QRP Quarterly

Journal of the QRP Amateur Radio Club, International

April 1996 Volume XXXIV Number 2

The winner of our first cover photo contest.
Wilderness Radio Sierra kit built and photographed by
Stan Cooper, K4DRD.
Be sure to read his review of this radio on page 41.

The QRP ARCI is a non-profit organization dedicated to increasing world-wide enjoyment of QRP operation and experimentation. QRP, as defined by the club, is 5 watts output CW and 10 watts output PEP on SSB.

The first anaual *FOUR DAYS IN MAY*

Top QRP event of the year

The first annual **QRP Amateur Radio Club, International** (QRP-ARCI) sponsored "Four Days in May (c)" QRP Symposium is shaping up to be the Top QRP event for 1996. The FDIM committee is happy to announce the following exciting updates:

1. EXCLUSIVE: The Four Days in May (c) Committee has secured exclusive rights for the premier of a new and exciting QRP Technical Book. We don't want to divulge more at this time but let it be said that this book will become a classic in the QRP community. To augment this book introduction we have booked a special Symposium presentation by the author and the sponsoring QRP club publisher. ALL "Four Days in May (c)" attendees will receive an autographed copy of the new book as part of their registration fee. This offering is exclusive to the QRP Symposium attendees.

2. QRP SYMPOSIUM PRESENTERS: **Bruce Muscolino W6TOY/3**, our FDIM Technical Paper Chairperson, has commitments in hand from seven dynamic and talented QRP presenters. You will not want to miss these presentations. Although the QRP Symposium Proceedings will be available for sale after the event there is nothing like the live presentation with the spirited question-and-answer period. The FDIM attendees will receive a special copy of the QRP Symposium Proceedings as part of their registration fee.

3. LUNCHEON SPEAKER: **Paulette Quick N9OHU**, our FDIM Registration Chairperson has lined up a scrumptious luncheon for ALL QRP Symposium attendees. This will be a sit down affair complete with a surprise luncheon guest QRP speaker. We aim to fill each Symposium attendee with some QRP "food for though". The cost is included in the FDIM registration fee.

4. REGISTRATION FEE: Registration for the QRP Symposium will be $30 if prepaid to **Paulette N9OHU** by May 1, 1996 and $35 if paid after that date or at the door. We may have to limit May 16, 1995 at-the-door registrations if we are sold out of facilities. So please register early to guarantee a seat at this not-to-be-missed QRP event. Registration will cover a full day of QRP Symposium activities which include the QRP presentations, the exclusive autographed QRP Technical book, the QRP Symposium Proceedings, the scrumptious QRP luncheon and finally an endless QRO coffee pot.

Please send your $30 (**US check or money order**) FDIM QRP Symposium Registration fee by May 1, 1995 to:
Paulette Quick, N9OUH, FDIM registration
P.O. Box 145, Madison, WI 53701-0145
plquick@facstaff.wisc.edu - email for information only
608) 263-9326 (work phone)- telephone for information only

FOUR DAYS IN MAY (c) - The QRP Event of 1996. **QRP Amateur Radio Club, International** (QRP-ARCI) proudly announces the first annual QRP Symposium to be held on **Thursday, May 16 1996** - the first day of four festive days of 1996 Dayton Hamvention QRP activities.

QRP-ARCI continues the "Four Days in May" QRP extravaganza with nightly hospitality suite sessions, were QRP projects from around the world are displayed with a pride that only a QRPer could appreciate. "Four Days in May" QRP-ARCI week culminates with the annual QRP-ARCI Friday Night Banquet honouring QRP dignitaries for their service to the amateur radio community.

Your 1996 QRP-ARCI "FDIM(c)" Symposium Committee:

Bob Gobrick VO1DRB/WA6ERB, public relations chair
Bruce Muscolino W6TOY/3, technical paper chair
Paulette Quick, N9OUH, registration chair

New Member/Renewal Data Sheet

Full Name________________ Call________ QRP #______

Mailing Address________________________

City____________ State/Country________ Post Code______

❑ New Address? ❑ New Call?

USA	DX
❑ New Member, $12 (DX: $14) ❑ Renewal, $10 (DX: $12) Amount enclosed in U.S. funds____ Check or MO in U.S. funds payable to "QRP-ARCI". Do not send cash. Mail to: **Mike Bryce, WB8VGE** **2225 Mayflower, NW** **Massilon, OH 44647**	❑ New Member, £7 ❑ Renewal, £6 Check or MO in British pounds payable to "G-QRP" Mail to: **Dick Pascoe, GØBPS** **Seaview House** **Crete Road East** **Folkestone, Kent CT18 7EG** **England**

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NOTES FROM THE PRESIDENT

Buck Switzer, N8CQA

As Spring (Dayton!!) approaches, we are wrapping up several important club activities. First, the election of the Board of Directors will be finalized by the time you read this. The "new" Board of Directors will be installed 01 April, 1996 and will be "brought up to speed" prior to Dayton. The BoD will (hopefully) meet on Thursday evening (if a quorum is available) and/or Saturday evening. Second, the Hall of Fame election process will have been completed (results to be announced at Dayton). Many thanks to **Mike Czuhajewski, WA8MCQ,** for honchoing this heretofore neglected project.

Formal Dayton activities begin with the "Four Days In May" activities on Thursday, 16 May, 1996; the QRP-ARCI Banquet at 1900 hours on Friday, 17 May, 1996; and the QRP-ARCI Pizza Party (combined with the NorCal Construction judging?) on Saturday, 18 May, 1996.

I'll squeeze in a couple of BoD meetings, and some time at the club booth, trying to leave time to "do" the Flea Market. I strongly recommend you get through the entire Flea Market if you possibly can. If it's a radio or parts for a radio, it's out there, somewhere.

I, for one, can't wait!!! Hope to see all of you who can attend, and to work you in the MI-QRP Good Friday Sprint, 05 April, 1996, and the QRP-ARCI Spring CW Contest, 13&14 April, 1996. I'll have the loop/dipole up by then and intend to put in a good effort this time. Build Something and put it on the air!

NOTES FROM THE VEEP

Mike Czuhajewski, WA8MCQ

At the time of writing I still haven't sent out the ballots to the outgoing Board of Directors to vote on the nominees for the QRP Hall of Fame for 1996, but the results will be released publicly at Dayton in May and reported in the July issue. Since **WB9TBU** went through this in 1992, I know what to expect--a certain amount of enraged mail demanding to know why their QRP Hero, Joe Blow, wasn't inducted.

There can be several reasons why someones name won't be announced at Dayton. Perhaps they were nominated but not enough voters were convinced that the accomplishments were great enough to merit the honor. Perhaps the person is quite well known but the nomination letter didn't go into sufficient detail to convince the voters--remember the words of **K8DD**: we'll go into the voting with the attitude that no one is worthy, but we'll read the letters anyhow and see if we can be proven wrong. The nominating letters are crucial and must contain facts, justification and rationale; you must present good evidence that the person is deserving and not simply toss out a name and expect everyone to automatically vote for them since "everyone" knows who they are and what they've done.

There's always the possibility that some voters simply do not know about one or more of the nominees and thus don't vote for them. There is anecdotal evidence that at least one deserving person in 1992 didn't make it into the HoF for this very reason.

As is the case with any awards program there may be some on the voting body who don't think the level of accomplishment is great enough, while others see it differently. There are, after all, no hard and fast rules, and probably never will be.

One final possibility is that Joe Blow was never nominated in the first place! Don't forget, there is no nominating committee for the HoF--nominations are accepted from anyone who wants to send them in. I received a few e-mails asking if certain individuals had been nominated yet. I told them that they had not been and invited them to submit one themselves. Some responded, some did not--and thus certain deserving people who had a good chance were not even on the ballot.

We'd like to make the Hall of Fame a yearly procedure to recognize those who have done outstanding things with or for QRP. Don't forget, if one of your QRP Heroes didn't make it this year, for whatever reason, there is no reason they can't be nominated for next year. It's up to you!

TIME TO CHECK THE ADDRESS LABELS

Please remember to check your address label to see if you need to renew your membership in the QRP ARCI.

REMEMBER: THERE IS NO OTHER WARNING

ELECTION RESULTS

As most of you are aware, the ballots have been counted, **(by N8DHT & WB8VGE)** and the results, in order of number of ballots, are:

Doug Hendricks, KI6DS Western Area Rep.	4 year term
Danny Gingell, K3TKS	4 year term
Jim Stafford, W4QO	4 year term
Cameron Bailey, KT3A	2 year term
Hank Kohl, K8DD Central Area Rep.	2 year term
Bob Gobrick, VO1DRB E.Canada Rep.	2 year term
Bob Schnick, KA3YJG	1st Alternate
Byron Johnson, WA8LCZ	2nd Alternate
Dave Johnson, WA4NID	3rd Alternate

A little explanation is in order, as this was an unusual election. Due to the need to get the Board elections back on a "normal" basis,it was decided that the top 3 candidates would hold their seats for 4 years, the next 3 candidates would hold their seats for 2 years. The next election (1998) will be for the latter 3 seats. After this period, 3 seats will be voted on every 2 years.

It was also decided to utilize the candidates who were not seated on the Board, as alternates, to be available to fill a vacancy until the next election. All three candidates that did not win a seat have agreed to act as an alternate. They will be called in order of their vote count, as listed above. This seems a completely rational system as these folks have amply demonstrated their serious interest in QRP-ARCI by running in the first place. During their "alternate" period, they will be included in BoD correspondence and decisions so that they could step in well prepared to exercise their duties.

Area Representatives: Doug and **Hank** have agreed to continue to act as the Western and Central representatives, I am working on confirming the Eastern representative. **Bob Gobrick** has agreed to act as the E. Canada representative. I have a candidate for the W. Canada representative and am awaiting his agreement. The Canadian representatives are an idea I've been working on for a year, I feel that we can increase our influence and membership amongst Canadian QRP'ers by giving them an "in country" voice. The By Laws allow for such representatives and I don't think that we ever utilized that clause. More on this later.

The "new" BoD members will be seated 04/01/96 (no pun intended). This allows the existing BoD to finish the HOF voting and any other issues between now andthen. It will also allow the new members of the BoD to get "up to speed" as to By Laws, upcoming issues, the next HOF vote, etc., prior to the Dayton meeting(s)

My most sincere thanks to departing BoD members, **Mike Czuhajewski, WA8MCQ, Jim Fitton, W1FMR** and **Paula Franke, WB9TBU**. Mike has been a long-term member and Jim an Paula agreed to step in last year to fill out the depleted ranks for a short period. These folks are always there to assist in periods of crisis; **THANKS!!!**

Any questions?? Feel free to contact me (private e-mail please). I should have the ability to send e-mail from work, again, by late next week.

I, for one, am very glad to see this part of the process finally completed. Now we can get back to cleaning up some of the organizational details still to be reviewed/changed. We will need to agree on some further By Law changes at Dayton and finalize several issues still hanging out there.

72/73 **Buck, N8CQA** President, QRP-ARCI

W8YNA - SK

John E Westphal, W8YNA, became a silent key on Tuesday, January 9, 1996. He passed away after going to the hospital feeling ill.

John, even in his late seventies, was very active in QRP, especially in radio construction. A few years ago at Dayton he demonstrated a 40 meter "Twofer" DC transceiver built into a metal Bandaid, (TM), can, complete with plug-in band change modules. He was years ahead of his time. I still have a Twofer transceiver he made for me for 40 meters. Always a gentleman, John had many QRP friends and will be sadly missed by all.

He is survived by his wife and children at this address.

(John E Westphal, W8YNA)
1721 Delmonte, Toledo, OH 43615-3607

Jim Fitton W1FMR

FROM THE EDITOR

Monte "Ron" Stark, KU7Y

It.s late February as I write this. The wind is blowing, snow is on it's way and we are moving! Well, actually, we are in the new place now but still have a few loads of the outside "things" to get. Beams, towers, coax and a few other treasures that my wife keeps calling junk!

The reason for mentioning the move is to let you all know that this issue is not getting the attention from me that it should. But I promise to do better the next time. To all the fine staff and writers who make the Quarterly possible, I think I found all the pages!

It was fun looking over all the nice pictures entered in the cover contest. The winner gets a one year subscription or renewal to the Quarterly. Congratulations to **Stan Cooper, K4DRD**. He also sent in a very nice article on that rig.

I would like to take a moment to thank everyone who has written and told us what they think of the Quarterly. Most seem to want more technical articles. And one or two want to see a more professional look, one that has fewer grammatical errors and a better overall job of editing.

What most people would like to see, we can give. However, this entire magazine is done by volunteers. Almost no one on the staff is a professional in the field of publication. For us to actually get a magazine out, on time and worth reading is a major accomplishment in itself, let alone catching all the errors!

Congratulations to the new BoD. Remember, when you are all at Dayton, you are there as BoD members. Don't have too much fun! (Well, if I can't go and have fun.............)

Get ready for **WIMU**, (Wyoming, Idaho, Montana and Utah), the hamfest of the Northwest. The ARCI and NorCal will be there and we are trying to get a little building contest up and running. Details in the next issue.

Thanks for your support during the past few months. While so many of you are off to Dayton, I will be trying to get up at least 3 towers, (2 for yagi's and one for a 160m vertical), phased verticals on 30m and 40m and a long wire that runs all around the 3 acres. Eat your heart out, Bruce! **Ron, KU7Y**

Incoming Mail

Dear Ron,

This is something that has bothered me for some time now, so thought I would put it on paper. If you find room, could you please publish the following letter somewhere in the QRP Quarterly next issue? I'm sure I'm not the only one who has been irked by this practice. Feel free to edit or change my wording. Thanks -- Paul, KB5DQ.

Dear Fellow QRP'er,

I recently received your QSL card for our contact in the latest QRP contest. During the contest we exchanged signal reports and ARCI QRP membership numbers. On your QSL you state that you were QRP with 5 watts and that you needed my state to help with your WAS award. You even enclosed an SASE to help expedite the return of my card.

But, nowhere on your card do you indicate that I was also QRP, (KB5DQ/QRP). So, your QSL is worthless to me in my pursuit of any type of a two way QRP award. You could have, at least, marked it 2xQRP in the mode column of you card. As it is, it looks like you were QRP while I was not. I work as hard for each of my QRP contacts as you do.

In the future, if you know that I an also QRP, please indicate that we both were QRP so that we both may reap the benefits of the contact. That way you QSL card will have more meaning to me. Who knows, I may even place it upon my wall for display!

Yours truly,

D. Paul Ridley, KB5DQ/QRP
1276 Highway 116
Belen, NM 87002

I checked with the QRP ARCI Awards Chairman, ***Chuck Adams, K5FO****, and he said to send in the cards. Our awards are made on the basis of what the applicant claims. The cards "prove" the contact but the applicant states the power used. It's the honor system. I think the ARRL and other sponsors of awards do the same. Many times in a contest, the other station has no idea of what my power is. But I will say that I also like to see the /QRP put next to my call just to make it look better!* ***TO ALL:*** *If you know the other station is QRP, then please make the proper notation on the card and make a lot of people feel better! Thanks for your letter Paul. de Ron, KU7Y.*

Dear Larry,

The January issue of QRP Quarterly arrived safe and well, not that I have ever had any problems, so a big "thank you" to the USA postal service.

I have just spent my available time operating in the G-QRP Club Winter Sports get-together over the holiday period. I worked many stateside QRP stations who are members of the G-QRP Club, but why are they so reluctant to give out their ARCI QRP numbers?

I was very surprised to read in one of the resumes for the [ARCI] board of directors the suggestion that the ARCI go for a change of name and concentrate more on the local / USA scene. I think that it is **very important** that the ARCI remain an international group, promoting QRP operating, home construction, high operating standards and last but not least the **promotion and protection** of the internationally recognized QRP frequencies. The reason I am saying this is because of the severe QRM caused by digital operators using AMTOR, PACTOR, etc. on 14.060 and 7.030. The QRM is now so bad that it is almost impossible to work around these frequencies. The really annoying thing is that these operators **never QRL** or listen before starting up on frequency. I feel it is time that all QRP clubs / groups were more forceful in their approach with the "Powers that Be" so as to ensure "our" frequencies are kept from data QRM.

I am very active and now work 100% QRP CW using a Ten-Tec Argosy (I would never part with it) using 3 Watts or less to a Hygain TH3 at 50 feet on HF and various delta loops and wire antennas for LF. I have many H.B. receivers and transmitters plus all the usual test gear. I hope to work many ARCI members in the coming years. I am not far off WAS QRP on 20 M, and already have QRP WAC (with wire antennas) and 94 countries (QRP) confirmed; I have worded 126 but the cards are slow in coming! You can normally find me on or around 14.060, and if I am not about you should listen for Geroge, GM3OXX who is very active with one Watt or less and wire antennas.

All the best for now and hope to work you soon!

73,

Brian Waddell, GM4XQJ
(member G-QRP and ARCI)
Stirlingshire, Scotland

I, too, hope to see the ARCI remain international in nature. I'm afraid that many of my fellow Americans tend to be a bit provincial in their outlook and attitudes and forget (or at least ignore) the fact that we are not the only people on the planet! As for protecting "our" frequencies, there is probably not much that can be done from a regulatory point of view since no one interest group "owns" any amateur band frequency. However, we can certainly work through our respective national organizations to emphasize good operating practice (like listening before transmitting) and promote band plans that include "preferred frequencies" for low power operation.

I don't believe that I have ever worked you, Brian, at least I don't have a QSL from you. However, I did find a card in my QSL files from ***George, GM3OXX****. We had a QSO on 20 CW in 1988 when I lived in Connecticut; he was running 1W and I was running a mightily 3W with my HW-9 and attic multiband dipole! 72 de Larry, W1HUE.*

Hi Ron,

Many thanks for all the work you and your staff have done editing the Quarterly. The new format sure is nice, 52 pages is more like it. For a while, I was so embarrassed about the Quarterly that I quit pushing membership. I'll enclose a photo of me that Luke took at a Wichita Falls hamfest several years ago (1991 I think, at least 3 or 4 years). I tried to get more "hand outs" but Mike Bryce told me he didn't have enough to send me. I must have signed up 50 or 60 new members in the last 4 to 5 years. That includes P.R. and South America.

Good Luck and 72/73,
Burl, N5DUG

Dear Ron,

I really like the "new" QQ! You and your staff are to be commended for your super high-quality work on behalf of the ARCI members.

-- BUT --

I take some offense at the chestnut gracing the front cover bottom of the Jan '96 QQ "... so that amateurs all over the world may enjoy amateur radio." Please, let's leave this kind of fluff for the weird social tinkerers of the world. QRP'ers do just fine without having to bear the stigma of defining "equality" for others, much less being committed to imposing it on anyone. Mr. Covey would make a lousy QRP'er.

Thanks for listening to my (admittedly) minor gripe. Please keep up the great work! Happy New Year!

72,

Ric Haworth, WI6I

Oh no! I've been accused of being politically correct! All my friends fell to the floor laughing aver that! Please notice the corrected statement on this issue's cover. ***Mike Czuhajewski, WA8MCQ****, had already pointed out that the earlier statement was not right and provided the corrected version. Thanks for taking the time to write. de Ron, KU7Y.*

Hello all,

I just received the January '96 QQ -- WOW! Congratulations to Ron and all contributors for making this another great issue of The Quarterly. I can hardly wait until the next edition. I have yet to digest this one, but from first appearances, it will be a time consuming effort (although enjoyable). I did take a moment to look at LB's dissertation on ATU's -- great stuff. The whole issue just looks great. Thanks again to all responsible.

Ray Colbert, W5XE / V31XE
El Paso, Texas
af852@rgfn.epcc.edu

Hi,

I just received my first edition of QQ and I just love it! Thanks for a great publication. I am looking forward to a long and fruitful relationship [with ARCI]. I have been a low power faithful since my beginnings in Hamdom with my trusty Yeasu FT-7. I have just finished my first kit, an OHR Spirit II for 40M (oh yes, I built the OHR WM-1 Wattmeter too). While some of the articles [in The Quarterly] are just a bit over my head at the moment, I look forward to learning through my membership, and that's why I tool up amateur radio from the start. Thanks again!

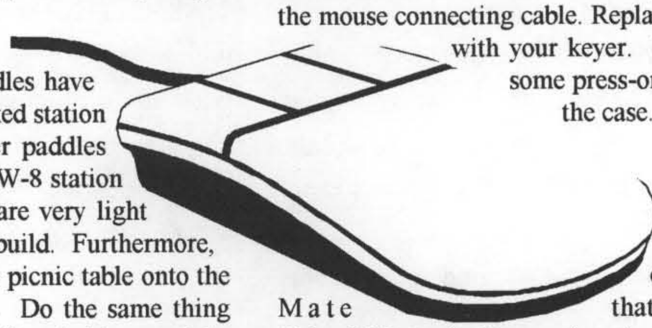
Rich Hall, N7XNL
n7xnl@primenet.com

Unless specifically requested that it not be published, any letter, note, etc. received by the editors and staff of The QRP Quarterly that is of general interest to our readers will be published when space is available. We reserve the right to edit all published correspondence as we find necessary. Opinions expressed are those of the authors' and do not necessarily reflect those of The Quarterly editors or the ARCI Board of Directors. ----- -----

CHEAP AND EASY KEYER PADDLES

Bill Jones, KD7S, 83 Redwood Ave., Sanger, CA 93657 kd7s@valleynet.com

Every once in a while an idea comes along that is so clever and unique that you wonder why you didn't think of it yourself. So it was with the QST article, THE CODE AT YOUR FINGERTIPS 1 by John S. Lewis. The author described the design and construction of a two-finger keyer paddle made from a few scraps of metal and some magnets. The paddles (levers, actually)were mounted horizontally, side by side on a small metal base, and were operated by pressing the dot lever with the index finger and the dash lever with the middle finger of either hand. The paddles were fairly easy to duplicate using simple tools and a few hours work.



Numerous versions of two-finger paddles have seen almost daily use at KD7S, both for fixed station and portable operation. I use two-finger paddles exclusively when operating my portable HW-8 station while camping in the mountains. They are very light weight, small and cost next to nothing to build. Furthermore, if you happen to knock the paddles off the picnic table onto the ground, they will keep right on working. Do the same thing with a conventional set of paddles and you'll probably spend the rest of your camping trip bird watching.

The latest variation of my keyer paddles came about quite by accident. A non-working computer mouse was discovered in the "freebie" bin at a local hamfest. Although the circuitry inside the plastic shell was defective, the micro switches under the buttons were still good as new. Thus was born what I call the Mouse-Key.

Building your own Mouse-Key consists of little more than isolating the micro switches under each mouse button from the rest of the electronics and rewiring the existing connecting cable. I have converted a dozen or more mice over the years and none took more than thirty minutes to complete.

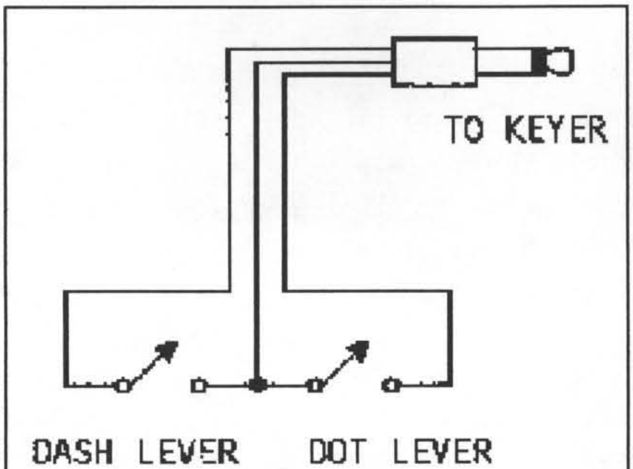


FIGURE 2

Locating a defective mouse should be a simple task. Check your telephone book for the nearest computer repair facility. You should be able to pick up a non-working mouse for little or nothing. If all you can find is a 3-button mouse, so much the better. Use the center button as a TUNE switch or even a straight key.

Begin construction by carefully removing the top cover from the base. Look for some small screws on the underside of the base. They may be covered with a press-on label. Once the internal PC board is exposed, confirm that the micro switches are functional using an ohm meter. If they check out okay, use a sharp hobby knife to cut a break in the PC board traces connected to the switches. The goal is to have two isolated, independent SPST switches. Perform a continuity check on the wires in the connecting cable. The mouse may have been discarded in the first place due to one or more broken wires. You will need three separate wires, dot, dash and common for a two-button device. See figure 2 for details. Solder the selected wires to the micro switches. Next, cut the plug from the end of the mouse connecting cable. Replace it with whatever will mate with your keyer. Finish the project by adding some press-on rubber feet to the bottom of the case.

If you like to operate CW mobile, put a piece of adhesive backed VelcroTM on the underside of the case. Mate that to another piece of VelcroTM attached to a nylon strap long enough to wraparound your right leg just above the knee. When strapped to your leg your keyer paddles will always be within easy reach and you'll never have to worry about them sliding around. This approach is also convenient while working outdoor contests such as Field Day where your station layout may not be as convenient as what you have at home.

An experienced builder might wish to enclose a battery operated keyer inside the mouse case itself. A small thumb wheel speed control knob could be installed near the operator's thumb. There is plenty of room inside the mouse case for a Curtis keyer chip and associated circuitry.

Testing the completed paddles consists of nothing more than pressing the buttons to see if your keyer responds. By convention, the left mouse button controls the dots while the right button sends dashes.

It will probably take an hour or two of practice to get used to sending CW with the Mouse-Key but most keyer users should have little difficulty making the transition. Speaking from experience, it soon becomes just as natural as using conventional paddles.

1 John S. Lewis "The Code at Your Fingertips," QST, Nov 1976, Page 28

Making Your Own Quality Microphones

Steve Pituch, N2MNN
N2MNN@OPENIX.COM, and QRP-L

Now that QRP SSB is becoming more popular, my friends on QRP-L have been asking for suggestions for microphones to use with their QRP SSB rigs like the QRP+, and the Cascade. The design in this article provides high quality audio which you can tailor to your own liking, and it is really cheap.

The design is built around an electret element from Radio Shack, and an LM324 OP amp to provide a user adjustable high and low pass filter. The audio response can be made the same as is shown in Heil's HC-5 literature, and guess what; it then sounds just like a Heil. The audio can be shaped to complement the user's personal preferences.

The element, an RS 270-090 ($1.99), has a uniform response from 20 Hz to 15 KHz. I have often seen similar elements used in high quality commercial mikes. Its the filtering that makes a $1.99 element into a $100 mike. The specs on the element are as follows:

Supply Voltage:	2 to 10 VDC (4.5V optimum)
Current Drain:	1.0 mA (max.)
Signal/Noise:	40 dB (min)
Sensitivity:	-65 ± 4 dB
Output impedance:	1 K

When I first became a ham in 1991, I built a mike from an article in QST[1], but it used more current than could be provided from my friend's 8 pin mike connector on his TS-850. He therefore had to use a 9V battery which was a hassle. I used the mike for year with no problems, but I did not understand enough about electronics to investigate the circuit design. Now, five years later, I've learned enough to build my own circuit with QRP in mind.

Refer to Figure 1. R1 and R2 form a voltage divider to deliver about 4V to the mike element. This voltage is not critical, but the divider consumes only about 1 mA in this configuration.

Components R3, R4, C1, and C2 form part of the high pass filter circuitry. R3 and R4, and C1 and C2 are always equal. The formula for the 3 dB cutoff frequency is: frequency = $1/(2\pi RC)$, where the frequency is in Hz, resistance is in Ohms, and the capacitance is in Farads. Thus if the capacitors are .01μF and the resistors are 39 K , the cutoff frequency is 408 Hz. Buy 5 % value capacitors if you don't have a capacitance meter. If you have a meter, simply find and remove 2 disc capacitors of similar type and manufacture from an old circuit board, and carefully measure their values after they have cooled down. Take some sandpaper and grind down one edge of the higher value disc capacitor until it reads the same as the other capacitor. Wait a few minutes after sanding until the capacitor cools down again before taking the measurement. Don't laugh! I've been doing this for several years and I can easily match a pair of capacitors to within 1 percent in a few minutes. After you're sure that you have a match put a dab of epoxy on the exposed wound of the mutilated disc. Now plug in the exact value of the capacitors in the above formula, along with the frequency, and find the resistance needed. Congratulations! You've just designed a high pass filter.

These filters are called a VCVS (voltage controlled voltage source), or "Sallen and Key" design. R5, and R6 are part of the filter design and do not change in value. Actually its their ratio that must always be a constant. The 47K and 27K values are what are commonly used. Notice that pin 11 to the LM324 is grounded. Normally this pin is connected to a negative voltage source of the same magnitude as the positive voltage source. This is cumbersome, so pin 11 is grounded instead, and the plus input at pin 3 is biased to a voltage equal to one half of the source DC voltage. This was done by adding R7, and it forms a voltage divider in conjunction with R4. Because DC has been added to the audio circuit, the audio inputs and outputs must be isolated from DC. This is done by C1, and C3.

The low pass filter uses the same circuit as the high pass design except that the two capacitors and two resistors are interchanged. Thus for a capacitance of .01µF, and a resistance of 5.1 K , the cutoff frequency is 3121 Hz. Once again, R8, and R9 provide a voltage divider to bias the audio circuit with approximately 4 Volts, to allow single supply operation. R10, R11, C4, and C5 are the RC components for the low pass filter, and C3 and C6 provide DC isolation. R14 is an attenuator, and C7 is for RFI proofing. Don't forget to also place a .1µF capacitor across the PTT switch for additional RFI protection2,3.

To adjust, set your transciever's mike gain control for mid range, or the normal position. Then adjust R14 for the optimum ALC reading.

By tailoring the two cutoff points, you should be able to similate the response of most any commercially available microphone. For those trendy hams who are building one of those combination keyer-speaker-mikes into the shell of a broken computer mouse, try the circuit in Figure 2, since it has only a few parts, and can fit anywhere. I built it for a friend, and gave it to him to try for a week. When I asked for it back to put the Figure 1 circuit in it, he refused to give it up, saying that he had never gotten better on the air reports with any other mike. This circuit gives you some bass attenuation which is the most important part of the audio shaping. All you need to do is try different value capacitors starting with a higher value and working down until the bass is reduced enough for your liking. A .1µF capacitor did the job for use with my TS 850. You must use a capacitor here even if not for the filtering just to isolate the DC from the rig's mike input. A 10µF capacitor will not attenuate the signal at all.

So now you guys with the QRP Plusses and Cascades have no excuse for not going on SSB.

[1] R. Klimas, "A Quality Desk Mike for under $25," *QST*, Dec 1991, pp 26-28.
[2] D. DeMaw, "Build a Low-Cost Booster Microphone," *QST*, Aug 1989, pp 19-21.
[3] D. DeMaw, "Beware of Mike RFI," *QST*, Mar 1992, p 88.
[4] J. Schultz, "Does Your Microphone Have Too Much Bass Response?," *QST*, Jan 1996, p 76.

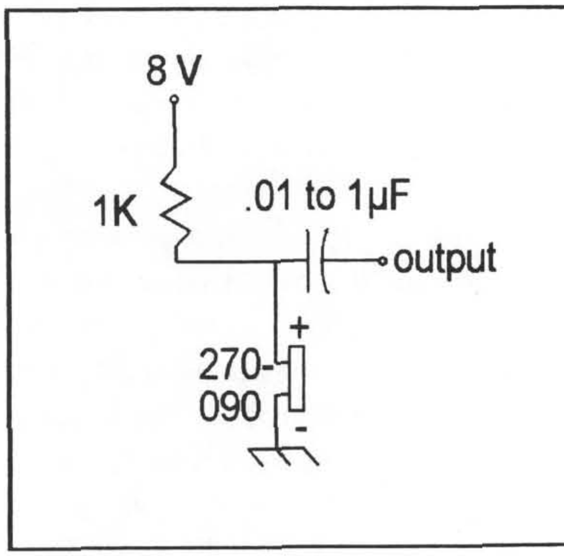


Figure 2. Experimental Microphone High Pass Filter Diagram

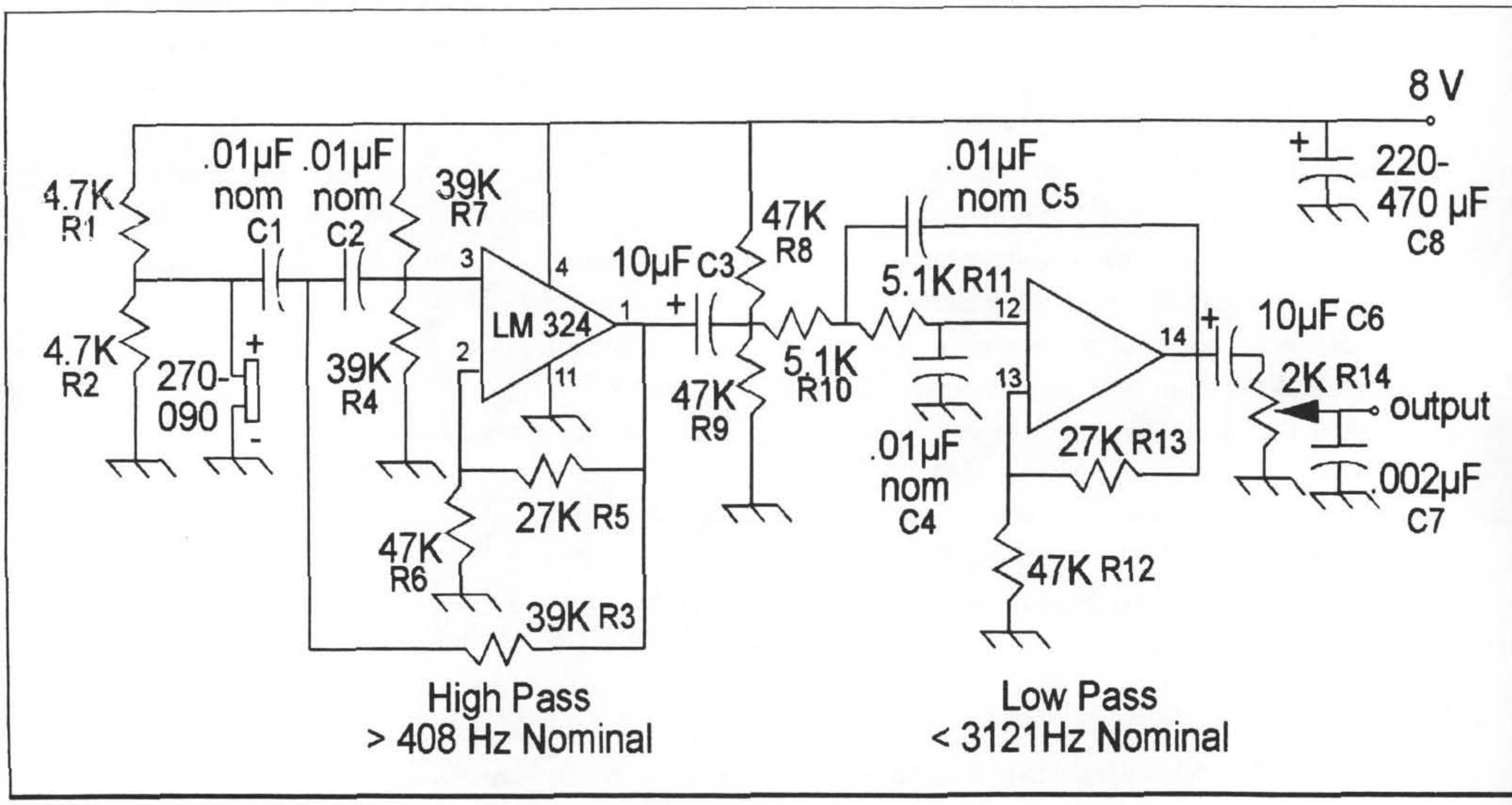


Figure 1. Microphone-High/Low Pass Filter Diagram

<u>QRP WISDOM FROM UNCLE BRUCE</u>

QRP, REALLY!

Bruce Muscolino, W6TOY
P.O. Box 9333
Silver Springs, MD 20916
bruce3900@delphi.com

Dayton Approacheth

Yes, the umptheenth annual Dayton Hamvention will be only a few weeks away as you read this. Rescheduled into May, we hope for better weather than past Hamventions. For once I'd like to tour the whole swap meet without benefit of either cross-country skis or rowboat.

Are you coming to Dayton? Remember, this is the home of dreams come true like the $300 Argonaut 515. They do exist -- I saw the radio and it was pretty nice! In addition to the usual Hamvention activities -- pressing the flesh with 50,000 of your fellow hams, drooling at equipment displays, spending next century's lunch money (and maybe dinner too) out among `em in the swap meet, sore feet and all. We QRPers seem to have developed our own form of entertainment -- "the hospitality suite". Imagine a room where you can see the best in QRP hardware being demonstrated by the folks who designed it. Imagine a room where you can sit down and have a face to face chat with many of QRP's movers and shakers -- for example, **Chuck Adams, K5FO, Mike Czuhajewski, WA8MCQ, the Reverend George Dobbs, G3RJV**, and the ARCI officers.

Imagine a room where you can see much of QRP's best equipment AND meet the designers -- previous years have seen S&S Engineering, MXM Industries, Oak Hills Research, and the clubs, NORCAL, and NE-QRP. This year we'll probably see Wilderness Radio and Green Mountain too. And around the fringes of the room, many QRPers you've worked on the air, like Ernie, W8MVN, who came last year with a marvelous model of his antenna tree. It is not to be missed if at all possible.

One last thought about the Hamvention -- maybe you ought to think about buying your ticket(s) in advance, or do you like to stand in line? Yes, you can buy your tickets ahead of time, by mail. The advantage; Thursday morning you can tumble out of bed (or sleeping bag), get on the bus and hit the swap meet before they open the main hall! Of course, if you don't buy tickets early you can stand in line and watch your peers clean up the bargains!

Four Days in May (FIDM)

Of course I must put in a plug for Four Days in May (c). This is an extra day of QRP fun added to our already crowded Dayton schedule. Come a day early and join us for a QRP technical conference and party. This event is the child of Bob Gobrick, Paulette Quick, and myself. We felt QRPers wanted more from their visit to Dayton than just two forums at the Hamvention and three nights of debauchery in the hospitality suite.

Together we came up with Four Days in May -- a technical conference for QRPers. As I write this there are 9 confirmed speakers (with room for a few more) who will speak about hardware design, construction, antennas , and operating activities. The event includes a complimentary coffee bar in the morning, lunch, and snacks plus each attendee will receive a printed copy of the "proceedings" (a complete set of technical papers) and an autographed copy of a new QRP Design Data book being introduced at FIDM. All this for $35.00

Obligatory grumble

At one time I gave some serious thought to renaming my column "Crumbs from the Curmudgeon" because it seemed I spent an inordinate amount of time griping about things that offended my delicate sensibilities. But, I made a New Year's resolution to emphasize the positive this year, so I'll stick with QRP, Really! (c). QRP Really! expresses my attitude toward QRP operation. I don't think QRP is anything more special than contestsing or chasing DX or running traffic nets. It's just what we do.. Friends, lots of folks used low power for many years before we tossed our 5 watt hats into the ring. Remember, even this club had a 100 watt (or so) limit when it was first founded. So, am I putting us down? Not at all; we do what we do for our own personal reasons. BUT when I hear us wasting precious energy talking about inconsequential things when we should be improving our stations and our skills, I'm gonna have to say something. For instance: What's the best key/keyer, or the best QRP antenna.

You should already know the best key or keyer is the one you're using right now. Why? Because if you sit at your operating table worrying about whether you have the best key or keyer for the job in your hand you're going to miss an awful lot of good stuff on the air. You'll be worrying if the key is smooth enough, or the keyer weighted just right, and others, like your humble scribe will be working the guy using two pieces of wire touched together! QRP antennas? There is no such thing as a QRP antenna. Antenna are equal opportunity accessories -- they work equally well at 1000 mw as they do at 1000 watts! Frankly, they don't give a d... Really!

The best antenna is the biggest or best one you can put up that will let you make contacts. I routinely use a little piece of magnet wire, about 40 to 45 feet long, that runs out through the aluminum window frame of my third floor condo bedroom into a nearby tree. Insulators? Sure, where the antenna goes through the window there's a piece of unshrunk heat shrink tubing, and at the tree -- the insulation on the wire

Does it work? In a word, YES. Is it the best antenna in the world? NO. I'd love to have a full size dipole, or a real LONG wire, or A BEAM, but circumstances do not permit it at the moment. Does that mean I should give up? Nope. I've been using this antenna about 18 years now, and have given lots of thought to optimizing it. I've added a counterpoise, a "ground tuner", a better matching network, and the like -- everything short of going back to QRO operation! In short, use what you can and plan for better.

Recent doings in my world I have a NE-4040 that I built a couple of years ago. It never worked very well and until **Mike Czuhajewski** found the problem, I more or less routinely consigned it to use as a visual demonstrator for hamfests. The problem was the receiver was stone deaf to all but the very strongest signals. The problem was an open choke in series with the crystal filter. Mind you I had used this little rig to accrue the a respectable QRP score in the 1995 Pennsylvania QRP contest!

Anyhow, I got the bug in my bonnet to repackage this little dear into a very small box and maybe use it as a travel radio. Drill... drill... screw... screw... solder... file... Eureka! The rig was in a new box. Now, for the acid test... I wanted to try some under 1 watt QRPing since I'd not done any since that Pennsylvania QSO party, so I hooked up the scope and the dummy load and set the final output to what I thought was about 950 mw. Off to the stealth antenna to see what hath Bruce wrought!

I managed four contacts -- best DX was either Fulton, Missouri, or somewhere in Florida --but the QSOs were like pulling teeth. Each one was an experience in calling and recalling, and imposing on the very good graces of the other guy's antenna and receiver!Not remembering that I'd had this much trouble beforer, I dug out the scope and rechecked my output power. Darn! It was a whopping 125 mw. **Hey milliwatters, you really have my respect!**

Also crossing my desk this period has been an S&S Engineering 40 meter TAC-1 transceiver. Please allow me to say this radio will not disappoint you! It is a big kit, plan ahead or buy the factory assembled unit, but it does work well, and it was fun to build. Look for a review article in one of the glossy magazines.

TOROID INDUCTORS AND TRANSFORMERS FOR QRP APPLICATIONS

Paul Kranz W1CFI
kranz@an.hp.com
26 Mettacomett Path
Harvard, MA 01451

INTRODUCTION

Today it is difficult to find a QRP kit or a homebrew article that does not include a toroid inductor or transformer. Many of us regard these components as consisting of a little mystery and magic. In fact, a recent unexplainable problem with a MOSFET transmitter forced me to dig deeper into the theory behind RF power transformer design and to uncover information that easily solved my problem. Since I was aware of others who had had similar difficulty I thought it would be helpful to pass along what I had learned.

This article will discuss powdered iron and ferrite cores, inductance and Q, core and winding losses, inductor and transformer design guidelines and transmission line transformers. I hope to provide enough information to make the design of these components more straightforward and remove some of the mystery.

POWDERED IRON AND FERRITE CORE MATERIALS

The most important quantity needed for describing a magnetic material is the core's permeability, usually referred to as μ or mu. This quantity relates the magnetic flux density to the magnetizing force much the same as resistance relates voltage and current. Permeabilities of powdered iron and ferrites range from those slightly greater than air, which is one, to several thousand. Higher permeability cores require fewer turns of wire to achieve a specified amount of inductance.

Powdered iron material finds most of its applications in high Q inductors. Two types of powdered iron materials are in common use; hydrogen reduced iron ($\mu<100$) and carbonyl irons ($3<\mu<35$). If high Q is not required, the useful frequency range of these materials may be extended by 10 or even 100 times.

Ferrites can be many combinations of iron oxide and other metal alloys such as nickel-zinc, manganese-zinc or even non metalic ceramic ferromagnetic compounds (1,2). All these materials have higher permeabilities and less temperature stability than do powdered iron materials. Ferrites find most of their applications in transformers and RF chokes for EMI suppression where low Q and wide bandwidth are required.

INDUCTANCE AND Q

Manufacturers often simplify the calculation of the number of turns of wire needed for a desired inductance by combining permeability and other core specific quantities into a single quantity known as A_L. This quantity relates inductance to the number of turns of wire on the core according to the following equation.

$$N = 100 * SQRT (L/A_L) \qquad (1)$$

N = Number of Turns
L = Inductance in michrohenrys
A_L = L rating in uH/100 turns

The number of turns of wire needed can be seen to vary as the square root of the inductance. In the case of a transformer the winding inductance or magnetizing inductance should have a reactance of at least 3 to 5 times the source impedance. This is true because the equivalent circuit has the source impedance, leakage inductance and the magnetizing inductance connected in series. A low magnetizing inductance will cause an undesirable voltage drop to occur across the source impedance and the series leakage inductance.

The Q of an inductor is the ratio of inductive reactance to resistance (Q=2*PI*L/R). Q can also be expressed as the tangent of the phase angle between the inductive reactance and resistance of the inductor so that when the phase angle is 90 degrees, the Q is infinite and when it is 45 degrees, the Q is one. This resistance is an AC quantity which depends upon the losses in the core and the winding. As frequency increases, these losses increase also so that only low permeability cores have low enough losses for high Q, high frequency use. Core losses depend upon material type, frequency, flux density and core size. Winding loss depends upon wire size, turn-to-turn and turn-to-core capacitance. The optimum Q occurs at the point where core and winding losses are equal.

Winding capacitance, turn-to-turn and turn-to-core, lowers the Q as the square of frequency so that the winding AC resistance will dominate Q at low to medium frequencies and winding capacitance will dominate the Q at higher frequencies.

CORE SATURATION AND WINDING LOSS IN POWER INDUCTORS AND TRANSFORMERS

Core saturation is the point where an increase in magnetizing force does not result in a corresponding increase in flux density and occurs at about 5000 Gauss in Powdered Iron cores and 2000 Gauss in Ferrite cores (3). When saturation occurs, the permeability of the core drops markedly. Core saturation will appear as a dramatic loss in inductance or in the case of a transformer as an apparent primary to secondary voltage ratio which doesn't equal the turns ratio.

It is a common misconception that core saturation is the primary limiting factor in selecting a core for RF power applications and is the cause of the apparent loss in inductance or lower that expected turns ratio (2). The actual cause may in fact be core and winding loss. When Faraday's Law, expressed below in equation (2), is used to calculate the peak AC saturation flux density for sine waves the resulting calculated flux density may be found to be far below the saturation flux density.

$$B = \frac{(E * 10^8)}{(4.44 * A * N * f)} \qquad (2)$$

B = Peak AC Flux Density (Gauss)
E = RMS Sine wave Voltage (Volts)
A = Effective Cross-Sectional Area in Core (in square centimeters)
N = Number of Turns
f = Frequency (Hertz)

In these cases the apparent low inductance or low turns ratio will be due to excessive core heating caused by winding losses and/or core losses. These losses can cause the core temperature to rise to 100 or 200 degrees Celsius, where the permeability of the core drops precipitously as is shown in figure 1.

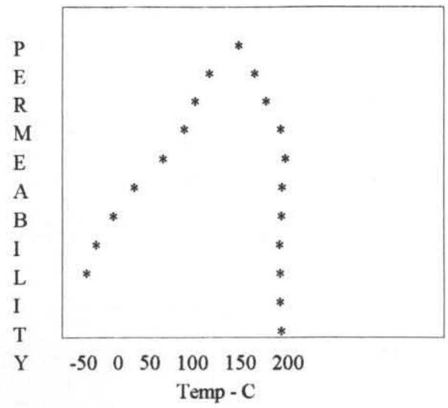


Figure 1

(Permeability as a function of Temperature for Fair-Rite 73

The flux density limits in Table 1 can be used as guide-lines for BOTH Iron Powder and Ferrite cores to avoid excessive heating (3) and should be used in conjunction with Faraday's Law to examine the possibility of core saturation or heating of the core due to high winding or core loss.

TABLE 1

Frequency:	100KHz	1MHz	7MHz	14MHz	21MHz	28MHz
AC Flux Density*:	500 G	150 G	57 G	42 G	36 G	30 G

*=Gauss

Applying Faraday's law above, the flux density in the core will be larger for Ferrites than for Iron Powder cores due to the fact that a smaller number of turns of wire will be needed on the Ferrite core. This results in a smaller denominator in this equation which produces a larger flux density and more heating due to core losses.

Losses in the winding cause heating of the core and will increase with increasing frequency. The skin depth or the portion of a wire in which the AC current actually flows is inversely proportional to the square root of frequency which will cause the AC resistance of the winding to increase with the square root of frequency.

WINDING INDUCTORS AND TRANSFORMERS

The Amidon catalog contains the necessary data for selecting the optimum wire size for winding a given toroid. The tables include a copper wire table and a core size vs turns of wire of various sizes. This last table will help select a wire size to fit the selected core so that the core is filled with a single layer of wire.

Transformer primary to secondary coupling can be improved by twisting the primary and secondary wires together with an electric drill before winding them on the toroid. The core will provide the coupling at low frequencies while the inter-winding capacitance will couple the primary and secondary at higher frequencies. This technique is commonly referred to as bifilar and trifilar winding.

To design an inductor or transformer the first step might be to calculate the required inductance. Next make a tentative core selection from the cores listed in the tables in the Amidon catalog. Now that the A_L is known calculate the number of turns of wire from equation (1) and the cross sectional area of the core. Next use equation (2) to calculate the flux density. Compare this flux density with the data in table 1. If the calculated flux density is larger than the table value, select a larger core with a similar A_L and repeat the above procedure. Lastly, use the wire table in the Amidon catalog to select a wire size which will fill the chosen core.

Magnet wire for winding an inductor or transformer can be bought with an insulation which is "solderable", e.g. Belden Single Beldsol Solderable wire type. The soldering iron can be held against the wire and the insulation will melt leaving bare copper which is easily soldered. Belden Heavy Armored Poly-Thermaleze is not solderable and must have its insulation removed with a chemical stripper or mechanical scraping.

If the winding is not spread evenly over the core, then the flux will not link all of the turns and will result in an increased leakage inductance. This inductance acts in series with the magnetizing inductance, which appears across the primary in the equivalent circuit, and will have the effect of lowering the primary inductance. For example if a 10 turn winding is bunched up as opposed to evenly spread over the winding the equivalent primary inductance will be half the expected value. This is more of a problem at high frequencies where few turns of wire are used. In general, the largest wire which will fill the core with a single layer will produce the best results.

All toroid magnetic materials have temperature coefficients which result in the winding inductance being a function of temperature. The most temperature stable materials are the Carbonyl Powdered Iron cores, Micrometals -2, -6 and -7 materials, with -7 being the most temperature stable. It is these temperature stable types which should be used in frequency determining circuits such as VFO inductors. Even then, *the temperature stability of the inductor* can be improved by an order of magnitude just by heating the wound inductor with a hair dryer or a heat gun so that the stress in the wire is reduced.

TRANSMISSION LINE TRANSFORMERS

Transmission line transformers provide 3 dB bandwidths in the order of 1000:1 and are able to handle large amounts of RF power. These transformers take advantage of the inter-winding capacitance and the winding inductance to form a transmission line which has inherently wide bandwidth. The high power handling capability is due to the low flux density in the core which results from the primary and secondary currents flowing in opposite directions in the core. These winding requirements often result in a limited range of turns ratios, i.e. 1:1, 1:4, 1:9, 1:16 etc. It is sometimes difficult to isolate the primary and secondary winding which results in the primary and secondary sharing a common terminal. More detailed information can be obtained in references 4 through 8.

For Further Reading:

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THE G3YCC MINI DIPOLE FOR 14 MHz

Frank G3YCC (G QRP 042)
(frank@yorks.demon.co.uk)

(Note: this article is reprinted with the permission of the author and the publisher of Practical Wireless where it first appeared.)

The aerial to be described is an inductively loaded dipole for the twenty metre band and may be found to be useful for amateurs with limited space. The first time I came upon an article describing the idea this antenna is based on was in Amateur Radio Techniques, edition 5, by Pat Hawker G3VA.

Construction is facilitated by using readily available aluminium tubing and a handful of hardware. The original article used coils of 2 1/2 inch in diameter. This makes construction difficult, so was modified by using a much smaller diameter PVC tube, which also joins the two halves of each element. The dimensions for the dipole are in figure 1.

```
----------==========/////==========
2 ft. adjust   3.5 ft.    coil   3.5 ft.
        (half shown, fed with coax)
```

Figure 1

Coil is 18 turns of pvc covered wire, single strand, on 22 mm pvc tube.

CONSTRUCTION

Six pieces of aluminium tube were obtained, four 3.5 foot long pieces of 1 inch outside diameter and two 2 foot pieces of 7/8 inch outside diameter. These were the only two available that are a sliding fit at my local suppliers. Two 1 foot off cuts of 22mm PVC pipe were available, which is a reasonable fit in the larger tube. This is strengthened by inserting pieces of hard wood dowels, and is used to join the two halves of the larger tubing also acting as a former for the two small loading coils. To ensure a good fit, the PVC tubing is wrapped with a couple of layers of tape. The free ends of the larger tubes have three saw cuts in them and a hose clip is used to secure the sliding inner tube when tuning the aerial. The centre piece of the dipole in the prototype, was made from a defunct nylon chopping board about 10 inches square and 1/4 inch thick. Any strong insulated material could be employed here, possibly outside quality plywood treated with polyurethane varnish. The dipole elements are secured to the centre plate by suitable exhaust clamps. Another piece of 22mm PVC tubing strengthened as above with dowel, about 6 inches long, is inserted into the elements at the centre to help with rigidity. Again, to ensure a good fit, a couple of layers of adhesive tape is applied. Self tapping screws secure the aluminium tubing to the PVC joining sections at the centre and at the location of the loadingcoils. The loading coils were wound using 18 turns of plastic coated single strand wire, with the ends secured under the self tappers with suitable washers. PVC tape covers the coils to prevent the turns moving.

When the aerial is finished, the coils and their associated fastening screws are covered with heat shrink tubing. The coaxial cable is connected using crimp-on connectors from the local motorist's shop, under suitable washers and screws at the centre if the dipole as can be seen from the photographs. The end of the coax is coated with Waxoyl to prevent water ingress and the various screws and fasteners are similarly treated. This method has proved to be an effective way to water proof antennas and coaxial cable joints. The ends of the thinner tubing can be sealed with an insert of dowelling, dipped in polyurethane varnish.

The dipole is fastened to the mast support using suitably sized u-bolts to suit the mast diameter. The two u-bolts pass through the nylon centre plate.

TUNING

Tuning is simple and should be done with the dipole in the clear, preferably in it's final position. In my case, tuning was done with an MFJ Antenna Analyser, but it can be done satisfactorily using rig on low power and SWR bridge, adjusting the end tubes a little at a time for minimum reflected power.

If the dipole is initially tuned near the ground, it will need to be readjusted when raised to it's final position, to compensate for effect of the ground. In my case, initial tuning was done at a height of 4 feet and resonance was easily obtained.

At this point, it was decided to wait until the next day before finally attaching the dipole to the crank-up mast (it was getting dark). However, my MFJ 9420 QRP rig was connected up to the aerial in the shack and signals were being received quite well. But, it would be no use trying to transmit using the dipole at four feet, or would it? A strong CQ came thundering through from S59DBC in Slovenia, so why not try? The station came straight back to my QRP call with a 5&9 report! So, if it works at four feet... it should be useful at 30 feet, at the top of the mast!

The next day, with the Mini Dipole at the top of the mast, several stations were worked at good strength with the QRP rig. The only one of note was VL1F, a special event station on Cape Breton Island (IOTA: NA10), who I managed to work with the 10 watts through a pile-up with a RST of 5&9, a good test for any aerial. Many Europeans were worked with good results and initial impressions are, that the loaded dipole will be a useful aerial, especially where space is at a premium.

MATERIALS

7/8 inch OD 18 guage seam welded aluminium tube: two lengths, 2 feet long.
1 inch OD 18 guage seam welded aluminium tube: four lengths 3 feet 6 inches long.
22mm PVC plumbers' tubing.

Insulated material for dipole centre, approximately 10 inches square.

two hose clamps, four exhaust clamps.
Self tappers, washers, PVC tape,
plastic covered wire, U-bolts, etc.

-QRP-

IDEA EXCHANGE

Technical Tidbits for the QRPer

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

e-mail WA8MCQ@bbs.abs.net
packet WA8MCQ@WB3FFV.MD

IN THIS EDITION OF THE IDEA EXCHANGE

NE-4040 COMMENTS AND REPLY

Bruce Tiemann, N6URH, *commented on the NE-4040 via cyberspace*--I built the NN1G 40 meter QRP CW transceiver (Nov 1994 QST), and made a few mods and measurements. The receive sensitivity has been increased, QSK is approached, the use of a different final amp is described, and the tuning range has been increased. Birdies serve as convenient frequency markers.

Receive sensitivity was low: My IC-726 with a 6' whip could hear signals that the 40-40 with a full size dipole couldn't. Two mods cured this: increasing C31, and adding a preamp.

With the antenna connected directly to the RF gain pot, R3, sensitivity was better than with the antenna at the intended place (L6/C30), indicating that loss occurred somewhere in the front end. Walking the antenna away from R3 identified C31 as the deafener. Replacing the 68 pF with a 1000 pF ceramic made the thing hear about as well with the antenna connected to antenna port as at R3, indicating there were no more significant front-end losses. This increased coupling did not lead to significantly louder sidetone on transmit; it was still too loud. Increasing the 4.7 megohm TX-audio-shunt resistor interconnecting the drain and source of FET Q1 to 22 meg fixed it.

However, it was still insensitive, so how about a preamp? W1FB's QRP notebook describes "the preamp that ICOM uses" in its HF transceivers - and sure enough it's in my IC-726 schematic (though I used MPF102s instead) It made the 40-40 able to hear atmospheric noise (but barely). It's nice because it's transparent to RF when power isn't applied - you merely give it juice if you want gain. It draws 10 ma - a good candidate for a front panel switch.

I found the hang time for T-R turnaround too long. It's dictated by the 1M resistor and 0.1 uF cap at the gate of FET Q1. A 0.01 was fast but gave a loud pop on T-R turnaround; a 0.02 was ideal.

For the final amp I used a 2SC2075, "identical to an MRF476," in place of the 2N3553. (The MRF476 is spec'd for 3 W output at 50 MHz.) With the '2075, my 40-40 maxes out at about 4.5 watts. The article said, "Adjust R2 as needed for 1.5 W key-down power.... More is NOT better - you'll coax a little more power out at the expense of efficiency!" However, I found increasing efficiency with greater power, up to 3W, though this probably has more to do with the transistor than with the circuit. With 15 volts on the rail, here's what I got:

0.05 W	80 ma TX draw	1.2 W Input	4% eff.iciency
0.5 W	160 ma	2.4 W	21%
1 W	215 ma	3.23 W	31%
2 W	290 ma	4.35 W	46%
3 W	365 ma	5.48 W	55%
4 W	510 ma	7.65 W	52%

With the 2SC2075 it looks like the highest efficiency is at 3W, right at the spec of an MRF476. Note also that though it drops up top, it's still more efficient at 4 W out than at 1.5 W.

Increasing C9 above 68 pF is mentioned as how to get more than 40 kHz of tuning range. I settled on 270 pF for C9, and a MV1162 varactor - 275 pF nominal -for a tuning range of just over 130 kHz. This much added capacitance required reducing C5-C7 to 2000 pF each, with some small NP0 caps

(68 and 12 pF in my case, but may be different for others) in parallel to put the bottom at 6997 kHz. This is enough spread that a ten-turn pot is called for as the freq. knob, but I'm exploring use of two single turn pots, a "coarse" and a "fine".

As promised in the text, there is a HUGE birdie right at 7000 kHz - and it makes an excellent marker! The radio is usable within 2 kHz of this birdie, so it doesn't result in much loss of spectrum, and I chose the bottom of the tuning range as 6997 to be sure I could tune across it. In addition, I found two other birdies, a weak one at 7077 kHz, and a strong one at 7117 kHz, and these too were suitable markers, also being unobtrusive and stable. (I wouldn't feel so kindly toward them if there were another means for frequency calibration!)

--DE N6URH tiemann@spot.Colorado.EDU

Dave Benson, NN1G, responds--

Receiver Gain: At my location, attaching a full-size antenna to the unmodified 40-40 results in a noticeable increase in receiver noise, perhaps on the order of 15-20 dB. I changed C31 from the original .01 uF to a 68 pF to improve image rejection, which was more of a concern with the 10.1 Mhz version. As measured, the additional loss due to the 68 pF value of C31 was less than 2 dB. The value of C31 will greatly affect the sensitivity, however, if the C1/C2/T1 network is way off resonance and thus presenting a low impedance at 'RF In'.

In my experience troubleshooting this rig, the symptoms you describe (increasing C31 or connecting the antenna directly to T1 increases gain considerably) may be traced to one of several problems:

1) Accidental use of a -43 core instead of the -61 core for T1 results in a front end way off resonance. Trimmer cap C1 yields a broad peak when tuned and is set at the 3/6/9/12 o'clock position.

2) A short between pins 1 and 2 of U1 (across T1 secondary) or between one of those pins and ground. Trimmer cap C1 has little effect in this case.

3) One other long shot- Components left lying around for long periods of time (without inert gas packaging) will become increasingly difficult to solder due to lead oxidation. For some reason this seems most acute with crystals, perhaps because suppliers turn this inventory over slowly. I'd recommend retouching all solder joints in the IF filter "just in case".

It sounds from your description like your 40-40 is down 20-30 dB from proper operation if adding a preamp barely lets you hear atmospheric noise. I'd start there. This design is definitely not internally noise-floor limited on 40 Meters.

More receiver gain: If the sensitivity on the 40-40 is really low, then you've likely got the RF gain control maxed out most of the time. When the band is is good shape, and assuming the front end is functioning properly, the NE602 is going to suffer intermodulation distortion (IMD) pretty badly with a preamp. It offers a much lower (worse) third order intercept (IP3) than the diode-ring mixers and other Gilbert cell devices like the Plessey SL6440. The unmodified 40-40 is usable during hot band conditions because the RF Gain is right out at the front end. In general, I'd advise against using a preamp with this mixer on 7 Mhz.

Transmitter efficiency: I note that the test measurements were taken using a 15V supply. Solving for a 50-ohm collector impedance, optimum efficiency would be expected to occur at 2.25 watts. I characterized the 40-40 for 12V operation in my writeups, as this supply voltage is normal for the battery sources often encountered in QRP/portable applications. Also, if you're running the modified 40-40 at 3-5 watts you may want to consider modifying the output network for a collector impedance on the order of 25 ohms.

I've also been asked why the 40-40 wasn't designed for more output power. When this design was first produced for the New England QRP club, I was getting the PAs for under a buck and no heat sink was needed. We put a high premium on cost/benefit in the original design and this trade was one of the outcomes.

Birdies and Bandspread: Yep, there's a strong birdie at 7.000. Most builders end up setting the 35-40 KHz bandspread to include the QRP operating frequency of 7.040, so they never experience this problem. You might try 4.096 Mhz microprocessor crystals for the IF, which relocates that low-order spur to 7.168 Mhz. I'm not sure how much bandspread you'll get out of the 40-40 before output power falloff becomes objectionable. The TX bandpass filter is pretty narrow, and swamping down this network by reducing the Q4 bias resistors and increasing the coupling capacitors will increase the useful range. I'd doublecheck spectral purity, though, if this were pushed too far, since the reduced bandpass Q will increase the transmitter spur energy .

--DE NN1G

REVERSED SWR METER FOR MORE SENSITIVITY

In his original posting, **N6URH** mentioned that he measured the power output of his rig by reversing his MFJ-949D tuner, pumping the power into the antenna connector and connecting the dummy load to the transmitter side (with it in the tuner bypass mode). The reason? Like many SWR meters, it's a dual meter movement, cross needle device. It simultaneously indicates both forward and reflected power, and full scale power on the REFLECTED side is much lower than on FORWARD; in this case, 5 times less. If all you want to do is measure power, you can effectively get a lower range by simply reversing the input and output connections temporarily (but don't forget to restore them before you try measuring SWR!). As he pointed out, in the FORWARD position the lowest mark on the meter was at 0.5 watts, while the lowest mark for REFLECTED is at 0.1 watt. This tip has surfaced a few times over the years, and is worth repeating every now and then. This doesn't apply to just MFJs, of course; take a look at your SWR meter--you just might be able to get a lower power range out of it.

QRP PLUS: STEREO PHONE JACK; "DRIFT"

From ***Frank Brumbaugh, KB4ZGC*** *of Salinas, PR, 2 tidbits for the QRP Plus*--I don't know how others feel about having stereo phone jacks in gear having monaural audio, having the ring and tip connections on the phone jack shorted together, but I hate it! Everything in my shack uses monaural plugs. They do not work with stereo jacks like this since the sleeve (ground) touches the ring contact and shorts out the signal. Instead of replacing the jack in the QRP Plus with a mono unit, I modified the wiring slightly.

There are two gray wires soldered to the jack. One of them is attached to a terminal which also has a bare wire jumper going to another terminal on the jack. Remove the jumper, and move that gray wire to the terminal where the other end of the jumper was; you can now use your mono phones with it. (See Figure 1.)

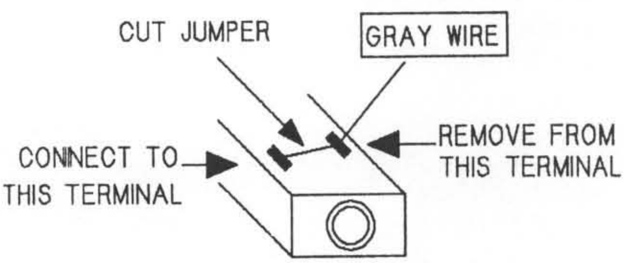


Figure 1

I noticed some "drift" in my QRP Plus, which shouldn't happen in a digital rig like this. The problem turned out to be mechanical, not electronic. The large tuning knob has no drag--it is free spinning--and it is not perfectly balanced. Once I set a frequency, the knob very slowly turns as it responds to gravity. This results in a frequency change of 900 to 1000 Hz, occasionally less. There does not appear to be a single heavier part of the rim, but several, depending on the position when I take my hand off.

The cure would be simple--a thick (1/4") wool felt "washer" behind the knob. Having none, I tried adding some drag with a piece of plastic; I was afraid it would grab and cause backlash, and I was right. I had WA8MCQ send me some felt to make washers, and it works well. Before I put my home made washers on the shaft, I put two more nuts on the shaft bushing of the optical encoder, with the outer one providing a bearing surface for the rear of the felt. Now the knob stays put when I tune a signal in; what a relief!

--DE KB4ZGC

PEAKING TUNED CIRCUITS WITH TRIMMER CAPS

*From **Ed Burke, KI7KW**, via QRP-L:* Trimmer capacitors, such as the miniature types used in the NorCal40, Sierra and Cascade, have a capacitance profile resembling a saw-tooth waveform, with one "tooth" per revolution. That is, if you take a 5pF to 40pF trimmer and set it at its minimum capacitance (5 pF) and turn the adjusting slot, it will increase to its maximum value (40 pF) at 180 degrees and then return to the minimum at 360 degrees. So why is this important?

When you peak a tuned circuit for resonance you should see two peaks for every complete rotation of the trimmer, not one! Seeing two peaks is a pretty good indication that things are working properly, and getting only one probably means that the inductor is the wrong value for the frequency involved.

Suppose you have correctly wound a toroid for 5 Mhz such that it will resonate with 20 pF. When you rotate the 5 to 40 pF trimmer through 360 degrees, it will pass through 20 pF twice and you will get two peaks. Now imagine that you made a mistake and produced a toroid which needs 50 pF to resonate. When you adjust the trimmer cap it cannot yield more than 40 pF, so it will not really resonate, but you may get a relative peak indication at 40 pF; "I'm not at resonance, but I'm doing the best I can".

Counting peaks is a good technique when aligning tuned circuits. If you see only one peak with 360 degree rotation, there is a problem somewhere. *[Actually, either the cap or coil could be considered "incorrect", and changing either one will solve the problem. However, most of the time the cap will be "correct", since it was probably part of a kit or you bought the value specified for the project. The toroid, on the other hand, is most likely the culprit since net inductance is dependent on several things--you may have wound the wrong number of turns, the core may be slightly off its nominal permeability value, or you might even have used the wrong core type by mistake. And even if those are correct you can still get a significant variation in inductance by varying the spacing of the turns. In most cases, the coil should get the evil eye, not the cap. --WA8MCQ]*

--DE KI7KW
(edward.f.burke@bangate1.TEK.COM)

WATCHING YOUR I'S AND V'S

*Number 17 in the endless stream of technical Quickies from **Joe Everhart, N2CX** of Brooklawn, NJ*--At a recent hamfest I got a handy little solar panel and a gel cell battery for powering my QRP stuff. To get the best use out of them, I wanted to be able to monitor the charging current and battery voltage. This Quickie describes the metering circuit I came up with.

The best meter candidate was a small edge-reading unit from the junk box. It had some odd-ball color bands on it but no numeric scale or sensitivity markings. Using the techniques in the ARRL Handbook (any of them from the last 40 years or so) I measured the following characteristics:

1. Full scale deflection of 150 microamps
2. Fairly linear deflection up to 3/4 scale, but very nonlinear above that.
3. Internal resistance of about 900 ohms

The meters nonlinearity really didn't matter because I wanted it mainly for relative readings anyway. In fact, since human nature says that analog meters are read by position, not by numeric value, the best calibration is just to set the normal readings to mid scale.

The solar panel had a maximum rating of 150 mA with full sun illumination and a short circuit load. Its open circuit voltage was about 20 volts. It also had an internal series diode to prevent battery discharge with no sun. With the gel cell battery, I decided on meter mid-scale readings of about 100 mA and 15 volts.

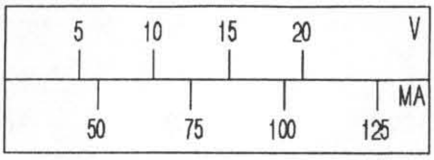


Figure 2

Figure 2 shows the meter scale. Since it originally had no usable markings, I used Doug DeMaws scale construction technique. I glued a sheet of white paper over the original scale and hand calibrated it with a fine point black pen.

There was no need to be terribly fussy about lining the scales up. I first picked a carbon comp resistor that gave a mid scale deflection of about 15 volts (150K ohms). Using a variable voltage supply, marks were made at 5, 10, 15 and 20 volts. A second scale was made for current readings. Three 2.7 ohm resistors were paralleled as a meter shunt (you can also use small gauge magnet wire per the ARRL Handbook). The same variable supply was used with a current limiting resistor for calibration. Mid scale was about 100 mA and additional marks were made at 50, 75 and 150 mA. The voltage multiplier and shunt resistors were NOT carefully selected. Since the meter scales were calibrated by hand, careful adjustment would have been a waste of time!

The metering circuit is shown in Figure 3. The current metering shunt resistor is always in series between the solar panel and the battery. The SPDT switch connects the meter either to it to monitor current or to the multiplier resistor to measure the battery voltage.

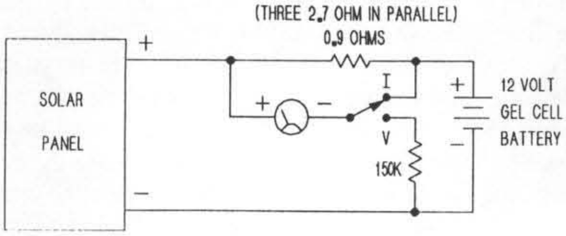


Figure 3

Now I can charge my battery (making mils while the sun shines) and watch my I's and V's while I'm doing it!

--DE N2CX

HIGH IMPEDANCE PHONES CAUSE PROBLEMS

The subject of inexpensive headphones was discussed on QRP-L, and someone said that many of the "walkman" style units are 50 to 100 ohms and result in a lighter load for the audio amp in a simple receiver. ***Dave Meacham, W6EMD,*** *who is the NorCal QRP Club Technical Advisor, had this reply*--The fact that high-impedance phones put a light load on the audio amp can be a problem. The audio chips designed for 4 or 8 ohms can become unstable with a light load (oscillate, motorboat, etc). A fix that works quite often is to put a 4 ohm resistor across the output terminals. That way, the audio chip is happy and there is still plenty of audio for the phones.

Another common problem in QRP radios is the use of a coupling capacitor from chip to output that is too small a value. A typical size is 100uF, but chip manufacturers specify values as high as 2000uF! Just a few days ago I cured an audio-oscillation problem in a friends radio by putting a 470uF cap in parallel with the original 100uF cap.

--DE W6EMD ddm@datatamers.com

BEWARE SUPER-FLEXIBLE ANTENNA WIRE

From me, WA8MCQ--You've probably all seen the ads for the super-flexible antenna wire with 168 strands. It really IS incredibly flexible, but does have a down side--it can be worn through by abrasion.

It consists of several "macro-strands" twisted together; I counted the number of wires in one of the strands and multiplied it, and it really does contain 168. However, my dial calipers tell me that each one is about 0.007" diameter and my eyes tell me they are very tiny! Here's the rub (pun intended): In an ideal world, when you put up an antenna the wire should not touch anything. Many of us live in real-world situations where this is not possible, and sometimes it is unavoidable that antenna wire will contact limbs and branches of trees.

That was the downfall of my 40 meter delta loop one year. The copperweld wire was getting badly pitted after many years use so I decided to try the 168 strand wire for a change. After only four months, with lots of wind moving the trees around and constantly rubbing on the wire, it fell from the sky. Naturally, this was while it was late winter and still quite nasty; a basic law of physics states that antennas never fall down during warm weather! When I looked at the antenna wire, both ends showed a tremendous amount of fraying. Needless to say, I went back to standard copperweld antenna wire the next time around. I never had any problems with it, even though the branches had abused it for several years.

Use the super flexible wire if you wish, but make sure it does not come in contact with tree parts or other things that can wear it down over time. If that is unavoidable, use regular antenna wire.

--DE WA8MCQ

THE FRANKLIN VFO

More from ***Frank Brumbaugh,*** *KB4ZGC*--Here's a schematic of the Franklin VFO, which is essentially an astable multivibrator. It's not my design, but I used it years ago in a band switched 1.5--30 MHz signal generator. I found it to be extremely stable, even at the high frequency end. Because it uses a parallel tank with one end grounded and no taps, it is easy to build for any frequency range.

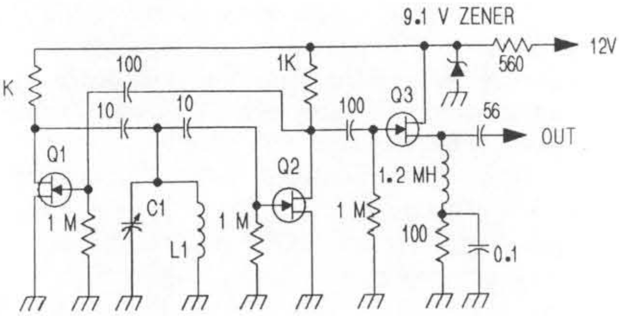


Figure 4

Figure 4 is the basic Franklin oscillator with one stage of buffering, and should be followed by the standard buffer amplifiers. The tank circuit, L1 and C1, is the sole frequency determining network. Trimmer caps could be used to tailor the frequency range, provide bandspread, etc. Usual VFO construction practices apply, for toroid core choice, component quality, mechanical rigidity, etc. The original circuit did not have the usual diode from the FET gate(s) to ground; I didn't add them so don't know how much, if any, they would help stability here.

I used MPF102 FETs but I suggest 2N4416 as a better choice for Q1 and Q2. All small capacitors are NP0 ceramic and resistors can be 1/4 watt, 5%. I used a 9.1V zener diode to regulate it; a 78L09 (or 78L08) regulator would be even better, but don't forget to bypass the input and output to keep it stable--try 0.1 uF.

I don't know who Franklin was, nor when the basic circuit was developed, nor do I recall just where I discovered this particular circuit in some book or magazine, but I found this in my notebook from 1987. I also have no idea why I have not seen it in any of the ham magazines over the years. All I know is it functioned quite well for me! Because my experience with the Franklin was unusually satisfactory, I think it should start getting some publicity.

--DE KB4ZGC

OHR EXPLORER II VFO NOTES

From our Features Editor, ***Larry East, W1HUE****, of Idaho Falls, ID*--After completing my Oak Hills 30M Explorer II, I followed the VFO calibration instructions and adjusted L9 and C62 for proper frequency at each end of the dial (0 and 50). However, there was very poor match between the dial reading and actual frequency at other points on the dial -- differences of several kHz at some points. I decided that the problem was due to the non-linear nature of the main tuning cap at its low capacitance end, and that it would probably be better NOT to try to get the dial and frequency to match at the high end of the dial.

I decided to try aligning it between the 0 and 45 (rather than 50) dial markings. In order to do this, I had to add some capacitance in parallel with C62 -- a 68 pF NPO and a 22 pF N750 (to reduce the negative warm-up drift -- see below). After doing this, the output frequency and dial markings matched to within 1 kHz from 10.100 to 10.145 kHz -- not bad! I lost about 2 kHz at the top end (output is 10.148 kHz at a dial reading of 50), but I never operate above about 10.120 kHz anyway.

Some other observations:

1. The VFO frequency would drift from several seconds to a few minutes each time C62 was adjusted, making it difficult to adjust. Dick at OHR confirmed that this has been a problem, and said that C62 has been replaced with a fixed cap in current kits.

2. I noted a VFO warmup drift of almost 1 kHz (downward) before adding the 22 pF N750 and 68 pF NPO caps. After adding the caps, I measured a drift of -380 Hz over the first hour (room temperature constant to within 1 degree F), -90 Hz over the next hour, and +/- 100 Hz or so over the next 18 hours (temperature fluctuated 3 or 4 degrees over the long term test period). Not bad, but indications are that a little larger N750 cap might be better. I tried a single 100 pF N750, but that produced a large positive drift. Oh well -- back to the 22 and 68 combination.

3. The instability noted in C62 may be contributing to the drift; when I get "a round tuit" I'll try replacing it with an NPO trimmer or fixed NPO cap and see what happens. A side note: Measurements on my NorCal 40A show a warmup drift of less than 50 Hz over the first 15 minutes, and stability to within +/- 50 Hz over a 24 hour period!

--DE W1HUE

ADDING AN SWR INDICATOR TO THE NORCAL 40A

More from ***Larry East, W1HUE***--A recent article in QST [1] described a simple SWR indicator using LED's to indicate relative forward and reverse power. The circuit uses a fairly standard directional coupler using a toroid transformer, but instead of a meter it uses a dual op-amp to drive LED indicators. This seemed like an ideal addition to my little NorCal 40A -- but where to put the toroid transformer?

The output BNC connector is attached directly to the circuit board, and there is no space available between it and the output low-pass filter. Then I looked closely at the connector; it's a right-angle type mounted in a plastic housing, with (very stiff) wires from the connector itself to the circuit board. It looked like a T30 toroid would fit inside the opening in the rear of the plastic housing -- provided I could straighten the wire from the center conductor of the BNC and pass it through the center of the toroid. I could, and it did!

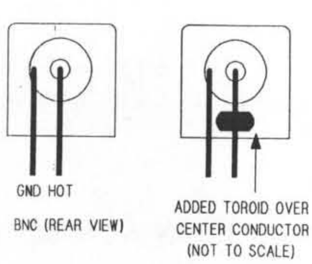


Figure 5

I ended up using a T30-6 toroid with 30 turns of #30 wire in place of the T50-2 toroid specified in the article (I didn't have any T30-2's). The toroid fits nicely into the plastic housing and is held in place with Q-dope. The wire from the BNC center conductor passes through the toroid, is clipped off and a piece of wire soldered to it and passed through the original hole in the PC board.

I built the remainder of the SWR circuit (TL072 dual op-amp, 78L05 voltage regulator and assorted other parts) on a small piece of "perf-board" mounted on a small right-angle bracket attached to a hole in the BNC housing with a self-tapping screw. I had to put the "null" trimmer on the transmitter side of the transformer rather than the output side, but it works just fine. The LED's are mounted on the front panel and connected to the perf-board with ribbon cable.

I now have a self-contained SWR indicator! The power drain due to the SWR indicator is about 4.5 mA when not transmitting; power drain when transmitting is an additional 3 to 5 mA, depending on output power and SWR. (I selected the op-amp resistors to provide 5 mA of LED current at 3W output).

[1] Tony Brock-Fisher, "Build a Super-Simple SWR Indicator," QST, June 1995 (p. 40).

--DE W1HUE

AUTEK RF ANALYST POWER FIX

From a posting on QRP-L from ***Roy Boggs, KE4KDT*** *of cyberspace*-- For owners having intermittent power-up problems with the RF Analyst, as I did, the engineer at Autek provided me with a fix without having to mail it to them and spend $31.00. The problem is that one of the pins on the board is too long when plugged into the connector and exerts pressure on something that shorts out the power. Even he wasn't sure what really happens, but advised that they had several calls about this symptom. It will act like a shorted battery connector or defective on/off switch.

The row of pins is located next to one end of the two halves of the RF Analyst; the offending pin is the farthest one from that edge. The fix involves cutting 1/32 to 1/16 of an inch off the tip to prevent it from protruding too far into the connector on the opposing half. I did this to mine and presto, instant "on" and no more problems.

--DE KE4KDT rboggs@pcc-uky.campus.mci.net

RF TESTING PLASTIC MATERIALS

Some materials you might be tempted to use for antenna insulators are not suitable and can break down with high RF voltages. Some QRPers need to be concerned about this too, since tuned loop antennas can generate high voltages even at QRP levels. From QRP-L comes this posting from ***Stuart Rohre, K5KVH***--If you are concerned with what a certain plastic material will do under RF influence, there is a very QRO test most of us can do at home.

Take a glass cup of water and place it in your microwave; the most popular sizes of kitchen microwaves today are 750 watt units, thus this is a QRO experiment. Take a paper towel or paper plate and place your piece of test plastic on it next to the cup of water. Set the timer for about 4 or 5 minutes on high, or whatever the time it takes your machine to boil a cup of water. After it boils for a few seconds, turn the microwave off and, with a wetted end of a finger, touch the plastic under test. (Watch out for the cup of boiling water).

If the plastic is NOT hot, you have a suitable RF plastic. Remove the test subject and cup of hot water, prepare your favorite hot beverage with it, and sit down and contemplate what a nice RF form the plastic will make---if it did not heat up. If it did get hot, clean up FAST before the Chief of Kitchen finds out what is smelling up the microwave!

--DE K5KVH rohre@arlut.utexas.edu

MEASURING POWER WITH A SCOPE

*From me, **WA8MCQ***--An oscilloscope is a good tool for measuring the output of QRP rigs, especially at milliwatt levels. However, it can be misleading if you're not careful; I made a silly mistake a while back and don't want to see you do the same thing.

Some basics first--to measure power, connect your RF output to a dummy load, and measure the signal with the scope, using the probe that came with it (Figure 6). It will be either an X1 or X10 probe. With most scopes you will have to mentally multiply the volts/division setting by 10 with the X10 probe, although some scopes will automatically switch the display when X10 probes are detected.

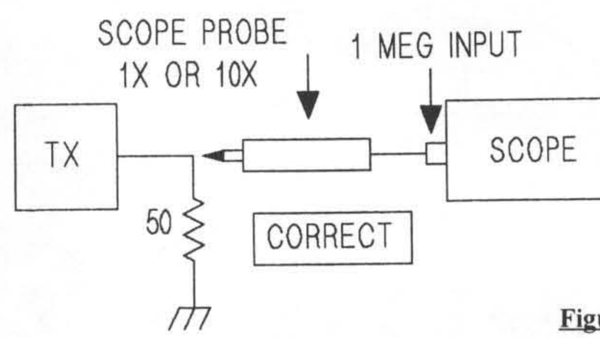
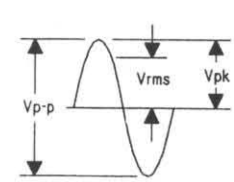


Figure 6

Set the scope for a suitable display and measure the peak to peak voltage. Divide the P-P value by 2 to get peak volts, and divide again by 1.414 to get RMS voltage (divide P-P by a total of 2.828). Find the power by squaring the RMS voltage and dividing that by the impedance (normally 50 ohms). See Figure 7.



$$POWER = \frac{E^2}{R} \quad OR, \quad \frac{Vrms^2}{R}$$

$$POWER = \frac{(Vpk \times 0.707)^2}{R} \quad OR, \quad \frac{\left(\frac{Vpk}{1.414}\right)^2}{R}$$

$$POWER = \frac{(Vp\text{-}p \times 0.3535)^2}{R} \quad OR, \quad \frac{\left(\frac{Vpp}{2.828}\right)^2}{R}$$

$$\frac{(Vpk \times 0.707)^2}{50} = \frac{Vpk^2 \times 0.707^2}{50} = \frac{Vpk^2 \times \frac{1}{2}}{50} = \frac{Vpk^2}{100}$$

Figure 7

A little trick that I've done for years is to stop at peak voltage, square that, and divide by 100. It makes it a bit simpler since I just need to shift the decimal point over two places. This only works for 50 ohms, though. Converting peak to RMS is done by dividing by 1.414, or multiplying by 0.707. The formula for power is voltage squared, divided by resistance. The way the math works out, you can use peak voltage squared, divided by 2R, and in the case of 50 ohms that's 100. (Figure 7 again.)

Here's how NOT to do it, as shown in Figure 8, the one marked "don't do this!". I was working someone with my power control all the way down and wanted to tell him how many milliwatts I had. I couldn't find my meter to use my diode detector, so I used my scope. It was on the other side of the room and I couldn't move it closer, so I connected it to the dummy load with a long 50 ohm cable with BNC plugs on both ends, 10 to 15 feet long.

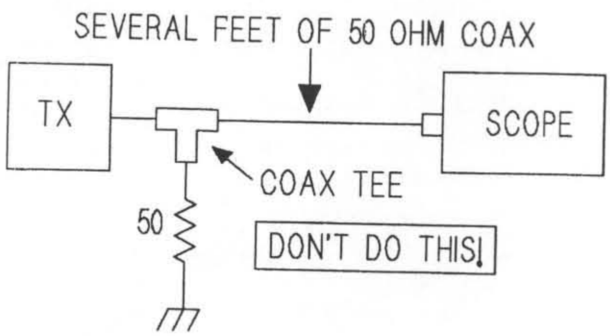


Figure 8

I measured 5 volts peak or about 250 milliwatts, but based on past experience I knew it should have been closer to 3 volts, or 90 mw. Some tests later showed that the power really was about 90 mw, but I had been using an "amplifying cable". The problem is that the 50 ohm cable was plugged directly into the 1 megohm input of the scope, causing the voltage at the input to be higher than normal due to the impedance mismatch and high SWR on the cable. The actual impedance was 1 megohm resistive plus a small reactive component, since scope inputs also exhibit a certain amount of capacitance to ground (the value is sometimes stenciled on the panel near the input connectors); it was about 13 pF in this case, or a reactance of over 1700 ohms at 7 MHz. I got a lower reading when I terminated the scope input with 50 ohms, but the reading was still erroneous since the transmitter was now terminated by 25 ohms.

Figure 9 shows the proper way to do it if you must use a long cable; the end of the cable at the scope is terminated with 50 ohms, and there is no other 50 ohm load on the line. This should be done directly at the vertical input, if you have a scope termination, or you can use the dummy load and a coax tee with a very SHORT piece of coax. Test equipment terminations are small devices with male and female BNC connectors (usually) on the ends and a terminating resistor inside. (If shopping hamfests for these, be sure they are 50 ohms since they can also be 75 or 93 ohms, and probably others.) Think of them as a tee with a wire from end to end and a resistor from the wire to ground.

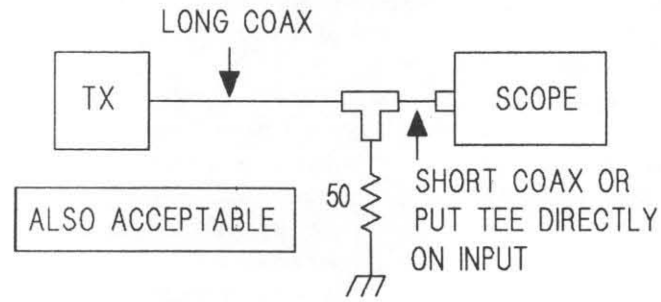


Figure 9

Don't forget that in this case the termination acts as the dummy load and must be able to handle the power applied to it. Typical test equipment terminations are 1 or 2 watts, though there are also some 5 watt "monsters" out there. I have one of those, from Tektronix, and it's about 3" long. That's a rather dangerous thing to have sticking out from a scope input connector--an accidental yank on the cable could be disastrous, so I use a right angle adapter to make the termination hang down, and the cable can be tied down to the scope cart.

--DE WA8MCQ

QRP-L: "THE QRP DAILY"

I get a number of quarterly QRP journals and enjoy them all, but I also need my daily fix of QRP. It's time to coin a new phrase--"The QRP Daily"--and that's the QRP-L mail reflector at **lehigh.edu** in cyberspace. All you need is an e-mail account somewhere and you can sign up for a deluge of QRP. It's grown quite a bit since it was started up by K5FO a few years ago; there are currently about 900 people signed up for it, and it's been running anywhere from 30 to 60 or more postings per day. If that's too much on-line time or mailbox clutter for you, you can get the "daily digest", which is a single daily message with all the postings. Those usually run to 2000 lines or more, but at least it's only a single message so it doesn't clutter up your mailbox. (To save precious on-line time, I save it to disk and read it off-line later.)

To subscribe, send e-mail to **listserv@lehigh.edu** and in the text just say **subscribe QRP-L [your name] [your call]** -- for example, **subscribe QRP-L Mike Czuhajewski WA8MCQ** and you'll receive a welcoming message shortly. Study it well and save it to disk--it has all sorts of good info about the list, such as how to get the daily digest and retrieve a lot of QRP info files via e-mail or ftp.

THE FINE PRINT: Have any interesting tidbits to share with the QRP community? Send them along, via e-mail, floppy disk in ASCII or most word processor formats, or handwritten--anything that is readable by me or my computer is perfectly OK, and hand drawn schematics are OK since I redraw those with KeyCAD in most cases. You get paid the same as me (which is nothing!) but you do get the gratitude of the other QRP Quarterly readers.

--qrp--

MILLIWATTING: 10db BELOW QRP

Bob White WO3B
8293 Shilling Road
Pasadena, MD 21122
bob_white@ccmail.aerosys.loral.com

RESPONSE TO LETTERS

John, K3WWP rightfully pointed out to me that in my last column I neglected to describe any of the station setups when I mentioned recent QRPp ARRL CWSS achievements. John's point is well taken. We are often quick to list our achievements, but neglect to devluge our "secret" formula for success. The sad note is that quite often someone will look at your achievements and assume the 40 meter 4 element beam at 66 feet when you were only using a longwire at 30 feet. By gosh if you bagged that ZL on a longwire take credit for it. Better yet let someone else out there know that just because he has a modest antenna system doesn't mean that he can't work 10 db below QRP and expect results.

K3WWP you asked for it......
K5FO's 1995 QRPp CWSS CONTEST STATION

Rigs were a Oak Hills Explores I for 40M and NN1G Mrk II for 20M, both at 950mw output measured on a OHR WM-1 QRP wattmeter. Keying was accomplished with a Grid Laptop computer running CT contest software.

Antenna(s) consisted of a unbalanced dipole with 30M of wire on the "hot" side and 10M of wire on the ground side, feed with 8M of 300 ohm ladder line. Chuck also setup a temporary V-Beam pointed to the NE with only 150 feet per leg. The V-Beam was feed with 450 ohm ladder line and worked quite well. Chuck uses a MFJ-941C for an antenna tuner.

Audio aids for this event were a OHR SCAF filter and a W9GR DSP III. Chucks preference was for the SCAF filter, but admits that he needs more air time on the DSP III before he can make an accurate judgement.

Operating from Dallas, TX, with this very affordable station, Chuck was able to work 72 of the possible 77 1995 ARRL CWSS sections while racking up 199 contacts. Chuck also completed his 950mw 20M WAS during this contest by bagging a 20M KL7.

Next quarter I will describe my own station including my comments on the new and improved QRP Plus. My QRP Plus (#597) is currently in Gig Harbor being upgraded to the new version.

THIS MONTHS FEATURE: Low Power Beacons

At this point I am going to turn the column over to a rising QRPp beacon expert, Paul AA4XX. Paul, with the support of the KnightLite group, runs a beacon located on Harkers Island, NC. Paul's beacon is one of the two east coast 40 meter low power beacons which I know about. The other beacon is run by Pete, WA3NNA from Newtown Square, PA. I have found that Paul does not limit his operating to beacon transmissions, he has "Big Ears" as well. While he was running as net control for the 80M KnightLite net last Sunday Paul checked me in with a 229 while I was running a TS-940s measured at 200mw by a WM-1 then attenuated -24db by a Ten-Tec model 290 Step Attenuator down to 796uw and fed through a MFJ-941E tuner via 450 ohm ladder line to the west corner of a full wave 160M sky loop at 55 feet. The man is not all talk, but knows how to operate both sides of a QRPp contact.

40 METER BEACON FUN By Paul Stroud AA4XX

Two years ago, I read with great interest about **WA8MCQ**'s milliwatting exploits. I was surprised to read that he had checked into the ARCI net several times running from one to two milliwatts. I began to wonder if it were possible for a regular guy such as myself to do the same thing. I ordered an Oak Hills wattmeter and put it together in a couple of evenings as part one of my plan. I laughed out loud when I saw the 0-100 milliwatt scale. I said to myself , "Is it really possible to talk to anybody using such ridiculously low power levels?" The following discussion answers that question.

The Saturday after completing the wattmeter. I had the good fortune to have **Fran Slavinski, KA3WTF**, answer my 250 mW CQ on 7040 Khz. Before the QSO was over, Fran was copying me solidly at 10 mW. Good gracious! Sakes alive! Fran and I were both hooked big time. We made a schedule for the following Saturday morning and Fran managed to copy me at 900 microwatts. We continued to meet every Saturday morning for several weeks and eventually established a QSO at 221 microwatts.

By this time, others were interested in joining in the challenge of micropower experiments. A 40 meter beacon was assembled, using an Oak Hills QRP Classic and a Super CMOS II Keyer. The keyer worked perfectly for the intended beacon application. Early on, it was decided to incorporate a four letter codeword into each beacon string. This would ensure that the receiving stations did, indeed, copy the beacon.

A typical beacon transmission is as follows:
VVV VVV VVV 2 mW BIRD de AA4XX/B
(To repeat after a 2 second delay)

The beacon power is measured directly with a 100 MHZ oscilloscope (More about this later). Several different antennas are used, including a quarter wave vertical with 16 radials, an inverted vee at 45 feet, a 3 element wire beam at 35 feet (beaming north) , and a 2 element inverted vee phased array dubbed "The New England Simple Titan" or "Nessie" Nessie beams west, with an apex height of 60 feet. These antennas are manually switched as per a preannounced schedule. Presently two different transmitters are used: An Oak Hills QRP Classic and a Yaesu FT-757GX.

One of the most critical concerns for the beacon transmitter is frequency stability. Many listeners use very tight IF bandpass filtering to window out adjacent QRM. It is important that the beacon signal does not drift out of the listener's bandpass. Another critical concern is power measurement. While it is not difficult to measure microwatt power levels, the beacon transmitting station needs to have some means of verifying output power against at least one standard.

The response from the first beacon sessions, and from subsequent sessions, continues to be exciting! The beacon permits many receiving stations to simultaneously share in the fun. While not being considered a contest, the beacon sessions do provide a means by which low power enthusiasts can evaluate their various receivers and antennas. The typical QRP receivers and antennas provide more than adequate results for most listening stations.

Announcements concerning future beacon sessions are sent out simultaneously via two Internet sources--QRP-L and the KnightLite's Beacon Mail List. Those who do not have Inet access may receive the beacon announcements by keeping a SASE on file with **AA4XX**. To date, confirmed beacon reception reports have been received from 19 states and Canada. Eight stations have confirmed reception reports in excess of one million Miles-per-Watt!

It is hoped that more QRPp enthusiasts might consider activating beacons in different parts of the country, in order to allow more folks to participate in the listening fun. It should be noted that all beacons below 10 meters must be run in the "attended" mode. This means that the beacon operator must maintain a constant presence at the beacon site as long as the beacon is in operation.

The North Carolina milliwatt beacon project is sponsored by the KnightLites Group. The KnightLites offer certificates and QSL card confirmation for each reception report. The certificates and QSL's may be applied to any of the ARCI awards. The Knightlite's Internet Website includes specific information on the antennas and the power measurement methods employed for beacon work by **AA4XX**. This site also includes a current summary log of all confirmed reception reports for beacons which are sponsored by the Knightlites. The Website address is:

http://www.duke.edu/~djohnson/

For those readers who do not have Internet access, I'll be glad to send the information via regular US Mail. Please include a 9X12" mailing envelope with three units of postage. Internet inquiries may be addressed to **AA4XX@amsat.org.**

Thanks to all of you who have made the beacon program so much fun! (Thank you Paul for your Beacon input.)

WO3B WORDS FROM THE PAST

QRP Quarterly July 1989Veteran QRPer **Brice Anderson, W9PNE,** reports from Lancaster, IL, jumping into the ARRL CW DX contest to see what he could do while running 50 mW input to his TenTec Argonaut 515. "I can't measure the output accurately, but it's below 25 mw and probably less than 20 mw," brice says.

After a slow start trying to break through the pileups, Brice found conditions better by the afternoon. When he checked his log later, he found he had worked five continents in 112 minutes, but it took another 80 minutes to round out his mW/WAC.

Next day, he was back at it and qualified for WAC I 1 hour, 56 minutes at 25 mW. Brices antenna is an 8 year old TH5DX at 52 feet and fed through 225 feet of RG-213/U.

"Several years ago, I worked all 50 states with 50mW output," the 70 year old ham says. "I'M now trying with 25mW output and have worked 38 states. Many have been worked on 40 meters with my sloping dipole and some on 3.5 MHZ."

WOW! WASTP or 2.5 W - WO3B --ORPp--

Members' News

Richard Fisher, KI6SN
1940 Wetherly St.
Riverside, CA 92506
(e-mail: KI6SN@aol.com)

A salute to 'Four Days in May'

Many of the QRPers making the pilgrimage to the 1996 Dayton Hamvention next month will be making history. They'll be participating in the first ever "Four Days in May" QRP symposium.

KI6SN
. . .Richard Fisher

Premiering May 16, FDIM will feature four days of practically non-stop QRP activity — stretching far beyond the world renowned "QRP hospitality suite."

Lynchpins for the four-day event are **Bob Gobrick, VO1DRB/WA6ERB; Paulette Quick, N9OHU;** and **Bruce Muscolino W6TOY/3.** Anyone who has followed their FDIM groundwork knows what a tremendous debt of gratitude the QRP community owes these operators. They've spent months and months in preparation. QRP Amateur Radio Club International is sponsoring event.

Programs are slated to touch on QRP interests ranging from radio design techniques and advances in wire antenna design to radio construction and operating practices.

For months, the committee has been calling for papers for presentation. Among those submitting their work are **the Rev. George Dobbs, G3RJV,** writing on the path to homebrewing; **L.B. Cebik, W4RNL,** on antennas and tuners; **Paul Harden, NA5N,** on his new QRP data book and how it relates to homebrew design; and Muscolino on helically wound antennas.

The "Four Days in May" agenda will also include the annual QRP ARCI Banquet Dinner Friday evening and activities in the QRP Hospitality Suite.

All events take place at Days Inn Dayton South, 3555 Miamisburg-Centerville Rd., in South Dayton.

For more information and registration, contact Quick at (608) 263-9326, or via e-mail: *plquick@facstaff.wisc.edu*

Remember, too, that these kinds of events don't "just happen." The hard work of three dedicated QRPers and QRP ARCI should be applauded for offering low power operators from around the world this delicious smorgasbord.

— R. E. F.

QRP and the 'Write Stuff'

J. Frank Brumbaugh, KB4ZGC, of Salinas, Puerto Rico, writes that two of his "old designs, originally published in '73 Amateur Radio Today' have been included in McGraw-Hill's 'Encyclopedia of Electronic Circuits,' Volume IV. Figure 15-3 on page 83, and Figure 26-4 on page 154.

"I am pleased to be included in such good company.

"There is a Volume V in print — I have only the first four volumes. Perhaps a couple more of my designs may have sneaked into the latest volume, but I'll probably never know.

"Propagation has been very poor so I haven't accomplished very much. Jamaica is my only *new* country on 20-meter SSB with 8-watts PEP and an impossibly poor antenna. But I try!"

Keeping in QRP contact

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

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

Here are the only mailing addresses you need:

Richard Fisher, KI6SN
Quarterly Members' News
1940 Wetherly St.
Riverside, CA 92506
(e-mail: KI6SN@aol.com)

QRP DXer's dream, and lesson learned

Larry Mergen, N0IZZ, writes from Raymore, Mo., that he was "really surprised when I heard **OX3RS** in the clear near 7.040 MHz calling CQ — and no takers! It was 9 a.m., daylight.

"I got him with my extended Zepp up 20 feet. I ran QRO (50 watts), he gave me a 589. I gave him 579, then he replied back. He was running 2 watts!

"That will teach me to crank back my power on DX. I hope others got to work him."

QRP on Top Band

John H. Shannon, K3WWP, writes from Kittanning, Pa., that he "was sitting at my station the other night calling 'CQ' on 160 meters, and the thought occurred to me that I hardly ever hear any QRP activity on the Top Band. Perhaps everyone thinks, as I used to think, that QRP won't work on this band.

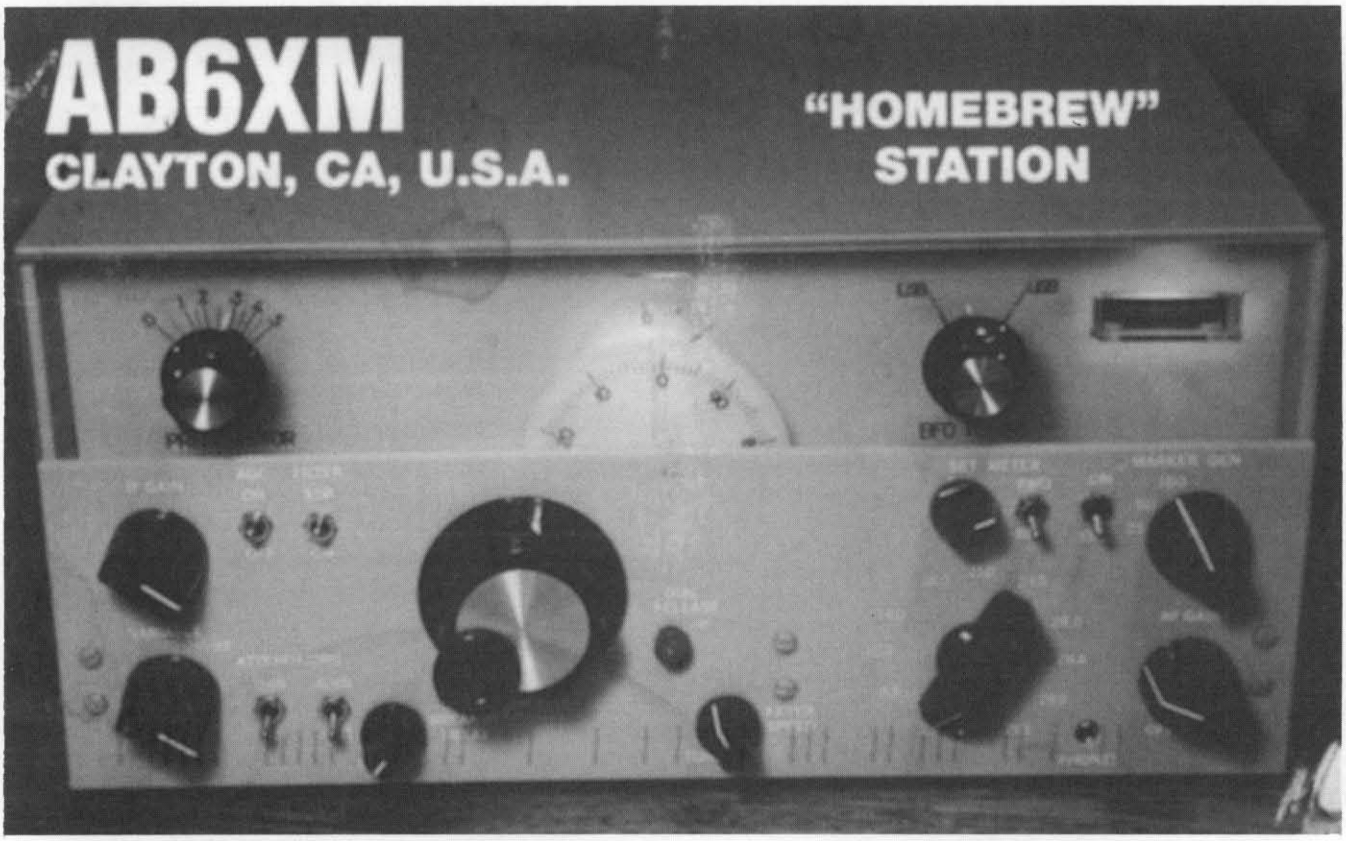
"Well, I proved myself wrong and I challenge other QRPers to prove themselves wrong, also.

"I started operating 160 meters for the first time in the middle of February last year, and as I write this letter, I have made 482 QSOs in 33 states and Canada. I guess my most distant contact would be **WA0CML, James Kjar,** (in Parker, Colo.).

"All QSOs were made with a power output of 5 watts into a random wire antenna about 100 feet long. The random wire is only about 30 feet high at the apex, and that apex is up in my attic. To have the ideal match between the transmitter and the end of the antenna, I use a homebrew C-L-C tee antenna tuner. So, you see, I don't have a big antenna to go with the QRP power.

"You can succeed on 160 with a simple set up.

"I haven't worked any DX yet because my antenna has its major lobes of radiation at too high an angle since I am unable to get it up any higher. I am hoping to figure out



A homebrew QRP transceiver is the featured attraction on the QSL card of Warren Gregoire, AB6XM, from Clayton, CA. The rig is based on a design by Wes Hayward, W7ZOI.

some way to get up a vertical or inverted L antenna on this small lot of mine.

"Getting a good ground system will really be hard. If I succeed, hopefully that will give me the lower angle of radiation needed for working DX.

"Maybe QRP ARCI could sponsor its own 160 meter QRP contest to encourage QRP activity. Perhaps a sprint-type contest, four to six hours on a Saturday or Sunday evening.

"If it could be held, say, the weekend before Christmas when there seem to be no contests at all, then the ideal time would be 2300-0500 or 0000-0600."

Looking for some QRP gear

Brian Howard, KA9SZX, of Fort Wayne, Ind., says that he's "trying to locate used gear to use at a local teen club to promote interest in amateur radio and computers.

"At this time, without funding, it is difficult to find QRP gear already assembled. Without a computer (and e-mail/ Internet), we miss a lot of good gear that is on the market.

"Some of our interested children are apartment dwellers with their parents. Research has led them to the QRP route, which is showing that they do know what they can and can't do.

"Later, the 'big rig' will come — they expressed. Older gear, books and accessories is needed also.

"I explained to them that networking, field work and good communication skills will land what we need until the government funding is approved.

"I have five interested kids/parents involved (currently), and more to come."

If you'd like to learn more about Howard's effort, write him at 1226 E. Lewis St., Fort Wayne, IN 46803.

A fine bit of QRP homebrew

Tom Chisnell, W6XF, of Sun Valley, Nev., writes that Members' News readers might be interested in hearing about a homebrew QRP transceiver built by **Warren Gregoire, AB6XM,** of Clayton, CA.

It's featured on AB6XM's QSL card which describes the rig's background:

"AB6XM's transceiver, derived from a wide dynamic range superhet by **Wes Hayward, W7ZOI,** ("QST," Nov., 1991), utilizes a permeability-tuned VFO. The linear dial reads frequency directly, in 1-KHz steps. IF filters are homemade 8-pole ladder units using microprocessor crystals."

The rig runs 5-watts.

QRP news from the Caribbean

Pablo Luis Robles, WP4JXD, of Yauco, Puerto Rico, sends "a big '72' from the 'Shining Star of the Caribbean.'

"I have just received (QRP Quarterly) after I missed a year of the best QRP magazine I've ever read. I'm really glad to be part of the fun again and see that the Quarterly has grown to 48 pages — that was really impressive.

" . . . Maybe there are hundreds of stories more impressive than mine, but I really need to let our fellow QRPers know how I got started in QRPing and my achievements as a QRPer.

"I just got on the air after two years of silence . . . my station consists of an HW-8, an inverted V for 20 meters, and a sloper for 40 and 80 meters. I also have a direct conversion receiver, VXO-controlled transmitter (from April 1992 "QST") QRP transmatch, 'boots' for the HW-8, audio filter and power supply — all three homebrew.

"I live in a small town surrounded by mountains. This makes things harder for a setting like mine. Even though there are limitations — such as mountains and antennas limited to 30 feet above ground — I find my log quite impressive.

". . . I got interested in QRP mainly because I needed to get on the air with very limited economical resources. There was no way that as a college student I could set up a better antenna system or buy (rigs) you almost need a college degree to operate.

"So I started with small research to find out a cheap way to get on the air. I found that a guy has worked 1,000 miles with just one watt on an old '73 Amateur Radio Today' magazine (project). That was the first time the QRP bug bit me, but I still was doubtful about how real this thing was.

"I'm also an electronics technician. This took care of the self confidence needed for homebrewing. But some encouragement was necessary to break the ice. **KP4F, Pablo Pietri Troche,** of Yauco, PR, an oldtimer and still avid homebrewer after 40 years as a ham, was the first person to tell me that you don't need fancy rigs to make fancy QSOs.

"Just after he told me he has run the world with a watt and let me taste QRP with his HW-8, I fell in love with QRP and here I am a 'QRP CW-do-or-die' operator hooked forever.

"Personally I think that the 1,000-Miles-Per-Watt Award is easy to achieve. I make (them) every early evening when I work many European stations with only four watts or less. Maybe it should be raised to 5,000-Miles-Per-Watt, or something more challenging.

"Right now I'm planning some improvements, such as a better receiver than my direct conversion, so I can pick up the weak ones. I'll probably give the OHR Explorer a try. Also, have to set up my sloper to work the 40- and 80-meter bands."

QRPing from the club house

Marv Holmes, W0YHE, in a e-mail dispatch from Newport, Minn., writes that he has "been into QRP for a number of years now with HW-7s and HW-8s, the Ten-Tec Argosy and IC-751A. I really like the challenge of low power.

"While looking for a program for our radio club — the 3M ARC — I heard about building kits at a meeting. Well, I looked around and decided to try the Pixie II. I built one up on one of the plug-in bread boards and it worked right off.

"So I made up five kits of parts with tools, components, bread boards and a schematic. At the meeting we counted off those in attendance into five groups, and gave them a kit.

"We told them the meeting would be over when they had them built and working. I got a lot of chuckles from them about anything so simple working, but they were willing to try. Well, after about 35-40 minutes, one was completed.

"With about three feet of wire for an antenna, we could work each other for a contact. Four of the five were completed and worked. In the other, several components were destroyed.

"So, I thought 80 percent (working) was good. Some of the people had never seen a transistor or resistor or any components. Everyone had a good time and I have had several requests for another 'kit' night."

2-way NorCal-40 QSO — in the mobile

Jim Cates, WA6GER, writes from Sacramento, CA, that "this contact is no record, but interesting.

"(Recently) NorCal (Northern California QRP Club) member No. 100, **Mac McClurkin, W7JDZ,** and his wife were enroute home — to Idaho Falls — after attending our 50th anniversary bash. That day I had to go to Pleasanton to pick up my 14th Century 21, which I had just arranged via packet to purchase. Yes, 14 I have owned — three digital and 11 analog.

"I knew Mac would be mobile with his NorCal-40, so I hooked mine in the car. I rolled through town and threw out a 'CQ,' and hooked **KK6FI, John Fries** in Ventura. Got a 569 and worked him for 50 miles. He also has an HW-9 and I was telling him all about NorCal.

"South of Stockton I signed (with John), and Mac — who had been reading the mail — called me.

"Wow! A NorCal-40 to NorCal-40 mobile QSO driving at or below 65 mph, each 2 watts, each using Hamsticks mounted on the roof. Mac was average Q5, S3. He gave me a Q5, S4 on QSB peaks. But it was a solid QSO. Mac was in Battle Mountain, Nev.; I was rolling into Tracy, CA."

The Goodie Giveaway

Timing, they say, is everything. And having a good clock to keep an accurate log of treasured QRP contacts is a plus in any low power radio shack.

If you're a tried-and-true homebrewer, cobbling a clock can be a bit of a challenge. For this quarter's Goodie Giveaway winner, though, it won't be a problem.

A nifty **MA1003 automotive/instrument clock module** goes to **Marv Holmes, W0YHE,** of Newport, Minn., with a hearty "72" and thanks for his contribution to this issue's MN.

The prize comes as a generous contribution from **Don Dorn, KJ5MG,** of Oklahoma City. "Although it is meant to be for automotive use," he writes, "it also makes an acceptable station clock, with the addition of 12-volt power and a couple of switches." A complete data sheet from Digi-Key Corp., containing clock specifications is also included with the timepiece.

Everyone submitting an item to MN is in the running for a quarterly prize. Names and callsigns are thrown into a hat, and the winner is selected by random drawing. It's as simple as that.

The hat is emptied after each winner is selected, and filled anew with the next quarter's contributors. Odds for taking a prize are pretty good, wouldn't you agree?

So here's hoping you'll take a moment to share your successes, challenges, photographs and QRP adventure with "QRP Quarterly" readers in Members' News — and join the race for a "goodie" while you're at it.

Cards, letters, photographs, and e-mail are all welcomed. The addresses for contribution appear at the head of this column.

GL, and hope to hear from you soon.

EQUIPMENT MODIFICATION
IMPROVED HARMONIC SUPPRESSION FOR THE RAMSEY 40M CW TRANSMITTER

Michael A. Czuhajewski WA8MCQ
945 Citadel Drive
Severn, MD 21144

As mentioned in the Idea Exchange column in the January 1993 issue, I had the chance to look at the output of a 40 meter Ramsey QRP transmitter kit on a "spectrum analyzer". I did it on two different communications monitors (in the $5K and $10K price ranges), and later confirmed the results on a "real" spectrum analyzer, a late model Hewlett Packard ($20K+). Results were discouraging--the second harmonic was down only about 20 dB from the fundamental.

FCC: "30 DB BELOW THE CARRIER"

The output filter only has three elements and you probably can't expect much more from such a simple filter, regardless of design, on the output of a class C final. (Consult any recent ARRL handbook for details, and see the sidebar in this article.) At these power levels, would those harmonics really bother anyone? Perhaps not, especially if they fall within a ham band anyhow, but the FCC rules still say that spurious emissions of an HF rig (including harmonics) must be at least 30 dB below the power of the signal, so this rig did not meet the FCC requirements.

Being a QRPer has its advantages--that 30 dB figure applies to 5 watts or less; anything over 5 watts must have at least 40 dB attenuation. So, let's say you're running 4 watts on 40 meters and have only 20 dB attenuation--will anyone hear it? The average ham might not think so, but we're QRPers and know better. That second harmonic, on 20 meters, would be 40 milliwatts; I've worked into Europe many times with less power, on 20, 15 and 10 meters, as have others.

Clearly, something better was needed. I told the owner of the rig, KA3GNG, that I'd build a better filter if he'd supply the toroids, which he did. I designed a 5 element filter (Figure 1), put it in series with the output and cleared it right up.

In fairness to Ramsey, I should point out that I did this several years ago. I have no knowledge of their current output filter design, so this may not necessarily be applicable to newer Ramsey QRP rigs. Also, I only had the 40 meter version available to me for tests and cannot speak about the other bands. (However, the rig was correctly built, all parts were in the proper places and of the correct value as verified with my Boonton 260A Q meter.)

MAKING MY NEW FILTER

I used the tables of normalized filters (from the 1986 ARRL handbook) and calculated the values for a 5 element Chebyshev low pass filter with a cutoff frequency of 7.5 MHz. The outer capacitors are 486 pF, the center is 838 pF, and the two coils are 1.454 uH. I used 18 turns on T37-2 cores for those.

I carefully wound and pruned the coils for the correct inductance, and chose capacitors as close to the proper

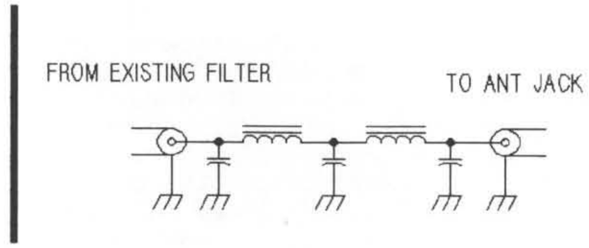


FIGURE 1

value as possible, by actual measurement of all parts. (I used my Boonton 260A Q-meter, but any good L/C measuring device will work.) I built the filter ugly-style on a scrap of PCB material. Checking the insertion loss at 7 MHz by comparing "before" and "after" power, I found it to be negligible. (A later test with the HP analyzer showed it to be 0.21 dB, an acceptable amount, dropping 1.60 watts to about 1.53.) I measured the loss at 14 MHz at home, using the procedures in the January 1993 Idea Exchange, and it was about 33 dB, which agreed with the HP measurement.

When using the tables of normalized filters, you select a certain type of filter (topology, number of elements, ripple), write down the values of inductance and capacitance from the chart, then scale them for the frequency you want to use. (Charts in some books must also be scaled to 50 ohms, although that's not required for the handbook tables.) The drawback to this is that you come up with oddball capacitor values, and will probably have to mix and match and solder two caps in parallel to get the proper values. Inductors are less of a problem, since you can vary them by compressing or expanding the turns, or adding or subtracting a turn.

Doing the calculations from the filter tables can be a bit of a chore. A computer program to design filters would be nice, and there's a good one available via Internet, written by Bob Lombardi. It does high pass, low pass, band pass, elliptic, Chebyshev, Butterworth, etc. (Note 1.)

Another possibility is to use charts of "standard value capacitor" filters, which appear in many handbooks. These have many more choices; you select one with a cutoff frequency somewhat higher than the band you'll be using. They are based on standard capacitor values, so no mixing and matching is required. (It's much easier to find a 470 pF cap than 486 pF!)

Unfortunately, it's a bit more complicated than simply picking a cutoff frequency that looks good. In many cases you can choose from several filters in a table which may all look good, but they can have differing amounts of passband ripple, insertion loss and frequency responses. There are many factors to consider and trade offs to make, and that's the subject of a future article (possibly in the next issue). I started to cover the topic here but it kept growing and growing, so will have to come later by itself.

REPLACE OR SUPPLEMENT?

My original plans were to replace the filter in the Ramsey with my new one. I later decided to leave the existing filter in place and add mine between it and the antenna connector. After all, although the attenuation of the original filter left something to be desired, everything was working as it was, and I didn't want to mess with it. Besides, with two filters in series the harmonics would really drop off the scale.

Since there is plenty of open room on the circuit board I mounted the filter there using hot melt glue, and ran coax to and from the transmitter output line. (See figure 2.) I cut the PCB trace between the hot side of the antenna jack and the rest of the circuit. I soldered the center conductor of a piece of RG-174 to the jack, and the braid to the jacks frame. The coax went to one side of the filter, and a second piece went from the other side back to the circuit board, where it was soldered onto the left side of the coil in the existing filter. (Don't forget to ground the braids at the new filter PCB.) See figure 3.

RESULTS

I checked the output on the HP 8562E analyzer again, and saw that the 14 MHz signal had dropped to 51 dB below the carrier--not too shabby by any standard, and certainly good enough, by a huge margin, to satisfy the FCC if they knock on your door with a spectrum analyzer in tow.

I did more than simply grab a few parts and put them on a board--I pruned the coils to the precise value and chose the capacitors carefully--in fact, the outer caps both consist of two caps soldered together. If you just use off-the-shelf components your filter may not work quite as well, so that's another advantage of putting it in series with the existing filter instead of replacing it. Even if the new filter is off by several dB compared to mine, the net result at the antenna connector will still be far in excess of what the FCC requires.

APPLIES TO MANY RIGS

This can be done to Ramseys (or other rigs) for other bands as well. Where do you find the filter info for those bands? It can be found in many places, such as the ARRL Handbook, the W1FB QRP Notebook, Solid State Design for the Radio Amateur, etc. Unfortunately, some published tables of filters for the ham bands don't have exceptionally good attenuation at the second harmonic and may not be suitable for some QRP rigs. You have to consider the harmonic content of the final as well as response of the filter. Tables of normalized filters or standard value capacitor filters both require some knowledge to come up with suitable designs. A future article will cover these topics.

There was a good article in CQ recently by Doug DeMaw, W1FB (note 2). He talked about the low harmonic rejection of many simple filters, ones that are used in a lot of QRP rigs. If you're using any rig with a simple output filter and suspect the harmonics might not be down low enough, you could build up an extra filter and add it, either internally or in an external box. With proper selection and pruning of component values, a simple additional filter can help you clean up the output of any QRP rig.

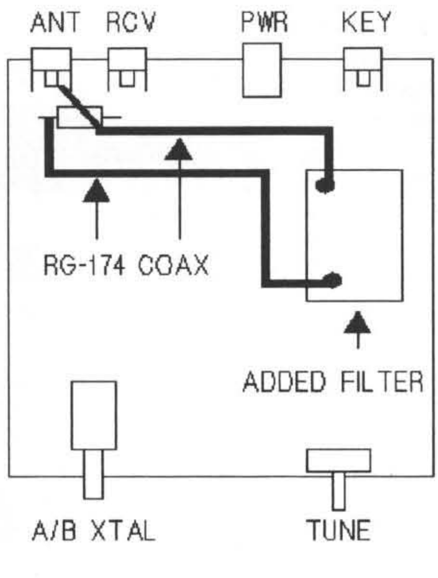


FIGURE 2

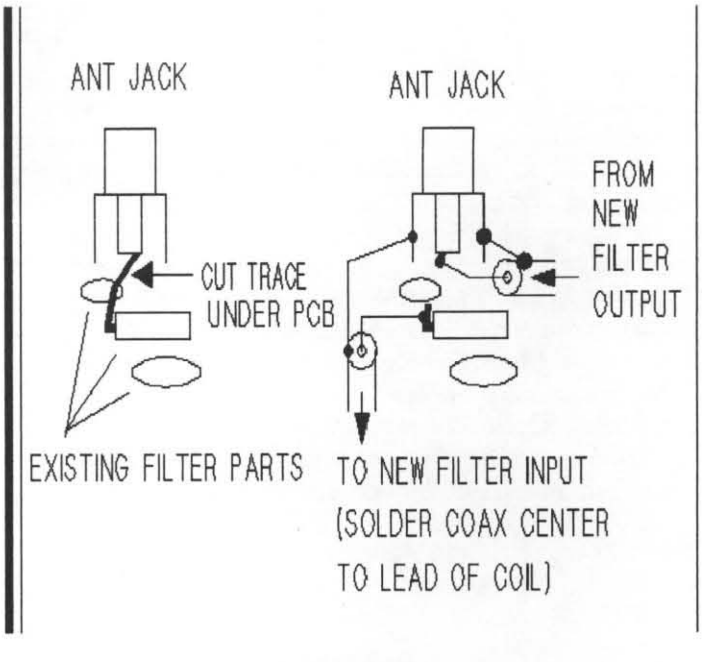


FIGURE 3

Notes:

1. A good filter synthesis program is Filter Design System by Bob Lombardi. It is copyrighted to protect himself, but it's freeware--use and share it all you like, just don't try to sell it. It runs on IBM clones and is available via anonymous ftp from ftp.lehigh.edu. Go to pub/listserv/qrp-l/tools and get filename FDS124.ZIP. Be sure that mode is set to binary (instead of ASCII) before transferring or you won't be able to run it. If you can't get the file from ftp, you can send me a formatted floppy disk (either size) and return postage and I'll send you a copy.

2. Dougs Desk, May 1995 CQ, topic "Getting to Know RF Filters", p. 98.

3. Wes Hayward, W7ZOI, June 1984 Ham Radio, "The Peaked Lowpass: A Look at the Ultraspherical Filter"

4. Touchstone by EESOF is great for computer analysis of filters but costs several thousand dollars. (To be fair, it does considerably more than just analyze filters!) A more reasonable program for home use is GPLA, General Purpose Ladder Analysis by Wes Hayward, W7ZOI. It is one of several programs on the disk that comes with the ARRL reprint of his Introduction to Radio Frequency Design. The book/disk combo is in the $30 range.

--qrp--

TECH TALK--WHAT'S A CHEBYSHEV FILTER?

There are many different types of filter response curves, and when dealing with low, high and band pass filters you'll usually hear the names Chebyshev and Butterworth (although there are others, as well). The Butterworth has a nice smooth response in the pass band, but the roll-off outside the pass band isn't as steep as a Chebyshev filter, and the ultimate attenuation isn't as great. On the other hand, the Chebyshev has some definite ripple in the pass band, but it falls off faster above the cutoff and has higher ultimate attenuation. As you tune across the pass band, the signal strength will rise and fall in a Chebyshev filter but remain constant in a Butterworth. However, the amount of ripple in the Chebyshev can be controlled by the design of the filter.

As W7ZOI once said, that pass band ripple isn't necessarily a problem (Note 3). He makes the point that while we use low pass filters a lot, we don't always need true low pass operation, ie, passing all frequencies equally up to some cut off frequency. In a transmitter, we usually just want to pass the output frequency and attenuate its harmonics. We want 7 MHz energy to get out with minimal loss and 14 (and above) MHz energy to be cut down, but don't really care if the filter has somewhat more loss at 4 or 6 MHz than it does at 7. We can deal with some ripple in the pass band by careful selection of the filter cut off. We just need to make sure the signal we're sending out is at a peak of the response.

A 5 element filter with 0.1 dB ripple can give 35 dB attenuation of the second harmonic (and more on higher order harmonics), and 0.1 dB means a variation of less than 3% across the pass band. Both figures were acceptable to me, and this is the filter I settled on. (While 7 elements give even better performance, it comes at a price of increased cost and complexity, which I did not want.)

There is a trade off between the amount of ripple you're willing to accept and the steepness of the attenuation curve outside the pass band. Here are some examples of Chebyshev low pass filters, from a table in the ARRL Handbook, along with my calculations of the same. (Note 4.)

Elements	Ripple, in dB	Attenuation of second harmonic	
		ARRL Handbook	My calculations
3	1	22	23
3	0.1	12	11.9
3	0.01	4	2.4
5	1	45	41.8
5	0.1	35	31.3
5	0.01	25	21.3
7	1	68	63
7	0.1	58	52
7	0.01	48	43

If the amplifier itself has high harmonic content (and Class C amps usually do), 3 element filters with 0.1 or 0.01 dB ripple would not be good choices; the 1 dB ripple version might be acceptable, depending on the harmonic strength, but could have excessive insertion loss. So what's a good compromise?

The output to the antenna must have harmonics at least 30 dB down from the fundamental. You won't normally know, or be able to easily measure, the harmonic content of the final, although I like to use a figure of 10 dB down for typical QRP rigs with class C amps, based on some spectrum analyzer tests. The safest bet is a filter that has at least 30 dB attenuation at the second harmonic, or in the high 20's--that way you're guaranteed to be FCC-legal, and should still have a few dB margin. **--WA8MCQ**

2nd Annual Great Dayton Building Contest
Sponsored by NorCal QRP Club

by Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620
209-392-3522

The NorCal QRP Club is again sponsoring the Building Contest at this year's Dayton Hamvention. We started it last year with the Pixie 2, and it was a great success. The idea was that we would hand out a schematic at the Hospitality Suite sponsored by the ARCI at the Day's Inn Dayton South, and that the entrants would pick up the needed parts at the flea market on Friday and Saturday, with the contest to be held Saturday night.

It was a lot of fun, but there were some things that needed to be ironed out. One of the problems was that for many the trip to Dayton is a once in a lifetime experience, and they should spend that time meeting people and experiencing Dayton, not searching for parts and building. Hey, we can build and locate parts all year long, but we can't talk with our QRP friends at the Hospitality Suite except for the time we are at Dayton.

So, we decided that for this year's contest, we would announce the project in advance and let you bring the completed entry to Dayton for judging on Saturday night. We have even expanded to two projects this year. They are the 49er 40 Meter CW transceiver designed by Wayne Burdick, N6KR, and the Regenerative Receiver designed by Paul Harden, NA5N. All you have to do to enter the contest is to pick your project or build both of them, and bring them to Dayton for judging by K5FO, KI6DS, and WA6GER. The prize? Bragging rights for one year, and a 1 year extension to your subscription to QRPp. We will award 3 prizes for each project, and the only requirement is that the rig actually works. We will hook them up to a 9V battery so make sure that you have a 9V connector or adapter to fit your rig.

You may use any type of construction that you wish. Circuit boards are available for the 49er, and can be obtained from the information in the article. But, if you wish to roll your own, by all means feel free to do so. Remember, judging is Saturday night at the Hospitality suite at the ARCI Dayton Headquarters, the Day's Inn, Dayton South.

The Forty-9er: A 9-volt 40-meter Transceiver

By Wayne Burdick, N6KR
1432 6th Ave.
Belmont, CA 94002

Doug Hendricks found a batch of 7.040MHz crystals, and had no choice but to get someone to design a rig around them. In this article I'll describe a very simple 40m D-C (direct conversion) transceiver that I call the "Forty-9er," because it can run on a 9V battery. In the spirit of NorCal collaboration, Doug will do the PC layout, and part with his crystals at some reasonable price.

Another motivation for this rig was to improve performance over the D-C transceiver that some of us built at Dayton last year. The Forty-9er has a few more parts (about 1/3 as many parts as a NorCal 40), but as a result it is actually usable.

Features:

* Runs on any DC voltage from 7 to 12V
* Power output of roughly 250mW at 9 volts, 500mW @ 12V
* VXO covers about 5kHz (7.037 to 7.042 w/7.040MHz crystal)
* Full QSK — really helps when you're using such low power
* Very low current drain: 10mA receive, about 70mA transmit (@9V)
* Only one simple alignment step, and NO toroids

Circuit Details

Refer to the schematic. U1 is the product detector and VXO. To minimize AM broadcast and portable phone pickup (both are problems with direct conversion receivers), the input tuned circuit has a low L-C ratio. This increases the Q of the tuned circuit, and the small loss in signal is not a problem. On transmit, D1 detunes the input tuned circuit and unbalances the mixer, preventing the transmitter from modulating the VXO signal.

JFET mute switch Q1 is used to provide full QSK. Q1 must be a low pinch-off voltage type (J309, J310, 2N5484, etc.) because the voltage at pin 4 of U1 is only about 4V. This detail is occasionally overlooked. For example, you'll see MPF102 mute switches used with NE602s running at 6V, even though an MPF102 can have a Vp of up to 8V, and may not be completely cut off on transmit.

Q1 is followed by a passive low-pass filter (RFC2, C10) and a simple, high-gain AF amplifier circuit (U2). RFC2 and C10 are quite large because they must resonate in the AF range (see parts list).

The VXO covers about 5kHz. To get the VXO output high and consistent, I used two tricks: (1) C4 is bigger than C5; (2) R4 was added to increase the oscillator bias a bit. Don't use these techniques in every '602 project, since they may degrade receiver performance. Also, since good crystal starting and low oscillator current drain are conflicting goals, don't expect to be able to increase the size of RFC6. At some point, your transmit power will drop dramatically at one end of the VXO trim cap.

The transmitter has only two stages. The 2N3904 is self-biased for simplicity, and provides enough gain to drive the 2N3866 to around 200mW. The final operates class C, and is reasonably efficient. I could have used a class A final amp stage instead and possibly eliminated the low-pass filter, but I wanted to minimize current drain. This is a good strategy for operation from a 9V battery, which may provide only a hundred milliampere-hours (higher with alkaline or lithium).

Sidetone is not included, since it would have added another five or six parts. You can hear a soft buzz when you key the rig, though, which is acceptable if you're using a push-button key.

Construction:

If you use your own PCB or breadboard layout, here are some things to keep in mind: (1) in general, keep the RF chokes a good distance apart, or if you can't, use toroids; (2) keep lead lengths short; (3) use as much ground plane as possible.

There are many ways to improve on the design. You can change the QSK delay by changing C8 (with .002uF, you can hear between dits at 15WPM). If you want better low-pass filtering, add another L-network after C10 (82mH and 0.47uF). This will improve rejection of high-pitch signals but will increase insertion loss.

Operation:

You can use 7 to 16 volts with this rig, but put a heatsink on Q3 if you use over 12V. IMPORTANT: Since there is no SWR protection at the output, you MUST use a known, matched antenna (or a 50-ohm dummy load) with this rig. If you use an antenna tuner, be sure you use an absorptive-type SWR bridge so that the final will see a reasonable load during tune-up. In-line SWR bridges provide no protection for the final.

The frequency shift from receive to transmit is very small—typically 100 Hz. The shift is in the downward direction, so when you call a station, make sure you're listening on the HIGH frequency side of zero beat. (There are two places you can set the VXO cap to listen to any particular station; use the lower-capacitance setting and you'll be on the high side.)

The rig can be used hand-held with a push-button code key. In the field, you'd just hook up a 33' piece of wire and toss it into a tree, and toss out a ground radial of the same length. Use #22 or larger stranded copper wire and a small, smooth fishing weight. Bring a backup antenna in the event that your tree was hungry.

Conclusion:

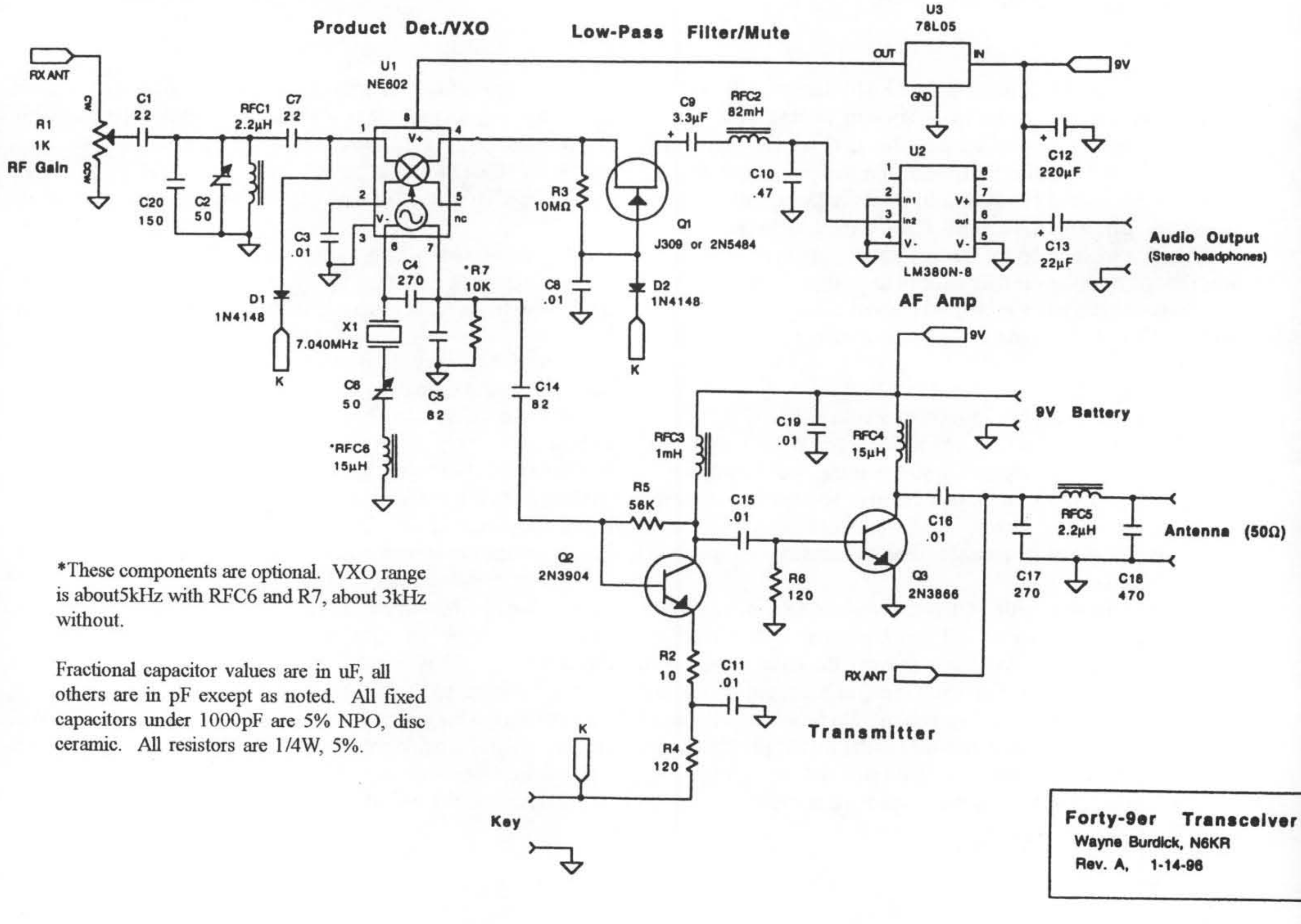
It's a nice change to build something so simple, and it really seems to work. On the day I built it, I worked Washington state and Michigan, both on the first call! It seemed deceptively easy, so I suspect conditions were good.

This is a good rig to take for emergencies or just for fun wherever you're going, since the whole station (including antenna wire and fold-up stereo headphones) will fit in your pocket.

The design is still preliminary, so please send me your comments and suggestions if you build one. (I can be reached by e-mail at burdick@interval.com.)

Parts List:

2	C1,7	22pF NPO (141-100N5-022J)	Mouser
2	C2,6	9-50pF Trimcap (24AA024)	Mouser
6	C3,8,11,15,16,19	.01 Mono (21RZ410)	Mouser
1	C4,17	270pF NPO (140-CD50S5-271J)	Mouser
2	C5,14	82pF NPO (141-100N5-082J)	Mouser
1	C9	3.3uF/25 Elect. (208-50V3.3)	Mouser
1	C10	.47uF Mono (581-470NJ63)	Mouser
1	C12	220uF/25 Elect. (208-25V220)	Mouser
1	C13	22uF/25 Elect.(208-50V22)	Mouser



*These components are optional. VXO range is about5kHz with RFC6 and R7, about 3kHz without.

Fractional capacitor values are in uF, all others are in pF except as noted. All fixed capacitors under 1000pF are 5% NPO, disc ceramic. All resistors are 1/4W, 5%.

1	C18	470pF NPO (140-CD50S-471J)	Mouser
2	D1,2	1N4148	
1	C20	150pF (140-CD50N6-151K)	Mouser
1	R1	1K Trimpot (323-5000-1K)	Mouser
1	R2	10 ohm	
1	R3	10M	
2	R4,6	120 ohm	
1	R5	56K	
1	R7	10K	
2	RFC1,5	2.2uH (43LS226)	Mouser
1	RFC2	82mH (434-02-823J)	Mouser
1	RFC3	1mH (43LS103)	Mouser
2	RFC4,6	15uH (43LS155)	Mouser
1	Q1	J309, J310, 2N5484	Anchor
1	Q2	2N3904	Mouser
1	Q3	2N3866, 2N3553., 2SC799	Mouser
1	U1	NE602AN	Digikey
1	U2	LM380-N	Digikey
1	U3	78L05 (333-78L005AP) Mouser	

Misc. Parts:

1 9V battery connector, 2 - 1/8" chassis mount phone jacks, 1 BNC chassis mount antenna connector, hookup wire, small case or cabinet of choice. (The pcboard is layed out to fit inside an Altoids or Sucrets box.)

HSC 1-800-4HALTED

Mouser Electronics 1-800-346-6873

DigiKey 1-800-344-4539

Circuit boards for this project are available from NorCal. The boards are single sided, plated, drilled, with a silk screen. There is no solder mask. The cost is $5 postpaid. To order, send your money, check or money order made out to Jim Cates, to:

Jim Cates
3241 Eastwood Rd.
Sacramento, CA 95821

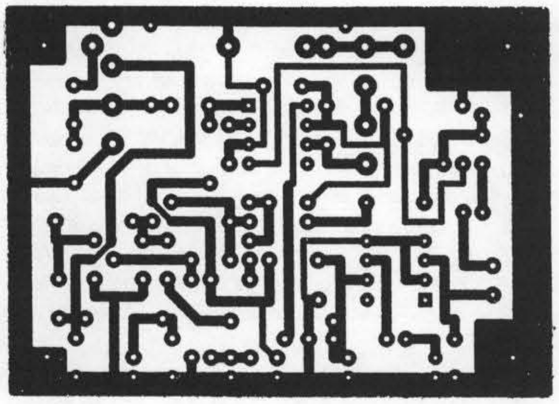
Be sure to indicate that you are ordering 49er boards.

A limited number of 7.040 crystals are available for $3 each from Doug Hendricks. Send $3 to:

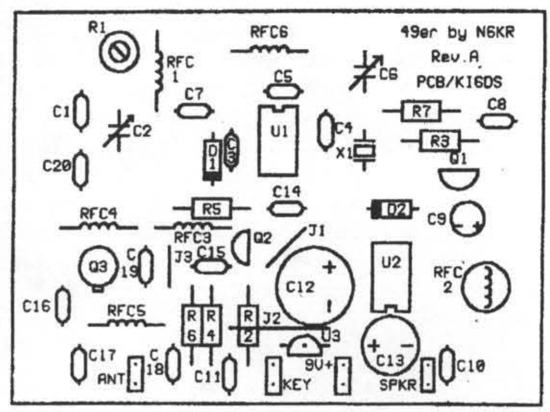
Doug Hendricks
862 Frank Ave.
Dos Palos, CA 93620

Again, make checks or money orders out to Doug Hendricks and not NorCal.

If clubs or groups are interested in a group buy for a club building contest, NorCal will sell boards for $4 each in units of 10 or more. We have had several building contests at NorCal meetings and they have always been very popular with the group. The format that we use is that we hand out the information one month and then judge the results the next meeting. We give a small prize, but it seems that members just like to bring their creations and show them to their fellow members.



49er PC Board Layout (X-ray View)



49er Parts Placement

A Regenerative Receiver

by Paul Harden, NA5N
120 Garden Circle
Socorro, NM 87801
pharden@nrao.edu

[Reprinted with permission from "The Peanut Whistle", Journal of the St. Louis QRP Society, November 1995]

I have been fascinated by regenerative receivers since the first one I built in the early 1960's - the receiver that opened the world of short wave to me at a young age, and probably what launched me on a career in electronics and a ham ever since. Even with 1R5 vacuum tubes now long gone, I still find myself building a regen now and again, experimenting with different bipolar and FET transistor circuits. Last year in *Electronic Design News* (EDN), there was a simple regen receiver that caught my eye.... a simple circuit, but implemented slightly different than circuits I've seen before. So, I built one, and it worked as well as the fancier FET versions I've built. Making a few of my own modifications, such as using an LM386 IC for better audio gain, I called it the "PipSqueak". So impressed with the circuit, I called the author at Analog Devices, Charles Kitchin, who turns out to be a ham and an avid low power builder, N1TEV.

I then built another "Kitchin" detector with a front-end preamp for more RF gain and other embellishments. I called this one the "Desert Ratt". This one works so well, I listen to it several times a week... the BBC World News primarily.... from the speaker, while doing other things in the shack. But it's always been a kinda private endeavor - building regen's just isn't the sort of thing you want to brag about to fellow QRPers.

Then one day on the QRP-L internet group, Dave, NF0R asked about the article and I could not resist but to respond. It was time to come out of the closet and admit, I too, build regens.

WHY BUILD A REGEN?

Regenerative receivers were the first generation of radio receivers used by hams, back to the days of Armstrong. Even though built today with semiconductors, they still have the original "sound" and romance of their turn-of-the-century cousins. They are much different from the ease of a superhet: they take some practice and skill to operate, but once a station is properly tuned in, you'll be amazed at the gain and how well it sounds for a single transistor stage. It will send you back to the old days of radio... is that the SOS from the Titanic? Regens have a charm of their own and can entertain you for hours.

From a project point of view, they are an ideal project. First, they're almost a fail safe circuit, guaranteed to work almost no matter what. All parts (except the variable capacitor) can be bought at Radio Shack for about $10; if you have a junk box of parts, you probably have everything you need. Due to its low parts count, you can build it about any way you choose. Fancy perf board, copper clad board, pretty or ugly. If you've never built anything from scratch before, try a regen circuit. Just figuring out how to solder everything together and build the thing mechanically is fun in itself.

On the practical side, just think of the electronics you'll learn. Even though it's a very simple circuit, over half of the basic circuits used in electronics are there.... tuned circuits, RF amplifiers, oscillators, audio amplifiers, biasing transistors, diode rectification, interstage coupling, dc bypassing, etc. Build one, poke around the circuit with a DVM, change a component to a different value and see what happens. You'll be ready to upgrade in no time -- or your money back! You can learn how this stuff really works and you'll never forget it.

HOW THE CIRCUIT WORKS

Q1 is basically a Hartley oscillator circuit, the kind with the tapped coil. The current through Q1 is controlled by Pot R1. With sufficient current through Q1, enough energy will flow through C3 to sustain oscillation. The objective is to increase R1, the regeneration control, just to the point of oscillation. At this point, Q1 becomes a very high gain, hi-Q amplifier, with gains >100,000 not unusual. Any signal on the antenna, at the resonant frequency determined by L1 and C2, will be amplified by Q1. However, when Q1 breaks into oscillation, it will mask the RF signal. Setting R1 for maximum RF gain without inducing oscillation is critical, but once achieved, tremendous gain occurs. The amplified RF signal is detected by D1 to recover the audio. It is capacitively coupled to Q2, an audio amplifier. Q2 will conduct with a base voltage >0.6V. R4 biases the base at about 1V to ensure constant conduction (the definition of a Class A amplifier). Thus, the small voltage variations on the base from D1 will be amplified. R5 is the collector load, where the amplified signal is developed. It is tapped off by R5, the volume control and capacitively coupled to the LM386. C8 can be any value >1uF; the larger the value, the lower the frequency response. The gain of U1 is determined by C9. With no C9, the gain is 26dB, sufficient to drive earphones; 10uF will produce the maximum gain of 46dB, sufficient to drive a speaker. A value less than 10uF will produce an intermediate gain. The output audio is applied to the speaker (or phones) through C10. Like C8, it can be any value >1uF.

Charles Kitchin uses D2-D4 to establish a very stable voltage for the Q1 regen stage, which makes this circuit very stable compared to others I have built. A 0.6V drop occurs across a diode junction, such that D2-D4, with limiter R3, forms a 1.8V voltage regulator. C6 stores this voltage while C5 keeps the RF out of this dc bias. It provides for a very smooth regeneration action.

WINDING COIL L1

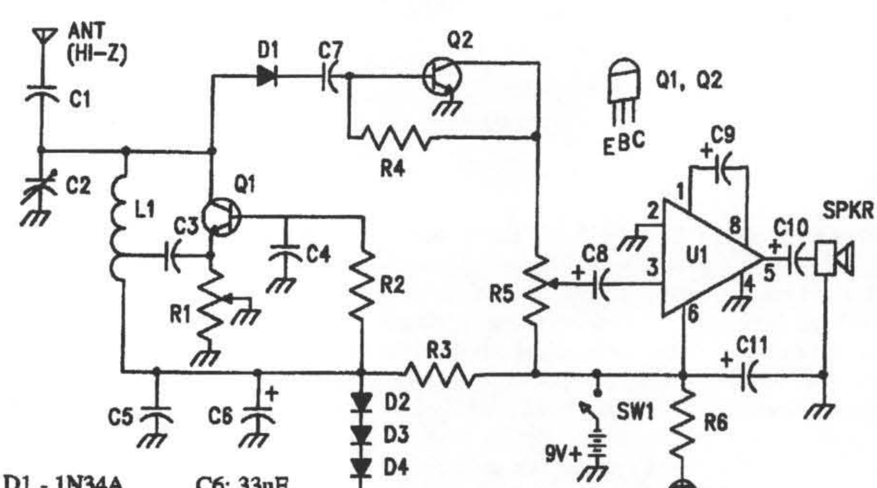
Another beauty of building a regen is winding your own coil and I don't mean a toroid! Good old fashioned coil. Kitchin recommends a 35-mm plastic film case, which works quite well; I use IC shipping tubes with equal success. Here's where you can be real creative. Just don't use anything that's metallic. L1 consists of 15 windings for the RF part and 5 windings for the "tickler" part. With a 200pF variable cap for C2, this produces a frequency range of about 6-16 MHz. Your mileage will vary. Experiment with different number of windings. The rule of thumb is for the tickler winding to be about 1/3 of the RF winding.

SOME CONSTRUCTION HINTS

The circuit can be built almost any conceivable way. Keep the RF components as close to each other as you can, however. It is best to build the circuit on a piece of wood, as a metal chassis causes lots of hand capacity effects. Do not put a metal case over your finished radio.... it can keep L1-C2 from oscillating. The LM386 is carried by Radio Shack for $1. I recommend you also get an 8-pin IC socket. It makes soldering things together much nicer without the chance of overheating the IC.

You will find this circuit to be very tolerant of circuit values. If you are using junk box components, just come as close as you can... it will likely work. R1 can be 100K or greater; R5 can be 2K to 10K; C1 any small value. C3 and C4 must be the same value, but can be 700pF to 1500pF (= .0015uF). Q1 and Q2 can be any NPN transistor, although a high Hfe and high FT works best.

"PipSqueak Regen Rcvr"
NA5N



D1 - 1N34A	C6: 33uF	
D2-4 : 1N914	C7: .1uF	
C3: 1000pF	C8-10: 10uF	R3: 150K
C4: 1000pF	C11: 33uF	R4: 470K
C5: .01uF	R2: 100K	R6: 750

If you're a new builder, I recommend you build the audio portion first. Power it up, R5 to maximum and you should hear a slight hiss. A touch of the finger to the base of Q2 should produce a hum. Then build the regen stage. When completed, power it up again and advance R1. Towards maximum, you should hear it start to "squeal". It's working. Attach to a wire antenna (not 50-ohm coax). A 12 foot wire or more works great.

OPERATION

Turn on the receiver and advance the regen control until you hear a squeal. Back off to just before it squeals, or oscillates. As you tune C2, you will hear occasional squeals. These are usually stations. Stop and adjust R1 for proper regeneration. For the international broadcasters, such as the BBC or Radio Nederlands, their powerful signals gives good starting practice on proper tuning. This is aggravated by an effect called "pulling". This is where you advance the regen control for proper amplification and the received frequency will pull downwards a bit. It's a two handed operation jiggling both the tune and regen controls. But you'll quickly learn that regens indeed have a charm and romance of their own. Good luck and have FUN!! 72, Paul, NA5N

Review: Wilderness Radio Sierra QRP Transceiverand KC1 Keyer/Counter Kits

Stan Cooper, K4DRD
3214 Countryside Drive
San Mateo, CA 94403
e-mail: 71154.331@compuserve.com

Wilderness Radio has recently made available a refined version of the NorCal Sierra, a multiband QRP CW transceiver designed as a Northern California QRP Club project by Wayne Burdick, N6KR. As a builder and operator of both the NorCal and Wilderness versions, I thought readers might be interested in a review of the Sierra with emphasis on some of the improvements that have been made to the original design. Also of possible interest to readers is the Wilderness KC1 Keyer/Counter kit that I chose to incorporate into my new Sierra. The KC1 is a dual function add-in kit that complements the Sierra -- as well as virtually any other transceiver -- with a memory keyer and a displayless frequency counter. The Sierra and KC1 together make a nicely integrated package.

The Sierra

The Sierra is an all band CW-only HF transceiver optimized for low power consumption, drawing only 30 mA from a 12 volt source in receive mode. This feature makes it ideal for use with battery power when backpacking. Power output, which varies slightly from band to band, is nominally 2 Watts. This power level was chosen to minimize battery consumption while still transmitting a signal only half an S-unit or so below a full QRP "gallon" (5 Watts). Plug-in band modules are used, eliminating the need for power consuming diode switching or multiple wafer rotary switches that can cause reliability problems in dusty environments. The band module connector uses redundant gold-plated fingers, and the contacts on the band modules themselves are gold plated to provide extra reliability. The top cover of the Sierra is secured with quick-release latches, so switching band modules takes just a few seconds. All controls and connectors are mounted directly to the single printed circuit board, eliminating wiring except for add-in devices such as keyers, S-meters, etc.

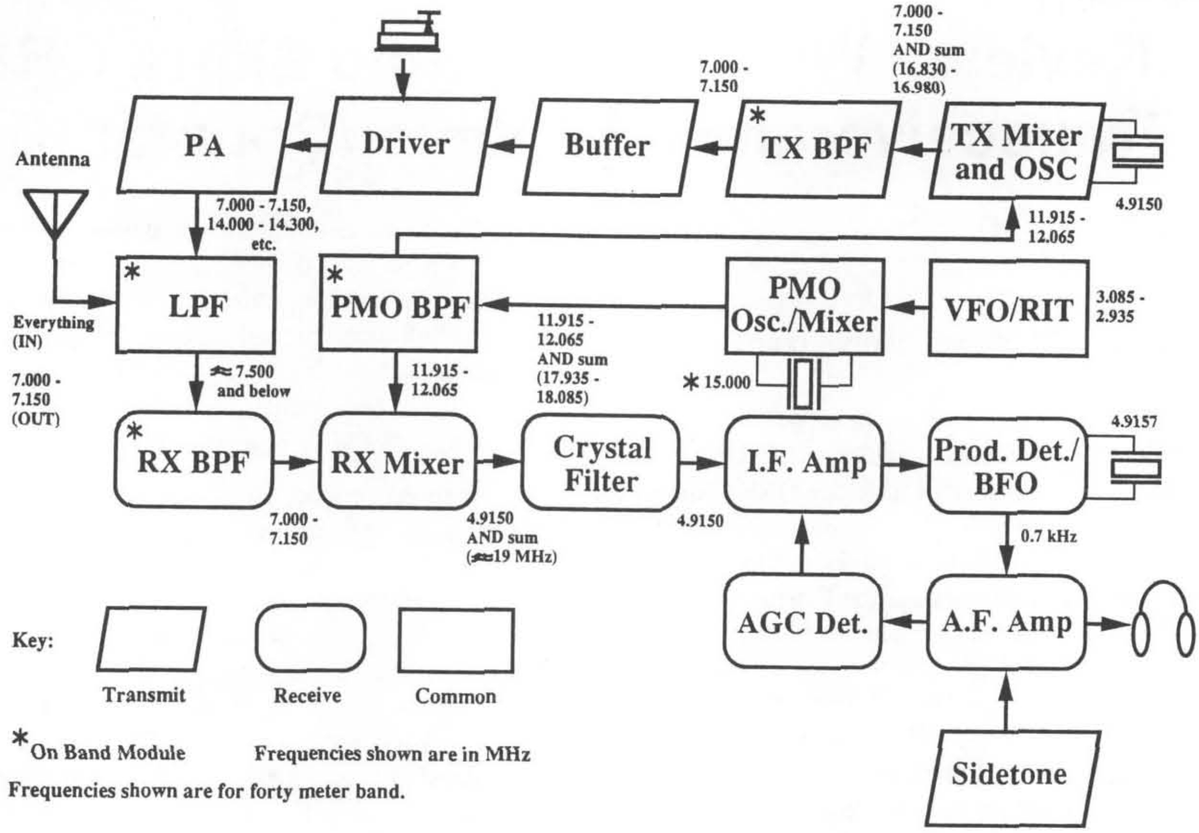
The Sierra's VFO operates between 2.935 and 3.085 MHz, providing 150 kHz of coverage for each band module. The low VFO operating frequency and careful design result in a highly stable rig. Drift after a fifteen minute warm-up is less than 100 Hz per hour.

The block diagram shown below illustrates the transceiver's high level design. The shape of the block denotes whether it is used in transmit only, receive only, or is common to both transmit and receive functions. An asterisk (*) indicates that the block is part of the band module. In the example shown, frequencies noted are for operation in the 7.000 to 7.150 MHz portion of forty meters.

In receive mode, all frequencies are picked up by the antenna and passed through the low pass filter on the band module. For forty meters, everything below about 7.5 MHz is passed on to the receive bandpass filter, also on the band module. The output of the receive bandpass filter is 7.000 to 7.150 MHz, which is presented to the receive mixer. The other receive mixer input is a signal that originates in the VFO and is mixed with a 15.000 MHz pre-mix oscillator signal. After passing through the pre-mix bandpass filter, this signal has a frequency between 11.915 and 12.065 MHz, depending on the VFO frequency setting. With the RF from the antenna and the output of the pre-mix oscillator as inputs, the output of the receive mixer is 4.915 MHz, which is the IF. This signal is then passed through the four pole crystal ladder filter, an IF amplifier stage, the product detector/BFO, and on to the audio amplifier. An audio derived AGC is used and provides better than 60 dB of AGC range.

In the transmit mode, the VFO signal is again mixed with the pre-mix oscillator signal and passed through the pre-mix oscillator bandpass filter. The output of the pre-mix oscillator bandpass filter is a signal between 11.915 and 12.065 MHz, depending on the VFO frequency. This signal is mixed with the 4.915 MHz output of a crystal oscillator and passed through the transmit bandpass filter to produce the forty meter transmit signal. The transmit signal then passes through a buffer, to the driver where keying occurs, on to the power amplifier stage, and finally through the low pass filter to the antenna. Included on the Sierra circuit board are components that may be used to provide a signal for relative RF power measurement.

A suggested metering circuit which functions as a relative power meter in transmit and an S-meter in receive is shown on the Sierra schematic diagram. I fabricated this circuit on a small piece of perfboard and mounted it to the bottom of a small edge-mounted meter (see accompanying photos). It works perfectly.



Block Diagram of Wilderness Radio Sierra Transceiver

Building the kit

The Sierra kit arrives from Wilderness Radio in a US Postal Service Priority Mail package. Inside is a large, padded envelope with the pre-painted silk-screened cabinet and double-sided silk-screened board with through-plated holes. Also in the envelope are two plastic bags. One contains the transistors, diodes, capacitors, resistors, RF chokes, ICs, toroids, etc., while the other contains knobs and hardware.

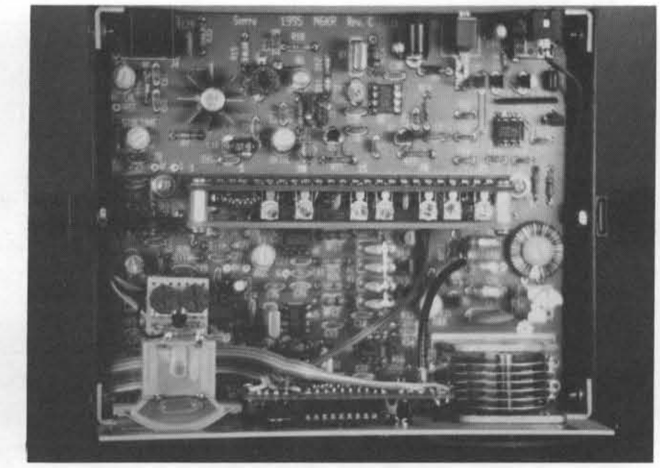
The toroids are not pre-wound in this kit, and there are plenty of them. There are five toroidal inductors on the main board (including one transformer), and eight on each band module. Please don't let this scare you off though, as winding these things is really sort of therapeutic.

The instruction manual is a work of art. Although not "component by component" a la Heathkit®, instructions are very thorough, allowing little chance for error. The manual has been completely rewritten and is now much clearer than the original NorCal version. There is a complete parts list with illustrations, and it's a good idea to inventory the parts before beginning construction. I would also recommend a magnifying glass as part of the tool assortment since many of the components are so small it's difficult to read the color codes and printed value labels with the naked eye. The kit I received was complete, but I almost threw out two MOSFET transistors that were hiding in the IC carrier.

It took me about eight hours one evening to complete the Sierra kit (sans band modules). Wilderness Radio has designed its version so that band modules built for the NorCal version may be used. This "backward compatibility" relieved me of the task of building band modules as I can use the ones I previously built for my NorCal Sierra. Because of the eight toroids per band module, I budgeted one evening per band module when I built mine. They only took a couple of hours apiece to build, but these fifty-three year old eyes needed a break. I have no doubt that a younger person with better eyesight could build two or three band modules in an evening.

The rig worked as soon as power was applied. After alignment, I fired it up on forty meters and had three solid QSOs in rapid succession. Comments on stability and keying characteristics have been very complimentary, and the receiver is a pleasure to listen to. The tuning capacitor has a very smooth 8:1 vernier mechanism, so even though the dial covers 150 kHz in 180 degrees of rotation, the tuning knob rotates three and a half turns from 0 to 150, making it very easy to tune in signals with great precision. The QSK delay is nominally 200 milliseconds, but may be adjusted to suit the operator by changing the value of one capacitor. A front panel mounted RIT control permits the received frequency to be offset from the transmitted frequency by plus or minus 2 kHz.

Front view of the completed Sierra. The meter and KC-1 controls are not part of the basic Sierra kit.



Top view of Sierra with cover removed. KC-1 board and S-meter are installed directly on the front panel.

NorCal and Wilderness Radio Versions Compared

A number of noteworthy improvements have been made to the Sierra as part of the evolution from a NorCal club project to the Wilderness Radio commercial kit. These include improved sidetone, adjustable IF bandwidth, new premix oscillator and transmit buffer circuits for improved transmitter stability, an AGC threshold control, better decoupling in the receiver for improved stability, keyline buffering, and refined band module component values. Also, the Wilderness Radio version includes pads on the PC board for all KC1 Keyer/Counter connections.

The sidetone in the NorCal version is actually the transmitted signal. This scheme, while having some advantages, resulted in variations of sidetone volume on different bands as drive level varied. In the Wilderness Radio version, a separate sidetone generator is used. A sidetone level adjustment has been added, and the frequency of the sidetone may be varied to insure the transmitted signal is on the same operating frequency as the received signal.

The IF bandwidth in the Wilderness version is controlled using a board-mounted potentiometer (labeled "ABX" for "adjustable bandwidth crystal filter") to vary the voltage applied to varactor diodes in the four-pole IF crystal filter and the single crystal filter following the IF amplifier. This control permits the operator to adjust the IF bandwidth from about 1.5 kHz to 150 Hz. In the NorCal version, fixed capacitors were used in the IF filters, resulting in a nominal IF bandwidth of 400 Hz.

Some builders of the NorCal Sierra found it difficult to align band modules on 15, 12, and 10 meters. At certain power levels, the transmitter output would break into oscillation on these bands. The new Wilderness Sierra has better buffering and better terminations for both the pre-mix and transmit bandpass filters, resulting in elimination of the oscillation problem and much more stable operation.

In order to prevent power output fluctuations due to non-zero resistance in an external key or keyer, a new keyline buffer has been added. Some keyers do not fully pull the keyline to ground, putting an upper bound on the original version's driver emitter current. The keyline buffer now isolates the driver from the keying device.

Since the Wilderness Radio Sierra improvements were designed after the KC1 Keyer/Counter became available, all necessary connections to interface the KC1 to the Sierra are incorporated onto the Sierra printed circuit board and the revised manual includes interface details for the KC1.

Mechanically, the front and rear panels now have welded L-brackets that secure the panels to the lower case with screws, greatly improving structural rigidity. Also, the new band modules have rugged ABS plastic covers to protect the circuitry and facilitate module insertion and extraction.

These improvements have made an already very good multiband QRP transceiver kit even better.

The KC1 Keyer/Counter

The Wilderness Radio model KC1 Keyer/Counter combines two of the most frequently desired add-on functions for QRP transceivers in a small, inexpensive kit. The heart of the KC1 is a preprogrammed PIC16C84 microprocessor. This device functions as both an iambic keyer with message memory and a "displayless" frequency counter with programmable offsets. These offsets permit the counter to be tailored for use with virtually any transceiver. Instead of displaying the frequency on a digital display, the counter enunciates the least significant three digits of the operating frequency (to the closest kilohertz) in Morse code in the receiver's audio. The complexity, cost, panel space, and multiplexer hash noise usually associated with digital frequency displays are eliminated by using this technique. KC1 command prompts and responses are likewise enunciated.

The KC1 consists of a single printed circuit board measuring 2.5" x 0.8", on which all components are mounted. Three board-mounted controls are provided: keyer speed potentiometer, memory message play/record push-button, and frequency read/search push-button. These controls are labeled SPEED, MSG, and FREQ, respectively, and all user communications to the KC1 are accomplished either through these three controls or keyer paddles. Keyer paddles are used to enter commands when the unit is placed in Command mode by depressing MSG and FREQ buttons simultaneously until "C" is heard in the receiver audio. Sending the letter "D" (done) from the paddles while in Command mode restores the KC1 to operating mode. The KC1 draws only about 4 mA from a 7 to 16 volt supply.

From eight to fourteen connections between the KC1 and the transceiver are required, depending on which features are used. Fourteen, you say? Yep. They include power, ground, keyline, dot and dash paddle inputs, VFO pickup, audio out and audio ground, receiver mute, and connections for selecting the VFO offset depending on the band module installed. I used ribbon cable for my installation, routing the cable to the underside of the Sierra PC board before separating the wires and routing them to their individual pads. As the photos show, this makes for a pretty clean looking installation.

The keyer emulates two popular iambic modes: Curtis mode A, and Super-CMOS II mode B. The iambic mode is selected through a paddle command and, like other parameters, is stored in non-volatile memory. Other keyer commands input through the paddle set QSK delay, key the transmitter continuously for tune-up, report the keyer speed, and set the keying weight. Keyer speed range is from approximately 7 wpm to 50 wpm, but the high end can be changed by changing the value of one capacitor.

The keyer message memory is limited to approximately fifty characters, but this memory may be separated into multiple messages by using an "end of message" character. Also, memory can be used very efficiently with a "word repeat" character. For example, in the message "CQ CQ CQ DE K4DRD K4DRD K4DRD K", "word repeat" could be used for the second and third CQs and the second and third K4DRDs.

To record a message in memory, the MSG button is depressed and held until the keyer responds with "M". The desired message is then entered into memory from the paddles. After the message has been entered, the MSG button is depressed momentarily, signaling the keyer that message entry is complete. To hear the message as it is stored in memory (and, coincidentally, key the transmitter), press the MSG button momentarily once more.

The KC1 frequency counter counts the transceiver's VFO frequency, then adds it to (or subtracts it from) a three digit offset entered by the builder from the paddles while in command mode. Up to four different offsets can be programmed into the KC1, and the proper offset is selected by grounding one, both, or neither of the two KC1 inputs labeled BAND1 and BAND2. In the Sierra, this is accomplished with jumpers on the band modules. The multiple offset feature is needed as band edges vary, e.g. 1800 kHz, 3500 kHz, 7000 kHz, etc.

The operating frequency is enunciated when the FREQ button is momentarily depressed. I have found that the Lexan dial tracks very nicely with the counter, but is sometimes two or three kHz off. Having the counter is insurance against accidentally violating a band edge. In fact, another nice feature of the KC1 counter is the "search" mode. Using this feature, a specific target frequency such as a band edge or net frequency is inputted via the paddles. When the transceiver is tuned to within ± 2 kHz of the target frequency, the KC1 enunciates the current frequency and then exits the search mode.

The addition of the KC1 to the Sierra transceiver has greatly enhanced my operating pleasure. It adds two "big rig" features at a very modest cost.

Conclusion

After building my NorCal Sierra and adding a Curtis keyer, it became my favorite QRP rig. In addition to the NorCal Sierra, I own an OHR QRP 20, a Heathkit HW-9, a Ten-Tec Argonaut 505, and a NorCal 40A. Although the Sierra had become my rig of choice, I was aware of some of the shortcomings described above. When the Wilderness Radio version was first advertised, I talked to Wayne Burdick about the improvements he had made. For me, the changes justified buying the new version. The refinements have made it a much better rig than the original, and the addition of the KC1 is icing on the cake.

Wilderness Radio
P.O. Box 734
Los Altos, CA 94023-0734

Phone (415) 494-3806

Sierra Kit only (No Band Modules)	-	*$215.00*
Sierra Band Module Kits	-	*$31.50*
KC1 Keyer/Frequency Counter Kit	-	*$44.50*

I Won a Sierra at Dayton!

Byron Johnson, WA8LCZ
27426 Winslow Ave.
Warren, MI 48092
email: Byron8LCZ@AOL.COM

I had a great time at the Dayton HamVention '95. I found some terrific one foot-square solar panels, a book with a complete listing of the IOTA (Islands on the Air) awards program, a "smart-chip" battery charger kit, a speech processor kit for my Argonaut 509 and much more. But the best part of Dayton, as usual, was the QRP suite on Friday and Saturday evenings. I got to meet many of QRP'ers I've worked on the air and read about in the magazines and see all the latest kits and hear about kits that haven't hit the market yet. I also enjoyed seeing the prototype of the new Oak Hills four band Classic rig and talking with the designers and distributors of other QRP kits.

For me, the high point of the weekend happened at the QRP Banquet on Saturday night. We had a great dinner, then listened to the president of Ten-Tec talk about the early days of Ten-Tec and QRP and how the Argonaut series of transceivers came to be. Then Wayne Burdick, N6KR, designer of the NorCal 40 and Sierra transceivers, discussed rig ergonomics or how many knobs and buttons can you possible use and understand on one rig. He talked about hidden features in rigs, menu systems and the things you only find out about if you read the manual from cover to cover. Sometimes we spend more time fiddling with knobs than actually operating our rigs.

After the talks, there was a prize drawing. I was stunned to find I had won the top prize, a Sierra kit with five band modules! As I stood up, I could feel my knees buckle. I got two offers to buy the kit before I could get back to my table and sit down. Talk about a hot kit!

I missed the chance to buy a Sierra when they were first offered by NorCal as they sold out very quickly. I tried to convince myself that I would rather operate than build anyway -- but that's not really true. I've been building kits, off and on, since 1963. The smell of solder, burning fingers, dropping tiny parts on the floor; it's all part of the total involvement you get when you build.

When I got home and opened kit, I realized that parts have gotten smaller and my eyes have gotten weaker. Older eyes make it difficult to read the color bands on the resistors, so I measured each one with an Ohm meter.For the capacitors, I dug out a magnifying glass I bought at a local swap-meet. It did the trick. I was now ready to heat up the iron! The toroids put me off a while; I haven't wound toroids before and it took a while to convince myself to get started. However, it turned out to be pretty easy; the hardest part was getting all the enamel off the wire before soldering.

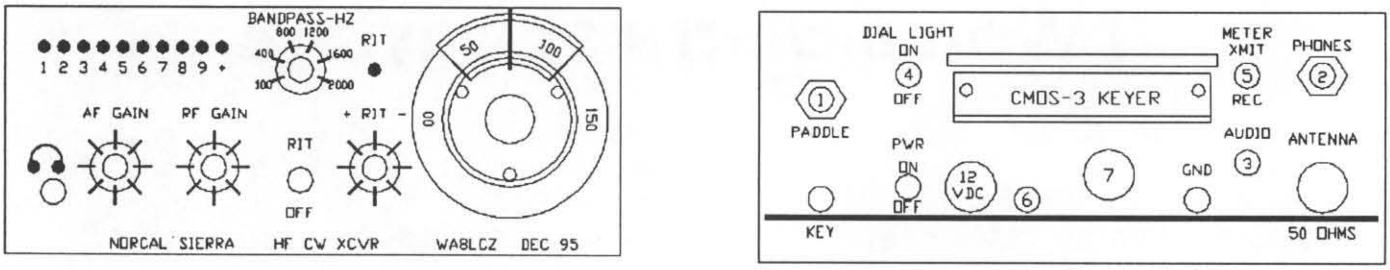
After the transceiver and a 20 meter band module were built, I applied power and gave it the smoke test. I heard some noise, but no signals. After probing around a little, I detected a poor solder joint on a toroid lead. I removed the toroid, used a match to burn off any remaining enamel, sanded the lead once again and resoldered it. That was it! Now with just a wire on the floor for an antenna, I was copying a WA7 on 20 meters. I felt great!

I took my new pride-and-joy into the radio room, hooked it up to my Gap vertical and called CQ. My first contact was Al, N8WYO, a retired school teacher in Troy Michigan, about 8 miles from my house. The next contact was Hot Springs South Dakota, then Saskatchewan, Texas and Washington. The Sierra was getting out like gang busters, with signal reports ranging from S-1 to S-8. Power output was about 1.5 Watts.

The next thing to do was figure out what modifications I could add inside the Sierra enclosure. Wayne Burdick did an excellent job of leaving space on the front and rear panels for additional user installed features. He even suggested how to add an S/RF meter, showing tie points on the circuitboard. Now it was time to search through all the QRPp and QRP Quarterly magazines to findjust the right features to add to this dynamite little transceiver. I would keepthe same design guide-lines that Wayne used; minimal current draw possibleand maximum efficiency.

After much searching and reading, I decided to add the following:

1. A keyer. I chose a keyer kit that has 18 memories and very low current drain (10 µA when idle, 10 mA maximum when running).[1] I can mount the keyer on an L bracket on the rear panel and reserve some extra room for shielding around it just in case RF hash from the microprocessor got into the receiver.Another L bracket attached to my keyer paddles to support the six memory switches will keep them near my sending hand.
2. An RIT warning circuit. Thanks to Paul Harden, NA5N, for a this little circuit consisting of an operational amplifier that lights an LED when the receiver incremental tuning is not zeroed.[2] I found



CAD generated front and rear panel layouts for the author's modified Sierra transceiver.

some 2 mA LEDs at Radio Shack[3] that should result in a total current drain of less than 5 mA.

3. An S-meter. I couldn't find any nice edge panel meters that were affordable, so I thought about using an LED bar-graph driven by an LM3915but I was unwilling to put up with a current drain of 50 mA or more for an S-meter circuit.[4] I finally found some miniature LEDs that only draw 2 mA and come in green, yellow, and red and decided to use those in place of a bar-graph.[5] They will be arranged as follows: three green, three yellow and three red for S-1 through S-9 and one yellow for over S-9.
4. A jack for external amplified speakers. The audio output is usually low in portable QRP rigs, so I added a 3.5 mm stereo jack to the rear panel for a pair of amplified speakers. I've found that two speakers, one near each ear, makes it much easier for me to copy CW. There's a wide range ofsmall amplified speakers available. I found some that were only two inches square, perfect for portable use and very affordable.
5. Increased power output. The Sierra's RF output was a bit on the low side. An article I read indicated that some power was being lost in the disc capacitors in the band modules.[6] After replacing these with silver mica caps, I obtained about 0.5W more power output, and the output was more uniform from band to band.

Since many modifications were being performed, using a standard silk screen pattern for the front and rear panels didn't seem practical. So I designed a new front and rear panel layout on my computer using CAD (computer aided drafting). Using CAD has many advantages; it's easy to change a panel layout, rearrange or add to it. After printing it, you can laminate it very inexpensively and attach it to the rig using double sided tape, or even stick the laminate on the panel directly. *[You can also print directly on self-adhesive film. -- W1HUE]* You can add modifications, then update the CAD drawing and have a new front or rear panel layout, easily and inexpensively.

Lighting for night use was a major concern. In the past, using white lights, I've been attacked by so many bugs it was impossible to operate. This time I would be using a yellow light, small but bright enough to be useful. I decided on a 12 volt 25 mA bulb available from Radio Shack. I cut a hole in the front panel behind the tuning dial and used a yellow sheet of plastic available at office supply stores. A little "hot glue" holds everything to the inside of the front panel. A switch added to the rear panel allows the light to be turned off when not needed.

The hardest part of adding modifications is knowing when to stop!

When I won the Sierra, I had no idea how much fun it would be reading through back issues of QRP magazines looking for modifications, finding the parts and actually adding these mods to the rig. Between a solar panel, two batteries, the modifications, and all the future projects geared around a portable QRP station I'll be busy all this winter. But come next spring, I'll be QRP portable with a rig I built with my own hands.

Thanks to Wayne Burdick for designing such a great rig (keep those mods coming, Wayne!), to Doug Hendricks, KI6DS, Jim Cates, WA6GER and the rest of NorCal for donating it to the QRP banquet. And a big thanks also to the ARCI for hosting this exciting annual QRP event in Dayton Ohio. I just can't wait until next year!

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1 CMOS-III keyer available from Idiom Press, P.O. Box 1025, Geyserville, CA 95441.

2 The QRP Quarterly for July 1995, Page 22.

3 Radio Shack part number 276-044.

4 QRPp for June 1994, page 76.

5 Linrose Super Bright LEDs: B4300F1LC red, B4300F5LC green, and B4300F7LC yellow.

6 QRPp for September 1995, page 31.

Yet Another Idea -- The Stealth Antenna

G. Danny Gingell, K3TKS
3052 Fairland Rd.
Silver Spring, MD 20904

email: George.Gingell@bbs.abs.net

I was recently prompted to reflect on an old idea that I had for a way to make an antenna invisible. It also goes along with my thoughts of designing a truly "Ham Radio Orientated" house. It would include solar panels as the roof covering, mingled with passive water heating panels. The dimensions of the house would conform to "standard" 1/4 and 1/2 wavelengths. It might be practical to mix aluminum and vinyl siding to form elements of the house antenna system. Of course we all know how to Make the UHF/VHF antennas on glass.

Now for some "stealth" design ideas for those who must work with an existing structure. I must forewarn you that these are only my ideas and have not as yet been tested. I welcome all reports and encourage you to give them a try.

First of all, it is possible to construct a nearly invisible dipole or beam antenna using "copper foil tape" applied directly to the vinyl siding of the house [*wire stuffed under the siding would also work -- W1HUE*]. It can be the silvered burglar alarm tape (expensive) or better yet, I recommend using the copper foil tape sold in large rolls in stained glass window supply houses. It comes in several widths, is reasonably priced, and has about 36 yards on a roll if memory serves me right. The tape can be applied to the lower edge of vinyl siding in cases where it is not desirable to have a "gold stripe" around the house and where it is not practical to spray paint over the finished product.

One suggestion for feeding this system is to carefully drill small holes through an outside wall and poke a piece of stiff wire through the hole. I'd use Piano Wire, since it can be filed to a point and used as a crude, but long drill. It works best if you use a piece of brass tubing as a sleeve/guide. Then you can insert some #18 or #20 Stranded wire through for the feed. (Home Made Ladder Line.) It is also possible to make a PCB connector that fits over/under the siding to make the connection. I thought of using pieces of brass rod or tubing as feed through connections to the PCB also. It is readily available at your local hobby shop. You can also get a nice selection of camouflage paint while you are there.

This next one is best for smaller antennas -- VHF/UHF etc. -- but might work on HF if you want to take the time and expense to make the effort. It consists of painting the antenna elements on the structure using "conductive paint". Such paint is available at your local TV repair supplier in small bottles, sold for the purpose of repairing printed circuit boards [*at about $10 per bottle, as I recall! -- W1HUE*].

If you are unfortunate enough to have aluminum siding on your house, I hope that it is "dimensionally correct" for amateur radio use. You will never know if you don't give it a try. Just run a wire out the window and attach it to the siding through your handy dandy tuner. Try the W3TS QRP Tuner; I heard it works on anything. The soon to be offered "St. Louis Antenna Tuner" shows promise as well. I would also consider running a counterpoise wire around the base of the house (outside). I would use a piece of old coax, RG-58 or RG-59 flavor.

The last idea that I would like to share with you relates to feed lines and counterpoise wires. I use old garden hose buried in the ground to get some of my wires and cables to their destination. This would also be a good way to get wires out to the fence or garage/out building. I always run the feed to my ground mounted verticals that way. I saves having to install new feeders right after the lawn is mowed. The fence can make a great counterpoise. If wood, run the wire along the bottom with a staple here and there and a ground rod or two if you like. If it is chain link, just connect to it, or weave the wire through it. I like to ground it as well. It is also possible to thread coax through the top rails of the chain link fence. No, I haven't tried to use the top rail as a dipole (not yet!).

I hope that you all have good luck with your "stealth antenna" experiments. Please remember to share them with us. Not everyone has an antenna farm out in the back yard. A few spider webs in the trees, but no beams here.

The Ramsey CB-1 Voice Recorder Kit
Review and Comments

Larry East, W1HUE
1355 Rimline Dr.
Idaho Falls, ID 83401

Although not strictly QRP related, you might find the Ramsey CB-1 "Chatterbox" Voice Recorder to be a useful accessory if you operate SSB -- especially if you operate contents. The device can electronically store up to 20 seconds of audio from an internal microphone or external signal source, and play it back upon demand. The unit is available [1] as a kit that can be easily constructed by an experienced builder. I would not, however, recommend this as a first time construction project unless an "Elmer" is available for guidance.

I purchased the kit with the idea of using it for SSB contesting and field day. Ramsey's description of the unit states that it "has excellent audio quality" and is "compatible with most ham and CB radios." The statement about being "compatible" with most radios, although basically correct, is somewhat misleading; the "excellent audio quality" claim is, at best, an overstatement. These and other observations will be discussed later.

First, a brief description of how the gadget works. The heart of the CB-1 is a special chip made by Information Storage Devices (ISD). This chip uses a proprietary method to store analog data (in this case, audio) in memory cells and retrieve it without the use of analog-to-digital or digital-to-analog converters. Storage memory is nonvolatile, which means that its contents will not be lost when the power supply is turned off. The chip contains a microphone amplifier with automatic gain control (AGC), all necessary filters and an output amplifier in addition to the data storage array. Simple external logic is required to select the mode (record, playback once, playback continuous, etc.) and the segment of memory to be accessed. The CB-1 uses a pre-programmed 68HC705K1 microcontroller for this purpose. Memory can be accessed in quarters, halves or full allowing up to four messages to be recorded and played back. Modes and memory segments are selected by momentary contact switches and displayed on two 7-segment LED's. Additional amplification by an LM380 IC provides up to 2 Watts of audio output.

I should note in passing that several other voice recorders (all using ISD chips, from what I can tell) intended for amateur radio applications are available from a variety of sources. ISD chips (type ISD1000) are also available from Radio Shack (part number 276-1325) with sample circuits for audio recording and playback.

The basic price of the kit (about $60.00) does not include a case or power supply. A "custom cabinet" is available for an additional $15 or so, but you have to supply your own source of 12V DC power. I decided to get the cabinet as well; it has pre-drilled front and back panels, and the front panel is made of translucent red plastic that allows the board-mounted LED's to be seen through it.

When the kit arrived, I discovered that the holes in the rear panel supplied with the cabinet did not line up with the positions of connectors on the PC board. A phone call to Ramsey brought a new panel in a few days. The holes in the new panel were in their proper places, but were not labeled! Oh well, luckily I had some dry transfer labels...

The quality of the kit components and PC board are reasonably good -- definitely better than some other Ramsey kits I have seen. I was favorably impressed by the detail of the assembly instructions in the 23 page manual; each step is described in some detail and a (rather simplified) description of the purpose of the various components was included. However, when I started assembling the kit, I soon ran into some problems:

> Step 49, page 12 refers to R7, a 2.2K resistor in the microphone keying circuit. This should be R17 according to both the schematic and parts layout drawing.
>
> Step 50, page 12 refers to R17; judging from the discussion, I decided that this should be R27. No R27 is shown on the schematic, but is shown on the parts layout diagram and marked on the PC board.

There were several other discrepancies between the schematic diagram and the actual circuit board. The most notable example is that the schematic shows separate pots for controlling audio output to a speaker and external device (such as a transmitter), whereas a single pot controls both levels.

IC sockets are provided for the ISD and microcontroller chips, but not for the LED driver or the audio amplifier IC's. The assembly instructions state that a socket should not be used for the LED driver because it would interfere with the front panel; however, I found that a low profile socket worked without any problems. I also used a socket for the LM380 audio amplifier, but later decided that this might not be a good idea. This IC uses the PC board as a heat sink and use of a socket could lead to overheating if it is required to provide its rated two Watts of output (not likely if just driving a small speaker).

After assembly was completed, there was noticeable noise in the audio output in "standby" mode, particularly when listening with headphones. In addition, the playback of recorded audio from the internal electret microphone or an external low impedance microphone was of rather poor quality with a considerable amount of background noise. The one page of "Trouble Shooting Tips" in the manual provided no help so I called Ramsey's customer service department. The person I spoke with "never heard of such problems" (has anyone else built one of these things?) and suggested that I check my wiring for errors. I checked and re-checked, including a one-to-one comparison of resistor and capacitor values with the schematic, but found no errors. I therefore set about to see what I could do to solve the problems on my own.

The noise in the audio output amplifier appeared to be a combination of power supply hum and "buzz" from the microcontroller. I checked the output of my 12V power supply on an oscilloscope, and the 120 Hz ripple was about 1 millivolt -- a little high but not excessive. Changing a bypass capacitor (labeled C6) at pin 1 of the LM380 from 0.01 μF to 6.8 μF cured the hum problem. According to my linear IC handbook, the purpose of this capacitor is to decouple the high gain input stage of the LM380 from the power supply; this capacitor should be at least 1.0 μF (0.01 μF is certainly inadequate). I finally reduced the microcontroller generated noise to an acceptable level by connecting a jumper from the ground end of C6 to the ground end of JMP3.

I found that changing the microphone coupling capacitors (C19 and C13) from 0.01 μF to 0.1 μF greatly improved the quality of the recorded audio. According to a specification sheet that I was able to find for the ISD1000 series sound recorder IC's, the coupling capacitors at the differential record amplifier inputs should be the same size; this means that C19 and C13 should be the same size as C11 (0.1 μF). Recorder background noise was reduced somewhat by adding a 0.1 μF capacitor on the trace side of the PC board directly between the microcontroller (U4) pin 16 and the ground plane connecting pins 1 and 5. However, some background noise still remained even when no microphone was connected.

After these changes were made, I found the audio quality to be acceptable, but not outstanding. The ISD chip contains a bandpass filter that limits the frequency response to the range of about 250 Hz. to 3000 Hz. This is fine for voice communications, but don't expect to record excerpts from your favorite CD and have the playback sound like the original!

For good measure, I added a reverse polarity protection diode (a 1N4001) between the power connector power switch. I also added a small heat sink to the 7805 voltage regulator as it seemed to be running a bit on the warm side.

The next job was getting the CB-1 interfaced to my TenTec 509 in time for field day. The CB-1 contains an electret microphone mounted on the front panel; this is useful for testing, but not too practical for anything else. Unfortunately, there is no switch to disable the internal microphone, and it should be disconnected when using an external microphone. A 5-pin DIN connector on the rear panel provides low level (before the LM380 amplifier) audio output, microphone-level input, and a control line that goes to ground (sort of) when playback begins intended for transmitter control. Also on the rear panel are 2.1 mm power connector and 1/4 in. phone jacks for speaker/headphone output and microphone input. No push-to-talk line is provided on the microphone connector. Instead, resistance change is sensed when an external switch in series with the microphone is closed. However, this will <u>not</u> work with a high impedance crystal or ceramic microphone! The audio output available at the DIN connector is intended to be connected to the microphone input of a radio. The output level is adjusted by the front panel control that also controls the output level to the external speaker/phones. The transmitter control signal at the DIN connector is derived from a Darlington open collector transistor pair that is switched on when playback begins. Unfortunately it does not switch completely to ground, and this can cause problems with some transceivers. For example, my TenTec 509 would switch to transmit but not provide full output power.

In order to successfully interface the unit to my 509, I made he following modifications:

I connected pin 5 (unused) of the DIN connector, J1, to the base of Q8 through a 4.7K resistor for use as an external "start" control; momentarily connecting pin 5 to ground will now start playback or record, depending on mode selection. I found it necessary to add a capacitor from the base of Q8 to ground for "de-bounce" control; I used 1.0 μF, but 0.1 μF would probably be adequate.

I removed the 2.2K resistor, R17, originally used to sense when an external microphone was turned on.

I mounted a small switch on the PC board to disconnect the internal microphohe.

I changed the configuration of Q1 - Q2, the Darlington pair used for transmitter control, as shown in Figure 1.

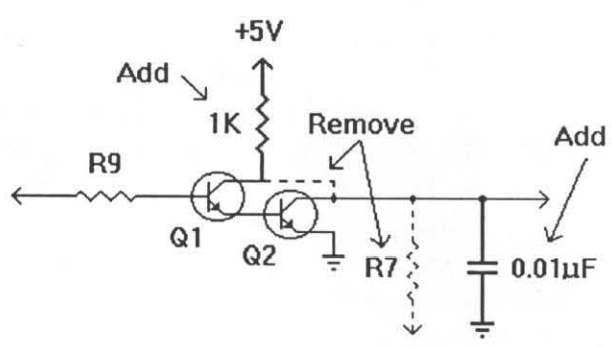

Figure 1. Modified TX Switching Circuit.

After these changes were made, I was able to successfully interface the CB-1 to my 509. With proper cabling, I could start the recorder playback and it would switch the radio to transmit and feed audio into its microphone input. To eliminate having to switch cables every time I wanted to record audio from the radio's microphone and/or feed audio from the CB-1 to the radio, I built an external switch box (which took about as long as building the kit). With this box, I can now switch a microphone between transceiver and recorder inputs, recorder output between a speaker (or headphones) and transceiver input, and transceiver audio output between a speaker and recorder input.

I informed Ramsey of the problems that I encountered and my solutions. Maybe they will take some of my suggestions to heart and come out with a modified version of the kit -- time will tell.

The bottom line: is this gadget useful and worth the money? Well, I have found it quite useful, especially after I constructed the external switch box. I can use it for automatic CQing, transmitter testing, and recording short segments of received signals. The latter is particularly useful for "capturing" the call signs of CW pile-up producers who only send their calls once every 10 minutes (or longer) at 35+ WPM! Although the price of the kit seems a little high, it is the same as another voice recorder kit I have seen advertised that does not appear to contain a microcontroller or any means of displaying mode or selected memory segment. With the "custom cabinet", it is about $25 less than a voice recorder available from MFJ (which, I suspect, would also require some external switching for maximum ease of use). An ISD chip is available, as noted above, from Radio Shack for about $15; with another $10 - $15 worth of parts, you could probably "roll your own". However, incorporating the sophistication of a microcontroller to select and display modes and memory segments would be difficult without special development tools.

If you enjoy kit building, would like an electronic voice recorder to play with and wouldn't mind having to "customize" it to your particular needs, then give it a try. On the other hand, if you are not comfortable with circuit trouble shooting and modifications, then you might be better off passing on this one.

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[1] The CB-1 kit is produced Ramsey Electronics, Inc., 793 Canning Parkway, Victor, NY 14564. It is available from Ramsey and several distributors.

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CONTESTS

CAM HARTFORD, N6GA

QRP ARCI Contest Manager

- ❐ Results of the Holiday Spirits Homebrew Sprint
- ❐ Announcing the Hootowl Sprint
- ❐ Announcing the New Milliwatt Field Day Rules
- ❐ The Everpresent Errata

The Holiday Spirits Homebrew Sprint continues to be one of our most popular short-format contests, with 77 entries this last December. A couple years ago, we were lucky to get 77 entries in a big QSO party!

Rules for the Hootowl and Milliwatt Field Day appear later in this coulm. I'll be making one change to the MW FD, not a rule change per se, but a change to the way the scores appear when reported here in the Quarterly. The 1 and 2 Operator classes will remain defined as they are, but I'll separate the results into 1-op and 2-op listings, as does the ARRL. This way those who toil in solitude won't be intermingled with those who go at it with help.

Hope to hear you on the bands - 72/73, Cam

UPCOMING EVENTS

Spring QSO Party (rules in 1/96 QQ)	April 13 -14
NorCal QRP To the Field	April 27
Hootowl	May 26
Milliwatt Field Day	June 22 - 23

1995 Fall QSO Party Addendum

The following entries into the Fall QSO Party were lost somewhere in cyberspace. Few things are more frustrating than working hard for something and getting no reward. My apologies are offered to all. These entries were all Low-Band entries

CALL	SCORE	POINTS	SPC	POWER	BANDS	TIME	RIG	ANTENNA
W2RPH	61,411	283	31	4	L-2	9	NN1G, CORSAIR	DIPOLES
WO3B	32,400	120	18	0.2	L-2	2	QRP+	LOOP @ 55'
N2MNN	30,751	191	23	5	L-2	6.5	TS-850	VERT LOOP
WZ2T	9,492	113	12	1.5	L-2	12	NORCAL SIERRA	VERTICAL
KE4MIQ	84	6	2	5	L-2	6	QRP+	INVERTED VEE @ 30'

HOLIDAY SPIRITS HOMEBREW SPRINT

We rang in the Holiday Season with a rousing turnout in this year's Holiday Spirits gathering. A total of 77 celebrants got into the spirit of the season, the largest turnout for a sprint in recent memory. Congratulations to the top three, who are

W3TS 187,875
WAØRPI 149,585
WA9PWP 100,979

A few of the participants, myself included, remembered a little too late that this was a Homebrew sprint, and that bonus points were awarded for the use of homebrew gear. My only excuse was that I was concentrating on trying out the new N6TR logging software, and forgot to use one of the numerous HB rigs available. Oh well,10,000 points down the drain. A few contestants lamented similar lapses, including "I forgot to try the other bands, and could have had another 5000 points!" Trying the other bands can have it's rewards, as you will often find people lurking in the strangest of places, such as 15 meters. Give it a try, you might be surprised!

Soapbox: MY 800' LW BROKE 2 HOURS BEFORE THE TEST. GOT 500' BACK UP JUST BEFORE THE START - **WX7R**; I WORKED THE 160 METER CONTEST THE TWO NIGHTS PRIOR TO THIS ONE... - **N4ROA**; CAN'T WAIT TILL 10 AND 15 START TO OPEN UP AGAIN - **WAØRPI**; I READ THE RULES THIS TIME BUT STILL DIDN'T GET A QSO ON 15 METERS - **KE2WB**; IT TESTS MY LISTENING ABILITY MORE THAN ANY OTHER TYPE OF CONTEST - **N2LSK**; SOME GUY CALLING "CQ TOILET PAPER" RUNNING 1500 WATTS - **N9DAW**; FINISHED THE EXPLORER II ON SATURDAY, PUT IT TO WORK ON SUNDAY - **WA4KAC**; NOT SURE I FIGURED MY SCORE CORRECTLY, BUT I AM POSITIVE I HAD A GREAT TIME - **KA2PQY**; WORKING KH6 WITH 900MW MAKES UP FOR ALOT OF SILENCE OTHER THAN MY LONESOME CQ TO A MOSTLY DEAD BAND - **AB5TV**; MY FIRST SPRINT - LOOKING FORWARD TO THE NEXT ONE - **K5ERJ**; AN ALLTIME PERSONAL BEST FOR ME IN THIS CONTEST... - **AB6DG**; DISCOVERED MY UTC CLOCK WAS ONE HOUR SLOW! - **N1RCG**; FORGOT IT WAS HB - COULD HAVE USED MY ARK4 - **AC4QX**; GREAT FUN! WHY DIDN'T I MAKE AT LEAST ONE CONTACT ON 20 AND 15 FOR THE BONUS POINTS - **AE4IC**; DECIDED TO TRY SINGLE BAND ENTRY (80 M) SURE WAS LONELY THAT FIRST HOUR - **KF2HC**; TRANSMITTER FROM QST 11/94 HINTS AND KINKS - **KJ5TF**; WAS A BIT TIRED AFTER DOING TWO NIGHTS OF 160M CONTEST, BUT HAD TO GIVE IT A GOOD SHOT - **W3TS**; MORE ACTIVITY THAN I EXPECTED - LOTSA FUN! - **WA9PWP**; I WILL BE CHANGING THE 10MHZ IF IN THE NN1G, WAS GETTING HEAVY QRM FROM WWV! - **AA7WT**; I JUST LOVE THESE SPRINT CONTESTS - **WB4ZKA**; TOO NICE A DAY TO STAY INDIDE AND OPERATE - 65 DEGREES - **W9FHA**; GREAT FUN, THERE ARE A LOT OF GOOD EARS OUT THERE - **WØLK**; WHAT A WAY TO SPEND A SUNDAY AFTERNOON - **K5ZTY**.

HOLIDAY SPIRITS HOMEBREW SPRINT 1995

CALL	STATE	SCORE	POINTS	SPC	POWER	TIME	RIG	ANTENNA	BANDS
15 METER STATIONS									
AB5TV	TX	8,570	51	7	0.95	4	HW 8	YAGI	15M
KE4BF	AL	168	8	3	4	2	ARGO 515	YAGI, R5 VERTICAL	15M
20 METER STATIONS									
HP1AC	PAN	74,978	103	18	5	3	K9AY TX, TS430 RX	YAGI	20M
AA7WT	MT	19,112	112	18	1.2	3	NN1G	MOSELY TA53M 3 EL	20M
AE4CA	GA	17,480	96	13	1	3	NN1G DUAL BANDER	99' CF ZEPP	20M
W4OEL	VA	17,290	130	19	4	3	TS130V	YAGI @ 28'	20M
WB4ZKA	AZ	14,875	125	17	3	2	MFJ-9020	GROUND MTD VERTICAL	20M
KJ5MG	OK	10,467	71	11	5	2.5	HB TCVR	DIPOLE	20M
KJ5TF	AR	9,425	55	9	0.23	4	74HC240 CHIP	HALFSQUARE	20M
KG5LO	MI	6,560	26	6	0.9	1.25	NN1G	VERTICAL	20M
WB2QAP	FL	3,542	46	11	4	1	FT 840	MFJ 1796 VERT	20M
VE7CQK	BC	2,156	44	7	2	1.5	HW-8	40 FT VERT	20M
40 METER STATIONS									
WAØOUI	MO	28,345	145	23	4	2.5	NN1G 40/40, W7EL AMP	?	40M
N2YVF	NJ	26,168	168	18	4	3.5	ARK-4	DIPOLE	40M
K5ERJ	KS	21,359	123	19	4	3.5	OHR CLASSIC	80/40 TRAP DIPOLE	40M
WO3B	MD	20,790	99	14	0.2	3	QRP+	4 WAVELENGTH LOOP @55'	40M
AC4QX	NC	18,900	150	18	5	3	ARGOSY	SHORT LOADED ATTIC DIPOLE	40M
WA4KAC	MD	17,300	82	15	0.95	2.75	OHR EXPLORER 2	98' ATTIC LOOP	40M
N2LSK	NY	16,758	126	19	5	1.5	?	?	40M

W9FHA	IN	15,640	95	16	5	1	OHR QRP CLASSIC	80M ZEPP	40M
VE2BLX	QUE	14,100	100	13	4	4	MAVTI-40	END-FED LONG WIRE	40M
KE4AGT	AL	13,610	82	15	5	3.5	SW-40 & RAMSEY AMP	DIPOLE	40M
N9DD	IN	13,250	75	11	0.95	2.5	NORCAL 40A	RANDOM WIRE	40M
KF8EE	OH	12,040	64	11	1	4	SW-40	120' END-FED WIRE @ 15'	40M
N9ZBR	IL	11,781	99	17	5	2	QRP+	G5RV	40M
W8AC	OH	11,750	50	9	0.2	1.5	XTAL + 2 TRANSISTOR, DC RX	32' GND MOUNTED VERTICAL	40M
N3DQU	PA	10,460	65	12	3	4	HB VXO TX, T-KIT DC RX	40M DIPOLE	40M
KB8UKP	MI	9,898	101	14	5	?	?	?	40M
KIØG	CO	9,662	74	9	2	2	NORCAL 40A	G5RV	40M
W6SIY	CA	8,075	41	5	0.25	3.5	TUNA TIN, NEOPHYTE	40/20 DIPOLE @ 18'	40M
N2SMH	NJ	7,464	44	8	2	4	NORCAL 40	40M LOOP STAPLED TO ROOF	40M
N9DAW	IN	7,007	77	13	4	2.5	MFJ 9040	R7 VERTICAL	40M
K1TAV	CT	6,813	37	7	2	0.75	OHR CLASSIC	EXT DOUBLE ZEPP	40M
NØIZZ	MO	6,699	87	11	5	2	TS 520	EXT DBL ZEPP @ 20'	40M
KF7ET	ID	6,650	95	10	5	4	QRP+	INV VEE @ 30'	40M
AC4ZH	KY	6,620	27	6	0.45	1.5	NN1G	DIPOLES	40M
N1RCG	CT	6,568	32	7	1.8	2	NORCAL 40A	DIPOLE @ 45'	40M
WB5MPQ	ID	5,910	26	5	2	4	NORCAL 40A	14AVQ VERT	40M
WK9C	OR	5,420	14	3	0.52	3.5	HB TCVR	?	40M
AB6DG	CA	5,238	17	2	2	0.5	NORCAL 40A	DROOPY LOOP	40M
AD4ZE	NC	2,457	39	9	5	1	TS-450	80M DIPOLE	40M
80 METER STATIONS									
WA3YON	PA	15,374	114	13	5	2	TAC-1	80M HORIZ LOOP	80M
KF2HC	NJ	13,988	107	12	1.5	4	SW-80 (NN1G)	80/40 TRAP INV VEE	80M
K3WWP	PA	8,510	93	10	5	1.25	HB 6Y6 FINAL	RANDOM WIRE, DIPOLES	80M
WZ2T	NY	6,120	40	4	1.5	3.5	NORCAL SIERRA	DELTA LOOP @ 40'	80M
WB2KKX	NY	5,640	52	7	1	3	RAMSAY QRP 80	80' RANDOM WIRE	80M
ALL-BAND STATIONS									
W3TS	PA	185,875	275	39	0.25	3.5	HB TCVR	YAGI @ 52', 80/40 INV VEE	A-5
WAØRPI	MN	149,585	405	51	5	4	HW9, IC 735	DELTA LOOPS, DIPOLE	A-5
WA9PWP	WI	100,979	317	41	5	4	QRP-20, NN1G, ARGOSY	VERT, YAGI, END-FED WIRE	A-3
KE2WB	GA	95,934	282	41	5	4	HW-9	131' DIPOLE @ 40'	A-3
K1GDW	MA	73,960	136	24	0.25	4	HW-9	YAGI @ 60', DIPOLE @ 40'	A-5
K5ZTY	TX	50,618	162	27	3	4	HW-8	YAGI, 140' DIPOLE	A-4
WØLK	AR	50,572	207	28	5	2.3	OHR CLASSIC	80M DELTA LOOP	A-2
N2KPY	NY	39,200	200	28	4	3.5	ARGO 509	YAGI @ 35', DIPOLE	A-3
N7JXS	AZ	36,575	209	25	4.5	4	FT-757GX	TH6DXX, VERTICAL	A-3
WN2V	SC	33,810	161	30	4	3	QRP+	DIPOLES	A-2
VE4AKI	MN	23,345	145	23	5	3.5	TT SCOUT 555	SLOPER, DELTA LOOP, VERT	A-3
KD2IX	NY	22,330	145	22	5	2	?	210' DIPOLE	A-3
WX7R	OR	18,963	129	21	4	3.5	IC 735	500' LW, VEE BEAM	A-3
AA6UL	VA	17,961	47	9	5	0.5	OHR HP, OHR CLASSIC	LOW DIPOLE	A-3
NØIBT	CO	17,787	121	21	5	4	TS-830	DIPOLE	A-2
N9MDK	IL	16,800	120	20	5	2	QRP+	G5RV, R5 VERT	A-2
W2JEK	NJ	16,568	32	7	2	1	OHR40, NN1G 20 & 80	20M GP, 40M DIP, 80M HERTZ	A-3
WBØIQK	OH	14,990	115	18	4	3	ARGO 556	YAGI, 80M INV VEE	A-2
AA1MR	MA	14,180	87	14	1	4	RAMSEY KIT, IC 735	200" ZEPP @ 40'	A-3
VE6GK	AB	11,500	30	5	0.95	1	NORCAL SIERRA	INV VEE @ 60'	A-2
N1CJB	CT	10,920	104	15	5	3	ARGO 556	GROUND MOUNTED VERTICAL	A-3
N6GA	CA	7,546	77	14	2	2	CORSAIR II	DIPOLE, YAGI @ 35'	A-2
KA2PQY	NJ	5,313	69	11	3	1.5	HW 8	80 METER DOUBLET	A-3
N4ROA	VA	4,340	62	10	5	1	QRP+	INVERTED L, YAGI	A-2
KB5DQ	NM	2,632	47	8	5	1	QRP+	YAGI, INV VEE	A-2
KI5EZ	AR	1,586	32	7	5	1	QRP+	GROUND-MOUNTED VERTICAL	A-2
KS4XS	KY	510	17	3	1	1.75	QRP+	WIRE	A-2
LOW-BAND STATIONS									
K2LGJ	NY	60,960	196	26	0.9	3.5	HW-9	SHUNT-FED TOWER	L-2
KN1H	NH	45,240	144	14	0.25	3.5	HB TCVRS, ARGOSY ON 160	DIPOLE	L-3
AE4IC	NC	25,876	126	18	2	4	NORCAL SIERRA	G5RV	L-2
W3GF	FL	13,150	50	9	4	1	HB RXS AND TXS	136' END FED	L-2

HOOTOWL SPRINT

Date/Time:
May 26, 1996; 8:00PM to 12:00PM Local Time
Exchange:
Member - RST, State/Province/Country, ARCI Number
Non-Member - RST, State/Province/Country, Power Out
QSO Points:
Member = 5 Points
Non-Member, Different Continent = 4 Points
Non-Member, Same Continent = 2 Points
Multiplier:
SPC (State/Province/Country) total for all bands.
The same station may be worked on more than one band for QSO points and SPC credit.
Power Multiplier:
0 - 250 MW = X 15; 250 MW - 1 Watt = X 10
1 W - 5 W = X 7; Over 5 W = X 1.
Suggested Frequencies:

	GENERAL	NOVICE
160 Meters	1810 KHz	
80 Meters	3560 KHz	3710 KHz
40 Meters	7040 KHz	7110 KHz
20 Meter	14060 KHz	
15 Meters	21060 KHz	21110 KHz
10 Meters	28060 KHz	28110 KHz
6 Meters	50060 KHz	

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

Entry may be an All-Band, Single Band, Hi-Band (20M, 15M, 10M and 6M) or Lo-Band (160M, 80M and 40M). Certificates to the top three scores, to the top score in each Single-band, Lo-band and Hi-band class, and to the top score in each class in each SPC. The contest manager reserves the right to recognize special significant entries with a certificate award.

Entry includes a copy of the logs and a separate summary sheet. Include duplicate check sheets with entries of 100 QSOs or more. Indicate total time-on-the-air, and include a legible name, call, QRP ARCI Number (if any) and address.

All entries must be received within 30 days of the contest date. Late entries will be counted as check logs. Members and non-members indicate their output power for each band. The highest power used will determine the power multiplier. Output power is considered as 1/2 of input power.

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

Send an SASE for a summary and sample log sheets. Include an SASE with your entry for a copy of the results. Results will be published in the next available issue of the QRP ARCI Quarterly.

The final decision on all matters concerning the contests rests with the contest manager. Send entries via E-Mail to CamQRP@cyberg8t.com, or by mail to:

Cam Hartford, N6GA
1959 Bridgeport Ave.
Claremont, CA 91711

MILLIWATT FIELD DAY

Sponsored by the M-QRP Club and QRP ARCI

Date/Time:
June 22, 1996 - 1800Z through June 23, 1996 - 1800Z
Exchange:
Class/ ARRL Section, per ARRL Field Day rules
Points:
Same as ARRL FD, ie: Phone contacts count one point each, CW contacts count 2 points each.
Bonus Multiplier:
X1.5 for fully portable setup
Scoring:
Multiply total of contact points by ARRL power multiplier, which would be X5 for an output power of 5 watts or less. Multiply this score by Bonus multiplier, if applicable.
Entry classes:
One watt, one or two operators, one transmitter
Five watts, one or two operators, one transmitter
Club, more than two operators, one or more transmitters

Trophies to the top score in each one- or two-operator class, plaque to the top club score. Trophy or plaque may be won by the same winner only once in a three year period.

Entry is a duplicate of the ARRL Field Day entry, consisting of a summary sheet and alpha-numeric listing of contacts by band, or dupe sheets. Sample summary sheet and logs are available from the ARRL. All ARRL Field Day rules are to be followed.

All entries must contain complete name, call, address, and must be received within 30 days of the contest. Include a description of antenna and equipment. Also include an SASE for contest results. Entries may be submitted via E-Mail to CamQRP@ cyberg8t.com, or by mail to Cam Hartford, N6GA, 1959 Bridgeport Ave., Claremont, CA 91711.

Review: ICOM IC-706 HF/VHF All Mode Transceiver

Marrie Rosenbrand, PA3FZS
PO Box 33
5160 AA Sprang Capelle
N. Br. The Netherlands

E-mail: 100543.124@compuserve.com

[This review comes to us via Bob Gobrick, VO1DRB/WA6ERB, a frequent contributor to The QRP Quarterly. Bob writes: "I ran into Marrie on CompuServe and after some discussions between Larry East, W1HUE, and myself, I convinced him to write a review of his new QRP rig. The deal with Marrie was that I would 'proof-read' his work and 'Americanise' his proper English. I think Marrie did a great job (forget my translations) and now The QRP Quarterly owes him a QRP article in Dutch... Any Volunteers?" -- W1HUE]

Late this summer (1995) ICOM introduced a new all-mode transceiver boasting not only full HF coverage with 100 Watt output, but also 6 meter (100 Watt) and 2 meter (10 Watt) coverage. After some enquiries on the HamNet Forum of CompuServe™, I learned that the power could be reduced to 5 Watts on HF and 6 meters and 0.5 Watt on 2 meters. My dream for a "do-it-all" QRP base-radio had come true. I was so excited, I immediately went out and bought one. What follows is my impressions of this great "little" rig.

The IC-706 is a marvel of packaging. The radio looks like an over-grown FM VHF/UHF dual-bander, and it is <u>small</u>. Like some of the newer VHF/UHF rigs, the front panel can be removed for "remote" operation. Starting at the left of the front panel, there are three push buttons underneath each other: POWER, P.AMP/ATT, TUNER/CALL and a miniature headphone jack. Next are the AF-RF/SQL controls, RIT push button and RIT/SHIFT controls. At the upper right is the main tuning dial with an up/down button beside it. At the right-side of the radio are four adjustable pots: COMP GAIN, BEEP/SIDETONE, VOX GAIN and ANTI VOX. On the back there are two SO-239 connectors -- one for HF/6 meters, the other for 2 meters. Other connectors are for GND, RTTY terminal unit, REMOTE, ACC, External Speaker, ATU, CW Key, DC Power, and a second microphone jack.

The LCD display is BIG and in a relaxing green color. Under the display are the MENU F1 F2 F3 buttons. Between the display and the main dial are MODE, TS (Tuning Shift), DISP (Display) and a LOCK. The IC-706 hosts a number of menus, selected with the DISP button. A selected menu usually has several "branches", which are certainly not cluttered. For example, the "M" menu has four branches, the contents of the last one depending on operating mode:

```
M1    SPL   A/B   A=B
M2    MW    M>V   V/M
M3    NAR   NB    MET
M4    VOX   COM   AGC   (SSB/AM)
      BRK   AGC   (CW)
      1/4   AGC   (RTTY)
      VOX   COM   TON   (FM WFM)
      F1    F2    F3
```

Menu and function selection are instantaneous. Only if you want menu "Q" do you need to keep DISP pressed for longer than one second. Describing all menus in detail is beyond the scope of this review. Rest assured that they are easily accessible, well laid out and clearly visible on the large LCD display. All functions are well described in the manual, with which ICOM has done a thorough job.

Let's look at some of the more notable features. The first worth mentioning is the variable sidetone/CW offset. When the radio's sidetone is changed, so changes the pitch of the received signals. Sidetone volume is also controlled by the AF-gain setting.

Another unusual feature is a simple, yet effective "band scope" function in the G-menu. Sweeps are possible from 500 Hz to 20 kHz, showing activity in the selected bandwidth. Pressing F3 gives a continuous sweep -- ideal for monitoring. Pressing F3 again stops the sweep and you can check out the activity indicated on the display; your position in the spectrum is 'dotted' on the x-axis and moving the main dial moves this 'dot', and hence your frequency.

Menu G3 shows your transmit frequency when split (F1 in Menu M1) is activated, in 10 Hz resolution. G4 lets you insert alpha-numerical names for the memory channels (101 memories are available, plus 2 band-edges). No more guessing what those QRP frequencies are; just set QRP-40, for example, to "label" 7.040 MHz.

My favourite "novelty" is the Memo Pad (Menu S1). There are 5 or 10 positions available (selected in the Quick Set procedure). The default of 5 is more than enough for normal use. With this function you don't have to scribble down frequencies you would like to check again later on. The Pad works FILO (First In Last Out) which means that the last frequency you entered in the pad is the first one to show up when pressing F3 (Memo Pad Read). This is ideal for keeping track of DX, as well as tuning the SW broadcast bands (Radio Netherlands DX Show is one of my favourites).

Speaking of DX, don't you just hate it when the DX station says "one up" and you have to fumble setting up the other VFO? Well, ICOM has given us QRP'ers an extra edge. By continually pressing the split button (F1 in Menu M1) the other

VFO is immediately changed to say, one kHz above your working frequency. The split frequency can be preset in the Quick Set menu. With a press of a button you can have the DX in your log before the big guns know what hit them!

Last but not least, I would like to mention the possibility of running digital modes (QRP, of course!) with true FSK, either via the ACC socket or a RTTY 3.5mm jack on the back of the radio. I am not a great fan of the digital modes, but I could become one. This feature is unheard of in a rig in this price-range! [*"Street price" in the US is about $1300. -- W1HUE*] For the "other" digital mode I use the built-in keyer to do my machine-gunning at 30-35 WPM (maximum speed is 60 WPM). Enough for even the keenest of CW operators, I would say. On the subject of CW, a CW-R(everse) seems to be standard nowadays. Of course this doesn't exclude the IC-706. Yet another addition to work those fellow QRP'ers through all that high QRM and QRN.

Many nice gadgets, but how does it perform? Well, the first thing I normally do to test a new rig is switch to 40M, as the QRM on this band is horrible in Europe because of the nearby broadcast stations. You might know that here the allocation for amateur radio is only 100 kHz wide. Right at 7.100 MHz the horror starts, especially at night. I was pleased to see that with the pre-amp OFF the IC-706 does not suffer from front-end overloading at my location in the southern part of the Netherlands. A pleasant surprise since my FT-890 does suffer from overload with the pre-amp off. The pre-amp works very well to give those weak QRP signals a real good boost. Weak signals become plainly audible when the preamp is switched on.

Although the built-in speaker gives plenty of audio, I think a separate speaker would be advisable (true for any radio, for that matter). Remember, you want to hear those fellow QRP'ers come booming in when you switch on the pre-amp! All in all, I am satisfied with the performance of the receiver, especially in this price range.

Keying is smooth despite the T/R relay (I have been spoiled with the very smooth QSK of the FT-890). No clicks or other funny noises. You can even use the supplied hand-mic to key the rig! The build-in keyer lets you set ratio (weight), speed, type of key (set it to OFF to use your own keyer), pitch, and break-in delay.

Tuning takes some getting used to, but when you get the hang of it, it's very logical. Upon pressing TS, one or two dots appear above the MHz figure (keeping TS pressed changes the number of dots). One dot means tuning in Hz steps; two dots means tuning HAM bands only (very fast!). Pressing TS again moves the dot to the 1 kHz figure. And keeping TS pressed at this position give you a menu to alter the step size from 0.1 to 100 kHz. Press TS again to return to tuning mode. There's more -- pressing TS again puts the radio in 10 Hz tuning (the dots disappear). Keeping TS pressed in this tuning mode gives you one Hz tuning, which is very smooth! In collaboration with the 250 Hz filter and IF shift, I have found this very useful to steer just enough away from a QRO station and still hear the QRP signal I was listening to. Very nice!

At the beginning of this review I said I was excited about using this radio as a base-QRP station. The reason for this can be found in the ICOM manual. Clearly indicated are the locations of three pots that can be used to tweak this little marvel to get real QRP power! When I got this rig home, the first thing I did was open it up and start tweaking those pots to see how low it would go. If you're a milliwatter, you can go all the way to zero Watts (real QRPp)! Although power adjustment from the menu is continuous, there are actually eleven settings: Low, 1 to 9 and High. Monitoring the power with a QRP power meter (e.g., Oak Hills Research WM-1) while adjusting the power from the menu shows no sudden jumps or other quirks. My highest power setting is about 20-25 Watts and lowest about 500 milliwatts.

With this low power output, I have found no awkward behaviour when transmitting nor in receive. This is what I think will make the IC-706 a most wanted radio by the QRP addict who likes some "big rig" comfort when she/he gets home after a hiking trip with a favourite "no frills" portable-homebrew-kit-but-still-rolled-my-own radio. The extra power (about 20 Watts) helps when the propagation is poor. I mean, I watch what I eat, but I like my chocolate too! ☺

You might think I have nothing but praise for this radio, but there are some things that annoy me. Like the fan. When you switch the rig on, the fan immediately starts to work, creating background noise like a computer fan. When you transmit, it starts blowing faster, generating more noise. No doubt ICOM did this for a good reason but it is still annoying when using CW. I would have liked the option to have it switched on only when the rig gets too hot. With my QRP power levels, this baby stays cool. And I mean really cool. The other day I disconnected the fan power lead and left the radio running in receive. When I checked it after a few hours, I noticed that several parts were hot. Not exactly boiling, but hot enough to get me worried and reconnect the fan. Oh well..

I hope this one will be with me for many years. Like I said -- an ideal rig for a QRP fan like me. Easy to use, clear menu's with immediate band access (unlike the TS-50), and good RX and TX (I have received good audio reports on both HF and VHF). Working the QRP frequencies and beyond has been a real joy. It's a pity radios of this kind have too high a current drain to take with you on a hiking trip. Carrying a sufficient battery would be too exhausting! But as a mobile and as a base station, it's a great rig -- make that a great QRP rig!

QRP ARCI AWARDS

Quarterly Awards Column written by Chuck Adams, K5FO

In the January 1996 issue of the Quarterly my explanation of the material was left out, thus its inclusion in this issue of the Quarterly. In the electronic age something was bound to wind up in the electronic bit bucket.

Previous issues of the Quarterly included forms for various awards and in the process I ran out of room, thus an additional form last month was printed that I had created for the WAS award. This form has a column for ARCI numbers, i.e. ones that the other contact will give you either during a QSO or during a contest exchange in one of the ARCI QSO parties. One way to really rack up the states count without a great deal of postage expense for QSL exchanges is to participate in as many QRP ARCI QSO Parties as possible. With ARCI membership numbers that you exchange during the test you don't need to exchange or have all or any QSL cards. Since the ARCI doesn't publish the membership list or numbers you get them direct and they count. At todays postal and printing rates you could spend more than $25 just to get the QSLs necessary for the 50 states to complete the award. It seems there is always one or more stubborn individuals we need a card from for an award. A letter was published in the February 1996 issue of QST in the letters section that I know has already generated quite a stir on the Internet about QSLing. If you do get a card then in the column for the number place the call of the station and photocopy the card. Please do not send me cards for any award. A photocopy is sufficient or a GCR. There is too great a chance for cards to get lost in the postal system. It has not happened yet and I don't want it to either.

Note that you can obtain the WAS award for single mode, single band, 2xQRP where both stations are QRP, and a designated power level under 5W where each contact was at that power level or lower. When I get some space I'll discuss endorsements for the other awards.

Burl A. Keeton, **N5DUQ**, is the first person to reach 5 Band WAS SSB QRP. He did this on 80M, 40M, 20M, 15M, and 10M. Congratulations to Burl on this achievement. We all know how much effort this must have taken over the years.

Also in consolidating the awards information to the computer and cross examination of the data we find that Randy Rand, **AA2U**, has quietly obtained an 8 Band DXCC Award with the following counts on the following bands:

```
80M   107 countries
40M   196 countries
30M   215 countries
20M   295 countries
17M   254 countries
15M   291 countries
12M   226 countries
10M   271 countries
```

and he has 59 countries confirmed on 6M.

His total country count is 317 and he has 1929 band countries. Congratulations to Randy for this fantastic achievement at QRP levels of 5W or less CW and 5W or less PEP SSB.

Now we don't officially have the multi-band awards, but I have printed up on a laser printer an award for these achievements and sent to these gentlemen. I am using the same certificate form that Cam uses for the Contest Awards. I'll have copies of these at Dayton.

Last month I started a listing of the most prolific award that the organization has been doing for almost 30 years. That is the 1,000 Mile Per Watt award, abbreviated in the past as KWM. The first 1,000 mile per watt award was issued in August 1966 (almost 30 years ago) to K7QXG, Bob Peschka. At that time QRP was 100 watts or less, but VK3NC was running only 8W and was more than 8,000 miles away. Todays awards are now done at the 5W or less level. To date we have issued over 1500 awards for the 1,000 mile per watt certificate. It is one that can be obtained by either station or both and requires only one contact to get it. Other awards typically take a number of cards or QSOs to get.

I often get the question and others have discussed just who is doing the work for QRP operation. Most will agree without the receiving station and good ears of the receiving station the contact would not have taken place. The KWM award (as it is usually abbreviated) can be obtained by the receiver by showing proof of contact and the power level of the other station with their QSL showing their power output. There have been many awards done this way and also some QRPers will send in the money with photocopy of received QSL and have the award issued to the other station as a courtesy and as an individual award for a job well done. The CALL, AWARDED TO, and CERTIFICATE TO lines on the awards application in October 1995 issue of QQ should reflect this information. The power level is the lowest of the two stations in QSO to compute the miles per watt value.

As a result of putting the records on the computer I have been able to come up with some interesting statistics on the data that we do have. Assuming that this is a representative cross section of QSOs in the past and through almost three cycles of solar sunspot levels we can break this down. I will spend some time in each issue going over this data.

Here is a breakdown on the number of contacts by band and modes for the CW and SSB:

BAND	CW	SSB
160M	7	3
80M	39	5
40M	195	10
30M	16	0
20M	341	57
17M	3	0
15M	377	78
12M	3	2
10M	130	104

This makes for an interesting table. Below 10M CW is the leading mode in the number of contacts at QRP levels. On 10M there is not that great a difference. As we all know at solar sunspot peaks you can work the world with very little power output levels on 10 meters. It will be interesting to see how this works out in this next cycle. The above table does not include other modes and other bands. At the higher frequencies there is a tendency to use microwatts of power and line of sight distances to achieve very impressive numbers. The Japanese hams lead the field in this area of experimenting.

Here is a table of the greatest distances per watt for the 160M through 2M bands. This are "records" that are in the database. These are not official world records for I know that on 10M there is a 2 Billion Miles per Watt value for a Fireball QSO. And we won't even discuss the records that the US Government agencies in the space program have with communications outside the Earth-Moon system. With this posting I know that I will get a lot of attempts to beat these records and we will probably have to put into place a method for validation which makes it very very difficult for me and the people involved. In this day and age everyone wants to be sure that there is a clean record and valid measurements obtained. Accurate power measurements are sometimes difficult to confirm and get without considerable effort and expense.

BAND[MHZ]	MILES/WATT	CALL
1.8	13,300	GW4AEC
3.5	851,339	AA2U
7.0	1,909,502	AA4XX
10.1	20,727	NWOO
14.0	87,800,000	OK1DKW
18.0	59,380	K4TWJ
21.0	19,250,000	WB6UNH
24.0	2,445	JL1FXW
28.0	218,333,333	K7IRK
50.0	134,200,000	JO1XWH
144.0	87,800,000	OK1DKW

The listings of the KWM in the January issue and within this issue (assuming that I don't get cut out) on the following pages have several columns of data and I have removed some that are in the data base to allow a format that will fit with the font size used. The columns have the certificate number, date in format of year-month-date as a six digit number, station call that the certificate is awarded to, the stations power level (and if not known QRO shown or left blank) and the other station call and power level, the resulting miles per watt (given the lowest power you can calculate the actual great circle bearing distance), band in MHz, mode, and date of qso also in year-month-day.

In the beginning when an individual was awarded several awards in one setting the same number was used and a letter appended. Later, award managers dropped this, thus all numbers now are just that with no appended letters. Makes the information easier to manipulate. There is also another set of numbers, not shown, that are in sequence for the mode and band. I'll summarize these from time to time.

The reason for the date in a single number format was for space and for computer sorting to gather statistics on monthly averages over the years vs. band and solar sunspot data. Something that no one has ever done before. It is another reason why this database is so valuable now and will continue to be so. I will take the data and results as space permits and show in tabular and graphic formats the results of these studies. I think they will make interesting reading and provide valuable insight as to what we as QRPers have done over the years and will continue to do.

In a phone call to the ARRL I found out that they have no records that they could have accumulated over the years from Code Proficiency Certificates. Can you imagine what that would have shown? I have one at 60 wpm for the Samuel F.B. Morse Bicentennal runs and the only one. It would have been interesting to see how many at 55, 50, etc. Anyway, the QRP ARCI has several databases now that will be useful for years to come. Stay tuned for additional information to follow each month. After the KWM data, we'll start in on DXCC, WAS, and WAC awards. These are much fewer in number and will go by in a hurry. So don't let your subscription to the Quarterly slip.

dit dit de K5FO

NR	DATE	TO	POWER	WITH	POWER	MI/WATT	BND	MDE	QSO DATE
94	671203	W3AZR	0.25	K1VJC	0.25	1,800	7	CW	630425
95	671209	WA7CZA	45	W6TYP	0.5	1,100	7	CW	670814
96	671209	WA0FMX	1	YV4AR		3,000	28	AM	671021
97	671209	K7LNS	50	W6TYP	0.5	1,070	7	CW	671104
98	671222	K6LWT	0.09	W6TYP	0.5	5,100	7	CW	671213
99	680113	WA1CQW	50	W8AVB	0.2	2,700	3.5	CW	671216
100	680113	OK2BLH	3	WA1HFN		1,333	14	CW	670831
101	680120	W2SMR	0.7	W4RNL	90	1,043	7	CW	671206
102	680127	DL6CT		TF3MA	1	1,400	21	CW	671207
103	680127	PA0KOR	150	VE1ASJ	0.15	14,700	3.5	CW	000000
104	680211	WB6JNT	1	W6TYP	0.001	360,000	7	CW	680206
105	680211	W7NUN	75	W6TYP	0.5	1,420	7	CW	680131
106	680211	K6URI	5	W6TYP	350uW	191,000	7	CW	680123
107	680211	W6URA	QRO	W6TYP	12.5uW	200,000	7	CW	680126
108	680218	K6KHA	4	UA0KZB		1,000	7	CW	640311
109	680218	WB6WPL	0.412	WA7CZA	20	1,395	3.5	CW	680202
110	680303	WA5BMN/5	0.5	W6TYP	0.5	2,400	7	CW	680213
111	680303	WB2YPA	0.003	WA6ZHD	0.5	800,000	7	CW	680201
112	680303	WA1IOB	1	WA4NBQ	170	1,000	28	CW	680219
113	680303	WA4NBQ	170	WA1IOB	1	1,000	28	CW	680219
114	680303	WA1BEB	0.5	DL8VS	75	7,600	21	CW	661103
115	680309	WB2RBG	10	W0JGG	1	1,175	21	CW	670210
116	680309	WB2RBG	0.25	VE3FZM		1,180	7	CW	671224
117	680309	WA8VOG	0.2MW	WN8VQS		1,200	7	CW	680203
118	680316	W8LAU	10	VK5FM	100	1,000	14	CW	671212
119	680330	WB2YKX	0.5	WA9NKN		1,620	7	CW	680311
120	680427	WA9MFZ	0.48	W4JPV	1KW	1,250	7	CW	670408
121	680428	K1OBT	0.5	W6BRV	300	5,200	7	CW	680327
122	680428	WP38JLL	SWL	WA8MCQ	0.004	2,550	3.5	CW	680409
123	680428	WA0GWC	5	9J2DT		1,660	28	AM	661219
124	680511	W7RZY	200	CE3CU	2.4	2,420	28	AM	590923
125	680511	WA6JPR	0.25	W6TYP	354uW	1,000,000	7	CW	680412
126	680511	W6TYP	354uW	WA6JPR	0.25	1,000,000	7	CW	680412
127	680518	VE3MCI	5	4X4TP	90	1,100	3.5	AM	680404
128	680604	WA8MCQ	0.8	W6BQR	300	2,312	21	CW	680530
128A	680615	WA8MCQ	0.8	W4BJ/4		1,468	14	CW	680604
129	680604	WB4GTI	0.01	WN4GSS		1,000	7	CW	670821
130	680615	WB2YJT	1	K5IZH	75	1,680	7	CW	680629
131	680603	WA2CHE	0.6	W9GAQ	150	1,170	14	CW	680629
132	680703	K8IXU	2.75	K0VQY	0.6	1,180	50	AM	680620
133	680727	WA7HOP	75	K7BPR	0.075	11,600	21	CW	671207
134	680727	WA2BHJ	1	WA5MVC	60	1,000+	3.5	CW	680130
135	680727	G3LXP		LA9PE	0.5	1,480	14	CW	620310
136	680813	G8TK	12	VK7CK	10	1,200	14	CW	480815
137	680813	CT1LN	QRO	YO3FK	2	1,000	28	AM	000000
138	680813	OK1AHI	8	VK3HL		1,000	3.5	CW	651127
138A	680813	OK1AHI	8	VK2IC		1,000	14	CW	670702
139	680813	YO6EX	6	SWL		1,300	7	CW	630222
140	680815	WN4HWG	0.6	W5OWC	100	1,540	7	CW	000000
141	680901	G3VJP	10	VK3RJ		1,200	14	CW	680821
142	680901	G3NOH	450uW	G8AWD		11,666	144	CW	680825
143	680918	WA9UOT	QRO	WA8MCQ	0.12	1,100	7	CW	000000
144	680918	WA8MCQ	0.12	WA9UOT	QRO	1,100	7	CW	000000
145	680930	G3KGP	8	VK6AJ	QRO	1,141	14	CW	670901
146	681019	G3IAR	0.4	OH3MM	50	2,925	3.5	CW	680330
147	681030	K2MFF	0.25	W2DRN	120	1,160	7	CW	000000
148	681130	VE4GV	QRO	WA8MCQ	0.8	1,062	14	CW	681118
149	681203	WA8QAA	0.7	WA1HDP	QRO	1,035	14	CW	681003
150	681214	W1MDO	3	UW0BQ	QRO	1,485	14	CW	681127
151	681214	WA8MCQ	0.8	K7CXB	QRO	2,000	28	CW	681125
152	681227	WA7FYW	0.5	WB6OWS	QRO	1,700	7	CW	681125

NR	DATE	TO	POWER	WITH	POWER	MI/WATT	BND	MDE	QSO DATE
153	681227	WA4UQQ	QRO	WA8MCQ	0.6	1,250	14	CW	681121
154	690106	WA7FKD	400	WA8MCQ	0.8	1,531	14	CW	681122
155	690106	WA8RQQ	0.5	K9IHG/4	200	1,602	7	CW	680907
156	690120	WA5OOB	100	W8AVB	0.2	4,000	3.5	CW	681215
157	690120	ZS6BMD	100	YO4WO	5	1,000	28	CW	680804
158	690130	WA1HDP	400	WA8QAA	0.7	1,085	14	MIX	681109
159	690216	WN6ZRU	75	WA5OOB	1	1,055	21	CW	690116
160	690321	DJ8VY	1	LA2T	QRO	1,100	3.5	SSB	680922
161	690406	KH6SP	1	VK5BS	QRO	5,400	14	CW	690306
162	690406	K4OCE	7	ZL2AFZ	QRO	1,143	14	CW	690302
163	690406	ZL2AFZ	QRO	K4OCE	7	1,143	14	CW	690302
164	690429	WB2HNA	2.7	WB6HFX	QRO	1,062	28	AM	690330
165	690528	CT1MW	QRO	YO7VS	1	1,600	28	AM	690528
166	690620	G3DOP	0.2	F8TM	QRO	1,000	3.5	CW	690406
167	690620	I1BMV	QRO	PY6AT	6	---	14	AM	690529
168	680627	W4CRW	50	4Z4NBS	5	1,180	21	CW	690412
169	690627	4Z4NBS	5	W4CRW	50	1,180	21	CW	690412
170	690627	ZS5QU	QRO	K4OCE	6	1,333	14	CW	681221
171	690627	G3WTJ	QRO	K4OCE	1	3,800	14	CW	690621
172	690708	WA8RPB	1.2	VE6AUR	90	1,208	7	CW	681116
173	690713	ZL2BCJ	QRO	SATLTE	2	12,000	144	CW	SYNCM3
174	690731	WPE5CHD	SWL	W5RER	0.3	8,666	28	--	000000
175	690731	K2GBW	0.4	G3TLX	QRO	8,000	21	CW	680907
176	690814	K8MMZ	55	W4VNE	0.2	1,500	7	CW	690731
177	690814	OK2BPF	12	VK4DU	8	1,705	14	CW	680610
178	690819	W4RNL	90	WB2JYM	0.25	2,720	7	CW	690510
179	690819	WA8MCQ	0.25	WA0CGS	500	2,400	28	SSB	690809
180	690819	WA8MCQ	0.5	W4KNB	180	2,000	14	SSB	690809
181	690903	WA2DVO	0.38	K8JPF	130	1,540	7	CW	690817
182	690917	WA8DEB	0.5MW	WB8AHY	QRO	52,000	50	CW	690222
183	690917	WA8DEB	1MW	K8YVK	30	21,000	50	AM	690216
184	691007	W3CZ	1	W5CRZ	QRO	1,160	7	CW	690108
185	691007	WA7LOP	1	W3LSH	QRO	2,245	28	AM	690927
186	691007	OK2BMF	75	WB2ZGE	1	4,260	21	CW	690918
187	691022	I1BRF	QRO	LU4DD	4	2,075	28	AM	490429
188	691108	K6EIL/2	1.01	K8EEG/0	70	1,064	7	CW	691025
189	691210	WA3GKF	25	K6EIL/2	0.125	1,000	7	CW	691130
190	691210	G2CP	9	VK4ZB	60	1,889	21	CW	680630
191	691210	G2CP	5	VK3MR	150	2,166	14	CW	690309
192	691222	WN8AEX	0.5	W1DIY	150	1,300	7	CW	690510
193	700117	W4CRW	50	DJ6OM/P	3.6	1,178	28	CW	681006
194	700207	K0DYM	275	UI8IZ	3	2,333	14	CW	690402
195	700207	WB4LQV	180	K6EIL/2	0.125	1,800	7	CW	700131
196	700207	WB4GOR	2	W7YTN	QRO	1,417	7	CW	700121
197	700228	W7VJI	QRO	W4VNE	1	1,950	28	CW	700131
198	700430	WA6ABP	0.5	JA5VQ	220	13,400	28	CW	700328
199	700430	WB8BCO	2	WA6YVT	KW	2,320	7	CW	691220
200	700430	EA2CR	1	ZL1AH	QRO	12,500	14	CW	680608
201	700430	EA2CR	0.5	UF6KPE	QRO	8,400	21	CW	680628
202	700430	EA2CR	0.5	KG4DO	QRO	10,400	28	CW	680526
203	700515	W9SCH	5	I1TKK	QRO	1,050	14	CW	700324
204	700610	W5KFN	5	ZL2CH	150	1,460	14	CW	700530
205	700620	WB4GOR	2	WA6JUD	QRO	1,175	14	CW	700322
206	700620	DL4SA	QRO	K6EIL/2	1.6	2,440	14	CW	700606
207	700620	UB5TG	QRO	K6EIL/2	1.4	3,480	14	CW	700610
208	700620	G3APN	QRO	K6EIL/2	1.68	2,025	14	CW	700611
209	700723	W5JKD	0.096	W5TFG	QRP	4,167	1.8	CW	700603
210	700723	3Z8CCC	1	UL7GW	QRO	2,604	3.5	CW	691105
211	700918	WA6HMT	2	W1HRJ	50	1,300	14	CW	700825
212	701128	W7BBX/4	30MW	K8ORD	175	13,667	7	CW	701128
213	710111	WA4QXC	2	W6WLQ	5	1,150	14	CW	700514

NR	DATE	TO	POWER	WITH	POWER	MI/WATT	BND	MDE	QSO DATE
214	710119	W6JXH	150MW	LU1SE	100	45,000	14	CW	710107
215	710119	ZS6YK	5	WB2JYM	QRO	1,600	21	CW	701226
216	710225	W6IEU	5	AX2GR	150	1,400	7	CW	701023
217	710413	W4ZRP	1.6	W7PS	175	1,080	7	CW	710217
218	710421	WA9RAT	QRO	WB2JYM	0.25	2,880	7	CW	681005
219	710422	W5TVW	5	ZL1CO	25	1,540	14	CW	710316
220	710424	OK2PDN	10	VK2OO	QRO	1,000	1.8	CW	690202
221	710428	K6AAW	50MW	W1HRJ	QRO	54,800	14	CW	690413
222	710510	VK3RP	9	WB2JYM	QRO	1,200	7	CW	710214
223	710528	K6GKU	4.75	JA2WP	20	1,188	28	AM	701010
224	710608	K4DGJ/5	1	K7VAY/6	90	1,160	7	CW	701219
225	710625	KL7GLL	75	WA6ADK	1	1,500	7	CW	710614
226	710709	WA9WJS	2MW	WB2ZMO	QRO	26,750	14	CW	710128
227	710728	W6IEU	12MW	XE2OU	75	48,330	7	CW	710703
228	710728	WA7MMM	75	W5JLY	350MW	4,715	21	CW	710610
229	710728	W5JLY	350MW	WA7MMM	75	4,715	21	CW	710610
230	710824	WA3KMY	2	K7JVZ	175	1,042	7	CW	710213
231	710902	K6RB	2.1	KH6HJO	180	1,153	7	CW	710821
232	710902	KH6HJO	180	K6RB	2.1	1,153	7	CW	710821
233	710903	ZL1CO	100	W5TVW	5	1,540	21	CW	710316
234	710906	WB8EDE	75	W5JLY	0.960	1,094	7	CW	710319
235	710929	K8LSB	5	LZ2EE	100	1,025	14	CW	710404
236	710930	CT2AZ	1.6	UW3UO	40	1,656	14	CW	700830
237	711123	WB2NGT	2	W7YTN	QRO	1,200	14	CW	710912
238	711123	W0NTW	5	IT1AGA	70	1,000	7	CW	711115
239	711226	W4EZW	0.360	W4UKA	QRO	2,222	7	CW	711106
240	720310	G8BTB	75MW	G8CVD	30	1,066	144	AM	000000
241	720310	W5TVW	2	KH6AD	QRO	2,070	7	CW	711126
242	720310	WA8KNE/6	1.5	W1PMR	150	1,610	14	CW	711120
243	720316	G3VWK	20MW	GW4AEC	QRO	6,650	1.8	SSB	710525
244	720316	G3VWK	20MW	GW4AEC	10MW	13,300	1.8	SSB	710525
245	720411	VE3FUB	2	F5QF	100	1,750	7	CW	720323
246	720416	WB2MNO	20	F6AID	1.5	2,400	28	AM	720310
247	720428	G4AEZ	10	G3VWK	90MW	2,666	1.8	SSB	720509
248	720606	W4WQW	5	IT1AGA	75	1,000	14	CW	720419
249	720623	WA6UAM	15	WB6LLD	1MW	1,500	1296	CW	720527
250	720719	WB6LLD	1MW	WA6UAM	15	1,500	1296	CW	720527
251	720828	WA6UAM	20uW	WA6LLD	15	75,000	220	CW	720728
252	720828	W4DNI	1.375	G3JVU	QRO	2,713	14	CW	720731
253	720828	K2VIV	1	VK9CC	QRO	9,000	14	CW	720701
254	720828	JH1IFC	270MW	JA2YII	QRO	102,857	50	FM	720429
255	720930	WA6UAM	24uW	WA6OHT	QRO	300,833	144	CW	720809
256	721017	WB5DIZ	900MW	W8TXN	170	1,233	14	CW	720917
257	721020	WB0DEN	300MW	W3EGL/0	20	1,160	7	CW	720408
258	721020	WA5HPV	5	PY3CFN	QRO	1,000	21	SSB	721017
259	721030	WA6DKD	5	ZL2JB	300	1,492	14	SSB	720802
260	721030	K6OVN	2	W2LSN	125	1,225	21	CW	721021
261	721106	WA7RQP	1.8	JH1WIX	QRO	2,611	21	CW	721018
262	721109	WA0OCU	5	ZM2BE	10	1,600	28	AM	721104
263	721120	WA1OFP	2	ON6DX	QRO	1,800	21	CW	721025
264	721120	ON6DX	QRO	WA1OFP	2	1,800	21	CW	721025
265	721120	WA6DKD	5	VK7AK	180	1,600	28	SSB	720408
266	721120	WA6DKD	0.1	WN4ONR	2	23,400	21	CW	700815
267	721213	K8BHG	2	K7ZVA	75	1,085	14	CW	720820
268	721221	WA6KGB	2.5	KG6SW	QRO	2,386	28	AM	721125
269	721221	WA6KGB	2.5	KC4USB	QRO	3,200	14	AM	721204
270	730114	WN2CWS	2	WN6SFY	75	1,395	21	CW	721202
271	730126	WN6SFY	75	WN2CWS	2	1,395	21	CW	721202
272	730126	WA1MKP	1.8	PY1DUB	QRO	2,694	21	CW	720827
273	730126	PY1DUB	QRO	WA1MKP	1.8	2,694	21	CW	720827
274	730127	WN4ZOH	2	WN7STX	75	1,160	7	CW	721114

NR	DATE	TO	POWER	WITH	POWER	MI/WATT	BND	MDE	QSO DATE
275	730129	WA3NZR	7	CR7FM	60	1,178	21	CW	721015
276	730306	WN6UJZ	2	WA1MKP	150	1,350	21	CW	730221
277	730309	WA3GHG/TF	1.74	W4BW	QRO	1,613	14	CW	730222
278	730326	OK3ZMT	4.2	K3JH	QRO	1,048	3.5	CW	710325
279	730327	WA6KGB	2.5	KA6HQ	QRO	2,557	21	SSB	730128
280	730327	WA6KGB	2.5	JA2HNP	QRO	2,182	7	SSB	730206
281	730331	WA3GHC/TF	1.38	WB8HVG	QRO	2,078	21	CW	730311
282	730402	W2GSZ	1.5	XE1FFC	200	1,333	14	CW	720716
283	730420	K4FPF/0	2	WH6IBT	75	1,870	21	CW	730204
284	730430	WA9RLH	80	WB0DEN	50MW	2,500	7	CW	721229
285	730609	WB5IBQ	320MW	W1BMW	QRO	5,250	21	CW	730406
286	730618	G3DPS	600	KV4AD	0.8	5,450	28	SSB	720409
287	730618	WA2FIQ/1	2	K6GG	QRO	1,310	14	CW	730530
288	731027	WB4TNB	1	K7CPC	QRO	1,614	14	CW	000000
289	731027	WB4TNB	1	WA6TYR	QRO	1,308	21	SSB	000000
290	731118	WB4TNB	0.5	VE3EQF	QRO	1,818	28	SSB	730701
291	731118	PA0GG	2.5	W2EEH	QRO	1,500	14	CW	731016
292	731130	WA3NNG	2	VK3JI	150	4,925	14	CW	730408
293	740126	K6QWH	5	VK3JI	150	1,435	21	CW	730603
294	740126	K6QWH	5	ZL3GG/2	130	1,305	21	SSB	730715
295	740126	K6QWH	5	LU5HEN	260	1,233	28	SSB	730902
296	740223	WN7VMG	2	JH1WIX	QRO	2,340	21	CW	731105
297	740316	WN6WKQ	2	WN3URB	QRO	1,100	21	CW	000000
298	740316	K7BD	2.5	ZL1OI	QRO	3,100	14	CW	730627
299	740429	WA8KNE/6	3	VK2ASD	560	2,104	14	SSB	730628
300	740429	WA8KNE/6	3	JA2OCA/C21	QRO	1,573	21	SSB	730705
301	740429	WA3RJS	10MW	W2BNA	40	36,000	7	CW	740130
302	740525	WB6STC	3	VK3ATN	KW	2,666	14	SSB	740425
303	740525	WN2TLQ	0.5	WB4ZOQ	180	1,800	7	CW	740303
304	740525	WB4ZOQ	180	WN2TLQ	0.5	1,800	7	CW	740303
305	740525	G3VWK	5	VQ9HCS	5	1,056	21	SSB	740430
306	740525	VQ9HCS	5	G3VWK	5	1,056	21	SSB	740430
307	740525	W2ECW	2	WN6QFO	75	1109	21	CW	740202
308	740531	WA8KNE/6	3	KV4AD	KW	1,145	28	SSB	740419
309	740704	WB0CGJ	5	9J2BL	300	1,830	28	SSB	731003
310	740704	W8ILC	1	K7RSC	QRO	1,900	3.5	CW	740509
311	740710	WA4CAO	5	VK3BJB	400	2,100	21	SSB	740530
312	740710	VK3BJB	400	WA4CAO	5	2,100	21	SSB	740530
313	740721	K4KJP	2	YU2CDS	90	2,750	21	CW	740314
314	740803	WB0CGJ	5	VK6MK	150	1,600	14	SSB	730608
315	740803	WB0CGJ	5	ZD7FT	180	1,608	21	SSB	740204
316	740908	W0MHK	2	ZL3GQ	15	4,050	21	CW	740216
317	740908	WA1RUY	2	WA7YJX	QRO	1,250	14	CW	740508
318	741013	WN8PJR	2	G4CWN	150	1,887	21	CW	740912
319	741013	G4CWN	150	WN8PJR	2	1,887	21	CW	740912
320	741110	WA8KNE/6	0.5MW	WR6ACF		50,000	144	FM	740805
321	741114	WB2TEN	5	ZL1ADD	100	2,000	14	CW	720223
322	741114	WA8KNE/6	3	JA2VUP	QRO	1,357	21	CW	740327
323	750110	WB9HWO	1.7	WN6SQD	75	1,011	21	CW	780407
324	750211	WB4BUL	3	KH6CF	QRO	1,584	14	CW	750103
325	750211	WA4BUJ	1	WN6GXQ	75	2,266	21	CW	741224
326	750220	WB4DNQ	1	WA5OLS/5	QRO	1,200	21	CW	750216
327	750413	G3RJV	2	W2AXZ	170	1,700	14	CW	750910
328	750416	WB9HPV	0.4	W7DAZ	QRO	4,125	21	CW	741219
329	750416	JA1BN	1	OA6DX	500	10,200	14	CW	740721
330	750504	WA0AGN	5	JA1OHV	200	1,240	7	CW	741223
331	750505	W2ECW	2	W6PRP	QRO	1,174	21	CW	740311
332	750605	WA4BUJ	2	I5CZE	QRO	---	14	CW	750505
333	750715	K4KJP	2.5	KH6HNT	150	1,710	14	CW	750602
334	750728	JA2BRM	4.8	WA6IVM	KW	1,062	7	CW	750906
335	750728	WB9MAO	1.5	DL6PE	100	2,984	21	CW	741003

NR	DATE	TO	POWER	WITH	POWER	MI/WATT	BND	MDE	QSO DATE
336	750811	WB5FKC	0.48	WA6HXR	100	1,667	14	CW	750720
337	750811	BRS32755	SWL	427AS	5	1,260	14	CW	750419
338	751005	ZF1JH	5	FK0IC	QRO	1,640	14	SSB	741202
339	751005	WA6VNR	5	JA2DQT	QRO	1,150	7	CW	741118
340	751127	KL7ICL	2	K2KUR	2	1,618	14	CW	751022
341	751212	JF1BYK	1MW	JA1VUI	240	5,120	21	CW	750929
342	760112	WA5DGI	2.5	PY7BIN	400	1,900	14	CW	731023
343	760530	JA2BRM	4	UK2PAF	QRO	1,208	14	CW	750413
344	760620	WWA2RHA	5	KC4AAC	QRO	1,600	7	SSB	041276
345	760802	WB8PJR	5	KC4AAC	QRO	1,296	14	SSB	041976
346	760806	WN2JOC	2	KH6RS	KW	2,800	21	CW	740908
347	760806	F5CRK	2.5	WB2FSO	QRO	1,460	14	CW	760420
348	760823	OK1SBA	5	VK5RC	180	2,880	14	SSB	750105
349	760926	WB8KOD	1	W7ZMD	100MW	17,500	7	CW	760822
350	761108	WB5QYH	2	AJ3AA	QRO	1,000	14	CW	760924
351	761110	WB9MBH	1.6	WA6KNG		1,064	14	CW	760926
352	761115	WB5KFC		WA0FQF		35,000	14	CW	760908
353	761115	WA0FQF		WB5FKC		35,000	14	CW	760908
354	770105	WB8OWM	2	F8FE		2,000	14	CW	761009
355	770130	WA4FTJ	1.5	G4CPA	75	2,400	14	CW	761226
356	770207	W8ILC	1	ZL2BT	250	9,500	3.5	SSB	770108
357	770207	W8ILC	1	VK5QI	400	10,500	14	SSB	760807
358	770216	G8IB	2.5	VE3EIM		1,400	14	CW	760821
359	770314	G4BUE	2.5	W2EFI		1,360	14	CW	770219
360	770321	WA3ZXK	2	WA7VKQ		2,045	21	CW	770109
361	770321	WA3ZXK	2.5	WA8WDZ/6		1,595	14	CW	770120
362	770266	WA4IAR	5	VK3JW	300	1,900	14	SSB	770417
363	770622	WA4IAR	5	ZL1BOK	300	1,600	14	CW	770505
364	77075	WA4IAR	5	VK9RH	180	1,650	21	SSB	770526
365	770705	WA4IAR	5	KP6AL	200	1,080	21	CW	770616
366	770705	WA4IAR	5	VK5WO	200	1,807	28	SSB	770402
367	770705	WA2OTC	2.5	G4EUH	180	1,360	21	CW	770528
368	770731	JA1TCV	1MW	JJ1DZX	6	1,300	50	CW	770619
369	770731	WB4ZOJ	3	DJ7YE	500	1,583	14	CW	770715
370	770731	WD4EGN	0.5	YV1NK	200	46,810	28	CW	770708
371	770808	PA0PHK	3	AC4OZF	200	1,567	21	CW	761023
372	770901	JA1SXH	3	LU1AD	60	3,867	21	CW	691113
373	770901	JA4FVV	0.5	JA8CD	20	1,558	21	CW	770619
374	770915	WB3CIJ	2	WA6MON	180	1,050	21	CW	000000
375	771006	W4GBB	5	ZS1JT	300	1,560	28	SSB	770927
376	771006	WD9BMQ	2.5	F6DUK	160	1,520	21	CW	770916
377	771010	WB8YUU	3	DK7UF/HBO	QRO	1,417	14	CW	770403
378	881017	WA4ZXC	50	K8LJQ	0.2	4,750	14	CW	770920
379	771023	WB1CJT	2.5	WB6SBM	180	1,014	14	CW	770925
380	771023	WA2ZWH	5	JA3BVD	200	1,440	14	CW	761022
381	771102	WD9ADE	5	KH6JDM	2	2,100	21	CW	770411
382	771102	WB2RVF	1.5	WA6NUJ	25	1,000	21	CW	771003
383	771114	W6IRA	2	JH3RRA	250	2,650	7	CW	760916
384	771114	W1IRA	50	JA2BN	1.5	3,400	14	CW	770605
385	771125	WA2JOC	2.5	ZL2MM	100	3,600	14	CW	771019
386	771125	WA3YQC	4	JA1AZS		1,602	21	CW	771108
387	771125	WB4ZOJ	3	KH6BYG	100	1,471	7	CW	770403
388	771125	WB4ZOJ	3	VJ2XB	35	3,167	14	CW	771012
389	771213	WA3YQC	5	JA4VQX	100	1,290	14	CW	771209
390	771228	KH6JHS	3	W1HRJ		1,600	7	CE	770129
391	771228	WA3MAS	0.5	W1BOU		1,200	7	CW	770621
392	780106	K4KJP	33MW	VE3JEE	65	29,697	7	CW	771102
393	780106	WA2OTC	3	DK5WL	KW	1,233	14	CW	771127
394	780116	VE1BQQ	3	ZS1Y		2,510	14	CW	771221
395	780116	ZS1Y		VE1BQQ	3	2,510	14	CW	771221
396	780116	QA8V	5	VE11BQQ	3	1,283	14	CW	771013
397	781024	VE7CJF	2.5	JH1WKS	500	1,920	21	CW	771025
398	780202	WA3YQC	5	ZL3AAA	260	1,780	14	SSB	780116
399	780204	WD9APY	2.5	JH1WDN		2,480	21	CW	771005
400	780226	WB7QWA	5	DJ4TR	350	1,040	14	CW	780223

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401	780226	KH6JST	5	PY1BAR	100	1,685	28	SSB	780212
402	280226	WA7LNW	2	KL7IBS	200	1,213	21	CW	780205
403	280226	WB9QPS	2.5	9H1CH	150	2,040	21	CW	771222
404	780311	OA8V	2	9U1SH	50	6,350	28	SSB	751025
405	780311	WB9JXU	5	FO0RS	200	1,140	21	SSB	000000
406	780311	VE7CJF	2.5	VK2AHK	KW	3,200	21	CW	780107
407	780320	K9PNG	2.5	F5IN	QRO	1,648	14	CW	770308
408	780326	N4GR	2.5	F6BWF	QRO	1,604	14	CW	750428
409	780329	K5SN	3	JR1NRP	100	2,100	21	CW	780217
410	780412	WA7NWL	1	WA1WHJ	240	2,200	21	CW	771213
411	780412	WA7LNW	2	JA8AED	100	2,800	21	CW	780402
412	780414	W4GBB	5	VK2AMC		1,950	28	SSB	780409
413	780418	WA2OTC	90	K2SM	0.2	2,250	7	CW	780403
414	780418	WB7VCK	0.85	WB1AOQ		2,941	28	CW	000000
415	780418	K6CWM	2.5	QA2JOC		1,080	21	CW	780402
416	780418	WA5CVM	2.5	ZL1ATW		3,740	21	CW	780330
417	780427	WB9LKC	4	WB4OBP/KH6	200	1,039	28	SSB	780204
418	780503	WWBOQQW	5	ZS2EM	100	1,231	7	CW	780214
419	780503	WA5CVM	3	WD5DEQ/KH6	180	1,333	14	CW	780401
420	780503	WA5CVM	5	SMOAJU	100	1,080	28	SSB	780416
421	780412	WD6CGW	2	JH1WIX	150	2,250	21	CW	770914
422	780412	JH1WIX	150	WD6CGW	2	2,250	21	CW	770914
423	780512	K4KJP	0.3MW	W8LZK	3	2,566,666	21	CW	780309
424	780512	WD8AON	3	IT9DY		1,633	21	CW	780506
425	780530	WA7LNW	3	WB6YWK	.025	2,400	7	CW	780507
426	780613	WA2DAC	2	KJ5OU	50	1,850	21	CW	780330
427	780613	SM5ENX	2	UA0BL	200	1,500	21	CW	771230
428	780623	WB7VCK	1	WA2ALY	10	2,400	28	CW	780409
429	780723	WD8MCN	0.2114	W3OTS	60	1,217	7	CW	780510
430	780723	VE1BQQ	3	VK7AE	250	3,685	14	CE	780508
431	780723	WB6JBD	2	JH7FQK		2,690	21	CW	771013
432	780809	WD9AEF/7	2.5	WB4FMJ	140	1,027	21	CW	780611
433	780822	WD9ENH	2.5	VK2WN	100	3,620	21	CW	780702
434	780822	WB2UNH	1	WA6PWP	200	2,570	21	CW	780729
435	780822	WA2JSG	2	F6EYM		2,030	21	CW	780426
436	780822	JA0KOH	0.24	JA8RBR	20	1,782	7	CW	761015
437	780912	WB2VWS	2	LK2BJQ	75	2,000	14	CW	771013
438	780922	WA2FSW	3	KZ6KU	100	2,630	21	CW	770929
439	780922	AA4W	1.8	JF1XAM	100	3,975	28	SSB	780919
440	780922	JF1XAM	100	AA4W	1.8	3,975	28	CW	780919
441	780930	WA4JJY	5	I8ZJZ		1,020	28	CW	780921
442	780930	WB8BHU	2.5	ON6OX		1,617	21	CW	780803
443	780930	ON6OX		WB8BHU	2.5	1,617	21	CW	780803
444	781006	KB9BS	0.75	KA7ATD	25	3,200	21	CW	780816
445	781106	SM7BNG	2.5	JA8AYN	100	2,480	21	CW	780923
446	781120	WB0WGS	2.5	G6DDS	160	1620	21	CW	780322
447	781126	AB0G	2.5	JH7FQK	200	2,345	21	CW	781010
448	781206	N4EY	5	JA2EDA	100	1,375	28	CW	781007
449	781206	JA2EDA	100	N4EY	5	1,375	28	CW	781007
450	781206	WD0DMN	2.5	JA2BWD	100	2,360	21	CW	280328
451	790102	WA5CVM	5	JJ1HW/4	200	1,360	21	SSB	000000
452	790102	WA5CVM	5	JR1KYC	20	1,350	28	CW	000000
453	790120	WA4BTL	5	ZL3HI		1,622	28	SSB	781031
454	790120	WD4LGQ	5	LZ1TB	140	1,820	21	CW	780316
455	790129	N2GF	2.5	ZL1NG		3,533	14	CW	790117
456	790129	WB7EBN	3	JJ1MHI		2,680	21	CW	790102
457	790129	WD4SAJ	1	KA0CRT		1,050	21	CW	790113

QRP Net Information

1995 ARCI QRP Net Schedule

Net	Frequency	NCS (Alt. NCS)	Day	Time (1)
TCN (2)	14060	W5LXS (K2LGJ)	Sunday	2300 UTC
SEN (3)	7030 3535	K3TKS (AA1OC)	Wednesday (4)	0100 UTC 0130 UTC
GSN (5)	3560	W5TTE	Thursday (4)	0200 UTC
GLN	3560	W1CFI (WA1JXR)	Thursday (4)	0200 UTC
NEN	7040-41	K3TKS (KC1DI)	Saturday	1300 UTC
WSN-80	3558	KI6SN (KD7S)	Thursday (4)	0300 UTC
WSN-40	7040	W6SIY (several)	Saturday	1700 UTC

Notes:

1. Adjust UTC times to one hour earlier when local time switches to daylight savings time unless otherwise noted.
2. TCN remains at 2300 UTC Sunday the year around except on major contest weekends, then it will meet one hour later.
3. If conditions on 7030 kHz are poor, QSY to 3535 kHz at 0130 UTC (0030 UTC Spring/Summer). Please note that 3535 kHz is the Michigan QRP Club net frequency at 0200 UTC (see "Other QRP Nets" listing).
4. Note that in North America, net meets on the evening of the day before local time.
5. Net temporarily inactive.

Other QRP Nets

Net	Frequency	NCS	Day	Time (1)
BC (SSB)	3729	- - -	Every Evening	0300 UTC
MI-QRP	3535	K8JRO	Wednesday (2)	0200 UTC
NE-QRP (SSB)	3855	WA1JXR	Monday	2100 EST
NEIQS	3560	- - -	Friday (2)	0200 UTC
OK-QRP	7060 (3560)	- - -	Sunday	1330 UTC
NW-QRP	10123	N7MFB	Tuesday (2)	0200 UTC
NW-QRP	7035	- - -	Saturday	0730 PST
N.C.QRP	3710	WA4NID (AA4SX)	Sunday	2200 EST
VE-QRP	14060	VE6BLY	Sunday	1800 UTC

Notes:

1. Adjust UTC times to one hour earlier when local time switches to daylight savings time.
2. Note that in North America, net meets on the evening of the day before local time.

QRP ARCI NETWORK MANAGER -- Danny Gingell, K3TKS

Phone: (301) 572-6789
Packet: K3TKS @ WB3FFV.MD.NOAM .USA
E-mail: George.Gingell@bbs.abs.net

Hi Gang-

This is to let you know that the "Green Mountain" series of monobander CW transceivers is ready to go. I'm presently shipping 30, 20 and 15 Meter versions, and 17M and 40M versions are pending. I'll be verifying the 17M version over the holidays; this flavor should be available by December 30th. Due to the interest in 17M here lately, I'll post a report as soon as it's ready. If you hadn't seen earlier postings, here's a summary of GM-series characteristics:

-Monoband Operation
-100 Khz coverage nominal
-High stability
-Heterodyne LO
- Temperature-compensated varicap tuning
- 2.5W output power
- Improved audio- LM380 output
- Effective crystal and front-end filtering.
- Interconnect to controls uses 0.100" headers
- built-in RIT
* Currently available as a Board Kit

High-quality 3.5" x 5.0" PC board
-Double-sided, PTH, masked & silkscreened
-All on-board parts
-Selected crystals
-18-page Manual

* A high-quality enclosure option will be announced shortly. This product will feature a handsome extrusion enclosure with silkscreened front panel legends. The board kit is currently available for $72 postpaid , US and Canada, $75 overseas. Please contact me for further information.

73, Dave Benson, NN1G (Small Wonder Labs)

Problems, Questions, Comments?

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

*__Subscriptions, dues, membership:__ Mike Bryce, WB8VGE; 2225 Mayflower, N.W.; Massilon, OH 44647 73357.222@compuserve.com
*__Techinical articles:__ Ray Anderson, WB6TPU; 3440 Gross Road, Santa Cruz, CA 95062 rander@netcom.com
*__Feature articles and Letters to the Editor:__ Larry Ease, W1HUE; 1355 S. Rimline Dr., Idaho Falls, ID 83401
*__Idea Exchange:__ Mike Czuhajewski, WA8MCQ; 7945 Citadel Drive, Severn, MD 21144 wa8mcq@bbs.abs.net
*__QRP Contests:__ Cam Hartford, N6GA; 1959 Bridgeport Ave; Claremont, CA 91711 CamQRPQaol.com
*__Member News:__ Richard Fisher, KI6SN; 1940 Wetherly St. Riverside, CA 92506 KI6SN@aol.com
*__Nets:__ Danny Gingell, K3TKS; 3052 Fairland Road, Silver Spring, MD 20904 K3TKS@bbs.abs.net
*__Awards:__ Chuck Adams, K5FO; PO Box 181150, Dallas, TX 75218 adams@sgi.com
*__Club Operations:__ Buck Switzer, N8CQA; 65 Gerogia Ave, Marysville, MI 48040 n8cqa@tir.com
*__Club Information Packets: (Include $2):__ Mike Bryce, WB8VGE; 2225 Mayflower, N.W., Massilon, OH 44647
*__Managing Editor, QRP Quarterly:__ Monte "Ron" Stark, KU7Y; 3320 Nye Drive, Carson City, NV 89704 ku7y@sage.dri.edu

QRP ARCI Officers and Committee Chairmen

President / COB
Buck Switzer, N8CQA
654 Georgia Ave
Marysville, MI 48040
N8CQA@tir.com

Vice President
Michael Czuhajewski, WA8MCQ
7945 Citadel Drive
Severn, MD 21144

Secretary / Treasurer
Myron Koyle, N8DHT
1101 Miles Ave. SW
Canton, Ohio 44710

Publicity Officer
Michael Bryce, WB8VGE
2225 Mayflower, N.W.
Massilon, OH 44647

Membership Chairperson
Michael Bryce, WB8VGE
2225 Mayflower, N.W.
Massilon, OH 44710

Awards Chairman
Chuck Adams, K5FO
P. O. Box 181150
Dallas, TX 75218-8150

Contest Manager
Cam Hartford, N6GA
1959 Bridgeport Ave.
Claremont, CA 91711

Net Manager
G. Danny Gingell, K3TKS
3052 Fairland Road
Silver Springs, MD 20904

Board of Directors

President / COB
Buck Switzer, N8CQA
654 Georgia Ave.
Marysville, MI 48040
N8CQA@tir.com

At-Large Member
Jim Fitton, W1FMR
P. O. Box 2226
Salem, NH 03079

Eastern Division
Michael Czuhajewski, WA8MCQ
7945 Citadel Drive
Severn, MD 21144

At-Large Member
Paula Franke, WB9TBU
P. O. Box 873
Beecher, IL 66401

Central Division
Hank Kohl, K8DD
1640 Henry Street
Port Huron, MI 48060

At-Large Member
G. Danny Gingell, K3TKS
3052 Fairland Road
Silver Springs, MD 21144

Western Division
Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620
ki6ds@telis.com

Quarterly Staff

Technical Editor
Ray Anderson, WB6TPU
3440 Gross Road
Santa Cruz, CA 95062

Idea Exchange Editor
Mike Czuhajewski, WA8MCQ
7945 Citadel Drive
Severn, MD 21144

Features Editor
Larry East, W1HUE
1355 S. Rimline Dr.
Idaho Falls, ID 83401

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

QRP Wisdom Editor
Bruce Muscolino, W6TOY
P. O. Box 9333
Silver Spring, MD 20916

Managing Editor
Monte "Ron" Stark, KU7Y
3320 Nye Drive
Carson City, NV 89704
KU7Y@sage.dri.edu

Milliwatting Editor
Bob White, WO3B
8293 Shilling Road
Pasadena, MD 21122
bob_white@ccmail.aerosys.loral.com

QRP Quarterly

Myron Koyle, N8DHT
Secretary, QRP ARCI
1101 Miles Ave., SW
Canton, OH 44710-1241
e-mail: n8dht@aol.com

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