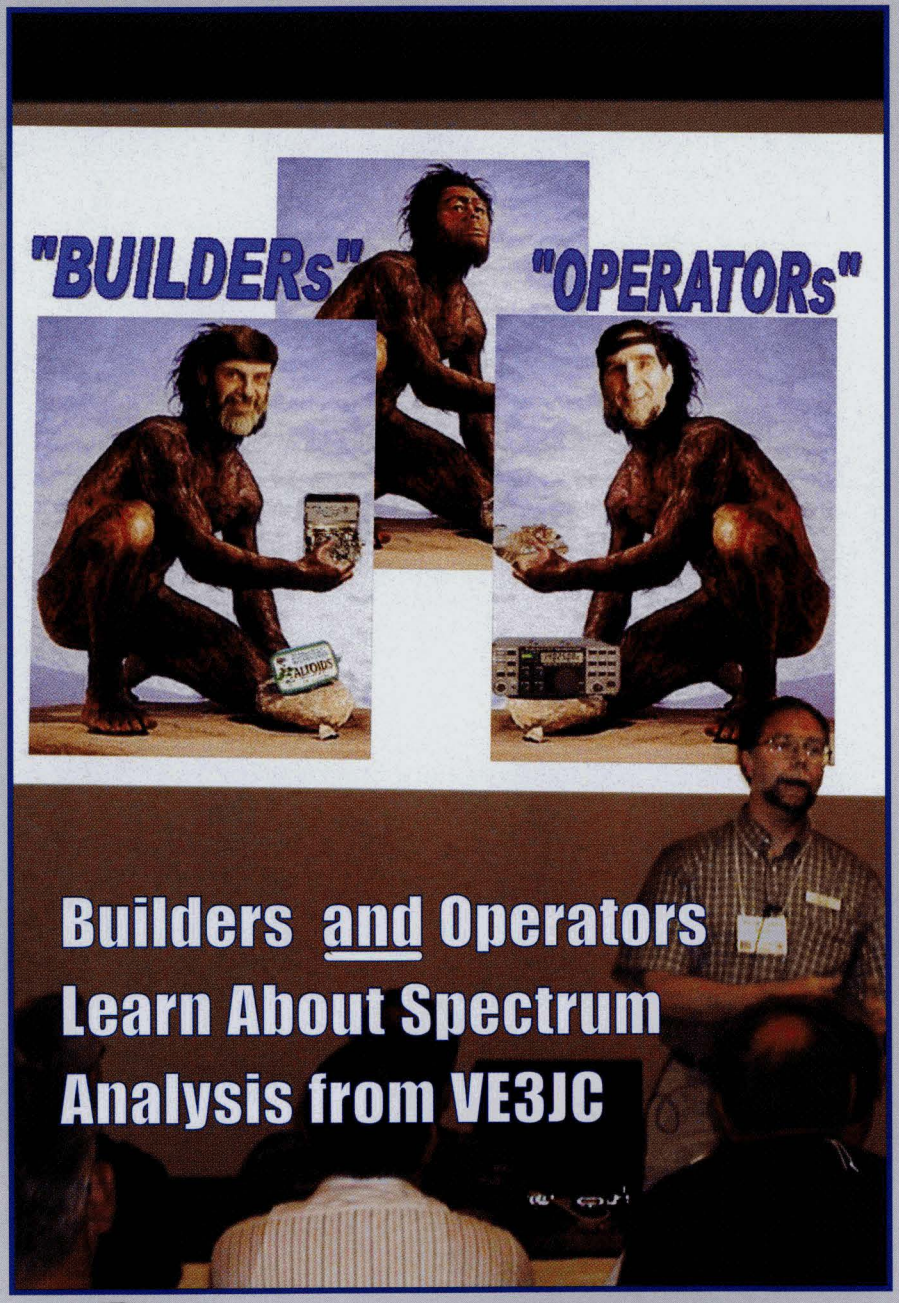
YOUR CONSTRUCTION AND OPERATING QRP SOURCEBOOK

# QRP Quarterly

Volume 44 Number 3
Summer 2003
$4.95

Journal of the QRP Amateur Radio Club International




- Two New Columns: 'The QRP Home Companion' *and* 'Does QRP Apply to VHF?'
- A Dual-Band Version of the Rock-Mite
- AA4BW Tells How to Organize 'Building Day' at Your Club
- Contest Results—Spring QSO Party Fireside SSB Sprint
- QRP ARCI Awards Information and Forms

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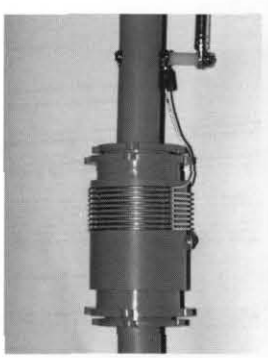

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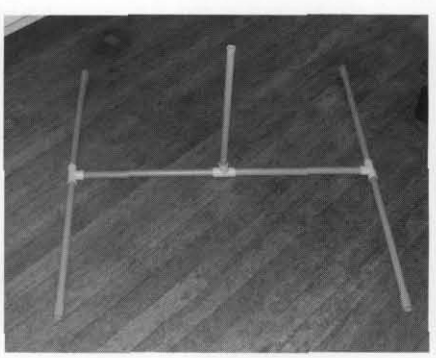

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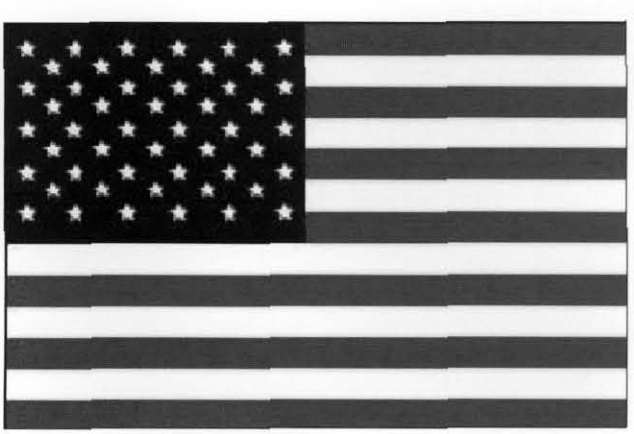

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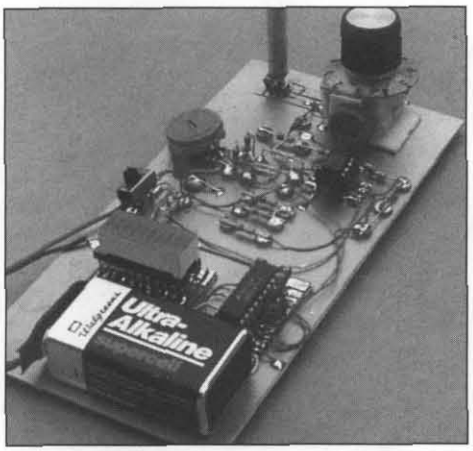
Volume 44 Number 3 – Summer 2003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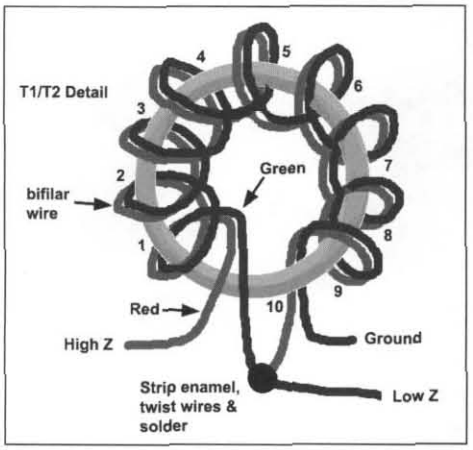


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# From the Editor's Desk


Mike Boatright, KO4WX—Editor ko4wx@mindspring.com


How many people do you know that would spend their annual vacation (or at least a big chunk of it) at the Ramada Inn in Miamisburg (Dayton), Ohio? OK, so there is a cool museum or two there and it is the home of aviation, but some how it just does not have the lure and the appeal of the sands of the Atlantic Ocean or the Gulf of Mexico (affectionately called the Redneck Riviera here in the south).

Yet, here we go, a couple of hundred or so of us, each year, like lemmings returning to the primordial ooze from whence we come. Honestly, I cannot think of anywhere else on the planet that I would rather be for Four Days In May than in Dayton/Miamisburg, Ohio.

We have lots of coverage of FDIM in this issue. You will read about our three newest members of the QRP Hall of Fame. The QRP ARCI Vice-President will give his thoughts on what may have been the best FDIM ever. And for a special treat, we have edited and reprinted one of the articles from the symposium proceedings-because it is not only an interesting technical article, it may be the best visualization of radio waves ever presented.

Besides giving us a peek at the unique FDIM experience, these reflections also demonstrate the true international character of our organization. Of the three new members of the Hall of Fame, none are from the US—one is from Cuba and two are from the UK. Our Vice-President's ham shack sits on the cliffs overlooking the English Channel and France, a few kilometers away. And the symposium paper comes from one of the nicest Canadians you will ever meet, eh?

In my previous editorial, I tossed down the gauntlet, challenging the membership of QRP ARCI to bring forth a new column and four articles from international authors. As you will see, we are almost there! I am grateful to everyone who pitched in to make this issue happen, especially those that fought the whims of time zones and languages to make their contribution.

Like every organization that has been around as long as QRP ARCI, transitions must always happen, and *QRP Quarterly* is not immune. With some sadness, we say goodbye to Joe Everhart, N2CX, George Heron, N2APB, and Joel Denison, KE1LA, who are moving on to write for other publications. On behalf of the entire *QRP Quarterly* staff, I wish them well in their new endeavors, and a very special "Thank You" to Joe, N2CX for giving us his penultimate "Test Topics and More."

I am very pleased to welcome Bob Witte, KØNR, and Anthony Luscre, K8ZT, to the *QQ* staff as regular columnists, and Mike Fletecher, KL7IXI/7, who returns after a few months' hiatus with his "QRP Clubhouse" column. Bob approached me this spring wondering if there might be interest in discussing VHF QRP operations. "Absolutely," I said; so now I need you all to give him feedback and ideas on interesting topics related to QRP, as like any of us, none of us can do it alone.

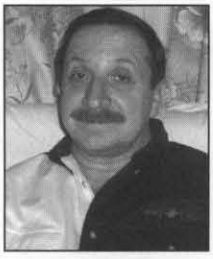
Anthony, K8ZT, is well known to many as an accomplished author for the ARRL 'Members Only' Amateur Radio News. He has been writing about the fun of QRP operating for quite some time, and I know that you, as I, will be looking forward to each new installment of "The QRP Home Companion."

Finally, where would we be without the *QRP Quarterly* staff? You can chock up an editor's first issue to his predecessors, but I will tell you that this one would not have come together were it not for a lot of hard work by Larry East, W1HUE, John King, KB3WK, Randy Foltz, K7TQ, Gary Breed, K9AY and Mike Czuhajewski, WA8MCQ. Words simply cannot express my gratitude to these fine gentlemen for all of the tremendous effort that they have put forth to make this issue happen!

*—72 de Mike, KO4WX*

# From the President

Joe Spencer—KK5NA kk5na@quadj.com



Well here it is the Summer Issue and time for Field Day again...one of my favorite QRP events. I hope your FD was great fun!

We had another fantastic FDIM this year in Dayton. Thanks go out to Tom Dooley, his staff and all who made it happen and attended.

We have added three excellent members to the QRP Hall of Fame this year. They are Arnie Coro, CO2KK, Graham Firth, G5MFJ, and Tony Fishpool, G4WIF. These three hams were picked out of a group of other fine nominees. You should find a more detailed account elsewhere in this issue of *QQ*. Our Hall of Fame continues to grow as does our hobby with fine representatives like these.

I am pleased to see the "American QRP Club" form out of two very excellent clubs (NJQRP and NORCAL QRP) and wish them well in their endeavor.

The management of QRP ARCI is pleased to announce that Mike Boatright, KO4WX, will stay on as our editor of *QRP Quarterly*. He is already making this excellent magazine better!

We also have a new Secretary/Treasurer, Jack Nelson, K5FSE, who is replacing Mark Milburn, KQØI . Mark, we wish you well in your retirement from QRP ARCI and thank you most heartily for your many great years of service to QRP ARCI and to QRP in general.

Tom Owens, WB5KHC, has become our new certificate manager, and is already receiving compliments on his new designs and fine work.

I would like to give a special thanks to Chuck Carpenter, W5USJ, for his work on the CDROM version of the *QRP Quarterly* for the visually impaired, and to Mike Duke, K5XU who did the Braille label work on them. This project was initiated by Mike Goins and has been very beneficial to many of our members.

Another project that has benefited us and QRP in general is "The QRP-L CD Volume 5." This project was based on an idea of John McDonough, WB8RCR (who did the work) and Jim Stafford, W4QO (who volunteered a method of distribution). John made a compilation of posts from the QRP-L listserve, put onto a CD-ROM and Hank Kohl, K8DD has set up a process to distribute it. The CD is now available though the Toy Store. I understand they were popular in Dayton.

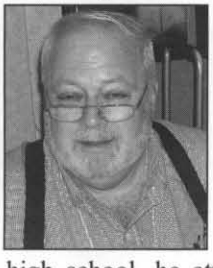
As always, I urge you to continue to enjoy the great fun and the camaraderie of QRP. By doing so, others may see and perhaps want to join in as well. Many talk about great QRP experiences...but being a good example of the QRP Spirit makes a more lasting impressions.

*—72 Joe KK5NA*

# Announcements

### New QRP ARCI Management Team Members

**Secretary/Treasurer—Jack Nelson, K5FSE**



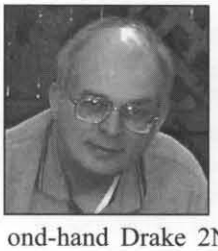
Jack Nelson, K5FSE, takes over the reigns of Secretary/Treasurer of QRP ARCI from Mark Milburn, KQØI. He was first licensed sometime in 1959 or 1960 as KN5FSE while still in high school in Dallas, Texas.

From 1961-1963, he operated as 5A2TS, from Tripoli, Libya, where his father worked with Mobile company. After graduating from high school, he attended the University of Texas in Arlington before serving in the Marine Corps from 1967-1970 as a KC-130 radio operator and loadmaster.

Jack works for Home Depot's corporate office in Atlanta, and he and his wife, Charlotte, live in Cumming, GA. He is an active member of the North Georgia QRP Club and after 43 years as a ham, he attended his first FDIM (and Dayton Hamvention) this spring. In addition to amateur radio, he enjoys woodworking, fly fishing and raising purebred Birman cats. Contact information is:

Jack Nelson
1540 Stonehaven
Cumming, GA 30040
jack.nelson@mindspring.com

**Awards Manager—Tom Owens, WB5KHC**



The new QRP ARCI Awards Certificate Manager is Tom Owens, WB5KHC. He was originally licensed in 1973, as WN5KHC while attending East Central State College in Oklahoma, pursuing a BS degree with double majors; chemistry and math and a minor in Computer Science. His first rig was a second-hand Drake 2NT and 2C receiver into a homebrew multiband dipole hung between trees in Pecan Valley south of Ada, Oklahoma.

Although he never earned WAS, WAC or worked a single DX station from that QTH, he did have fun, learned to love CW, and earned his ARRL 30 WPM Code Proficiency while still a Novice—one of his prized certificates that now hangs on his wall.

Like many of us, career got in the way in the way of active operating for many years, but he did keep his license up. Then, like most of us, he returned to his favorite hobby and discovered QRP. He is an active member of FISTS, QRP ARCI, the Adventure Radio Society and the Flying Pigs International QRP Club (#253-OO).

Tom is married to Sue, AD5JS and they share a beam antenna in Irving, Texas (life is good when you can share a beam). He is an ex-Marine, Vietnam Vet, and was a Presidential Ceremonial Guard, Marine Barracks 8th & I SW, Washington DC, in 1969.

Tom's contact information is:

Tom Owens
1916 Addington Street
Irving, Texas 75062-3505
wb5khc@2hams.net

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### QRP ARCI Operating Awards

The objective of the QRP ARCI Operating Awards Program is to demonstrate that "power is no substitute for skill." It encourages full enjoyment of amateur radio while running the minimum power necessary to complete a QSO and thereby reducing QRM on our crowded bands. QRP is defined by the club as 5 watts output CW and 10 watts PEP output SSB. The following awards are available to any amateur operator.

**1000 Mile Per Watt (kM/W)**

The 1000 Mile Per Watt award is issued by QRP ARCI to any amateur transmitting from, or receiving the transmission of, a QRP station such that the Great Circle Bearing distance between the two stations, divided by the QRP stations' power output equals or exceeds 1000 miles per watt. Additional certificates can be earned for contacts on different modes and bands.

**WAS-QRP**

The QRP ARCI WAS QRP award is issued to any amateur for confirming QSOs with stations in 20 or more of the 50 states of the USA while running QRP. Endorsement certificates are issued at 30, 40 and 50 states confirmed.

**DXCC-QRP**

The QRP ARCI DXCC-QRP award is issued to any amateur for confirmed QSOs with 100 ARRL DXCC countries while running QRP.

**QRP-25**

This QRP ARCI award is issued to any amateur for working 25 members of QRP ARCI while those members were running QRP. Endorsement certificates are offered for 50, 100 and every 100 thereafter. To apply send list (note that QSLs, eQSLs, or email confirmation are required for this award) of members worked. List should be in QRP ARCI member number order.

**Applying for QRP ARCI Awards**

The fee for all awards or endorsement certificates for W/K amateurs is $4.00 US or for non-W/K, $5 or 10 IRCs. Make checks or money orders (preferred) payable to Thom Durfee, WI8W (QRP ARCI Awards Manager). Cash is acceptable, but is sent at your risk. For the 1,000 Mile Per Watt award, if you would like an award certificate sent to the ham at the other end of the QSO (the one with the good ears who made your QSO possible), please enclose an additional $4.00 (or $5/10 IRCs).

QRP ARCI will accept as satisfactory proof of confirmed QSOs and that the QSLs/eQSLs are on hand ("GCR-General Certificate Rule"), as claimed by the applicant, if a list of QSOs is signed by: (a) a radio club official, *or* (b) two amateur radio operators, General class or higher, *or* (c) a notary public, *or* (d) a CPA. If none of the above are readily available, a photocopy of both sides of the QSLs is OK. If you must send QSLs, include postage for their return. Note that QRP ARCI is not responsible for lost or damaged QSLs.


The QRP ARCI Awards Program will accept as satisfactory proof for any of the club awards a QSO with a club member confirmed by an QSL, or eQSL (and only for QRP-25 awards, simple email confirmation may also be used) showing the details of the contact. The QRP ARIC membership number need not be shown on the QSL for QRP-25 awards since member numbers are published online at http://www.qrparci.org/lookup.html. You must, however, note the membership number of each contact with your application. GCR should be used for awards involving membership numbers.

Endorsement certificates are available for a) One Band, b) One Mode, c) Natural Power, d) Novice and e) Two-way QRP if log data so indicates.

All QSOs for awards requiring multiple contacts, e.g., WAS, DXCC, WAC and QRP-25, must be made within a 50 mile radius. This means you cannot start WAS in Virginia and finish it after moving to California.

*Application forms are printed in this issue on page 61—make a photocopy of the page to submit for your own awards.*

## On the Cover

Kicking off the 2003 Four Days In May Symposium is John Cumming, VE3JC, with his presentation, "Making Waves: A QRP celebration of Spectrum Analysis." Assisting John are QRP Hall of Fame members, the Rev. George Dobbs, G3RJV (left) and Ade Weiss, WØRSP (right)—or at least, reasonable facsimiles of the same. See John's symposium proceedings paper, beginning on Page 20.

*—72 de Mike, KO4WX*

# Idea Exchange

## Technical Tidbits for the QRPer

Mike Czuhajewski—WA8MCQ wa8mcq@comcast.net

**IN THIS EDITION OF THE IDEA EXCHANGE:**



### Quickie Bargraph Meter

Although he will be moving his Test Topics column to the American QRP Club's new *Homebrewer* publication, I am pleased to report that Joe Everhart, N2CX, intends to continue submitting his endless string of Technical Quickies to the Idea Exchange. Here's #46 in the series—

Back in the "dark ages" before digital techniques were common, analog meters were the inexpensive displays of choice for electronic equipment. They combined both a numeric readout and an almost intuitive relative indication that was well suited to front panel monitoring. Now these analog meters have been replaced almost entirely by digital displays. This new breed is often less expensive, more rugged and provides added sophistication. For simple equipment though, fancy digital displays are overkill.

One example familiar to QRPers is the common field strength meter. It is used to give uncalibrated relative radiated RF readings for antenna adjustments and hidden transmitter location. What's important for its display is to show a relative indication of field strength rather than an exact numeric value.

The recent (2003) NJQRP Atlanticon project, the Sniffer (Figure 1) is just such a device. It provides tunable high sensitivity monitoring in a small low-cost circuit. You can find more detail by following the "Sniffer" link at www.njqrp.org.

Thanks to good will and masterful economical parts locating by Doug Hendricks, KI6DS, the club was able to provide the kit at low cost. One of the key low-cost components was a 200 µA analog meter. But all good things must end and the meter deal turned out to be a one-shot event.

The replacement metering solution is not as simple or economical but has the advantage of retaining a user-friendly relative display using components that are readily available. Figure 2 is a Sniffer Breadboard with a bargraph display. It displays the output reading by lighting a series of LED elements in a 10-element array. When the reading is at its minimum only the left-hand LED lights and more illuminate successively for higher field strength values. While the reading granularity is only one-in-ten it still offers a convenient sliding scale indication to indicate the monitored signal strength. And the IC driver chip and LED display device can be purchased from DigiKey and other mail order sources. Figure 3 shows the schematic diagram.

The analog meter used for the Sniffer has an internal resistance of about 1000 ohms so it will have a 200 mV drop for full-scale deflection. (Analog meters are designed to have only a 150 to 200 mV


**Figure 1—The NJQRP Sniffer with analog meter.**

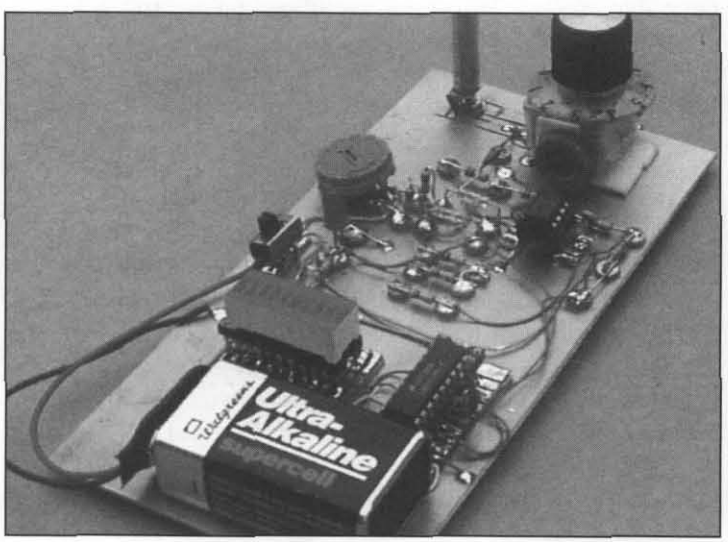



**Figure 2—The Sniffer with LED bargraph (above battery).**

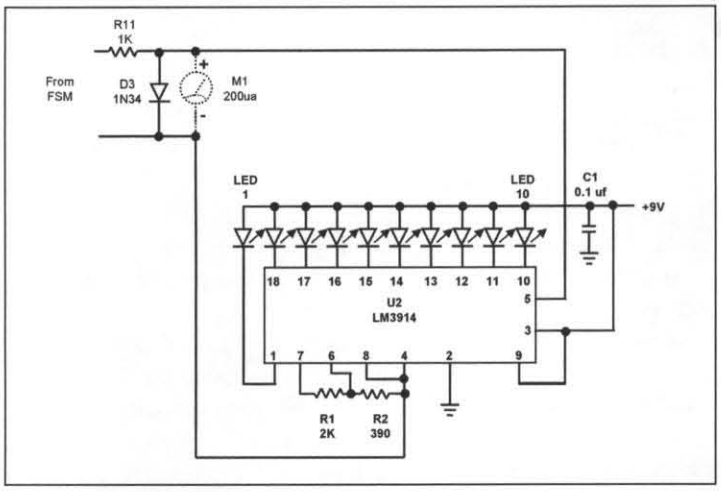



**Figure 3—Schematic of the bargraph display.**

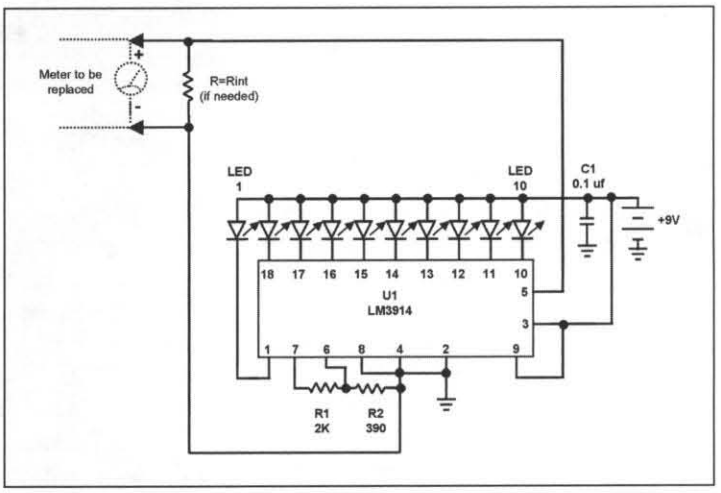



**Figure 4—General meter replacement.**

drop at full-scale to offer minimal introduced circuit error when used for series current measurement.) So the bar-graph display needs to be designed to show "full-scale" deflection with this maximum input voltage. For complete theory of operation for the LM3914 driver IC refer to the National Semiconductor data sheet at http://www.national.com/ds/LM/LM3914.pdf. For purposes of this Quickie it's enough to know that there is an internal voltage reference source that produces about 1.25 V that can be used to set the voltage required to light all of the LEDs. This voltage is divided internally into 10 equal steps to produce a 10 bar display. R2 sets the voltage between pins 6 and 4 to set this maximum value of about 200 mV.

For the Sniffer application, the bargraph meter acts as a voltmeter rather than an ammeter so it simply connects where the microammeter would have been since the Sniffer output is really voltage rather than current. In fact the series resistor R11 and parallel diode D3 needed to protect the analog diode can be removed to provide added sensitivity when using the bargraph display.

The circuit needs minor changes to use as a meter replacement. This is shown in Figure 4. Assuming that the meter being monitored has the same internal resistance and voltage drop, the circuit can be connected in place of the meter. Resistor Rm produces the 200 mV level needed to drive the bargraph display to "full scale." Note that this circuit uses its own 9-volt supply so the circuit common "floats" with respect to the circuit being monitored and pins 4 and 8 of the LM3914 chip connect to the bargraph circuit common connection.

The configuration needed to power the bargraph display from the monitored circuit supply requires some changes that vary from application to application. If you want to use it this way drop me a note with the circuit in question and I will try to give advice on how to do this. E-mail is the easiest way to do this. Send the e-mail to me at n2cx@voicenet.com. If you want an exchange by snail mail, send the info to me at the address listed at the end of this column and please include an SASE for the reply.

But, as they say in TV ads, just wait—there's more! The same bargraph display chip can be used by visually impaired hams in an "audible bargraph display." An earlier Joe's Quickie from the Idea Exchange column in the July 1999 *QRP Quarterly* presented a simple audio oscillator capable of directly driving a loudspeaker. Its tone frequency was set by a single resistor so by changing this resistor you can vary the pitch. The LM3914 chip can be used to switch resistors instead of powering LEDs. The resultant circuit as applied to the Sniffer is shown in Figure 5. Transistor Q1 forms a blocking oscillator using feedback from transformer T1. Capacitor C2 provides signal coupling and DC isolation. Resistors R3 through R12 are switched by U1 so that the oscillator's pitch varies from about 300 Hz to 3 kHz. Momentary pushbutton switches can be added across the R3, R8 and R12 to give operator-selectable tone references for low-, mid- and full-scale.

The audible bargraph display schematic shows the configuration to replace the Sniffer analog meter. Naturally the audible bargraph circuit can be used as a replacement for an analog meter as with the visual version. As mentioned above, contact me for advice for your particular application.

*WA8MCQ note*—After he submitted the article, Joe made these additional comments by e-mail: "As for the 3914, I've had a love/hate relationship with it since it first came out over 20 years ago. It is very handy and I've designed it into a number of products at several of my jobs. What I do not like is the high current drain needed for the LEDs. The 'single LED at a time' mode is power conservative but I don't like that display."

As Joe indicates, the chip has two different modes; the one he

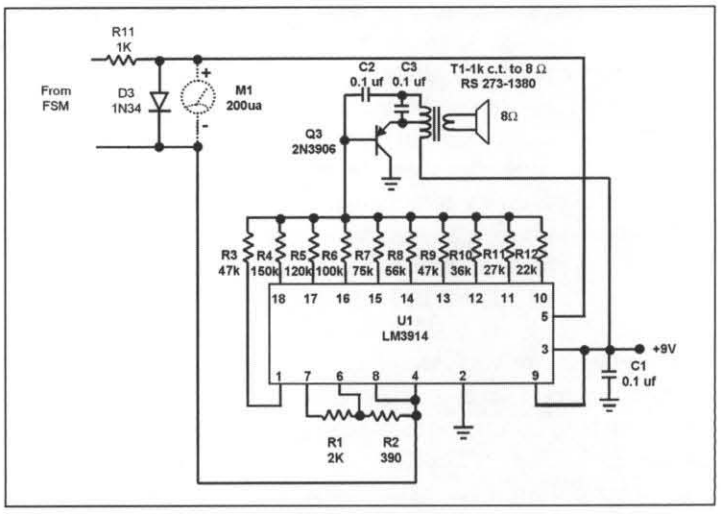



**Figure 5—Audible Sniffer "bargraph" display.**

uses is bargraph mode, in which an increasing number of LEDs are turned on as the voltage increases. Thus, as the input voltage increases, so does the amount of current drawn by the display. This can lead to shorter battery life. In the other mode, only a single LED is turned on at any time. As the input voltage increases, the current drawn by the display remains at a constant low value. Different LEDs are turned on, one at a time, in a "moving dot" display. This doesn't have the same intuitive feel as a bar of lights that changes length with input. The choice is up to the builder—minimal current draw versus the more intuitive display.

Pin 9 controls the display mode. When tied to the positive supply line (pin 3), it selects bargraph mode. If multiple chips are chained to give bargraph displays of 20 or more LEDs, tie pin 9 on each one to pin 3. To choose the moving dot display, leave pin 9 open if only one chip is used. If using more than one chip for a larger dot display, consult the data sheet (under Mode Pin Use in the Functional Description) for wiring details.

*—Joe Everhart, N2CX*

**HW-8 VFO Tuning Capacitors are Available**

I'd long ago given up hope of finding an exact, drop-in replacement for the VFO tuning capacitor in the HW-8. Every now and then someone asks how to fix the plates on theirs, since they sometimes fall off the shaft. (The problem is caused by the amount of torque that the reduction drive can supply, as explained below, and continuing to turn the knob after the capacitor hits the end stops.) Although they can be put back in place it can be a pain and may not last forever, and it would be better to have a replacement capacitor.

Suddenly, like a bolt out of the blue, I got e-mail on 3 April 03 from Larry Baker, WB5OFD (wb5ofd@wcc.net), telling me that he tracked down the company that made them—still in business—and found that they can still supply the capacitor. He really went beyond the call of duty in tracking them down, and HW-8 owners will be grateful for years to come.

And you don't have to own an HW-8 to take advantage of this, since the capacitor can be used in any VFO that you might want to build. Here's his info—

For anyone with an HW-8 collecting dust because of a broken VFO tuning capacitor you may take heart, an exact replacement is available.

I recently purchased an HW-8 in which the rotor plates had become detached from the tuning shaft. BIG PROBLEM. Or, at least I thought so. This HW-8 was destined to become a spare parts donor. After removing the capacitor from the case I noticed the Heathkit part number 26-152 stamped into the frame, as well as the letters ASP*7703.

After a few days of attempting to remember (talking with some old timers) or discover (search the web) who or what ASP stood for, I got lucky.

ASP stands for American Steel Packaging or American Star Products depending on what they manufactured and when. As you can see from above, 26-152 ASP*7703 is a Heathkit part number and a manufacturer code.

ASP is now known as Oren Elliot Products. They are located in Edgerton, Ohio, and their plant facilities have been producing capacitors since 1925. They are the largest domestic manufacturer of air-dielectric variable capacitors. Their web site URL is www.orenelliottproducts.com.

With thanks to Mr. Steven Elliot I was able to obtain the following information:

The VFO tuning capacitor in the HW-8 is a model NS-51, with direct drive, and two rotor and two stator blades with a 0.032" air gap. It has CCW rotation, mounting holes tapped for 6-32 threads, with a trimmer and copper stator blades. This capacitor has a range of 5.2 pF to 15.1 pF. The trimmer can add 2-15 pF to both the minimum and maximum.

This capacitor, as well as others, was manufactured for the Heathkit Company product line over many years.

Mr. Elliot was also able to shed some light on how this capacitor could be easily damaged. The vernier drive on the HW-8 is a reduction drive (planetary) with a probable output torque of about 100 inch ounces. The 26-152 can only stand about 20 inch ounces of pressure (at the end of the stop) before succumbing to damage. You would only have to exert an input torque force of about three inch ounces on the VFO knob, with the capacitor at the end of its rotation, before possible failure.

I purchased the last 26-152 that was still in stock. However, the good news is that Mr. Elliott can provide a newly manufactured replacement capacitor, identical to the original 26-152. Contact him at: Oren Elliott Products, telephone (419) 298-2306, fax (419) 298-3545, or e-mail: oep@bright.net. Their postal address is 128 W. Vine St., PO Box 638, Edgerton, OH 43517 USA.

Current pricing is $14.00 for one capacitor; $11.50 each for two capacitors; and $9.50 each for five capacitors.

OEP also has a slightly different capacitor that may be suitable for use on the HW-8. It has the same capacitance value; however the shaft is 0.25 inches longer and it has a built-in 8:1 planetary reduction drive unit. This acts as sort of a viscous slip clutch, slipping when the capacitor reaches its minimum or maximum rotation. Use of this capacitor would help prevent damage as described above but will necessitate a number of changes to the original Heathkit design. A new mounting bracket would be required as well as ensuring the VFO dial markings track correctly since this shaft will rotate 8 times faster than the rotor. I will experiment with this very soon and determine if it is feasible.

If anyone needs an HW-8 VFO tuning capacitor, contact Mr. Elliot and request a direct drive, 26-152 replacement. Please be sure to thank him for supporting QRP ARCI and hams in general.

*—de WB5OFD*

***HW-8 Handbook*, Second Edition is Now Available**

This collection of mods for the Heath HW-7, -8 and -9 has been around in one form or another since the late '80s and Mike Bryce, WB8VGE, has been doing it since about 1990. Originally known as the *Hotwater Handbook*, Mike changed the name to the *HW-8 Handbook* during one of the revisions. The problem was that some people saw the name Hotwater and thought the book was devoted to the entire HW series of Heath rigs, commonly referred to as the HotWater 12, HotWater 32, etc.

It's been a while since the last revision, but now he has another one in the works and said it would be available starting in May, at Dayton. He asked me to post his announcement on the QRP Internet lists, which I did.

PS—I recently discovered that Mike now has a second web site in addition to the one for his solar energy business. It's called The Heathkit Shop, and contains

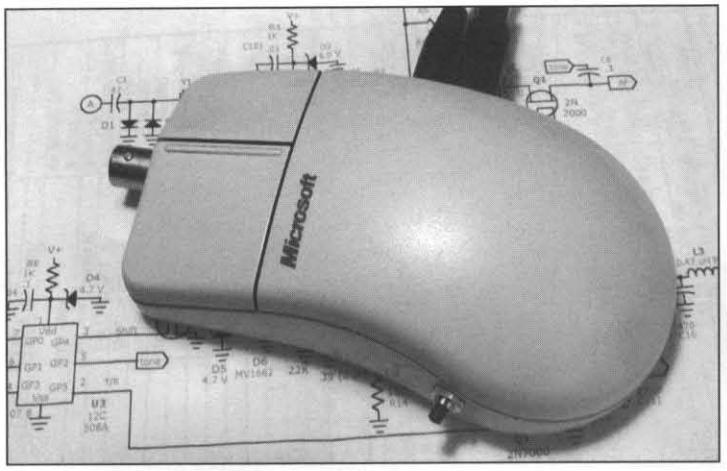



**Figure 6—The KL7R Mitey-Mouse.**

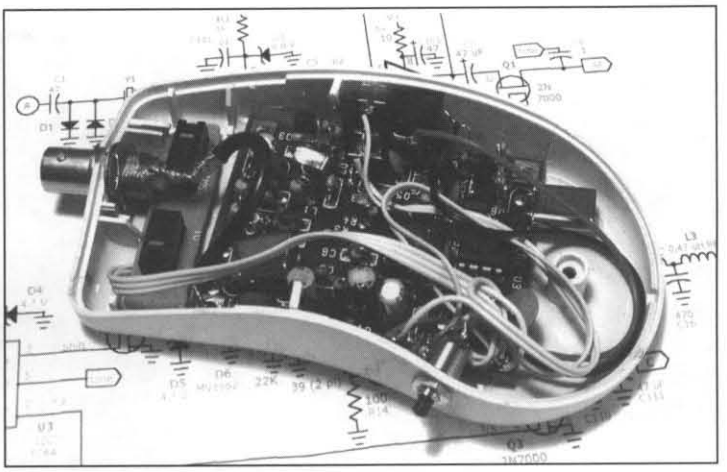


**Figure 7—Inside the Mitey-Mouse.**

info on some Heath ham radio products, with more to follow. (It already has a good article on working on the HW-8.) I'd recommend checking back on it every now and then since I expect it to grow quite a bit as time allows. The URL is given later Here's the WB8VGE announcement:

The second edition of the *HW-8 Handbook* will be ready by Dayton 2003, and is a complete rewrite of the first edition. It's 104 pages long and spiral bound so it will lay flat on the table. There are lots of photos and schematics in it. I've included a LOT more stuff for the HW-7, and a new DUAL RIT mod for the HW-8. There are complete PC board patterns and part overlays for the HW-7, HW-8 and HW-9.

I've also included all the factory service updates from Heath. There are full length articles in it about troubleshooting. There are some new mods and I kept the best of the old ones. Spread throughout the book you'll find "Heathtips."

The book is printed on 60# ultra white paper, with embossed cover. It looks great!

And the best part? It's only $15 plus shipping, which is $4 for priority mail in the US.

The files are at the printer as I write this. The drop dead date is April 15; the books will be ready by then [*they are—editor*].

You can order your book now, using MasterCard or Visa. Your card will NOT be charged until the book ships.

Order toll free at 1 888 476 5279.
Mike Bryce WB8VGE
SunLight Energy Systems
e-mail prosolar@sssnet.com
http://www.seslogic.com
http://www.theheathkitshop.com
955 Manchester Ave SW
North Lawrence, OH 44666 USA

Make check/money order out to SunLight Energy, not to the Heathkit Shop, which is part of SunLight Energy Systems.

*—de WB8VGE*

**Some Interesting Rock Mites**

The Rock Mite is a minimalist crystal controlled CW transceiver sold in kit form by Dave Benson (K1SWL) of Small Wonder Labs. It was introduced to the public in the April 2003 issue of *QST*, although it had been very well known and popular in QRP circles for months before that. (And yes, it was designed so that it can fit into the ever popular Altoids tin.)

**The web site—**

Rod Cerkoney, NØRC, has a web page devoted to it, called The Rock Mite Files. It has a variety of material about the radio ranging from pictures to modifications to some supplemental information from Dave Benson. The URL is:

http://www.radioactivehams.com/~n0rc/rm/

That takes you directly to the Rock Mite section. Click on the various highlighted sections for details. You can also view pictures submitted by various people, showing off their Rock Mites. With many web pages you can click on pictures to get larger versions for easier viewing. In this case, clicking on the pictures takes you to various links giving details and sometimes additional pictures from the same person. The Rock Mite examples shown here were taken from the web page.

**The mail reflector—**

Started in late October 2002, the Rock Mite reflector had over 900 messages as of early April, and they can all be searched and read by subscribers. Although hosted by Yahoo.com, you don't have to be signed up for Yahoo (which is free) to join the list. I thought you did, but Tony Fishpool, G4WIF, told me it's not necessary. He said that while the web interface of a Yahoo account does give you some extra options, you can sign up directly without setting up a Yahoo account.

To subscribe directly, send an email to the following without subject or text:

Rock-Mite_Group-subscribe@yahoogroups.com

After that, you'll receive mail from the list moderator who will ask for some additional information before approving the subscription request. (This is common practice on many lists, as a measure to keep out spammers who are only subscribing so they can pick up more active e-mail addresses.)

**The Mitey-Mouse—**

Mike Caughran, KL7R (kl7r@yahoo.com) took the classic "paddles made from a mouse" concept one step further and put a Rock Mite into the mouse, as shown in Figures 6 and 7. He had this to say about the project—

"Using the mouse buttons as paddles takes a bit of getting used to. I imagine if you are used to the tapper style paddles you will have no problems. At first I had to

use my thumb on the left button and my index finger on the right until I could get my brain retrained to use index and middle fingers.

"I got the idea from a photo I saw on the Alaska QRP club page where I saw AL7FS and another ham using a mouse as a set of paddles. At least I assume they were; they might have been using it as a straight key.

"I thought it would be cool to enclose the whole transceiver in the mouse. A little work with some carving tools and I dug out enough space for the Rock Mite board. I left a little slack in the crystal leads so I could fold them over. I couldn't fit the power jack so I used another headphone jack instead.

"I took a pair of dikes to the mouse circuit board and removed all but a little bit of board around the two microswitches. I then installed the BNC connector, slipped the microswitch PCB under it and superglued the PCB in place. (I had to carve a bit of the dielectric material off the BNC connector to get it to fit.)"

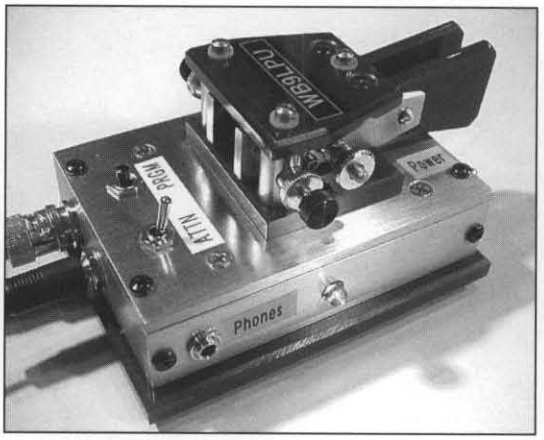



**Figure 8—A Rock Mite built into the base of a Parkwood Paddle.**


**Figure 9—Rock Mite with Parkwood paddle, in the stowed position.**

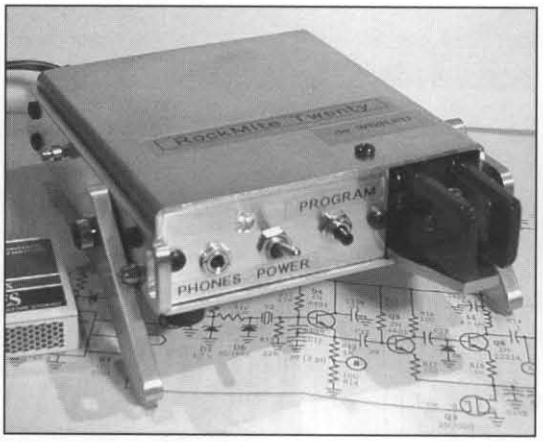



**Figure 10—Paddle opened up for business.**

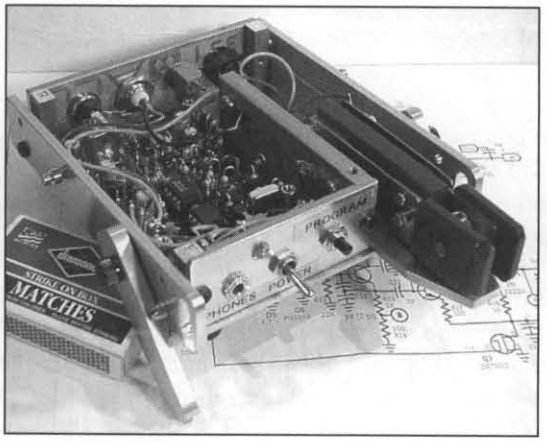



**Figure 11—Inside the unit.**

**Two Rock Mites with real paddles—**

Rich Meiss, WB9LPU, is responsible for two nifty Rock Mite packaging jobs shown on the NØRC Rock Mite site. His comments on the first—

"Figure 8 is a picture of a Rock Mite built into the base of a 'Parkwood Paddle.' The base is made of brass flat-stock held together with screws. On the front panel are an OFF/ON switch and an external paddle/key jack, and the rear panel has a BNC connector and DC power jack. Headphones plug into the side with the blue pilot light. On the top panel are the programming and attenuator switches, and, obviously, the paddle mechanism.

"Space limitations meant that there was no room for an RF-gain control, so I use a switch that can connect an 820-ohm resistor between the junction of D1 and D2 as needed. I determined the value by using a pot to find the minimum attenuation needed to reject a local broadcast station. I then measured the resistance and wired in a fixed resistor.

"There are no other modifications to the rig, which puts out slightly over 500 mW. Most distant contact so far is about 250 miles, with a 559 report. This little rig will be a lot of fun as 40 meter conditions begin to improve in the fall."

His other Rock Mite, shown in Figures 9, 10 and 11, was built into a homemade aluminum box. This one contains a built-in set of Parkwood paddles which slide out for use and in for storage. Rich says—

"The housing of this 20M unit is made of aluminum sheet stock held together with 1/8" aluminum side rails. The side-mounted legs swing down to provide a comfortable operating height. I built in an iambic paddle that slides out of the case when it is in use.

"Figure 9 shows the unit with the legs folded away and the paddle stowed. Figure 10 shows the unit opened up for business and propped up on the legs. The phone jack is on the front panel, and power, antenna, and an auxiliary key jack are on the rear panel. There is a switch on the rear for RF attenuation as in my 40M Rock Mite, but I found that I didn't need it.

"Figure 11 shows the unit with the cover off. The paddles slide in and out of a compartment, and a screw through the bottom locks them in position."

*WA8MCQ comments*—Rich is also known for the nifty Parkwood Paddles, named after the street he lives on. These are handcrafted, custom keying devices that he makes in his spare time. In addition to paddles, he has also made straight keys of various sorts. You can view some of his fine work at the N9VV web page, http://www.n9vv.com/n9vv.html and then click on the WB9LPU button. You can see some additional info and pictures on the W1TP web site at http://www.w1tp.com/mrm.htm.

(Professor Tom Perera, W1TP, is also quite a collector of old CW instruments, and often has some on display at Dayton in


**Figure 12—Front of the W5USJ Rock Mite.**


**Figure 13—Rear view of the W5USJ rig.**

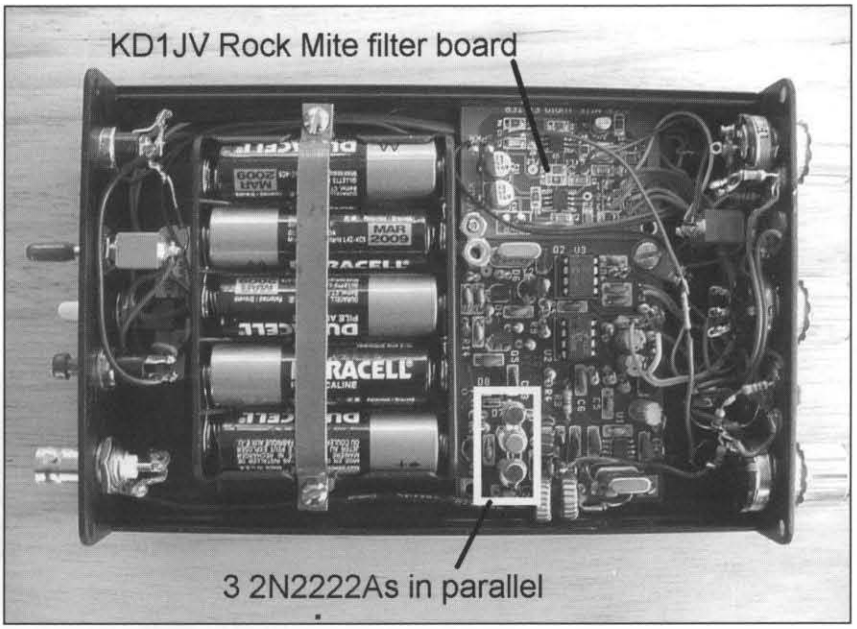



**Figure 14—Top view of Chuck's Rock Mite.**

the outside area. You can check out his online museum at http://www.w1tp.com/.)

In private e-mail Rich told me, "Paddle-making is a sort of hobby-business. Since this is a part time venture, I am pretty well backed up, with a fairly long waiting list. Hopefully, in 4 or 5 years when I am scheduled to retire I will be able to spend more time making CW instruments. I don't want people to get the impression that I am turning out large quantities and selling off the shelf."

If interested in more info, you can write to him for a copy of his brochure and price list. (It mentions that there is typically a one to three month wait after placing an order.) His addresses are Richard A. Meiss, WB9LPU, 2626 Parkwood Drive, Speedway, IN 46224-3223 and wb9lpu@earthlink.net, or wb9lpu@arrl.net. He can also send a PDF file of the brochure by e-mail attachment.

**Rock Mite in the fancy box—**

Figures 12, 13 and 14 show one of the Rock Mites built by Chuck Carpenter, W5USJ. (See the NØRC web page for some of his other efforts; click on the picture of his Chuck Wagon to link to the additional info.) He put this one into a Context Engineering #4006B box he got from the Fry's Electronics web page (http://www.outpost.com/). It wasn't cheap, but it makes for a neat looking rig.

He included the Rock Mite audio filter board, a limited edition kit sold by Steve Weber, KD1JV. In this particular version of the rig, slightly different from the one on the web site, Chuck used three 2N2222A transistors in parallel for the final amp (Q6). He used a 2N2219A with heat sink earlier, but the 2222s gave more power.

Don't get too excited about the nice lettering on the front and rear panels and ask how it was done; it doesn't exist! When the pictures were taken the panels were blank. Like the photos on the web site, the text was placed there by computer. (He used a program called Canvas 5 and I used the image processing program that comes with Windows 98.)

Although the KD1JV filter (visible in Figure 14) was originally designed to go with the Rock Mite, it can be used with any small rig. It's also a good project to get your feet wet with surface mount construction. Details on it can be found on his web site; go to http://www.qsl.net/kd1jv/ and scroll down to Rock Mite Audio Filter Board. The two mounting holes are the same spacing as the Rock Mite holes, for ease of mounting. The kit comes with the board and all board mounted parts, but does require an external volume control which is not supplied. (The schematic is given on his web page, so you can roll your own if desired.)

Steve made a larger batch of these (300) than he usually does, but in early April I learned he was down to his last hundred. He's well known for his long string of "limited edition" kits and I thought the days of this one were numbered. However, in mid June he told me that he purchased another 400 boards and expects to be doing this kit for some time to come. (I think he has a winner here.) The price is $12.00 postpaid. (In addition to e-mail, he can also be reached at 633 Champlain St, Berlin, NH 03570.)

**A perfect fit for Altoids—**

Finally, to prove that the Rock Mite really was designed to fit into an Altoids tin, see Figure 15. This one was built by Denny Payton, N9JXY, and later donated to the WA8MCQ shack. (I'm ashamed to

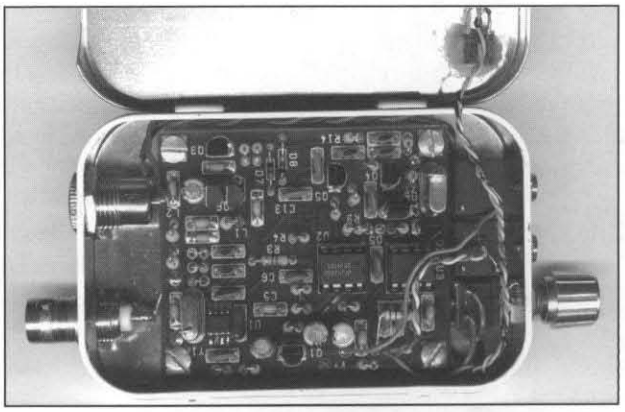


**Figure 15—The Rock Mite is a good fit for the ubiquitous Altoids tin. (The push button switch is glued to the cover.)**

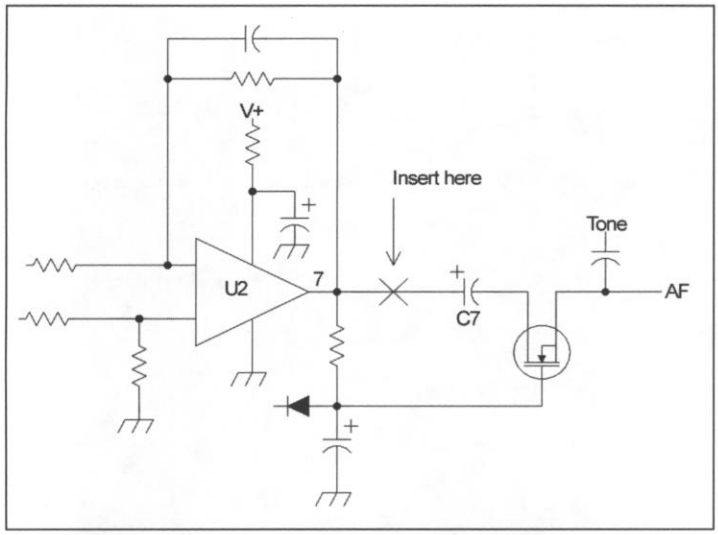



**Figure 16—Part of the original circuitry of the Rock Mite. Insert additional circuitry where indicated.**

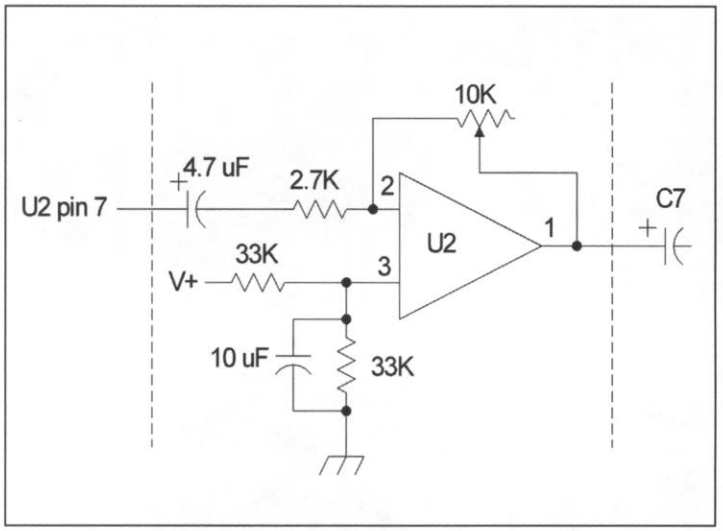



**Figure 17—Modified circuit for more audio output.**

admit that I have over 75 Altoids tins in my collection and yet I've never built anything into one of them!)

### More Audio for the Rock Mite

Denny loaned out one of his Rock Mites and got it back with more audio output. He had this to say on the NØRC Rock Mite web site (http://www.radioactive-hams.com/~n0rc/rm/)—

I received a Rock-Mite kit about the time I was leaving on a trip so I gave it to my buddy Jim Roberts, NC9H, to build and play around with until I got back. Not being one to leave an original design alone, he used the other half of op amp U2 to add more audio amplification and it works very well, powering an external speaker nicely. Lift the positive lead of C7 from the board, and insert the circuit between the lead and the PCB pad it was soldered to. Figure 16 shows a portion of the original schematic, and Figure 17 is the modification.

I'm enjoying this little rig much more than I expected! Now I wish I'd been more elaborate in packaging it—maybe stacking two Altoids boxes and including a paddle and internal speaker.

### Using SCAFs

Although Digital Signal Processing (DSP) has been the rage for some time now and gives excellent performance, the older, analog Switched Capacitor Audio Filter (SCAF) technology also makes good audio filters. An example of one can be found on the KnightLites QRP club web page at http://www.knightlites.org/Knightlite/randys_filter.htm. Built by Randy Hargenrader, WJ4P, it uses the LTC1059 SCIF chip from Linear Technologies. In this case, it can be used as either a low pass or notch filter. Maxim also makes some SCAF chips.

The SCAF technology does have some practical limitations when used in a receiver, and it was discussed on QRP-L. K2ZN had run across some unused MF8 SCAF chips (no longer in production) and asked if anyone still used this type of filter. He figured that they could do wonders for a direct conversion or other receiver which depends on it's selectivity being provided in the audio chain. This prompted the following comments—

From Dan Tayloe, N7VE (dtayloe@cox.net)—

These devices seem to be of marginal use in a CW receiver. In my opinion, they are good as "comfort" filters, but not as the primary selectivity.

These things are extremely noisy. As such, they have to go at the very end of the amplifier chain so the inherent noise is not amplified and becomes objectionable.

With this limitation in mind, they can be useful in attenuating "annoyance" interference. However, if the interfering signal is at a high level, it will simply drive the audio chain and the filter into distortion as the volume is increased to hear a weak signal.

The majority of a radio's primary filtering should be performed at as low a level as possible, and these filters are simply not suitable for that purpose.

Ed Tanton, N4XY (n4xy@earthlink.net) had this reply—

I disagree. Of the inexpensive filters I have (e.g. not DSP like my NIR-12s) two are SCAFs, and are far superior to any other of the non-DSPs. I have both the OHR SCAF filter and one made several years ago by an Alabama company named Dynamic Electronics. The one exception I would make to this sweeping endorsement is 88 mH-based (telephone toroid) filters. Their single center frequency audio response makes them very good-sounding filters. However, without variable bandwidth (the OHR filter can be varied) they are more like what you described for the SCAFs... but admittedly do sound really nice.

You cannot buy either one of those SCAF filters now, but I believe Vectronics has a kit SCAF filter still available. If I had to give up my OHR SCAF, I'd probably want to get a Vectronics. I wouldn't take my NIR-12 DSP units to the field, but the OHR, etc, are small, inexpensive, and effective. They beat the daylights out of any inexpensive filter I know of.

Dan responds—

I do not mean to give the impression that they are useless. That is clearly not the case. They can be used to good advantage to supplement the main filtering, but is simply too late in the audio chain to stop big adjacent signals.

The problem with the SCAF chips, such as the cool Linear Technologies and Maxim 5th and 8th order elliptic low pass filters, is that the noise is only 80 dB or so

down from full output. That sounds like a lot, but that is roughly 0.5 mV of noise. Comfortable headphone level is often only 40 mV or so. That means that a SCAF filter is best used with almost no gain between it and the headphones or they will become noticeably noisy.

The good news is that there is 40 dB between 40 mV and 4 V, so a SCAF can be used to get rid of a fairly good sized interferer. However, when pushed beyond that boundary, distortion and distortion products can make things sound kind of nasty.

Steve "Melt Solder" Weber, KD1JV (kd1jv@moose.ncia.net) had this to say—

Dan might be right in his first comments, but I have a SCAF filter using an LTC1068 chip in my homebrew "big rig" and leave it switched in most of the time. I find it greatly reduces wide band noise and makes weak CW signals easier to copy.

Granted, this rig does have a four crystal IF filter, RF derived AGC and the SCAF is the last thing in line before the audio power amp.

My main problem was finding a clock for the SCAF which didn't drift and make harmonics and get into the IF and RF input of the receiver. I ended up using a "multiple output" clock IC which starts with a built-in 20 MHz crystal oscillator and had a divided output at just the right frequency for the SCAF (or close enough).

Jim "Dr. Megacycle" Duffey, KK6MC/5 (JamesDuffey@comcast.net) had these comments—

Dan is right, the SCAF performs best at fairly signal high levels, say with 50 to 60 dB of gain in front of them; the audio output of a receiver is a good place.

Filtering should be distributed throughout a receiver, not just in the low level stages. The selectivity should be as narrow as possible as soon as possible. Each stage that has gain should be accompanied by one that has selectivity. This does two things; it reduces the signals available in the receiver's bandwidth to generate intermodulation distortion and reduces the wideband noise introduced by the gain stage.

So, in a superhet, the first filter, or preselector, is between the antenna and first mixer. This filter is fairly broad and usually serves primarily to reduce problems with second order intermodulation, IF leak through, and image response. A two stage filter, usually coupled resonators, is commonly used. A single stage has too little out of band rejection, and filters with three or more stages can be tedious to align.

The second significant stage of filtering usually comes after the first mixer, although there are mixers that provide some selectivity. (Dan designed one.) The filter after the first mixer is usually where most of the selectivity in a receiver is achieved. This is usually a crystal filter, and the more poles the better. This filter also reduces noise by virtue of reducing the bandwidth. This filter is usually followed by an IF amplifier, but there are receivers which do away with this stage.

The IF amplifier has not only gain, but also introduces noise outside of the bandwidth of the crystal filter. A second filter can be used here to reduce the noise that is seen by the product detector. A simple filter is sufficient; one consisting of a single crystal is adequate. The Red Hot 20 (commercial version of the NorCal-20) uses this configuration, as does the Sierra. This filter also helps to improve the strong signal handling capability of the product detector.

If the product detector has gain, like an NE602, it will also introduce noise. Often an active filter follows an active mixer, but an LC filter is a better choice here. Unless large, high Q inductors are used, these filters can be lossy. If older op amps, like the 741, are used in the audio chain, they can introduce noise. Modern op amps like the NE 5532 and OP604 are preferred.

In most receivers, a SCAF can be introduced between the last stages of audio preamplification and the final audio amplifier without introducing excess noise. This will probably not be true in minimalist receivers such as the Neophyte (NE602 mixer plus LM386 audio amp), but it does depend on frequency.

The final audio amplifier can introduce noise outside the bandwidth of interest, and a low pass filter (L and C) at the output will make a receiver much more enjoyable to listen to.

The problems with strong signals reducing desired signal strength and introducing distortion in the SCAF can be largely eliminated by using the SCAF after the final amplifier, turning off the AGC, or both.

Outboard filters made from SCAFs should be fine, and are probably the best application of SCAF technology.

Not all SCAFs are created equal. The Linear Technology ones are probably the best of the crop, but they are expensive. Linear has a pretty good free sample policy. The Maxim filters are a bit noisy. They also have a good free sample policy. All SCAFs require careful bypassing.

Here are a couple of good URLs that describe two simple, effective SCAFs, both designed by Dan Tayloe.

http://www.extremezone.com/~nk7m/miniscaf.htm

http://www.extremezone.com/~nk7m/n7vescaf.htm

Finally, Al Scanandoah, K2ZN (k2zn@rochester.rr.com), who kicked off the discussion with his question about SCAFs, reported on his results—

Thanks to all who responded to my query. I built up a 4th order band pass filter with the MF8 chip and inserted it between the output of the audio filter and input of the high-gain audio stage (IC2) in my HW8.

With approximately 2 μV applied to the rig, I don't notice any significant change in THD [distortion] when I switch the SCAF in and out. Even with larger signals (20 μV), the difference wasn't all that great, but it was more noticeable. With the audio level to the filter input at about 50 mV, the 80 dB noise figure puts the undesired products in the 5 μV range.

Measurements were made running Analyzer2000 on my computer; certainly not an HP audio analyzer, but good enough. Even with the slight increase in distortion, the benefit of significantly improved selectivity is well worth the trade-off.

[Analyzer2000 is a shareware program that uses the existing sound card in your PC. Information can be found at http://www.brownbear.de/ and you can get the files from http://www.brownbear.de/download.htm. (When I checked the main page it didn't seem to have any provision for getting to the download area so I did a google.com search to find it.) There are two ZIP files; the main program is 2.19 MB, and there is also a PSK31 driver, 802 kB. According to the download page the software is fully functional, limited to 30 minutes per session, and must be registered after 30 days evaluation. —*WA8MCQ*]

*WA8MCQ comments*—As K2ZN later

said in private mail, "It looks like this 'ancient' technology was dropped once affordable DSP hit the streets." However, the "ancient" SCAF technology still has it's place in many applications. And if one wants to have built-in audio filtering in a variety of rigs, the simpler SCAF filters are more economical to implement. (To say nothing of not being at the mercy of someone who knows how to design and program DSP filters!)

As for the LTC chips being expensive, everything is relative. According to the LTC web site in early April, pricing on the LTC1068 family ranges from $6.85 to $7.70. (You can find the data sheet, in PDF format, by going to the home page at http://www.linear.com/ and doing a search on part number.) That's relatively expensive compared to most of the chips that homebrewers buy, but as K2ZN also said, "If I were to play around with something like a TI TMS320C51 DSP chip, I'd have to shell out a heck of a lot more cash just for the development tools. And for an HW8 that I paid $50 for? I don't think so!" He also indicated that they pay around $25 each for that chip at work.

DSP is the newer, fancier, digital technology, and SCAFs are older as well as being analog. But as is the case with most things in life, there is always a use for things on both the low and high end of a particular product type, and audio filtering in receivers is no exception.

**Faux AA Cells**

Rechargeable and alkaline AA cells have different voltages and this can be a problem sometimes. Max Moon, KØMAX (maxmoon@umn.edu)posted this nifty solution to QRP-L—

I have a battery holder for 12 AA cells, for outings powered by NiCd and NiMH rechargeable cells (12 x 1.2 volts = 14.4 V). However, recently I found myself with only alkaline AAs, at 1.5 V each. If I loaded up the battery holder, I'd have 18V. Not a good idea!

I found that soft, 1/2-inch diameter copper pipe with both ends capped makes a useful fake battery, a conductive spacer or place-holder. I cut the pipe so that, with the end caps soldered on, it is just as long as an AA cell. The end caps are fatter than the pipe, but actually only 0.02 inches thicker than an AA cell. The faux batteries fit into my regular Radio Shack battery holder; it's tight but they go in and come out. Your mileage may vary. (After soldering, I used some tongs and held the whole thing over a stove burner to harden it.)

It works fine and now I can use the 12-battery holder with 8 or 9 alkaline batteries, or 10 or 11 NiCds, and maybe even replace the fakes one by one with fresh, real batteries as the output falls.

What with buying the caps at 69 or 79 cents each, the fakes cost more than real batteries. But they last so much longer!!

*—de KØMAX*

**The Milliwatt is Still Available on CD**

Old timers will probably remember the legendary *Milliwatt: National Journal of QRPp* published by Ade Weiss, WØRSP, K8EEG at the time, from 1970 to 1975. (Although I had a seminal role, the vision that created it and 99.5% of the hard work were all Ade's.) On rare occasion copies of it appear for sale, but not very often. In the early '90s, with Ade's permission, I did two runs of photocopy reprints which sold well. (The first was a very limited run of less than a dozen, I think, and the second was over a hundred, done in conjunction with Bill Kelsey, N8ET.)

Several years ago, Tom Arvo, WA8DXD, worked with Ade and scanned in the entire run of 33 issues and put it onto CD, in PDF format. (The free PDF reader is included on the CD. Although it is probably not the latest version by now, it's still entirely suitable for reading the files on the CD.)

I checked with Tom recently and discovered that the CD is still available for purchase. You can find details at

http://www.qrpworld.com/

A word of caution—the Milliwatt was done in the days before home computers and laser printers appeared on the scene. Even the funky old Altairs with front panel toggle switches didn't appear for years afterward! Everything was by hand on typewriters and done with offset printing, and as a result it's a bit light and difficult to read in places. Naturally, the scans (and photocopies) reflect this. But think of it this way—it preserves the historic feeling and spirit of the original copies.

Here's what Tom has to say about it on the web site—

"What each individual issue lacked in polish was made up for in content many times over. These were the days BC, 'Before Computer.' No word processors or spell checkers here. The *Milliwatt* is a tribute to Ade's diligence and perseverance, the results being a publication chock full of information to delight QRPers of all ages and degrees of experience. Each issue, a total of 33 in all, covered all aspects of QRP with an emphasis on operating and construction. Though over a generation has passed since Ade first brought us the *Milliwatt*, much of the information contained is still relevant for today's QRP newcomers as well as the more seasoned among us.

"The *Milliwatt* is also an excellent piece of nostalgia well worth the price of admission."

After I posted the above info to QRP-L, Ade Weiss responded with this post about *The Milliwatt*—

Mike's comments are well taken. I'll add a few. *THE MILLIWATT* introduced the "world," i.e., a scattered bunch of solitary QRPers, to the fact that they existed and were plugging away thinking no one else was nuts enough to try running under 5 watts output!

Early on, Bob Rosier, K4OCE, applied for the first DXCC QRP trophy offered by *THE MILLIWATT*—boy, did that open a lot of eyes! The operating news section was included to detail the success and frustration of operating QRP at the time. Taken as a whole, the info printed in that section encouraged a large number of QRPers to work even harder and pay attention to theory about antennas and efficiency.

To create a 'real life' image, we backed up the operating news with a 'logs' section in which portions of logs submitted by QRPers were printed. In hindsight, I think that this laborious job of typing was extremely important—remember that back then there were no local QRP clubs or conventions like Atlanticon where QRPers could gather and compare notes personally. That section showed the world both the elation and travails of the QRPers. Back then there was no chance of announcing the first DSW-II QSO when it just happened—QRPers experienced a very different 'reality TV' in those days!

A lot of technical stuff probably helped out, too. For instance, Yardley Beers, WØJF (his credentials were impressive) contributed interesting material including

the square law performance of detectors at or near the noise level.

At any rate, it's a different world now at Atlanticon, Arkiecon, Pacificon and Dayton [to say nothing of QRP-L]. *THE MILLIWATT* CD probably can still help discouraged QRPers and there is a massive amount of info in the 33 issues. So, it's nostalgia for those of us who were there, but for those newcomers who are accustomed to excellent publications like the *QRP Quarterly*, NorCal's *QRPp*, the NJQRP Club's *QRP Homebrewer* and others, it might just be informative to see where it all started.

It's well worth the price that Tom Arvo, WA8DXD, charges for this 'labor of love' CD (currently $20). (The usual disclaimers apply; I don't make any money on it.)

*—Ade, WØRSP*

### HAMCALC Available on *CQ* Web Site

George Murphy, VE3ERP (ve3erp@encode.com), is well known for his HAMCALC program, a very large collection of handy, DOS based calculation programs (close to 300). It could be downloaded from various online sources, and was also available directly from him on CD for a nominal charge.

He recently announced that HAMCALC, currently in version 64, is no longer available from him on CD and that it can now be downloaded (free) from www.cq-amateur-radio.com. (When I checked the *CQ* web site in early April, the button for the download appeared prominently on the opening page.) The ZIP file is about 1.1 MB long. While in the download section be sure to print out the information on how to run the programs under MS-DOS.

When you unzip the file, it produces three things—a folder called HAMCALC and 2 files: GWBASIC.EXE and VE3ERP.BAT. Those online instructions tell you what to do with those to run HAMCALC.

This is the official online location of the program. When you get to the download area, a note reminds you to visit that web site for the latest version. It also says, "Unauthorized versions found elsewhere on the Internet are usually outdated. Some have been altered and may not run properly."

While you're on the *CQ* home page, here's another good button to click on (if it's still there), "A Warning About Deep Discount *CQ* Subscriptions." It's a caution about some online scams.

### Free Attenuator Calculation Program

In the last issue I wrote about the free W8DIZ toroid program and mentioned that it has an attenuator calculator under the Tools button. It's a good calculator, and there are others out there as well. However, after seeing quite a few over the years my all time favorite remains the attenuator routine in RF Toolbox, some DOS based freeware put out in 1987 by Teledyne Microelectronics. (But by all means use the W8DIZ program for it's main purpose of toroid calculations.)

The attenuator routine in RF Toolbox is the most versatile of any I've ever seen. It will calculate the resistors for T or Pi attenuators of any specified impedance, which can be different on both input and output (to allow design of impedance matching pads), and gives exact resistance values as well as those for 1%, 5% and 10% resistors. On top of that, it also shows the actual input and output impedances that result, as well as actual attenuation values, for all resistor tolerances.

To enter the routine, select #2 from the main menu, Resistive Attenuator Values. Figure 18 shows a typical screen. (I made this into a negative view for better visibility; the actual screen is white on a black background and cannot be changed.) This shows the results for a 50 ohm in/out PI attenuator of 3 dB, with 5% resistor values. Figure 19 shows the data for various resistor tolerances.

Press F6 to toggle between the values for resistors of other tolerances. F2 toggles between Pi and T designs and recalculates the resistors. F10 forces a calculation after you enter impedances and desired attenuation.

Since the program lets you specify different input and output impedances, you can use it to design impedance matching pads. The most common would probably be one to match 50 ohms to 75. Every now and then I see 75 ohm step attenuators at hamfests. If the price is attractive, you could build a pair of 50/75 ohm matching pads (also known as "minimum loss pads") into a couple of small boxes with appropriate connectors and use the attenuator for 50 ohm circuits.

A word of caution, though; any resistive impedance matching pad comes at a cost of several dB of extra attenuation. Depending on the specific application this might be unacceptable or might not make a bit of difference as long as you factor the extra dB into your measurements. (You could also make a matching transformer or autotransformer to convert 50 to 75 ohms. The loss would be much less, but frequency response becomes an issue.)

In the case of a 50/75 ohm pad, the minimum possible attenuation is 5.71 dB, although you could specify a larger amount if desired. If you set Desired Attenuation to a lesser amount it will still perform the calculation but provide a negative resistor value, along with a note telling what the minimum theoretical attenuation is. It also doesn't seem to like a value precisely equal to that amount, although it's perfectly happy with 5.72.

Using this pad on a 75 ohm attenuator in a 50 ohm system requires a pair of them, so you're adding 11.4 dB in series with it. Be sure to add that to the setting on the

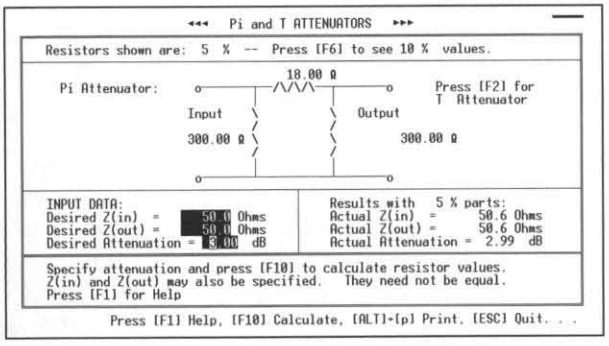



**Figure 18—Typical screen of the RF Toolbox attenuator calculator.**

| Resistor Tolerance | R1, R3 | R2 | Zin, Zout | Actual Attenuation |
|---|---|---|---|---|
| Exact | 292.4 | 17.6 | 50 | 3.00 |
| 1% | 294.0 | 17.8 | 50.2 | 3.01 |
| 5% | 300 | 18 | 50.6 | 2.99 |
| 10% | 270 | 18 | 49.2 | 3.16 |

**Figure 19—Using resistors of different tolerances has an effect on the actual impedance and attenuation. R1 and R3 are the legs of the PI and R2 is on the top.**

attenuator. (Depending on the resistor tolerance, the actual attenuation can range from 5.58 to 6.07 dB per pad.)

When doing a 50/75 pad like this, the resistor to ground on the 75 ohm side is over 1 megohm. In the real world that can be omitted, making the circuit an L rather than a Pi. The effect on the circuit will be very small. (I once opened up a commercially made unit and it only had the 2 resistors.)

The minimum attenuation increases when making larger impedance transformations. For example, for a 50/300 ohm conversion the minimum is 13.4 dB, and 16.6 dB for 50/600. Remember, those are for single units. If using a pair on a 50 ohm step attenuator, those would add about 27 and 33 dB respectively. But again, this additional attenuation may be entirely acceptable in some cases.

RF Toolbox has several other routines which may also be of interest, although similar ones can probably be found elsewhere. I have only looked at a couple of them.

The program can be found on the QRP-L home page. Go to http://qrp.lehigh.edu/lists/qrp-l/ and click on QRP-L File Archive. Next, click under the Tools directory and download rftools.zip, which is about 98 k long. (Don't bother with the file rftools.txt; that's just a brief intro I wrote when I uploaded the program.) For anyone who can't download the file, I can supply it on a floppy disk at no charge. (This is a PC program and will not work on Apples unless you have a PC emulation program.)

*—de WA8MCQ*

**Online S Parameter Tutorials**

Folks who are more deeply involved with RF work are familiar with S parameters. For those who don't know much about this advanced topic but want to learn more, here are a couple of good online tutorials which you can download and print out. These are not for the faint of heart, but even if you don't understand everything in them you can come away with some good information.

Both can be accessed through rfcafe.com; you can find the index at

http://www.rfcafe.com/references/app_note_links.htm

The shorter of the two is from *Test & Measurement World*, a trade journal. Look under S in the index and click on 'S-Parameters: Test & Measurement World.' It prints out at ten pages.

The other is a 44 page Agilent application note. (Agilent was spun off from Hewlett Packard several years ago, and makes the test equipment line.) Click on 'S-Parameter Design: Agilent AN-154,' right above the other tutorial.

The rfcafe.com site is well worth bookmarking in your browser since it contains links to a large number of RF related topics at various manufacturer's sites. And if you ever get tired of looking at all the links on the URL above, go to the tabs at the top of the screen; the App Notes index is just the tip of the iceberg.

**The Tiniest Altoids Rig Yet**

Most QRPers know of the Altoids tins by now. A few years ago they came out with an even smaller one called The Tiny Tin, sized approximately 2.375" L X 1.47" W X 0.615" D. And then several months ago the Altoids folks came out with yet another product, an even tinier container which holds 32 "breath strips." After Dayton, someone mentioned on QRP-L that they had seen a QRP rig there which was built into one of the breath strips tins. It turns out that it was built by our very own Mike Boatright, KO4WX.

It's essentially the same circuit as the NOGA QRP Club's NOGAnaut, a crystal controlled, single transistor transmitter. Mike calls this one the NOGAnit. (You can find into on the NOGAnaut on the web at http://www.qsl.net/ko4wx/Construction/Projects/NOGAnaut.pdf.) Not part of the original circuit, Mike added a surface mount 2N3906 for a keying switch. He sent me two pictures of the rig, shown in figures 20 and 21. And even though it's hard to see, it does contain a 3 element PI output filter.

To give some idea of the sizes of the 3 Altoids tins, I bought some of the breath strips for a photo session. I already had the middle size, given to me by the wife of W3MKE at Atlanticon a couple of years back. She told me to build something into it, and I'm ashamed to say I still haven't done it. As for the "normal" tin, it's hard to walk around my house without tripping over them. Figure 22 shows all 3 of them; KO4WX used the smallest one. Figure 23 shows the relative depths of the tins, and you can see that the smallest is an extra challenge since it tapers down at one end. Mike had to flatten out the ridges in the bottom of the deep end to get extra space; he called it cheating, but I consider it retrieving volume that was rightfully his.

Back in 1989, a local ham came up with the DB-25 Challenge, which I wrote about in the April 1990 issue of the *QRP Quarterly*. (That's the one with the tiny rig in a pill bottle on the cover.) The challenge was to build something into a specific plastic bottle that we had access to, with an internal volume of 3/4 cubic inch. Three of us did it; I built a 40M crystal controlled transmitter, wasting a huge amount of the volume. WA5JAY (not to be confused with well known QRPer W5JAY!) built a 40M VFO controlled, direct conversion CW transceiver into his bottle, and the originator of the challenge did the same but with a phasing type DC receiver using a pair of MiniCircuits TFM-2 mixers. (Both of them used almost all of the volume in the bottle.) Both of their VFOs were tuned with multiturn trimmer pots and a jeweler's screwdriver.

Phase 2 of the challenge, which none of us ever got around to doing due to lack of spare time, was to build something into one of two specific smaller packages. (Even in 1990, all 3 of us were quite capable of pulling it off. Although surface mount parts were not as common then, and we didn't use any, there were still plenty of tiny resistors, monolithic capacitors, etc.) One of the packages was an empty 9 V transistor radio battery case. Extra credit would be given if some of the cells were left inside to power it!

(Interestingly, many years later someone—I think it was Jeff Anderson, WA6AHL4—showed up at Dayton with what I believe was essentially the NorCal "49er" circuit in an emptied 9 V battery case. Designed by Wayne Burdick (N6KR) for the 1996 Dayton QRP building contest, the 49er is a simple crystal controlled CW transceiver with an NE602/LM380 receiver and two transistor transmitter. Anyone interested in it can find the schematic and a wealth of mods on the NorCal web site, under the "Projects"" section.)

The other package could be either one of those tins that hold a dozen aspirin tablets, or the boxes that 5 cartridge fuses come in. Now we have the Altoids breath strips tins, which are in the same class as those but even more challenging—smaller still, and tapered to boot! My congratula-

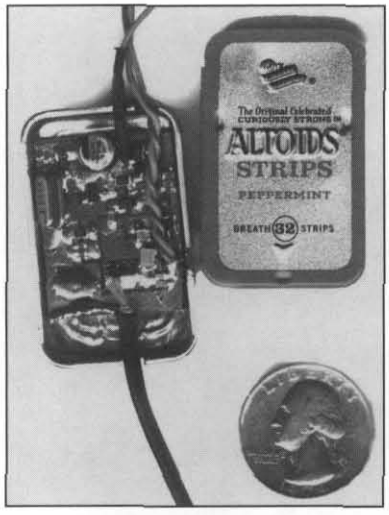



**Figure 20--The NOGAnit by KO4WX, in the smallest Altoids tin available.**

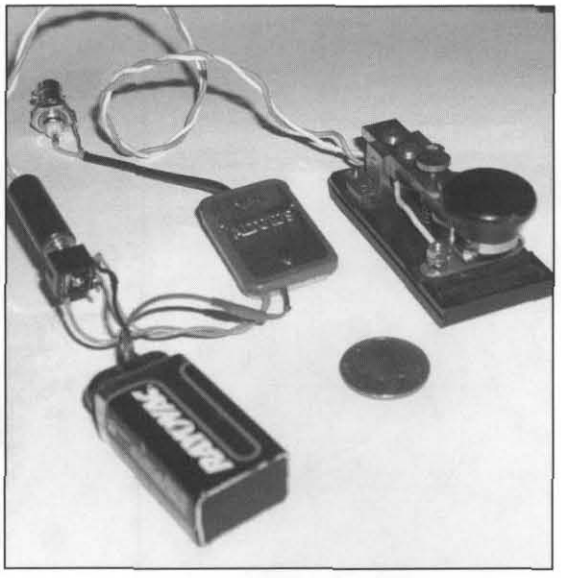


**Figure 21--The NOGAnit operating setup.**

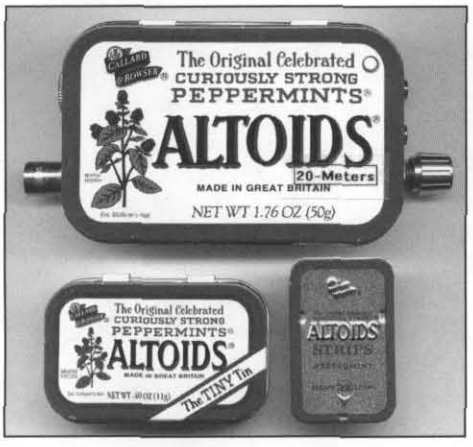



**Figure 22--The three Altoids tins. KO4WX used the smallest one.**


**Figure 23--Compare the depths of the 3 tins. The smallest tapers down at one end for an extra challenge.**

tions to Mike for pulling this off. Yes, little rigs like this are not very practical for regular daily use, but they are a lot of fun to build and an interesting challenge.

By the way, I don't hold it against him that he used wires and cables for all external connections since that was allowed in the old DB-25 Challenge. Our reasoning was that some of the new Kenwood VHF mobile radios being sold at the time had neither power nor RF connectors mounted on the chassis. Both were located at the end of wires and coax that extended several inches out of the rear of the radios. If the Big Boys could do that on commercially produced units, then we could certainly allow it on our miniature QRP rigs!

If anyone else builds a really tiny little rig, I'd love to feature it in a future column.

### QRP Online

As I say every issue, there's been a huge amount of QRP info flying around the Internet for years, and it's still there! Here are some of the online forums available:

QRP-L, which I call the "QRP Daily," is the online QRP discussion forum started in 1993 by QRP Hall of Fame member Chuck Adams, K7QO (K5FO at the time). It continues to run several dozen postings per day on a variety of topics related to QRP. And as I said in the last issue, if you unsubscribed because of all of the sniping, personal attacks, etc, it's safe to go back. It's a moderated list now and back to what it used to be.

QRP-F is an alternative QRP forum started by the QRP ARCI in October 1999 to take some of the load off QRP-L. The activity is much lower than on QRP-L, but so is the noise level.

While not specifically a QRP list, the Elecraft reflector is dedicated to owners of those products, most of which are QRP. Even non-owners may find it interesting since they cover a number of homebrew topics.

To check out the online QRP world, go to these URLs:

QRP-L: go to http://qrp.lehigh.edu/lists/qrp-l/ and you're at the home page where you can sign up, read the archives, etc.

QRP-F: go to http://www.qrparci.org/ and click to enter the site, then click on QRP-F on the menu at the top.

Elecraft: http://mailman.qth.net/mailman/listinfo/Elecraft to subscribe; home page at http://www.elecraft.com/

And while you're on those home pages, don't forget to check out their lists of QRP related links; and at each link that you go to, check THEIR lists as well, since not all sites list all others. In addition to the QRP ARCI site, another excellent place to use as a jumping-off point for checking out QRP related sites is the NorCal home page, run by Jerry Parker WA6OWR, at http://www.fix.net/~jparker/norcal.html. You'll find quite a wealth of QRP info online.

As this is being written in mid June, I don't know if the NorCal web page will continue as a separate entity or be merged in with the new American QRP Club site. But make a note of this URL and keep an eye on it: http://www.amqrp.org/

### The fine print

Do you have something you'd like to share with the readers? You can send it by e-mail, floppy disks or even handwritten notes. And I don't mind hand drawn schematics since I redraw most of them on the computer. My job is to edit, rewrite, redraw, etc; yours is to send in the info to share.

●●

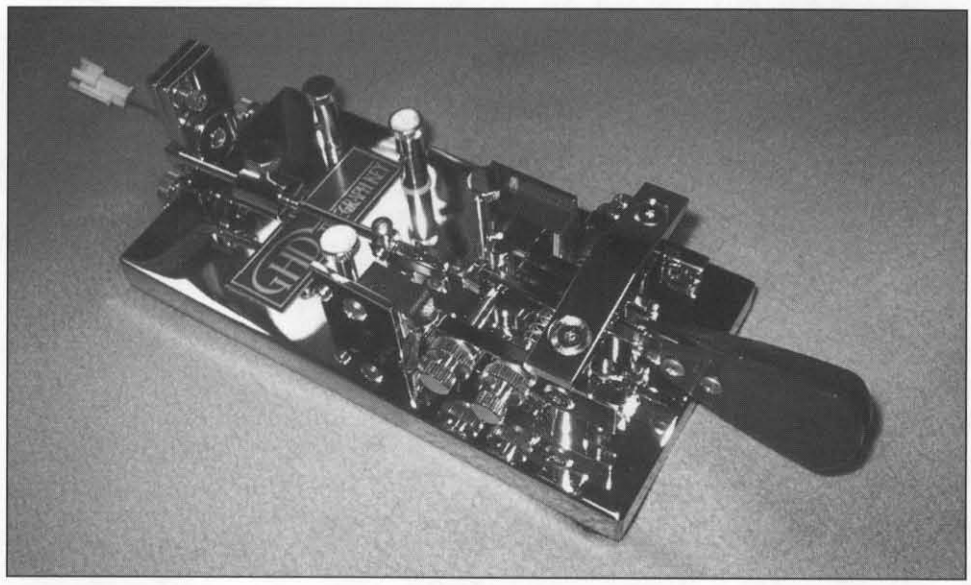
# Review: The GHD GD107WS High Tech Bug

Dick Arnold—AF8X af8x@comcast.net

My fascination with bugs began early in my ham career. The melodic rhythm emitted from a bug in the hands of a capable operator is music to my ears. I also like the idea that "bug sounds" have a bit of the operator's personality embedded. Not many fists can be identified by sound these days as most of the CW signals heard originate from electronic keyers.

The bug or semi-automatic key was invented in 1904 by Horace G. Martin. The purpose of this new invention was to alleviate the condition known as "Glass Arm" that plagued telegraphers of the day using straight keys. The Vibroplex, as it was named, is still being manufactured today and the Vibroplex Company is experiencing a new wave of interest by hams in operating a semi-automatic key as well as starting collections.

I have been happy with my two Vibroplex keys, "The Standard Original"" and the "Blue Racer;" both are great in quality and workmanship. But then a short time ago as my birthday was approaching, my very good friend Dr. Luke Nakamura, JN3XAO thought I would like the new Japanese GHD bug and made me a present of the GD107WS model. The GHD Company is located in Sendai City, approximately one hundred eighty-seven miles North of Tokyo, Japan. The complete line of straight keys, paddles and bugs can be found at the U. S. distributor's web site, www.morsex.com (Milestone Technologies Inc.).



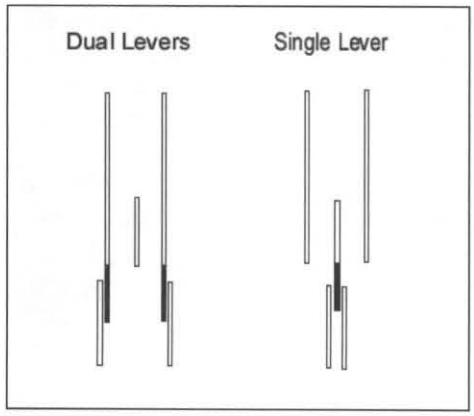
**The GD107WS bug is made by the GHD Company in Sendai City, Japan.**

**First Impressions**

When I opened the package from Luke, I almost had a cardiac arrest. This unbelievably gorgeous device was all mine! The absolutely perfect chrome finish was like looking into a pool of mercury. And the mechanism—outstanding mechanical artistry. I eagerly read the straightforward adjustment instructions, which were much simpler than that of the Vibroplex, and in minutes I was ready for the connection to my radio.

The GD107WS has no mechanical electrical contacts. Optical sensors are used in their place; there is no spacing concerns or the scratchy CW note from dirty contacts. If there is one word that describes this key, it is *smooth*. The "WS" indicates a double lever mechanism, one for the dah side and one for the dit side. These two levers are independent of each other and for that reason I opted to convert it to a single lever operation.

There is a center lever flanked by the two operating levers. By removing the one-inch extensions of the outer operating levers and adding one extension to the center lever, the key becomes a single lever bug. See the drawing below. The reason I chose to convert to a single lever was that I am used to operating the single lever Vibroplex mechanism where the timing between the dit and dah is regulated by how fast the lever travels between the two contacts, therefore the conversion would allow my timing to remain the same for both bugs. The GHD dual lever allows the dit or dah to be activated without regard to the other. If both levers were held simultaneously, a constant carrier would obviously be emitted.




**Double-lever (left) and single-lever configurations of the bug paddles.**

With regards to adjusting speed, there is no need for a collection of weights or special levers as with the Vibroplex—the speed of the GHD bug is controlled by a single weight which when placed at the extreme ends of the vibrating arm, allows for a range of 15 to 40 wpm (as close as I can estimate).

Operating this device is very pleasurable and the only down side—if you could call it that—is the fact that the optical sensor circuitry needs power to operate. Also the company recommends that you don't operate in direct sun light for obvious reasons. Therefore, this key is intended for in-shack use where power and sunlight would not pose problems.

The GHD company's other keys appear to be of the same quality as the GD107WS, however, to many, these products may seem a bit pricey. The GD107WS goes for $329.95, but after using it, I feel the "quality is worth the coin" if you can afford it. ●●

# Peak Power Modification for the WM-2

Ingo Meyer—DK3RED dk3red@qsl.net

A few years ago some modifications to the OHR WM-1 QRP Wattmeter were described by Larry East, W1HUE [1]. His modification to use an external power source is incorporated in the newer WM-2 models, but unfortunately, not his "peak power" modification. I found that his peak power modification could easily be applied to the WM-2. I decided not to use the switch (for switching between the modified and unmodified circuit) shown in W1HUE's article. You can see my simpler circuit in Figure 1.

The WM-2 has a little bit different PCB than the older WM-1. Figure 2 shows the two PCB cuts required for the mod. The round cut on U2 pin 5 was made with a drill before I installed the IC. There is ample space for the parts on the bottom side of the PCB, as shown in Figure 3.

In the original WM-2 circuit, the reverse polarity protection diode, D3, is placed between the external power supply jack and ground. But what would one do if the diode is burned up after an incorrect connected supply? The WM-2 is better protected with diode D3 in series with the external supply. I soldered the diode between the power jack (J3) and the power source switch (S3) as shown in Figure 4.

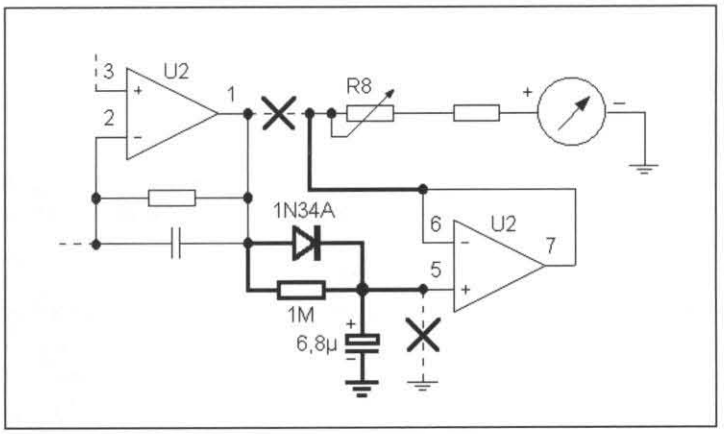



**Figure 1. Circuit for the peak power modification.**

**Reference**

1. The original article appeared in January 1995 *QRP Quarterly*; the article is available online at www.qrparci.org/east/MODS_WM1.html ●●

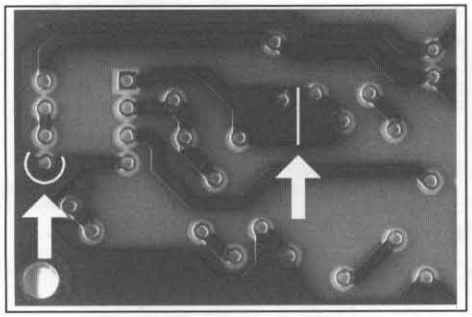


**Figure 2. This photo shows the two PCB cuts required for the peak power mod.**

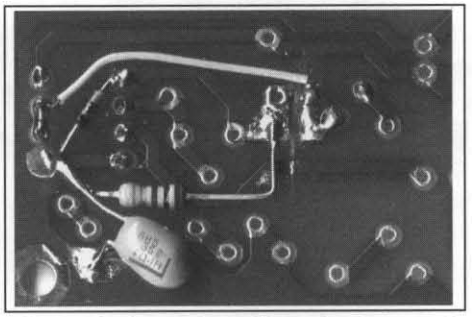


**Figure 3. Parts installed for the mod. [Oops—looks like you installed the cap backwards, Ingo!]**

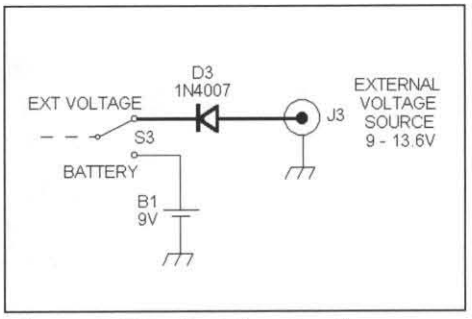
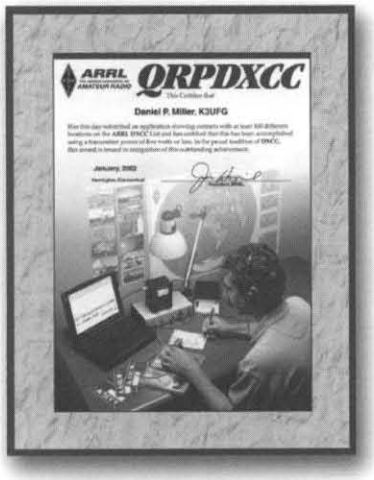



**Figure 4. New location for the reverse polarity protection diode, D3.**

## ARRL QRP DXCC Award




In recognition of the popularity of QRP, the ARRL offers a QRP operating award—the QRP DX Century Club, or QRP DXCC. The award is available to amateurs who have contacted at least 100 DXCC entities (the list of valid DXCC entities is available on the ARRL web site at http://www.arrl.org/awards/dxcc/) using 5 W output or less. Contacts made any time in the past count, and no QSLs are required.

The QRP DXCC is a one-time award and is non-endorsable. You do not have to be an ARRL member to qualify.

To apply for the QRP DXCC, just send a list of your contacts including call signs, countries/entities and contact dates. Do not send QSLs. The list must also carry a signed statement from you that all of the contacts were made with 5 W RF output (as measured at the antenna system input) or less.

Along with your contact list, include a $10 application fee in the form of a check or money order in US funds. Make sure to indicate your mailing address and your name as you want it to appear on the certificate. Mail everything to: QRP DXCC, ARRL, 225 Main St, Newington, CT 06111. For a complete set of rules, go to the QRP DXCC Award rules page on the ARRL web site at http://www.arrl.org/awards/dxcc/qrp/qrp-dxcc-rules.html. —*KO4WX*

# Making Waves: A QRP Celebration of Spectrum Analysis

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Whether your main passion lies in *building* or *operating* low power radio equipment, as a member of the QRP community you just love to make waves. Everything you build, every rig you operate, converts information into waves (a transmitter), or waves into information (a receiver).

In ham radio—especially in QRP, where homebrewing and continuous wave transmission are central pursuits—understanding waves is important. The purpose of this article is help you discover (or perhaps re-discover) the magic that *spectrum analysis* performs to help understand the signal waveforms we create.

**It all started with Fourier**

**Figure 1—Jean Baptiste Joseph Baron Fourier.**

One could say that spectrum analysis (or more precisely, analysis of the spectrum) began two centuries ago, with an important mathematical theorem by Fourier (Figure 1).

Fourier's theorem basically states that any signal, no matter how simple or exotic, is just a family of sine waves added together (one sine wave at the "fundamental" frequency, another at two times the fundamental frequency, another at three times the fundamental frequency, another at...well, you get the picture!).

So if we take a sine wave, with a particular amplitude, add in another sine wave at twice the frequency of the first (i.e. the "second harmonic") with its own amplitude (some fraction of the fundamental amplitude), and so on, we can create any signal we want. Figure 2 shows what our signal will look like if we blend "50% second harmonic" with our fundamental frequency.

The amplitude of some harmonics can of course be "zero." In the simple example above, all harmonics greater than the second harmonic have zero amplitude.

A true square wave happens to have only "odd" harmonics-so the amplitude of the second, fourth, sixth, etc. harmonics is zero. The "square wave" shown in Figure 3 is not perfect, because we have only added in the first few harmonics (up to the 9th).

One could ask how you would go about determining the amplitudes of the various harmonics which sum together to produce a particular waveform. We're not going to worry about that here. (Fourier had to do it the hard way—mathematically. For a square wave, we could have some fun approaching it experimentally with an unfiltered "fireball" transmitter and some homebrew bandpass filters.)

Figure 4 shows the mathematical representation of the "Fourier series" for a square wave. But, consider another waveform that's "pretty close" to a pure sine wave. Adding just 10% third harmonic to a pure sine wave produces a waveform that is somewhat flattened, or "clipped" in appearance. Conversely, if the signal we're observing on our oscilloscope looks "clipped," we know there's harmonic content there (see Figure 5)!

If you think about it, knowing that any signal is a "sum" of discrete, harmonically related sine waves, it becomes apparent that we can look at the same signal from two different perspectives (a sine wave is a function of time, but a signal is composed of multiple sine waves at different frequencies). The "3-D" views of Figure 6,7 and 8 help visualize the signal in both domains..

Consider the "almost square wave" I illustrated above. You can look at it "head on," as an oscilloscope would. This is the time domain, in which the signal's fingerprint appears as a repetitive waveform (the sum of all frequency components) starting at t = 0 (see Figure 7).

If we change our perspective, we can look at the same signal in the frequency domain where our signal's fingerprint appears as a series of "bars" at each harmonic frequency, the height of each representing the magnitude of the particular harmonic (see Figure 8). This begins to approach the view that a spectrum analyzer provides. But, unlike the linearly scaled "peak to peak" profiles in the frequency domain view shown at bottom right, spectrum analyzers typically provide a logarithmic display, for reasons which should become quite apparent to QRPers. (and are referenced to power, e.g. 0 dBm, as opposed to absolute voltage magnitude).

Whether we look from the time or frequency vantage point, it is important to keep in mind that the signal is the same. The view from either domain gives a complete description of the wave.

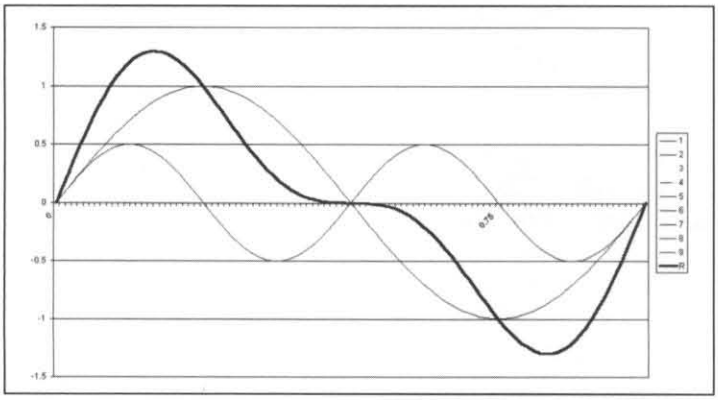

**Figure 2—A signal that is a sine wave plus 50% second harmonic.**

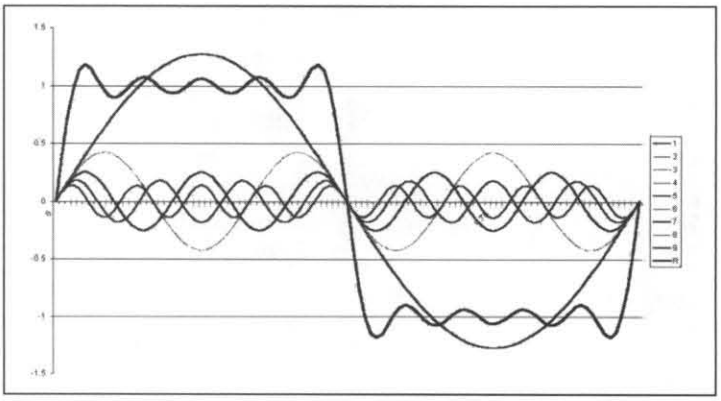

**Figure 3—Approximation of a square wave from sum of first nine harmonics.**

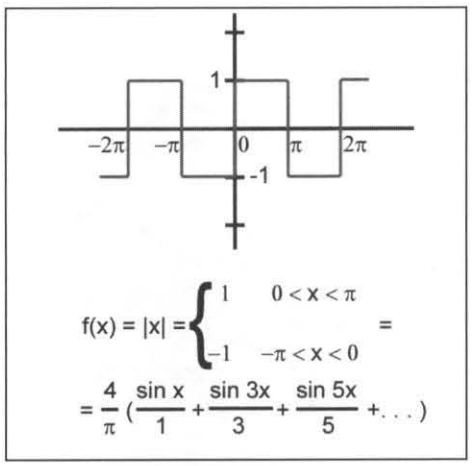


**Figure 4—Mathematical representation of the "Fourier Series" for a square wave.**

The difference between the two perspectives, however, is the ease with which we can observe or measure particular characteristics of the signal.

So what is the big deal about Fourier's way of looking at signals? If we observe the frequency domain view of our signal, then we will know how it will behave in the big, bad world, since each frequency component will play it's own individual role. Consider the simple clipped waveform with 10% 3rd harmonic, shown above. Assume our clipped signal is a 1 watt 7.02 MHz signal. If we fed that signal (appropriately attenuated) into our broadband receiver, we will see a particular deflection of the S-meter at 7.02 MHz, and another smaller deflection of the S-meter, at 21.060 MHz. And if we were to pass our clipped signal through a perfect 21.06 MHz band-pass filter, we would end up with a single pure 15 meter QRPp CW signal! Harmonics are not all bad!

A spectrum analyzer is just a specialized piece of test equipment, which allows us to see the frequency domain "snapshot" of any signal (within the performance limitations of the instrument).

So how would you build such a beast? If we were to pass signals through a *series* of band-pass filters, each having a slightly different (progressively increasing) center frequency, and measure the signal strength at each frequency, we would be able to get a snap-shot of the frequency domain of the injected signal. This is the operating principle of one type of real-time spectrum analyzer. (A second type of real-time spectrum analyzer uses digital signal processing and number-crunching to "transform" the signal information into its Fourier representation—Fourier would be proud!)

But, we are going to focus on a simpler type of spectrum analyzer, which uses the "swept-tuned" approach. In addition to being cheaper and offering particular advantages when compared to real-time spectrum analyzers, the swept-tuned spectrum analyzer appeals to QRPers, because it is just so gosh-darned cute, using many of the building blocks and circuit concepts we have come to know and love in our construction of QRP receivers and transmitters.

The swept-tuned spectrum analyzer is essentially a VCO- (voltage controlled oscillator) controlled superheterodyne receiver, swept across a chosen frequency range, providing a visual display of

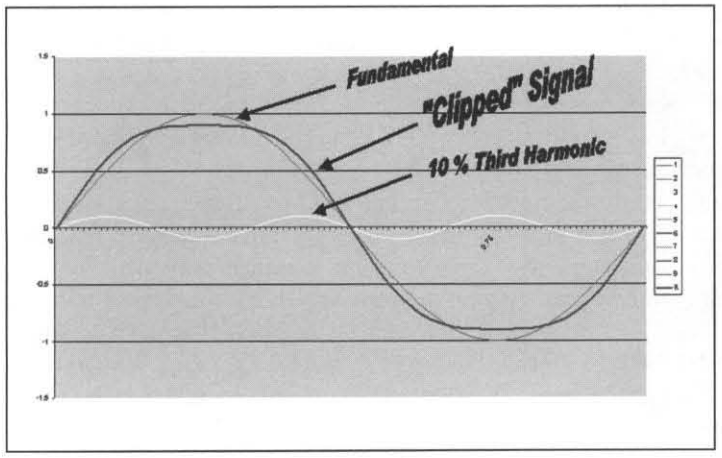


**Figure 5—Sine wave with harmonic content.**

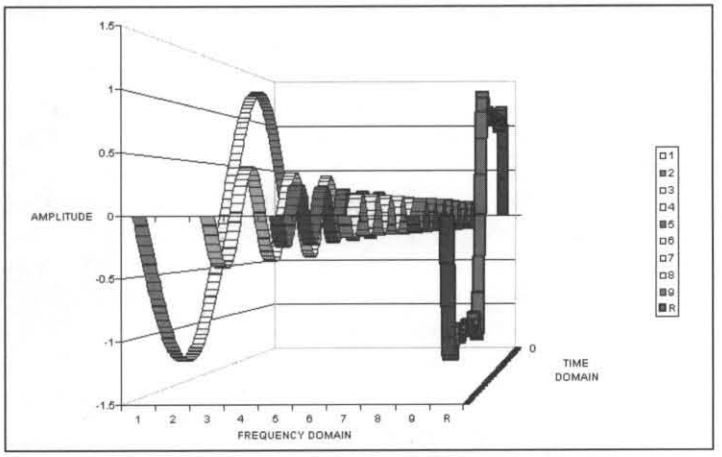


**Figure 6—Spectrum in time and frequency domains.**

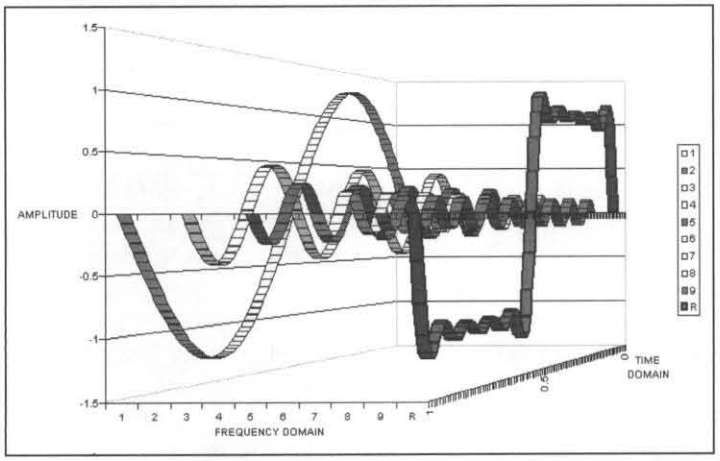


**Figure 7—View of the spectrum in the time domain.**

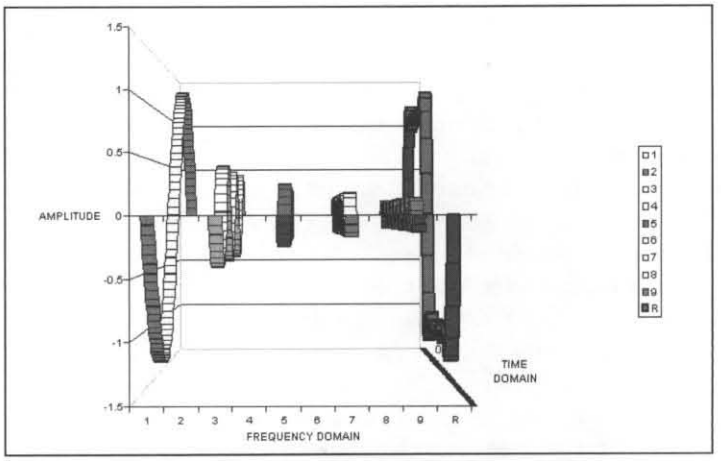


**Figure 8—View of the spectrum in the frequency domain.**

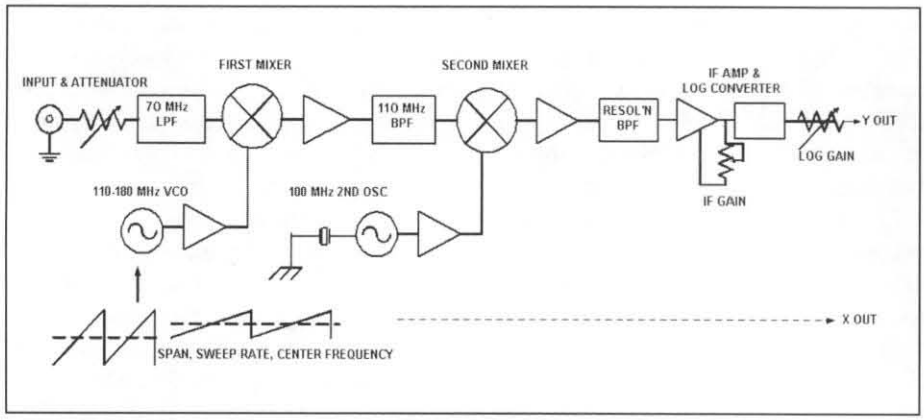


**Figure 9—W7ZOI/K7TAU spectrum analyzer block diagram.**

**Figure 10—VE3JC's completed spectrum analyzer boards and other components ready for assembly.**

received signal strength. Each signal, or harmonic component of a non-sinusoidal signal, "...is represented by a line or blip that rises out of the background noise, with all signals referred to a reference level at the top of the screen" (W7ZOI, '98).

W7ZOI and K7TAU's spectrum analyzer, first described in *QST* and available in "boards and parts" kit form from Kanga US, is the swept-tuned SA design most commonly built by QRPers. A simplified block diagram is shown in Figure 9. This is not a complete block diagram—readers should refer to the original article (and to *EMRFD*) for a full discussion of the circuit. This is just the "*Reader's Digest*" version, to highlight the main components and operating parameters of this wonderful piece of test equipment.

The main stops on our ten-minute tour of the various elements in the W7ZOI/K7TAU spectrum analyzer are:

**1. Input and Step Attenuator**—The basic spectrum analyzer design allows us to snoop at signals in the 0 to 70 MHz range. In other words, we can see at least the second harmonic for the HF QRP rigs we are likely to build. (For a 28 MHz rig, we will see 2nd harmonic, for a 3.5 MHz rig, we will see more, the actual number depending on the dynamic range of our analyzer). For maximum utility, a step attenuator should be incorporated into the spectrum analyzer. Alternatively, an external step-attenuator can be used.

**2. VCO and 1st Mixer**—In a typical superhet receiver, we would mix a desired single input signal with the necessary selected VFO frequency, to produce the required IF (intermediate frequency). Since our spectrum analyzer must tune across a range of frequencies, we use a VCO, driven by a ramp voltage waveform (adjustable to provide specific center frequency, sweep range, and sweep rate). The control voltage shown on the left in Figure 9 will produce a wider frequency range, lower center frequency, and faster sweep rate output from the VCO than the control voltage shown on the right. By referencing the oscilloscope's x-axis to the VCO control ramp voltage, the oscilloscope horizontal display will represent the selected frequency range of interest.

**3. Input Low Pass Filter**—As the 110 MHz to 180 MHz VCO sweeps across it's range, a 110 MHz output will result from the signals we're interested in (in the 0 to 70 MHz range), but will also result from any image signals (in the 220 MHz to 290 MHz range). To reject these images, low pass filtering of our input signal is required.

**4. 1st IF Band Pass Filter**—Understanding (and fulfilling) the requirements for the triple-tuned VHF 1st IF filter offers one of the most interesting learning opportunities within the spectrum analyzer building project.

**5. 2nd Mixer & Oscillator**—This mixer and BFO (beat frequency oscillator) down converts the 110 MHz IF to 10 MHz, which will drive our logarithmic amplifier, below.

**6. Resolution Filter**—A single 300 kHz LC filter is used in the basic analyzer, but a second switchable narrow crystal filter is a practical add-on.

**7. IF Amp and Logarithmic Amplifier**—Our 10 MHz IF must be converted to a DC voltage proportional to the logarithmic value of the input signal. The circuit presented in the original article is based on an MC3356 log amp and a discrete component IF amp design, while an improved version (using AD603 IF and AD8307 log amp) is presented in EMRFD and on the web.

**8. Tracking Generator**—If we are using the spectrum analyzer to check out a homebrew transmitter or to observe received signals from our antenna system, the input signal energy is "pre-supplied." If, however, we wish to measure or optimize the frequency response of a newly-built filter, we also require a signal generator, whose frequency tracks that of the spectrum analyzer. In other words, at the instant the spectrum analyzer is looking for a particular frequency (e.g. 21.0 MHz, when the VCO input to the first mixer is 131.0 MHz ), then the Tracking Generator needs to be injecting 21.0 MHz into the system under test. A companion tracking generator to the W7ZOI/K7TAU analyzer was described by the same authors in a 1999 *QST* article, and is available in kit form.

## Building the Spectrum Analyzer/Tracking Generator

A number of other spectrum analyzer designs, and a wide range of construction techniques, are available for building a practical spectrum analyzer. References and builders' web sites listed at the end of this paper will get you underway.

To provide more detailed analysis of spectrum analyzer designs in this presentation would simply repeat what others (especially Wes Hayward, W7ZOI) have already presented in very readable and accessible formats. Instead, I will illustrate the evolution of my own spectrum analyzer/tracking generator, in the hope that you will see such a project is both magical and

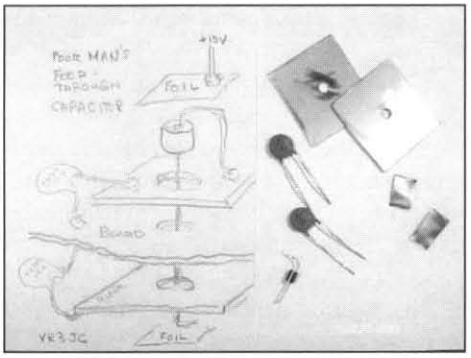


**Figure 11—Technique for constructing inexpensive feed-through capacitors.**

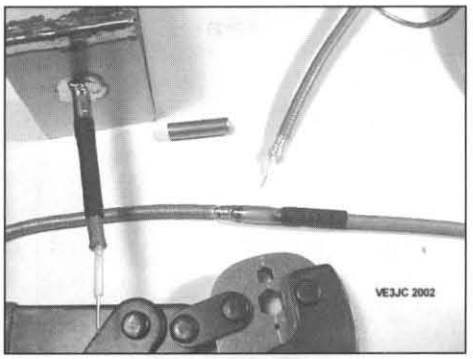


**Figure 12—Connecting stages using Mil-spec Teflon® coax and copper tubing**

**Figure 13—Planning for construction of the spectrum analyzer.**

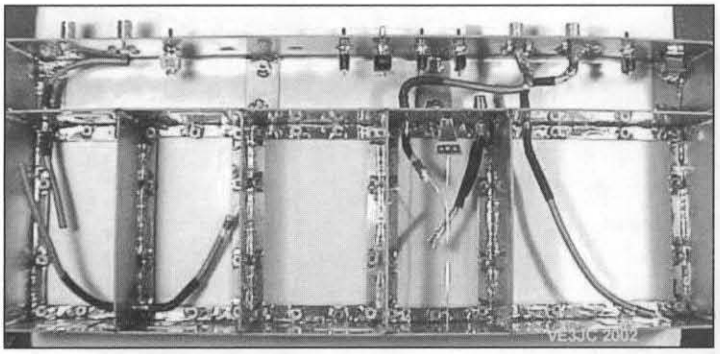

**Figure 14—Soldering a lip around the edge of the top of each module cell.**

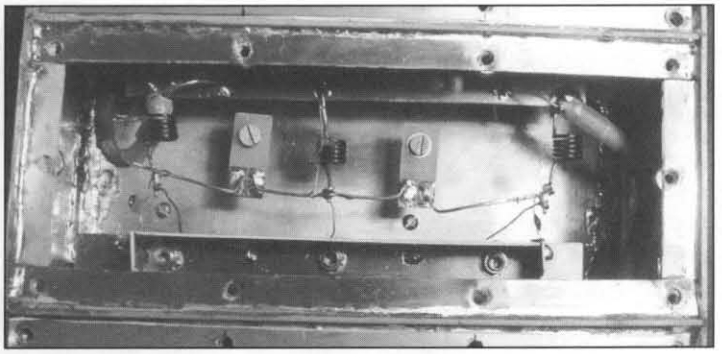

**Figure 15—Close-up view of the 110 MHz bandpass filter.**

'do-able.' I am sure you will then seek out the rich body of material available on the subject from a variety of gifted writers and designers.

My sense is that the average QRPer enjoys melting solder and the serendipity of finding exotic parts from varied sources. While finding "kit" building a relaxing and pleasant pursuit, he also likes to be creative, dabbling in circuit enhancements, and Manhattan/ugly construction methods. The "W7ZOI/K7TAU/KANGA" spectrum analyzer/tracking generator project is a multi-faceted experience, providing opportunity for all of these endeavors.

Actually, this project is a number of simultaneous projects. Wes and Terry caution against "building it all at once." The original articles lay out a logical sequence for construction, so that already-constructed modules are used in testing and optimizing next-built modules. That approach is much easier if discrete shielded—and generally expensive—die-cast boxes are used to house each module. However, as inspired by Mike Boatright, KO4WX, I wanted to use roll-your-own double sided circuit board enclosure techniques. The completed Kanga kit boards, collected off-board components, and the integrated enclosure, in the planning stage are shown in Figure 10.

Critical to the success of this project is shielding integrity between the various modules. DC cannot simply be routed to each module using hookup wire through a grommetted hole. Feed-through capacitors-even though they are expensive and difficult to find-need to be used extensively. I thought I was extremely clever to come up with the technique shown in Figure 11 for constructing inexpensive feed-through capacitors. However re-reading old *QRP Quarterlies* forced me to admit I had subconsciously picked it up from one of Joe Everhart, N2CX's excellent articles. (The unlabeled "donut" in the sketch is a ferrite bead)

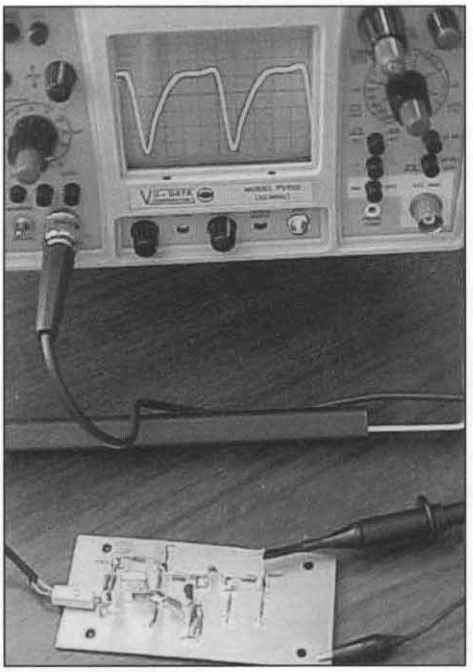

**Figure 16—10 MHz crystal calibrator.**

Another potentially major expense in building a homebrew spectrum analyzer is the hardware (coaxial connectors, bulkheads, etc.) necessary to route RF signals between the various modules. Inexpensive connectors can be used successfully (see K3NHI's clever use of phono plugs, on W7ZOI's website). I chose to completely eliminate connectors wherever possible, using mil-spec Teflon® 50 ohm coax and 1/4" copper tubing-see Figure 12. The coax cover is removed over a short length of the cable, and a small piece of copper tubing is slid over the coax and then crimped. The cable is then inserted into a 1/4" hole drilled in the enclosure, and soldered on both sides.

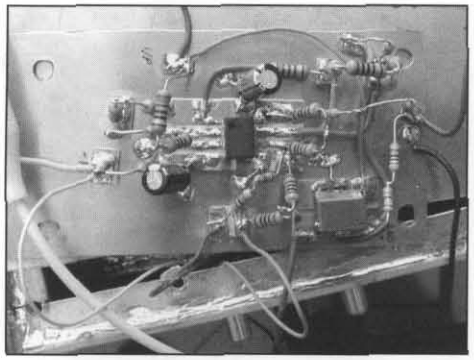

**Figure 17—2dB/division log amplifier.**

Mil-spec Teflon coax, in both RG58 and RG174 equivalent diameters, is available at reasonable prices (don't leave Dayton without some!).

Using the integrated enclosure, connector-less technique obviously requires considerable planning. Full scale photocopies of the various boards were used, to assure that correct orientation, cable routing, and provision for drilling stand-offs, was maintained-see Figure 13.

Following initial assembly, a lip was soldered around the edge of the top of each module cell. Corrugated cardboard, cut to the same dimensions as the cell opening, was used to recess the lip while soldering-see Figure 14. Using another idea shamelessly stolen from N2CX, stainless steel screws were used to hold brass nuts in place while soldering the nuts on the underside of the shield lips..

Constructing the W7ZOI/K7TAU analyzer provides extensive opportunity to learn and experiment with filter concepts. The triple-tuned 110 MHz bandpass filter is one of the most interesting elements of the project. The three glass piston trimmer capacitors are at the bottom of the photo in Figure 15, partially enclosed (so that shielding is maintained when holes are drilled in the lid for trimmer adjustment).

A crystal calibrator (presented by K7TAU, and available on the Kanga "updates" page) is a must-build addition for the spectrum analyzer. Using a 10 MHz crystal, the harmonically-rich output from this circuit provides measurable reference markers over the spectrum analyzer's 70 MHz range (see Figure 16).

Another useful add-on to the spectrum analyzer is a 2 dB/division amplifier (see Figure 17). Two pots mounted on the side of the spectrum snalyzer are used to bring the desired expanded range onto the scope screen. Manhattan style construction (and some obvious series/parallel resistor combinations, to compensate for limited precision resistor selection) were used.

The improved AD8307-based IF/Log Amp is described extensively in EMRFD. I found the original (less linear MC3356 log amp) to be satisfactory for casual shack use, especially with a step attenuator and reference level signal source available to "benchmark." I had no burning urge to build the improved amp. However, obtaining several SOIC AD8307s and AD603s provided the impetus, and an opportunity to try out SOIC "Surfboards" available from Digikey. The physical dimensions of the "improved" IF/log amps shown in Figure 18 are identical to the original Kanga IF/Log Amp board.

The nearly-complete spectrum analyzer/tracking generator is shown in Figure 19. It will never be entirely finished, because it invites perpetual tinkering and enhancement.

Several examples of transmitter testing are shown in the following figures. In Figure 20, is the output of a 20 meter SST during troubleshooting. In Figure 21, an 80 m "Snap" transmitter and output are shown.

An easy-to-construct mint tin return loss bridge (Figure 22) is used in conjunction with the spectrum analyzer and tracking generator, to permit "across the band" observation of antenna performance. Figure 23 illustrates resonance of a three element tri-band Yagi. In Figure 24, a visual appreciation of ZM-2 tuner adjustment is possible.

As Clint Eastwood says, "A man's got to know his limitations." The same goes for spectrum analyzers. We have to assume that our $450 homebrew spectrum analyzer has some performance limitations, especially when stacked up against a $20,000 commercial instrument. But how important are they?

First, let's look at the limitations of swept-tuned spectrum analyzers in general. As we are sweeping across the whole frequency range, we can only see what is going on with the frequency being observed at that particular instant. In other words, we cannot see transient events. Swept-tuned spectrum analyzers also present a trade-off between bandwidth and sweep rate. When using a narrow bandwidth, we need to keep the sweep rate slow enough to allow our narrow bandwidth filter sufficient time to respond to signals at each successive frequency. (See W7ZOI's "hot off the press" discussion of this on his SA Updates site). A third limitation of swept-tuned spectrum analyzers is that we are only using a small portion of the signal's energy at any time for our measurement (as compared to real-time analysis, which uses the signal as a whole).

When we evaluate our homebrew analyzer against high end commercial swept-tuned spectrum analyzers, the main points

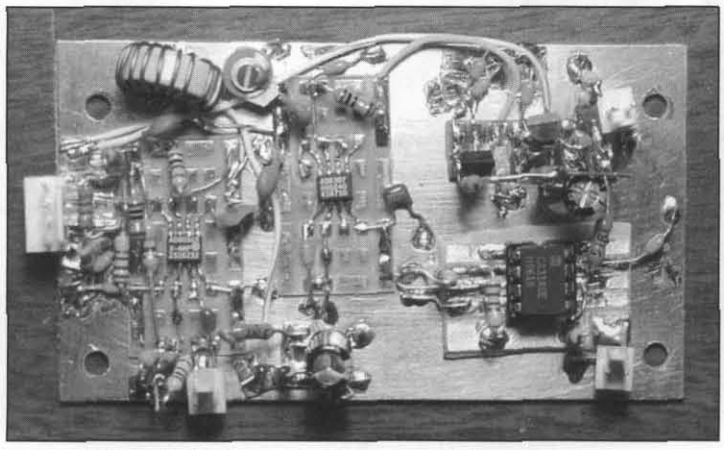

**Figure 18—AD8307-based IF/log amplifier.**

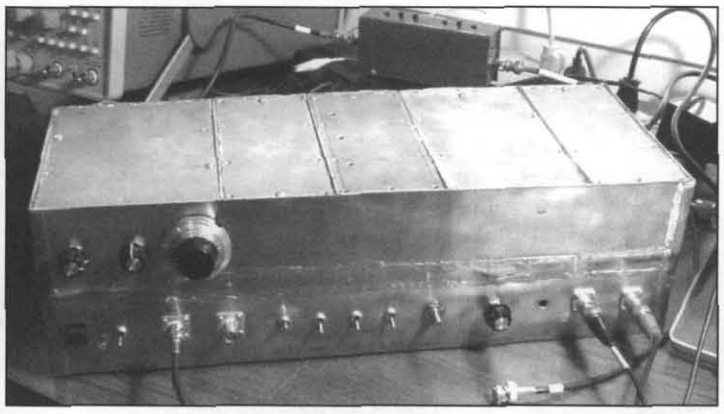

**Figure 19—The working and "nearly-complete" spectrum analyzer/tracking generator.**

of comparison will be bandwidth, resolution, linearity, dynamic range, and convenience "bells and whistles." While the contrasts may be significant, many shortcomings in our homebrew unit are found to be tolerable, or can be "worked around." For example, wise use of a step attenuator can help to get around slight log amp non-linearity (if an additional 34 dB attenuation drops the fundamental signal to the same level on the screen as the "pre-attenuated" 2nd harmonic, I have my desired measurement). Frequency converters can be built to expand the frequency range over which this homebrew spectrum analyzer can be used. Even the "display printout" perk of high-end spectrum analyzers can be emulated with our homebrew unit, using a digital camera or "sound card oscilloscope" computer software.

The W7ZOI K7TAU/Kanga spectrum analyzer has been found by numerous QRP home-brewers to be a rewarding, highly educational, and multi-faceted building adventure. The fact that you end up with an extremely useful piece of test equipment, at a fraction of the price of commercial units, is just a bonus!

**Spectrum Analysis and QRP Reference List**

The following articles and references will provide a deeper understanding of spectrum analysis, and the construction and use of swept-tuned spectrum analyzers.

For a general introduction, start with three books which are sitting on the shelf in your shack already (you do have all of these of these, don't you?):

*The Art of Electronics*, Horowitz & Hill, 2nd Edition, pages 1035-1038, "Spectrum Analysis & Fourier Trans-forms." Like so many other topics in this book, the authors actually make the topic fun. How unusual for an engineering text!

The *ARRL Handbook*, American Radio Relay League—any edition—will have a brief discussion of spectrum analyzers.

*Experimental Methods in RF Design*, Wes Hayward, W7ZOI, et al, ARRL 2003. This book (and companion CDROM) is really "one stop shopping"—everything you need to start building the W7ZOI/K7TAU spectrum analyzer and tracking generator, including the articles, circuits for modification and enhancement, and a wealth of applications.

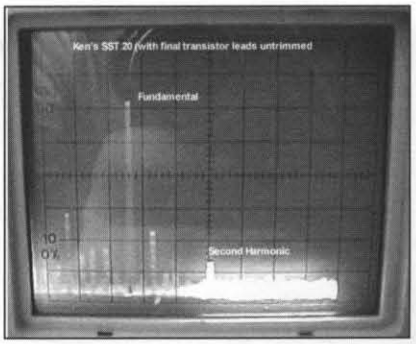


**Figure 20—Troubleshooting a 20 meter SST using the SA.**


**Figure 22—"Mint Tin" return loss bridge.**

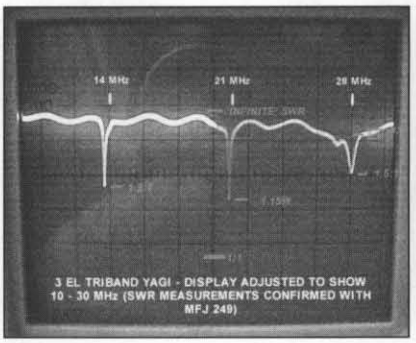


**Figure 23—Using SA and return loss bridge to show resonance of a tri-band Yagi antenna.**


**Figure 21. Output of an 80M "Snap" transmitter.**


**Figure 24—Tuning an antenna system using a ZM-2, SA and return loss bridge.**

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# The QRP Home Companion

Anthony A. Luscre—K8ZT k8zt@arrl.net

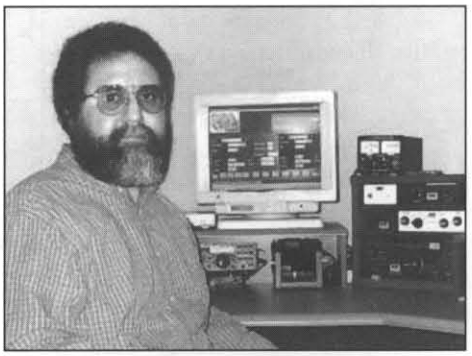
Welcome to the first edition of the "QRP Home Companion" column. As a long-time reader, I was honored when Editor Mike Boatright, KO4WX asked me if me if I would be willing to write a regular column for the QQ. In this first column I want to give you an overview of who I am, what I will cover each issue and a few tidbits of information for you to chew on until the next QQ.

**Who is K8ZT?**

First here are the facts—I am 47 years old and have been a ham since 1981. I live in Northeast Ohio with my wife Linda, KA8ODP, and our teenage children Aaron and Erica. I am employed as a Technology Director for a small public school district (which means I am responsible for all aspects of technology: computers, software, repairs, purchasing, installation, network administration, staff training, Internet access, district web page, telephones, etc.). Welcome to the first edition of the QRP Home Companion column.

I had been interested in becoming a ham since my high school days but did not know how to become one. After college and marriage, my wife read a newspaper piece about a class to get your Amateur Radio license being held in the area. She did not have to ask me twice, I was ready to go. She agreed to go along with me. After a few months we both had our Novice licenses. My call sign was KA8NRC. I upgraded to Technician later that year.

How I came to be a QRPer was the result of a radio advertisement I had lusted over in an electronics magazine from my high school days. I had been very active in Boy Scouts and camping so the Ten-Tec PM-1 in the ad seemed like the perfect radio, lightweight, low battery drain and very portable (for its time!). So when it came time to buy my first radio, my thoughts went back to that radio ad. In 1981 Ten-Tec was no longer producing the Power Mites, but they did have another small portable radio, the Ten-Tec Argonaut 515. After saving up money for a few months, I made my first ham purchase—a brand new shiny black Argonaut 515



**K8ZT and his QRP hamshack.**

(which is still a prized possession of mine). With my purchase, I had become a QRPer from the very beginning of my ham career.

Back in the pre-Internet days, the main source of information for a new comer to any hobby was magazines written on the subject. I love to read and definitely needed more information to actually get on the air, so I subscribed to the big three: *QST*, *CQ* and *73*. I soon spent my lunch hour at work accompanied by a ham magazine. I read an article about QRP (unfortunately I don't remember the exact article) and two clubs, the G-QRP and QRP-ARCI. The next day I sent off checks to join both clubs. The two quarterly QRP journals soon became my favorite reading material and I waited impatiently for each new issue to arrive.

With the two QRP journals as encouragement and my QRP rig, I proceeded to get on the air and actually work stations. I didn't know that "QRP wasn't the best way to start out as a new ham" as others would later tell me. That is how I started my almost exclusively QRP ham adventure of over twenty years. Starting with the Argonaut's approximately two watts taught me many trick to make contacts with little power. Along the way I read many invaluable operating, equipment and antenna hints in the *QRP Quarterly*.

In the mid 1980s, through the *QRP Quarterly*, I learned about an informal gathering of QRP operators at a now defunct downtown hotel in Dayton. I had been to the Hamvention before, but now it was even more fun. The hotel was marginal, but the QRP gathering was fabulous. I got a chance to put faces and personalities on many of the QRPers who wrote for *QQ* and *SPRAT*, the QRP ARCI officers and QRPers that I had contacted on the air. These gatherings predated the now well-organized FDIM event and were much more informal but full of information for a curious new QRPer.

Let's fast forward to 2000 (don't worry I will fill in the gaps in future columns). In 2000, I upgraded my license to Extra Class and after many agonizing hours I decided to change my call sign to K8ZT. You can read my article "Selecting an Ideal Vanity Call Sign" and get a copy of a spreadsheet to assist you at my web site: www.qsl.net/k8zt/vanity_callsign.htm. This article led me to write a monthly column on QRP for the ARRL's website called The QRP Community. You can visit www.arrl.org to read past columns, just search using "QRP Community" or my call sign.

That is enough about me for now (maybe too much!).

**What is the QRP Home Companion column?**

My goal for each edition is to highlight some of the fun in QRP. We will be taking a look at operating events, contests and awards. I will keep you up-to-date on some of the cool gear for the QRPer including kits, homebrewing and commercial equipment. I will pass on hints and tricks for QRP success and fun. Each column will include a wide variety of QRP resources (both in print and on-line) to help you improve your enjoyment of QRP. So here's a start with a link to my own website's QRP page: www.qsl.net/k8zt/qrplinks.html where you can find a variety of QRP links to get you started.

I welcome your input and suggestions for this column. Please contact me via e-mail. Thanks for the opportunity to write for the *QRP Quarterly* and hope to work you on the air, QRP.

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*Editor's note—Don't hesitate to offer suggestions and comments to K8ZT, or any of the other columnists in* QRP Quarterly*! They'll love to hear from you.*

# Test Topics and More

Joe Everhart—N2CX n2cx@voicenet.com

This installment (#16) of TTAM includes what has become a continuing thread in the Coming to Terms section. CTT deals with "loading" effects of test equipment and (here's the continuing thread) how to assess and minimize the effect of loading on measurement accuracy.

Designed for Test presents the HPE, a HeadPhone Evaluator using the NJQRP QuickieLab to check out headphones to determine their sensitivity for CW receive usage.

Stimulus and Response is a look into the future by listing prospective future test and measurement applications for the Quickielab.

**Coming To Terms**

The term this time around is "loading." I think we've all experienced the effect when we hook up a meter and get readings that are 'way off what we expect. It's really an underlying effect that has been mentioned before and compared to the Heisenberg Uncertainty Principle. Any time we attempt to make a measurement we inadvertently affect exactly the very thing we're trying to measure!

Now quite often the effect is so small that we don't notice it (fortunately!). In fact there are several categories of effects. First let's look at the categories and some examples.

*1. The effect is unmeasurably small*—As mentioned above, this is the ideal case where the error introduced is smaller than the accuracy to which we can measure. Usually we try to use a piece of test gear or technique that puts us in this condition. Testing DC voltages with a digital multimeter is a prime example. The 10 megohm input impedance of the meter is much higher than most circuits we test so the error is negligible. We only get in trouble when we measure things like high impedance timing or audio circuits or when measuring bias in audio or RF circuits, particularly oscillators. In those circuits stray capacitance in the test leads or unwanted feedback to the circuit being tested disrupt its operation. Often connecting a 100 k resistor between the circuit being tested and the test leads can minimize the disruption.

*2. The effect is noticeable but small enough that we don't care*—There are lots of examples of this. Connecting a meter to check for presence or absence of voltage in a circuit gives valuable information even though the exact reading is inexact. Or connecting a 'scope or RF probe to an RF circuit might load down the readings but if voltage values increase when going from stage to stage, we know that the circuit shows gain.

*3. The effect is noticeable but we can calculate the effect and correct the reading to calibrate out the error*—For example measuring voltage in a bias circuit with a 1 megohm resistance means that the voltage is loaded by the 10 megohm meter resistance. But we know that the 10 meg loads down the voltage to 90.9% of the unloaded value so we simply add 9% to the reading.

*4. The effect is noticeable and unsteady*—This most often happens in RF circuits where the test leads act as in case 2, but drastically affect the circuit being tested. The first choice to correct this problem is to try the series resistor already suggested. Alternatively a high-impedance probe such as the one described in TTAM 11 (In April *QQ* if I recall correctly) can drastically reduce circuit loading. Ultimately, if none of the above works you have to either figure a different way to do the measurement or run the test in a different part of the circuit.

**Designed for Test**

I don't know about you but I have a whole bunch of headsets in my shack. Most are low-impedance, either 16 or 32 ohms and they are a mix of mono and stereo units. The more expensive ones have specified amplitude and frequency response while the cheap ones that come with consumer radios, CDs, tape players, etc do not. But even the static specs for the good ones don't accurately tell how well they will work with a ham rig. For voice use the specs are usable, however CW response is another matter.

The project to be described is called the HPE, or HeadPhone Evaluator is an attempt to characterize headphones for CW use. It uses the NJQRP Quickielab (QL) to generate a simulated CW signal at 800 Hz and lets the user vary the signal level in a predictable way so that sensitivity can be measured under controlled conditions. Using a simulated CW signal adds a degree of realism to the test and having carefully controlled repeatable amplitude makes the task of comparing headsets very fast and simple.

The simulated CW signal is simply the Morse character "I" sent as 2 dits with appropriate spacing and repeated endlessly. The tone level is adjustable in 100 steps between approximately 0 dBm and –40 dBm into a 16 ohm load. Calibration is not assured for other impedances but since the driver circuit simulates a radio output stage, comparison testing gives reasonable results.

The QuickieLab setup is too complex to describe here. Similarly the program is not printed in this article. They are both available on the NJQRP web site www.njqrp.org by going to the QuickieLab section and looking for the HeadPhone Evaluator. Those without web access can get a hard copy of the QL setup and program by sending a business-size SASE to the author at the address indicated below.

A very simple interface circuit is built on the QuickieLab plugboard area. The schematic diagram is given in Figure 1. The pulsewidth modulated audio signal from the QL is filtered to a clean sinewave by a low-pass filter consisting of R1, R2, C1 and C2. It is attenuated to about 0 dBm by R3 and the 100k digipot R4. The latter is part of the QL Input Output eXpander (IOX) that has been described in an earlier column. Those without the IOX can use a Maxim/Dallas Semiconductor DS1804-0100 digipot connected directly the QL processor with some changes to the operating program. Digipot R4 is adjusted by the QL program to attenuate the 0 dBm level as desired.

The attenuated output is fed to the gate of MOSFET Q1 through coupling capaci-

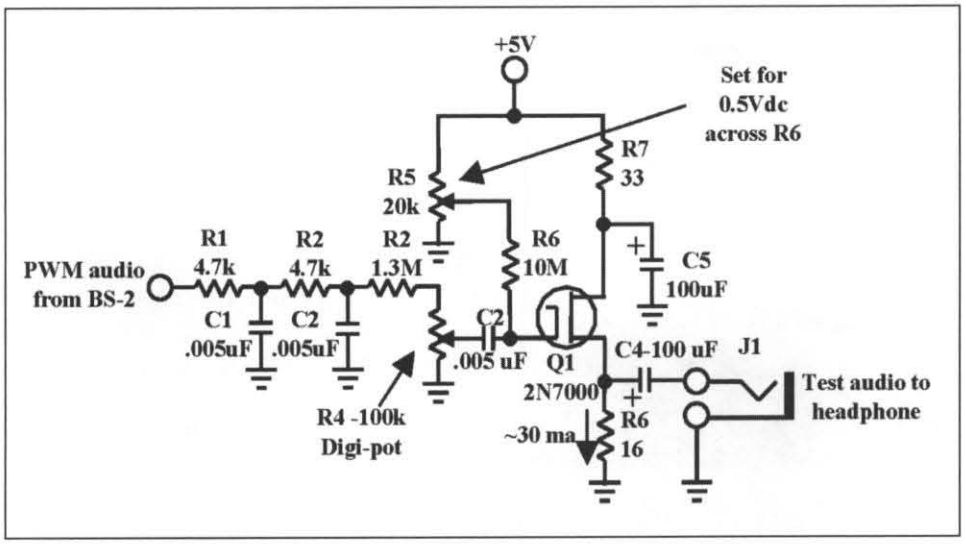


**Figure 1—Headphone evaluator output circuit.**

tor C3. Operating bias for Q1 is set by R5 and isolated by 10 Meg resistor R6 (remember the circuit loading discussion?). R5 is adjusted for a DC voltage reading of about 0.5 volts across source resistor R6. Since 0 dBm at 16 ohms is 355 mVp-p the 0.5 volt bias allows full swing across R6.

Output to headphone jack J1 is through decoupling capacitor C4. Resistor R7 in the drain circuit of Q1 prevents damage if the bias is mis-adjusted. Capacitor C5 provides a low impedance bypass for R7.

Selecting the right device for Q1 is important. The VN10 device offers a high operating current with low gate bias. The more common 2N7000 is optimized for lower current operation. According to spec sheets a VN2222 should also work but this has not been verified.

You may wish to use two headphone jacks, one for mono and the other for stereo phones. Wire the stereo jack to connect the right and left headphone elements in either series or parallel depending on your usual choice. I usually use them in series.

Operation is quite simple. When the program begins the digipot is set to mid-range (50). The familiar dit-dit tone is audible in the headset. Press PB2 on the QL to increase volume and PB3 to decrease it. Ah but how do you know what the actual setting is? Simple—press PB4 and the two-digit relative pot setting (0 to 99) is sent via Morse code on the QL loudspeaker.

A more sophisticated HPE is in the works. It will add the ability to vary the test signals pitch in addition to the current amplitude control. And it will display both the pitch and digipot position on the IOX LCD screen. The updated version will be described in the QuickieLab section of the NJQRP web pages.

**Stimulus And Response**

I'm frequently queried "What can I use the QuickieLab for?" I usually answer with a quote from Winston Churchill in answering an open-ended question—"Madam of what use is a new-born baby?"

Since the focus of this column is testing and measuring equipment and techniques I'll concentrate on a couple of ideas that I intend to develop in the near future using the QL. Note that several seem to be similar to some commercial items. So that they do not directly compete with our valued QRP vendors' products the will not offer the full functions or accuracy of commercial products.

The candidate projects include:

- A digital RF power meter using the QL as a DC voltmeter in conjunction with a 50 ohm dummy load and an RF detector.
- A digital directional wattmeter and SWR meter that extends the above idea to monitor the output of a directional RF power sensor such as the Stockton or NoGa RF wattmeter.
- A battery life tester that provides loads simulating typical transmit and receive load currents and monitors the battery to determine how long it takes to reach the end-of-life terminal voltage. This lets you estimate how long a given battery type will operate your QRP rig.
- A semiconductor identifier and tester similar to the Atlas Peak tester that determines the proper terminal connections for a semiconductor device and measures its parameters.
- A capacitor and inductor tester to provide an automated digital reading of their values.
- A Q-meter to measure RF inductors.
- An automated crystal tester to measure resonant frequencies, motional inductance and series resistance for crystal filter design.

It is anticipated that these projects and more will appear in future TTAM columns. However after four years (has it really been that long?) the column will be moving to a new QRP journal. Starting with the next installment TTAM will now appear to the brand new American QRP Club journal *The Homebrewer*. The run here in *QRP Quarterly* has been fun and I enjoyed contributing this column. But it's now time to move on so I encourage my loyal readers to enjoy *The Homebrewer* in addition to *QRP Quarterly*.

*—72/73, Joe E., N2CX*

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# Four Days in May, 2003

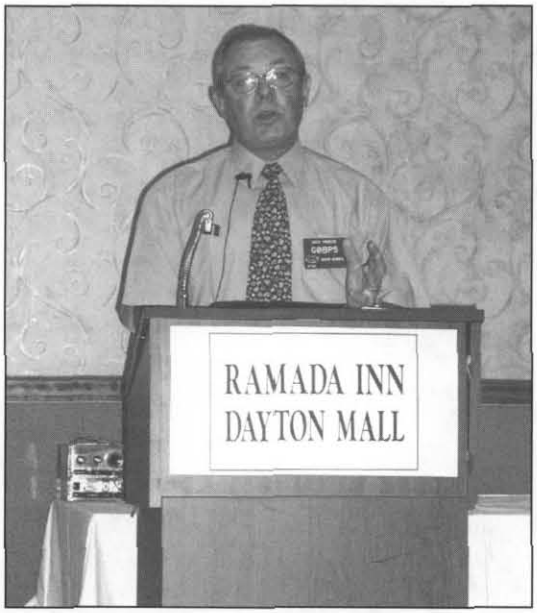
Dick Pascoe—GØBPS g0bps@gqrp.com

I have not been to the Four Days In May for four or five years, although I did several years before that starting at the downtown Dayton Knights Inn. I knew that the FDIM had been run well over many years with several prominent QRPers doing 'their bit' to ensure it ran smoothly. This year after missing a few opened my eyes again. This event was SUPERB! Congratulations to ALL who had a hand in it, they were all EXCELLENT.

On a personal level I summed up it up in one word, the weekend was "WOW!"—I had a ball!

**FDIM Seminars**

The packed audience as I opened the FDIM seminars was a bonus, seeing so many familiar faces after my "vacation." The Thursday speakers were great, the coffee superb and everyone seemed to be enjoying themselves. The evening get-together was marvelous too!




**QRP ARCI VP GØBPS opens the seminars with a few well-chosen remarks.**

**Hamvention QRP Forum**

On Friday at the Hara Arena forums, the first talk by moi saw a packed room with many standing or sitting around the edges of the room. They seemed to enjoy hearing about "Introducing QRP." George Dobbs, G3RJV's talk that followed on the hobby was, as usual, excellent.

After the talks, ARRL President, Jim Haynie, W5JBP, came to visit the G-QRP stand to introduce himself. Among the many questions that he asked was, "How can a QRP club get so many people to come on a Thursday? What are you doing that works so well?" I was able to explain a little of our success and asked him to come next year.

**Building Contest**

Friday evening's building contest was judged by two Brits: Graham Firth, G3MFJ, and myself, GØBPS. Someone made the comment "Why are two English judging, what do they know about building?" which saw both of us foaming at the mouth. We got our own back later! The construction standard was, as usual excellent and Graham and I had a hard job deciding on a winner. It brought back memories of doing the same job for several years during the mid 1990s.

My Saturday was spent at the arena until the banquet in the evening where the prizes for the construction contest announced and I presented the prizes.

**QRP Hall of Fame**

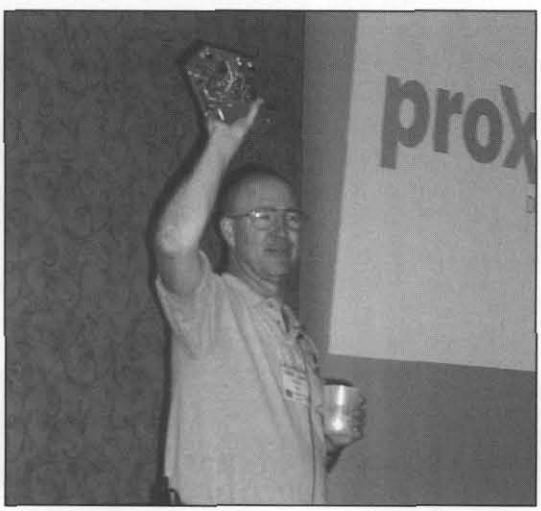
I also had the honor of announcing the inductees to the QRP ARCI Hall of Fame 2003—Arnie Coro, CO2KK, Graham Firth, G3MFJ, and Tony Fishpool, G4WIF.

Most US hams will not know of Arnie, but he has been around for many years promoting QRP in his own special way in Cuba. His commercial radio broadcasts often include bits about ham radio and QRP in particular. He has spent many hours encouraging hams to raid old TV sets for bits of hardware.

Many members will know of Graham and Arnie through their visits to several Hamfests throughout the US. I even introduced them as the "Laurel and Hardy" of QRP or, dare I say it the "President Bush & Prime Minister Blair" of ham radio.

After presenting the awards to the latter two I was amazed to see the first ever standing ovation for a HOF inductee. Two guys who were especially admired by all

**Symposium speakers "played to a full house" of eager-to-learn QRPers.**




**Jim, K8IQY gets everyone's attention**

present. Well done both and "gotcha" to Tony—revenge is sweet (he nominated me back in 1997)!

Sunday saw the wind down of the Hamvention and the FDIM, packing bags and the stand ready for next year. Who will it be in the HOF I wonder? Who will win the construction contest?

(Oh yes, the comments about the English Judges—we were both commercially involved in electronics during our professional careers.)

**Come Back Next Year**

As for next year, I already have permission to go as long as she comes too! So see all y'all at FDIM 2004!

Finally: The thrill is back—QRP IS!!!!

*—72, de GØBPS*

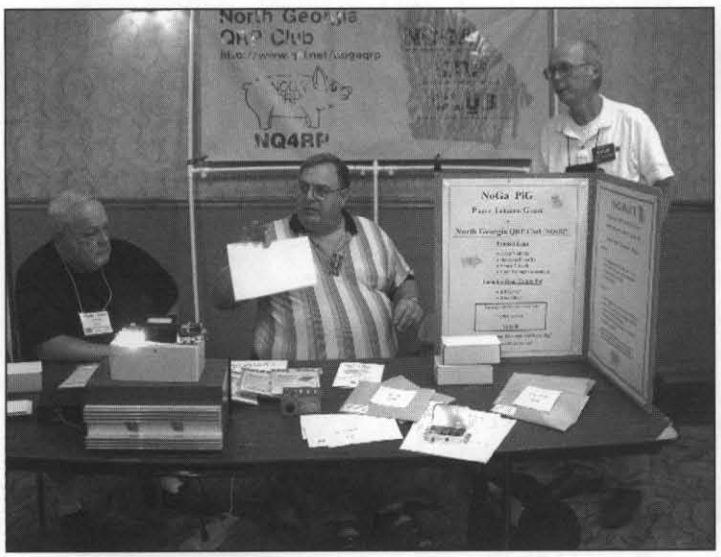
**It's those British guys—Dick, GØBPS; Tony, G4WIF; and George, G3RJV.**

## FDIM Vendor Night—A Chance for a Close-up Look at QRP Products

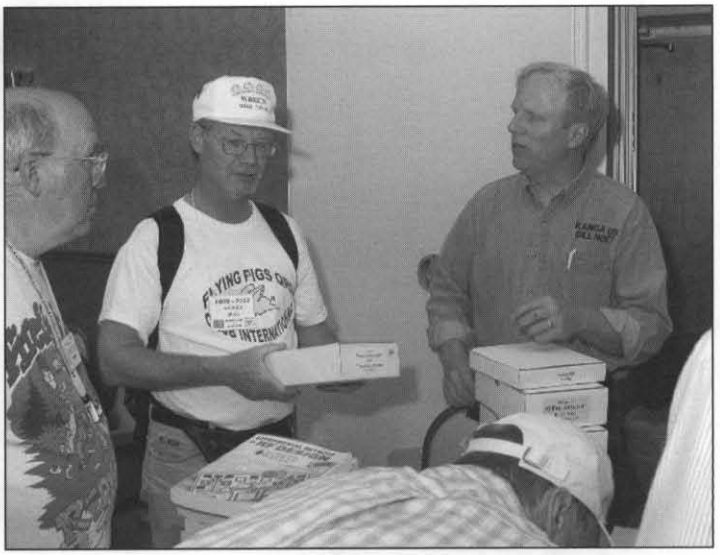
*photos by AA9YH*

**Vendor Night always draws a big crowd.**


**Once again, the QRP Cheeseheads provided cheesy snacks.**




**NOGA QRPers having too much fun.**



**The Kanga table is an annual favorite at Vendor Night.**

## 2003 FDIM Team

**2003 FDIM team (left to right): Pickett Cummins, AD4S; Joe Roof, W4JHR; John King, AB4GK; Ken Evans, W4DU; Tom Dooley, K4TJD. (Team members not pictured: Hank Kohl, K8DD, Bill Phillips, AD6JV; Tom Feeny, K8KOX and Scott Rosenfeld, N7JI.)**

**The FDIM Team for 2003 included:**
Tom Dooley, K4TJD—FDIM Chairman;
Hank Kohl, K8DD—FDIM Guest Room Reservations;
John P. "Pickett" Cummins, AD4S—QRP Proceedings Editor;
Ken Evans, W4DU—Special Events (with support of the North GA QRP Club and the Flying Pigs International QRP Club)
Bill Phillips, AD6JV—Vendor Night
Tom Feeny, K8KOX—Publicity
Joe Roof, W4JHR—Sign-in and Registrations; and
Scott Rosenfeld, N7JI—QRP ARCI Donations.

Many others contributed their time and I apologize to those that I may have inadvertently forgotten.
*—Tom Dooley, K4TJD*

**Some of the team pose with GØBPS. From left: Ken, W4DU; Dick, GØBPS; Tom, K4TJD; Hank, K8DD.**

## More Vendor Night Photos

**Here's a clever portable antenna.**

**The IC-703 generated plenty of interest.**

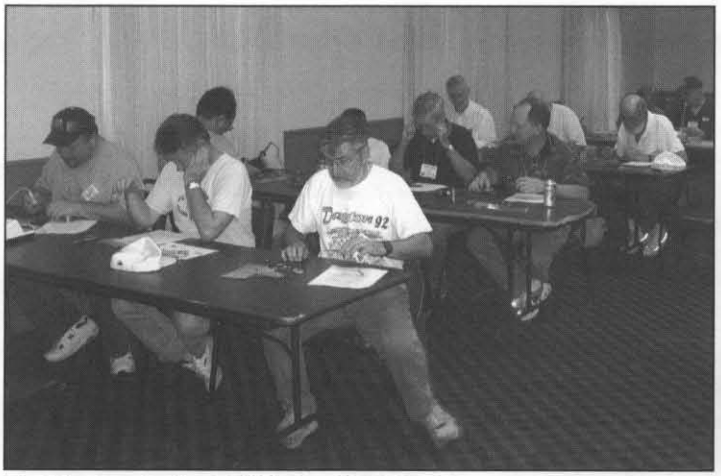
**Do *you* own a K1?**

**Nice to have SGC at Vendor Night.**

*photos by AA9YH*

## The Popular NOGA/Flying Pigs FDIM Build-a-thon

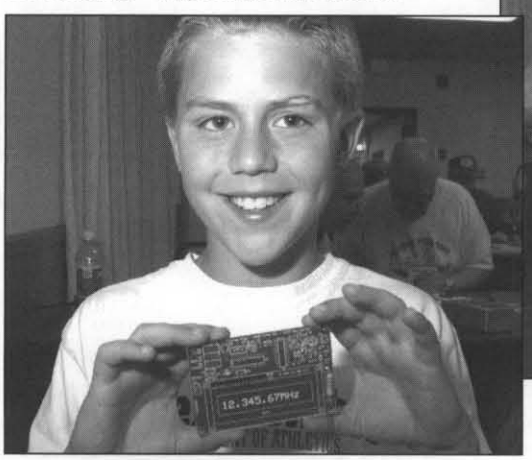
*2003 Project— A frequency counter*



**Buildathon is the highlight of FDIM for some QRPers!**

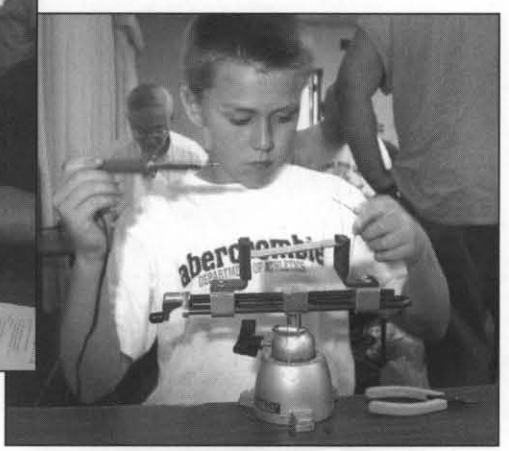
**Bruce, VE5RC found several willing Elmers.**

**Brach Schwegman is ready for his Buildathon "Excellent Adventure."**



**First the parts get installed on the p.c. board...**

**...then the fragrance of melted solder and flux.**



**Then comes the final checkout by Diz, W8DIZ, and *voila*, we have a working frequency counter!**

*photos by AA9YH*

**A little guidance helps, provided by Ken, W4DU...**

**...and some more soldering.**

# A Dual-Band Version of the Rock-Mite

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*NOTE: N5FC was Monty's former call. This project was constructed while that call was valid, so you may observe references to it in the figures, etc. For additional photos and information on some more of Monty's projects, visit his web site at http://www.dit-dididit-dit.com.*

**Overview**

I love seeing how much functionality can be packed into a small electronic package. So when I heard that Dave Benson, K1SWL, and Small Wonder Labs [1] was offering a tiny single-band CW transceiver kit called the Rock-Mite for just $27, I knew I had to have one... er... two. Currently offered in two versions, 20 and 40 meters, it seemed the ideal candidate for a minimalist dual-band rig. In this article, I'll describe my experience building the Rock-Mites, and show how I packaged it to become a tiny dual-band CW transceiver.

The Rock-Mite is a "minimalist" rig in the finest tradition of the QRP "KISS" philosophy (Keep It Simple, Stupid!). That is not to say that it is a poor performer. I have built direct-conversion receivers based on the NE602 active mixer and a follow-on audio amplifier chip, and my experience has taught me that they never have enough gain to provide adequate headphone volume. When I saw that this receiver used that schema, I was understandably skeptical, but somehow Dave Benson has managed to overcome the typical shortcomings without complicating the circuit. I think I can safely say that he is the master of optimization, and that's a good thing to be when engineering a very simple circuit.

The Rock-Mite is a single-frequency rig, with the transmitter and receiver fixed-tuned to just below the 40 M QRP Calling frequency of 7040 kHz (14060 kHz for the 20 M version). A fixed offset of about 700 Hz is provided between the receiver and transmitter frequencies, and a switch allows the RX and TX frequencies to be swapped. This prevents the unpleasant situation of having someone call you zero-beat at the receiver frequency, with no recourse to tune away. A crystal-controlled Colpitts oscillator provides both transmit and receiver injection. A bipolar transistor buffer stage provides drive to the bipolar final amplifier, which provides 3/8 to 1/2 watt of RF output (depending on the supply voltage). A 5-element pi-network provides matching to a 50-ohm load, i.e., your antenna or tuner.

It's amazing what features Dave has managed to pack into a 2 x 2.5-inch PC board. Would you expect automatic T/R switching in a minimalist $27 rig? How about receiver muting and sidetone? Well, you have it with the Rock-Mite! How about a built-in iambic keyer capable of 5 to 40 WPM? It's yours, all on the same tiny board! All these are possible due to the clever use of an 8-pin pre-programmed microcontroller chip.

**Board Construction**

The Rock-Mite arrived in a padded envelope, with a four-page instruction sheet (two sheets, both sides). Instructions were clear, and the parts list, schematic, and parts layout drawings were accurate. Beginners might have a little trouble figuring out how to connect external wires and controls because those details are pretty much left to the user, being only alluded to in the narrative.

My first board went together in about three hours, from start to test, so this is an easy evening project. Packaging will eat up a little more time, depending on how elaborate you want to get. For those who don't want to fabricate their own enclosure (or use an Altoids box), a first-class machined (yes, machined!) and anodized enclosure (called the "MintyBox") is available for $20 from The San Luis Machine Company [2].

Figure 1 shows my 20 M Rock-Mite prior to testing. Rock-Mite owners with sharp eyes will notice that it is not exactly "stock" ... I'll explain the differences in the next section.

**The Dual-Band Rock-Mite**

I really wanted to package my two boards in a unique way, and as compactly as possible. In order to accomplish that goal, I decided to do three things:

1. Lower the height profile of the individual board;
2. Stack two Rock-Mite boards together, making a dual-band unit;
3. Build my own custom cabinet.

In order to lower the overall height of two stacked boards, I modified the individual boards (during assembly) by substituting lower-profile components wherever parts stuck up above the board in excess of 5/16 inch. As I have a pretty good junk box for homebrewing, this did not add to the cost for me. The following list summarizes these changes:

- Change vertically-mounted 1/4 watt resistors to 1/8 watt resistors
- Change electrolytic can capacitors to dipped tantalum capacitors
- Substitute smaller monolithic capacitors for disc caps that exceed the profile
- Mount all TO-92 transistors and ICs as close to the board as possible
- Use a lower-profile DIP socket at U3, and no socket at U2
- Mount crystal Y1 horizontal to the board, and crystal Y2 vertically, but angled outward
- Use a metal-can 2N2222A for the final, so that a low-profile heat sink can be attached
- Closely clip the leads on the bottom of the board

This all allows the two Rock-Mite boards to be stacked together, using four 5/8-in. long by 3/16-in. diameter) male-female threaded spacers, which I salvaged from some discarded computer equipment. The vertical height of the stack is less than 1 inch. Figure 2 shows the stack from the input end.

Notice here that the Y2 crystals are angled outward, because they're just a smidgen too tall to fit between the 5/8-in. spacers. Also, notice the "tophat" heatsink mounted on the metal-can 2N2222A (on the right, bottom board, just behind the two resistors, and to the left of Q3). The tophat exceeds the 5/16-in. profile slightly, but it so happens that the components on the mating board are well under the profile,

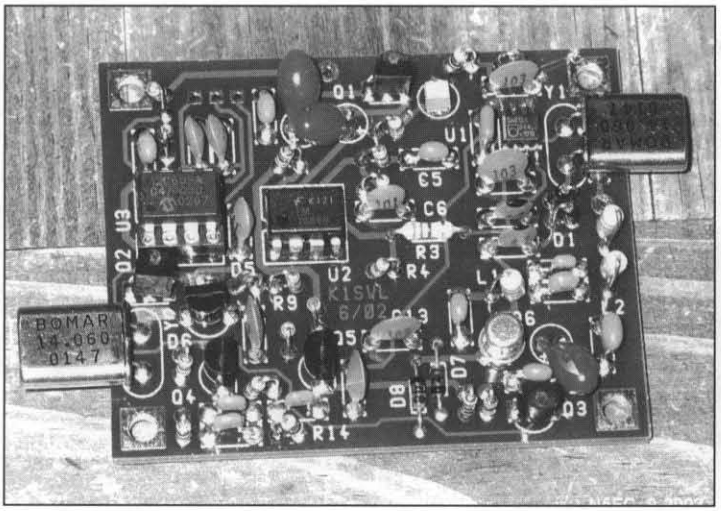

**Figure 1—Completed 20 M Rock-Mite board.**

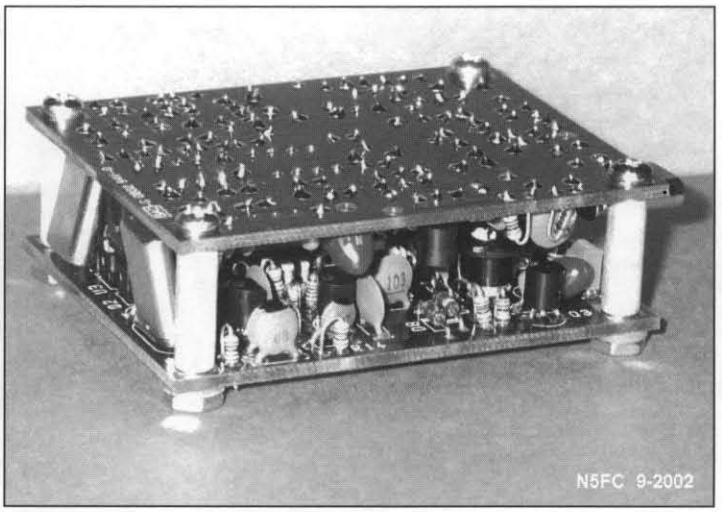


**Figure 2—Dual-band Rock-Mite PC board stack.**

hence no fit interference takes place. Almost like it was planned that way!

The enclosure for the dual band Rock-Mite was homebrewed from double-sided 1/16-in. PCB stock. This is a nifty way to make a strong, custom-sized enclosure, and I've used it on several projects. The technique is to carefully cut each panel of the enclosure, then use a medium-to-high Wattage soldering iron to run a solder-bead along any right-angle joints, forming an amazingly strong construction. TIP: use a 3M scrubbing pad (or steel wool) to removed oxidation from the copper first, and apply a thin film of acid-free flux just prior to soldering; this will make the process go much more smoothly. The trick is keeping the panels at right angles while soldering, and it may take a little practice before you acquire the finesse needed. I usually tack-solder the joint at the two ends first so I can adjust it if necessary; then, I run my solder bead.

Using this technique, I constructed a chassis 2.25-in. W x 4.25-in. L x 1.125-in. H (outside dimensions). The chassis consists of a bottom plate, two end panels (which form the front and rear panels), and two 1/4-in. high side panels (for additional rigidity). I also constructed a slip-on top cover, which consists of two side panels (1.24-in. H, OD), and a top plate. The top cover is held in place with two No. 4 x 1/4-in. sheet metal screws, one on each side, which screw into the chassis' side panels.

To make it look "purty," I constructed labels on in my computer, printed to sticky-back paper (mailing label paper, available in any office supply store), and applied them to the front and rear panels prior to mounting controls and connectors. Then I painted the chassis (outside only) with clear acrylic lacquer, and the top with bright blue enamel.

In order to consolidate connectors and controls (in other words, to avoid having two complete sets of connectors and controls), I used a DPDT toggle switch and some external diodes and wiring to connect the two boards together, as shown in Figure 3. The result is what appears to be a dual-band Rock-Mite.

Notice that the "bandswitch" is a DPDT center-off subminiature toggle switch (RS 275-620). It serves the dual purpose of bandswitch and power switch, with the center-off position being the power-off position.

The two resistors (10-20 ohms each, typical) at the headphone jack prevent an accidental short circuit in the event someone plugs a 1/8-in. mono plug into the stereo jack. You could certainly leave these off if you like, connecting both the tip and ring terminal together.

One note before I get questions: to reduce the possibility that RF feedback via the power line, causing hum and poor receiver performance, special care was taken to shield and decouple the power. To do this, RG-174 miniature coax was used to route power from the bandswitch to the individual boards, with the shield connected to the ground plane of the rear panel (so that there is a low-impedance path to the antenna jack's ground). On the end nearest the board, the shield is left unterminated

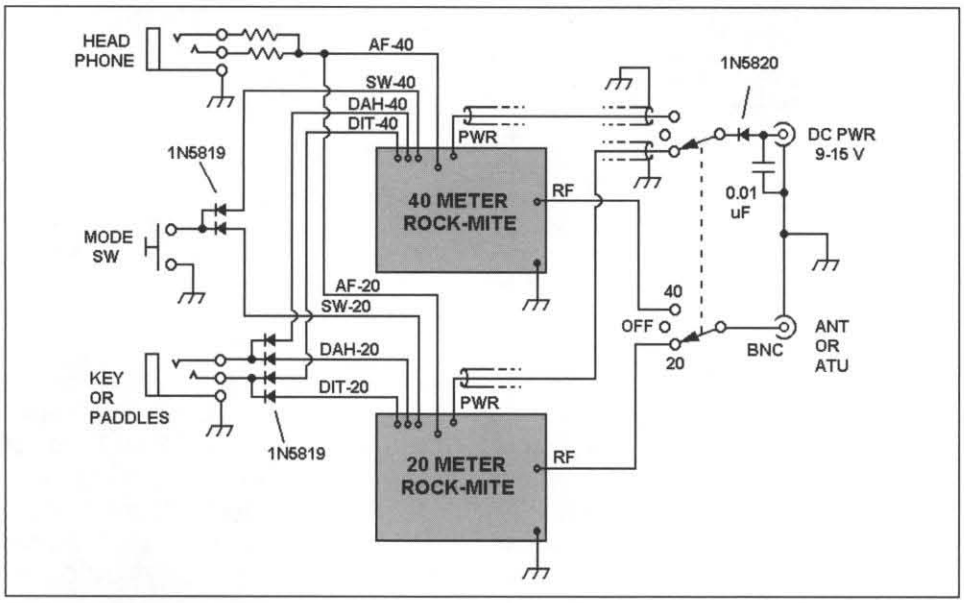


**Figure 3—Dual-band Rock-Mite wiring diagram.**

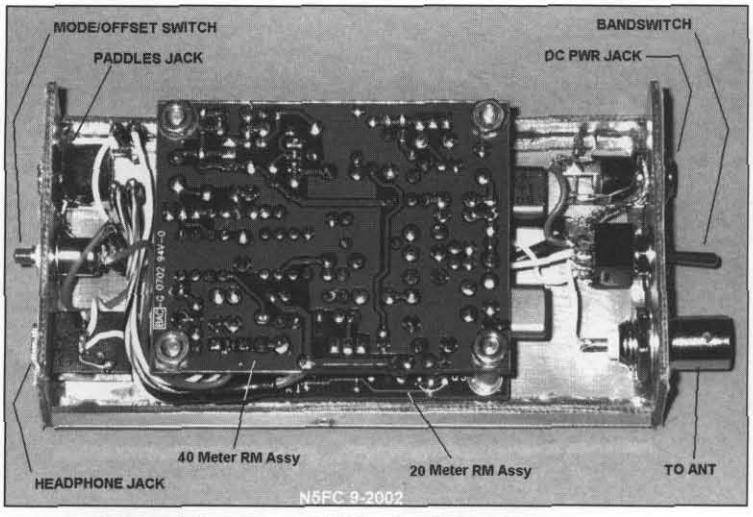


**Figure 4—Dual-band Rock-Mite, inside view.**


**Figure 5—Front Panel.**

(i.e., open); this provides good electrostatic shielding. Also, at the DC power jack, the incoming DC is decoupled with a 0.01 µF monolithic capacitor, to keep radiated RF from entering via the power line.

Figure 4 shows the completed wiring, the board stack, chassis components, and layout. A view of the front panel is shown in Figure 5.

### Operation

Operation is straightforward. Hook up your antenna or antenna tuner, power supply (I used a 12-Volt gel-cell battery), earphones, and your key or paddles. Use the bandswitch to select your desired band. Assuming everything works, you should hear some band noise or signals. Key to tune-up or transmit. Pushing the front panel pushbutton once quickly will reverse the offset. Answering CQs can be tricky... you don't really know which side of zero-beat you're on. Here are some guidelines: If the pitch of the signal is very low (less than 350 Hz), push the button once and call the station. If the pitch sounds somewhere around 500-1000 Hz (medium pitch), push the button once. If the pitch gets lower, push the button again to switch it back, and give 'em a call. If, on the other hand, it gets higher in pitch, you're probably too far off-frequency; go ahead and call, but don't be surprised if the other station doesn't hear you.

When calling CQ with your mighty 1/4-watt, don't expect everyone within several kHz to come a-runnin' when they hear your booming signal. When listening after a CQ, push the button once in a while to see if someone is off-zero-beat calling you, but always switch it back prior to transmitting, so they don't lose you (hey! how could they lose you?)

Here are some measurements I took to assess my Rock-Mites' performance:

**ROCK-MITE PERFORMANCE**

**Receiver:**

| | Blocking | MDS |
|---|---|---|
| 40M | >1 V | ~0.3 µV |
| 20M | >1 V | <0.25 µV |

**Transmitter (12.15 VDC):**

| | Power Output |
|---|---|
| 40M | 400 mW |
| 20M | 375 mW |

**Current Consumption:**

| | RX (12.25 VDC) | TX (12.15 VDC) |
|---|---|---|
| 40M | 25 mA | 240 mA |
| 20M | 39 mA | 189 mA |

### Put Up or Shut Up...

Keying was exceptionally clean and crisp. After a 15 minute QSO, the output transistor's heat sink is only slightly warm. I was surprised to hear no hum on 40 Meters, using my 40 meter inverted vee fed with open-wire. The 20 meter receiver, however, had some noticeable hum, but not enough to mask weak signals. I have poor grounds on 20 meters at my shack, so that may have contributed to the hum on that band. The front-end crystal seems to make a difference in receiver performance, as this receiver seemed much less susceptible to front end overload, and no SW BC signals could be heard on 40 Meters at night.

With most novelty rigs, I generally use them one evening, then put them on the shelf to collect dust. After my first evening of operating with the Dual-Band Rock-Mite, it was hard to keep with that tradition. My first QSO on 20 Meters was with Earl, VA6RF, in Bassano, Alberta, who was also running a Rock-Mite! We exchanged 539 reports, and proceeded to have a 16-minute QSO. At 1660 miles DX, and 400 mW, that's a two-way QRPp QSO at over 4000 miles-per-watt... not bad!

I then QSY'd to 40 (hey! that flip of the switch was easy!), adjusted the antenna tuner, and found Jim, WB4HUX, in Birmingham, Alabama, running a QRP full gallon. The Rock-Mite performed at nearly 2000 miles-per-Watt on 40, too, and we QSO'd for a little over 20 minutes. An auspicious beginning.

### Conclusion

Besides being inexpensive and easy and fun to build, the little Rock-Mite is a great performer. Packaging two of them together to create a dual-bander yielded a light and compact rig that's ideal for keeping in the travel bag or in the glove compartment of the car.

### Notes and References

1. Small Wonder Labs, 32 Mountain Road, Colchester, CT 06415. On the World Wide Web at http://smalwonderlabs.com.

2. American Morse Equipment, San Luis Machine Co. Unit F2, 200 Suburban Rd., San Luis Obispo, CA 93401. On the Web at http://www.americanmorse.com/mitybox.com. ●●

# QRV?

## Absolute Power Corrupts Absolutely—But You Need Electricity

Mike Boatright—KO4WX ko4wx@mindspring.com

*Mike:*

*Please excuse my forwardness but I just had to comment on your excellent article on "Power" in the last issue of QRP Quarterly. It answered a lot of questions whose answers I have long forgotten since I got my call in 1975.*

*I am a Beacon operator and have had a 10 meter beacon running continuously for about 8 years. It's on 28.246 and signs VE9BEA/B. I also have a "Little Joe" transmitter running as a Beacon on 21.145 at 225 milliwatts, on the air for about 6 months. For some time I have been looking for a QRP amp for the Little Joe that would boost the power to about 3 watts and it looks like your schematic, Figure 6 in your article, would do the job.*

*If you agree, I have a question... Are transformers T1 and T2 off the shelf or do they have to be custom wound? I've wound a few toroids but am not familiar with the term "bifilar" in your component designation.*

*Any comments would be much appreciated and accept my thanks in advance!*

*—73, de Vern, VE9VS*

**No Problem!**

The amateur radio literature is full of nifty little (and big!) circuit ideas, many of which reflect something that the author built, thought was a good idea and published. All too often, however, you find-after spending considerable time building and testing it on your own bench-that for one reason or another, the circuit is not really as reproducible as the author would have liked for it to be.

Such is the case with the IRF510 amplifier from last issue's QRV? column. The circuit does indeed work, but will not give exactly what you hope that it will for all amateur bands.

Nearly everything that I have seen written about the IRF510 Field-Effect Transistor (FET) says that it is really only useful up to 10 or 14 MHz or so. But I had completely forgotten that when I answered Vern's email:

"Now, the gain of this amp is somewhere around 10 or 12 dB. So if you feed it 225 milliwatts, you might get as much as 3.9 watts out. Sounds like it's in the ball park that you want. In theory, you should get no more than about 6 watts out total, because as a class C amp, it's probably about 50% efficient. Since the peak-to-peak voltage is almost 12 V and $P = V^2_{p\text{-}p}/2R$, the absolute maximum power you could get out of this would be 11.5 watts, but at 50% efficiency, about half of that is dissipated as heat in the device."

Oops! I completely forgot about gain roll-off in the IRF510 FET! I got to wondering, however, if it would amplify at all. Since I have been looking for an excuse (and waiting for the bands to die!) to build the Cub-15 kit that I bought at Dayton two years ago, it occurred to me that it might make a nice "exciter" to use to test out the amplifier on 15 meters.

If you have never built a Cub kit from MFJ, it is a very nice weekend or evening project. For information on building this kit, reprints of my QRV? columns on the subject (*QRP Quarterly*, April, July, October, 2001) are available on my website, http://www.qsl.net/ko4wx.

**OK, What Does "Bifilar" Mean?**

One thing that I also do way too often is assume that everyone else has learned the same construction techniques along the way that I have. As you get more experienced with construction, you will definitely gain a lot of handy "hints and kinks" in your toolkit, but you can never know everything—heck, that is what makes our NOGA QRP Club monthly meetings so fun, as most everybody has something cool to show.

So, I personally think that the only stupid question is the one that is not asked. Vern's questions about T1 and T2 are excellent, because the first several times I tried to wind a bifilar broadband transformer, I made a terrible mess.

The American Heritage Dictionary defines the word bifilar (pronounced *bye-fye-ler*) as "fitted with or involving the use of two threads or wires." Essentially, you wind the transformer with ten turns of two wires wound together. In radio construction literature, there are at least a couple of ways described of doing this, but the easiest that I have found is to take the two wires and twist them together. You can do this by hand, but it is really easy to make twisted-pair wire by putting the two wires together in the chuck of a drill as shown in Figure 1. Hold the other end of the two wires together and slowly turning the drill until you have about eight or ten twists per inch. This is not too difficult, and comes fairly quickly with a little practice. Note that it really helps to have two different color of wires as you will see in the next step.

Once you have made up a sufficient length of twisted-pair wire (about 6-1/2 inches or so are needed for the T50 toroid), you wind the transformer just like you would any other toroid, only you wind it with the pair of wires that have been twisted together.

Selecting which wire connects where in the circuit is where having two different colored wires really helps. Refer to Figure 2; here we have one red wire and one green wire. Notice that the green wire from one side of the toroid winding is connected to the red wire from the other side. It doesn't matter which red and which green, as long as they are at opposite ends of the toroid winding—do not connect the two wires that at the same end!

Removing the enamel from enameled magnet wire (the easiest stuff to use to wind toroids) can be tricky. The easiest way I've found to do this is shown in Figure 3. Take the wire that is to be stripped and lay it on an old scrap of wood (I always have a couple of blocks of 2x4 around my construction bench for the occasional loose bit of drilling that I might have to do). Melt a small glob of solder on the end of your hot soldering iron and lay this against the wire and press it into the wood briefly. A little smoke (ahh, I love that smell! But caution—only perform this in a well ventilated area!) and voila, a small bit of the paint will melt off and the copper wire underneath will tin with the solder. Once that little bit of paint is gone, it is fairly easy to get it to burn off the rest

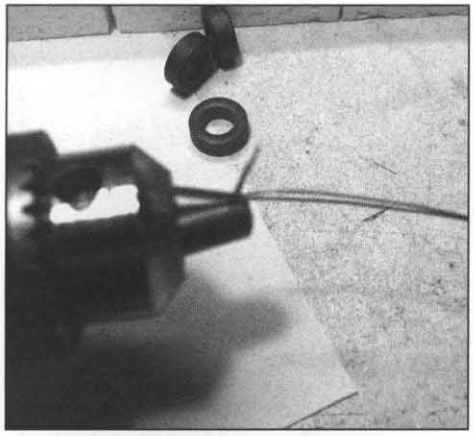

**Figure 1—Making a bifilar wire (actually a bifilar pair of wires).**

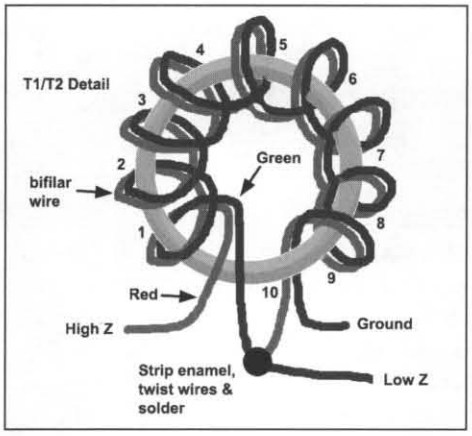


**Figure 2—Transformer T1 and T2 winding detail.**

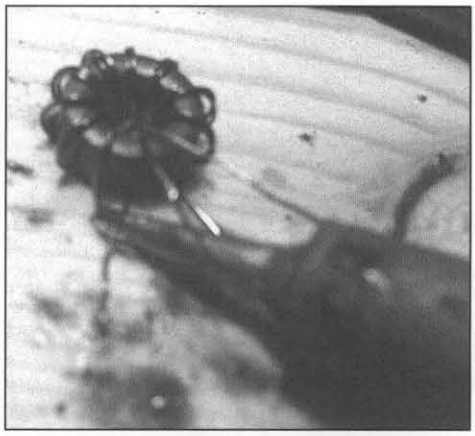

**Figure 3—Burning the coating off of enameled wire.**

of the paint by slowly drawing the iron (with a small glob of solder melted onto it) up the wire to the loose end. It may take a try or two to learn how to do this, but it is far better than trying to scrape the paint off with a knife (which can cause nicks that will make the wire break off) or with sandpaper (which can take forever!).

Referring to Figure 4 (the amplifier circuit from last time), transformers, T1 and T2 are what is known as broadband impedance matching transformers—that is, they will transform the impedance of an RF circuit from a high impedance (usually abbreviated as "Z") to a low impedance. In the case of T1 and T2, the ratio of high impedance to low impedance is always 4 to 1, for example, it will transform a 200 ohm impedance down to 50 ohms (high Z to low Z) or up to 800 ohms (low Z to high Z).

If you take the transformer shown in Figure 2, the loose red wire should always be connected to the "high Z" side and the red-green connection to the "low Z" side. The loose green wire will always be connected to ground.

In the IRF510 amplifier, T1 will have the red-green connection connected to the input of the circuit (e.g. the output from the "exciter") and the red wire will connect to the top of the 200 ohm resistor (whose other end goes to ground) and the 0.1 µF capacitor.

T2, on the other hand transforms the low impedance output of the IRF510 from 12.5 ohms up to the desired 50 ohm output.

**Building a Practical FET Amplifier**

There have been lots of discussions around the QRP homebrewing press about different ways to construct circuits. Manhattan is one of my favorite methods. Only thing I don't like about it is that sometimes the pads can come unglued.

Almost anyone would agree that a nicely etched and plated circuit board is the best way to go. Short of that, my favorite method—when it is appropriate—is to use my Dremel tool (or "hobby tool") to fabricate a board out of PCB material.

Here's a simple trick that can be used if the circuit isn't too complicated. First, print out an exact replica of the board layout graphic, correctly scaled (e.g. if the board is 2" x 2", print it out so it is 2" x 2" on paper). Do not reverse the graphic (as you might if you were etching a board).

Cut the printed board layout out from the paper and use paste glue to glue it to the copper side of a suitably sized piece of PC board. Using your Dremel tool, cut along the areas of the board where the copper is to be removed (see Figure 5). The best way to do this is to lightly etch the board first, as some of the paper will tear off. You want a clean outline of the copper that is to be removed, and then you can go at the excess copper in earnest.

Figure 6 provides a suitable PCB layout for the FET power amplifier. In this layout, the black lines represent where the copper is to be removed. Just cut your Dremel tool along these black lines, leaving large copper pads. Figure 7 shows where the parts from the amplifier schematic are placed—using the Manhattan style, that is, standing up, soldered to the pads you cut using the Dremel. Note that T1 and T2 have 3 solder points—the red wire, the red/green twisted wire on pads and the green wire on the ground plane. Also note that Q1 is installed face down—that is, the lettering on the front touches the copper on the board. This gives you some room to put a small heat sink on Q1—which you will need if you put out more that a watt or so of power (Doug DeMaw, W1FB, SK, said that he would put a heat sink on anything that felt warm to the touch upon application of power).

This board is quite small, and you can scale it if you light, because it is a very tight fit. In my case, I had given some

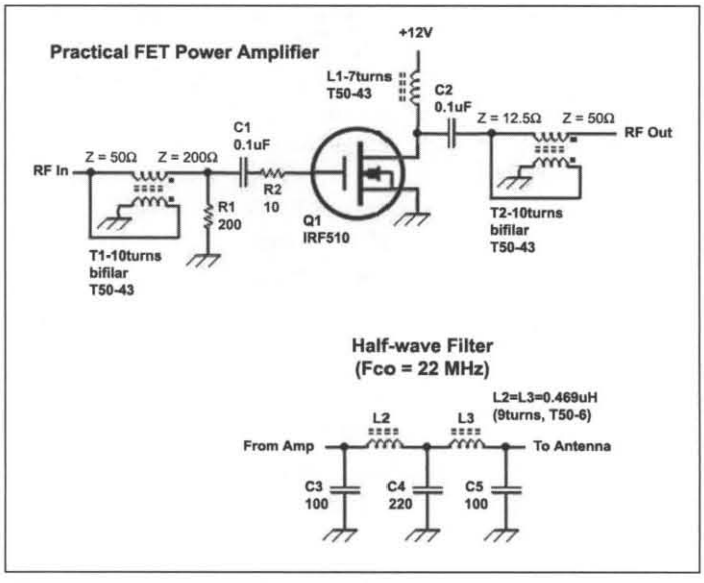


**Figure 4—FET amplifier and output filter.**

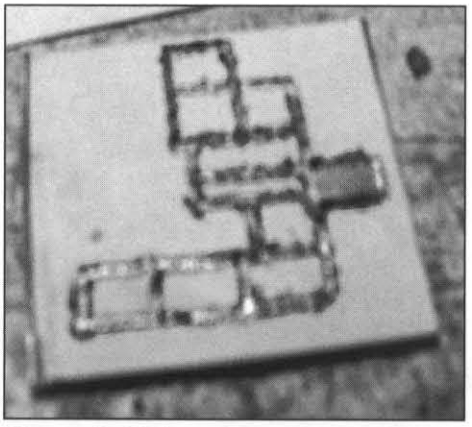

**Figure 5—Using a Dremel tool to make the PC board.**

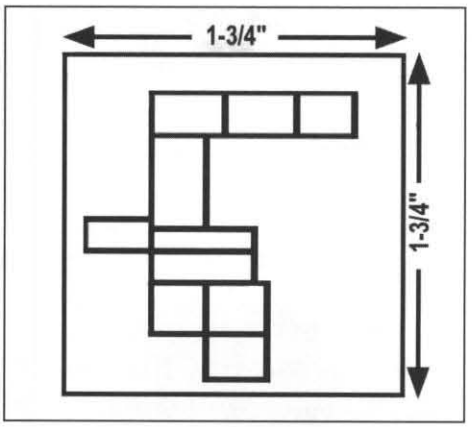


**Figure 6—The amplifier/filter PC board layout**

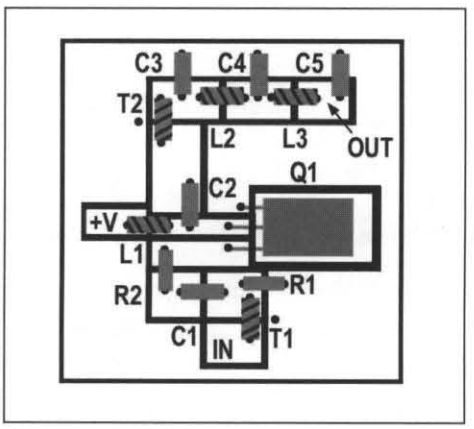


**Figure 7—PC board parts layout diagram.**

thought to putting this inside the Cub-15, so I decided that a 1.75" x 1.75" board would be best. Your results might vary.

Note that L2 and L3 are made by winding 9 turns on a T50-6 toroid. The *ARRL Handbook* calls for these inductors to actually be 10 turns, but when I wound them and then measured them with my AADE inductance meter (which I now rely upon quite heavily), I discovered that I couldn't get down to the required 0.469 µH of inductance using 10 turns. Again, your results might vary—that is the fun of amateur radio construction!

These two inductors are part of a 5-pole half-wave low pass filter, which you absolutely must have if you are going to use this amplifier on the air—in fact, a 7-pole filter would actually be better. This filter is designed to attenuate unwanted signals above the cutoff frequency, or $F_c$. $F_c$ is defined as the frequency at which a signal is attenuated by 3 dB. As the frequency gets further from the cutoff frequency (higher in the case of this low pass filter), it is attenuated more and more (depending, of course on the actual characteristics of the filter). This filter is designed for 15 meter use, and has a $F_c$ = 22 MHz.

**So Does It Work?**

After building the Cub-15, I measured the output into a 50 ohm dummy load. Since I wanted an accurate gain measurement, I used my oscilloscope to measure the peak-to-peak voltage at about 16 V. From this, I determined that the power output from the Cub-15 is about 640 mW, calculated like this:

$$P = (V_{p\text{-}p} \times .3535)^2 / \text{Rload}$$
$$= (16 \times .3535)^2 / 50 = .639 \text{ watts}$$

I then took the output of the Cub-15 into the input of the amplifier, as shown in Figure 8. Note that for this testing, I had not put a heatsink on the FET—so it is very important that I do not key down for long periods, as this could destroy the transistor. Using this set up, I measured the peak-to-peek voltage of the output at 27.5 V—obviously there is some gain here! Calculating the power into the 50 ohm dummy load yields an output from the amplifier at 1.9 watts.

Power gain can be calculated by multiplying the log (base 10) of the ratio of two powers and multiplying it by 10. So the power gain of this amplifier at 21 MHz is:

$$P = 10 \log_{10}(1.9/0.640) = 4.7 \text{ dB}$$

Remember, I told Vern that he should expect 10-12 dB of gain, but all we got was 4.7 dB. What is going on here? Remember that all the literature says this transistor is good to 14 MHz—and in most transistors, the higher the frequency, the lower the gain. So, if you think about it, for a device that is only supposed to work to 14 MHz, 4.7 dB of gain is not really all that bad.

How to solve Vern's problem? Well, he said his current power output is 225 mW. Amplify this by 4.7 dB and you get 669 mW (not far from our 640 mW). Feed the 669 mW into a second stage of amplification (exactly identical to the first) and you will get 2 watts out. Now this is not quite the 3 watts that he wanted, but it's only 1.7 dB less (remember that 1 dB power gain is just about the only noticeable change in signal strength that the ear can detect), which isn't too bad.

And that 2 watts will definitely get him QRV!

*—72 de Mike, KO4WX*

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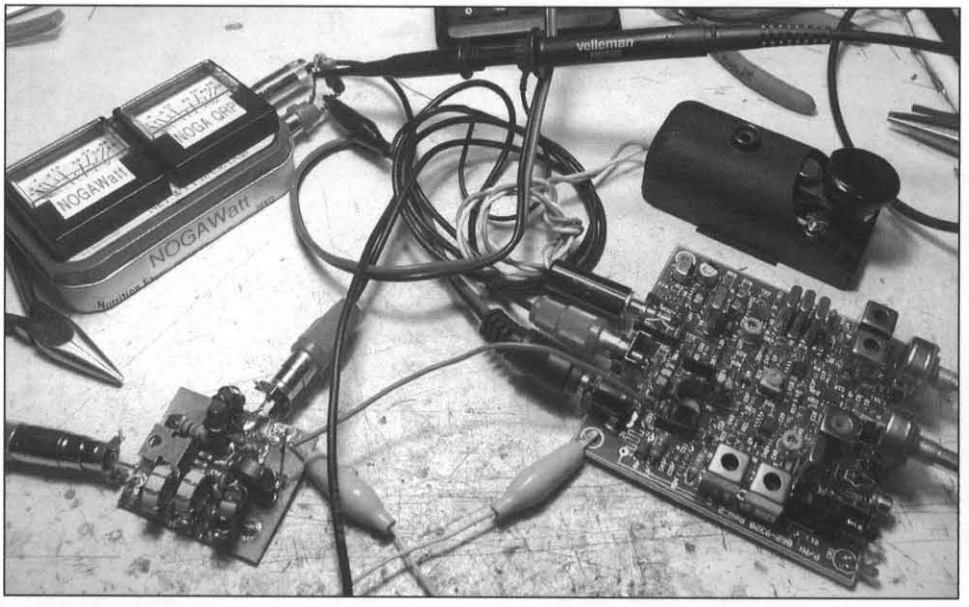


**Figure 8—Testing the amplifier with the Cub-15.**

# QRP Clubhouse: Slow Speed CW Nets

Mike Fletcher—KL7IXI/7 kl7ixi@attbi.com

As a Novice in 1964 I discovered the Northwest Slow Speed Net on 3700 KHz where operators handled formal traffic between 5 and 10 WPM. I took apart a FT-243 crystal and swirled circles of heavy pencil lead on one side to lower the frequency close to the band edge and got involved—my CW sending and speed improved.

Recently I received an email from a QRPer asking about current slow-speed nets for those who wanted to improve their CW ability.

I was surprised to find that there seems to be more slow-speed CW nets now than in the '60s. Even the net that got me started contines as the West Coast Slow Speed Net. These nets provide opportunites for the present 5 wpm licensees to learn traffic handling and emergency communications without the fear of having to cope with high-speed CW. Net Control Stations adjust their sending to the slowest member. Newcomers and low power stations are generally welcome. As these are formal nets, power level isn't important. The main handicap for some QRP ops is that the majority of frequencies used are within the old Novice bands, outside the tuning range of many homebrew and kit QRP transceivers.

Some nets meet nightly and transfer message traffic to regional nets, others meet weekly. Most meet evenings on 80 meters, but I found nets on 40, and even 10 meters.

On the right is a list of nets that I was able to verify and websites where available. Since these are local and regional nets, the times are all local time.

All nets use similar structure and Q signals. Thanks to Alan, N5LF, for his Quick and Dirty Netiquette (http://www.qsl.net/n5lf/cw-nts.html) which has everything you need to check into a CW traffic net and participate. Another source that might be on your bookshelf is *The ARRL Operating Manual*.

I know that I've missed some nets as well as scheduled slow-speed ragchew sessions. Please send me updates and new net listings and I'll post an updated list.

*—72, Mike KL7IXI/7*

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**West Coast Slow Speed Net** (Formerly Northwest Slow Speed Net) — Daily at 7 p.m. PST, on 3.702 MHz.

**Virginia Slow Net** (VSN) — Tuesday evening at 7 p.m. EST on 3680 kHz (200 watt power limit.

**All Florida Slow-Speed CW Traffic Net** — Daily at 8 p.m. EST on 3.715 MHz.

**Kansas Slow-Speed CW Traffic Net** — 7:30 CST, M-W-F on 3710 kHz

**Ohio Slow Speed Net** — 6:10 p.m. CST nightly on 3.708 MHz.

**Wisconsin Slow Speed Traffic Net** — Daily 6:30 p.m. CST on 3.645 MHz

**Hit and Bounce Net** — Every morning at 7:30 a.m. EST on 3.714 MHz

**Tennessee Slow Speed CW Net** — Monday 6:30 CST on 3.682 MHz

**Mountain States Slow Speed CW Traffic Net** — will return to 3.715± MHz

**Michigan Slow Speed CW Net** — Tuesday and Thursday 2330z on 3663 kHz.

**Empire Slow-Speed CW Net** — Daily 1800 East Coast on 3.590 MHz.

**Loudoun Amateur Radio Group** — conducts a Slow Speed CW Net each Tuesday Night at 8 p.m. local time on 28.050 MHz. Look for Gary—NC4S, Mark—N3GMW or Paul—N4PD.

**Metro Amateur Club Slow Speed Code Net** — 2nd, 3rd and 4th Wednesdays 0100 UTC on 7.138 MHz.

**3900 Club Slow Speed CW Net (Iowa)** — 7:45 to 8:30 a.m. CST on 3.560 MHz

**Four State QRP Club Slow Speed Net** — Tuesday evenings at 9:00 p.m. CST within a kHz of 3560 kHz.

**Northern CA Net (NCN2)** — Slow-speed CW net session 9:00 p.m. PST on 3705 kHz.

**Chesapeake Bay Chapter (MD)** — weekly slow speed CW net Monday evenings at 6:45 p.m. EST on 28.140 MHz.

**Minuteman (MA) chapter of Ten Ten International** — slow speed CW net Sunday 7:30 p.m. EST on 28.150 MHz

**POT-LID CW NET** — informal slow-speed CW net sponsored and conducted by VE3GX Sunday, (except July and August) at 11:00 a.m. EST (except July and August) on 3.620 MHz.

**NoGa Slow Speed CW Net** — Tuesday 9:30 p.m. EST on 3686 kHz.

**QKS-SS Slow Speed CW Net (Kansas)** — MWF 7:30 p.m. CST on 3710 kHz.

**Imperial Valley Amateur Radio Club** — slow speed CW net 8 p.m. PST on 7060 kHz

**Minnesota Slow Speed CW Net** — 6 p.m. daily on 3.710 MHz.

**15 meter Slow-Chat** — Sundays 1700 - 2300 UTC on 21.158 MHz at about 8 wpm. (Not a net, Fists-affiliated slow-chat group that meets for slow speed QSOs.)

**Utah Slow Speed CW** — 1400/1500 UTC, Saturday on 3.723 MHz

**Maryland Slow CW Net** — Daily 7:30 p.m. on 3717 KHz

**VWS Slow Speed CW** — Daily 8:30 p.m. EST on 28.390 MHz

**Texas Slow Speed Net** — 8 PM CST on 3.717 MHz

**Alaska CW Net** — Tuesdays and Thursdays 7:30 - 9:30 p.m. on 3.534 MHz and 7.042 MHz

**Mississippi Slow Net HF CW Net** — 7 p.m. EST daily on 3.688 MHz

*Please additional slow-speed net information to: kl7ixi@attbi.com*

# Does QRP Apply to VHF?

Bob Witte—KØNR k0nr@arrl.net

Most of the action in the world of QRP is on the high frequency bands (below 30 MHz.) Take a look at a typical issue of *QRP Quarterly* and you'll see many articles on HF transmitters, HF antennas, HF contests and HF operating. But what about VHF (above 50 MHz)? There doesn't seem to be much energy focused on QRP on the VHF and higher bands.

**Two Questions**

This article will examine two questions: 1) Do the principles associated with QRP apply to the VHF and higher bands? 2) Is there interest in VHF in the QRP community (specifically in the QRP ARCI)?

I am using the term "VHF" rather loosely, referring to operation above 50 MHz. The most popular bands are 6 Meters (50 MHz), 2 Meters (144 MHz) and 70 centimeters (432 MHz).

QRP is defined as operating with low power, nominally 5 watts. Of course, there is a lot more to QRP than just the power level. QRP is generally associated with:

- Compact, portable, battery-powered equipment (often used in the outdoors)
- A personal challenge and/or a minimalist approach (get the job done using efficient equipment)
- Emphasis on operator skill (especially CW operation)
- Contesting or other events that promote QRP activity

Let's take a look at how these elements of QRP stack up with respect to VHF operation. First, let's look at the power level. All of the transceivers shown in the Figure 1 produce RF power levels of 5 watts or less, so they are inherently QRP transceivers. You may question whether an FM-only handheld transceiver qualifies as QRP if it is used mainly in conjunction with an FM repeater. A high-power repeater on the top of a hill or tower doesn't seem to fit with our notion of QRP. I'll set aside the issue of repeater operation as not fitting our notion of QRP. (Hmmmm.... what if the repeater only ran 5 watts, oh, let's not go there.)

With the emphasis on efficient use of low power, FM is clearly at a disadvantage relative to SSB and CW. Some QRP enthusiasts aren't even sure SSB is appropriate for QRP, so FM may seem out of the question! Still, it is amazing the distances that can be worked from the top of a mountain using an FM handheld and a decent antenna. Here in Colorado, we often hear visiting hams having fun operating from Pikes Peak and working stations one hundred miles away on 146.52 MHz FM. In August, we have a mountain-topping event called the Colorado 14er Event (http://www.Colorado14erEvent.org) where the preferred transceiver is a dual-band (2M/ 70cm) FM HT. Contacts out to 150 miles are routine and better DX occurs frequently.

**These four VHF/UHF radios all operate at QRP power levels. Are they "real QRP" or just low power transceivers?**

The Yaesu FT-817 is a bit more on target for traditional QRP since it covers the HF bands and the VHF/UHF bands, including the CW and SSB modes. There have been other transceivers (such as the IC-202 and the FT-290R) that offered portable all-mode VHF capability but none with the popularity of the FT-817. The advantages of SSB and CW that we enjoy on the HF bands also apply at VHF frequencies. This means that virtually all serious VHF enthusiasts use the "weak-signal modes" of SSB, CW and (recently) digital.

With regard to portable and battery power, the VHF transceivers in the photo have that item covered. They are commonly used for portable operation in a variety of locations, including the outdoors.

**Weak Signal VHF**

Traditionally, weak-signal VHF is defined by challenge as in "get a signal from point A to point B" via propagation modes that are very challenging. Propagation modes range from normal tropospheric propagation to meteor scatter and moon-bounce. There is clearly an emphasis on operator skill and using CW to squeeze out marginal contacts is common, similar to HF QRP. But for many operators, the poor propagation paths lead to the use of higher power, sensitive preamps and high-gain antennas.

Perhaps the time that VHF QRP is most clearly defined and visible is during VHF contests. The ARRL and CQ VHF contests all have a QRP category (called Single Operator Portable in the ARRL contests), although the power level is defined as 10 watts. This entry category is intended to promote portable operation presumably from rare grids and mountaintop locations. (With VHF and higher frequencies, height above average terrain is important.) This definitely sounds like QRP...take your portable, low-power transceiver out into the wilderness and have fun seeing who you can work.

The 6-meter band (50 MHz) deserves special mention here. Normally, this band is limited to local communications, with line-of-sight and height above average terrain being critical factors. However, 50 MHz does open up quite often. During these band openings, 6 Meters takes on the characteristics of HF and running QRP power levels produce long distance contacts.

In summary, I submit that the answer to the first question is, "Yes, QRP principles definitely apply to VHF operating." I'll leave the second question to you. Is there interest in VHF in the QRP community (specifically in the QRP ARCI)? Let me or the QRP Quarterly Editor know via email.

**References**

General Rules for ARRL Contests on Bands Above 50 MHz can be found at: http://www.arrl.org/contests/announcements/rules-vhf.html

"Operating VHF QRP Portable," Bob Witte, KØNR; *CQ VHF*, Spring 2003.

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# Salvaging Roller Inductors for the Differential-T Tuner

Mike Branca—W3IRZ w3irz@att.net

In the last issue of *QRP Quarterly*, I covered the construction and use of differential capacitors in "T"-type tuners. Unlike differential capacitors-which are difficult to find and usually must be home brewed—there are many different types of roller inductors available. Some are complete assemblies and others are just a hand full of loose parts. The same goes for turns indicators-needed to show how far you down the inductor you have turned the roller—where there is quite a variety to choose from. The parts you find will determine your construction techniques.

Obviously, the easiest inductors to work with will be the complete assemblies such as those made by Johnson or one of a number of other surplus inductors. These assemblies are often found at the bottom of piles of junk at hamfests on the cheap, and often include an installed roller contact and rotation end stops. All you have to do is add a surplus or commercial crank with a turns counter. An example is shown in Figure 1. This photo shows a Johnson 14 μH (maximum inductance), 27-turn inductor with an attached turns counter and knob. (Note that this gem also has a wonderful commercial shaft coupling; a real find!)

Probably the most common inductors will be those salvaged from World War 2 ARC-5 transmitters. These come in two versions, one with 33-turn coils (#6034) and one with 24-turn coils (#6035). The 33-turn coils will provide enough inductance to tune most antennas down through 160 meters and come from the 80 meter units BC-696 and BC-457. The 24-turn coils should tune 80 through 10 meters and are from the 40 meter units

BC-458 and BC-459. Often these roller inductors are missing the roller contact (see below) but that's OK as long as you have the insulated end support. The biggest problem with these inductors is that there are no end stops-so whatever turns calibration you have marked will be lost if/when the roller runs off the track.

There are two fixes to keep the roller from running off the track, and the first is quite simple—mount the coil as in the original transmitter, but make it parallel to the front panel behind either an open or plastic window. Bring the knob either out of the right side of the box or use a right angle drive to position the knob on the front panel. Take a Popsicle stick and lay it across the coil and make a pen mark for each turn. Lash the Popsicle stick to the roller supports so that when you look thru the window you will see from top to bottom the coil; the roller; and the inked Popsicle stick turns indicator, as shown in Figure 2.

This same type of indicator also works well if you decide to motorize the coil The motor from an old electric screwdriver could save you the trouble of making a gear reduction drive (see Figure 3).

The second fix for keeping the roller from running off track is to find the aircraft receiver remote control boxes for either the ARC-5 or one of the radio compass receivers. This will give you the basis for making a turns counting dial and for adding end stops. First, start with the ARC-5 remote control parts. Assemble the gears on to the coil and study the assembly so that you can determine where the screw stops belong (see Figure 4). If you make a mistake there is plenty of room on the drum to make new holes. The sketch will illustrate these stops. Use the original dial as reference points or make a new one using the actual number of turns.

The radio compass gears can be used also with a new calibration glued to the large gear (see Figure 5). A pointer can be fashioned easily and a plastic front panel allows visual access. A single Fillister-head screw on the back side of the big gear will contact the fabricated sheet aluminum cam that stops the knob from turning (see Figure 6). For the 33-turn coil only one screw is required. If you are using a 24-turn coil then two Phillips-head screws will be necessary.

A wire spring, fabricated from a piece of piano wire, keeps the cam in place during normal rotation. I got real lucky as the first cam I cut worked perfectly. There is a 1/4 inch hole and bushing in the center of the large gear that I used for the shaft of the differential capacitor that was discussed in the previous article.

Commercial Johnson roller inductors and a number of surplus inductors will already have turn stop devices so the above counter-stop methods will not be necessary.

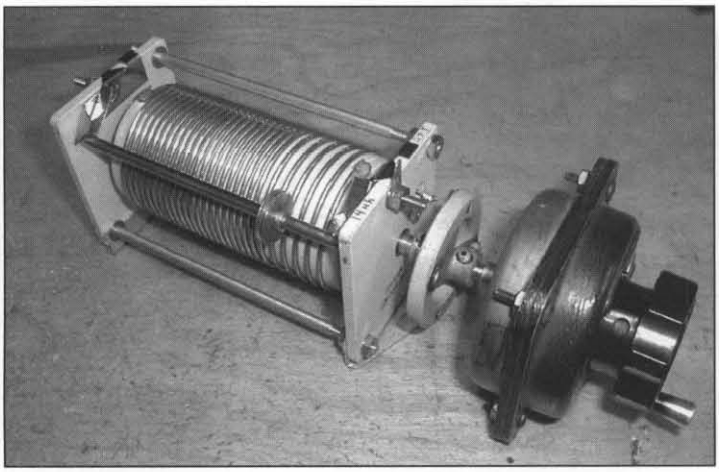


**Figure 1—A Johnson 14-turn roller inductor.**

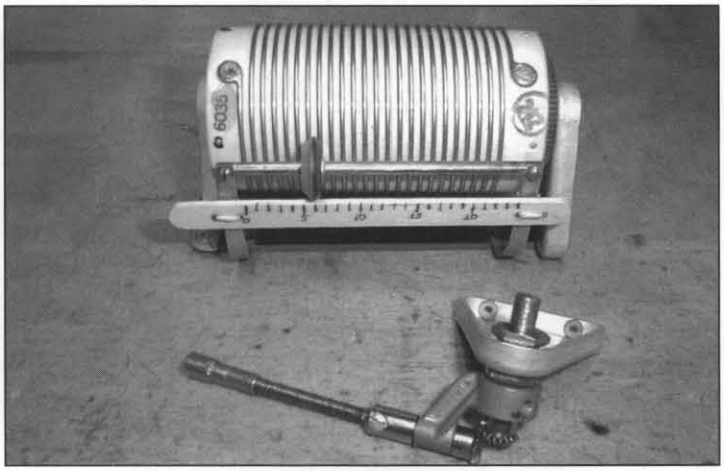


**Figure 2—Using a Posicle stick as a turns indicator.**

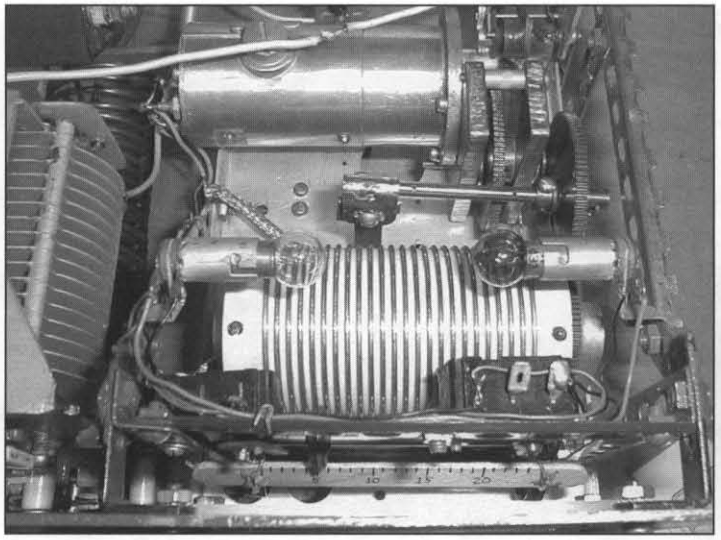


**Figure 3—Turns indicator used with a motorized coil.**

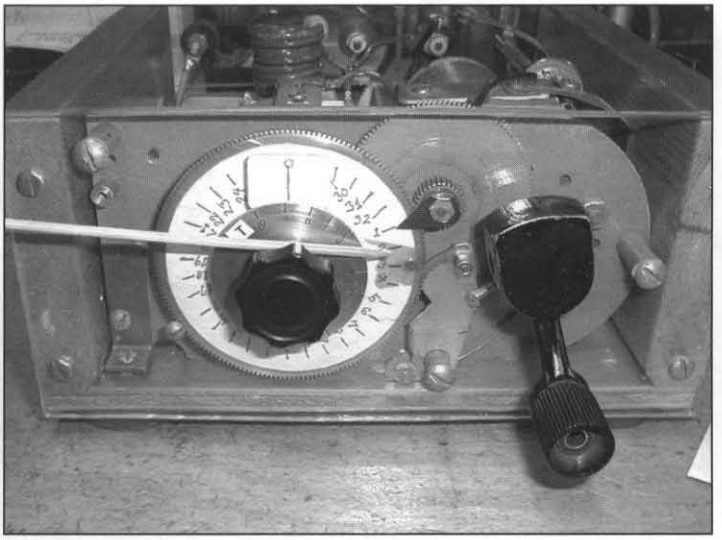


**Figure 5—Dial turns indicator using radio compass gears.**

All of these arrangements will need shaft couplings of some sort. It will usually take less time to make your own than to find the odd sizes that may be needed. I use aluminum, brass, copper or steel depending on the situation. I use my drill press and a number of standard drills. The only tap needed is a 6-32 and you will need a tap drill as well. In some cases you will find it easier to solder a brass coupling to the end of the coil rather than putting set screws on the end of the coupling.

Missing roller contacts can be fabricated in several ways. Start with a new 1/4 inch shaft of either brass or chrome. Chrome is almost frictionless and is pretty conductive and can be found in old printers and office in-boxes.

Remove the brass 1/4 inch bushing from an old volume control. To this bushing attach a large brass washer and taper the edges so that it will go between the coil turns but not touch the coil form (see Figure 7). Shorting two turns will not hurt. Roller contacts can also be made from old auto radio friction drives.

The shaft support can be made from springy brass with enough tension to keep the roller against the coil. Shaft supports can also be made from rigid materials like the ARC-5 padder capacitor lock clamps.

There is a lot of room for creativity guys, so have at it! ●●

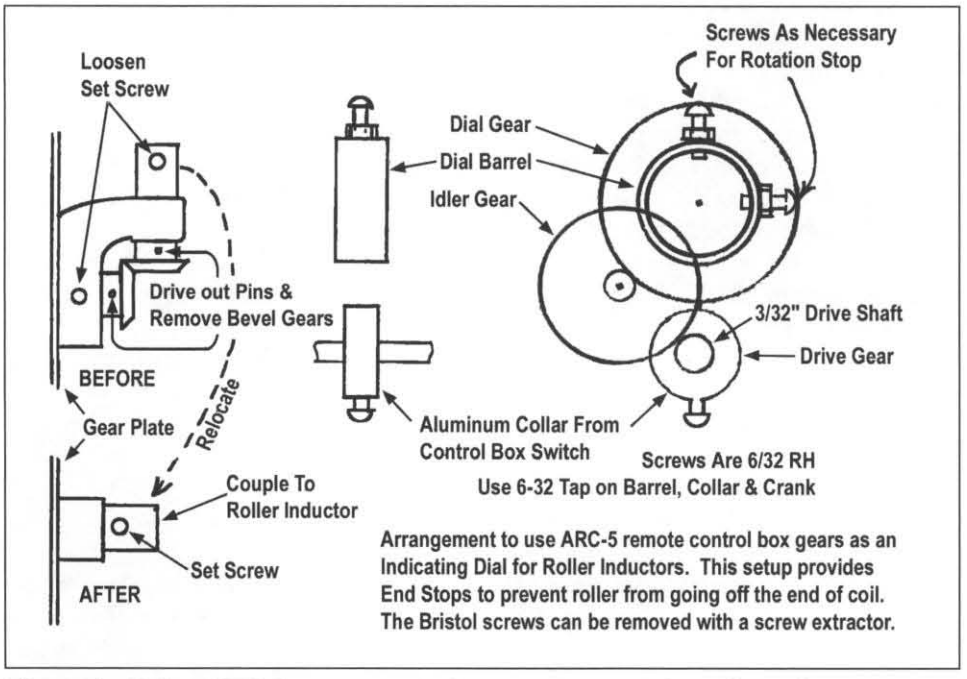



**Figure 4—Using ARC-5 remote control parts to operate the roller coil.**

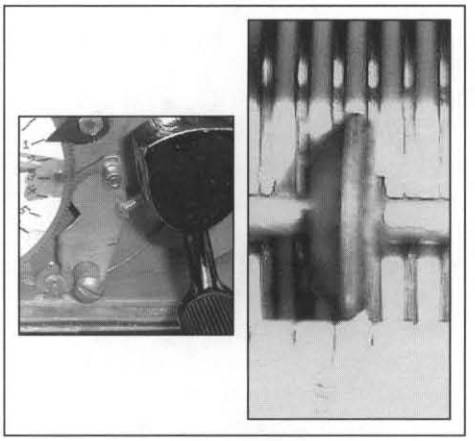


**Figure 6 (left)—Close-up of the cam that stops the knob from turning.**

**Figure 7 (right)—Roller contact made from a 1/4-inch bushing and brass washer.**

# Building Day!

Steve Hudson—AA4BW

steve.hudson@cmdg.com

Here's how members of the North Georgia QRP Club have been rediscovering the joys of old-fashioned homebrewing get-togethers—and how your QRP group can launch its own Building Day, too!

**"When is the next Building Day?"**

A fellow ham asked me that question the other day, and he was talking about what become a particularly enjoyable aspect of this hobby for members of the North Georgia QRP Club. It's a simple idea-a get-together now and then to homebrew a QRP project start-to-finish-but it's one that has been a great deal of fun for all involved.

I hope this article will get you thinking about how your group might implement a Building Day too.

For me, the "Building Day" idea developed as a way to give something back to the QRP community. Many times I've thought back to those early days in the hobby when I'd get together with a couple of my other ham buddies and spend an afternoon home-brewing, and it wouldn't be long till we had the soldering irons out and were putting something together.

Not long ago, while sorting through long-forgotten boxes in preparation for a move, I ran across one of those long-ago projects.

"You know," I remember thinking, "I'll bet there are a lot of hams these days who would enjoy a day of building something!" Which is how Building Day was born.

The guinea pigs for that first Building Day were hams from the North Georgia QRP Club-and since then I've had the pleasure of hosting a number of other such get-togethers. In the process, I've found a number of things which, when incorporated into the planning, will help it all go more smoothly.

What I want to do here is to take a look at how you can plan and host a Building Day of your own. Believe me—it's fun to host a Building Day! Yes, it does take a bit of effort, but I can guarantee you that the payback will be tremendous. After all, there is nothing like it when that first-time builder looks up from the test bench and says "It works—and I built it myself!"

**You too can host a club Building Day! Here, Steve, AA4BW explains the project to NOGA QRP Club members at the start of a Building Day.**

**The Schedule**

The first thing you've got to determine is the schedule for your Building Day program. The best such programs are those built something that can be completed in a single day, with time for breaks and a break for lunch. I've learned that participants don't mind devoting most or all of a day to the project (particularly if breaks are included), but I've also found that at some point the day becomes too long.

All things considered, the best time for a Building Day event seems to be a Saturday. Starting time should be reasonable; I've found that 9:30 to 10 a.m. is ideal.

You'll also want to include a break for lunch, and I've found that it works best when you "go out." The change of scene is refreshing, and lunch provides an opportunity for an altogether different sort of camaraderie. The NOGA group is especially lucky as there's a great barbecue restaurant about a mile from our favorite Building Day location!

After lunch, you'll find that participants return to the workbench with renewed enthusiasm, ready to finish the day's project. This allows you to have it wrapped up by mid-afternoon, allowing participants to return home before the day gets too old.

Our typical Building Day schedule, then, looks something like this:

9:30 to 10 a.m.—Folks arrive and set up
10 'til 12—Work on the project
12 'til 1:30—Lunchtime!
1:30 'til 4 or 4:30—Complete the project

This general schedule has worked well, provides plenty of time, and does not cause stress for host, participants or families.

**Picking A Project**

Another preliminary decision is what sort of project to build.

The temptation is to pick something impressive—a transceiver, for example—but the reality is that in almost every case such projects are too much to handle in a Building Day setting.

So—how complex should your Building Day project be?

Even though the Building Day schedule includes four to five hours of "building" time, avoid selecting a project that requires a full four to five hours for construction. That won't work. Instead, shoot for something that requires just a couple of hours of actual construction time. In a group setting, particularly with folks of varying experience and where the emphasis is on fellowship and learning, such pro-

**A key to a successful Building Day is the work area-set out materials at each workstation-a copy of the instructions, plus all other necessary components and materials.**

**Projects should be built one stage at a time, with a pause after each stage for testing and any necessary troubleshooting (like Matt, WB6BWZ is doing here).**

jects will likely take at least twice that long to finish.

I've found that a Building Day project should also be something that can be built and tested in modular stages. It should be built one stage at a time, with a pause after each stage for testing and any necessary troubleshooting.

Note, too, that the entire group should complete each stage before moving on as a group to the next one. Of course, this means that experienced builders may end up working at a slower pace than they're used to. But if you can keep the group together, at least on the "stage"" level, the overall day will be more manageable and more successful.

For a first Building Day project, consider a simple transmitter. They lend themselves well to that modular approach. More importantly, they're great enthusiasm builders that provide almost instant gratification. There's nothing like the look on a builder's face when he or she closes the key and sees that wattmeter needle kick upscale!

A future article will look at a transmitter project that has been the centerpiece of a couple of NOGA Building Day events. It's a straightforward three-transistor design (one keying stage, two RF stages) that's easy to construct and simple to troubleshoot. Meanwhile, take a look at your own favorite circuits to see which one might be good for a Building Day of your own.

Incidentally, whatever the project, I've decided that hams like to build things that light up. Thus, where feasible, I've started adding some sort of LED indicator to Building Day projects. Sure, it's firmly in the bells-and-whistles category, but that's okay!

### How To Build It?

The next thing to decide is how to build the project-on a PC board, ugly style, Manhattan style, or from a kit. I've used each method, and each has its pros and cons.

### Kits

The simplest approach is to build a kit. Kits generally include a PC board, so construction may be no more complex than stuffin' and solderin'. One NOGA Building Day focused on building a receiver kit, and the results were good.

On the plus side, a kit includes everything you need. That means you don't have to any scrounging, though you will want to be sure you have spare parts on hand.

The downside of some kits is their instructions, which may be little more than "stuff in the parts and turn it on." That was the case with the receiver kit we used; the solution was to rewrite the instructions so that building took the stage-based approach outlined earlier.

### Non-Kit PC Board Projects

PC boards are available for an abundance of projects these days, many of them good candidates for Building Day projects, and there is no denying that PC board construction is quick and easy.

The big plus of a PC board project, of course, is that there's relatively little wiring to do. This can be a definite plus. On the downside, you've got to round up parts. Another downside—inexperienced builders may overheat pads or traces, causing them to come off the board. That can be a severe disruption in a Building Day setting, where you're working to keep a number of builders moving ahead at more or less the same pace.

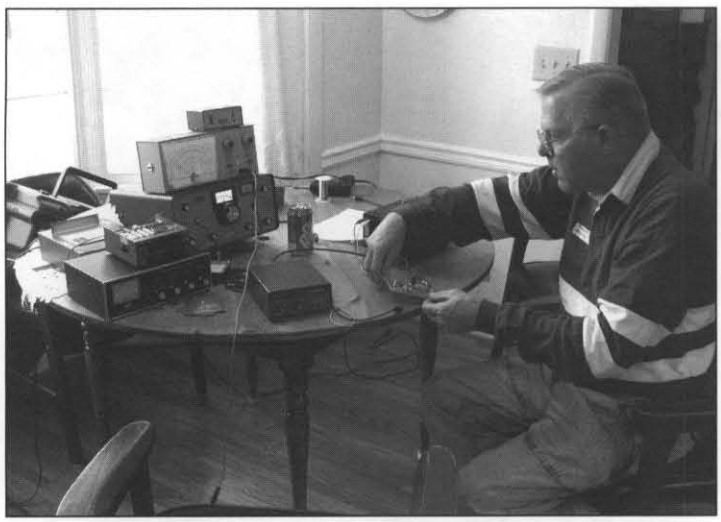
### Ugly Construction

The first NOGA Building Day utilized so-called "ugly" construction techniques, in which components are soldered directly to a ground-plane with additional connections made "in the air" as required. The nice thing is that no PC board is required; there's also plenty of room to make adjustments based on component size or the whims of the individual builder.

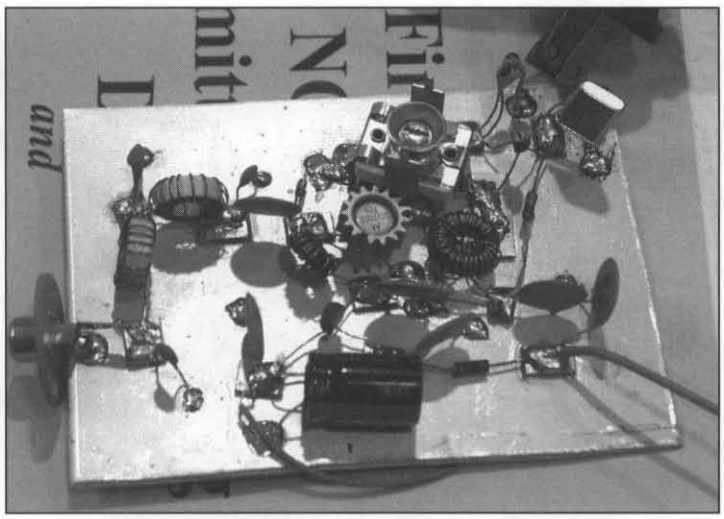
During that first Building Day we built ugly-style transmitters, and at the end of the day every one of them worked. But while experienced builders had no problem with the technique, I found that it was confusing to less-experienced or beginning builders. For that reason, I've come to favor another technique for Building Day projects-and that technique is Manhattan construction.

### Manhattan Style Construction

Manhattan style construction is similar to ugly construction in that ground connections are made directly to the ground plane. Non-ground connections, however, are not



**Pickett, AD4S, works on final troubleshooting and tune-up.**



**A completed Building Day transmitter.**

made in the air but are made instead on small pads of PC material that are glued to the ground-plane. Pad layout is determined in advance as part of the preplanning operation. The pad layout is provided to participants, and the project actually begins with pad placement on the ground-plane board.

This has come to be my preferred Building Day construction method. It allows easy stage-by-stage construction, plus plenty of room for less experienced builders to work.

**The Matter Of Instructions**

Having selected a project and chosen a construction technique, you're ready to tackle the toughest part of putting together a Building Day program-preparing the instructions.

Do you really need written instructions? Yes! Written instructions provide a clear set of guidelines to your builders, giving them something they can refer to during the building process and keeping everyone moving together.

Good instructions can go a long way toward insuring a successful Building Day, and it may take some time to develop them. I've found the following process to work well in developing instruction material for Building Day projects; you should be able to modify this basic approach to suit your own project and situation.

1. Make a complete list of parts for the project. Then, using that list as a guide, gather up everything needed.
2. Break the project into stages and decide on the order in which you'll build them.
3. Build a prototype, documenting (in writing) what you do.
4. Now, following the instructions you've just created, build the project again-further fine-tuning the instructions as you go. Don't forget to include instructions for testing each stage.
5. Update the instruction set to include all changes and improvements (and there will be some!)
6. Repeat steps 4 and 5 until you feel you have the best and clearest instructions possible.

On all but the simplest Building Day projects, you may find yourself building the project three or more times as you refine instructions and work out bugs. Each time, your written instructions will get better. Yes, it's work-but your Building Day participants will thank you in the end.

You'll find that planning a group project is very different from building a project just for yourself. If you're building for yourself and paint yourself into a corner, you can simply fix things on the fly-but when you're leading a group such bumps in the road can mean disaster. Your goal is to develop a set of instructions that move, step by step, through the entire project-layout, construction and testing too—with no surprises along the way.

Now you can stretch back and breathe that sigh of relief. The hard part is done!

**Getting The Parts**

For our NOGA Building Days, each participant has been provided with a complete pack of parts for the project at hand, including all electronic parts, hardware, and (where appropriate) enclosure components. These are bagged ahead of time, insuring that all parts are on hand.

I won't belabor the matter of parts procurement, as that's a universal challenge these days. But don't be bashful about asking members of your group if they'd be willing to open their junque boxes to help with the project. Most will cheerfully answer, "Of course!"

**Setting Up The Work Area**

One key to a successful Building Day is the work area. You need enough room for participants to spread out-more room than you'd think, so plan accordingly.

Participants also need power for soldering irons. As you set up the work area, make sure that there are plenty of power outlets located so folks can move around without the danger of tripping over someone's soldering iron cord. I like to place several tables together, with multi-outlet power strips located in the center. That way, all soldering iron cords go to the center, with none on the outside where they could be caught and pulled.

Participants also need adequate lighting and should bring small high-intensity lamps; they go a long way toward insuring a successful day.

When planning, you'll need to include a spare-parts cache somewhere convenient to the building area. Inevitably, parts will be dropped, leads will be cut too short, components will be cooked during testing, and so on. Those things are all part of building, and to keep them from disrupting

progress you'll want to have an inventory of spares on hand.

A refreshment table, stocked with drinks and snacks, provides a convenient place to take a break.

Finally, set up a separate check-out and testing area. This should be located away from the building area and should include any needed test gear, power supplies or other items needed to align or check out the project.

**The Big Day**

So all the work is done and the big day has arrived. What now?

First, arrive early to double-check your preparations. It's easy to forget some critical detail, and a last-minute check gives you an opportunity to catch it.

Set out materials at each workstation-a copy of the instructions, plus all other necessary components and materials. Depending on the project, you may want to hand out parts as each stage is completed rather than all at once. Do what works best for your project and setting.

Make sure you've got extra solder and soldering irons on hand. Yes, someone will forget! Also, if you're doing any cabinet construction or control mounting, make sure that you have the proper tools.

Also make sure you've got name tags. You may know everyone, but they may not know each other. Nametags solve the problem.

As participants arrive, show them the general layout and then direct them to their work areas. I find it helpful to arrange seating so that veteran constructors are sitting next to less experienced builders.

So everyone has arrived? Good. Time to dive in and start building!

**Give It A Try**

Every time we host a Building Day, I'm always amazed at the enthusiasm I see in the participants. For some, it's an opportunity to get together for a few hours of fellowship and homebrewing; for others, it's an introduction to the homebrewer's art, a first experience with building your own gear.

But one thing is certain—for everybody involved, it's fun! "This is ham radio like it used to be," one ham said at a recent NOGA Building Day.

Another, having just finished building a CW transmitter for 20 meters—his first-ever homebrew project—had a grin on his face a mile wide. "Do you think," he said, "that we can do this again sometime?"

You can count on that!

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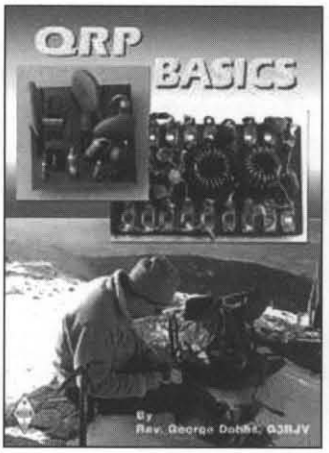
# Book Review: *QRP Basics*

Tony Fishpool—G4WIF g4wif@btinternet.com




*QRP Basics* is a new book written by the Reverend George Dobbs, G3RJV, for the Radio Society of Great Britain. The RSGB are very keen to promote the new Foundation class licence and this book is targeted at that market. The book begins with some personal history and what "hooked" George into pursuit of the QRP side of ham radio. George also pays homage to the late Doug DeMaw, W1FB (SK), whose articles inspired George and who later became a dear friend.

Beginning with "What is QRP?" George introduces the reader to what can be achieved both in terms of power and home built equipment. Some simple antennas that will suit most pockets are discussed along with suitable antenna matching units.

One of my favorite chapters covers with superb photographs, various commercial QRP radios, both past and present. There is discussion of many QRP kits which (sadly for us Brits) are now mostly available from the USA.

Then onto the practicalities. George discusses equipment you can build from scratch and introduces construction tips and techniques starting with how to solder and then onto how to build using strip-board through to Manhattan construction.

Why the word "toroid" puts people off I will never know, but George spends a good while discussing both how to wind them, and the differences between all the materials that are available. Here, again, there are superb photographs showing how to wind both the simple and slightly more complex (such as bifilar transformers). The author then moves onto harmonic filters with a step by step guide on how to make them. There are further constructional chapters on building test gear and simple transmitters and receivers. Over 200 pages of concise and sound advice from a QRP "master of his trade."

If I were looking for a book to give a beginner then this would be it. It is a superb introduction to low power operating and very well produced. The George and the RSGB have excelled themselves and it is well worth the price of £14.95 (or £12.74 for members). Please go to the online bookshop at www.rsgb.org.

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[*We also expect that the ARRL — www.arrl.org — will offer this book for sale, as it does for many other RSGB publications*]

*Mark your calendar for the QRP ARCI Fall QSO Party:*
*October 18 and 19, 2003*

# QRP Hall of Fame

QRP Hall of Fame members have all had a significant impact on the QRP community through their many outstanding accomplishments (technical, operating, organizational, etc.). Nominees are amateur radio operators who have made significant, long-term contributions to the QRP community.

Some members of the QRP Hall of Fame are builders. Others are operators. Some are designers. Most are authors. Many have made significant contributions to the greater amateur radio art. To a person, however, they all have left their mark on QRP.

Nominations are taken prior to the annual QRP ARCI Four Days In May, and new inductees are announced at the FDIM banquet. The voting body consists of the QRP ARCI Board of Directors, Officers and the past two year's inductees. All inductees must be elected by a 2/3 majority vote. Nominations may be submitted by anyone, whether a member of the QRP ARCI or not, and membership in QRP ARCI is not required in order to be recognized as a member of the QRP Hall of Fame.

### 2003 QRP Hall of Fame Inductees

**Arnie Coro—CO2KK**

Arnie Coro, is a well known radio and TV journalist in Cuba. He produces two programs, twice weekly, on the shortwave service of Radio Havana Cuba, "Science and Technology Today"" and "DX Unlimited." If you have ever listened to the DX programs on other international shortwave stations, they tend to be quite lame and aimed at the beginning shortwave listener. For years, Arnie's "DX Unlimited" has been dedicated to ham radio and QRP, giving specific instructions on how to build antennas, antenna tuners, receivers and transmitters, that have helped many people in Cuba and throughout Latin America get their amateur radio licenses and "get on the air."

With the assistance of a few other Cuban hams, Arnie is responsible for many Cubans and Latin Americans becoming hams and for building their own equipment, using commonly available parts, often salvaged from Russian TVs. This equipment is—out of necessity—QRP and is very important to Cuban amateurs. In Cuba, most hams operate from club stations, since few Cubans are fortunate enough to have their own stations. If an amateur can prove he has his own ham radio station in his home, he is entitled to a six-year license. Otherwise, the amateur must renew his license every two years, and must operate from a club station, providing an activity log signed by a club officer in order to renew his license.

Thus, Arnie has promoted QRP very heavily in Cuba for years, as a cheap way to build a station and get on the air. Amateurs can build simple QRP transceivers, hand carry them into the government communications department, and receive a full six-year license. For this reason, QRP has become very popular in Cuba.

Despite the political difficulties that exist between the US and Cuba, Arnie's efforts, along with those of others, have resulted in a close, brotherly, amateur radio fellowship that transcends international boundaries. Cuban hams know that many of the QRP kits and parts that Arnie distributes are from American hams, who are taking risks by being "Elmers" to them. Since it is illegal for U.S. citizens to send such items to Cuba, they are usually sent by amateurs in Mexico, Canada, and the UK, making support of amateur radio in Cuba a truly international endeavor.

These same political difficulties made it impossible for Arnie to travel to the US to receive his award at the FDIM banquet in Dayton. Accepting the plaque on Arnie's behalf, Jim Kortge, K8IQY—a QRP Hall of Famer himself and personal friend of Arnie and his family—related his experiences traveling to Cuba and observing first hand the impact of Arnie's work in the Cuban amateur radio community. Jim also received the standing ovation given by the banquet attendees in Arnie's honor.

Arnie Coro has been an instrumental part of the growth of ham radio, QRP, and the international fraternity of our hobby in Cuba and throughout Latin America for many years. He represents the best of QRP and amateur radio in his home country and in the world.

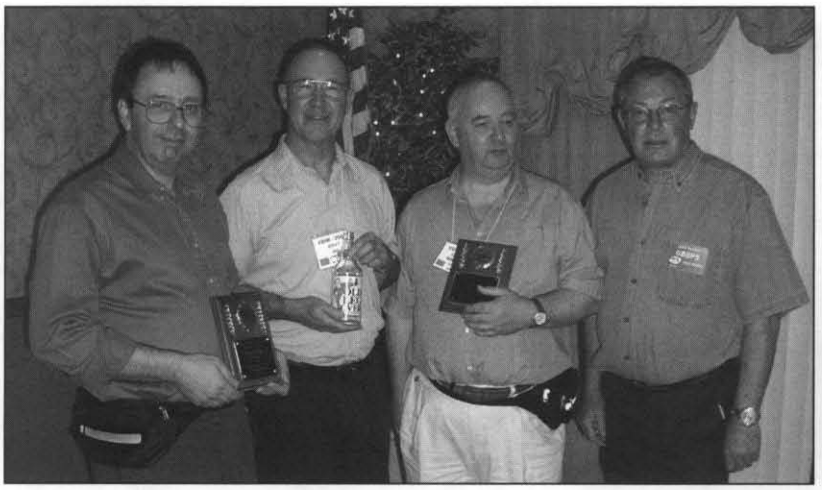
**Graham Firth—G3MFJ**

Graham was first licensed in the UK in 1957 while still in school. He has been a long-serving G-QRP Club (arguably the oldest continuous QRP club) as the Address and Membership Database Manager, the Sales Manager, manages the SPRAT distribution, and sometimes serves as editor of SPRAT as well.

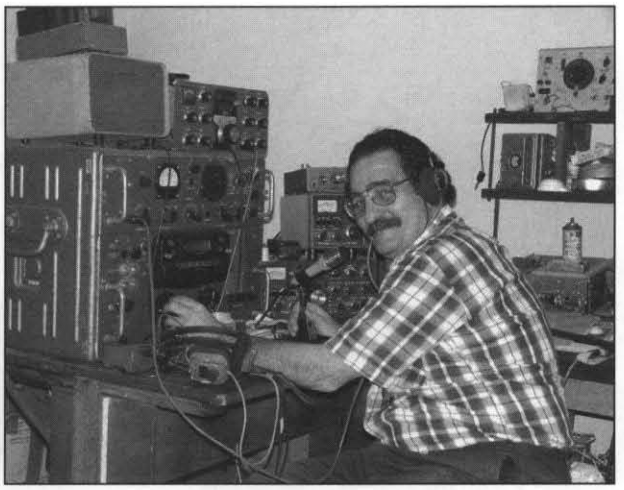
At his own motivation at expense, Graham has undertaken to visit and speak at QRP events throughout the USA,

| | |
|---|---|
| Chuck Adams, K7QO | Graham Firth, G3MFJ |
| Arnie Coro, CO2KK | Tony Fishpool, G4WIF |
| Rich Arland, K7SZ | Paul Harden, NA5N |
| Brice Anderson, W9PNE | Wes Hayward, W7ZOI |
| Dave Benson, NN1G | Doug Hendricks, KI6DS |
| Mike Bryce, WB8VGE | George Heron, N2APB |
| Wayne Burdick, N6KR | Jim Kortge, K8IQY |
| George Burt, GM3OXX | Roy Lewallen, W7EL |
| Jim Cates, WA6GER | Rick Littlefield, K1BQT |
| L. B. Cebik, W4RNL | Dick Pascoe, GØBPS |
| Mike Czuhajewski, WA8MCQ | Randy Rand, AA2U |
| Tom Davis, K8IF | C. F. Rockey, W9SCH |
| Doug DeMaw, W1FB (silent key) | Gus Taylor, G8PG |
| Rev. George Dobbs, G3RJV | Adrian Weiss, WØRSP |
| Joe Everhart, N2CX | Peter Zenker, DL2FI |

**Current members of the QRP Hall of Fame (in alphabetical order).**



**2003 QRP Hall of Fame Induction: (left to right) Tony Fishpool, G4WIF, Jim Kortge, K8IQY (previous inductee, accepting the award for Arnie Coro, CO2KK), Graham Firth, G3MFJ, and QRP ARCI Vice President Dick Pascoe, GØBPS.**



**2003 QRP Hall of Fame Inductee, Arnie Coro, CO2KK**

including FDIM, Atlanticon, Arkiecon and HamComm. He has carried the amateur's international goodwill and friendship to China and Hong Kong and has forged many new links for the G-QRP Club and has established many international QRP friendships.

Graham is an avid QRP designer and builder. His designs are known throughout the QRP world, including being shown on the RADIO HABANA CUBA Dxers Unlimited web page, run by Arnie Coro, CO2KK—who is also being inducted into the QRP Hall of Fame this year. He has served as a "beta tester"" for many QRP kit projects and has given technical help to many other kit builders, both in the UK and throughout the rest of the world. He has both judged and won awards in the QRP construction contest at the QRP ARCI Four Days In May.

Along with Tony Fishpool, G4WIF-also an inductee in the QRP Hall of Fame this year—Graham is joint author, and publisher, of Simple Test Equipment for the QRPer—a tremendously valuable resource to the QRP Community.

A Google search on "G3MFJ" yields seven pages of results, all pointing to Graham's very long and very active participation in many different areas of the QRP Community. Like all the QRP Hall of Fame members before him, Graham has most definitely left his mark on the world of QRP.

**Tony Fishpool—G4WIF**

If you have worked Tony Fishpool, G4WIF, you've worked a friend. His friends span the UK, Europe, the US—he is a world class guy. When Tony takes his annual holiday, he visits his friends abroad—and usually manages to find a QRP Club or hamfest to share his enthusiasm for QRP (always on his own time and expense).

Tony is a true ambassador of the G-QRP Club and his diplomatic duties range from maintaining the G-QRP Club website (http://www.gqrp.com) to running the SPRAT reprint and datasheet service to maintaining the G-QRP Club internet reflector-perhaps the best moderated and "to the point" forum on the Internet.

Not only does Tony enjoy sharing his hobby with his QRP friends, he also loves designing and building radio equipment. Has been a "beta tester" for a number of QRP kits (including the Rock Mite to which he contributed some of the very first modifications, and the Freq Mite used in many QRP projects) and has given technical help to countless kit builders.

Tony is also an accomplished author and contributes regularly to *QRP Quarterly* and other mainstream amateur radio magazines. He is joint author of *Simple Test Equipment for the QRPer* with Graham Firth, G3MFJ—also an inductee in the QRP Hall of Fame this year—and regularly uses a complete set of test equipment, each piece of which fits in an Altoids tin.

If one had to pick a QRPer who enjoyed his hobby more than any other, it would probably be Tony. He absolutely insists on enjoying QRP—and on sharing it with others.

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**A Correction—**

On page 27 of the Spring 2003 issue of *QRP Quarterly*, we mistakenly published a photograph that clearly shows the subject antenna and feed system in close proximity to electric power wires. Under no circumstances should an amateur radio operator ever install an antenna system that could come in contact with electric power lines. The author subsequently replaced his new antenna with a vertical. We regret the error and apologize for any confusion that may have arisen.

# QRP Contests

Randy Foltz—K7TQ rfoltz@turbonet.com

A hearty hello to you fellow QRP contest enthusiasts! In this issue of the QRP Contests you will find results and soapboxes from the Fireside SSB and the Spring QSO Party. There are announcements for the Summer Homebrew Sprint and the Fall QSO Party. After each of these contests you can use the High Claimed Scores Form at http://personal.palouse.net/rfoltz/arci/form.htm to send me your contest summary. Your log can be sent separately by either e-mail or regular mail. Watch the claimed scores change each evening at 9 PM Pacific Time for one week after the contest by looking at http://personal. palouse.net/rfoltz/arci/highclm.htm. This web page contains only those results submitted by those who use the web form above.

*Mark your Calendars:*

*Summer Homebrew Sprint*
*July 13, 2003*

*Fall QSO Party*
*October 18 and 19, 2003*

**New Contest Certificate Czar**

The biggest news in the QRP ARCI contest world is that Tom Owens, WB5KHC, has taken over printing and mailing of the contest certificates. In early June he finished whittling down the large back log from late 2002 and early 2003. I've seen his work and it is very nice looking! Thanks, Tom, for taking on this job. I'm looking forward to working with you on sending out many more contest certificates. If you work Tom on the air, please take the time to thank him. If he is too busy with certificates to be on the air take a look at his web page, http://2hams.net/WB5KHC/WB5KHC.htm.

Since the last *QRP Quarterly*, I've made some changes to the contest web page arrangement. Past results and record scores are now arranged by contest. For example, a visit to the Fall QSO Party page will lead you to past results as well as the record high scores in several categories. The QRP ARCI contests home page is http://personal.palouse.net/rfoltz/arci/arcitst.htm.

Finally, following a suggestion by AA4XX, Paul, I've added a new power multiplier for you really dedicated extremely low power QRPers. Starting with the Summer Homebrew Sprint and continuing through the Fall QSO Party, you can earn a power multiplier of 20, if you run 50 mW or less. We'll give this a try for these two contests and evaluate its effectiveness after the Fall QSO Party.

On to the results and see you on the air!

**Winter Fireside SSB Sprint**

The 2003 Winter Fireside SSB Sprint was held on February 9. Twenty-nine operators sent in reports for this one. Solar flux had not taken the dive that we are seeing here at the beginning of summer and was still in the 140 neighborhood. This allowed contacts on the high bands all the way up to 10M. Many operators used all the low bands, as well. Unlike last year when we had less than 2 and less than 500 mW stations, no one reported using less than 10 W PEP.

**Winter Fireside SSB Sprint Top Three**

| | |
|---|---|
| N9NE | 156,114 |
| KL7FDQ | 67,977 |
| W9WIS | 42,315 |

Todd, N9NE, lead the winners circle with over twice as many points as anyone else. In last year's contest Todd was 3rd. If you look closely, you"ll see that he does very well in CW contests, too. The 2nd place finisher, Wayne KL7FDQ, undoubtedly pleased many folks by giving them a Montana contact. The 3rd place call, W9WIS, belongs to Mike in Wisconsin. Would you expect otherwise from that call?

**Soapbox**

**W9WIS**—Tough conditions here on all but 15 meters. Had a contact with K7NTW who was running one watt at the time. Interesting that I didn't have one DX contact! **N9NE**—Nice to hear voices of folks often worked on CW. Welcome to the newcomers! 10 and 15 meters were a QRP haven compared to the thicket of QRO SSB and AM stations on 20 and 40 meters. **N9DI**—Had a great time. Was my first QRP contest. **N1AOB**—1st Fireside Sprint! Had lots of fun despite mediocre band conditions. Will definitely enter again! Thanks to all for the points and encouragement. **LU3DR**—Very poor conditions on 15 with electrical storm. I only heard stations last hour. Was a good QRP experience. Sorry to all stations that call me, but was impossible hear well. See you next contest. **KL7FDQ**—Difficult contest, but it was fulfilling. Wish more QRP ARCI members would participate. **KG4GVL**—First fireside contest. Heard some great ops goin' on. I was especially glad to get KL7FDQ cause it took like 8 tries to get his info rite! Same story for NØTK. **KG4FGC**—20M was in rough shape! **KB8AOB**—The sprint started out with a bang and ended with a snooze. The first hour I was planning on a new trophy for the case but 45 minutes into the event the sizzle was gone. Thanks for all the contacts! **K9IUA**—Conditions seemed bad this year. Operated for only 3 hours before I just gave up; voice was going hoarse with little it seemed to show for it. Sorry about that. Had fun nonetheless. **K4JPN**—Conditions seemed poor, but please to work SK on 10 Meters, he was the only station I worked on 10 Meters. 15 Meters seemed to be the band to be on. **K3CHP**—Conditions OK but not much activity. SW QRM on 40 meters made band useless. **K2CPE**—This was my first try (casual) at a contest. **K1THP**—Got into contest "spur of the moment." Next time I'll get the software working before the contest. **K1HJ**—15 meters worked out the best for just about the entire contest. Just a few sigs heard on 10 and a lot of QRM on the other bands. **KØRDS**—Nice working club members. **ABØKF**—First QRP SSB contest. Fun, even with interruptions.

**2003 Winter Fireside SSB Sprint**

| QTH | Call | Score | Pts | SPC | Power | Bands | Time | Rig | Antenna |
|---|---|---|---|---|---|---|---|---|---|
| AR | K5DKH | 1617 | 33 | 7 | LT10 | 80,40 | 1 | | |
| CA | NK6A | 28350 | 162 | 25 | LT10 | 20,15,10 | 2.5 | K2 | C4 |
| CT | K1THP | 21868 | 142 | 22 | LT10 | 80,20,15,10 | 2.5 | FT817 | 80 m dipole, TA33 |
| | N1AOB | 7455 | 71 | 15 | LT10 | 80,20,15,10 | 4 | K2 | 40 m ext dbl zepp |
| DE | K3CHP | 11718 | 93 | 18 | LT10 | 40,20,15,10 | 4 | IC756PRO | Vert |
| FL | KX5U | 140 | 10 | 2 | LT10 | 15 | 1 | Argo II | Gap vert |
| GA | K4BAI | 22204 | 122 | 26 | LT10 | 40,20,15,10 | 1.25 | FT1000MP | TH6DXX |
| | K4JPN | 17864 | 116 | 22 | LT10 | 20,15,10 | 1.25 | K2 | 3 el yagi @ 32' |
| | KG4GVL | 4032 | 48 | 12 | LT10 | | 3 | FT817 | 85 ' 18 gauge speaker wire |
| | ABØKF | 1960 | 40 | 7 | LT10 | 80,15,10 | 2.5 | FT817 | 80/40 m inv vee @ 50' |
| IA | K9IUA | 20566 | 113 | 26 | LT10 | 20,15,10 | 3 | Scout | 55 ' dipole @ 20' |
| IL | N9DI | 25088 | 112 | 32 | LT10 | 15 | 4 | FT817 | Buddi pole |
| | W9HL | 5712 | 68 | 12 | LT10 | 20,15,10 | 2.5 | K2 | R7000 |
| LU | LU3DR | 1596 | 38 | 6 | LT10 | 15 | 1.5 | TS140S | 2 el quad |
| MA | K1HJ | 23562 | 153 | 22 | LT10 | 80,20,15,10 | 4 | IC735 | Dipole |
| MI | KC8LTL | 770 | 22 | 5 | LT10 | 20,15 | | | |
| | N8TDH | 252 | 12 | 3 | LT10 | 10 | 1.5 | RCI 2950 | Dipole |
| MT | KL7FDQ | 67977 | 249 | 39 | LT10 | 40,20,15,10 | 4 | FT817 | Dipole @ 15' |
| NC | KG4FGC | 98 | 7 | 2 | LT10 | 20 | 0.75 | TS180S | Dipole sloper |
| NJ | W2JEK | 2961 | 47 | 9 | LT10 | 20,15,10 | 2 | FT840 | 20 m gnd plane, 15 m dipole, 10 end fed hertz |
| | K2CPE | 1134 | 27 | 6 | LT10 | 15,10 | 1.33 | K2 | 440' horiz loop |
| NY | WB7OCV | 2776 | 44 | 9 | LT10 | 20,15,10 | 4 | SG2020 | 4BTV |
| ON | VA3STL | 3773 | 49 | 11 | LT10 | 80,20,15,10 | 4 | K2 | G5RV |
| TX | KØRDS | 35280 | 210 | 24 | LT10 | 15 | 2 | SG2020 | 15 m HB rot dipole |
| | KIØG | 3640 | 364 | 10 | LT10 | 40,20,15,10 | 3 | FT817 | Hustler Vert |
| WI | N9NE | 156114 | 378 | 59 | LT10 | 80,40,20,15,10 | 4 | K2 | Doublet, dipole, beam |
| | W9WIS | 42315 | 195 | 31 | LT10 | 20,15,10 | 4 | Omni | GAP Titan |
| WV | KB8AOB | 4410 | 63 | 10 | LT10 | | 4 | FT817 | Outbacker outreach vert |

**2003 Spring QSO Party**

The 2003 Spring QSO Party, held on April 12 and 13, resulted in 89 folks sending in a report. There were thirty-six states, two provinces, and 2 DX countries represented. Unlike it had for the Winter Fireside SSB Sprint, the solar flux did not cooperate giving us only a paltry 102. Such a value resulted in weak, fading signals on 20 and 15 and little to no propagation on 10. In fact only nine contests reported any contacts on 10M. As some remarked, these conditions are a hint of things to come as the solar cycle declines. However, the upside is that we will get more use out of 40 and 80.

Taking top honors was Bob, N4BP, with over 2 million points. Contest after contest Bob keeps winning and often by a large margin. Brian, K7RE, in South Dakota placed second. He recently moved there and is still getting his antenna farm in shape. I'm looking forward to Brian giving Bob some closer competition. Al, KØFRP, George, K5TR, and Jim, NØUR, were 3rd, 4th, and 5th with only some 70,000 points separating them. Al and Jim are a long time participants, but for George this was the first QRP ARCI contest in a long while. He is a "big time" contest operator and I'm glad that he joined our fun.

Half of the top ten ran the full 5 W. Probably because of the anemic solar flux values. Look closely, however, and you will see that numbers 9 and 10 both ran less than 250 mW. An interesting turn of events. I don't recall any of our contests where such a high finish was achieved by running less than 250 mW.

The next QRP ARCI contest of this size is the Fall QSO Party in October. Don't miss it.

**2003 Spring QSO Party Soapbox**

**WJ9B**—Difficult going, especially on Sunday! **WJ7L**—Thanks. It was fun. **WB9MII**—Had some fun. **WA7LNW**—Very poor band conditions. But as usual…great turn out from the QRP community. Thanks to all who gave me a contact. One of my favorite QRP events. **WA4DOU**—It is always amazing how strong QRP signals can be at times and how fast they can fall in the noise. The high point was being told by KD5RVX that he needs my card for the kMpW award. **W9XT**—Just finished building the Rockmite a few days earlier. I decided to see how it played in a contest. **W9KV**—My Norcal 20 developed TX frequency offset problems so had to use the Kenwood. **W8VE**—Limited hours. I was not able to get in contest until evening. **W5TA**—Unfortunately, due to personal issues, only got on for 3 hours of the contest. 20M is always good. We need more activity on 15. The band was open but not many signals. Was surprised to get a call from K1ZZ. **W5KDJ**—Contest was fun but wish there had been more folks in it. Props were good on 7 & 14, 21 was open at my QTH but heard very few signals. **W2AGN**—No excuses. Conditions were not bad. Had hoped for a big score, but seemed slow from the start. CQed on 20 and 15 for first 2 hours and only 15 QSOs. I knew it was going to be tough! **W1QHG**—Snapped antenna under snow

**2003 Spring QSO Party**

**Top Ten**

| | | |
|---|---|---|
| 1 | N4BP | 2,367,092 |
| 2 | K7RE | 1,5220,020 |
| 3 | KØFRP | 1,172,160 |
| 4 | K5TR | 1,146,550 |
| 5 | NØUR | 1,102,038 |
| 6 | WJ9B | 834,260 |
| 7 | WA7LNW | 710,094 |
| 8 | K7TQ | 652,680 |
| 9 | W5KDJ | 471,225 |
| 10 | AA4XX | 400,680 |

**Category Winners**

| | | |
|---|---|---|
| 20 meters | WA4DOU | 118,188 |
| 40 meters | K9PX | 350,217 |
| 80 meters | N7EIE | 1,568 |
| High Band | K9IUA | 23,226 |

**Teams**

Aluminum Kings—N4BP, KØFRP, NØUR, KCØIOX, K7RE = 6,163,300
QRP Wire Nuts—KD7AEE, WA7LNW, K7TQ = 1,410,262
Knightlights—AA4XX, AB4PP, AE4IC, N4HAY = 1,341,308

all winter. Got it part way back up for a little contesting. **W1FWB**—No contacts with Rockmite 40. All with Vectronics 1320. Had a good time. First contest. **WØUFO**—Sorry I could not work longer, but it was fun working many friends. **OK1CZ**—I found conditions good on Sunday night, could hear many NA QRP sigs around 14060, not all of them could hear me though. Pity I did not have time to check the other bands during the weekend. **NU4B**—Did work CA on 15—only 1 station heard on 15 and none on 10. But it was alot of fun. One of these days I hope to do the whole contest. Thanks all for the QSOs! **NK6A**—Conditions didn't seem that great from CA this time around. Kept hearing the same stations I already worked. Woke up at 4 AM on Sunday morning and decided to try 40M. Same stations again. **NJ2OM**—Conditions not that great. 15M was virtually empty. Worked DE on 2 bands and RI on one. **NG7Z**—Well I did better than last time. An improvement over the last effort in the Fall. I guess that's what counts. I broke my own record! **NA3V**—10M and 15M seemed pretty dead, but most of the old crew still showed up on the lower bands. **N9AG**—I'm going to have to try this with QRPp someday. VE3VA's 130 mW, KØCV's 300 mW and W9FNB's 400 mW were outstanding! **N7EIE**—80 was only open in WA for a couple of hours. **N5UW**—My first contest in 3 years. Fun to be back in the action. Bands could have been better but still a blast! **N4UK**—Not much activity when I was able to be on the air. Also the Georgia QSO Party was on this same weekend. Neither 15 nor 10 Meters seemed to be open at all. **N4HAY**—Conditions not great but we sure had an excellent time! Thanks to the organizers. **N4BP**—Had originally planned to run 1W, but the prop forecast was so dismal that I decided instead to run a full 5W. 40M was to be the real work horse due to the antennas at K1TO—2/2 at 165 ft and 80 ft. **N3AO**—wish I had had more time. I love this contest! Thanks to all those who responded to my calls, and great fun to hear old friends again! **NØTK**—Was great to work AA1MY on 80M. **KX7L**—Tried to squeeze a little contesting in this weekend. 40 was modestly active Saturday night, and I managed to give the 2n2/40 a bit of a workout. (nothing like a contest to find the little bugs in a rig). **KN1H**—Station was a Small Wonder 40 on the beach at Lake Michigan just north of Milwaukee, WI. A straight key and a gel cell rounded out the station. Had a good time till it got too cold to sit there in the wind and blowing sand any longer! **KIØII**—Out of town company so had to slink away and make a few contacts when possible. **K9IUA**—Bits and pieces of time in between errands, laundry, etc. Called CQ as much as I could to give folks a chance to "discover" Iowa. Always a fun contest. **K8ZFJ**—Always fun playing radio in a QRP ARCI contest, in spite of the local QRN. **K8KFJ**—A minor storm didn't help propagation but I still had fun. **K7RJ**—Utah to Fla using my 500 mW Rockmite. **K7RE**—Propagation during the first day was terrible. I tried 10M many times, but never heard even one beacon during the entire contest period. Nevertheless I called CQ on several occasions, with zero success. **K6III**—Vacationing in TX on a lake. Didn't plan on operating but just heard the activity on and joined in the action. **K5TR**—I operated as I could on and off during the weekend. It was fun. Nice to hear all the QRPers out there on the bands. I will have to make time for this contest next time and operate it in a more planned manner. **K5OI**—As usual, fun. But bands weren't in very good shape. Nice to hear and work old friends. **K3CHP**—Conditions not bad but turnout not too good. Could not raise anybody on

**K6III had a great time operating the Spring QSO Party "lakeside portable" in TX.**

## 2003 Spring QSO Party

| QTH | Call | Score | Pts | SPC | Power | Bands | Time | Rig | Antenna |
|---|---|---|---|---|---|---|---|---|---|
| AK | AL7FS | 15428 | 116 | 19 | LT5 | 40,20 | 3.5 | K2 | KT34A @ 40', trap dipole |
| AL | AB9CA | 77140 | 290 | 38 | LT5 | 40,20,15 | 8.5 | K1 | 230' wire, 20 m wire vert |
| | K4NVJ | 15113 | 127 | 17 | LT5 | 40 | 6 | K1 | Dipole |
| AZ | W9UQB | 35910 | 190 | 27 | LT5 | 40,20,15 | 11.5 | Jupiter | Vert G.P. |
| BC | VA7NT | 244790 | 538 | 65 | LT5 | 160,80,40,20,15 | | | |
| CA | AD6GI | 94864 | 308 | 44 | LT5 | 40,20,15,10 | 12 | K2 | Dipoles |
| | NK6A | 60515 | 247 | 35 | LT5 | 40,20,15 | 3 | K2 | C4 |
| | K6III | 3857 | 29 | 19 | LT5 | 20 | 1 | K2 | Hamstick |
| CO | KØFRP | 1172160 | 1221 | 96 | LT1 | 80,40,20,15,10 | 19.5 | | |
| | NØTK | 138376 | 353 | 56 | LT5 | 80,40,20,15 | 6 | K1, FT817 | Attic dipoles, 44' cf doublet |
| | NKØE | 77280 | 276 | 40 | LT5 | 40,20,15 | 6 | IC706 MKIIG | G5RV @ 25' |
| | NØIBT | 24948 | 162 | 22 | LT5 | 40,20,15,10 | 6 | TS870 | Dipoles |
| | KIØII | 24864 | 148 | 24 | LT5 | 40 | 3 | K2 | EDZ for 17 m |
| | W9KV | 11186 | 94 | 17 | LT5 | 40,20 | 13.5 | TS850 | Dipole |
| CT | K1THP | 59052 | 222 | 38 | LT5 | 40,20,15 | 7 | K1 | HF6V, 40 m dipole, TA33 @ 40' |
| | W1FWB | 420 | 20 | 3 | LT5 | 20 | 2 | Vectronics 1320, Rockmite R7000 | |
| DE | K3CHP | 237888 | 531 | 64 | LT5 | 80,40,20,15 | 23 | FT817 | HF6V |
| FL | N4BP | 2367092 | 1858 | 182 | LT5 | 160,80,40,20,15,10 | 24 | K2 | Monobanders |
| | K1TO | 2520 | 40 | 9 | LT5 | 40 | 0.3 | K2 | |
| GA | KE2WB | 202944 | 453 | 64 | LT5 | 80,40,20,15 | 10 | K2 | 80 m dipole |
| | AF4PP | 41160 | 196 | 30 | LT5 | 80,40,20,15 | 4.6 | K1, K2 | Doublet @ 50' |
| | K4BAI | 22540 | 980 | 23 | LT5 | 40,20 | | FT1000MP | TH6DXX stuck south, dipole |
| IA | K9IUA | 23226 | 158 | 21 | LT5 | 20,15 | 6 | Scout | Dipole |
| ID | K7TQ | 652680 | 1036 | 90 | LT5 | 80,40,20,15 | 24 | K2 | C4S @ 50' |
| IL | N9KO | 17388 | 138 | 18 | LT5 | 40,20,15 | 6 | TS570 | Vert |
| | WB9MII | 560 | 20 | 4 | LT5 | 40,20 | 1 | FT817 | HB indoor loop |
| IN | K9PX | 350217 | 981 | 51 | LT5 | 40 | 13.5 | K2 | 80 m loop |
| MA | K1HJ | 306800 | 472 | 65 | LT1 | 80,40,20,15 | 18.5 | IC735 | 80 m dipole @ 45' |
| MD | K3AJ | 219450 | 550 | 57 | LT5 | 80,40,20,15 | 7.9 | K1, TS570 | Tribander, dipole |
| ME | W1QHG | 2464 | 44 | 8 | LT5 | 20 | 1 | K1 | Carolina windom |
| MI | K8AAX | 44940 | 214 | 30 | LT5 | 80,40,20 | 2.5 | QRP + | Carolina Windom |
| | N8TDH | 2800 | 50 | 8 | LT5 | 40 | 2.5 | MFJ 9040 | Dipole |
| MN | NØUR | 1102038 | 1381 | 114 | LT5 | 160,80,40,20,15,10 | 19 | K2, FT920 | Yagi, wires |
| | WØUFO | 233870 | 514 | 65 | LT5 | 80,40,20,15,10 | 8 | K2 | Triband yagi, 40 m inv vee, 80 m zepp |
| MO | KØLWV | 49504 | 221 | 32 | LT5 | 40,20 | 13 | TS520 | End fed Hertz @ 20' |
| | KGØTW | 21840 | 130 | 24 | LT5 | 80,40,20,15 | 9 | TS540S | Dipole @ 22' |
| | WØAV | 10332 | 246 | 42 | LT5 | 80,40,20,15 | | K2 | Sloper |
| NC | WJ9B | 834260 | 1180 | 101 | LT5 | 80,40,20,15 | 18 | FT1000MP | A3, 2 el yagi, 80 m loop |
| | AA4XX | 400680 | 424 | 63 | LT250 | 160,80,40,20,15 | 14 | K2, NC40A, Sierra | Beam, loops |
| | N4HAY | 375200 | 536 | 70 | LT1 | 160,80,40,20,15 | 18.1 | K2, Sierra, NC40A | 20 m beam, loops |
| | AE4IC | 285278 | 4018 | 71 | LT5 | 160,80,40,20,15 | 9 | | |
| | AB4PP | 280150 | 431 | 65 | LT1 | 160,80,40,20,15 | 19 | NC40A, K2 | Beam, loops |
| | WA4DOU | 118188 | 402 | 42 | LT5 | 20 | 10.5 | FT990 | 2 el yagi @ 53' |
| | AE4EC | 36337 | 179 | 29 | LT5 | 40,20,15 | 8 | K2 | Inv vee, vert |
| NH | W1PID | 12971 | 109 | 17 | LT5 | 40,20 | 7 | | |
| NJ | W2AGN | 357840 | 720 | 71 | LT5 | 80,40,20,15 | 14 | K2 | KT34, 300' horiz loop |
| | NJ2OM | 227115 | 515 | 63 | LT5 | 80,40,20,15 | 12 | Sierra | Windom |
| | K2JT | 118800 | 270 | 44 | LT1 | 80,40,20,15 | 5 | Sierra | Doublet, Inv vee |
| | W2JEK | 88704 | 288 | 44 | LT5 | 80,40,20,15 | 4.5 | FT840 | Dipole, gnd plane, end fed hertz |
| NM | WA7LNW | 710094 | 957 | 106 | LT5 | 80,40,20,15 | 9 | K2 | Zepp @ 67', HF2V |
| | K5AM | 3276 | | | LT5 | | 1 | HB | Loop |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NY | N2JNZ | 1500 | 30 | 5 | LT1 | 40 | 1.5 | Omni D | G5RV @ 20' |
| OH | N9AG | 151949 | 443 | 49 | LT5 | 80,40,20,15,10 | 4.5 | TS850, FT1000MP | Vert, beams |
| | AA8IV | 11970 | 95 | 18 | LT5 | 80,40,20 | 24 | Argonaut II | G5RV @ 30' |
| | AB8FJ | 8610 | 82 | 15 | LT5 | 80,40,20 | 2 | Argonaut II | Random wire |
| | W8VE | 8281 | 91 | 13 | LT5 | 20,15 | 2 | TR4 | C4S @ 54' |
| OK | N5UW | 218316 | 452 | 69 | LT5 | 160,80,40,20,15 | 9 | Omni VI+ | TA33, HF6-V, Inv L |
| | K5OI | 44702 | 206 | 31 | LT5 | 40,20,15 | 10 | K2 | 44' EZD in attic |
| ON | VE3NXB | 18200 | 130 | 20 | LT5 | 80,40,20 | | | Butternut vert |
| | VE3XT | 4389 | 57 | 11 | LT5 | 40,20,15 | 8 | K1 | HB Vert |
| PA | NA3V | 128520 | 360 | 51 | LT5 | 80,40,20,15 | 6.5 | IC756 | 130' doublet @ 65' |
| | N3AO | 35728 | 176 | 29 | LT5 | 80,40,20,15 | 3 | K2 | Yagi |
| | N3IUT | 31871 | 157 | 29 | LT5 | 40,20,15 | 5.5 | K1, K2 | C4, GAP Titan |
| | W3ZMN | 13566 | 102 | 19 | LT5 | 80,40,20 | 1.8 | K2 | Dipole |
| RI | K8ZFJ | 25200 | 120 | 21 | LT1 | 80,40,20,15 | 6 | Argo 515 | Horiz loop |
| SD | K7RE | 1522010 | 1279 | 119 | LT1 | 160,80,40,15 | 24 | K2 | |
| TN | NU4B | 163506 | 458 | 51 | LT5 | 80,40,20,15 | 11.75 | Argo V | HF5B, HF2V |
| TX | K5TR | 1146550 | 997 | 115 | LT1 | 160,80,40,20,15,10 | 12 | TS850 | Monobanders, wires |
| | W5KDJ | 471225 | 515 | 61 | LT250 | 40,20,15 | 12.8 | K1 | PRO57B_LW |
| | W5TA | 58254 | 219 | 38 | LT5 | 40,20,15 | 3 | TS430S | Vert, zepp |
| UT | KD7AEE | 47488 | 212 | 32 | LT5 | | | | |
| | WJ7L | 17549 | 109 | 23 | LT5 | 40,20 | 3 | K1 | Dipoles |
| | K7RJ | 9520 | 80 | 17 | LT5 | 40,20,15 | 20.75 | FT817, Rockmite | |
| VA | K4UK | 43239 | 213 | 29 | LT5 | 40,20 | 3.5 | | |
| | K2EKM | 3500 | 50 | 7 | LT1 | 40 | 3 | Rockmite | HFp vert |
| WA | WA7NCL | 135051 | 327 | 59 | LT5 | 80,40,20,15,10 | 8 | TS870 | Horiz vee |
| | K7NTW | 83377 | 277 | 43 | LT5 | 40,20,15 | 4.5 | Omni VI | 2 el quad, 40 m vert |
| | NG7Z | 76076 | 286 | 38 | LT5 | 40,20,15 | 5 | K1 | Dipole |
| | AC7MA | 7644 | 78 | 14 | LT5 | 40,20,15 | 3 | HB | End fed wire |
| | KX7L | 1848 | 33 | 8 | LT5 | 40 | 1.2 | 2n2/40, IC735 | Inv L |
| | N7EIE | 1568 | 32 | 7 | LT5 | 80 | 2 | TS570D | 80 m dipole |
| | K7WA | 1428 | 34 | 6 | LT5 | 20 | 3 | IC735 | 20 m mini-dipole of Hamsticks |
| WI | W9XT | 26880 | 128 | 21 | LT1 | 40 | 9 | Rockmite | 2 el yagi |
| | KN1H | 750 | 25 | 3 | LT1 | 40 | 1 | SW40 | Dipole @ 15' |
| WV | K8KFJ | 30975 | 177 | 25 | LT5 | 40 | 4.75 | K1 | 14AVQ |
| | | | | | | | | | |
| GW | GWØVSW | 6468 | 77 | 12 | LT5 | | 9.5 | FT817 | Inv G5RV @ 10 m |
| OK | OK1CZ | 6048 | 72 | 12 | LT5 | 20 | 2 | FT100 | Yagi |
| | | | | | | | | | |
| Check log | | NI5F | | | | | | | |

ten meters. **K2JT**—Getting called by K7CA in Utah on 40 mtrs was very exciting for me at my 900 mW power level. **K2EKM**—First QRP ARCI QSO Party. Had loads of fun on 40 with my RockMite and portable vertical. Best DX was N4BP in Plantation, FL—890 away for 1780 miles per watt! **K1TO**—Worked a few after N4BP crashed for the night. You guys should also gain visibility by getting WA7BNM and N7WA to include this contest on the "3830" pages. **K1THP**—Lots of fun with new K1. **K1HJ**—Not much heard from other contesters on 15M most of the time but moved down the band and worked a few European stations at one point. Got some pretty good mileage on 40M and 80M late at night. **KØLWV**—Signals seemed weak. **KØFRP**—Poor conditions and it was a very slow moving contest. No runs at all. I had to work for every Q. Just a reminder of the conditions we will have for the next few years. **GWØVSW**—Hard contest from this side of the pond. High static noise, several EU contests coupled with poor propagation did not help! I was pleased to have '7Q' in the log for a new QRP country on 15M. **AF4PP**—Spring weather enabled mostly solar powered backyard portable operation. Very fun event. **AE4EC**—Did not get to operate as much as I would have liked because of honey doos and Raleigh, NC hamfest. But when I did operate I experienced very noisy conditions at my QTH on all bands but 15. **AD6GI**—Conditions were good. Sunday was very sparse. The guys from NC helped make it worth the effort. My thanks to all for a good contest. See you next time. **AB9CA**—Thanks for hosting this great event. Had a great time and thanks to everyone for working with

my poor fist. **AB4PP**—Multiop station as Knightlites was a lot of fun. We ate well and had a wonderful weekend with the beautiful warm weather. A first for us out of our last 8 expeditions that were in storms and a near hurricane. **AA8IV**—Nice to hear so many on the bands. Always a pleasure to work so many friends. Will do this again with better antenna.

**Note About Certificates:**

Contest certificates are awarded in each contest for the top three finishers (top 10 in Spring and Fall QSO Parties), highest score in each class, highest score on each single band, 40M-80M (low-band), and 20M-10M (high-band), and highest score in each state/province/country.

Remember that the new certificate handler, Tom WB5KHC, only deals with the printing and mailing of certificates after the contest results have been determined. Contest entries are still submitted to the Contest Chairman, Randy K7TQ.

# Contest Announcements

## 2003 Fall QSO Party

**Date/Time:**

October 18, 2003, 1200 Z through October 19, 2400 Z. You may work a maximum of 24 hours of the 36 hour period. CW HF only.

**Exchange:**

Member—RST, State/Province/Country, ARCI member 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 one band for QSO points and SPC credit.

**Power Multiplier:**

0 - 50 mW = x 20
>50 mW - 250 mW = x15
>250 mW - 1 W = x10
>1 W - 5 W = x7
over 5 W = x1

**Suggested Frequencies:**

| | |
|---|---|
| 160M | 1810 kHz |
| 80M | 3560 kHz |
| 40M | 7040 kHz |
| 20M | 14060 kHz |
| 15M | 21060 kHz |
| 10M | 28060 kHz |

**Score:**

Points (total for all bands) x SPCs (total for all bands) x Power Multiplier.

**Teams**:

You may enter as a team of either 2 to 5 members per team or unlimited number of operators as long as a maximum of 5 transmitters on the air at a time. You compete individually as well as on the team. Teams need not be in the same location. Team captain must send list of members to Contest Manager before the contest.

**Categories:**

Entry may be All-band, Single-, High-, or Low-band.

Entry includes a copy of logs and summary sheet. Include legible name, call, address, and ARCI number, if any. Entry must be received within 30 days of contest date. Highest power used will determine the power multiplier.

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

Entries are welcome via e-mail to rfoltz@turbonet.com or by mail to

Randy Foltz
809 Leith St.
Moscow, ID 83843

After the contest send your Claimed Score by visiting http://personal.palouse.net/rfoltz/arci/form.htm. You must still submit your logs by either e-mail or regular mail if you use the High Claimed Score form. Check the web page for one week after the contest to see what others have said and claimed as their scores.

●●

***How to Operate the Contest:* Fall QSO Party**

*Date:* October 18, 2003, 1200 Z through October 19, 2400 Z. Work up to 24 hours of the 36.

*How to participate:* Get on any of the HF bands except the WARC bands and hang out near the QRP frequencies of 3560, 7040, 14060, 21060, and 28060 kHz. Work as many stations calling CQ QRP or CQ TST as possible, or call CQ QRP or CQ TST yourself. You can work a station again on a different band.

*What to send:* Give a signal report and your state (for Americans), province (for Canadians), or country (for everyone else), and QRP ARCI member number if you have one, or your power if you don't have one.

*Best reason to participate:* This one and the Spring QSO Party have the greatest QRP participation of any QRP contest!

*Relative challenge:* Easy to Moderate. (Slow CW speeds, long duration, large number of participants, QRP only contest).

*Scoring:* Standard QRP ARCI method for CW contests

*Web link:* http://personal.palouse.net/rfoltz/spring.htm

# More FDIM Photos

**At Four Days in May, the banquet is the culmination of a long weekend of QRP and homebrew activity!**

**QRPers, sign in please!**

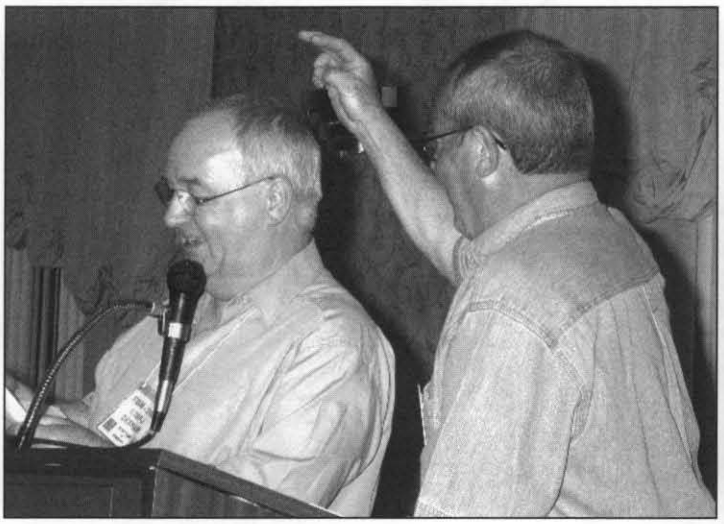

**Awards are a highlight of the banquet.**


*photos by WDØFPY and KO4WX*

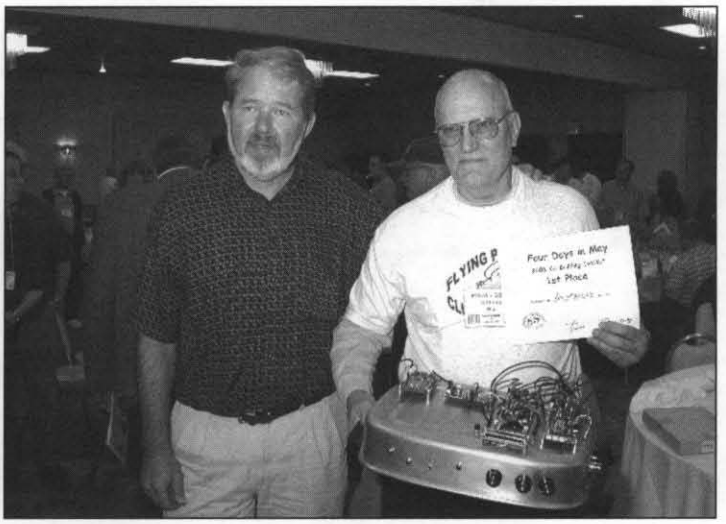
**Lots of door prizes increases the odds of going home with something new!**

## Yet Another Great Part of FDIM ... The Building Contest

**Recognition for skillful homebrew construction**

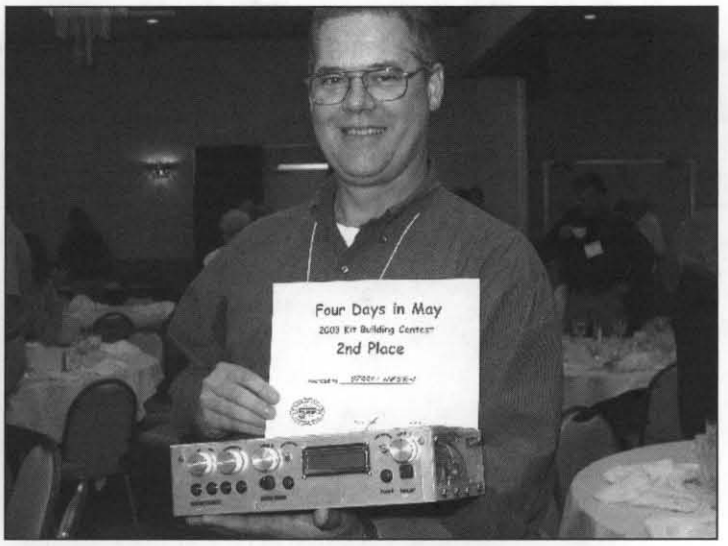


**OK, let's get things started.**



**Of course, the winner needs to pose with Diz.**


**A close-up of the winning project that was cooked up in a roasting pan. Nothing half-baked about it.**




**With this kind of competition, second place is great, too!**

*photos by AA9YH*

*...more photos on the next page.*

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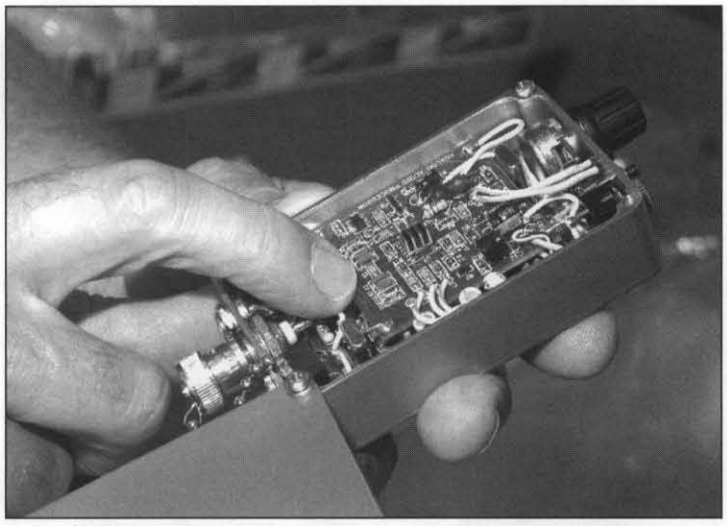
**START PLANNING TODAY FOR YOUR NEXT PROJECT!**

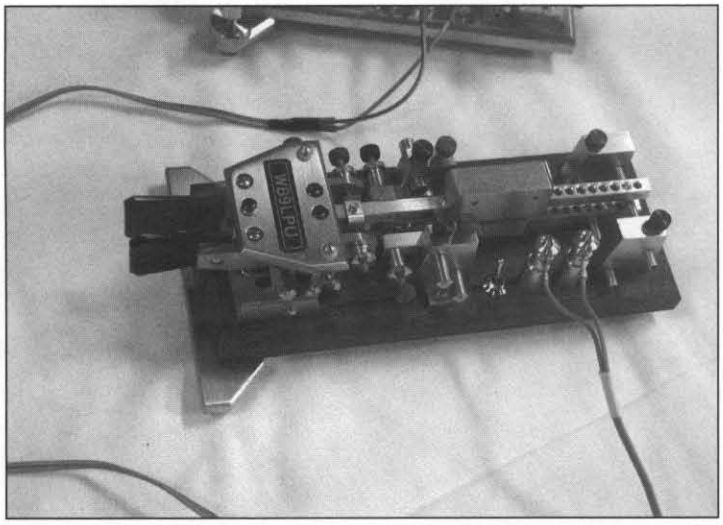
**BRING IT TO FDIM 2004 AND ENTER IT IN THE BUILDING CONTEST**

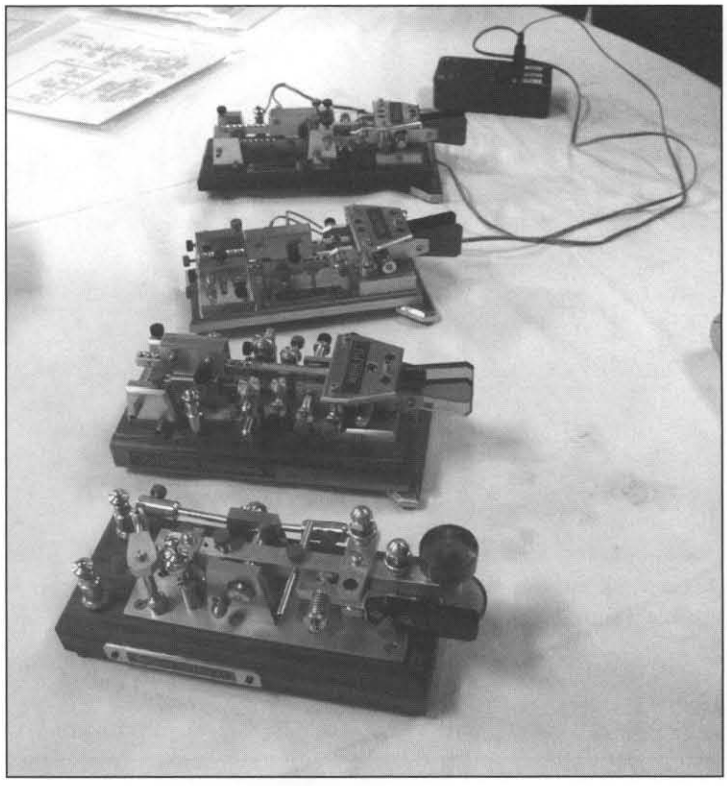
**(OR AT LEAST BRING IT FOR SHOW 'N TELL)**

## More Building Contest Photos

**A great job on a Rock-Mite (close-up on the right) wins the Specialty Building Contest.**



**Who doesn't like keys, paddles and bugs! Especially when they are drop-dead gorgeous like this collelction.**

*photos by AA9YH, KO4WX and WDØFPY*

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**READING QRP QUARTERLY IS LIKE A YEAR 'ROUND FDIM!**

**IT'S FULL OF IDEAS FOR RIGS, ANTENNAS, OPERATING... AND SIMPLY HAVING FUN WITH YOUR LOCAL QRP CLUB!**

# New ARCI Members This Quarter

| | | |
|---|---|---|
| 11451 | | JEFFREY SKERKER |
| 11452 | VK6ZD | BRIAN GOVIER |
| 11453 | K4DRW | DONALD WADE |
| 11454 | N4VFK | HEYWARD BOZARD JR. |
| 11455 | WØAJM | ANNA MONTON |
| 11456 | AE7RW | RICHARD PATRICK |
| 11457 | W9GTA | PATRICK CROFT |
| 11458 | W5JSA | JOHN ABBOTT |
| 11459 | KC8USU | JON COULTER |
| 11460 | K3EEE | GILBERT WOODWORTH |
| 11461 | WB8REH | JAMES THIESEN |
| 11462 | K9NX | TIM JONES |
| 11463 | K5MO | JOHN BREWER |
| 11464 | AC4UR | MICHAEL BYRD |
| 11465 | VE2EQL | JOHN GROW |
| 11466 | KG6JSI | PETER LUCIC |
| 11467 | WB7EUX | TOM BINGHAM |
| 11468 | K1VX | DONALD MILLS |
| 11469 | KØEMT | BRYAN NEHL |
| 11470 | AC5XK | DON PERESE |
| 11471 | WI2C | JOHN FLEISCHMANN |
| 11472 | WB9NLZ | TIMOTHY STABLER |
| 11473 | KG6PDR | ERIC GRUBER |
| 11474 | KG6CYN | TREVOR JACOBS |
| 11475 | KB9WVG | ROBERT TALBOT |
| 11476 | | SHANE DOVETON |
| 11477 | KG4YAH | KURT HEWELL |
| 11478 | NØUX | TERRY MURROW |
| 11479 | KC8TQT | JOHN HILLMAN |
| 11480 | KB1AF | WENDY KINCAID |
| 11481 | N9KIY | JAMES JOHNSON |
| 11482 | KT6LA | EDWARD BELLUSO |
| 11483 | | REGIS ROSEBERRY |
| 11484 | NØEVH | JOHN WATKINS |
| 11485 | KA1WZA | RICHARD ALLEN |
| 11486 | KB1JAV | MYRNA ALLEN |
| 11487 | AC7YE | KENNETH BERTRAN |
| 11488 | KD7TBD | BRETT DOWNEY |
| 11489 | K2CAD | CLAYTON DECOSTERD |
| 11490 | VE3YZA | JAMES BYERS |
| 11491 | K6CT | C T MORTON |
| 11492 | WA8THK | PERRY BAKER |
| 11493 | JN3XAO | LUKE NAKAMURA |
| 11494 | KØEX | MARK FOSTER |
| 11495 | WAØITP | TERRY FLETCHER |
| 11496 | AA3WN | S BRIAN WILLIAMS |
| 11497 | AB2MD | RICHARD LOURETTE |
| 11498 | K5IC | AUDIE KAUFMAN |
| 11499 | PA9TT | DANIEL VAN DALEN |
| 11500 | K8WIW | RICHARD SHAFER |
| 11501 | KG4UMW | JAMES STANLEY |
| 11502 | K7OI | TERRY PERMENTER |
| 11503 | W8HF | STEVE HALL |
| 11504 | KG6WP | HOWARD STEPHENSON |
| 11505 | KCØPMH | WAYNE DILLON |
| 11506 | KC2LBO | WALTER O'BRIEN |
| 11507 | KG8NR | JOHN HESS |
| 11508 | W2GMV | GENE SCHAFFNER |
| 11509 | N8PH | PAUL HRIVNAK |
| 11510 | W7HLH | HARRY HELMS |
| 11511 | M3BBZ | NICOLAS PIKE |
| 11512 | | WILLIAM CHRISTIE |
| 11513 | WA2TAK | STEHPEN TETORKA |
| 11514 | AA9ZV | HOWARD MIZE |
| 11515 | KU4FP | RUSSEL CHANDLER |
| 11516 | KG4KGY | TOM BUCHANAN |
| 11517 | K5FSE | JACK NELSON |
| 11518 | N1OLO | JOHN KALOTAI |
| 11519 | K8VU | GEORGE KATZENBERGER |
| 11520 | K8EN | KEN REHSE |
| 11521 | K2XT | RICK STEALY |
| 11522 | K8LJU | FREDERICK VAN CLEVE |
| 11523 | W5WLW | ROBERT SLUDER |
| 11524 | N8JK | JOHN KERR |
| 11525 | K4RF | STEVE ADAMS |
| 11526 | WI4LD | ERIC LUTHER |
| 11527 | K1ND | J JAN JELLEMA |
| 11528 | K4BYF | JACK FALKENHOF |
| 11529 | AB8CO | RANDY DURRUM |
| 11530 | KX4G | GERALD STUART |
| 11531 | WAØPOD | TOM MIKKELSON |
| 11532 | WI2Q | DAVE BUDA |
| 11533 | WD9DEX | GREGORY OVERKAMP |
| 11534 | KG8YG | HAROLD HEATH |
| 11535 | WB6ZQZ | ALAN BIOCCA |
| 11536 | N8CDN | TERRY CALLAHAN |
| 11537 | NS9M | MARK PUPILLI |
| 11538 | AE6AI | MITCHELL CIPRIANO |
| 11539 | N8EFO | TOM SOMSAK |
| 11540 | K4XTC | CLAUDE SUNDERMAN JR |
| 11541 | N3XPD | MICHAEL WARNER |
| 11542 | WØGXO | STEVE KICKERT |
| 11543 | NU6A | STEVEN OI |
| 11544 | EI5EM | TONY BREATHNACH |
| 11545 | W9RTP | GEORGE STANEK |
| 11546 | KG5U | DALE MARTIN |
| 11547 | W4CC | JOHN COVINGTON |
| 11548 | N3GXY | JOEL GRILLY |
| 11549 | WB9IHP | DAVID STAUROPOULOS |
| 11550 | WB2WXN | JOHN MARTINSON |
| 11551 | K8GV | DONALD BARBER |
| 11552 | K4ZLE | JAY SLOUGH |
| 11553 | KT4EL | WALTER PARSONS III |
| 11554 | KA8GEF | EMIL TODD |
| 11555 | W7ND | FRANK CONNELLY |
| 11556 | WA7ZZI | DONALD JONES |
| 11557 | AA3YW | DAVID PARKHILL |
| 11558 | KGØSH | BRUCE THOMPSON |
| 11559 | WN8VOT | DAVID MEDLEY |
| 11560 | K3MOV | TOM BAXTER |
| 11561 | N7UXX | EDWARD PARRISH |
| 11562 | VE3HDK | ROBERT KIDD |
| 11563 | WD8OJK | BOB TAYLOR |
| 11564 | N2KKO | L LOVELL |
| 11565 | N3RBJ | JOHN GELIEBTER |
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| 11567 | N4TKD | JOHN REASOR |
| 11568 | KF7MW | JAMES WILLIAMS |
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QRP ARCI BOOKKEEPING AREA:

AWARD NR: _____ BAND ____ MHz NR: ____
MODE _____ NR: ____
AWARD DATE: _____

## 1,000 MILE/WATT AWARD APPLICATION

DATE OF APPLICATION: _____. CALL: _____

EMAIL ADDRESS: _____

BAND: _____ MHZ.

MODE (CIRCLE ONE): CW SSB FM OTHER MODE: _____

PAYMENT ($4 US/$5 non-US): CASH M/O CHECK or 10 IRCs

AMOUNT: _____ US DOLLARS.

DATE OF QSO: _____ (Y-M-D — example: 970203 for February 3, 1997)

FIRST STATION CALL: _____ PWR: _____ (if known)

QTH: _____ (City, State, Country)

LAT: _____ LONG: _____ (in decimal degrees)

QRP STATION CALL: _____ PWR: _____

QTH: _____ (City, State/Country)

LAT: _____ LONG: _____ (in decimal degrees)

POWER LEVEL: _____ WATTS. MILES: _____ MILES

MILES PER WATT: _____ MILES/WATT

MAIL CERTIFICATE TO: _____

_____

_____

_____

1. Form must be on one 8.5 x 11 inch page.
2. Photocopy QSL(s) with form, do not send original QSL cards.
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4. Make checks payable to Thom Durfee.

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| | | |
|---|---|---|
| ___ WAC AWARD APPLICATION | ___ WAS AWARD APPLICATION | ___ DXCC AWARD APPLICATION |
| ___ WAC AWARD ENDORSEMENT | ___ WAS AWARD ENDORSEMENT | ___ DXCC AWARD ENDORSEMENT |

AWARD NR: _____
(OFFICIAL USE)

CALL: _____ DATE: _____
BAND: _____MHZ MIXED MODE: CW SSB FM RTTY MIXED
PAYMENT: CASH MO CHECK IRCS (10) _____AMOUNT: _____ US DOLLARS -- See Note 2
MAX POWER LEVEL:_____WATTS
STATES: 20 30 40 50 (Circle) COUNTRIES: 100 IF MORE, HOW MANY?_____
ENDORSEMENT: NO YES-Circle: One Band One Mode Natural Power Novice Two-way
MAIL CERTIFICATE TO:_____
_____
_____

GCR QUALIFICATION FOR HAM RADIO AWARD

WE, THE UNDERSIGNED, ON THE DATES AFFIXED NEXT TO OUR SIGNATURES, HAVE EXAMINED THE QSL CARDS ASSEMBLED AS PROOF FOR EARNING THIS AWARD, AND AFFIRM THAT THE CLAIM IS VALID AND TRUE.

| | |
|---|---|
| _____ | _____ |
| SIGNATURE DATE | SIGNATURE DATE |
| _____ | _____ |
| CALLSIGN | CALLSIGN |

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Mail to: QRP ARCI Awards Chairman
Thom Durfee, WI8W
3509 Collingwood Avenue SW
Wyoming, MI 49509

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# The QRP-ARCI Toy Store

The **official** QRP-ARCI Coffee Mug. Used by the top QRP Fox hunters, contesters and casual operators found near the normal QRP Frequencies. Kelly Green on White and the Logo is on both sides. Coffee, tea or milk not included.


The blue and brass metal pins have a tie-tac pin and clasp on the back.

The White '72' pins say "WISHING YOU 72 GOOD QRP"

Midnight Blue mugs are still available.

The QRP-ARCI patches are fully stitched, black on white. 3-9/16" wide x 2-1/2" high oval. And they can either be ironed on, or sewn on the finest evening wear!

Trouble reading those resistors? Plastic magnifiers for kit builders in a carrying case. Magnifiers are $1.00 each.

All Prices PostPaid!

Patches $5 Coffee Mugs $8 Blue Pins $7

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No shipping & handling on pins & patches when ordered with a coffee mug!

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Denim Blue Tan Charcoal Tan/Blue
Tan/Green Green

Hats are $15 each postpaid

**Orders to:**

**QRP-ARCI Toy Store**
**2130 Harrington Road**
**Attica, MI 48412-9312**
**Checks made out to: QRP-ARCI**
**or PayPal to k8dd@arrl.net**

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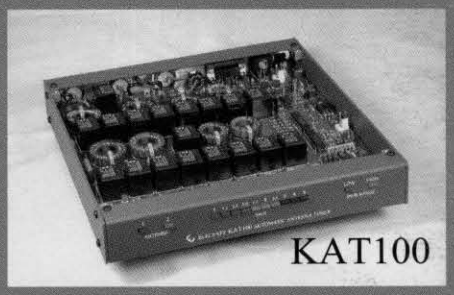
# NEW! Updated K2 Transceiver

The K2 is one of the highest-performance HF rigs you can buy, with chart-topping receiver specs, the features of a desktop rig, and the efficiency of a go-anywhere portable. But now we've made our top-of-the-line QRP kit even better. We've improved peformance, added new features, and simplified construction and alignment. There's never been a better time to buy a K2! (For a full list of changes, please visit our web site. Upgrade kits available for existing K2s.)

## New KAT100 Automatic Antenna Tuner

You now have two choices for an automatic antenna tuner for your K2: the original KAT2 internal QRP ATU, or the new KAT100. The KAT100 can handle up to 150 watts, so it's the ideal companion for our QRP/QRO transceiver, the K2/100. Like the KAT2, the KAT100 provides *two* antenna jacks. L-network settings are instantly recalled on band or antenna change.



KAT100

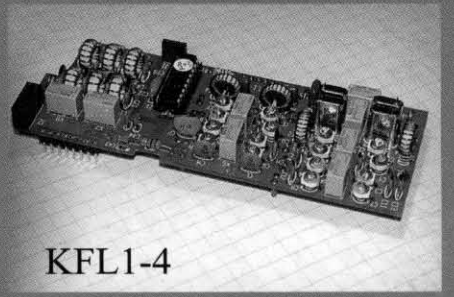

"I am absolutely taken by the K2. No comparison in the way of performance, feel, and all-around operating pleasure.... a fantastic piece of engineering." – Jim, K9FI

"In 42 years of hamming, I have never had so much consistent good luck with customer service from a ham radio manufacturer.... in my experience, Elecraft is tops on the list." – Brian, K7RE

"This K1 is a piece of art. The integration of form and function is superb. The care taken to make it build-able is unmatched." – Mike, W1MU

## K1 4-band CW Transceiver

With its small size, low current drain, and 5-watt+ output, the K1 is a great rig for home or field operation. The 4-band KFL1-4 module covers 40, 30, 20, and your choice of 17 or 15 meters; dual-band modules cover any two bands of your choice. Adding the internal auto-tuner (KAT1), internal AA battery pack (KBT1), and wide-range tilt-stand (KTS1) makes the K1 a truly "trail-friendly" radio. Starts at $289.



KFL1-4

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