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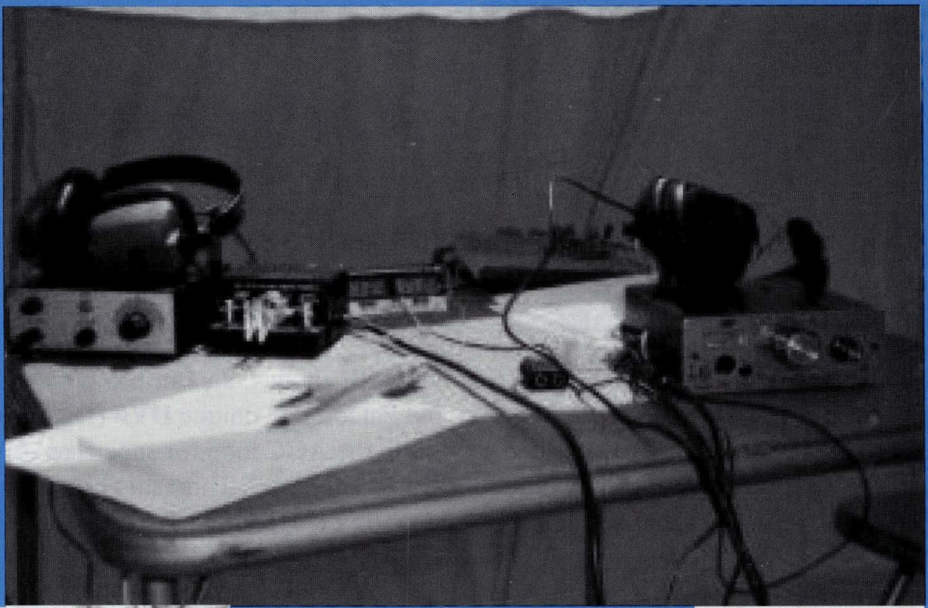
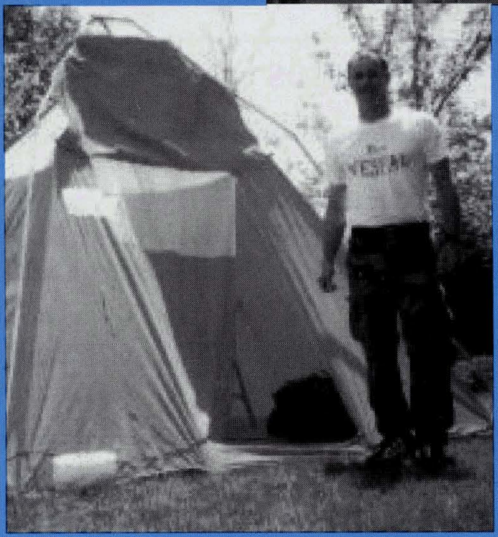
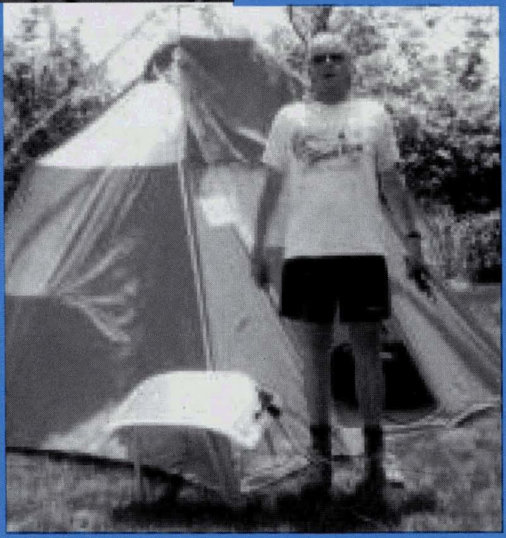
October 2000 Volume XXXXI Number 4





FIELD DAY 2000
CANADIAN STYLE

Fred Lesnick, VE3FAL and Richard Kimpton, VE3AVS



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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

I want you all to know what a pleasure its been being the Editor of the ARCI QRP Quarterly. This will be my last issue and I hope you enjoy reading it as much as I enjoyed putting it to press. I won't bore everyone with details because we all have personal lives outside of ham radio . . . no really, we do!!! And contrary to what some think I am not getting out of the hobby even tho I sold my K2. I'll still be involved with ARCI finishing up the book by L.B., W4RNL and a few other projects that I've been working on.

The new Editor of the QQ is Craig Behrens, NM4T. I've not had the pleasure of meeting Craig personally, but we've chatted on the landline and via email and he's going to make an outstanding Editor. Craig's email address is

craigwb@hiwaay.net

and his snail mail address is:

Craig W. Behrens, NM4T
520 Browns Ferry Road
Madison, AL 35758

I leave you with these photos. You'll have to ask Joe, N2CX the title of the photo of George, N2APB and I. Here's wishing you awesome propogation and good DX. See you on the bands.

72 . . . de Mary, NA6E

Mary, NA6E and George Herron, N2APG at FDIM 2000. Photo taken by Joe Everhart, N2CX

Steve Roberts, N4RVE on his Behemoth Megacycle checking out the new QQ editor, Craig, NM4T at the Huntsville Hamfest

TECHNICAL CORRESPONDENCE

Modified 15M MFJ Cub

As you are aware, my modified 15M MFJ Cub transceiver was used by Russ Carpenter, AA7QU, for his technical review which appeared on page 56 of the July 2000 QRP Quarterly. (My Cub mods also appeared in the July 2000 issue, page 42.) Russ reviewed my mods and was careful not to report any measurement results that might be influenced by them. After the review was published, I received email from the Cub's designer, Rick Littlefield, K1BQT, stating that the minimum detectable signal (MDS) of -127dBm reported by Russ was high by several dB compared to his data. Rick felt that the 2N7000 MOSFET that I had added to my Cub to allow the sidetone level to be adjusted might be influencing the noise figure and/or overall gain of the receiver - something which neither Russ nor I had thought about. Regrettably, I had neglected to make before and after MDS measurements on my Cub during the modification process. I borrowed an IRF-1500 service monitor and used its calibrated signal generator along with my HP 403B AF voltmeter to make MDS measurements on my Cub with and without the 2N7000. These measurements indicated that the MOSFET was not the cause of the poorer than expected receiver sensitivity - removing it resulted in a change of less than 0.5dB in the measured MDS. So, I set about looking for another cause and found it - a wiring error!

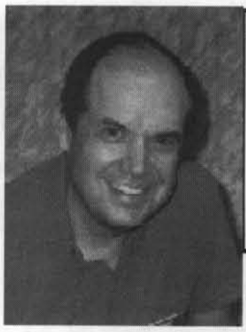
My "keying mod" included the addition of a 10uF tantalum capacitor from the base of Q9 to ground - and I had installed it with reversed polarity! That error resulted in insufficient voltage to turn on the diode T/R switch during receive, resulting in several dB of input signal attenuation. I installed the capacitor correctly and remeasured the MDS: the value is now -132dBm - a 5dB improvement! Boy, am I embarrassed! It's one thing to make a wiring error when putting a kit together, but quite another to make a wiring error in one's own modification!

In the meantime, Russ obtained another (unmodified) 15M Cub and confirmed an MDS of -132dBm. He has redone measurements that are influenced by receiver noise and/or sensitivity and posted a revised review on the web at http://www.natworld.com/ars/pages/back_issue/0800_text/cub_supp.html.

Rick has come up with an alternate QSK mod that does not require an adjustment in the sidetone level. His mod can be found in this issue.

Larry East, W1HUE

ABOUT THE COVER: The equipment used was all QRP,and battery/solar powered. Batteries charged by solar power. The equipment was an OHR HP 40 meter tranceiver running 1 watt and a MFJ 9420 20 meter tranceiver running 1.5 watts. Antennas were dipoles ,one for 40 and one for 20. Field day took place at the Terry Fox Lookout on HWY 11/17 just outside of the city of Thunder Bay. **72/73 de Fred, VE3FAL**



Base Current—

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

The thrill is back! **2k in 2k** - As I'm sure you have followed here, we are trying to get the club to 2000 paid subscriptions by year's end. We had fantastic signup/renewal results at Dayton and folks have responded to our plea to continue their subscriptions (remember once you are a member, you are always a member but you do have to re-subscribe when your subscription runs out) and our numbers have grown to almost 1700 in the past few months. But as you can see, we still need quite a few to reach our goal. So here are my suggestions: 1) find a friend who is not a member or who has not subscribed since 1998 and give him/her a pleasant Christmas present, 2) download the signup sheet from the web site, make some copies and pass them out at your next QRP club meeting, and 3) just call a ham and say "want to bring back the thrill in ham radio?", when they say "yes", tell them about QRP and take them through the steps to join. Not sure who is a member or if your sub has expired? Why not check our new online database? Go to the website and click on Member Lookup from the menu on the front page. To see what you might win when you "sponsor" someone into the club, go to the JOIN page and click on the "2k in 2k" link. Let's get some of those old members back into the "active" status.

Web Site - There have been quite a few changes to the web site during the past few months. I think one of the nicest features we offer is the QRP Forum. I especially like the Search Feature where you can find any old message in a second. We had at one time suggested that all technical topics be confined to the QRP-L list but with the ability to post pictures and schematics on the Forum, it seems there is a place for plenty of tech stuff on the Forum. Try it out if you haven't already. And don't forget, you can "subscribe" and get all the posts to the forum via email. Just go to: http://qrpf.listbot.com and sign up.

PSK31 Contest - QRP ARCI again broke new ground by sponsoring a PSK31 contest on September 10. It was a sprint and this is being written before the contest so don't know how it came out. But if you haven't tried this mode, you should. Mark Milburn tells me it is great. And of course, Dave Benson of Small Wonder Labs has left us with no excuses with his offering of the PSK20 transceiver kit. Stay tuned for more on PSK31 in the future.

QQ Staff Changes - When Mary, NA6E, came on as editor, she told me that she would do this for at least a year. Well, based on her wishes to step down, I had to go on a search for a new editor. I am very pleased to announce that Craig Behrens, NM4T, of the Huntsville, AL area is our new QQ editor. Craig is a very enthusiastic QRPer and Dxer. He may be reached via craigwb@hiwaay.net He has edited an outstanding DX newsletter for some time and has all the techie tools to for job. Plus he wants to do it!!! We really appreciate what Mary accomplished during her "reign" as editor and wish her well in all her future activities. Oh, she is still actively involved in several club projects. You can get involved too. Check out the QRP Action Team on the web site. There are always a number of "chores" that need to be done. Sign up for the Action Team and see where you can fit in

New Book & More - The club is proud to announce (just in time for Christmas) a new book by **L. B. Cebik, W4RNL**. LB is a regular (leadoff) speaker at the club's FDIM conference each year at Dayton. Now you can get a compendium of all his antenna articles from the first 5 FDIM conferences plus an all new, never before published article by ordering his new book, see details elsewhere in this issue. In addition, copies of the FDIM Proceedings 2000 are now available. Both are $13 postpaid from the QRP Toy Store.

ARRL Winner is a QRPer - I noted with interest from a recent ARRL letter that 20-year-old Brian Mileshosky, N5ZGT,of Albuquerque, New Mexico, is the winner of the 1999 Hiram Percy Maxim Award. I met Brian a couple year's ago at the Huntsville Hamfest and he impressed me as a very excited young ham. He was really into QRP and it seems he's into just about everything in ham radio. The Hiram Percy Maxim Award goes each year to a radio amateur under the age of 21 whose Amateur Radio accomplishments and contributions are of the most exemplary nature. Congratulations Brian.

Mark Milburn - I want to take a moment to thank publicly our Secretary/Treasurer. Mark has now completed a little over a year in this post and is doing a simply outstanding job. Mark has continued to absorb more and more "work" within the club and is now keeping the membership database as well as all the other chores. He also recently picked up mailing out the member certificates. The way he put it, "It is logical that since I get the applications and renewals, I should simply update the database and mail out the certificates/member numbers." This is a big time job, believe me and so here is a "hats off" to Mark. Thank you very much.

Personal Activities - I hope by now I'm back from Celticon 2000 in Dublin and a tour of Ireland and England with Marilyn, K4ZOL, my wife. If not, then I've been captured, detained, run over, or just plain decided to "run away" and hide in the Irish barrens. I feel sure I'm back and that we had a great time. I'll give you a bigger report next time. I'm also active in my local club - NoGaQRP. We have a ball each first Saturday of the month at Radioshack.com at 10 AM. In Atlanta. We only have the room for three hours and that doesn't seem to be long enough for our meetings. The room also only holds 25 people. We might have to look for another facility soon - perhaps the GA Dome! I continue to hear of "clubs" like this springing up in all corners of the earth. Recently, Sr. Araujo, PP2KJA, contacted me to get a list of members in South America so he could see about forming a club there. That's what makes this all so much fun and really why -

The Thrill is Back!

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 No. 35, DRILLING PC BOARD ENCLOSURE PANELS

***Joe Everhart, N2CX** of Brooklawn, NJ is an endless source of ideas. Foolish one that I am, I was slightly concerned that his starting a QRP Quarterly column of his own would slow or stop the flow of Joe's Quickies. But instead, for a few issues now we've had both a column and a Joe's Quickie! Here's the latest installment in the endless series. (As usual, Joe provided his own graphics.)*

The relatively recent interest in Manhattan style construction has added the use of printed circuit board material to the bag-o-tricks of many home brewers. I've tried to aid and abet this fervor by "pushing" use of home-built pc board cases with an article in the now-defunct 72 newsletter and more recently, in a Quickie in the April 2000 IX column. Not only that, but NJQRP has recently begun offering do-it-yourself pc board cases for the NorCal SMK-1 and BLT kits as well as the NJQRP SOP Receiver (see www.njqrp.org for more info).

Figure 1—Typical drill press.

In the course of my case building I've re-discovered a couple of wrinkles in drilling glass-epoxy material. Now I'm no expert in materials nor am I a master machinist. However I'd like to pass along a few practical ideas. Any further info from readers who may be experts would be appreciated as feedback. The info will be directed toward making good clean holes in glass-epoxy board used as equipment cabinet panels.

Before You Drill

For years I've used a good old electric hand drill at home, though a Christmas gift Black and Decker cordless took over those duties back in the mid-90's. When I had something really critical to do, I'd lug the project into work where I could use a drill-press during lunch or after hours. But recently NJQRP decided to get into the case kit arena and bought a shiny new drill press for me to use. Kinda on the Tom Sawyer / Huck Finn principle.

I won't tell you which drill press to use, but you will find a variety of choices in the Harbor Freight catalog. You can either call them at 1-800-423-2567 to request a catalog by mail or check them out on the internet. Their URL is www.harborfreight.com and from that page you can click on "search" then enter the type of item you want to see. A photo of a typical drill press is shown in figure 1. You can find several under $100 though shipping will add to this. On the other hand if you find a special sale, the shipping may be included! *[WA8MCQ note—you could also check a local Sears store which has a tool section; they have a few different sizes of drill presses.]*

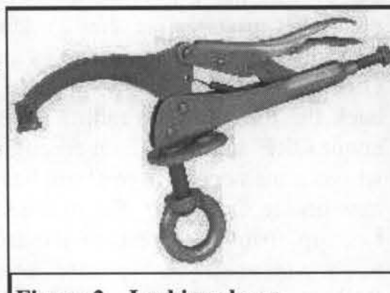


Figure 2—Locking clamp.

I also use a locking clamp to hold stock to be drilled or drilling fixtures securely on the drill press bed. Figure 2 shows the clamp from – you guessed it – Harbor Freight.

You will also need some good drill bits. Good quality bits are important to doing a good job. Common steel bits are fine for wood, aluminum and plastic but you'll need something better for PC board stock. A later section will discuss what types to use.

A very important thing to consider is just where do you want your holes? A formal layout is invaluable in getting this right. Now this isn't too tough for the cabinet holes that will be used to mount your internal circuit board or components, but the front and rear panels need to be done right so that the finished product will be presentable. Use either your manual drafting skills or a computer. A CAD program is ideal, but even the common Paintbrush or PowerPoint can be put to good use. Accurate hole placement will assure that everything will fit and trying out various orientations and spacing before any errrr… metalwork will save time and wasted material. From these drawings you want to extract a template that can be used to transfer your dimensions to the piece being drilled. Of course the same dimensions can be reused on other templates to make front panel marking labels or transparencies so that everything will "line up."

Figure 3 is a sample drilling template for the front panel of the SOP receiver (not to scale). Note that hole locations are indicated

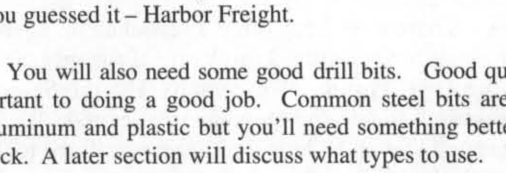


Figure 3—Sample drilling template. Make with any drawing program and print out actual size.

by "crosses" to locate the hole centers exactly. Naturally it is printed out as a 1:1 reproduction.

For "one-off" work simply cut out the template precisely and attach it temporarily to the piece to be drilled. You **did** cut that piece exactly to size didn't you? The temporary attachment can be done by using either rubber cement or transparent tape so that the template won't move during drilling. Using the template, small "pilot" holes are drilled where you want the final holes. I use 1/16-in. holes as guides. Once this is done you can remove the template and drill to the final size. Precision is needed only for drilling the pilot holes. Unless you are very sloppy, they will then center the drill for the final job.

However, if you are doing a number of panels as I did for the NJQRP projects, you need to make up a permanent template. This is only one step beyond the drill guide. Simply cut a sample panel, affix the paper template and drill out guide holes. Actually you can use sheet aluminum for the guide if you want a more permanent fixture, but I usually use pc material since it is so easy to work with.

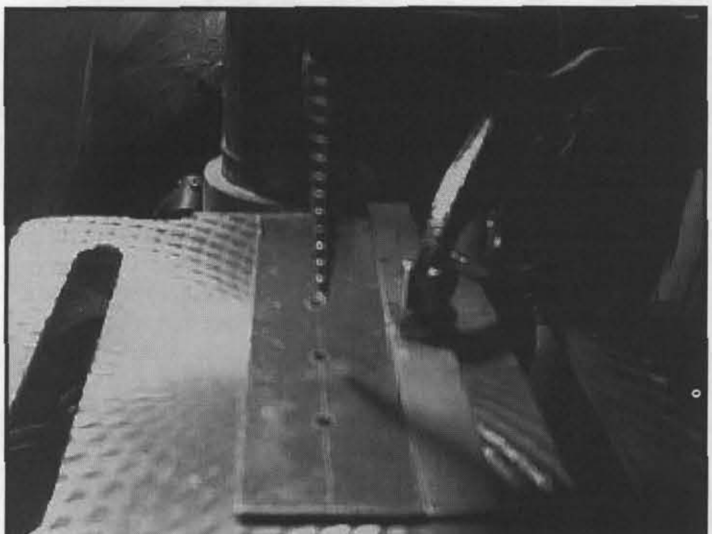


Figure 4—The template on the bed and a drill guide clamped in place.

Figure 5—Alignment marks on the drill guide

If you are extremely good you can attach the hard template to the material you are drilling but I find this clumsy. I use the template to set up a drill guide on the bed of the drill press. The first part of this process is to align a long flat guide made of a strip of metal or pc board material on the drill press bed. It is lined up so that the stock to be drilled can be slid along it with the drill bit along the centerline of the holes (assuming that the final holes will be along a single line). Figure 4 shows a fuzzy picture of the template on the bed and a drill guide clamped in place.

Once the drill guide is in place, I slide the template along it and place marks on the guide for hole location. I make a mark with an indelible pen where the end of the panel needs to be for each hole. You can get an idea of this by viewing Figure 5. For clarity of presentation the locking clamp was removed for this photo. The whole idea when making lots of panels is to do things quickly and "good enough" as opposed to perfect. Absolute precision is not needed so I don't use pilot holes. I **do** drill twice but exactly why will be discussed shortly.

Illegitimi Non Carborundum

Now let's get back to drill bits. The common steel bits we find in hardware stores are fine for common materials such as wood, plastic, aluminum or thin steel. However the glass-epoxy composite used for pc board stock is very abrasive. It will dull ordinary drill bits very quickly. There is an optimum bit rotational speed for each material and you can look it up for the common stuff I mentioned above. But I don't know which is best for PC board stock. The rule of thumb, however, is that smaller bits need higher speeds and lower speeds are used for large holes. I use the very fastest speed available on the drill press for the 1/16 and 1/8-inch holes and proportionately slower speeds for larger holes.

For smaller-sized holes, up to about 1/8 inch, I have found that cobalt treated bits hold up much longer. (Carbide-tipped bits would last longer, but they tend to be much too expensive!) However, even so, after a hundred or so holes they tend to dull as well. Unfortunately they cost about $2 each so when they do dull, I live with the inevitable sloppiness of the holes. What happens when they dull is that they simply push through the material and leave a "crater" of copper around the exit hole. This needs to be removed by using a sharp knife run around the hole.

For larger holes even cobalt treated drill bits get pricey. I have found that step bits with the brand name of Unibit ™ work pretty well. The one I've used covers 1/8 to ½ inch in 1/32 bit steps. They are available from local hardware megastores for $15 to $20 each or

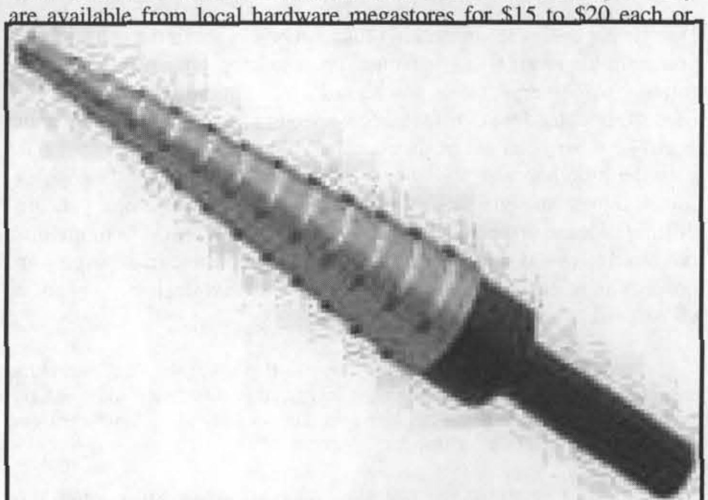


Figure 6—The "Unibit" stepped drill bit.

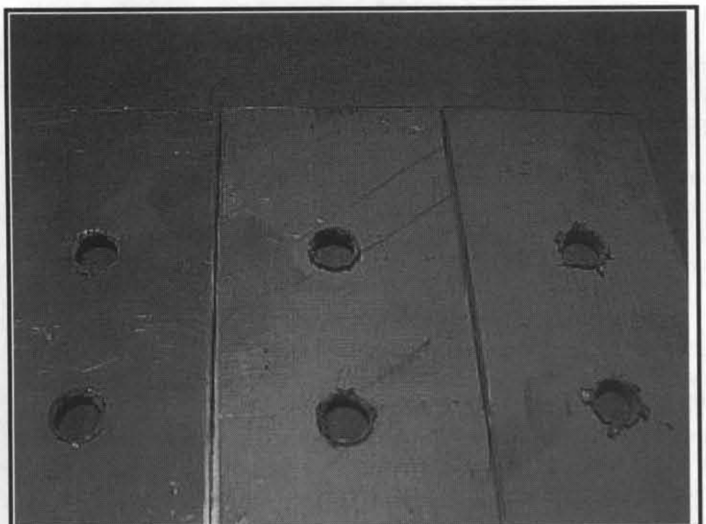


Figure 7—Cratering (burrs) that result when the drill starts getting dull.

somewhat less from Harbor Freight. If you think that's expensive, price a couple of cobalt drills in comparable sizes. Figure 6 is a photo of the stepped drill bit.

As with the smaller drill, the step drill dulls pretty quickly with use. The first 50 or so holes were **great** but things got progressively tougher after that. The cratering got rather severe after about 100 holes. But I eventually developed a strategy to minimize the problem. I found that if I drilled a hole two steps smaller than the final one then flipped the material over to drill out the final size I would end up with only a relatively small crater on both sides. It's not a perfect situation, but it's livable. Figure 7 shows, from right to left, holes drilled on one side only, the twice-drilled piece and one with the holes knifed clean. The photo resolution isn't super so the difference may not be as apparent as it is in person!

Safety First

I have to add a few words about safety when drilling. Whether you use a rechargeable drill or a large drill press the drill is a powerful machine. Even a moment's sloppiness or inattention can result in serious injury. Keep a clean workspace and work in an open area when using power tools. Wear appropriate clothing, too. You need clothing to keep the filings, dust, etc. off sensitive body parts. Don't wear ties or loose clothing that can be caught in the drill. And if you have long hair (man or woman) please keep your hair away from rotating machinery. I one saw an attractive young lady lose half her head of shoulder-length hair in a low-speed lathe. Fortunately a plastic guard kept her head out of the machine. As it was, it took years to regain the little hair she was able to regrow. And don't forget goggles. Metal filings and glass-epoxy dust spray everywhere when you are drilling. Please protect your eyes. And if you are sensitive to the dust produced it would be a good idea to wear a protective mask over your nose. The price of safety is extremely low so taking chances is not at all cost effective!

[WA8MCQ note—And don't breathe that fiberglass dust, either! I'm not an MD, but I think it's safe to say a lot of that in your lungs would be very bad over time. Also, be sure to clean that dust up when done, and wash your hands and clothes as well. Think "itching powder."]

As I mentioned earlier, I'm no expert. If anyone reading this does have experience and advice on anything I've discussed I'd like to hear from them. **—DE N2CX**

EPSON PROGRAMMABLE OSCILLATORS TOO NOISY?

A few issues back I reported on an interesting new device that has been available from DigiKey for a while. It's made by Epson, and is one of those familiar computer oscillators in a small can. The twist with this one is that you order the frequency you want, DigiKey pops it into a programming unit and punches in your numbers, and that sets it. It uses phase locked loop technology, and is one-time programmable. (Sorry, it can't be changed once it's programmed, but they are in the same price range as other oscillator cans and very reasonable.)

There was a bit of discussion about them on QRP-L (the Internet QRP mail reflector) a few months ago, and someone indicated that they have too much phase noise to be seriously considered for use in a transmitting device. Although I haven't ordered and used any myself, I would imagine that they might still be suitable for noncritical receiver projects.

One possible application for them, which might make a good club project for someone (hint, hint) would be to put one or more together in a box as a marker generator to be used with some of the simpler QRP rigs. It could be very handy to have a couple of markers within a single band to serve as reference points to verify the dial calibration, such as 7025 and 7050 KHz. Another possibility would be to have several on different bands, such as 7040, 10110, 14060, etc, selected by a switch. While a single signal on a band wouldn't be as useful as a pair, it still gives you a good reference point for one spot on your dial. They would be turned off when not in use, to prevent them from masking desired signals. (Some DC blocking and attenuation of the outputs would be necessary, but are trivial matters.)

—DE WA8MCQ

ADAPTING THE SIERRA RIT TO THE MFJ CUB

Larry East, W1HUE, asked the author for permission to use this and passed it along to me. This RIT modification to the popular new MFJ Cub originally appeared on the MFJ Cub mail reflector. (If interested in signing up for the reflector, you can go to the QRP ARCI web page, www.qrparci.org, and follow the links for the Cub.) The mod comes from ***Guido Tedeschi, IK2BCP, ik2bcp@hamlan.org.***

Figure 8 is my adaptation to the 20M CUB of the RIT circuit used in the NorCal Sierra (page 17.90 of 1998 ARRL Handbook). This RIT is working fine on my 20m CUB; the only issue is the short range of tuning on upper frequencies and the large range on lower frequencies (like the CUB tune control). I don't use a switch for RIT ON/OFF because I need the remaining front panel space for the push button of a K8 keyer that I want to build into my CUB. I must only remember to check if the RIT dial is in the center position to have it "excluded".

—DE IK2BCP

SIMPLE RIT FOR THE MFJ CUB

Larry East, W1HUE *of Idaho Falls, ID, passed along his own RIT mod for the Cub—*

Figure 9 shows the simple RIT circuit that I recently added to my 15M Cub. The circuit is certainly not original, but I don't recall where I first saw it. A 1N4004 is used as a "tuning diode" -- reverse voltage applied to it via the 2K pot varies it's capacitance. (Do not use a 1N4001,2 or 3 -- they won't have sufficient capacitance range.) The 1N4004 is coupled to the oscillator via a small capacitor. I used a mini trimmer (Digi-Key part number SG1022-ND) to allow the RIT range to

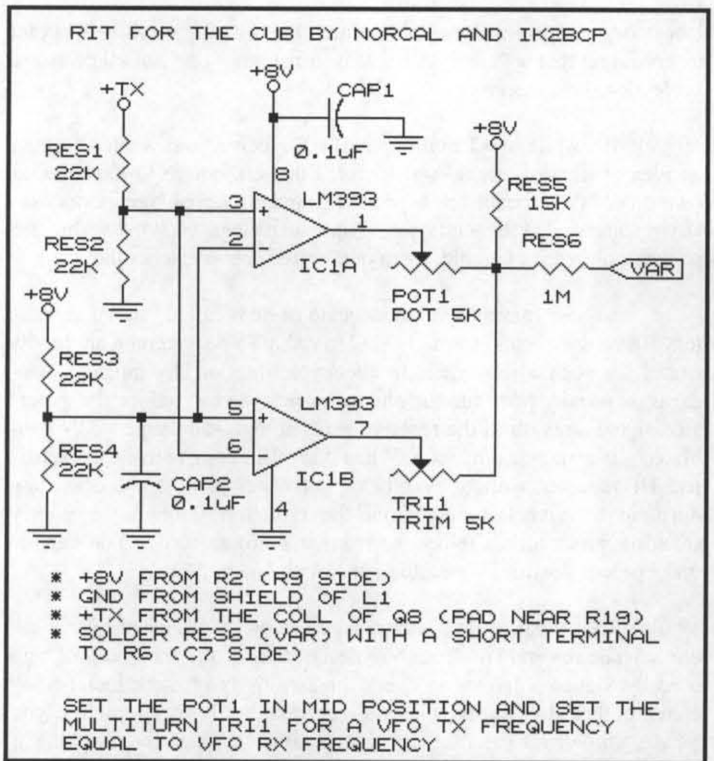


Figure 8—NorCal Sierra RIT adapted to the MFJ Cub. (Drawing provided by IK2BCP.)

be set (a total range of 3-4 kHz is about right). However, a small fixed NPO capacitor can also be used; 10 pF will probably be required for the 20M version, and 4.7 - 6.8 pF should work for other versions.

The 2N7000 is used as a switch to set the voltage on the 1N4004 to "mid range" during transmit, thus disabling the RIT. The original circuit used an NPN transistor switch, but the small collector-emitter voltage present when the transistor was conducting resulted in the RIT having a slight effect on transmit frequency. The very low on-resistance (less than 10 Ohms) of the 2N7000 MOSFET completely eliminates that problem (a BS170 MOSFET can also be used).

Note that there is no RIT on/off switch shown; if you wish to add one, use a SPDT type to switch the MOSFET gate resistor between

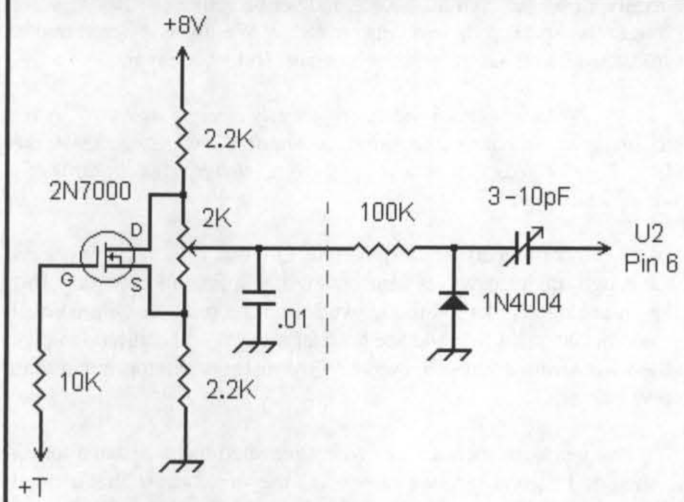


Figure 9—Another RIT for the MFJ Cub. (W1HUE drawing.)

+12V (disabled) and +T (enabled). I used a center-detent pot for the RIT control and did not find a switch necessary.

The RIT control resistance can be anything between 1K and 10K; the resistors connecting it to +8V and ground should be approximately the same value as the pot and matched to each other to within a few percent.

The components to the right of the dotted line should be mounted on the PC board using very short leads. I soldered one end of the trimmer cap to the solder pad of C6 that connects to U2 pin 6 and bent the other tab upward. The 1N4004 and 100K resistor are soldered to the upward-pointing tab, and the anode of the diode is soldered to a ground feed-through to the rear of U2. The other components are mounted on a small piece of "perf board" attached to the RIT control.

The "+T" control voltage can be obtained at the junction of R21, R23 and C43; simply solder a wire to one of the component's solder pads.

I mounted the RIT control in the upper left-hand corner of the front panel. The MFJ logo in that position can be easily removed, if desired, using denatured alcohol.

During initial testing, you may wish to ground the 10K resistor from the MOSFET gate rather than connecting it to +T. This will result in the RIT being enabled during transmit so that you can check the RIT range by measuring the transmit frequency. The RIT range will not be symmetrical; there will be about 20% more VFO offset on the low-frequency side than on the high side. Note that after the RIT circuit is installed, you will need to readjust L3 for the proper transmit/receive frequency range.

Good luck and enjoy!

—DE W1HUE

RIT FOR THE K9AY/A&A ENGINEERING TRANSCEIVER

A while back I was asked about a possible RIT modification for the K9AY (Gary Breed) transceiver that appeared as a two-part article in the December 1990 and January 1991 issues of QST. It was later sold as a kit by A&A Engineering, as well as 624 Kits (now out of business). I finally got a lead on a modification by asking on QRP-L, and here's what I came up with.

At the end of the first part of the article, K9AY suggested a method of adding RIT using a few parts and another relay connected across the existing T/R relay, but no details were provided. **Bob Engelman, WB8UOJ** of Grafton OH, told me that he had actually built up an RIT for his rig using the idea in the article as a guide. I redrew the schematic he sent me, and it appears in Figure 10.

I noticed that the values of the added resistors in his schematic were inconsistent with those in the article, being much higher. He replied,

"The values that I gave you are the same as those in my rig put out by 624 Kits, and identical in the A & A rig. I contacted Gary Breed about a year ago on a drift problem that I had with mine. He told me that he had worked with A & A on upgrading his design for mass production. I believe that Gary and A & A changed the values of R1 and R2 and the tuning pot to give a better fine tune. I'm able to get a 7 KHz spread with the fine tune pot, and the same with the RIT engaged. I'm sure though, if desired, that one could use the "other" values that you mentioned, directly from the article, and apply them to the RIT circuit.

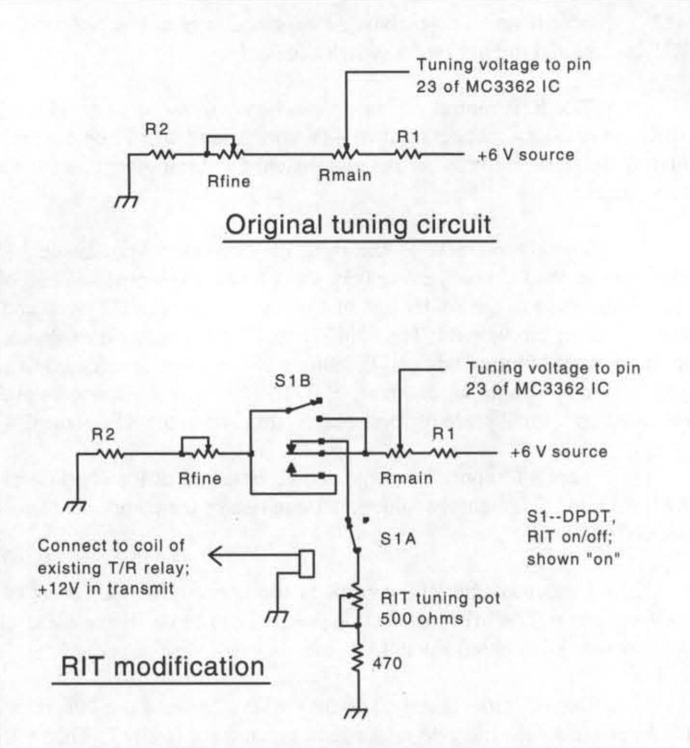


Figure 10—RIT for the K9AY transceiver produced by both A&A Engineering and 624 Kits. R2 and Rfine are for fine VFO tuning ("bandspread"). With the RIT mod installed, they still control the frequency in transmit. In receive, a new pot and resistor of the same value as Rfine and R1 control the frequency. These values are for the kit versions of the rigs. If the unit was built directly from the article, the values of those parts will be lower.

"I have not seen the RIT circuit in print anywhere. I did the design from the suggestion in Gary's 1990 article on the rig. Simple, but it works."

"MICROVOLTING" THE POOR MAN'S WAY

Or, "A simple but effective means of testing relative receiver sensitivity." ***C. F. Rockey, W9SCH*** *of Albany, WI, sent me this idea recently. Something a lot of us are guilty of is developing a belief that we simply must have the latest and greatest software, radio, test equipment, etc to be effective, and that the older, simpler versions are somehow suspect or below us. But there's nothing wrong with taking a simpler approach to things, which can be equally effective at doing what we need. Sure, it's nice if you have a sophisticated signal generator with which to check receiver sensitivity, and those low microvolt numbers can be good for bragging rights, but do we always need to know precisely how low the minimum discernible signal (MDS) level is?*

Sometimes it's enough to simply know that one receiver is more sensitive than another, or to be able to tell whether some tuning or repair action we did made it better or worse. We could spend a few hundred dollars for a nifty, neat surplus signal generator or scrounge up a few parts for a simple device from the junk box and have a no-cost solution.

Here is a little experiment which I have done to get an idea of the practical sensitivity of an amateur receiver when no precision laboratory equipment is available. Sure, this is a bit "primitive," but let us not forget that we are QRPers, still "amateurs," and not all of us are professional engineers.

A while ago I built a small HF receiver and wanted to gain an idea of its weak signal sensitivity. But I am not so fortunate as to own one of those beautiful, expensive Standard Signal Generators usually recommended for such a job. (Alas, such elegance is not within the pocketbook reach of an old, worn out, retired schoolteacher like me.)

Those inexpensive, inadequate devices called "signal generators" (note the quotes) formerly sold to radio/TV servicemen are hardly useful for such a job. Their frequency calibration, by amateur standards, is usually poor and the attenuator provided to reduce the generated signal strength to the receiver being tested—and supposedly calibrated—is usually a silly joke. When one of these just sits near a sensitive HF receiver, without even being connected to it, it will often produce an S9 signal merely from the radiation through the poorly shielded generator's cabinet, or from it's power cord. You cannot make proper sensitivity measurements with one of those.

So, what to do? A rummage through the ancient history of our science reveals an interesting description of the method long ago used by Signore Marconi to check the sensitivity of those metal-filing coherers then used in his wireless receivers. And this research, if you please, stimulated the essence of a possible method for checking a modern receiver's sensitivity.

How did Marconi make such a coherer check? He set up an ordinary door buzzer, with it's batteries, upon a table and brought his connected coherer to be tested near the sparking buzzer.

How sensitive was the coherer under test? When the buzzer was set up and buzzing, the sparks at it's contacts radiated a small but useful test signal. An ordinary coherer useful for communication at ten or twelve mile range, from the spark coils used at the time, should respond when the coherer under test was within a few feet of the buzzer. A really good coherer "clicked" at five feet, one proposed for use at forty or fifty mile range would respond at 12 feet from the buzzer, and a real goodie, 'tis said, would speak up at fifty feet. (The buzzer signals meanwhile having possibly passed "even through closed doors and walls….")

Now there's an idea, something told me. Why not try something like that to check a radio receiver's sensitivity today? See how far the receiver may be from the source and yet be activated? But alas, we no longer use spark coils and coherer today. We use CW (continuous wave) transmission. Changes must be made. But let's go on…

[WA8MCQ note—what we usually refer to as "CW" is actually on/off keyed continuous wave communications, using the Morse code. "True" CW is just that, a continuous, steady, signal that is not keyed or modulated.]

Modern receivers, designed for CW use, respond very poorly to the rough, damped waves sent out by the sparks of a buzzer. But using an analogous method today, we set up the receiver with a small test antenna attached to it and see how far away it will continue to pick up the waves from a little unkeyed CW transistor oscillator, rather than a noisy buzzer.

Even with such a short wire connected to its antenna terminal, shouldn't a good receiver respond to the weak waves that a small oscillator sent out from a considerable distance? If so, then the distance away that the little oscillator can be to yet produce a definite received signal should then practically indicate the receiver's relative usable sensitivity, shouldn't it?

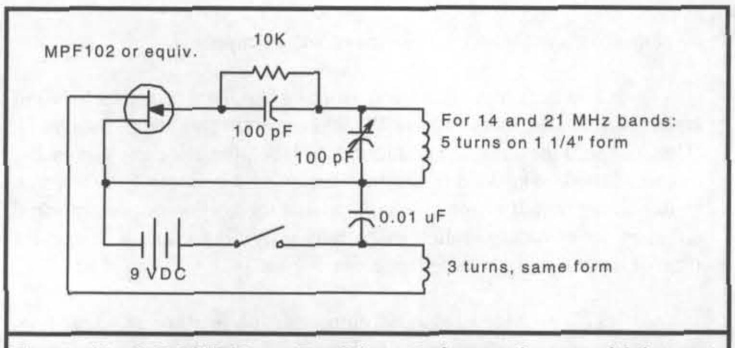


Figure 11—W9SCH "Buzz Box" for relative receiver sensitivity testing. Coil form can be any convenient nonconducting material, but using a toroid—which is self-shielding—might significantly reduce the amount of signal that the device would radiate. Wire size not given and not critical; try #22 to #28. No spacing between turns or between the two coils was specified; try winding both coils close spaced. Experiment a bit with spacing between the two coils if necessary, for best results. Do not shield the coils. A reduction drive on the variable capacitor will make tuning less critical, or place a smaller variable capacitor across it to act as a fine tuning control. Different coil and capacitor combinations will allow operation on other bands.

To try this out, I built a little self-excited oscillator using a Radio Sack FET, run by a nine-volt transistor battery, shown in Figure 11. This "buzz box," as I call it, is built inside a wooden box once used for filing kitchen recipes, although any other small enclosure would do as well. But do NOT shield the coil!

To make a sensitivity test, I hang a two foot long piece of wire vertically down from the receiver antenna terminal, set the "buzz box" going, and observe how far I can separate it from the receiver and yet continue to receive a perceptible signal therefrom. (See Figure 12.) This turns out to be a convenient distance that can be readily measured with an ordinary surveyor's style tape, using the "buzz box" oscillator I describe.

No antenna is used, the coil's radiation being sufficient. Measuring the distance from the oscillators coil to the receiver's two foot antenna with an ordinary tape measure, I find that a mediocre twenty meter receiver should continue to reveal a minimally audible signal at thirty feet, at least. A good, home brew receiver, under these same conditions, should produce a minimum received signal with the oscillator at about forty feet and a super job, a signal at nearly fifty feet distant, and maybe more. For example, my TenTec Century 22, on 20

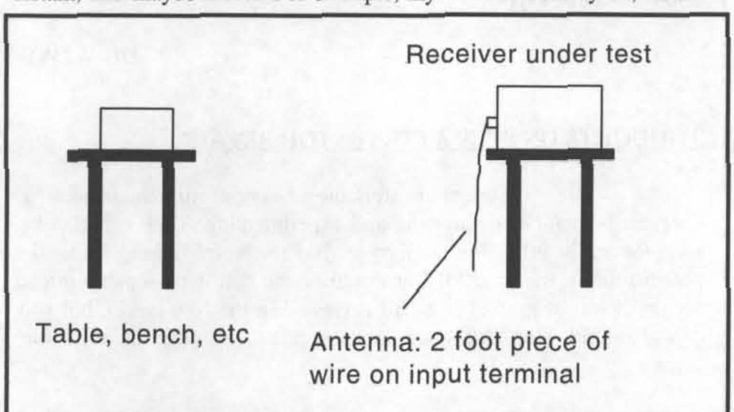


Figure 12—W9SCH Buzz Box test setup. Hang a 2 foot long piece of wire from the antenna terminal of the receiver.

meters, responds minimally to my "buzz box" when about 45 feet away. A simpler receiver responds when the box is 37 feet away. Thus this minimum signal distance gives us a practical measure of our receivers relative working sensitivity. (Figure 13.)

Now when I described this technique to my acquaintances, the guffaws that followed were boisterous! "What the heck ya doin'?" "Who ya think ya are, Marconi?" "Man, what precision!" "You can probably guess your receivers sensitivity better than that!" "Have you got no stupider way to waste your time?" And even more scurrilous remarks followed. And of course the well equipped QRP savants will ignore this whole story; it is not written for them, but rather for other

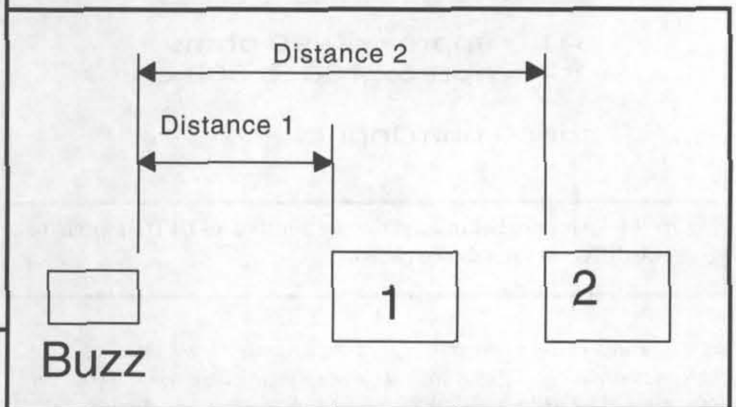


Figure 13—Usage of the Buzz Box technique. Receiver 1 is moved away from the oscillator until the signal is at some barely discernable level. Receiver 2, using the same length of antenna wire, is moved away until the signal is at the same minimum point. Whichever receiver is farther away is more sensitive than the other. Boxes 1 and 2 could also represent a single receiver before and after repair or tuning up. If it can be moved farther away after the repair, etc, then the sensitivity was improved. If it must be closer than it was the first time, the sensitivity has decreased.

"poor folks" who, although owning no high grade, lab quality gear, like myself, still enjoy making apparatus tests as well as merely operating.

Yes, I admit such a simple method gives you no specific information on such important receiver characteristics as "noise floor," signal to noise ratio, absolute minimal microvolts per meter, etc. In fact, it gives you no highly precise numbers at all. But it does give you a quick and useful sensitivity comparison between one receiver and another, and enables you to know, for example, whether any changes you may have made in your receiver have been worthwhile or not. This is the sort of thing which we really want to know, most of us, for we are amateurs, not professional engineers.

A procedure like this provides some really helpful information to QRPers at a truly minimal cost, teaches you something about radio which is practical and worthwhile, and furthermore is fun to do. Try it yourself and see.

[WA8MCQ comments—The signal strength of the oscillator will decrease as battery voltage drops, which could lead to erroneous results when comparing different testing sessions. It might not be a bad idea to feed it from a regulated source, to insure constant amplitude over time. This could be a simple 3-terminal regulator or even a Zener diode.]

—DE W9SCH

USING THE G5RV ON 160 METERS

A number of QRPers enjoy operation on this band, which

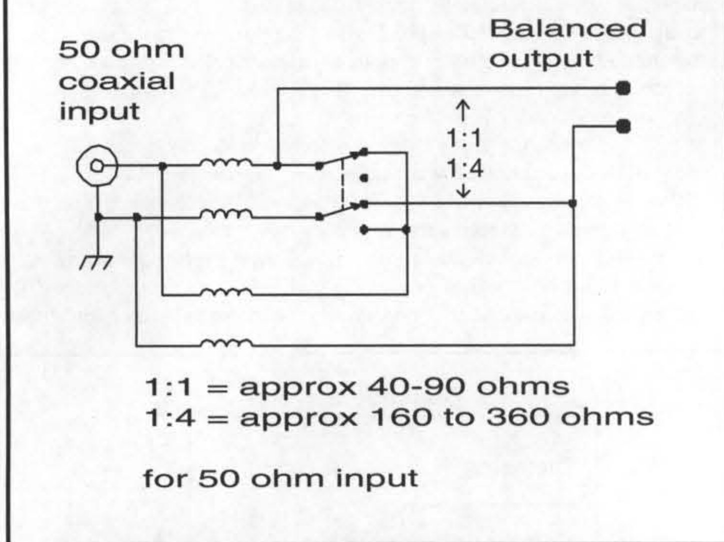


Figure 14—Air core balun modified by addition of DPDT switch to give two different impedance ratios.

can be challenging to anyone regardless of power level since efficient antennas are more difficult to erect due to their great size. Here's an idea from ***Al LaPlaca, W2WW****. First published in the August 2000 issue of Worldradio, it appears here with his permission. Although he's not a QRPer himself, as far as I know, this could give some QRPers an easy way to try out this interesting band. While it can't be as good as a full size antenna, he makes use of what he had and found a way to get better performance from it.*

The evolution of this technique came about because I wanted to get back on 160 meters. The only antenna I had up at the time was a homemade G5RV inverted vee, fed with approximately 76 feet of 450-ohm window line (slotted twinlead). The experts will, of course, tell you that the use of such an antenna is a hopeless cause on 1.8 MHz. But I am a Ham. Im endowed with the undying optimism handed down to us from the spark days. Damn the experts—full speed ahead!

The first thing I tried was to simply tie the feeders together in the shack, and, using a homemade CLC-type T-section tuner, I fed the entire antenna system as a top loaded vertical antenna (sans radials). The vertical feedline acted as the antenna and the dipole sections of the G5RV acted as top-hat capacitive loading. This did work. But a vertical antenna without a radial or counterpoise system is not a very good antenna. Signals (in and out) were not what I expected.

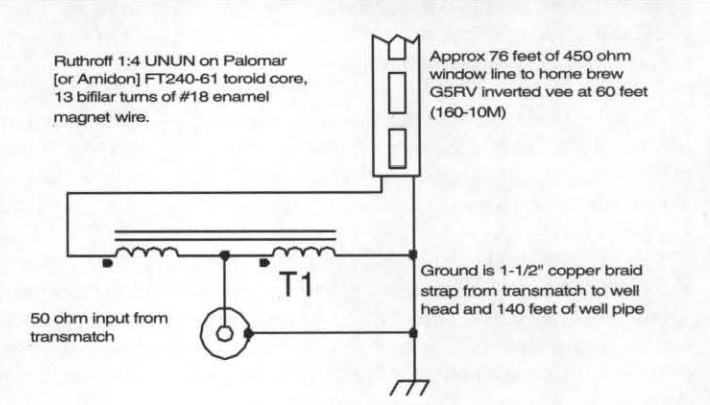


Figure 15—Ferrite core unun (T1) performing unbalanced to unbalanced, 1:4 impedance transformation.

The next thing tried was working the tuner, coax in/coax out style, into an old modified B&W air-core (current) balun assembly. (Heathkit sold the same thing under their label, for a while.) The modification I made consisted of the installation of a ceramic DPDT wafer switch at the output of the assembly so that the coil outputs were wired either in series or in parallel, essentially providing either a 1:1 or 1:4 ratio of input to output impedance. See Figure 14.

This provided balanced output for the feedline in either high or low impedance ranges. By making the correctly switched impedance choice as I went from band to band on 80 through 10 meters, this configuration worked out pretty well. But, surprisingly, it also worked on 160M, even though B&W said the coils were not rated for use on that band. Well, mission accomplished! Signals were an improvement over the first lash up. I was back on 160M!

But while this did work on Top Band, signal reports were still not what I considered to be up to par. But I didn't know if that was because the coils were not really up to the job at that low a frequency, or because the antenna was so short for the frequency, or a combination of the two things. I had to find out.

Phase III

This consisted of replacing the air balun with a homemade ferrite core "unun." I decided to build a 1:4 Ruthroff (current) unun. I purchased a 2.4 inch, 61 mix ferrite core from Palomar, and wound 13 bifilar turns of #18 enamel wire on it. (See Figure 15.) *[WA8MCQ note—the core is the same as an FT240-61 from Amidon.]*

Why an unun and not a balun? Good question. My reasoning was that a balun would treat the antenna as a balanced short dipole (which in fact it was, physically) but an unun would make one side of the feedline plus one side of the antenna "hot" and that an identical system, the other side of the feedline and the other half of the dipole, would be "cold" (grounded). It would act as a counterpoise, and this would effectively make the whole system seem twice as long, electrically.

And more efficient? Now I don't know if that's really true or not, but I do know that in less than a year of using this set up I worked 47 states, 35 countries and made WAC (Worked All Continents) on 160M using only 100 watts. My best DX was a pair of back-to-back ZL's worked during a contest. This was a vast operational improvement over anything else I'd tried to date on that band. I must have been doing something right!

--DE W2WW

THOUGHTS ON STEP ATTENUATOR REPAIR

Step attenuators are always useful accessories for QRPers, both for homebrewing and experimenting. They can also be used for milliwatting fun, as long as you're careful to keep under the power limit of the unit. MFJ now makes one that is reasonably priced for the hobbyist market (which I reviewed in the July issue), but you can also find used step attenuators at hamfests, often at attractive prices.

But there's some risk involved in buying one from someone you may never see again or be able to track down. They may be sold as-is, or with a verbal guarantee that it's OK, but when you get home it turns out to have problems. You could toss it in the trash and chalk it up to experience, send it out to the manufacturer or other facility for repair, or try fixing it yourself. The latter looks pretty attractive when you consider that repair will probably cost far more than you paid in the first place for that "bargain."

I'll describe a few of the step attenuators I've picked up over the years. It's hardly comprehensive and I only talk about a few units, but the basic principles can be applied to most. The information might come in handy if you ever have to fix one, and might also help in making a decision on whether to buy a unit that you suspect of having some damage. You're a step ahead if you have some idea of the chances for successful repair.

Before buying one, examine it for obvious signs of physical damage, such as a squashed-in BNC connector, which might be simple or difficult to fix depending on the unit. Operate the controls—either a rotary knob or several toggle or pushbutton switches—to see if everything feels OK, not sloppy, binding, etc. Mechanical adjustment or repair could be easy or complicated.

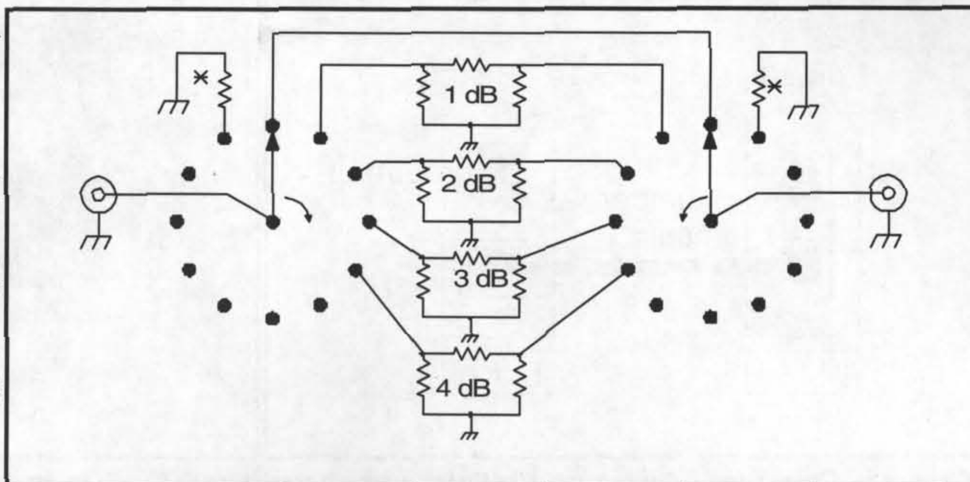


Figure 16—Typical rotary turret attenuator, with steps of 0.1, 1 or 10 dB. Some units may have a resistor to ground on each end, marked with an asterisk here, but most don't. When in this position, each end is terminated in it's characteristic impedance and there is no connection between input and output.

If you have a multimeter you can do some quick resistance checks to get an idea if something is seriously wrong inside, such as fried resistors. (I won't get into that one this time.) Precision resistors are readily available from DigiKey, but the resistors inside the unit may not be easy to reach. Dirty or bad contacts can cause poor operation, but this can't be checked until you get home. And if it does have intermittent operation, cleaning those contacts can be a breeze or next to impossible.

I keep emphasizing that repair of just about anything in the attenuator can be simple or complicated. There is a wide variety of construction techniques, and some are much more conducive to repair than others. In some cases you can fix something with little effort, and in other cases it could be very expensive and/or time consuming.

You can do your part to minimize future troubles by carefully observing the power rating of attenuators and keep from burning out the resistors. Mechanical wear takes a toll over the years, too. You can't tell how much use an attenuator has had in the past and how much life is left, but you shouldn't have to worry too much about wearing it out since home use is usually pretty low compared to a professional setting such as an engineering lab or production floor.

Basic Attenuator Types

There are two basic types of step attenuators. One has a knob and uses a rotary turret, like the very old TV tuners and some old signal generators. Figure 16 shows the schematic and Figure 17 gives some mechanical details. What are drawn on the schematic as wipers are actually fixed contacts soldered onto the connector, and "stationary contacts" are really small metal contacts near the perimeter of rotating, nonmetallic disks. A completely different attenuator section is

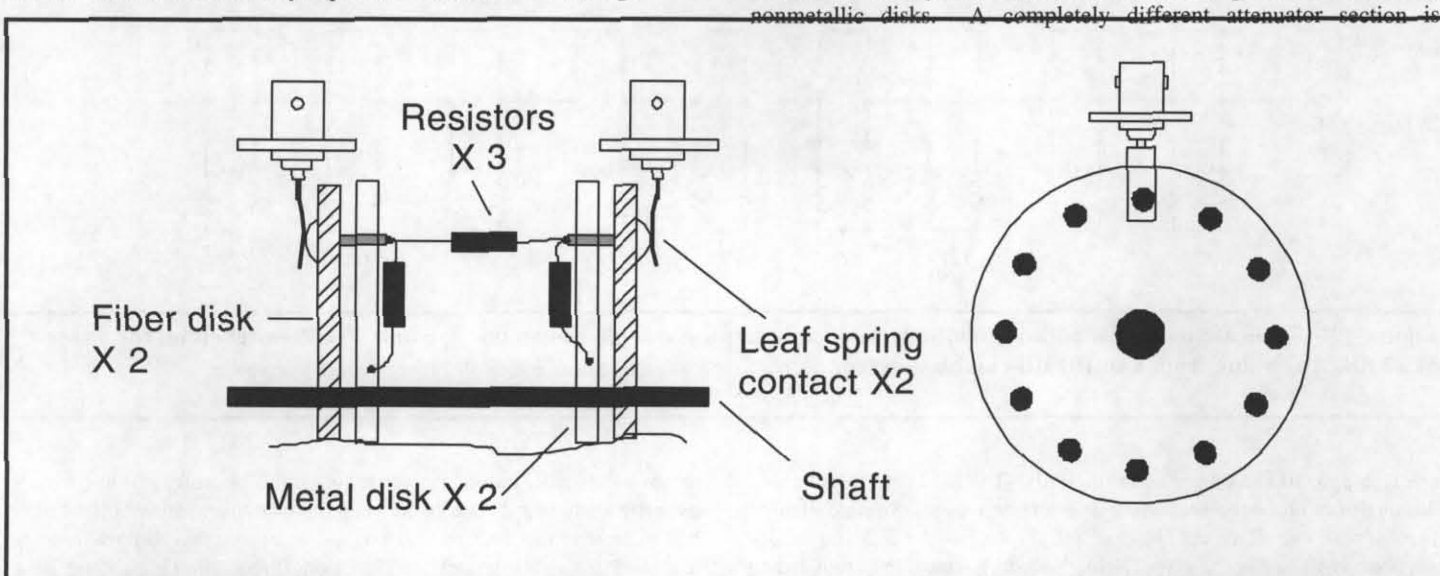


Figure 17—Side and end views of typical rotary attenuator internal construction. This is not to scale and is just a general representation, but it gives the basic idea. Sets of 3 resistors, 1 set per position, are connected between contact studs on 2 fiber disks, which rotate to make contact with the leaf spring contacts soldered onto the connectors. The metal disks, also rotating, provide connection to the metal body of the attenuator by way of grounding finger stock.

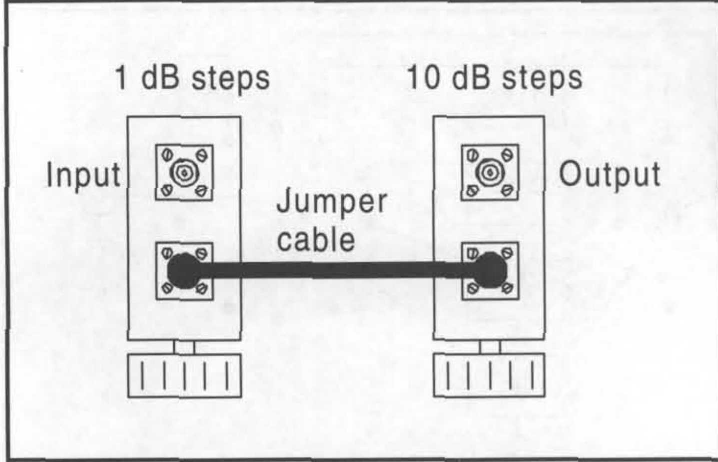


Figure 18—Connecting 1 db/step and 10 dB/step attenuators in series to obtain wide range of values.

switched in at each different position. Those will be in either 1 or 10 dB increments, and occasionally in 0.1 dB steps. Those with 1 dB steps typically have a maximum position of 10 dB, while the 10 dB step units may go to 40, 50, 60, 70, or higher depending on model.

To get a large attenuation range, it will be necessary to connect two units in series, with 1 dB and 10 dB steps as shown in Figure 18. You then dial in both digits of the value you want, such as setting one to 30 dB and the other to 6 to get 36 dB. (Some companies have models with two attenuators in an enclosure and a jumper cable between them. Sometimes they also include a third one, with 0.1 dB steps, which is not an especially useful range for home use—but buy it anyhow if the price is good and ignore the 0.1 dB section.) Some companies also make dual models, with two knobs on concentric shafts, which have both 1 and 10 dB steps in a single attenuator housing.

The schematic of Figure 19 shows a different approach, and achieves a wide range in a single unit. The sections can be independently switched in or out to add up to the desired value. Typical sections are 1, 2, 3, 5, 10 and one or more of 20 dB. (The MFJ uses this method, although not all of the sections in it are pi-type as shown here; half of their sections are T-type.) The example shown has the 2, 5 and 20 dB sections switched in, to give 27 dB. You do have to be careful when adding up the numbers to make sure you really have the value you think you do. (Either toggle or pushbutton switches are used in commercial units, and slide switches have been used in homebrew units.)

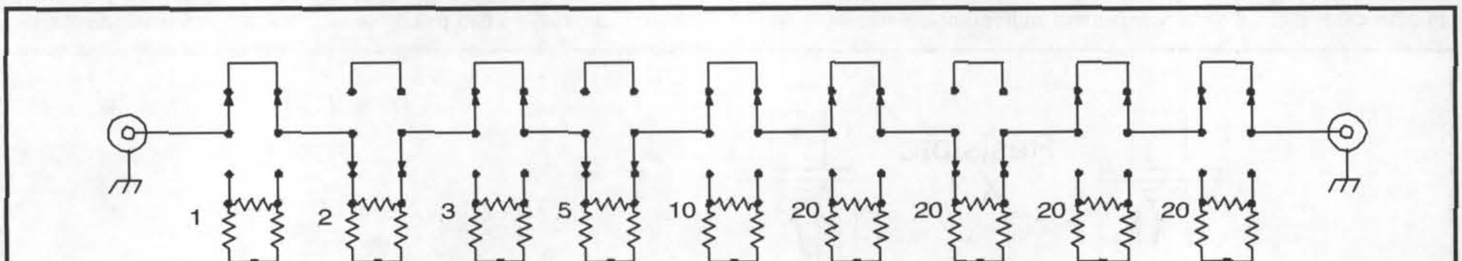


Figure 19—Typical attenuator with individually selectable steps. Example shown has 2, 5 and 20 dB switched in, for a total of 27 dB. Any value from 1 to 101 dB can be selected.

A Look at the Popular HP 355 Series

Hewlett Packard makes a hybrid of these two types with their

Figure 20—Hewlett Packard model 355D, 0-120 dB in 10 dB steps. (This particular unit is a relatively late unit; older ones have similar appearance although the color and style varied somewhat over the years.)

355C (1 dB steps) and 355D (10 dB steps) attenuators. Shown in Figure 20, these models are often seen at hamfests and are usually sold for $50 to $100 by the surplus microwave component dealers. (The one shown is a relatively late model. They've been making the 355 series for a very long time, and the appearance changed slightly a few times over the years.) While they have a knob, with numbers going from 0-12 or 0-120 dB depending on model, they are essentially the same as Figure 19. The individual sections are switched in and out in the appropriate combinations by microswitches, activated by a number of cams on the shaft.

Figure 21 shows the view inside the top cover of an older model, and the cam shaft can be seen running from end to end. (Like most of the attenuator "photos" here, this was actually made by setting the unit on a flat bed scanner.) You won't normally have to remove this cover unless the shaft binds as you turn the knob, or it feels mushy. To remove the shaft, loosen the setscrew on the bushing; it's in the hole over the shaft near the knob, between the two cover screw holes. I once had to remove the shaft on one and use an arbor press to push the cam assembly back into proper position along the shaft. That should be a very rare occurrence; I had reason to believe that someone had been playing around with it.

The underside is shown in Figure 22; if no screws are missing, you'll have to remove 20 of them to get here. If the BNC connectors need to be replaced, you can use a good quality single hole mount

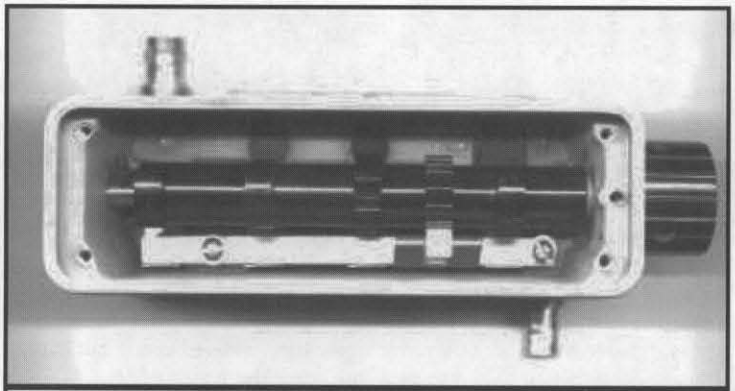


Figure 21—Inside the top cover of an HP355C or D. Note the camshaft running end to end, switching in the sections in various combinations as the knob is rotated.

connector. Carefully unsolder the wires, unscrew the bad BNC and screw the new one in. The threads are the same. Don't overtighten and risk damage to the threaded hole in the chassis. (The nut and washers from the new connector are not needed.)

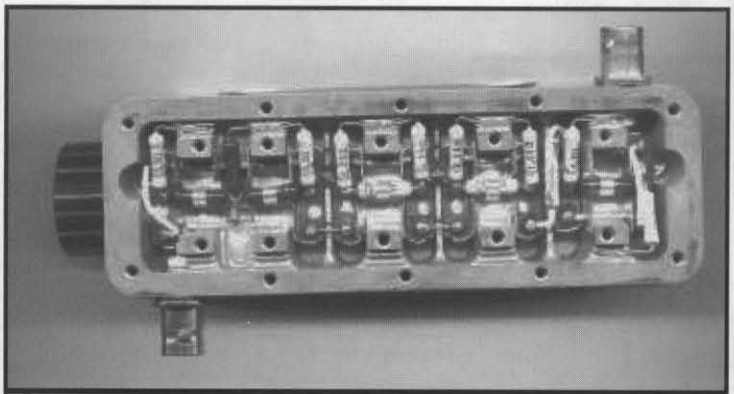


Figure 22—Underside of an HP355x attenuator.

The resistors are easily accessible, making replacement a snap. There is a slight complication—the leads going to ground are laid between tiny ridges in the metal body, and then the walls of the ridges are crimped over the wires to secure them. That's best left undisturbed; don't invite trouble. To replace a resistor which has one end grounded, leave the existing ground wire crimped in place. Snip the lead as close as possible to the body of the old resistor, and solder the new lead onto that wire. (Although not identical to the old resistors, 1% resistors can be bought from DigiKey.)

Switches and Cams

If you have erratic operation or if one or more settings are bad, you may have a bad microswitch or two. Isolating it is easy enough, and replacement should be fairly simple. I've never replaced one myself, but I would suspect they used special microswitches to give good frequency response. If you replace it with a run of the mill microswitch there may be some degradation of the frequency response, although I would suspect it would still be good enough at the frequencies that most hams use (ie, up to and including 148 MHz).

You have more of a problem if one of the cams should turn out to be cracked; that will keep a section from being switched in when it should, giving some very interesting outputs. There are 4 sections of 10, 20, 30 and 60 dB each, or 1, 2, 3 and 6, depending on model. (Physically, they are in the sequence of 60, 10, 20, 30.) As the knob is rotated, they are activated in this sequence:

1 2 3 3+1 3+2 6 6+1 6+2 6+3 6+3+1 6+3+2 6+3+2 +1

KU4QO asked for advice on his HP 8640B (Option 323) signal generator. The Option 323 version is the large, heavy, yellow military version of the 8640B which has appeared on the surplus market in recent years. Although lacking a few features of the commercial version, it comes in a ruggedized carrying case. It uses what is basically an HP355D in the output section.

The output on his decreased smoothly when stepping through the ranges of 10 dB each, but when he hit the –70 dBm range it suddenly shot way up. My reply was that it was probably a bad 60 dB section, not being switched in for some reason. He later reported disassembling the unit and finding that a section of the camshaft was broken into pieces and not engaging the microswitches for that section. He glued the broken part together and it was holding for the time being. As a long term fix, he located a bad attenuator of the same model and was going to use the camshaft from it.

If the 60 dB section isn't being switched in, the attenuator remains usable for 0-50, which is still a quite useful range in many cases, although any dead section in the 1 dB step version renders it pretty much useless. (There's not too much call for a 0-5 dB attenuator.) Things are different if another section is locked out. For instance, if the 20 dB section isn't being activated, the attenuator would go through the sequence of 10, 0, 30, 40, 30, 60, 70, 60, 90, 100, 90 and 100 dB.

Check the Connectors

As with any attenuator, examine the connectors for damage or signs of excessive wear. I've been a number of squashed-in BNC's over the years on various types of electronic equipment, and they are usually easy to replace. There are some complications when they're in attenuators, though. In some cases you can use standard BNC connectors to replace them, as with the HP's. and in other cases they will be specialized connectors.

On the HP355x series, replacement is a snap. With rotary turret attenuators it gets a bit more complicated. They're usually standard connectors but need a little extra work. As shown back in Figure 17, the BNC usually has a leaf spring switch contact soldered to it. The old BNC is pulled out, the leaf spring is removed, and the center terminal stud of the new BNC is cut down or otherwise modified as necessary to accept it. Remember that the end of the leaf spring contact must extend the same distance from the new BNC as the old one, so it will properly mate with the rotating contacts. Use high temperature solder if available, for extra strength.

Attenuators by Kay

Figure 23 is a miniature unit made by Kay Elemetrics, of the type shown back in Figure 19. It's similar to models they sold separately, although this one was used as a subassembly in a piece of equipment they built and thus not labeled. This one is a delight to work on, as seen in Figure 24. Everything is out in the open and the connectors are standard 4 hole mount types.

As with the microswitches in the HP units, I suspect these toggle switches are special ones. Replacement with ordinary switches might have some effect on the frequency response at higher frequencies, but that might be an acceptable trade-off.

Presumably to improve the frequency response, the unit has a few small ceramic capacitors in key places, as well as what appear to

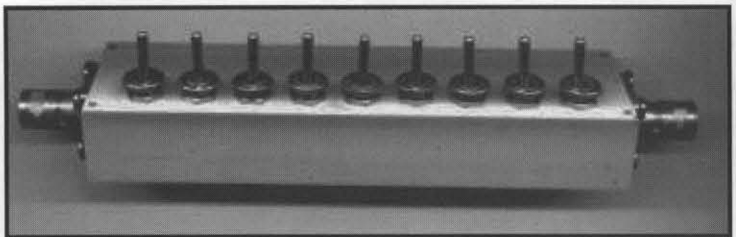


Figure 23—Miniature unit made by Kay Elemetrics. This unit was not labeled since it was built into a piece of Kay test equipment, but they also sold ones like this separately.

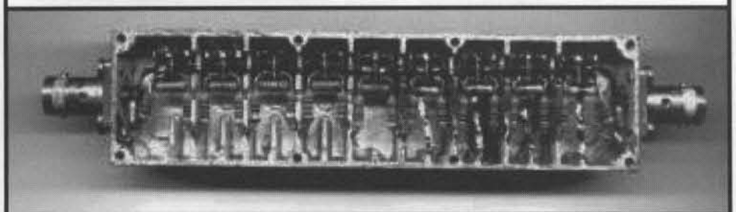


Figure 24—Underside of the miniature Kay attenuator.

be "tuning stubs" on the switch terminals. Not obvious in the photo but shown in Figure 25, the bypass side of each switch has a small copper shorting strap between the terminals which also extends away from the switch, running upward. They are very close to the walls, giving a bit of added capacitance to ground, which can be varied by moving them closer to or farther from the wall. Try not to disturb them, and be careful not to accidentally push them into contact with the wall. If you replace a switch, the position of its tuning strap would probably have to be determined by trial and error for best frequency response. This is simple if you have access to an RF network analyzer or spectrum analyzer with tracking generator, which many hams do.

A larger, older and much heavier version, the Kay model 432 is shown in Figure 26. This one is also simple to work with (see underside in Figure 27), and I've replaced the BNC connectors on them with

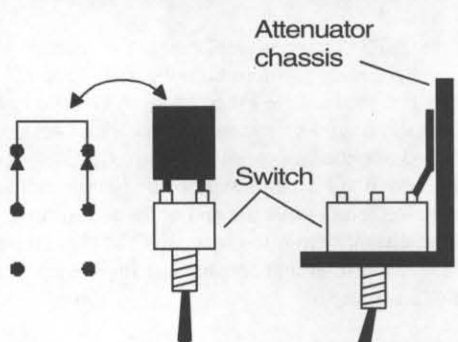


Figure 25—Tuning stubs on the switches in the miniature Kay.

Figure 26—The Kay 432, a beefy, hefty, man-size attenuator. (If you ever see one, you'll understand!)

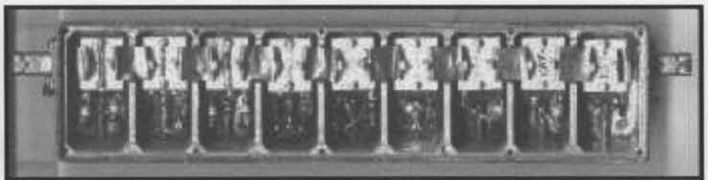


Figure 27—Inside the Kay 432. Cramped, but everything is ac-

relative ease, although the area is a bit cramped. As with the smaller Kay, this has a number of ceramic capacitors scattered about, but many more. Each section has between 1 and 3 caps, for a total of 16.

Intermittent operation due to dirty contacts presents an interesting problem, though. The body of the switches on these start out life as Teflon blocks approximately 0.8" X 0.65" X by 0.8", hardly run of the mill devices. They are closed units and you can't reach the contacts to clean them or spray cleaner inside. In the early 90's I contacted the company and was told that the cost of a replacement was $47. In all fairness, that also included the three resistors associated with the switch.

The only viable option was repair. I ground the heads off the rivets holding the switch together, opened it up and carefully burnished all contact parts inside. To button it up again I used a pair of long 2-56 screws to replace the rivets. Not fun, but the attenuator was usable again and I still had my $47.

Some HP Clones

Figures 28 and 29 show the RLC Electronics model AT201-SR 0-120 dB attenuator, 10 dB steps. This is similar in size and appearance to the HP 355 series, and also activates sections with a camshaft although it uses leaf springs instead of microswitches. Prospects for repair of this unit aren't quite as good due to the construction methods.

To start with, the BNC connectors are special types. They thread into the body, but the tapped portion is considerably smaller than a standard single hole mount BNC. If they are squashed in slightly you might be able to massage them back into shape. (That will probably result in it still being somewhat misshapen and a bit difficult to mate easily, and possibly damage mating connectors with repeated use. In that case, I'd mate a BNC tee or right angle adapter to it and leave it permanently in place. Test cables would then mate with that.) With a bit of mechanical ingenuity it might be possible to use a standard 4 hole mount BNC, although not all 4 mounting screws could be used.

I once made a crude tool for straightening out a moderately

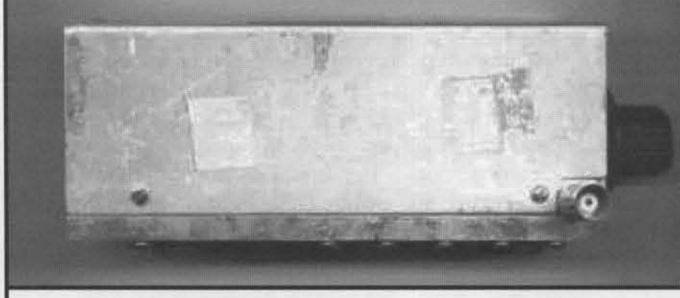


Figure 28—Side view of the RLC Electronics AT201-SR, 0-120 dB in 10 dB steps. When opening the unit, beware of the tiny springs and plungers. Remove the 12 screws on the bottom, hold the unit together and place it in this position, and then pull the

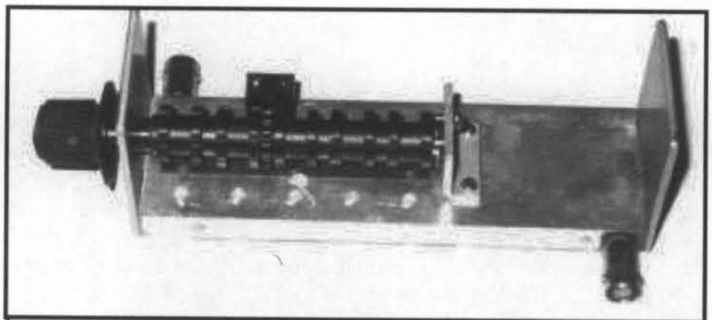


Figure 29—Under the cover of the AT201. The black object behind the shaft is part of the detent mechanism.

distorted BNC on an old RF SPDT switch and the technique could be used on attenuators as well. Due to construction of the switch, replacement with anything but the original design, a highly customized BNC connector, would have been next to impossible even with a lot of mechanical ingenuity. The only option was to try to straighten it out.

I took a piece of steel rod with a diameter somewhat larger than the outer diameter of the BNC and drilled a hole in the end somewhat larger than the diameter of the center insulator in the connector. I then used a lathe to carefully turn the end down to a cone of such a shape that it would easily fit into the end of the BNC and be able to work it back into shape. Careful manipulation of the tool and connector by hand restored it to a usable shape.

Figure 30 shows some discouraging news about this model. The attenuator sections are mounted on the undersides of 5 white ceramic rectangles, which are glued onto the ledges of a channel cut into the attenuator floor. There are two gold plated wires visible on the top of each, which are the contacts. (A diagonal slash is visible in the center of one, but that's actually a mark with a pen.) I haven't seen the underside of the ceramic sections, but presume that the resistors are printed and fired onto the ceramic. It might be possible to replace them with small surface mount resistors, but clearance could be a problem. Also, removing the ceramic blocks without breaking them could be tricky.

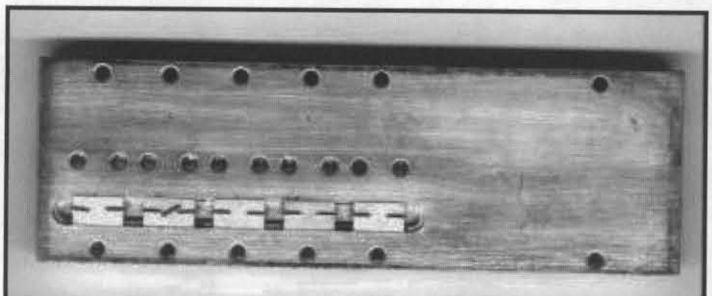


Figure 30—Bottom plate of the AT201 attenuator. The 5 white ceramic plates contain wire contacts on top, with resistors (probably printed and fired onto the ceramic) on the underside.

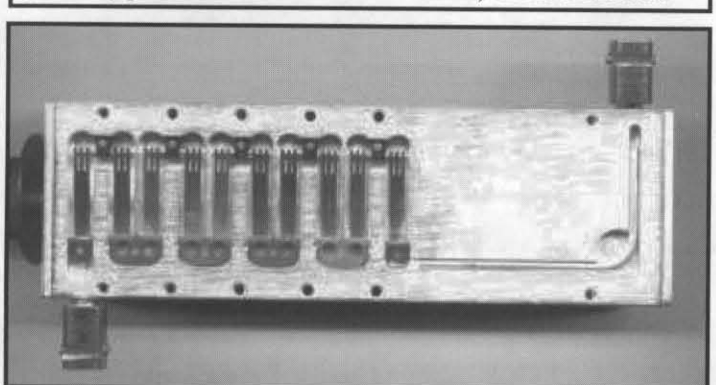


Figure 31—Underside of the main body of the AT201. The BNC in the upper right is connected with a short run of semi-rigid coaxial

On the plus side, cleaning contacts in case of intermittent operation is a breeze since the contacts on the ceramic are out in the open, as are the mating leaf spring contacts (Figure 31). To clean, I'd suggest a contact burnisher—use the blades, not the rods—or perhaps an orange stick. Or you could use the trick I learned in the military long ago, which is to use a dollar bill to carefully rub the contacts with light pressure applied.

Open with Care

A word of warning—when taking this unit apart you must do it in the proper sequence or a lot of tiny, spring loaded parts will fly off into the distance. Running down the center of the base (Figure 30) is a series of 10 holes. Each one has a tiny coil spring and a small plastic plunger sitting on it, to provide tension for the movable contacts. Here's how NOT to do it: turn the unit upside down, remove all 12 screws, and lift the bottom off. If you do that, all 10 springs and plungers will fall out and scatter to the 4 winds.

Instead, turn it upside down, remove the screws, and then turn the entire unit over while holding it all together. Set it upright on a flat surface—as shown in Figure 28—and then carefully lift the top part off. If you want to pick up the bottom and examine it, remove the parts first and put them in a safe place so they don't get lost.

(Fortunately, when I learned this disassembly lesson the hard way there was no one else in the room and I was able to recover all the pieces and reassemble it with no one being the wiser. Also fortunate was the fact that I was the newly assigned superintendent of the USAF satellite Earth terminal where this occurred, and there was only one person above me in the food chain who could have given me grief about it. Still, it would have been an amusing topic of conversation in the break room for months to come!)

Another HP Clone

Figure 32 shows the RLC model AT200-SR with the cover removed. Also operated by a camshaft but using 4 sections instead of 5 like the AT201, this unit does 0-12 dB in 1 dB steps. Like the HP models and the AT201, this can have mechanical problems related to the camshaft. Note that the portion of the body containing the BNC connector is thicker than that on the AT201, and that it uses a 4 hole mount connector which is easy to replace as needed.

To disassemble, remove the 8 screws on the underside of the

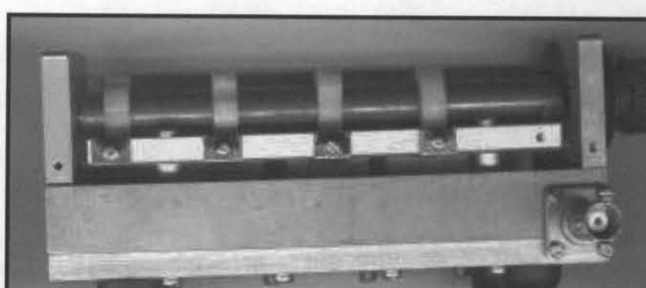


Figure 32—AT200-SR, 0-12 dB by 1 dB steps, with cover removed.

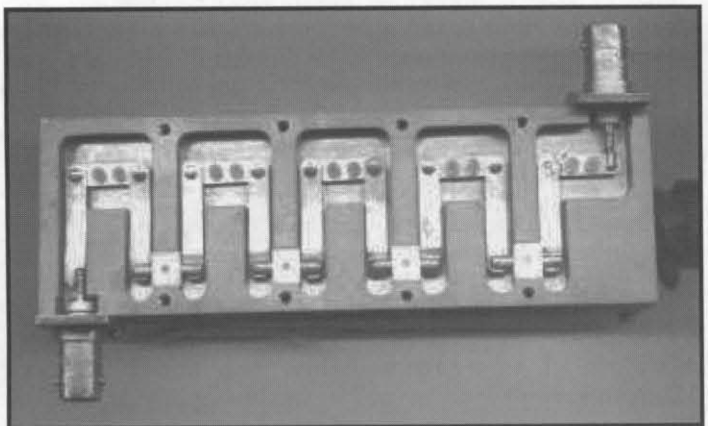


Figure 33—Underside of the body of the AT200.

attenuator, as well as the 2 screws on each BNC that go into the bottom plate. Leave the other 2 screws in each BNC. This lets you remove the plate while the connectors remain attached to the body. There's less worry about plungers and coil springs with this unit. There is one set but it's held in place underneath a leaf spring contact attached to a BNC. Having the connectors and attached leaf springs loose is an unnecessary complication, and also invites the plunger and coil spring to get lost.

Figure 33 shows the underside of the body. The round, button contacts are out in the open at the top end of the leaf springs, and easy to clean. If adjustment of the leaf springs is necessary, that's easily done, as it is on the other RLC unit. Figure 34 shows the other half, with the resistor leads soldered to the contact studs. Replacement of bad resistors is easy enough, although you do need to use small ones since everything has to fit into the open areas in the body between the ends of the leaf springs and the wall when the attenuator is reassembled. And don't get any solder on the ends (tops) of the studs, since those are the fixed contacts and must remain clean.

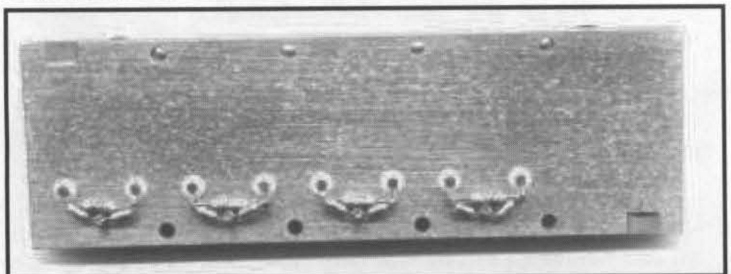


Figure 34—Bottom plate of the AT200, with the resistors. If any are replaced, keep them close together since they must fit into the cavity on the main body without shorting when assembled.

Summary

When thinking about buying a step attenuator in a situation where you'll probably have no recourse against the seller—such as at a hamfest—it's good if you can factor the ease of possible repair into your decision. There's a good chance you'll see the HP models I described, although probably not as late a model as the one in Figure 20, and maybe one of the Kays. Repair on any of those is fairly easy, or at least doable. While you might never see either of the RLC models, the description of them does make you aware that repair on other units might be more difficult than expected.

—DE WA8MCQ

QRP ONLINE

QRP-L, which I call the "QRP Daily," is the online QRP discussion forum started in 1993 by Chuck Adams, K7QO. It continues to run several dozen postings per day on a variety of topics related to QRP. QRP-F is an alternative QRP forum started in October 1999 to take some of the load off QRP-L. The forum, QRP-F, requires a web browser such as Internet Explorer or Netscape, while QRP-L is a mail reflector and only requires an e-mail account. To check out either one, just go to the QRP ARCI home page at

www.qrparci.org

From the opening page, click on the spot indicated to enter the web site. For now, resist the temptation to just click on the QRP-F button on the side on that initial page. What follows gives you a bit more flexibility. After entering the web site you'll see a few rows of clickable items at the top. You can click on both QRP-L and QRP-F there.

QRP-L is an independent entity, separate from the QRP ARCI, although the club web page gives a convenient entry point. If you prefer to go to the opening page directly, point your browser to the following URL. (That's a lower case letter "L" at the end, not a number 1.)

http://qrp.lehigh.edu/lists/qrp-l/

There's been some change recently with regard to QRP-L. There used to be a web page for it run by Steve Hideg out of nd.edu (Notre Dame), but he got out of ham radio several months ago and took the page down. A new page was eventually set up at lehigh.edu, which is where QRP-L itself is hosted. It includes useful information on the various options available with QRP-L, such as the daily digest mode to bundle a whole day's traffic into a single e-mail, or the POSTPONE mode to put it on "pause" while you're out of town. You can also subscribe from there, read the HTML archives without subscribing, and look at past traffic as well.

Since QRP-L is a mail reflector, even those who have just an e-mail account and nothing else can subscribe and take part. If you only have an e-mail account, send mail to me at wa8mcq@erols.com and I'll send info on signing up for the mail reflector.

While the HTML format of QRP-F 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!

THE FINE PRINT

N2CX usually sends his inputs via e-mail and supplies his own drawings. You can do that if you want, or just scribble things on a piece of paper and let me do everything, including redrawing your schematics and pictures. Either way, get your QRP tidbits to Severn to share with the rest of the QRP community.

73 and queue our pea DE WA8MCQ

—qrp

Cub QSK Revisited

Rick Littlefield, K1BQT 109A McDaniel Shore Drive, Barrington, NH 03825 email: k1bqt@aol.com

*Here's an alternative to W1HUE's Cub QSK mode published in the July 2000 issue of the **QRP Quarterly.** Rick did the original design work on the Cub for MFJ. –Ed.*

Theory Behind the Modification

The current problem with the stock Cub's receiver recovery occurs because the AGC loop is left partially charged after each CW character is sent. Because the Cub's AGC release time is (by necessity) slow, recovery seems correspondingly long on a quiet band.

My cure began by eliminating the AGC hang function that was used to reduce receiver sensitivity on transmit (see **Fig. 1**). I then installed a dual time constant in the AGC loop. This second, faster, time constant is activated by means of a FET switch controlled by the +T line. Its job is to force a "soft dump" of the AGC loop voltage after each transmitted dot or dash, while allowing the normal slow AGC release on received signals. When adding the switch, I found it necessary to program a short hold onto the gate to allow time for the receiver's antenna line to fully damp out before the AGC dump is removed. Without this sequencing, the AGC still had a tendency to pick up T/R transients and partially defeat the modification.

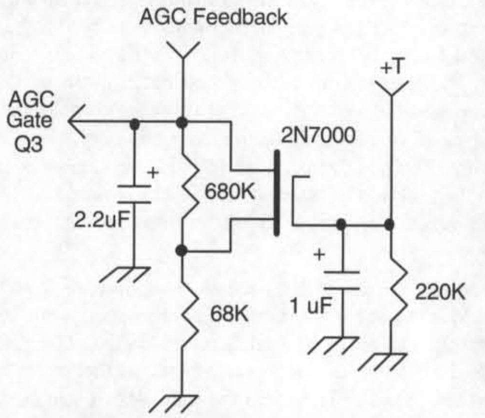


Figure-1. *Schematic of AGC Modification*

Parts List

- 1 - 2N7000 FET
- 1 - 1 µF electrolytic
- 1 - 68K resistor
- 1 - 220K resistor

Installing the Modification

The modification configures the Cub's AGC for dual recovery time (see **Fig. 2**). To achieve this, cut the ground trace on the 680K AGC timing resistor and add a 68K resistor in series to ground. Next, tack-solder a 2N7000 FET across the existing 680K SMD timing resistor (R12). This configures the AGC loop so that when the 2N7000 is in conduction (gate high), the 680K resistor is bypassed and release time is fast. When the FET is open, release time is normally slow.

To provide a control circuit for the 2N7000 gate, cut the trace connecting the rear pad of R30 with the rear pad of R13. Remove the 4.7K resistor at R30 and replace it with 220K. Next, install a 1-µF cap from the rear pad of R30 to ground using the eyelet to the right of C34. Finally, connect the 2N7000 gate lead to the rear pad of R30. This RC combination (220K and 1 µF) provides a sequencing delay to hold the gate high momentarily after +T is removed.

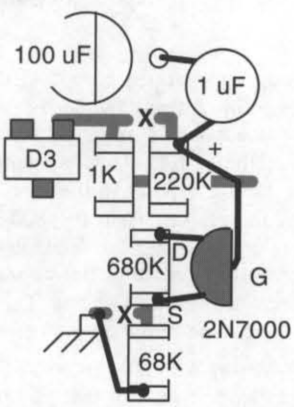


Figure-2. *Layout of AGC Modification*

Conclusion

How good is the QSK with this modification? Think "Meg Ryan in a Restaurant" (actually, that may be overstating the case)! It will, however, cure the slow recovery problem and make your little Cub act like one of the QSK big kids. Key up, full background noise or incoming signal. Key down, comfortable sidetone. My only regret? I shoulda done it this way the first time!

Ft. Tuthill 2000 K@ group photo. Submitted by Larry East,

"Just how long did you say the boom needs to be, L.B.? Photo submitted by our new editor Craig, NM4T.

Notes on the Terminated Wide-Band "Folded Dipole"

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This article originally appeared in the ***AntenneX Online Magazine*** *for May 2000 (http://www.antennex.com). It is reprinted here by permission of the author and* ***AntennX****. For many more interesting articles on antennas and antenna modeling, visit LB's web site at http://www.cebik.com.*

As space for antennas continues to shrink in the present era of smaller urban and suburban yard, hams have begun to turn to 1-antenna solutions to their operating needs. Among the choices for a horizontal antenna that operates on all of the HF amateur bands, the "wide-band folded dipole" (WBFD) has been gaining popularity. I thought that it might be useful to do some comparative studies using this antenna as a base-line.

The basic WBFD looks something like **Fig. 1**.

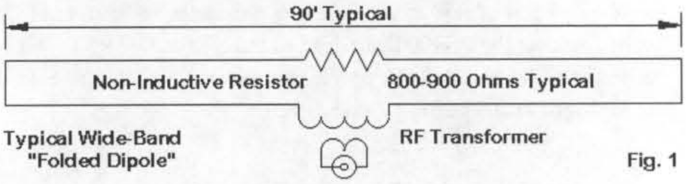


Fig. 1

The antenna design appears to be a folded dipole. However, a folded dipole is a resonant antenna, while the WBFD is designed to operate with a low feedpoint impedance across a wide range of frequencies. Moreover, the WBFD contains a non-inductive terminating resistor usually located at the point in the loop directly opposite the feedpoint. Normally, the resistor is in the 800-900 Ohm range. This impedance is roughly replicated at the feedpoint. Therefore, builders install a 16:1 RF transformer (either of transmission-line transformer or normal transformer design) at the feedpoint. The result is a low SWR value for 50-Ohm coaxial cable across the entire frequency range.

For receiving use, such as in SWL service, the terminating resistor can be a low wattage carbon type. For transmitting service, the resistor must have a power value capable of dissipating a fair share of the applied power. The exact amount will vary with frequency, but commercial versions of the antenna are often rated for reduced power at the low end of the operating range, where power dissipation is highest.

Commonly, WBFD antennas are offered in a 90 to 100 foot length (27-28 meters) for service between 2 and 30 MHz. However, one can build WBFD antennas in almost any length. Only the effective operating range of frequencies will change.

Since we may also construct doublets of the same length and feed them with parallel transmission line to an antenna tuner, it seemed fair to compare the gain of such a doublet with that of a WBFD of the same length across the 2-30 MHz range. The model I chose for the WBFD is 27.2 m (89.25') long, with the wires separated 0.2 m (7.8"). The terminating resistor is 820 Ohms, a standard value used in some commercial models. The wire is #14 AWG. The doublet is a simple length of #14 copper wire exactly as long as the WBFD.

Fig. 2 compares the free-space gain of the two antennas at 1 MHz intervals from 2 to 30 MHz. Since the elevation angle of maximum radiation will be the same for both antennas for any height above ground and for any ground conditions, any differences that show up in the free-space model will also show up in actual antennas at any height above ground.

Several instructive notes emerge from the comparison of gain in **Fig. 2** First, the overall average difference in gain between the two antennas is nearly 6.3 dB, with the advantage going to the doublet. If we neglect frequencies below 7 MHz, the average difference diminishes to 5.0 dB. For most of the range of use of the WBFD, then, there is about a one Sunit deficit in gain relative to a standard doublet of the same length in the same position.

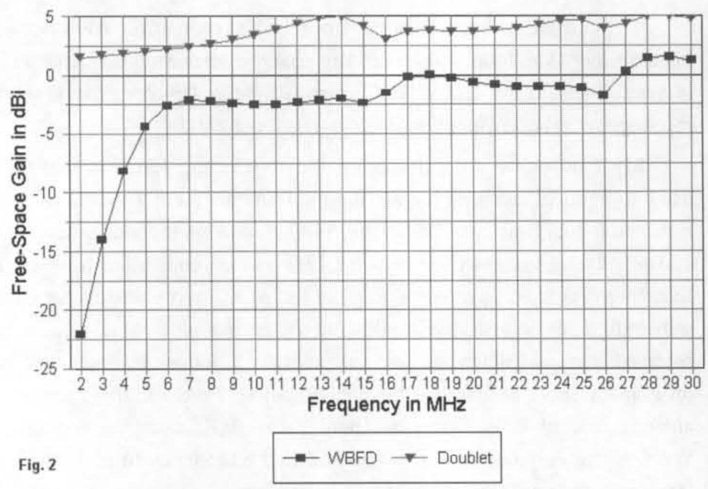


Fig. 2

Second, the WBFD gain curve displays a significant knee—a frequency below which its gain deteriorates rapidly. In the case of the current model, that frequency is about 6 MHz. At or below the knee-frequency, the terminating resistor dissipates more and more of the power. The result is not only a large decrease in gain and higher temperature stresses on the resistor, but as well, very low SWR values at the feedpoint. The knee-effect as the WBFD becomes significantly short relative to the length of a resonant dipole easily accounts for the need to derate the antenna relative to transmitting power below a certain frequency.

The deficit in gain is not necessarily a disadvantage for receiving purposes. Modern receivers tend to be equipped with receiving pre-amplifiers that the user can switch in as desired. The gain may range from 10 to 20 dB, depending upon design, and in some receivers may be stepped or variable. Therefore the gain deficit can be largely made up in the lower HF range. Moreover, the basic receiver, apart from preamplification, already has excess gain that is rarely used in the lower HF region.

In addition, one of the major problems in reception in the lower HF range, especially with respect to SW broadcast stations, is front-end overload from excessive signal strength. The overload also tends to produce spurious products within the receiver. Hence, reduced gain of the antenna can be in some circumstances an advantage rather than a disadvantage. Combined with the RF attenuator built into many receivers—which may be a single reduction value or stepped—the WBFD offers a potential for excellent lower HF reception, free of some of the problems that occur with higher gain antennas.

Because the WBFD is also a closed loop with a terminating resistor, many users claim quieter reception relative to doublets for a given receiver input signal strength. The degree to which this is both true and separable from the freedom from front-end overload is difficult to determine. Nonetheless, SWLs have found the WBFD a very useful tool for their efforts.

In order to establish that the WBFD has the same pattern as a doublet of the same length for any given frequency and height above ground, let's look at a couple of sample free-space patterns. For example, see **Fig. 3**.

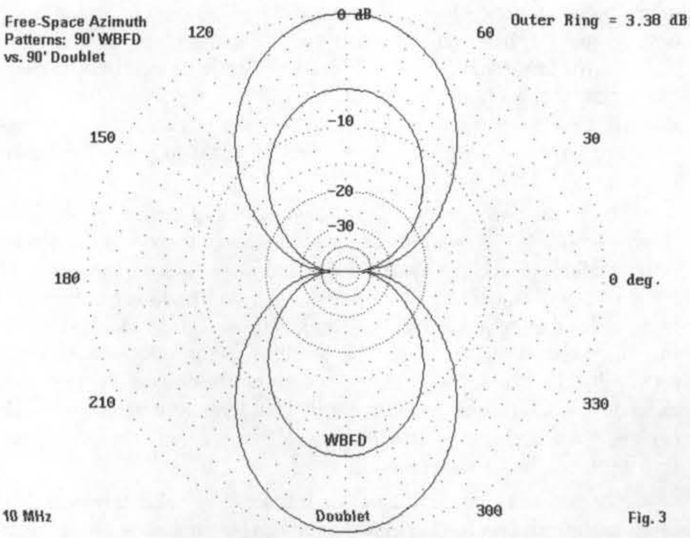


Fig. 3

The 27.2-meter WBFD and its comparison doublet exhibit a bi-directional pattern at 10 MHz. The shape of the pattern is identical, with only the 6-dB gain differential separating the two antennas. The -3 dB beamwidth points are also virtually identical. Since the take-off angle (elevation angle of maximum radiation), the reflection from a given set of ground conditions, and other such factors are not dependent upon signal strength, the two antennas would also show elevation patterns for any equal antenna height that are likewise congruent.

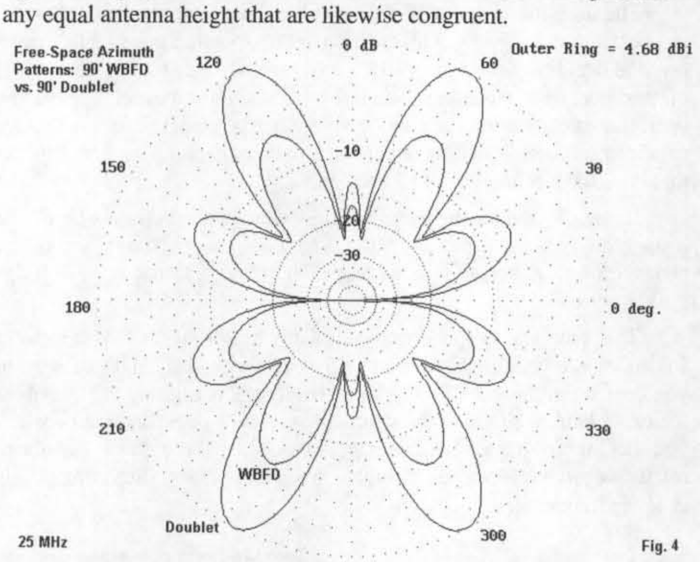


Fig. 4

Fig. 4 shows comparative free-space azimuth patterns for the two antennas at 25 MHz. The WBFD pattern is simply a "mini" version of the doublet pattern, with about a 6 dB difference in strength.

There is an additional point in displaying these patterns. The exact pattern of lobes and nulls in the azimuth readings for a WBFD is identical to that of a doublet. As the length of the antenna exceeds 1.25 wavelength and approaches 1.5 wavelength, the bi-directional pattern at lower frequencies will break up into a collection of lobes and a collection of nulls. Therefore, the antenna is variably selective in its favored directions of good signal strength as one changes frequency. Those who contemplate installing either a doublet or a WBFD antenna need to consider well the patterns at key frequencies of interest in order to orient the antenna for maximum effectiveness.

The antenna type has also been used vertically to provide omnidirectional coverage. However, in this orientation, when the antenna exceeds 1.25 wave-length in over length, the pattern begins to show primarily high angle radiation—exactly the opposite of what one normally desires from the upper HF band. As a result, some installations may use a pair of vertical WBFDs for full low-angle HF coverage.

A Note on Knees and Length

The knee we observed in the gain of the 27.2-meter WBFD is interesting, since it suggests that we may vary the low frequency gain by changing the length of the antenna. Changing the length, of course, will also change the frequency at which the antenna changes from a bi-directional pattern into a multi-lobed pattern.

To examine this question, I recreated the 27.2-m antenna model to perform frequency sweeps on both longer and shorter versions. As a sample, I ran a 50-m version and a 15-m version. All of the models used 820-Ohm terminating resistors, #14 AWG copper wire, and a spacing of 0.2 meters.

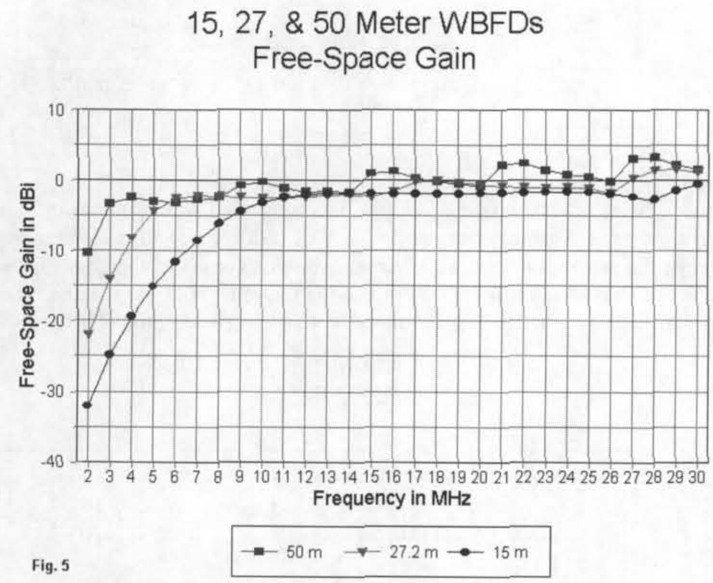


Fig. 5

Fig. 5 compares the gain of the three antennas from 2 through 30 MHz in 1 MHz steps. As suspected, the 50-m antenna reduces the knee frequency to about 3 MHz. In contrast, the 15-m version increases the knee frequency to about 10 MHz. In general, a home builder may interpolate values for the knee frequency for other lengths in the overall range.

The longest of the antenna models shows a mere -10 dBi gain at 2 MHz, a value easily made up by the receiver and only about 1.5 to 2 S-units below the average gain of the antenna. Hence, it is likely to be more satisfactory as a transmitting antenna in the lower HF region. In contrast, the 2 MHz performance of the 15-m version is more than 30 dB lower than the average antenna performance, making it more suitable for higher HF transmitting.

The variations in gain among the curves in the relatively flat region of performance are a function of lobe formation. Maximum gain tends to attach to the major lobes of patterns taken at just higher than integral multiple of a wavelength, relative to antenna length. Minimum gain levels tend to be associated with antenna lengths near the "x+.5" wavelength (where x is an integer) points. When an antenna is 1.5, 2.5, 3.5, etc. wavelengths long, its pattern consists of a combination of emerging and disappearing lobes, all of relatively equal strength. For example, a one-wavelength wire has two strong lobes that are 180 degrees apart and a two-wavelength wire has four strong lobes that are roughly 90 degrees apart. A 1.5 wavelength wire has six lobes, as the one-wavelength lobes diminish and the two wavelength lobes grow. Hence, coverage is wide, but at a reduction in maximum strength.

The number of peaks and valleys in the three gain curves is a function of length. The 50-m antenna passes through many more transitions from x wavelength to x.5 wavelength (where x is an integer) across the frequency span than do either of the shorter antennas. Hence, we should expect more highs and lows in the gain pattern.

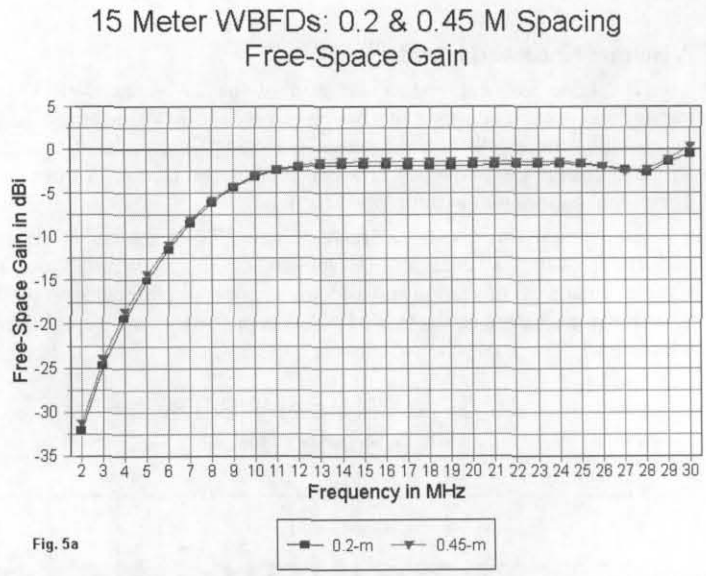


Fig. 5a

One question posed by various recommended wire spacings in past literature is whether wire spacing makes a difference to performance. **Fig. 5a** provides something of an answer as it compares the gain values for models of a 15-meter long version in 0.2-m and 0.45-m spacing. The gain values are insignificantly different, ranging from 0.2 to 0.4 dB.

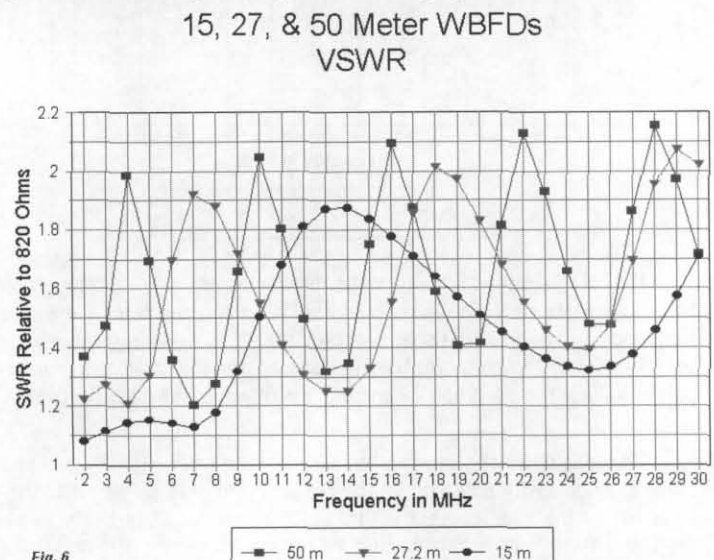


Fig. 6

We find that the curve of SWR relative to the value of the terminating resistor will also show similar transitions according to WBFD antenna length. **Fig. 6** shows the SWR pattern for the three antenna models. If we look at the most dramatic fluctuations—in the case of the 50-m antenna, we discover SWR peaks at X+2/3 wavelength points (where X is an integer). In contrast, we find SWR minimum values at the X+1/6 wavelength points (where X is an integer). The frequency span between points relative to the antenna length is 1/2 wavelength. The shorter antennas show the same pattern. However, the pattern is less evident because there are fewer maximum and minimum values to sample.

We may also note that the longer the WBFD, the higher the SWR excursions for a given value of terminating resistor. However, if we examine the lowest values of minimum SWR and exclude the region below the gain knee of the curve, the corresponding low points in the curve show the longest antenna also to exhibit the lowest minimum value of SWR. In other words, for a given wire size, spacing, and terminating resistor, longer WBFDs will exhibit a larger range within any given SWR cycle. As we approach the upper HF range, the values may exceed the desired 2:1 SWR limit.

The amount by which a long WBFD exceeds a 2:1 SWR is not great, but it is noticeable. For receiving applications, mild excursions beyond the 2:1 limit have virtually no affect on the received signal strength for any length of 50-Ohm coax. Some transmitters use automatic power reduction circuitry as the SWR approaches 2:1 (using an internal reverse voltage sensor), and some linear amplifiers begin reducing power at lower levels of SWR in order to protect expensive transmitting tubes.

There are two means of overcoming the potential problems of "high" SWR. Some manufacturers recommend the use of very long coaxial cables. Since the losses in the line increase with frequency, the SWR observed at the station end of the line will be lower at higher HF frequencies than at lower HF frequencies for any given value of SWR at the antenna end of the cable. The result of using longer coaxial cable runs will then be an SWR curve at the transmitter output that never exceeds 2:1. Compared to the reduced gain already inherent in WBFD design, the added losses of a long cable run are not considered excessive when totaling the overall system gain.

Alternatively, modern amateur transceivers (and those in other services) are routinely (but not universally) equipped with automatic antenna tuner circuitry. Although limited in range compared to a wide-range external antenna tuner, these tuners are certainly adequate to handle the modest SWR values presented by even the longest WBFDs. Hence, the transmitter output circuitry prior to the tuner will show a very low SWR.

Construction

The decision to use a WBFD involves an evaluation of one's goals in operating or listening. Only with a set of specifications of this order can one decide whether the WBFD will meet the needs. The description of the antenna's advantages and limitations must be set against the operating specifications and along side other potential antennas that are candidates. Then selection becomes a matter of choosing the antenna that does most of the jobs well enough.

If you do decide to use a WBFD, you can purchase one of the commercially made types. B&W (USA), Giovannini (Italy), and others produce these antennas in a variety of lengths. Alternatively, you can build your own.

The antenna proper uses standard techniques of wide-spaced folded dipole construction. You will need twice the length of wire as you determine the antenna length to be. There is nothing critical about the exact length, although the general length will be a function of where you decide to place the frequency that forms the knee separating relative even performance at higher frequencies from diminishing gain at lower frequencies.

Fig. 7

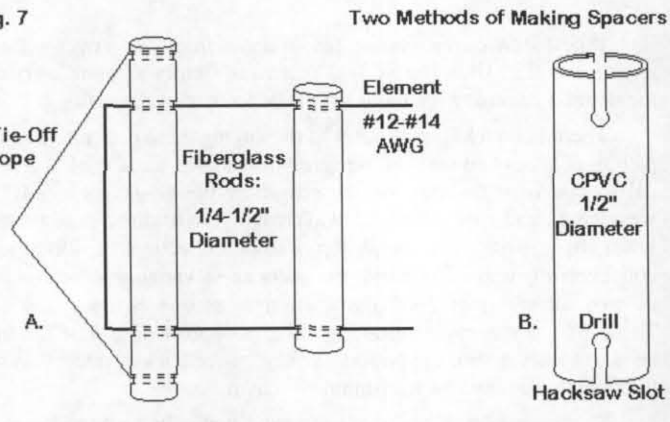


Fig. 7 shows just 2 of many ways to space the wires along their length. In the 1930s, we might have used wood dowels boiled in paraffin. Today, we have access to a variety of better materials. Part A of the sketches shows fiberglass rods, with holes drilled to pass the size wire we decide to use. #12 to #14 AWG copper wire (0.06-0.08" or 1.5-

2.0 mm) is likely to be the most common choice. The end post can be longer to hold tie-off ropes for the assembly. Fiberglass rods can be purchased from mail order sources. However, local home improvement centers often carry adaptable materials. For example, I recently spotted some 1/2" diameter fiberglass rod under the guise of chimney flue brush extension handles.

Alternatively, I have also had good luck using 1/2" diameter CPVC, a thin-wall form of PVC tubing that replicates copper tubing sizes, shown in Part B of **Fig. 7**. A hacksaw cut in each end leads to a hole drilled to pass the chosen wire size. The wire press fits down the slot and into the hole. If the holes are not deburred, the wires stay put, although the spacers can be repositioned with fair ease.

These are simply two of many ways to make the required spacers. Narrow strips of polycarbonate, acrylic, or plexiglass would also work. Polycarbonate likely has the best UV resistance of this group. When adapting materials to a new use and environment, it is wise to check the structure every so often to ensure that it is wearing well under the influence of sunlight, precipitation, and temperature excursions. Of course, cut any spacers that you use to the desired length—about 8" (0.2 m) between wire holes for the models examined here. However, this spacing is not very critical.

Locating a non-inductive resistor of sufficient power dissipation is likely to be the chief problem for WBFD builders who intend to transmit with the antenna. Unless you can find a suitable resistor at one of the surplus outlets, purchasing an antenna may prove economical in the long run, if we add both cost and parts-searching time together. Any value in the 800-900 Ohm range—or even "thereabouts," if a bargain appears—will serve.

Manufacturers use different methods of packaging the resistor into the antenna assembly. Some prefer a total enclosure to weather-proof and bug-proof the resistor. However, one might have to derate the resistor's power handling capability under these circumstances. To maximize power dissipation, the resistor can be placed within a tube that is about twice the diameter and about 1.5 times the resistor's length. Air passing through the tube provides cooling, while the tube itself protects against weather impacts. Since the antenna wire and resistor terminals will attach to strips of metal bonded to the tube, the resistor itself is relieved of strain. The down side of this technique is the need to clean out bugs and others debris on a regular basis. However, semi-annual inspection and antenna maintenance is always a good policy.

For receiving-only applications, the resistor problem is much simplified. A series-parallel combination of carbon resistors with a net value of about 820 Ohms is easy to arrange. 1 to 5 watt non-inductive resistors provide the sturdiest construction. The assembly should be mounted in a UV-resistant plastic housing with strong terminals for connecting the antenna wires.

The other challenging component is the 16:1 RF transformer. The builder has two general types of transformers to use: a transmission-line transformer or a standard wide-bandwidth transformer using a toroidal core. Transmission-line transformers are slightly more efficient for transmitting purposes, although they prefer purely resistive loads. Jerry Sevick, W2FMI, has written extensively on these units, with instructions on how to build them for many impedance transformation ratios. In a pinch, one might place two 4:1 baluns in series.

There are proponents of standard RF transformers using toroidal cores. Doug DeMaw, W1FB, has written on their use, including calculating the power-handling capability of various cores. For receiving-only applications, small cores can be used, and the basic requirements and calculations are described in recent editions of the ***ARRL Handbook***, Chapter 6.

Whatever form of RF transformer you use, package it to withstand weather. A sealed UV-resistant plastic box with a correctly placed "weep" hole for moisture drainage is a good choice. Obviously, you will need connections for the antenna wires as well as a coax connector.

Conclusion

A WBFD antenna is not for everyone. However, gaining some understanding of its operation, its advantages, and its limitations may be useful in the process of choosing an antenna—or even simply learning more about what various antenna types can do. The WBFD has its niche among amateur, governmental/military, and SWL antennas, but that niche is certainly not universal.

Receiving versions of the antenna can be home built for not much more than the cost of the wire, since the materials necessary for low-power terminating resistors and wide-band RF transformers are low. However, building a transmitting version of the antenna at home may be much more problematical, since parts may be hard to find or hard to fabricate. The alternative, of course, is one of the commercial versions, in an exchange of bucks for bother.

Edited by W1HU

Georgia Sierra Gets a Voice Transplant—Operation Successful

by Bob Confrey WA1EDJ and Sam Billingsley AE4GX (North Georgia QRP Club)

Over the last six months a small group of NoGa-ites (North Georgia QRP club members) have been working on a project to build a homebrew version of the Norcal Sierra from the ARRL Handbook templates. Each participant had different MOD requirements and special features they wanted to try. Our goal was learning by experimenting and home brewing, as much as possible, so buying off-the-shelve kits and products was to be minimized.

Sam/AE4GX and Bob/WA1EDJ were particularly interested in using an audio output enunciation (AFA – Audio Freq. Annunicator) from a frequency counter since we were using a 10-turn pot to tune a varactor VFO. The VFO MOD was based on Mike Branca W3IRZ the "Georgia Sierra" QRP Transceiver article published in the ARCI Jan 2000 QRP Quarterly (see reference). Mike had elected to use an available frequency counter kit with LCD output. Bob and I were looking for a lower power requirement and smaller implementation for trail friendly use. We both had some experience with PIC programming but were looking for short cuts and didn't want to reinvent the wheel if it was available but at the same time wanted to be able to customize the code and circuits to suit our needs.

A QST Dec 1998 article by Dave Benson NN1G "Freq-Mite – A Programmable Morse Code Frequency Readout" looked like it was the ticket but the article mentioned he only supplied programmed PICs and we wouldn't be able to add and MODs of our own. The article did have a schematic and general input sensitivity and frequency response data. We found out that Small Wonders Labs (see reference) was selling complete Freq-Mite kit for $20. While that's not bad we wanted more control on the operating characteristics and layout. The Freq-Mite used a different PIC than 16F84 we were familiar with so we needed some help here. The Internet comes to the rescue.

Since we were familiar with the PIC 16F84 microprocessor, which is similar to the 16C622 PIC used in the Freq-Mite, from some experiments with code to drive a DDS device we thought that some of the ham PIC experimenters might be able to help.

We put out feelers on several of the ham related reflector lists including Ham-Pic reflector out of the NJQRP site (see reference). Bob and I subscribe to ham-pic list since we are generally interested in the creation and use of ham related PIC products. Well we got suggestions and pointers on frequency counter frontends and possible PIC code to perform the frequency counting and morse output function from several sources. The best code suggestion was from Bernd Kernbaum DK3WX, a ham in Germany who had previously published some PIC based articles in SPRAT (see reference). Bernd had a very useful piece of code that he was willing to share and only requested that we mention his name and call and credit his code segments we used in our efforts. This email dialogue occurred over a several month period. We reestablished contact with him recently to obtain the permission to use his work and identity in any non-profit article targeted for the ham community.

We checked out the PIC creator, Microchip, at their web page (see reference) and got their data sheets and detailed applications notes on the use of the internal timer and counter features of this particular chip.

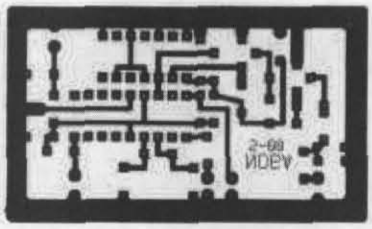
So using the schematic from the QST article and Bernd's code we burned a PIC, etched a prototype board and tried it out. Well it was good news and bad news. The code worked but the sensitivity and frequency range of the counter transistor front-end was not adequate for our needs. We hoped to use the output from the HB Sierra premix BP stages but the levels are at the –20dBm to –15dBm in our rigs and the ten meter band module needs to have a 32 mHz BP to mix with our unique 4.000 mHz I/f. The 4.000 mHz I/F is another W3IRZ MOD and not standard in the Norcal Sierra. The QST article graph had indicated that this sensitivity and freq range might be too limited for our needs and sure enough that's what we found with the initial breadboard. Close but no cigar. So we needed a better front-end for the PIC counter but still wanted it simple. Our earlier queries had yielded several other front-ends to other PIC implementations so we tried several. We had problems with one or the other of the two limiting characteristics (sensitivity and frequency response).

Neither of us are electronics engineers but in the best ham tradition we started looking at the pieces we had collected and started trying out various combinations of circuits. The best we found that met our needs was a small portion of the PIC front-end from the K2. Wow the K2 has a PIC? We didn't even know that until someone responded from a list. Well the good news is the K2 schematics are on the Internet (thank you Elecraft <see reference>) and the two cascaded transistor amp stages was picked.

We did substitute common 2N3904 transistors and all worked just fine. This two stage circuit is very similar to the original Freq-Mite article front-end except in the Freq-Mite the first transistor is setup as emitter follower and the second transistor is common emitter amplifier. So the two stage emitter follower amplifier from the K2 seemed to have the needed response up to about 30 mHz but we still needed 32.2 mHz for the ten meter HB Sierra module. My old scope appeared to show that the signal being presented to the PIC pin 3 was not quite defined enough to be reliable above 30 mHz. We pulled a Schmitt Trigger inverter IC out of the junk box and tacked it into place between the second transistor amp stage and the PIC. We put a 10K pull-up resistor on the output of the S.T. to insure maximum rise and fall of the wave shape into the PIC. Bingo. The input can now be lower than 100mVP-P on most bands and the readings are good through 32.2 mHz. This MOD did add an IC (cheap one thank goodness) to the board but the results are now reliable for the HB Sierra premix bandpass output signal to be detected, counted and outputted in morse during the receive period of the rig.

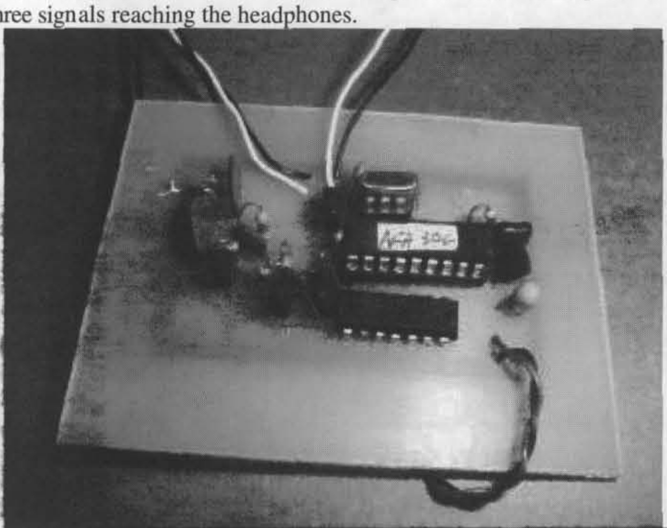
Unfortunately the PIC is an 18 pin IC and the ST inverter is a 14 pin IC and they are not conducive to ugly construction but if you're willing to put the IC(s) on their backs and directly wire it up it's very possible. For hams anything is possible. We recommend one of the small Radio shack perf boards with holes and foil pads (RS part # in ref. Section) if you don't want to etch. It's not critical. That's the beauty of homebrew stuff you can tweak it anyway you want to meet your needs.

Although Bob is not an engineer he is a very professional electronic technician that is picky about the looks of a HB module so only etched PCB boards were an option in this case. So we had to commit the schematic to a PCB layout. If you have ever tried this manually when you have big pin ICs you know it is nearly impossible. So since we were developing other small boards this last year we had picked up a neat, simple PCB layout product from a little German company. It is a low priced product called PCB Developer's Individual Assistant (see reference). With it, most QRP sized projects can be laid out very quickly. The software package can produce component side screens as well as two top and bottom etches, if necessary. We needed only single sided etches for this project. BTW we used this package for the NOGAPIG (see reference) To illustrate the output of the package the component side looks like this:

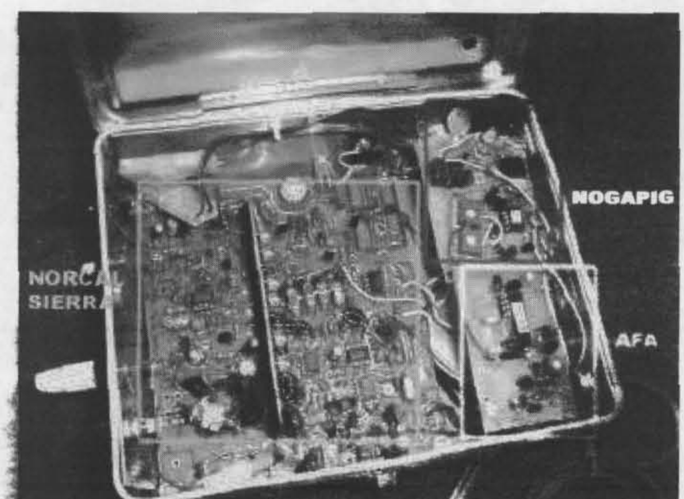


We use the very simple Press-n-Peel PnP Blue technique from Techniks, Inc (see reference) to get the camera-ready layout into the etched environment. Basically you need a clean x1 size original and a good copy machine to transfer the etched image to the PnP Blue film sheet. The blue film is ironed onto the copper foil and then the film is removed and the PCB etched. We generally do just one or two at the time since these are actually just prototypes. It's amazing how many times you miss something during this process no matter how careful you are. My hat is off to the professionals for this.

Mounting and interfaces are going to be unique with the user. In my case I have mounted an AFA prototype board next to a NOGAPIG power monitor board and K8 keyer on an inside wall of my HB Sierra enclosure, in a kid's type lunch box. Since the AFA, the NOGAPIG and the HB sierra all have audio output I have coupled the outputs via individual gain controls to feed the headphones thus leveling out the three signals reaching the headphones.



prototype board used in testing



Picture of AE4GX's implementation of the previous AFA version into his HB Sierra.

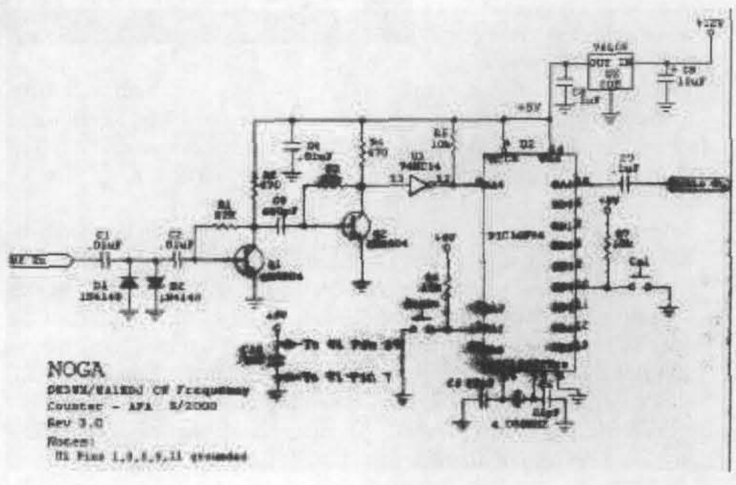
We were lucky with Bernd's code since our Sierra implementation uses a 4.000 mHz I/F so you don't need to have offsets to add or subtract values (if you ignore the mHz digits) thus a direct reading frequency counter logic would do for us. Bernd has offset routines in his code and they could be enabled. We can customize the output for anything desired but currently we are used the three lower kHz digits (all are available) since we know the band and because we have to manually change the band module in the Sierra. The PIC has several unused I/O pins that could be used for a variety of functions. We can add them later. The other great feature of this particular PIC it is reprogrammable so we are free to experiment with different versions of code at will. The prototype is using (16mA idle and 35 mA PIC outputting from an on board 5V regulator (12v to board). We use a push button switch (N.O.) to turn on the board for readout so you're only running it for seconds at the time. The audio outputted value of the AFA tracks with my MFJ 359B SWR analyzer (w/frequency counter). Since we're only interested in getting to a general area of the band the 1 kHz resolution is adequate. With a 10-turn control POT it's a BIG help.

This has been a very useful learning experience for us and we would encourage everyone that has any interest or previous experience with software to checkout the PIC and see how easy it is to use. The PIC and its later versions should be found in many ham projects in the future. The latest version of source code for this AFA project can be obtained from the NOGA web page (see reference).

References:

1. Mike Branca W3IRZ, "The 'Georgia Sierra' QRP Transceiver", ARCI QRP Quarterly Jan 2000, pp. 29-31
2. Dave Benson NN1G, "FREQ-Mite – A Programmable Morse Code Frequency Readout", QST Dec 1998, pp. 34-36
3. Ham-Pic reflector list http://www.njqrp.org/ham-pic/index.htm
4. Bernd Kernbaum DK3WX, ELBUG-Controlled CW Transceiver named ELBC two years ago published in SPRAT Nr. 94/1998. All control inputs and outputs, incl. frequency tuning and readout is possible with Keyer and Headfone
5. Press-n-Peel Blue Toner sheets - Techniks, Inc P.O. Box 483 Ringoes, NJ 08551-0463 Voice: (908) 788-8249
6. NOGAPIG – North Georgia Power Indicator Guard – check out NOGA web page for details: http://www.qsl.net/nogaqrp/
7. Small Wonders Labs at http://www.smallwonderlabs.com/
8. Elecraft, Inc. at http://www.elecraft.com/
9. PCB Developer's Individual Assistant – V2.2 at http://www.waldherr.com/index.html
10. PC Board with DIP Pads – Small: RadioShack.com Part # 910-3804 ($.99)
11. PICmicro Developer, Microchip, data sheets and application notes at http://www.microchip.com/
12. North Georgia QRP Club (NOGA) web page at http:// www.qsl.net/ nogaqrp/ (Go to club projects section)

The current circuit is shown below. This is easily changed so feel free to experiment with options like we did.



Revisiting the Resonant Feed-line Dipole

by Mike Boatright, KO4WX *email: ko4wx@mindspring.com*

For someone who's helping to build the Internet, I somehow find myself spending a lot of time on the road. When not traveling, I also enjoy portable, lightweight operations—probably in the hope that one day I'll find more time to backpack and camp in the wilderness. In any case, I'm fascinated by the challenge of getting the most signal out in the smallest, lightest weight package—so much so that the monthly Spartan Sprint and the annual Flight of the Bumblebees contests, both sponsored by the Adventure Radio Society (http://www.natworld.com/ars), are two of my favorites.

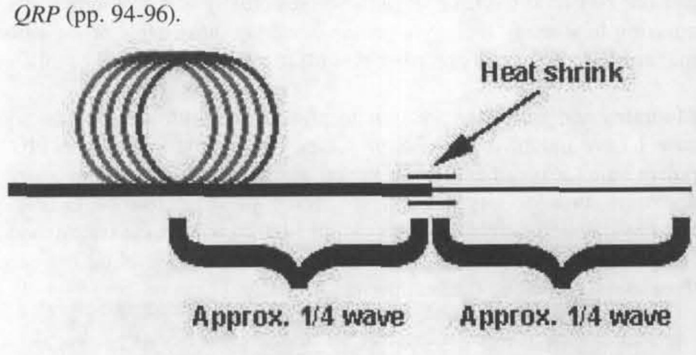
When I'm on the road, I usually don't have a lot of time for operating ("hey, he's from out of town doesn't have a life—he can stay late and finish the report!"), or more often than not, I'm too tired to operate (travel takes more out of me these days than it did in my youth). But it's fun when I make the attempt. I once worked the Spartan Sprint from a third floor hotel room at Fisherman's Wharf in San Francisco, using my DSW-20 (at one Watt) and a dipole, half of which was hanging strait down from the window and the other half tossed into a tree with a bar of soap as a weight on the end, about 10 feet from the electric trolley line. QRN (or is trolley bus static QRM?) aside, I managed to work the states of Washington, Alaska, and Hawaii. That was fun!

For the past couple of years, I've been carrying around a dipole, made from orange #26 wire (easily found when setting up and taking down in the woods), a two-terminal connector block, some RG-174 coax and a BNC connector. I've used it in various configurations, including dipole, inverted-V, vertical, and the occasional sling-it-out-the-window-with-a-bar-of-soap-attached configuration. It has served me well, but it a bit bulky to pack (albeit the most compact antenna I had found to date).

Enter the Resonant Feedline Dipole. At the NOGA QRP Club (http://www.qsl.net/nogaqrp) meeting in August, Jim Worthington, AD4J, talked about his recent trip to London, and how he used his "toilet paper" antenna from his hotel room. I was fascinated! This was just the antenna I had been looking for! Basically, it is a quarter wave of wire connected to the center conductor of a piece of RG-174 coax ¾ of a wavelength or so long. At ¼ wavelength back from where the wire connects to the coax, a "choke balun" or RF choke is formed by making a loop of 8 to 10 turns of the coax around a roll of toilet paper. (Alright! Knock it off with the TP jokes!)

Several of us got to talking after the meeting. Doesn't an end-fed half-wave antenna have very high impedance at the feed-point? Yes, but while this antenna looks to be end-fed, it's not really! It turns out that because of the "skin effect," the RF current flows on the *inside* of the coax shield to the point where the shield stops, and then it turns around and flows down the *outside* of the coax shield until it reaches the RF choke formed by the coil of wire. This choke has sufficient impedance to effectively terminate the end. The net result is that the antenna acts just like a ***center-fed dipole***!

The idea behind the Resonant Feedline Dipole (or RSD) is not a new one. According to the *ARRL Handbook* (1996 edition, p. 20.17), it was first described by James Taylor, W2OZH, in the August 1991 *QST*. Dave Ingram, K4TWJ, talks about it in his book *How to Get Started in QRP* (pp. 94-96).



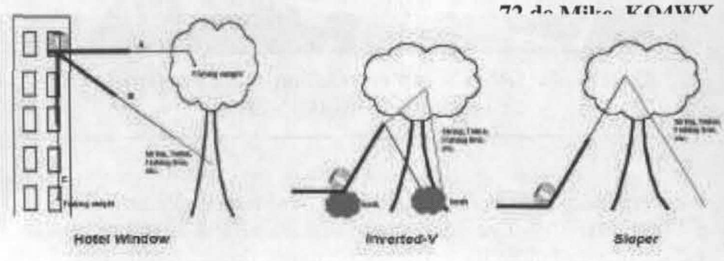
The exact location of the choke varies slightly, but should be located at approximately ¼ wave from where the single wire connects to the center conductor.. On my RSD, I trimmed off about ¾ inch of the shield, and then stripped ¼ of insulation off the center conductor. I soldered a ¼ wave (at 20 meters, about 16 feet 7 inches) piece of #26 black wire (black is stealthier) to the center conductor, and tied a small loop at the other end (of the black wire). I connected a couple of small fishing weights to a piece of twine to aid in hanging the antenna out the window.

The NOGA meeting was very timely for me, as I was traveling to Germany the next week. When he travels, Jim just carries the entire antenna in a big loop in his suitcase. He pulls it out, gets the roll of toilet paper (I've been in very few hotel rooms that don't have a bar of soap, but even fewer that don't have a roll of toilet paper!), and adjusts for resonance. On my trip, I didn't want to have to take extra time for adjusting it, so I made my choke by wrapping several turns in a small loop and attaching them to the side of a three inch wire spool with cable ties.

A resonant dipole, in free space, exhibits low impedance at the feedpoint (approximately 50 Ohms) that matches well to coax. However, depending on the configuration, there maybe significant SWR if care isn't taken. For example, at the hotel where I was staying in Germany, the windows had heavy metal frames that seriously affected the antenna. I carried my ZM2 tuner along with me, however, and it tuned up quite nicely.

The neat thing about this antenna is that it gives you a lot of flexibility in how you configure it for operations. This makes it an incredibly versatile antenna! It seems to perform fairly well, as I got a 559 from Moscow to Guetersloh, Germany, on one Watt, with the antenna hanging out a window facing west, during a solar coronal mass discharge!

72 de Mike KO4WX



Bypassing Your Automatic Antenna Tuner

Grant Bingeman, KM5KG   1908 Paris Ave., Plano, TX 75025   email: DrBingo@compuserve.com

I use LDG's excellent AT-11 (version 2.5) automatic antenna tuner in a variety of applications, and I needed a means to switch it in and out of line easily. In the OFF (actually standby) mode, the 17 AT-11 RF relays all fall into their normally closed positions, which creates a decent bypass mode below 20 MHz. However above 20 MHz, SWR increases significantly because of the relatively long and complicated circuit-board path from the input to the output UHF connectors. The modification described in this article brings the maximum insertion SWR down from in excess of 1.6 to less than 1.2 across the HF bands, and can be applied to other in-line devices besides the AT-11. Reducing SWR from 1.6 to 1.2 can typically increase RF power output from a transistor power amplifier by ten percent, based on measurements I have made.[1]

The following impedances were measured with an Autek VA-1, which is reasonably accurate when the load impedance is close to 50 Ohms resonant, and the frequency is low. If you wish greater impedance measurement accuracy, I recommend a Hewlett Packard vector impedance meter. Note that these impedances rotate clockwise with increasing frequency on the Smith chart; if you ever measure impedances that do not behave this way, then your data are bogus. I highly recommend that you develop the habit of plotting measured impedances on a Smith chart as a means of checking your data. RF interference, faulty equipment and noise, not to mention cockpit error, can all affect the validity of your readings. Also, be sure to take enough data points to see all the spirals that may exist when you plot your data on a Smith chart. For example, there is a resonance condition in the ten-meter band that can benefit from additional data taken between 25 and 35 MHz in Table 1 below.

Table 1. AT-11 Input Impedances with Imperfect Test Load

MHz	TEST LOAD		ORIGINAL		CORRECTED	
	Impedance	SWR	Impedance	SWR	Impedance	SWR
5.0	50 + j0	1.00	53 + j0	1.06	52 + j0	1.04
10.0	50 - j1	1.02	52 - j3	1.07	53 + j3	1.09
15.0	50 + j0	1.00	49 - j3	1.07	54 + j5	1.13
20.0	47 + j0	1.06	44 + j2	1.14	53 + j7	1.16
25.0	47 - j1	1.07	38 + j4	1.34	54 + j6	1.15
30.0	47 - j2	1.08	34 - j12	1.62	55 + j8	1.18
35.0	48 - j3	1.08	31 - j4	1.63	61 + j0	1.22

Keep in mind that the test load used for the measurements shown in Table 2 was not a perfect resonant 50 Ohms, although it was pretty close. If you want a perfect test load, you may have to insert an adjustable impedance matching box between the test load and the auto-tuner. When I did this, the input impedances I measured with the modified AT-11 were quite different from the imperfect load case. Thus in this application a very good test load is necessary if you expect to get the best results. I would also recommend using a Hewlett Packard vector impedance meter, especially at frequencies above 20 MHz, if you have any doubts about the accuracy of inexpensive impedance measuring devices you might presently be using.

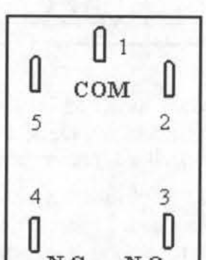


Figure 2.

SPDT Relay

Table 2. Measured Data for the Physically Modified AT-11 Using a Perfect Test Load

MHz	TEST LOAD		UNCORRECTED		CORRECTED	
	Impedance	SWR	Impedance	SWR	Impedance	SWR
20	50 + j0	1.00	36 - j10	1.50	54 + j3	1.10
25	50 + j0	1.00	30 + j0	1.67	55 + j0	1.10
30	50 + j0	1.00	31 + j5	1.64	49 + j0	1.02
35	50 + j0	1.00	29 + j1	1.73	46 - j2	1.10

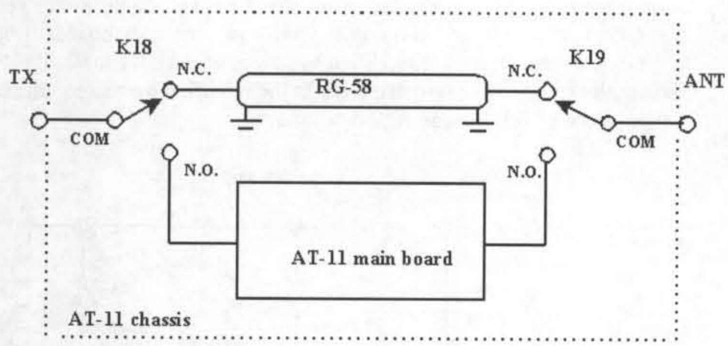


Figure 1. RF bypass via coaxial cable

As you can see from the measured input impedances at the TX port, the RF path through the AT-11 circuit card does not behave as a simple series inductance. If it did, we would only need to add a small shunt capacitor to tune out the inductive reactance at the higher frequencies. We might be able to devise a special lumped-parameter impedance matching circuit that would transform the 20 through 30 MHz impedances closer to 50 Ohms resonant, but we would still have to switch this in and out of circuit. So it appears that the best solution is to replace the AT-11 RF path with a length of 50 Ohm transmission line when the power switch is in the OFF position. This means we need to add a SPDT relay at each UHF connector to switch seven or eight inches of RG-58 in and out of the RF path per **Fig. 1**.

Keep in mind that the impedances may be affected by the chassis cover. Since you are going to be operating with the cover normally in place, be sure to attach the cover before you make your measurements. Resist the temptation during construction to make measurements with the cover off, or you may be surprised by the ultimate result.

LDG was kind enough to supply me with the same small enclosed relays that they use on their board. These relays have a 12-volt DC coil, and are designed to be soldered directly to a printed circuit. There are two mounting approaches one can take when installing the additional relays: off-board, or on-board. An on-board configuration would be cleaner, but would require modifications to the board itself, which might void the warranty if not done very carefully. Fortunately, there does appear to be enough real estate on the board to install two more relays (left of K1 and above K8) if LDG decides to incorporate this modification in future versions of the auto-tuner. However, I decided to mount the new relays next to the UHF connectors using GE Silicone II adhesive to attach them to the rear panel. That way I would not have to remove the circuit board from the chassis. You may wish to use a small chassis-mount relay that has solder eyelets instead of tabs if you are operating your AT-11 where a lot of vibration may compromise your solder joints.

Front-panel switch S1 controls the +12 volts sent to the relay driver chip, pin U3-1. We need to wire this switched + 12 volts to both the K18 and K19 coils so that they are energized in the ON position, and the RF path is connected from the common pin to the normally-open pin of each relay. Then in the OFF position, the relays relax to their normally-closed positions, and the RF path reverts to the RG-58 bypass link (about ten electrical degrees long at 30 MHz).

By the way, S1 does not control the +5 volt rail on the circuit board. The +5V is always on when the external AC adapter is plugged into J5, regardless of the position of S1. In other words, it is a bit misleading to call S1 the "power" switch, since it only controls the relay coil voltage. The microprocessor chip detects the state of S1 via U1 pin 44, and enters a "standby" mode when it senses that S1 is in the OFF state.

It is important to remember that the microprocessor will set relays K1 through K17 to the last remembered positions when S1 is placed in the ON position. Thus when making comparative impedance measurements, modified bypass versus un-modified bypass, be sure that you don't have a couple of relays energized that aren't supposed to be energized. In the original unmodified bypass condition, K1 through K17 should all be relaxed or un-energized. In the modified bypass condition, the positions of K1 through K17 don't matter.

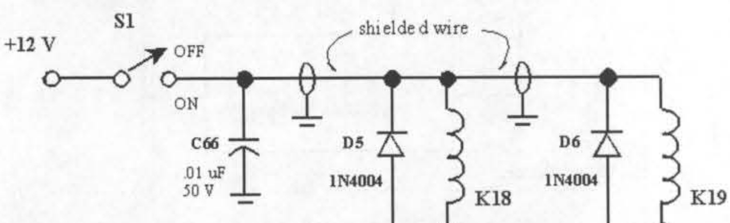


Figure 3. Relay coil connections

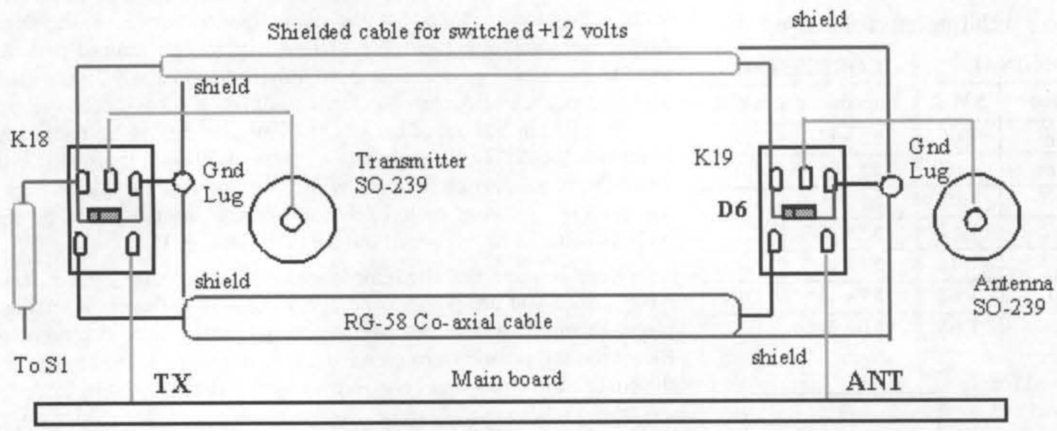


Figure 4. Physical Layout of Rear Panel

Of course when working on the AT-11, be sure to disconnect the power. In order to minimize inductance, use short lengths of 12 AWG solid copper for the relay RF connections (**Fig. 4**), especially since they will now be longer than the original buss. You will have to mount K19 higher on the panel than K18 in order to avoid the larger toroidal coils on the right side of the AT-11. But don't get too close to the top aluminum cover plate! Use a shielded cable to bring the switched +12 volts from the upper terminal of S1 to the coils of K18 and K19. And be sure to add a transient suppression 1N4004 diode across each relay coil per **Fig. 3**. It is also a good idea to add an RF bypass capacitor (C66) at S1 to reduce the RF picked up by the new circuitry that may otherwise get onto the board's +12 volt rail. You may wish to add the same value capacitor across the two diodes, to prevent them from rectifying any RF. Be sure to ground each end of the RG-58 shield to a lug on the closest UHF connector. Do the same for the +12 volt cable. Route the new cables carefully along the sides of the chassis so as not to interfere with the proper operation of the RF components in the box.

If you would like to reduce the insertion SWR even more, you can experiment with a shunt mica capacitor placed from the normally-closed terminal of K18 to ground, depending on the input impedances. The impedances must have some inductive reactance for the capacitor to work with, such as in Table 1. This technique would not work with the impedances listed in Table 2 because they are already essentially resonant. The best value for this shunt capacitor will depend on the length of your RG-58 and your RF buss wires, plus component placement, which will vary from one builder to the next. The impedances you measure will determine if you can use the shunt capacitor approach. Be sure your test load SWR is less than 1.02 at all frequencies of interest. A good starting value for your experimental capacitor is 15 pF, 200 Volts.

I have a new Windows98 RF Design program demo available for download from the Internet, with many of the impedance matching functions enabled. This program will save you a lot of time if you plan to get the best possible SWR out of any box. See **Notes** below for details.

The reason a shunt capacitor is preferable to a series capacitor in this case is the fact that the reactance of the capacitor will be higher at the lower frequencies, so it won't compromise an SWR that is already low. In other words we would like the capacitor to be invisible if the input impedance is already 50 + j0 Ohms. You also may be wondering what effect the shunt capacitor will have on the input resistance. Fortunately, small values of shunt capacitance tend to affect the input reactance more than the resistance. So if our resistance is fairly close to 50 Ohms to begin with, a shunt capacitance is ideal for tuning out inductive reactance in a load and bringing down the SWR. Again be sure that your impedance measurements are valid and that your test load is very close to 50 Ohms resonant before embarking on the shunt-capacitor experiment.

When properly installed, this shunt capacitor will only appear across the input to the AT-11 in the bypass mode. Note that the Table 1 SWR at 35 MHz will be degraded by a shunt capacitor because there is no inductance in the corrected input impedance (60 + j0 Ohms) at this frequency. But since the 10-meter ham band stops at 30 MHz, this is a moot point. The AT-11 is not rated for operation in the six-meter band. Don't take a chance on a capacitor with a low voltage rating. At 150 Watts, the peak RF CW voltage that will appear across this capacitor is about 100 Volts when the load is 50 Ohms resonant. However, the voltage can be considerably higher when the load SWR is higher, so a 200-Volt capacitor is recommended.

Consider the simple example of an 8 inch length of 12 AWG buss wire about one inch above ground (**Fig. 5**). This looks like a 200-Ohm transmission line, which looks approximately like a 0.14 ìH inductor for electrically short lengths of line. Table 3 tells us that we can tune out the reactance of this inductor by placing a 39 pF capacitor in shunt, with only a minimal effect on resistance. Of course, the buss inductor is correctly modeled as a transmission line, hence the 50-Ohm load resistance is transformed per the "original impedance" column in Table 3. Then when we add the 39 pF in shunt at the input to this buss, we see some additional input resistance transformation, but this is secondary to the input reactance change insofar as the SWR is improved.

Table 3. Effects of A 39pF Shunt Capacitor on a Series Inductance

MHz	ORIGINAL			CORRECTED	
	Impedance	SWR	Capacitive Reactance	Impedance	SWR
5	50.0 + j4.0	1.08	- j816	50.3 + j0.9	1.02
10	50.1 + j8.0	1.17	- j408	51.3 + j1.6	1.04
15	50.2 + j12.0	1.27	- j272	53.0 + j2.1	1.07
20	50.3 + j16. 0	1.37	- j204	55.3 + j2.3	1.12
25	50.5 + j20.0	1.49	- j163	58.4 + j1.8	1.17
30	50.8 + j24.0	1.60	- j136	62.1 + j0.5	1.24
35	51.1 + j28.1	1.73	- j116	66.5 - j1.9	1.33

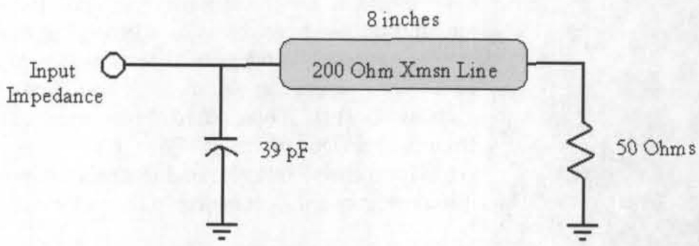


Figure 5. Configuration used with Table 3

This shunt capacitor technique is mentioned as a tutorial exercise, and may not be applicable to your situation in light of Table 2. I included this technique in the article in order to point out that very careful impedance measurements and a very good test load are necessary for this kind of work. If you don't have the right impedance data, you could be wasting your time adding shunt-compensating capacitors here and there. The only thing worse than no measurement is a bad measurement.

You may need to re-adjust calibration components C1, R9 and R10 on the main board after you have modified the AT-11, especially if the automatic tuning does not start at the same SWR that triggered it before your modifications. Don't forget to install the RF bypass capacitors with as short leads as practical. Just to be sure the capacitors you are using are effective at HF, measure their impedance at 30 MHz. If the resistance and reactance are greater than a few Ohms, try a smaller capacitor.

One final reminder: since the overall current requirement will increase with the added relays, be sure that your 12-Volt DC power supply is rated to handle the heavier load. The original 400 Ohm relay coils do not require much current (about 30 mA at 12 V), but if you use a different relay, especially one out of the junk box, you may wish to measure its current draw when connected to a 12 Volt supply. Also, keep in mind that typical AC adapters labeled as 12 VDC run at 14 or 15 Volts when lightly loaded.

Parts List

Qnty	Part Number	Description
3	C66 C67 C68	.01 ìF 50 Volt capacitor for RF bypass and transient filtering
2	D5 D6	1N4004 diode for relay transient suppression
2	K18 K19	small SPDT relay with 12 volt DC coil for switching in the RG-58 bypass link
8 inches		RG-58
14 inches		small-diameter shielded cable to provide the switched +12 V to the relays

Notes

Visit the following web site for a free copy of the Windows98 KM5KG RF Designer demo: www.qsl.net/km5kg

LDG has a web site at www.ldgelectronics.com

LDG can be reached by e-mail at ldg@ldgelectronics.com

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1. Grant Bingeman, *Transistor PA RF Output Power vs. Load Impedance*, April 2000 **QRP Quarterly** – this is about the MFJ 9410 10-meter SSB transceiver.

2. Grant Bingeman, *RF Output Power vs. Load Impedance*, Feb 1999 **Radcom** – this is about the MFJ 9420 20-meter SSB transceiver.

Grant Bingeman is a Lead Engineer at Continental Electronics in Dallas, Texas.

Edited by W1HUE

Profiles in QRP —

Rich Arland, K7SZ
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In this installment of **Profiles in QRP** we'll chat with Joe Everhart, N2CX, a long time QRPer, and prime mover in the New Jersey QRP Club. Joe was recently inducted into the QRP ARCI Hall of Fame. He presented a very interesting paper on his homebrew 10 meter monitor receiver at Atlanticon 2000 in March. His engineering talents are constantly being used to further the technical side of our hobby.

QQ: Welcome, Joe. Please give our readers a brief history of your ham radio career.

Joe: I was first licensed as a Novice in 1960. I was always building simple one tube transmitters of the 6V6 or 6L6 variety, running only a few watts. Since I'm convinced that homebrewing is the best part of ham radio, these simple circuits allowed me to undertake the radio hobby at minimal cost while honing my building skills. I have always run at or near QRP power levels (except for a couple of years when I backslid using a Johnson Viking Valliant at the 100 watt level!) so QRP has always been in my blood, so to speak. I got serious about QRP and joined the QRP ARCI in 1964 (#169) back when it was a 100 watt club.

QQ: Well, Joe, this is customarily the point I ask what drew you to QRP, but you have pretty well answered that question. Any other comments you'd like to make egarding your entry into QRP?

Joe: Yes, since I love to build rigs, I became excited at the possibilities of building portable, battery operated radio gear when transistors became popular in the late 1960s. Since early transistors were not capable of medium or high power, we were limited in what we could produce as far as RF output was concerned. This was just fine, as far as I was concerned. I started building small solid state QRP rigs and haven't looked back.

In addition I am now experimenting with microcontrollers to build intelligence into QRP rigs. I enjoy taking my QRP hobby on the road with me and camping using minimalist radios.

QQ: Tell us a bit about your professional credentials.

Joe: I am an Electrical Engineer and hold a Masters Degree in Computer Science. I have been involved with 2 way commercial radio and military communications for many years. Currently I am working on the Bradley Fighting Vehicle Mobile Command and Control (C2) system, which is fascinating work.

QQ: It's obvious you really enjoy homebrewing. Do you chase DX or contest? What are some of your other interests within the ham radio hobby?

Joe: I'm a casual DX er. If I run across a DX station I'll work him, but I don't go out of my way to cruise the bands looking for the new one. Contesting is another matter. I love to work QRP contests. I enjoy getting on and giving out points and working the other folks on the air. It's even more fun when I use homebrew gear I've designed and built myself. I think antenna experimentation is a lot of fun, too. Nothing beats building and using a minimalist station and that includes the antenna. As I mentioned before I enjoy camping and really love to operate ARRL Field Day and the QRP To The Field sprints that are held several times each year. I also love to write about my exploits in building and share these with other QRPers.

QQ: Speaking of your writing, most of the folks reading this will recognize your name and callsign from the by-line on the **Tech Topics and More** column in each issue of the **QRP Quarterly**. How did this column come about?

Joe: Over the last few years I'd written a lot of "**Joe's Quickies** for the **Idea Exchange** column. I was asked to expand this into a test equipment and procedures column. I have a lot of commercial lab-quality test gear at work. However, at home I am limited in my test gear. It became evident that the vast majority of ham radio operators and homebrewers are just like me, and do not have access to a bench full of quality test gear. At the same time, we all need to do some testing, troubleshooting and circuit evaluation. **Tech Topics and More** evolved from my previous offerings allowing me to develop inexpensive test gear and test procedures that most hams can accomplish in their shacks.

QQ: Do you think you'll ever run out of column fodder for Tech **Tech Topics and More**?

Joe: Not a chance. I have a notebook with over fifty pages of ideas and topics that I'd like to explore. This is the classic case of too many topics and so little time .

QQ: Tell our readers about your other radio related passion, Gusher Antennas.

Joe: Well, this goes along with my passion for homebewing and antenna experimentation. I have to confess that I stole the idea from Fred Turpin, K6MDJ, who came up with the Bic Flamethrower antenna which used a discarded Bic lighter body for the center insulator/feedpoint, RG-174 coax and very light weight wire for the dipole elements. Since I always like a play on words, I adopted PVC pipe fittings for use as the center and end insulators and named my antennas "Gushers". Each antenna is less than one pound in weight and this includes the feedline, insulators, dipole elements and BNC connector.

There are several models: the Gusher Classic is a 40 meter dipole that can be used on 40 or cut for any band between 40-10 meters. Then comes the Gusher High-Bander which is a 20 meter dipole which can also be cut for any band from 20 to 10 meters. The Gusher 2L has a feature where the dipole elements can be detached from the center insulator which allows you to have several dipole elements cut for different bands, making it a multiband antenna. I have recently added the Gusher 2B which is a dual band antenna. It can be configured for any two bands between 40 and 10 meters. You must specify which two bands you want when you order.

The Gushers are designed to be used as inverted vee antennas or slopers. It is acceptable to hoist one end up into the top of a tree and terminate the other end near the ground, erecting a sloper. This is especially useful for added gain in a favored direction. The antennas have about 30 feet of RG174 coax terminated in a BNC connector (the current favored RF connector of homebrews). RG-174 is lossy but for a run of only 30 feet, the losses are tolerable up through 10 meters.

QQ: I mentioned at the start of this interview that you were recently inducted into the QRP ARCI Hall of Fame at Dayton this year. How do you feel about this honor?

Joe: GREAT! I am both thrilled and humbled at the same time. It is an awesome honor to be thought of in the same context as some of the truly great people who have advanced the QRP hobby over the years. This is the kind of feedback that makes me want to do more for the QRP hobby.

QQ: Where do you think the QRP hobby is headed?

Joe: There is a surprising momentum within the ham radio hobby right now. I know for a fact that the Internet and e-mail has been instrumental in helping QRP grow. In the past (before the internet) if you had a problem, you wrote to someone at the magazine, and waited for their reply. Now days, you can solve problems in minutes or hours that would have taken months in the past. This is a great way to do business. It brings QRPers together and makes for a more cohesive hobby.

I also see the trend developing where microcontrollers and digital circuitry are being implanted into QRP rig designs to greatly improve the operational convenience and overall performance of the radio. I think that this trend will continue to grow. In effect, QRP homebrew is sort of "retro" with a digital twist. We see lots of good rig designs coming off the drawing boards. This coupled with new modes like PSK-31 and frequency hopping techniques, using commercial off-the-shelf chips, will make for some interesting times in ham radio.

QQ: I know that you are heavily involved with the New Jersey QRP Club. Give our readers a run down of your take on regional clubs.

Joe: Until recently, the QRP ARCI had been the only QRP organization available to many stateside QRPers. With the advent of regional clubs, QRP has entered a new era. Regional clubs allow QRPers within a geographical area to get together on a regular basis, share thoughts and ideas, troubleshoot problems and plan operating events and club projects. In addition, as with the NJ Club, we have come out with some really neat, inexpensive kits that help folks get started in homebrewing. **QRP Homebrew** is a quarterly publication from the NJ Club and focuses entirely on homebrew projects for QRPers.

QQ: I've put this question to everyone I've interviewed todate, so I might as well ask you: Do you think that the ARRL needs to offer a QRP endorsement for their DXCC program?

Joe: ABSOLUTELY!! QRP DXCC is a monumental undertaking and it should be recognized. If the ARRL can't verify if someone uses 10 kilowatts why worry about someone using 5 watts or less? A QRP DXCC endorsement would encourage participation in one of the fastest growing areas of ham radio: QRP.

My thanks to Joe Everhart, N2CX for taking the time out of his busy schedule to do this interview for **Profiles in QRP.**

Till next time . . . 73, Rich K7SZ

Adventures of a Displaced Cajun in Maine

Joel, KE1LA (ex WA5CVM) *email: hamjoel@juno.com*

High Y'all, it's me again. It be August now and we done Take to the Field, Fielded the Day, SSBed the QRP Sprint and managed to stay alive doing it... 'course now we done got a K2 along with my QRP++ to work the world with, so we be in "high cotton" up heah!

U kneaux on July 19, me and my Cajun belle celebrated our anniversary. We gone went to a movie and dinner and had a good time... when we got ourself home, I went to check on the guineas (got six guinea pigs) and thar was Pepper laying in front of the cage... she was sleeping the eternal sleep of the silent key...

Boy did I got myself upset... I cried like a baby, got my nose to running. Pepper was the picture of health when we went out to celebrate... a pretty grey color...she was strong and one of the brave ones and boy she done got into everything, given half a chance.

I used to brought her upstairs to my operating bench and let her ham along with me. She would sit back and watch the SSTV picture form on the computer screen and just oink and oink. On CW she got to where she could recognize my call sign and just make all kinds of racket when she heard it...sometimes she would roll on her back and run with her feet in the air and just oink away...

She quickly learned where the message key on the K2 was and would push it with her nose and go wild when my call sign was sent.... she even recognized my call when someone answered the CW CQ. We really had a good time with pepper...one night she got to playing with my key and learned how to send either dots or dashes. She would take her paw and hit the key and just oink away.... as the side tone whistled out the dits or dahs.

Course , every now and then she would eat through the keyer cable or Mic cable and my tuning knob has some gnaw marks on it... however I kept things outta reach and we had some good times....'course when she got sleepy she would crawl under my T-shirt and go to sleep.

U kneaux the strangest thing done happened... a coupla nights after pepper passed on, I was looking out the window towards Louisiana... that's south west from Strong, Maine... and I saw a star I hadn't seen before. A little one it was, about half way up the horizon. I reached over and pushed the auto CQ buttons on the K2 and looked out the window again...and u kneaux that little star started blinking like crazy when my call sign was sent... sheaux nuff... each time my call was sent or someone sent my call that little star would just blink away.

If I saw the little star blinking and couldn't hear my call I used the RIT and sheaux nuff someone just off frequency was calling me. Finally I bit the gator...I looked out at that little star and said "Pepper"... u done thought a mama gator done caught me on her nest... that little star just started blinking and blinking!

So now when I work CW on a clear night and can see that little star to the SW I watch it blink each time my call is sent or when I whisper "Pepper".

U might want to check the night sky for that little star and iffin u think u see it, just whisper "Pepper" or send my call KE1LA. If it blinks, that's Pepper...

Y'all be good now! . . .From a Displaced Cajun in Maine.

The NoGa Twin Tube 80 Transmitter

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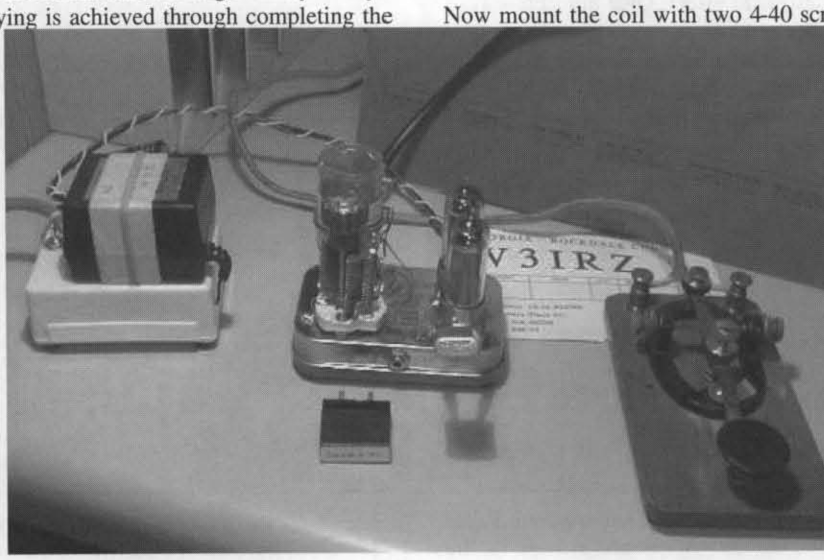
In the North Georgia QRP Club, we are always kicking around ideas for new rigs and kits. For some time there has been an expressed interest in some kind of tube transmitter. Simple in design and using a minimum of parts, it should be something that every QRPer could build regardless of skill level. The NoGa Twin Tube 80 was designed to meet such needs and uses a pair of 6AR5 tubes (see note for availability) that can produce 1.5 watts on 80 with a simple 150 volt power supply. Upping the plate voltage to 250 will produce 7 to 10 watts. This transmitter is constructed on an Altoids tin and safely contains all voltages (except RF) within the tin. Two tubes are used in parallel in order to pull enough current to produce over 1 watt with the transformerless B+ supply. For the circuit, a crystal controlled colpitts oscillator was chosen because it works so well with the 6AR5 pentode tubes. A capacitive voltage divider feedback arrangement is used across the crystal. A 3579 kHz crystal is used to check in with the boat anchor bunch and in the basic package; we eliminated the crystal socket in favor of clip leads to accommodate the large variety of crystals we might run across. Keying is achieved through completing the cathode circuit. The plate tank circuit is parallel tuned and the high voltage is kept off the tuning capacitor (and the top of the chassis) by using the .01 uf capacitor in series. RF output is via a 4 turn link on the middle of the tank coil and the link can be slid down the tank coil to reduce the power if desired.



A word of caution here - *This unit was designed so it could be built easy and cheaply. It does however require you to recognize certain potential voltages in a transformerless design. Every effort has been taken to insure that shock does not occur. However, if you do not understand where in this circuit that potentially harmful voltages could occur, we suggest you review your construction with an experienced builder before you "fire it up." Safety has been taken into account and if you follow these instructions, there is nothing unsafe about this unit. For complete isolation of voltages (although there will still be harmful voltages present inside the rig) from ground, an isolation transformer should be used.*

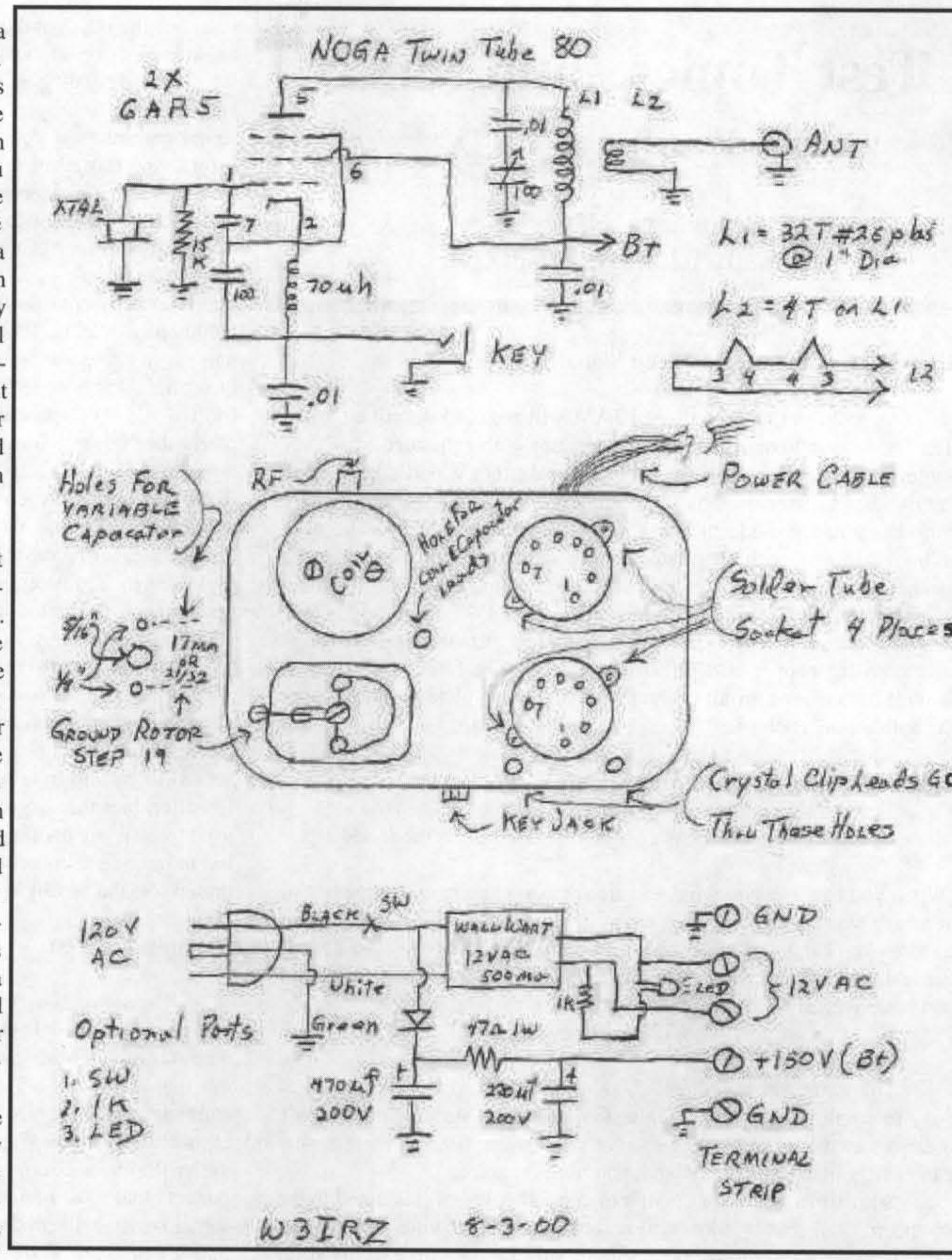
Construction Thoughts - You should start your assembly by preparing an Altoids tin by removing the hinged lid carefully. Set the lid aside as all parts will be mounted on the bottom and the tin will be used face down. This is to give room for the key jack and the RF connector on the edges of the tin. Using a chunk of 2x4 wood to support the metal, start punching the holes with an awl or ice pick from the outside. The holes may be enlarged with increasingly larger sizes of phillips screwdrivers and by using the needle nose pliers to open the tube socket holes. Possibly one could use a Dremel tool to cut the holes with one of the rotary files. The punched holes are actually stronger because of the rolled metal on the front and the rear. Note the pin position of the tube sockets then scrape the paint from the Altoids tin where the mounting ears contact the metal. Using a solder gun or larger iron tin those 4 areas where you scraped the paint off. Then tin both sides of the tube socket mounting ears. Now solder the tube sockets in place. Take two screws and mount the variable capacitor. Mount the key jack and the RF jack.

Winding the Coil - Now wind the coil. Start with a "narrow" pill bottle about 1 inch in diameter and two inches or more tall and drill two holes in the bottom, one near the bottom on the side and one near the top on the same side. If there is any gummy label residue on the bottle, you might want to clean off with paint thinner. Now pass about 4 inches of wire into the lower side hole and through one of the bottom holes. Wind 32 turns around the bottle in either direction. This will take about 11 feet of 26 gauge wire. Pass back through the hole near the top and then down through the other bottom hole. You should now have a very neat coil with two wires coming out the bottom. Put a strip of masking tape around the middle of the coil. Now take two feet of wire and wind 4 runs on the middle of the masking tape. Twist the ends 3 or 4 times to keep the wire in place. This is the RF output link coil. One end should be 2 inches and the other end will be 4 inches. Now mount the coil with two 4-40 screws and nuts orienting the wire leads toward the tubes.

The bulk of the wiring is now done below the chassis. Since this is an 80 meter rig, nothing it is really that critical and it is supposed to oscillate anyway! All the tube pins are jumpered in parallel except pins 3 and 4 - the filaments are wired in series. Remember that under the chassis the pins are numbered clockwise.

Power Supply - The power supply should be built inside a plastic box to prevent exposure to AC and high voltage. A wall wart is used to supply the 12 volts needed by the series connected tube filaments and due to the weight should be tied down with a tie wrap or clamp. The capacitors should be tied down with lacing cord, string or tie wraps. All wiring can be done point to point. Use a 3 wire power cord with safety ground or this design will not work. (Ed. Note: To insure that your house wiring is connected correctly, place a neon bulb and series resistor (220k) between the black wire and the green wire in the power supply. If this bulb does not light, the rig may not work and your house wiring is defective, possibly dangerous.) The terminal strip should be inside the plastic box used to house the power supply (see diagram). Only insulated wire should be run from the power supply to the rig with no exposed connections. Do not plug in the crystal or tubes for the initial test.

Testing - Test the power supply by plugging it in and measuring the voltages at the terminal strip. Disconnect power. Let the filter capacitors discharge; it will take several minutes! Wire the cable to the power supply and plug in the AC cord. Now check the transmitter for +150 volts at the B+ bus. Also, check for 12 volts (AC) from pin 3 to pin 3. Again, disconnect and let the caps discharge. If all is OK, install a crystal and plug in the tubes. There is only one adjustment in this transmitter, the air variable. Connect a wattmeter and dummy load to the output jack. Connect a key, press the key and adjust the capacitor for maximum power on the peak. Use the point of maximum of capacity for this setting. You may also note a peak near the minimum capacity. This is a 40m output. The rig will work on 40 meters with this method. (Close attention should be paid here - the rig may chirp as not all 80m crystals enjoy working in this mode and you may be out of band. A 40m crystal could be used, of course. - Ed.). Operating with the variable cap open on 40 meters will produce a significant 20 meter output so be sure to use an antenna tuner tuned to 40 meters. A better way would entail removing 1/3 to 1/2 of the coil turns (and 1 or 2 link turns) for 40 meter operation. Back to 80 meters, you should see about 1.5 watts output. Now go look for boatanchor users on 3.579 MHz knowing that you rolled your own and are doing it the thrilling way on QRP!



Some notes on Safety—If your house is not wired with grounded outlets then you will definitely need to use an isolation transformer here. You will also have to connect the wires in the power supply to the "white" wire instead of the "green" safety wire. However, if grounded outlets are provided, then there is no need for an isolation transformer. Let me explain. The use of a 3 wire power cord is a tremendous safety device. First, the round pin (and green wire) is connected to the household ground and the radio chassis. The other two wires are tied direct (soldered) to the two pins of the wall wart which is mounted inside the plastic cabinet/box. This wall wart provides the 12 volts AC for the tube filaments. Now for the HV, a diode is wired from the black wire on the wall wart to the positive side of the electrolytic filter capacitor. The negative side of the filter capacitor goes to the green and chassis ground. Yes, this will put a bit of current into the ground wire (about 40—60 ma.) when the key is closed so it is not serious, but it may be considered by some to be a violation of the electrical code. Is it safe? Absolutely! The code is designed to make wiring safe for the "masses" and this design is safe. But that does not mean that there are not other safety arrangements. Perhaps others will write in with their preferred method of using rigs in the transformerless mode.

One last suggestion - Go to your electrical box, take a screwdriver and remove the cover. Inside you will notice that the white wires, green wires and bare wires are all tied to the same ground buss bar as well s the service ground. Before you reattach the box cover put a rubber mat on the floor, put on rubber gloves, get a large well-insulated screwdriver and tighten all the screws that have wires attached. **BE CAREFUL!** I have never found a box with no loose screws, usually at least half are loose. As they did not loosen with use, then they were not tightened by the installer! Just think of all the radio noise that you have just eliminated. If you read the NEC, go to article 250-21(c) where it talks about temporary (ground) currents (only during key down for us) not classified as objectionable currents (intentional for us) but performing the intended safety grounding function. This description may very well make this totally within the code! In any event, please exercise caution in construction and have an experienced ham check your work if this is at all unfamiliar to you. And now to the shack for a little "glowbug" QRP operating.

Edited by W4QO

Note: a set of two new 6AR5 tubes may be ordered from NoGa member Dave Meadows, K4LDI, 2920 Shillingford Ct., Marietta, GA 30067 for $6.00 postpaid. Please include an address label with your request.

Test Topics...and More

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A Low-Level Calibrated RF Test Signal Source

As promised last time this TTAM will begin to describe the design for a crystal-controlled signal generator with calibrated low-level outputs. This project is sufficiently complex that it will take several installments to handle. This time around we will discuss the overall philosophy and provide the basic crystal oscillator circuit. The next column will deal with attenuator details and calibration. In addition, mechanical construction details will be in the Joe's Quickie in Mike C's Information Exchange column in the next QRP Quarterly. The overall enclosure and internal shielded compartments will be constructed using copper clad pc board material. The future Quickie will provide dimensions for all of the pieces and a complete outline of how to duplicate the enclosure.

Coming To Terms – Calibration

A favorite quote that has always impressed me is the following:

"When you can measure what you are speaking about, and express it in numbers, you know something about it. But when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind. It may be the beginning of knowledge but you have scarcely in your thoughts advanced to the state of science."
William Thomson, Lord Kelvin, 1824-1907

This expresses how I feel about testing and shows the philosophy I try to employ when designing test equipment. Measurements don't mean an awful lot other than to give you "warm fuzzies" unless you can exactly quantify exactly what you have measured.

Sometimes it's good enough to know that your rig is tuned to the 40 meter band, but to stay legal and to be sure that you can find the QRP frequency, you have to be able to tell exactly where in the band you are tuned. As mentioned in an earlier column, this requires precision of measurement to tell that you are at 7040 kHz and not 7030 or 7050 and it also requires that your measurement is accurate enough that the 7040 ***you*** measure is the same 7040 that everyone else does. You arrive at this accuracy through calibration or making sure that you adhere to a frequency standard that is the same as everyone else's.

Another example comes from real life. (As opposed to ham radio!) You want the radar gun the police use to monitor your car's speed to read the same as your speedometer. If there's any disagreement in calibration you know who loses...

Back to the topic on hand. Getting good frequency calibration is quite easy these days. You either buy a well-calibrated frequency counter or calibrate it yourself using a reference from a GPS receiver or one of the WWV stations. Of course you ***do*** recheck your calibration periodically, don't you?

Other electronic parameters are not quite so easy. Devices such as the AADE L/C meter (ref 1) and RF analyzers from MFJ and Autek (refs 2 and 3) make SWR and LC easy to handle. And similarly we can buy inexpensive digital multimeters that measure DC and audio frequency voltage and current and DC resistance. But when it comes to RF voltage, things get more interesting. Simple RF detector probes are quite usable with the DMMs for RF voltages on the order of several volts but the inherent 0.2 volt or more forward drop of ordinary diodes cause large errors at low RF voltages (ref 4, 5).

This difficulty in accurate low-level RF measurement makes it very difficult to properly calibrate the milli-and micro-volt outputs of signal generators if you do not have access to a $20K+ spectrum analyzer. And those low levels are exactly what you need to work on receivers. The signal generator described in Designed For Test this time and next will tell how to build just such a signal source with very little in the way of fancy test equipment.

An example of just how fussy things can be in calibration can be appreciated by considering how a simple voltmeter is calibrated in the commercial world. To begin, the standard volt is defined on an internationally agreed-to standard based on measurement of fundamental quantities. Each major country then has its own national standards (in the US it's the National Institute of Standards and Technology, formerly the National Bureau of Standards) traceable back to the international standard. This, in turn is used to certify secondary voltage standards maintained by commercial calibration laboratories. These for-profit companies use their secondary standards to calibrate individual voltage measuring devices (voltmeters or digital multimeters for example) used by equipment manufacturers. And finally those manufacturers use their calibrated meters to calibrate the products they make and we homebrewers buy.

Now every step in this calibration chain adds a bit of uncertainty. So you can see that since errors propagate down the chain and there is no corrective mechanism, each calibration operation must be done very carefully to maintain overall accuracy. How this is done is far too involved to go into in this column but a small flavor of it can be derived from the fact that a good rule of thumb is that when done device is used to calibrate another (or to check calibration) the "standard" device has to have an accuracy 10 times the accuracy of the device being calibrated. So that's why it's tough for you to do in your home workshop!

Designed For Test

The signal source is intended for receiver measurements. It will be operate on a single crystal-controlled frequency and produce known output levels. Those levels will be sufficient to do a very strong signal, one that is S-9 and S-3, respectively, into a 50-ohm load. The goal for calibration accuracy is 3 dB, which is quite entirely satisfactory for homebrew purposes. This accuracy will be gotten by means of conservative design and some (I think) clever use of test equipment and components that most homebrewers already have on hand. In addition the signal source will produce no off-frequency harmonic or spurious outputs greater than 30 dB below the desired output.

One downside is that it will operate on a single frequency and you will have to obtain a crystal for that frequency. Of course QRP-frequency crystals are commonly available so this should not be difficult. And the output levels will not be adjustable. However you should be able to set them to almost any (preset) voltage close to the design values by tailoring components and calibration methods yourself.

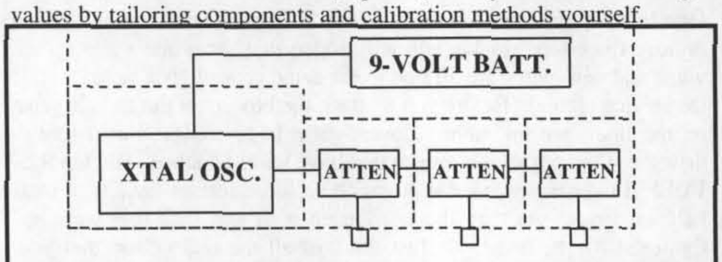

Figure 1—Signal source block diagram shows 2 levels of shielding

Figure 1 shows the signal source block diagram. A crystal-controlled oscillator generates a signal at about 0 dBm (about 224 mV) which is attenuated to the desired levels by means of cascaded resistive voltage dividers. Note the dotted lines around the oscillator and attenuator sections. Each is individually shielded from each other and a second level of shielding isolates each from the outside world. Note also that the 9-volt battery used for power is also within the outer shielded compartment.

This may seem like overkill until you realize that the total attenuation required is nearly 120 dB! Using nested shielded boxes nips any leakage in the bud so that special-purpose equipment and techniques are not needed to make an easily-reproduced low-level signal generator. The idea is an extension of a "low-level RF source" described in Ref 4 and is probably attributable to Wes Hayward, W7ZOI.

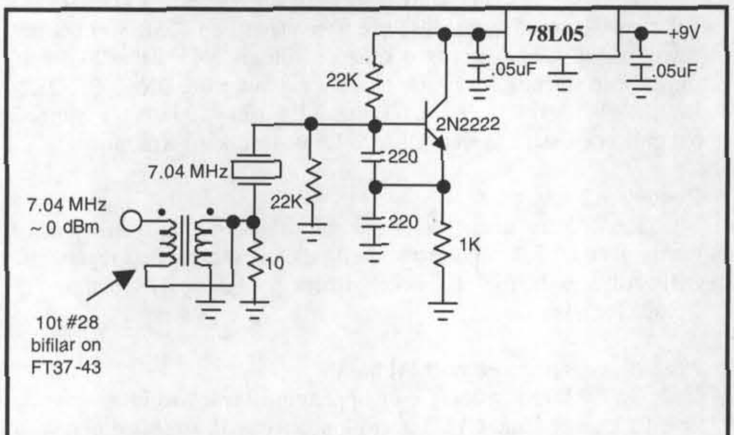

Figure 2 - Signal source crystal oscillator

Figure 2 is the schematic diagram of the crystal oscillator. It uses the familiar "crystal colpitts" type circuit but derives a very clean output waveform in an unusual manner. Note that the output is obtained from resistor in series with the crystal! This elegant "trick" uses the high-Q crystal itself to filter out noise and harmonics from the oscillator signal. It is described in Reference 6.

Component values are given for 40 meter operation. To use on other frequencies change the quartz crystal and scale the 220 pf feedback capacitors by frequency. For 80 meters use about double the capacitance shown and for 20 meters use half. Resistor values given are a good starting point though they may need to be changed to obtain the proper RF output voltage as will be described in the next column.

A sample layout is provided in Figure 3. The components intentionally ***not*** labeled so that you will have to identify them yourself. Construction is done in the so-called Manhattan style or as I called it "PC Dots' in a Joe's Quickie back several years ago. The open layout is fine for the purpose especially since the final project will be enclosed entirely in a shielded box.

So you can get a good head start on the final project if you build up the crystal oscillator ahead of time. What's more the very clean oscillator is a fine project by itself even if you don't use it for the low-level signal generator.

Stimulus and Response

To make room for the project started in this column, this section is being postponed for a couple of issues. If you have questions please send them to me at n2cx@voicenet.com or my snail mail address:

Joe Everhart
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Brooklawn, NJ

I will endeavor to answer the questions personally though the responses probably won't appear in this column for a while. Your questions are important to me so please don't hesitate to ask!

References:

1. Almost All Digital Electronics web site - www.aade.com
2. MFJ web site - www.mfjenterprises.com
3. Autek Research web site - www.autekresearch.com/
4. Test Equipment chapter of "ARRL Radio Amateur's Handbook"
5. Test Equipment chapter "Solid State Design for the Radio Amateur" by Demaw and Hayward
6. "Digital PLL Frequency Synthesizers – Theory and Design" by Ulrich Rohde KA2WEU

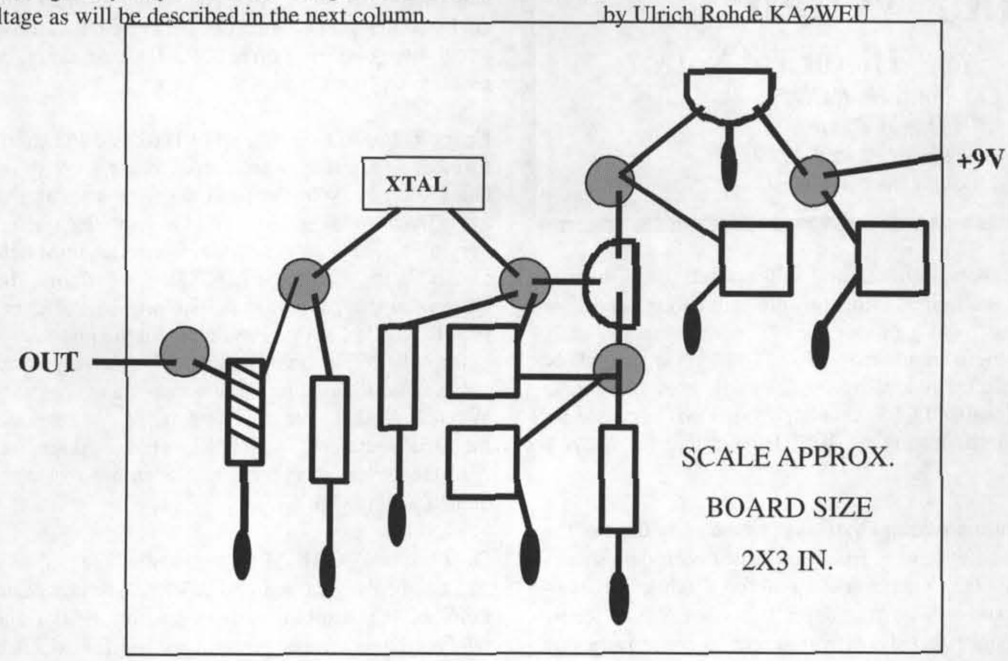

Figure 3 - Sample layout for crystal oscillator

Adventures in . . . Milliwatting

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In January 1999 I was so impressed with how well milliwatts were working that I decided to try and get my DXCC with only milliwatts. Band conditions in most of 1999 cooperated pretty well with my efforts, and my DX'ing was fruitful. Conditions so far in 2000 have been disappointing for the most part. But still there has been some progress in the road to my 100 DX stations. I just received a QSL this past week for Clipperton Island FO0AAA, that I worked on 12M CW with 600mW. This is DXCC country number 68, and I'm hopeful that I can get the other 32 by the end of 2000.

Back to Slate Gap Island

In an earlier column, I wrote about my "Goodbye To Summer" expedition's to Slate Gap Island, here in Arkansas. On August 1, 2000, I was able to land there again, and operated for about 1-½ hours. Despite the band conditions, I made three contacts running 1.5w - 700mW. On 15M was HP1AC, Cam in Panama City, Panama. He gave me a 559 with my 700mW. He dropped to 5w and we made it QRPx2.

To qualify an island, on a lake or river in the USA or Canada for the US Island awards program, you need 25 contacts and at least two countries. When I left off last fall, I had 19 logged. My first trip this year resulted in 3 QSO's logged, so I need 3 more to get an official number for Slate Gap Island under USI rules. Once an island has qualified, it will be hunted by island hunters all over the world. And Arkansas is a rare one for island hunters. Its kind of interesting to have DX stations calling you for a contact. And, I'm operating on a beach, and running milliwatts. Can it get any better?

My equipment on these expeditions are a QRP+ and Black Widow 20ft pole/wire vertical with 2 raised radials. I power the station with recycled Nicad "C" cell batteries. The complete story with pictures, is available on my webpage at http://www.madisoncounty.net/~kj5tf/. And in my links page you can click and go to the US Islands website. If you don't have web access, you can contact the program coordinator N9WDQ via CBA.

Russian WW RTTY

The last weekend of July is the Russian WW RTTY contest. The Solar index was 153, but still there were signals on 15M. So I put my newly rebuilt 15M quad to work, along with my old reliable 20M half square wire antenna. I was able to work the following DX: VP5, OK2, LZ2, UW8, T94, F5, YL2, LA7, and XE1 using 700mW. I wimped out only one time, and went QRO to 1.5w to work a VK6 station.

Randy's K2 mW mod

Randy Hargenrader WJ4P has come up with a pretty neat way to get the Elecraft K2 to go down to 10 milliwatts, as well as regular 5w QRP. All with the flip of a switch. I have posted Randy's mod on my website for all to see.

250,000 miles per watt on 12M band

On 7/23/00 FO0MOT on Clippertoin island, was in a light pile up on 12 meter band CW. I heard him very well, so called him with 40mW. He got a partial on my call, and the next time he copied me ok, and we made the exchange. I knew I could do better, so I lowered my power to only 20mW and called him using the Arkansas QRP Club callsign, NQ5RP. Again, he called "QRZ?", and I made the exchange as I did only 17 minutes before with my personal call. The best mileage for 12M band is held by yours truly, for a 12mW QSO with CO8LY in Cuba. That was about 127,000 miles per watt. This new mark, when confirmed, almost doubles my mileage.

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

Remember When . . .

Historical Notes

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Hello again ARCI members! This issue I will scratch the surface of how the club broke it's administration up into "divisions" and how these divisions spawned local groups called "Chapters" in the early days. Of course today there are many localized QRP in the early days. Of course today there are many localized in the early days. Of course today there are many localized QRP clubs or groups that interface for activities. But early in our history we had chapters like the QCWA does.

First, we will talk about the Admin Divisions. In the early days of the club an idea was hatched to elect a Board rep from each call area or Division as it was known. This worked out for a while but was changed when reps could not be found for many areas. It seems throughout our club history that the officers seem to come from one call area. Most of the officers started out on the west coast and later a group on the east coast was in prominence. And so it moved around the country. Several Texans even held the offices for a while. This was done mostly because communication between officers was scarce at best. When most of the officers lived on one coast or another they saw each other more often and communicated in the QRP ARCI nets. As I said in a past column our net system was the only way of knowing what was going on before QRP-L came along, or you had to wait 3 months for your Quarterly.

Chapters began to spring up in 1962 or 1963 shortly after the club was formed. Again they were useful to get a group in an area together at hamfests, etc. While several chapters were active, one chapter seems to really have taken off. The Oregon Chapter seems to have evolved very nicely. I read their little newsletter in March 1964 with great interest. With K7LNS and K7QXG as editors, they covered news of QRPers in the 7th call area. The original name of their newsletter was R-S-T. While I am still trying to put the pieces together, a 1967 Newsletter called "Random Radiation" was very nicely done with some color. The 7th area rep at that time was none other than Howard Pyle, W7OE. At that time, this Chapter or Area newsletter was better than the QRP Quarterly, which was about a dozen mimeographed pages. And they even accepted ads, something that did not come along for quite a while in the QQ.

On a last note, QRP ARCI also had a "branch" as it was called in Australia and New Zealand with a VK/ZL Representative. I can't help but think of the similarities between the 1960's and today. Groups of QRPers have always gotten together for social bonding and the exchange of ideas. As always, if you have any old QRP ARCI newsletters, certificates, etc., could you send me a copy? I will be happy to pay for the copying and mailing. Thank you.

72 Les,K4NK

SOUTH DAKOTA RESONANT VERTICAL
FOR 20-30-40 METERS.

by Ade Weiss, W0RSP *email: aweiss@usd.edu*

The SDRV-234 is a RESONANT ground-mounted vertical for 20, 30, and 40 meters using the popular Black Widow or the SD-20 collapsible "crappie" fishing pole. It employs linear loading to achieve resonance on 30/40 meters where the radiator is shorter than the resonant length for those bands. On 20 meters, the radiator is cut to its resonant length when mounted on the Black Widow pole (see later discussion).

Let me emphasize upfront that the dimensions shown are for a SYSTEM including a MINIMUM of ten 20-ft radials. More radials of equal or greater length can be added for increased efficiency, but going below the MINIMUM cancels resonance and decreases efficiency, especially on 30/40 meters. The efficiency of a ground mounted vertical depends almost entirely upon the number of radials under the vertical (assuming good coax and connections). The purpose of the radials is to provide a low-loss return path for ground currents to eliminate ground loss. Hence, the size of the wire used in the radials is unimportant since the total ground return current is divided among the radial wires. My two earlier articles (QRP Quarterly, October, 1999, pp. 36-40; January, 2000, pp. 20-26) provide lengthy discussions of the function and behavior of radials and can be consulted for more explanation of these basic principles.

Two points should be restated here about the popular kind of radial in which four or five conductors of a strip of computer ribbon are cut to resonant lengths for several bands. Alternately, 5-conductor rotor cable and other kinds of multi-conductor cables have been used in this manner. However, in electrical terms, each bundle of conductors in such a radial functions ONLY AS A SINGLE WIRE, and thus amounts to only one radial wire. Furthermore, none of the conductors are resonant when placed on the ground under a vertical. The claimed functions and advantages of this kind of radial, in a word, are an illusion and a waste of time, energy, and hope.

I should note that the W6MMA Vertical, like the SDRV-234, is a resonant vertical but uses inductive center loading to achieve resonance on 30/40 meters (and 80 meters with the big loading coil). So, if you are using a W6MMA Vertical, there is not much point in switching to the SDRV-234 (but change the length of radiators for 20-10 meters -- see below). If you wish to improve its operation, simply add more real radials to bring up its efficiency. However, if you are using one of the random-wire non-resonant verticals that are supposedly resonated by an antenna tuner in the shack, then a switch to the SDRV-234 is well worth the effort.

Design Theory.

Although the concept of linear loading has been around for a long time, it has found very limited application in amateur radio antennas. A few commercial yagi designs (and a few in the ham literature) with shortened driven elements have used the technique. Shortened dipoles with folded-back sections are the most common application of linear loading.

Linear loading is quite simple. When a section of transmission line is shorted at the far end, it forms an inductance. In effect, it becomes a stretched-out coil with one long "turn". A shortened antenna (i.e., too short for resonance at the frequency of operation) exhibits a capacitive reactance whose magnitude increases as the length of the radiator decreases relative to the resonant length required for the frequency of operation. The shortened radiator can be brought back to resonance by inserting an inductive reactance equal to its capacitive reactance. The reactance is thus cancelled, and resonance is achieved.

In simple terms, the missing portion of a shortened vertical radiator can be replaced by an inductor. The W6MMA Vertical uses a lumped inductance in the form of its "loading coil." The SDRV-234 uses a section of transmission line as its "one-turn loading coil." To vary the inductance of the W6MMA Vertical's loading coil, a shorting tap slides along the coil, determining how many of its turns are in the circuit and hence how much inductance it exhibits. In the SDRV-234 design, a short across the transmission line loading section determines how long the "one-turn loading coil" is and thus establishes its inductance. The total length of the loading section is selected for resonating the SDRV-234 on 40 meters. The 30 meter tap is adjusted to shorten the "one turn coil" to the smaller value of inductance needed to resonate the SDRV-234 on 30 meters. The loading section is shorted at both ends to form the equivalent of a single wide wire which resonates on 20 meters and functions as the radiator.

In general, a linear loading section made from low-loss twinlead has two advantages relative to a loading coil. First, the loading section radiates the energy passing through it, whereas a loading coil does not. Second, the loading section is virtually lossless, whereas a coil always exhibits a minimum of several ohms of loss. However, the efficiency of a loading coil system can be increased by moving the insertion point upward and away from the base of the vertical where the current is at a maximum -- the strategy used in the W6MMA Vertical. In contrast, inserting the linear loading section at the base of the vertical is the most effective use of the inductive characteristic of a shorted transmission line. Since the loading section radiates, possible loss due to high current is not a concern.

Development.

The SDRV-234 was developed as an Elmer project during the winter and spring of 2000. In late 1999, Denny Payton, N9JXY, e-mailed me asking about some vague comments I'd made about linear loading a Black Widow vertical on 30/40 meters. He emphasized that he knew next to nothing about antennas but wanted to learn more as well as end up with an efficient vertical that would be better than the various antennas he had tried. The SDRV-234 would never have reached its final stage without Denny's questions and perseverance. As part of the project, he agreed to keep records of his measurements and experiments.

This is an important aspect of working with antennas which is necessary to establish and track the relationships among the variables that can affect the performance of the antenna. Denny's first step was to get an RX bridge capable of making reactance and resistance measurements which are essential to understanding what is happening as a design goes through its stages of development. Unfortunately, the RX bridge that he borrowed was uncalibrated (no dial scales!), and when he followed my instructions for calibrating it, we found that both the zero reactance "null" point and 50-Ohms resistance point shifted with frequency! Denny's bafflement and frustration were outweighed by his persistence -- his second test session lasted into a cold night in January during which he jettisoned the faulty RX bridge and attempted to adjust the antenna by duplicating my SWR measurements. Actually, he was making good measurements, but because of the un-nullable RX bridge, he ended up feeling that he was to blame and that he was actually dumber than he had previously claimed! This is a very common response for newcomers when their version does not match the published or claimed results. It isn't always the fault of the newcomer! Finally, Denny acquired a calibrated RX bridge and then our measurements matched.

Several unsuspected variables and my "unscientific" approach delayed the project through three stages. During a 1999 Christmas trip to AZ, I worked on 30/20 meters operation (no rig for 40m). However, I used my W6MMA Vertical with loading coil, an 86-in A-section, and B-section radiators still in place! Dumb! So, because of the mutual coupling between the loading section and the various wires hanging on the pole, the dimensions were way off (a 13'8" 20 meter twinlead radiator separated from the pole by about an inch, and a 30 meter tap up 36-in).

My puzzlement led to measuring the twinlead and other 13'8" radiators (wire) without the pole -- they resonated at around 14750kHz! Aha!

The first major unsuspected variable

I had assumed (as does everyone) that the Black Widow and SD-20 poles are electrically inert because they are made from fiberglass. So, theoretically, one should be able to slap a quarterwave wire cut to about 16'6" per formula on the pole and end up with a resonant quarter-wave vertical on 20 meters. This works with a bamboo pole or a 2x2 piece of pine. Not so with the Black Widow and SD-20! That length of wire (of any size) will resonate at about 13.4mHz on these two poles. The key to the puzzle was provided by Jim Duffey (KK6MC/5): the black or gray paint probably contains graphite -- good old carbon, a fairly good conductor! That also explained the second major unsuspected variable -- the degree of mutual coupling between the A-B sections of the radiator and the loading section which detuned the radiator on 20 meters. (Incidentally, the serious detuning effect that results from overlapping wires on the pole is the reason why 15/10 meters cannot be added to the design.)

But time was up, and I sent Denny the faulty dimensions including the length of a 40 meter loading section found the previous summer in a hasty experiment using junk twinlead. Since he was using a clean Black Widow pole (no extraneous wires), he couldn't duplicate my test results! But having gotten a calibrated RX bridge in the meantime and learned how to use it, he went ahead and found loading section lengths for 40/30 meters, but the section wouldn't resonate on 20 meters. The original A-section (86-in) and B-section, left floating, were detuning it!

During a March trip to AZ, I used a clean Black Widow pole and duplicated Denny's results. The final step eliminated the mutual coupling effects -- using a 20 meter resonant length (on the pole) for both the loading section and the A-section. No doubt there are formulae which show why a one-eighth wavelength (on 40 meters) loading section (quarterwave on 20 meters) loads a 20-ft radiator down to 40 meters -- but we'll leave that demonstration to "L.B."! It was a chance discovery suggested by the effect of folding back the too-long loading section on itself. Finally, in late April, Denny's excited email was headed: "Tests--Perfect!" His measurements matched mine exactly. We both had identical antennas electrically speaking except that he was using twelve radials instead of ten. Working with Denny on this project was a really satisfying experience for me -- we were both committed to producing a functional vertical and it was "happy dance" time when the objective was achieved! Then we had a great chat about the antenna and the project at FDIM 2000!

The SDRV-234 Design and Construction

Figure 1 provides the dimensions and band switching details for the SDRV-234. Yes, bandswitching of some kind is necessary in a multiband design. The only way to change a radiator's resonant frequency is by changing its electrical length. That means that a trip out to the antenna is required for changing bands unless traps or decoupling stubs are used. As seen in Figure 1, 20 meter resonance over the 10-radial ground plane occurs at a radiator length of 15'5" due to the loading effect of the paint on the Black Widow and SD-20 poles.

30/40 Meter Radiator. The 30/40m radiator is made from either stranded or solid #18 insulated copper wire. I use one insulated #18 conductor stripped from R.S. #18 stranded speaker wire for the A-section, and a solid insulated #18 wire for the B-section. (#22 is the smallest size that should be used.) The poles actually extend to only about 19'4", so the B-section reaches about 6" beyond the end of the pole -- just feed the excess thru the eyelet after winding it around the last sections of the pole several times; it is then looped around the eyelet and straightened upward (not critical).

The simplest method of making the A-B gap is to strip the conductors away from a 4-inch piece of scrap twinlead. Bore a hole in each end; thread the end of the A-section thru one hole, loop it, and leave the bare end accessible. Thread the end of the B-section thru the other hole, loop it, and leave the bare end exposed. Or, for a more permanent approach, solder an alligator clip to the bottom end of the B-section, leaving the alligator clip lead long enough to reach the bare end of the A-section with some spare length. Switching from 20 meter to 30/40 meter operation, or vice verse, requires dropping the pole to attach or detach the A-B jumper. For 30/40 meter operation, simply connect the A and B sections with the alligator clip. The actual length of the clip lead to make the A-B connection is not critical -- think of adding 2-inches to each side of a 69-ft 40m dipole and you'll see why. Switching between 30 and 40 meters is a simple matter of attaching or removing an alligator clip at the 30 meter tap point.

Loading Section & 20 Meter Radiator. The loading section is made from Radio Shack lowloss foam 300-Ohms twinlead with stranded #18 conductors. The length of the loading section was determined by trimming a 16-ft piece of twinlead a half-inch at a time and taking measurements with an RX-bridge until resonance on 7040kHz meters was reached over the 10 radial ground system. The conductors at the top end of the twinlead are bared, spliced, and soldered to form a permanent short. The addition of more and/or longer radials has a negligible effect on the resonant frequency of the vertical. The SDRV-234 with the dimensions shown has been duplicated in several test models on both poles by myself and Denny Payton using RX-bridge measurements as well as SWR measurements. (The dimensions for cheapie R. S. brown dielectric twinlead and ACE Hardware cheapie twinlead are about the same -- perhaps 2- or 3-inches shorter, at least for the varieties that I tried.) The 30m tap is formed by baring the conductors of the twinlead by carefully slicing away the dielectric around the conductors with a sharp knife or razor at a very shallow angle (to avoid cutting the conductor strands). An alligator clip with jaws spread wide is clipped across the twinlead to short the• conductors. (A loop of bare wire will do in a pinch.)

As seen in the Figure 1 20 meter connections diagram, the A-section of the 30/40 meter radiator is paralleled with both conductors of the loading section to form the 20 meter radiator. The A-section cannot be left unconnected because it will mutually couple into the radiator formed by the twinlead and pull it off resonance. In effect, it will function as a detuning stub when disconnected.

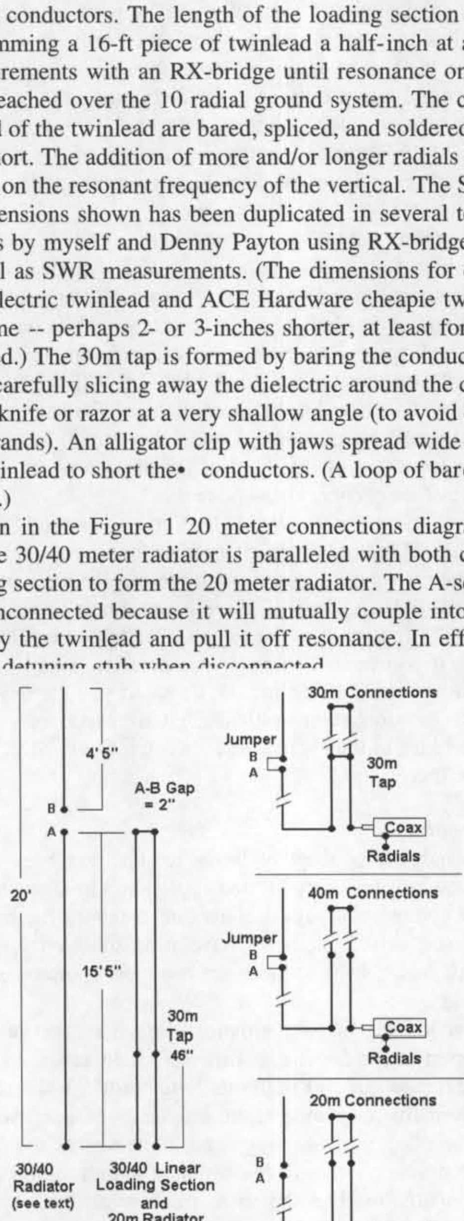


Figure1. SDRV-234 Resonant Vertical for 20, 30, 40 Meters.

P.C. Board Terminal Strip

Figure 2 shows the simple method that I use for connecting the radiator, loading section, coax, and radials. The p.c. board terminal strip dimensions are not critical but were selected to provide adequate space for my fingers when I fiddled with the securing nuts. Construction is quite simple. After marking the two dashed lines on the p.c. strip, a hacksaw is drawn across to remove the copper foil under the lines. Three isolated copper foil pads result. Next, correct size holes are drilled for the 8-32 brass (or stainless steel) mounting screws. The screws "I" (input) and "O" (output) are mounted on the p.c.b. with a nut and tightened very firmly. Then, a second nut is used to secure the wires to the screws. Terminal-post nuts are best (they're round and long). Again, the dimensions shown in Figure 2 are not critical.

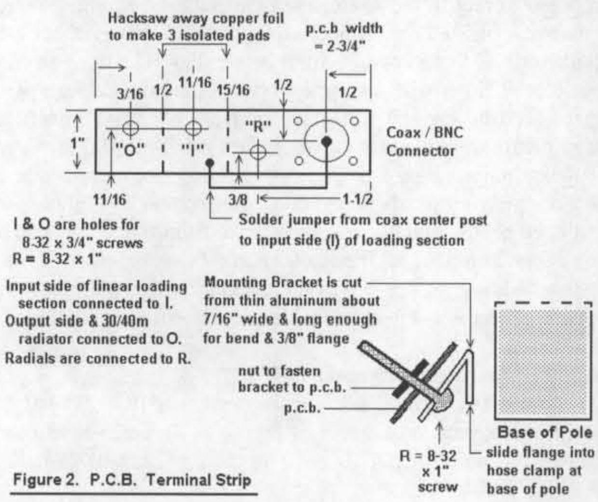


Figure 2. P.C.B. Terminal Strip

The "R" (radial) mounting screw serves double duty. The method of mounting the terminal strip on the pole can be seen in Figure 2. A standard hose-clamp that fits over the end of the pole secures the terminal strip to the pole by means of a bracket made from thin aluminum. The bracket is first cut to size. A hole for the "R" screw is drilled about 1/4-in back from one end. The other end is bent to an angle, leaving a 3/8-in or so vertical flange which slides between the hose-clamp and the pole. The angle of the bend is non-critical -- a 90-degree bend will work. The acute angle makes it easier to connect the leads of the radiator and loading section. Once the bracket is finished, the "R" screw fastens it to the BACKSIDE of the p.c. terminal strip. Be sure to leave enough space around the "R" screw for your fingers.

The coax or BNC connector for the feedline is mounted at one end of the p.c. terminal strip. One end of a #16 or #18 jumper is soldered to the center conductor post of the connector. The other end is soldered directly to the copper pad on which the "I" (input) screw is mounted.

Repeatedly connecting and disconnecting the bottom ends of the twinlead loading section to the "I" & "O" screws (and the radial lead to the "R" screw) will eventually shred the conductors. To avoid this problem, I soldered a 2-inch extension of #18 insulated stranded wire to the end of each conductor. The length of these extensions is part of the overall length of the loading section, so actually, start by stripping about 2-inches of the dielectric from the outside of the conductors. Then pull the 2-in conductors away from the dielectric. Cut off about 1-1/4-in of the dielectric -- this will leave about a 3/4-in tongue beyond the conductors. The extensions are soldered to the conductors where they emerge from the dielectric. After trimming, tape the extensions firmly to the dielectric tongue. The tape allows some "give" and no tension is placed upon the twinlead conductors themselves. Form the ends of the extensions around the mounting screws, and tin them (i.e., run a bead of solder around the resulting "hook"). A finishing touch would be to terminate the extensions in open-end solder lugs which will slip onto the mounting screws. The same approach should be followed for the radials. The ends of the radials and a 5-in #18 stranded extension are twisted together, with the extension going back in the same direction as the radials. Then the splice is soldered. The extension is taped to the bundle of radials, and bends forward to make the connection to the "R"• terminal screw. This method avoids putting tension on the ends of the radials.

Base Mount

Various base mounts have been described, ranging from W6MMA's tightly engineered unit to less sophisticated designs -- all using PVC tubing of various sizes and types. All require trips to the hardware store, then cutting, filing, fitting, re-filing, adjusting, expoxying, trashing, starting over etc. etc. My solution is a result of (1) laziness and (2) taking Aristotle seriously. Although he was speaking about biology (that was his main "thing"), he stated a very wise principle that applies here: "The most perfect solution is the one that achieves the objective with the simplest method." My analysis of the problem went something like this: (1) to make a pole stand vertically, stick it into the ground; (2) the end of the Black Widow pole is a hole and won't stick into the ground; (3) ergo, stick something else into the ground that fits in the pole's hole, and slide the pole onto that something else. A screwdriver with a 10-in shaft will stick into any kind of ground except solid rock. One with a wooden handle can easily be whittled and sanded down to fit into the pole's hole; a plastic handle is almost as easily filed down to size. Cost is about $1.50 for the wooden handle variety, about $5.00 for the high quality Black and Decker plastic handle variety. Time required: about 10-15 minutes. The shaft will not pull out of this mount and it won't rust for a very long time!

The idea is to trim/file and sand the handle for a loose-snug fit inside the base of the Black Widow or SD-20 -- it seems that the fiberglass material in the pole responds to sunlight or whatever, so that a snug-fit becomes a too-tight fit quickly. Or, the wooden handle will pick up humidity, and expand and bind inside the pole. If this happens, to retract the screwdriver handle, vise-grip the shaft to a 1-inch or so thick piece of wood, hold the bottom section of the pole, and bang at the piece of wood AWAY from the pole. You basically have to pound the handle out of the pole. But if you start with a loose-snug fit, the problem won't occur.

Both plastic and wooden handles have grooves. These are important in this application. After trimming and sanding for a loose-snug fit, use a triangular file to cut deep notches into the top of the handle to keep open the air-passages formed by the original grooves. Cut them where the normal grooves end. The grooves themselves may need to be filed deeper after the sanding-down process. The reason for this step may not be obvious. When the pole is extended, the joints form an almost air-tight fit. If no notches are cut and the grooves that remain after sanding are too shallow, pulling the screwdriver out creates a vacuum of sorts which increases the difficulty of removal. Even with the filed-in air-passage grooves and fairly easy sliding, I still get a "pop" when the handle pulls out. Easy lifting of the pole off the handle when switching from 20 to 30/40 meter operation is important. Also, when going from 20m to 30/40m or v-v, disconnect the radials before pulling the pole off the base mount -- otherwise you'll have to straighten out the radials again. Don't forget to reconnect the radial lug!

Black Widow Joint Binding

Incidentally, the Black Widow and SD-20 pole joints will bind up after some exposure to the environment if they are pulled too tight. For overnight operation, usually no problem. I've had SD-20's outside thru summer storms, spring showers, and winter blizzards -- and under 3-ft snowdrifts for weeks at a time (the wind pulled them off the W6MMA base, if you can imagine that! -- that's when I found out that 3 guy strings about 5-ft up are very helpful in SD winds!). Once a joint really binds up, there is no way of twisting it loose -- I have two joint ends splintered at the hand-twisting position to prove it (just tape'em up and they're ready to go again!) The procedure for breaking a frozen joint loose is simple. The bottom of the pole is aimed perpendicularly at a wall, a piece of wood placed at the estimated impact point, the upper section of the frozen joint grasped firmly, and then the end of the pole is repeatedly banged against the wall, lightly at first, then with increasing pressure. Keep the aim perpendicular to avoid damaging the end of the pole. Sooner or later the joint bangs loose. The repetition rather than the power seems to be the key. I take an "ugly" approach now -- I'd rather pull sections firmly out but short of total tightness, and do a quick wrap of electrical tape to keep them in place for longer term setups. Build-up of tape adhesive is easily removed with any of the "goo remover" products on the market.

Setting Up the SDRV-234

Setup is as simple as can be, thanks to my discovery of the simplest but most effective solution to the problem of fastening the various wires to the pole (see below).

The first step in setup is to fully extend the pole and lay it on the ground. Uncoil the loading section twinlead and radiator wire on opposite sides of the pole. Make the connections to the "I" & "O" screws on the p.c.b. terminal strip. Loosen the hose-clamp at the base of the pole, slide in the p.c.b. terminal strip mounting flange, and moderately tighten the hose clamp. Next, the loading section and radiator are fastened to the pole.

(For facilitating this step, I mounted a piece of self-adhesive Velcro (from Radio Shack) at each end of the first section of the Black Widow pole, with two pieces on the twinlead loading section to match up. However, the Velcro strips aren't actually necessary -- I just used them to be fancy! Line up the Velcro strips and press the loading section in place if you take this approach.)

The 30/40 meter radiator wire is run up the side of the pole opposite to the twinlead, so a half-turn at about a 45-degree angle places it on the other side. For securing the twinlead and radiator to the pole, I use "ponytail" rubber bands -- the kind with a little marble-like ball at each end. "Buy'em anywhere that little girls shop -- drugstores, Walmart etc." Loop a ponytail band around the pole, the radiator, and the loading section at the base and everything will stay in place. Work your way to the end of the loading section, repeating the ponytail bands at intervals -- I use one toward the end of each section. After all the ponytail bands are in place, the radiator and loading section can be pulled tight against the pole at each ponytail band. And believe it or not, they will stay straight and tight regardless of wind, rain, etc. Overall, the setup process using the ponytail bands takes about the same time as writing this paragraph. As noted, the B-section of the radiator is loosely wound several turns around the two top sections of the pole and fed thru the eyelet at the top, looped and straightened up, more or less. The radials are then laid out symmetrically around the base of the antenna.

For the radials, I use R.S. 20-conductor computer ribbon which can be purchased in the desired length at many Radio Shack stores. Split into two-conductor bundles, these kink much less easily than discrete radial wires. The computer ribbon is split into two-conductor bundles, leaving about 4-in of the ribbon intact at the antenna end. Then, split this end into two-conductor bundles about 1.5-in long. The easiest way to strip the insulation off the #28 stranded conductors is as follows. Place the end of a bundle into the flame of a match or a cigarette lighter until it melts, curls, and smokes (don't breath this stuff!). Then quickly lay it on a flat surface, clamp it down with a metal edge like the back of the blade of a knife or a scrap piece of metal, and pull the bundle away from the blade. The conductors will pull out of the molten plastic. After all bundle ends are bare, pull them from under a piece of steel wool a couple of times to shine up the conductors. Next, fold over the intact part of the ribbon lengthwise to form a half-width ribbon and tape it around. Splice the ends of the conductors. As noted above, a 5-in extension of #18 stranded wire is spliced around the end of the radial conductors, and the whole splice is soldered and firmly taped around.

Alternately, the radials can be made from separate wires spliced at the antenna end with the 5-in extension added for connecting to the "R" terminal. Denny came up with a neat idea for storing discrete radials and avoiding kinking when they are deployed. Perhaps he'll write up a description for WA8MCQ's monthly "Idea Exchange." Briefly, Denny cut a (about) 6-in X 9-in. piece of regular box cardboard with the internal chambers running lengthwise. He cut 10 slots into each end of the cardboard. The far end of each radial is looped around a 2-in thin nail. To begin winding the radials, the antenna end of each is slid into its slot, then the cardboard flipped over repeatedly to wind the radials in. The nails are the key to kink-free deployment. They are stuck in the ground several inches apart about 20-ft from the vertical, the radials are unwound keeping them taut, and then fanned out around the vertical.

Carrying a 15'-5" hunk of twinlead around as well as a roll of radials takes some space. However, the twinlead can be rolled into a flat pancake or doughnut in a couple of minutes. Begin by forming a 2-5/8-in hole with the first turn. Lay the edge of the turn on a flat surface, and proceed to reel in the rest of the twinlead. The resulting doughnut has a diameter of 5-1/2-in. (R.S. cheapie twinlead shaves about 2-in off the diameter.) The center hole could be smaller. The doughnut shape can be secured either with a couple pieces of tape run through the hole, or alternately (my choice) with three ponytail bands. (Ponytail bands will also secure the rolled-up radials.) I use a U.S. Postal Priority Mail shipping box measuring 8-1/2" X 5-3/8" X 1-3/4" for carrying the loading section, ponytail bands, tools, clips, connectors, and other assorted stuff. If need be, the radials can be wound to fit into another such box. -- It just occurred to me that the radials could be wound around the long axis of the loading section box! New solution to age-old problem: use the outside of a box, not just the inside. How about that, Aristotle?

Impedance Measurements and SWR

As noted, several test versions of the SDRV-234 have been built with the dimensions shown in Figure 1. The measured base impedances with ten 20-ft radials are: 40m: Z=22-Ohms 30m: Z=25-Ohms 20m: Z=50-Ohms.

The low base impedances on 30/40 meters are to be expected with the degree of shortening that occurs on those bands. In fact, these base impedances are considerably higher than they should be -- primarily the result of ground loss with only ten radials.

The SWR measured at the base of the SDRV-234 through a short piece of coax (about 8-in) is: 40m = 2.1:1, 30m = 1.7:1, and 20m, 1:1. With an additional ten radials, the 20 meter base impedance drops to Z=40-Ohms due to further elimination of ground loss. Hence, the SWR rises to 1.2:1. Note that "lowest SWR" does not equal "most efficient" or "resonant" in this case! It is worth restating the point that SWR is a measurement of the degree of mismatch between base impedance and coax impedance. Ideally, a resonant quarterwave vertical over a near-perfect groundplane exhibits a base impedance of about Z=36-Ohms. A perfect 1:1 SWR would result ONLY IF the vertical were fed with 36-Ohms coax. In this case, the 1:1 SWR of the SDRV-234 on 20 meters is a result of the amount of ground loss that exists with only ten 20-ft radials under the vertical. Adding another ten radials eliminates about 10-Ohms of ground loss but RAISES the SWR! So here, "BETTER SWR" actual equals "MORE LOSS"!

Now, note that the 40 meter base impedance of Z=22-Ohms, when hooked to RG8X 52-Ohms coax, should produce an SWR=2.36:1, but the measured value is 2.1:1. Similarly, the measured 30 meter SWR is too low. Several explanations are possible. First, the coax impedance is actually lower than 52-Ohms, bringing it closer to the base impedance value and lowering the SWR a bit. Second, the measurement could have been made slightly off the resonant frequency, adding reactance into the base impedance and raising it closer to the coax impedance. And third, ground loss resistance creates the "better" SWR, as in the 20 meter ten vs. twenty radials comparison.

Denny drew my attention to the fact that many hams will shy away from an antenna that shows a 2.1:1 SWR, since the popular myth is that a well designed resonant antenna has to show a 1:1 SWR or something is wrong with it. In fact, the opposite is true. If an antenna such as a dipole does show a 1:1 SWR, something is wrong with it unless it is being fed with 72-Ohms coax and is positioned at exactly the right height above ground. At all other heights, the feedpoint impedance of the dipole is not 72-Ohms and hence some SWR must be present. When fed with 52-Ohms coax, the SWR cannot be 1:1 unless losses are present. At heights below a quarter wavelength, ground losses have been shown to "swamp out" the expected sharp drop in feedpoint impedance toward zero. So, many very low dipoles do show a very good SWR -- only because a big resistor (ground loss) has been added to the circuit and is absorbing a lot of power.

In practical terms, the loss from a 2.1:1 SWR with good coax is negligible. Consider the following numbers for 50-ft of good lowloss RG8X:

Matched 1:1 SWR loss = 0.37dB
Mismatched 2.1:1 SWR loss = 0.12dB
Total line loss = 0.49dB For 5 watts input, 4.47 watts radiated

Life is even better with RG 213. However, backpackers are often advised to use RG-174 mini-coax, the industry standard for maximum loss. For a 50-ft run of good highloss RG-174:

Matched 1:1 SWR loss = 1.67dB
Mismatched 2.1:1 SWR loss = 0.46dB
Total line loss = 2.13dB For 5 watts input, 3.1 watts radiated

The trade-off in loss is a matter of choice -- RG-174 can make sense for a long hike up a mountain where the operating site just might provide some good focusing gain to offset the feedline loss. But for the regular kind of portable operation, with the gear stowed in the car or a suitcase etc., what's the point of the RG-174?

Notice that the 2.1:1 SWR loss for good coax figures to about 25% of the total feedline loss. In actual terms of wasted power, the SWR loss is minor and negligible, given the fact that 0.12dB cannot be detected by the human ear. It can be eliminated entirely by inserting an L-network between coax and feedpoint -- but the improvement is not worth the effort. But, most QRP rigs -- or at least all the ones I've built and/or used -- operate most efficiently with a perfectly matched line. In fact, I've seen some that will "take off" and generate all kinds of nasty signals when presented with a 2.1:1 mismatch -- until the final smokes. This brings up another general point. An antenna tuner should be used with QRP rigs regardless of the kind of feedline that is used except in one instance. A rig whose driver/final stages are operating at very low efficiency will usually be stable under mismatched conditions -- the circuitry itself is swamping out the effects of the mismatch. However, moderate and high efficiency driver/final circuits are very sensitive to the slightest mismatch. Puncturing the base-emitter junction takes only a few microseconds!

Performance

On-the-air performance tests require the ability to switch rapidly between the test antenna and a reference antenna. Comparing a vertical to horizontal antennas has a built-in catch: the different angles of radiation. During a given listening period across many evenings of DX'ing, however, the arrival angles of incoming signals shift across a pretty wide range as the ionosphere goes throught its daily readjustment following sunset. The difference thus tends to average out over time. In this case, the SDRV-234 has run neck-n-neck about 50% of the time in direct competition with my 30 meter fullwave at 50-ft in its favored direction (EU, PAC) and a 30 meter dipole at 50-ft. The fullwave is rather directional, so the SDRV-234 beat it almost all of the time to the Caribbean and most of the time to Africa (off the end of the fullwave). Although my phased pair of W6MMA Verticals was not available for direct comparison on 30 meters, my notes comparing the phased verticals against the 30 meter fullwave suggest that the single SDRV-234 is better than the phased verticals. (This is probably a good indication that my phasing system was not tuned correctly despite the existence of a decent f/b rejection ratio.) However, this remains subjective since those comparisons involved a different ionosphere. On 20 meters, the SDRV-234 proved superior to a 20m Delta loop with apex at 50-ft on long hauls. And it beat a HyGain 18AVT on 40 meters when both had 17 radials of 20- to 24-ft lengths under them. This result is puzzling and suggests that the 18AVT has some hidden losses somewhere. It ought to have equaled the SDRV-234.

Regardless of the antenna's effectiveness as suggested by these comparisons, the SDRV-234 is nothing more than a resonant vertical with a marginally efficient radial system which can be improved by the addition of more radials. (Laying 10 more radials in a portable setup takes another five minutes but adds considerably to performance.) The SDRV-234 is NOT a "magi c" antenna. However, it will perform well in either portable or home operation.

Which Way, Vertical or Horizontal?

In choosing between a vertical vs. a horizontal antenna, the attainable height for the horizontal is the key consideration. The common belief that verticals are superior for low-angle radiation and DX work ignores the effect of height and gain on the comparison. As a horizontal antenna's height increases, its radiation angle decreases. Furthermore, a simple dipole exhibits several dB gain in its major lobes relative to a vertical. In simple terms, at a half-wavelength or higher, the horizontal's low angle gain cancels the vertical's edge in low angle radiation except for a very narrow slot of a couple degrees. In addition, the horizontal's gain across the 20- to 40-degree range makes it the overall superior antenna. Remember that incoming DX signals are at very low angles (usually) only a small part of the time. (Tests performed at W1AW switching among stacked yagis provided this insight.) So, if you can put a dipole at a height of a half-wavelength or higher, I'd suggest choosing the dipole. However, if attainable heights are lower), or considerably lower than a half-wavelength, I'd suggest choosing the vertical, provided that you have space for the radials. (As explained in my two previous articles, there is no point in using quarterwave radials, which take up a lot of space on 40/30 meters.) Note that the Black Widow or SD-20 poles are almost a half-wavelength high on 15 meters and even higher on 10. I'd probably hang a dipole or Inverted-Vee from the pole for those bands. But I'd use the SDRV-234 on the lower bands. So, assess your situation and needs and then decide whether the SDRV-234 or a horizontal antenna is the right choice for you. Don't build it because I told you "you'll like it."

(The Black Widow pole is available from BassPro Shops, 1-800-227-7776 for about $26.00 shipped. Or, enter "crappie pole" in the search window at their website: http://www.basspro-shops.com and charge it on your credit card. This way is really fun -- the pole shows up a couple of days later in a ready-made carrying case (i.e., shipping container).

... de Ade Weiss, W0RSP

The Search for Extra Terrestrial Intelligence: How You Can Help

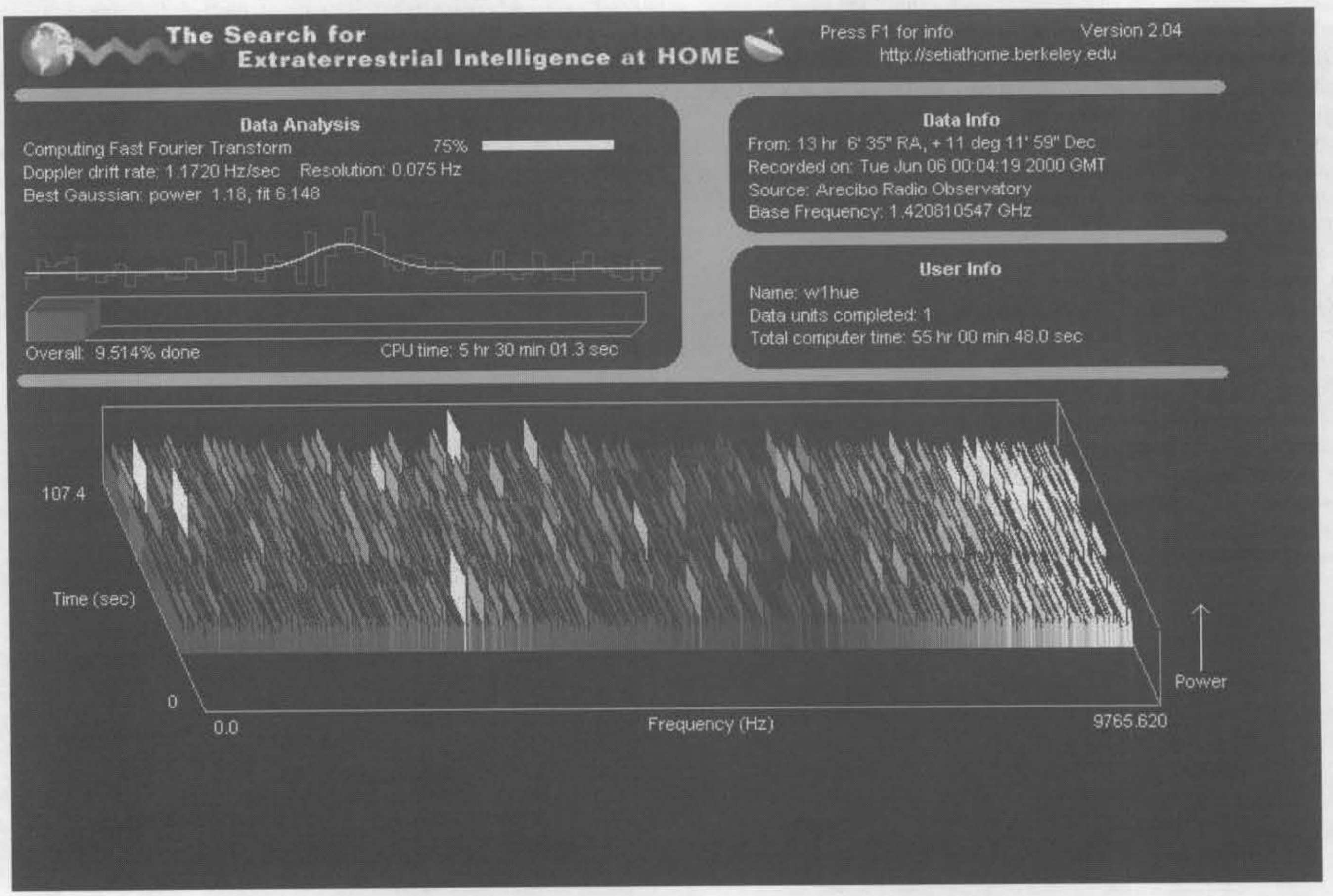
Larry East, W1HUE *Idaho Falls, ID USA* *email: w1hue@arrl.net*

The question "Are we alone in the universe?" has intrigued mankind for centuries. The answer – if we ever find it – will have great philosophical as well as practical impacts on humankind. Only within the last half century has it become possible to make a meaningful search for intelligent life beyond our own little planet – not by flying spaceships to other star system *a la* "Star Trek" but by listening for possible radio signals using large radio telescopes. For nearly 40 years researchers have been scanning the cosmos looking for such signals using instruments such as the world's largest radio telescope, the Arecibo Radio Telescope, near the town of Arecibo, Puerto Rico. The project is called "SETI" – Search for Extra Terrestrial Intelligence. This project has received some degree of public awareness through the movie "Contact" staring Jodi Foster (based on the book of the same name by Carl Sagan).

Point a large antenna like the one at Arecibo at the sky and you will receive all kind of radio signals – radiation from the remnants of the "Big Bang", signals from "Pulsars", galactic noise and noise from our own atmosphere. If you were to plot the received noise intensity as a function of frequency, you would find that there is a very high noise level at low frequencies do to our own galaxy and again at very high frequencies due to our own atmosphere Between these two regions of noise is a relatively quiet region at about 1-10 GHz. It is interesting that within this region natural signals are radiated by two molecules important to life as we know it: neutral hydrogen gas at 1.42 GHz and hydroxyl radicals (OH^+) at 1.64 GHz. The spectrum between these two frequencies is relatively quiet and is referred to as "the water hole." This is the region that is currently being searched for signals indicative of intelligent life.

Even though a fairly limited frequency range is being searched, the search has been very slow and laborious. It's like picking a very small needle out of a very large haystack and there just aren't enough super computers available to crunch all of the data being collected. An astrophysicist at the University of California at Berkeley came up with the idea of using thousands of home computers to crunch the data – yours and mine! Ah, you say, "I use my computer for lots of stuff and can't devote it to just one task." Well, how about all that time that it is not doing anything but showing pictures of flying toasters, goldfish or what-have-you across the screen? Yes, I'm talking about the screen saver that is displayed when your computer is idle. The folks at the Space Science Lab. in Berkeley have come up with a neat little screen saver that does something really useful – analyzing blocks of data from the Arecibo Radio Telescope looking for time correlated signals from somewhere out there in the cosmos. The program is called "SETI@home" and can be downloaded free from their web site at http://setiathome.ssl.berkeley.edu. The program periodically downloads data, analyzes it, and then uploads the results – all while your computer is sitting idle. And it gives a graphical display of what it is doing in case you like to sit in front of your computer and watch screen savers (see the figure below).

Tired of watching flying toasters, gold fish or K2 pictures on your idle PC? Then give SETI@home a try. You might even be lucky enough to help discover someone "out there"!



QRV?

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email: ko4wx@mindspring.com

Well, here it is, QRV time, and once again, I find myself on my way home from another business trip to Germany. It seems like yesterday that I was flying down the Autobahn and thinking about transistors and biasing. I did get to operate a bit this time--which was really fun--using my DSW-20. That is one sweet rig!

So, I have to apologize for not making the NOGA QRP HF CW net lately (Tuesdays, 9:30PM Eastern, 3686.4KHz). Have you?

Of course, with the normal summertime increase in atmospheric noise, thunderstorms and the occasional solar coronal mass ejection, you may be waiting for those nice quiet winter evenings on 80 meters. So how about if we get those final touches on our NOGAnauts and get QRV?

To recap, over the past few issues, we've (1) built a basic crystal oscillator, (2) added a power amplifier, and (3) constructed a filter so that the output meets FCC spectral purity requirements. A lot of contacts can be made with the NOGAnaut just as it is (you can almost always find somebody on 3686.4KHz after sundown).

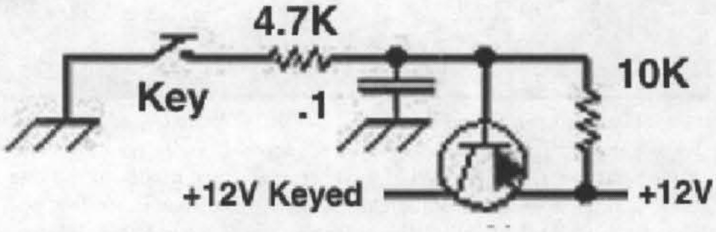
However, you may want to attach the rig to a keyer, instead of using a straight key. The trouble is, the NOGAnaut is keyed by interrupting the +12Volt power supply to the oscillator. Most keyers, though, are set up to *ground* the key-line. Grounding the power supply would make a mess of things in a hurry.

One thing you could do is rig up a battery and a relay, and interrupt the flow of current to ground through the relay coil. The normally open contacts can be inserted between the power supply and L1.

One problem with this technique is that the relay is an electromechanical device, and the inertia that the relay arm must overcome will cause a slight delay each time the key pressed or released. This might work for really slow Morse code, and the relay click could possibly serve as a pseudo-sidetone, but clearly, this arrangement is less than optimal.

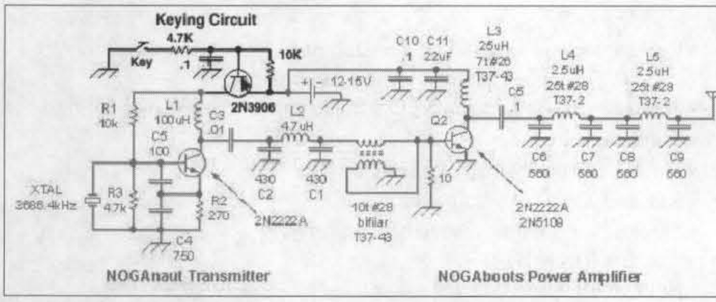
Enter the transistor switch. Remember from last time that when the base of a transistor is given a positive *bias*, current will flow between the emitter and the collector. In an NPN transistor, when the base is biased positively, the collector is made positive with respect to both the emitter and base and the emitter is made negative with respect to the emitter and base. In a PNP transistor, the opposite is true, that is, when the base is biased positively, the emitter is made positive with respect to both the collector and base and the collector is made negative with respect to the emitter and base.

If too much bias is applied to the base, the transistor *saturates*. When a transistor is saturated, it ceases to operate in a linear manner, however, the maximum collector-emitter voltage difference, also called Vce(sat) exists. Switching the bias on the base causes a nearly simultaneous flow of current between emitter and collector (determined by the frequency-response characteristics of the transistor). This allows a small bias to control a large amount of switched voltage (it is extremely important, however, to not exceed the maximum transistor voltage ratings).

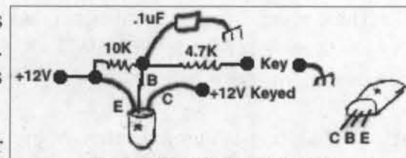


The PNP transistor above acts very effectively as a keying switch. The 10K and the 4.7K resistors work together as a voltage divider. When the key is grounded, 6V bias is applied to the base of the 2N3906 transistor. This is enough bias to saturate the transistor, so +12V appears at the collector of the transistor, and the keyed circuit receives power. The transistor is truly a remarkable device, isn't it?

So, here's our final circuit for the NOGAnaut, using a 2N3906 PNP transistor to key the oscillator on and off:



This little keying circuit is incredibly easy to construct. The easiest, perhaps, is "dead bug" style, like so:



Keying Circuit Construction

Start by gluing the transistor upside down to the PC board, and then build the rest of the circuit around it. On my board, I also added a 1/8 inch mono phone jack, which I use as standard in my shack for key jacks.

Perhaps, one day, I'll write about Zen and the art of radio construction. I feel that if you're going to go to the trouble of building a radio, it should look nice as well. To house my NOGAnaut, I chose a Whitman's Sampler box, available in many drug stores. Due to the heat sink on my power amplifier, there wasn't quite enough room in an Altoid's tin, and besides, I really like the chocolate that comes inside!

In small QRP rigs, I usually use RCA jacks for the antenna, 1/8 inch phone jacks for keys and coaxial power jacks for the power input. Be sure to use a small nail or punch to start the holes, otherwise, the drill might slip and mar the box. Also, there is a layer of paint on the inside of the Whitman's Sampler box, so use a knife or sandpaper to scrape off the paint around the inside of each hole to get a good ground. You can glue or tape the PC board to the inside bottom of the box, but be sure to also solder a couple of wires from the ground plane on the board to the bottom of the box (after scraping an area to solder to).

Now it's time to get QRV! Hope to CU soon on 3686.4KHz!

72 de Mike, KO4WX

Sneak Preview: Elecraft's K1 QRP Dual-Bander

Conrad Weiss, NN6CW *San Carlos, CA USA* *email: radman@best.com*

Elecraft's pint-sized K1, their new QRP CW dual-band kit, delivers a gallon of performance in a small, travel-friendly package. The K1's uniqueness, in the world of travel-friendly rigs, resides in its "one box" approach to travel and field-oriented operation. Elecraft's philosophy is to integrate all of the accessory items required for field operation within the rig enclosure itself – just as they've done in the K2. Gone are the days of interconnecting cables between the rig and ATU – the optional ATU resides inside the rig, and it's fully automated to boot! The folks at Elecraft are researching an internal battery for the K1 – although it will likely be several months until they finalize the battery and charging design.

The announced base price of the K1 is $269. The basic kit includes the following features:

- Coverage of up to 150 kHz on each of two HF bands; your choice of 40, 30, 20 or 15 meters in any combination.
- 3 MHz low-noise analog VFO with 10-turn potentiometer tuning.
- Three digit LCD for text and bar-graph.
- 100 Hz frequency display resolution.
- RIT and XIT for split operation.
- Single conversion superhet receiver with 4.915 MHz IF.
- Built-in high sensitivity speaker.
- Three programmable IF filter bandwidths.
- Output power adjustable 0-5W.
- Built-in memory keyer.

At the time this is being written, options include:

- Additional 2-band module.
- Noise Blanker.
- Wide range tilt stand.
-

Figure 1: K1 Front Panel (Elecraft photo)

In addition, an automatic antenna tuner should be available by the time this is published.

The K1 should be attractive to less-experienced kit-builders yet it offers seasoned builders, DX hounds, Fox Hunters and world travelers some serious performance for their QRP dollar. The interior layout consists of a single main board and front panel board. There is no 'control board' behind the front panel board as in the K2 layout. The two-band module filter-board mounts atop the main board, as do the optional noise blanker and auto-tuner option boards. Consistent with Elecraft's "no-wires" design philosophy, you'll find all board-to-board connections accomplished with pin headers, as in the K2, so there's no point-to-point wiring to clutter things up. Component layout is very spacious – no resistors standing on end or resistor packs jammed-up against ICs – the K1 board layout should put any newcomer at ease. Some diehard K2 veterans will probably attempt to build the K1 without benefit of the instructions – it's that friendly looking!

The case-works and front panel are reminiscent of the K2. In fact, at first glance, the K1 even looks like a baby K2 – but they're really two entirely different rigs. The K1 utilizes the same aluminum panel/2D-fastener packaging strategy employed in the K2. The K1 front panel has only three knobs – Main Tuning, AF Gain and RIT/XIT (see **Fig. 1**). Above the main tuning knob are two LEDs that alert you to Attenuator and RIT/XIT status – important information – and those LEDs really get your attention! The LCD main display has three-digits with decimal point. It's very readable and offers a wealth of information – VFO frequency, RX S-meter, BATT (supply voltage) and TX bar-graph with one bar per Watt granularity. To the left of the LCD you'll find two buttons – one for Band/Display and one for Menu/Edit – similar to the K2. The 1/8-in headphone jack is at the lower left. On the extreme right side of the front panel you'll find three buttons vertically aligned. WPM/XFIL are a pair of buttons that allow you to increment/decrement keyer speed OR change your filter settings from 1 to 3. At the lower right corner is a single button that allows you to play or record message buffers. Tap/hold rules apply to the front panel user-interface, and those familiar with the K2 will pick it right up. Those new to tap/hold will be guided by the Elecraft K1 Quick Reference Guide – a one page 'cheat sheet' designed to bring you up to speed in a hurry. For those enamored with Elecraft's first-class K2 documentation, you'll find the same level of detail and description in the K1 manual. Final alignment instructions are geared toward the newcomer with little to no instrumentation or kit-building experience.

Outfitting the K1 with its clever array of options including the KAT1 internal ATU and the KNB1 Noise Blanker yields a rig that's backpack-ready and concourse-friendly, depending on your destination. With the KAT1 and KNB1 installed, the K1 tips the scales at just 1.55 pounds! You can still add ***one*** external option – the KTS1 Wide Range Tilt Stand – a knock-down, three-point aluminum mounting-stand, offering 'in your face' K1 rig-positioning while at your campsite or Holiday Inn suite. It disassembles into a thin, flat package that will stuff into a soft-sided camera bag along with the K1. You'll need to add some small paddles, a wire antenna and batteries. Your entire travel pack can be about half the size of a shoebox!

The K1 kit includes your choice of any two bands (40-15 meters.) This is accomplished by means of the KFL1 dual-band module. This is not a module that is quickly trail-swapped. It's well protected inside the K1, and screwed to rugged aluminum stand-offs for electro-mechanical toughness. The user can buy/configure an additional KFL1 for another pair of bands, but the K1 will only accommodate a single KFL1 filter board at any one time – you can't make a band-switching 4-bander out of the K1. For example, if your primary bands of choice are 30/15M, you might want to also buy a 40/20M filter board for contests or Field Day operations. The beauty of this architecture is you get to pick your favorite default night/day band combination. You can order a filter board for 40/30, 30/20 or any two-band combination you like – you decide!

The K1's receive section is a power-stingy (50mA) single conversion superhet design with a 4.915 MHz IF. Receive sensitivity is 0.15 µV (typical) and it boasts narrow double-tuned bandpass filters, sharp four-crystal filtering to prevent RX overload from signals outside the passband. It offers three programmable filter bandwidths – reminding one that it was designed by the same guys who developed the K2. The combination of great sensitivity and programmable filters will make the K1 a popular choice with Fox Hunters and DXers on the go! With its beefy AF strip, top-firing speaker, digital S-meter, switchable attenuator and AF-derived AGC, the K1's receiver is feature-packed.

The transmit section features fully-adjustable RF power output of 0-5 Watts, diode-switched full break-in – no relays – and a single PA transistor that's SWR-protected. The built-in memory keyer offers a choice of iambic modes A and B, 9-50 WPM keying speed (greater than 70 WPM is possible with an external keyer), two 80-byte message buffers, auto-repeat and message chaining, and a programmable message repeat interval of 1-250 seconds, making it useful for beacon operation or 'lazy CQs' on a quiet band out at the campsite.

I've had only an hour's worth of time on this new rig, at the time of this writing, yet I'm convinced it's another Elecraft winner! While it's certainly not a two-band K2, the little K1 with its optional accessories will make you think twice before buying a couple of monobanders for travel. The K1 receiver sounds typically Burdick-like – sensitive, refined and mojo-ready. The TX section seems Swartz-like – a clean, rugged design with a beefy PA delivering "legal-limit" QRP power with ease. Gone are the days of fretting about an "afterburner" for your new QRP rig – you simply won't need it with the K1.

With only a half-hour devoted to hunt-and-pounce on 20 meters, state-side QSOs and Midway Island were easy targets using a modest wire antenna. As the K2 crowd says, "Must be the mojo!" Tightening down the K1's filters is a real pleasure and filter-loss is very minimal with no ringing. The AF-derived AGC, the multi-turn tuning pot and the non-backlit LCD reminded me that I wasn't operating a K2 – but the 50mA RX current of the K1 and its superb keying will make keep you smiling when you're on your last set of batteries, and in a pinch you can walk down to the corner market and buy a 9-volt battery. The K1 runs nicely on those, but you'll want to keep the TX power down.

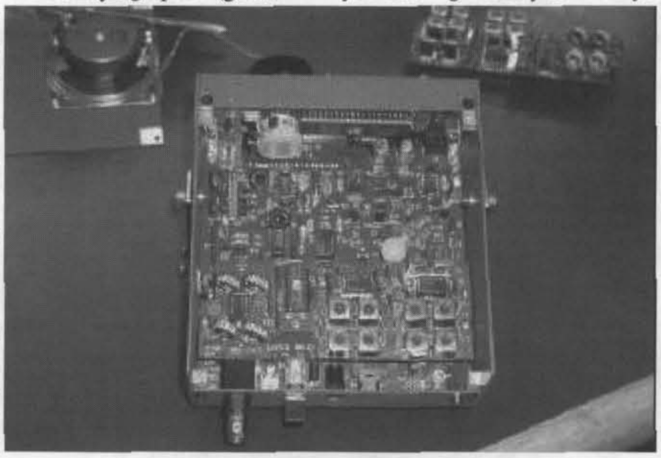


Figure 2: Inside view of the K1. An extra band module is shown at the upper right (K1MG photo)

Bottom Line: For this frequent flyer, the K1 will get some serious "air time" in more ways than one! It's ready for my carry-on bag. Elecraft's continued dedication to "one box" QRP rigs will please many size/weight-conscious QRP travelers. The base price of the K1 seems reasonable for a two-bander, considering it offers 150kHz tuning with all the amenities. Some travelers, like me, will dream of a 4-band K1 with an SSB option board and backlit LCD, but Elecraft will steer us toward the K2 for those requirements. At a nominal weight of 1.55 pounds, measuring 2.2h x 5.2w x 5.6d inches, this is the rig that packs next to my shaving kit! Where's my Visa card?

The K1 two-band transceiver kit is available from:

Elecraft
P.O. Box 69
Aptos, CA 95001-0069
Phone: (813) 662-8345
Email: sales@elecraft.com
URL: www.elecraft.com

Edited by W1HUE

AWARDS

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Summer is coming to a close and the award applications continue to roll in. In the last issue, I mentioned that I had cleared out the backlog – well, it's back. By the time you read this, hopefully everyone who submitted an award prior to August 15th will have received it.

There are some new records in the making, but they are not official yet as I have not received the applications. Now is time to take advantage of the high sunspots before the numbers start to head down again. This may be the best fall and winter contest season we have for several years to come. A QRP contact in a contest is just as eligible for an award as one made by random or scheduled QSO.

There is not much new in the world of awards – just that many members and non-members are receiving the 1,000 mile per watt award without a lot of trouble in earning it. 10 and 12 meters continue to amaze me with the length of openings. If you have not received one of these awards, our most popular, now is a good time to earn one. Full rules are on the QRP ARCI homepage, but basically you have to work a station 1,000 miles away with one watt – or the equivalent – .5 watts for 500 miles, 5 watts for 5,000 miles, etc. The certificate itself is very nicely done on heavy paper in color and looks a bit like an old time stock certificate.

As QRP ARCI Awards Manager, the simple answer as to how you confirm QRP for our awards is .....(drum roll)..... you say you operated QRP. There is no other way. Unless you want to have a witness in your house certify each and every contact, we gotta trust you, and we do (and even if you had a witness, who would witness the witness?). Gotta stop drinking coffee late in the day.

The other station you just told that you were QRP has no more way of knowing your real power than the color of your hair. We call it trust. Some organizations want the other station to note on the card they send you that you said you were QRP in the QSO. And so what?? Proves nothing. I worked an F6 on 20 CW last night using my HW-9. I told him I was running 4 watts. He gave me a 579. For all he knew, I could have been using a linear.

Please see our rules at http://www.qrparci.org. We accept email QSLs, letters or copies of conventional QSLs for all our awards, any other form of verification from the station you worked which includes contact data.

If we can't do this through trust, then we can't do it at all. QRP ARCI is issuing more operating awards than ever before - and we do it based on trust. If someone wants to falsify a record, they have to live with it, not us. Do your best and submit an application. We will accept it.

• .. **Steve, N4EUK**

Q-R-Pedaling – K2/Gary Fisher Style

John Cumming, VE3JC *Delaware, ON Canada* *email: ve3jc@rac.ca*

For the past few years, I have been taking my QRP operation on the road, using a QRP-Plus and an Outbacker Perth antenna mounted on an aging mountain bike. This bicycle mobile set-up, described in past issues of the Quarterly [1] [1], provided hundreds of kilometers of pleasant riding and many enjoyable QSO's. With all-band, multi-mode capability, and the many convenient features of the QRP-Plus, I would often think that my QRPedaling [2] station was "just about the ultimate". It just couldn't get any better than this...

Figure 1. The K2/Gary Fisher Bicycle Mobile, complete with mini-paddles, boom microphone, and Outbacker Perth Antenna

But then I adopted one of the early "test-builder" Elecraft K2's, and as the noise blanker, SSB, and autotuner options were added, I began to realize that the full-featured K2 would be an ideal bicycle mobile rig. My resolution to allow the K2 to lead a sheltered life was cast aside, and K2 #041 was soon learning to ride in the handlebar bag of my old bicycle. Cycling around the countryside on a very cold afternoon in mid-November, I was able to have an SSB QSO on 17 Meters with Ned, WC4X/bicycle mobile near Atlanta – a two-way K2 Bike mobile thrill! As I listened to Ned complain about the heat in Georgia, my own fingers were turning blue from the strong headwind. Holding a microphone in one frozen hand while steering and braking with the other, with the K2 stuffed awkwardly in the handlebar bag, I knew that modifications to my QRPedaling apparatus would be in order over the winter!

This short list of planned mods and upgrades turned into a major overhaul project when I picked out a Christmas present for myself – a slightly-used 1997 Gary Fisher Big Sur Mountain Bike, complete with front shocks, precision components, and twenty-four speeds ("Arghh Arghh," to quote Tim Allen). It was obvious that the dimensions and geometry of the new bike were significantly different from my old hardware-store-special bicycle. With more sophisticated brake levers and grip shifters, there was less real estate on the handlebars for attaching QRP gear, and with front suspension to cushion both rider and radio, the front wheel hub could no longer be used as an "anchor" point for any handlebar-mounted radio platform. With the January snow falling outside and my Gary Fisher hibernated in the shack, I set about to design new mounting arrangements for the QRP gear.

For all of my QRPedaling design projects, I have used a "junk box up" approach: I rummage through my scrap bin and see what bits of aluminum and hardware might have a useful purpose for bicycle mobile application. Keep the following in mind when looking for sources of bicycle mobile hardware parts:

- Scrap commercial antennas: light-weight aluminum tubing, boom-to-mast brackets, and U-bolts will be invaluable in getting your bicycle to "radiate".
- Scrap aluminum electronic equipment enclosures: side aluminum panels are useful in constructing platforms for you qrpedaling rig or handlebar mounted mini-paddle
- "CB" antenna brackets: mobile antenna brackets in a variety of shapes are cheap and readily available at flea markets.
- Discarded sports equipment: old bike parts, ski poles, or jolly-jumpers may just provide that little piece of hardware you need to securely mount your rig on the bike.

So how was I going to get the K2 to ride on my new Gary Fisher bike? My initial approach was to mount a platform directly over the handlebars, using two U-bolts to secure it to the handlebars. However, I quickly discovered that this arrangement placed the rig too far forward, providing incorrect audio deflection, and making safe and ergonomic operation of the K2 controls impossible. It was apparent that the face of the K2 would have to be no further forward than the handlebars, and angled to direct audio from the top-mounted speaker towards the rider's ears (For safety reasons, I never wear earphones while riding the bike). To support the entire weight of the internal-battery-equipped K2 beyond the handlebars, a third "damped" anchor point, in addition to the two handlebar support points, would be essential.

Figure 2. K2 on handlebar-platform

[1] Notes and references are listed at the end of the article.

The rig support system which ultimately evolved is shown in **Fig. 2**. The K2 sits on a platform constructed from 1/8" thick aluminum The width of the platform is identical to the K2, while its depth is about one inch greater than the rig, permitting the rear of the platform to support the weight of the coax, paddle and external battery cables. Holes matching the K2's plastic feet have been cut in the platform, and anchors for bungee cords are installed on the platform's underside. The K2 is secured to the platform by aligning the rig over the foot holes, and securing with two wrap-around bungee cords. I use an additional nylon buckled "sleeping bag" strap for added security. I have also glued a piece of 1/8" cork over the front holes on the platform, as a "spacer" to accommodate the thickness of the collapsed tilt bail on the front of the K2.

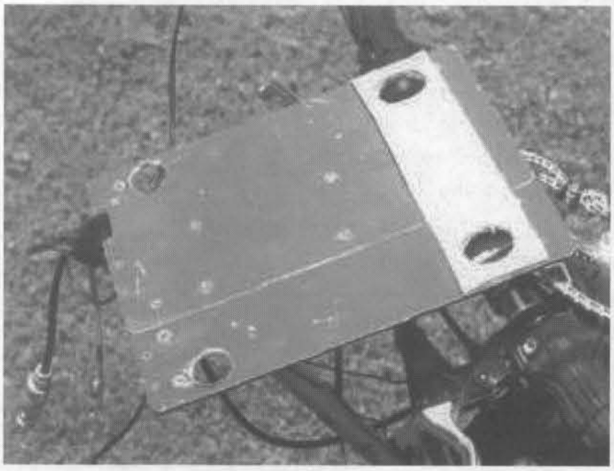


Figure 3. Handlebar platform with rig removed.

To attach the rig platform to the bike, two aluminum blocks are U-bolted onto the handlebars. Four machine screws connect the platform to these blocks, via an L-shaped piece along the front of the platform. The "third leg" for supporting the rig platform is constructed from a 10" length of 3/4" OD. aluminum tubing. This leg is attached to the bike's front forks – above the shocks – using the bracket shown in **Fig. 4**. I have deliberately omitted exact dimensions and detailed construction information for the rig support components, since the geometry of your bicycle, and the construction materials available to you, will be different from my experience.

Figure 4. Front fork support bracket

The rig mount illustrated provides a remarkably sturdy ride for the K2. My apprehension that it would be necessary to "lighten the load" by removing the K2's internal battery was unfounded. Even when fully loaded, the K2 remains firmly in place over the bumpiest roads, and steering control is not significantly compromised by the weight of the rig. One final note regarding the radio mount: The support platform and front support tube can be easily removed from the bike when not required, by disconnecting them from the handlebar blocks and the tube-to-fork bracket. The latter components remain on the bike at all times, and are unobtrusive for "radio free" mountain bike riding.

Transferring the antenna mount from the old bike to the Big Sur was fairly straightforward. Unlike my old bicycle, the Big Sur has brake and shifter cables exposed above the frame's top tube. However, there is sufficient clearance under the cables to permit continued use of a commercial U-lock holder attached to the top tube for supporting the front of the antenna "boom." The rear antenna boom support arrangement on the pannier rack is unchanged from the old bike (see the October 1998 ***QRP Quarterly*** for construction details). For added stability, the antenna boom is anchored to the bike seat post using an aluminum "L" bracket and two U-bolts.

Figure 5. Antenna "boom" bike seat bracket

With the K2 and the Outbacker antenna system happily mounted on the Big Sur, I could begin to explore the advanced capabilities of my highly revised bicycle mobile system. The versatility of the K2's message memories was an immediate benefit. Using a pre-recorded "CQ" in auto-repeat mode, it is possible to enjoy the passing countryside, while waiting for someone to pull my signal out of the ether. Additional pre-recorded replies, such as "hr bicycle mobile, pwr 5 W", allow me to maintain the QSO while braking, shifting gears, or negotiating a tricky bend in the road.

The features provided by the auto-tuner were another welcome enhancement to my qrpedaling. Although the Outbacker Perth is "resonant" on all bands without the use of a tuner, the K2 allows me to check the SWR, and adjust the turns and whip length on the Outbacker for optimal match. The autotuner can be called into action when I want to move far off the resonant frequency in the selected band without having to dismount the bike for adjustment of the whip. Several successful QSO's have even been achieved while inadvertently using the autotuner with the Outbacker sitting on the wrong band tap! I leave the tuner assigned to one of the K2's programmable function keys, so I can easily access the tuner options while riding.

Most of the K2's features and settings can be safely adjusted "on the fly". For example, selection of stored messages or fequencies, changing modes or filter bandwidths, and adjustment of keyer speed and output power can all be accomplished while in motion on the bicycle.

Obviously, more complex menu selections or actions requiring greater concentration should only be performed while stationary, away from the road. As with the QRP-Plus, the K2's dial lock feature is frequently used, especially when riding on rough roads.

The side-band capabilities of the K2 provide another dimension to bicycle mobiling. While CW is more effective at QRP levels with inevitably inefficient mobile antennas, enjoyable SSB contacts are certainly possible. I use a small foam-covered electret microphone attached to a length of aluminum ground wire as a boom mic. Because of ambient road noise, push-to-talk operation is required. But Elecraft's neat trick of using the "Dit" paddle input to key the PTT, and the compact "bulldog" paddles conveniently mounted on the end of my handlebar extension, combine to provide practically "hands free" PTT control.

Figure 6. Vinyl case provides some protection from rain, dust and bugs!

The K2 has performed flawlessly in casual bicycle mobile operation over the past few months. During construction of the K2 options (and especially when installing the toroids on the autotuner), I had attempted to prepare the K2 for the rough road ahead. Insulated spacers were added under all tuner toriods and care was taken to minimize "play" and maximize clearance between components. To protect the rig from minor scrapes, and to provide some degree of weatherproofing, a custom soft vinyl case has been designed [3]. The case's velcro-trimmed front cover can be quickly installed when the raindrops or snowflakes begin to fall.

Another accessory home-brewed to compliment my K2 bicycle mobiling is a heavy-duty portable bike stand. Because of the Big Sur's high center of gravity with the K2 and Outbacker installed, no conventional "kick stand" will reliably keep the parked bike upright. The portable stand shown in **Fig 1** is constructed from sections of two aluminum ski poles and two halves of a die-cast boom-to-mast vhf antenna bracket. The stand's main member supports the weight of the bike, while the second member, hinged part way down the first, attaches at the left handlebar to prevent the front of the bike from rotating. When not in use, the stand collapses and rides on top of the antenna boom, secured by velcro straps.

Undoubtedly, I will continue to develop add-ons for the K2/Gary Fisher QRPedaling machine. Finding new ways to efficiently and creatively combine two wonderful hobbies is an ongoing challenge. Who says, "It can't get any better than this"...?

Notes and References

1. "Eight Bands on Two Wheels!" Part 1, October 1998 ***QRP Quarterly***; Part 2, January 1999 ***QRP Quarterly***.
2. I must give credit to Nelson Dewey, VE7FTL, for labeling my addiction "qrpedaling" in a January 1999 personal email.
3. My thanks to Mr. Greenjeans Furniture Upholstery, London, On for the sewing job.

Edited by W1HUE

Putting Your Mike Where Your Mouth Is – QRP SSB in Contests

Jim Gooch, NA3V 2475 Miller Avenue, Huntingdon, PA 16652 email: Jgooch@penn.com

We all associate QRP with CW. Unless replaced by PSK31 or the like, CW will remain the mode of choice of the QRP op because it's easier to homebrew a CW rig, and, Watt for Watt, the modulated, wideband phone signal lacks the intelligibility of CW. Some QRPers are so fiercely loyal to CW that they avoid the phone bands like poison. Sure, it's masochistic to try to ragchew at 5W in the middle of the 20M-phone band. But in a contest, plenty of points and multipliers hang out on SSB, and you shouldn't always turn up your nose at them.

To encourage more QRP phone operation, ARCI sponsors two short contests, the Summer Daze SSB Sprint and the wintertime Fireside SSB Sprint. The state QSO parties operate both CW and SSB, and the scoring usually combines points from both modes. Although the largest international contests usually run CW and SSB on different weekends, lots of middle-sized ones run and score them together. How much difference would those SSB contacts make in a QRPer's contest effort? Operating at 5W with good wire antennas, I average about 20% of my QSOs on SSB in stateside contests. Your results, depending on QTH, station, and antennas, will differ.

On a quiet band, a 5W SSB signal is copyable over a long distance. Unfortunately, QRN and contest QRM prematurely drag our signals into the mud. Unless you have stacked monobanders, you'll have a tough time running QRO stations at QRP power levels. Even 100W contesters are run off frequency by kilowatt-pounding big guns and crusty old ragchew netters. Most QRPers will make their contacts via S & P. This doesn't apply to the ARCI SSB sprints, where the contest QRM isn't as bad, and all the ops have their ears tuned for weak signals.

Contests attract a number of big-gun stations that camp out on a frequency for the duration. Like frogs picking off flies, they're hungry for every station they can get in their logs, and they have the antennas to hear your flea-power signal. All you have to do is answer their CQ or QRZ.

That can be a problem, though. At peak operating times, you'll be buried under the pileup of stations trying to work the big gun. In CW, you can tune a little off frequency to be noticed. In SSB, that just makes you unintelligible – so it's best to keep the RIT off. You have two options: one is to try to toss your call into the few milliseconds of comparative quiet between blasts of QRM. Normally you should give your bare-bones call – crisply and in phonetics. A short call is an advantage. In a big pileup, it sometimes works to tail-end your call with "QRP". The other op is more likely to catch the "QRP" than your call and it may come back with "the QRP station please." The second option is to give up and return to the big gun later when things have quieted down.

In a typical contest you should be able to work most of the big-gun SSB stations on one or more bands. Sandwiched between the biggies are more modest, less persistent CQing stations and the ones with antenna gain lobes pointing at you will be workable. As a rough rule of thumb for the low bands, I can usually work fixed stations that are S8 in a noisy band, and S7 when it's quiet. Mobile ops are used to weak signals and I come back to mobiles who register at least S6. Things are trickier on the higher bands, but the stations with the strongest signals usually have a beam or quad on your heading and it's worth a stab at working them. W5WU, Sam Stimson, and WB3AAL, Ron Polityka, ran up plenty of cross-country contacts with their beams in the Fireside sprint. If 10M is open you can make solid contacts even with a wire or vertical antenna. A pet peeve: the kilowatt station with a lousy receiving antenna. I yell into the mike till I'm hoarse, but it CQs blithely on, deaf as a doorknob.

Sometimes we QRPers can be a contest nuisance. Contest etiquette says that a contest caller should come back to anything it hears. On SSB, a QRPer should think twice about replying to a QRO station's CQ unless it's running reasonable power (3-5W?) into a decent antenna. Otherwise, the QRPer may have to repeat the exchange till he/she is blue in the face before the calling station finally gets it right – if it ever does. This is unfair to the other op, who is trying to work stations as fast as possible.

Good transmitted voice quality helps to make SSB contacts. Some hams use mikes that don't match the audio spectrum of their voices. In person they resonate like Lionel Barrymore, but over the air they sound like they're face down in a bowl of mush. It's worthwhile trying different microphones and to adjust the gain, ALC, and level of RF clipping of your rig to minimize splatter and distortion. Some modern rigs have controls that customize the transmitted frequency response, reinforcing the higher frequencies for bassy voices and lower frequencies for trebles. Microphone elements and audio equalizers are available that let you tailor your voice from sharp and piercing - good in contests – to rich and full-bodied – nice for ragchewing. The only suggestion here is to experiment with your audio components and get feedback on your on-the-air voice quality from your friends.

It's also not a bad idea to work on pronunciation and phonetics of your call letters to help punch them through the noise. When I speak my call "NA3V" without phonetics, the first part gets through OK, but the "Three Vee" is often copied as "3B", "3C", or the like. When I use standard phonetics – November Alpha Three Victor – it's the "Alpha" that's missed. The tactic that works best for me is to come back to the CQer with my call in standard phonetics. If the caller asks for a fill, I give the same, this time clearly and slowly. If he still hasn't got it, I try different phonetics. For some reason geographical phonetics – Norway America Three Victoria – gets through the QRM best. A ploy some hams use when standard phonetics fail is to give their call suffix as a familiar jingle (SAH "Shave And a Haircut," YRT "Yellow Rose of Texas," etc.). If the other station gets a piece of it, it can usually supply the rest.

The exchange in some SSB contests is fast. If you are using VOX and the delay is set long, the caller may start his exchange while your receiver is still muted. To prevent the embarrassment of not knowing if the caller is working you or someone else, consider setting the delay shorter than you would use in an ordinary ragchew.

A few last points: WB3AAL emphasizes the importance of a good mike and aggressive persistence in making contacts. QRP SSB is not for the bashful. W5WU gives useful tactics for any low-power op: scan the bands for activity and propagation conditions before the contest, and start on the high bands and work down, always looking for the needed multipliers. He also keeps a second receiver handy to monitor the bands he's not currently working.

So there you have it. On the day we came into the world, we all let out a big squall. That's what voices are for. Why quit now? Put away that key now and then, lubricate that rusty jaw, and make some QRP SSB QSOs.

Edited by W1HUE

A High Dynamic Range Power Meter and Antenna Tuner Aid

by Steven Weber, KD1JV   Box 140, Gorham, NH, 03570   kd1jv@moose.ncia.net

Would you like to adjust your antenna tuner for the best possible match, using as little as 1 mw of power? Would you like to measure your output power from less than 10 microwatts up to 100 watts, on one meter scale? Than you need to build this high dynamic range power meter.

This meter is based on the popular "Stockton" directional coupler. (which is apparently based on a circuit patented in 1969 by Sontheimer and Fredrick) The usual diode detectors have been replaced by the Analog Devices AD8307 log amp. The 8307 is an interesting chip. It has over 90 dB of dynamic range, with a native range of -75 dBm to +17 dBm, a frequency range of DC to 500 MHz and a linearity of +/- 0.3 dB. It is also reasonably inexpensive and is available in an easy to use 8 pin dip package.

Since the AD8307 is so sensitive, we need a way to attenuate the signal going to it for high power measurements. Since we also want to use it to adjust an antenna tuner, we need a means of determining SWR. That is the function of the directional coupler. The "Stockton" bridge is ideal, as it doesn't use a capacitive divider for balance and is fairly immune to operational frequency. An additional amount of attenuation is added between the sense ports of the coupler and the input to the log amps. (a simple series resistor) This reduces the number of turns needed on the pick-up toroids to a reasonable number and also reduces loading effects of the log amp input impedance on the bridge balance resistors. The total amount of attenuation as seen by the log amp input is about 40 dB.

In a perfect world, the directional coupler would have perfect isolation between the forward and reverse power sense ports. i.e., when connected to a 50 ohm dummy load, there would be zero power on the reverse sense port. In practice, there will always be some power on the reverse port. This can come about by imbalances in the circuit and stray coupling.

With the log amps in place, it is easy to measure the amount of directivity the directional coupler is providing. Simply by measuring the voltage between the forward and reverse sensing amps and dividing by 0.025, as the 8307 has a linear 25 mv per dB output slope, will give us the amount of isolation in dBm. In my prototype, the amount of isolation varies from a high of 38 dBm on 160 M and a low of 25 dBm on 10 M. This is a reasonable amount of isolation. An attempt to improve the isolation by placing a shield between the two toroids did not make any significant improvement, so the shield was left out.

Finding "best match", lowest SWR

The way that we are used to adjusting a tuner for best match is to look at the voltage on the reverse port and tune for the minimum reading, or zero, which corresponds to a 1:1 SWR. Another way to do it is to put the meter across the forward and reverse ports and tune for a maximum meter reading. This indicates when you have the most forward power and the least amount of reflected power. This may not be the lowest SWR, but it is the best match.

This is the approach taken for this meter. Since the output of our detectors are logarithmic and by connecting the meter across the two outputs, we have in effect created a "Return Loss Bridge". Unlike a bridge using diodes, this meter has no "dead zone" where the reverse power can drop to a level below which the diode can detect. Therefore, a more precise match can be achieved. In addition, since the isolation of the bridge is constant for a given frequency, the differential voltage between the forward and reverse ports stays constant, regardless of power applied. As power to the bridge is increased, both the forward and reverse detected levels go up in proportion, so the difference stays the same. The only criteria for the amount of power required to tune a tuner is that there is sufficient power to get a good indication on the reverse sensing log amp.

Using this approach, I have been able to tune my antenna tuner with as little as 1 mw and have perfect 1:1 SWR. 1:1 SWR was confirmed by increasing the power sufficient to get a reading on the Radio Shack digital SWR meter. I have however noted that it takes a little more power (10 mw) to get a good definitive meter movement on the higher bands, such as 15 and 10 meters. This is no doubt due to the lesser amount of isolation on these bands. You will also find that the antenna tuner now needs more precise adjustments to find the ideal match. This is because there is no "dead zone" as is the case with a typical SWR meter, which gives the impression there is a 1:1 SWR over a much wider range.

To make tuning easier, a smaller resistor than the one used for calibrated power readings is used in the tune mode. This spreads the scale out and we get more meter movement. Since the bridge directionality is the limiting factor in the amount of dynamic range we get, we can expand the scale to reflect this restricted amount of dynamic range.

It is possible to correlate return loss to SWR. Since this bridge has somewhat limited directionality, 25 dB on 10M, it will only indicate down to a SWR of 1:1.12, although your actual match may be better than that. In fact, for a reason I can't explain, I can peak the tuner for a higher return loss that what one would expect by the reading going into a dummy load. If we calibrate our meter scale to read 0 to 50 dB, we can figure out the SWR with the help of a table.

Here are some of the values for Return loss vs. SWR

dB	SWR
0	infinite
1	17.4
2	8.72
4	4.42
6	3.01
8	2.32
10	1.92
14	1.50
18	1.29
25	1.12
30	1.07
40	1.02
50	1.006

If you really don't care what the exact SWR is, there is no need to calibrate the scale. Simply adjust your tuner for maximum meter reading and call it good.

Power measurement.

As noted earlier, this bridge can be used to measure power from less than 10 microwatts up to 100 watts. However, the measurements will be in dBm. This makes for fairly coarse power readings. Also, unless well calibrated, it may not be extremely accurate. Remember, a 3 dB increase in power is a doubling in watts. Also, the power increases faster as you get closer to a decade change. Going from 30 dBm to 31 dBm is a change of 1.0 watts to 1.26 watts, or a delta of 260 mw, while going from 39 dBm to 40 dBm is a change of 7.9 watts to 10 watts, or a delta of 2.1 watts. As you can see, a small change in dBm can mean a big change in power, especially at higher power levels. Even so, since this meter can measure down to very low power levels, it will give a useful indication well below that of traditional meters. It will also give you useful "magnitude of order" information.

The lower limit of measurement is set by the internal noise generated by the log amp and the amount of attenuation placed before it. In the case of this meter, the minimum reading will be about 1 microwatts, or -30 dBm. This is so little power, simply connecting an antenna will produce a meter reading. Also note that because of the residual output from the log amp, the meter will not go to zero.

The maximum power the bridge can measure is determined by the log amps dynamic range. If we were to go solely upon that, the full scale could be 1 Kw. However, I don't believe this bridge would take that kind of power. 1 KW produces some very large peak-to-peak voltages, and arcing could well occur before one reached those power levels. In addition, the sensing cores will saturate well before we get to 1 KW. I have only tested the meter to 40 watts, the most I can produce here. (I am after all, a QRPer!)

Building the meter.

Printed circuit board construction is recommend. Use single sided stock. The layout is shown in fig 2. The "proof of concept" board was made ugly style, simply cutting "islands" out of the copper foil (with a hobby knife) for the directional coupler connections and mounting the log amps dead-bug style. This worked well, so this is an option if you don't want to etch a board. Cutting the holes for the toroids may be the most difficult part of making the board. I used a 1/8th inch carbide router bit, which made easy work of it. If you drill holes, using a fairly large bit, drill at a very slow speed and if at all possible, clamp the board down. It is very easy for a large size drill bit to grab the board and spin it. This can slice you up very badly if it's spinning fast. I have the scars to prove it!

Since this "Stockton" bridge is popular, you may already have one. In which case, one could remove the diode detectors and replace them with the log amps. No matter which way you chose to build it, remember the log amp has a frequency response up to 500 MHz. Therefore, the leads on the by-pass caps must be made as short as possible.

There are no plans at this time to have boards made or sell a kit. It is an option though, if there is enough demand (let me know...)

The primary turn of the toroid transformer is simply a short piece of RG-58 coax, with the jacket removed. The shield is used as a Faraday shield. This makes the bridge less responsive to harmonics. Only ground one end of the shield. Wrap some electrical tape or Teflon plumbers tape over the shield to bring the diameter up to the point the wound toroid is a fairly snug fit and to insulate the end that isn't grounded.

A good quality analog panel meter is recommended, the bigger the better, especially if you want to calibrate a dBm power scale. It is much easier to peak an analog meter than it is a digital one. If you simply want to use the bridge to adjust your antenna tuner, any old meter would be fine. Ideally, you want a meter with ten major dvisions. Typically, with an "off-the-shelf" meter, these would be marked 0 to 100.

The meter limiting resistor values shown on the schematic are for the 50 ua meter movement I used. It's an old meter, probably of WW II vintage. 100 ua or 200 ua movements are more common, just scale the limiting resistors appropriately. (1/2 the values for a 100 ua movement)

A metal box is required to enclose the bridge. This ensures stray RF stays out of the sensitive log amps, which may upset the readings. I mounted my board by soldering it directly to the center pins of BNC jacks. Stand-offs on the corners are used for additional support. No reason you can't run coax to the board from RF jacks mounted some distance away.

Unlike most other SWR meters, this one needs power to run the electronics. Supply current is reasonable, about 16 ma, so an internal battery pack is a good option, to keep it self-contained. 5 AA cells should power it for a reasonably long time., provided you remember to turn it off. If an external supply is used, such as a 9V wall wart or your station's 12 V supply, additional by-passing and an RF choke at the power jack would be a good idea.

It is important to use the specified LM324 type op amp. The output of the log amps are fairly high impedance and need to be buffered to drive the meter. Also, the inputs and outputs of the op amp need to be able to work near ground. Many other common op-amps, such as the TL-084, will not work.

The Analog Devices AD8703AN is not stocked by the part suppliers many of us are used to buying parts from. Analog Devices will sell small quantities direct from their web page, using credit cards. (or you can call in the order) (www. analog.com) These chips currently sell for $9.75 each.

Test and calibration.

Do the usual pre-power check ups. Inspect solder connections, component placement, wiring, et. Connect up a transmitter and 50 W dummy load. Apply power to the circuit. In the tune mode, the meter should read zero or very close to it. In the power mode, there should be a small upward deflection of the meter. Now key the transmitter and look for a meter movement. You can check the amount of isolation between the forward and reverse ports by putting a DVM directly across the op amp outputs for the two ports. On 80 M, you should get at least 800 mv and on 10M, 550 mv. Divide these readings by 25 mv to find the amount of isolation in dB. Do this test transmitting into a dummy load.

Power calibration.

If a meter with 10 major divisions is used, we will have 10 dBm increments. "40" on the meter will correspond to 0 dBm (1 mw). 10 watts is a reasonable power level to use for calibration and is equivalent to +40 dBm. Set the meter switch to measure forward power. Apply 10 watts through the bridge and into a 50 ohm dummy load. If possible, use a watt meter you trust to use as a reference. Adjust the power cal pot so the meter reads 80. With zero input, the meter should read about 10, or -30 dBm (1uw). If you wish, re-label the meter scale to read directly in dBm.

Your final meter scale will be such:

10 = -30 dBm, 1 uw
20 = -20 dBm, 10 uw
30 = -10 dBm, 100 uw
40 = 0 dBm, 1 mw
50 = +10 dBm, 10 mw
60 = +20 dBm, 100 mw
70 = +30 dBm, 1 w
80 = +40 dBm, 10 w
90 = +50 dBm, 100 w

Calibrating Return Loss

If you don't need or want to calibrate the return loss mode, skip these steps and simply use the 22K resistor specified in the parts list.

There wasn't enough room on the circuit board to add a cal pot for return loss. So, of you want to calibrate this scale, you will need to find a place to mount a trimmer pot. This pot will go in series with R10. You will also need to reduce the value of R10 to say, 10K and use a 25K trimmer.

Assuming you have a 0-100 scale on the meter, make 100 equal to 50 dB. If possible use 160 or 80 meters to find the return loss of 1:1 by transmitting into a dummy load, using a few watts. As was described earlier, use a DVM to measure the voltage between the outputs of the log amp buffers, pins 1 and 7 of U3. Divide the reading by 25 mv to get dB and adjust the trimmer to get the meter to read this value.

You will probably find that adding the meter leads across the op amp outputs will make the meter change it's zero reading. However, it doesn't affect the reading at higher deflections. Assume zero volts for the no RF input value and use the reading on the DVM when RF power is applied through the bridge to calculate the return loss.

Parts List

R1,2,3,4	100 W, 1/4w (1% preferred, or matched 5%)
R5,6	3.6K, 1/4w
R7,8	1K, 1/4w
R9	47K, 1/4w
R10	22K, 1/4w
Trim pot	25K, 0.2" spaced pins
C1,2,3,5,6,7	0.01 ufd/ 50v monolithic ceramic, 0.1" LS
C4,8	0.001 ufd/ 50V monolithic ceramic, 0.1" LS
C9	10ufd, 16V alum electrolytic.
C10	0.1ufd/50V monolithic ceramic, 0.1" LS

U1,2	AD8307AN log amp, 8 pin dip
U3	LM324 quad op amp
U4	78L05, +5V, TO-92 regulator
T1,2	FT50-43 ferrite core, sec 20T # 24 magnet wire
J1,2	BNC jacks
S1	DPDT miniature switch
M1	50 ua meter

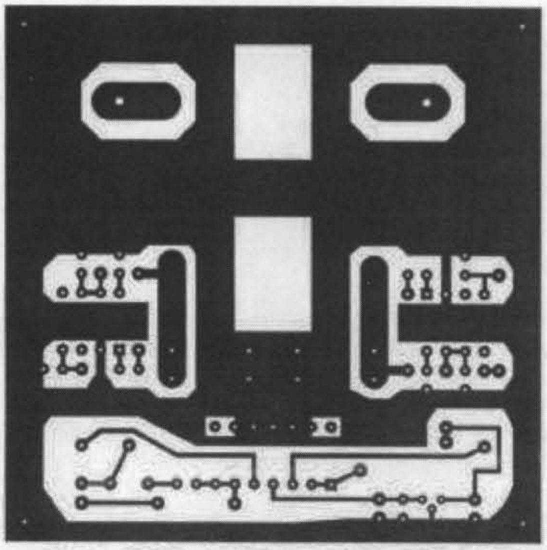
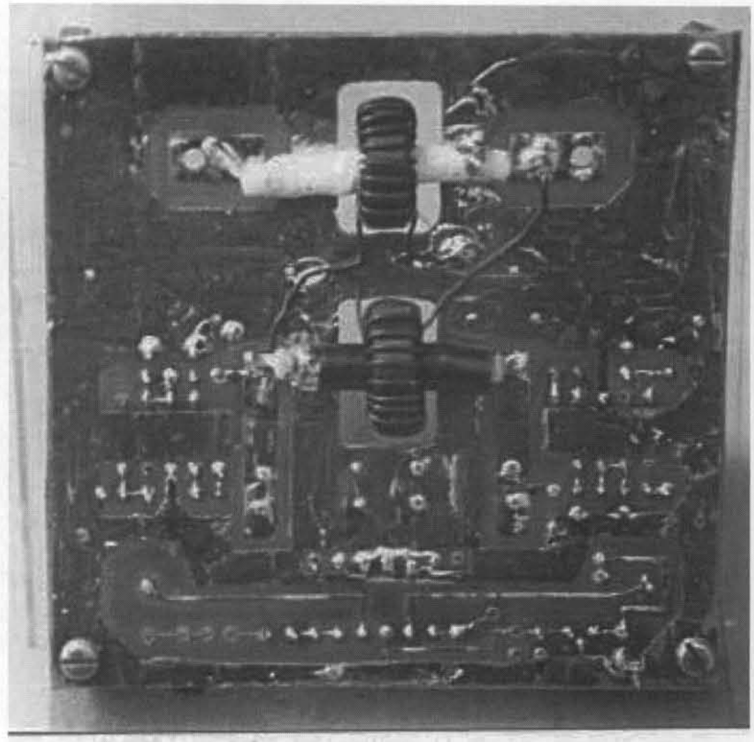


FIG 1, PCB LAYOUT BOTTOM, ETCH VIEW



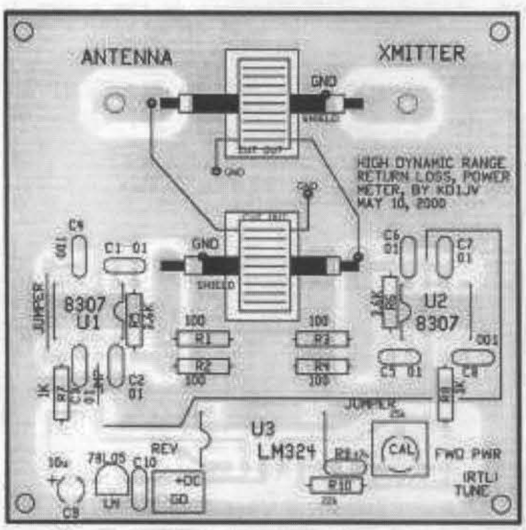
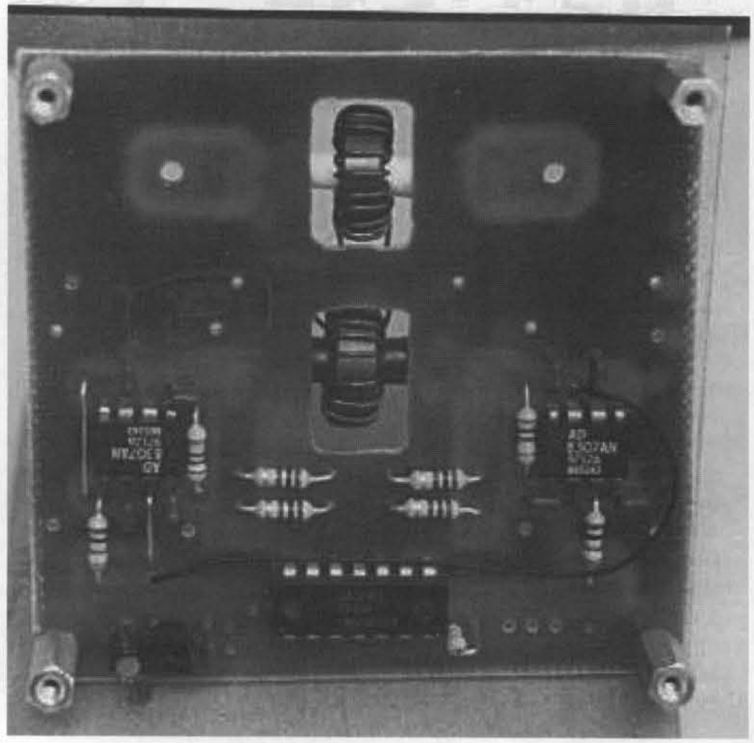
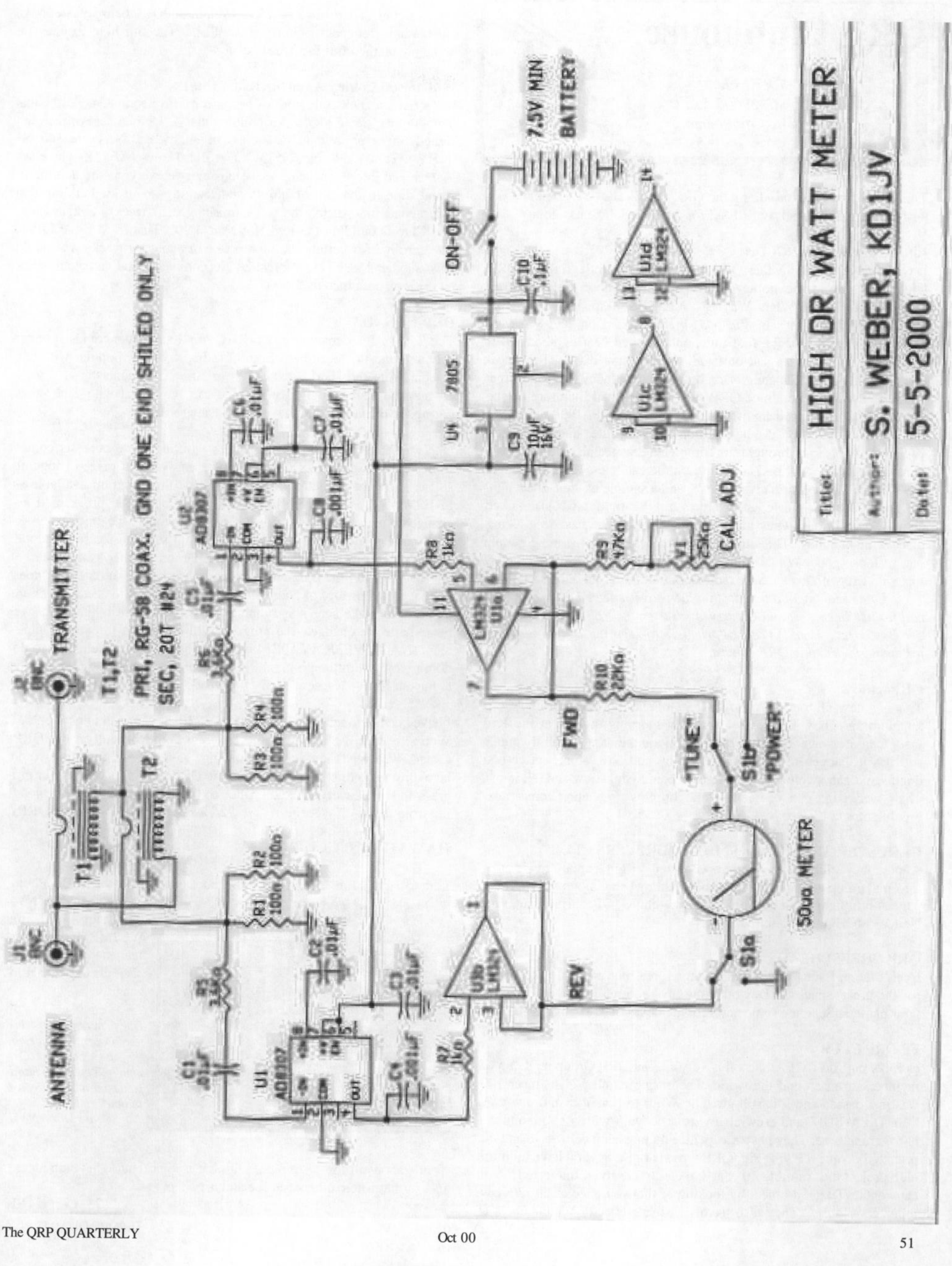


Fig 2, PARTS PLACEMENT




ANTENNA
J1 BNC
TRANSMITTER
J2 BNC
T1,T2
PRI, RG-58 COAX. GND ONE END SHILED ONLY
SEC, 20T #24
T1
T2
R1 100Ω
R2 100Ω
R3 100Ω
R4 100Ω
R5 3.6KΩ
R6 3.6KΩ
C1 .01uF
C2 .01uF
C3 .01uF
C4 .001uF
C5 .01uF
C6 .01uF
C7 .01uF
C8 .001uF
U1 AD8307
U2 AD8307
R7 1kΩ
R8 1kΩ
U1b LM324
U1a LM324
U1c LM324
U1d LM324
REV
FWD
R9 47KΩ
R10 22KΩ
V1 25KΩ
CAL ADJ
"TUNE"
"POWER"
S1a
S1b
50ua METER
U4 7805
C9 10uF 16V
C10 .1uF
ON-OFF
7.5V MIN BATTERY
Title: HIGH DR WATT METER
Author: S. WEBER, KD1JV
Date: 5-5-2000

QRP Clubhouse

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This is my first issue of editing the QRP CLUB HOUSE column. We wish to thank Doc Lindsay K0EVZ for the great job he has done.

Little Thunder QRP CLUB

It was time again for another QRP meeting by the Little Thunder QRP Club. We met at the home of VE3XT,Bill. Those present were: VE3XT Bill, VA3WRL Wayne, VE3BBS Skip VE3CAP Don, VA3BEL Vic, and myself, VE3FAL Fred. Skip, Don, and Vic were out to the meeting for the first time, and enjoyed hearing about QRP and seeing some of the gear on hand. Vic brought his TenTec Argonaut station to show the gang. Don brought some fancy enclosures that could be used for some nice QRP stuff and Bill had literature on the Spartan Sprints as well as information on the QRPARCI Fall QSO Party. Bill also had on display his homebrew paddle, and a switched capacitor filter. Fred brought his completed 38 special , and his newly purchased Kenwood TH-G71 for use on the satellites. He also brought the W5KQJ Laser Transceiver boards, and a sample of the Little Thunder QRP Club Certificate, and pictures of QRP field day. Also talked about were various types and experimentation that has been taking place with antennas. The club seems to be drawing some more people out, so looks good. We also talked about how QRP is really taking off like wild fire with the amateur radio communities around the world.

Late breaking info tells us that they have received their own club call for use in contest and QRP events. Listen for VE3LTQ from Thunder Bay , Ont. Fred, VE3FAL, promises to keep the call active, look for them in upcoming QRP contest.

QRPacific

This is a new club in the central Oregon area. Started to promote qrp/kit building. They meet every Saturday morning at 9am at the Red Door Cafe in Newport, Oregon. They tell me they are a friendly bunch and if you happen to be in town stop by and have some coffee and donuts and gab awhile. Don't for get to being your show and tell items. Their web page can be viewed at: http://www.teleport.com/~cqdx/qrpclub.htm .

GLOUSTER AREA QRP and HOMEBREWERS CLUB

Another new club is located in the Glouster, Virginia area. This is an informal group and information can be had by bringing up their web page at http://pages.hotbot.com/photo/wa4chq/G_QRP.html Thanks to Neil WA4CHQ for this info.

QRP CHEESEHEADS

I can't let an issue go with out saying a great big thanks to the Group for the great snacks at Dayton. You guys you really made a hit with your platters. Send me some news for the next issue. Thanks again.

FP QRP CLUB

es folks pigs do fly ! At least this very special QRP Group made up of members from around the world. The magic number of member 100 was just passed and it is still growing. Your truly is #25 and my XYL #66. Diz W8DIZ and crew also were at Dayton with a booth and we had a grand time. They have a very nice membership certificate and the price to become a FlyingPig (QRP type) is right. Several have built the club project the "miniPig 10" , a 10 meter transceiver. Interested ? You can contact Diz and others by looking at the web page at http://www.mpna.com/fpqrp/ They also have an e-mail reflector for members at egroups.com. There are 2 new kits from the FPQRP being offered. An outstanding frequency counter and a PLL. The finishing touches are being put on the MultiPig Transciever.

Williamson County Amateur Radio Club

Not strictly a QRP club, but this news from Bill Sepulveda, K5LN, that the club has started a QRP kit building class. 15 members of the club signed up to participate in a class given by K5LN, Dave Hassell (N5IW), Tom Whiteside (N5TW), and Bob Helms (AF5Z). The class is separated into 9 weekend secessions to give everyone ample time to spend time in the class building and learning about kit building and then spend time during the week finishing their weekly assignments. The Club is building the Red Hot Norcal 20. Thanks to Dave Fifield and Caroline for getting the kits to us. In about 10 weeks we should have another 15 Red Hot Norcal 20 kits completed and on the air, so be on the look out on 20 meters.

QRP-CANADA

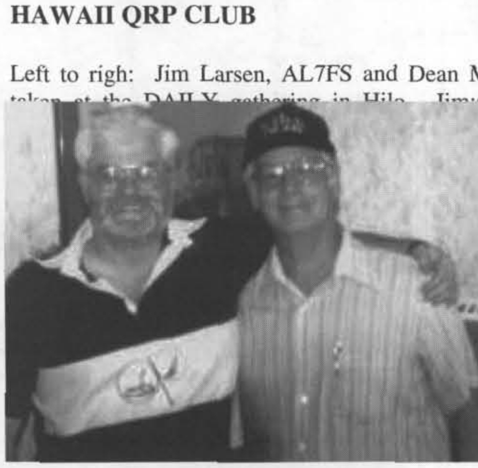
The Radio Amateurs of Canada (RAC) run two annual contests; one in July and one in December. Both have become very popular with one reason being the "laid back" nature of these fun contests. It's very common to hear participants stopping to have a chat with each other during the event and both have a QRP category.

One contribution that really enhances working these contests comes from Paul Cassel, VE3XXX, who wrote an excellent piece of logging software for these contests. Paul has made this program available as FREEWARE. Paul is no longer able to support the program. I exchanged e-mail with him, asking if I could support the software in order to make sure it was still available. Paul sent me the source code. My son, Scott & I (Scott's the expert & I'm on another learning curve) are investigating the program in order to bring it up to date as it does not have the territory of Nunavut in it. We also want to check the entire program to make sure it is running 100%. The plan is that once we have made the changes, the program will be sent to three other amateurs (NA6E, VE3JC, VA6RF) who have volunteered their time to do dummy runs with the program, looking for any problems. Our hope is to have it ready, as freeware, for this year's Winter contest.

I have been in touch with Ken Pulfer, VE3PU, who maintains the RAC Web site with the idea that the program could be put on the QRP-Canada web page there for downloading. Ken has said that they would be happy to do this. I will be using the QRP reflectors to post our progress and to let everyone know when the project is ready for downloading from the RAC Website. **72/73 - Bruce (VE5RC+VE5QRP)**

HAWAII QRP CLUB

Left to righ: Jim Larsen, AL7FS and Dean Manley, KH6B. Photo taken at the DAILY gathering in Hilo. Jim's YF Nancy KL7NY, daughter Juliann WL7MP and mother Jeanette KA0NMO also visited the Hilo gang.



Due to my oversight this photo wasn't included in the last Clubhouse Column and two such handsome ops deserve recognition!!
de Mary, NA6E

That's about all for this month. I think it is important to get club ideas in a format where others can see and use them .

73 Les K4NK

Contests

Randy Foltz, K7TQ *email:rfoltz@turbonet.com*

UPCOMING EVENTS

ARCI Fall QSO Party	October 21-22
Holiday Spirits Homebrew Spring	December 3
Winter Fireside SSB Sprint	February 11

First off, let me apologize for some omissions in the July QRP Quarterly. Scores were listed for neither the Spring QSO Party nor the Winter Fireside Sprint. Also there were no announcements with rules for the upcoming contests. All of these were submitted, approved by the editor, but didn't make the final copy. We'll do better this time.

This issue contains the Spring QSO Party and the Winter Fireside Sprint scores, results from the Hootowl Sprint, Milliwatt Field Day, and the Summer Homebrew Sprint. The results are sorted by state. If you would rather see them sorted by descending score, take a look at the QRP ARCI Contest web page at http://personal.palouse.net/rfoltz/arci/arcitst.htm. The issue also contains full rules for the Holiday Spirits Sprint and the Winter Fireside SSB Sprint. Finally there is a contest summary sheet that you can fill out and send to me if you prefer that method over using e-mail.

Finally a reminder. If you use the High Claimed Scores form at http://personal.palouse.net/rfoltz/arci/form.htm to send me your contest summary, you still need to send me a copy of your log. Either e-mail or regular mail is fine. The log doesn't have to be fancy, just readable.

2000 Winter Fireside SSB

QTH	Call	Score	QSO Pts	SPC	Power	Bands	Time	Rig	Antenna
CA	W6ZH	36,792	146	36	LT5	40-10	4	K2	KT-34XA, 40 m yagi
	N6VVK	9,408	84	16	LT5	40-10	4	Knwd 440	
CO	KI0II	10,780	77	20	LT5	20-10		Argo 556	A-99, windom
FL	W2VE	12,544	128	14	LT5	20	3	MFJ 9420	Inv vee
ID	W1HUE	17,080	122	20	LT5	20-10	3.5	QRP+	450 ft long wire
MA	K1QM	25,025	143	25	LT5	40-15	3.5	QRP+	dipole
MD	KB3WK	40,320	180	32	LT5	40-10	4	K2	dipole, beam
	K3CHP	4,543	59	11	LT5	40-10	4	PC-9000	yagi, vert
NJ	N2EI	7,777	101	11	LT5				
	W2JEK	4,452	53	12	LT5	40-10	2	FT840	dipole, gnd plane, end fed hz
	N4JS	2,520	45	8	LT5			K2	dipole, kt34, gap
NY	KB2HSH	960	96	10	GT5				
OK	NA5E	35	5	1	LT5	20	0.2	White Mtn 20	
PA	WB3AAL	25,578	174	21	LT5	20	4	TS-50	beam
	W3TS	20,900	110	19	LT1	40-10	1.6	K2	Inv vee, yagi
	N3AO	10,752	96	16	LT5	40-10	3.25		
	KB3AAG	1,078	77	14	GT5	40-10	3	Yaesu 757	40 m loop
SC	K4NK	8,645	95	13	LT5		2	Argo	yagi
SK	VE5QRP	7,462	82	13	LT5		1.75	TS430S	2 el yagi
TX	N5WU	45,969	199	33	LT5	20-10			
	NN5B	30,450	174	25	LT5	20-10	4	FT920	carolina window
UT	WA7LNW	69,825	285	35	LT5	40-10	4	K2	vert loops
VA	N4EUK	2,303	47	7	LT5	40-15	1.5	FT840	100 ft longwire
WA	K7NTW	1,764	42	6	LT5	20	2	White Mountain 20	2 el quad
	NW7DX	1,715	35	7	LT5	20,15	1	TS-570	40 m loop

2000 SPRING QSO PARTY

QTH	Call	Score	Pts	SPC	PWR	Bands	Time	Rig	Antenna
AK	AL7FS	49,000	200	35	LT5	40-10	5.5	TS450S	KLM KT34A, 2 ele yagi on 40m
AL	W4DEC	632,492	922	98	LT5	160,40-10	15.25	K2	Triband beam & 160 m inv vee
	K4AGT	68,614	338	29	LT5	20	6	OHR-100	Dipole
AR	AB5XQ	7,826	86	13	LT5	20,15	3.5	Icom 707	G5RV @ 20', vert
	W5TB	7,665	73	15	LT5	40	3	Sierra	Doublet fed w/ 300 ohm
AZ	K7RE	1,202,782	1621	106	LT5	20-10	24	K2	3 ele beam @ 35'
	NQ7X	598,878	882	97	LT5	40-10	10	TS-850	Triband & 40m dipole
CA	KN6YD	115,388	317	52	LT5	20-10	5	FT890	R7 vert, rotary dipole
	AD6JY	47,250	225	30	LT5	80-10	11.5	K2	Butternut HF9U, attic multiband dipole
	K6III	36,400	208	25	LT5	15	1	K2	Force 12 C3 @ 45'
	AD6GI	30,744	183	24	LT5	15	14	K2	40 m dipole
	N6WG	22,260	212	15	LT5	40	21	K2	N-S dipole, E-W dipole
CO	N0IBT	230,720	515	64	LT5	40-10	16	TS-870	Dipoles
	N0RC	209,622	434	69	LT5		12	K2	Attic multiband dublet
CT	W1VT	463,932	789	84	LT5	80-10	15	HW-9	Yagi @ 60', 40m dipole
	N1EI	79,380	189	28	LT250	80-15	8.75	OHR 500	80m doublet, 40m loop
	W1FB	36,848	188	28	LT5	40-15	5	TS-570D	Inv vee @ 25'
FINLAND	OH9VL	9,620	74	13	LT1	15	11	Homebrew	dipole, 2 loops
FL	N4BP	1,755,292	1804	139	LT5	160-10	23	K2	TH7DXX, 402BA, dipoles
	W4MLA	59,052	228	37	LT5	40-10	10	SC-2020	Vert, KT-34 @ 50'
G	G3XJS	42,840	180	34	LT5	20-10	5.5	K2	DX-32
GA	K4BAI	536,844	913	84	LT5	40-10	11.3	FT1000MP	TH6DXX, dipole
	AF4PP	51,408	204	36	LT5	40-15	4.5	Sierra	40 m dipole, 20 m dipole
	AE4GX	2,835	45	9	LT5	20	0.5	IC756	Inv L 120' long @ 30'
GW	GW0VSW	38,850	150	37	LT5	40-10	9.8	Argo II	Half size G5RV @ 9m
IA	KB0JUL	24,472	152	23	LT5	20,15	7	Argo 509	Indoor dipole
ID	K7TQ	299,404	629	68	LT5	40-10	14	K2	7 el yagi @ 90'
	W1HUE	160,000	320	50	LT1	80-10	9	K2	GAP vert, inv vee, 450' long wire
IL	N9MZP	49,266	207	34	LT5	40-10	14	TS450	G5RV@50'
	W9CHN	6,216	74	12	LT5	40	2	TT Delta 580	80&40m loops @ 8'
IN	K9PX	250,432	832	43	LT5	40	15	K2	80 m loop
	W9SR	159,544	616	37	LT5	40	18	Homebrew	160m full wave loop @ 53'
	K9DIY	1,680	40	6	LT5	40,15	1	Corsair I	Inv Vee
JA	JR0BAQ	2,016	48	6	LT5	20-10	2.5	TS-440V	Beam
KS	WB0SMZ	33,936	202	24	LT5	20	4	Norcal 20	Butternut vert
KY	KG4BIG	77,560	277	40	LT5	40-10	7	Omni VI +	135' centerfed, HF9V, 2L yagi
LA	N5IB	40,936	172	34	LT5	40-10	21.5	DSW40, NW20, TS430S	40m horiz. loop, 10m GP
LY	LY2FE	123,200	352	50	LT5	20-10	13.25	HB RA3A0	Yagis, 200m long wire
LZ	LZ2RS	48,265	197	35	LT5	20-10		K2	5 el log yagi, 2 el HB9CV
MA	K1QM	549,626	913	86	LT5	80-10	23.5	Icom 706	Dipole
MD	W3MWY	59,024	248	34	LT5	40-15	16	Argo 556	Full wave 30m @ 50', gnd plane
	W6TOY/3	21,679	163	19	LT5	20	7	TS130V	135' wire
ME	K0ZK	424,830	714	85	LT5	40-10		K2	Dipole 40m, inside dipole high bands
	KB1CKS	11,648	104	16	LT5	40,20	8	Scout, homebrew, R4	Random wire
MI	K8CV	273,728	611	64	LT5	160-10			
	KA1DDB	209,916	476	63	LT5	80-10	13	Sierra	G5RV @ 37'
	AA8SN	46,592	208	32	LT5	40,20	7		
	KI8AF	41,769	221	27	LT5	20	10	OHR 500	Dipole
	AB8DF	21,098	137	22	LT5	40-15	4	Triton IV, NC20, SW40+	105' dipole @ 35'
	W8TIM	18,060	129	14	LT1	40	4.3	SW-40	Dipole
	N8TDH	12,446	127	14	LT5	40	10	MFJ9040	Droopy dipole
	WB8RCR	10,710	90	17	LT5	20	10	NC-20	Homebrew vert
MN	N0UR	1,227,744	1392	126	LT5	160-10	20	FT-902	3 el yagi, wires
	W0UFO	72,800	260	40	LT5	40-15	6.8	FT840	3 el tribander
MO	AA0B	24,150	115	21	LT1	40-10	4	TS-120S	140' Zepp
	N0WM	20,860	149	20	LT5	40-15	9		
MS	K5HQV	399,378	771	74	LT5	80-10	17.5	FT-1000MP	140' dipole, Ham Stick
NC	WQ4RP	368,298	711	74	LT5	80-15	16.6	Homebrew	Wire dipoles
	WA4DOU	178,500	510	50	LT5	20	16.25	Yaesu FT840	Force 12 C3SS @ 53'

2000 SPRING QSO PARTY cont...

QTH	Call	Score	Pts	SPC	PWR	Bands	Time	Rig	Antenna
NH	AA1CA	211,358	487	62	LT5	80-10	12	HW-9	8 el 10 m Sterba Curtain
	KN1H	129,360	294	44	LT1	160-10	8	Argo 509	140' dipole
NJ	N2CQ	539,448	988	78	LT5	80-10	11.25	TS-850	TA33jr, Zepp
	K2JT	377,400	555	68	LT1	160-10	7	Sierra	Doublet
	W2BVH	20,160	144	14	LT1	40	5	Tuna Tin II	Center fed Zepp
	W2JEK	7,035	67	15	LT5	80-15	1.3	FT-840	Dipole, gnd plane
NM	K5AM	254,058	526	69	LT5	40-10	9		
	KM5VY	34,510	170	29	LT5	40-15	6.5	K2	100 ' doublet @ 25'
	N1IRZ	13,986	111	18	LT5	20	6	MFJ Cub	Random wire
NV	N7AC	65,410	211	31	LT1	20	16	SG2020	40 m horiz loop
NY	N2CU	371,497	727	73	LT5	80-10	13	FT1000MP	TH6DXX @ 50', dipoles
	WA2BQI	97,006	338	41	LT5	40-10	17	Icom 707	Dipoles
	K2QO	96,320	320	43	LT5	80-10	6	Argosy	HF6V, 58' doublet @ 30'
	W2QYA	44,820	166	27	LT1	40-15	11	HW-8	Inv Vee
	W2XS	21,679	163	19	LT5	40	6	OHR400	CF Zepp
OH	N8ET	792,442	1058	107	LT5	160-10	17	Omni 6 +	Beams, dipoles, & 160 m loop
	KB8YUC	44,044	242	26	LT5	40	9.5	OHR 100A	G5RV @ 35'
	KF8EE	35,616	159	32	LT5	40-10	5.5	Argo II	Random wire
	K8NI	17,500	125	20	LT5	40-10	2.5	Icom 756PRO	Dipoles, R7
OK	K5DP	190,500	381	50	LT1	40-10	8	HW-9	40 m loop
	N5OBC	32,732	167	28	LT5	40,20	12	SST & NC20	Dipole
ON	VE3KQN	47,840	184	26	LT1	40-15		Sierra	Inv vee
	VE3SMA	30,240	216	14	LT1	40	12	TX=2 transistor, RX=2 transistors	Vertical
OR	WX7R	46,648	238	28	LT5	10	6	FT920	EDZ lazy H, mono yagi
PA	W3TS	461,700	513	60	LT250	80-10	7	Homebrew, K2	Yagi, inv vees
	WB3AAL	379,750	775	70	LT5	40-10	21.2	TS-50	HF9V
	W3BBO	362,880	720	72	LT5	80-10	17	K2	135' doublet, R5 vert
	N3AO	192,402	509	54	LT5	80-10	8.5	K2	Beam & windom
	K3ZX	40,320	192	30	LT5	80,40,15	5	HT-37 & SX-111	Dipoles
	WA3WSJ	37,975	175	31	LT5		4.25	K2	Tribander & HF6V
	K3NVI	22,344	152	21	LT5	20,15	5	TS130V	2 el hybrid miniquad
RI	K8ZFJ	61,070	197	31	LT1	40-10	9	Argo 515	G5RV & 1/4 wave vert
SC	WC4CW	187,320	446	60	LT5	40-10	18	Icom 706	G5RV
	WJ4P	178,200	360	33	LT250	20	9	K2	Off center fed 135' dipole
	K4ADI	51,863	239	31	LT5	40-10	6	Icom 735	KT34XA, vert, dipole
TX	AF5Z	164,220	391	60	LT5	20-10	4	TT Corsair II	TH7DX @ 80', 80m loop
	K5NZ	70,125	187	25	LT250	20	4	OHR 400	Tribanders
VA	N4ROA	216,660	471	46	LT1	160-40	9	K2	450' loop, 1/4 wave 160m inv L
	KK4R	58,688	262	32	LT5	40-15	3.5	IC 735	Dipole
	N4UY	45,045	195	33	LT5	40-10	4	FT757	Fan wire dipoles in attic
	K3SS	26,838	142	27	LT5	80-10	5	FT-757GX	Dipole
WA	N7RVD	68,880	246	40	LT5	40-10		K2	80 m horiz loop, 1/4W 20m vert
	K7NTW	27,500	125	22	LT1	20	6	NN1G	2 el quad @ 50'
WI	N9AW	981,190	1310	107	LT5		21	FT1000MP	Mosley PRO57B, 40m loop
	NQ9RP	82,950	237	50	LT5	80-20	4.5	TS-870S	3 el beam, DX-A slopers
	N9SD	4,400	88	5	LT1	10	12	TS-440S	Cushcraft A-3

Check logs: WE6W, AA1MY, WR4I, NL7Z, WT9S, KB7WW

HOOTOWL SPRINT 2000

This year's running of the Hootowl Sprint on May 28, 2000 had more entries than either of the two previous years. The combination of more players and a higher solar flux resulted in the top score by N9AW being over twice as high as last year's. Most folks thought 40m and 20m were in good shape. In fact, 20 m was good enough for LZ2RS to make over 15 QSOs with most of them North American stations. The A-index was 10 with a solar flux of 155. The 2001 Hootowl will be on May 27.

TOP THREE	
N9AW	124,320
N8XI	110,768
W9PNE	79,200

CATEGORY WINNERS		
20 m	N4FNG	20,880
40 m	K9PX	70,224
Less than 5 W	N9AW	124,320
Less than 1 W	KN1H	31,020
Less than 250 W	W9PNE	79,200

2000 Hoot Owl Sprint **NA3V:** Nice contest till the QRN on 20 & 40 m got bad. Biggest surprise ~ being called by LZ2RS after working a local (Ohio) station! Sometimes you forget how far those signals can travel! **NK9G:** 15 dead, 20/40 so so...K9PX & N8XI: What signals! **W2JEK:** Great contest on 40 & 20. 80 m was vy noisy. **WA7LNW:** Really enjoyed this year's event, but wish band conditions had been a little better. **W1VT:** 50 QSOs in first 2 hours. **K1QM:** Where was everyone on 15 m? **K4AHK:** Lots of QRN from local rain storms. Never did hear the West Coast stations. **K3NVI:** Only had short-time (2 ½ hours) but a lot of members! Great! **N5UW:** Conditions were pretty good, but not too many players. I guess the holiday weekend and CQ WPX took their toll. My first contest with the new call, and old friends didn't know me. Heck, it took me 3 months to remember who I am! **N4FNG:** First try at contest milliwatting. Lots of fun & easy logging. HI. **AB0GD:** Participated from portable location in Pike National Forest. **N9AW:** Fair band conditions on 40 and 20 mtrs. Only one QSO on 80 mtrs. No activity heard on other bands. **N8XI:** The Bands were a little noisey and was pleasantly surprised when an LZ (Bulgaria) answered my CQ. **W0PWE:** Stumbled onto the contest at about 9:30. Had a great time with 500mW. Thanks and 72. **K8CV:** Don't like the local time feature. **AC5JH:** Being rock bound with the TT2 makes for tough contesting but every QSO felt like a real victory. Thanks for all the hard work that goes into a contest like this and to all those who found me and gave me a call. **N6WG:** Things were rather slow at first, but gradually picked up as the evening went on. This is certainly my best score so far for this event. I think this is my third time for the Hoot Owl Sprint. Lots of QRN at times, so had to give the famous SOC cry of AGN? I enjoyed running into acquaintances during the contest, and ragchewing with them for a moment. Definitely a low-key contest. A good warmup for late evening on Field Day. **KB9LGJ:** I love these short contests! Only after four hours, my fist was hurting! **LZ2RS:** I would like say: Thanks to ALL hams for the pleasure working in the contest. **W5SB:** My first QRP contest in quite a while. Now that I have a real QRP rig I will do more. Running a FT-1000D at 5W is major over kill. I purchased the OHR-400 from K5ZTY who now has a K2. The OHR worked well. Bill has put a lot of neat mod's in it that makes it even better than original. **W9QZ:** My 1st ARCI contest. Great fun!

HOOTOWL SPRINT 2000

QTH	Call	Score	Pts	SPC	Power	Bands	Time	Rig	Antenna
CO	N0RC	10,920	91	12	LT1		3.5	IC746	Multi band doublet in attic
	AB0GO	1,960	40	7	LT5	40	1.5	Sierra	Inv vee
CT	W1VT	42,042	231	26	LT5	40,20	2.25	K2	
FL	N4FNG	20,880	116	12	LT250	20	2	Argo II	3 el yagi @ 35'
GA	W4QO	46,221	213	31	LT5	40,20	2	TS940	80 m loop
	WA4SQM	10,234	86	17	LT5	40,20	2.5	QRP+	G5RV
IA	KQ0I	25,200	144	25	LT5	40,20	2.25	TenTec 580 Delta	Multi band dipole
	W0PWE	3,080	44	7	LT1	40	2.5	Original Tuna Tin 2	Inv vee
ID	K7TQ	6,216	74	12	LT5	40,20	4	K2	14AVQ
IL	W9PNE	79,200	176	30	LT250	80 -15	4	Argo 515	TH5DX, slopers
	N9MZP	14,497	109	19	LT5	40,20	4	TS450S	G5RV
	N9MDK	6,958	71	14	LT5	40	2	2N2/40	G5RV
	KG9PQ	4,928	64	11	LT5	40,20,15	2.5	TS570D	Hamsticks
IN	K9PX	70,224	304	33	LT5	40	3.5	K2	80 m loop
	W9QZ	17,255	145	17	LT5	40	4	MFJ 9040	Flat top @ 65'
MA	K1QM	29,925	171	25	LT5	80,40,20	3	QRP+	G5RV @ 40'
MD	W3MWY	19,040	136	20	LT5	40,20	4	Argo 556	Vert ground plane @ 50'
ME	K0ZK	51,072	228	32	LT5	40,20	4	K2	Indoor 20 m dipole
MI	N8XI	110,768	368	43	LT5	40,20	3.75	K2	3 el tribander, dipole
	K8CV	23,373	159	21	LT5	80,40,20	2		
MN	KB9LGJ	21,280	152	20	LT5	40,20	4	SST, SW+	G5RV
NH	KN1H	31,020	141	22	LT1	40,20	3	QRP+	140' dipole
NJ	W2JEK	18,081	123	21	LT5	80,40,20	3	OHR 100A, 40, TT1380	Gnd plane, dipole, end fed
	W2KBF	11,872	106	16	LT5	40,20	4	OHR Sprit/ TS-570	
OH	KB8X	21,014	158	19	LT5	40	3	OHR 100A	G5RV @ 35'
	N8RN	11,424	96	17	LT5	40,20	3.25		
OK	N5UW	53,165	245	31	LT5	40,20	4	OHR 400	Tri-bander, vert, windom
	K5DP	12,160	76	16	LT1	40,20	1	HW9	40 m horiz loop
	AC5JH	1,300	26	5	LT1	40	4	TT2 & Omni 6	Dipole
PA	NA3V	59,724	237	36	LT5	80,40,20	3.6	TS470D	Multi-band doublet
	KT3A	14,497	109	19	LT5	40,20	4	IC726	Trap vert, attic loop
	K3NVI	6,916	76	13	LT5	40,20	2.5	TS130V	14AVQ, 2 el quad
SC	WJ4P	8,775	65	9	LT250	20	3.5	K2	Off center fed dipole
TX	W5SB	37,100	212	25	LT5	40	3	OHR400	2 el @ 115', 40 m dipole @ 110'
	K5NZ	20,874	142	21	LT5	40,20,15	1.5	OHR 400	Tribander, dipole
	W5WO	6,480	54	12	LT1	40,20	2	Homebuilt	Dipoles
UT	WA7LNW	78,736	296	38	LT5	80,40,20	3.75	K2	Loop on 20, vert on 40
VA	K4AHK	26,600	190	20	LT5	40	3.25	IC735	Attic dipole
WI	N9AW	124,320	370	48	LT5	80,40,20	4	FT1000MP	Yagi, delta loop
	NK9G	41,811	181	33	LT5	40,20	4	FT900	Shorty G5RV

Check logs: LZ2RS, N6WG

MILLIWATT FIELD DAY 2000

This contest, Milliwatt Field Day, run piggy -back on the ARRL Field Day is really a misnomer. You do NOT have to run less than 1 W to enter the QRP ARCI Milliwatt Field Day contest! The classic QRP power levels of 5 W or less are just fine. (Yes, the ARRL and the QRP ARCI definition for QRP SSB are different. To make things simple in scoring this contest you need to adhere to the ARRL QRP SSB definition of 5 W PEP).

This year's event on June 24 & 25 produced 11 entries. Some of them will rival QRO entries! The Guano Reef Bashful Perverts lead by N4BP took top honors with a score of 8,415. N0UR with only 1 operator turned in a score of 6,455.

Next year I'll promote this contest more.

MILLIWATT FIELD DAY 2000

Group Name	Call	Score	CW Qs	Digital Qs	Phone Qs	Nr. Ops	Class	Rig	Antennas
CLUB CLASS									
Guano Reef Bashful Perverts	N4BP	8415	732	0	39	4	1A	K2, C-706, IC-706	4 band Ugly Vert, 40 dipole, 6 m 2 el quad
Eastern PA QRP Club	N3EPA	4370	300	0	234	8	2A		
NJ QRP Club	WQ2RP	3885	305	0	27	5	5A		
Natchaug ARC	N1EI	2125	124	0	77	8	2A	OHR 500, Scout	40 m delta loop, 10m-160m fan dipole
Hawaii QRP Club & Hilo ARC	KH6IN	2095	127	0	5	5	1A	K2, SGC-2020	TA33jr, 2 el vert beam for 40 m, 40m dipole
S.V. Special Purpose	W7SAW	2080	145	0	126	2	2C		
5 WATTS - 2 OP	W3PNL	1990	189	0	0	2	1B	K2	Doublet fed w/ twin lead
	N7TX	525	35	0	15	2	1B		
5 WATTS - 1 OP	N0UR	6455	579	0	53	1	1B	IC-735	G5RV
	W3TS	4300	430	0	0	1	1E	K2	Two 130 ft doublets @ 50'
	KB9LGJ	795	53	4	5	1	1E		

SUMMER HOMEBREW SPRINT 2000

Heat and thunderstorms were a common theme for the July 9, 2000 version of the Summer Homebrew Sprint. The purpose of this contest is to promote building your own equipment by giving a bonus for using a rig you built. The bonus is PER BAND, just like SPCs are. If you used a Sierra on 15, 20, and 40 meters and you built it, then you get 15,000 bonus points. Some folks overlook this per band bonus. I try to catch it, but am not always successful.

One of the more interesting rigs was built by W0PWE. Jerry's homebrew receiver was a superhet using 2 SA612, an LM386, a 4 MHz xtal filter, and a VXO. The homebrew transmitter contained a SA612, two 2N2222, one 2N697, and a VXO. He finished the 40 m transmitter a week before the contest and scored 10,200 points, which was good enough for 1st place in Iowa.

Participation was about the same as last year, but this year's high score by K7RE was over twice as high as last year's winner. An A-index of 5 and a solar flux of 240 had to have helped. There were several folks who reported that it was the first contest they entered. Glad to have you participate and hope you come back again!

With a quiet A-index of 5 and a solar flux of 240 it doesn't get much better. However, there were several reports of only a little activity on 15 and nearly none on 10. I suspect that lack of participants on the higher bands was more a factor than lack of propagation.

Next year's Summer Homebrew will be on July 8.

CATEGORY WINNERS

15 m	JR0BAQ	140
20 m	N5UW	50,472
40 m	KO4PY	31,250
High Bands	K7RE	167,675
Less than 5 W	K7RE	167,675
Less than 1 W	KB3WK	77,460
Less than 250 W	WJ4P	43,700

TOP THREE

K7RE	167,675
KB3WK	77,460
N9AW	76,440

2000 Summer Homebrew Sprint **AF4PP:** Thanks for another great contest! I really enjoy the ARCI events...they are the best. **NU3N:** As my first real sprint, it was a hoot. I'll be back. **W4MVZ:** Had to QRT about 30 minutes due to an afternoon thunderstorm: violent type. **N5UW:** It was 97 degrees today, so a good day to stay inside! It was great to hear HP1AC & GM30XX, even worked a Fox! **N9MDK:** Conditions were only ok. **W3DP:** Good signals but local QRM. Number of new stations dropped after the first hour. I still enjoy sprints. 72 to all. **WB7OEM:** This is pathetic, I either need a new rig or better bands. Hi! Hi! **KO4PY:** Slow going at first but things eventually came around. **W1SVU:** 1st time contester. **WB9HFK:** 40 meters relatively slow here in midwest. **K2UD:** It rained so good opportunity to play radio. Ran my 2N2/40 xcvr. Still contest capable. **K4KJP:** Total of 8 QSO's on homebrew xcvrs: not great, but much fun had in contest. **K3NY:** Wish I could have worked the whole 4 hrs. My first time holding a frequency, kind of scary at first but turned out to be really fun, more fun than hunting and pouncing! Tried 15 and found it dead, 10 was pretty much dead in the a.m. during the other contest, so stuck with 20 and 40.

Loads of fun! Highlight was being called by PA0CMU, also running 5 watts, on 20m. **W0UFO:** Fun to operate with NC-20 from my cabin. Wanted to try 40 m with NC-40, but too busy on 20 m. **K7RE:** Spent all 4 hours of the contest having lot's of fun. 10M was no go, but 15 showed some pretty decent activity, but probably more folks could have used it. 20 was the bread and butter band as usual, but a moderate amount of thunderstorm activity from the northeast made copy rough on the weaker folks. Not one participating station was heard on 40M during the times that I checked. It sure is great to hear so much activity, and also hear the newer folks coming on board for these events. These ARCI events are always so laid back, you can't help but have fun. I used my own HB dupe/logging program. I also got to use my KD1JV (Steve Weber) LCD keyer. This thing is a jewel. If you didn't get one of these semi-kits from Steve, you missed out. I'll be posting a little review later on in the week. Bottom line: I love this thing. Rig was my K-2, 5W, to a 3 element trap tribander up 35 feet. Thanks once again to Randy Foltz K7TQ and ARCI for this event. **WD9IFF:** Could only operate 2 hours but loads of fun! Stuck to 20 meters & conditions were up and down here in 9 land. Really had to dig for WJ4P waaay dwn in the noise .. Did the old straight key thing for the first hour. I sure enjoy these sprints! Thanks to all! **NO8C:** my first QRP contest. It was interesting to say the least. hihi **W3BBO:** Thought the thunderstorms would go away after the first hour of the test, but they did come back. Got almost an hour in though, while running up and down stairs disconnecting/connecting antennas (good exercise, I guess!) **KQ0I:** Always nice to notice the member numbers. The ones with five digits remind us that the new members are being active,too, and the old numbers remind us of old friends that have been around for a long time. What a great mixture...the club must be doing some things right! **W6ZH:** Called every-so-often on 10, 80 & 160 to no avail. Pleased to get call from ARCI member JR0BAQ and to work ARCI member Cam, HP1AC. Conditions not very good but fun. **KT3A:** Low stress contest, even got a nap in! **W0PWE:** Threw the transmitter together last week for the contest. 40M wasn't the hottest but the contest was fun anyway. Thanks and 72. **N9AW:** Fun contest. Would like to see more 15 mtr activity. Operated portable from campground. **N0RC:** Less than 1W, about 2hrs and 20m only. That was my effort for this sprint. Using my NC20 I managed ~19k points. Thanks to all who managed to copy my puny signal. I didn't get started until 2030 because of s9+ QRN-- that low frequency bone numbing static that makes your teeth hurt! I swear somebody must have been using an arc-welder nearby. Had to quit early to go to work, and in between tried to catch the fox. Never the less, lot's of familiar calls, and lots of fun with very little power! **VE3JC:** Very enjoyable sprint: wish I could have been on for the whole thing. It was great to hear all the five-digit member numbers, along with the familiar calls. **JR0BAQ:** Condx was poor on 20 for stateside so that no chance to use my NC20. Several stations in east coast could be heard here in Japan but no one answered. **KB3WK:** Conditions were not the best, but it was fun anyway. K2 did great. **AD6GI:** Great start, light middle and very slow ending. Guess my hopes were too high. Oh, well! Back to the drawing board to prepare for the next one. See you then. **N4JS:** Enjoy these sprints. Gave the K2 a good workout. Also tried my Sierra on 20 for a couple contacts. **WA6ARA:** Had a great time running the little SMK-1. Just played around, wasn't too serious but an enjoyable break.

2000 Holiday Spirits Homebrew Sprint

Date/Time: *December 3, 2000; 2000Z through 2400Z.* CW 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.
Homebrew Definition: If you built it, it is homebrew!
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

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, 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 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. You must still submit your logs by either e-mail or regular mail if you use the High Claimed Score form. Check the web page for 10 days after the contest to see what others have said and claimed as their scores.

2001 Winter Fireside SSB Sprint

Date/Time: February 11, 2001; 2000Z to 2400Z SSB HF only
Exchange: Member - RS, State/Province/Country, ARCI Number
Non-member - RS, State/Province/Country, Power Out
QSO Points: Member = 5 points
Non-member, Different Continent = 4 points
Non-member, Same Continent = 2 points
Multiplier: SPC (State/Province/Country) total for all bands. The same station may be worked on more than one band for QSO points and SPC credit.
Power Multiplier (PEP): Note the higher SSB power limits!

0 - 500 mW = X 15	500 mW - 2 W = X 10
2 W - 10 W = X 7	Over 10 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, 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 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.

QRP ARCI CONTEST SUMMARY SHEET

QRP ARCI CONTEST________________________________ MODE__________

CALL__________ S/P/C(QTH)_____ POWER______ ENTRY: MULTIBAND___ SINGLE BAND__

BAND	POINTS	S/P/C
160		
80		
40		
20		
15		
10		
Totals		

Enter Points and S/P/C PER BAND. Treat each band separately for S/P/C credit.

Total points and S/P/Cs before inserting them in the equation below.

Multiply points, S/P/Cs and Power Multiplier, then add Bonus Points, if any.

Send Entry to: Randy Foltz K7TQ
QRP ARCI Contest Manager
809 Leith St.
Moscow, ID 83843

or e-mail to rfoltz@turbonet.com

Total Points X Total S/P/C X Power Mult + Bonus Points = Final Score

________ X ________ X ________ + ________ = ________

TOTAL OPERATING TIME __________

TRANSMITTER/TRANSCEIVER ____________________ POWER OUTPUT ________

RECEIVER ____________________

ANTENNA(S)____

COMMENTS____

____

NAME ____________________ CALL ____________

ADDRESS ____

CITY ____________________ STATE __________ ZIP __________

New Member/Renewal Form NEW MEMBER? (Indicate Yes or No)_____

Full Name ____

CALL _______________ New Call? Y N QRP ARCI#(if renewal) ________

Mailing Address ____

City ___________________________________ State/Country _____________

Post Code (ZIP + 4 for USA) ____________________ New Address? Y N

Sponsor (if any)
Name/call/nr____

(The following is optional but helpful.)

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Previous Callsign(s)____

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Mail completed application to either:

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All applications MUST BE RECEIVED at least 30 days prior to the cover date to receive that issue.
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117 E. Philip St.
Des Moines, IA 50315-4114

For a Club Information Pack, write to:
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3052 Fairland Road
Silver Spring, MD 20904
K3TKS@abs.net

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Checks for 13.50 UK pounds ONLY.
Make checks payable to: "GQRP" (ONLY)

Send to:

Dick Pascoe, G0BPS
Seaview House, Crete Road East
Folkestone. Kent CT18 7EG UK

Tel/Fax 44(0)1303 891106 from 0930 to 1900 GMT ONLY
If in doubt, ring Dick, but ONLY for Membership.

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The Last Word

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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 ToC 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.

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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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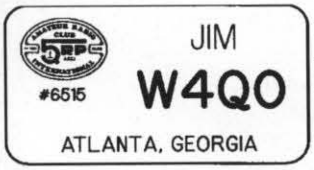

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__ Swivel Alligator Clip	$9.20	City/St ____________
__ Military Posts	$9.20	Ph (__) ________ Zip _____
		E-mail: ____________

Check payable to: **Rick Pourciau** Check # _______ for $ ___.__
Visa MC Amx Disc Name on Card ____________
Credit Card # _____ _____ _____ _____ Exp __/__
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