reduce the Q meter capacitance until you have resonance again. The amount that you reduced it is equal to the unknown capacitor.

The drawing in figure 6 [the original article had a photo] will help you identify the 260A at hamfests. Boonton also made the model 160A, which is older but similar; among other things, the meters are

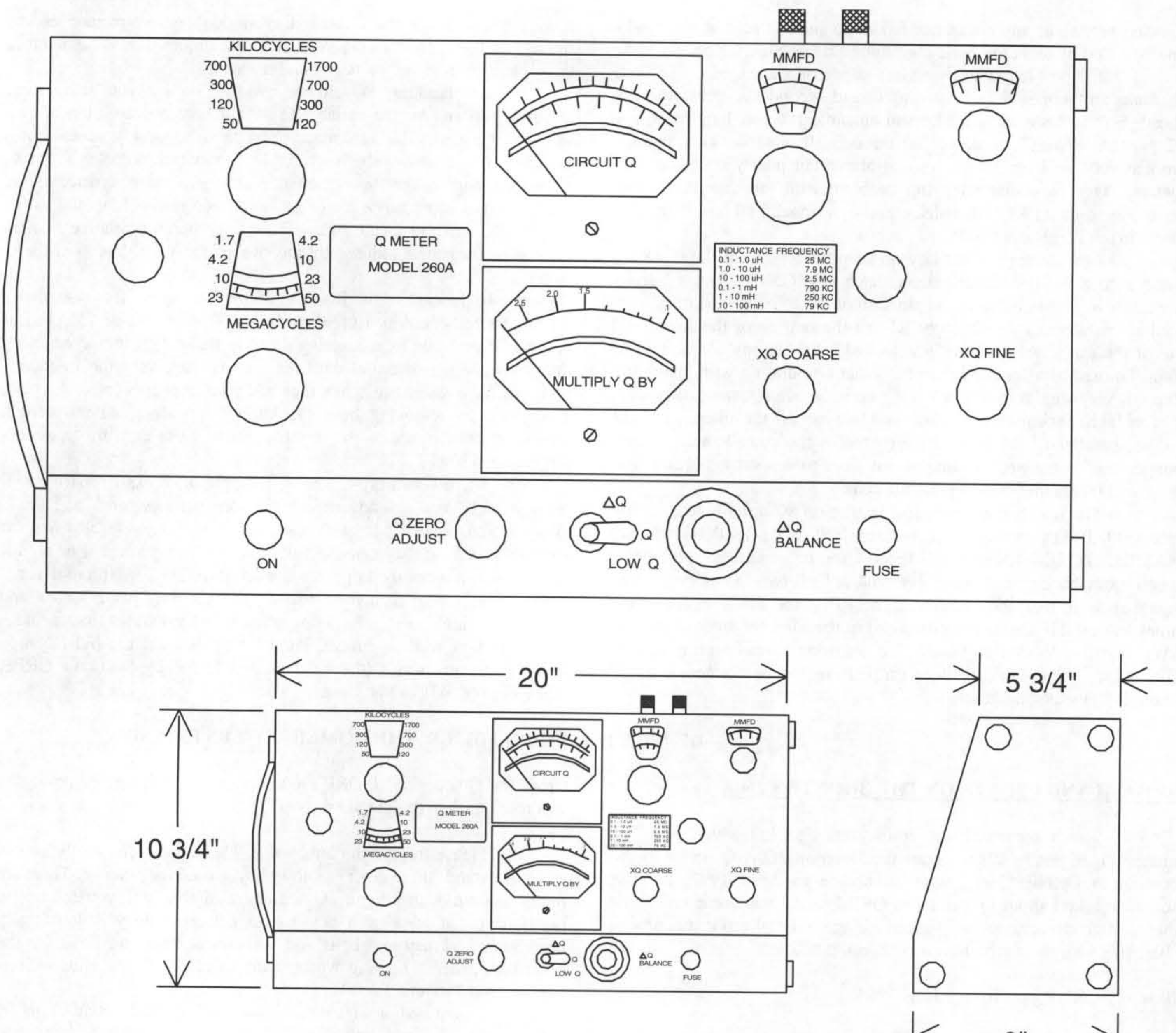


Figure 6—The Boonton 260A Q meter. The unit is painted black. Size of knobs may vary from those shown here. Components are connected to the terminals on top. Not marked on the unit, the knob below the frequency dial windows on the left is the bandswitch.

round and different sizes, and the dials are on the outside of the cabinet instead of peaking out through windows. I saw another Boonton Q meter at a hamfest once with a number between these two, but it's a VHF version. (Details are sketchy, but I believe there might be two VHF versions, models 170A and 190A.)

Both devices use vacuum tubes, and it would be a good idea to pick up a few spares if you can find them at hamfests. This particularly applies to the detector tube, which is the same in both units; it's one of those old 6 pin tubes with grid cap on top. The 260A otherwise uses relatively new tubes, with 7 and 9 pin miniature bases. The December 1989 issue of Ham Radio magazine had a good article by W3QOM on Q meters, including replacement of the ancient tubes in the 160A with some which are merely old. Replacement of the detector tube is also applicable to the 260A. (The article also contains a picture of the 160A.)

160A tubes:

5Y3 rectifier
45 oscillator
Boonton 535A detector (2A6)

260A tubes:

6X4 rectifier
0A2 regulator
0B2 regulator
5763 oscillator
Boonton 535A detector (2A6)

Actually, there were three Boonton Q meters in the HF region, though I only recently heard of the model 100A. It was introduced in 1935, the 160A in 1939, and the 260A in 1953. I know nothing about the 100A, nor the VHF model(s), which appeared to be of similar vintage to the 260A. Either the 160A or 260A should be suitable, though I'd recommend the latter. Price? According to a 1963 Boonton brochure, the 260A cost $990.00. My folks bought a new Chevrolet that year for only twice that amount. The 260A was considered a laboratory grade instrument at one time; although technology has come quite a way since then, it's still a good unit to have. I've seen some advertised by dealers for $150 to $200, which is probably top dollar, but you should be able to pick one up for considerably less, depending on condition and your negotiating powers. W3QOM mentioned a figure of under $50. When doing your bargaining, don't forget to point out that even the newer 260A is an antiquated device for which parts are hard to find--tubes, high voltage transformers, high voltage electrolytic caps, etc. They don't need to know that it's such a useful device that you'd sell your grandmother to get one.

The thermocouple—an important component

An important consideration is the thermocouple; ask the seller if he knows whether it's good. When measuring Q, you set the level of the oscillator to a precise value on the lower meter, which is driven by the thermocouple--RF energy flowing through it results in a proportional DC output. It can be burned out by excess drive, and if it is the unit isn't worth as much and the price should drop accordingly. (It's still quite usable though, so don't pass it up--details later). I was told that there is still a company which will replace the thermocouple and calibrate the 260A to the new one for about $200. (They won't sell the thermocouple by itself.) One of the improvements of the 260A is that it's harder to burn out, and the oscillator level is deliberately limited to well below the burnout point, as long as you keep the needle on the scale.

The lower meter is "MULTIPLY Q BY". The top meter, which is essentially a vacuum tube voltmeter connected to measure voltage rise at resonance, is calibrated in Q from 0 to 250. (Q is a unitless measurement.) If the oscillator is set to the X1 mark on the lower meter (which is near full scale), the top meter scale is read directly. If you are measuring something with a Q higher than 250, you crank down the oscillator level to X1.5, X2 or X2.5. This gives an effective full scale Q reading of 375, 500 or 625.

If the thermocouple is burned out or otherwise defective, the unit is not useless (but don't tell this to the seller!). You cannot accurately set the multiplication factor, so you can't use the Q scale directly. However, you can still measure the Q by another method, detailed in the W3MT article in the May 1984 issue of QST. Tune the variable capacitor for resonance at the frequency of choice, and note the meter reading on the Q scale, whatever it is. (For maximum accuracy, adjust the oscillator level to give a reading as high as possible on the Q scale.) Next, increase the capacitance until the reading drops to 70.7% of that value and record the picofarads. Decrease the capacitance back through the peak and continue until it once again shows 70.7% of the peak value, and note the new capacitance. See Figure 7. Divide the sum of these two by the difference between them to get the Q; eg, for values of 120 and 130 pF, the Q would be (130 + 120)/(130-120) or 25.

If simply measuring inductance or capacitance, the oscillator level is not critical--just look for a peak reading on the Q scale, which indicates resonance; the actual value is unimportant. Use any level that gives a usable reading on the Q meter; the thermocouple is only needed when reading Q directly from the scale, to give proper calibration. With the thermocouple burned out the price of the unit should drop considerably, and yet, as you can see, it remains quite usable! (Realistically, most homebrewers probably have little more than academic interest in measuring Q anyhow; inductance and capacitance are usually of greater importance to the typical builder.)

Easy inductance readings

Not only is the 260A newer and better looking than the 160A, it's easier to measure inductance. On the 160A you set the frequency and tune the variable capacitor for resonance. To find the inductance, read the capacitance on the dial, and plug that and the frequency into the standard inductance formula. Things are simpler on the 260A--not only is the capacitor dial calibrated in picofarads (though marked "micromicrofarads") it also has an inductance scale, from 0.95 to 13, so no calculations are required as long as one of the standard test frequencies is used. The scale multiplier is read from a chart on the front panel, according to frequency. For instance, if the oscillator is set to 7.9 MHz, the inductance scale on the capacitor dial indicates 1 to 10 uh (plus some overlap, 0.95 to 13 uh).

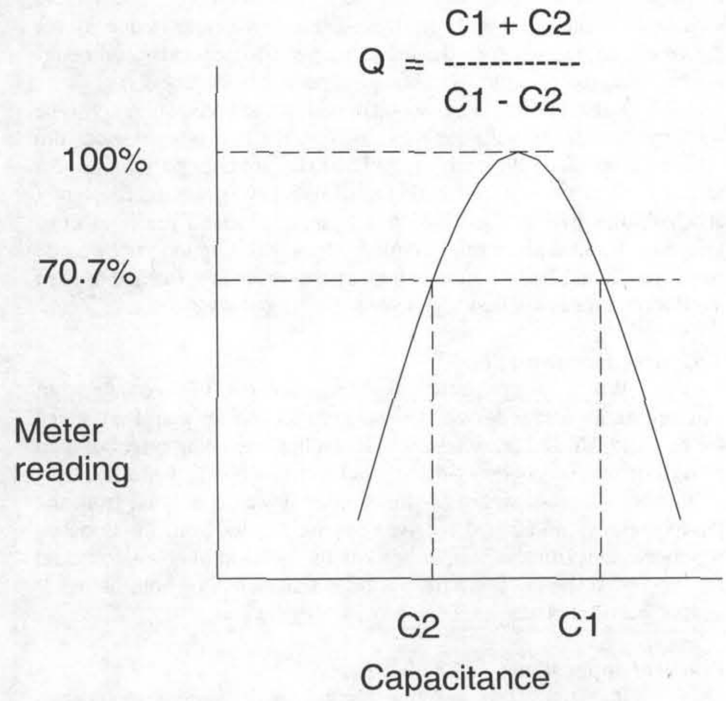


Figure 7—Calculating Q by varying the resonating capacitor

Note that while the inductance scale is only accurate when certain specified frequencies are used, you can still measure inductance at any frequency by plugging the values into the formula. (Q, of course, is measured at whatever frequency you want.) The test frequencies and inductance ranges of the 260A are:

25 MHz: 0.1-1.0 uH
7.9 MHz: 1-10 uH
2.5 MHz: 10-100 uH
790 kHz: 0.1-1.0 mH
250 kHz: 1-10 mH
79 kHz: 10-100 mH

On the 260A, the oscillator output is connected to the thermocouple assembly with a BNC connector, which is accessible through a hole in the rear of the case. I added a BNC tee to this connection so I can hook up my frequency counter when needed for maximum accuracy. There is a detectable effect on readings when the cable is connected, probably due mainly to the capacitance of the four feet of RG-58, but it is slight.

Can't measure some cores

The Boonton Q meters, as with anything using the "voltage rise at resonance" method, aren't perfect as I found out the hard way.

Some coils simply refuse to give a reading. For example, I wound a few turns on a T50-26 core and calculated that it should have about 4 uH inductance. I checked it at an appropriate frequency for 4 uh, 7.9 MHz, and never got a flicker on the meter. I tried the ranges on either side, using 2.5 and 25 MHz, and still nothing. I put the coil on a $150 handheld LCR meter and a $5000 Hewlett Packard digital LCZ meter, and got readings of about 4 uh on both of them.

The problem? The frequency was appropriate to resonate 4 uH with the 30-460 pF capacitor in the 260A. Unfortunately, it turns out that type 26 powdered iron material is designed for power line frequencies, and is a low Q material to boot. By the time you get up into the MHz region the Q of the material is microscopic, as is the voltage rise at resonance. Technically, it was a good coil since the winding had continuity and there was a certain inductance, but the frequency was inappropriate for the core material. I could have switched the meter down to a lower, more appropriate frequency for the core material, but then the inductance of this particular coil could not be resonated with the 30 to 460 pF capacitor in the 260A.

I also had the same problem with some coils wound on type 43 ferrite cores. As with the type 26 core, the two other devices did give readings since they test at 1 kHz. (This touches on the issue of testing coils at the standard 1 kHz test frequency versus the frequency at which they will be used, which is a can of worms I prefer to leave unopened for now since this column is already getting too long.) Aside from "problems" like this, the voltage rise at resonance method used in the Boonton meters is basically a good, sound and classic one.

Technical documentation

Where to get technical information on this outdated but extraordinarily useful device? I've solved that one for you. I put a cry for help in QST and received about 20 replies, including offers of help as well as several copies of the manual for the 260A. (Unfortunately, all but one of those were abandoned when I was evacuated from the Philippines.) In addition, I received several articles from the Boonton Notebook series of the 50's, as well as the test and alignment manual for the 160A/260A. (The latter includes schematics of both units.) If anyone needs photocopies, I can provide them at cost.

Practical applications

It's great fun playing around with various coils and experimenting, but how about a practical application? I built some low pass filters with toroids for 20 and 40 meters once and ran frequency response tests--they didn't work as expected, giving high insertion loss at the design frequencies. I wound the coils according to the recipes, with the number of turns called for, but the inductances were off. After I got the 260A I adjusted them to get the correct inductance. New frequency response tests showed they now work as expected.

I later built a low pass filter into a 10 meter QRP rig, using the meter to adjust the inductances before installing them. Once again, wound according to the recipe, the inductances were off. When I tested the rig on a spectrum analyzer I found the filter worked properly off the bat.

Related articles

Some related articles for further reading on measuring inductance and capacitance:

1. A Crystal Controlled Q Meter, W3MT, QST, May 1984. Measures Q at 3 crystal controlled frequencies; also measures inductance and capacitance.
2. A Simple L-C Meter, W3MT, QST, February 1983. Measures L and C at 2 crystal controlled frequencies.
3. Capacitance and Inductance Measuring Devices, KB4ZGC, QST, February 1980 (Hints & Kinks). Separate crystal controlled devices to measure each parameter.
4. A Tester for Coil Inductance, W1FB, QST, April 1986. Dual range, crystal controlled tester.
5. Measuring Inductance and Capacitance with a Reflection Coefficient Bridge, W6ZGN, QST, May 1982. Adapter used with previous device by same author ("A Reflection Coefficient Bridge--Impedance Matching Measurement the Easy Way", QST, October 1981). Used in conjunction with signal generator at chosen frequency.
6. A Simple Inductance Meter by KH6CP/1, based on a W1FB design, ARRL Handbook for 1989, 1990 and 1991, Test Equipment and Measurements chapter. Measures inductance using 4 fixed frequency LC-tuned oscillators.

I've found the 260A to be an extremely useful and fascinating device, and it quickly became the favorite toy in my workshop. Anyone who is seriously interested in the more technical side of homebrewing should strongly consider picking one up if they have the chance--it's well worth it.

Q METER UPDATE

[from the April 1992 Idea Exchange]

I wrote about Q meters in a previous issue; here are a few additional notes. First, Boonton was not the only one to make such devices. Marconi and General Radio also made them, and there are probably others. Most of the basic principles remain the same, though.

As for price, at a local hamfest I saw a model 160A in the "everything in this pile--$20" section. I also saw a 260A in good condition for $60. It was missing the 535A detector tube, rendering it inoperative, but the owner refused to negotiate so I passed it up. (I've been kicking myself ever since. Even if a tube couldn't be found, I could whip up a suitable solid state replacement.) I later saw a 160A for $15 at an estate sale.

I had mentioned that the 160A did not have an inductance scale on the capacitor dial. I read that in a Ham Radio article and saw one which did not have it, but after writing that column I came across one which did. I later found a note in one of the Boonton Notebook issues saying that 160A models after a certain serial number had radical design changes.

According to the 260A manual, only genuine Boonton model 535A tubes should be used. They used the type 2A6 in the ancient model 100A Q meter, but went to the 535A starting with the 160A. The schematic of the 160A says "(105A)" near the tube. I checked the tube tables in ARRL handbooks going back to the mid 1950's and couldn't find that or 535A. Some old Boonton information says that they used specially selected 2A6s in the 100A, which excelled in certain characteristics making them useful in that application.

I opened up my 260A, pulled out the tube, and "535A" was printed on the base, along with the Boonton name and logo. The base also had "(105A)", along with a date code indicating that it was made in 1965. This tube is one of those "old" types with 6 pins, of which two are fatter than the others, and a grid cap on top. While most of that style have been out of production for years and years, Hewlett Packard (which eventually bought out Boonton) was still selling the 260A Q meter in the 60's, and naturally repair parts had to be available as well. The envelope of the tube had type number 1659, but that wasn't listed in the handbooks, either. (Perhaps they culled large batches of 1659's and labeled the best ones as 535A.)

I don't know how closely the 2A6 resembles the 535A, and how well it would do in its place. However, when my 535A finally gives up the ghost I'll get a 2A6 and see how it works. While the 535A would probably give superior performance, homebrewers don't need laboratory quality and some compromise is acceptable for home use. The 2A6 is available for [1992 price deleted] (plus shipping), with guarantee, from Antique Electronic Supply. You can easily pay that much or more at a hamfest, and HOPE the tube works. They also have the 5763 oscillator tube (which I've had a hard time finding at hamfests), as well as the rectifier and regulators. (If either of those two fail, it might be cheaper and simpler to replace them with 1N4007s and zener diodes.) Their new address is 6221 S. Maple Avenue, Tempe, AZ 85283. They also have a few parts of interest to homebrewers and antique radio buffs, and their catalog is worth asking for, if you don't mind sending the $2 they ask for.

Y2K update

At the tailgating area at Pacificon 1998 I bought a 260A for $25. I didn't need another—I'd bought a second one several years back and later sold it—and certainly didn't want to haul this one back to Maryland on the plane. I just wanted to pass it on to an interested QRPer, and with a couple hundred of them there for the QRP forum sponsored by NorCal I knew I could find one. I took it back to the hotel room and made sure that it had signs of life. A half hour later I ran into John Moriarity, K6QQ, coming out of one of the QRP talks and offered it to him for my price. Knowing the value of it, he snapped it up immediately.

A note about the handle on the left end of the unit--don't place too much trust in it. On some units they are rather deteriorated, and the devices are quite heavy.

Antique Electronic Supply now has a web page:
http://www.tubesandmore.com/

I checked it in mid February, and they still have the 2A6, still reasonably priced at $5.15. I didn't bother looking up the other tubes, since they can usually be found at hamfests.

On the web page, it's listed under "new tubes." Those are what is known as NOS, or "new old stock." That's something that was made years ago but still unused, and in the original box.

The homebrew scene has changed a lot since I first wrote about the Boonton Q meter in 1991. We have moderately priced items available now that do essentially the same thing and with precision that is quite acceptable for home use. These come from MFJ, Autek, AADE, and probably others. These are all much smaller and lighter than the vacuum tube technology of the Boonton, but the latter is still a solid, rugged item that is very useful for someone who knows how to use it. And the emphasis is on the "rugged" part; while the Boonton is very heavy and sits on one place on the bench and never moves, it will take a great deal more abuse than the other units.

The Boonton can require a bit of math in some cases, which is simple with a scientific calculator, and does not have the digital readout of the more modern units (although you can hook up a counter to monitor the frequency). Neither is a major drawback, and if you can find one at a reasonable price, it could be worth looking into. (Being the old cheapskate that I am, I would never pay more than $50 for one, preferably half that or less, though you might have to look for quite a while to find one at that price. And keep in mind that you probably won't see these very often in the first place.)

Finally, the offer of copies of technical documentation still stands. In addition to the operating manual and articles from the Boonton newsletters, I now also have what appears to be a very rare item, the repair and alignment manual (which covers both the 260A and 160A). I can provide copies at cost if anyone needs them.

NEW AMIDON PART NUMBERS FOR POWDERED IRONS?

No. Let me repeat that: No. Well, not really, though this is something to be aware of since there is the possibility for some confusion. As it turns out, they have two different part numbers for the exact same thing, depending how you order from them, but most people will probably never know it and don't need to be concerned. But just to be safe, I'll let you in on it.

I needed to order another ten year supply of the ferrite cores needed to fix bad output networks in the HW-8, and went to their web site to order online. The URL is:
http://www.amidoncorp.com/

I had heard that Amidon had acquired a manufacturing capability a few years ago, and now make some of their own cores in addition to being a distributor for others. The latter includes the ferrites from Fair-Rite and powdered irons from Micrometals. The familiar color code for powdered irons that we all know is actually the Micrometals code; as I've mentioned over the years, there is no such thing as an industry wide color code for powdered iron cores. It just happens that we all get our powdered irons from a few sources, mostly Amidon, and they are all made by the same company.

If you want to check out their web page, go to the section called "ham radio products" and don't look at anything else; that way, there will be no confusion. But I noticed that they have a section on the web page called Manufacturing, and under that is a section called "iron powder cores." That's where the potential confusion comes from. They now make some of their own powdered irons, and they have different part numbers. Most of the material types are identical to those we already know, but the numbers can cause some confusion. Unfortunately, they are not much different from the color code we already know; in fact, they are virtually identical, but completely scrambled up. The bottom line is that you can buy a particular type of powdered iron core from Amidon under two different part numbers.

I talked with someone at Amidon and was told that there would be no problem as long as I stuck with the "ham radio products" section. That's where we should buy our cores, and those are the same familiar products we've known for years. He indicated that the products under the other area are primarily sold to industrial users, and that they will continue to sell the Fair-Rite and Micrometals products to the hobbyist market.

It's probably unlikely that many people will even stumble on the other part numbers, and from talking to them I got the impression that if a hobbyist did try to order small quantities from that section they'd steer them over to the ham radio side. However, there's always the chance that some of these items, with their other numbering system, might one day make it into surplus channels and appear at hamfests, etc, and cause some confusion.

Here are the two numbering systems:

Traditional	Industrial	Color	Permeability
0	00	tan	1
1	07	blue	20
2	06	red	10
3	09	gray	35
6	04	yellow	8
7	05	white	9
8	19	white-orange	35
10	02	black	6
17	23	blue-yellow	4
26	16	white-yellow	75

There are others, but this gives the most familiar ones. Imagine the confusion that could result if someone finds a bag of cores at a hamfest with an Amidon label and a part number that indicates type 07 material. We expect type 7 to be white, but these are blue, and the permeability is twice what we expect of type 7. That could cause some head scratching when someone tries to use one in a VFO. Or the number might indicate type 06 material, and we'd expect the familiar yellow core, but these would be red and identical to the type 2 we're used to. You get the picture.

There's no need to panic, and you may never see any cores with these new markings on them. With luck, all we'll ever encounter will be the same old cores we've known for years. Just don't be totally surprised if you ever come across some cores labeled as Amidon where the color and the number don't match up. You can always go to the Amidon web page (or have a friend do it, if not online yourself) and translate the number into the system we know.

SOURCE OF SURPLUS SURFACE MOUNT PARTS

Those who are on QRP-L, the online QRP discussion forum, have heard me mention "Baggy Bob" every now and then. That's Bob Kelly of Lake Geneva, WI. (He told me he was a ham once but is currently unlicensed.) Among other things, he carries an assortment of surface mount parts; most of them are capacitors of various sorts, though he does have some other items as well, such as diodes, a few transistors, and a resistor assortment. I've bought from him for 4 consecutive years at Dayton, and every now and then I offer to pass along his e-mailed list of parts for sale. (He also does business by mail order in addition to hamfest sales.) I recently found out that he now has his list of surplus parts available online, at the web site of the Minnesota QRP folks. (Although the web site has the list of SMD parts, as well as his list of leaded parts, you have to order by US mail. He's not set up to take orders online.) The URL is

http://www.qsl.net/mnqrp/baggy.txt

The usual disclaimers apply; neither the Idea Exchange, the MN QRP Club nor the QRP ARCI warrant this offer. And in case anyone wonders about the name, people started calling him Baggy Bob because he hits a lot of hamfests and sells parts for a dollar a bag.

QRP-L, THE "QRP DAILY," AND THE QRP-F FORUM

QRP-L, the online QRP discussion forum started in 1993 by Chuck Adams, K7QO, continues to run several dozen postings per day on a variety of topics related to QRP. If interested in subscribing (which is free), send me e-mail and I'll send the details. To check out QRP-F, the alternative QRP forum started to take some of the load off QRP-L, just go to the QRP ARCI home page at

www.qrparci.org

and click on the QRP-F button. QRP-L is a mail reflector and can be subscribed to by anyone with an e-mail account; QRP-F is a web-based, HTML forum and requires worldwide web access. While the HTML forum format may seem a bit odd at first, those who read the QRP-L HTML archives, in the "sort by thread" mode, will feel right at home. About the only real difference between that and QRP-F is that the most recent messages are at the top of the list on QRP-F and at the bottom on the QRP-L HTML archives.

Regardless of the forum, any QRPer who is online owes it to themselves to check out both of these. There is a huge amount of online QRP info flying around, and has been for several years!

A CORRECTION

In the January issue I mentioned that Dave Maliniak, N2SMH of the New Jersey QRP Club, was editor of EE Product News, an electronics trade journal. He informed me that he has since left the company for other employment.

THE FINE PRINT

Although much of the Idea Exchange seems to be coming from online sources in recent years, we still gladly accept inputs from readers. I take word processor files, e-mail, floppy disks, handwritten notes, hand drawn schematics, whatever you want to send. Don't worry about the editing and graphics; that's my job. Your job is to send it in and share it with the QRP community.

--qrp--

Mutterings of a Displaced Cajun

Joel, KE1LA (ex WA5CVM), Freezin' in Maine *email: hamjoe@juno.com*

Hi Y'all once meaux ... did I ever told u about my QRP to the field trip the other day? I flew back to Louisiana and me and my buddy Alphonse decided to go to Vermillion bay and operate in the Take To The Field contest. So we loaded the John boat with wires and ropes and my QRP++ and 7Ah gel cell battery. My Cajun mama fixed us some lunch and we jumped in the boat and took off down the swamp to Vermillion Bay.

We went to an oil platform called the flare ... 'cause they had a pipe coming outta the water that burnt off unwanted gas and everybody called the place "the flare" and it is on Shell Reef ... 'bout the only place the water was kinda clear. Anyhow, Alphonse him, he run up the platform and hooked one end of a full wave 160mtr dipole to the platform and we scooted over to the other platform and hooked up the other end ... lots of sag ... but what a beautiful antenna, feed in the middle with Radio Shack twin lead and about thirty feet in the air. U talk 'bout two happy Cajun lads, that was us!

We anchored the boat under the twin lead and hooked the antenna up to the 'tuner. Man did we hear some stations ... they were from all over and loud too! A few hours and many contacts later the battery started to go down ... seems we forgot to charge the battery, so I told Alphonse to pull out the battery charger (an old car generator we modified so the water current, tide, could turn it) But Alphonse him, he just smiled and said he brought a better charger with himself.

He reached into a little but long box what he brought with himself and pulled out an electric eel!! Alphonse him, he's a bit weird but sharp as a tack so I kinda kept my thoughts to myself. Finally, I asked him how we were gonna find the polarity of the electric eel. Alphonse him, he smiled and showed me two marks on the eel ... one + and one - ... "I measured the polarity at the cabin yesterday", he said proudly (but he didn't tell me he blew his meter in the process).

So Alphonse laid the 'lectric eel across the battery and aggravated the critter so it would let out some voltage. Alphonse musta aggravated that eel too much, 'cause sparks flew, the battery blew, and we watched as parts of battery and eel flew in the air ... everywhere. Alphonse him, he sat down and said "Wow man, guess I shouldn't use the fast charge again."

That's when I saw this big hole in the bottom of the boat and shure 'nuff we sank the thing in a minute flat. Dem John boats got built in flotation so me and Alphonse just sat there in the boat full of water waiting for someone to pass by and pick us up. That's when we saw the lightning on the horizon! Thunderstorm time in the south ... coming our way. The big 'lectric eel in the sky was gonna get even! We watched as the lightning got closer and closer...

Finally the coward in both of us took over and we left the boat and QSYed swimming to one of the platforms. U ever watch a 160mtr dipole go up in smoke? It's a sight, I'll tell u... Just one, well placed lightning stroke!

We saved the radio equipment and boat but lost our logs so our score is unknown... However, we had one heck of an antenna for a while, I'll tell u man.

THANKS TO A SPECIAL FELLOW

I had the pleasure of being the managing editor of the QRP ARCI Quarterly journal. During that time there were a lot of people who gave me a lot of help. Look at the names of the Staff on the back covers of the issues that I edited. While EVERY one of them means a great deal to me, there is one that stands out in my mind.

Larry East, W1HUE/7 was always there. Larry and I first met soon after I took over as the editor. This was at a hamfest called WIMU, held in Jackson, WY. From that first chat I knew that he was a person who could be trusted and that knew what he was doing. I told him that I didn't have a clue as to what I was supposed to do as an editor. I think he thought I was kidding at first but soon the look of horror on his face told me that he was starting to believe me! In spite of this, he pledged his support and offered to always be there to help and he always was.

He has now survived another change of editors, this time for the better! (Mary, NA6E really is a much better editor than I was!). One of the first things to happen after Mary came on board was that our Technical Editor had to leave. That left the Quarterly in a bind. But Larry stepped up to the plate and took over that hat while a new one was found. In all this time and even after taking on the "extra" hat, he never missed a deadline and his work has always been first class.

Wearing both the Features Editor and the Technical Editor hats is not something I'd care to do! That is a LOT of work and is well above and beyond the "call of duty" for anyone to do.

A new Technical Editor has been found. I'll let Mary tell you about that. And Larry will still be the Features Editor. I just wanted to give a BIG THANK YOU to Larry, right here in the Quarterly. We are often too fast to complain and too slow to praise. Larry, this Bud's for you!

Thanks for everything, **Ron, KU7Y**

New Board Members Elected

The club is very fortunate in having interested volunteers who want to advance the goals of the club and enhance the QRP experience for an ever-increasing number of amateurs. Six outstanding candidates for board of directors were presented in the last issue of QQ. Also, the bios are retained on the club web site for those who may have missed the voting deadline but would like to know the candidates. Terms for the winners will run for 3 years from April 1, 2000.

With the new online voting process this year, voting for board members was fast and furious at times. The club set a precedence during the past two elections that open seats would be filled with the top three vote getters, but the remaining names would be held to fill any vacancies created in the ensuing years until the next election. Board members Preston Douglas, WJ2V, Danny Gingell, K3TKS, and Ron Stark, KU7Y are leaving the board this year. In addition, Cam Bailey, KT3A, has tendered his resignation due to time constraints. Their work effort, ideas, support, and analysis have been very helpful to the club and they will be missed. Thank you, fellows. We all hope that they will remain active, of course. Board members Chuck Adams, K7QO, and Hank Kohl, K8DD will remain on the board until 2002. If you are interested in obtaining a copy of the official voting count, contact Mark Milburn at kq0i@arrl.net.

The three new members are **Dick Pascoe, G0BPS** of Kent, England; **Jim Larsen, AL7FS** of Anchorage, Alaska, and **Ken Evans, W4DU** of Lilburn, GA who will serve until March 31, 2003. In accordance with previous action, **Joe Spenser, KK5NA** of Arlington, Texas, is appointed to serve the remaining term of Cam Bailey until March 31, 2002. **Bill Harding, K4AHK**, and **Jerry Huldeen, WB0T**, will be held and given preference should any other vacancies occur in the next two years. We appreciate the willingness to serve by all our candidates and appreciate all those who took the time to vote. I feel certain that these folks will carry on the traditions of QRP ARCI and that with their help we will grow even more during the ensuing years ahead.

- Jim Stafford, W4QO, President

NEW MEMBERSHIP CHAIRMAN!

Attention, this is Dave WA4NID, announcing that QRP ARCI Membership Chairman is now Dale Holloway and the person in charge of renewals and subscriptions is Mark Milburn, KQ0I., the current Treasurer. That's right, Mark has taken over the post I've held for over two years. I've had to step down due to increased demands on my time from career and family. PLEASE NOTE that you must use Mark's address now for ALL matters pertaining to new member applications, renewals, and associated payments, and he will also be your contact for any questions regarding subscriptions. This will be a good change for all members, as the functions of Treasurer and Membership will be combined for one contact person, and one address.

Please refrain from making routine inquiries about delivery of the QRP Quarterly until after the middle of the MONTH FOLLOWING the issue month, since there is a wide variation of delivery times. I've been glad to serve as your Membership Chairman for the last couple years, and will remain available as an advisor to Mark and other officers, as needed. Mark has already been learning how to handle the membership database, and I will be making sure he learns how to manage the system we have been using to produce the mailing labels for the QRP Quarterly.

The production of certificates for new members will be handled by Steve Pituch, W2MY. I'm sorry that I got behind on the sending of new member certificates, but I've tried to get caught up recently. I will help coordinate with Steve and Mark so that we get a smooth-running system for data transfer for production of the certificates.

There was a problem with incorrect address for me in the October 1999 and January 2000 issues! People who sent materials to my address as listed in those two issues may wish to check with Mark on the status of those. My postman has TRIED to catch all the mail sent to this wrong address, but I don't know if he got 100% of it to me. I've forwarded ALL that I received to Mark.

Best wishes to all.
Dave Johnson, WA4NID

The MFJ QRP-Cub™- a mini-review

Jim Stafford, W4QO   email: W4QO@arrl.net

When Martin Jue of MFJ visited the QRP Forum at last year's Dayton Hamvention, he brought along a prototype QRP transceiver kit. It was very small and had some very interesting features. For example, it ran about 2 Watts output, contained a superhet receiver, and used all board-mounted parts except for the knobs. In short it was cute. It was not until I saw the actual product at the Jackson, MS hamfest in early February that I saw some real potential for this little kit. Read on.

The kit is now available (in fact you get a nice discount if you order through the QRP ARCI's bulk purchase program). I picked one up for 15M and built it in about 2 1/2 hours! This means to me that it is a great kit for the beginner or someone who is hesitant about building a kit. Some 85 or so parts are those very small SMT parts. Now don't worry, these are already installed and soldered when you get the kit! You have about 50 parts to install and they are the bigger ones. Yes, I used my magnifying glass lamp but it wasn't bad at all.

When you get the kit, you get it in three bags of parts (inside a box of course). One bag is for hardware, one is the "generic" bag which is the same for all the various bands, and the last is specific to your band of choice - 80M through 15M, yes, including 30M and 17M. There is an operating manual and a construction manual in the Heathkit style. Rich Littlefield, K1BQT, designed the kit and wrote the material. He did a good job here. I usually don't count or check off the parts but I did in this case and they were all there - no more, no less. I noticed that the case had a nice almond coat of paint on the bottom half and a darker color on the top half.

It claims a hot 0.2 microvolt sensitivity, a differential mode AGC, low current drain - 36 mA on receive and 380 mA on transmit with the standard final stock 2N5109 transistor. The manual lists several alternatives for more output power. This openness to experimentation is a plus in my book. I suspect there will be other mods for this one. One might be a RIT that is not included in the stock package. The power output is adjustable down to the milliWatt level through a pot accessible through the top case.

I built the kit while watching TV in one evening. You do have to wind two identical toroids, not bad. There were no major problems. The only thing I had a little trouble with was: the power switch required some force to get it into the eight holes where it mounts. I noted that a hole is already on the back panel to accommodate a BNC, replacing the standard RCA socket - a nice feature, as are some pads to install speaker leads. I understand that a top is available with the holes ready for this option.

Once the unit was built, I had to find some alignment tools to tune it up. Once I had them in hand, it took about a half hour to set up. Just about right to make you feel a sense of accomplishment - "I lined up the unit myself!" I noted that the pi output network peaked very close to the end of the variable coil range but it peaked. Signals were comfortable on my 80 meter loop. I hooked up an external keyer and set the offset tone with ease. I worked a while to get the BFO set for a pleasant passband on the proper side of zero, well, maybe 3 minutes! The keying was pleasant and the QSK smooth. You could hear the AGC during recovery, which was quick.

Putting the board with all its components into the case took some effort, as it is a tight fit. When I had it mounted, all the knobs and switch covers fit perfectly. South American signals were comfortable during the late afternoon. I did not have time to make full measurements on the rig but it puts out almost one Watt on my 15 meter unit.

There is room in the case for other circuits or parts. I understand a small antenna tuner is planned to fit in the lid. A keyer will definitely fit in there. The rig is very light - the completed rig weighs in at 8 oz with the cover and 6 without. Can you say Spartan Sprint? With alternative finals, the rig will run almost 4 Watts output on the lower bands per the manual.

I anticipate lots of fun building and chatting about this rig. It could be built by most any youngster after some brief soldering practice. When you consider you get a full superhet, easy to build, lightweight transceiver, this is a "good thing."

de Jim, W4QO

QRP ARCI starts QRP-Cub™ Transceiver Bulk Purchase Program

QRP ARCI has instituted a bulk purchase program with the MFJ Enterprises company for their new Cub transceiver kit. As part of the program, there is an owner's list called QRPCUB@listbot.com You may sign up for the list on the club web site and exchange ideas/mods/trouble shooting/etc. This transceiver is designed by QRP Hall of Famer, Rich Littlefield, K1BQT. The club felt this might be a great one for the newcomer to kit building. It is very small - about 3.5x3.5x1.5 inches but almost 2/3 of the parts are SMT and soldered in when you get it!

The Cub is a single band transceiver kit—superhet with about 2 watts output, slightly less on the higher bands. It is available for 80 thru 15 meters. As part of the bulk purchase, the kit is available for $85 plus $5 shipping/handling. When the batch gets big enough, an order is placed and yours is mailed to you. Credit card orders accepted on the club web site.

Just send your $90 to Mark Milburn (see back cover) and get in on the fun!

QRP Amateur Radio Club International

See What The Excitement is All About!

2k in 2k Membership Drive

In order to increase our paid up memberships in the year 2000, we are instituting a Membership contest. We want to reach the 2000 member level this year and you can help. First, you can renew your own membership at least one month ahead of the next issue so we don't have to "track you down." Second, you may now sponsor other folks. You may sponsor NEW members or those who have been lapsed since before 1999. A spot on the membership form is now included to accept your name/call/number. So talk it up, set up a table at a hamfest (we'll provide some materials to help), or give a talk at your radio club. You can win in two ways: be the one who signs up the most during the calendar year 2000 or for each one you sign up, you get a chance in a drawing to be held at the end. These two people may choose one item from this list of MFJ products:

MFJ-886 1 to 3 GHz Frequency Counter (NEW)
MFJ-762 Attenuator + MFJ-124 24 hr Dream Clock
MFJ-201 MHz Dip Meter (1.5-250 MHz)
MFJ-1118 High Current DC Power Outlet
MFJ-971 Portable QRP Antenna Tuner
MFJ-396 Professional Boom Mic/Headset (NEW)
MFJ-852 Power Line Noise Detector (NEW)
MFJ-120 Atomic WWV Digital Clock + MFJ-3507 DeMaw RF Design Manual
MFJ-492 Memory Keyer
MFJ-1621 Portable Antenna
MFJ-93XXK Cub Transceiver Kit
AV-12AVQ hy-gain 20,15,10 vertical
VEC-4001K Vectronics Professional Function Generator (NEW)

Some cad suggested an Ameritron Amp, no thanks!
That's it. Quite simple. Now go do it!

Test Topics...and More

Joe Everhart, N2CX

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Designed For Test

The circuit this time is an old favorite of mine - a simple twin-tee audio oscillator. It was the very first Joe's Quickie in Mike C's Information Exchange column and is still a favorite on the N2CX workbench. Though very simple, this circuit is an excellent signal source for debugging and troubleshooting. An example of its use will be discussed later in this column.

Figures 1 and figure 2 are the circuit diagram and photo. Power is supplied by a 9-volt battery (a carbon-zinc "cheapie" is fine) and the output is a 1 kHz (check this) sine wave. A simple resistive divider from the transistor collector reduces the output to about 1 mV while the 0.1 uF capacitor provides DC isolation. Check the original article for a table of resistor attenuator, which set the output levels.

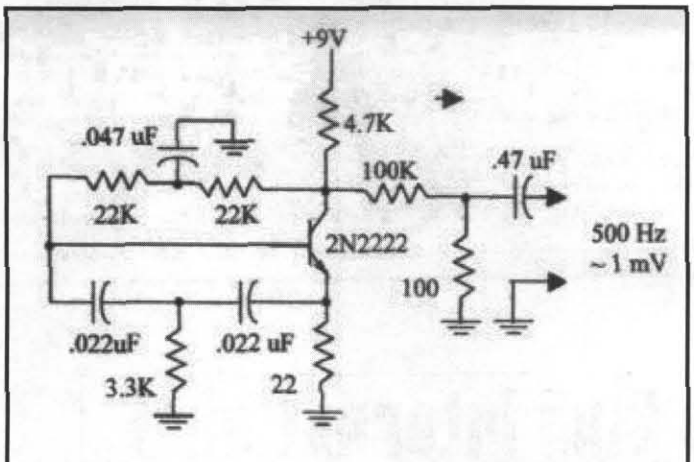


Figure 1 – "Quickie" Twin-tee audio oscillator

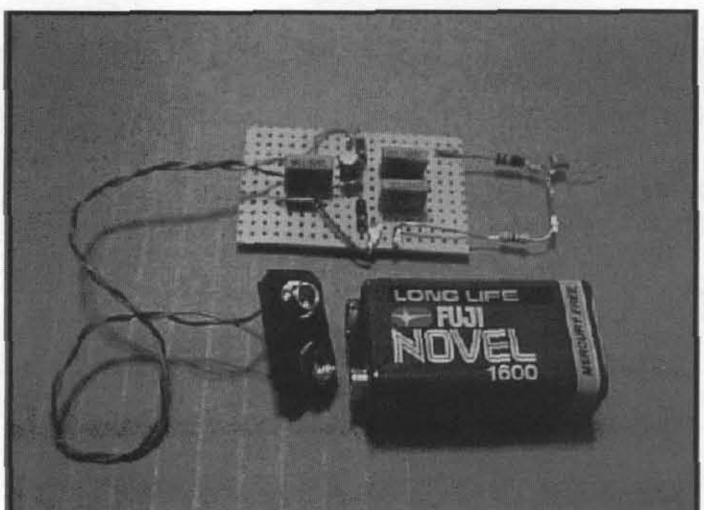


Figure 2

It's a pretty non-critical circuit that can be built ugly or beautiful. I built mine (a number of them actually) on a scrap of perf board. There is no power switch - to turn it on I simply clip a 9-volt battery onto the power connector. And there's no fancy output connector, either. An output and ground lead are wrapped over the edge of the board for access to a clip lead or soldered-on wires. In the one shown the attenuator pad and dc decoupling capacitor is soldered externally to these leads.

I recently used this oscillator to debug a prototype SOP receiver. While it worked fine in ugly breadboard style, the transition to a printed circuit is almost guaranteed to *not* work. I think there's some law of nature that says that...

Figure 3 is a portion of the SOP audio section in schematic/block diagram form. Debugging process starts at its output then proceeds backward toward the input. Going at it this way lets you hear what's going on so you need only the only test equipment you need is the tone oscillator and a DC multimeter. In the interest of brevity (and saving trees) I'll show the debug steps and results in summary form.

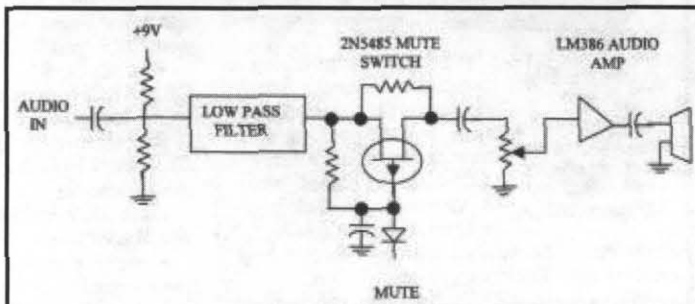


Figure 3 – Partial SOP Audio Chain Diagram

- Connect power - no smoke! I used a 9 volt alkaline battery to minimize damage if something was not right in the circuit.
- Check pin 6 of LM386 - should be about 1/2 supply voltage. Reads about 4.4 volts.
- Apply audio to top of volume control. Tone audible in loudspeaker. Apply audio to input of mute switch. Weak tone.
- Check dc bias on output of low pass filter. Should be 1/2 supply voltage but reads 0 volts.
- Check bias divider on the low pass filter input. Should be 1/2 supply voltage but also reads 0 volts. Found that divider is shorted to ground. Found pc board trace that incorrectly shorts to ground. Cut trace with Xacto knife.
- DC bias on divider and output of low pass filter now reads about 4.3 volts. Tone applied to input of low pass filter is audible in loudspeaker and volume control works normally.
- When mute line is grounded tone disappears as it should but there is a loud click in speaker.
- Check pinouts on mute switch with ohmmeter. Paul Harden's "Data Book for Homebrewers and QRPers" shows 2N5485 FET basing has the gate pin between source and drain. As it turns out the device I used has the gate at one end. See Figure 4 for the "equivalent circuit" for ohmmeter checks. The FET is an N-channel device so to an ohmmeter the gate should look like a diode to both source and drain as shown in 4a. If the FET had its gate as the middle it's basing would be as shown in 4b. Instead it looks like 4c. Apparently different manufacturers have different pinouts for this device.

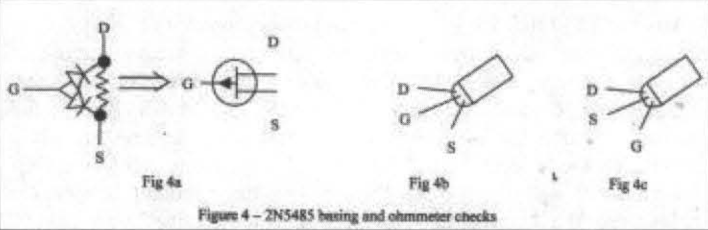


Figure 4 – 2N5485 basing and ohmmeter checks

- With the correct FET connections the mute switch passes audio when the mute line is open and shuts off the tone without a loud click when it is grounded.

- Finally, when the tone is connected to the input of the whole amplifier chain, it is very loud and, of course, can be adjusted using the volume control.

To this point only the audio chain was checked. The RF end of things is a different matter. Perhaps a future installment will show an example of RF circuit debugging.

Coming to terms - Accuracy and Precision

We all use the terms accuracy and precision interchangeably. To be facetious I've gotta say that we really should exercise more accuracy when we speak, taking care to use words precisely...

When we're dealing with measurements there are some simple things to remember. I'll give you some definitions along with examples to help clarify the distinction. Accuracy means how close whatever you are describing is to some established standard while precision deals with how closely a given measurement or description can be made.

Consider a dartboard. Accuracy means that your shots are close – preferably inside - the bullseye. Precision, on the other hand can mean how near multiple shots can be made to each other, regardless of how near they are to the bullseye.

The wide world of sports brings a number of other analogies to mind. One that I find odd is on the football field. When a play ends an official "eyeballs" its position relative to the yard marks. The side workers mark its position with a two poles tied together with a 10 yard chain. The to determine if a ball has been moved the requisite 10 yards for a new down, the chain is moved to the center of the field and a precise measurement is made from the guestimated previous position. This is a precision measurement made on the basis of a probably inaccurate estimate.

Now here's an electronics-world example. A fresh carbon zinc dry cell has a terminal voltage of about 1.556 volts. If your analog meter (with a 1% resolution) reads between 1.55, 1.56 or 1.57 volts the reading is accurate within the meter's ratings. However a four-digit meter that reads 1.583 volts on the same cell has more precision but less accuracy. So more digits does not necessarily guarantee accuracy if the instrument is not properly calibrated or is used in a way that adds measurement error (and that is a topic in itself!).

Frequency counters can be victims of poor accuracy with great resolution (precision) for a number of reasons such as a timebase that is incorrectly set, using the counter at temperature extremes that make the timebase drift, or attempting to read the frequency of a signal that has too much noise on it. Two common ways to check accuracy and precision of an instrument are either by verifying measurements made using a known signal source (called a standard) or by comparing readings on your instrument with another whose calibration is known.

Ensuring calibration is an important issue particularly for the homebrewer and may be difficult to achieve without access to proven standards. Lots of companies make big bucks by providing calibration and measurement standards to businesses and governments. Future TTAM columns will help homebrewers to make their own inexpensive measurement standards.

Stimulus and Response

In keeping with the "And More" theme of TTAM let's look at a reader's circuit request.

Hal Bergeson W0MXY is looking for "a keying monitor or what is often called a sidetone generator. I am aware that the current trend, particularly in the case of QRP transceivers, is to incorporate a side tone generator as part of the rig. However, I prefer to use a stand-alone sidetone generator that can be used with any rig."

Hal mentions that he had one years ago but lost track of it during a move. I can certainly identify with that! Here is a short summary of his wish list of features:

1. Self-power from RF would be desirable but using an internal 9-volt battery or external 12-volt source would be OK.
2. It needs a sensitivity control for use with either QRP or QRO rigs.
3. Another handy feature would be a tunable resonant loop pickup circuit to use in conjunction with an antenna tuner. He remembers a pickup coil for use with Johnson Matchbox tuners and wonders if something similar could be incorporated into, say a ZM-2.

Let's treat this as a group project. Here is what I would do to make one but I'd like to hear what others think.

a. I would go for a battery-powered monitor. It might be feasible to use a 9-volt battery or even a couple of AA cells. With QRP it may prove impractical to use the transmitted signal to power the monitor directly.
b. An RF detector is easy to envision and a simple way to hook it up so that it keys only from your transmitter is to use a "tee" connector in line with the coax feedline and tap off some of the RF from the center conductor on the tee leg. A high value resistor or small capacitor would be used for isolation then a potentiometer could be provide a sensitivity adjustment.
c. An alternative pickup could use the same detector with a link-coupled tuned circuit input for direct pickup from radiated RF or a "sniffer" loop Placed inside in a tuner.
d. The detector would provide a DC output, which would drive either, the base of a bipolar transistor or the gate of a low threshold FET (VN10 or 2N7000). This would key the power to a tone oscillator.
e. The tone generator could be done several ways. The simplest one that will drive a loudspeaker is the "Quicktone" described in one of my my recent Quickies.

Please let me know what you think. Meanwhile I will whomp up the circuit for next time.

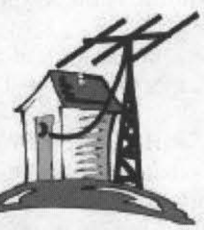
The next column will feature something a little different. The Designed For Test section will detail a stab at the RF sensing monitor and there will be a short Coming to Terms description, and there will be a detailed description of how Antenna Analyzers work. Plus the ongoing Stimulus and Response will, well, respond to whatever you write to me about. Please address questions to me at:

e-mail: n2cx@voicenet.com

snail-mail: Joe Everhart
214 NJ Rd
Brooklawn, NJ 08030

QRP Clubhouse

by Doc Lindsey
PO Box 6028
Bismark, ND 58506
email: k0evz@arrl.net



Thanks to all who sent information about your club meetings and other activities. If your club is not listed, it means we ran out of space. I have been amazed and delighted to discover so many QRP clubs. Some are the well-known giants, while others are newer and smaller. But each serves a purpose in its own way. It is great to know that amateur radio continues to grow and develop, QRP-wise.

Please feel free to write or send me materials. I gladly collect them and compile the column close to deadline. In fact, the earlier you can send it, the better it is from my perspective. Thanks. Remember, my aim is to include every QRP club, so please let me hear from you.

NOGA (North George QRP Club) - NOGA continued its record breaking attendance streak when 28 QRPers including 8 first timers attended the monthly meeting on February 5, 2000. As usual the meeting included a wide range of topics and show and tell items. One new member, Steve Ray K4JPN traveled 150 miles to attend the meeting. It was noted that the club had kitted 200 NOGAPIG kits to date.

NOGA meets every other month. The next two meetings are April 8 and June 3 at the RadioShack.Com (formerly TechAmerica) on Buford Highway just outside I-285 in metro Atlanta. Meetings begin at 11 am and end at 2 pm. There are no officers, no dues, and even no agenda-just fun. Guests are cordially invited to attend.

Currently the club is making available the NoGaPiG Power Indicator/ Guard kit. This amazing device gives the QRPers rigs and other electronic devices protection from a wide range of voltage dangers and mishaps. It is pictured in World Radio for February 2000 on page 52. For past and future meeting details, NoGaPIG kit information and other information about NOGA activities, point your web browser to http://www.qsl.net/nogaqrp/.

GW QRP Club (Cymdeithas QRP Cymru) was formed in 1994 to encourage low power amateur radio operation among the 4000-plus radio amateurs in Wales. On the air discussions took place during the spring of 1994 among GW0LBI, GW0RQP and GW0JUJ. Leighton Smart GW0LBI now publishes the newsletter and deals with awards, and Dave GW0JUJ is membership director. At last count the club was up to 40 members. Meetings are kept informal.

The club newsletter,The Mighty Milliwatt, is published four times a year (January, March, July and October). The club also sponsors a number of QRP contests during the year, and offers five awards to its members. To find out more about GW QRP Club, turn to their web page at http://www.gwqrp.free-online.co.uk.

NE QRP (New England QRP Club) - The next meeting of the NEQRP Club is set for Saturday, April 1, 2000, at the ARRL Headquarters (W1AW)! The gathering will begin at 9 am. Members are encouraged to bring their homebrew QRP rigs, great stories, new kits-whatever you are interested in-and show what they are doing with QRP. For more information, go to the club web page at http://www.eichhoff.com/.

Austin (TX) QRP Club - This tiny club is composed of QRPers who enjoy building, operating and discussing low power radio communications, equipment and system. The club's station call is KQ5RP, often heard in QRP contests and sprints. Originally all members lived in the Austin, TX, area, but now they may be found all across the USA and in several overseas locations. Club officials, speaking of membership requirements, noted only one = the applicant must actually be alive (or at least fool the onlooker into believing he or she is alive)!

Meetings are held irregularly on the second Saturday of each month at 11 am. For further information, including a do-it-yourself membership certificate, visit their web site at http://www.flashnet.~k5hgb/aqrp.html.

CQC (Colorado QRP Club) - This is one of the larger clubs, with a membership of over 600 at present. The club was formed in 1994 to promote QRP in Colorado and worldwide. Meetings are held bimonthly in January, March, May, July, September and November. The club publishes an excellent, award-winning bimonthly newsletter, The Low Down. In addition, members with e-mail or packet addresses can access CQC Online for more current information on club events and other items of interest.

CQC participates in Field Day every year using its club call W0CQC. Is also sponsors two QRP QSO parties annually, and offers several awards to its members. The club is welcoming new members. If you would like to join, send your request to Colorado QRP Club, PO Box 371883, Denver, CO 80237-1883. Annual dues presently are $12.00 for USA residents and $15.00 for DX members. Funds should be sent in US dollars.

If you would like to find out more about CQC, browse their website at http://www.mtechnologies.com/cqc.

Australia QRP Club - this club maintains a web site containing several articles of interest to QRPers, among them "Ten Steps to QRP Success (the secrets of doing more with less). I found a wealth of information in this short article. There is also a valuable page of links to a number of QRP-related home pages. Check out http://www.alphalink.com.au/~parkerp/qrp.htm.

Columbus QRP Club - Club call is K8QR. The club was originally founded in 1996 primarily for QRPers in central Ohio. Their purpose is simple-to help members enjoy QRP operating. Current president is Steve Bornstein K8IDN. Meetings are the first Saturday of each month at Universal Radio in Reynoldsburg, OH.

Little Thunder Bay QRP Club— This is a brand new club and will be holding their first meeting the second week of March. Fred Lesnick, VE3FAL, will be giving a talk on the foxhunts, how they work etc, and also fill them in on the Spartan Sprints, and QRPL, as well as QRPC Fred says: "We are going to meet to discuss equipment (and show off what we have) articles, and anything else that has to do with QRP"

SPECIAL NOTE: Paul Valko W8KC (Momma FOX) sent me a note about a new web search site. It is http://www.google.com. I immediately began looking up QRP clubs with it, and the typical search time was less than 1 second. Unbelievable. Give it a try. Thanks, Paul, for this invaluable information.

I look forward to hearing from you and your club. **72, --Doc/K0EVZ**

The Zig-Zag Dipole-Doublet

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One over-age myth about wire antennas is that they must be straight. Ideally, we would like them to be truly linear. However, even a kinky wire can perform quite well.

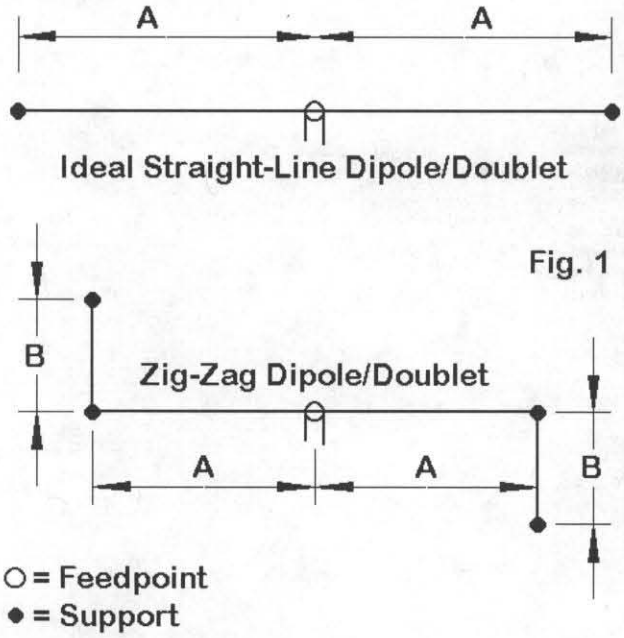


Fig. 1

Consider the scenario sketched in **Fig. 1**. A standard 1/2 wavelength dipole for 80 meters—about 135' long when about 50' up—would look like the upper sketch if we had the room for a 67.5' long wire runs on each side of the feedpoint. However, suppose that we do not have the room for the full length of the wires. We can settle for a shorter wire antenna, but we do have another option if supports are available: the zig-zag special. What we did with dimension A in the top drawing, we shall now do with A + B in the lower drawing.

The antenna could have been made into a U, but the loss of gain would have been slightly higher than with the zig-zag—due to the partial cancellation of the radiation from the facing end sections. However, the amount is small enough that, if a U is all that you can manage on a site, "U"se it.

To see what happens when we zig-zag our traditional dipole I ran a series of models, each of #12 copper wire over average soil. Modeling is limited in that it assumes clear, level terrain, and so it cannot take into account the hills, valleys, and ground clutter of the typical ham installation. Nonetheless, the trends are quite useful for comparative purposes.

If the antenna is set 50' up, the typical dipole pattern at an elevation angle of about 20 degrees is an oval at right angles to the wire. Let's see what happens as we turn more and more of the antenna into opposing end pieces. For the example, I used 5% increments of the half length, thus shortening each side of center by 3 3/8' with each move. Theoretically, the end piece should grow by that amount to keep the antenna resonant. Actually, we shall have to lengthen the ends slightly with each change in order to compensate for coupling between the wires near the corners.

The following table lists the wire lengths each side of center (A) with both the calculated and actual end pieces (B) need to restore resonance at 3.5 MHz. The feedpoint resistive impedance at resonance is also shown, along with the maximum gain. The final figure is the number of degrees off broadside that the pattern tilts as a result of the zig-zag ends.

End (B) %	Calc. Feet	Act. Feet	Length A Feet	Gain dBi	Pat. Tilt degrees	Feed R Ohms
0	0	0	67.5	0.06	0	70.0
5	3.4	3.7	64.2	0.06	0	67.6
10	6.8	7.3	60.8	0.04	1	66.4
15	10.0	11.0	57.4	0.02	1	64.9
20	13.5	14.5	54.0	-0.01	2	62.3
25	16.9	18.2	50.6	-0.05	2	59.7
30	20.3	21.7	47.3	-0.09	5	56.2

The total loss in gain within the situation set up is 0.15 dB for the entire spread from a linear wire to an antenna with 30% of each side turned at right angles to the main wire. If the zig-zag happens to be more open than the right angle used in the example as an extreme case, the loss will be less. However, it is already so low as to be undetectable in operation.

Had we bent the ends to form a U, the gain in the most extreme case would have been very slightly lower than for the zig-zag dipole, and so too would have been the source resistance at resonance. Another comparison of note is between the 20% zig-zag model and a wire 108' long and linear—something close to the traditional G5RV length. The G5RV would have shown about 0.1 dB less gain than the zig-zag, which would have been far less operationally significant than the high capacitive reactance at the feedpoint. However, if we feed the antenna with parallel feedline and an antenna tuner, all of these differences fall among the trivial.

The greater the amount of antenna devoted to the zig-zag ends, the longer the wire must be to restore resonance. Again, a more open zig-zag will show smaller amounts of required lengthening. Likewise, the feedpoint resistance goes down more rapidly as the zig-zag becomes more extreme.

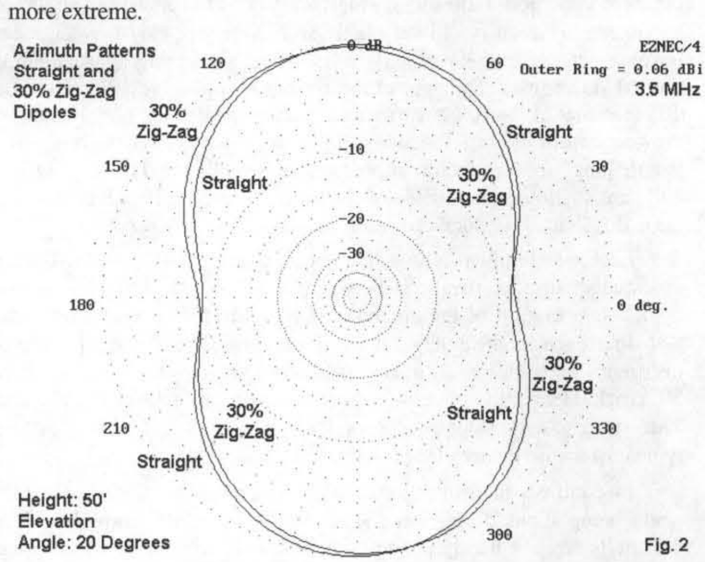


Fig. 2

The amount of pattern tilt is very mild, even at the 30% zig-zag mark. **Fig. 2** above sows an overlay of the straight wire and the zig-zag azimuth patterns for the 20-degree elevation angle. Again, in real operation, the difference will be unnoticeable. Notice that the pattern tilt is away from the bent ends.

As the zig-zag involves more than 30% of the wire on each side of center, the pattern tilt becomes more extreme, exceeding 10 degrees as the lengths A and B approach each other. We can view this amount of tilt as a disadvantage, or we can put it to use. Suppose the main supports we have will place the broadside pattern some 10 degrees off target for our desired operation. Making the antenna into a zig-zag dipole can put us back on target.

The Dipole Becomes a Doublet

If we choose to use the zig-zag on other HF bands, what happens?

The first thing that happens is that the antenna is no longer a dipole. A dipole is an antenna with a single current maximum at its center and voltage maxima at its ends. It is a center-fed dipole in the version with which we are working. However, since its length will no longer be apt to produce the current and voltage conditions along its length once we increase the frequency of operation, it will no longer be a dipole. Typically, a multi-band single (simple) wire is best termed a "doublet," a term that implies nothing in itself about the current and voltage distribution along the length.

The second thing that happens is this: the exact length is no longer of great consequence. Our first tests intentionally strove for resonance at 3.5 MHz in order to see what happened to the length of the end pieces. In multi-band use with parallel feeders and an antenna tuner, the length is no longer critical. The patterns will not significantly change with up to 5% differences in overall length, and antenna resonance is no longer a serious consideration.

A third phenomenon is the variation of the patterns of lobes and nulls from those that we are used to associating with a straight-wire doublet. To see what happens, let's use 40, 20, 15, and 10 meters as test bands to compare the patterns of a straight-wire doublet and our 30% zig-zag doublet—both of #12 copper wire 50' up. Of course, if we use a smaller amount of zig- zagging, then any deviations of patterns from the normal doublet pattern will be that much less.

In each of the patterns shown below, the antenna extends from one side of the pattern to the other. The zig-zag legs bend downward (relative to the page) on the left and upward on the right. Hence, most of the pattern tilting will be to the upper left corner of the page, at least at lower frequencies.

At 7.0 MHz, the zig-zag pattern shows a 5-degree tilt relative to the broadside lobes of the normal doublet. The elevation angle of maximum radiation is still very high, so a 20-degree elevation angle has been selected for the comparison to reflect something approximating normal skip angles. The gain of the zig-zag is slightly less (by about 0.5 dB) than that of the straight wire and is accompanied by a broadening of the beamwidth in both directions. Since the antenna is about one wave-length long, the feedpoint impedance is very high. The zig-zag side nulls are shallower than those of the normal doublet. However, none of these differences are likely to result in any gained or lost contacts.

Lest we simply presume that the remaining HF bands will show essentially similar parallels between the straight and the zig-zag doublets, operation of the antennas at 14.0 MHz serves as a reminder that difference might emerge at any frequency. The elevation angle of maximum radiation on 20 meters is 20 degrees with the antenna at the 50' mark. Hence, the patterns show the maximum gain of the antenna. The straight-wire doublet shows the familiar 4-leaf clover pattern typical of a wire 2 wave-length long.

In contrast, the zig-zag antenna shows much greater tilt, with the peaks being about 20 degrees distant from those of the normal doublet. The nulls are just barely perceptible, but with that improved coverage comes a price: the lobes are weaker than those of the normal doublet by about 1.3 dB.

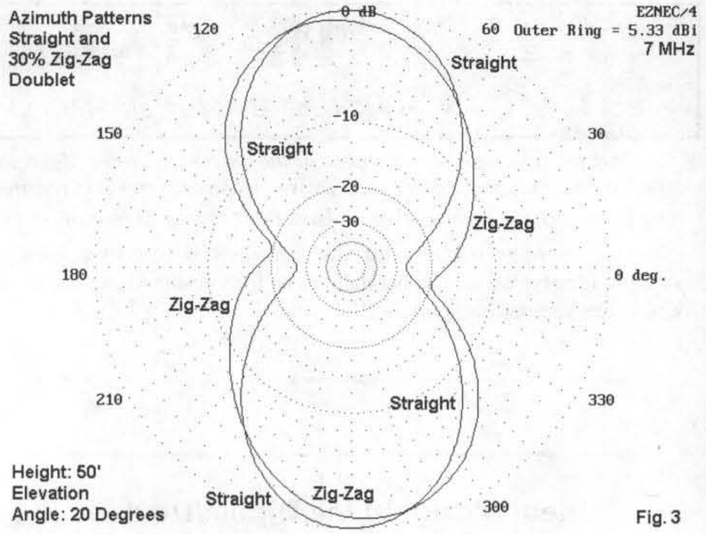


Fig. 3

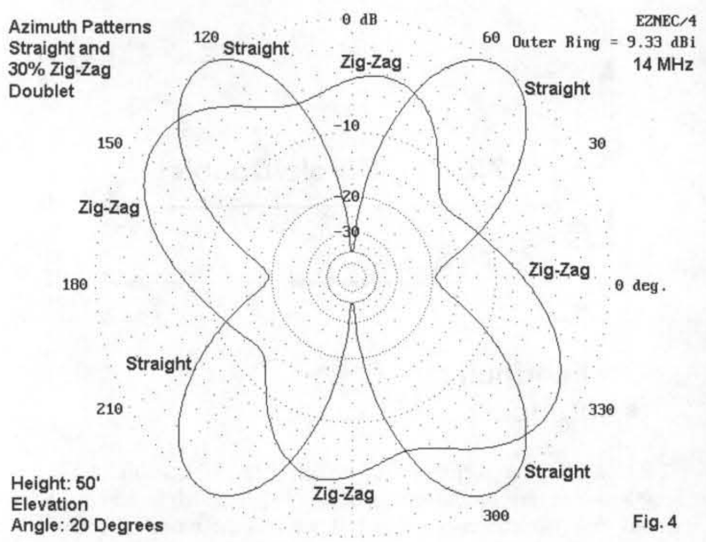


Fig. 4

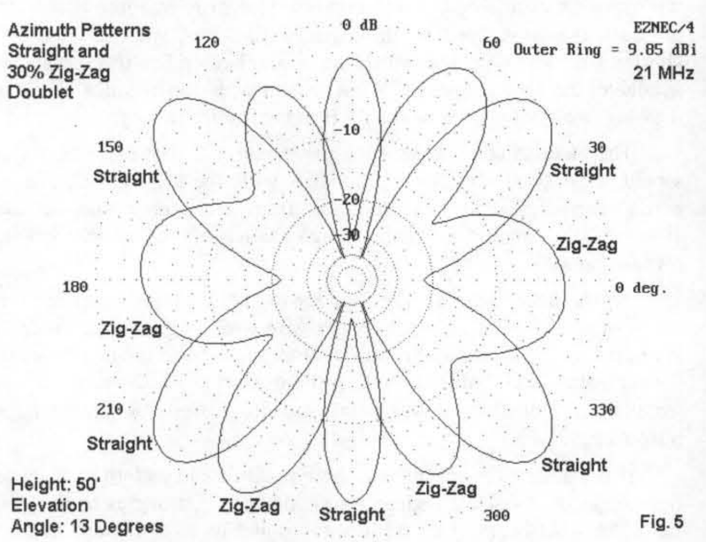


Fig. 5

At 21 MHz, the normal and the zig-zag patterns almost oppose each other, with zig-zag lobes filling normal nulls and vice versa. Once more, the normal doublet shows a higher maximum gain (by about 1 dB), but the zig-zag doublet tends to have shallower nulls.

Part of the reason for the especially strong zig-zag lobes off the ends of the antenna is that each bent section of the zig-zag is approximately 1/2 wave-length long at 15 meters. Had the zig-zag "B" length been shortened, the end radiation would have decreased rapidly. When operating the antenna at multiples of its initial frequency, the current magnitude shows a number of peaks, and the geometric configuration plays an increasingly significant role on the ultimate azimuth pattern generated.

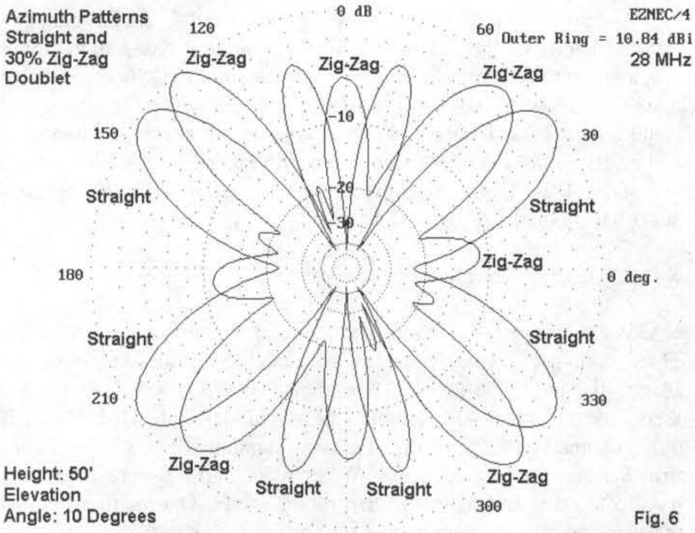


Fig. 6

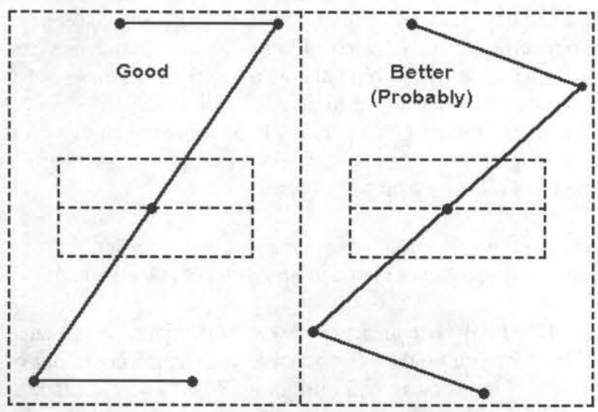
On 10 meters, at 28 MHz, there are so many lobes that the differences in the two patterns becomes less significant operationally. In fact, there is no significant difference in the strength of the largest lobes of the two antennas. However, we may note the two small lobes off the end of the zig- zag antenna. Because the end of "B" lengths are no longer close to 1/2 wave-length long, they develop lesser lobes. Some of the versions of the zig-zag with shorter "B" dimensions might well show stronger radiation off the antenna ends.

The feedpoint impedance of both antennas at the even harmonics of the original 1/2 wave-length frequency of the antenna will be high. The exact figures will be functions of the antenna's exact length. At harmonics, effects of the zig-zag will vary slightly from band to band, and hence the feedpoint impedances will not be identical to those of the straight wire. Values of resistance in the 1,000 to 4,000 Ohm range and values of reactance from 500 to 1200 Ohms are likely to be common for both the straight-wire and the zig-zag doublets. What values appear at the antenna tuner terminals will depend not only on these load values, but as well on the characteristics and length of the feedline used. If a tuner cannot handle the values presented on a certain band, insertion of a short length of additional feedline will usually correct the situation.

Other Variations

We have already noted that when the ends of the antenna are bent in the same horizontal direction, the resulting U-shaped antenna is only a tiny bit lower in gain than the 30% zig-zag. A more common scenario is to droop both ends downward. At the fundamental frequency, this configuration tends to lower gain still further, since the ends are closer to the ground. However, the result is far from disastrous. At higher frequencies of operation, the ends may show significant vertically polarized radiation, but the net effect will not be sufficient to alter the basic horizontally polarized patterns for each band.

Fig. 7



Two Configurations of a 135' Doublet: Zig-Zagged

Perhaps the ultimate utility of the zig-zag doublet is to fit a full 80-meter length into a fairly restricted yard size, as suggested in **Fig. 7**, running the antenna diagonally across the yard for the available space and then tilting the wires back along the yard lines (assuming supports are available) can make a multi-band doublet available to almost anyone.

The principle can also be applied to hidden roof-top or attic antennas. The ends can be run along the rafters and roof trusses, if appropriate care is taken to give clearance to conductive materials.

The urban dweller can still operate effectively even if circumstance seems to dictate undersized antennas. The key is to think in designer shapes, of which the zig-zag is a perennial winner. The losses, compared to traditional straight-line designs, may be far smaller than initially imagined.

Edited by W1HUE

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Bitten By the Bug —
Profiles in QRP

Rich Arland, K7SZ
email: k7sz@epix.net

This edition of Profiles in QRP will feature well-known QRPer, Fran Slavinski, KA3WTF. Fran lives in Larksville, PA, and has made quite a name for himself using milliwatt power levels to set several low power records on forty meters. Fran is also a charter member of the Wyoming Valley QRP Commandos, a lose knit collection of QRPers who get together once a year to do ARRL Field Day.

An outstanding CW operator, Fran leads the charge on the CW station, logging many hours each Field Day and dramatically increasing the Commando's score.

K7SZ: Fran, we've known each other for well over ten years. Tell our readers a little about yourself and how you got started n ham radio.

KA3WTF: I have been fascinated with radio since I was a small child. The idea that you could talk and have your voice come out of a box thousands of miles away was intriguing. When I was in grade school, I had an old shortwave radio and stumbled across some ham radio operators using AM. Here were ordinary people getting on the air and talking all over the world. I was hooked!

K7SZ: What drew you to QRP operation?

KA3WTF: Well before I was licensed I was subscribing to several ham radio magazines. Ade Weiss' QRP columns in CQ had a very positive influence on my decision to follow the low power path. His articles described a facet of the hobby that was challenging and fun.

K7SZ: Is it true that you bought your first QRP rig, a Ten-Tec Argonaut 515, before you were even licensed?

KA3WTF: Yes. At that time Ten-Tec was the premier manufacturer of QRP gear so I bought an Argonaut 515 well before I was licensed.

K7SZ: I guess the QRP Bug bit you way before your license ever arrived!

KA3WTF: Yes, that is correct. I never even considered using a 100 watt rig and would absolutely *never* fire up a high power linear amp. My philosophy was, and still is, "do it with as little power as possible".

K7SZ: What is your favorite pursuit regarding QRP operation?

KA3WTF: Without a doubt, chasing DX.. I love DXing. It's a tremendous thrill to work a rare DX station and compete head-to-head with the Big Guns. I also enjoy contesting and regularly enter the PA QSO party and several other contests each year. The competition is fierce and I really get a kick out of that. I also thoroughly enjoy milliwatting and microwatting. This is the "magic" of QRP.

K7SZ: Contesting and DXing are quite a challenge to QRPers. Share with us some of your secrets of success.

KA3WTF: The first point I'd like to make is that in order to be successful with QRP, in any arena, you *must* believe that QRP will work and have faith in your abilities and skills as an operator. I always take great pride in doing a good job and never handicapping myself or using the fact I'm at QRP power levels as an excuse for failure. In less than one year I managed to work DXCC using only 2 watts RF output. I didn't let the fact that I as at least 13dB below everyone else on the band get in the way of making my goal (DXCC) a reality. Another case in point is how I managed to work Albania, ZA1A. I listened to the ZA1 operation for over 8 hours, never giving a call. I just listened, getting the habits of the DX station down. The next day I didn't have propagation to Albania, so I blew off any attempt to QSO the DXpedition. The following day I took off from work for several hour just so I could try for ZA1. I started tuning around on the advertised frequency and easily found ZA1A, "CQing" with no takers. I gave him a quick call and got the QSO! All along, I *knew* that QRP would prevail. I never had a doubt I'd bag ZA1A, never.

K7SZ: Describe your station to our readers.

KA3WTF: Currently I have six active QRP stations at KA3WTF. Three Ten-Tec transceivers: an Argonaut 515, an Argonaut 535 (Argo –II), and a 556 (Scout). There are two Wilderness Radio rigs: a Sierra and a NorCal-40A. Finally I have an Index Labs QRP Plus. My only antenna is a Radio Works Carolina Windom-40 at 30 feet. I am a firm believer in wire antennas. Wires work and they are much less painful to erect and maintain than rotary arrays. One of these days I may erect a rotatable antenna but for now, I'll stick with the wires.

K7SZ: Do you collect QRP rigs? If so, give us a run down.

KA3WTF: In addition to the three Ten-Tec rigs, I also have a Ten-Tec PM2 and PM-3A Power Mite transceivers and an Oak Hills Radio 100A.

K7SZ: I've been in your shack a time or two and have noticed some boatanchor gear on the shelves. What's your connection with the older gear?

KA3WTF: I am fascinated with tube technology and the outstanding audio quality achieved using the older gear. Pre 1960s construction techniques are intriguing especially when you see how well they work, even today. I have a Cake Pan 1 watt CW transmitter and a matching Cake Pan Regen receiver along with a Hallicrafters SX-100 and two Johnson Viking Challenger transmitters. Not a large collection, but they are fun to play with.

K7SZ: Earlier I mentioned your world records using milliwatts/ microwatts on 40 meters. Give our readers some insight as to what goes into making and then breaking a world QRP record.

KA3WTF: *Believing* you'll break the record is 99% of the game. Without faith in your abilities you don't stand a chance. Obviously close coordination with the other operator with whom you intend to attempt the record is a prime concern. This is where you set up the frequencies and times for the record attempt.

One thing you have to remember is that the signals you're trying to copy are so weak that they border on the "imagination level". Many times when trying to copy a microwatt beacon you actually hear an absence of noise rather than an actual CW signal. It's very difficult to explain exactly what to listen for.

When making a record attempt the first thing I do is put on the headphones, turn on the rig and listen to the receiver noise for about an hour *before* I connect an antenna. This prepares my ears and improves the sensitivity of my hearing. After connecting the antenna to the receiver I then spend an equal amount of time tuning out the receiver noise and concentrating on the actual signal being received. Now I know this sound a bit weird, but it is how I train my ears to listen for extremely weak signals.

K7SZ: What are the most important traits that a QRPer can develop to further their enjoyment of the hobby?

KA3WTF: Tenacity and positive mental attitude. Throw away any negative thoughts regarding QRP. A negative attitude will only hinder your progress. I started out with QRP and it quickly became the norm for me. I knew what to expect and I also knew that I would ultimately prevail. QRO ops, on the other hand, are easily frustrated when trying QRP. They are use to the instant gratification that a kilowatt signal yields and they really don't believe that QRP will work all that well. They've handicapped themselves before they even start!

K7SZ: You've been involved with QRP since you've been licensed. Where do you see the hobby heading?

KA3WTF: I think that QRP is very healthy at this point. There is much more activity than ten years ago. The Internet is a great support structure for QRP. The concept of regional clubs has really taken off and these clubs provide a wonderful source of news and idea exchanges, not to mention radio kits. QRP is growing like mad and is the wave of the future in ham radio.

K7SZ: The on-going "hot button" topic is the need for a QRP endorsement for the ARRL's DXCC award. Where do you weigh in on this subject? Do we need a QRP endorsement? If so, why?

KA3WTF: **ABSOLUTELY!** We need a QRP endorsement for the DXCC award. A QRP station that sits on top of a DX station hour after hour waiting to work the rare one, should be recognized for this feat. After all, we QRPers are doing something that the QRO crowd takes for granted. The League should definitely offer a QRP endorsement for DXCC.

K7SZ: What's the single most important thought you'd like to leave our readers with?

KA3WTF: Less really is more. Believe in QRP. Believe in your abilities and skills as an operator. Never let negative thoughts burden you, for to do so is to fail. Spread the word about QRP operation. Let others know how much fun you are having with the hobby.

My thanks to Fran for sharing his insight and thoughts with the readers of the QRP Quarterly. You can regularly find KA3WTF on the low end of 40 meters (7040 kHz). You'll recognize him...he's got the great sounding "fist".

Till next time....73 Rich K7SZ

The Ultimate Backpacking Rig?

Bill Jones, KD7S *83 Redwood Avenue, Sanger, CA 93657* *e-mail: kd7s@psnw.com*

My first portable station [1][a] consisted of a Heathkit HW-8, 7-Ah gel-cell, MFJ transmatch, headphones, keyer, paddles, antenna, coaxial feedline, cables, connectors and so on. Needless to say, this setup didn't see much backpacking action. In fact, it rarely went much further than from the trunk of the car to a picnic table.

The HW-8 was eventually replaced with an MFJ-9040 that later gave way to one of Dave Benson's (NN1G) early transceiver designs [2]. As the equipment got smaller and lighter I was able to venture further and further away from my base camp, but backpacking a rig into the wilderness was still a major event. All that changed when Small Wonder Labs [3] introduced the DSW-xx transceiver line. When a DSW-20 kit showed up in my mailbox [4] in August 1999, I knew it was just a matter of time before cumbersome and awkward portable operation was a thing of the past.

The DSW-20 has all the features I have been looking for in a backpacking transceiver. The PC board is small, it measures 3-in. by 4-in., and includes a selective superhet receiver alongside a two Watt transmitter. Instead of a conventional VFO it features a PIC microcontroller and an AD9835 DDS synthesizer chip. That means there is no warm up drift to contend with. In fact, there's no drift at all. Moving from cool shade to bright sunlight doesn't mean having to chase a station all over the tuning dial. The PIC has other jobs, too. It also serves as a 5-50 WPM Iambic keyer, which helps cut down on weight and extra batteries. Finally, the PIC has been configured as a frequency counter with audible (CW) output. That means there is no dial calibration or fragile digital displays to worry about. *[See the DSW-20 technical review elsewhere in this issue. –W1HUE]*

Figure 1 Bill's custom packaged DSW-20.

I packaged the transceiver (**Fig. 1**) in a rugged, light-weight extruded aluminum case found in the freebie bin at a flea market. Besides the transceiver itself, the cabinet is large enough to house an N7VE ScQRPions Visual SWR Indicator [5]. There is also a pull-out storage drawer that holds a set of ear bud headphones and my homebrew finger paddles.

The finger paddles (**Fig. 2**) are made from scraps of ABS plastic and some aluminum channel I found in the scrap bin at my local hardware store. The design evolved from an article I found in **QST** [6] several years ago. The paddles weigh about an ounce and are extremely rugged. It doesn't take long to make the transition from side-to-side keying to an up and down motion. As an added advantage, these paddles stay put when in use. They don't need a second hand or heavy base to keep them from moving all over the place like conventional paddles.

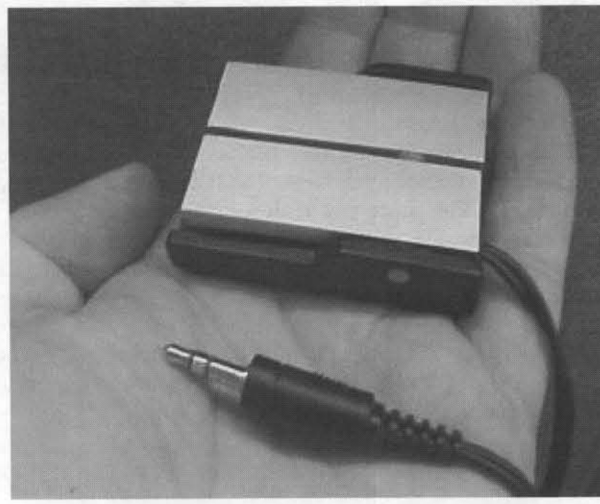

Figure 2. Bill's homebrew paddles.

Antennas have always been a problem for backpackers. Although a dipole works well, I've never liked the idea of carrying a length of coax as a feedline. Instead, I use an end-fed, half-wave wire in conjunction with a quarter-wave counterpoise. Almost everywhere I hike there are trees and it's usually a simple matter to toss the end of a 34-foot piece of wire over a branch.

For antenna launching, I commandeered one of my wife's knee-high nylon socks. I put a small rock in the toe and knot the top. Then I thread the antenna wire through the knot and swing the sock in an arc over my head. A well-timed release will put my "rock-in-a-sock" exactly where I want it, usually on the first try.

Several fellow backpackers have been quick to point out that an end fed, half-wave antenna requires a matching network, and of course they're right. But a transmatch doesn't have to be big, bulky and heavy. I built a 2 oz., 20-meter transmatch into an Advantix film container [7] as shown in **Fig. 3** It consists of a mica compression capacitor in parallel with a toroid transformer (see **Fig. 4**). The antenna attaches to the red binding post while the counterpoise connects to the black one. This ultra simple tuner presents a perfect, 50-Ohm match to the transmitter according to the transceiver's built-in SWR bridge.

Figure 3. Bill's Transmatch built in a film case.

[a] Notes are listed at the end of the article.

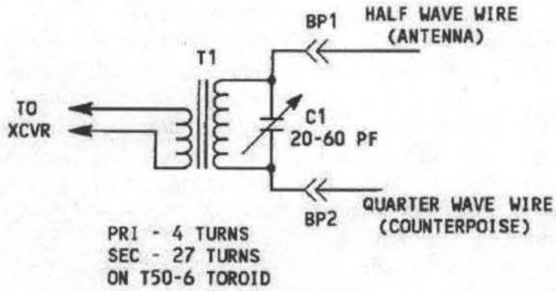

Figure 4. Transmatch schematic.

For extended trips, a 3-Ah gel-cell will power this little rig for many nights of casual operation. For shorter excursions an 8-pack of AA batteries in a plastic holder is enough. I always carry plenty of AA cells anyway because both my flashlight and GPS receiver use them.

Even though the DSW-20 is fully solid state, it still "glows in the dark." That is, the panel lettering is made from glow-in-the-dark paint purchased from an art supply store. A two-second blast from a flashlight will keep the control labels visible for at least a half-hour inside a sleeping bag at night. The soft geen glow is especially comforting when the weather outside my tent is dark and rainy.

For storage and packing, I keep the transceiver and all its accessories in a zippered, black canvas book cover. The whole thing measures 6-in. x 9-in. x 1.5-in. and weighs less than my down jacket. It's small enough to be rolled up inside my sleeping bag for added protection on the trail.

Whether this diminutive little station qualifies as "The Ultimate Backpacking Rig" or not is purely subjective. But it sure beats the socks off the old Heathkit HW-8, 7 Ah gel-cell, MFJ transmatch, headphones, keyer, paddles, antenna, coaxial feedline, cables, connectors and stuff I used to carry.

Notes:

1 Bill Jones, KD7S, "Build the Camper's Portable Hamshack," **QST**, April 1995, p 60.

2 Dave Benson, NN1G, "A single-Board Superhet QRP Transceiver for 40 or 30 Meters," **QST**, November 1994, p 36.

3 Small Wonder Labs can be found on the Internet at http://www.smallwonderlabs.com

4 The DSW-20 kit was a prize donated by QRP ARCI for my entry into the "regen receiver building contest" at Hamcom in Arlington, Texas in June, 1999. I am indebted to QRP ARCI for their generosity.

5 Go to http://www.extremezone.com/~ki7mn/n7veswr.htm for details on the SWR indicator.

6. John S. Lewis, W5TS, "The Code at Your Fingertips," **QST**, November 1976, p28.

7. Bill Jones, KD7S, "Keeping in Perfect Tune: A Film-Can Transmatch," **The ARS Sojourner Online Magazine**, January 1999 (http://www.natworld.com/ars/).

Edited by W1HUE

QRV?

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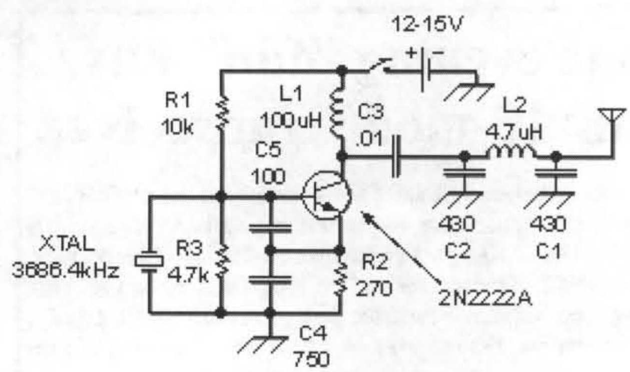
The NOGA QRP Club is a bunch of hams in the Atlanta area that love building stuff, love operating QRP and really love talking about it! Whenever we get together, we always have FUN! For grins last summer, a few of us decided to kit together a project for the Atlanta Hamfest. The idea was to stir interest in construction and to get more folks involved in our weekly net (Tuesdays, 9:30pm ET, 3686.4 kHz). I called the project the "NOGAnaut" since it was fashioned after Dave Ingram, K4TWJ's, Micronaut transmitter. It was definitely a fun project, but I sure did gain a new respect for the work that the folks at NORCAL, Small Wonders Labs, Kanga and others do for the hobby! (Details can be found in the Projects section of the NOGA website, http://www.qsl.net/nogaqrp).

The Micronaut was a one-transistor transmitter that put out 20 to 30 mW of power, originally described in *CQ Magazine* in 1997. The NOGAnaut is an adaptation of this circuit, with modifications for operation on 80 meters, increased output, and increased stability. It is the simplest kind of transmitter possible—the crystal oscillator—in this case a Colpitts crystal oscillator.



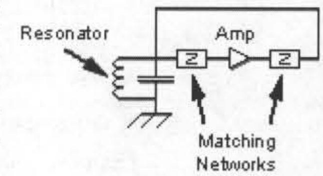
NOGAnaut Transmitter

In putting this kit together, quite honestly, I took a lot for granted. But in the subsequent months, I've wondered, "*Exactly how does this thing work?*"

Have you ever stood looking into a mirror with a mirror directly behind you? What you see is a reflection of a reflection of a reflection of a reflection, etc. This experiment demonstrates one of the two things that are necessary in order to achieve oscillation—*feedback*. Here, the reflectivity of each mirror to the other provides the feedback, and the repeating reflections visibly demonstrate oscillation.

In electrical terms, *feedback* means that some of the output signal of a circuit is *fed back* into its input (a good example of electrical feedback is the howl you get when you hold a microphone connected to the input of an PA in front of a speaker connected to the PA's output). The output signal applied as feedback should be higher in amplitude than the original input signal, that is, the signal must be *amplified*. If the signal is not amplified, losses in the circuit will eventually cause the signal to *dampen* (e.g., the reflected mirror images "fade into the distance").

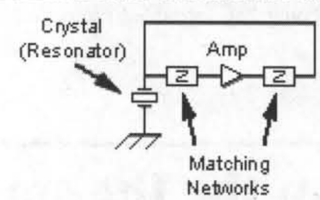
The second condition required for oscillation is that the phase of the output signal should be exactly the same as that of the input signal. This sort of makes sense, since two sine waves exactly in phase added together result in a sine wave, whose amplitude is the sum of the amplitudes of the two waves. In the LC oscillator shown here, the two matching networks (labeled "Z") ensure that the input and output signals are in phase. When an inductor and a capacitor are connected in parallel, they form a resonant circuit, or resonator. The resonator shunts signals not at the resonant frequency to ground. This ensures that the oscillator operates on a single frequency.



LC Oscillator from *Solid State Design for the Radio Amateur*

The two conditions for oscillation in an electrical circuit (in phase feedback with gain) are known as the Barkhausen criterion. Note that too much gain, or too much feedback leads to runaway oscillation—how many times have we had to tame an unwieldy audio amplifier under such conditions? The amount of gain in the amplifier is just that amount needed to overcome the losses in the electrical circuit, which come primarily from the resonator and the matching networks.

The NOGAnaut is a crystal-controlled oscillator. Crystals used in amateur radio oscillators are usually made from quartz. Quartz has the characteristic that when it is subjected to an electric field, the crystal structure changes mechanically, i.e. it moves slightly. Interestingly, not only does an electric field cause mechanical stress in the crystal, mechanical stress to the crystal also generates an electric field. This is known as the *piezoelectric effect*.

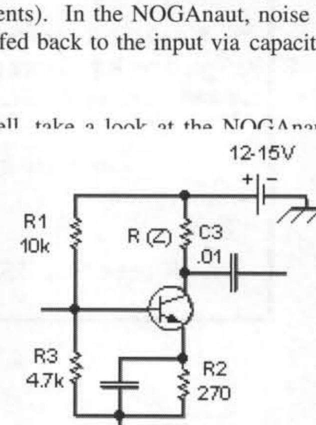


Crystal Oscillator

As an experiment, hook up a battery, a telegraph key and a piezoelectric buzzer from your local Radio Shack store. The buzzer is actually a crystal, *resonant* on a particular audio frequency. The crystal used in the NOGAnaut is just a piece of quartz, with two electrical connections, that is resonant (i.e. it behaves just like a *tuned circuit*) on the NOGA net frequency, 3686.4 kHz.

You might wonder, how does the oscillation get started? Or, put another way, which came first, the chicken or the egg? If all of the components in an oscillator were perfect, then a signal would somehow have to be injected into the circuit to begin oscillation. However, real components generate *noise* when current flows through them (for example, from heating of the components). In the NOGAnaut, noise is amplified by the transistor and then fed back to the input via capacitor C5, starting the oscillation.

Where is all this headed? Well, take a look at the NOGAnaut with feedback capacitor C5 removed. In this diagram, I've also changed L1 to a resistor, representing the impedance of L1. This is a common circuit for biasing a transistor into operation as an amplifier (I'll go into amplifiers in more detail in the next QRV, but if you are curious, check out *Solid State Design for the Radio Amateur*, by Doug DeMaw, W1FB, and Wes Hayward, W7ZOI, called "SSD" by fans).



NOGAnaut without C5

So in the NOGAnaut, C5 actually performs three separate functions—it serves as the input and output matching networks, as well as providing a path for feeding back the output signal into the amplifier input (actually C5 and C4 form a RF voltage divider helping to control the amount of signal feedback).

In this discussion, I've left out one important detail—the circuit formed by C1, C2 and L2. This circuit is called a pi network. In the NOGAnaut, it helps to attenuate some of the harmonic energy that might be generated by the oscillator. Note that at the power levels generated by the NOGAnaut, it's unlikely you will ever create interference from harmonics; however, the pi filter in this circuit is not sufficient to meet FCC spectral purity requirements. If you plan to use this transmitter on the air, you should probably add a half-wave filter—more about this next time.

Even though Doug DeMaw, W1FB (SK) published several one-transmitter circuits (such as the "Mighty Mite"), he and Wes Hayward, W7ZOI, say in *Solid State Design for the Radio Amateur*, "It is *not* recommended that a single oscillator be used as a simple transmitter. The addition of an amplifier is so straightforward, and the system efficiency is so much better, that the minimal simplicity is not of value."

Well, the NOGAnaut is a fun little project, can be built fairly quickly, and can be used to communicate with nearby stations. So for now, have fun, and next time, we'll talk more about amplifiers, and build a power amplifier for the NOGAnaut.

72 de Mike, KO4WX

(Editors note: Mike Boatright, KO4WX is the Assistant Section Emergency Coordinator for Georgia. He is an active member of the North Georgia QRP Club, and is webmaster of the NOGA QRP Club website (http://www.qsl.net/nogaqrp). He is an Extra Class operator and was first licensed as KD4BDE in 1991. His passion is QRP and in particular, homebrew construction. He can be reached at ko4wx@mindspring.com.)

Welcome to QRP ARCI

QRP Amateur Radio Club International, an organization begun in the early 60s has grown to over 10,000 members. The club is international in nature with members all over the world. Club members like to build and/or operate small, low powered rigs. Most of our members are not against high power and as a group we have never advocated the elimination of amplifiers or high powered contacts. We simply enjoy operating at low power levels - lower than we were used to operating. Why? Because it's FUN!

We have found that there is a real thrill associated with low power contacts. Because low power rigs are relatively easy to build, we have also found that an even greater thrill results from operating a rig that we have built ourselves. Accordingly, there are a lot of technical folks in the club who enjoy talking about new ways to build small transceivers/receivers/transmitters. Finding parts and sharing sources with others is a way of enjoying QRP as well. In fact, most all of our members get very excited about helping others who may be new to building or operating QRP.

Why join our club? Here are some of the benefits of being a member of QRP ARCI:

1. The QRP Quarterly - This journal is published each quarter in an 8 1/2 x 11 format and is usually 60-70 pages in length. It is packed with technical content but also has something for everyone from rank beginner to seasoned veteran.

2. QRP Awards program - Numerous awards are offered by the club. By the way, these are available for non-members as well as members. The most popular is the 1000 miles per watt. Simply take your output power and divide by the miles between the two stations. If it is greater than 1000, you WIN!

3. QRP Contests - Again, you do not have to be a member to enter out contests. If you are a member, you send your club number. If not, send your power output instead. The standard exchange of the RST and State/Province/Country precedes this information. The contests are very informal and you won't find much in the way of "hogging" frequencies and that sort of thing. They may be thought of as a way to test out your rigs and antennas with other QRPers. Don't own a QRP rig? Well, simply turn your power down on your "big" transceiver as much as you can and have a go at it.

4. Local club support - We try to help local/regional clubs with their programs by promotion and assistance. We also try to have our officers and board members at as many hamfests per year as possible. We bring along or send out a box of materials and promo items for use at hamfests as well.

5. Dayton Four Days In May - The club sponsors a huge event each year in conjunction wit the Dayton Hamvention. We actually add a full day of seminars before the hamfest and we have a whole program of activities each evening of the hamfest. You'll find almost a QRP Hamfest at the Days Inn South Dayton motel where we take over most of the facility.

6. QRP Forum online- A place to ask questions, trade ideas, seek information, make friends, in short - have fun! Check it out.

There are many more reasons to join. Take a tour of our web site. Thank you for visiting us and "try QRP, you'll like it!"

THE THRILL IS BACK!

A CW Adapter for the Radio Shack HTX-10 Ten Meter AM/FM/SSB Transceiver

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Introduction

The HTX-10 gives good performance-per-dollar on the phone modes, but many operators have bemoaned the lack of CW mode in this popular rig. Fortunately, adding a provision for CW is not a difficult undertaking. The circuit shown below connects to the HTX-10 microphone jack and can be easily completed in a weekend. I built it in the "traditional" Altoids® tin using "ugly construction"—see **Fig. 1**. With the exception of the microphone connector (Vanco JCB C-6, a common item at most CB shops) and possibly the relay, all the parts can be obtained from Radio Shack.

Circuit Description

The adapter schematic is shown in **Fig. 2** It operates by injecting a pure sinusoidal audio tone of about 800 Hz into the microphone input. As long as carrier and opposite sideband suppression are up to specifications, the result will be a "nearly pure" carrier. Power output can be controlled by adjusting the transceiver's microphone gain control. The frequency of the tone effectively sets the offset between transmit and receive frequency.

The circuit is a combination and adaptation from several sources, with little or no original design by this writer. References are given for those who would like more details on the "parents" of this little device.

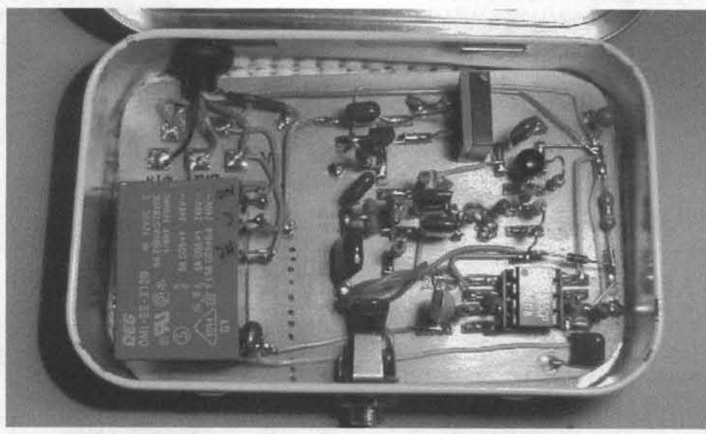


Figure 1. Prototype CW adapter built into an Altoids® tin.

Q1 functions as a twin-T audio oscillator [1][a]. This oscillator configuration was chosen because it produces a particularly pure sine wave, and requires no bulky inductors. The frequency determining elements are the pair of RC networks connected between the base and collector. The component values shown will yield a tone of between 750 and 800 Hz. Small changes in the .047 and .022 microfarad capacitors (or the 18K and 1500 Ohm resistors) can be made to change that frequency to the operators preference. Don't meddle too much with the 18K values, as those set the bias for Q1.

An emitter follower buffer is implemented by Q2, whose input signal is picked up across the middle capacitor of one of Q1's RC networks. This is a point where the distortion of the signal is minimum, but this point must not be loaded very heavily if distortion is to be avoided. The emitter follower provides a nice high impedance load to protect the purity of the waveform. Output is taken from the wiper of a trimpot in the emitter circuit of Q2. About 10 to 20 mV RMS is required at the wiper to drive the transceiver to full output.

Q3 is the keying transistor. The RC network in its base circuit shapes the keying to minimize clicks [2]. In an earlier version of this circuit the oscillator (Q1) was allowed to run all the time and the buffer (Q2) was keyed, but the key clicks were troublesome. So, at the risk of now having chirp instead of clicks, a change was made to key the oscillator and allow the buffer to

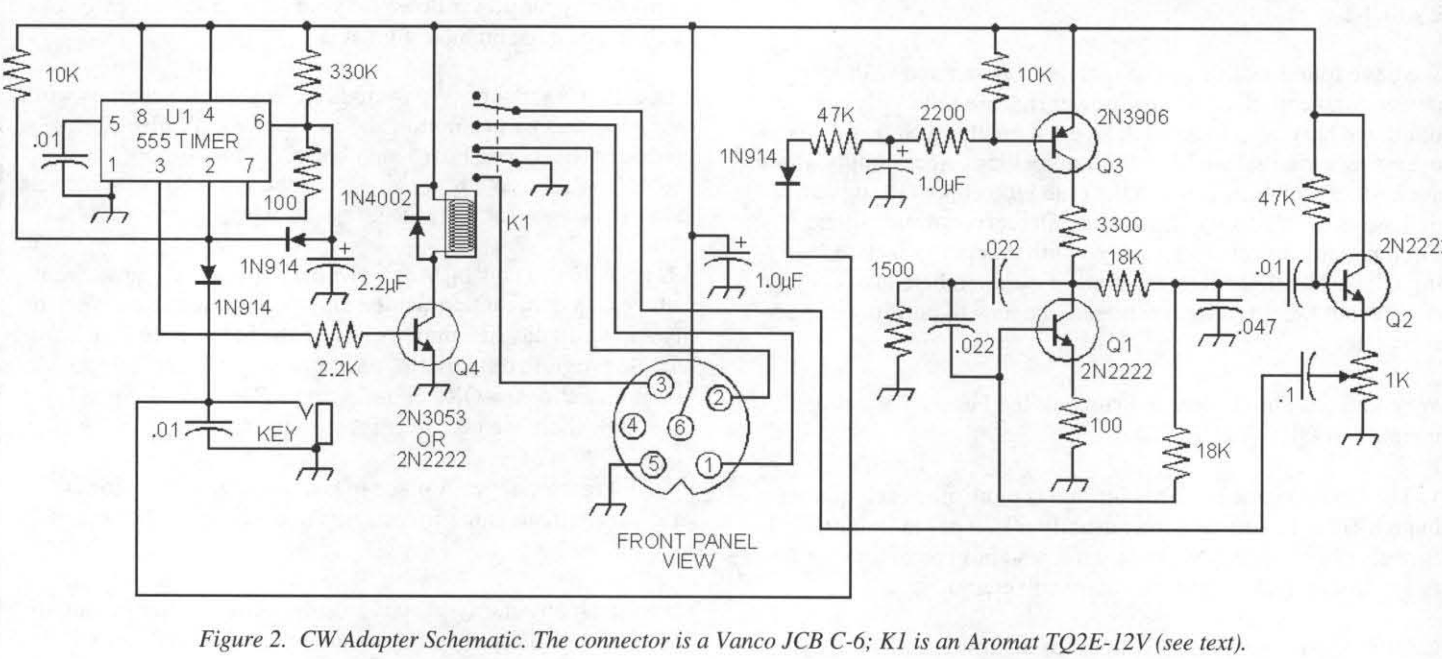


Figure 2. CW Adapter Schematic. The connector is a Vanco JCB C-6; K1 is an Aromat TQ2E-12V (see text).

[a] References are listed at the end of the article.

run all the time. The result was a substantial reduction in clicks, and, surprisingly, no objectionable chirp.

Transmit/receive switching is provided by relay K1 and its driver, Q4 [3]. The relay should be a DIP-style, low coil-current type. The one used in the prototype was obtained from Radio Shack, but I recommend an Aromat TQ2E-12V (Digi-Key 255-1002-ND). Operation of the relay is controlled by the timer, U1. When the key is first depressed, U1 turns on Q4 and energizes K1. As long as the key remains depressed, U1 is not allowed to begin "timing out." As soon as the key is released, U1 begins a timing sequence, whose length is set by the 330K resistor and 2.2 microfarad capacitor. In the prototype circuit shown, these are fixed values, but a pot could be used in place of, or in series with, the fixed resistor to allow adjustment of T/R delay. The fixed values shown are satisfactory for casual (non- contest) operating at 15-20 WPM.

A word should be said about the function of the circuit inside the HTX-10 microphone, shown in **Fig. 3** Part of this circuit must be emulated by the CW adapter. The PTT switch on the microphone does double duty. One pole is used to switch the audio line, disconnecting the mic from the rig when in receive mode. The other pole, whose common is grounded, places the rig in transmit mode by grounding the PTT line via the NO contact. The common side of the speaker is connected to the NC contact and is grounded when the rig is in receive mode. When the NC contact opens, the speaker common floats, serving as a receive mute. The control line that places the rig into transmit mode can easily be switched by a bipolar transistor, rather than a relay, but the speaker common must be grounded through a quite low (1 Ohm or less) impedance if audio output quality is to be preserved. Hence the choice of relay switching, although a MOSFET switch might also do the job.

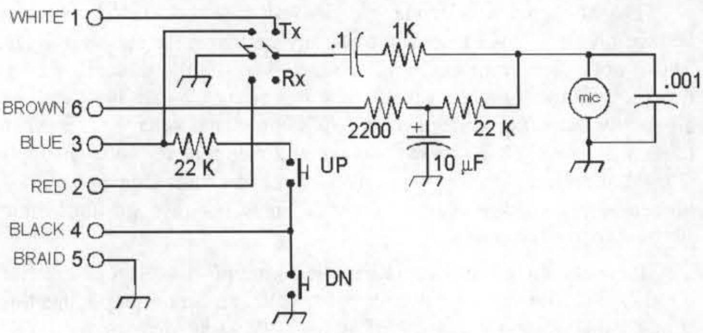


Figure 3. Radio Shack HTX-10 Microphone.

Operation

Operation is simple. Unplug the microphone and plug in the CW adapter. All needed power is derived from the HTX-10. Tune a CW signal so that its audio pitch is approximately the same frequency as the adapter's audio oscillator. Press the key to transmit. Adjust the rig's mic gain control for desired power output. Either sideband may be selected for operation. This fact may require some explanation:

Suppose you wish to call a station transmitting exactly on 28060.0 kHz. To obtain an audio note of about 800 Hz when in the upper sideband mode you would have to tune the HTX-10 to a frequency below the station, that is, 28059.2 kHz. This places the received frequency within the passband of the if filters. On transmit, the adapter injects an 800 Hz tone. The modulation produces three signals - the *carrier* at 28059.2 kHz, the *lower sideband* at 28058.4 kHz, and the *upper sideband* at 28060.0 kHz. The carrier and lower sideband are suppressed by the balanced modulator and filter circuits. Only the upper sideband signal (28060.0 kHz) is transmitted, which is on the same frequency as the station being called. You are zero beat with the station you are calling.

If lower sideband had been chosen, you would have to tune to 28060.8 kHz to obtain the 800 Hz audio note. The three generated frequencies would now be the carrier at 28060.8 kHz, the upper sideband at 28061.6 kHz, and the lower sideband at 28060.0 kHz. If everything is working to Riley Hollingsworth's satisfaction, the only thing that makes it out of the rig without being suppressed is the lower sideband signal at 2806.0 kHz. You are still zero beat.

Note that you may be able to take advantage of the fact that there is more space in the filter passband above 800 Hz than below. It may be possible to minimize nearby QRM by changing sideband selection to place the interfering signal further away from the center of the if passband.

Because the circuit that keys the oscillator is controlled by the same key line that controls the timer/relay circuit, the first code element of a transmission sequence will be shortened and will have a discernable chirp. This designer has not yet become clever enough to eliminate this shortcoming. The rest of the transmission, while the relay stays pulled in, will be free of such artifacts.

Conclusion

The prototype does not include provision for a side tone. Many users will pair the unit with a keyer that has integral sidetone. If this is not the case, there is enough room in an Altoids tin to include a TIC keyer or one of the similar PIC-based circuits. All of these include a sidetone provision. Alternatively, a dual timer chip could be used, with one of the two timers used as an astable multivibrator to generate sidetone.

Quite a number of contacts, at 5 W or less, have been made with the prototype in casual operation. No one has yet reported a noticeable click or chirp other than that described above.

References

[1] **1999 ARRL Radio Amateur's Handbook**, page 26.19.

[2] Douglas Camopbell, N1CWR, "A Morse Code Adapter for FM Transceivers," **QST** *Hints and Kinks,* January 1998, p. 78.

[3] Doug DeMaw and Wes Hayward, **Solid State Design for the Radio Amateur**, page 177.

Edited by W1HUE

Some Mods For The NorCal-20 Transceiver

Larry East, W1HUE *Idaho Falls, ID* *email: w1hue@arrl.net*

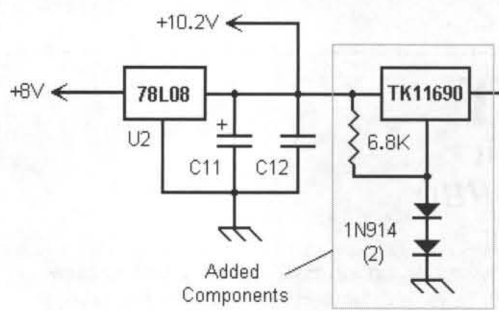
This note describes some mods for the popular NorCal-20 kit that have not, as far as I know, been previously described in print.

Transmitter Chirp Fix

Some NC20's have a noticeable keying chirp (or "whoop", as some have called it) on transmit. This is caused by the +12V supply voltage "sagging" slightly from the increased transmit current drain. A 78L08 linear regulator provides the reference voltage for the VCO (voltage controlled VFO) and any change in its output voltage will produce a change in the VCO frequency. 78Lxx regulators do not have perfect line regulation, and a few tenths of a volt change in input voltage can cause a few millivolts change in output voltage. An instantaneous change would not be noticed when the transmitter is keyed. However, the +12V supply voltage does not change instantaneously when the transmitter is keyed. In addition, there is a time constant associated with the reference voltage on pin 3 of U1. The net result is that it takes a fraction of a second for the VFO frequency to shift (a few tens of Hz, typically) and this is manifested as a "chirp" in the transmitted signal.

The generally recommended cure for this problem is to hand-pick a 78L08 regulator[1] that has better than average line regulation in conjunction with a "stiff" power source) to minimize voltage "sag" when the rig is keyed.

However, I decided to go to the heart of the problem and provide a very stable VCO reference voltage by using "double regulation". I did this by placing a 9V regulator IC ahead of the 78L08 to isolate it as much as possible from any change in the +12V supply buss. Since the input to the 78L08 needs to be at least 2V higher than its output for proper regulation, I increased the 9V regulator's output to 10.2V by placing two Si diodes between its common lead and ground. (Why not use a 10V regulator? Because I couldn't find one!) The 9V regulator that I used is a Toko TK11690; this is a low-dropout type that will maintain regulation as long as its input is at least ~0.1V above its output. A 79L09 could be used, but the supply voltage would need to be kept above ~12.5V (taking into account the ~0.3V drop across the reverse-polarity protection diode). The TK11690, on the other hand, will maintain regulation with a supply voltage of only 10.6V. I used the TO92 version of the Toko device (same pin-out as the 78Lxx devices). However, this is an "obsolete" item and has been replaced by an SOT-89 surface mount version, the TK11690U. Digi-Key currently has the TO-92 version in stock (part no. TK11690CT-ND), but they may not have any more once current inventory is depleted. They also stock the SM version (part no. TK11690UCT-ND); this can be used in the NC20, but you will need a good pair of tweezers, small soldering iron tip, a steady hand and probably a magnifying glass!



Dual regulator circuit (the 10.2V output use is explained later)

[1] LM78L08ACZ chips manufactured by SGS Thompson are reported to have very good regulation characteristics. These can be obtained from "Red Hot Radio" (http://www.redhotradio.com/) for a very nominal charge.

OK, so where did I stick the extra regulator? If you look at the top of the NC20 PC board, you will see a short "jumper trace" starting near C11 and running toward C63. If you follow this trace through to the bottom of the board, you will see that it is part of the +12V supply line to U2. I simply cut that PC trace and "bridged" it with the TK11690. The two 1N914 (or 1N4148) diodes run between the TK's center terminal and the ground pad for C99. The 6.8K resistor (used to insure sufficient current through the diodes) is connected between the TK11690's output and the diodes. Space is a little tight, but it will fit if mounted vertically. Simple, eh?

It should be possible to mount the SOT-89 version of the regulator in a similar manner. Make sure that the large single ground tab is soldered to the PC board ground plane (to act as a heat sink) and the "common" tab is over the break in the PC trace. As stated above, a good set of tweezers and a small soldering iron tip are needed here!

Before I made this mod, I measured a VFO shift of about 30Hz when the supply voltage was changed 0.5V. This was with the "stock" 78L08. After the mode, a 0.5V change in the supply voltage did not cause any detectable shift (less than 1Hz) in the VFO frequency. Varying the supply voltage from 10.5V to 14V produced a shift of less than 5Hz.

Regulated Voltage for the AGC Amplifier

The no-signal AGC voltage is derived from the +12V buss via a voltage divider. It will therefore track any change in the supply voltage. This is not a problem if the supply voltage is relatively stable. However, it could become a problem if multiple power sources are used and not all supply the same voltage. If the AGC no-signal voltage is set when using a "normal voltage" power source and then a lower voltage supply is used, a noticeable drop in receiver gain can occur. Conversely, if a higher supply voltage is used, the AGC may not respond until input signals become rather large.

It would therefore seem advisable to supply the AGC amplifier (Q10-Q13) with a regulated supply voltage. Some experimenting showed that a supply voltage of at least 9V is needed for the AGC amplifier to function properly. The 10.2V output of the "pre-regulator" described above is therefore just about right! It is a simple matter to use that to power the AGC amp.

To make the mod, proceed as follows:

Locate the PC trace that supplies +12V to the AGC amp. Looking at the bottom of the board with the tuning pot to your right, this trace is just to the right of Q13. Cut this trace between the point where R65 attaches and where it passes through the board. Solder a jumper wire between this trace (the solder pad for R68 or R61 is a convenient attachment point) and the output of the TK11609 (the solder pad for C12 is a convenient attachment point).

That's it! All that remains to be done is readjust VR5 as per instructions in the NC20 manual (or as described in Dave Fifield's AGC mod, which I highly recommend – see below).

Reducing AGC Warm-up Drift

The warm-up drift in the AGC zero-signal voltage can be essentially eliminated by a very simple mod: Insert a 1N914 (or 1N4148) in series with R63 to ground (the diode's cathode goes to ground). You can install the diode on top of the board (vertically) next to R63; cut the lead from R63 to ground and insert the diode. Readjust VR5 for the proper zero-signal AGC voltage; if you can't get the AGC voltage high enough, replace R63 with a smaller value (680 Ohms worked for me). Before I made this mod, the AGC voltage drifted about 300mV during warm-up. After the mod, the drift was less than 10mV.

Making the TiCK and AFA Outputs Independent of the Audio Gain Control

In a note published in the July 1999 **QRP Quarterly** (p. 44), Steve Weber, KD1JV, pointed out that the best way to obtain sidetone "volume control independence" is to use the second audio input of the LM386-LM380 audio IC's commonly used in QRP rigs. Since the second input of the NC20's LM380 (pin 2) is connected directly to the ground-plane on top of the board, this would require some effort—especially after the LM380 is installed. I used a simpler, although less elegant, method to isolate the TiCK and AFA outputs from the audio gain control.

This modification will allow the TiCK and AFA audio output levels to be as independent of the audio gain control (VR4) setting as you wish. This mod requires two PCB traces to be cut and one resistor to be added. The resistor value controls the degree to which the TiCK/AFA tones are independent of the audio gain control (VR4) setting. Select the value as follows:

If you want the TiCK and AFA audio levels to be somewhat dependent on the setting of VR4, use a resistor in the range 1-3K (e.g., 2.2K). This might be useful if you frequently switch between headphones and a speaker.

If you want the TiCK and AFA tone levels to be essentially independent of the setting of VR4, use a value in the range 5-10K (6.2K works for me. I don't recommend using a value greater than 10K.)

To make the mod, proceed as follows:

Find the PCB trace that runs from the wiper contact on VR4 to C56. Looking at the bottom of the board with the front panel facing you, the trace in question is the one running from VR4 along the right-hand edge of the board toward U6.

Using a sharp "hobby knife" or razor blade, cut a small gap in the trace near the VR4 solder pads. Solder a 1K to 10K resistor (see above concerning choice of value) across the gap in the PC trace. (You will have to carefully scrape away the green coating and tin the trace at the points where the resistor will be connected.)

Locate the PCB trace that runs from the common ends of C96 and C101 to pin six of U5B. Cut a short gap in the trace near the junction of C96 and C101. Solder a short length of insulated wire (#30 wire-wrap wire, for example) from the junction of C96 and C101 to the end of the resistor installed above that is away from VR4 (toward U6). In other words, the wire should connect the junction of C96 and C101 to the wiper of VR4 via a 1–10K resistor and directly to the end of C56 that previously connected to the VR4 wiper. Dress the wire neatly against the bottom of the board; avoid passing it directly over solder pads.

That's it! All that remains to be done is to readjust VR7 and VR8 for proper levels of the TiCK and AFA tones, respectively.

After making this mod, you may notice less receiver audio output–especially when driving a speaker. If that is the case, decrease the value of R56 (try 33K for starters) to increase the drive to the LM380N.

Other Mods

I performed the AGC mode described by Dave Fifield on his WEB site (http://www.redhotradio.com/) and highly recommend it; it makes the AGC operation much smoother. That mod and several others are also described in the Autumn 1999 issue of NorCal's journal, **QRPp**.

I did not encounter any "pops" or "screeches" after making Dave's AGC mod when the rig is keyed as reported by some folks on QRP-L. Maybe I'm just lucky. However, the mute circuit must be operating properly; the voltage on pins 1 and 2 of U4 should be reduced to almost zero (certainly below 0.5V) during transmit to eliminate any "bleed through" of transmitter RF into succeeding receiver stages. If it is not, check D17 and D18. Diodes D5-D8 must also be connected correctly to protect the receiver input from transmitter RF.

Shootout At The PA Corral – QRP Popguns In The PA QSO Party

Jim Gooch, NA3V *Huntingdon, PA* *email: Gooch@Juniata.edu*

When QRPers decide to try their hand in the state QSO parties, they should draw a red circle around the October dates of those twin monster QSO extravaganzas, the California and the Pennsylvania QSO Parties. During both events hordes of in-state hams grab a key and/or mike and hit the airwaves for the weekend contest, knocking off counties, states, provinces, and DX. Since my QTH is smack in the center of PA, I'll leave discussion of the CA QSO Party to a better-situated QRPer, and concentrate on the local contest.

The PA QSO Party is one of the oldies. Doug Maddox, W3HDH, for many years the organizational mastermind of the contest, writes that records of the PQP date to1968, and earlier versions of the contest are older yet. The current rules define the usual high power, medium power, and QRP categories, with QRP QSOs counting X2 those of the other categories. CW 160 and 80M contacts count X2 phone QSOs, and CW contacts on the higher bands are worth X1.5 phone. That means Joe Qrp gets as many QSO points with 100 80M CW QSOs as Jack Qro does with 400 phone contacts - pretty good odds for the QRPer!

The other rules are fairly standard: PA ops give serial number and county, out-of-staters give ARRL or RAC section or DX prefix in place of county. The final score is QSO points x the number of geographical multipliers. There are special rules for mobile, portable, special event stations, novices and techs, multi-ops, and clubs, etc. Plenty of plaques and certificates are awarded, and entrants with 100 valid QSOs in the log get—if they remit $9.50—a nice PQP mug imprinted with their call letters. Contest details can be found at the PQP WWW site: members.aol.com/doughdh/paqsoparty/paqso.htm.

QRP ops, especially those with an antenna capable of crashing the party on 80M, have made out like bandits. A quick skim of the 1998 PQP results shows that QRPers came in first or second in 11 of Pennsylvania's 67 counties, and out-of-state QRPers made high scores in several ARRL and RAC sections. The highest single-op in-state score went to QRPer N3BK, who topped all medium- and high-power entries. Likewise, the two highest out-of-states scores were QRP - K1VUT (1st) and K5IID (2nd). Winners received handsome plaques or certificates from the PQP sponsor, the Nittany Amateur Radio Club. The preliminary posted QRP scores in the 1999 PQP are a little lower, but still impressive. This is a contest tailor-made for QRPers who lust after wallpaper, or who just want to practice their operating skills and have a good time.

The rest of this article consists of a few tactical hints for out-of-state entrants in the PQP. I've worked the contest only a couple of years and that was in-state, so this is not the last word on the subject! There are two feasible goals in the PQP: (1) making a clean sweep of all 67 PA counties, and (2) piling up the highest possible score.

No many entrants pass up scoring to chase down counties exclusively, but if counties are your thing, you'll need to know which ones are rare and how to search for them. In PA the counties east of the line Allentown-Scranton-Harrisburg-York are easy to work (using a search engine on the WWW you can find a county map of most states). The city/county of Philadelphia is an exception and should be jumped on if you overhear PHI in a QSO. Allegheny County - Pittsburgh - and surrounding counties in western PA are also easy. Hams are sparser in northern and central PA, excluding populous CEN and ERI (I'm using the county exchange abbreviations). In the forested counties of northern PA, in fact, deer outnumber people and hams are as scarce as passenger pigeons. This is the region Punxutawney Phil, famed Groundhog Day WX prognosticator, has his hole. However, so many mobile and portable ops head for the northern counties such as CAM, ELK, FOR, POT, TIO, and UNI, for the contest, that some are easier to work than the overlooked counties of central PA such as BED, DAU, FUL, INN, and JUN. A popular spot for portable operation is the four contiguous corners of ELK, FOR, MCK, and WAR Counties, where one QSO lands you all four.

Note that some counties may be on the air CW or SSB only. You'll have to work both modes to have a chance of bagging all 67. QRPer John Shannon, K3WWP, for example, chugs away on CW from ARM County in the PQP, but you can't be certain of finding a SSB station in ARM. Ditto, some other rare county will only be found on SSB. The county stalker also should track the movements of the mobile ops. There are a lot of these in the PQP. Their inefficient antennas sometimes make them hard to work QRP, but they operate from hilltops when they can and the CW mobiles have good ears for weak signals. The PQP maintains an e-mail reflector, and mobile and portable ops usually post their itineraries before the contest. It's a good idea for county baggers to check these out.

Is making a clean sweep a realistic goal for the out-of-state QRPer? Several QRPers reached 64-65 counties in recent years, and one teetered on the brink with 66, even though they appeared to be chasing score more than a clean sweep. It's a challenge, and that 67-county plaque on the wall is one you know you've earned.

For QRPers trying to maximize their score, it makes sense to make rapid-fire QSOs rather than join pileups for rare counties, at least until late in the contest when those multipliers become very desirable. The highest scoring out-of-state QRPers, operating more than one mode, have occasionally come close to 400 QSOs. CW-only QRP ops have exceeded 200 QSOs. Because of the 80 and 160M CW bonus and the large ham population within close range, the low bands are crowded with activity compared with, say, the CA QSO Party, where the name of the game is a high-band antenna pointed east. QRP ops in most of eastern North American will have no trouble S&Ping most of the PA stations they hear on 40 and 80M. Late in the contest, when PA stations are prowling for fresh blood, QRPers can switch to CQ mode and make good runs.

QRP stations in the middle of the continent will be able to work many PA stations on the low bands, especially 40 and 80M CW at night, and will have short-hop 20M, and maybe 15M, available in the day and early evening. KA3LOC has done very well from Kansas on both CW and SSB. At this distance, however, most QRPers will operate CW primarily.

QRP ops out west will have their best luck with CW on the high bands. Though they won't work many of the casual PA stations hanging out on the low bands, they'll find plenty of serious PA entrants calling on 40 to10M CW. The trouble is, western QRPers don't seem to be listening! No QRP logs from call areas 6 and 7 are listed in the 1998 and preliminary 1999 PQP summaries. What gives with you folks - feeling bashful 'cuz we easterners are so smart and sophisticated? Is your RF six-shooter shooting blanks? We Pennsylvanians need you in our logs, so mark a red circle around October 14-15, 2000, put some Viagra on you antennas, fire up those popgun rigs, and join us in the next shootout at the PA corral.

Edited by W1HUE

QRPp – The QRPer's QRP!

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Most radio amateurs are familiar with the term 'QRP', it being the Q code for low power. Indeed, many amateurs are not only familiar with the term, but specialize in this form of communication, using low power levels to contact stations hundreds, and sometimes thousands of miles distant. Clubs dedicated to low power amateur radio operation exist all over the world, and most if not all report a growing interest in this particular aspect of the amateur radio hobby.

For low power operators, QRP refers to what is agreed to as up to 5 Watts output on the carrier modes such as CW, AM, NBFM and up to 10 Watts PEP SSB. *[The ARCI still has a 5W PEP limit for SSB QRP. –W1HUE]*. Even at these power levels it is possible to work all parts of the globe and many amateurs have done just this, working DXCC-QRP for instance, although not always with ease!

Having said that, most QRPer's will admit that using low power gives a sense of achievement which no other aspect of the hobby can bring, and that for many, DX is not the sole reason they get on the air. Just to make contacts using low power, regardless of the distances, is quite enough for many low power enthusiasts, and indeed some consider that every station they work is DX at such low power levels. Personally speaking, I became a QRP operator after suffering serious 'burn-out'; I lost interest in amateur radio after I'd worked all over the globe with my high power station, but discovered that low power operating gave me a reason to continue in the hobby, to stick with it.

How Low Can You Go?

If QRP operation can provide such a tremendous sense of achievement, then what about QRPp, meaning less than 1 Watt output? After all, if one can work stations with 5 Watts, why not with even lower power? For example, if you were working a station with 2 Watts of CW, receiving say, a 549 report, then, in theory at least, at 500mW your report should be 539, assuming that one 'S' unit equals 6dB.

I've heard amateurs saying that QRPp is 'QRP the hard way', and I must say I tend to agree. Countries which a QRPer may well work as a matter of routine with 5 Watts are an entirely different matter when only 100mW are going 'up the spout'!

After a few years of working with 5 Watts, my operating habits turned to even lower power, and I further discovered that it was possible to work stations and even to maintain reasonably reliable communication with milliwatt power levels. Now, QRP at 5 Watts is 'high power' for me, and QRPp is 'low power'—if that makes any sense to you!

I've discovered that for instance, one Watt, or even half-a-Watt of CW on the 3.5MHz band is enough to work stations all over Wales, Scotland and England and parts of Ireland at good (S7-ish) signal strengths during the daytime, despite the D layer absorption during daylight hours on this band. I've found that a good time for this type of operation on 3.5MHz is during the mid afternoon, as the skip begins to lengthen, as D layer absorption decreases, and before the 'heavy mob' from mainland Europe come storming in to swamp my milliwatts! A few CQ calls using milliwatts around the QRP frequency of 3.560MHz at this time rarely fails to bring forth a contact or two.

Another good time is around 0530 - 0730, as the annoying maritime and commercial QRM begins to fade from 3.5MHz. At this time of day, my 1-Watt CW signals have reached out as far as North America, as well as all over northern Europe, often with good steady signal strengths too. Operating at this time of the day is well worth the effort of rising with the larks!

On the other hand, the higher frequency bands can provide excellent opportunities for QRPp. With good conditions and relatively good antennas for these bands, it's just about anybody's guess where your milliwatts will end up.

Nor is CW the only mode for both QRP and QRPp - I once worked a US station with just 50mW (yes - fifty milliwatts!) of SSB. and a wire dipole antenna on the 28MHz band. I admit of course that band conditions were excellent at the time, and the station at the other end, K1AR, was using a high gain antenna system, but nevertheless a QRPp contact was completed which worked out to roughly 75,000 miles-per-watt of output power—effectively three times around the world!

The 1.8MHz band is another fine example of where milliwatt power levels can be quite effective. Using a 60m end-fed wire and an absolute maximum of 1-Watt, I've worked a total of 22 countries, with Russia being the best DX so far at the 1-Watt level, the distance being in the region of 1660 miles. With even lower power France has been worked using just 50mW at 320 miles, while Germany and Sweden are worked fairly regularly at power output levels of 300 - 500mW at around 770 and 970 miles respectively.

Try The Higher Bands

Newcomers to QRPp operation would perhaps be best advised to take their milliwatts onto the higher frequency bands such as 18 or 24MHz, as these bands tend to be quieter than the more heavily congested HF allocations, and are more likely to provide newcomers with their first milliwatting successes.

18MHz in particular is especially capable of supporting QRPp signals, having similar propagation characteristics to both the 14 and 21MHz bands, but, at present at least, suffering less from the high levels of QRM found on the other bands. Operation there is also more 'laid back' than on some of the other bands.

Band occupancy is one of the main things to check when considering putting out a QRPp signal. An abundance of strong signals can be a double-edged sword; it shows that band conditions are good, but will your milliwatts be heard with so many strong signals to compete with? On the other hand, if you are listening around the QRP frequencies and the strong signals you hear are emanating from QRP stations, then you're definitely in with a clear chance of being heard with milliwatts.

Do you call CQ with QRPp? Yes – if the band doesn't appear too crowded and signals are reasonably strong. Otherwise, try 'tail-ending' – calling a station as the operator finishes a contact with another station. Usually an operator will listen briefly following the completion of a contact, or even call 'QRZ?' – and that's where you come in!

You'll Get Squashed!

Before you all 'get the QRPp bug' and dash off into your shacks, I think it's only fair to warn you that with QRPp operation you are virtually guaranteed to be the one who will end up being 'squashed' under someone else's signals. For the 'milliwatter', life on the HF bands can be quite rough indeed, so don't be surprised when you call CQ and the only reply you get is: 'Is this frequency in use please?'

Contacts using milliwatt power levels can be few and far between at times, which can result in a high level of frustration for the milliwatter. Patience therefore is a necessity rather than a mere virtue for the QRPper! On the other hand, when a station does reply to your pounding 100mW signal and a successful contact is completed, the thrill just has to be experienced to be believed, it really does.

And it's not as impossible as it may seem; DXCC and WAC with milliwatts have been achieved by many amateurs, often using antennas such as simple dipoles.

But what next after QRPp you may well ask? Well, I think I might try working DX with a dummy load. I've already managed to work a local station a quarter of a mile distant on the 1.8MHz band, so I guess that a half a mile contact will be real DX!

Edited by W1HUE

Transistor PA RF Output Power vs. Load Impedance

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This is an article based primarily on empirical evidence, and is not the usual theoretical treatment of the subject of PA design, although it is in full agreement with the laws of physics. As such I think you will find it offers some fresh information in the spirit of amateur radio and experimentation, and will be of particular interest to QRP (50 Watts SSB, five Watts CW) aficionados. You may be surprised that I chose 50 Watts as the SSB QRP level, but the fact is that CW enjoys at least a ten dB advantage over SSB -- that is, CW can be copied when its S/N ratio is 10 dB worse than that of an SSB signal that is barely intelligible [1][1]. There are those who insist that QRP CW and SSB should both be defined as five Watts or less. I think this is unrealistic and does not create a level playing field. So let us compromise for the moment and assign 20 Watts as the SSB QRP threshold. It so happens that the output rating of the new 10 meter band MFJ 9410 SSB transceiver is 20 Watts PEP. And it is also significant that the latest version of the 20-meter band MFJ 9420 generates more RF power than its predecessors.

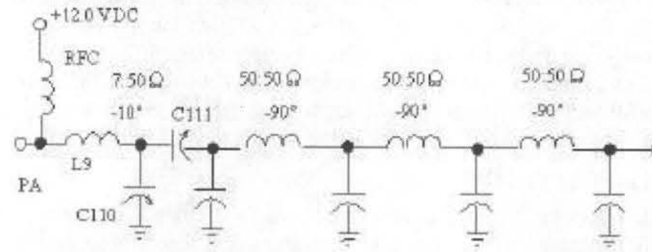
The first version of this article appeared in the January 1999 issue of the RSGB's **RadCom**, and addressed the output network and PA of the 10 Watt MFJ 9420 SSB transceiver. Since then the 9420 has been improved and produces more output power. The second part of this series of articles discusses the 20-Watt MFJ 9410, which uses a different PA transistor and output network. It will be interesting to see how the PA performance of the 9410 compares to that of the original 10 Watt 9420. For example, will the PA efficiency be lower at the higher frequency 10-meter band? Later in this article, we will see that just the opposite is true. But the main point of this article is that, rather than relying on theoretical device models, I decided to *measure* the PA performance of my MFJ 9410. The data also shed some light on the great debate about PA source impedance matching [2].

Conventional wisdom asserts that the RF power output level from a transmitter is optimal when the impedance presented to the power amplifier is closest to its design center value. An RF output network serves to transform the typical 50 Ohm load impedance to this desired PA value. But what happens when your antenna and transmission line present something other than 50 + j0 Ohms to your transmitter? Most of us are aware that a transmitter load impedance specification often simply refers to a maximum tolerable SWR value. Since there are an infinite number of impedances that fall within the typical load SWR tolerance specification of 2.0, one might ask the question, "are some of these impedances better than others?" This article will discuss specifically how much the *measured* PA efficiency and RF power output level from an MFJ 9410 vary over a large set of impedances other than 50 Ohms resonant. If QRP were defined as 20 Watts PEP for SSB operation, it would be good to know if certain loads cause the PA to deliver more than 20 Watts. For example, if you are working towards a QRP Worked All Counties award, but you discovered after the fact that some of your QSLs were made at 22 Watts, would you start over?

The MFJ 9410 is a CW and SSB "travel radio" rated at 20 Watts PEP, tuned to the 10 meter amateur radio band. Its PA uses a Mitsubishi 2SC3133 (the equivalent Motorola MRF479 has been discontinued). This transistor is an epitaxial planar type operating single-ended class AB. The 2SC3133 is capable of dissipating 20 Watts with a perfect heat sink, but 10 Watts for practical convection-cooled heat sinks, if the ambient air temperature is reasonable. Note that the power dissipation rating of a device is not the same as its RF output capability.

If PA efficiency is 67 percent, then 20 Watts of RF output would require a total input power of 30 Watts, and a collector dissipation of 10 Watts. Since this is right at the practical working rating of a 2SC3133, when operating mobile don't leave the key down and walk away from your car on a hot day. At 13.8 Volts, 20 Watts RF output requires about 550 mW RF input to the 2SC3133. This transistor is capable of about 72 percent collector efficiency in the ten-meter band.

The output network of the 9410 consists of an adjustable -10 degree 7:50 Ohm tee network followed by three 50:50 Ohm -90 degree pi networks (Figure 1). All the inductors consist of 8 or 9 turns of 22 AWG enameled wire wound on 1.0 cm diameter toroids (mix number 6 powdered-iron yields a Q near 150 with this size wire at 28 MHz). Capacitors are surface mount, except for the tee network variable caps (a nice feature that allows precise tuning of the PA load). This is not to be confused with the fine-tuning control on the front panel (a feature also added to the latest version of the 9420, by the way). This four-stage output network behaves pretty much the same across the 28.3 to 28.6 MHz 10 meter sub-band for which the 9410 is designed.



C110 and C111 are factory adjusted for maximum power output at 13.8 VDC

Figure 1. MFJ9410 RF Output Network

A 50 Ohm resistive load connected to the transmitter presents a non-resonant impedance to the collector of the PA transistor of about 7 + j4 Ohms for maximum RF power output at 12 VDC. Motorola application note AN1107 says that when you tune for maximum power output you have created a complex conjugate impedance match [3]. This erroneously implies that the "source" impedance of the 2SC3133 for a 12 VDC collector voltage is 7 - j4 Ohms. In the literature, this impedance is called Z_{OUT}.

Of course the source resistance, R_{OUT}, of the 2SC3133 is not actually 7 Ohms, since this would mean that the maximum collector efficiency would only be 50 percent when a 7-Ohm load was connected. The fact is that R_{OUT} is simply the load resistance that will produce the maximum RF power output from the transistor for a given set of conditions. The 2SC3133 spec quotes a 27 MHz value for Z_{OUT} of 7 - j3.5 Ohms at 12 VDC and 13 Watts RF. The 9410 output network is actually adjusted for maximum power output at a higher DC voltage, which means that the factory-set load resistance may be different from 7 Ohms.

Many transistor models assume that there are no power supply limits, and no feedback, deliberate or stray. However, in the real world there is not much headroom designed into a transmitter power supply, because unnecessary headroom wastes money. During these tests, I used a typical "economy" power supply and lossy cable that resulted in some voltage sag at the input to the 9410 when the PA was turned on. I compensated for this sag within the data reduction. Generally the operating voltage ranged between 11.6 and 12.5 Volts (I was careful to ensure that the on-board 10.25 Volt regulator did not slip out of regulation).

[1] References are listed at the end of the article.

The PA power supply choke, RFC9, is terminated in several bypass capacitors to keep RF out of the rest of the transceiver. There is no discrete swamping resistor in the 9410 as there is in the older 9420. With a 50 Ohm load attached to the transmitter, but no RF output, I measured a PA DC current of 0.11 Amps when using a 12 VDC supply, and with the audio off. Thus the overhead power consumed by the 9410 is a remarkably low 1.3 Watts. There is an additional power loss in the driver stage of less than one Watt when the key is down.

The PA RF choke in the power supply lead has about 0.2 Ohms of DC resistance; this is an improvement over the original 9420's 0.6 Ohms. With the key down and 12.0 Volts at 1.98 Amps supplied to the 9410, the RF power delivered to a 50 + j0 Ohm load is about 14 Watts. About two Watts of the DC input power to the 9410 is used by the low-level circuits when the key is down. Thus the transistor input power is 12.0 Volts times 1.98 Amps minus 2.0 Watts, or about 21.8 Watts, yielding a PA efficiency of about 64 percent at 28.45 MHz, which includes output network and power supply choke losses. This is consistent with the published device maximum collector efficiency specification of 72 percent in the manufacturer's literature.

The insertion loss of the DC test ammeter in series with the 9410 was accounted for by placing the voltmeter on the 9410 side of the ammeter. Note that the PA bias and all other parameters were left at the factory settings throughout the testing. Using an attic quarter-wave whip antenna 30 feet off the ground, this particular 9410 received a good SSB signal report from Paraguay during its first QSO from Texas in May 1999, so the factory settings appear to be okay.

The power delivered to the load was determined simply by subtracting the reflected power from the forward power on the 20-Watt scale of a Diamond SX-200 calibrated to a laboratory standard. The impedances were measured with a Hewlett Packard vector impedance meter calibrated to an NBS standard. I chose the HP meter after I tried two different hand-held impedance measuring products designed for the amateur radio market [4] and found their accuracies to be very poor in the 10 meter band except when the load was close to 50 Ohms. Impedance is a bit harder to measure accurately at 28 MHz than at 14 MHz where the original 9420 data were collected for the first article in this series.

The impedances were presented to the 9410 with an MFJ 969B tuner switched to its internal dummy load. The 30 Watt scale on the 969B was not as readable as the 20 Watt scale on the Diamond RF power meter, but it was still a useful backup during data collection. In the previous article treating the MFJ 9420, I used discrete load components, which I found to be rather tedious. This time I used the MFJ 969B antenna tuner in order to have continuous and more convenient control of the load impedance. The 969B uses a roller coil instead of tapped inductor, which allows continuous rather than stepped adjustment, thereby eliminating a lot of frustration and wasted time. Sometimes a tapped inductor just can't get you where you want to go!

The following data (Table 1) were taken with a constant 12 Volts DC supplied to the transceiver. The full 20 Watts of RF cannot be developed at this voltage, but it is a practical value for portable operation. The 9410 uses a number of voltage regulators on its printed circuit cards, but the PA is connected directly to the 12 Volt DC input and has no voltage regulation. The 9410 is designed to operate over a supply voltage range of 12 to 15 VDC. There is no series protective diode, only a shunt crowbar diode and a fuse-able printed circuit trace, so be careful not to hook up your power supply leads backwards! If you add a conventional fuse, you may find that you lose half a Watt in its resistance when the key is down.

Keep in mind that the phase shift across the output network from the PA transistor to the UHF connector is about -100 degrees on the Smith chart (Figure 2). This means that the output network behaves more or less as a quarter-wave transformer. Thus an impedance that is higher than 50 Ohms at the UHF connector appears at the PA transistor as an impedance that is lower than the desired nominal 7 Ohm load. In other words, be aware that if you think you are unloading the PA by increasing the load resistance at the output of the transceiver, you may actually be increasing the load at the PA transistor. But the reactance seen by the PA also affects its performance, particularly the efficiency. More about this later.

TABLE 1. Output Characteristics as a Function of Load

Load impedance (Ohms)	PA input SWR	PA input current (Amps)	RF load power* (Watts)	PA power (Watts)	Effc. (%)
50 + j0	1.00	1.98	21.8	13.9	64
54 - j6	1.15	1.92	21.0	13.9	66
42 + j0	1.19	1.89	20.7	13.0	63
62 + j0	1.24	1.75	19.0	12.2	64
53 - j19	1.45	1.76	19.1	12.4	65
73 + j0	1.46	1.79	19.5	12.3	63
41 + j15	1.47	1.85	20.2	12.6	63
32 + j0	1.56	1.76	19.1	12.1	63
77 + j14	1.62	1.78	19.4	11.6	60
47 - j27	1.74	1.59	17.1	11.0	64
75 + j27	1.81	1.78	19.4	10.8	56
90 + j6	1.85	1.70	18.4	10.0	54
28 - j10	1.89	1.49	15.9	9.1	57
68 + j39	2.06	1.80	19.6	9.6	49
41 - j35	2.18	1.39	14.7	9.2	63
28 + j23	2.29	1.90	20.8	9.9	48
21 + j0	2.38	1.67	18.0	9.6	53
37 + j37	2.42	1.86	20.3	9.4	46
58 + j49	2.44	1.82	19.8	8.4	42
87 - j50	2.49	1.70	18.4	9.3	51
37 - j44	2.78	1.25	13.0	7.5	58
21 - j21	2.87	1.15	11.8	6.7	57
45 + j54	2.97	1.72	18.6	7.5	40
17 - j6	2.99	1.46	15.5	7.7	50
150 + j0	3.00	1.71	18.5	7.6	41
108 -j63	3.03	1.92	21.0	8.4	40
18 + j15	3.06	1.78	19.4	8.0	41
14 + j0	3.57	1.65	17.8	7.3	41
180 + j0	3.60	1.80	19.6	6.5	33
30 + j52	3.81	1.74	18.9	6.0	32
31 - j54	3.85	1.12	11.4	5.8	51
129 + j125	5.20	1.79	19.5	4.2	22
173 + j192	7.88	1.83	20.1	1.6	8

* PA input power = $12 \times I - 2.0$ Watts, where I is the DC input current to the 9410 at 12 Volts.

We can draw some general conclusions from these data. First of all one can see that the general trend per Figures 3 and 4 is towards lower power output and lower efficiency with increasing SWR. As expected, for a given SWR, PA efficiency is significantly greater when the load reactance is negative even though the RF power output is the same on either side of the chart. This means that the PA is looking into a positive reactance for its highest efficiency, since the PA is located about 100 degrees away from the load (more-or-less on the opposite side of the Smith chart). And since the 2SC3133 published specifications indicate it produces maximum power output into 7 + j4 Ohms, this preference for the inductive side of the Smith chart makes sense.

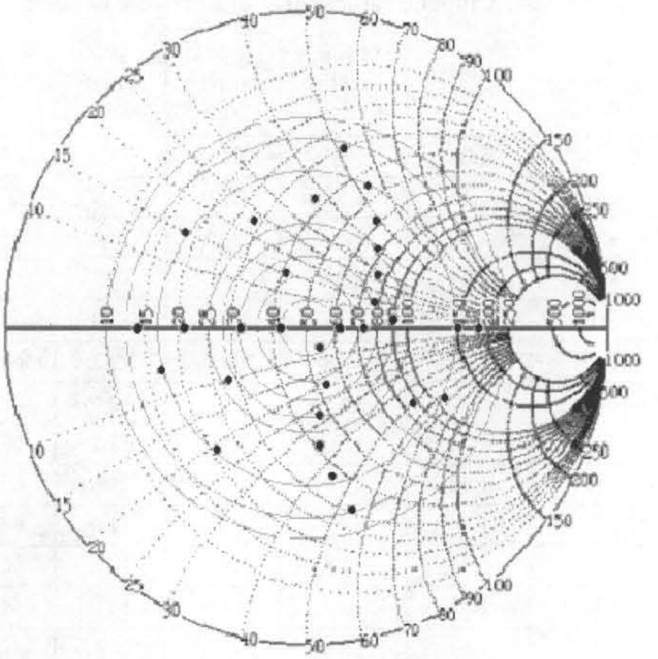


Figure 2 Load Impedances at Output of 9410

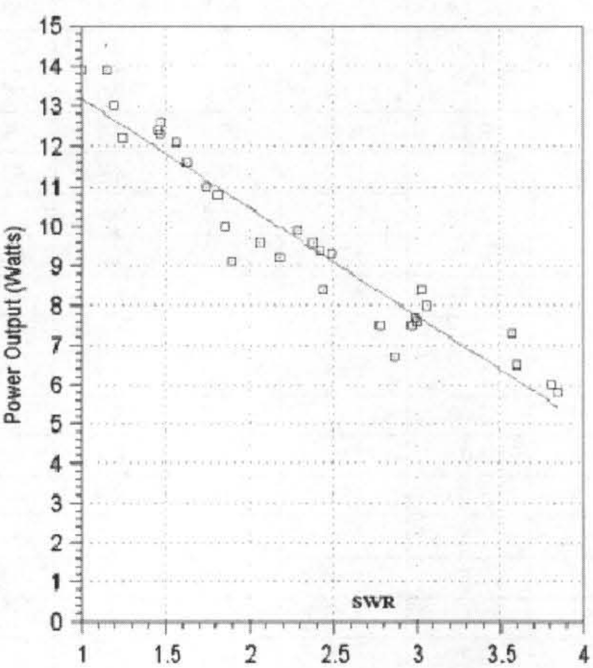


Figure 3. MFJ-9410 Output Power vs. Load SWR

The constant power curves form concentric rings around the maximum power output location, which is at the center of the Smith chart (Figure 2). The constant-power rings are closer to perfect circles in the case of the MFJ 9410 compared to the older 9420.

9410 Power Output	SWR Circle
14 Watts	1.0
12	1.5
10	1.9
8	3.0

You can get a reasonable idea of the power delivered to your load by subtracting the reflected power reading from the forward power reading of your directional coupler, if it has been properly calibrated. Note that the diodes used to drive the meters in an RF power meter are non-linear, and the closer you can keep the needles to the upper end of the meter scales, the better. By the way, when was the last time you verified the accuracy of your power meter, or calibrated the impedance of your dummy load? Chances are your reflectometer, or directional-coupler, or magni-phase, or power meter, or SWR meter may only provide reasonable accuracy for loads close to 50 Ohms. I also measured a commercial "50 Ohm" ham radio load as 56 + j0 Ohms at 28.45 MHz, so when in doubt, be sure to measure. A commercial dummy load may be specified as having a SWR of 1.2 over a fixed frequency range, and may not present 50 + j0 Ohms at any frequency. If you really want to do a professional job, you need professional tools. So if you have to borrow or lease $30,000 worth of test equipment to achieve the accuracy you want, by all means do so. There is only one thing worse than no data, and that is bad data.

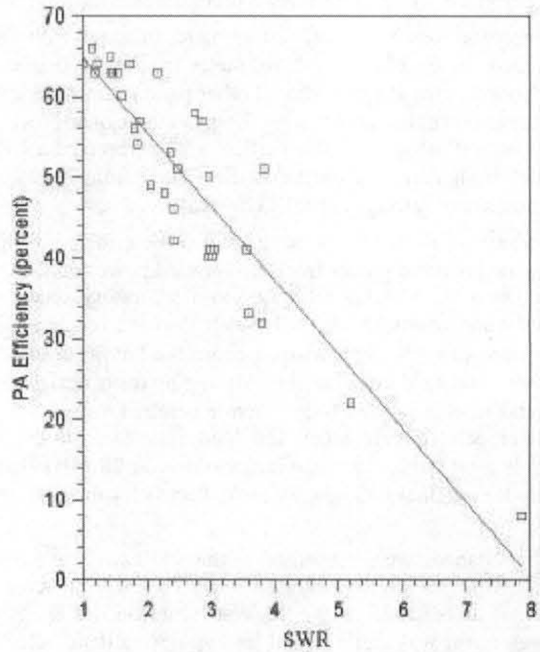


Figure 4 MFJ 9410 PA Efficiency vs. Load SWR

To determine power delivered to the load, I used the Diamond SX-200 directional coupler, rather than a lab-calibrated 100 MHz or better oscilloscope and probe, $P = (V/Z)^2 R$. I felt using the directional coupler was more in the spirit of ham radio. A good wide-band oscilloscope costs a lot more than a good directional coupler, and may not be readily available to the amateur experimenter. I did feel compelled to use an expensive impedance-measuring device, however. I estimate the combined accuracy of the test equipment I used is within ten percent for RF power output, DC power input, and efficiency results listed in this article. There is just one caveat to using a directional coupler, and that is the fact that if your PA becomes unstable and produces significant harmonics, the coupler will give bogus values. An oscilloscope would alert you to any instability right away, whereas a directional coupler may not.

You can also determine the delivered power to your load as I^2R assuming you have an accurate RF ammeter and impedance measuring device, or as V^2/R assuming you have an accurate RF voltmeter or oscilloscope, and, again, a trustworthy impedance measuring device. A calorimetric load is used by professional transmitter manufacturers, designers and broadcasters when they want a really accurate measurement of RF power output, and this requires accurate coolant flow and temperature measurement, not to mention knowledge of the specific gravity of the coolant, or humidity if the coolant is air, etc.

Unprocessed single sideband voice modulation requires less average current from the power supply than tone modulation or typical Morse CW, so the PA may produce higher peak transient power outputs for SSB voice than for CW, unless your power supply is very well regulated. If the power supply voltage regulation is reasonably stiff and its current rating is conservative, the peak envelope power and CW output power may be the same. You can consider the PEP value to be the CW value over one RF cycle at the maximum level of modulation. Normal voice transients don't stick around long enough to cause the typical power supply to sag as much as it will during a key-down situation. Have you ever measured the DC voltage supplied to your PA while the key is down or your modulation density is high? How much does it sag? You might be surprised by the size of the voltage drop in the DC supply cable alone. A regulated supply won't help much in that case, unless the "sense" wire is connected to the transceiver end of the cable.

Since the radiated field intensity is proportional to the square-root of the power output from your transmitter, a receiver would hardly see any change in signal strength from a 9410 operating into the full range of loads within a 3.0 SWR circle on the Smith chart according to Table 1. One S unit is typically considered to be 6 dB, and the least power output for the 2.0 SWR data in Table 1 is down less than 2 dB. Therefore one might conclude that as long as the reduced PA efficiency and stability are tolerable, why worry about matching the load impedance down to the nit? If you are voice modulating, the average modulation depth is relatively light compared to some other modes, and the duty cycle of a normal QSO allows the PA to cool quite a bit between transmissions. Of course, if your chosen mode has a high modulation density and high duty cycle, then you should be more concerned about mismatch. But in the case of the 9410's 2SC3133 PA, even with the worst-case 2.0 SWR load you will still be operating within the power dissipation rating of this transistor when your DC supply voltage is 12 Volts.

But there are other performance considerations related to load impedance. For example, will the radio be able to modulate cleanly and fully if the power supply is already taxed by poor PA efficiency? If RF audio processing is used, will the feedback sample be degraded by a poor load? Will PA stability be okay without modulation, but degenerate with modulation when a poor load is present? When in doubt, play it safe and match that impedance.

Keep in mind that Class C and D RF power amplifiers behave quite differently from Class AB amplifiers, and every class AB transmitter has a different output network, so be careful that you don't indiscriminately apply the information contained in this article to an amplifier operating with a different amount of bias or a different set of filters and impedance matching networks.

So in conclusion, it appears that when the SWR of the load impedance presented to an MFJ 9410 is kept below 3.0, then the worst reduction in signal strength one can expect is about three dB, which is about half an S unit. Some additional good news is that if you define 20 Watts PEP as an official QRP level for SSB, then you will probably never violate this limit by operating a 9410 into a mismatched load. Figure 3 leads one to the conclusion that 20-Watts output is only possible when the load is close to a perfect match and the power supply voltage is greater than 14 Volts. The maximum RF power output I recorded was 14 Watts for a power supply voltage of 12 VDC and a resonant 50-Ohm load. Since output power is proportional to the square of the DC supply voltage, we can expect about 18.5 Watts of RF when the supply voltage is 13.8 Volts. The PA efficiency of the 9410 is considerably higher than that of the original 9420 design. However, the latest 9420 design has a higher PA efficiency than its predecessor. It is interesting to note that for a given SWR, impedances on one side of the Smith chart yield much higher PA efficiencies than do impedances on the opposite side of the chart even when the RF power delivered to each load is the same. Again, this can be predicted by the published value of "Z_{OUT}" for a particular PA transistor.

I invite the reader to make his own set of PA performance measurements for various load conditions, and it would not surprise me if there were certain loads that yielded a PA output power greater than that obtained with the nominal 50 Ohm resonant condition in other transmitters. Of course, this will depend on the power supply performance, the RF output network, the type of PA transistor(s) and feedback, etc. But I think that if you characterize your transmitter's PA performance with an empirical set of data such as I did for my little 9410, then you will know exactly what to expect. And if you are operating QRP or looking for extra points in a contest by staying below a certain power level, it is nice to know under what RF load conditions you might be disqualified!

Notes and References

1. John Devoldere, **Low Band DXing**, 1994, p3-1, paragraph 1.2.
2. See Warren Bruene's letter starting on page 7 of the Spring 1999 issue of **Communications Quarterly**. I agree with Bruene, by the way.
3. Norman Dye, "Understanding RF Data Sheet Parameters," 1991, page 7. Available by FAX as document AN1107 from Motorola, 800-774-1848.
4. I did not try any of the MFJ impedance meters, since none were available at the time.

Edited by W1HUE

Technical Review: The Small Wonder Labs DSW-20 Transceiver Kit

Russ Carpenter, AA7QU 47227 Goodpasture Rd., Vida, OR 97488 email: russ@natworld.com

This is a summary of an in-depth review of the DSW-20 that appeared in the November 1999 issue of the Adventure Radio Society's on-line magazine, ***The ARS Sojourner*** *(www.natworld.com/ars/). See the complete review for details on measurement procedures and comparisons with other HF transceivers.*

The DSW-20 is literally a "small wonder." Weighing just 4 ounces (without case) and packed on a single 2-3/4 by 4 inch board, this radio is ideal for portable operations. It has just the right amount of firmware, adding genuinely useful functions to the DSW-20, while avoiding frills. This radio sets a standard for elegant simplicity.

You can find basic information on the DSW-20 on the Small Wonders Lab web site, http://www.smallwonderlabs.com, and we won't repeat it here.

Our tests of the DSW-20 were performed without a case. The board was in a very quiet RF environment, and we have assumed that the lack of a case did not affect the test results.

Transmitter Tests

Power Output

Rated output for the DSW-20 is 2.5 Watts. Our sample produced 2 Watts with a 13.8 Volt power supply and 1.3 Watts with a 12 Volt power supply.

Power Requirements on Transmit

With a 13.8 Volt power supply, our DSW-20 drew 330 mA with 2.0 Watts of RF output. With a 12 Volt power supply, our DSW-20 drew 285 mA with 1.3 Watts of RF output.

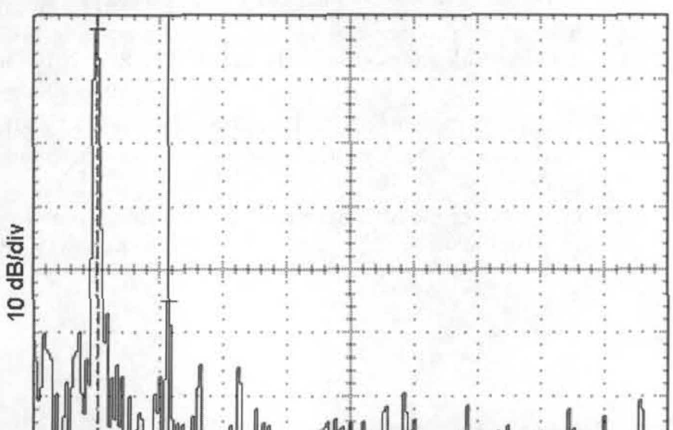


Figure 1. DSW-20 spectral purity plot. The carrier is indicated by the dotted vertical line. The worst-case spur is indicated by the solid line (second harmonic) and is 45 dB below the carrier.

Spectral Purity

FCC regulations require the spurious emissions from a 2.5 Watt radio to be at least 30 dB below the carrier. Our sample easily met this requirement.

The measurement was performed with a Tektronix TDS 380 scope with Fast Fourier Transform capability. The spectrum obtained is shown in **Fig. 1**.[a]

Introduction to Receiver Tests

Many of our receiver test reports use bar charts that compare the unit being reviewed to a number of other HF transceivers. Please read this brief explanation of the purpose and layout of these charts.

Receiver Tests—When No External Signals are Present

Spurious signals

There were three birdies in our sample, at 14.002, 14.045 and 14.046 MHz. They were all near the minimum discernible signal and would probably be masked by typical 20 meter noise levels.

Power Requirements on Receive

Our sample drew 49 mA on receive with a 13.8 Volt power supply, and the same amount with a 12 Volt power supply.

Receiver Tests—When One External Signal is Present

Minimum Discernible Signal

On 14 MHz we measured an MDS of -134 dBm, indicating a very sensitive receiver, right up there with the "big boys".

Phase Noise

We were unable to make a definitive measurement of the DSW-20's phase noise, because gain compression occurred before we were able to detect phase noise. In general, DDS systems such as the one used by the DSW-20, are known for good phase noise performance.

If we had detected phase noise at the point at which gain compression occurred, the phase noise, 10 kHz from the carrier, would have been -131 dBc/Hz. So we are at least able to conclude that the DSW-20's phase noise 10 kHz from the carrier is better than -131 dBc/Hz. We would rate this performance as "Good".

Spurs

This section of our report falls in the realm of "no free lunch." While the phase noise of a DDS system is usually good, the system has a major weakness. DDS generates both quantization noise and spurs. The spurs occur throughout the entire frequency range passed by the DDS's low pass filter.

The implication of having spurs in the receiver local oscillator can be profound. Even a spur that is 60 dB down from the carrier will mix with an incoming signal when the difference between the signal and the spur equals the IF. If the signal is very strong, the "extra" received signal may be above the noise, adding to the QRM.

We injected a -30 dBm signal in our DSW-20 at 14.030 MHz. We found spurs on both sides of the carrier. The carrier dominated the middle part of our test range, but we found about 10 spurs in the range of 14.000 to 14.020 MHz and another 10 spurs in the range of 14.040 to 14.060 MHz. Some of the spurs were close to the minimum discernible signal and probably would be masked by external noise. Others were quite strong.

[a] The spectral plot that originally appeared in **The ARS Sojourner** indicated a strong spur at 70 MHz that was later determined to have resulted from a measurement problem.

IF Rejection

Our sample had an IF rejection of 79 dB. This is not as good as one might like, but it compares favorably with the performance with many other HF radios (see the complete review for a comparison plot).

Image Rejection

Our sample had an image rejection of 58 dB; again, not as good as one might like but not completely out of the ballpark.

Audio Output

Using the standard ARRL test tone of -70 dBm, we measured total harmonic distortion of 4.5 percent. The tone in our headphones was painfully loud.

Receiver Tests—When Multiple Signals are Present

Selectivity

We measured a 6 dB bandwidth of 670 Hz.

Blocking Dynamic Range

Our DSW-20 had a blocking dynamic range of 103 dB.

Third Order IMD Dynamic Range

In one of the more important tests of our review, we measured a worst case third order IMD dynamic range of 83 dB. A comparison with some other HF radios is shown in **Fig. 2.**

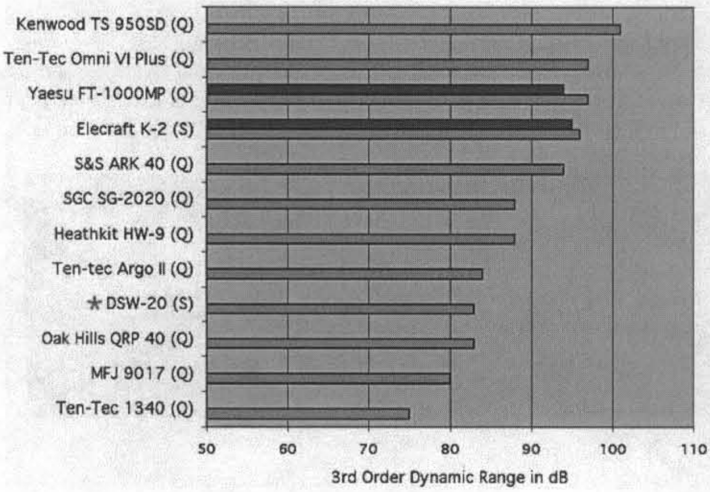


Figure 2. DSW-20 third order dynamic range comparison. The black lines are with preamplifier engaged (where applicable).

Third Order IMD Intercept Point

We calculated a worst-case third order intercept point for our DSW-20 of -9.5.

Second Order IMD Dynamic Range

Although this test was ignored in earlier times, it is now receiving increasing attention. Our measurement of second order dynamic range for the DSW-20 could not be completed, because it was noise limited at 101 dB.

Second Order IMD Intercept Point

Because our measurement of second order IMD dynamic range was noise limited, we did not calculate the second order intercept point.

In-band IMD

This is another test that hasn't received much attention. But we have a hunch it will be important for the low power community, because it may shed light on the superhet/direct conversion trade offs, and because it may help us quantify the poor audio we see in some simple transceivers.

In the DSW-20, the test signals generated a rich array of strong IMD products. The AF spectrum analyzer graph is shown in **Fig. 3.** The complete review includes AF spectrum analyzer graphs for two much more expensive and complex radios, the Yaesu FT-1000 MP and the Elecraft K2, for comparison. (Also, see the January 2000 **QRP Quarterly**, page 43, for a spectrum from the Elecraft K2.)

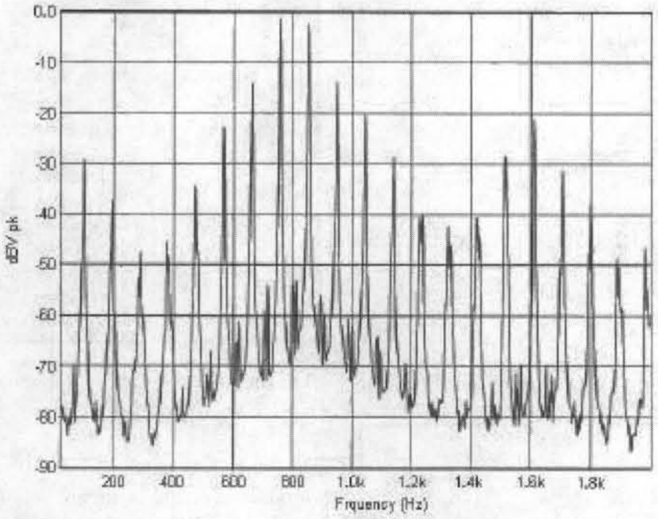


Figure 3. Two-tone in-band IMD display.

Conclusion

The DSW-20 is most notable for its clever use of firmware and DDS technology. It is also a fascinating case study in the tradeoffs that every radio designer must address.

This transceiver gets high marks for small size, featherweight, low power consumption, reasonable price, operating conveniences, and, in an uncomplicated operating environment, good performance. But like other simple radios, especially those using the NE602A (superseded by the SA612AN) as a first mixer, the DSW-20 is allergic to strong signals. Big signals can cause big problems, with IMD products, DDS spurs, desensitization, leakage into the IF, and interference from signals on the image frequencies. When the KWs appear, it might be a good opportunity to mow the lawn.

Overall, Dave Benson, the talented and amiable designer of the DSW-20, has dealt with design tradeoffs very impressively. It's hard to see how more performance could be squeezed out of a $95 radio.

Edited by W1HUE

The Ten-Tec Powermite Transceiver

John Marranca, Jr, KB2HSH *email: jmarran@juno.com*

During the late 1960's, a small company was formed in Sevierville, Tennessee by Jack Burchfield and Al Kahn. Their original company was involved in the production of small, lightweight, and versatile Amateur Radio gear. The Powermite, or PM series was a flexible system of separate modules that were available separately or completely pre-assembled. These modules were available at the outrageously affordable price of just $7.95 per unit.

In case the ham of yesterday wanted all of the necessary components at the same time, they were available for the meager price of $29.95.

And at the top, was the Powermite: all of the modules and components pre assembled and factory aligned, at a price tag of just $49.95 new.

The rig that was made up of all of the modules for the homebrewer to assemble was known as the MR-1. Whether PM or MR, the concept was a simple one to understand: Easy to build and use CW rig that almost anyone could afford, clean keying, low current drain-allowing for portable/Field Day use, and a decent receiver with good sensitivity and selectivity, and low noise as well. All of these objectives were met with the Powermite.

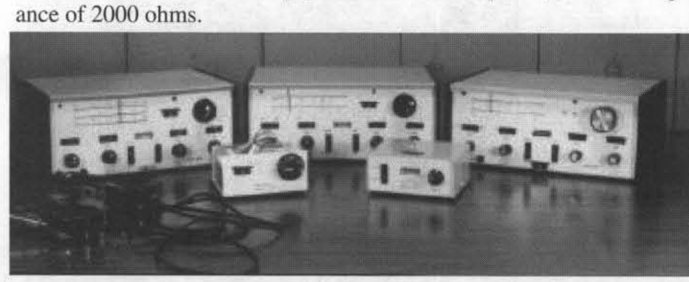
Internally the Powermite was four modules: the TX-1 transmitter module, the MX-1 mixer module, the VO-1 VFO module, and the AA-1 audio amplifier module. These were wired together and soldered at various connection points along the edges of the circuit boards. The design was quite durable, and this style of interconnecting via posts made it very simple to modify the configuration.

The TX-1 was a basic circuit-not too difficult by today's standards: oscillator and amplifier in separate stages, coupled to the output connector with a toroid coil. Two variable capacitors aid in peaking the amount of current and oscillation in the circuit. Ten-Tec rated this module at 2 watts input, but after speaking with Garland Jenkins at Ten-Tec, he assured me that due to a low transmitter efficiency rating, somewhere around 25-30%, power ratings of 300-700mW from a 2N4427 was the order of the day. The circuit could handle a mismatch no more than 2:1. The circuit's low efficiency was the culprit: the by-product of the power output was heat, as more than 60% of the power was dissipated as heat, and as the SWR mismatch increased, the chances of blowing the final increased as well. Trust me...I know too

The VO-1 module was Ten-Tec's VFO. Another varicap, a large tuned inductor, and a few other various components comprise this module. By comparison with some newer devices, it was and is still a stable means of frequency control. The VO-1 made the Powermite attractive to the higher classed ham not restricted by the crystal rule implemented by the FCC years ago. The VO-1 had a rating of less than 100 Hz drift after one-half hour of operation. As an experiment, while restoring my PM-1, I wanted to see how well the little VFO worked, and mating it loosely to my other homebrew rig, I found the operation to be smooth and stable, just as promised 30 years ago.

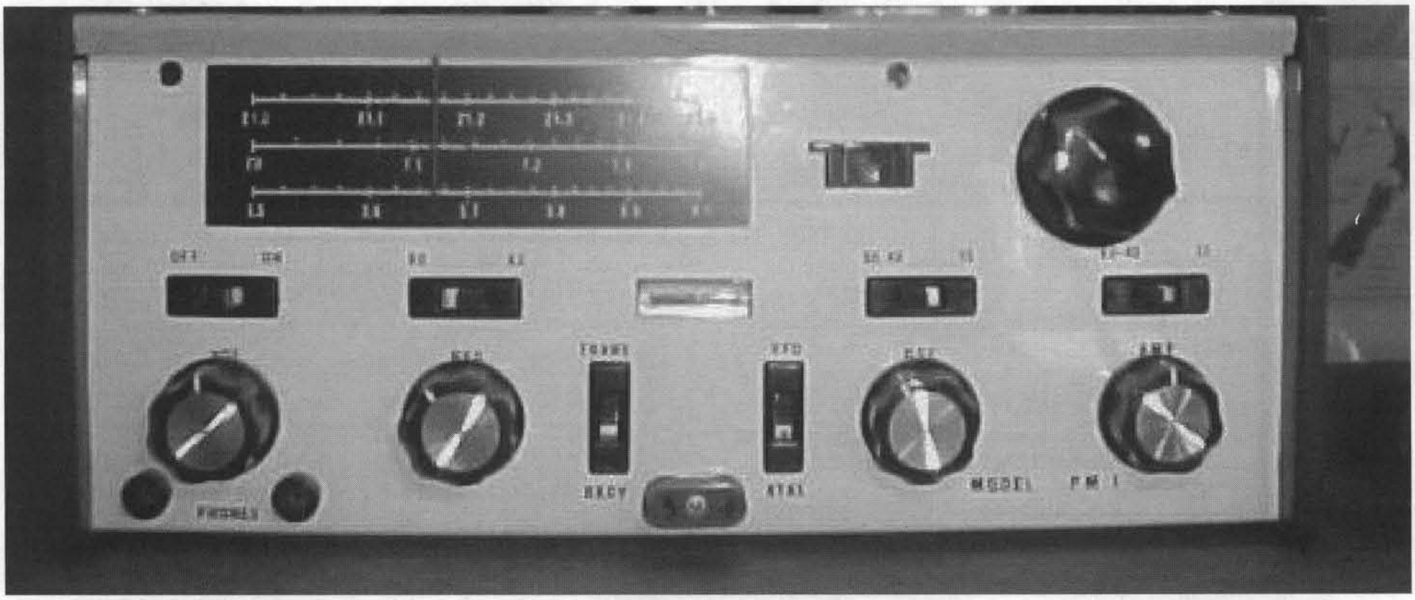
The MX-1 module was the heart of the rig. This was a synchrodyne, or direct conversion receiver, that utilized a mosfet similar to a 40673. It took a portion of the oscillator's signal, amplified it, and converted it to audio.

The AA-1 module did then what the NE602 does now, but with more components. The CA3035VI IC was the "brains" behind the operation. This IC has 6 pins, but resembled a TO-39 transistor case. Performance from this unit was adequate, as it suffered from overload and a mild case of insensitivity. But the AA-1 did the job, and delivered audio to the listener via the tip jacks on the front panel, all at an impedance of 2000 ohms.



Optional modules such as the AC3, and the AC5, expanded the little radio's original band implementation. The rigs had the room inside for the modifications, and instructions included with them took the ham step by step through installing and operating the PM with the new band kit. Try modifying a modern day rig...most of us couldn't, but the PM proved that it could be done. Silk screened pre-labeling allowed for almost instant use once the AC modules were installed. The AC3, originally manufactured for the PM-1, was the band kit for 15 meter expansion, while the AC6 gave the PM-2 20 meter capability with side-tone.

Not resting on their laurels, Ten-Tec continually improved both the features and the function of their little tykes. Not being satisfied for long, they introduced the PM-2, followed by the PM-2B, and shortly thereafter with the PM-3 and PM-3A. Confused? Here are the differences: PM-1's were the standard fare; bare bones 40 and 80 meter transceiver...pretty basic stuff. The AC3 gave the PM-1 the 15 meter capability mentioned earlier. The PM-2 was theoretically the same radio, but with side tone. The PM-2B had the AC6 kit installed inside, giving the PM-2 20 meter functionality. The PM-3 was a 20 and 40 meter radio, with 5 watts of muscle, and a more modern final network. The PM-3A was the same radio, but with Ten-Tec's famous QSK, still popular today with Ten-Tec's CW enthusiasts. This QSK kit was the AC7, but it was able to be used in any of the Powermite rigs. By the time the PM-3A was introduced, the $49.95 "wonder-radio" had grown



first of the Powermites to EXCLUDE the crystal socket on the front panel. Further, the knobs had changed too. Gone were the octagonal knobs; soon replaced with the smooth chrome units, found later on the Argonauts. By the end of the production run of the Powermite 3A, a more refined radio was on the horizon. But it wasn't a Powermite 4. This closest cousin to the Powermites was to feature SSB, unheard of in a low-cost QRP rig. Also, it was to have more than just a couple of bands to play with. You would be correct by naming the Argonaut 505 as the next of kin to the PM. The two almost look alike, as the PM-3 and the 505 share paint, cabinet layouts, knobs, and the like. The Powermite had grown up, indeed.

Restoring these rigs is very enjoyable, as most of the components can be faithfully reproduced with modern counterparts. Ten-Tec ivory, one of the colors of the Powermite, is reproduced by Krylon Ivory #1504. It is close to perfect, and will coat the aluminum chassis quite well. Switches are tough, but Radio Shacks should have the necessary size and configuration needed to complete the front panel. The only drawback to this is trying to not break the little black nylon frames around the switch that actually held the switch in place on the chassis. The earliest PM didn't use the frame-it used standard bolts and nuts to hold them tight. Also, the meter is a problem area: where are you going to find the little Ten-Tec unit 30 years later?

One area that some of us may face or have faced is what to do when a module with specialized components, like the AA-1 with its CA3035VI audio amp, dies and can't be revived. I am the very proud owner of a PM-1, serial number 12101. After the MX-1 module AND AA-1 modules died, I let the radio sit for 5 years. It had had a tough life after being opened and modified and altered in the most distasteful ways. It was in sad shape when I received it as a gift, and at last count I was the sixth or seventh owner. I wanted to keep the radio as original as possible, but I knew that some modifications had to be done, as some of the components just couldn't be had today. Ten-Tec's T-Kit, model 1056 Direct Conversion receiver was the first and only choice. It has superior sensitivity, and the bandspread and bandwidth controls give the receiver the feeling of a much larger radio. There is plenty of room inside the spacious aluminum housing for the receiver's circuit board to reside, so adapting the rig to accept it shouldn't be difficult. And, the wood-grained plastic end panels, commonly drilled to accept phone plugs and the like, are still available from Ten-Tec at the meager price of about $15.00 after shipping. With these refreshenings performed on it, the little Powermite has a new lease on life, with performance on par with modern day QRPp rigs.

In closing, the Powermite is a very important player in the modern day sport of QRP. It was ahead of its time due largely to its flexible platform and ease of use. Add to it aggressive marketing from Ten-Tec, and you soon see why it became what it did. Within the stretch of just one year, Ten-Tec had more than 5 separate ads extolling the virtues of its new "child". The Powermite series led us to the complex QRP rigs of today.

Also, I am in the process of forming a Powermite Owners Group. We own very special little radios, and it is a joy to use them and to help others enjoy them, too.

http://homestead.juno.com/jmarran/KB2HSH.html

. . . John, KB2HSH

An All-Band CW/SSB QRP Transceiver
Part 2

Frank Nance, W6MN *email:frank@reno,.nv.us*

Since the first part of this article was published in the April 1999 issue, three other issues have included brief updating info about the kit status and design. The discussion in this second part is centered on the detailed block diagram, which is shown at the end of this article. The intent is to amplify the basic information contained in part one.

First, I want to acknowledge the many encouraging email responses from, first, Jon Iza, EA2SN, and from so many others that I do not have room to name them but do appreciate what they have sent to me by way of critiques and comments. Two RF engineers have given the design of this kit the eagle eye and their comments to me have been favorable – mainly giving added confidence that I am on the right track with this rig's design.

Since the April 99 article, additions have been made to the kit mainly at the suggestions from many at the Pacificon Convention, these additions are:

1) New PC boards that minimize the number of interconnecting cables (the first or proto-type of a production model was crammed full of these).

2) A K1MG digital clock/counter.

3) A CodeBoy Keyer.

4) An X/RIT adj. Pot that has a center detent.

5) A sidetone oscillator that is frequency adjustable.

6) AGC derived from both RF and AF with weighing resistors at the input of an op amp to control the effects of each.

7) A socket and a mode switch position are included to allow inclusion of a new CW, 6-crystal filter, which is the only option on this rig.

8) Some of the DC control circuits of the VFO were refined and simplified.

In previous articles, I projected some target dates and these have come and gone by the wayside, imposed by some of those typical development problems – but the design and the R&D is firmly in place and hopefully, the current version will be worth the delays. In the January 2000 issue, I indicated the reason for the most time consuming setback, that being PC board software layout problems which forced me to redo the 50 sets of PC boards on hand. The PC house engineer found many minute air-line traces which went across many of the part pads and the designated grounds had hairline separations from the ground planes. I am writing this on February 17th, and at this moment, using a new PC layout program, the layout of the most "populated" PC board is 95% completed.

Target dates are a must in any R&D project where production is just around the corner, and I now am confident that the first kits will be ready and delivered to HSC sometime during April.

I have set up a business, Sierra Radio Enterprises, registered in the State of Nevada. Also, I have taken the first step in setting up a website by reserving the address, www.sierraradio.com for two years. It is not yet operational, but just as soon as I finish this production kit delivery, I will then turn to the website and include detailed technical articles about this rig. During this year, I plan to include articles and PC layouts for modules used in this rig for those who want to build up a QRP rig with the functional parts of this MN9 kit. If there is enough interest in these modules, the PC's will be made up and offered for sale on the website.

Detailed Block Diagram

The first part of this discussion is to cover power and control signal functions and the second elaborates on the transmit and receive signal flow covered in part one.

The transmit and receive signal flow directions are the same as in the simplified block diagram in the April '99 article. That is, (1) transmit SSB starts at the upper left corner and flows basically in the right-hand direction to the antenna at the lower right-hand corner, and (2) the receive signals flow in the opposite direction, from antenna to the speaker. The CW transmit path is not quite the same as that of the transmit SSB signal. However, in the receive path, both CW and SSB flow thru the same circuits.

To simplify parts illustration in the detailed block diagram, resistors and pots at key points are show as short strips of thicker bus wire. Pots are show with an arrow in the center of the bus.

Power and Control

The 12 volt distribution is shown at zones A & B, 2 in a low current and a high current path. The low current path is turned on by the power switch, attached to the AF gain control. This low current patch is distributed to all circuits except for the transmitter driver and final stages. Q511 turns on the high current path by a DC control signal called +TX. The input to the two regulators, 4 and 9.5v, shown at zone B2 is from the low current path.

Transmit/receive switching circuits are controlled by four DC control signals. When activated a control signal is pulled up to +12 volts when made "true". As the name implies, +TX is made true when one of three conditions is true (1) VOX is off and PTT switch of the mic is pressed, (2) PTT is off and the VOX circuit puts out a DC with the presence of mic AF, or (3) the key or keyer paddle is pressed. The diodes, shown at zone A1 and 2, are OR circuits fed to each control output transistor. These transistors are shown as triangles to the right of the diodes.

When =TX is true, the receive signal, +RX is false. These two signals are used to control signal flow direction through the transmit/receive (T/R) switches. In the detailed block diagram these switches are shown as squares with an X inside each one.

The source of the two remaining control signals, +TXCW and +TXSSB can be traced from their sources thru the diodes to their output transistors. These special signals are needed in only a few spots, where a distinction between SSB and CW signal flow is required. The +TXSSB signal is made active either by pressing the PTT switch or by the VOX signal being turned on and made "true" (low true in this case). The +TXCW is true when key or keyer paddle is pressed.

Tracing the Transmit SSB

At the right of the mic, the gap shown represents and 8-pin mic and PC headers allowing for jumpers to connect any 8-pin mic pin configuration to the four internal uses. (1) the mic AF hot lead, (2) mic ground, (3) PTT hot lead, and (4) PTT ground

Before continuing with signal flow, some have suggested that I mention why bi-directional flow transmit and receive signals are possible in this rig's design. For one thing, double-balanced mixers (DBM) are used in the modulator/product detector as well as Mixer's 1 thru 4 and SBL-1's are used in these cases. In tube or transistor mixers, the receive signal cannot be passed backward from plate (collector) to grid (base) but DBMs are bi-directional

Back to the SSB generation. The mic AF goes thru two op amp preamps to the mic gain pot on the front panel and then to two op amps in series, each having dual RCs in feedback and input circuit, making up a AF butterworth bandpass filter. Standard values of R&C are used in these op amps, with roll offs of 40 dB per octave at 159 Hz at 3180 Hz.

Filtered mic AF is passed thru switch S1 by application of +TXSSB and is fed to the modulator. The modulator mixes the AF with the output of an 11 MHz crystal oscillator, producing a modulator output that is a double-side band, suppressed carrier signal which is centered on 11 MHz. This is the fixed, center frequency of the second IF. In the block diagram, this IF extends from the modulator to the left side of Mixer 3.

The next functional section is the combo of Mixer's 1 and 2, the 9 MHz crystal filter (or optional CW filter) and the 20 MHz xtal oscillator. This section is used for (1) selecting a side band in SSB transmit, and (2) in receive, to filter incoming SSB in a similar way and also provide what is called IF shift. In either case, transmit SSB is in the left to right direction and receive CW and SSB is in the right to left direction as they are passed thru the 9 MHz filter.

As mentioned above, a new option will soon be available. It is a 6-crystal CW filter. PC headers with DC signals and power needed to operate this new filter are incorporated on the PC board which holds the 9 MHz filter. Two jumpers are removed to make this installation. An added position of the mode switch allows for selection of this new filter.

Continuing with transmit SSB flow, the DSB output is converted by Mixer 1 to 9 MHz where it flows, if the filter passband allows it, thru the 9 MHz filter. With the mode switch on the front panel, either LSB or USB can be selected, this being done by pulling the 20 MHz oscillator to one of two fixed frequencies needed to place either the upper or the lower sideband within the filter's passband.

Therefore, the output of the 9 MHz filter is the selected SSB which is mixed, in Mixer 2, and converted back to the 2nd IF and is passed thru the top parts of S4 and S5 thru the 11 MHz series resonant circuit, L303 and C344 to Mixer 3 where it is mixed with the output of the VFO. The function of Mixer 3 is to convert this signal to the 1st IF.

By way of introduction to the operation of this rig's VFO and 1st IF, note that the VFO frequency is controlled by D301, a Motorola MV104. The DC bias needed to control D301 is primarily from the front panel tuning pot.

But, what I did not show is that a sample of the DC bias is also fed to an op amp which is scaled in gain and applied to the Series Resonant 1st IF circuit. The C part of this LC circuit is controlled by the DC bias applied to a second varactor. In this way ,the 1st IF is made to electronically track with the VFO's tuning - an electronic equivalent to the ole ganged, two section tuning capacitor.

This dual tuning is needed because, in the design of this rig, band-selected TTL xtal oscillators are used in Mixer 4 and these are fixed in frequency, requiring that the using a new PC layout program using a new PC layout program VFO and 1st IF 'slide' together thru the range needed to cover the tuning bandspread.

Two front-panel pots, LO and HI , are used to set the limits in main VFO tuning. Using stock kit parts the maximum VFO coverage is about 26.5 to 29.3 MHz. When this output is mixed with the incoming 11 MHz SSB, the first IF is produced. The range of tuning of this 1st IF, as mentioned above is made to track with the VFO main tuning and covers a max range of about 15.5 to 17.9 MHz.

Continuing with 1st IF, Miser 4 and RF Signal Flow

After going thru Mixer 3, this 1st IF signal is passed thru switches S7 and 8, and then thru the 1st IF series resonant circuit shown at the bottom of zone C2. This SSB at the 1st IF is applied to the left of Mixer 4. At this point, Mixer 4 uses one of 8 TTL xtal oscillators. The band switch selects one for each band, except for 20 and 17 meters, which use the same osc frequency, meaning that there are 8 instead of 9 TTL oscillators to cover 160 thru 10 meters.

The transmit signal at the right of Mixer 4 now falls in the selected ham band. In the transmit direction, this ham-band SSB is now sent thru the series resonant, RF tuning circuit which is tunable from the front panel RF Tune knob. Until a solid state scheme is found which will handle the amplitude of the transmit signals, this RF tuning is via an air variable capacitor. If such a solid-state equivalent was found, I would have made it track with the VFO and 1st IF.

Finally, the transmit SSB now flows via S9,10 and 11 to Q402, a low level transmit 2N2222A amplifier. The rest of the path to the antenna is via the push-pull driver and final amplifiers, and then thru the band-selected, harmonic filter as well as the SWR transformer primary.

In the design of the driver and final, there are no shortcuts taken in this rig to reduce parts count as in the case in many commercial amplifiers. The driver and final are modeled after the article in Motorola's' APP Note AN779 which covers a 1.6 to 30 MHz broadband 25 watt, two stage amplifier. I have chosen to limit the power out to about 12 watts to keep down toroid sizes and sizes of other higher power parts.

An example of an SSB signal will help to see how the original DSB 11 MHz signal is converted and tuned to a spot in the 160 meter band. In the mixing scheme used in this rig, the TTL oscillator feeding Mixer 4 on the 160 meter band operates at 15.0 MHz. In this example assume that the main tuning is tuned to 1.90 MHz and that the mode switch is in the LSB position (no auto SSB switching is used in this rig as bands are changed). If a 200 Hz tone is applied to the mic AF input, it will come out of Mixer 2 at 11.0002 MHz. As the DSB passes thru the 9 MHz filter, the tone's equivalent is at 9.003 MHz, which gets thru this filter. To do this, the 20 MHz xtal is pulled to 20.0032 MHz.

Next, the reconversion back to 11, 0002 MHz is done in Mixer 2. Then, this 1st IF is mixed with the VFO in Mixer 3. When the dial is tuned to 1.900 MHz, the VFO output is at 27.9 MHz, producing a Mixer 3 output at the 1st IF of 16.8998 MHz. Then, finally, when mixed with the 15.0 MHz TTL oscillator in Mixer4, the output of mixer 4 is at 1.8998 MHz.

In a similar manner it can be shown that a 3 kHz tone into the mic AF input would come out 1.887 MHz in the LSB mode.

When the mode switch is changed to select USB, the 20 MHz oscillator is set at 20.0 MHz. By doing this, the original 200 Hz tone is converted to 9.0002 in the 9 MHz filter, and then to a 1st IF of 16.9002. Then RF out of Mixer 4 is at 1.9002 (200 Hz tone) or at 1.9003 for the example using a 3 kHz tone. I will have an entire mixing scheme table in the theory section of the upcoming website.

The CW transmit signal originates in the 11 MHz xtal oscillator and is passed thru a front-panel CW PWR pot, and thru Q207, shown at zone C1, and is injected into the transmit path via switch S6 and S5 to the right to Mixer 3 which is shown at zone D1. From here, the rest of this CW transmit signal flow is the same as in SSB mode. I chose this design over one which upsets the balance in a DBM as is the case in many modern rigs.

As transmit and receive signals are traced, it is helpful to note that there are three MC1350 IF amplifiers U304, 305 and 401 used in the receive path. These amps are not required in the transmit path and the amps are bypassed in the 2nd IF by S3,4 and S4,5 and in the 1st IF by S7 and S8.

In the receive path, signal flow from the antenna to the product detector is through the same path as that of the transmit SSB signal but in the opposite direction. Note that the detected receive signal passes thru receive AF amps to the speaker – and not shown are jacks for external speaker or phones. This AF amplifier also receives the output of the sidetone oscillator.

VFO, Comp circuits and X/RIT

The heart of the main tuning of this rig is the Vackar, series-LC tuned schematically. The two compensating op amp circuits originally used have been simplified considerably at NO sacrifice in desired zero-drift adjustments. Incidentally, these zero-drift adjustments apply not only to the varactor but also to the entire rig.

To follow the method for tuning and drift compensation of the VFO, four sources of DC reverse bias are used. These sources are applied to the four inputs to U301D, the 4input DC adder, zone D2 where they are quite preceisely algebraically added and the sum is applied to the varactor. These four inputs are, (1) main-tuning DC bias from a precision, 10-turn, 10k pot, via a load-isolating, voltage following op amp, U303B, then (2) and (3) the two comp op amp outputs, Delta and Temp Sense, and (4) the X/RIT DC bias.

The purpose of having the LO and HI pots was introduced above and these pots are shown at zone C2. The two DC voltages, one at the top of the tuning pot shown at zone C2. The two DC voltages, one at the top of the funing pot and the other at the bottom are set by these pots. To keep the HI pot voltage from going below the maximum output of the LO pot (and reversing rolls) the bottom of the HI pot is connected to the top of the LO pot. If a direct connection was made between these two points, the minimum coverage of the tuning pot would be zero! Instead, a 68 ohm resisor is not shown in the block diagram but is included between the LO pot voltage isolator output and the low end of the HI pot. The small voltage developed across this resistor is what controls the minimum difference between the top of the LO pot and the bottom of the HI pot.

An example might help. Assume that an operator wants to operate the rig with a bandspread that is as narrow as possible. To do this, the HI pot has to be set to the CCW limit. Assume that an operator wants to operate the rig with a bandspread that is as narrow as possible. To do this, the HI pot has to be set to the CCW limit. Assume that the LO pot is set to the bottom of this desired bandspread, somewhere in a given ham band and with the main tuning pot set to the CCW limit. If you trace the outputs of these two pots, they go to the top and bottom of the tuning pot. Thus, the full swing of the 10-turn tuning pot is limited to the voltage across this 68 ohm resistor, or in this rig, it corresponds to a minimum bandspread of about 15 kHz.

A feature of this rig that is provided by the main tuning working in combo with the HI and LO pots is that a chosen ham bandspread width can be shifted to any desired part of any ham band by adjusting the LO pot with the tuning pot set to a CCW position. The bandspread is set by adjusting the HI pot with the tuning pot set to some position near or at the CW limit. A second feature bandspread feature is that these LO and HI pots can be set with the tuning pot set to any desired CCW and CW positions, which, in effect varies the tuning dial vernier.

A sort of tricky scaling was required of the DC signals applied to the CW and CCW end of the tuning pot. This "trickiness" was imposed by the need for a VFO offset of differing amounts for some ham bands. These amounts are fully covered in the kit manual, but, for now suffice it to say that the three circuits below the LO pot, zone C2, are individually selected by an appropriate band switch input to one of the three resistors in the low end of the LO pot. Two of these are adjustable, although I did not show them as being pots. At this point, it might be helpful to mention that these three circuits are needed to make the VFO and 1st IF go to some fixed offset on some of the ham bands. This offset works with the K1MG counter offset to make the counter show the correct readout for the selected ham band frequency. This is done so that the VFO frequency can be monitored by the K1MG counter. This counter has the capability of 32 different offsets. I have used 9 diode Ors to use 9 offsets of the counter to show each band readout.

The Two Comp Circuits

Using thermistor in the first prototype, the temp compensation was not linear in the areas of 32 degrees and 120 degrees and I did not want to impse upon the kit builder the need to "K" value the circuit around the Thermistor to improve this non linearity. Instead, a National Semiconductor 3-pin IC the size of a 2N3904 transistor provides a very linear voltage compared to Fahrenheit temp changes from 32 to 212 degrees. This IC voltage output is scaled by U301A, zone C2 and is adjustable via a rear panel pot to provide a range of temp comp that varies from under to over compensation. It is set at the mid point of the VFO's maximum tuning range so that the drift of the rig at this setting can be zero'd out.

The second source of compensation is still necessary, i.e. the one that I have called "Delta" comp, shown at zone D2. Reviewing this need, the Motorola MV103 temp compensation changes with changes in DC bias. Note that a sample of the Tuning Pot voltage is sent thru U301C, where it is inverted in polarity and scaled down and adjustable via a second rear panel pot. This mini, opposite polarity of DC bias variation is adjustable and applied to the 4-input adder to zero out the change in temp coefficient with change in DC biasing.

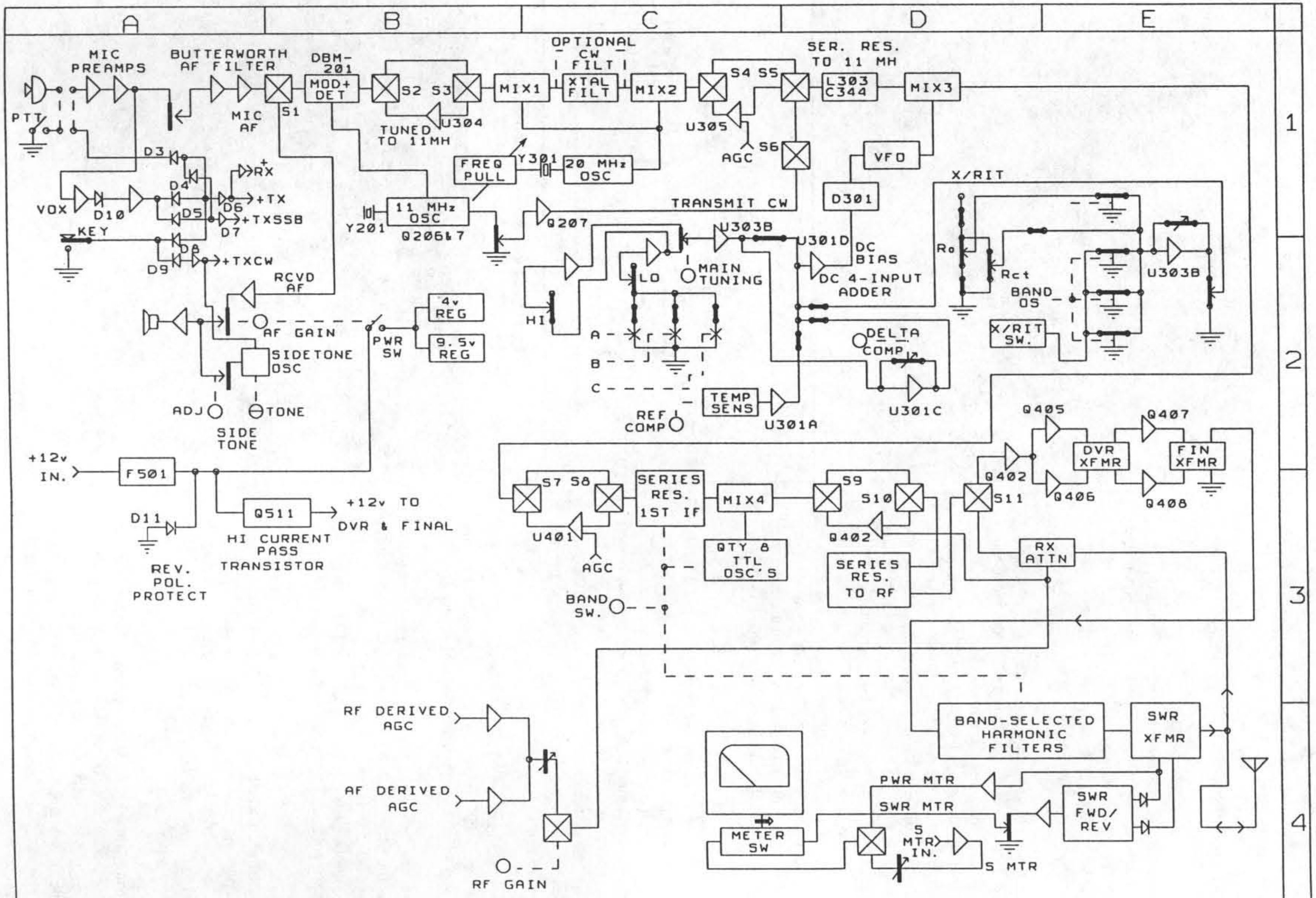
The adjustment range of both of these comp circuits extend from a point that is well below zero settings to a point at the other end of the pots where it is well above the zero settings. In my lab tests of this circuit, I was able to reduce the overall VFO drift to less than 0.1 Hz per degree C change in temperature. Built in settings of the K1MG counter to zero drift as well as these pots allows the operator to a very satisfactorily zero drift without the need for a temp chamber.

Finally, note the X/RIT circuit in the vicinity of zone D2. Basically three voltage levels are required of the circuitry. One is to provide a fixed bias for use when the S/RIT switch is turned off. The other two take care of adjusting X/RIT. Adjust Pot voltages such that with the pot set in the center detent, the XIT (transmit) and the separate RIT (receive) VFO frequencies will be the same as the fixed voltage when X/RIT is turned off.

Another unique feature of this is that the X/RIT range is adjustable over a very wide range. Note that there is a scaling pot connected across U303B, zone E1. With the kit stock parts this range is adjustable from about 1 kHz to about 15 kHz. In the theory of operation in the manual (and upcoming on my website) I explain how a user can change the value of the resistor across U303B and it is possible to make the range of this X/RIT Adjust Pot to act a s a second VFO in either the transmit or the receive setting of the S/RIT On/Off switch. (By the way, this switch has a center off position).

This concludes part 2. Further info and circuit details will soon be on the upcoming website at www.sierraradio.com. I look forward to your comments to date about the design of this rig.

de Frank, W6MN



MN9 QRP TRANSCEIVER DETAILED BLOCK DIAGRAM

"Natural Power" . . . Solar Powered Field Day

Jim Giammanco, N5IB *email: giamman@rouge.phys.lsu.edu*

Having just completed a DSW-40 a few days before Field Day 1999, I decided I would like to try operating with solar power, gaining the "Natural Power" bonus points for the Baton Rouge Amateur Radio Club effort.

A solar panel was constructed using 36 individual cells wired in series. The cells were obtained from Plastecs, Inc.: (http://www.plastecs.com/solar.htm) part number WB-21A, a 1.2" x 1.5" cell rated 225 mA. An 8.5" x 11" clear plastic certificate holder bought at the supermarket served as the case for the panel.

The hardest part about the construction was soldering the cells together. I used short pieces of wire-wrap wire, and found that a bit of extra rosin-type flux made the job much easier. Just be sure to clean any excess flux after soldering. I soldered the cells together in strips of six at a time, then joined six strips to make the complete panel. I soldered the wire to the front side of each cell, then turned the cells upside down and aligned them with about 1/8" space between them and used two thin ribbons of hot glue across (at right angles) the gap to hold the cells in alignment. The wire was then soldered to the back side. The result is an array of cells loosely held together by a grid of hot glue filaments. The cells were carefully placed into the certificate holder and a piece of urethane foam was cut to fit snugly to hold the cells in place and cushion them from mechanical shocks.

The panel is capable of about greater than 200 mA at 15 volts or higher, depending on illumination. I used it to charge a 12 V, 2.2 A-hr gel-cell battery. Since the maximum panel output current is approximately a tenth of the battery's capacity, there is little danger of overcharging the battery unless it is left for a very long time. The intended use was to charge the battery while in use, so the only additional electronics needed was a series blocking diode to prevent discharging the battery through the panel.

However, I decided I would like to operate, at least in the receive mode, on "pure solar" power, without the battery. For this type service some sort of voltage regulation would be needed. The end result was a very simple "power controller" for the solar panel. It works in two modes. The first is as a voltage regulator, to provide 12 V output, as long as the panel voltage is high enough. For this mode I chose an ordinary TO-220 1 amp regulator (LM340T-12). The second mode is to simply charge a battery, allowing the battery to serve as the voltage regulator. This mode requires only the series blocking diode.

The circuit (Fig 2) was built into a small plastic box with banana jacks for input and output connections and a DPDT slide switch to select between "regulated" and "unregulated" modes of operation. The LM340T-12 in its TO-220 package can pass 1 amp without additional heat sinking.

Later during the Field Day activities John, *<insert lastname and callsign>*, asked if we would like to try some "real" solar power. He produced from his motor home two very large panels, each capable of 4.5 amps at 13.8 volts. More in fun than anything else, we connected the panels to my DSW-40, using the regulated mode of the power controller and made a few more contacts on "pure" natural power, without the use of any storage batteries.

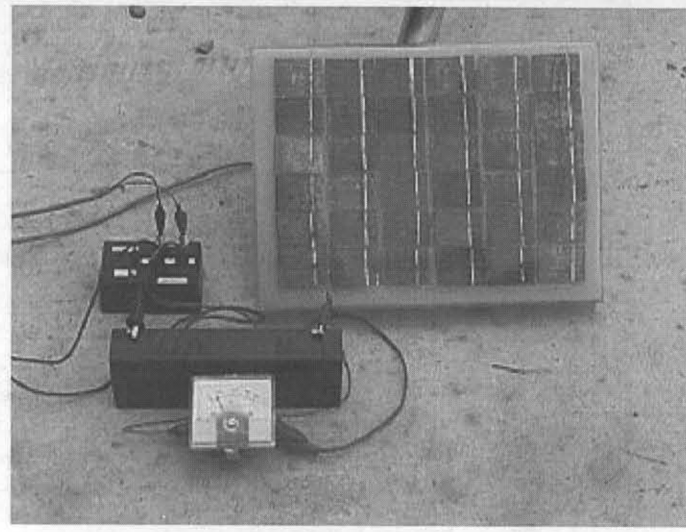


Figure 1. *Solar panel, battery, and power controller.*

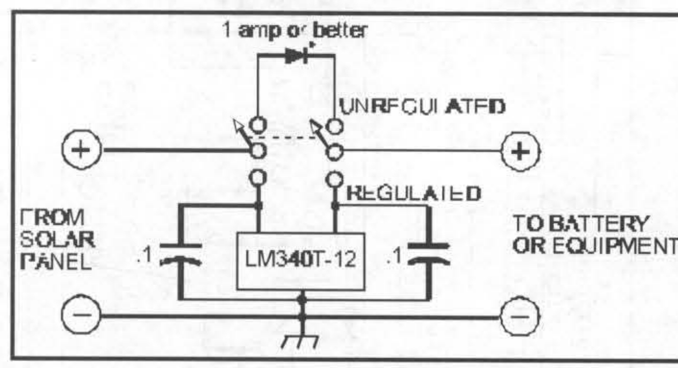


Figure 2. *Power controller schematic*

Figure 3. *Serious QRP at W5GIX Field Day. DANGER - 2000 milliwatts!*

AWARDS

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First, please note my new e-mail address: radioham@home.com. If, for some reason, that one is down, try restonham@yahoo.com. My old address @erols.com, which is in previous issues of the Quarterly, is now gone.

The last few months have seen an unprecedented (at least for me) inflow of award applications. The rate at which awards are being applied for sometimes creates a processing backlog, so please bear with me. If you keep applying at the present rate, 2000 will set a new record for QRP ARCI awards.

Not only are we getting more applications, but in the past two months three 1,000 Mile Per Watt records have been broken, one of them twice. First, congratulations go to N4ROA and WB8QYY who broke the 1.8 Mhz record on January 14, 2000 with a 25,625 mpw QSO. Unfortunately, for them, but fortunately for Jim Hale, our milliwatt maestro, KJ5TF and W8JI set a new 1.8 Mhz record of 26,800 mpw on January 29, 2000. Jim has also achieved 2 other new records – one with VE3MFN of 181,600 mpw on 18 MHz on December 21, 1999 and the other with C08LY of 127,583 mpw on 24 MHz on February 3, 2000.

At the risk of boring everyone with too many numbers, I believe each ham who earned an award in 1999 should have his or her call listed here. I will not put down the full information, as to distance, date, etc., as that is too much to fit in the small space allotted. Instead, here are the calls (both ends for 1,000 mpw awards) of all our 1999 awardees (note – the awards were issued in 1999, the QSO may have taken place years before, due to the difficulty of getting confirmation – see http://www.qrparci.org for our rules, which are more liberal than those of some other organizations):

1,000 Miles Per Watt (Multiple awards are shown):

KF4HZH and AA5TA 2xQRP, AF4LQ and ON7CK, N0AR and AL7FS 2xQRP, W1TY and CE4/K2BS, KJ5TF and KL2A, KB3DBS and N7YQ, AF4CM and F2YT, KF4KSM and UT5IM, AF4LQ and KC0W, WA3GYW and HP1AC 2xQRP, W4LJD and H5AKP, W4LJD and YO2LAM, W3MWY and VK6HQ, N5WU and KH6IHK, WA4PJP and KH6AFS 2xQRP, VE7STB and VE3FFN, AB0GO and N4BP 2xQRP, N0AR and W6BAB/N6MM, W8TIM and N6MM 2xQRP, KD5AIJ and JA7OWD, K0EVZ and KU7Y 2xQRP, WW5XX and K5EYE 2xQRP, N5TW and K6PWP, W8RIK and VK2AYD, K5ZTY and DL3YBM, N0RC, W6OPO and VK4CY, WB9MII and VE5SF, KC5EEY and N8VEA 2xQRP, K3LO and S53O, G0JOH and WA8DVC, N1ODL and OK1KT, N2DMZ and ZS2BBG, KE1LA and K9KDX, HL9BK and UU2JQ, KB3AAG and DL9RCF, WB8IJN and JG3UVN, ZL2BIL and JE7MFI, AA3SJ and T97M, VE3HYK and VK3XU, V3IXE and ZS5LB, W5XE and JA7UQB, KE5TC and ZL1BSG, N2JNZ and OH0JJS, WV3J and K5ZTY, NW7DX and T97M, KE1LA and WU2M 2xQRP, KA1LPA and KB1HJ, S53MA and JR1MVA, DK8UH and VK6BCP, N3XRV and K7GT, N9JXY and S59A, WD3P and KC4UG, KA2HZO and KE1LA 2xQRP, WA0SMQ and KE1LA, AL7FS and K7GT 2xQRP, WA2NCF and ZS4NR, KE6RS and WE6W 2xQRP, HP1AC and OK2PEX 2xQRP, N3YVC and KH6B 2xQRP, K3YUN and DL1GGM, GW0VSW and HF0POL, GW0VSW and ZL4SEA 2xQRP, GW0VSW and FY/DJ0PJ 2xQRP, W7UFM and JH1EHO, KJ5TF, KB3WK and WH6CXI

WAS-

WD3P – 50, WN6HYX – 50 Novice, W8RIK – 50, N8PVZ - 20 Solar, K5EYE – 26,
AB7TT - 50 2xQRP, KD0CA – 50, K0EVZ – 50, W4RMM – 50, N2DMZ – 50,
KB3AAG – 24, SM5DQ – 26, N4ROA - 50 2xQRP, WB4JJJ – 50, WD3P - 50 1KMPW,
N2JNZ – 50, K5HQV – 50 2xQRP, W4STX - 30, KJ5TF - 50 70mw

DXCC-

SM5DQ – 152 countries
N4ROA - 110
KJ5TF- 38 300mw
AA1MI - 104

WAC-

W8RIK, AB5UA, N2JNZ 28MHz, K5HQV, HP1AC, S53MA, GW0VSW 14MHz

QRP 25-

K5EYE, K7TQ – 100, N1OCJ – 50, WB4JJJ, N8TDH – 34, W6TOY – 151

Each of these individuals deserves recognition for their accomplishments. I hope to see correspondence from all of you (though not all at once ☺) during the coming year as you apply for an award.

Here are the current 1,000 Mile Per Watt Records –

Band (MHz)	Award No.	Awardee	Power	Other Station	Power	Distance (Miles)	Miles per Watt	Mode	Date
1.8	1708	KJ5TF	20 mw	W8JI	QRO	536	26,800	CW	000129
3.5	1122	AA2U	613 uW	CH9ASJ	QRO	522	851,549	CW	880203
7	1481	AA4XX	221 uW	KA3WTF	5 W	452	2,045,249	CW	951226
10	914	AA2U	480 uW	KW9O	QRO	774	1,612,500	CW	841005
14	979	AA2U	80 uW	N4RM	QRO	1,294	16,175,000	CW	840714
18	1707	KJ5TF	5 mw	VE3MFN	50 W	908	181,600	CW	991221
21	1455	G0IFK	39.9 uW	K1RM	5 W	3,217	80,626,566	CW	910519
24	1709	KJ5TF	12 mw	CO8LY	50 W	1,531	127,583	CW	000203
28	1178	K7IRK	6 uW	WA6YPE	QRP	1,310	218,333,333	CW	891025
50	1149	JO1XWH	0.050 uW	JH1MBQ	4 W	6.71	134,200,000	AM	890503
144	1177	OK1DKW	0.160 uW	OK1OFK	QRO	14	87,500,000	SSB	870620
1296	894	KF4JU	150 uW	W4ODW	QRO	346	2,306,670	CW	840429
5760	1550	W1VT	155 uW	WB1FKF	QRO	37	238,700	SSB	960622
10 GHz	879	VK4ZSH	1 mw	VK4ZNC	1 mW	124	124,000	FM	780414

As you can see, some records are ripe for breaking. It's up to you – conditions in 2000 may well be the best we are going to have for the next 10 years. It's also a great opportunity to go for awards such as DXCC, WAS and WAC. A few contests and you will have earned one. In fact, George, N2JNZ, recently informed me that he has achieved DXCC on 10 meters as a tech plus. Now that is quite an accomplishment.

Again, I wish you all a great year in 2000, for your families, for your jobs and for ham radio. Please e-mail me if you have any questions, suggestions, gripes, etc. about the QRP ARCI awards program at radioham@home.com and check out the complete awards program at http://www.qrparci.org. It is still my goal to issue all awards within 30 days of receipt, though that time-frame can get a bit longer during peak periods.

. . . Steve, N4EUK

Remember When . . .

Historical Notes

Les Shattuck, K4NK
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I am always looking for old issues of our QRP QUARTERLY at hamfests and sales. And issues before 1980 seem to be very rare. I often wonder where these might be, stuffed in some attic or basement shack, long forgotten. Today I have pulled out a copy of issue number 1, a tiny one sheet reverse mimeographed issue, and thought how far we have come. Issue #1 was edited and published by founder Harry Blomquist K6JSS. It was printed and sent out in September 1961. Of course the QRP ARCI was a whole different club than we have today. It was started to promote low power operation, but the founding fathers idea of low power was 100 watts. One of the comments made by the author was those using really low power, such as 5 watts etc., were called ultra-qrpers. Well, I guess we are all ultra qrpers today and those milliwatters are super ultra qrpers. There is a list of the charter members in this first issue. Listed are 25 names, addresses and call signs. I have read this often and wondered where some of these fellows might be. I would presume a good share might be SK , but I do remember speaking with some of them in the early 80's. Economics have changed a bit also, a subscription to the Quarterly in 1961 was a mere fifty cents and he preferred you send it in stamps.

Yes...many people don't think of the beginnings of a club like ARCI, but as one who has studied all the information I could get, we have an interesting past. I am going to write a new chapter each issue of the Quarterly and hope you find this interesting readings. For those of you that would like to have a "copy' of this first issue just send me a SASE and I'll get one to you.

OK, now for some trivia. Who was the secretary/treasurer in 1979? How about another? What object was given out as a QRP ARCI promo at the Dayton hamfest in the mid 80"s? Know the answer . . send me an email at K4NK@aol.com.

72 Les Shattuck, K4NK
ARCI Club Historian

Contests

Randy Foltz, K7TQ email:rfoltz@turbonet.com

UPCOMING EVENTS

ARCI Spring QSO Party	April 8-9
Hootowl Sprint	May 28
Summer Homebrew Sprint	July 9
Summer Daze SSB Sprint	August 6

SOME THOUGHTS FROM THE NEW CONTEST MANAGER

Greetings, all. As Joe, AB7TT, announced in the January 2000 issue, I'm your new contest manager. Thanks, Joe, for your efforts during the past year as contest manager.

In this issue are the results from the 1999 Fall QSO Party and the 1999 Holiday Spirits Sprint, as well as a couple of announcements of coming contests. The Fall QSO Party was a transition time so there might be some omissions in the results. Some reports went to me, some to Joe, and a few to Cam who was Joe's predecessor. We worked to get them all together, but may not have done so. Please accept my apology if there are errors in that report.

For those of you with web browsing capability, take a look at the ARCI contest pages. They include dates of QRP contests, both ARCI and not, rules for ARCI contests, and a sheet to help with scoring ARCI contests. There is also a form to report your score and comments immediately after each ARCI contest. The scores and comments are updated daily for 10 days after the contest. This system was used beginning with the Holiday Spirits and seemed to work well. The url is http://personal.palouse.net/rfoltz/arci/arcisums.htm. Please remember that if you use the quick reporting form, you still need to submit your logs to me to be included in the final results.

With the help of W2MY, Steve, contest certificates will again be issued. The back log of over 100 certificates from last year's contests is being whittled away. Certificates are issued for first place and high score in each power category, each state, each band, high bands, and low bands. Thanks to Steve for his help with the certificates.

On a final note, yes, there are member numbers over 1,000 so don't be surprised during contests.

QRP ARCI FALL QSO PARTY 1999

The Fall QSO Party and the Spring QSO Party are the ARCI premier contests. In previous years the contest was the same weekend as the Pacificon Hamfest, where half the western US QRPers attend. Former ARCI Contest Chairman, Joe, AB7TT, worked hard to move this contest away from Pacificon weekend. That effort paid off with participation up by about 50% over last year. In the 1999 event there were 151 entries compared to the 105 from the previous year. Atta' boy, Joe.

Scores were also up reflecting the efforts of ol' sol, more folks, and improved skills. Four of the top five finishers dropped their power to less than 1 watt and took advantage of the 10 X multiplier compared to the 7 X for less than 5 watts output. That interesting strategy that paid off.

TOP TEN	
N4BP	4,276,320
K0FRP	2,879,120
N0UR	2,290,554
KU7Y	2,263,050
W7RM (N7OU op)	2,196,450
K4BAI	1,783,236
K5TF	1,679,027
N9AW	1,643,082
N8ET	1,509,151
WA8RXI	1,390,088

SINGLE BAND					
160 m	N7RI	98	10 m	WX7R	32,802
40 m	K9PX	341,502	High-band	W5VBO	389,200
20 m	KC8FXR	167,580	Low-band	N4ROA	452,228
15 m	AB5UA	136,612			

TEAMS		
Aluminum Kings	KU7Y, K0FRP, N4BP, N8ET	10,927,641
NJQRPeaNuts	WQ2RP, W3BBO, N1EI, K2HPV	2,391,375
QRP Cheeseheads	AE9K, NK9G, N9AW	1,948,037
AZ ScQRPions	NQ7X, W5VBO, AB7OA	1,379,658
Eastern PA QRP Club	WA3WSJ, K7SZ	343,742

1999 Fall QSO Party Soapbox **K5HP:** This was my first QRP contest. The contest proved to be a real challenge. I only have a NW80/20 rug running less than 1.5 watts out, plus the receiver noise floor is about 1 microvolt, so the folks I worked had good signals and good receivers. I found the operators to be great, with lots of courtesy dished out. My thanks to the sponsors and all those I was able to squeak a signal into. Great contest and I'll be back again. **NA3V:** Condx were good for the contest, and I almost doubled my previous high score in ARCI contests. I used slingshot to get apex of a temporary inv-vee up about 65-70 ft into top of oak tree in back yard. It worked like a champ on 80, 40, and 20 m, less good on 15 and 10 m. **N9AW:** Good condx once ole' sol settled down after Friday's solar storm. Always a good time. Thanks to all for the fun! **NK9G:** R7 KAPUT! High and low SWR on windy day. **K2UD:** Made more QSOs by calling CQ. Glad to work HP1AC on 40m! I think there should be bonus points for working those milliwatters. **W9SR:** Lots of fun!! Glad to get a chance to check out the new loop antenna. **W0RSP:** Couldn't get Argo 505 under 1 watt most of time on 20- bias wrong. So, lost the X10 mult! Next time < 250 mW-Doing this many QSOs is too much effort as far as the log/scoring is concerned. < 250 mW ought to produce a lot less work! Best QRP contest EVER! **N7OU:** Many thanks to Rush, W7RM, for letting me tease his mighty antenna farm with less than a watt. **KQ0I:** Sure enjoyed seeing how many members turned out. **K5HQV:** Again it was a fun weekend. The conditions were better than the Spring but still a long way from being great. **WA8RXI:** Thought I would make an effort in this one! The bands stayed open and signals kept coming. Worked power multipliers from the 5mW of KJ5TF to N1NVY/7's whopping 800W. Murphy taught me a lesson, save your data properly before exiting contest software. But, with a little help, we were able to piece everything back together. I did miss 6 states on my quest for WAS in the test: DE, HI, LA, MT, NE, and VT. I guess I should have done a little more S&P. **W5USJ:** Great party: thoroughly enjoyed the event. **WA7LNW:** Look forward to QRP ARCI Fall QSO Party each year. Chose "Low Band" category this year due to weekend work schedule. Full wave delta loops worked well on 40 meters. See everyone next year. **N1EI:** Heard people on 10 m, but no contesters. **K0FRP:** I am very sorry for the poor logging situation. I used a shareware logger and it crashed twice. I lost over 215 QSO points, maybe more. **K5TF:** This was the most enjoyable contest I've ever operated. Good band conditions. Great participation! **K5DKH:** Great contest. Many great signals and operators. Looking forward to next year. **W3DP:** Another fun event. Good activity on 40 m. Some QRO and digital QRM. Great ops! Few repeats. **K2JT:** Most stations that I called on 15 & 20 m did not hear me, worked about 2/3 the people I heard on 40, maybe 85% on 80. Very limited hours available. QRPp is not easy from here. **N4ROA:** Really enjoyed operating the K2. Thanks to everyone for the contacts. **K4AT:** Would have liked to see better band conditions here. Had fun anyway. **VE6AAN:** Fairly challenging propagation up here but fine contest nonetheless. Three new states for me. Where are the other Ves? **VE3VX:** First real contest effort. Had a gud time operating while building LNA for my new 10 Ghz WBFM rig. Should have stuck to one or t'other I guess. Didn't acomplish a great deal on either. I guess I did ok. Heard on guy on 20m running 50 mW. LOUD! **K4KJP:** Another great QRP contest. I enjoyed it immensely. **K3SS:** First hamming after open heart surgery! **K8ZFJ:** What a great weekend for a contest! Still have leaves to rake though; but at least the priorities are in order. *Ed note: Randy included pizza coupons.* **KC7MZT:** Lots of fun despite only being on the air a couple of hours and not having a CW filter in the rig. **KH6B:** Worked 18 states on 4 bands, 40, 20, 15, 10. Best DX was AL7FS, W3RDF, and KI1QM. **WU0L:** I combined camping, fishing, and ARCI QSO Party. I caught some nice rainbow trout each day and the weather was wonderful. The camping was great, but it got a little cool at 7500 feet elevation. It froze half inch of ice in the wash basin in my popup camper. Thanks for running a nice contest. **KC0M:** As always, enjoyed the contest very much...thanks. **W8TIM:** Great contest as usual. Got pretty congested around 7.04 at times. **W2JEK:** Great contest. Fantastic propagation. **N3IUT** -Amazing the strength of some QRP signals with good propagation. Fun contest. Thanks! **W3BBO:** Bands were great, good turnout and lots of fun. Finished off my QRP WAS! **KB0JUL:** Bands were poor from central Iowa. Still lots of fun! **WX7R:** Too many disruptions including my parent's house burning down! **K3CHP:** Sunday hamfest cut into operating time, so my best strategy was a single-band entry. **K5OI:** Didn't do spectacular but had fun. Was using the Elecraft K2 for the first time in a contest. Seems to work ok. It's still in the 'field test' version awaiting upgrades. Nice little rig. **AE4EC:** New mono-band antenna made all the difference in getting a signal out. Two carefully selected crystals gave me about 40 kHz spread on 20 m on xmit. **N2WG:** A great event. Very relaxed. **WB0YPO:** This is my first ARCI contest and I enjoyed it quite a bit. **K4NK:** Log for 40 m only single band. Sorry, not much time this year. **K2HPV:** Great time! Propagation good here. Lost most of Sunday to church and school reunion. Thanks to all for the QSOs. **W4EEX:** I'm glad for a good night's sleep and will be leaving off the caffeine for a couple of days. Haven't smoked so much since final exams back in college (this was more fun, though!). **WB0SMZ:** I managed a little contesting in between chores and honeydo's. Great fun. **K5ZTY:** I only got to put in 9 hours but it was great to find the bands very active when I was on. It was also great to find the large percentage of member numbers being given. Great contest. **W6SU:** First contest with the K2-what a great rig! **K4GEL:** Switching relay mounted on loop antenna squashed a insulated bug. Had to burnish contact. **W2QYA:** Power output measured with Radio Shack Pwr/SWR meter calibrated by me with Heathkit VTVM measuring 1:m.s. into 50 ohm non-inductive load. **AF9J:** Had fun. Party was a nice test for revamped antenna. **N9DD:** A great turnout. The Fall QSO Party is my favorite QRP Contest. It is always fun to work the "regulars" and to see what new "hot-shots" have entered the fray. **NW7DX:** My first QRP ARCI QSO PARTY. Very nice contest **K5AM:** Operated from Horse Mtn. at 7900 ft. in Catron Cty, DM54. **AD8DF:** I am not much of a contester but had lots of fun. It was great to have the higher bands available. Thanks for another fine contest. **N4EUK:** Lots of fun, but much QRM on 40. How do we get rid of those SSB stations? **KD5AIJ:** This was my first QRP contest. Sure was fun. It was great how people slowed down for me. **N1QY:** Conditions were very good, with lots of QSOs and multipliers on both 15 and 10. It seemed like there were a lot of stations competing very hard, so I expect you to get a lot of high scores. This is still my favorite contest because it puts the operator and his equipment --- especially his receiver --- to the test. I'm glad that real signal reports are the norm, but I did detect some creeping "5NN" ism. I hope we will always keep real signal reports. **K7TQ:** Great contest. Thanks to all who participated. **WB4JJJ:** Not much time to operate, but had fun. Gonna use my 25 ARCI #s worked in the contest for a Worked QRP-ARCI members certificate. Nice job on the instructions, etc., Joe. **N8CQA:** Limited time and bands this time. Hope to have the tower up later in the Fall. Great contest!!. **GW0VSW:** Missed Saturday and early part of Sunday as it was the GQRP Convention in Rochdale so I could only operate from 1900: 2223 Sunday evening. Band conditions were very poor and there was QSB on the few stations I heard. I did copy a few callsigns on 20/40m but was unable to work them. I cannot say it was good fun, Hi. Hope all other members enjoyed themselves. **N7RI:** This was my first contest on 160 meters. I worked all morning searching for some antenna/tuner combination that would give me an acceptable SWR. I was fascinated by all the raspy gurgling, howling, chattering and roaring of the 160m QRN, stirred up by a geomagnetic storm following a solar coronal ejection. From 0100Z to 0400Z, I listened near 1810 KHz about every half hour. I heard three CQ's, answered all of them, and had QSOs with stations in IN and CT. It was a thrill much like my first few novice contacts through the din of 80m QRN. I expect to haunt 160m all winter! **K8DD:** Great condx from the midwest!

WZ2T: *Ed: From station description* ...TRLog running on a 386 'pooter Gatorade, Fig Newtons and DiGiornio Rising Crust Pizza **N8ET:** There sure was plenty of activity that weekend: I missed the first several hours trying to get the Rig I was using (at a club station) cranked back to 5W! Took a couple of trips home to get parts and tools before I got it right! **VE3BBH:** My first entry in your contest. Enjoyed myself and found it a good way to evaluate my antennas (with low power). I'm not sure if I calculated my score correctly, I found the scoring instructions confusing regarding the points for own continent, etc. **K4AT:** Would have like to see better band conditions here. Had fun anyway. **K3WWP:** Decided to try a 15M only entry this time since I can no longer win PA overall. There should be a separate category in QRP contests for these big professional contest stations who merely lower their power to 5 watts or so and enter as QRP against those of us operating minimal QRP. Maybe something like the CQC did with separate categories based on antenna types. I think it was something like Beam, Vertical, Single wire, and Portable. At any rate, I had fun, and that's the bottom line in contesting as far as I'm concerned. Although it is nice to win a certificate now and then. HI. **W7/JR1NKN:** Thank you for the QSOs. **W5VBO:** I only operated on 10, 15 and 20M, as I wanted to enter as a top band entry category. No 40 or 80M at all. I worked about 20 hours as best as I can tell. States missed: RI, DE, WY, NE. I worked a lot of 15M, and even had a number of QSO's on 10M. I worked AK and HI (they called ME!). I even worked W7/JR1XXX something or other. I think though that I sprained my brain somewhere along the line. Sure wish that I hadn't destroyed those brain cells in the 1960's ;) It was a blast. I never cease to be amazed at well QRP fares in these contests. **K3NCO** -It was really neat being called by ZL2GH on 10. At 200W it was wierd that he was worse copy than I was at 5W but then I get a LOT of line noise pointing west (a real annoyance when trying to work MOST of the US. It was good for 1000 mi/W. This was followed in a little while by KH6AFS for a 2xQRP, which it turns out I have just calculated as being 4700 miles: guess I missed an opportunity of 2x1000mi/W: he was running 4 W: if I had realized how close this was, I would have reduced power to 4 W! HP1AC was nowhere near as far: but was another surprize, with a nice standout signal on 15 meters. **AE2T:** First serious contest with the K2. This is going to be a serious QRP contest rig. Conditions were not great, but good enough for stateside on 20 and up. 80M was dissapointing, QRN was high. 40M was not up to par either and rain Saturday messed up the SWR on both 40M antennas. Made up for it on 40M Sunday afternoon. Worked HP1AC (twice) on 20M for my only DX. Lots of short skip on 20 helped the mults. **N4UY:** Had a good time in the contest -- nice to work some old friends and to pick up some new 2-way QRP states on 15 and 20m. Also nice to know the old Ten Tec 509 still works -- thanks. **AA1CA:** My first contest effort with almost all other players operating below 5 watts. What a pleasure not to deal with the QRO QRM! Was amazed at how little bandwidth we QRPers could get by with. Seemed like there were seven or eight folks running stations from 14.060 to about 14.068 (where the RTTY QRM started). All perfectly readable and workable. Didn't stay in contest as long as I'd like to, had other irons in the fire. Couldn't seem to punch into CA but did get as far west as WA, AZ, and NV. **KJ5TF:** Multi for <250mW is ok, but what about <100mW or <50mw multis? Maybe in the future there will be incentive to run low down mW if there's a decent multi. **KC8FXR:** I have never been in a QRP Test before. I only have a 20 meter radio so put me down for single band. It was a lot of fun. I'll be back for more of this. **AB7OA:** Fun time! **AA1MI:** All contacts <1W (My QRP+ has decreasing output level as you jump to higher-freq bands. I set 950 mW on 80 and 40, and power on 10m roughly 650 Mw.) **N4XDW:** A really fun time. 10 and 80 meter bands were virtually dead. I managed 23 new 2X QRP states during the contest bringing my total to 37. **AF4PS:** GREAT fun this year, my best outing ever. **AA0B:** Had a good time, couldn't work the entire event but had fun. **N0UR:** wow!! **WB5JBM/8:** 1W on 80 just doesn't do the trick! for a QRP contest, I sure ran down the deep-cycles!!!! Pulled almost 70 AH out total! (of course, watching the World Series, 12V lighting, air pump for mattress and chair, Lots of fun!!! First real FPQRP Club event!!! **AF5Z:** Dave Hassell, AB5WX and I set up a portable station at the Williamson County Amateur Radio Club picnic site on Lake Georgetown. A center-fed 102' dipole was hung between trees about 20 feet up. Band conditions were good and lots of fun was had as fellow club members arrived during the operation. Murphy attended as the audio output of the rig was accidentally shorted when trying a newly built resonant speaker. A cloud of smoke poured from a couple of resistors in the receiver audio output circuit but when the speaker was properly connected the rig still worked fine! QSOs made were 6 on 7 MHz, 56 on 14 MHz, 63 on 21 MHz, 17 on 28 MHz for a total of 142 contacts and 623 QSO points. States/provinces/countries worked were 5 on 7 MHz, 30 on 14 MHz, 33 on 21 MHz, 12 on 28 MHz for a SPC multiplier total of 80 and 41 unique states/provinces. Thanks to Dave for helping with the operating and station setup. And many thanks to all the participants who helped me have FUN. **N4XDW:** A really fun time. 10 and 80 meter bands were virtually dead. I managed 23 new 2X QRP states during the contest bringing my total to 37. **AE4IC:** This contest was busier than any for the last several years. I'll bet that many QRPers made their highest scores ever. I doubled my previous best. **WA2BQI:** Great contest, semi-good conditions. See you next time. **KK4R:** I had a great time, and the bands were in good condition.

1999 FALL QSO PARTY

QTH	CALL	SCORE	PTS	SPC	PWR	BAND	TIME	RIG	ANTENNA
AB	VE6AAN	35588	164	31	5	40 - 10	6	TR7, GM-15, OHR	
AK	AL7FS	10710	90	17	5	20 - 10	8	TS450S	KLM KT34A @ 40 feet
AL	W4DEC	751464	994	108	5	160 - 10	13.5	K2, QRP+	Cushcraft A4S, 160m inverted vee
	W4NTI	178360	637	40	5	80 - 10	10		
	N4XDW	114156	302	54	5	40 - 10	17.5	TenTec 509	phased 4 band verts, GAP vert
	K2VL	68068	286	34	5	80 - 15	8		
AR	KJ5TF	35100	117	20	250	40 - 15	14	QRP+	half square, 3 ele quad, dipole
	K5DKH	19096	124	22	5	20 - 10	8	Knwd 450S	2 ele quad @ 28 feet
AZ	NQ7X	980462	1187	118	5	80 - 10			
	W5VBO	389200	1112	50	5	20 - 10	19		
	N7KT	127449	357	51	5	40 - 10	18	K2	R7
	AB7OA	9996	102	14	5	20	6	NW20	1/4 wave vert
BC	VE6BIR/7	281190	515	78	5	80 - 10	15	Argo 509	80 m dipole
CA	WE6W	492107	847	83	5	80 - 10		K2	Dipole
	W6ZH	455616	678	96	5	160 - 10	6	Omni 6+	KT-34XA, 40m-2 el yagi, vert
	W6SU	6840	57	8	250	160 - 10	2	K2	R7 and dipoles

1999 FALL QSO PARTY cont...

QTH	CALL	SCORE	PTS	SPC	PWR	BAND	TIME	RIG	ANTENNA
CO	K0FRP	2879120	1972	146	1	80 - 10	18.5		
	AB0GO	627396	924	97	5	40 - 10	23	IC706	Inverted vees
	N0RC	302708	569	76	5	80 - 10	12.5	K2	Attic dipole
	N0IBT	234234	507	66	5	40 - 10	13	TS-870S	Dipoles
	WU0L	93786	319	42	5	40/20	6.5	Homebrew	End fed half wave
	WB0YPO	15680	140	16	5	10	6		
CT	N1EI	277200	385	48	250	160 - 15	16	SST, OHR500, Sierra	80m doublet @ 60 feet
FL	N4BP	4276320	2416	177	1	160 - 10	23.5	FT-1000MP	TH7DXX @ 65 feet
	AF4PS	206682	518	57	5	40/20	8.5	Norcal20, SW40+	Fan dipole in attic
	K4KJP	103040	320	46	5	40 - 15			
GA	K4BAI	1783236	1794	142	5	80 - 10	17.25	IC736	TH6DXX, 40 - dipole, 80-inv vee
	K5TF	1679027	1831	131	5	80 - 10	23	IC-735	Dipole on 80m, Loop on 40-10
	K4JPN	27783	147	27	5	80 - 15	2.5	HW-8	80 m zepp, 3 ele yagi
GW	GW0VSW	98	7	2	5	40/20	3.5	QRP+	Half size G5RV @ 9 m
HI	KH6B	27216	144	27	5	40 - 10	6	K2	14AVQ
HP	HP1AC	148960	380	56	5	40 - 10		Knwd-430S, HW-9	Mosley TA-33Jr, dipole
IA	KQ0I	240856	506	68	5	80 - 10	14	TenTec 580 Dea	Muiband dipole
	KB0JUL	22176	144	22	5	20/15	4	Argonaut 509	Indoor dipole
	KC0AYG	84	6	2	5	15		IC730	End fed wire
ID	K7TQ	1174068	1553	108	5	40 - 10	24	K2	TH7DXX @ 90 feet, 160 m dipole
IL	W9CUN	26019	177	21	5	40	3	TenTec Dea 580	40 m horizontal loop @ 8 feet
	WB9MII	1813	37	7	5	20	2	MFJ9020	Indoor dipole
	N9JCV	546	26	3	5			Tac1	
IN	W9SR	1051127	1241	121	5	160 - 10	15	Homebrew & Corsair	160 m full wave loop @ 53 feet
	N8DD	446880	840	76	5	80 - 15	13	IC-735	Horizontal loop
	K9PX	341502	1038	47	5	40	16	K2	80 m loop
KS	WB0SMZ	19740	141	20	5	20	3.5	Norcal 20	Butternut Vertical
KY	W4EEX	1197840	1380	124	5	80 - 10	21.5	Knwd TS120S	40-beam, dipoles all other
	K4AT	264901	533	71	5	80 - 10	16	Knwd TS570D	80/40 dipole, R7 vert
	N4LH	9996	84	17	5	40/20	4	HW-8	80 m dea loop, 30 m vert dipole
LA	N5IB	39270	187	30	5	40 - 10	8	DSW20/40, TS430S	Full wave 40 m horiz loop
MA	N1QY	1191190	1430	119	5	80 - 10	23	OMNI-6	R7 Vert, trap dipole for 80/40
	K1QM	253729	541	67	5	20 - 10	20	Icom 706	dipole
MD	K3NCO	247324	484	73	5	80 - 10	9	IC746	80/40 Inv vee, 20-10 4 el yagi
	W6TOY/3	188790	465	58	5	80 - 10	13	Knwd TS130V	End fed long wire
	K3CHP	26642	173	22	5	15	10	PC-9000	3 el yagi
ME	KB1CKS	11655	111	15	5	20		homebrew	
MI	WA8RXI	1390088	1928	103	5	80 - 10	17.5	K2	3 ele tribander, 80 m inv-L
	N8CQA	889200	2470	36	1	40/20	8	NC40A, Explorer	End fed wire @ 25 feet
	K8DD	841920	877	96	1	80 - 10	7.75		
	K8CV	579600	828	100	5	80 - 10			
	KC8FXR	167580	1260	19	5	20	3.25		
	K8IQY	114016	509	32	5	40	12	2N2/40 homebrew	
	AB8DF	80549	311	37	5	40 - 10	7	Triton IV	105 foot dipole
	W8RU	75264	336	32	5	40	2.75		
	W8TIM	18200	130	14	1	40	3.5	SW-40	Dipole
	KI8AF	17787	121	21	5	20	5	OHR 500	
	N8TDH	17262	137	18	5	40	11	MFJ 9040	dipole @ 10 feet
	K8VFR	693	63	11	QRO	40	4		
MN	N0UR	2290554	2058	159	5	160 - 10	24		
MO	KC0M	383474	637	86	5	80 - 10	14.5	Yaesu FT900	Dipole
	AA0B	46172	194	34	5	20 - 10	4.5	TS120s	140 ft center fed dipole
	WA0OTV							CHECK LOG	
MS	K5HQV	1185597	1377	123	5	80 - 10	19	Yaesu FT1000MP	140 ft dipole, Ham stick dipole
MT	KC7MZT	4928	64	11	5	15	2	Knwd TS-520	Wire vertical

1999 FALL QSO PARTY cont...

QTH	CALL	SCORE	PTS	SPC	PWR	BAND	TIME	RIG	ANTENNA
NC	AE4IC	1314950	1445	130	5	160 - 10	21		
	N2WG	395850	725	78	5	80 - 10	18.75	K2	Portable vertical loop
	AE4EC	78300	270	29	1	20	8	Ramsey QRP-20	Yagi
	WJ9B	63480	184	23	250	40	6	Argo II	2 el Yagi @ 70 ft
	KG4CRU	52052	338	22	5	40	5.5	Norcal 40A	attic dipole
	KF4AR	40425	175	33	5	80 - 15	6	K2	130 ft random wire
NH	AA1MI	233820	433	54	1	80 - 10	14	QRP+	R7 vert, 80 dipole
	AA1CA	94962	399	34	5	20	7	HW9	40 m quad, 8 el Sterba on 10 m
NJ	WQ2RP	1270962	1441	126	5	80 - 10	14.5	TS850	Center fed zepp, TA33jr
	W3BBO	651168	969	96	5	80 - 10	21	Sierra	Horizontal 80 m loop, R5 vert
	W2JEK	268842	519	74	5	160 - 10	10	Yaesu FT840	dipole, gnd plane, 160-10 end fed
	K2HPV	192045	465	59	5	80 - 10	10	IC-735	GAP Titan
	K2JT	104550	205	34	250	160 - 15	3	Sierra, TS130V	Dipoles, long wire (160m)
	AA2YO	85995	351	35	5	40 - 15	10		
	N2EI	38500	220	25	5		10	Argonaut 535	Dipole @ 35'
NM	K5OI	54180	215	36	5	40/20/10	12	K2	40 m dipole
	K5AM	12096	96	18	5	20 - 10	3		
NV	KU7Y	2263050	1605	141	1	80 - 10			
NY	WZ2T	1120560	1380	116	5	80 - 10	24	TS940, FT847	Dipolest, Hygain DX77 vert
	AE2T	739200	1100	96	5	80 - 10	12	K2	Cushcraft A3, Gladiator vert, dipole
	N2VPK	183120	436	60	5	80 - 10		Argo 556	Butternut HF6V, 40 m dipole
	W2EZ	139860	555	36	5	40 - 15	15.5		
	WA2BQI	110593	427	37	5	80 - 15	19		
	K2UD	107849	497	31	5	40	12	Argo 509	End fed half wave
	W2QYA	88900	254	35	1	40 - 15	9	HW-8	90 m inverted Vee
	KC2AFK	7007	77	13	5	80 - 10	2	TenTec Omni	Window
	WA1GWH	6230	89	10	5	40	2.5	TS430S	Insulated wires on lawn
OH	N8ET	1509151	1621	133	5	160 - 10	24		
	WB6JBM/8	42735	185	33	5		13.5	K2, HW8, SW40+	Wires in trees
OK	K5AAR	482496	718	96	5	80 - 10	16	Homebrew	80 m dipole
	AB5UA	136612	574	34	5	15	9	OHR 100	Mosley TA33M
	K5HP	81312	352	33	5	20	17	NW80/20	Mosley CL33 @ 85 feet
ON	VE3ZT	352184	662	76	5	80 - 10	13		Inverted vees, dipoles, 5 el yagi
	VE3VX	93450	267	35	1	40 - 10	9.5	Yaesu 757 GXII	HI-Q Loop @ 10 feet
OR	WX7R	32802	213	22	5	10	4	FT920	mono band yagi
PA	NA3V	676396	986	98	5	80 - 10	17.5	TS570	Inverted vee
	W3TS	597450	569	70	250	160 - 10	8	Homebrew	Inv vee, 3 el yagi
	K7SZ	289562	559	74	5	80 - 10		TenTec Omni-C	TH7DX @ 52 feet, ext dbl zepp
	N3IUT	172767	433	57	5	40 - 10	10.5	TT Scout, Knwd 440	9 el Yagi, R7000
	N3FYW	101430	345	42	5	80 - 15	15	Knwd TS570D	G5RV inv Vee
	W3DP	90538	446	29	5	40	6	OHR 100A	G5RV @ 25 feet
	WA3WSJ	54180	258	30	5	20	3	K2	Mosley TA33
	K3WWP	33075	225	21	5	15	10	TS570D	random wire in attic, inv vee, dipole
RI	K8ZFJ	90880	284	32	1	40 - 15	12	Argo 515	G5RV
SC	K4NK	10920	104	15	5	40	6	Argonaut 509	dipole
SD	W0RSP	621712	976	91	5	80 - 15	15	Argo 505	18AVT, 20 m dea loop
TN	KT4OR	22680	135	24	5	80 - 10	14	Sierra	G5RV, Cushcraft A3
TX	K5ZTY	630000	900	100	5	40 - 10	9	K2	Yagi
	AF5Z *	348880	623	80	5	80 - 10	6.5	ARGO 505, Corsair II	dipole, TH7DX @ 80 ft, 80m full loop
	K5NZ	213003	483	63	5	160/80/40		OHR400, FT1000MP	
	WA8GHZ/5	130144	332	56	5	40 - 10	11		
	W5USJ	102424	472	31	5	40 - 10	10	TS570, TS430	Inverted vee
	W5WO	49300	170	29	1	20/15	6.5	homebrew	dipoles
	AB5WX	46221	213	31	5	40 - 10			
	KA5T	14364	108	19	5	20 - 10	2		80 & 40 dipole
	KD5AIJ	11424	96	17	5	20 - 10	6	K2	Force 12 C3SS

1999 FALL QSO PARTY cont...

QTH	CALL	SCORE	PTS	SPC	PWR	BAND	TIME	RIG	ANTENNA
UT	NC7X	1191729	1407	121	5	80 - 10	20.75	K2	80 m zepp @ 40 feet
	WA7LNW	125307	459	39	5	80/40	8		Dea loop for 40m
	W0YSE	11340	81	14	1	20/15	5		R7000
VA	N4ROA	452228	1042	62	5	80/40	15	K2	450 ft loop
	K3SS	179340	427	60	5	80 - 10	9	Yaesu FT757GX	Dipole @ 35 feet
	KK4R	169302	417	58	5	80 - 10	5.5	IC 735	
	K4GEL	151221	379	57	5	80 - 10	9	homebrew	80-dea loop,-2 el dea loop, 4 el quad
	N4UY	122108	356	49	5	40 - 10	6.5	Argonaut 509	dipoles, 20 full wave loop,
	WA4CHQ	77440	352	22	1	40	18	homebrew	40 m dipole
	WR4I	46683	247	27	5			Argosy I	Carolina 80m Windom
	WB4JJJ	17423	131	19	5	40/20	3.5	Argo 556	Carolina Windom
	N4EUK	756	27	4	5	40	2	Emtech NW40	100 foot long wire
	N7RI	98	7	2	5	160	3	FT890	two low dipoles
WA	N7OU	2196450	1627	135	1	80 - 10	24	K2	Stacked yagis
	NW7DX	274820	604	65	5	80 - 10	16	Knwd TS-570DG	40 m dea loop, R7 vert
	N7RVD	86436	294	42	5	80 - 10	8.5	K2, Yaesu FT101ZD	20 m 1/4 wave vert up 16 feet
	WA2OCG	32340	165	28	5	40 - 10	7	IC737	R7
	W7/JR1NKN	3402	54	9	5	15	7	Mizuho MX-21S	Ground plane
WI	N9AW	1643082	1653	142	5	80 - 10	20	FT1000MP	dipole, dea loop, Mosley@ 50 ft
	AE9K	274575	523	75	5	80 - 10	8	TS430	AP8A vert
	N9CIQ	262276	551	68	5	40 - 10	4	IC737	TA33jr, 80 m inv vee
	AF9J	69960	212	33	1	40 - 10	11.9	SG2020	170 ft end feed open loop
	NK9G	30380	155	28	5	40 - 15		FT900	R7 vert
WV	WF8X	393120	780	72	5	40 - 10	12	Knwd 120V	R7 vert

*AF5Z operated by AF5Z and AB5WX

HOLIDAY SPIRITS HOMEBREW 1999

Most folks reported that they liked the four-hour format of this relaxed event. Perhaps due to this, participation in the 1999 running of the Holiday Spirits Homebrew was up compared to last year. In 1999 there were 54 entries compared to 35 entries the previous year. Scores were also up. The top score by N4BP of 447k was well above the 232k from last year. In fact, the top 4 finishers this year had higher scores than last year's 1st place finisher. Solar flux this year was 145 with an A-index of 15. A special tip of the hat to KB2HSH for his entry using a 2-chip TTL transmitter running less than 250 mW.

The 2000 event is scheduled for December 3, 2000.

TOP TEN	
N4BP	447,100
K0FRP	352,220
N4ROA	339,015
K5NZ	333,680
K5ZTY	245,120
AF5Z	190,120
K7TQ	170,626
NC7W	170,114
W3RDF	166,675
W3TS	156,540

SINGLE BAND						
40 m	K9PX	70,163		10 m	WA2BQI	1,974
20 m	W4EEX	81,560		High-band	K7RE	102,808
15 m	N7GS	15,185				

1999 Holiday Spirits Homebrew Soapbox **KL7GN:**Bands very noisy here. Didn't hear any stations on 20 m until about 2315Z. **N1EI:**Upper bands were in nice shape. 40 m QRM was bad. **N4BP:**Jumped into the sprint following a full effort in the ARRL 160M Contest. My head was still spinning from two nights of listening to noise and struggling for every contact! What a pleasure to be able to hear and run stations for a while. Condx seemed better on 10 & 15 than on 20 m. **K7RE:**Condx supplied plenty of QSB, but great fun as always. It seems as if the operators just keep getting better and better. **K4EQ:**Just finished the rig this week and jumped in the contest for a little fun--not to be competitive. Had lots of fun. **K8CV:**Much needed rain here not snow! **KB9BVN:**Very nice way to spend a rainy afternoon. Got 76 points on 15m. Got 5 points on 20m. Got 10920 on 40m plus 5000 bonus for the 40A. Not the big winner, but it sure was fun! **K5NZ:**Fantastic ops pulling my 900mw out on 20/40m. Also the guys that would QSY for mults, VE6CGX, K0FRP, N7GS, K0ZK, NC7W. That's what makes the Sprint fun! **K5ZTY:**I started out to run <1watt but wimped out. Had fun working all the regulars and some newcomers too. Merry Christmas to all. **AF5Z:**There was some confusion between the TP (Telephone Pioneers?) activity and the ARCI QRP event due to similar exchange and suggested frequencies. I logged N6MM, VE3EGG and KA9TIE as non-members due to this. **W0UFO:**Good contest. Will have an *RH-40* on too for the next test. **W4EEX:**Had a blast, and was amazed at the number of really great cw ops out there. I've got a lot to learn from you! Conversely, I was dismayed at the other digital ops, particularly the AMTOR/PACTOR crowd. **K0FRP:**10/15 were good, was late getting to 20/40. Worked Jim AI7FS twice and KI7GN. Lots of 1-2 watter non members maybe more member QRPp. Fun four hours. **WB4JJJ:**Had much fun using my newly finished K2. Surprised to see ARCI numbers above 10,000. **KS4L:**Lots of fun! Ops were very effective and courteous. **WJ2V:**Rig was exclusively my 2N2/40 scratch built (very homebrew!). My K2 was not used-it needed a rest anyway! One station was calling CQ with a memory keyer with an "X" in his call, but identifying by hand with a "K" in his call. That was interesting. The 2N2/40 is a first rate QRP contest rig. I had been meaning to try it out under fire, and it confirmed its mettle. Cruised right along at 1+ watt. Operation at WJ2V was casual, with time out for dinner in the middle. *After all, this is a hobby, right folks?* ***KB2HSH:****Nice sprint, nice to* talk to the locals. But where was the activity? In 1997, that sprint was great! This year, entrants were few, at least on 40 meters. That's OK, though, because, I had fun, and so did my son Aron watching me use the key! ***AD6GI:****Had a great time and thanks to the great operators* out there for their patience with my operating. Did improve a bit from last time; but, much improvement is needed. Plans are underway to straighten out technique and to improve my skills. **N7GS:**Enjoyed the contest, just couldn't spare the time for all 4 hours. **K3HX:**Great fun! **W5TB:**Talk about a sprint! I got home from a trip just 12 minutes before the end of the contest. QSO rate was pretty good for the 11 minutes I was on :-) See ya next time guys & gals! **VE2ATD:**I did not make DXCC but I had lots of fun! **N4ROA:**Very relaxing contest-operators friendly and laid back. Big change from the 160 m pace. **AB0GO:**Great fun! Had to scramble to get my 20m band module built for my Sierra in order to get a homebrew rig on the air and get the bonus. Lots of good signals heard! **W3DP:**Really enjoyed the Sprint in spite of South American SSB QRM. 40M activity seemed down from the Fall Sprint. Also had some local Wx QRM. Amazing how good your ears adapt to copying multiple weak sigs and picking one out! Used German WW2 army key and Vibroplex bug. Power was 12 volt B&D power tool battery for 3W output. Keep the Sprints coming.

1999 HOLIDAY SPIRITS HOMEBREW SPRINT

QTH	CALL	SCORE	PTS	SPC	PWR	BAND	TIME	RIG	ANTENNA
AK	KL7GN	19404	132	21	5	20 - 10	4	IC735	TH6DXX
AL	KS4L	105750	245	50	5	40 -10	3	K2	350 ft horiz loop
	NZ4M	13036	82	14	5	20	4	OHR 100A	G5RV
AZ	K7RE	102808	256	49	5	20 - 10	4	K2	3 el @ 35 ft
CA	W6ZH	48028	154	26	5	40 -10	3	K2	KT34XA, 2 el yagi
	AD6GI	47202	134	29	5	40 -10	4	K2	40 m short dipole
CO	K0FRP	352220	482	71	1	40 -10	4	Sierra, TS850	4 el 20, 2 el 40, tribander 10/15
	N0RC	90315	245	41	5	40 -10	4	K2, NorCal20	Dipole in attic
	AB0GO	21002	127	18	5	20	2	Wilderness Sierra	Mini-G5RV
CT	N1EI	80345	149	27	250	80 - 15	4	OHR 500	80 m doublet
FL	N4BP	447100	670	90	5	80 - 10	4	K2	TH7DXX @ 65 ft
HP	HP1AC	69300	225	44	5	20 - 10	3	TS430S	TA33jr
IA	KQ0I	21672	129	24	5	20/15	1.5	TT580 delta	Multiband wire
ID	K7TQ	170626	371	58	5	40 -10	4	K2	TH7DXX @ 90 ft
IL	W9CL	66170	215	34	5	40 - 15	4	SST, HW8	PRO67C
	WB9MII	392	14	4	5	20	0.5	MFJ9020	STL on the wall indoors
IN	K9PX	70163	321	29	5	40	4	K2	80 m loop
	W9SR	61231	277	29	5	40	4	Homebrew	160 m loop, inv vee
	KB9BVN	24180	137	20	5			NorCal 40A, Scout 555	Dipole in attic
	K9DIY	4095	65	9	5	40/10	2	TT-Corsair	Inv vee
KS	WB0SMZ	8472	62	8	5	20	0.5	Norcal 20	Butternut vert
KY	W4EEX	81560	264	29	1	20	4	Sierra	20 m vee, 80 m loop
MA	K1QM	62510	235	38	5	20 - 10	4	IC706	Dipole
MD	KB3WK	152420	277	46	1	80 - 10	4	K2	3 el yagi, dipole
	K3NCO	104615	305	49	5	80 - 10	4	IC-746	Inv vee, 4 el yagi
	K3CHP	44360	116	21	1	80 - 15	4	HW8	3 el yagi, vert
ME	K0ZK	77680	206	40	5	40 -10	4	K2	Indoor dipoles
MI	K8CV	81872	272	43	5	80 - 10	4		
MN	W0UFO	61637	261	31	5	20	4	NC20	TA33
MO	WA0OTV	238	34	7	20 W	15	1	HT40, HA5	Homebrew
MT	N7GS	15185	97	15	5	15	2	K2	3 el yagi
NJ	N2CQ	68620	187	26	1	40 -10	2.5	GM10&15, 8020, OHR100A	
NY	K2UD	22850	150	17	5	40	4	2N2/40	End-fed halfwave
	WJ2V	10180	74	10	5	40	2	2N2/40	
	KB2HSH	2495	11	3	250	40	2.25	TTL 2 chip transmitter	Extended double Zepp
	WA2BQI	1974	47	6	5	10	4	IC707	Dipole

1999 HOLIDAY SPIRITS HOMEBREW SPRINT cont...									
QTH	CALL	SCORE	PTS	SPC	PWR	BAND	TIME	RIG	ANTENNA
OH	K8UCL	41775	153	25	5	40 - 15	4	HW-8	Attic dipoles
ON	VE3KQN	69262	249	34	5	40/20	4	Sierra	G5RV, vert
PA	W3TS	156540	222	38	250	160 - 10	2.5	Homebrew	160m tee, 80&40m Vee, 2 el yagi
	K3HX	49700	284	25	5	40	3.5	TS-870S	Dipole
	W3DP	21485	157	15	5	40	2.5	OHR-100A	G5RV @ 25 ft
QU	VE2ATD	1512	36	6	5	40	3.5	Oak Hills Sprint	14AVQ
SC	W3RDF	166675	355	55	5	160 - 10	4	K2	Quad, 150 ft end fed wire
TN	K4EQ	21422	138	17	5	40	4	DSW-40	R7
TX	K5NZ	333680	544	85	5	80 - 10	4	FT1000MP, OHR 400	
	K5ZTY	245120	480	67	5	40 -10	4	K2	Force 12 C4S
	AF5Z	190120	388	70	5	80 - 10	4	Ten-Tec Corsair II	TH7DX @ 80 ft, 80 m full wave horiz loop
	W5TB	5525	25	3	5	40	0.18	NorCal 40A	G5RV
UT	NC7W	170114	419	58	5	80 - 10	4	TS820	1/4 wave vert each band
	W0YSE	10080	56	12	250	20 - 10	3		
VA	N4ROA	339015	545	81	5	160 - 10	4	K2	450 ft loop, inverted L
	K4GEL	67833	211	29	5	80 - 10	4	Homebrew	delta loop, 40m 2 el delta loop, 4el quad
	WB4JJJ	50576	168	26	5	40 -10		K2	
	N4UY	12520	36	7	1	40/20	1	Tuna Tin II,GM -20	Wire dipoles

WINTER FIRESIDE SSB SPRINT 2000

The first QRP ARCI contest of the year was held February 13, 2000. This is a preliminary report of that contest. The next issue will have the complete contest results and soapbox comments.

These preliminary results were taken from the web page High Claimed Scores Report form. It will be available for all QRP ARCI contests at http://personal.palouse.net/rfoltz/arci/form.htm.

Nr	Call	QTH	Power	S/M	QSO Pts	SPC	Score
1	WA7LNW	UT	LT5	M	285	35	69,825
2	N5WU	TX	LT5	M	199	33	45,969
3	W6ZH	CA	LT5	M	146	36	36,792
4	NN5B	TX	LT5	M	174	25	30,450
5	WB3AAL	PA	LT5	S	174	21	25,578
6	K1QM	MA	LT5	M	111	25	19,425
7	W1HUE	ID	LT5	M	122	20	17,080
8	N3AO	PA	LT5	M	96	16	10,752
9	K4NK	SC	LT5	M	95	13	8,645
10	N2EI	NJ	LT5	M	101	11	7,777
11	VE5QRP	SK	LT5	M	82	13	7,462
12	N4JS	NJ	LT5	M	45	8	2,520
13	N4EUK	VA	LT5	M	47	7	2,303
14	KB2HSH	NY	GT5	S	96	10	960

2000 Hootowl Sprint

Date/Time: May 28, 2000; 8:00 pm to 12:00 pm **Local Time**
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 for all bands. The same station may be worked on more than one band for QSO points and SPC credit.
Power Multiplier:

0 - 250 mW = X 15	250 mW - 1 W = X 10
1 W - 5 W = X 7	Over 5 W = X 1

Suggested Frequencies:

	General	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	50128 kHz	

Score: Points (total for all bands) X SPCs (total for all bands) X Power Multiplier + Bonus Points.

Entry may be All-band, Single-, High-, or Low-Band. Entry includes a copy of logs and summary sheet. Include legible name, call, address, and ARCI number, if any. Entry must be received within 30 days of contest date. Highest power used will determine the power multiplier.

The final decision on all matters concerning the contest rests with the contest manager. Entries are welcome via e-mail to rfoltz@turbonet.com or by mail to: Randy Foltz, 809 Leith St., Moscow, ID 83843. After the contest send your Claimed Score by visiting http://personal.palouse.net/rfoltz/arci/arcisum.htm. Check the web page for 10 days after the contest to see what others have said and claimed as their scores.

2000 Summer Homebrew Sprint

Date/Time: July 9, 2000; 2000Z to 2400Z CW HF only
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 for all bands. The same station may be worked on more than one band for QSO points and SPC credit.
Power Multiplier:

0 - 250 mW = X 15	250 mW - 1 W = X 10
1 W - 5 W = X 7	Over 5 W = X 1

Bonus Points: For homebrew gear (per band) add 2,000 points for using HB transmitter, add 3,000 points for using HB receiver, or add 5,000 points for using HB transceiver.
Suggested Frequencies:

	General	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	50128 kHz	

Score: Points (total for all bands) X SPCs (total for all bands) X Power Multiplier + **Bonus Points:** Entry may be All-band, Single-, High-, or Low-Band. Entry includes a copy of logs and summary sheet. Include legible name, call, address, and ARCI number, if any. Entry must be received within 30 days of contest date. Highest power used will determine the power multiplier.
The final decision on all matters concerning the contest rests with the contest manager. Entries are welcome via e-mail to rfoltz@turbonet.com or by mail to: Randy Foltz, 809 Leith St., Moscow, ID 83843. After the contest send your Claimed Score by visiting http://personal.palouse.net/rfoltz/arci/arcisum.htm. Check the web page for 10 days after the contest to see what others have said and claimed as their scores.

2000 Summer Daze SSB Sprint

Date/Time: August 6, 2000; 2000Z to 2400Z SSB HF only
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 for all bands. The same station may be worked on more than one band for QSO points and SPC credit.
Power Multiplier:

0 - 250 mW = X 15	250 mW - 1 W = X 10
1 W - 5 W = X 7	Over 5 W = X 1

Suggested Frequencies:

80 m	3865 kHz
40 m	7285 kHz
20 m	14285 kHz
15 m	21385 kHz
10 m	28385 kHz

Score: Points (total for all bands) X SPCs (total for all bands) X Power Multiplier.

Entry may be All-band, Single-, High-, or Low-Band. Entry includes a copy of logs and summary sheet. Include legible name, call, address, and ARCI number, if any. Entry must be received within 30 days of contest date. Highest power used will determine the power multiplier.

The final decision on all matters concerning the contest rests with the contest manager. Entries are welcome via e-mail to rfoltz@turbonet.com or by mail to: Randy Foltz, 809 Leith St., Moscow, ID 83843. After the contest send your Claimed Score by visiting http://personal.palouse.net/rfoltz/arci/arcisum.htm. Check the web page for 10 days after the contest to see what others have said and claimed as their scores.

Adventures in . . . Milliwatting

Jim Hale, KJ5TF
kj5tf@madisoncounty.net

12 Meter Records

CO8LY Ed, was CQ'ing on 24.898 mHz Feb. 3rd at 13:08Z with no callers. A milliwatters dream! I had contacted him the day before with 20mW, so this time I set my Ten Tec 290 step attenuator at 12mW and called. He came right back to me, remembered me and gave me a 599. In a follow up email he said I was a solid 569 at 12mW. He must have a great antenna. My antenna is the tree quad, with the center only 8 feet off the ground. Its reflector is shaped like a trapezoid, & the driven element is like a bent slice of pizza! And aimed at Europe. Our distance is 1531 miles/.012w and miles per watt is 127,583 MPW. The old 12M MPW record was set back on July 31st 1990, by JL1FXW who was running 2 watts SSB, in a QSO with A35QC.

17M Record lowered

The 18 mHz band record was also begging to be broken. The standing record was 44,180 mpw, set by K4TWJ & VK6HG in 1992. K4TWJ was running 250mW.

So, I trimmed my inverted vee dipole and started monitoring the band. On December 21st I was trolling 18 mHz with my new K2 # 702. The Mojo was working again for me, I heard VE3MFN and I called him with mW's. Getting a good RST, I sent "QRP?" and got the ok. I quickly dropped to 5mW and got "at 5mW ur 419". The band went QSB, so I came up to "QRO", 200mW and we finished the QSO. Checking our distance of at least 880 mi. / .005 = 176,000 MPW. The QSL card came in the mail finally in early February.

160M Assault

The 160 meter band miles per watt record was set back in 1971, held by G3VWK, & GW4AEC. They did it on SSB and established the record at 13,300MPW. Then along came Dan, N4ROA & Diz, WB8QYY on January 14, 2000. Their distance was 202 miles and they made a valid contact with 8mW which equates to 25,250 MPW. As I listened the day before, they had done it with 12mW.

Then in the CQ 160M contest on 29 January I got lucky and had a valid contact with W8JI in GA. It was 11:18Z with 20mW. Our distance was 570 miles / .02w and a new record for 160M of 28,500MPW.

Milliwatt QRP, or QRPp is getting more popular all the time, so I'm sure my record will not stand for nearly 10 years like the one we just knocked off. I keep the QRP miles per watt records for all bands updated on my homepage

http://www.madisoncounty.net/~kj5tf/

mW Triple Crown Contest from the Knightlites

Remember the 49'er contest put on by the Knightlites QRP Club? Well, after three years running it has evolved into the first milliwatt contest. It ran December 26 – 39 1999 and was well attended by QRP'ers , and at least six QRP club stations.

The first day of the event it went very well, in spite poor band conditions. The second day conditions were worse than the first. The last day of the contest was the best day. Seems that always happened in the 49er event too. As it got dark 40M opened pretty good, and even the SSB QRM was low, contacts rolled in!

The top five finishers are listed below, and there prizes too!

Ø CALL	SCORE	Prizes
N4R0A	94656	OHR 30M xcvr kit, Tee Shirt
K1QM	31348	KnightSMiTe, Tee Shirt
AB8DF	27968	Tee Shirt
NF0R	26320	Tee Shirt

The top Club station was NQ5RP Arkansas QRP Club (KJ5TF op) with a score of 72416

Dan N4ROA is clearly an "undiscovered" milliwatt wizard! I'm sure we will be seeing him in the next two rounds. Seems like everyone enjoyed getting there feet wet with the milliwatters. And low and behold the 1st mW contest has evolved into a Milliwatt Triple Crown. This will involve the IA QRP Club, & Fort Smith QRP Club, maybe others. At press time it looks like the 2nd round of the mW Triple Crown will be April 15th.2000. But check for updates on my homepage. There I have the rules posted from round one, and this can give you an idea on what to expect for the next two rounds. http://www.madisoncounty.net/~kj5tf/

Milliwatting in Bulgaria with LZ2RS/QRPp

I must share with You, I am active on QRP the last five years, but since I met and worked with Ade,W0RSP/3/QRP and when He sent his book "The Joy of QRP" to me-I just began love the low power very much! I am also very thank full of Bill, W1HIJ/6,Who was so kind sent to me a Ten Tec KIT 1320,I have already built and work with 1 watt power out on 20 m band. I use most my old TS 520X with low power, but I hope one day/when the price gets down and my salary gets up/I buy my dream "K2" by Elecraft. Recently with my KIT on 20 m band with 1 watt I worked ZL2LJ by the long path with 2 el beam; Also HF0POL,South Pole and VE7VF with Sloper dipole and same power. I just received yesterday the first Nr in 2000 year "QRP Quarterly" and I must say it is a perfect magazine, I like so much! Today I looked at the "QRP Quarterly" Nr 4 ,October '99 and I read through again Your story "Adventures in Milliwatting". I was again pleased reading and think about it. Today I made two nice contacts on 15 m band with USA. My Antenna is only 2 el /HB9CV/ home brew, but it is 7 meters high above the roof. Firstly, on my "CQ QRP USA" answered - Marc N4DR from Rockville, MD. We started with 5 Watts on both sides and I gave him RST 599-his antenna is 5 el beam; He gave me RST 579. Later We dropped the PWR: I run 1 W and I got 569,He-300 mW-549, Me-100 mW-539,He -50 mW-309, Me -50 mW - 319.Well,it been pleasure and fun, We enjoyed the short good CONDX with Milliwatting!

I wish You &Yours good health and many DX with low Power!

72,71 Rumi LZ2RS/QRP ARCI # 10042
Rumen Stefanov

Milliwatting the Elecraft K2

Got an email from Wayne Burdick with a possible way to get a better power resolution with the Elecraft K2. It would basically move the decimal point, & a switch would put you back to normal. If anyone wants to try this mod, contact me and I'll send it to you.

In the future they will be making changes to the K2 firmware to make it more mW friendly.

Best of 73's, 72's and sometimes 71's! Jim, KJ5TF

MW'ing the contests

QRP ARCI Spring QSO Party 1200Z, Apr 8 - 2400Z, Apr 9
CQ WW WPX Contest, CW 0000Z, May 27 - 2400Z, May 28
QRP ARCI Hootowl Sprint 2000 - 2400 local, May 28
MI QRP Club Memorial Day CW Sprint 2300Z, May 29 to 0300Z, May 30
WW South America CW Contest 0000Z, Jun 3 - 1600Z, Jun 4
IARU Region 1 Field Day, CW 1500Z, Jun 3 - 1500Z, Jun 4
All Asian DX Contest, CW 0000Z, Jun 17 - 2400Z, Jun 18
MI QRP Club July 4th CW Sprint 2300Z, Jul 4 - 0300Z, Jul 5
IARU HF World Championship 1200Z, Jul 8 - 1200Z, Jul 9
QRP ARCI Summer Homebrew Sprint 2000Z - 2400Z, Jul 9

CQ QRP

by Mary, NA6E
na6e@arrl.net

One thing I've noticed in this great hobby are the people that share their talents, time and money in a way that is unbelievable. Whether QRP or QRO, jere are two that I feel are exceptional, Scott Davis, N3FJP and Al Waller, K3TKJ.

Scott Davis, N3FJP, has created a wonderful logging program that is free for the downloading. Here is a brief bio and introduction from Scott about himself and his product.

I was born and raised in Bel Air Maryland, and was first licensed at the age of 14 in 1976. Not being particularly technically oriented, I've always been fascinated by the "magic" of radio. I enjoy contesting as well a a good rag chew. I am blessed with a wonderful wife, Kimberly, KA3SEQ and we have two sons; Chris is 9 and Brad is 5.

When computers came on the scene I just had to learn what I could about them. Since my day job doesn't give me the opportunity to do any programming. . I've been learning whatever I can through self study and experimentation. I learn best by doing, so before I really knew how to program much of anything I decided to write the November Sweepstakes Logging Program. It took several months to write, but once completed I made mention of it to a few friends who asked that I make it available to them. After I put the program up on the web I started getting lots of nice e-mail and requests for other programs.

Well, one program led to the next until now I have programs that support Sweepstakes, Field Day, International DX, Ten Meter, and VHF Contests. I have also written a generally logging program (ACLog) which keeps track of your worked all states, counties, and countries progress; and has many other features including a call book lookup function. All these programs can be downloaded from the following site:

http://members.aol.com/snkdavis/page1.html

I thoroughly enjoy programming. My dream is to be self employed writing freelance programs. I still have lots to learn but I'm gaining experience with every project.

73, Scott, N3FJP

And from Alan, K3TKJ:

WWW.QSL.NET "Connecting Hams around the World"

QSL.NET was started in the winter of 1996 by K3TKJ as an experiment in managing a live Internet network and learning the Linux Operating System. The system has grown by word of mouth to be the latest site devoted totally to Amateur Radio on the Internet.

Recently QSL.NET went over 200,000 users. It sends and receives over 1 million e-mails daily...and has online over 50,000 individual and club web pages. Not links...the pages live in the QS.L.NET servers. Now 3 years old, QSL.NET, QTH.NET and SWL.NET are the largest collection points of ham radio knowledge to be found anywhere.

Volunteers helping in various positions now number over 250 and are the reason this system works, and looks, as good as it does. It would not be possible for 1 person to have done this alone.

The QSL system consists of 8 Internet servers offering the following FREE services...all you need is to be a Ham.

WWW.QSL.NET

- Free email address automatically forwarded to your real address . . . YourCall@qsl.net
- Free space for your homepage . . .
  URL is http://www.qsl.net/YourCall
- Free FTP Access
- All 50,000+ QSL.NET Web Pages are indexed in our Search Engines

WWW.QTH.NET

- Free "email reflectors" for your Radio Club, private use, or general amateur radio topics. Over 900 in operation now on every topic you can imagine relating to the hobby.
- Almost 3 years of QTH.NET postings are indexed in our search engines.

WWW.SWL.NET

- Just like www.qsl.net but for Radio Hobbies without a ham license.

DX.QSL.NET

- Many DxPedition's and Contest Station logs are on line to verify your QSO. (Almost 2 million QSO's).
- Real time propagation pulled from sites all over the world and displayed in one easy place with valuable data and lots of graphics. This site has won many acclaims in CQ, QST and other DX Journals.

CQDX IRC

- A chat room with worldwide DX spotting in real time.

PROXY.QSL.NET

- QSL.NET is also an International Internet Service provide offering v.90 and ISDN dialup accounts as a local call in 95% of the US, and most major Canadian cities. This is a large fiber optic network (over 10,000 miles of fiber) built for the internet and nothing else. There is a monthly fee for this service but it is most competitive.

QSL.NET is a hobby site and not a business. I do this because it allows me to give back to Ham Radio some of what it has given me. Having been licensed for almost 40 years, Ham Radio ahs driven many of my life decisions and I am most grateful to the hobby. This is funded by K3TKJ, user and club donations, and income derived from the non-free services.

73, Al
Laurel, Delaware
k3tkj@qsl.net
http://www.qsl.net

Have something you'd like to share? Exciting QSO...new rig...interesting photo? Send your contribution to me at:

Mary Cherry, NA6E
8383 Sierra Sunset Dr.
Sacramento, CA 95828-5304
or
Na6e@arrl.net

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QRP ARCI is now taking non-US membership applications/renewals via Credit Card! Amateurs outside the US may now pay for their membership using VISA or MasterCard. To apply or renew, you may send regular international surface or airmail and include your credit card type, number and expiration date. Include a reasonable copy of the form from inside the cover of your QRP Quarterly. This info should be sent to our agent: Bill Kelsey c/o Kanga US 3521 Spring Lake Dr. Findlay, OH 45840 Email with the same information may be sent to kanga@bright.net Or you may call him at US 419-423-4604 with the same information. Remember subscriptions may only be made for a maximum of two years. The rates are $18 US per year for Canada and $20 US per year outside US/Canada. Lastly, you may also enter data at the join/membership page on the club web site: http://www.qrparci.org Pro-

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The Last Word

The QRP Quarterly invites readers to submit original technical and feature articles as a service to their fellow QRP enthusiasts. Although The QRP Quarterly cannot pay for submissions accepted for publication, it will acknowledge, with thanks, authorship of all published articles.

Due to space limitations, articles should be concise. Where appropriate, they should be illustrated with publishable photos and/or drawings.

Full articles should go to any of the volunteer editors for review. Information for columns should be sent directly to the column editor. See the back cover for addresses. Submit technical and feature articles with a printed copy and a copy on disk (if possible). ASCII text is preferred. Photos and drawings should be camera-ready or .tif format. Other formats can be used with prior approval.

Technical and feature articles should be original and not be under consideration by any other publication at the time of submission to the QRP Quarterly or while the QRP Quarterly is reviewing the article. If you contemplate simultaneous submission to another publication, please explain the situation in a cover letter.

Material for possible use in the QRP Quarterly should be sent to only one of the editorial volunteers, not to several at the same time. The QRP Quarterly editors and columnists will transmit the submission to others on the staff if they believe it better fits another category.

Accepting advertisements for publication in the Quarterly does not constitute endorsement of either the product or the advertiser.

Material cannot be returned unless accompanied by sufficient postage.

The act of mailing a manuscript constitutes the author's certification of originality of material.

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(With thanks to **L.B. Cebik** for all his help)

de Mary, NA6E

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Mark Milburn, KQ0I

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