QRPp

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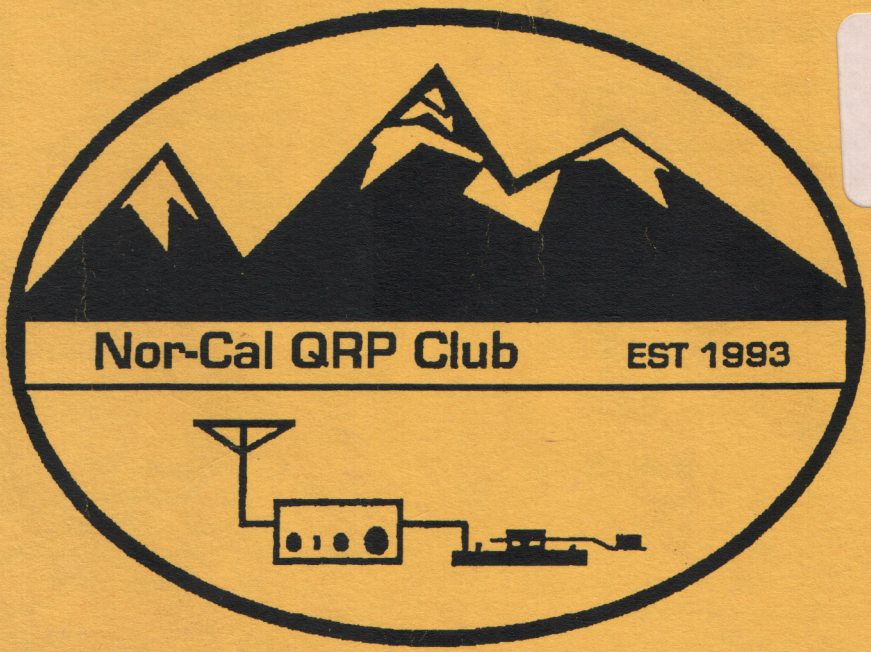


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From The Editor

by Doug Hendricks, KI6DS
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The first thing that you noticed about this issue is the size of the table of contents. We have 59 articles in this issue. You will notice that I said we, and that is what the QRPp is about, teamwork. There are literally dozens of people who contribute to the journal, and my thanks goes out to each and everyone of them.

Notice the slick new logo on the front cover? It was designed by Denis Englander, KD6ETI. If you want copies of it to put on your QSL's or stationary, contact Denis at 687 Second Ave., San Francisco, CA 94118. Nice job Denis.

When you look at the table of contents for this issue, you will recognize many old favorite authors who have been in previous editions, but you will also see several new ones. That means we are growing. One of the results of the growth is that we have to do a better job of distributing QRPp. The club has purchased a bag sealing machine so that the QRPp can be mailed in a protective plastic bag and we don't have to put staples in it. We had to replace 14 issues the last time we mailed, because the Post Office ate them. Hopefully this will solve the problem. You will also notice that this issue is mailed bulk rate. What that means is that instead of paying 98 cents postage for this issue, we pay 19.8 cents. That allows us to give you a bigger journal, even though it may take a little longer to get to you. We are asking the Post Office to return all issues that are undeliverable because of a wrong address. This means that they must make an attempt to deliver them and can't throw them away. Also, it gives us a chance to make corrections in case of a wrong address.

Jim Cates, WA6GER and I will be going to Dayton again this year. We are taking along an extra 200 copies of QRPp to give away at the QRP-ARCI hospitality room at the Days Inn Dayton South, where we will be staying. If you are going to Dayton, make plans to stop by the ARCI hospitality room and have an eyeball with us. We will have a "surprise or two to show you". I have also been honored to have been chosen as a QRP Forum speaker on Sunday at the Dayton Hamvention. I will be on a panel with Jim Fitton, W1FMR, and Chuck Adams, K5FO. Jim will speak on Coordinating a QRP Club, Chuck will talk about techical advising and helping club members, and I will discuss editing and publishing a club newsletter.

One last item. Last issue I mentioned that our Awards Manager, Steve Cates, KC6TEV, was going for his General ticket. He passed! Congrats to Steve. I am out of space, and so will close with best wishes to all of you and hope to hear you on the air. 72, Doug, KI6DS

Low Cost Wattmeter

by Richard Urmonas, VK3DRU
11 Kolor Way
Templestowe, Australia 3106

The easiest way to make a wattmeter is to add a diode detector across a dummy load. If you make your own dummy load use carbon composition resistors if possible (not carbon film which are the common "carbon resistors"). Design for a power dissipation at least twice your expected max power (the resistors get very hot if run at full power rating).

The diode detector should be in the same case if you homebrew. Use a general purpose diode for QRP (1N914, 1N4148 etc.) anode to the input. A capacitor should be connected between the cathode and ground (100n parallel with 10n is good for HF. Use ceramic caps). By measuring the voltage across the capacitor with a HIGH impedance voltmeter the output power can be calculated from the voltage which is the PEAK voltage. Don't forget to allow for the diode voltage drop at low power (at higher power the error becomes small (0.4 dB at 2W).

73 Richard Urmonas VK3DRU

"Incidentally, What Is A 10-10 Award?"

by Duane P. Mantick, WB9OMC
400 N. River Rd, Apt. 1709
West Lafayette, IN 47906

Weeeeeell, I guess we can take a stab at that. 10-10 International is an organization that you might say is dedicated to the use and preservation of Ten Meters. Most everyone knows that when ten is good, it can be outstanding. It is just as true that when it isn't so good, it really sucks!

Anyway, 10-10 sponsors some 10-meter contests for both CW and phone. There are also awards. There are the usual awards, like Worked All States, Worked All Continents, there is a Countries award with a basic certificate starting at 25 countries. There is a Worked All US Counties award, and one member just recently was awarded certificate #1.

Keep in mind that these awards require you to work other 10-10 members, not just any ham. So when K6SIW was awarded certificate #1 of the Counties award, he had worked 10-10 members in something like 3076 counties! I think 3076 is the right number, I know it is pretty outrageous.....

I believe that the basic counties award is 100 counties. You go up from there. There are other things, like the bar program. For each 100 10-10 numbers you work, you add another "bar". At 500 there is a certificate called VP (and sometimes called a few other things), and you are issued a separate VP number. There are awards that are only open to VP members. Another award that K6SIW is going after is the OM/XYL award. Theupshot of this one is to work husband/wife 10-10 teams. Uh.....there is a Worked All State Capitals award. I'm sure I am probably leaving something out.

The contest typically is to make as many contacts as possible. You count 2 points for a 10-10 member, 1 point for non-members. I had suggested adding a point category for those working QRP, say 5 points for ops below 25 watts and maybe even 10 points for those below 5 watts. So far I don't think there has been enough interest for them to try it. Of course, with all you hard-core QRPers out there..... It might be more interesting to run a separate QRP contest rather than doing something that might must confuse the issue.

To join, you need to work 10 10-10 members, collecting their call, their membership number, their name and QTH. You will send this list plus some cash, I don't recall how

much....maybe it's 8 bucks for a year..... anyhow, you send this to the manager for the call area you live in, and he/she will get your certificate and card ready for you. For your 8 bucks, you also get the quarterly newsletter. Aside from interesting stories about hams and so forth, the newsletter tends to have information on DX stations (like what address to send a card, etc.) plus all the dope on the 10-10 contests and awards.

Once you get your number, it is your number for life. Even if later you decide not to renew your membership (gads! horrors!) the number is still yours (and some folks use it in self defense when they are asked for it!) and will count as a valid number for someone else who is hunting. To date, something around 65,000 numbers have been issued. Quite a few of these are still active, and it seems like an increasing number of them are DX stations. I have done all my 10-10 work under 25 watts. I'm three states off the WAS, one continent off the WAC. I probably have enough counties via QSL (or could get them) for the basic Counties award, but I'm not too worried about that right now.

I think I have 391 #'s worked, so I am close to the 400 bar, and hoping to nail down enough for the 500 bar in the next phone contest in February Some guys have close to 25,000 worked, I think. I believe that the aforementioned K6SIW is either close to or at the top of the list in this regard.

No doubt, it *IS* more difficult, the less power you use. Running low power during the phone contest borders on the masochistic....I have been known to give my phonetic callsign, during this contest, as "whiskey bravo nine one masochistic communicator", which is often good for a laugh.....but even so, having worked this stuff at a reduced power level, I feel that I have accomplished MORE than if I just went out and "bought" my QSO's like so many other folks have.

Anyhow, something for y'all out in QRP land to think about. Perhaps a strong QRP surge in 10-10 would be good for it and induce some new awards and/or contests.....
Duane WB9OMC

Characterizing Station Performance

by Howie Cahn, WB2CPU
295 Beacon St.
Boston, MA 02116

I've often been asked questions like "How much will .5 dB in coax losses hurt me?" or, "What can I work with two watts into a dipole?". There are a lot of anecdotal answers floating around but I think many of them are wrong.

To try to get some better answers I did a little data analysis exercise using results from the recent CQWW cw contest. Whether or not you're interested in contests, a contest is a good place to get data; lots of stations with different configurations making lots of QSOs. Results and station descriptions are usually posted to Internet so I had lots of information to play with. I made a graph with one axis (x) as the effective radiated power (in dB relative to 1 watt into an arbitrary dipole), ERPd. The other axis (y) is the total number of QSOs made. Both scales are logarithmic. On this graph I plotted four points — representing the winners in each of three categories: high power, low power (150W), and QRP, and the results for my station. I assumed the three winners used the maximum power allowed in their class. I estimated their average antenna gain by taking the gains of their antennas on each band and weighting them based on what percentage of the total contacts that band accounted for. For example, AA2U has stacked 6-element tribanders on the upper bands, a 2-el on 40, and a loop for 80/160. I estimated that this averages out to 10 dB gain.

The resulting data points were:

Call	QSOs	Effective Power(ERPd watts)	
K1KI	2927	24000	high power
K2ZJ	1292	2000	low power
AA2U	734	50	QRP
WB2CPU	234	3	me

The points are surprisingly colinear. The only anomaly was that AA2U, the QRP winner, was a bit over the line that connects the other three. Since Randy often places in the top ten in the LOW POWER category while running QRP, this is not unexpected. The line that resulted had a slope of about 4 log power/log QSOs, i.e., it takes 4 dB of effective power increase to increase your QSOs by 1 dB's worth. I won't try to draw it here using ASCII characters, but you can start with a point representing 1 watt, 300 Q's and draw the line to the right from there with a slope of four.

From this data I'm concluding the following:

a. Getting rid of losses in coax, antenna switches, etc. improves things somewhat, but not that dramatically. The line's slope of 4 dB power per 'QSOs dB' says that reducing your power loss by 1 dB would have increased your QSO total by about 10 ** .025 ==> 6%. A 2 dB increase would give 12% more Qs, a 4 dB increase 26%, etc. While the numbers are only specifically applicable for this contest, they probably can be generalized to imply a success rate for working non-contest DX or making readable contacts in general.

b. While you're not going to be competitive with thebig guns, you can make a reasonable number of DX contest QSOs with QRP power and simple antennas. In this contest the graph suggests that you could have made over 400 QSOs with five watts and dipoles, and, 300 QSOs with just one watt and dipoles. Since these numbers were derived mostly by analyzing the contest winners, they represent the upper bound of what could be done. It might be surprising that the line was linear over a very wide power range, about 5 decades; from about 1 watt to tens of kilowatts. Actually, my experience indicates that it may be valid even lower than that, say down to .1 watt effective power. I hope this information provides a way of estimating the performance effects of changing station characteristics and encourages people to try working QRP. To save bandwidth here, I've described things quickly. I'd be glad to elaborate or discuss other people's thoughts on the subject.

73,
Howie, WB2CPU

QRP Club List

by Chuck Adams, K5FO
830 Waite Dr. Copper Canyon
Lewisville, TX 75067

I had started this list several times in the past few months because of the number of queries, but never got around to finishing it. Then along comes Richard Fisher, KI6SN, and does a bunch that I didn't know about. This list is a consolidation of both lists. His list appeared in the Jan '94 issue of World Radio. Reproduced here with permission of World Radio. Enjoy. These are in alphabetic order and do not represent any order of importance - politically, economically, or socially.

Name: Cleveland QRP Amateur Radio Club
Date Founded: 1993

Number of Members: 4
Cost to Join: Free
Annual Dues: None
Publication Name and Frequency: None
Net(s): None
Mailing Address:
Bruce A. Wright, N8MWL
P.O. Box 14052
410 Superior Ave.
Cleveland, OH 44114-9998

Name: G-QRP Club of Great Britain
Date Founded: 1974
Number of Members: 7,600
Cost to Join: $12
Annual Dues: $12
Publication Name and Frequency: SPRAT - quarterly
Net(s): None
Mailing Address:
G-QRP Club
Rev. George Dobbs, G3RJV
St. Aidans Vicarage
498 2 Manchester Rd
Rochdale, Lancs, OL11 3HE England

Name: Illinois QRP Group
Date Founded: 1992
Number of Members: 22
Cost to Join: Free
Annual Dues: None
Publication Name and Frequency: None
Net(s): None
Mailing Address:
Vikki Welch, WV9K
1307H N. Richmond Road
McHenry, IL 60050-1461

Name: Maryland Milliwatt Club
Date Founded: 1992
Number of Members: 2
Cost to Join: By invitation only.
Annual Dues: Not established
Publication Name and Frequency: None
Net(s): None
Mailing Address:
Maryland Milliwatt Club
3052 Fairland Rd
Silver Spring, MD 20904

Name: MFJ 90's Radio Club
Date Founded: 1993
Number of Members: 20
Cost to Join: Free
Publication Name and Frequency: The Nineties - 6 to 10 issues annually
Net(s): None
Mailing Address:
Joseph Falcone, AA8HV
3000 Town Center, Suite 2370
Southfield, MI 48075

Name: Michigan QRP Club
Date Founded: 1978
Number of Members: 1,200
Cost to Join: $7 US, $12 DX
Annual Dues: $5 US, $10 DX
Publication Name and Frequency: The Five Watter - quarterly (a.k.a. T5W)
Net(s): MI-QRP Net, 0200Z Wednesdays 3.535MHz
Mailing Address:
Michigan QRP Club
654 Georgia
Marysville, MI 48040

Name: NorthWest QRP Club
Date Founded: 1992
Number of Members: 250
Cost to Join: $10
Annual Dues: None
Publication Name and Frequency: The NWQ Newsletter - bimonthly
Net(s): NWQRP Net, 0400Z Tuesdays 10.123, 1530Z Saturdays 7.035MHz
Mailing Address:
Bill Todd, N7MFB
NW QRP Club
4153 49th Ave. SW
Seattle, WA 98116

Name: NorthEastern Illinois QRP Society
Date Founded: 1991
Number of Members: 85
Cost to Join: Free
Annual Dues: None
Publication Name and Frequency: NEIQS Newsletter - quarterly (SASE)
Net(s): NEIQS Net, 0200Z Wednesdays 3.560MHz
Mailing Address:
Don Kozlovsky, KE9GG
28 W 256 Purnell Rd.
West Chicago, IL 60185

Name: NorCal (Northern California) QRP Club
Date Founded: 1993

Number of Members: 275
Cost to Join: $5
Annual Dues: $5
Publication Name and Frequency: QRPp - quarterly
Net(s): None
Mailing Address:
Jim Cates, WA6GER
3241 Eastwood Road
Sacramento, CA 95821

Name: Oklahoma QRP Group
Date Founded: 1988
Number of Members: 40
Cost to Join: Free
Annual Dues: None
Publication Name and Frequency: Oklahoma QRP - quarterly
Net(s): Oklahoma QRP Net, 1430Z Sundays 7.060MHz
Mailing Address:
Oklahoma QRP Club
Don Kelly, KA5UOS
703 W. 8th Street
Edmond, OK 73034

Name: QRP Amateur Radio Club International
Date Founded: 1961
Number of Members: 8,800
Cost to Join: $12
Annual Dues: $10
Publication Name and Frequency: QRP Quarterly - quarterly Net(s): Bunch
Mailing Address:
Michael Bryce, WB8VGE, Publicity
2225 Mayflower NW
Massilon, OH 44647
Mike Kilgore, KG5F, Membership
2046 Ash Hill Road
Carrollton, TX 75007

Name: QRP Club of New England
Date Founded: 1991
Number of Members: 206
Cost to Join: $10
Annual Dues: $7
Publication Name and Frequency: 72 - quarterly
Net(s): QRP-NE SSB Net, 0200Z Tuesdays 3.855MHz
Mailing Address:
Jack Frake, NG1G
P.O. Box 1153
Barnard, VT 05031

Name: St. Louis QRP Society
Date Founded: 1987
Number of Members: 32 (Membership restricted to Greater St. Louis Area)
Cost to Join: Free
Annual Dues: $12
Publication Name and Frequency: The Peanut Whistle - quarterly Net(s): None
Mailing Address:
Keith Arns, KC0PP
2832 Pembroke
Saint Charles, MO 63301

HW8 + T50-6 + ECG488 = 5 Watts

by Gary D. Borich, W5UDV
1009 Harwood Place
Austin, TX 78704

Not long ago I had a QSO with a chap who boasted he was running 5 watts with his HW8. "What? QRS. Five watts?" I shot back. Sure enough, he repeated, "Five Watts". Impossible, I thought to myself, as I politely excused myself from the QSO. Some months later I was trying without luck to work HL1CG in Seoul, Korea, on 30 meters with my HW8, which had been converted according to the article by Howell Ching, KH6IJS, in the April, 1984 QRP Quarterly. After trying for more than an hour, the most I got for my efforts was "QRP?" before returning to bed at 4:30 AM, the last thought I remember as I drifted off to sleep was how nice it would have been to have "boots" on my HW8, a full QRPgallon. And, what about all those QRP contests I've been in when the other guys were running 3 to 5 watts? I had never been able to peak my 30 meter signal beyond 1.3 watts after countless attempts at retuning the heterodyne frequency oscillator, mixer amplifier and tank coils. I couldn't stop wondering if an HW8 really could be "tweaked" to run 5 watts.

My search for an answer to my question took me through two editions of the "Hot Water Handbook", edited by Fred Bonavita, W5QJM, and some past issues of "QST" and "CQ" collected by my good friend, Bob Logan, N5ZA. To my surprise, my question had been asked many times before and partly answered by more than a few hams. Unfortunately, like the story of the three blind men describing an elephant, each before me had discovered only a part of the answer. When I assembled all my sources, the puzzle came together. Here is what I found, and how, in about an hour, to put boots on an HW8.

My first discovery was a small insert by Howell Ching, KH6IJS, at the bottom of page 11 of the 1985 "Hot Water Handbook", describing how he switched the 2N4427 final for an ECG 488. He reported getting 3.0 to 3.7 watts out on 20, 30, and 40 meters and as much as 2 watts out on 15 meters using a 12.5 volt power source and a dummy load. His rig, like mine, had already been converted to 30 meters by removing the proper number of windings from the 80 meter toroids.

As it turns out, his choice of a new final couldn't have been better. The ECG 488 specifications are nearly identical to the 2N4427 (see Table 1), except that the rated output power for the ECG 488 is 4 watts instead of 1 watt for the 2N4427. Unlike some other substitutions I've made, the input and output impedances of the two devices are nearly identical, thereby requiring no other modification. In addition, the required drive level for the ECG 488 is only slightly more than the 2N4427 but well within the limits supplied by even an aging HW8. The downside is the cost of the ECG 488, which is about 11 dollars. Although I had invested very little time in making the substitution, I was disappointed in

the results. I obtained only a half-watt increase on 40 and 30 meters and practically no increase on 15 meters. My power levels now ran about 2 watts on 40, 1.7 watts on 30, and 1 watt on 15 meters. But, to my surprise I was getting 5 watts out on 20 meters with a 13.8 volt power source. My scope confirmed that my signal remained clean on all bands.

Then came the second piece of the puzzle: this time thanks to an article by Michael Czuhajewski, WA8MCQ, in March, 1993, "QST" on low output levels on 80 and 40 for the HW8. Like me, he also had unusually low output on 40 and 80 meters. He traced it to an increase in the permeability of the ferrite (FT) cores used by Heath for the 80 and 40 meter bands. While Heath used powdered iron (T) cores for 20 and 15 meters, the larger inductances for the lower frequencies required the use of ferrite cores. Ferrite cores have higher permeabilities than powdered iron which allow higher inductances to be achieved with fewer turns.

But, the permeability of ferrite cores tends to increaseover time due to changes in the magnetic properties of the core itself. To confirm this, I checked the inductances of L26 and L27 (30 meters, originally 80) and L28 and L29 (40 meters) and found all four had inductances substantially in excess of the design specifications reported in the HW8 assembly manual (p. 14). In fact, I was surprised how much they had drifted upward when my LCR meter showed inductances for L26 and L27 of more than 6 uH, when they should have been 3 uH, and showed inductances for L28 and L29 of more than 11 uH, when they should have been 7 uH. The power was being generated but not making it to the output! The 20 meter toroids were powdered iron and registered the correct inductances, right on the money. That's why I was getting 5 watts out on that band, but not on 30 or 40 meters.

Using T50-6 toroids, I wound new coils for 30 and 40 meters according to the required inductances (see Table 2, which also includes data for winding fresh coils for 80 meters) and retuned theheterodyne oscillator, mixer amplifier and tank circuits. I keyed the rig, and Presto! 5 watts out into a dummy load on 30 and 40 meters. By the way, if you key down for 30 seconds and notice a decline in your output, it's possible your toroids are heating up due to improper inductances (high SWR).

While I was satisfied I had solved the riddle for 30 and 40 meters and had a full 5 watts out on these bands as well as on 20, I wanted the same result on 15 meters. On 15 I had never been able to obtain more than 1 watt out. I knew 15 meter circuit losses are greater than at the lower frequencies, and I could see from my scope that the drive level into the final for 15 was less than the other bands, as Heath acknowledges. But, why so much less? And, why no improvement on 15 from my superfinal?

Given my previous success, I looked immediately to the toroids in the tank circuit for 15 meters. I measured their inductances and to my dismay they were exactly as Heath specified: 1.25 uH. The problem could not be due to changes in permeability. Then, the third and last piece of the puzzle came into place.

Could Heath have made a mistake? Could the inductances called for at 21 MHz be different than delivered by Heath? Given the values of the capacitors and inductances in my 15 meter tank circuit, I calculated the resonant frequency of the circuit. To my surprise, I found the tank circuit was resonant at 13 MHz, not 21 MHz. How could this happen, since everything was according to the design specifications given by Heath? So to determine if a design flaw had occurred, I recalculated the inductances that would be needed for 21 MHz and found them to be about 0.6 uH, not 1.25 uH, which Heath had supplied with the unit. I took four turns off L33 and L34 to lower the inductance to 0.6 uH and keyed the rig. I now had 2.5 watts out, which is about the maximum obtainable on 15 meters with the existing drive level.

Coincidently, afterward I heard that others had discovered the same flaw in the 15 meter tank circuit. However, in all fairness to the engineers at Heath, last minute changes, parts

substitutions, or communication foul ups could also have been the culprit.

So, what do I do now with my spare time and 5 watts on 30 meters? I keep looking for HL1CG at 4:30 AM. This time he won't get away.

Table 1. Comparative Data for 2N4427 and ECG488

Trans.	Collector to Base Volts	Collector to Emitter Volts	Base to Emitter Volts	Maximum Collector Current	Maximum Dissap. Watts	Current Gain Minimum	Case	Price Approx.
2N4426 ECG346 NPN, RF Driver, 1W	40	20	2	.4	3.5	10	TO-39	$3
ECG488 NPN RF Driver 4W	36	18	4	.8	8	5	TO-39	$11

Table 2, HW8 Tank circuit Modifications for Increased Output

Band	Toroid*	Turns	AL	Inductances
80	FT37-43	29 (L26)	177	15 uH
	FT50-63 (L27)	35	220	27 uH
40	T50-6	42 (L28) 42 (L29)	40	7 uH
30	T50-6	27 27 (L#'s may vary)	40	3 uH
15***	T37-6	14 (L33) 14 (L34)	30	0.6 uH

Depending on substitution band, L #'s for 30 meters may vary. No change was made for 20 Meters.

*Toroids available from Oak Hills Research, 20879 Madison, Big Rapids, MI 20879
** No. 26 wire with 30 degree gap between ends.
***Or, Alternatively, remove 4 turns from existing toroids, L33 and L34.

NN1G Up and Running

by Paul Mackanos, K2DB
86 Close Hollow Dr.
Hamlin, NY 14464

Well, the debugging is done, and the 20 meter version of the NN1G Mark II is up and running at K2DB. Had a few problems along the way, and all were building related. Things

to watch for 1) when you etch your own board (yes there are those of us who would rather HOMEBREW from scratch than send our hard earned money out) make sure it is completely etched. I thought mine was, but I found 2 little fuzzies (shorts) on the rx board. Fixed them, and the RX took right off. 2) Check each part VALUE carefully, my TX would not oscillate, and I found that I had put in 470 pf caps in the oscillator instead of 47 pf. Changing them, and off it went. This is a lesson to those of you have a surplus or electronics store in your area that has the parts in cardboard boxes (don't trust what it says on the box, look and verify the value). Having just gotten it up and going, and making 2 quick contacts with area hams, I have two things I have to work on. 1) RX seems to have a little too much background noise. (Changed the .033 cap to .047 and the .005 cap to .1 and most of the noise went away, but still too noisy & thanks to Brad, WB8YGG for that tip.) The RX does not offer full QSK it seems. When I was operating it at above about 13 wpm, the RX seems to act SEMI-QSK, any one got any suggestions to get it FULL QSK, what we gotta do, I haven't looked at the schematic about that yet??? Thanks to Brad WB8YGG for the use of his time and equipment to help me debug this NN1G Mark II, it is going to be a lot of fun running it.

As for the LO & Xtals, I chose 10.240 Mhz and this puts the LO at 3760 to come up with 14.000. The rig seems to track from 14.000 to 14.067 with the standard values. I had to add 66pf to the LO coil to get it to come down to that freq. It first oscillated at 3918, 33 pf brought it down to 3818 and the next 33 pf (66 total in parallel) brought it right on at 3760. Brad, WB8YGG will be changing his IF also, his 10.000MHZ xtals let WWV bleed thru quite readily (even though it is not in a box yet) and mine does not. At least Brad can keep up with the UTC time on a minute to minute basis. Any further changes, and I will print here. If ya want, send me a note, and we can talk direct here if you have any specific questions or comments. 72 de Paul K2DB

QRP = Cross Country Skiing

by Kalman Laudon,WD6CZI
591 Union Rd.
Spring Valley, NY 10977

I think that there is an honored place for what is derogatorily referred to as "fanaticism", in most all endeavors. It is the folks who are REALLY driven by a certain concept, ideal, or goal, who get out there and move mountains, develop the first PCs in their garages, find the cure for cancer, keep qrp and CW (yeeeaaahhhhhhhhh!!) alive, etc. Unfortunately, some of these folks combine this powerful and positive human trait with another powerful human trait - egotism. Egotism usually leads quickly to intolerance, hatred, and sometimes, cruelty and abuse! Sorry for the sermon, guys, but I just can't let remarks like have just come across the net go unchallenged. Saying that people who don't want to WORK for a qso, just BUY them with bux for KWs, and won't work anything but strong signals, have ceased to be hams (full stop!), is just out of line. C'mon guys, its a hobby! I fell off my chair laughing when I saw the ad with K7SS wearing fatcat sunglasses and chomping on a cigar with a s— eating grin on his face, leaning on a linear (that he OWNS). You gotta be able to laugh at yourself, regardless of whether or not other people appreciate your own rarefied point of view, even about something like CW which is, as we all well know, is a CLOSED discussion (nod in the up-and-down direction, class, my HS math teacher used to say).

It reminds me of the downright intolerance that many cross country skiing buffs have for the fat, non-environmentally conscious, money-and-fancy-ski clothes-with-only-Vaurnet-sunglasses, non-vegetarian downhill skiers. Many of them also make a point out of telling everyone on the slope (as they go out of their way to be obvious that they are going UP the

mountain, and not DOWN) that only theirs is "REAL" skiing.

I remember from 20 years ago, when I was only a kid and had no opportunity to get into qrp, that the QRPers even then had a holier-than-thou reputation, earned or not. Let's not go and EARN it, for Pete's sake!

Yes, yes, I agree that the bands would be a lot nicer, and more qrp stuff would be available with more features for less $ commercially, etc., if everyone out there thought as we did. But I still contend, there is NOTHING at all wrong with qro operation as a concept. A lot of hams just want to HAVE armchair qsos with their daily nets, skeds, etc. A lot of retirees keep themselves busy this way. And why not? Part of the hobby IS to try to maintain reliable communications for use when it may be needed. In my opinion, the biggest cause of problems on the bands is not the QRO, it is who is using IT. The exam process is just far too easy, and so there are a lot of lids out there clogging up the bands who just didn't have to learn and struggle to get their tickets. We don't even have to MENTION the CW req. It IS a privilege to get on the air, and many folks just don't respect that.

BTW, I just got my QRP ARCI membership certificate - it looks great!
72 de Kalman Laudon, WD6CZI in 2 land QRP ARCI No. 8385

Ten Tec Kits

by Jeff M. Gold, AC4HF
1751 Dry Creek Rd.
Cookeville, TN 38501

Here is a brief summary from Ten Tec about their kits. They are willing to get into the kit business as much as is profitable (don't take this wrong.. basically the want to produce High Quality kits as long as there is a market for them.. as the market shows them it is alive, they will expand their offerings).
First stage: 10-15 small single board one nighters such as audio amplifiers (I think he said under $50)
Second stage: 5-10 projects like receivers and QRP transmitters in the $40-$100 range, one will be a 2 meter brick, 1 or 2 watts in about 30 watts out.
By Dayton: 2 meter synthesized programmable 2 meter transceiver- about 10 channels for under $200 [put me in for one]. That's it so far. The catalogs and first kits should be available in a few weeks.
72, Jeff, AC4HF

ARCI Sprint

by Peter Hardie, VE5VA
567 Delaronde Road
Saskatoon, SK S7J4A7

Well I worked that famous contester, homebrewer and all-round bon-vivant Chuck K5FO on 20 and 15. Also worked Jim ,KR1S at WA1MBK and probably lots of other famous contesters whose callsigns I don't recognize due to a very poor memory. As Chuck mentioned, conditions were awful, K index was 3, and the only DX I worked was HP1AC/QRP. 34Qs 155pts * 29SPC * 10 (power 0.9W) = 44950. QSO rates were staggering! 9 in the first hour, 11 in 2nd hour, then 12, and 2 in the last hour. I could hear a couple of people on 40 in the last hour or so but 0.9W couldn't make it. No homebrew used - hang head in shame - I should at least have hauled out my 20m Howes Tx kit.

A confusing thing, and something to look out for next time, was that there was another contest of some sort going on that also gave out a 4 digit number. I don't know what it was but I had a QSO with VE3AHJ who gave me a number of 6191 which looks like a good ARCI

number. But he didn't give out his province (i.e. didn't follow the regular ARCI exchange format) and he sounded very loud given the conditions, so I asked for his power. 50W! Even if the 6191 was his ARCI number, I believe that his 50W would mean you'd have to use the 50W (a 2 point QSO) instead of his number (a 5 point QSO). Heard several U.S. stations later on giving out numbers in the same way and not giving their state.
72 de Pete, VE5VA

CQ-WW-CW Results For AA2U

by Randy Rand, AA2U
8 McDermott Pass
Denville, NJ 07834

I was busy working the CQ WW CW contest 2 weekends ago. I operated from home and was testing out my new improved antenna system that I have been working on for the past 2-3 months. I now have a pair of KT34XA's(6 ele tribanders) stacked on a 90 foot crankup tower. The top one is at 90ft and the lower one is on topof the second section at about 38ft. The resulting stack was fed separately or both in phase. I just used coax switches to change the feed as I am still not finished with the relay box that will allow me to change everything with the push of a single button using solid state logic. I will also add a selection for both antennas fed 180 degrees out of phase for gain at a higher radiation angle.

I used one of the TIC ringrotors to rotate the lower antenna around the tower. Seems to work ok, although its indicator ceased reading the true beam heading by the end of the contest. I had rushed setting it up so never really got sufficient time to calibrate it correctly. Here is my score breakdown:

Band	QSO's	Zones	Countries
160	3	2	2
80	32	10	20
40	161	23	81
20	268	30	85
15	212	24	73
10	58	18	37
Totals	734	107	298 = 821,745 points

I used a 2 element 40 meter yagi which is about 6 ft above the top KT34XA, and a full wave 80m loop for 80 and 160m. My score is down considerably over last year but I guess that is due the few openings on 10m.
73,
Randy Rand AA2U

MI QRP Contest

by Brad Mitchell, WB8YGG
148 Holley St.
Brockport, NY 14420

Hi all, I completed the electronics of my second NN1G MK-II over the holidays this one on 40 meters. I found that a 2N3725 switching transistor worked quite well to attain 1.0 watt out. (1W has been sufficient for me so far)

This was the first contest I had participated in, and found it to be a lot of fun. I guess that I'm hooked, at least for the easy paced, qrp contest. All in all I made 32 contacts for

just a few hours of operating off and on. And I even ran into NN1G himself , and chatted for a couple of minutes about the NN1G MK-II rigs that I made.

Oh yeah... with the 20 meter NN1G MK-II I talked to French Guyana over the holiday. Just 1 watt and an inverted vee!

Michigan QRP Contest

by Jeff Gold, AC4HF
1751 Dry Creek Rd.
Cookeville, TN 38501

Went to the Chatanooga Aquarium yesterday to meet a guy with a Yaesu 301 QRP rig.. worked the contest mobile on the way there and back. On the way back I got brave and called CQ.. had to pull off the road and got a string of about 7 in a row. Worked it withmy Argonaut 509 and a Texas bug catcher. Need a noise blanker on that rig.. I really enjoyed the contest.. even worked 80 meters the night before.. .sounded like thunder storms on the band and inside the rig.. made it real interesting..got to use every filter I had ever built.
Worked only 41 stations.. but wasn't on that much.
72 Jeff, AC4HF

Radio Kit QRP 20, A Review

by Jeff M. Gold, AC4HF
1751 Dry Creek Rd.,
Cookeville, TN 38501

I started on my 20 meter Radio Kit. Good part: real small, has built in audio filter and RIT. Bad: I am extremely disappointed so far in the quality of this kit. I think the Norcal 40 was a MUCH more professional venture. The schematics, directions and all were of a much higher quality. The board on this is not silk screened, this combined with closely packed parts and other things makes this a real challenge.

The instructions, schematics and such bring four letter words to my mouth. I find the schematic very not fun to read, ok for a student ruffing out some plans, but the worst I have seen so far.

The majority of the instructions deal with changes to the kit. Now I can see having changes, but get them organized. As best as I can tell the board is for the original 15 meter kit (it is labeled so). And then you tack on stuff and change parts and such to get 20 meters. The first page of instructions gives you a list of mods and parts to be tacked on to the bottom of the board.. I don't really like to tack onto the bottom of a board. There is a page that describes the way to test the relay to see if it has a diode or not..then you have to modify the circuit depending on which relay was sent to you.

There were some more not clear pages of mods and
changes.. yup that is the extent of the instructions.. again I don't think I would mind if they were clear and in some
reasonable order.

VERY unprofessional. Ithink the NorCal group needs to take over the company. The parts holes are at angles and such. This combined with the handrawn board overlay, is very confusing.. be prepared to work with the schematic for parts placements.

This is all personal preference. It would have probably been easier to have the parts and ugly constructed this one. I think if it was done correctly this could have been a great kit.. Smallest box I have seen and it is from Ten Tec. There are suppose to be some new directions coming out.

72
JEFF

Hambrew es QRPp Review

by Chuck Adams, K5FO
830 Waite Dr. Copper Canyon
Lewisville, TX 75067

Gang,, I received a few days ago in the mail two items: QRPp - Journal of the Northern California QRP Club and Hambrew - for Amateur Radio Designers and Builders.Let me give my impressions of both, and these are my impressions and mine alone.

	HAMBREW	QRPp
Date	Autumn 1993	December 1993
Pages	48 pages	60 pages
Size	5.5"W x 8.5"H	5.5"W x 8.5"H
Weight	2.7oz	2.3oz
Postage, if mailed 1st	$0.75	$0.75
Paper	60lb slick	20lb nongloss
Pictures	3 full page shots	No full page photos
B&W including F&B covers	22 B&W Photos (good qua.) total space of 10p.	1 B&W Photo (scanned) about 1/3 page total
Cartoons	2/3 of a page total	none
Advertising	4.5 pages	none

HAMBREW ARTICLES

1. Ramsey 30 Meter Transmitter Kit Review - Ramsey might go after them after this one. They changed the box (RS), added LED pwr, and other stuff to really cannabalize the thing. I personally don't think the results could be counted as a Ramsey kit. I really didn't like the way they split the article after one page and continued toward the last of the publication. They did this in a bunch of places. A definite turnoff for me.
2. Zapp The DX With The Zapper - how to build a mobile antenna for about $30 to $50 using PVC es stuff. "The Zapper" a play on the "Bug Catcher". Cute.
3. The NorthWest QRP Club "30-30" CW Transmitter by KG7CR. A crystal controlled QRP rig. 2.5 pages including one page for schematic and parts list and .5 page for winding toroids. Not much meat at all, like maybe a PC board layout for those who are interested. And other articles, which I leave for the others in the group to give us their feedback on. I wasn't too thrilled myself, but that's just me, I'm sure.

QRPp Articles (already a table of contents posted to the net, I think)

1. A bunch of articles by various people from this group, including yours truly. So, a bunch of it will be review for those who read this group.
2. Article by Wayne Burdick, N6KR, designer and father of the NorCal 40 Rig! This article alone is worth the $5 price for a whole years subscription to the newsxxxxx ooops, Journal of the Northern California QRP Club. Four pages of thedescription of the circuits and two full pages for the schematics. So, those of you who did not get to buy the kit, here's your

chance to get a look at it. No PC board layout. We'll let Wayne worry about that deal. It's his puppy, so to speak.
3. Three and a half pages on an Audio Filter by Jim Pepper, W6QIF, including graphs of frequency responses and circuit diagrams.
4. Three and a half pages with NorCal Club members, numbers, and addresses. I see some of you there in the list. Who's who of the internet. And I didn't want to get too detailed in the reviews.

Summary. Hambrew - $20 per year, four issues sent 3rd CLASS mail.
QRPp - $5 per year, four issues sent 1st CLASS mail.

I enjoyed the QRPp more and spent more time wading through it, since it has more print and more info and a lot fewer pictures and advertising.

Hambrew, P.O. Box 260083, Lakewood, CO 80226-0083 $20/yr.
QRPp, Jim Cates, WA6GER, 3241 Eastwood Rd., Sacramento, CA 95821 $5/yr

I don't think that Hambrew is aimed or going to attempt to do much for the QRP crowd. I got a call from George De Grazio, WF0K, Publisher, after I called on his 800-5-HAM-RIG number to see where my copy was. I received a copy first class mail a few days letter with note that this was a sample issue. What? I paid $20 for one year plus a bonus issue. Does he not have me down as a regular subscriber? Those of you who have not received your issue, call him. Since they are being sent 3RD Class mail and we know what the US Postal Service does to third class mail, I'd check up on it.

DISCLAIMER: I am a member of the NorCal Club, but I don't get anything special from them, so this is a review on what I have seen. The above is my opinion(s) and I'd be glad to have anyone that has seen the Hambrew issue and disagrees with the review, let US know. I make errors, but rarely.
dit dit Chuck Adams, K5FO - CP60 adams@sgi.com QRP ARCI Awards Chairman

Kits vs Homebrew

by Gary Diana,N2JGU
65 Pacer Dr.
Henrietta, NY 14467

Although kits have the advantage of a quick "open the box to operation cycle", I take lots more pride in my more "homebrew" approach. I start out with artwork and make my own PC boards, number one. This is fun and fairly easy. It also has the advantage of being about 1/10th the cost of commercially made boards.

I get to choose what power, key, antenna, and audio jacks I want to use (standardize on). For example, 1/4" audio jacks on qrp equipment is too clunky to me. I love to take a plain old aluminum box and carefully lay out the controls and jacks. I use painstaking care to paint and letter the box... although homebrewed, the appearance resembles something more "professional" than homebrew!

I am not to the point of being able to design my own equipment, but I think, when combined with the above steps, that is probably the ultimate in the homebrew-pride factor. Hats-off to the Haywards, NN1G, etc., who fill this major gap in my abilities.

I also realize that like contesting, CW, RTTY, packet, QRP, QRO, etc, etc, that homebrewing/homebrewers come in all sizes and shapes, and what one ham likes another dislikes. This is just an explanation of what interests and motivates me, in this sliver of the

hobby.
73 to all, and to all a good night.
Gary N2JGU

SSB Contesting QRP in the ARRL Sweepstakes

by Jeff Gold, AC4HF
1751 Dry Creek Rd.
Cookeville, TN 38501

Well since I didn't have any radios to fix or build this weekend, did all my chores and managed to get into the ARRL Sweepstakes for a few hours. My first SSB QRP contest. I I used my Kenwookd 850s with the Lightning Bolt 5 band Quad, the Gap vertical and a 160 meter dipole with tuner. Power output was real close to 4.8 watts max using the Kenwood compression and high boost for audio.

Observations: Heard some serious QRP contesters.. they were into the high numbers, heard more on the air than I have in any other contest. Even surprised me how well QRP worked on SSB. Couldn't believe how many people stopped their serious contesting to make comments about my signal, my REAL signal report and such. Easily over 65% of my contacts stopped and actually made comments. Comments varied from people insisting I was class "A" and made me repeat the "Q" about 20 times, to you are 20 over, MANY were "Great signal for Q". Think it may get people thinking about their power levels..since most people in the contest were "B" class or WAY TOO MUCH POWER.

I noticed that QRP was no different on 10,15,20 as far as I could tell from me getting through as easily as anyone else. On 40 a little more power might have been nice (but then again I don't have a competitive antenna for 40 or below). 80 meters may be a case where 100 watts should be legal.

***** A really good antenna makes a setup equal to using much higher power.. I have been informally contesting for a couple of years, I This is the first time I contested with the Quad.. It made a HUGE difference.

Summary (may have to do a contest QRP for real one of these days):

80 meters	13 contacts	2 sections
40 meters	42 contacts	8 sections
20 meters	82 contacts	38 sections *Quad on this band
15 meters	19 contacts	8 sections
10 meters	22 contacts	2 sections

178 contacts 58 sections

Building the NN1G Mark II

by Brad Mitchell, WB8YGG
148 Holley St.
Brockport, NY 14420

Some time ago my friend K2DB was operating sweepstakes, and he ran into NN1G on the air. Becuase of the popularity of the NN1G transceiver, Paul talked to Dave (NN1G) about getting the artwork for the original NN1G rig, so that we might make some of the 20 meter rigs. Dave was really helpful, and sent the entire NN1G Mark II package that I guess is going to appear in QRP quarterly in January.

With this new artwork in hand, I set out to make the 20 meter version of the rig, using the Mark II artwork. First I made the two boards using the July, 1993 QST process for making p.c. boards. I'll be honest, the result wasn't the best, but definitely usable boards.

Parts aquistion was a little work, but among my own parts drawer, and a friends parts drawer, I had enough parts to commence construction.

For the crystal filter, I used 10 Mhz xtals, because they were available. To match them, I found that setting the 10 MHz source up on one xtal, and the measuring the response on a scope, I could match them easily. But you know, I really found that the particular xtals that I had, all of them were close enough! Once I had the xtals, and the rest of the parts, I decided to start building the Receiver board. This is because the VFO circuitry is on the Rx, and I wanted to debug as I built the circuitry. As I started stuffing the board, I found a minor artwork error, but I won't mention it, becuase I guess that the artwork is already being fixed. Anyway, I got around that
problem, then fired up the receiver alone.

Two problems were encountered. One is that there was a sound comming from the receiver that sounded a lot like precipitation static. But I noticed the noise even though the antenna was not connected. This bothered me, because I knew I had a real problem. During the parts scrounging process, I could notfind 78L08's right off, and looked at the specs for the NE-602 for it's max voltage rating. This was listed as 8 volts MAX! So I finally found a 78L08, and measued it's output as 8.18 volts. As a guess, I cranked down the 12 volt supply , and the noise went away. I got the meter out, and as the reg voltage dropped below 8 volts, the precip noise, now narrowed down to a breakdown noise, went away! So I replaced the 78L08 with one that had 7.8 regulated volts out. This cured the problem, but it may be something to note, that you may wnat to be careful with this if you use an 8 volt regulator. Problem Number 2. I found that as I increased the volume, that the LM386 oscillated at a high freq audio. This was cured by changing various caps, and I really don't know if this problem is something that I introduced, and then cured or not.

Now the reciver was working great. The selectivity is fantastic! I can hear everything that my old Kenwood TS-520 can with the NN1G receiver!

Transmitter construction was next. This took only a very short time to complete, and there appeared to be no artwork errors. I got this put together with one exception the output transistor. I found that a good 2N3553 seems to work pretty good in place of the recommended transistor. I am getting more than a watt out, but haven't measured it on the scope with a dummy load yet.

I next wired the two together , and was ready for putting it on the air. I listened, and everything was CQ test.... oh boy! I hate contests, especially all that computer generated garbage. Anyway, I'll have to wait till this "test of my will" is over for my first contact with the NN1G Mark II , but I predict that it will work 10x better on receive than the Spider.

In retrospect, I might try to get 10.x Mhz xtals, something other than the 10 Mhz, because there is a little feedthrough of WWV. I predict that will go away when I put it in a metal box. Also, I probably have $20.00 into this whole project, and I bet I'll make one for other bands, and then some.

CMOS Super Keyer II

by Jeff Gold, AC4HF
1751 Dry Creek Rd.
Cookeville, TN 38501

I got my not working CMOS Super Keyer II out of the junk box Sunday to see if I could get it to work. This is the $25 R&R kit version. I built the original Idiom Press 2 years ago and use it during contests and love it. Have no idea why I ordered this.. have about 7 keyers. The kit was a bargain. The Idiom press came with a board and board components, you provide the case, the pushbuttons, the battery holders, the jacks. This kit came with the

board, board components, 4 nice pushbuttons that have wires coming off them, a small speaker.

My impression is the Idiom Press PC board was better quality. Some of the ground trace fell off the R&R version.. no problem.. didn't even need that part of the trace. I found withmy Idiom Press that I turned the monitor function off anyway, so only needed the speaker for programming the memories and changing parameters. The R&R speaker was fine for this. I put my original Idiom Press in a fairly large Radio Shack plastic box and used large push buttons. This time I bought a real small Radio Shack plastic box with the metal top.. I think it is about 4X2. This keyer is really small.. didn't have room for the 3 AA battery holder and such.. Stacked 2 of the holders and kinda shoved the whole thing in the box and didn't even fasten anything.. the assembly is so tight, I didn't need to.

I had carefully soldered all the components and wired up all the jacks and pushbuttons a while back and it didn't work. I knew I was careful and the bottom of the board looked real good. Had a bunch of stuff to do, so just put it away. Well I decided I should be able to fix the thing, not many parts to it. I took out the Idiom Press version and measured all the chip voltages, and then did the same for the R&R version. I was somewhat surprised to find the voltages identical. This got me thinking-I took my multimeter and checked the output of the chip and found it was ditting and dahing. Traced down the problem. It seems that the enclosed parts layout shows the transistors in one way and the transistors that came with it are backwards from the version in the article (emitter and collector on opposite sides). The transistors were in fact marked (one for the speaker and one for the keying transistor). I pulled them out and had in fact blown them. I found one 2222 in my junk box and put it in for the speaker. I found that all the funtions were in fact working.. but wouldn't key. I was going to go to RS to get a replacement for the keying transistor. Decided I didn't want to go to town so took out a 3904? and used it.I made 25 contacts with it in the contest using the ARK40 and my Gap Vertical. The only other perculiarity was Z1. The one in the R&R looks like a small cap and doesn't have a ground leg, so there is an extra hole in the board.

Well I can't tell any difference between the functionality of the 2 keyers.. They are both the best keyers (even taking out all the capabilities of the CMOS). The keyer just works great as a keyer (even better than my 3 Curtis keyers). As a contest keyer, I still feel it can't be beat. I like it better than the expensive AEA and have used both during contests.

72, Jeff, AC4HF

[Editors Note: Jeff later wrote and told me that he had trouble with the main chip in the kit. When he contacted R & R, they would not do anything about it. Said that it was a problem with the supplier, and that Jeff would have to contact them. He feels in light of this development that the Idiom Press kit is a better and safer buy. Doug, KI6DS]

SS '93

by Chuck Adams, K5FO
830 Waite Drive Copper Canyon
Lewisville, TX 75067

Well gang, it's all part of history now. I really don'tknow why I take the abuse. I work 16 hr days for a week. Decide to blow off any contesting at all. Get to the ranch on Friday night, kick off the old shoes, build a fire and just chill out. Didn't even think of turning the rig on. I was a vegetable, probably a radish or a lettuce. Brain dead. Just plain pooped. Saturday morning I run back into the office 'til lunch time to work on setting up a classroom for classes starting this Monday. Spend the afternoon cleaning around the shack. Still haven't touched a rig. Almost had a disaster. The NorCal 40 uses an RCA plug for power. Had the Gel Cell on the desk and moved it. Well, the plug came in contact with one of those

fancy dial critters, a fender washer. Almost melted the wire just in an instant. This is gonna change. Back to the 12V plug like in the OHR rigs. No problem.

So, got to thinking. Hey, AA2U is going to work this contest at a closer distance. This may be the chance of a lifetime. No pain, no gain.

OK, SS is the second biggest or third biggest contest of the year for CW ops. #1 is probably the DX TEST, coming up soon (more later). #2 is probably Field Day in the US and NA. Then SS contest, both CW es SSB. OK, wait, I haven't operated this thing since 1988. No logs or dup sheets. No problem. Down to the desk and make some up with the workstation and laser printer. Good job. ARRL won't mind these puppies.

So scramble to set up the NN1G rigs for 40 and 20. I was thinking about just doing 40, my favorite band in the whole universe. So, 0451 call the first station. Now mind you, I'm running 0.95W out on both bands. I'm out gunned and I'm out numbered. The first critter hears me. A 8 in LA? Used to be a 5, but now days, it doesn't matter!! And off I go, frequency hopping like a wild hare. An hour and a half later, I'm dead. Quit for the night. Nap time. Saw some logs.....

Next morning (Sunday), 1427 back on 40. Work two hours, band about dead. OK, let's do 20. Off to 20. On and off 20, then to 40M to finish at 0300. It's a miracle. The only time in the world that so many people are synced with WWV. The band goes from pure mayhem to almost dead quiet.

I didn't make 200 contacts. Spent too much time having fun looking for Sections. I needed PAC VI PR AK ND VT CT NLI DE NFL SFL MS SF and WY! Where was Florida? I heard one, but he had a pileup.

Pete, VE5VA, did you get the MT that you needed? I hope so. In last 45 minutes the section hunting paid off. Saturday nite, I heard a station calling AA2U around 7.015. I couldn' hear Randy. Listened hard, but pileup on him like mad. OK, Sunday 1909Z, there he is on 20. Randy must have been running less power than me. He was the weakest kid on the band all weekend from this qth. I know he has an antenna farm, but no juice headed my way. Randy, how much power were you running? Tell us, inquiring minds just gotta know. He's in the log. Fair and square. QSL in the mail Randy. SASE included, so don't send me one yet. High point of my day, for sure. Thanks Randy. I could have sworn that I heard him laugh when I gave him my NR. He sent his first and I was embarassed to give him mine. An order of magnitude difference. Of course, had I started from the start we would have been neck and neck!! Good show Randy.

Last hour was really a challenge. Had a bunch of sections to go and I was really worried. Had a goal, which I stupidly announced to this group. But ran a string together you would have been proud of.

Another high point. Needed SV and LAX in 6 land. Got both, but the hard way. K6FO in SV and AB6FO in LAX!!!! Both within 5 contacts of each other on 40 meters at 0149Z and 0158Z.

How did anyone else do? We know that Randy took the QRP division on this one again. Surely he did. Not that many Qs heard here. That's the QRP division of SS. Bunch of good ops. I got a lot of calls memorized and will probably be having dreams in CW for sure now. Randy had a freq locked down. I just hopped, but worked just about everyone that was new to me. What slows this down and not a good contest procedure is that you have to listen to a lot of two way exchanges before you get your chance to peep. CQs are easy to answer, but if exchange in progress you listen to both, just to get both calls and sections to make a decision. Even at 30 to 40 wpm, this takes time.

If you want to get your code speed up, this is the contest. Don't be afraid. You can practice by listening to a guy's call and exchange til you get it, then call him. It'll be second hand before you know it.

The NN1G receivers held up nicely and no complaints from me. Used OHR Switched Cap audio filter some, but not all that much. The AGC mod in the K5FO special worked fairly well. (My version of the NN1G with some other goodies to be announced shortly) Sorry, no advance press on this one, until I'm sure. Hold your horses.

Peter, VE5VA, wrote me a nice note about working the DX test to rack up the countries for my DXCC on 40M QRP within a year. Pete, I'm going for it. So plans in place to go all out in this one. Any help from others, Randy et.al., I'm open to suggestions. The HF6V comes outta the garage along with the long wire and a beam for 20 should help.
73 es gl to all de K5FO NR XXX Q K5FO 58 NTX K

93 Sweepstakes Report

by Warren E. Lewis, KD4YRN
127 S. Atley Ln.
Cary, NC 27513

I worked only 40 and 80 meters because I only tested in the wee morning hours and in the late afternoon and evenings. I did okay for my first real CW contest after Murphy struck during the ARCI QRP contest (lets put it this way I didn't come close to a clean sweep). I'll have to admit I didn't work QRP this time around. I was running about 25 watts. (I know what your thinking!! When I get my code speed up and get more experience under my belt I will be turning it farther and farther down. I worked two Qs, one in NNJ and one in EMA.

That is the exact method I used until I got some confidence and figured I'd try calling CQ SS myself...boy was that fun I hada pile-up instantly. I worked about 7-8 before the dust settled. Not a huge pile-up, but, when you are poking about 10 wpm with the long exchange that's about all that will hang around for you. Only had to ask for a couple of repeats. Not bad for a rookie CW op. Ya know this CW stuff is really a lot of fun, especially when you start to get the hang of it!!!
73 de KD4YRN NR XX A KD4YRN NC BK
SK de KD4YRN dit dit

93 Sweepstakes

by Bob Applegate, WA2ZZX
102 Peachfield Ct.
Marltown, NJ 08053

I did some QRPing this weekend, but only in the 40 novice band. I worked two other Qs, one in ENY, the other in OH. Nothing to write home about: only 49 QSOs and 23 sections (my dipole is not fit for QRP use: 25 feet above ground). Had fun and will certainly do it again next year (but with a realantenna).
73 Bob, WA2ZZX

My Favorite CW Contest

by Jeff Gold, AC4HF
1751 Dry Creek Rd.
Cookeville, TN 38501

Sweepstakes is probably my favorite CW contest. I like the longer exchange. I somehow messed up and was waiting for it next weekend. I unfortunately had my whole TV antenna and Satellite systems in various states of repair. I worked non-qrp for a while to test out my 850 and various filters.

Got a few minutes only at the end of the contest while doing some soldering repairs I turned on the ARK40.. figured it would be a good test. The 40 meter band was pretty tough,

at times the 500 hz filter on the 850 just didn't do the job and had do use the DSP and tried both the Oak Hills and Tejas audio filters. I was surprised how easy it was to get through on the ARK. I don't have anything but a vertical for 40 meters. I found if I turned on the Audio Filter on the ARK I was able to really only hear the one signal. I found that the push buttons for tuning that sometimes can be a pain, worked real well for contesting. If I can ever get the $25 Superkeyr going.. I can have a tiny contest setup up. I may have to try it from a mountain top in the Smokies.
72 Jeff, AC4HF

My Account of SS

by Mark Cronenwett, KA7ULD
1029 Duncan Ave.
Sunnyvale, CA 94089

Well guess what gang, Mark managed to make the decision that I wanted to put myself through more suffering by entering another CONTEST! Now mind you, the last experience was not allthat bad, if you get past the fact that I forgot CW at a crucial moment, and had to start with the code practice over the last couple of weeks to get the ability back. Again I ask, why does anybody do this?

I managed to get to the radio about 4 hours after the contest started. Of course this was better in the long run, this was the EVENING after all. Much better for my CW abilities (I now have none remember.)

Well I tune around on 40, and I find a nice pleasant station calling CQ, and strong to boot. KA7W..(naw).X..(can't be)..N..Not only am I astonished that I can even comprehend all those little rascals, but I can write them down too! But most of all, this is my dad who is doing the contest. Wow, make a great first contact. What came after is best described as a ROAR. I tried a couple of times to get him, but to no avail.

A couple of hours later, I notice that while I am having fun, my contact rate is 3 per DAY?....no silly, HOUR!!! Wow, I had better get going. I am supposed to WIN you know. I ended the contest with 36 contacts, for an average of 1 contact every 12 minutes, or 5 per hour. At times I even got 1 every 4 minutes!! What Joy-Joy feelings that brings.

Now I just need to get ready for that ARCI contest that comes in December. I think this contester was born yesterday, Good luck.
72, Mark (14 wpm and increasing)

Another SS Story

by Ron Majewski, WB8RUQ
3463 Pine Haven
Milford, MI 48042

I'm still riding the contest excitement and it's after 5pm, so I thought I'd join in and share my contest experience.

CW contests are always a blast! It's a great opportunity to move my code speed up a few notches. I also enjoy listening and going to school on the big boys as they smoothly rack up contact after contact. Class is in session for the next 24hrs!

I am in the process of getting a station set up for my younger brother who has relocated to American Samoa for two years, so I ran the rig as he will —100w with an R7 antenna mounted 5ft off the ground in the backyard. (I know — Boo! Hiss!) I wanted to get a feel for how the station played under battle conditions. I was very favorably impressed with the

R7 performance on the contest bands. I could work anything I could hear, 95% of the time on the first call.

My operating approach was to start at the top of the extra portion and tune upward, working each station in turn. In the end, I made 112 contacts in 54 sections over the course of 5hrs of operation. 40mtrs was really hot Saturday night — I worked Puerto Rico and six Californians. I used K8CC's NA software to do the logging, but sent and received by hand (Chuck — I had the pen in my sending hand at all times!).

I only had two stations give me a precedence of "Q" — AD6T and W0HEP. I also worked W6ISQ — John Troster of QST fame. Hewas in the 700's as far as QSO's go. A very enjoyable test at my QTH. Just wait until next year ...
73! Ron WB8RUQ

93 SS

by Greg Taylor, KD4HZ
110 Dairy Science Building
College Station, TX 77843

Had a blast in time available.Got in about 8 hours with 209 Qs and 63 sections. Don't know if I just didn't spend enough time, its the general decline in propagation with the cycle, or the weekend just didn't have good propagation (I've been going too many different directions lately to keep up) but my section count seems low relative to past years. Did notice that KH2/N6OP was not booming in as in previous years and KL7 was weak also. Ten meters also not good for much here. Saturday evening the rate really went down with the MUF but on Sunday was able to hit stretches of 40/hour. With a G5RV at 25 ft and 5 watts I know its tough copy so think there are some really first class operators out there that spent the time to dig me out.
72, Greg KD4HZ

Ten-Tec Scout - QRP?

by Dave Redfern, N4ELM
1784 Quail Ridge Rd.
Raleigh, NC 27609

In their recent ads, Ten-Tec has said that a QRP version of the Scout is coming. From a phone call to Ten-Tec, I was told that basically they were just going to remove the 50 watt power amplifier module and run directly from the driver stage. The Scout manual states that the output from the drivers is about 3 watts. So, I thought I would try running directly from the drivers and see what the results were. I removed the covers, uplugged the coax cable between the drivers and the input of the PA module, and unplugged the coax from the output of the PA module and plugged it into the output of the drivers. Then I connected up a wattmeter, dummy load, and power to the Scout and tested in CW mode. I have modules for 160,80,40,30,20,17,and 15 Meters. With the RF pot set for full output, the power output on 40 Meters was about 3 watts. On all of the other bands, the power output was 9-10 watts. The drivers did not get very warm during the testing, the DC voltage to the rig was 12.5 vdc. The Scout manual said about 3 watts from the driver, so I was surprised to get 10 watts out on every band but 40 Meters. I wonder if anyone else has tried this with their Scout and what the results were? If the 10 watts is normal from the drivers, I wonder how Ten-Tec is going to really create a QRP Scout. 73 - Dave, N4ELM

MFJ-1786 Hi-Q Loop

by David Baker, AB5PI

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Dallas, TX 75252

I have used the MFJ loop, and it does indeed work. It will outperform most any dipole that is not at least a half wavelength up in the air. I just got an AEA ISOLOOP which is about the same thing as the MFJ, and it usually gives me 2 to 4 S units over my 40 meter dipole (on any freq. between 10-30, of course). For comparison, my 40 meter dipole is attic mounted, about 15 feet above ground level, in a U shape. The loop is also horizontal, at 20ft, still inside the attic... However,before I mounted the loop, I used it mounted on a 5 ft pole, right in the room with me, and it still beat or equaled the dipole's gain. The major problem with a loop is tuning. They are slow and difficult to tune, due to their high Q nature. Bandwidth is also small due to the Q, typically 10 to 100KHz depending on freq. This will also help eliminate any TVI, especially at QRP levels.

Homebrew QRP loops should prove to be very functional, the only problem will be that it would be very difficult to make one with a remote tuner. As easy project might be a 40Meter QRP loop. Using loop antenna construction guidelines, it would be simple to create a loop with a fixed capacitor, but then it would only operate on a fixed frequency and at low power only. The other big problem with loops is that they create very high voltages on the loop during transmit. Commercial loops like MFJ, AEA, or AMA's are designed for higher power, and thus require HUGE tuning capacitors with high voltage ratings.

Bottom line: if you can't mount an antenna (dipole) up at the ideal height, a loop will probably beat it. I would still recommend putting up a long wire or something similiar just for scanning. It is somewhat tiring to try to retune the loop as you scan the band.

I want to clarify that the majority of the tests I ran were using the AEA ISOLOOP. I borrowed an MFJ 1786 from a friend for a few weeks, so I can tell you that the two loops are virtually identical in operation and gain, etc. But, I did not make any side by side comparisons or install his MFJ in the same configuration as my ISOLOOP (although this could probably be arranged).

I can give you another experience though, using the MFJ 1786: At the time I had a 150ft dipole, horizontally mounted about 35ft up. The MFJ was already mounted vertically on a small mast, so I just connected it to my rig, right there in the room with me, which was about 10 feet below the dipole. Again, the gain of the loop was typically equal or better than the dipole, by about 1-3 S units. However, since the loop was vertical, I could actually 'point' the loop at the source and get a better reading. Anything 90 degrees from the source was nulled noticeably. The horizontal configuration may be the reason that my AEA seemed to work better than the MFJ. Overall my impression of loop antennas is very good, excellent. For limited space applications, nothing beats them that I have seen. You can take a loop, mount it on a pole 5ft above ground, tune it to 20Meters and have SWR 1.1:1, and gain that FAR exceeds a dipole at the same height. And, these things makegreat portable antennas, even mobile if you have the right mounting configuration.

As for the construction of these two antennas: The MFJ is built using the loop as the structure of the antenna. The variable cap. is held by the rigid tubular loop, and the coax shield is connected to the loop. The coax center is connected to a 5 or 6 inch loop with a coil, returning to the shield (I think). The tuning motor is a DC motor, and there are various chokes and coils in the loop to extract the positive and negative DC for the motor. The tuning head is pretty easy to use. It has crossing needles for forward and reflected power, with SWR correlations. There are high speed tuning buttons and slow tuning buttons, and an 'auto' mode. The auto mode simply scans the band and stops when the SWR peaks low. You must then manually fine tune it. The only other way to tune it is to just listen to your noise level as you tune, and tune for max noise. I have heard the quite a bit of RF gets into the shack due to how they designed the tuning head. It does all of its tuning through the coax, no control

wire is needed. This is easy, but also limits what you can do automatically. Tuning is also very slow. To go from 10 to 30 MHz takes about a minute. There is also a lot of noise introduced when tuning since it uses the coax. The AEA ISOLOOP is very different from MFJ. They first of all use a flexible 2" wide flat strip instead of MFJ's 1" tube. The loop is held together by the case, which houses the capacitor and coupling loop. Unlike the MFJ, the loop of the AEA is not electrically connected to anything. The loop just loops around from one side of the variable air capacitor the other. The center (moving) part of the capacitor is controlled by a stepper motor, controlled by a 4-wire control cable. The coax is coupled to the loop using a Faraday coupler (as it is called in the November 1993 QST article). This is simply a loop of RG-58 about 5-6" in diameter. One half of the loop of RG-58 is connected center conductor only to the center conductor of the incoming coax. the other half of the loop is jumper-ed so that the inside of the first half of RG-58 connects to the outside of the other half, then the second half is connected to the shield of the incoming coax (see the QST article if this is confusing). The AEA loop can also be tweaked for any particular frequency by adjusting the distance between the coupling loop and the outer loop of the ISOLOOP. (MFJ has no way to fine tune other than the control head) This adjustment is useful for non-ideal conditions where the loop must be mounted next to metal, etc. Basically, it allows you to further couple the loop to the nearby metal to resonate more closely to your preferred freq. The AEA ISOLOOP is also very easy to move and transport due to its flexible nature. The MFJ is very awkward to put into a car or small trunk, and may present problems getting into small attic spaces.

The ISOLOOP comes with a very simple controller, featuring 2 dials, one for speed control and one for sensitivity (audio) control. It has UP/DOWN buttons and 4 tuning LEDs for noise. You can either tune for lowest SWR when transmitting, or tune for max noise either by watching the LED's or listening to the rigs output. Some might say the stepper motor makes it hard to tune,but the difference is not a problem. The MFJ is easier to get fine-tuned, but not by much, and the AEA is much more precise. Now it gets interesting: AEA offers the IT-1 (which should come as standard equipment) which is a computerized controller. To quickly summarize, it has a two digit freq display, eight freq memories, and the ability to automatically tune to either greatest received noise, or lowest SWR. It is very easy to use too, for example, if you want to use 14.020 MHz, just set the rig to that freq, send CW, and press 14# on the tuner. In a few seconds it will be tuned. If you don't want to transmit, just press 14# and it will tune to max noise. It may still require a little bit of adjustment with the large, smooth turning, speed sensitive dial, but that is easy. Tuning is noise-free with either controller, but to the isolated stepper motor design. Also, the stepper motor is capable of tuning from 10 to 30 Mhz is less than 5 seconds, so tuning is very fast, usually taking less than a few seconds.

For $219 the MFJ 1786 is a good value, but I would recommend the AEA ISOLOOP over the MFJ if you can afford it. Hopefully AEA will start selling the IT-1 with the loop and lower the price considerably. The ISOLOOP with IT-1 goes for about $329+$250=$579 (all prices are what I have seen at stores). I got lucky, my ISOLOOP with IT-1 (both used)was only $250. (Else I would probably have the MFJ).
72, David

MFJ-1786 Hi-Q Loop

by John Welch, N9JZW
1307H N. Richmond Rd.
McHenry, IL 60050

I'm not certain I know this antenna, but if it's similar to the AEA Iso-Loop, it isn't even

suitable for semi-serious QRO let alone QRP. With the IsoLopp and 100 watts, we were mostly inaudible in the noise. Flipping the antenna switch to a non-resonant dipole (through a tuner) and we were about S7. We also couldn't hear very well. (Yes, we tuned it properly. It just sux as an antenna, and it radiates a little too much for an expensive dummy load.)

Just on general principles, I would stay away from any shortened loop antenna *UNLESS* your only other option was to stay off the air. My $0.02 worth, your opinions are worth as much as mine, too.

72,
John Welch, N9JZW

My Version of the MFJ-1786 Hi-Q Loop

by Tom Farish, KJ5LT
34 Grand Canyon Dr.
Los Alamos, NM 87544

I built my own version of the MFJ and AEA units and posted my results on internet in rec.radio.antenna a while back. The unit was made of 3/4" copper tubing bent into a 43" diameter loop. 50 pF ofHIGH voltage doorknob capacitors gave me a 2:1 VSWR range covering almost 14.025 to 14.075. With a tuner (and a cap change) I worked the Novice portion of 15m with no problem. I mounted the antenna on a PVC tubing frame about 10 feet off the ground and worked Olympia Washington (1836 miles) on one watt with my MFJ 9020 QRP rig. I had most of the parts on hand so it cost me about $10. The reason the MFJ and AEA units cost so much is the stepper-motor-driven BIG air-variable HV capacitor. It takes me about 1 minute to change out the dorrknob cap on my loop, so I didn't cvare about being able to tune it faster. Also, I use it only on the code section of the bands, so I don't need a wide tuning range.

I got lots of requests for more info about the homebrew loop antenna I built last fall. Here are the details. I used 1/2 inch copper pipe bent into a circle 48" in diameter. My simple calculations show that this loop has an inductive reactance of 235 ohms at 14.05 MHz. thus to resonate at this frequency, Xc=235 whcih leads to a capacitanceof about 48 pF. I had a bunch of doorknowb capacitors rated to 20-30 KV, so I put several in series. Three 180 pF's gave me 60 pF. Too high, I said, but I had a tuner. Well, in my backyard, this seemed to give me less than 1.5 SWR from 14.025 to 14.075, with reactance of 185 ohms which is 50 less than the 235 ohms of inductive reactance! Just a coincidence it is 50 ohms? Well, when I set it up over my brick patio, I geta defferent resonance! I think this is because the loop is only about 6 feet off the ground (also, I watered the lawn that day, it was a Sunday, etc. I used doorknob caps as the voltages on such a look can easily get to the kilovolt range, so I am told. The feeline is coax. I attached the caps and SO-239 to the loop with hose clamps! The PVC frame is built from short sections of 3/4" thick wall tubing and T sections. The top of the frame is built from 2 short lengths of tubing and 3 T sections, one in the middle and one on each end. The copper pipe passes through the two end T sections. The T's are not threaded, but are held together by friction to allow easy take down. I have a 5 foot length that I put into the middle T as the mast. An identical section below forms the "feet" with the addition of 4 more 2 foot lengths stuck into the end T's instead of the copper antenna element. That's all there is to it. By the way, thin walled pvc pipe is too flimsy to hold the 1/2" copper tubing. You might try it for 1/4" tubing though.

So far it has worked lie a champ with my MFJ 9020. I'll be testing with some real power if I can get it up a bit higher.....beware of high voltages on this loop. Good luck! I find building antennas lots of fun...and MUCH cheaper than buying.
Tom, KJ5LT

Recollections: Bagging the NorCal 40 Kits

by Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

The NorCal 40 kits have been shipped, and the "torrent" of letters and packets reporting missing parts is down to a trickle.Even though there is a possibility that there are kits yet uninventoried and that the missing parts river may crest again, perhaps now I can stand back and take an objective look at the experience, collecting the money, keeping track of it and the kit orders, bagging components I had ordered from Mouser, Digikey, and Amideon, buying the padded envelopes, making out the UPS slips, adressing the shipments, going to UPS and the postoffice....

Hold it right there! This was nothing compared to what Wayne and Doug did! For starters, Wayne, N6KR, designed the NorCal-40, and he didn't just pull this out of his hat, talented though he is; this rig represents the results of months, no, years of experimenting with NE602's. Also, he did all the circuit board collaboration with Far Circuits, and the clever design of the cabinets. Plus, writing the manual!

Doug, KI6DS, roamed the central, San Joaquin, and Sacramento valleys, in addition to the bay area, finding parts at rock bottom prices. He cut 10 or 15 dollars off the cost of each kit. In addition, he made trips to Fresno to have the manual printed. He cut and wound the wire for the toroids, and I can't remember all the other contributions he and Wayne made.

And bear in mind, these guys have to earn a living as well; so shed no tears for me, but thank you anyway... hey, I'm retired!

Somewhere along the line I was told that the NorCal 40 has only 110 parts. For that I am grateful; 110 parts times 100 kits equals... well, a whole lot of components.

Then, there was taping the circuit boards and panels to one of the case halves; then taping the two together, plus, taping the padded envelopes. But the comments from some of the recipitants made my day. "Hey, it took me 10 minutes to get the package open." "Do you own stock in a tape company?" I'm still chuckling.

Would I undertake this project again? Yes, albeit with enthusiasm somewhat attenuated by experience. One reason I would do it again, I suppose, has to do with pride. I made a lot of errors, mostly my fault, though some were beyond my control. I learned a lot, and feel that a second time around, I could do better. Like: NO MISSING PARTS! The other reason has to do with, well, if not dedication, a sense of duty; then simply because I am QRP goofy.

Things I would do "next time around", include not setting a shipping date, which was met, incidentally. That date, fell, as it turned out, to conincide with friends from LU land (Argentina, so you won't have to look it up) visiting us. I would be at the "assembly line" at 0530, cranking out my self-set goal of eight kits a day, before the others were up. Trips to Tahoe, Yosemite, long days, did little to sharpen up my wits. This helped to increase the error count.

What was the hardest part of this enterprise? Actually, it was having to think. Eleven years of retirement have made concentrating more than a minute or so nigh impossible. My mind would wander; I would lose count as I dropped parts into the eight cups. Like three, six, nitne, twelve.....oops! Where wasI?

Another thing I would do is keep better records. Mine were adequate, but just barely. Slips of paper just don't make for CPA type accounting.

The nightmare of putting these kits together was that all had been shipped, and then in comes an inquiry, "Where is my kit?" Well, this did happen, but, heh, heh, I had not shipped all the kits. I held back a couple in reserve for just such an occurance.

Another thing I would do is to make sure I had the right parts list. Unbelievable, no it isn't, that I started bagging and shipping from a preliminary list rather than the final one with all the revisions. Wow! Fortunately, the first kit was to go to Bob Warmke, W6CYX, to parts debug, so that error was corrected early on.

Here's how I went about setting up the assembly line. I bought a few dozedn blue plastic cups. Doug, KI6DS, had printed up component labels for me to stick on them, e.g., stereo jacks -2. This was of tremendous help. I filled all the cups with various parts, and set them into rows on the table. Then put eight large white cups which would hold the components for each kit. example, seven chokes, 7, 14, 21, 28....as I dropped the supposedly correct number in the, hopefully, correct cup.

However, I managed to spread the mistakes around, not confining them to the parts count. On one package, I left a number out of the street address; so naturally UPS sent it back, with a cut and ripped tape; only the manual was left inside. I left the circuit board out of another kit; not easy, but I managed. The three pots out of another. Easier. Even managed an error in the hand drawn parts placement guide I put in to help new kit builders. I got the biggest laugh when I heard how professional the manual and errata sheet "everything except that crude hand drawn parts identification guide." Cracked me up, tickled my funny bone. My ego strength must be better than I realized. Because I'm still laughing.

To all of you: you were patient, you hung in there, not withstanding the frustration of missing parts.... my eternal gratitude.

72, Jim WA6GER

[Editors comments: As many of you know, we did do another run of 100 kits, and Jim is a big part of the second effort as well as the first. His goal i s NO MISSING PARTS! I want to publicly thank Jim for all of the work that he has done for the NorCal Club, not only the NorCal 40 project, but in the many other things that he does. Jim is the steadying influence on me, I am impetuous, tend to fly off in many directions, never afraid to try anything. When I get too far off coursce, Jim reels me in and for that I am ever so grateful. Jim's work on the NorCal 40 project was super. He was the perfect person for the thankless job of handling all of the complaints. When you see Jim, be sure to thank him for his efforts.]

NorCal 40 Completed

by Rich Mulvey, N2VDS
787 Elmwood Terr.
Rochester, NY 14620

Well, I got my Norcal 40 kit in the mail on Friday. After sorting out the parts, it took me a total of about 5 hours to build it for the Novice band. I hooked it up, and the receiver worked immediately, with about a 35 KHZ band spread. I tried the transmitter - no go. An hour later, I discovered that I hadn't stripped the insulation from one of the transmit-mixer toroids completely. Once I got THAT fixed, everything worked fine - about 2 watts out. I haven't tried any QSO's yet, since the antenna connection at this point consists of me pressing the PL-259 up against the BNC connector. The troubleshooting section and schematic were infinately helpful.

My first impression is that the sensitivity of the kit is pretty good - I could hear anything that I could pick out on my MFJ rig, with the exception of the very weakest signals. As I haven't completely aligned it yet, that may change, too. The transmitted signal has a very nice note to it.

I'll provide some further comments after I actually get the rig on the air after work tomorrow. Look for N2VDS on the air.

72, Rich

Evaluation of the NorCal 40 Kit

Jeff M. Gold, AC4HF
1751 Dry Creek Rd.
Cookeville, TN 38501

The kit: *this is an evaluation comparing it to commercial kits.. so it is way too picky for what it was designed for-

The artwork and instructions were good quality. The parts identification could probably have been a little better for a beginner.. but still ok. The schematic was first class as was the documentation, better than a good deal of the commercial kits out there.

The packaging of the kit was excellent. The kit has a low parts count and everything is on one board. The PC board is clearly silk screened. The parts on the board were not too densely packed and easy to place. The board was good quality. One of my personal favorite parts of this project was that most of the jacks and connectors were board mounted. There also weren't many jumpers needed. This board design took a great deal of careful planning and came out on top of the heap in my opinion. It is really nice to finish building the rig and not spend 2 days running wires all from panel mounted controls and jacks to the board. The finished project also looks a lot better.

The case is another TOP of the line item for this kit. It is GREAT. What do I mean by GREAT-well first of all it looks and feels as if you can through it out of a plane, pick it off the ground and continue a QSO immediately without any repairs. It also looks very nice. In addition, the case was also carefully designed so that if you want to remove the top and tinker with the controls inside, it is very easy to do so. I recently builtthe ARK40.. and loved it. Well I like to tinker with a new built radio till it feels right. With the ARK 40 it is pretty much of a major project to take the case apart and get to the bottom board. The only other rig that I have seen that does this is the MFJ QRP rigs. They also would make great kits and are very similar to the NorCal 40 in one board, all on the board, no wires all over the place design.

I had a slight problem with the rig when I first built it. Turned out to be a blown capacitor and 2 chokes that were not of specified values. This is probably me and no one else had this problem as far as I know. I seem to be cursed with this. I built the HW9.. and each soldering joint was a work of art. Put it together and it didn't work. Had a bunch of people try to locate the problem. Finally got some good help and my friend traced the problem to the double balanced mixer. I was told by Heath that these parts are NEVER bad and I must have done something wrong building. Well my friend pulled a comparable part out of a homebrew rig he had made. Stuck it in the HW9 and everything worked... Moral of the story ... there are bad parts out there.. but don't worry the number is so small that I am probably the only one that gets them HI HI.

The same guy who found the HW9 problem has been working on QRP designs for a while. I gave him the NorCal 40 to play with. The good news is that he hasn't shut up about the design of the radio. He said he couldn't see all that much to improve upon and loves it. He went into detail about how he felt that in the design process the designer would get to a particular part of the circuit and say.. "well how can I redesign this part to use common parts and make it uncomplicated". The bad news is that I think he has given up on his design.. said he couldn't think of what he would do different.

I like the fact the radio has RIT, an on/off switch and is really small. This is about perfect size for a portable rig. I was really impressed with the receiver. Conard, WS4S had the rig to find the blown capacitor and other problems while I was on vacation. He got it running

just in time for the CQ contest last weekend. He worked all over the world and said the front end of the receiver really held its own.. he doesn't give compliments easily. I really liked the keying, it seems to fit my style of CW. The sidetone note on the rig wasn't really to my liking, but this could have something to do with the way he set it up.. didn't have time to tinker with it.

This kit is easily comparable and beats many of the kits in the $120-$160 range. Thanks guys ... boy did you do some job.
72, Jeff, AC4HF

Norcal Revisited

by Jeff Gold, AC4HF
1751 Dry Creek Rd.
Cookeville, TN 38501

Hope you had a good weekend. I had a REALLY hassled week last week, so decided to take a break from building, writing and fixing (except for putting together a Quad for a friend). I hooked the Norcal up to a battery, then hooked up a Vibroplexbug. I love straight keys and use paddles, but never played with a bug. The bug is definitely a different kind of animal. Takes a little getting use to. Had to put a counter weight on the pack to get it to respond slow enough so that I could send in a manner that other could understand.

The Norcal was putting out about 1.8 Watts (the battery wasn't charged up). The bands in my area were horrible, lots of noise even on 20 meters. Kinda challenging conditions for QRP. I was once again amazed. The first cause of amazement was that I was able to get to the point where I could carry on a QSO using the bug. Liked it a lot. The second cause was that little old transceiver.

The Norcal is the smallest of all the transceivers I have built. Only worked with one smaller, Doug's NN1G in a teeny weeny case.. just big enough for the 2 boards. I have no idea how he crammed everything in the case, but you can store it in your pocket. The next up rig I have is the MFJs.. and the Norcal is significantly smaller.

The Norcal kinda reminded me of the MFJs in a way, but had some things I liked better. I made over 20 contacts as I remember. The amazing thing was that most of them were with guys running Japanese commercial rigs such as Icom 745s, Kenwood 850s and such. A good portion of them reported that the noise level in their area was so bad that they were going to go off the air. OK, now if the Norcal was putting out a signal that was just in the noise level, I could understand, but that wasn't what was reported. I got good signal reports, most around 559, but they were having bunches of trouble with the noise factor. I could hear a lot of noise on the band in between signals, when I tuned in a decent signal (449 or better) I just heard the signal, no noise, or not enough noise for me not to have a perfect copy. That is saying a bunch.. pretty impressive.

I checked out my MFJ afterward and one thing that really jumped out at me was the switching. I hadn't really been bothered by the relay switching in the MFJ before, but after spending the weekend with the Norcal, the relays annoyed me to no end. The changeover time for switching in each rig was about the same.. boy do I prefer the Norcal. I think the Norcal would make an excellent commercial rig.
72
Jeff, AC4HF

A Good Laugh with the NorCal 40

by Jeff Gold, AC4HF
1751 Dry Creek Rd.

Cookville, TN 38501

Well guys and gals, wasn't going to admitt it, but I am anyway. I finished up the NorCal 40 last nite.. was having a real bad day and should have stayed out of the shack.. guess I am to dumb to learn. I keep trying to believe in science and feel you should be able to have a bad day and not have it linked to doing really stupid things.

Well .. checked the bottom of the board with my magnifyingglass, didn't see any problems. I had hooked up the optional 3 parts to get rid of the birdie. plugged in the power supply and flipped the switch. Never seen so much smoke from such a small project in all my born days. Not being all that unfamiliar with the generation of high quantities of smoke using small components.. I immediately looked for a fried choke. Sure enough, fried RFC1.. BIG TIME.. Well traced a teeney weeney solder bridge to the modification and promptly unmodified it.

Also didn't find the problem right away and fried my stock of chokes.. all sizes and all shapes. About had to keep the fire extinguisher handy. My son never enjoyed ham radio so much in the last 2 years as he did watching me turn on the power supply and watching the billows of smoke rise from the board and cover the work bench. He would go off and do something while a replaced the choke and tried to find the problem, and made me promise to call him the next time I was going to fry something. Boy was he disappointed when I turned it on and no smoke came out.

Got up about 5:30 this morning and replaced the 3 ne602s and injected a signal into the rig with my antenna analyzer.. the receiver seems to work and the volume control, RIT and VFO seem to be doing something.. guess that is a good sign.

Well got a little confident and plugged in a key and turned on the power.. RFC1 gone again...Is there any chance a mono plug could cause this to happen.. couldn't find any more bridges.. there were 2 or 3 electrolytic capacitors in the circuit that didn't have the polarity marked.. do they have to go in a certain way.. looked at the schematic and couldn't figure how it would make a difference.. but who knows... HELP. have a good day.
72 Jeff, AC4HF

Fix for Weak Audio in NorCal 40

by Wayne Burdick, N6KR
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San Carlos, CA 94070

"Note to NorCal 40 builders: R6 may have to be larger than 10M in some cases. An easy trick is to use the 10M and 4.7M resistors in series. You'll know you have the right value for R6 when it doesn't reduce the receiver volume under no-signal conditions. However, you should be able to hear the AGC reducing the volume of loud signals.

As a final tweak, if you used an 8.2M or larger value for R6, you might want to decrease the size of the AGC capacitor, C29, to 1.0uF. You must use a non-polarized capacitor, since this point of the circuit can have either a positive or negative voltage.
72, Wayne

NA Sprint with the NorCal 40

by Ron Majewski, WB8RUQ
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Milford, MI 48042

It was another exciting QRP weekend here in Michigan! I fired up the NorCal 40 that I bought from Chuck, K5FO, and ranthe North American Sprint on 40 meters on Saturday

night. This was my first experience with both the rig and the contest. According to my MFJ wattmeter, the NorCal was putting out about 2watts. The antenna was a newly-constructed quarter wave ground plane. The base of this beast is about 12ft off the ground and I have six ground radials attached to it.

Band conditions on Saturday night were excellent — no noise and propagation in all directions. I didn't have much time to operate, but I worked 18 stations in 14 states in about 45 minutes. East-West, I worked California to New Hampshire; North-South, Manitoba to Florida. An outstanding evening on 40m. The rig is really great! The receiver stood up well to the crowded band. I could have used a bit more receiver selectivity at some points, but didn't play with any outboard filters. The T-R switching is smooth.

Did anyone else run their NorCal in the Sprints?

72 and 3!

Ron WB8RUQ

QRP Directional Power Meter and Antenna Tuner

by Jim Pepper, W6QIF
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The need for an antenna tuner becomes mandatory when using non resonant antenna systems. Such is the case with QRP rigs in field operations where a resonant half wave center fed doublet is not practical. In such cases the antenna is usually a length of wire of random length strung to some tree. The fed impedance of such an antenna can be either low or high depending on its length.

My home antenna is such a wire being 250 feet long and end fed and is designed for 160 meter operation. Using the tuner to be described, I can easily tune it for low SWR on 40 meters. The directional power meter used can be used as a SWR meter but knowing the SWR is not really that important on the low frequency bands. What is important is to electrically tune the antenna to match the output impedance of the transmitter for maximum transfer of energy. This is generally indicated when the forward power on the directional power meter reads maximum and the reverse is close to zero.

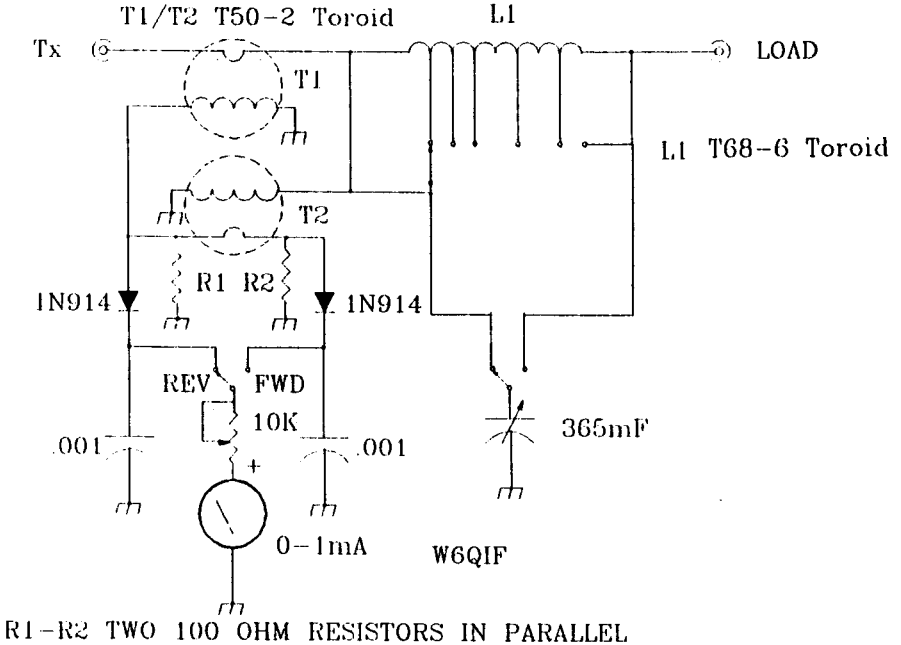
The directional power meter I use was described in the first issue of QRPp journal in June 1993 by David Stockman, G5ZNQ. Because my meter was 1 mA instead of 50 uA, I wondered if the club project rig would give sufficient reading on this movement. By reducing the series resistance to the 1 mA meter to zero a reading of about half scale was read for about 1.2 watts output. To handle greater outputs, the series resistance is made variable and should handle up to ten watts.

T1 and T2 are wound on T50-2 toroids with 18 turns of #22 AWG on the secondary. The primary is a piece of RG174u coax passed through the toroid center. Although I haven't tried it, it might be possible to get by with just an ordinary piece of wire instead of coax. The electrostatic shielding of the shortpiece of coax doesn't accomplish much on 40 meters. You will note that the meter is designed for a 50 ohm system. The output from your transmitter should be the same. If the transmitter has an internal tuner, it must be set for this output impedance to give correct results.

The antenna tuner consists of a tapped coil and a variable tuning capacitor. The capacitor I used is a 365 pF, a receiver type, with stator and rotor plates spaced about .03 inches. The coil is wound on a T68-2 toroid and consists of 60 turns of #22 AWG with taps about every ten turns. When working into a 50 ohm system, the coil will be shorted out and the capacitor set at minimum. The capacitor is capable of being switched from the input side of the coil or to the output side of the coil. This allows either high or low impedance antennas to be

resonated. Remember end fed antennas that are shorter than a half wave will require a ground system or counterpoise to produce resonance. To use the system, I find that rotating the coil switch and tuning capacitor to give maximum signal on receive results in a pretty close setting for maximum out and minimum return in the transmit mode. The capacitor can then be adjusted for minimum reflected power.

The forward and reflected power is obtained by switching from the input to the output side of the directional power meter. One could use two meters for this purpose, however a dual single shaft pot would be required to set the level. If you are going to use this tuner with less than 2 watts, then no series resistors would be required, or two fixed resistors could be used for higher power.



R1-R2 TWO 100 OHM RESISTORS IN PARALLEL

Parts Sources:

Meter 0-1mA	Radio Shack 270-1754 (Scaled 0 - 15 Volts) $7.99
365pF Variable Cap	Dan's Small Parts $7.50
T68-2 Toroid,	Dan's Small Parts $.45
T50-2 Toroid,	Dan's Small Parts $.33
Rotary Switch, One Pole 12 Position,	Radio Shack 275-1385, $1.39

Good luck and I hope you enjoy your project. I mounted mine in one of the NorCal 40 matching cases. It matches the NC40 perfectly.
72, Jim

Battling the Great QRP Epidemic of 1993 (And Losing)

(My Experiences with the NorCal 40)

by J.C. Smith, KC6EIJ
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Jim asked that I write an article for QRPp detailing my experience building and using the NC-40. Being a complete novice at this new fangled pc board stuff (I built some tube gear back in the early 60s, but that's the extent of my building experience!) I don't know how much insight I can offer, but here goes.

When the NC-40 kit arrived, the first thing I did was read the manual, twice. Then came the hardest part of the project (for me anyway), identifying all the parts. Thank God, (thank Jim actually) for the parts identification sheet. I sorted all the parts, and using a strong magnifying glass (I'm a sufferer of the "arms too short syndrome") identified each one. I used some masking tape and tagged each one with a big readable label that identified it by it's place in the circuit (R-1, C-2, Q-3 etc.). I also used my multitester and checked the values as I was labeling, which served as a double check on my color coding. I found a resistor out of the tolerance range (one of R4, 5., & 6 the manual said to be sure to verify) and was missing a few components. A quick note to Jim brought the missing parts, but the replacement resistor was also out of tolerance so off I went to the local electronics store to get another. I also picked up a 20 ohm resistor to replace the 22 ohm that was sent for R12 to prevent shipping delay, and asked about the MRF237 final transistor mentioned in the manual as a higher power alternative to the 2SC799 supplied with the kit. The tech there suggested a NTE 341 ($9.00) and we located a BIG heatsink (Phillips ECG 401, $5.40/2pk.) that fit it and the project (no other component changes were required). I also picked up and an intermediate value resistor to use for R6 in case the AGC needed more tweaking than could be obtained with the supplied resistors. (Turned out I didn't need it.)

Assembly came next. What can I say? I followed Wayne's advice in the manual and everything (well, almost) went off without a hitch. I had spent a prior evening carefully winding all the toroids so they just had to installed like any other component. I did stop after each soldering session and examine all solder joints with a magnifying glass. I touched up each joint that didn't look completely filled, and added plenty of extra solder to the joints of all components that went throughthe front and rear panels. The only confusion came when I went to install L9, the VFO coil. The parts placement picture showed the windings opposite the direction I had done it. Rechecking the winding instructions, I seemed to be correct, so I installed it the way I had wound it (opposite the picture on the circuit board).

Alignment went as advertised and I drew 14.1 mA @ 13.8 V on receive. I set my VFO with the birdie at the bottom of the band, and later confirmed with a frequency counter that I was tuning between 7.024 and 7.058 MHz. On transmitter tuneup I found I wasgetting 4.1 W output at full power. I turned it down to 2 and plan to add a rf power pot to the rear panel in the near future. At 2 watts, the final (with it's larger heatsink) never even gets warm. I still haven't calculated the amplifier efficiency as my ammeter only goes to 200 mA, and I was drawing something more than that at 2 watts out. I do plan to do that calculation for various output levels.

Now comes the best part. I hooked up my antenna (modified double crossed bazooka with SWR well under 1.2:1 over the full range of the NC-40) and keyer (the darn thing's bigger than the radio, got to get an inboard keyer installed). The first station I called, W6PSC, Buffy in San Juan Capistrano, came back immediately with a 579 report. I was shocked, I wasn't ready (nothing but the back of an envelope to copy on), I hadn't been on CW in years. I'm sure Buffy thought I was some kind of idiot or maybe a bootlegger who escaped from the novice portion of the band, but we made it through the QSO. Next I got a 559 from Colorado and then a 589 from Seattle. KL7S, John, said he couldn't believe I was running two watts. That has been the main comment I have received QSO after QSO,

"Two watts, WOW, FB signal." I even got a 10 to 20 over report from W6GZ in Morro Bay. Typical report is about 459 to 569. I got a 569 from JA9IPF, and a 589 from VE5PP.

I'm one of those people who can't sleep through the night. I usually wake up about 3 AM and read for an hour or so and then fall back to sleep. The NC-40 is so small, I can set it up on the bed with me and instead of reading, I operate. With the headphones, I don't bother anybody like I did when I tried operating late night phone with the HT. I did run into one problem. I had the coax running down the hall (on the floor) from the shack to the bedroom. One morning I woke up to find that my Lab pup had eaten about six feet of it. I guess I was lucky he didn't eat the radio. 70 lb. puppies can do a lot of damage. Feedline length is critical on my antenna, so I couldn't just splice in a length. That kept me off the air for about a week until I could build another one (I wanted to build another one anyway, so no big deal except the withdrawal symptoms. I was having altogether too much fun on 40 meter QRP.)

Now I have a new antenna up and am back on hotter than ever. The new one is even flatter than the old one if that's possible. So far, I have had 22 days of operating, and have worked 20 states including NY, SC, NH, TN, and HI and four countries (Japan, Canada, Mexico & USA). I usually use the hunt and pounce technique, often copying other QSOs to find out the QTH, thencalling after the SKs. I don't think calling CQ works as well when you are QRP. One thing that has surprised me is that I have often heard others calling the same station at the same time I was, and often as not they come back to me. That tells me a lot about the kind of signal the NC-40 puts out with two watts. Needless to say, I am very happy with the results of this project. I am having QRP QSL cards made up, and I'm shooting for 40M. WAS QRP before the winter is over. I already have an Oak Hills internal keyer kit on order (the only thing I feel the NC-40 really lacks) and I've ordered another NC-40 plus the new Sierra as soon as it becomes available. I plan to keep the front panel of my first NC-40 original (with keyer speed and RF out pots added to the back). On the other I am planning an audio amp and small speaker with volume control, a digital frequency readout, some LEDs as function indicators, adjustable power out, and of course the internal keyer (with built in paddle in the form of microswitches). Gee, I wonder if all that will fit in the case? I also ordered a blank set of cases to make a QRP antenna tuner.... Ouch! Something tells me I've been bitten by another bug.

72, J.C. Smith

NorCal 40 Mods

by Bob Warmke, W6CYX
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408-251-3843

I was sure thrilled to build one of the first NC-40's. It is beautifully designed and works very well. During the first couple of weeks I worked the following stations using just 2 watts: VE7NH, XE2FO, JH1CQV, JA7YAA, JA1NUT, 3D2YO, 3D2YA, P29DK, VK2ARZ, UA0ZAJ, NL7SA, HP1/KB2DQE, KH6RS, ZL1AMO, KH6BGE. I felt like a teenager again with QRP. Congratulations to Wayne, N6KR for a beautiful job and thanks to Doug Hendricks, KI6DS, and Jim Cates, WA6GER, for making it all possible.

Here are some mods which I found useful to me for the NC40: 1. Improved Keying, T/R switching, and AGC recovery time.

A) Add a .047 uF capacitor between the junction of R9 and D5 with the other side of the cap going to ground.

B) Change the value of C29 from 2.2 uF to 1.0 uF non-polarized.

C) Change the value of C28 from .047 uF to .01 uF.

2. To expand tuning range to 150 KHz, (7.000 - 7.150 MHz.)
   A) Change the value of C49 to 110 pF silver mica.
   B) L9 should be changed to 57 turns.
   C) Replace R17 with a 10 turn, 100K pot.
   D) For full output power across the whole tuning range without having to retune C39, replace L6 with 12 turns of #26 AWG on a FT37-61 core and change the value of C38 to a 50 pF silver mica cap.
   E) Ten turn counters are available from the surplus houses for the front panel.

3. For increased power output, see the write up from Dr. Ron Manabe, KN6VO, "The NC40 Power King", who has obtained as much as 7 watts output!! However, I found that by changing the value of C46 from 820 pF to a 680 pF silver mica increased the output power to about 3 to 4 watts without changing anything else.

4. Conversion of the NC-40 to the NC-30 (30 meter version). Change the following parts:
   C6 = 20 pF silver mica
   C14 = 16 pF silver mica
   C17 = 56 pF silver mica
   C18 = 200 pF silver mica
   C34 = 20 pF silver mica
   C35 = 68 pF silver mica
   C38 = 50 pF silver mica
   C45 = 240 pF silver mica
   C47 = 390 pF silver mica
   L1 = Replace with a 10 or 12 uH RF choke
   L7 = 16 Turns (same as NC-40 except fewer turns)
   L8 = 17 Turns (same as NC-40 except fewer turns)
   X1 - X6 = 8 MHz crystals matched to within 20 Hz.

The little NC-30 works great. DX on 30 meters is easier to work than on 40 meters but the activity on the band is much lower. Now on to the new Sierra All Band QRP Transceiver Wayne, N6KR, is designing. It's going to be a beauty, the receiver is a firecracker and it's almost ready! Please don't hesitate to give me a call at 408-251-3843 if you have any questions regarding the mods.
72, Bob, W6CYX

[Editors note: Bob was the beta tester for the NC40. He built the first kit from the NorCal Club NorCal 40 Kit offer. His work and enthusiasm have been invaluable to the club. If Ron Manabe is the "NC40 Power King", then Bob Warmke has to be the NC40 "Ambassador to the World". I remember Bob at the Foothill flea market singing the "praises" of the NorCal 40 to any and all who were listening or were in earshot. He is a great guy, and extremely willing to help. He is also one cracker jack cw operator. Doug, KI6DS]

Extra Audio for the NorCal 40

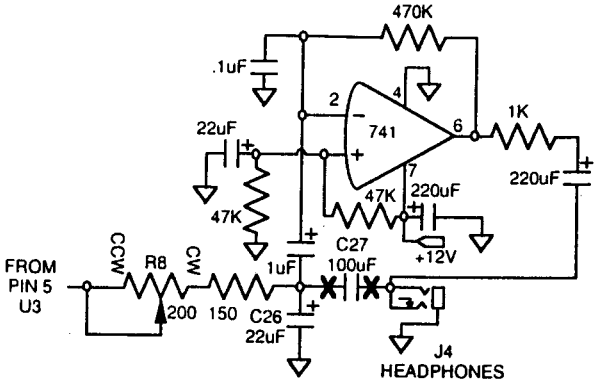
by Stan Cooper, K4DRD
1390 Market St.#2024
San Francisco, CA 94102

The NorCal 40, A Northern California QRP Club project designed by Wayne Burdick,

N6KR, is a 40 meter transceiver with outstanding performance. One of the design goals of the NorCal 40 is very low current drain in receive mode - approximately 15 ma. After completing my NorCal 40, however, I felt that the audio output level was not quite adequate for me as I suffer slight hearing loss in both ears.

I found the above audio amplifier circuit in one of the ARRL publications (sorry, I don't remember which one), and built it on a small piece of perfboard which handily fits inside the NorCal 40. Receive current drain with the additonal audio stage is now 18 ma., but this is a small sacrifice for the extra volume I now have.

Referring to the schematic, I added a 150 ohm resistor in series with R8 to give me the volume range most suitable to my ear. The input to the new audio amplifier is taken from the junction of this new 150 ohm resistor and C26. The original C27 is removed as indicated by the two "X"s. Because of the additional volume, the sidetone level may have to be lowered by incresing the value of R4. I replaced R4 with a 15 meg resistor, and the sidetone volume is now about the same as a 59+ signal, whereas with the original 8.2 meg resistor the sidetone was uncomfortably loud.



The addition of this audio amplifier has greatly improved my operating pleasure with the NorCal 40.
72, Stan Cooper, K4DRD

My NorCal 40

by Todd Nichols, KB0HQU/VE3
Box 2192
Boulder, CO 80306

I have pretty much assembled the entire Norcal 40. I primed and painted the end panels a deep royal blue, and put white rub-on letters (Datak) on to label the switches and etc. It looks really nice (even if I did build it and I really enjoyed putting it together. I don't usually get to build kits because one has to buy all the parts at once instead of one-at-a-time over

a six-month period, and there aren't that many to choose from anyway. But I am an electrical engineer (microwaves and RF) by profession, and I really appreciate the care and thoughtfulness that went into this design. I also used to be theLab Kit Committee Chairman (how's that for pretentiousness?) at Clemson University; we found out what parts were required for the EE labs, bought them, put them into ziplock bags, and sold them to the students every semester. Sounds a lot like what went into the distribution of the Norcal 40. So I can understand and appreciate the effort required in that aspect. I think it is a great job and a great product.

Todd, KB0HQU

NorCal 40 Full Band Modification

by Terry Young, KC6SOC
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San Jose, CA 93420

On receipt of my NorCal 40, I was very excited about the prospects of assembling something, a transceiver, that really worked. Like every other project I've taken on, I could not leave the thing stock, and felt the need to do a little customizing to make it my own.

My goal was to get the rig to cover all of the CW portion of 40M from 7.000 to 7.150. After consultation with my friend Bob,W6CYX, and a bit of experimentation, I was able to achieve the goal. If you follow the directions below I'm sure you will be able to duplicate my results.

1. Prepare the NorCal 40 for operation in the 7.100-7.1500 portion of the band. Only 59 turns on L9, and change C49 from 39 pF to 43 pF silver mica. the change to 43 pF will expand the tuning range of R17 to about 48 KHz. You could probably use another pF to gain 50+ KHz. if you wish

2. A trip to the junk box (surplus store) for some parts. I had decided to incorporate a 3 position slide switch into the circuit to allow shunting trim caps across C50 & L9. The switch I selected was a Switchcraft unit, but any suitable switch will do. The trim caps were 8-40 pF units. Total cost for the modification: one switch - $.25, one silver mica capacitor - $.20, two trim caps - $.35 each, making the total $1.15 plus the time to do the mod.

3. The front panel needs to be modified to accept the slide switch. I positioned my slide switch just above the RIT control pot. About 1/2 inch from the top edge of the front panel. I laid out a line parallel to the top edge. Using the control pot hole to establish center, two holes were drilled symmetrically about the center to mount the switch. a slot was then opened up between the center to allow the switch to reach all three positions.

4. The trim caps I selected were mounted directly to the back of the slide switch. The switch was wired so that the extreme right position would have no connection, since this would be the high end of the tuning range, 7.100 and up.

5. To wire the switch assembly to the PCB, I drilled two small (.030") holes. One close to the pads for C49 and C51, and one into the ground plane area just across from the first hole.

6. Tune up was easy. The rig is first tuned to the primary range of 7.100 with the VFO in full CCW position. Next the switch was placed in the center position, and the trim cap is adjusted to give a signal at 7.050 with the VFO full CCW. Finally the last trim cap is adjusted to 7.000. After replacing the covers I found that the range was pulled down about 500 Hz., so watch band edges.

The final tuning range of my rig is 7.000 - 7.044, 7.050 - 7.096, and 7.100 - 7.148. I had fun, and expect you will too.

72, Terry

QRP Plus Rig Review

by Andrew Comas, KF2JH
101 W. 12th
New York, NY 10011

6 months after ordering it, my QRP Plus arrived. A small box (5.5"w x 4"h x 6"d) and a lot heavier than I thought, maybe 4 pounds. The QRP Plus covers CW & SSB 160 meters through 10 meters. 5 Watts out on SSB and 0 - 5 watts on CW. It has a SCAF digital audio filter covering 100hz to 2400hz in 100hz steps. 20 memories, split and rit operation, and full break-in QSK. It also has a 20dB attenuator, a separate receiver antenna input andpower/S meter. It claims .14 Amp (140 ma) power draw on receive and 1 Amp on transmit at 12 V and an automatic turn-off at 11V and below. I measured .13 Amp (130ma) on receive with 50% volume, 147ma on 100% volume. Transmit drew 1.15 Amps normal and 1.51 Amps on >3 SWR. I haven't tried the 11V auto-off feature, but this would be great for not killing off gel-cels.

The unit is well made. A heavy 1/8" aluminum box holds 5 pc boards, 4 boards stacked on top of each other, separated by plastic-covered aluminum shields. The one other board holds the LCD and switches. Attached to the top cover is a large 3.5" speaker. The wiring is well laid out. The PC boards are connected with a detachable ribbon cable. I believe Bruce Franklin of Index Laboratories makes medical equipment and he applied those high standards to this little rig. Large switches, buttons and knobs make it a pleasure to operate. The display is easy to read, nice large .5" numbers on a .75" display. The fuse is mounted on the back in a standard fuse holder.

The heart of this rig is an Intel 80C39 microcomputer chip. The chip controls the synthesizer (frequency control), display, filters, RIT, split frequency operation, iambic keyer, sidetone, and memories. I spent some time talking with Bruce about his selection of this chip. (My first job out of college was using these microcomputer chips to build embedded systems). I asked him why he used the 8039 instead of the 8051 (a slightly newer and more functional chip). He said that the 8051 was more RF sensitive. Well I have seen RF reset 8051s many times myself and spent plenty a night trying to prevent just that. He has put plenty of research into this rig. Another example is the easy-to-access, standard lithium battery (for memory backup), as well as recessed pots to set CW power, sidetone and mic-gain. He also includes a nice large tuning dial with a finger point for easy tuning.

Having a nice tuning dial is very important, especially since all your selections are done by it. You press a FAST, MEMORY, or BANDWIDTH button (or combination to store into memory or set keyer speed) and then turn the main tuning dial to select. In frequency mode one full turn is 4Khz, in fast frequency mode one full turn is about 60Khz. You cover all the BANDWIDTH filters in a half turn, all 20 memories in 3 1/2 turns.

The head phone jack is set for walkman type stereo headphones (don't try mono headphones; they won't work unless you plug them in half- way). The volume output for the headphones is more than adequate. I never get beyond 3/4.

The receiver really shines. I could hear a lot more then I could ever hope to work and the SCAF filter is remarkable. You press the BANDWIDTH button and the display shows you the SCAF filter frequency in Khz. At 2.0 Khz, SSB is really clear, at .1 Khz it's a CW pile-up solver (or so says Bruce). The filters work very smoothly.

Other nice features are:

*There are three recessed pots on the back which set:

Mic Gain
CW output power 0 - 5 watts continuous

Sidetone volume (not frequency)

*The MEMory button toggles between the frequency in memory and the working frequency. A nice way to monitor a net or sked.

*The iambic keyer is not ready yet, but will be a free update when it is. The box is predrilled and labeled for the plug. So all that's needed is to upgrade the EPROM (the key is simulated in software like the CMOS Super Keyer II is) and the jack. The keyer speed is set via the main tuning knob and a button press.

As with everything I have my complaints. The antenna connect is via a standard BNC instead of an SO-259 connector. The FAST tuning button moved at 60Khz per tuning dial turn. There needs to be a 1Mhz rate for quickly tuning bands. Of course this is only a pain until you set memories and use them to set bands. (The rig has some preset band frequencies which you can re-load into memory). I would have added a light for the LCD, but Bruce decided to save the 20-30ma and not add one (I asked him about this). I built my own mic from the Radio Shack speaker mic, but I couldn't get the mic gain to give more than 1 Watt out on SSB. Bruce said people were having mixed results with building their own. Index Labs will be selling one as an option.

Other observations: As we see more and more things controlled by computers, functionality won't be our complaints, software bugs will be. And I hit one. When in RIT mode, pressing REVerse is suppose to give you the transmit frequency. It doesn't. It sets the receive and transmit frequencies to the RIT frequency. Nothing major and Bruce promises to fix it with the iambic keyer upgrade. Also the display frequency on my rig has a tendency to drift down 100hz after the first transmit. This is solved by switching into SPLIT mode. The SPLIT mode locks the frequency in and disables the tuning knob (and yes this means the BANDWIDTH control is locked out too, another software bug to be fixed). But on the upside, a software controlled rig allows for more functionality. Bruce is talking about letting the user set the QSK break-in time, paddle reverse all of which can be accomplished via software. The rig does not reduce power on high SWR since the transmit components are rated at much higher powerlevels than 5W, but may produce spurious signals.

Overall this is a fabulous rig for the money ($595). It was built by a man who loves QRP for the QRP lover and it shows. The address for the QRP Plus HF Amateur Radio Transceiver (it's not a kit) is:

Index Laboratories
9318 Randall Dr. NW
Gig Harbor, WA 98332
206-851-5725

72, Andrew, KF2JH

A 30 Meter VXO Transmitter

by Roy Gregson, W6EMT
13848 S.E. 10th St.
Belleview, WA 98005

With the changing sunspot cycles, the activity on the higher hf bands has just about disappeared, especially in the evening hours when I get a chance to operate.

I am a member of the Northwest QRP Club. We meet on Monday evenings at 0200 UTC during the summer months, and 0300 UTC for the winter season, on 10.123 MHz. We have checkins from the east to west coast, and sometimes Chris, HC1CK, checks in from Ecuador. 30 meters is sometimes open to Europe and VK, JA, UA, etc., all at the same time. I have been able to work into these areas with QRP, which amazes me. Admittedly, there are times

when the band is dead or noisy just like the other bands.

I was looking for a simple QRP rig, something that I could put together from my "junk box". I had seen an article from a QRP magazine by Ha-Jo Brandt, DJ1ZB, that used a cheap computer crystal for a VXO in the 30 meter band that looked promising. With a little extra circuitry and a power MOSFET, the result is a simple rig with no bad habits that is stable, has good keying quality and covers the best portion of the 30 meter band. To me the best part is that I made the thing myself You can easily duplicate this rig using ugly construction, or vector board. A kit with a screened PCB is available by mail order (see notes). This is an unusual transmitter design in that it's not only crystal controlled, but the VXO circuit gives more than 35 KHz frequency shift, most of the 30 meter band.

The unique features are.....

* Crystal control
* Covers 10.100 to 10.135 MHz
* 3.0 to 3.5 watts output
* Inexpensive power MOSFET PA
* Oscillator circuitry uses IC for simplicity
* Tuned circuits uses IF cans
* Simple, easy adjustments
* Excellent keying quality
* Provision for companion receiver muting and antenna switching
* A spot switch for finding where you are

I found that the computer crystal made a very stable VXO oscillator circuit. The need for matched transistors in the frequency doubler circuit led to the choice of the IC transistor array. And as it turned out, the transmitter is fairly compact without crowding. The choice of the 10.7 MHz IF's for the tuned circuits was for simplicity and ease of duplication.

The PA uses an IRF510 power MOSFET. It is inexpensive, and easier to use than some of the bipolar power transistors I have used in the past. It seems to be immune to SWR mismatches, antenna shorts and opens, etc. It puts out plenty of power and doesn't have a mind of its own.

The keying is clean and shaped for the best sound on the receiving end. +12 VDC keyed output is provided for the controlof a relay, keying a sidetone, muting a companion receiver, etc. The spot switch is necessary to put the transmitter on the received station frequency. This has a decided advantage over a QRP transceiver when a DX station is listening higher in frequency. With a separate receiver, you have wide range RIT.

Tuneup: It is important that a proper heatsink be provided for the PA transistor. A 2" x 2" aluminum square would be fine. But remember that the center drain lead and the mounting tab are internally connected and are at a 12VDC and RF potential.

Connect a voltmeter to TP2 and ground. Temporarily connect TP1 to ground. Apply 12V, key the transmitter, and adjust R14 for 4.5 volts on the voltmeter. This sets the proper bias for the IRF510. Disconnect the voltmeter and ground connection to TP1. connect a 50 ohm dummy load to the transmitter output. Key the transmitter and tune T2 & T3 for maximum output.

It may be necessary to adjust L6 and L7 by squeezing together or spreading apart the turns to obtain 3 to 3.5 watts into a 50 ohm load. Assuming you have interconnected the antenna circuit to a receiver, tune in a station and peak C23 for maximum volume. This completes the transmitter tuneup.

Operation is simple. It's just like the old days of separate transmitters and receivers. Just tune in the station you want to call, press the spot switch and tune the transmitter to the same ton (high side, right!). You will hear your transmitter in the receiver for a side tone.

Theory of Operation: The unusual method of pulling the crystal frequency came to me

through an article by Ha-Jo Brandt, DJ1ZB, in the July 1993 issue of QRP Quarterly. This was a reprint from Sprat #70. Ha-Jo had found that a single inductor, such as 150 uH for the total inductance as in this rig would not work. But several smaller inductors such as 18, 33 and 100 uH worked great. I had found that the inductors must be in series with the smallest closest to the crystal. The tuning range is from about 10.080 to 10.135 MHz. The small molded inductors of a 1/4 to 1/2 watt resistor size are found to be the best.

The frequency doubler is from the Amateur Handbook. The need for matched transistors led to the choice of a CA3086 transistor array because of it's matched transistor pair. I used two of the other transistors for the oscillator and buffer. In trying to use the remaining transistor as a driver, heating caused a problem with stability. A 2N3053 was a better choice, and it runs cool.

For the PA, a bipolar transistor would have worked, but the easy availability of the IRF510 MOSFET from Radio Shack was my choice. It seems to immune to high SWR, antenna shorts, opens, etc. It loafs along at 3 to 3.5 watts output.

The keying circuit is straight forward and the values chosen give the ideal keying envelope as described in the "Handbook". There is +12V or Ground keyed outputs for antenna switching,sidetone monitor, muting, etc.

The circuit comprised of D2 - D5, L8 and C23 is for a receiver antenna. The diodes protect the receiver during transmit. During receive, C23 and L8 form a low Q series resonant tuned circuit. This circuit in conjunction with a FET muting circuit designed by W7EL allows hearing between keyed characters, which I believe is called QSK.....

I hope you have as much fun with this rig as I have and if you hear me on 30 meters, give me a call.....72, Roy, W6EMT/QRP

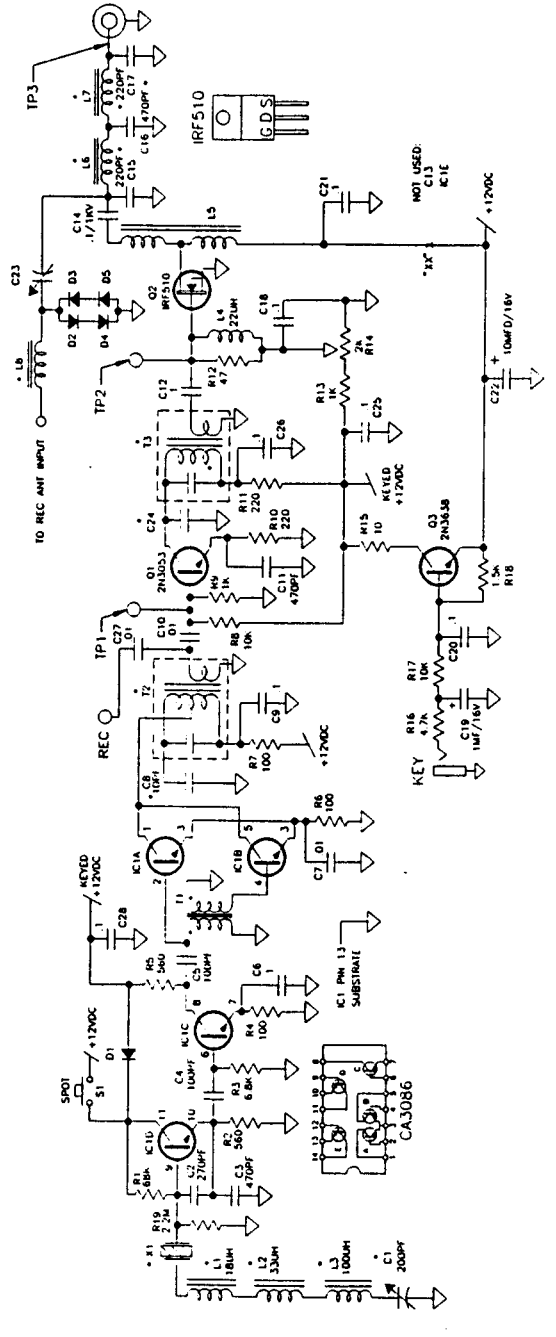
Notes: A parts kit with screened PCB is available from Dan's Small Parts & Kits, 1935 So. 3rd W. #1, Missoula, MT. 59501. Phone/Fax 1-406-543-2872. Price: $29.95 plus $3.75 shipping. [Editors note: I have seen the manual for this kit, and it is as good as the one for the NorCal 40. Roy has done an excellent job and I feel that anyone can build this kit. The price for the kit is very reasonable, and if you have never built any thing before, here is your chance to get your feet wet. Stay tuned, because Roy has promised a transceiver article for the near future, hopefully in the June issue. I also think that it would be very easy to design a Superhet receiver to go with this transmitter. How about some of you designing a matching receiver on a pcboard that will go with this transmitter?]

Back Issues of QRPp: I have had many requests for back issues of QRPp and have decided to make them available. There is good news and bad news. The good news is that they are available, the bad news is that they are expensive. I have taken the original masters to a printer and he is binding them in to a 1 volume book using the plastic comb binders. There is a heavy duty card stock front and back cover, and the book has 140 pages. The reason for the high cost is that the press run is so small, plus the cost of binding and putting them together. The cost is $10 postage paid (first class) to anywhere in the US and Canada. Foreign orders are $13. Please don't ask for individual issues as they are not available. Send your check or money order made out to Doug Hendricks. The address is:

Doug Hendricks
862 Frank Ave.
Dos Palos, CA 93620

I hope that this helps those who missed the first few issues and want to fill in their collection.
72, Doug, KI6DS

W6EMT 30 Meter VXO Transmitter



The K6LV Homebrew Paddles

by Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620

Several years ago I moved from Kansas to California due to a job change. Before I moved, I had loaned a keyer and a set of Hamkey paddles to a "friend", notice the quotes. When I moved, I asked him if he was through with them, and he said that he would like to keep them for a while. Being a trusting type of guy, I said that it would be ok if he would agree to send them to me when he was finished. Three years later, I decided that I was going to finally learn how to run the keyer and the set of paddles, so I called this "friend" and asked him to please return my keyer and paddles. His reply was that he had lost the paddles, and if I would send him $10, he would send my keyer back to me. Wow, was I upset, but to no avail. I glumly put $10 in an envelope and decided to cut my losses and realized that education costs, one way or another.

I was in a group of guys who met every night on 3878, which included KI6PR, KK6IU, N6RVV, KI6UP, and K6LV. We talked about everything, and usually had a good laugh every night. I got on one night and told my sad story about how terrible it was that I had loaned a keyer and paddle to a friend, and how shabbily he had treated me. I was moaning and groaning about having to buy another set of paddles. Carl, K6LV, came on and really let me have it. He told me that the thing that was wrong with the new hams (he had been licensed since 1932), was that they never built anything. All of their equipment was purchased. I asked him if he was talking about building a set of paddles, and he replied that it was easy to build a set. In fact, he could tell me how to do it right over the air. And, he proceeded to do so. This article is an attempt to show how to make a set of homebrew paddles for virtually nothing but your time.

I built my original set of paddles using nothing but a hand drill, hacksaw, table saw, and common hand tools. I have had it for six or seven years, and it still works fine. You will need a hack saw blade, a piece of hard wood, oak or maple works fine, about 4" of 1/2" round brass stock, 2 red and 1 black terminals for hooking up the keyer wire, a piece of plastic or acrylic that is 1/4" thick by 1 1/4" x 1 1/4", six 1" x 6-32 brass screws, #22 hookup wire, and a piece of 1/2" x 3" x 6" steel plate. You can get one at any welding or machine shop. They will probably have a scrap laying around that they will give you for the asking.

The paddles are built by first selecting the piece of hardwood and cutting it to 3" x 6", making sure to make square cuts. Drill three 1/8" holes in for the terminals, marked A & B on Fig. 1. These holes are 1/2" from the end and 3/4" from the edge and each other on center. After you drill the 1/8" holes all the way through, counter sink the holes with a bit large enough to insure that the screw head does not contact the steel base. Next, drill 1/8" holes at position C which will hold the dot and dash terminals. These holes are 4" from the same end as the terminals, and 3/4" from the edge. Again, counter sink sothat the head of the screw will not touch the base. The next step is to drill the hole at position D, which is the fulcrum of the paddle arm. It is drilled 1 3/4" from the terminal end and on the midline of the 3" x 6" board. Be sure to counter sink. When you are finished, you will need to run some wires from points C to the red terminals, A, and from D to B. I used an Xacto knife to cut a path. You could use a small pocket knife or even a router. The important thing is to provide clearance for the wires.

Lay the piece of wood aside and prepare to do some metal working. Don't be scared, because it is not hard. Take a hack saw and cut a piece of the 1/2" round stock that is 1 and

1/16" long. Then, use a file to square it up by chucking it in your electric drll and using it as a homebrew lathe to turn the brass while you use the file to square up the ends. Repeat this for the other two pieces (or if you have a friend that has a lathe, have him do it for you, or make friends with someone who has a lathe). The three pieces will need to be approximately 1" long when you finish. Take two of them and find the center of one end and use a center punch to mark the center. Then using a drill press, drill out the hole so that it will take a 6-32 tap. Be sure to drill the hole about 5/8" deep. Then, lay the piece on its side and drill a hole through the side on a line through the center. The distance for this hole will depend on thehole in the end of your hacksaw blade. Measure to the center of the hole from the edge of the blade and use this measurement to drill the hole for the transverse contact screw. Again, tap for 6-32 threads. (Hint: use a piece of wood that has a V cut out of it to hold the brass. Line up the drill bit with the vertex of the v. You will need to use a center punch to mark the start of the drill bit. Begin with a small bit and once you have drilled through, enlarge to the proper size.

Take the remaining piece of brass and drill and tap the hole in the bottom. Then, take the hacksaw blade (in a hacksaw ofcourse) and cut a slot the exact width of the blade you are going to use in the top of the brass. See Detail B. Then place the piece of brass in your V block so that the slot is parallel to the bench and the hole will be drilled perpendicular to it. Measure the distance to the center of the hole on one end of the hacksaw blade. Use this distance as a center point for your hole from the end. When you finish, tap only one side, and enlarge the other to be a smooth slip fit for the 6-32 screw.

Next, take the hack saw blade and place it in a vise where you want it to break. Use a pair of pliers and give it a sharp tug and bend it back and forth. It will break quite easily. My hacksaw blade is 5 1/2" long.

You are now ready to sand and varnish your piece of wood. Do so and set it aside. Next, you will cut a slot in the edge of the plastic to allow it to be glued to the hacksaw blade. If you don't want to use a slotted piece, you could glue two poker chips, one to each side. Or, use a nice piece of hardwood. Whatever, it is your paddle.

The last process is to assemble and wire your paddles. Put the terminal posts in, and then the brass posts for the dit and dah terminals and the fulcrum of the blade. Connect point A to C and point B to D. Then, tighten the screws. Mount the wood to the steel, and you are ready for final assembly. Put the screws in the 3 brass posts. Adjust the clearance on the dit and dahposts after you have mounted the blade. I put my blade teeth side down, although you may want to grind them off. I elected to leave the teeth on as it always elicits comments of "Hey, he used a hacksaw blade. Why didn't I think of that?" Your keyer is hooked to the terminal posts, and you are in business. Have fun. I would like to thank K6LV. Carl died 3 years ago, and I miss him. It is one of the regrets of my life that I never met Carl in person. He only lived about 70 miles from me. It was one of those things that I was always going to do but never took the time. We were friends on the air, and talked almost every night for over 4 years. He was a true gentleman, and he was the one to inspire me to get back in to building, hence QRP. Carl, I hope you approve of this article, it is dedicated to your memory.

72, Doug, KI6DS

Wanted: I would like to purchase a copy of "The Joy of QRP" by Adrian Weiss. If you have a copy that you would be willing to sell, please send a description of the condition and the asking price to: Doug Hendricks, KI6DS, 862 Frank Ave., Dos Palos, CA. 93620 or to my packet address: KI6DS @ K6RAU.#CENCA.CA.USA.NA or via internet dh@csustan.edu

The K6LV Paddle

TIDBITS

by Mark Cronenwett, KA7ULD
1029 Duncan Ave.
Sunnyvale, Ca 94089

Have any ideas that you would like to share with others? Well here is the place to do just that. Send your ideas to me at the address above, by packet at KA7ULD @ N0ARY.#NOCAL.CA.USA.NA, or by E-mail to mcronenw@pyramid.com via the Internet.

<> BACKPACKING TUNER OR TUNER FOR BACKPACKING

From: Clark Savage Turner WA3JPG

Ahhh, good topic. Tuners for backpacking. I always taken my Ten Tec AC-5 tuner along with my Argonaut and a lantern battery / mike / key backpacking. A bit bulky and heavy, but what fun.

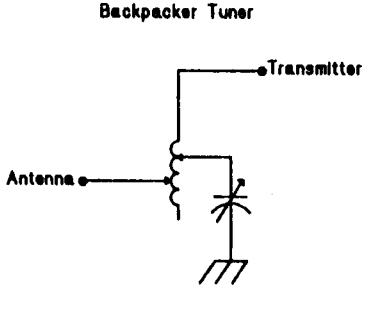
There are ways to build and use really tiny tuners for low power. That is the key - how much power are you going to put through the thing? You might also think about no tuner (lightest alternative) if you think you can get an antenna up that will be somewhere in the ballpark of a reasonable SWR.

BUT, the AC-5 provided a model for a tiny QRP tuner I use at times.... a QRP antenna tuner from junk box parts from my sparse junk box. It CAN BE very simple. I use a little 10-365 pf variable cap and a coil, and an alligator clip lead cut in half (two single alligators!), an antenna connector and piece of coax to the xmtr. It is so simple and works very nicely. It is designed for unbalanced lines (although it is not hard to make one for balanced OR unbalanced antennas with a two ganged variable cap from an old receiver or tuner somewhere). An swr meter is necessary, too....

Alligator clips can be connected to the coil at various taps. The coil I use is #18 wire wound on a pill bottle, with loops in the wire stripped and raised for easy connection by the clips. I use about 25 turns with 5 equally spaced taps. More would be a bit better.

I have also made a mini- Z match tuner that is sort of fun, but more complex than this. Good luck, and write me directly if you would like copies of schematics or stuff I have stashed in my little library about these things - mostly from the QRP Quarterly.

72,
Clark, WA3JPG



<>FENDER WASHERS REVISITED

From: Doug Hendricks, KI6DS

I have to second Chuck Adam's evaluation of the fender washer dial that was posted by Ed Pacyna. I went to the local mom and pop hardware store and bought five 3/8" x 1 1/2" fender washers for 90 cents. That works out to 18 cents each, so Chuck got a better deal. I then went to an electric motor repair shop and bought 3/8" grommets with a 1/4" hole for a nickel each. My dials cost me 23 cents each, but they are not painted yet. That comes tomorrow. Ed you are right. The fender washer method is mucheasier, and is a whole lot cheaper than the plastic dials. The grommets are less than 1/4" thick Chuck, so they should fit your dial with no problem. Have a good week and make a resolution to contribute something to Tidbits.

CUL, 72, Doug

<>MORE MODS FOR YOUR NORCAL 40

From: Robert Warmke, W6CYX

As constructed, the NorCal 40 has a tuning range of 39 khz. By changing the value of C49, you can change this range to suit your needs. In my case, I wanted to cover the Extra band as well as into the normal QRP calling frequencies. By changing C49 to a value of 43pf, the tuning range will change to approximately 47 khz. It is not recommended that the range not be increased much more due to the tuning becoming too sharp.

Good luck.

Bob, W6CYX

<>NC40 TRANSMIT KEYING SHAPE

From: Wayne Burdick, N6KR

To improve the NC40's transmit keying, add an 0.22uF cap from the anode of D5 to ground. This will slow the fall time and reduce key clicks. If you plan to use really fast CW, you might want to use 0.1uF or 0.047uF instead to keep the dots from getting stretched.

72, Wayne

<>PAINTING SCREWS TO MATCH YOUR CABINET

From: Doug Hendricks, KI6DS

Can't seem to hold on to that screw to paint it. Well just put the screw into a piece of cardboard and paint away. Remove when dry.

72, Doug

<>MORE ERASER CASE JEWELING

From: Jim Cates, WA6GER

Jim Cates, WA6GER, has once again come out with another wayto make your cases look much better. Some of the wording is mine, some is classic Jim, but I am sure you will get the message.

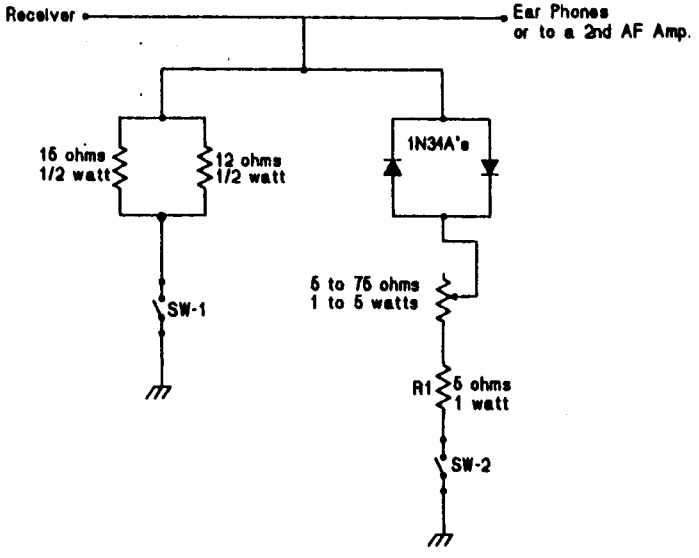
Since submitting the tidbit about how to do the "jeweling" (I'm told that gunsmiths call it jeweling, while I call it "engine turning"). Anyway, since then, I have discovered that pencil erasers apparently come in different degrees of hardness (abrasiveness?). Try to get the hard ones; I used some soft ones and they disintegrated too rapidly. It took two erasers to do one front panel on the NC-40. Way too much for my taste. I also noticed that the swirls were not as defined as I had done in the past. You probably will have to go to an arts and crafts store to find them, but do get the harder ones.

72,Jim

<>TAKE A "CLOSER" LOOK AT YOUR SOLDERING
From Jim Cates, WA6GER

Helping others with the building of their kits, I am finding solder splashes so fine they defy spotting without magnification. (I had to use a jeweler's loupe to spot one of mine.) I am now using an old 24 x glass, and WOW do those traces look far apart. So don't hesitate to acknowledge that Father Time does change one's vision. If you are having some trouble in getting your NC-40 to work, take much closer look at your work. <Mark's note: I fully expect Jim to report back on his use of the elecron micrscope for solder checking.>
72, Jim

<>EAR SAVER CIRCUIT
From: Jim Beaudry, N6JUG



If your ear phone has a tinny sound you don't like, has too many highs, makes QSB painful, or is generally making your ear for CW less than enjoyable, then this circuit may be for you. If you also using a shortwave receiver with an earphone, or even todays 32 ohm head phones, your audio might also be somewhere between crummy and lousy!! Putting a 5 to 7 ohm load across the amplifier or earphone frequently will work a miracle of minor proportions. It also "muffles" QRN as if a noise filter had been added. It in fact prevents the AF amp from working on the QRN portion of the pulse static by as much as 30 db. Two half wattcarbon resistors take up very little space and work well. The slightly lowered load resistance of the network makes the AF amp work slightly harder, but generally will not blow out the amplifier.

For the real perfectionist, and for those who want to clean up their QRP receiving, and also wish to "Extend their maximum ear life" (for CW will out into the 90's and beyond)

the "Ear Saver" is aptly named. The circuit can also help with those bad QRN days when a QRO station might actually be the answer for that contact. I have found the ear saver to help with a great many types of QRN. Results from this circuit will vary with different audio amplifiers.

Now for the circuit. SW-1 is used when high pitch CW note is poor. SW-2 is used when the QRN is especially bad. You can vary the setting of the potentiometer to suit the conditions. The pot is of the wire-wound variety. The resistor marked R1 is put in as 5 ohms, but you may find that 3 or 4 ohms works best. Anything less than 3 ohms is not recommended as you may blow out the audio amplifier.

I hope you find this circuit as helpful as I did.

72,
Jim, N6JUG

RadioKit Notes

by Chuck Adams, K5FO
830 Waite Dr., Copper Canyon
Lewisville, TX 75067

After helping one individual build one of these critters over the phone, I got another call this week from another ham in the mid-cities area of Dallas-Ft Worth about another one.

Background: This ham had been QRT for 20+ years, so in June got active again by buying the MFJ-9020 at HamCom in this area. He is having a blast using this little setup with a simple dipole.

He bought the RadioKit QRP-30 kit. Since he was having some difficulty, I drove 40 miles over to his place to take a look at it. I wound up spending about 3 hours working on odds and ends. His wiring job was pretty good and I found only one solder bridge. The spacing between some of the paths on the PC board were very tight. Here are just some of my notes on the kit:

1. Very small board compared to other K1BQT kits and NN1G rig.
2. Not silk screened, not solder masked. Just a single sided board.
3. I'd personally grade the parts quality as a B.
4. I'd grade the board as a D. We had to drill four of the holes that were missing. For a beginner with minimum tools, this would really cause problems.
5. About a half-dozen components were missing.
6. I don't like the relay for QSK. I think the solid state switching that everyone else uses is vastly superior. And cheaper too.
7. We didn't get to installation in case, as board was unfinished.
8. I think that everyone has to write a better set of instructions on the art of winding toroids or refer the builder to the ARRL handbook.
9. Schematic is wrong in some places, as I found out by tracing paths on board and components. I knew from the schematic, upon close examination, that there was no way this puppy was going to work if the board was really setup per the schematic. I have the K1BQT schematic, NN1G, and some of the others memorized.
10. Air variable capacitor was shorted. I believe the plates are just too close and would think that more than 30% of them would be shorted from the factory. Also, this will tend to cause thermal drift problems for the vfo.

Overall, I'd spend my money on something else for a xcvr kit. And I have.

72, Chuck, K5FO

RadioKit Review

by Ed Pacyna, W1AAZ
72 Pitman Rd.
Marblehead, MA 01945

I have built nearly a dozen of these transceivers, so here is my 2 cents. First of all, I can not comment on the parts quality, as I furnish my own parts (except for the air variable which I do buy from RadioKit). I buy the boards direct from FAR Circuits, the same source that RadioKit gets them. There are two versions, one from HR January 89 called NE602 QRP CW 20M transceiver sells for $8, and the other from CQ September 90 called QRP 15 transceiver and sells for $12. The earlier version had two COHN XTAL filters (one on each side of the IF amp. to develop 8 poles of selectivity and reduce board band noise) and a doublely tuned band pass filter in front of the RX mixer. The later has only a single tuned circuit in front of the mixer, a 4 pole Chebyshev XTAL filter and adds RIT. Both versions include 2 stages of active AF filtering after the product detector, AGC and can easily be put on any band by changing the VFO and XTAL filter frequencies.

Regarding the PCB boards:

They are not silk screened with the component shape and part designation. Actually, I prefer this as it makes for a nicer looking finished product. Most builders should have no problem just following the parts placement diagram. However, a paint by the numbers approach might make it easier for some. The boards are very well laid out with a lot of nice ground plane (pads are lined up and logical), however the later version does come with a couple missing drilled pad holes. None of the more than 50 PCB's I have purchased have come with a solder mask (including the NN1G board set). The usually good solder plate by FAR takes solder very nicely. It is always good practice to lightly clean any PCB with Comet before beginning. The board is very compact 4"W x 3"D (25% smaller than the NN1G board set and contains more circuitry e.g. RIT, active filter, AGC). With a higher parts density, soldering does take a little more skill. Also, use only a low wattage iron with a point tip and a good quality thin solder. Those over 40 like myself, might be more comfortable with the magnifying eye glasses as sold in drug stores. I have been able to unsolder and remove parts over and over with a little care (I make lots of modifications along the way).

Regarding the schematic:

I recall that both the schematic and parts placement diagrams being correct. The problem is that they are sightly different. The difference is fairly minor and as long as you didn't get your license by memorizing the answers, should not be to difficult to resolve. I recall having to install one part on the solder side of the board. Pin 4 on the NE602 product detector needs to have a bypass capacitor on it (since it is unused and has RF floating on it). This is shown on both diagrams.

Regarding the tuning capacitor:

This is a very nice capacitor and I sometimes buy them from RadioKit. It has a silky smooth built in 7:1 reduction drive and is 5 - 55pF. The frequency vs shaft tuning is exceptionally linear. The plate spacing is perhaps a bit wider than the broadcast band variables of yesterday. The stability is excellent. If it got shipped with the plates unmeshed or dropped on the floor, a rotor plate could bend.

Possible modifications:

The circuit works well as is. The RIT version is nice because the station your working

made be using the opposite sideband, or drift. The T/R switching is semi-break-in and as MFJ states in their ads "silky smooth". By the way, this circuit is the same as used in the MFJ 90XX. Full QSK is nice if its used (but I find few that do).

I usually run my radios from a 13.8V regulated power source (and believe most others do). The on board 12V regulator is unnecessary and reduces overall RX gain. It would also be a good idea to install some reverse polarity protection to protect your labor of love. A power diode in series with the power supply feed is simple (reduces voltage by about .7V) or install a series fuse in the line with a shunt power diode on the radio side of the fuse (cathode to fuse, anode to ground).

The AGC is a mixed blessing. It is audio derived and pops on strong signals. I don't like any AGC on CW. First of all, if a strong signal is nearby, it reduces the RX gain making it more difficult to receive the weak signal and the usual pumping action is unpleasant. In a similar fashion, it reduces the opposite sideband suppression that your XTAL filter provides). On the other hand it reduces the signals dumped into the product detector. This is a weakness in the NN1G design. The NE602 is a wonderful device provided it's used correctly. Due to it's gain, the input intercept is -15dBM or so. If you give it more signal than it's meant to handle, you get a lot of IMD product. By the way, one nice feature of this design is that the VFO is buffered and has an adjustable pot allowing you to control the TX mixer drive and thereby reduce IMD products. On the receive side, I control the IF gain with a front panel pot on RX (use AGC for TX monitoring only). I do not install the volume control (it's kind of hokeily installed on the AF power amp. anyway). You will have a much better receiver with this approach.

I always use IC sockets when I build. Use only low profile machined sockets (the ones that have round holes for the IC pins). There has recently been some discussion of NE602's oscillating (e.g. NN1G Marc II) when sockets are used. Although NE602's do have a lot of gain up into VHF, oscillations are usually due to poor circuit layout or improper decoupling. As shown in the data sheet, the NE602 supply voltage should be decoupled with a 5uH choke and bypassed at all frequencies with multiple bypass capacitors (e.g. .1uF, .001uF etc.). I usually use a 100 ohm resistor with a ferrite bead for the choke. Also since maximum supply voltage is 8 volts and the best noise figure is at 6 volts, I use 6 volts (78L06 regulators). Theadvantage of sockets is that it makes the radio very easy to debug and or repair. If you have a problem, remove the IC so it doesn't load the circuit and using a multimeter make measurements to easily find solder bridges, components installed incorrectly etc.. I always build my radios backwards. For example in a RX start at the output and build toward the input (reverse in a TX). Just build the audio output stage and test it before you go on. You'll never have to deal with more than a few parts or 1 error at a time. Its easy to test stage by stage without a lot of fancy equipment too. After you build the audio amp., put your finger on the input. You should hear a buzz. Next build the product detector. You will hear a hiss if all is well (or you actually now have a DC receiver and so connect an antenna and you might hear some signals as you tune the BFO cap.). Next build the IF amp. and the signals you heard before should be louder etc..

The other two changes I usually make to this radio are to change the VFO circuit to a series tuned config. (for lower noise) and stagger tune the AF active filter. With a little thought, the series circuit will fit on the same PCB pads provided. Most active filters simply repeat the same stages N times (e.g. same Q, frequency etc.). What you get is a very sharp needle nose response that rings and is not very useful. With stagger tuning, the Q, center frequency and gain is changed to get a bandpass response instead. Different bandpass shapes can be synthesized (e.g. Butterworth, Chebyshev etc.) with superior skirts. The circuit is exactly the same, only the R,C values change. I also build the filters with a little more gain so the signal into the product detector can be kept low. Some times instead of the in out

switch, I use a simple audio fader circuit like in the TenTec Century to simulate variable bandwidth.

Sorry for getting so carried away here guys. My main point is that these are very nice transceivers, and should not present difficultly to many home brewers. However, they are not suitable for novice level.

73

Ed W1AAZ

NN1G Notes

by Ed Pacyna, W1AAZ
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Marblehead, MA 01945

After sending yesterdays mail Re: RadioKit, I had a NN1G Mark II board set that I began building up. Well, now I see why the why the instructions tell you not to use sockets on the NE602's. From a RF design view, the layout is not very good. The NE602's are decoupled very poorly (if at all). As mentioned previously, put the V+ supply (pin 8) somewhere near a ground plane and install several bypass capacitors, a 100 ohm resistor and ferrite beads near pin 8. In the Mark II a feeble attempt was made to decouple the product detector (from pin 8 there is over a 1/2" of trace before a single MF bypass then almost 3/4" more trace before a 47 ohm decoupling resistor. On the product RX mixer, pin 8 doesn't get decoupled (yes there is about 3/4" of trace and a bypass capacitor at the 78L08 regulator). The BFO circuit has trace running all over the place. Not only could this cause VHF oscillations, but could couple BFO signal back into the IF amp. input (something you don't want in a RX). The input and output trace for the XTAL filter is also much to long (1 1/2" to 2"). This could really set you up for performance problems with filter blow-by and BFO noise.

I'm building the unit for 40M and using difference mixing in the RX, as this will reduce the potential for spurs (10MHz IF, 3Mhz VFO). I have built the filter on the bench using 390pF, 510pF and 640pF capacitors (vs 330/470/560) and measured a 500Hz 6 dB BW with a filter Z of 400 ohms. The resistor on the MC1350 input is now 470 ohms (470 ohms // R of MC1350 = 400 ohms).

There is also a difference between what is shown on the schematic for L2 (low end to ground) and the actual board (tied to +12V). Its part of the rubbering circuit for the BFO and a strange one at that. +V eventually gets AC coupled to ground, but it would have been better to put the inductor in series between Y5 and C2. With my band plan, in order to receive LSB mode I wanted the BFO to be on the high side of the filter anyway, so I won't install L2. To improve filter performance, I grounded all the crystals in the filter to eliminate coupling between the units.

I also see that the design runs the NE602's at 8 volts (ouch). The 8 volts also supplies the VFO. The NE602's are happier and perform better at 6 volts. But since I'm also going to add the QRP15 RIT circuit and need higher voltage to keep the varactor voltage more than the RF tank voltage I'll try go with the 8 volts (ouch). If your VFO doesn't oscillate with the 8 volt supply, get rid of the MPF102 (it's Vp specification is to broad and may not work with a low supply voltage). You can use a 2N5486 or better yet a J310.

73

Ed W1AAZ

[Editor's note: Ed posted this response to the Qrp@Think.COM forum on internet. He is suggesting modifications and improvements to the basic design. His experiences with the

QRP 15 & QRP 20 are from K1BQT's original article that appeared in CQ, not with the kits currently being sold by RadioKit. Doug, KI6DS]

A Curtis Keyer PCB - The Hard Way

by Mac McClurkin, W7JDZ
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Idaho Falls, Id. 83402

When I assembled my NorCal 40 an external keyer built using the Curtis Keyer chip 8044ABM was in my shack. One of the planned uses of the transceiver was mobile. The existing keyer was in a separate box with power leads and interconnecting cables. That was when it was decided to build a keyer into the transceiver. The wiring of the keyer on hand was done on a Radio Shack multipurpose board and was so messy, a pcb was the only way to go.

With the purchase of the first 8044ABM chip from Curtis Electro Devices, they sent along their application notes which contained operational info, a schematic, parts list, and a full size pcb layout. Pcb dry transfers were purchased from Radio Shack, and some etchant and an etch resist pen were on hand.

The pcb layout was copied on a copier, cut out and taped to a piece of single sided board that had been cut to size and cleaned with cleanser. A sharpened nail was used to lightly punch the locations of most of the solder points. Only a couple of locating points were punched for the 20 pin socket and the input/output connections. Just enough punches to align these two areas.

the layout copy is removed and using the layout and the punch marks, the solder points are put on the board using the dry transfers. Use a round ended hard object to rub on the transfers. When all the transfers are complete use the blue backup paper that comes with the transfers and lay it over the board and burnish the transfers down. Now with a straight edge, a resist pen (a Sandford Sharpie Fine Point Permanent Marker works great!) and looking at the pcb layout, join the dry transfer dots. The whole board could be made by using the permanent marker pen to make the dots and then connect them with the pen. Haven't tried the latter but it should work. The dots can be connected free hand if you have a steady hand.

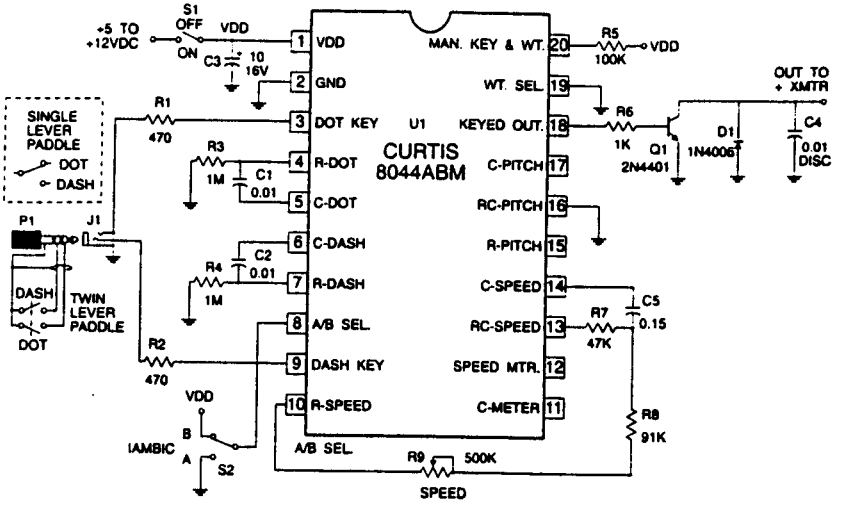
The boards (I've made more than one) were etched in an empty oleo tub with about 1/4 inch of etchant covering the board. Agitation is important to get the job done. Two boards can be etched in this amount of etchant (make a board for a friend), just be patient and agitate, agitate, agitate. the resultant board can be cleaned with steel wool or emery paper.

Drill the solder points and install the electronic components (omit C4 for QRP). Connection to the NorCal is obvious. The power was picked off downstream of the 8.2 volt regulator. The board was mounted on plastic stand offs (plastic straws) in the top front part of the transceiver. The speed control was mounted just above the RIT on/off switch.

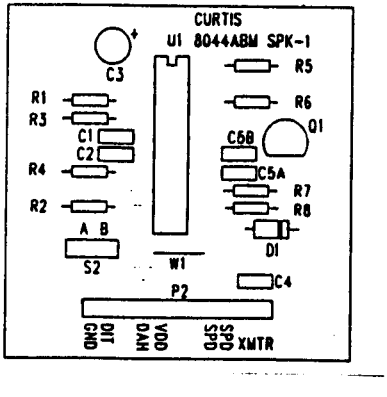
Making a pcb using this method is not easy or a production method, but it can produce a simple one sided board for the Curtis Keyer. The interconnecting lines won't be a perfect width, but the resulting pcb works. If you have an hour to spare, the required material and want your own Curtis Keyer toput inside that great working NorCal, have at it! Good Luck.

Figure 19 shows the minimum number of parts for a very basic keyer. The keyer has no weight control, no sidetone generator and an output circuit capable of driving only a solid state transmitter with a positive voltage keyline. An A/B switch is included however the A/B SEL in could be wired either to Vdd or ground if only A or B iambic (but not both) will be used.

73, Mac



Simplest Possible Keyer Circuit:



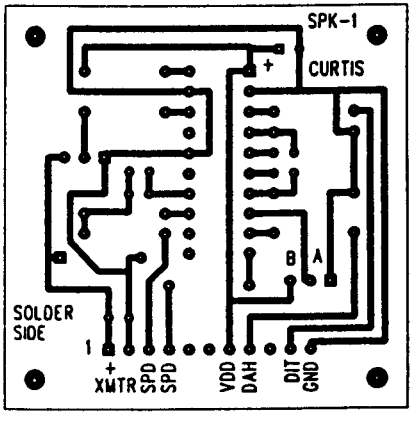


Fig. 20

Fig. 21

Figure 20 is a suggested PCB layout for the Simplest Possible Keyer. Figure 21 shows the copper pattern and can be used to make a single sided PCB for the keyer. Holes should be 0.035" in diameter except for D1 which should be 0.040" in diameter. Four mounting holes for 4-40 screws should be 0.125"

Parts List for Simplest Possible Keyer.

Part	Mouser P/N	Value	Comments
C1, C2, C4	581-UEZ103K1	0.01 uF	
C3	ME208-50V10	10uF/10V	
C5A	581UDZ104K	0.1uF	(1)

C5B	581UDZ473K	0.047uF	
D1	333-1N4006	1A, 600PRV	
J1	16PJ080	paddle jack	
P1	17PP090	paddle plug	
P2	544-CA-S36SP100	11x0.1" header	(2)
Q1	570-2N4401	NPN Transistor	
R1, R2	29SJ250-470	470 ohms, 1/4 watt	
R3, R4	29SJ250-1M	1 megaohm, 1/4 watt	
R5	29SJ250-100K	100K, 1/4 watt	
R6	29SJ250-1K	1K, 1/4 watt	
R7	29SJ250-47K	47K, 1/4 watt	
R8	29SJ250-91K	91K, 1/4 watt	
R9, S1	31CB505	500K Pot with on/off switch	(3)
S2	Clip from P2	3x.01" header	(4)
U1	509-8044ABM	Keyer IC	
W1	jumper	#24 wire	(5)

Miscellaneous:

Jack	16PJ035	RCA type xmtr jack	
Knob	45KN024	0.98" knob with pointer	
Cabinet	537-CR-332	3-3/4"Dx3Wx2-1/8H	(6)

Feet, 4-40 mtg. hardware, nylon spacers, wire, solder, 9V battery

Notes:

(1) Use C5A and C5B in parallel to obtain near the 0.15uF value.

(2) There are cheaper and more appropriate header strips available but Mouser does not stock them. Clip to make 11 pin header for P2 and 3 pin header for S2. Using a header makes a neater job but you may wire directly to the PCB.

(3) This potentiometer is an audio taper unit. Reverse taper units are difficult to find.

(4) Clip three pins from the same strip as P2 is cut from.

(5) Just use a clipping from one of the resistors to make this jumper.

(6) Just a suggestion. Plan your own to make sure it fits.

(7) Build th ePCB in a metal cabinet. Use an RCA type jack for the output to the transmitter. Use shielded cable as short as practicable for the paddle and the transmitter connection. The 8044, 8044B and 8044ABM are carried by Mouser Electronics (tel: 800-346-6873) in the US and Canada. They have numerous warehouses around the United States. They are an excellent source for parts for this keyer.

350 mW 40M CW Transmitter

by Antoine Galindo, AC6G
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Garden Grove, CA 92640

Here is the schematic and plans for a QRPp rig that I have been using the last 3 months or so. I have worked over 100 QSO's and 8 states. Best DX is Illinois. The output is 350 mW. At one time by reducing the value of the coupling capacitor, I lowered the power out to 80 mW and still managed to work stations in a 500 mile radius. The idea came from W1FB's "Design Notebook", page 156. As you can see I made few changes.

To eliminate a backwave, ATU, I used a 74HC00 instead of a 7400. I have some "Lazy" crystals, adding a 8 pF capacitor at U1 2-1 solved the problem.

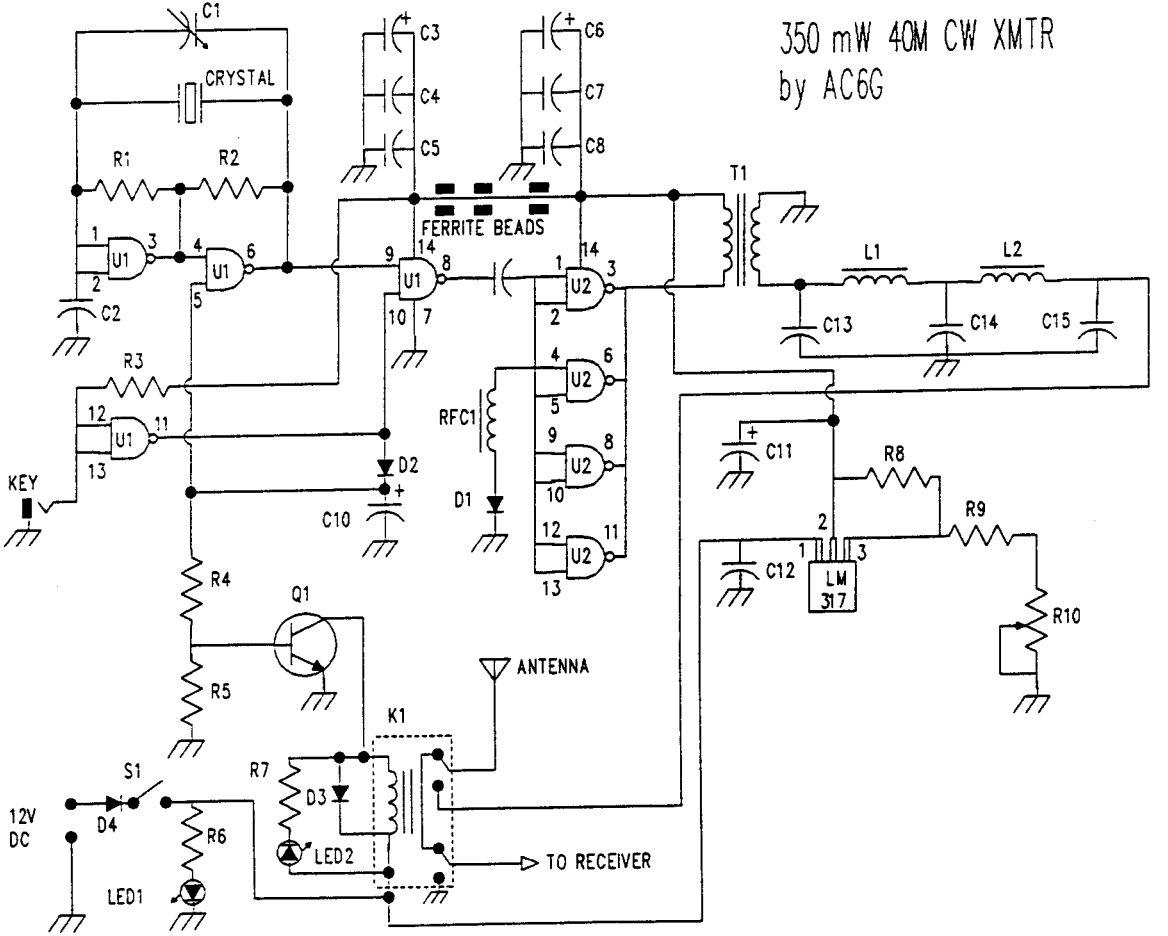
By connecting a 50 pF variable cap across the FT243 crystal, I was able to QSY by approximately 1 KHz. The variable cap must be isolated from chassis. I used a Radio Shack board (RS275-150). Also, I.C. sockets were used along with the wire wrap method. Makes it easier for changes, experimenting, etc. Oh, I almost forgot to mention that I am using a full wave diamond loop antenna with the apex at 36'. This antenna really helps on QRP.

Parts List:

C1	50 pF air variable
C2	8 pF NPO preferred
C3,6	10uF/16V elec.
C4,7,9	.01 uF disc
C5,8	100 pF disc
C10	30 to 47uF/16V elec.
C11	1uF/16V elec.
C12	.1 uF disc
C13,15	470 pF Silver Mica
C14	940 pF Silver Mica
D1-3	1N914
D4	50V/1A Diode
FB	FB-101-43 Amidon
K1	Relay Radio Shack 275-243
L1,2	16 Turns of #26 enamel wire on T30-2
LED1	Green LED
LED2	Red LED
LM317	Radio Shack 276-1778, ECG956 (Bolt to chassis for heatsink)
R1,2,9	470 ohm
R3	4.7K
R4	16K
R5	22K
R6,7	1.5K
R8	270 ohm
R10	2K Pot, adjusted to not exceed 6.0V at Pin 2 of LM317
RFC1	14 turns #28 on FB-43-2401 Amidon
T1	Primary and secondary 4 turns of #28 enamel wire on FB-43-2401 Amidon
U1	74HC00 or 7400
U2	7403 (ECG 7403) Should have a heatsink!

Note: C9 is the capacitor between U1 pin 8 and U2 pin 1. U2 should have a heatsind, I made one by cutting a 1/8" aluminum sheet slightly larger than the IC. I marked pin 1 of the IC with a punch on the aluminum before attaching to the IC with epoxy.

Wanted: Qrper's who like to build. I am offering a group special for the Neophyte Receiver kit and the NN1G Mark II Transceiver Kit (featured in the January Issue of QRP Quarterly). Here is the deal. Order 4 Neophyte kits for $80 plus $3.75 shipping. Order 4 of the NN1G Mark II kits with the tuning capacitor, and the price is $200 + $3.75 shipping. That is a $10 per kit savings. Watch future issues of QRPp for more new kits from Dan's Small Parts & Kits, 1935 S. 3rd W. #1, Missoula, MT 59801, 406-543-2872. Be sure to specify the band that you want your kits on. 72, Danny


350 mW 40M CW XMTR
by AC6G
C1
CRYSTAL
R1
R2
C2
C3
C4
C5
C6
C7
C8
FERRITE BEADS
T1
L1
L2
C13
C14
C15
U1
U2
R3
KEY
D2
C10
RFC1
D1
C11
R8
R9
C12
LM 317
R10
R4
Q1
R5
ANTENNA
K1
S1
12V DC
D4
R6
R7
D3
LED2
LED1
TO RECEIVER

Winter Contesting

by Rusty Smith, KD4GLC
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Louisville,KY 40207

The G-QRP Club Winter Sports was great fun. In casual operation I QSO'd about 20 QRPers, often ragchewing for an hour or more. I also had the thrill of QSOing GB0QRP (Chris Page, usually G4BUE) on 80 meters. I was running 4 watts. I was really excited to get "across the pond" on 80 meters.

I also put in a major effort for the MI-QRP Club CW Contest. I worked 163 stations for 33,972 points. I worked several new QRP states and many new band-states for my longterm goal of nine band WAS QRP, including my first ever QSO's on 160 meters.

The last QSL cards I bought, I purchased before I became interested in QRP. I therefore had to write: MI-QRP #1144, NorCal #77, G-QRP #7627, NW-QRP #207, QRP-NE #179, QRP ARCI #8123 about 170 times and that became quite tiresome. I was sick th first week of January, so I put my free time to good use designing a new QSL card with all my QRP information on it.

I really did enjoy the QRP contest, and I am looking forward to the next one.
72, Rusty

Operating In Barbados

by Greg Taylor, KD4HZ
2806 Normand
College Station, TX 77840

I have decided to write up experiences from my trip last October to 8P (Barbados) for what use it may be to others. We wound up going to Barbados after some late-breaking changes in travel plans which, other than some scrambling for a hotel room, didn't pose any major problems. Fortunately, Barbados licensing procedures don't require advance application (in fact, I think it must be done in person). I was 8P9BD about 15 minutes after walking through the door of the Communications Authority. Amazingly enough the checked baggage with accessories and anntenna components had arrived with the plane and everything went right through customs. I was able to use an AC supply because line voltage and sockets (at least at our hotel) were U.S. compatible. Unfortunately, because of the aforementioned scrambling for a hotel, the antenna situation was less than optimum. Although the room was on top floor, maybe 40 feet up, there was no way to run a wire in the open. Although a variety of configurations were tried (glad I brought the transmatch), evidently a noticable signal was never developed.

In fact, it was a lot like operating QRP from the home qth... you know...better results answering than calling CQs, etc. Also became a believer in the saying that a DX callsign gets you a 10db increase in signal. With a full-bore 5 watts, I was getting about the same signal reports as at the home QTH. About S7 from the super-stations with monobanders at 75 ft. etc, S5 from tribander at 35 ft crowd and, when we were able to connect, S3 from the stations with dipoles. Figure what was gained by the callsign was lost by the antenna.

Some general observations - appeared to be a two hop limit (all 20 meter operation) for contacts, signal just couldn't seem to make that third hop. Definitely different propagation patterns from there. PZ1DY, who had been running about S6 back in Texas, came blasting through like he was next door (which come to think of it, he was, and over salt water at that). Still had a great time, although I didn't draw big pile-ups that made for a little more relaxed

operation, which I think the XYL appreciated. And, hearing I was the first- ever 8P for some made it worthwhile anyway. Aside from ham radio, Barbados itself was interesting to visit.

If I had it to do over again wouldn't change much. I would certainly work on enhancing the antenna situation. Also, would try to borrow a two-meter handheld to take so I could talk to the locals. I did take a small assortment of tools, soldering iron, wire, string, tape, etc. which turned out to be nice to have in working on the antenna. And, hopefully, some day I will get a chance to try it again!

72, Greg KD4HZ

Call For Articles

by Doug Hendicks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620

Membership in the NorCal QRP Club is over 280 as I write this at the end of January. The club is strong, and we are growing every day. This club was founded with the purpose of encouraging homebrewing and QRP. There is a rich tradition in QRP circles of sharing and help to other hams by hams. Roy Lewellen, W7EL, Wes Hayward, W7ZOI, Dave Benson, NN1G, and Wayne Burdick, N6KR have all designed transceivers and freely given them to the amateur community without any renumeration of any kind.

I am sure that there are some NorCal members out there who are capable of designing or have designed projects but have never published them, because of various reasons. One reason is that it is relatively expensive to do the research and development of getting a circuit board produced. Usually the fee runs $50 to $100 just to made 2 or 3 prototype boards. This is a pretty good piece of change for something that you are going to give away. Another reason that more projects are not put out in kit form, is the huge expense involved in buying the parts for the kits. If you don't buy parts in at least units of 100, the cost can be prohibitive. I know, because the start up cost for the second run of 100 NorCal 40's was around $8000, and the NorCal 40 only had 110 parts! Now that is a lot of money.

That brings me to the purpose of this article. If you have a project that you would like to share with fellow QRPers and need some help with the costs of developing a pc board, The NorCal QRP Club is willing to help underwrite deserving projects. Basically, this would be the scenario. If your project is selected for support from the club, we will pay for the development of pc boards from a company such as Far Circuits. Your article will be published in QRPp, and the club members will be able to order boards that are made available through Far Circuits. The article will contain information to the effect that boards are available for $X from Far Circuits. Everyone is a winner. You have your article published and become world famous, ok, maybe I stretched that a little, QRP famous at least. The readers of QRPp get another great project to build, and NorCal QRPp has better material for it's readers.

What type of projects are we looking for? I think the number one priority is a QRP SSB transceiver with a superhet receiver. I get 2 or 3 letters a week asking for a source of a QRP SSB project. Other good candidates are an RS 12 transceiver, one with a 15 meter transmitter and a 10 meter receiver for the RS-12 satellite. And, I think there is interest in a simple Novice transceiver. One that uses varactor tuning. Maybe a two board design, one for the receiver and one for the transmitter. Or, how about a design for a receiver? The possibilities are endless. You come up with the project and NorCal will support you.

How do you become part of this process? All that you have to do is contact Jim Cates, WA6GER, 3241 Eastwood Rd., Sacramento, CA 93620 or me, Doug Hendricks, KI6DS, 862 Frank Ave., Dos Palos, CA 93620.

November NorCal Meeting

by Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

On 11/7/93 a couple dozen avid QRP'ers gathered for our third informal monthly meeting at the California Burger in Pleasanton. There were a half dozen NorCal 40's there, and much discussion of mods, paint jobs, and bells and whistles.

But, first, there were two unique antennas, one a vertical slinky type, the other a quad, different from any I have seen. Darn it, I did not get the details, nor the names of those who brought them. Can anyone help me on this? I will put out an addendum. I was busy signing up new members, of whom there were six. I think this brings the NorCal membership up to around 170+; not that we are going all out for numbers. It's the enthusiasm for QRP which counts!

Bob, W6CYX, brought his NorCal-30. Yep, he had cooked up a 30 meter versionand was DX'n with it. Others brought their 40 meter ones, and mods were discussed, and lots of ideas shared. Stan, K4DRD, will bring his silk screen outfit to the next meeting. Anyone wanting the panels to have a really professional look, bring them painted whatever color you like, and Bob will silk screen them. I did notice the lettering on his was black, so your color choice perhaps should be selected with that in mind.

Wayne, N6KR, designer of the NorCal-40, brought color drawings of the next Northern California QRP Club (NorCal) club project: A five band SSB/CW five watt transceiver! Size will be about six by six by two! Price range will be in the $ 250/300 range, depending on how well Doug, KI6DS, does with his proven ability to scrounge parts at minimum prices. (He chopped off about $15 per kit by his judicious shopping.)

NorCal is a non-profit QRP club, no officers, no dues, no constitution nor by-laws, no business meetings; in fact, no agenda nor format. Just get together in an informal group and/ or groups, and discuss QRP, look at items brought for show and tell, etc. Membership is free. That gets you on the mailing list. The QRPp Quarterly, cranked out by editor Doug, KI6DS, is five dollars a year, NorCal's cost. The next issue is a sixty pager of 100% pure, unadulterated QRP, 90% original! We do have many talented members in the group, and many thanks to them for sharing their knowledge and experience.

As for the NorCal-40 kits, we sold the last of the 100 at Pacificon, and 92 have been shipped. The remaining eight circuit boards have now arrived, and the remaining eight will be bagged this week. Thanks to all for your interest in QRP. Way to go! Jim, WA6GER

December NorCal Meeting

by Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620

The December meeting of the Northern California QRP Club was held at the California Burger Restaurant at the Santa Rita exit on I-580 west of Livermore on Sunday, Dec. 5. 32 members showed up with 7 NorCal 40's also there. Or, should I say 5 NorCal 40's and 2 NorCal 30's. The mods are starting to show up, as James, KI6JD, has his with lights, a keyer, and an audio amp. Bob Warmke, W6CYX, has a NorCal 30 and 40, and both have mods that increase the power output to 5 watts with coverage on the 40 meter model going from 7.000 to 7.150 MHz. Bob has promised to write up an article for the next issue of QRPp so the rest of us can play copy cat.

Stan Cooper is in Japan, but sent his rig that has the front and back panel silk screened

with the lettering and dial markings in black ink. It looks really professional, and Stan has very graciously offered to Screen print the front panels for the rest of the NorCal owners. All that you need to do is to mail your front and back panels, that have been painted of course, to him in a floppy disk mailer. Enclose postage for him to send it back to you along with a mailing label that has been pre addressed with your address. Please do not send money, Stan doesn't want any, he just wants to help out. But, please do send stamps and the label to make it as easy as possible for Stan. He will return from Japan on the 9th of December, and promises to have a 1 day turn around on the panels. Stan's address is:

Stan Cooper
1390 Market St.,
Apt. 2024
San Francisco, CA 94102-5313

Jim Cates, WA6GER, brought a much asked for item to the meeting. We have been able to get 50 more cases that match the case for the NorCal 40, except that the front and rear panels do not have holes drilled in them. I am going to attach mine with an "L" bracket to the bottom of the case, and put a tuner and keyer in it to match the NorCal 40. The cases cost us $10 each, and the club provided the standoffs and special screws at no additional charge. If you want one, send $10 plus $2 for shipping to:

Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

Jim Pepper is working on a design to build a digital readout for the NorCal 40. He has it designed and the board layed out. He will be building a prototype and hopefully will have it for the next meeting. His article on the 40M Transceiver that was to appear in the fall issue of Communications Quarterly was bumped to the Winter issue. Look for it to be on the news stand in January or February. The readout should be cheap to build, costing less than $25 for the parts and board.

Wayne Burdick had his "famous" bread board with the newest project, the receiver section of the Sierra 5, which is a 5 band CW transceiver that will cover the 40 & 30 meter bands and have options for 20, 17 & 15. Wayne describes it as the "big brother" to the NorCal 40. It has enough audio to drive a speaker, true agc, and even has an "S meter". Be patient, as it is in the R & D stage right now, but Wayne is working on it and it looks like a great next club project.

Denis Englander, KD6ETI, brought the "winning" entry to the club logo contest. It is oval shaped, with mountains in the backround representing the Sierras, and the NorCal 40 rig with an antenna and key in the foreground. The logo says "NorCal QRP Club Est. 1993". Dennis is investigating the cost of getting patches made, and will report back to the club.

Finally, it was decided to purchase a machine to package the QRPp in so that it will not have to be stapled, and so that the mailing label will not come off. 3 or 4 members have notified me that they did not get the QRPp, just the label, so we needed to do something. Starting with the next issue, we will mail QRPp in a plastic jacket, like QST comes in. The cost is $67 for the machine, and 2 cents apiece for the plastic bag.

Don't forget to submit your articles for QRPp soon. We need all types, and if it applies to QRP, we are interested. Several of you have commented on how you like the wide variety of articles. Keep sending them to me, and I will keep publishing them.

The members in attendance received an extra "bonus" for attending, as I handed out a nice meter to everyone with the assignment that they build a tuner and bring it to the next meeting. Bob Warmke brought some 10 turn pots and gave them away for use as a replacement on the NC40's. If you get the chance, come on by to the meetings. They are loads of fun, and hey, you never know when one of us will be giving away "extras"! 72, Doug

NorCal January Meeting

by Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620

The following is an account of the January meeting of the Northern California QRP Club. Meetings are held the 1st Sunday of each month starting at 11:00 at the California Burger Restaurant at the Santa Rita Exit of I-580 West of Livermore. Membership to NorCal is open to all and is free. To become a subscribing member, you need to send $5 to Jim Cates, WA6GER, 3241 Eastwood Rd., Sacramento, CA 95821. That will get you 4 issues of the Journal of the NorCal QRP Club, QRPp. The last issue was 60 pages in 5.5 x 8.5" format. Jim is also taking orders for the second run of the NorCal 40. They cost $89 plus $4 for shipping. Jim reports that 47 of the rigs have been sold and we have 53 left. The parts have been ordered and as soon as we have them we will ship. The cases have been promised the third week of January, and also the boards. So it looks like the likely shipping date is some time in February. Please be patient as we are at the mercy of our suppliers.

The January meeting of the NorCal QRP Club was another smashing success. 40 members showed up and the meeting place is sure getting crowded. Lots of old time members and several new ones at this meeting. People are coming from as far away as San Francisco, San Jose, San Carlos, Dos Palos, Merced, Atwater, and Sacramento. Several are coming over 100 miles one way! Membership is now over 240 with 210 subscribing members.

The main topic of this meeting was the mods being made to the NorCal 40. Jim Pepper had 2 of them there. First of all, he has a working prototype of the digital display for the NorCal 40. Yep, you read it right, a digital display. Jim is going to write up the article for the March issue of QRPp, and it will include a schematic, artwork for the pc board, and a list of suppliers for the parts. Cost should be around $25, depending on the cost for the pc board. Jim developed this as a favor to me, and is graciously going to put it in the public domain. The club will pay for the development costs to have the pc boards done by Far Circuits, and you will be able to order boards from Far Circuits. Money for this will come from some of the excess funds from the NorCal 40 kit sales. Far usually charges $50 to $100 to do the first boards, and then they sell them for about $1.25 per square inch. Looks like this board will be about 4 or 5 square inches. Details will be in the March issue of QRPp. Jim also built a tuner/swr/watt meter in one of the "plain" NorCal matching cases for the NorCal 40. It was really gratifying to see, as he used the Stockton circuit out of the first issue of QRPp, and two of the meters that I gave away at the last meeting. Everyone oohed and ahhhed at the neat work that Jim does.

Bob Lai and Terry Young are also working on tuners and watt meters. They are still in the process, but should be finished by the next meeting. Steve Cates has a new set of paddles that his wife gave him for Christmas. They are from England, and are about 2" by 1" with a strap that holds them to your leg. Really cute, and they have a great feel. Steve's dad, Jim, is already thinking of how neat they would be to go mobile with the NC40.

Wayne Burdick brought his Mac Powerbook computer with graphics of the new NorCal project in the works, the Sierra. It is going to be a multiband rig with plug in modules for the bands. It will be on 80 through 15, including the WARC bands. Should be available some time this summer. Wayne has breadboarded several of the plugins and they are working great. He is calling it the "big brother" of the NorCal. Several of the features of the NorCal are kept, and several improvements also. Stay tuned for more details.

Martin Jue donated some MFJ CWF-2 audio filter circuit boards and Joe at ACE Electronics

in Sunnyvale donated the LM747 ICs and we gave them away at the meeting. Several guys went home with a smile on their faces thanks to the kind generosity of Martin and Joe. Several have promised articles for the next issue of QRPp. We are planning on it being a NorCal 40 "special". So far we have been promised articles on the following mods; Converting the NorCal to 80 meters, Converting the NorCal to 30 meters, 2 increased audio output mods, a mod to strengthen the front and back panels of the NorCal, digital readout, putting a tuner and Stockton meter in a NorCal case, increasing the power output to 5 watts, and 2 different articles on how to increase the coverage from 40 Khz to 150 Khz! I am also interested in articles about your experiences of building the NorCal. Write a review of the NorCal and submit it. We want to know your thoughts and experiences. Tell us how to make it better, what you liked and what you didn't like. Deadline is Feb. 1st, and Jan. 20th would be even better.
Have a good month and hope to see you at the next meeting.

INSTALLING A KEYER IN THE NORCAL 40

by James Williams, KI6JD
1912 McLaughlin Ave.
San Jose, CA 95122

First of all I would like to begin by saying that it's hard to find anything about the NorCal 40 that needs changing....I have used my NorCal 40 for a couple of months now and am always amazed by the unsolicited compliments on the great sounding CW note and ease of copy...

I used a hand key for the first 10 or 12 years after becoming a Ham and was somewhat reluctant to change horses after such a long ride, but I was never able to get the horse up past about the 18 wpm with a hand key...So I finally broke down and bought a Bencher...At first it was pretty bad trying to have a QSO without sounding like a new Novice just learning the code...However...After some practice and MUCH patience from my friends...I think I have finally attained some skill with a keyer...I still make bobbles now and then!!!

After I had the NorCal 40 assembled and working...I was using my trusty but RUSTY old hand key...That was almost as bad as learning to use the Iambic keyer..I did do SKN with the hand key and eked out a couple of QSO's..The band was kind of dead...

I finally began to miss the keyer and decided it was time to bite the bullet and see what could be done to install a keyer in the NorCal 40...My friend Mike..KC6SEG had recently bought a keyer kit from Oak Hills Reasearch. I gave it a look at...It was on a nice printed circuit board about 1 inch square and it used the Curtis 8044 chip...I decided to give Oak Hills a call and order a kit...It arrived in a couple of days...I explained I was in a hurry and they sent it Express Mail for no additional charge...It came in time for me to spend some of my lunch period assembling the kit..Took maybe 25 or 30 minutes to assemble the board..It has the Curtis Chip and maybe 15 or so external components attached...I would have to wait until the weekend to find the time to install it in the NorCal rig...

Saturday finally arrived and I took the NorCal 40 into work to do the install...I have better access to small spacers and screws and whavever I might need there...Included with the kit were a 1/4 inch phone jack and a large, maybe two watt, pot for adjusting the speed...These items were DEFINITELY too LARGE for this project and I looked in the junk bin for something more suitable...I finally had to go to Radio Shack and buy a nice small 1/8 inch stereo jack that closely matched the orginal key line jack...I also bought a small 500k linear taper pot that would fit nicely in the rear panel just above the existing audio jack....I drilled two holes one inch center to center above the key input jack and the audio out jack on the rear panel...This layout retains the best looking symmetry in my opinion....

I spent quite a while looking at the insides of the radio trying to decide where the best location would be...I finally decided to install the board on some 3/4 inch standoffs just to the right of the output connector...I could take advantage of the WIDE gound plane traces in this area to drill through for the mounting screws..Drilling through the ground plane provided the LEAST likely-hood of damaging any of the small traces on the board...I used some 2-56 screws and some locking nuts I found in a drawer...I have a pin vise, so I hand drilled the holes taking my time and making sure by holding the board up to the light so that I could see the ground traces through the board material from the top...Every thing went well and the board was very secure after three standoffs ...So I stopped there...There are a total of three wire connections to the NorCal 40 from the keyer board...#1 is the +12 input to the keyer..#2 is the ground wire...and #3 is the keyline out of the keyer...I chose to attach it to the cathode of D101...I could have attached it to the original key jack also....There are also wires from the keyer board to the new 1/8 input jack and to the speed pot...All of this wiring is clearly marked in the information package included with the kit...I would like to say for those of you who are un-familiar with Oak Hills Reasearch...They make nice kits, with plenty of information and quality components...I have built several items from them and have been pleased with each..

I did not bring a key with me to work and so had to wait until I got home to try out the keyer...LO and BEHOLD!!! It worked just FB right from the start...The speed pot was just about perfect giving me a range of from about 10 WPM to about 25-30 WPM...I work the Novice bands a lot and you have to be willing to slow down for the newcomers and some of the old timers that have spent long periods on the fone band and haven't touched a key in quite a while...

So...I have been using the keyer now for about two months and It has been a welcome addition to a already GREAT rig.. Of course...the NorCal 40 sounds good as is, but I like to think the keyer addition is the icing on the cake!!

I am sure that any of you that choose to use the Oak Hills keyer kit will be happy with the outcome...If you need help or want some free advice...I have plenty of the latter to go around..HI HI...So...I'll be looking for you on 40m Novice bands and hope to hear ur FB CW soon..

Take Care es 73's James KI6JD

The "MouseKey"

by Andrew Cohn, K4ADL
7709 Durer Ct.
Springfield, VA 22153

Here's an idea for a MouseKey some of you might find useful. Personally, I don't care for the standard straight key, and I needed a durable key for the briefcase QRP station I'm putting together.

At a hamfest, I found a used 3-button mouse for $5. I rewired the guts so that two conductors of the cable went directly to the left button. Then I wired the right button in parallel. Next, I cut off the serial connector and replaced it with a mini jack. Finally, I stuck on 4 flat rubber feet at the bottom, along with Velcro (tm). The feet gave the mouse stability, and the Velcro allowed the mouse to be attached to the side of the rig for side-keying.

Most of you probably have a mouse attached to your computer, and you may have absentmindedly tapped out morse code with it. Actually, with a miminum of practice, you'll find a mouse makes a great key. In fact, it will probably work well as a paddle for an electronic keyer, by wiring the left button for dits and the right for dahs!

You can use the MouseKey as you would a regular mouse (with your palm over it's body), or you can turn it around 180 degrees and use it more like a standard straight key. Even as a straight key, you can use your index finger for dits, and the third finger for dahs. Probably, it would work well in a mobile installation.

Just a thought. Anyway, it works for me!

73, Andy, K4ADL

My Mousekey

by Dave Redfearn, N4ELM
1784 Quail Ridge Road
Raleigh, NC 27609

About six months ago I built a mousekey for my keyer to see how it would work for mobile operation. I scrounged up a three button mouse, cut off the serial connector, installed a plug to fit the keyer (1/8" stereo), and wired the left button to make dots and the right button for dashes.

The feel was considerably different from the regular paddles, but with some practice, I could manage a decent 13-15 wpm. I was able to use the heel of my hand to hold the mouse down which left my fingers free to key. A velcro strap or something similar to hold the mouse to my leg might work good too. At any rate the mouse worked out to be a cheap and resonably effective set of paddles. It did get a lot of attention during a CW open house during a Cary ARC club meeting.

73 - Dave, N4ELM

[Editor's note: Have you ever noticed how Great Minds work alike? Here is the same idea that occurred to two separate hams in different parts of the country. When Andrew posted his idea to the internet, it prompted Dave to post this reply. Should be a good use for all of those cheap mice that I see at Livermore! Doug, KI6DS]

QRP Notebook Shopping List

by Tom Randolph, N1OOQ
48 Dowson Rd.
Worcester, MA 01602

I, believe it or not, went through all the schematics in QRP Notebook and compiled this list of parts needed. This is everything that appeared more than once or twice. If it has a + next to it, buy lots of them! Oh, by the way, some of the important stuff, like air variable caps, are in onesie-twosie amounts, so they don't show here.

So now you all know what to stock up on for a QRP junk box...

Transistors	Amidon cores	Diodes	Electrolytic	Chokes
2N2222A+	T24-43	1N914+	or Tantulum	~~1mH+~~
~~2N3553~~	T37-6+		~~1+~~	~~22uH+~~
~~2N3866~~	T50-2+		~~2.2+~~	~~15uH~~
2N3904+	T50-6+		4.7	~~10uH~~
2N4400+	T68-2+		~~10+~~	
~~2N4401+~~	T68-6		22+ (16 & 25V)	
~~2N4403+~~	~~FT37-43+~~		220	
~~2N4416+~~	~~FT50-43+~~			
~~2N5179+~~	FT50-63			

MPF102+	BLN43-202			
40673	Bead, 850mu			
Pots	NP0 Caps	Caps	Hardware	Op Amps
100k+	0.001++ (102)	150	6-32	741
10k+	0.01++ (103)	68	4-40	747
1k	0.1++ (104)			TL081
				LM386

Resistors 1/4w 1/2w				
10+	100++	1.0k+	10k+	100k+
15	150	1.5k+	12k	220k+
22	180+	2.2k+	15k	470k+
33+	220	2.7k	22k+	
47	270+	3.3k+	27k+	
56+	390	3.9k	33k	
	470+	4.7k+	47k+	
	560+	5.6k+	56k+	

72, Tom, N1OOQ

Building the NN1G Mark II XCVR

by Bruce Lifter, KR4AQ
1920 Eva Ln.
Malabar, FL 32905

I was interested in building a small QRP rig that would fit in my brief case that I could take with me when I'm out of town. I really did not want to dump $200 into a kit for fear it would not perform that well and I might not get it working. I ran across a few references to the NN1G rig via various internet sources. It was getting pretty good remarks about it and, most important, it was inexpensive ($59.95). This seemed like pretty low risk, so I went ahead and ordered one from Dan's Small Parts and Kits. The NN1G Mark II is a 1.5 watt single band superhet transceiver. It was designed around three NE602 IC's (double balanced mixer and oscillator all on a single chip). The rig has a VFO based on the Hartley oscillator and has a crystal filter. According to the documentation provided, the rig is supposed to draw about 30 mA on receive and about 215 mA on transmit. The kit comes with two silk screened boards (one TX, one Recv), all board mounted components, a 10k audio pot, and a nice air variable capacitor. The air variable is optional. He sells the kit for $10 less without the air variable. The air variable Dan sends depends on what he has on hand. The one I received had a 7:1 reduction drive built in. The kit is for either 80, 40, 30, or 20 meter bands. I ordered the 40 meter kit. The builder must supply the case, hook up wire, and all knobs and connectors. The documentation that came with the kit consisted of a circuit diagram, 2 pages listing the parts included, 2 pages of parts layout diagrams (one for the TX board and one for the Recv board), an article describing the original NN1G rig by Dave Benson (NN1G) from the January 93 QRP Quarterly, 2 pages of information on building and aligning the NN1G Mark II transceiver (written by NN1G), and a page on putting the NN1G Transceiver on 80/40/30 meters, apparently from another edition of the QRP Quarterly.

This is definitely not a Heath kit! The documentation gives very little instruction on how to put the kit together. There are a few tips provided on building such as not putting the chips in sockets for it may cause one them to oscillate at VHF.

I started by checking the parts provided against the parts list. Everything checked out OK

except for two capacitors that were supposed to be 47pf which measured on my multimeter as 470pf. They were marked with 470 which can be interpreted as either 47 or 470.

Not having much experience in building XCVRs, I decided to solder it all together, mount it in its case and then jump right into the alignment procedure. I won't do that again. I got to step 3 in the alignment procedure and found that the local oscillator was not oscillating. This drove me crazy for about a week. To make a long story short, I ended up desoldering all the IC chips and methodically replacing every component in the VFO circuit. The bottom line was that a single 330pf NPO capacitor was bad. The worst part was that I had taken out the bad capacitor, measured it and then put it back in the board again only to later find out that it was the guilty party. I still don't know what is wrong with the cap, it checks out with my meter.

Once I got the LO to oscillate, things went much smoother. I plugged the ICs back in the board and completed the rest of the alignment with little trouble. The alignment procedure was easy to follow and well written.

I installed the rig in a Radio Shack 3 X 5.25 X 5.875 metal cabinet. The boards and air variable fit with plenty of room for future modifications. I have already made two minor mods to the rig. First, I added a trimmer cap in parallel to the air variable. This allows me to easily change the start and end frequency of the rig. (The rig has about 80 KHz coverage with air variable supplied with my kit.) The mod does not seem to affect the stability of the VFO. The other mod was also pretty minor; I placed a diode in series with the power supply for polarity protection.

The rig seems to operate quite well. My only complaints so far are in the audio portion of the rig (all of which should be fixed shortly with further minor modifications). The kit, as it comes, does not seem to be able to drive anything other than a set of head phones. The LM386 used in the audio section is supposed to have another 20 dB of gain in reserve. Dan is sending me a mod sheet that will allow the rig to easily drive a 5 inch speaker. My other complaint is that the side tone audio is too low while transmitting. While testing with a strong station across town, I could barely hear my side tone while transmitting. A mod to cure this is already floating around Internet.

Overall I am very pleased with this kit. My main rig is an ICOM 737 without a CW filter. The Mark II is actually easier to listen to at night during noisy band conditions due to its filter. I think I'm ready to build another one for 20 or 30 meters. I talked to Danny Stevig (of Dan's Small Parts and Kits) today and he tells me that he currently has the kits on special, 4/$200 mix and match the bands.

One more note,... special thanks to Doug Snowden, N4IJ and Dave Rush, WO4Z for their patient help in my struggle get the LO working.

73, Bruce

For Sale: I have all of the parts, boards, cabinet, knobs, and connectors to build the Ugly Transceiver that was featured in the 93 ARRL Handbook and June 92 QST. These parts were all purchased new by me, and the case is a nice heavy duty Bud case. I will include all of the necessary paper work, copies of all pertinent articles. All that you have to provide is the soldering iron and the solder. Price? $45 delivered to anywhere in the US. Why am I selling? I don't have time to build it (the real reason is I have a NorCal 40). Peter Eaton, WB9FLW, 35 Norspur Rd., Edwardsville, IL 62025.

NorCal QRP Club Membership Application

Name: _____

Call: _____

Address: _____

City: _____ State: _____ Zip: _____

Optional Information:

Packet Address: _____

Internet Address: _____

The NorCal QRP Club was formed in June of 1993 with the purpose of exchanging information and fellowship for and about QRP. There is no charge for membership, but to receive QRPp, the Journal of the Northern California QRP Club, you must pay a $5 per year subscription fee. The $5 is an attempt to break even. It is not the intent nor purpose of NorCal or QRPp to make any money. To join, photocopy this page and send along with your $5 to:

Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

Please make all checks and money orders out to Jim Cates, and not to QRPp or NorCal.

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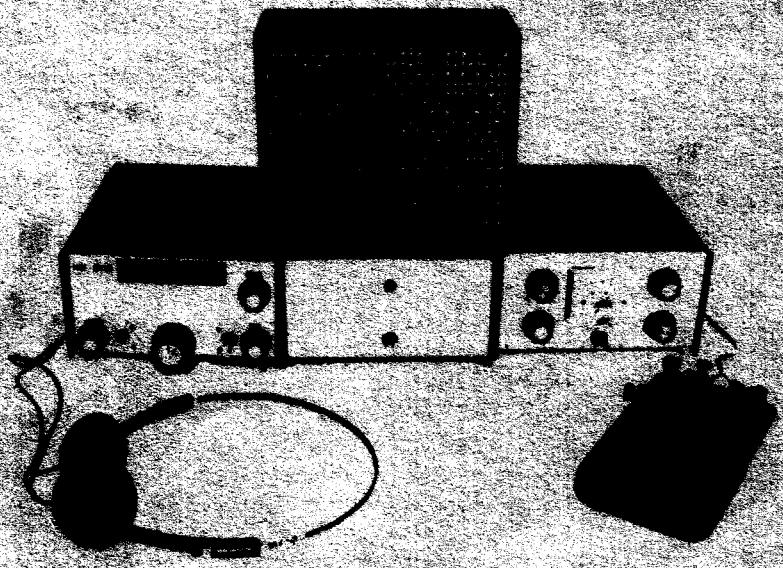
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Volume II, Number 2, June 1994



A Deluxe QRP Station

By Jim Pepper, W6QIF

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From the Editor

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Wow, another quarter has flown by, and we are growing by leaps and bounds. Our membeship is over 450 as I write this, and that in less than 10 months as a club. This is another good issue, in my opinion. The lead article, is over 20 pages long. When an article takes up one fourth of a magazine, there must be a reason, and there is. Jim Pepper's Deluxe QRP Station article was first published in the Winter edition of the Communications Quarterly. This is the magazine that took the place of Ham Radio, which died a few years ago, and it's passing is still mourned by the true blue home brewers everywhere. The next time you are at a ham fest, browse the used magazines and see if you can find a copy of Ham Radio, you will see what I mean. Jim told me that his article was going to be published in Communications Quarterly, and I was eager for it to come out. But, I was in shock when I found out how much a copy of the magazine was, $10.00!!! Per Issue!! I would imagine few QRPers subscribe to the magazine, due to it's high cost, so I decided to see if I could get permission to reprint Jim's article. I called Terry Littlefield, the editor, (by the way, yes she is Rick Littlefield's K1BQT, wife) and asked for permission to reprint in QRPp. Not only did Terry eagerly give me permission, she offered to send me the picture that is on this month's cover. Thank you Terry for being so kind, and Thank you Jim for writing a great article.

It has been a busy last 3 months for me. My mother-in-law died at the end of March which necessitated a trip back to Kansas for the funeral. While I was there, I stopped at Associated Radio in Overland Park. This is a store that has been in business for years but is under new ownership. The new owners are eager to please, and have done an excellent job. They are among the few stores that I know of that take trade ins of ham gear. One of their employees is Bill Wheatcraft, who is interested in QRP. He had never heard of NorCal, nor the NorCal 40 or Sierra. When I showed him the rigs, he could not believe his eyes. He immediately signed up for membership. Another convert. While I was on the trip I used the Sierra to make several contacts using a 66 foot long wire with a 33 foot counterpoise and a MFJ 971 QRP tuner.

Early in April I was invited to speak at the River City Amateur Radio Club in Sacramento by fellow member Terry Seeno. It was on a Tuesday night, so I was not able to leave Dos Palos until after school. I barely made it to Jim Cates house where his wife Electra had my favorite dinner waiting on the table. Talk about service. Thank you Electra. I expected about 30 or 35 people to be at the meeting. Wow, was I in for a surprise. The River City club is a big club, and they had about 125 to 150 people there. I spoke about QRP, NorCal QRP Club, the NorCal 40 and the Sierra. Then I fielded questions from the audience for 15 minutes. That was the surprise of the night. Several NorCal members were in the audience and stood up to support what I had said about the NorCal 40. I did not know they were out there, and it was quite gratifying to get the support. The members were quite receptive to QRP, and we signed up 15 new members! I think one of the hooks is the opportunity to build and homebrew.

The last of April, Jim and I will be going to Dayton for the second time. I think Iam even more excited about this trip than I was about the first. Probably because I have met so many more QRPers and feel that I know them now. I will be speaking at the QRP Forum on Sunday with Jim Fitton, W1FMR and Chuck Adams, K5FO. Both are members of NorCal and their respective regional QRP clubs, New England and Texas QRP Society. Jim will be talking about forming and running a local or regional QRP club, Chuck will cover the Technical aspects including kits and construction projects from a club point of view, and I will be speaking on

how to produce a newsletter.

Jim and I will have a table at the Hospitality room and we will be displaying the NorCal 40 and the Sierra, plus past issues of QRPp. We will be signing up new members as well. We are paying all of our own expenses for the trip, as it is for our pleasure and not a club venture. You will notice that there is an ad for the NorCal 40 Mini-Kits on page 69. The club does not want to do any more full kits, but will be making the hard to get parts available. The kits include the pc board, custom case, standoffs, special screws, and the MV108 varactor diode. There were over 50 requests for NorCal 40's that Jim had to return on the last run of 100 full kits. The demand is out there, so if you did not get in on the full kits, you can still have a NorCal 40.

Field Day is coming up, and I will be with the Zuni Loopers again. Jim will probably be in Europe, so he will miss the fun. If you have never done field day QRP, you are missing one of the great pleasures of ham radio. NO GENERATORS to mess with, it is quiet, lots of signals to work, and you get a chance to enjoy a weekend out in the wilds. Some of you will get a partner and do a two man effort, others will do it singly or in groups. It doesn't matter how you do it, just do it. Write up your experiences and send them to me. I love to print operating stories. In fact, that is the area that I think QRPp shines in. We do a better job of printing those type of stories than any other magazine or journal. Why? Because you write them and they are about real people and real events. The rest of us can read your story, close our eyes and imagine we were with you! We can relive the experience. Plus, it plants the seed for planning our own experiences. I know, because that is what I do.

Last issue was the first issue that was mailed with the bulk mailing permit. We are committed to using it through the December issue of this year. Many have asked that their issue be sent 1st Class, but that is not possible without a lot of hassle. Plus, it is much more expensive to do it that way. I learned several things about bulk mailing from our last experience. First of all it is a mistake to mail around the first of the month. The volume of mail is huge at that time. So, this issue will be mailed around the 10th to 15th of May. Hopefully delivery service will be better. But remember, this is the JUNE issue, and if you get it during the month, it is on time!! Most of them should arrive before the 1st of June. At least, that is the plan.

One of the benefits of this job is that I get tons of mail. In fact, my mailman is starting to snarl when he sees me (not really). I average 5 to 10 letters in the U.S. Mail, 30 to 40 messages on internet, and 4 to 5 packet messages per day!! I have a day job, and sometimes it takes me a while to respond. If you want a reply and you write me through the U.S. Mail, please enclose a SASE. It bothers me that I can't set down and respond with a 2 or 3 page reply to your letters, but there is just not enough time in the day.

Stan Cooper, who does the screen printing for the NorCal 40 has moved a few miles. His new address is: Stan Cooper, K4DRD, 3214 Countryside Dr., San Mateo, CA 94403. Stan now has both white and black ink, so if you are interested in having him screen your NorCal 40 panels, send them to him at the new address. Please remember to include a self addressed address label and postage (not money) for mailing it back to you. The idea is that Stan gets your package in the mail, opens it, screens it, puts it back in the original package, attaches your address label, puts the stamps on it, and mails it back to you. Thank you to Stan for providing this service.

The brochures for the Sierra kits were mailed the first of May. Be sure to note that your order with your payment must be postmarked by June 15, 1994 to ensure that you get a kit. We will order the parts the first of July, and anticipate shipping of kits the middle of August, but it all depends on the parts suppliers. Have fun with QRP this summer, write an article or two and submit it to QRPp. Next issue I will give a full report on Dayton, and hope to have more on the Sierra and possibly, just maybe, a SSB construction article. 72, Doug, KI6DS

Deluxe QRP Station

by Jim Pepper, W6QIF
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[Reprinted by permission from "Communications Quarterly", Winter 1994 edition]

Looking for a way to reacquaint yourself with homebrewing? This direct conversion (DC) receiver and QRP transmitter is ham tested and approved. It was built by seven members of the Mount Diablo Radio Club (MDARC) and three hams from other radio clubs. I also prototyped the project four times during the design process.

I call my project the Deluxe QRP Station because it has a number of innovations not ordinarily found in run-of-the-mill QRP rigs. For example, it includes:

*A peaking circuit to improve selectivity.
*A nulling circuit to reduce heterodyne interference.
*A switch for selecting upper or lower sideband.
*Receiver incremental tuning (RIT).
*Plug-in pc boards for receiver and transmitter.
*Optional digital frequency readout.
*VFO control of transmitter and receiver.
*4 watts output from a Power-FET transistor.
*Optional side tone (sinewave oscillator).

Receiver Description

Because it contains less circuitry, a direct conversion receiver is much easier to build than a superhet. Direct conversion receivers differ from superheterodynes because the local oscillator operates at the same frequency as the incoming signal. In addition, all of the gain rests primarily in the audio circuit. There are no intermediate amplifier stages or second detectors.

However, DC receivers have several short comings. First, they lack the sensitivity of the superheterodyne receiver. Second, they're prone to AC hum modulation from incoming signals due to ground loops. Third, because they require large amounts of audio gain to amplify the weak radio frequency signals to audio level, these receivers are subject to microphonics - a form of audio feedback that can cause the receiver to go into a continuous state of audio oscillation. Fourth, there's broadcast station feedthrough due to poor front-end selectivity and dynamic range.

After reading a number of recent articles on direct-conversion receivers that use the NE602N, I decided to try building one for CW operation.[1,2,3,4] Information on these DC receivers indicated that the NE602N solves two problems - the hum modulation and the AM broadcast station feedthrough. The microphonics can be controlled with good mechanical design.

With these problems solved, I needed to improve selectivity. In this type of receiver, the incoming signal appears on both the upper and lower side of the transmitted signal. The receiver oscillator must be offset from the transmitted signal to create an audible beat note against the incoming signal. The audio tone goes from a zero beat to a frequency well above the audible range on both sides of the incoming carrier. Because these are audio frequencies, I found that to improve selectivity, I needed a lowpass filter with a very sharp cutoff at a frequency just above the one desired for best CW reception (approximately 800 hertz).

I've used a very simple peaking circuit in previous projects.[5] This circuit uses an operational amplifier and four components. It provides about 20 dB of peaking and is adjustable from 300 Hz to 3 KHz. because this receiver is designed as a CW rig, the adjustment is set internally

to approximately 800 Hz. Figure 1 shows the peaking selectivity curve. The gain without peaking is shown as a reference.

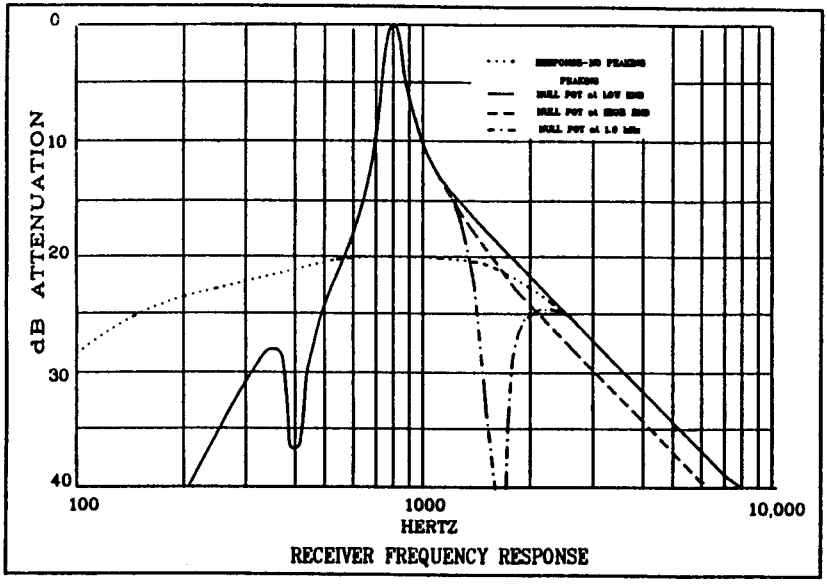


Fig. 1 Receiver Frequency Response

Now all that remained was the signal's presence on both sides of the received carrier. I decided to take advantage of the situation instead of considering it a limiting factor. I used a circuit that shifts the oscillator from one sideband to the other via a front panel switch. When interference is present on one sideband, it's possible to flip the switch and reduce the interference as shown in Figure 2. This method is preferable to retuning the dial to check the other sideband, risking loss of some information or the other person's signal. A notch filter5 also helps to improve the selectivity. This adjustable filter attenuates any frequency approximately 20 dB over the range of 200 Hz to 3 KHz. The combination gives my DC receiver better selectivity when compared to a standard DC receiver.

I designed the receiver to operate on the 80 or 40 meter CW bands, so the oscillator tunes about 130 KHz on the 80 band and the 150 KHz on the 40 meter band. (For greater range, increase the capacitor between the varicap, D1, and the oscillator coil, L3.) A 10 turn potentiometer that controls the varicap tuning capacitor yields a range of approximately 15 Hz per revolution of the tuning dial. The fine tuning resolution is necessary because the audio filter peaks sharply. The varicap is temperature sensitive but, because the main heat source (the power supply) is housed in another cabinet, the only major source of temperature change is the result of ambient temperature variation. Normally, this drift is minimal and has little effect on QSOs. Because the varicap's capacitance represents about one third of the total capacitance of the tuned circuit, its drift has less total temperature effect than if it supplied total tuning capacitance. Data derived from observations of 12 receivers containing this circuit showed an average initial turn on drift (three minutes) of less than 300 Hz. Drift due to ambient temperature changes was about 50 Hz per degree F, measured over 12 hours. With constant temperature, there was no apparent drift.

The capacitance of the tuning varicap is a function of its reverse bias level. Reverse bias is controlled by a 10 turn potentiometer that acts as an adjustable voltage divider. The varicap

has a nonlinear voltage to capacitance curve, the greatest change in capacitance occurs when the reverse voltage is lowest. I compensated for this by using a resistor from the arm of the

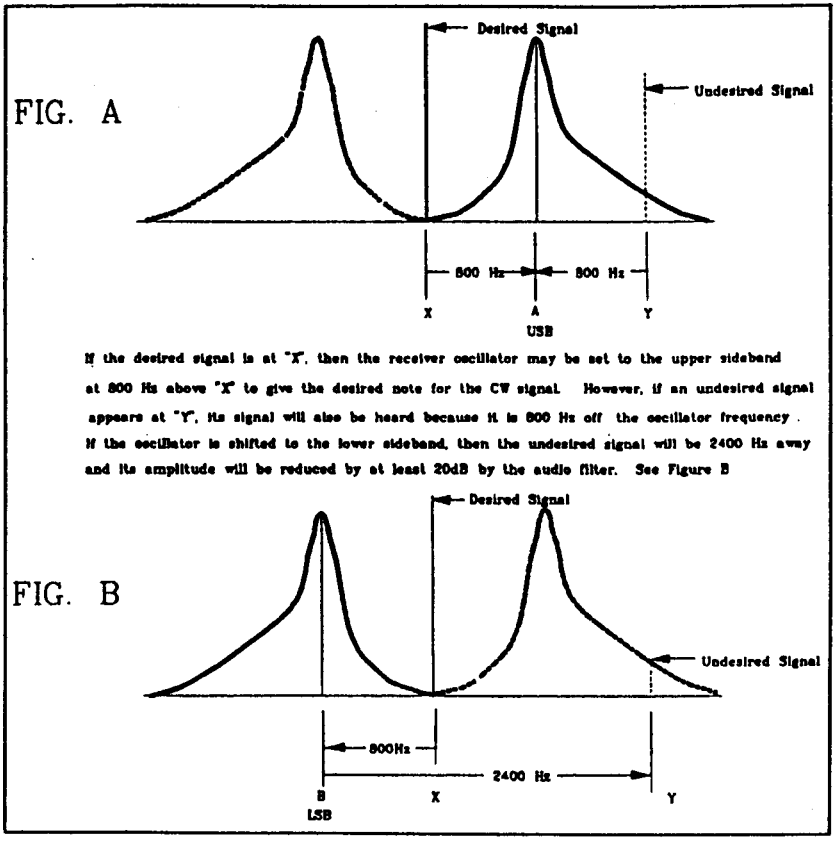


Fig. 2 Sideband Selection

pot to ground, which greatly improves the linearity.[6] A resistor in series with the lower part of the pot eliminates tuning over the nonlinear portion of the curve when the voltage nears zero.

The receiver is built on a plug in pc board to facilitate construction, modifications, or repairs. This modular construction provides the option of building plug in boards for different bands. The present design allows operation on either the 80 or 40 meter band. The pc board plugs into a 22/44 connector (Radio Shack #276-1551 or equivalent). I used only one side of the connector pins, so a 22 pin connector will work just as well providing the pin spacing is correct (0.156").

QRP Transmitter Description

I decided to incorporate a low power (QRP) transmitter to work with my receiver. Because the receiver's oscillator operates on the same frequency as the incoming signal, the receiver oscillator can also be used to drive the transmitter circuit directly. However, during transmit, the oscillator frequency must be offset by 800 Hz, up or down, depending on which side of the incoming signal you've tuned. This shift is performed automatically when the unit is switched to transmit. I'll cover the transmitter in more detail later.

Frequency Counter

As an added (optional) feature, I incorporated a frequency counter based on Intersil's ICM7216D. because the oscillator frequency is on the same frequency as the incoming signal, no special circuitry is needed to offset the counter. The counter increases the overall cost of

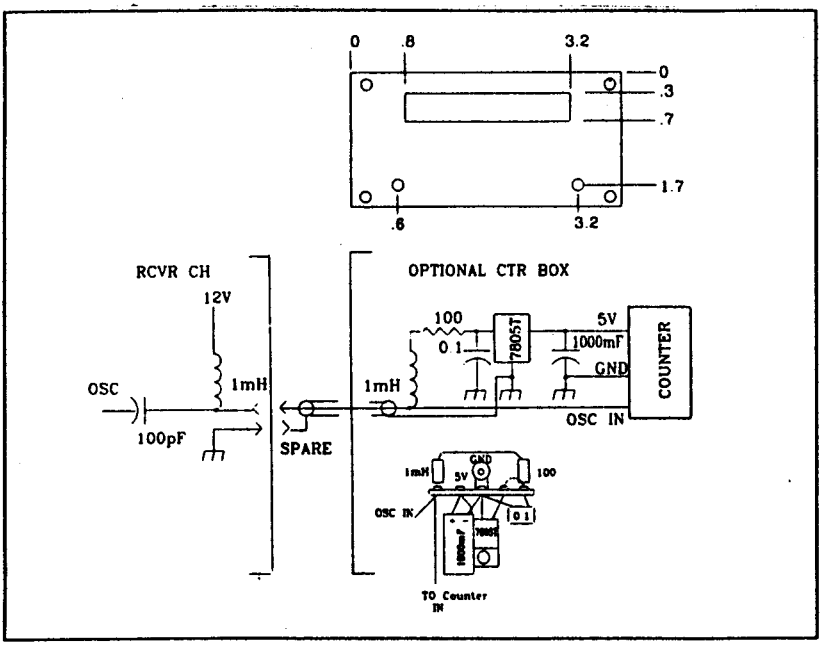


Fig. 3 Connecting Optional Frequency Counter

the receiver/transmitter by 30 percent, but is a worthwhile accessory. As a low cost alternative, you can substitute a mechanically driven frequency indicator.

The 5 digit frequency counter reads the incoming or the transmitted frequency to 100 Hz. The Intersil IC makes the counter very simple; everything except the crystal and 8 discrete components is contained in the ICM7216D. The pc board measures 1.8 x 2.8 inches and includes the five 7 segment displays.

If you want to add the frequency counter as a separate unit at a later date, you can connect it as shown in Figure 3. The spare phono connector on the receiver rear panel supplies the signal to the counter. The 5 volt regulator and filter are mounted in a separate box (Radio Shack #278-230) with the display board. The pc board is installed in the same way as the receiver assembly, and the 5 volt supply is mounted on the rear of the small cabinet. The oscillator signal and power are carried over the same line.

Receiver Circuit

As I've said, the receiver is designed to work on either 80 or 40 meters with some minor component changes. Figure 4 is a block diagram of the receiver and transmitter. Figure 5 shows the receiver schematic,. The NE602N is a double balanced mixer (or in this case a product detector) similar to the MC1496, but with all of the required external resistors built in.

I originally used the oscillator circuit of the NE602, but found the frequency shifted about 500 Hz. on transmit when the key was closed. I believe this was due to the lack of isolation in the antenna changeover relay. Some RF was being fed back into the NE602, causing the internal oscillator to shift. I cured this problem by using a separate oscillator. The local

oscillator uses an MPF102 in a Clapp circuit. The frequency is shifted from one sideband to the other via a circuit controlled by a front panel switch. The frequency is changed by connecting a 1N4002, acting as a varicap, in the oscillator circuit.

The detector input is tuned with a variable capacitor (C1). The circuit is broad enough that retuning isn't needed over the 150 KHz range. The audio recovered from the NE602N is fed differentially to an amplifier stage with a voltage gain of approximately 10. The output from this stage is capacitively coupled to the audio peaking stage. The null circuit follows this stage. It consists of two operational amplifiers in a dual package (MC1458).

The power amplifier uses the LM386 and can deliver about 0.5 watts to an 8 ohm load. (Oscillations may develop if the load is greater than 8 ohms.) Audio is ample with this circuit. The gain of the amplifier stage is set to 200 by the capacitor across pins 1 and 8 of the LM386.

Because of the optional QRP transmitter, I've included RIT and audio muting circuits. The transmit switch disables the voltage source to IC2 to mute the receiver when transmitting. Once again, a 1N4002 diode is used as a varicap in the RIT circuit. R2 shifts the oscillator offset by 800 Hz when transmitting. An audio tapered pot helps linearize the RIT pot. It must be connected as shown in the component placement drawing.

Power Supply

A second cabinet houses the receiver power supply and, if desired, the QRP transmitter. A Radio Shack transformer #273-1352 is used with a bridge rectifier circuit and a 4700 uF@ 25 volt capacitor for filtering (see Figures 6, 7, and 8).

The supply voltages are carried through a pigtail cable to a 4 pin connector (Radio Shack #274-002) and plug (Radio Shack #274-001) on the receiver chassis rear panel. The transmitter control signal is also carried on this cable. Separate pigtails for the receiver antenna input and the oscillator output for the transmitter are also located on the back of the chassis, and are terminated with RCA type phono jacks and plugs. (I used Radio Shack #274-346 jacks and a phono plug to phono plug cable from All Electronics cut to 8 inch pigtails.) The power supply front panel also has an AC power switch and a LED that's keyed with the transmitted signal.

Building the Direct Conversion Receiver

I used Radio shack cabinets (RS 270-253) as enclosures. One houses the receiver, the second

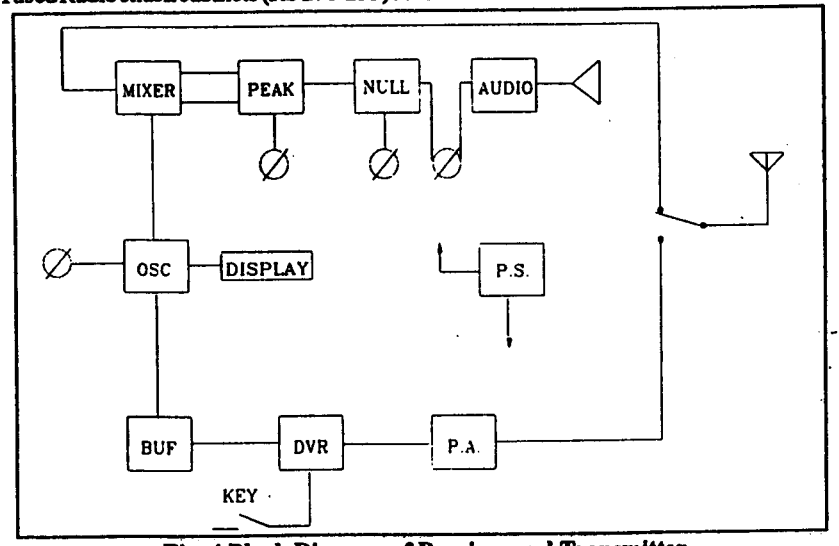


Fig. 4 Block Diagram of Receiver and Transmitter

the power supply and optional QRP transmitter.

The panels of these cabinets are constructed of very light metal and bend easily. To make the holes on the front and rear panels, I used a piece of 2 x 4 wood reinforcement cut to fit the inside of the box from front to rear (see Figures 9 and 10A). The board stiffens the panels so you can center punch and drill without distorting them. You can cut the counter display hole by making a series of small holes and filing them to fit. A nibbler tool also works.

The 12 and 5 volt regulators that supply the receiver and display boards are mounted on the rear of the receiver chassis. (The 5 volt regulator is necessary only if you add the counter.) They are mounted directly to the metal chassis wall and don't require insulators. Tie points are used on the rear panel to mount the counter's 1000 uF filter capacitor and the regulator terminals (see Figure 9).

The following controls are installed on the front panel: the ten turn pot used to set the VFO frequency, two switches (one for sideband shift and the other for transmit/receive), a null control, an RIT pot, and an audio gain pot. Before working on the pc board, I suggest you wire the various controls and the pc board connector as per the diagram in Figure 11. The pots must be wired as their terminal numbers indicate for proper operation. (Note: Look at the pots from the front of the panel to determine the numbering scheme.)

To give the front panels a more professional appearance, I sprayed them with high gloss white paint. I then covered the receiver panel with transparency material labeled with the various control functions. Negatives for the film are shown in Figure 10B. If your receiver doesn't contain the built in counter, use the second negative option. It's a reverse negative, so the printing will be on the inside when placed on the panel. The material, called Type 101 transparency, is manufactured by Kodak. It comes in an 8-1/2 x 11 sheet and is available from photocopy stores. I suggest that you copy the artwork onto a sheet of regular copy paper first. make three copies, and combine all three on one sheet. Place this composite sheet into a copier, insert the film in the paper drawer, and print. Choose the best copy for your project and keep the others as spares in case you make a mistake. Cut the completed film to fit the outline indicated. Carefully cut out the holes with a hobby knife. Mount the various pots and switches on the front panel over the film; they will hold it in place.

Because the pc board head room is restricted, it's necessary to flatten the connector solder terminals so they're at right angles to the connector. The component placement drawing Figure 11, indicates in which direction the terminals should be bent. The connector is mounted to the chassis with 4-40 screws using 6-32 nuts as spacers. To prevent the terminals from shorting to the chassis, I cut a 3 x 5 card 1 inch wide and placed it under the terminals. The receiver requires one shielded cable that runs from the oscillator output phono jack on the cabinet rear to the counter. To make this cable, use any shielded phono cable left over after making the antenna and oscillator pigtails. The shield is grounded on both ends.

Receiver PC Board Construction

Use Figure 11 as a parts placement guide. All pc boards are available from FAR Circuits for a nominal fee (Printed circuit boards can be obtained from FAR Circuits, 18N640 Field Court, Dundee, IL 60118. Prices are as follows: receiver board, $5.60; transmitter board, $4.40; counter board, $3.50; side tone board, $3.50. A set of boards is $14. Please add $2.00 shipping and handling per order.)

The receiver requires two coils, one for the oscillator and one for the detector, wound on T50-6 toroids. Coil and capacitor data are provided in Table 1. Use NPO ceramic or polystyrene capacitors in the oscillator circuit to ensure temperature stability. I obtained the best results when capacitors C2 and C3 were polystyrene and the others associated with the oscillator circuit were NPO type. Several articles have indicated that poly capacitors have a temperature coefficient that counteracts the temperature shift produced by the toroid.[7,8] My

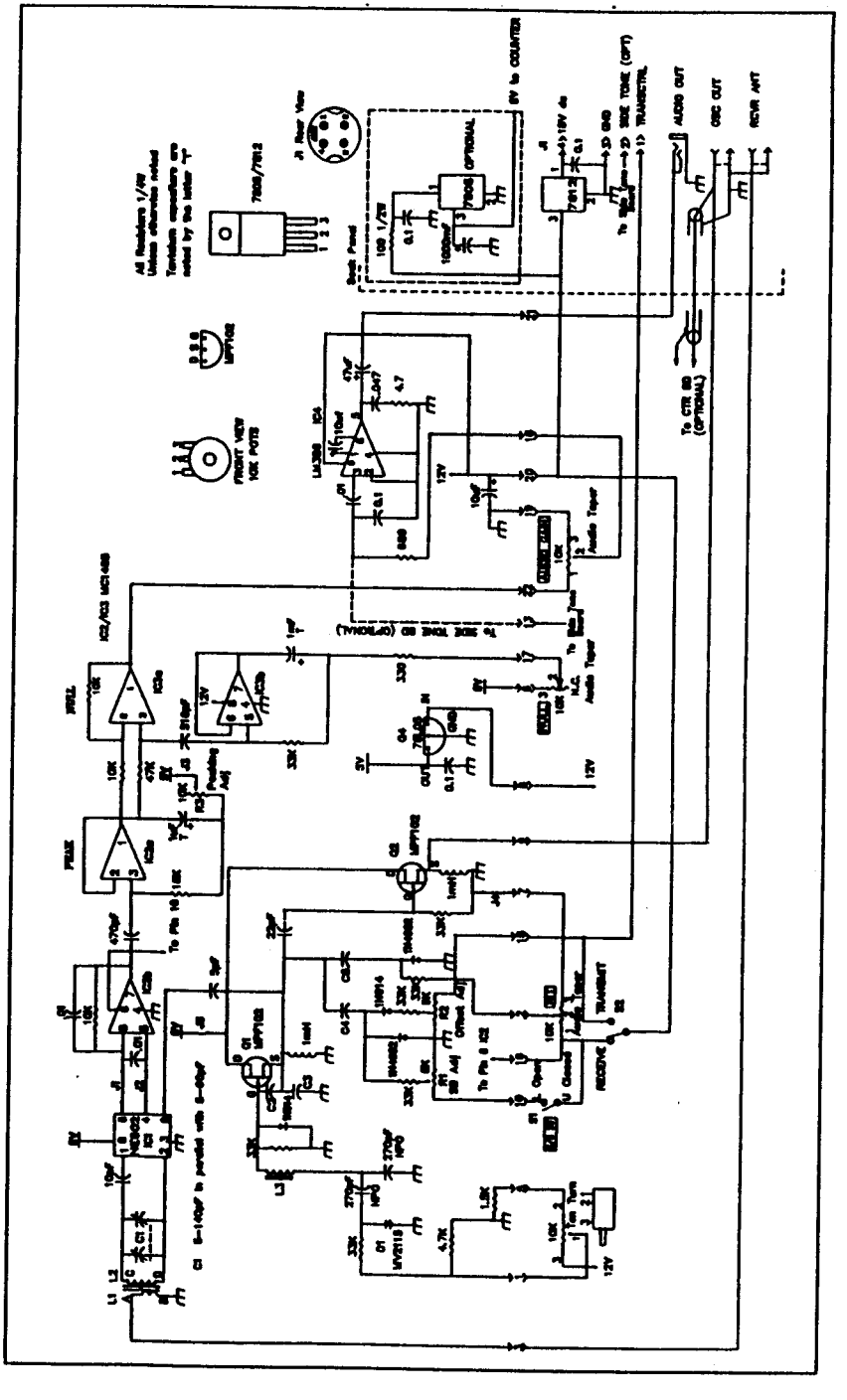


Fig. 5 Receiver Schematic

experimentation has proven this to be true. All 12 units I investigated showed a reduced fluctuation with temperature when they were used in this configuration.

Table 1

All Caps are in pF

Band	C1	C2	C3	C4	C5	L1	L2	L3
80	10-200	1000 poly	1000 poly	100 disc	33 disc	3T #26 3"	38T #26 29"	50T #26 31"
40	10-200	470 poly	470 poly	10 disc	5 disc	2T #26 2"	27T #26 18"	27T #26 18"

The ICs are mounted in 8 pin sockets. Be especially careful of the tantalum and electrolytic capacitors' polarization. The bar on the symbol indicates the plus terminal corresponding to the plus sign on the capacitor.

If you include the QRP transmitter, mount the pc board connector on the rear panel of the power supply cabinet. Even if you're not planning to build the transmitter now, it would be wise to drill the connector holes while making the other holes, so you can add it in the future.

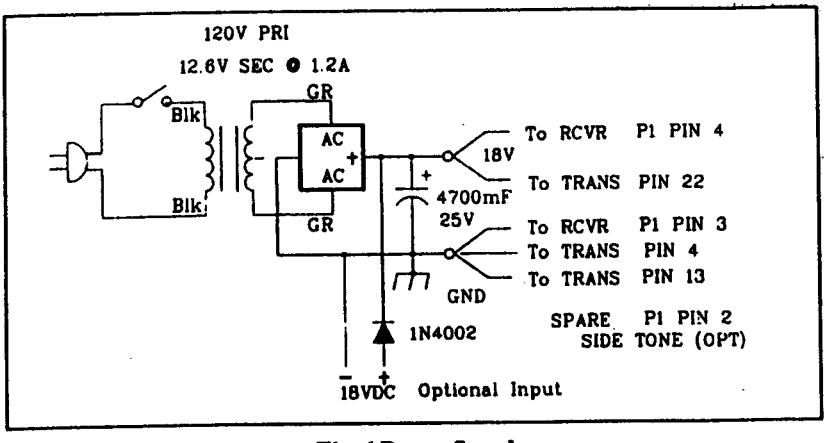


Fig. 6 Power Supply

Frequency Counter Construction

As I mentioned earlier, the frequency counter is also built on a pc board. The component placement and circuit schematic are shown in Figures 12A and B. figure 13 shows the eight jumper wires that must be installed on the back of the pc board; i.e., D1 goes to D1, and so on. The pc board consists of the Intersil ICM7216D, a driver transistor, and the displays. I used MAN74s for the displays; they're readily available and inexpensive. All ICs are mounted in sockets. The power for the counter is obtained from the 5 volt regulator on the rear panel of the receiver chassis. The ICM7216D is designed to work with a crystal calibrated in parallel. Unfortunately, almost all the 10 MHz crystals are calibrated in series. Consequently, the receiver oscillator readings were low. After some experimentation, I recalled the "rubber crystal" technique, where an inductance in series with a crystal lowers its frequency. Lowering the oscillator frequency increases the count time, allowing a higher number of cycles through, and a higher frequency reading. A 10 uH choke solved my problem and let me calibrate the counter correctly. A trim capacitor mounted on the board allows exact adjustment of the crystal frequency. One half inch threaded spacers and screws mount the pc board to the front panel. A piece of transparent red plastic is placed behind the display panel opening. I used "see thru report covers" from the stationary store. There are many types available. Try to

obtain the darkest red possible. It may take two layers of the material cut to size and secured to the panel with DUCO cement.

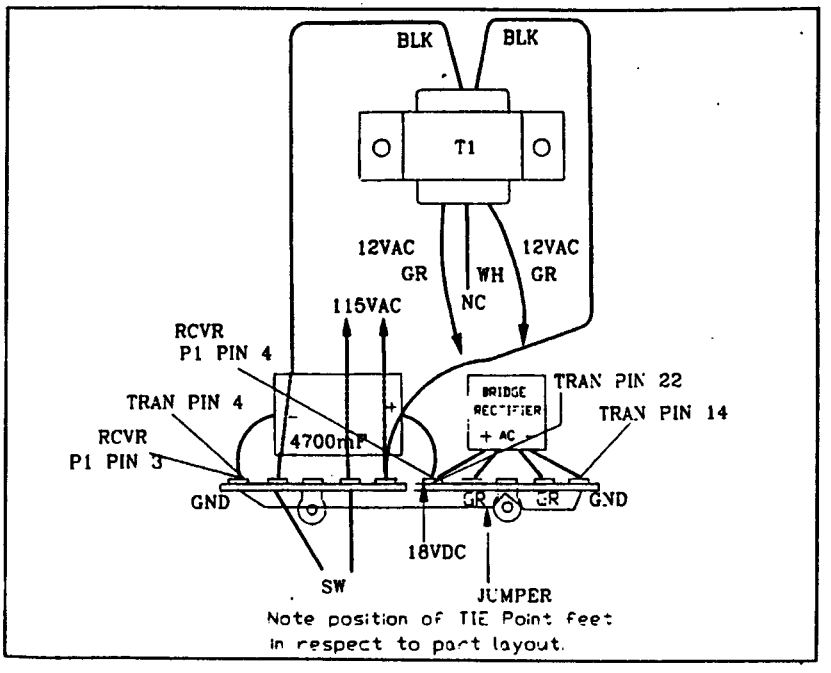


Fig. 7 Bridge Rectifier Circuit

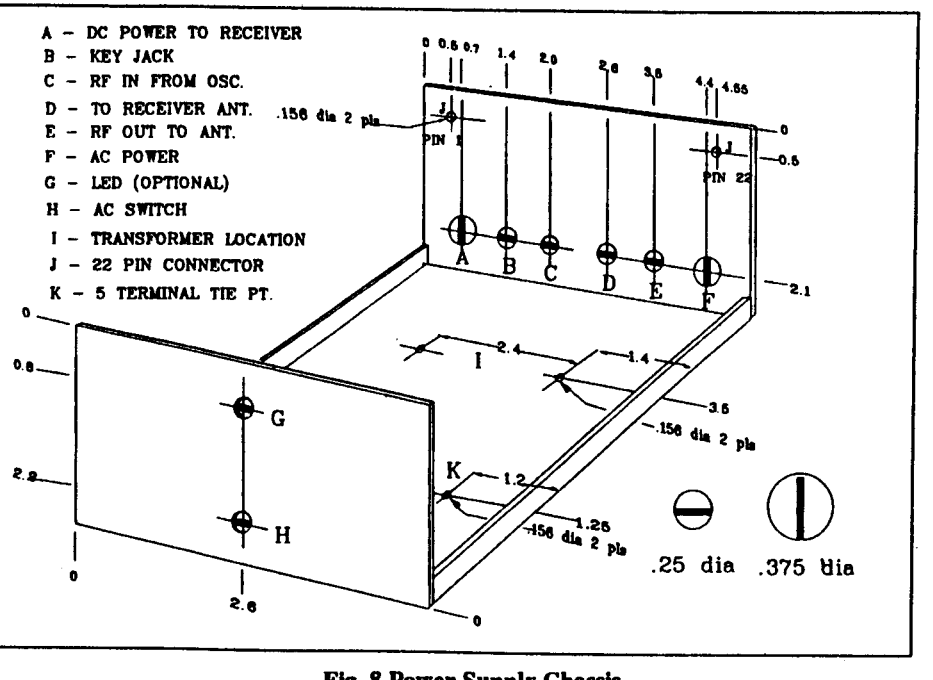


Fig. 8 Power Supply Chassis

Receiver Adjustments

Before inserting any ICs, check to see that all test points have the proper voltages. The voltage across the 4700 uF capacitor should be about 18 to 19 volts; all others on the pc board should be 12 or 5 volts. A 78L05 regulator provides the 5 volt source on the receiver board and this supplies voltages to the NE602 and the oscillator.

If your voltages are correct, it's time to check out the receiver. Set the REC/TRANS switch on REC. If you have another receiver, use it to help determine if the oscillator is working and the frequency to which it's tuned. If you've incorporated the counter, it will provide the oscillation frequency. (The counter displays 0.0 if the oscillator isn't working.) If the receiver is working, connect your dipole or long wire antenna to the antenna input. You should hear an increase in background noise when the detector capacitor (C1) is rotated to the oscillator's resonant frequency. (Because the capacitor rotor is floating in this circuit, you must use a nonmetallic adjustment tool to set it to the right spot. I used a wooden dowel with a slot in the end to fit over the shaft.) The audio gain should be at the 3/4 position for this check. The peaking potentiometer (R3) on the pc board should be set at approximately 1/2 clockwise for 800 Hz peaking.

If nothing is heard, look for a problem in the audio section. Remove the NE602N and connect a wire to pin 6 of the next stage (IC2). Touch this wire with the power on. You should hear a loud buzz in the speaker. If not, repeat the procedure with pin 3 of the output stage (LM386). This should help you locate the problem area.

Now that you've finished troubleshooting the audio section, you're ready to set the receiver frequency limits. Set the lower edge to 3595 KHz for the 80 meter band, or 6980 KHz for the 40 meter version. Turn the 10 turn pot to its full counterclockwise position. Determine its frequency, either by using the counter or a receiver located nearby. If the frequency is too high, try pushing the turns on oscillator coil L3 closer together. If it's too low, do the reverse. There's no setting for the high end, but it should be about 130 KHz higher. Use the same technique for the 40 meter band. When you're sure you have the proper settings, cement the wires in place. I recommend that you start at one end and do about three quarters of the coil.

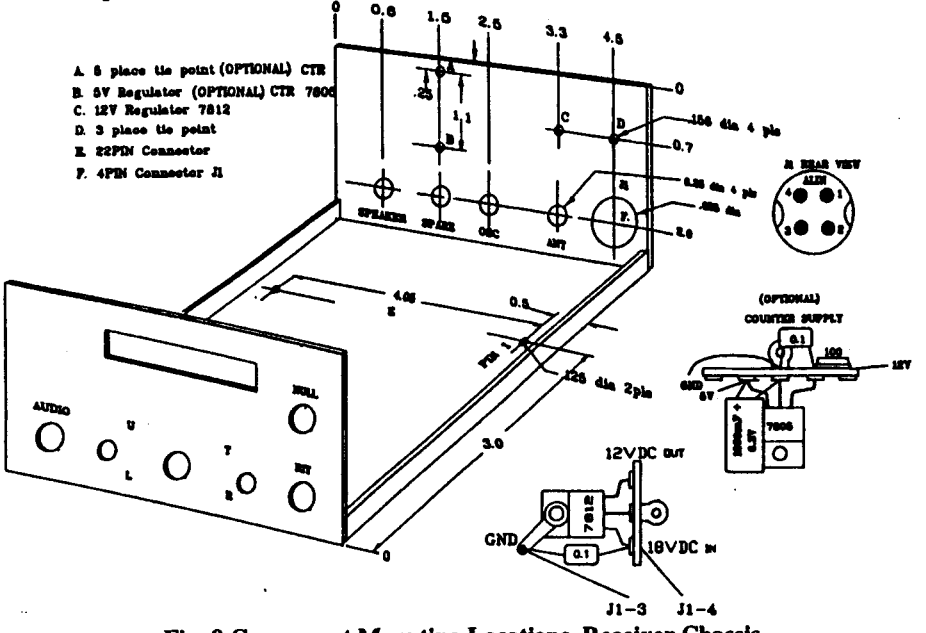


Fig. 9 Component Mounting Locations, Receiver Chassis

This lets youmake minor adjustments after the cement dries. You must also cement the coil to the pc board for stable frequency operation. (I used DUCO cement here.) The frequency will change when you put the cover on, so allow for this in your settings.

You should now hear CW signals (for 80 meters, listen at night; for 40 meters, listen day or night). You should also notice a definite increase in the received signal as you approach the 800 Hz audio frequency. This indicates that the peaking circuit is working.

Now check the null or notch circuit. Tune off a received signal until its audio note is about 1200 Hz in frequency and then rotate the null pot. Start with the pot in the clockwise position and slowly rotate it counterclockwise. The null is very sharp; you should hear a definite drop in the signal level. The null pot is normally left in the full clockwise position when not in use.

Next check the RIT circuit. Set the RIT pot to its center position. Zero beat a signal and rotate the pot from one end to the other. There should be a change in frequency of approximately plus or minus 2 KHz. The knob is normally set in the center position to allow for the plus or minus variation.

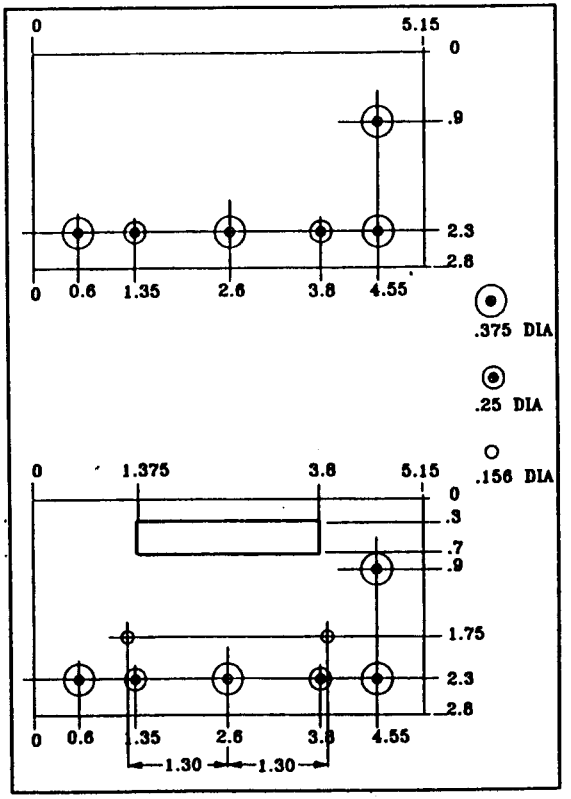


Fig. 10A Hole Template, Receiver Chassis

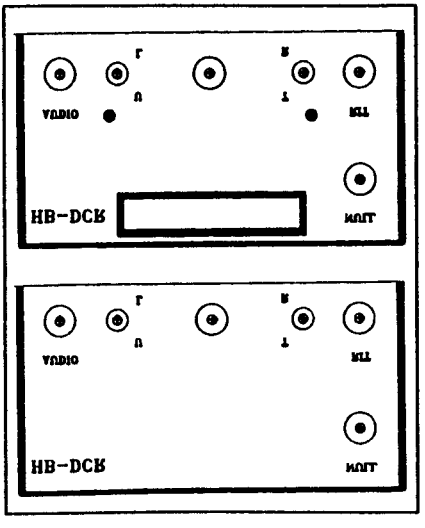


Fig. 10B Control Function Template, Receiver Chassis

It's a little more difficult to set the upper/lower sideband selection switch because you need a steady signal. (With a little patience, you can set it using a loud CW signal.) A signal source, like a signal generator, etc., makes this operation much easier.

First, set the RIT control to the CENTER. Then set the sideband switch to LOWER sideband. With the switch in this position, the full capacitance of the 1N4002 is across the circuit. (In the lower sideband position, no voltage is applied to the 1N4002, placing it at full capacitance.) Tune the receiver to the lower sideband of a signal until you reach a point where the tone peaks at 800 Hz. Now switch to the upper sideband. You should still hear the signal, although it may be at a different pitch. Adjust R1 until the tone peaks at 800 Hz again. Switch back to the lower sideband and retune the receiver to the peak CW note once more. Return to the upper sideband and recheck. If you still don't have the right frequency, readjust R1 and repeat the operation until there's only a minimal change in pitch from one sideband to the other. It may not be possible to get a perfect match from one band to the other, but it will be close enough to know that you're hearing the same signal.

The oscillator frequency is offset for transmitting in a similar fashion. The transmit switch on the front panel connects potentiometer R2 to the 1N4002. R1 is disconnected when the transmit switch is in the transmit position. (At the same time, it disconnects the supply voltage to IC2, which mutes the receiver in transmit.)

To make the adjustment, set the sideband switch to lower sideband (LSB). Connect a temporary wire from pin 8 of IC2 to pin 8 of IC3 on the pc board. This activates IC2 in transmit, so you can hear the audio. Set the RIT in the CENTER. Remove the transmitter board and jumper pins 2 and 4, or connect the receiving antenna directly to the receiver input. If you don't remove the transmitter board, the receiving antenna will be disconnected by the changeover relay in transmit. Tune the receiver to a signal on the lower sideband, peaking the signal at 800 Hz. Turn on the TRANSMIT switch. Set the RIT to full counterclockwise position and adjust R2 until the signal is zero beat. Switch back to RECEIVE and readjust the receiver to 800 Hz with RIT back in the CENTER. Repeat the process until no change

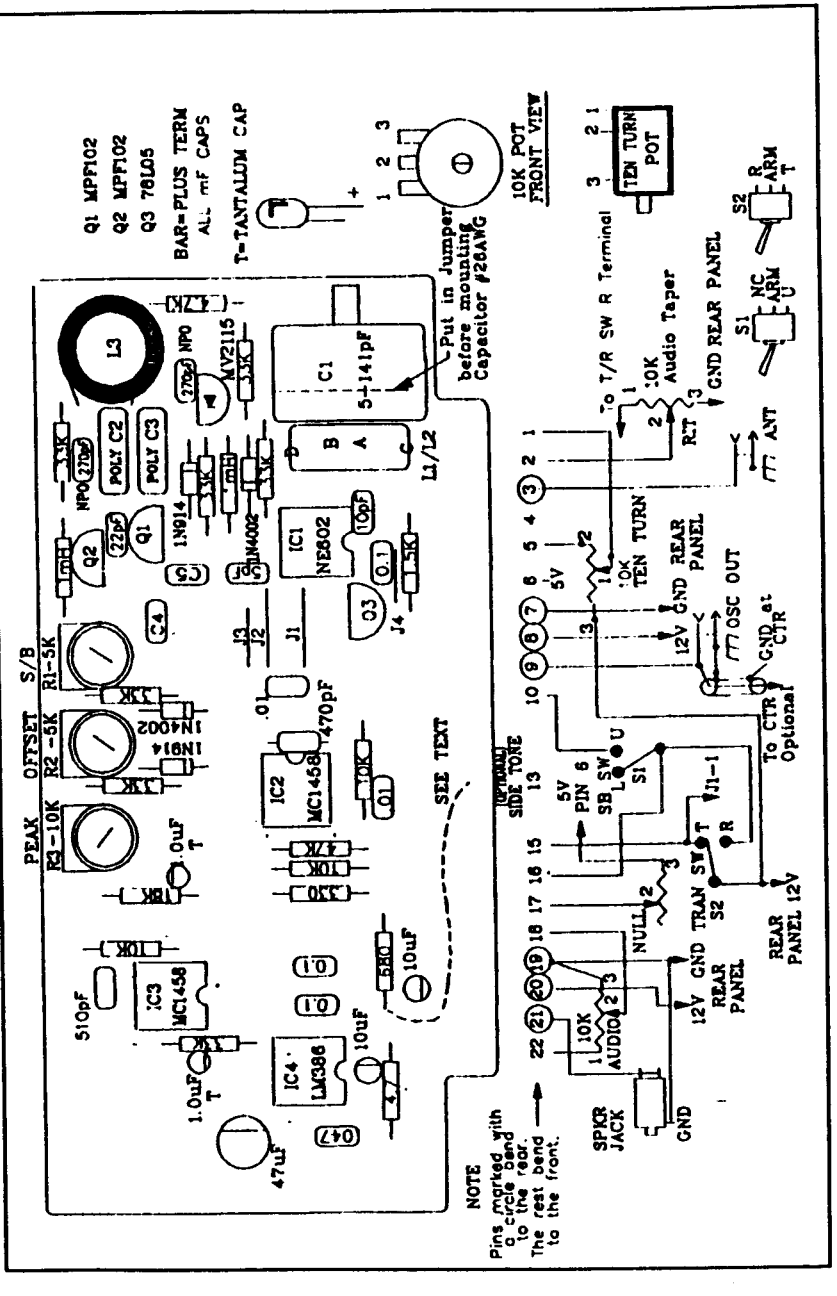


Fig. 11 Receiver Board Layout. Component Side

is required when going from lower sideband to zero beat. Reset the RIT to the center position and remove the jumper on the pc board.

If the counter is in the circuit, you should see the frequency shift upward by approximately 800 Hz. When moving in the opposite direction, upper sideband (USB) to zero beat may not shift down the same amount, but should be close enough that it won't create a problem for any station listening to you.

With the counter, the sideband offset adjustment is much simpler. Set the receiver oscillator frequency to 7100.0 KHz with the sideband switch in the lower position. Move the sideband switch to high. Adjust R1 to give a reading of 7101.6 KHz. Check to see if the LSB still reads 7100.0 KHz.

To set the transmit offset circuit, put the sideband switch in LSB with the counter reading 7100.0 KHz. Turn on the transmit switch and adjust R2 to give a frequency reading of 7100.8 KHz. Move the sideband switch to the USB. The reading should still be about 7100.8 KHz.

I've noticed some stations don't shift the same amount; this is where the RIT control comes in handy. You can tune in their signal with changing your transmitted frequency.

Caution: do not use the RIT to tune the station before you make a contact. Once you have made a contact, you can use the RIT to retune without upsetting your original transmitting frequency. After a contact, always reset the RIT back to the center position.

Tuning The Receiver

There's a special tuning method you must follow to use the receiver with the transmitter. Set the RIT control to the CENTER. If you're tuning across the band from the low end up, make sure the sideband switch is in LSB. If you come across a station on LSB, you can move the sideband switch to the USB to see if the signal has less QRM. Don't touch the dial when performing this operation. If you've chosen the correct sideband, the signal will still be present. If not, you're on the wrong sideband. If you tune from the upper end of the band downward, the sideband switch must be in USB. This feature lets you shift the received signal from upper sideband to lower sideband to see which side is in the clear. If there's QRM on both sides, adjust the notch filter to remove one of the interfering stations.

Antenna Requirements

The receiver is designed to use a low input impedance antenna. If you use a short antenna for receiving, you'll need some sort of matching network to obtain the best results. If you operate the receiver with the transmitter, use either a 50 or 75 ohm impedance dipole antenna; you'll need a matching network for any other type of antenna. I use both a 40 meter dipole and a 250 foot endfed long wire with a matching network.

The QRP Transmitter

The QRP transmitter fits into the cabinet that houses the power supply. The transmitter connector is mounted on the rear panel of the cabinet and the pc board is located above the power transformer.

The transmitter frequency is controlled by the receiver oscillator (see schematic in Figure 14). A source follower (MPF102) on the transmitter board improves isolation. The follower's output is connected to the base of a PN2222A transistor that acts as a driver to the output stage. The power output stage is a power MOS-FET. I chose the power FET because it is easy to drive and can stand an open output circuit without damage, thus it isn't affected by high SWRs.9 The power FET is rated at 20 watts dissipation, and with this low power I used a small heat sink.

The voltage to the source follower, driver, and bias for the output stage are keyed by a 2N2906 transistor, Q1. The voltage source for the keying stage is taken from the receiver

(TRANS CONTRL) and is controlled by the TRANSMIT switch on the receiver front panel. This switch also activates the transmit frequency offset, transfers the antenna over to the

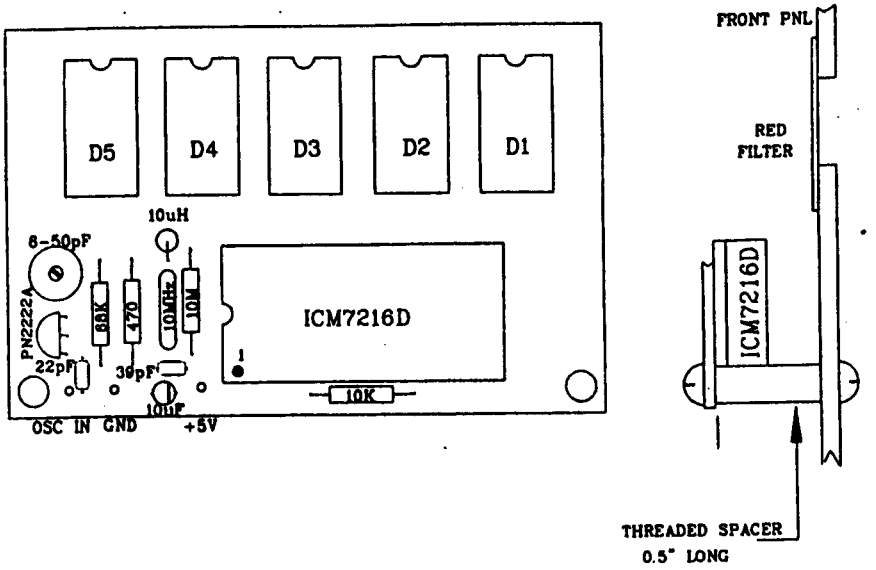


Fig. 12 A Frequency Counter Board Layout, Component Side

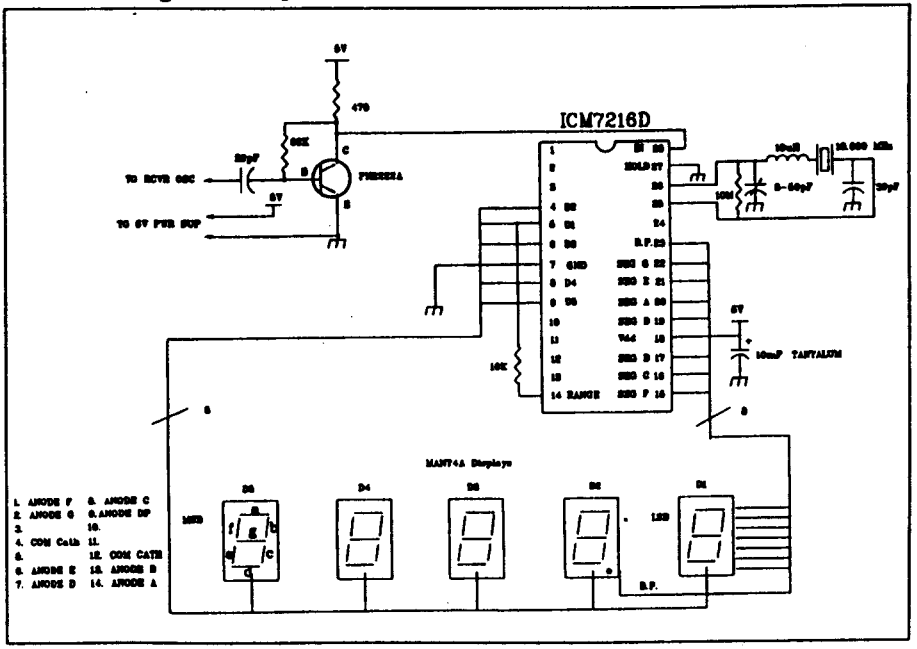


Fig. 12 B Frequency Counter Circuit Diagram

transmitter, and deactivates the RIT control.

When the key is closed, voltage is applied to driver Q3 by activating Q1. A properly shaped CW signal appears across L1 and is coupled to L2 to provide a gate signal for the power MOS-FET, Q4. The output FET feeds a lowpass filter designed to match its output to a 50 ohm

load.

If you're contemplating field operation, I suggest using three 6 volt lantern batteries in series. The one disadvantage of the power MOSFET is that it's not very efficient with low source voltages, so don't try 12 volt operation. The drain on the battery is about 800 mA key down. If you don't use the digital display, drain is about 100 mA less. You could include a switch to turn off the display if you want to operate using batteries. In receive, drain is about 40 mA without the display. For more information see the section "A Final Note".

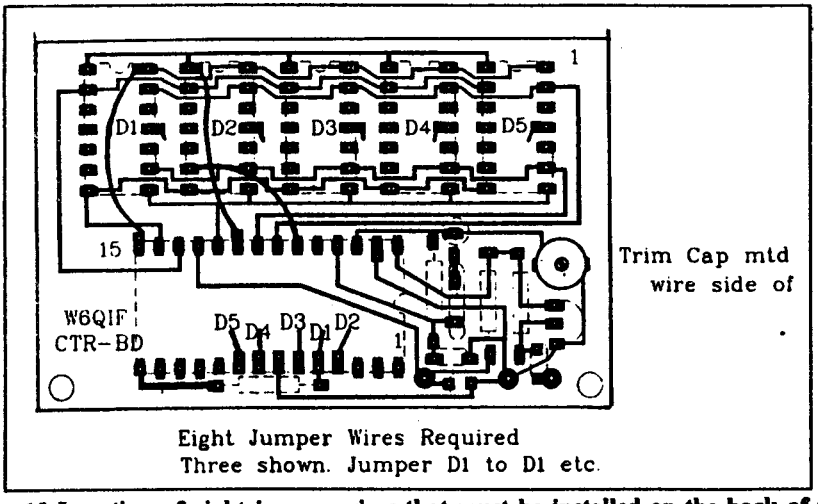


Fig. 13 Location of eight jumper wires that must be installed on the back of the frequency counter board.

Transmitter Construction

The component placement layout for the transmitter is shown in Figure 15. Note that you'll need to wind four coils. Coil winding data is shown in Table 2. When winding coils of this nature, I find it much easier to cut the wire to length and then pass half the wire through the toroid and wind out to both ends. I've provided the wire lengths to make the job easier.

Table 2

All caps are in pF

Band	C1	C2	C3	L1	L2	L3	L4	RFC
80M	1000	1800	680	*23T	*23T	17T	20T	50T
	mica	mica	mica	#26	#26	#26	#26	#26
				18"	18"	11"	15"	37"
40M	680	1000	470	*23T	*23T	12T	16T	50T
	mica	mica	mica	#26	#26	#26	#26	#26
				18"	18"	9"	10"	37"

*Bifilar Wound, 5 twists per inch

Be sure to get the correct polarity on the driver bifilar coil. It makes things easier if you use different color wire. Twist the two wires together so there are about 5 turns per inch.

Transmitter Operation

Connect the two shielded cables (oscillator and antenna) from the transmitter chassis to the proper terminals on the receiver, and connect your key. Put the TRANS/REC switch on the receiver in TRANSMIT.

The transmitter needs no adjustment. However, I do suggest operating into a 50 ohm dummy load before connecting the transmitter to an antenna. If you have an oscilloscope with

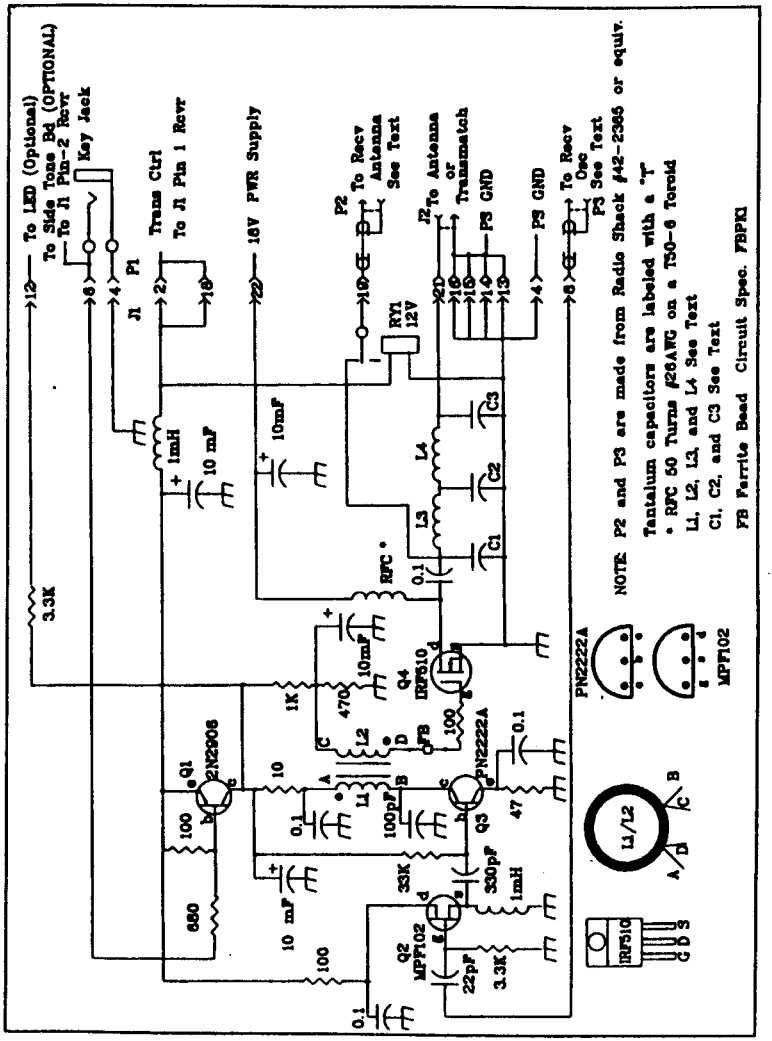


Fig. 14 Transmitter Schematic

sufficient bandwidth to give a correct voltage at 7 MHz, you can measure the voltage across a 50 ohm dummy load. The reading should be about 40 volts peak to peak, or 14 volts RMS. This equivalent to 4 watts output. If you don't have a 'scope but want to see if there's an output, connect an incandescent lamp type 1891 (Radio Shack #272-1112) as a dummy load. It will light up brightly if there's output from the transmitter. If you've incorporated the LED, it should also light when you close the key.

Antenna Matching Unit

The antenna matching unit is housed in the third cabinet in the photo. The unit includes a directional power meter that indicates forward and reverse power. Other than the fact that it uses a 1 mA movement meter, there's nothing special about this circuit. To obtain sufficient

signal from the RF transformer in series with the antenna line, I had to use a coil wound on a T68-6 toroid with 3 turns in series with the antenna lead and 50 turns on the secondary.

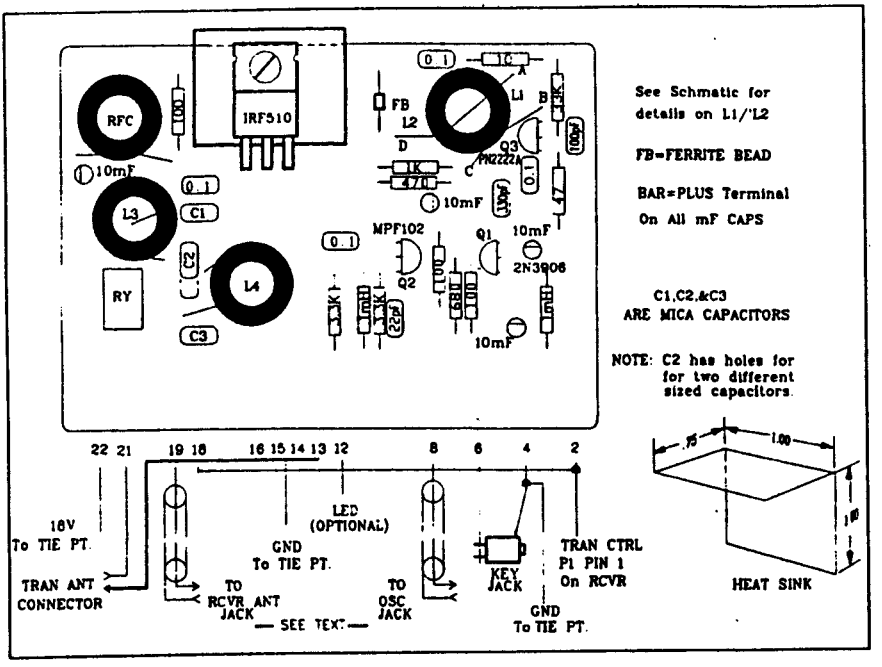


Fig. 15 Transmitter Board Component Side

Obviously, this wouldn't be satisfactory for VHF, but has little influence on the 40/80 meter bands' accuracy.

Parts Procurement

I've compiled a list of various sources that may be helpful in locating parts. When choosing a source, consider the minimum purchase order each company requires. By doing a little comparison shopping, you might find the same item elsewhere, at a place that has other parts you need, with a smaller minimum requirement. Some of my sources are:

1. Radio Shack. The Radio Shack chain carries a good assortment of standard parts, but no special parts.
2. Digi-Key. Located at 701 Brooks Avenue, P.O. Box 677, Thief River Falls, MN 56701. Digi-Key's minimum purchase charge is $5 for anything less than a $25 order. They have a wide assortment of parts and a good catalog.
3. Circuit Specialists. Write to P.O. Box 3047, Scottsdale, Arizona 85271. There is no minimum order charge, but a $4 shipping and handling charge.
4. Mouser Electronics. Write to P.O. Box 699, Mansfield, TX 76063. Mouser adds a $5 charge to any orders below $20.
5. Dan's Small Parts. Located at 1935 So. Third West #1, Missoula, MT 59801. Phone: 406-543-2872. No minimum order. $3.75 shipping and handling charge. Lots of special parts for builders.
6. Oak Hills Research. Located at 20579 Madison St., Big Rapids, MI 49307. No minimum order requirement; $4 shipping and handling charge.
7. Ocean State Electronics. Write to P.O. Box 1458, Westerly, RI 02891. Carries some hard to find items. The minimum order is $10; shipping and handling is $4.

8. BCD Electronics. Write to P.O. Box 450207, Garland, TX 75045. There is a charge of $.95 on orders under $30. Many hard to find items are available.
9. All Electronics Corp. Write to P.O. Box 567, Van Nuys, CA 91408. There is a $4 shipping and handling charge on orders and a $10 minimum order.

I suggest you send for these suppliers' catalogs and then decide where you want to purchase your parts. The parts list indicates where I purchased the various components. I tried to keep the number of sources to a minimum to reduce shipping costs. I've already listed the parts you should buy from Radio Shack. There are a few parts that can only be obtained from a couple of places. The NE602N or NE602AN, the upgrade version, the 10 turn wire wound potentiometer, and the frequency counter IC are in this category. The first number is the lower price source

*NE602N/AN: Listing numbers 5 and 2.
*10K, 10 Turn Pot: Listing numbers 3 and 2.
*ICM7216D frequency counter chip: Listing numbers 3 and 2.

All other parts can be found in one of these catalogs. I obtained my parts from listing numbers 1, 3, 5, and 9.

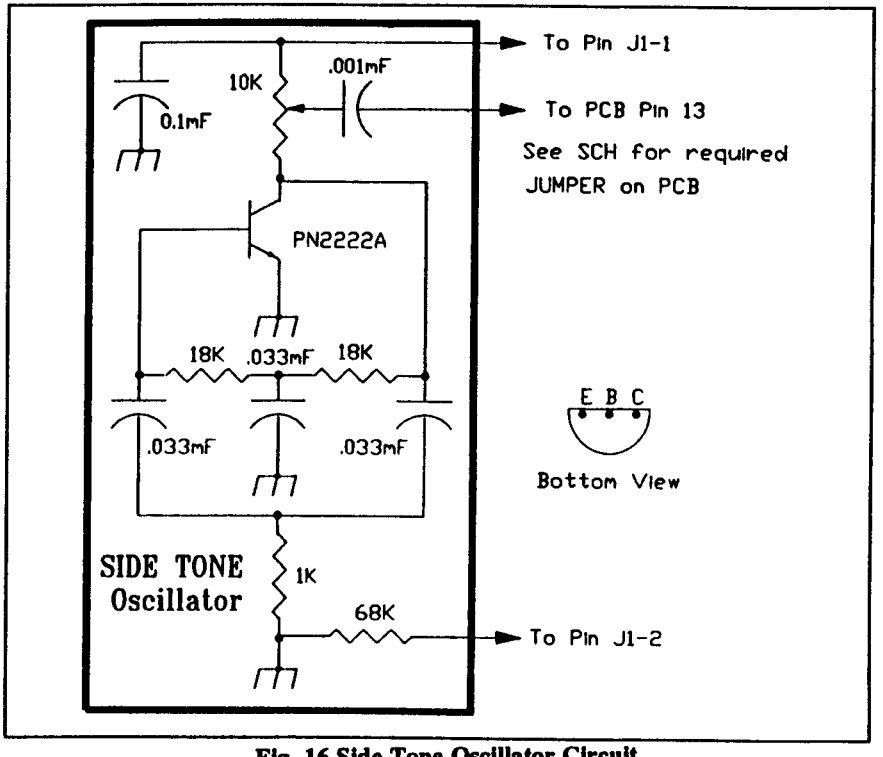


Fig. 16 Side Tone Oscillator Circuit

Summary

In the final analysis, I met all of my goals for this project, and the other builders and I are very happy with the results. The cost of the receiver, transmitter, and power supply was just over $115. If you include the frequency counter as an integral part of the unit, the total cost is about $140. If done as an auxiliary unit at a later date, the additional cost will be about $40.

I use a 250 foot antenna on the receiver through a matching network. There's a small amount of standard AM broadcast feedthrough on 80 and none on 40. At night there's a small amount

of feethrough from a shortwave AM station on the 250 foot antenna, but none on the 40 meter

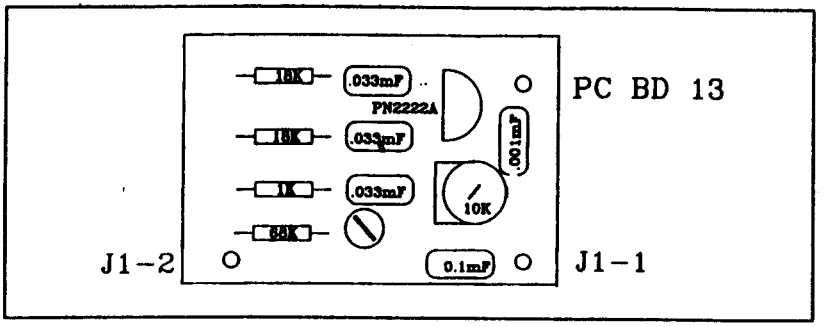


Fig. 17 Side Tone Oscillator Board, Component Side

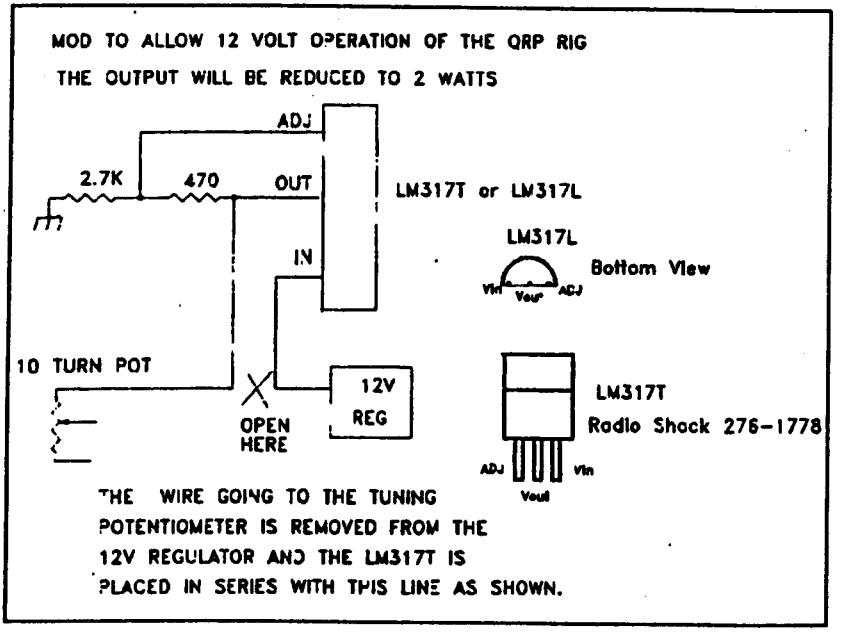


Fig. 18 Modification to allow 12 Volt operation of the QRP rig.

dipole. The USB/LSB switching works well and the receiver selectivity is quite adequate. I was concerned that digital noise from the counter might be a problem; but with enough filtering, there's only a trace, and it's well below the atmospheric noise level.

If you wish, you can incorporate a side tone circuit. There's an extra pin on the power connector that could connect from the keying circuit to the side tone oscillator. There's plenty of room on the receiver chassis for a small perfboard like the Radio Shack #276-150, or, you can purchase a pc board from FAR Circuits. The side tone oscillator schematic is shown in Figure 16. The parts layout and pc board are shown in Figure 17. A jumper wire must be added to the receiver pc board to complete the circuit (see Figure 11).

Acknowledgments

I'd like to thank Floyd Becker, W6RJY, for his help in checking the on the air performance of the transmitter, my wife for her patience, and my ten fellow amateurs who built the project and enabled me to improve construction data information.

A Final Note

With the upcoming field day, a number of the hams who built my QRP rig wanted to know if they could operate using a 12 volt battery. Initially the unit was designed to operate from a 120 Volt AC power source to obtain 4 watts output. With the power MOSFET, the rig needs at least 18 volts DC on the final amplifier stage. However, the participants said they would accept less output if they could run off a 12 volt battery.

Twelve volt operation requires a small change in the circuitry. The frequency tuning potentiometer obtains its voltage from the 12 volt regulator mounted on the rear of the receiver chassis. When operating from a 12 volt battery, the 12 volts from the regulator is no longer regulated, causing the frequency to shift every time the transmitter is keyed. The insertion of an additional regulator set for about 9 volts, restablizes the frequency. The circuit is reduced to 2 watts, but you'll find that such a small change is hardly detectable.

References:

1. Rodney A. Kreuter, WA3ENK, "A Simple Direct Conversion Transceiver," Ham Radio, December 1988, page 9.
2. Zack Lau, KH6CP, "The QRP Three Bander," QST, October 1989, page 25.
3. Michael A. Covington, "Single Chip Frequency Converter," Radio Electronics, April 1990, page 49.
4. Bill Parrot, W6VEH, "Simple Receivers from Complex ICs," Ham Radio, November 1988, page 10.
5. Jim Pepper, W6QIF, "The Magic Filter," 73, NOvember 1983, page 14. Reprinted in QRPp, Dec. 93, page 29.
6. Jim Pepper, W6QIF, "The Pepperdyne Receiver," Ham Radio, November 1988, page 33.
7. The ARRL Handbook, Chapter 10, Amateur Radio Relay League, Newington, Connecticut, 1989.
8. Doug DeMaw, W1FB, "The Practical Aspects of VFO Design Plus How to Build One," CQ, June 1991, page 16.
9. Doug DeMaw, W1FB, "Power-FET Switches as RF Amplifiers," QST, April 1989, page 30.

Receiver PC Board Parts List

Quantity	Part	Unit Price	Extended	Source
1	PC Board	$5.60	5.60	Far
1	NE602AN	2.25	2.25	Dan's
1	LM386-3	.75	.75	Dan's
1	78L05	.25	.25	Dan's
2	1N4002	.03	.06	Dan's
2	1N914	.03	.06	Dan's
2	T50-6	5/1.00	.40	Dan's
2	1 mH Choke	6/1.00	.32	Dan's
1	Varactor	1.26	1.26	CS MV2115
2	MC1458	.50	1.00	CS MC1458
2	MPF102	.40	.80	CS MPF102
1	47uF/16 Rad.	.15	.15	AE RAD47mF/16
2	10uF/16 Rad.	.13	.26	AE RAD10mF/16

Quantity	Part	Unit Price	Extended	Source
2	1uF/35 Tant.	.24	.48	CS TAC005
2	270 pF NPO	.47	.94	CS 21RR627
1	510 pF disc 5%	.20	.20	CS 21CB510
1	470 pF disc 5%	.20	.20	CS 21CB470
1	22 pF disc	.16	.16	CS 21CB022
1	10 pF disc	.16	.16	CS 21CB010
1	5 pF disc	.16	.16	CS 21CB005
3	.1 uF mylar	.19	.57	CS 23BK410
1	.047 uF mylar	.14	.14	CS 23BK347
2	.01 uF mylar	.14	.28	CS 23BK310
1	10 ohm 1/4 watt	.10	.10	CS
1	330 ohm 1/4	.10	.10	CS
1	680 ohm 1/4	.10	.10	CS
1	1.5K 1/4	.10	.10	CS
1	4.7K 1/4	.10	.10	CS
3	10K 1/4	.10	.30	CS
1	18K 1/4	.10	.10	CS
7	33K 1/4	.10	.70	CS
1	47K 1/4	.10	.10	CS
1	5-141 trimcap	1.38	1.38	CS 24TR222
4	8 pin sockets	.10	.40	CS C8408
1	1K H Trim pot	.20	.20	CS 32AA301
1	5K H Trim pot	.20	.20	CS 32AA305
1	10K H Trim pot	.20	.20	CS 32AA401
1	Mag. Wire	4.99	4.99	RS 278-1345
1	Hookup Wire	2.50	2.50	AE 22/ST
		40 Meter Receiver		
2	470 pF poly	2/1.00	1.00	W6QIF[1]
1	10 pF disc	.16	.16	CS 21CB010
1	5 pF disc	.16	.16	CS 21CB033
		80 Meter Receiver		
2	1000 pF poly	.50	.50	W6QIF[2]
1	100 pF disc	.16	.16	CS 21CB100
1	33 pF disc	.16	.16	CS 21CB033
		Receiver Chassis		
1	10T 10K Pot	6.49	6.49	CS 73JB10K
1	Mech. Ctr.	9.85	9.85	CS 316-11[3]
1	7812 Reg.	.40	.40	CS 7812T
1	Cabinet	6.99	6.99	RS 270-253
2	RCA Jacks	4/2.19	1.10	RS 274-346
1	Phone jack	2/1.59	.80	RS 274-249
1	5 Lug Tie	4/1.29	.33	RS 274-688
1	4 Pin Plug	1.69	1.69	RS 274-001
1	4 Pin Socket	1.29	1.29	RS 274-002
3	Knobs	4/1.69	1.29	RS 274-415

Quantity	Part	Unit Price	Extended	Source
1	Conn 22 pin	1.00	1.00	AE EBC-1G
2	SPDT switch	1.00	2.00	AE MTS-4PC
3	10K pot,aud.tpr	.50	1.50	AE PTA-10K
1	Trans. Film	1.00	1.00	Copy Store

Power Supply Chassis

1	Cabinet	6.99	6.99	RS 270-253
2	5 Lug Tie	Pur. on Recv.	.64	RS 274-688
1	Transformer	5.99	5.99	RS 273-1352
1	Bridge Rect.	.34	.34	CS KBP005
1	.001/500V disc	.18	.18	CS 21FA010
1	Power cord	.79	.79	CS PSC-2
1	SPDT Switch	1.35	1.35	AE MTS-14
1	Phono cable	.85	.85	AE ACB-6
1	4700 uF/25V	2.00	2.00	AE Axial
1	Key Jack	Pur. on Recv.	.79	RS 274-247
1	RCA Jack	Pur. on Recv.	.54	RS 274-346
1	LED	.50	.50	AE LED-111

Notes:
1. Available from author
2. Available from author
3. Not required if using digital counter option

Transmitter

Quantity	Part	Unit Price	Extended	Source
1	PC Board	4.40	4.40	FAR
1	Conn. 22 pin	1.00	1.00	AE EBC-1G
1	IRF510	1.99	1.99	RS 276-2072
1	Relay	1.99	1.99	RS 275-241
1	Mag. Wire	pur. on recv.	.20	RS
4	T50-6 Toroid	5/1.00	.80	Dan's
1	PN2222A	.05	.05	Dan's
1	2N3906	.05	.05	Dan's
2	1 mH choke	pur. on recv.	.13	Dan's
1	MPF102	.40	.40	CS MPF102
1	100 pF disc	.16	.16	CS 21CB100
1	330 pF disc	.16	.16	CS 21CB330
1	22 pF disc	.16	.16	CS 21CB022
4	10uF/16 rad.	.13	.52	AE RAD10mF/16
4	.1 uF mylar	.19	.76	CS 23BK410
1	Ferrite Bead	12/1.00	.08	CS FBPK1
2	10 ohm 1/4	.10	.20	CS
3	100 ohm 1/4	.10	.30	CS
1	470 ohm 1/4	.10	.10	CS
1	680 ohm 1/4	.10	.10	CS
1	1K 1/4	.10	.10	CS
2	3.3K 1/4	.10	.20	CS
2	33K 1/4	.10	.20	CS

1	Heat Sink	Homebrew see drawing	16GA aluminum	

40 Meter Operation

Quantity	Part	Unit Price	Extended	Source
C1	Mica cap 680pF	.64	.64	CS DM10-681J
C2	Mica cap 1000pF	.68	.68	CS DM10-102J
C3	Mica cap 470pF	.54	.54	CS DM10-471J

80 Meter Operation

C1	Mica cap 1000pF	.68	.68	CS DM10-102J
C2	Mica cap 1800pF	.88	.88	CS DM10-182J
C3	Mica cap 620pF	.64	.64	CS DM10-621J

Digital Frequency Counter

1	ICM7216DIPI	22.95	22.95	CS
5	MAN74	.99	.99	CS SC03-12HDB
1	PN2222	.20	.20	CS PN2222
1	8-50 Trimcap	.72	.72	CS 24AA074
1	10mF/16V tant.	.74	.74	CS TAC008
1	22 pF disc	.14	.14	CS 21CD022
1	39 pF disc	.14	.14	CS 21CD039
1	10 MHz crystal	2.50	2.50	CS C19
1	10 uH Choke	.39	.39	CS 43LS105
1	470 ohm 1/4	.10	.10	CS
1	10K 1/4	.10	.10	CS
1	68K 1/4	.10	.10	CS
1	10 Meg 1/4	.10	.10	CS
5	14 pin sockets	.12	.60	CS C8414
1	28 pin socket	.26	.26	CS C8428
1	7805 Reg.	.40	.40	CS 7805T
1	1000uF/16	.60	.60	CS CEM25-1000
1	100 ohm 1/2	2/29	.15	RS 271-012
1	5 Lug tie pt.	4/1.29	.32	RS 271-688
1	PC Board	3.50	3.50	FAR

Additional Parts If Remote Counter Is Built

Quantity	Part	Unit Price	Extended	Source
1	Cabinet	2.19	2.19	RS 270-231
1	Plug cable	1.79	1.79	RS 42-2635
2	1 mH choke	Purchased on Recvr	.32	Dan's
1	.001 poly	.12	.12	CS 23BK210

Notes:
AE = All Electronics
CS = Circuit Specialists
Dan's = Dan's Small Parts
RS = Radio Shack
All prices subject to change

[Editor's Note: I would like to thank Terry Littlefield, Editor of Communications Quarterly

for graciously granting permission to reprint this article. Terry provided the original picture that appears on the cover of this issue. Thank you Terry. Some of you may question as to why I would devote more than 20 pages to one article. The answer is simple, it is an excellent article and deserves to be printed. Also, even though it first appeared in Communications Quarterly, I doubt that many QRPers had the opportunity to see it, as that is a very expensive journal, $10 per issue! Thank you also to Jim for writing the article, he spent literally hundreds of hours on this project. I know, because I have spent several hours just typing it in. Doug, KI6DS]

What Test Equipment Do You Need for QRP?

by Robert Gobrick, WA6ERB/VE2DRB
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Mike, KK6GM, made a request for what folks are using in the way of test equipment to get their/other's projects going after they finish the soldering. The following is a list of some of the test equipment that I use in my "soldering room" (as my wife calls it). I will say that I don't have access to lab quality test gear at work and that in general my shop test gear is made up of things collected over the years. Maybe what is important is the order of priority of how I use the equipment. Anyway here goes:

1. Decent quality digital multimeter. My latest acquisition is the Radio Shack 22-175 Benchtop true RMS multimeter with frequency counter, transistor gain and capacitance ranges. About $100 list but usually on sale every once in a while. I mainly use if for the volt/ohm/ma readings.
2. FET-Input Analog Multimeter. Again another Radio Shack unit - model 22-220 with a "jumbo" 5" analog scale. Although I prefer the digital VOM above for most of my big time work (ie testing battery voltages) there is nothing like watching that needle swing to a peak reading (digital bar graphs just don't cut it). Another good price - $50 list and usually on sale every once in a while.
3. Digital Frequency Counter - I have an old Digimax oven temperature stabilized 1 GHz counter. For the price, any of the Optoelectronics/Startek type units is a must have piece of equipment.
4. A synthesized HF rig with (if possible) the transmit enabled for all band coverage so it can be used as piece of test equipment. I use my commercial rig as a piece of test equipment quite a bit - amazing what it sounds like to be actually "heard" or "being heard" when your troubleshooting a new project rig.
5. From this point on I have test equipment that sometimes I hardly ever use, but like anything else is invaluable when you need it. Randomly:
- Old B&K 5 MHz oscilloscope (wish I had a 20 MHz unit).
- Old B&K RF signal generator (my HF rig does a better job).
- Handheld Digital Capacitance tester - really comes in handy when you become brain-dead trying to interpret what the uf,nf,pf decimal markings really mean on a capacitor.
- Audio generator - use to have one, sold it (BIG mistake) now I need one.
- General purpose power supply - got a decent one at Dayton for good price.
6. Other goodies: MFJ SWR digital analyzer, little Kenwood 25 W dummy load.

I got the feeling I must be missing something - yea I know - an intelligent tester behind the test equipment. Can't vouch for that in my shop. I'd also be curious what others on the QRP list use.

72, Bob VE2DRB/WA6ERB.
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Learning to Design Your Own

by Jerry Kaidor, KF6VB
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A while back, somebody asked about what he should read in order to learn to design his own QRP equipment. People suggested things like the ARRL Handbook, the Solid State Design manual, a few other things....

I'd like to make a different suggestion. Anybody who wants to design their own gear needs to learn the basics of electrical circuitry, and learn them well. First of all, Ohm's Law backwards and forwards and around and through. Watt's Law. Loop analysis. Nodal analysis. Voltage sources. Current sources. Thevenin's theorem. Norton's theorem. Without a good solid grasp of the basics, one can only poke in the dark at explanations of transistor circuitry.

I recommend getting a college text on DC & AC circuit analysis. The kind they train technicians with. Avoid the engineer books, they're too enlightened, they bring in calculus for the fun of it. I used the book by Boylestad (nope, don't remember the name), and I'm sure there are other good ones. The neat thing about college texts, is that they have exercises. You can actually *learn* this stuff by doing the exercises. It's not rocket science, you just need high school algebra. The trouble with the ham books is that they proceed more or less directly to the "fun" stuff, without grounding you enough in the basics. And they don't have exercises.

You'd be amazed how different a lot of this stuff looks once you've got the basics. For example, did you know that you can analyze AC circuits, complete with inductors and capacitors, using Ohms Law? You just have to use vector algebra. You can take something like a PI network, calculate out the reactance of each component, figure out what it'll do with Ohms law, and find out interesting things like the input impedance of the PI network, the output voltage, output impedance, etc. Then pick another frequency and do it all again. Or do like I did, write a Basic program to figure it all out umpteen times. I first did that with a programmable calculator. Made beautiful plots of output voltage versus frequency. Then tried sticking a resistor (a load) across the output and did it again. Once you have the feel for a circuit by playing with all the values enough, it's almost anticlimactic to actually build the thing.
Jerry, KF6VB

Low Tech Bells for the NorCal 40

by Jim Cates, WA6GER
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Being a Senior citizen going on sixteen, I like to watch panel lights glow or flash, meter pointers swing. action! So I drilled three holes in the front panel of my NorCal 40 and installed LEDS; one for power on, one for RIT on, and one for transmit. Yes, they do draw some current, but that is not critical in my style of operating, a 20 amp power supply or a huge battery. And, if it were, I could have run these LEDs through an on/off switch. Anyway, here is how I did my rig.

Power On LED: Solder a quarter or half watt resistor, one around a thousand ohms (I used 1300) to the center leg of the three terminal on/off switch. Run a wire from the other lead of this resistor to the longer lead of the power on/off LED. A second wire is connected from the shorter lead to ground. I used the case of the RF pot for ground. How "low tech" can you get.

RIT ON LED: Can't use the switch which comes with the NorCal 40, apparently not enough voltage to fire the LED; so have to remove it and install a double pole, double throw, switch. One half of this switch will be used to activate the RIT function, and the other half

will be used to fire the LED, indicating that the RIT is on.

The switch I used fit the front panel hole, so it pays to dig in the olde junque box or shop around. Position the switch so the groove in the threads is down and attach it to the front panel. Wire it exactly as was the original, that is, the top terminal on one side of the switch is wired to the vacated circuit board hole fartherest from the front panel. The middle terminal is wired to the middle hole, and the bottom terminal to the hole nearest the front panel.

Wire size is not critical, because the original switch was not one which added stability to the front panel. However, if you use stiff wires, front panel stability will be enhanced. That restores the RIT function same as the original; up is on, down is off. How simple can a function get?

To power the LED, we will use the other half (side) of the switch. Run a wire from the junction of the power on resistor/long power on LED wire to the bottom terminal of the unused side of the new RIT switch. Now, run another wire from the middle terminal of the same side of the switch to the longer lead of the RIT on LED. Attach the other, the shorter lead to the same ground used for the power on LED.

TRANSMIT LED: Tidbit editor Mark, KA7ULD, showed me the easy way to do this one (Thanks Mark!). Use the keyed eight volt line. The LED will then flash out the dits and dahs as you send them. Looks like light signalling from a battleship. Whee!!

Using the third LED, previously installed on the front panel, and incidentally, crazy glue will hold it firmly; so will silicone gel like RTV, if the fit is not sloppy. But, where were we? Oh, yes, installing the transmit LED. I soldered a 1 K resistor to the long lead of the LED, and ran a wire to the UNGROUNDED side of C-36. This picks up the eight volts which appear on keydown, and reduces it to a voltage more to the liking of the LED. I think. In fact, forget all that; this article is strictly low tech, in keeping with MY status. But, I digress. Wire the other side of the LED, shorter lead, to ground.

If you used accepted component installation practice, you are going to have to find C-36 on the bottom side of the circuit board. Me? I install components with long leads. Makes the inevitable trouble shooting easier. So, I just wrapped the wire around the ungrounded leg of C-36, heh heh...

METER: Dag-nab it! Not enough room on the panel for any of my junk box meters. Had to settle for a 300 mil clunker in the positive side of the 12 volt line, positive to negative to the rig, unless you prefer that the needle peg the low end of the meter scale. Joke. Ignore it. Anyway, the needle kicks up smartly on transmit, providing breath taking action. Well, sort of, anyway. Not only that, but a healthy signal on receive will give the pointer a kick also. Does this mean my AGC isn't working Wayne? Whatever, fun, fun, fun.

FUTURE PLANS: I put Terry's (KC6SOC) expanded coverage mod in my NorCal 40. an easy mod if you use a toggle switch, sparing the grief of trying to file a rectangular hole for a slide switch, at least, that is for me. Now, I've been wondering, if I had a three pole switch, why couldn't LED's be hooked up to indicate the low or high segment? Middle? Haven't figured that far yet. But Wow!! More lights mean more fun. Right? You bet. Think I'll go over to Radio Shack and check out their FLASHING LED's! Whoope-Do and seventy two. Jim, WA6GER

Measuring NorCal 40 Output

by Doug Hendricks, KI6DS
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I spent the day today with ham radio and I had a blast. Bob Warmke, W6CYX and I are building beta rigs of the Sierra, the NorCal QRP Club's next club project, which is an all band

cw transceiver using plug in band modules designed by Wayne Burdick, N6KR. I had several parts that Bob needed, and he had the bottom to my case, so I drove over to San Jose and visited Bob.

We exchanged parts, and while I was there, I watched as Bob did 3 simple mods to my NorCal 40. He increased the coverage of the VFO from 38 KHz to 144 KHz by putting in a 10 turn pot and a capacitor, he improved the keying shape by changing two capacitors, and he increased the power by changing yet another capacitor. The unique part of all this was that Bob did the mods with a soldering iron, solder wick, and a general coverage digital receiver, I think it was a Kenwood 850. That is it.

He calibrated the rig by hooking the NorCal to an antenna, and unpluging the antenna to the Kenwood. Then, he keyed the NorCal and found it on the receiver of the Kenwood. He adjusted the variable capacitor on the vfo set, and put it right on 7.000 MHz. Then, he tuned to the top of the vfo range and found it on the receiver. It was at 7.144, which was good enough for me. He then put the rig in the mid range of its tuning range, 7.072 KHz, and adjusted the trim caps for the receiver and the trim pot for the transmitter.

That was it, no test equipment, just a wattmeter and receiver, and Bob had my NorCal up to snuff. His watt meter said 4 watts, and I didn't believe it, so when I got home, I decided to measure it myself.

I recently bought a good used Tektronics 465 Scope (Don't mention it to my wife), and now this was the way to use it. Bob told me that I could use the scope to measure the peak to peak voltage, and then figure out the RMS voltage and the power. I bought four 200 ohm 2 watt resistors and made a dummy load by soldering them together in parallel. You do remember that part of your Novice theory? This made a dummy load capable of handling 8 watts, with a measured resistance of 51 ohms. I used carbon resistors, and not the new type. Now that I have a dummy load, I was ready to go. Hooked up the NorCal to 12 volts, and took the 10X probe and the ground went to the sleeve of the SO239, and the probe tip went to the center conductor. Then I keyed the rig and looked at the scope. Ooops, should have been a sine wave, and it was a wide solid line. Hmn, call Wayne, and ask for help. Wayne told me that I had the scope display set wrong. These are the settings that worked. Time/division was set at .05 microseconds, and volts per division was set at 1. Tried it again! Success, beautiful sine wave, and the peak to peak measurement was 3.7. Wayne was on the phone with me, and said that means that it was 37 volts peak to peak, since I was using a 10X probe. I then divided 37 by 2.8 to get the RMS voltage, which was 13.21 volts. I then squared the RMS voltage, 13.21 and got 174.5. Since my resistance was 51 ohms, I divided 174.5 by 51 and discovered that my NorCal 40 is putting out 3.42 watts. I am excited! I learned something today. Thankyou to Bob and Wayne, but I learned!!! None of this would have happened if I was not working with building my own gear. Ham radio is great!! Now all of those formulas that I "learned" are starting to mean something. Jeff Gold is absolutely right. Build and you will learn. Get a scope, and you will really learn. By the way, full details of Bob's mods and others were in the March issue of QRPp. 72, Doug, KI6DS

How I Worked DX with the NorCal 40

by Jim Fitton, W1FMR
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I am so excited I could hardly sleep last night after this event.....
Waited for my daughter to come home from a night out.....~1:30 am, and before going to bed, I turned on the NorCal-40. Heard JH2AG (Japan) about RST 549, working stations and listening UP 2 kHz. Within 5 minutes I worked him with the NC-40, (2Watts) Here's how:

NorCal-40 rig: on ~7.010 - Extra Class portion of 40m. (UP 2) Turn the RIT switch to "ON" Turn the RIT control fully CCW Tune the main tuning knob until you hear the DX stn. JH2AG Confirming clues: Turn the RIT switch "OFF". Hear the pile-up calling DX station. Turn RIT switch "ON". Hear DX station talking to pile-up. Leave RIT on.
This technique provides ~ 2 kHz split xmt/rcv operation, the limit of the RIT adjustment. Leave RIT on. Here is the exchange: (I apologize for this, to experienced operators, but many questions seem to be asked by new operators)
DX...TU
ME.... W1FMR W1FMR
DX... DM7OVJ 5NN K (5NN = RST 599, a standard contest reply)
DX...TU (Thank You)
ME.... W1FMR W1FMR
DX... G3BYY 5NN K(Darn !! QRO Limey)
DX...TU
ME.... W1FMR W1FMR
DX... ZL2AMO 5NN K(Darn !! Ron Wright QRO from New Zealand)
DX...TU
ME.... W1FMR W1FMR
DX... W1 ??(Oooh my God, can it be me ? Please please!)
ME.... W1FMR W1FMR
DX... W1MR ?? (It's me It's me It's me Ooooh !!)
ME.... W1FMR W1FMR W1FMR k
DX... W1FMR 5NN (Yeooow ...wake up the neighbors !!!)
ME.... 5NN 5NN 2W 2W QRP QRP k (I'm having a heart attack)
DX... (pause) R R FB QRP TU
ME... TU TU TU TU TU (Thank You ! Thank You ! Thank You !)
DX... TU JH2EK
Me.... (Move up 2 khz) ZL1AMO ZL1AMO X10 de W1FMR....No reply.....
Me.... ZL1AMO ZL1AMO X10 de W1FMR....No reply.....
Me.... (ZL1AMO ZL1AMO X10 ....No reply.....
Me..... (Darn .... forgot to turn the RIT switch off !!!!!!!!)
Me.... ARGHHHHHH!!!! He might have been tuning and heard me.....
Stare at the wall the rest of the night.....
Three Days Later.....ARGHHHH! I feel like such a dope. The station I was so excited about was not JH2AG, but J52AG !! I thought it was too good to be true. Thanks to Fred Cady from Montana for the info....
73/72 Jim, W1FMR
[Editor's Note: Jim has worked over 60 countries with his NC-40 and a simple wire antenna from his home QTH. This was one that he thought was a rare one, but alas, in his excitement, he copied the call wrong. But, for all of you who want to work a DX contact in a pileup, this is exactly what it will sound like as you copy the code. Thanks Jim for sharing with us some valuable information. Doug KI6DS]

QRP QSO

by Larry Mull, KB7ZNE
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Last night I had my first QSO (partial) with another QRPer. As I was tuning around the Novice segement of 40 with all the noise and broadcast interference, in a quiet spot I heard

a faint CQ with a /QRP on the call sign. Normally, I won't pursue a faint station, assuming they are running 100 watts. Everytime I've tried this, I've drawn a blank. For this station I thought: If I can hear them at QRP levels, maybe they can hear me! I went after the call and made contact! What great fun! I'm in Portland, OR, the other station was in Santa Barbara, CA. A pretty good distance on 2.7 watts! Well, after two exchanges, we got squashed by an opera suddenly coming on, and by another station calling CQ. I had the NorCal front end wide open, but couldn't copy a thing. Oh well...

I've heard many people say just send the standard 3x3 CQ, with no /QRP. Does this work well? I've only had one QSO where I've called CQ. It seems I'm just not heard. I imagine life is better down below 7.1MHz, with a little less broadcast noise to deal with.

So, for a newbe who's been on the air since mid January, with only 9 contacts, all with my little NorCal40, it has not been real easy, but it has been fun! I'm going for General tomorrow night! 73, Larry, KB7ZNE

Confessions of an Appliance Operator or Thank Goodness for Elmer's

by D.J. McDonald, K6AGN
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It has often been said, and rightly so, that there is something for everybody in Amateur Radio. There are county hunters, certificate collectors, brass pounders, DX chasers, rag chewers, experimenters, kit builders, moon bouncers, satellite bangers, contesters, and many other ham activities.

But there is one group that most everyone knows about; a significant number of hams who are seldom mentioned — Appliance Operators! And, I am one.

I became interested in amateur radio when I was 10 years old. The grammar school I attended had a special radio course for a select few of the 7th and 8th graders. I could hardly wait to be a 7th grader. When I finally arrived after what to me was an interminable wait, the school discontinued the course. Figures, Murphy's Law.

Fortunately, a new kid moved into our small town and he not only was interested in amateur radio, but also had actually built a one tube receiver. His "shack" was a clothes closet his folds let him have for his "radio equipment". I was thrilled to my core when he took me to his home and showed me his setup and I heard my first ham. The big problem was that my friend was not a ham, and neither of us knew how to go about getting a license.

The years rolled by. In 1944, Uncle Sam said "I want you!" Great! I'll join the Navy; it has the world's best radio schools; I'll become a radio operator. Getting a ham license should be no problem after that. One small problem — though I specified radio operator as my first choice and radio tech as a second choice, the Navy in its superior wisdom made me a diesel mechanic, a mistake we both came to regret.

After WW II, there was college, marriage, and the starting of a 37 year career with the California Department of Corrections. The desire to be a ham had not diminished. Then came that great day in 1955 when I met my first Elmer, Reed, K6JUD, a graduate civil engineer. Reed not only guided my way to my Novice license, he built my first rig, a Heath Kit DX 40 and helped me put my first antenna, a 40 meter dipole. (Incidentally, that DX 40 looked like it was factory assembled when Reed finished it.)

The Novice exam, as the old timers will tell you, was not difficult. Though I can now do 20 WPM CW, the 5 WPM was tough. Because a Novice had to upgrade within a year or lose his license, I upgraded to a Technician as that class only required 5 WPM, and I was not as yet up to 13.

Many hours went into studying electronic theory and practice. Regrettably it didn't take and I ended up memorizing the questions and answers for the Tech and later for the Conditional license we had in those days. Before any of you start making unkind remarks about that, how many of you memorized your test? The code I passed by the skin of my teeth, an honest 13 words per minute.

I'll be up front, OK? I don't know the difference between a diode and a triode. Horrors! But then, neither do I know how the automatic transmission on my car works, nor the refrigerator in my kitchen, nor how to program my VCR. But I can drive the car, get a cold beer out of the fridge, and play movies on the VCR. Just as I know the laws relative to operating my car, so do I know the FCC rules for operating a ham station, and I very conscientiously abide by them.

I have been a ham for 37 years; have WAS, WAC, worked 110 countries and am on RTTY, SSB, CW, and Packet. Please understand, I greatly admire those who do understand and know electronic theory, but it is as obtuse to me as Einstein's Theory of Relativity.

Fess up now. Don't you know someone (reader exempt) who like me has only a very sketchy idea of electronics, but thoroughly enjoys hamming; one who only wants to be a competent operator and to leave the technical part to others? I am not alone. there is a sizeable group of us out there, judging by tacit admissions in eyeball QSO's. How many of you when something goes wrong with your Superfragilisticexpialidocious multiphasic transceiver dig into it to repair it when something goes wrong? Or do you do as I do and box it up and ship it to the authorized factory repair station.

I wish I were like Wayne, N6KR, or had the technical skill of some of our other members, but I am not. But then, maybe some of those technically gifted members wish they were a qualified fighter pilot, astronaut, or brain surgeon. The point is that interests and skills vary with the members.

Over and above operating, I enjoy helping hams put up antennas, being a "gofer", or being useful in any capacity that I can. One fun thing I have done was to single out an exceptional ham for special recognition. I created an award for outstanding hams, those who are always willing to help other hams solve their technical problems, "The Loyal Order of Elmers". Jim Cates, WA6GER, was presented with the first "Golden Screwdriver". I am sure those of you who know Jim through his many assists to others and his work on and for NorCal will agree that he stands as a model of what a Ham should and can be. I speak with some authority on this matter since I was instrumental in getting Jim interested in ham radio and have a thorough awareness of his many "Elmer" activities.

When Jim tried out his idea for a QRP club on me, little did I know I would become a QRPer. I had just reached one of my life time goals, I had just bought a 600 watt amp for my HF station. QRP was not a major interest of mine. Little did I know then that I would sign up for a NorCal 40. Under Jim's benevolent and eagle eye it become my first major ham construction project. No, it didn't work when I completed it, but good ole Elmer Jim soon had it working. Hey! I must have more technical skills than I thought. I said it wouldn't work, and it didn't! Now is that technical skill or isn't it? HI. HI.

OK, that's it. I am an Appliance Operator and I make no apologies for it. I suspect that as far as the newer high tech transceivers are concerned, more of us are operators than we are electronic techs. Enjoy the hobby for what it is for you. Best wishes to you and yours. 72, Mac, K6AGN

Our NorCal 40 Story

by Will Webber, KF8XC
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Gwinn, MI49841

Why is it called the NorCal40, anyway? Is it because it operates on 40 meters, or is it because it operates on about 40 KHz in the band, or is it because it took us about 40 days (and nights) to complete?! We ordered our NorCal40 from Jim Cates at Pacificon93. I say "we" because this was to be a family project; my wife is licensed and prepping for the General class exam, so why not mix a little hands-on with the book-theory. It was probably unintimidating to her because (a) it was cute (small), (b) it was cheap (too bad "40" doesn't stand for $40) and (c) they were such nice guys peddling these things. For those of you that didn't get one, I guess it's too late. For those who have one and haven't built it yet, it is as easy as it could be. (Although I think that you're either going to have to have perfect band conditions for alignment, or be the designer in order to align it without ANY test equipment.)

I wanted to be pretty methodical with this project (I hate doing things twice!). The last (only) rig I built was in high school, an HW-8, which I couldn't get to work. The experts fixed it, but I never made more than a couple contacts with it. So our kit arrived in December. Yeah, it was missing a couple knobs and a capacitor, no sweat. Those guys in California were quick to rectify the oversight. We have an almost two year old son who cannot resist any switch, button, knob, light, mic, key...maybe you can relate? So our construction sessions had to be when the youngster was asleep or out with grandpa, etc. They also had to be when my wife was awake. Then being in the first trimester, sleep was paramount and often came on early in the evening (like right when our son went to bed!). So as soon as the opportunity arose, it fell (that is if this was to be a family project). I counted and organized all the parts. Our first session we soldered ONE resister (I know that's not what Wayne's instructions recommend.) and went to bed! Although off to a snail's start, we were off nonetheless (remember the turtle and the hare).

Some sessions were more productive than others, waxing and waning with inspiration to quilt or sleep. I confess at times I worked alone (imagine that). However, to her credit, she competently soldered about a third of the components, never once installing a diode reverse polarity or even a resister backwards (neatness counts). Winding toroids (which I've never done) was a quiet Saturday morning job. All went well, until trying to diligently follow Wayne's orders to make sure the windings were tight and evenly spaced on L9 (the biggie), I found a piece became totally loose...in my hand...without enough wire to rewind the whole thing...and unable to remove a turn because I had already committed to the novice band. Winding any less would put us into the voice subband where Jena can't legally transmit (yet), and I have little interest in listening to SSB through a cw receiver! Anyway, the wire broke; I had no choice. I took a deep breath and pretending to be a surgeon, I carefully sanded the ends of the fractured wire for the delicate splice (my hands are still sore from sanding off that silly enamel!). Success.

Later, when my willing wife was before the project box, I gave her two trimmer pots to install. What could be easier, right? After struggling a while, she complained that they were hard to get in (now this is great for her confidence!). I take them, and, much to my chagrin and her justification, they don't fit. The holes were a little too small. A friend with the right bit opened them up.

Meanwhile, there's a perfect gentlemen in San Fransisco, named Stan Cooper, K4DRD, who very conscientiously received my front and back panels, stenciled them so they look professional, promptly returned them, called to tell me they were on the way and called again to make sure I got them. All at no charge, in true QRPp spirit. My panels arrived well-cared for with a nice note and a schematic for a more-audio-mod. What Stan may lack in hearing, he

certainly compensates for in kindness. I hereby nominate him for NorCal MVP. Stan was so quick with his efforts, we weren't yet ready for the panels. The last remaining components went in easily.

Don't tell Wayne, but I put in two of the capacitors last, only because I wasn't sure of the markings; so I waited until a friend could measure them.

Alignment: Like a good boy, I had read all the instructions before starting, including the errata page, but by the time I was ready to align I had forgotten NOT to install R6, which was critical. This meant I could hear nothing but an S9+20dB signal. Fortunately, as I was jabbering with Doug (QRPp editor) one evening when it's about 8 or 9 PM on the west coast (I'm in eastern time) he reminded me of what was stated on the errata sheet. Even so, I gave it my best shot without any real test equipment; your a better man than I (and Stan) if you can peak C1 and C2 by ear. That's where I got stuck. Just before I gave up, I called Dave, WA8DOF, who was raised on homebrew. With his help and test bench, alignment was a cinch, I'd even do it again! (P.S. I now have a $10 swap & shop oscilloscope so I can.) We did add a small capacitor to get the frequency band down where we wanted it in the novice portion.

With alignment complete, we were able to celebrate with a Valentine QSO, 14 Feb., between my wife and I. She on the NorCal40; I on our FT-757; both into dummy loads (so don't anyone tell me you heard it!). More recently, the real R6 found its proper home, and we added the finishing mist of paint. What color? Of course, baby blue. 72, Will & Jena Webber KF8XC & N8QKI

Optional Frequency Counter for NC40

by Jim Pepper, W6QIF
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Orinda, CA 94563

In most cases when operating QRP one usually doesn't need to know the exact frequency of operation. Why is this? Because one usually answers a CQ or tail ends a QSO to hook the other party. You rely on the other party to be on the correct frequency. However, if you have a certain class of license that restricts you to a certain portion of the band, then you need to know if the other station is in your band of operation.

The NorCal receiver does not have a closely calibrated dial although you can probably guess to within 5KHz of the correct frequency. To overcome this limitation, Doug Hendricks, KI6DS, asked me to design the following frequency counter. It can also be used with receivers of different designs.

The counter had several requirements. One, it had to fit into the present case size of the transceiver. Two, it had to read the true output frequency with the oscillator oscillating in the 2 MHz region. Three, it was not to be expensive and parts should be readily available. And last, the clock frequency of the counter should not cause any interference in the receiver.

Doug indicated he had purchased a number of 4 digit displays that could be used with the counter and they wouldb be available to club members. The unit was designed to use the 4 digit display although 4 single uits properly interwired could be used.

Because I had previously used such a counter in a receiver I had built, I decided to refit this circuit into the required space. It consists of an ICM7217D that can drive 4 multiplex displays with the additional feature of being able to be preset to account for the IF frequency of the receiver. This can be done either with switches or diodes. In this case, where there is only one preset required, diodes were used. The clock frequency is 3.2768 MHz and the counter will read to one kilohertz. The display updating takes place every 0.1 seconds.

The PC board mounts on the two standoff posts in the unit. It will require the posts to be in two sections, one a 1/2 inch M/F and one a 1 inch M/F. the 1 inch is on the bottom. (Note

it will be anecessary to grind of file off about 1/16 inch off the 1 inch spacer to accommodate the thickness of the pc board.) The counter signal is derived from the hot end of RFC2 located in the right front end of the receiver. The counter has a built in buffer to prevent loading of the oscillator circuit. There is a shift in frequency of about 10KHz so the will have to be adjusted to account for the change.

The plus voltage for the counter can be derived from the swinger leg of the power switch at the rear of the receiver chassis. The frame supporting the power plug can be used for the negative lead. The current consumption is about 200mA so one might want to put a switch or push button on the counter to use it only when necessary.

The display is slightly high in size to fit so it must befiled or ground down to just below the lettering (NSB3411 etc.). Be careful and do not cut in to the bus line! It is unfortunate that these custom fits are requred, but I know hams will always find a way to make things work.

NOTE: If one desires to apply this circuit to another receiver with a different IF, the following procedure can be used.

For example, in this case the IF is 4.915 MHz. therefore the preset number will be 4915. Starting with the MSD, 4 is obtained with the BCD number 4 (pin 5) and will go to D4. The next digit is 9 so it will require two diodes and go from pin 4 and 7 to D3. One to the 8 BCD and one to the 1 BCD. The next is 1 so only one diode is required to D2. The LSD is 5 so it also requires two diodes, but going to D1 on the counter.

However, if you want to use this counter with a direct conversion receiver, no diodes would be required to preset the counter.

The display is mounted on the front panel. I secured the display with double back tape, either 1/8 thick or two layers of 1/16 inch thick tape. Also, to prevent the possibility of the display from shorting on the two pots that lie below it, I put a piece of magic tape over the top part of each pot. Again, unfortunately, this is a retro-fit and requires a bit of ingenuity to make things fit. The panel requires a new silkscreen or one can use the overlay shown in figure 1. the overlay is held in place by the panel nuts and is made from a sheet of KODAK 101 transparency. The artwork is reversed, so when transferred on a copy machine, the printing will be on the inside of the transparency when palced on the panel. Both the true and mirror images are shown.

The artwork can also be used to layout the panel hole for the display. Lay the artwork on the panel and center punch the four corners of the display layout. Scribe four lines to these holes to indicate the size of the hole. The hole can be made by drilling about 5 holes with a 1/4 inch drill, then with a round file first then a flat file, make the hole the proper size.

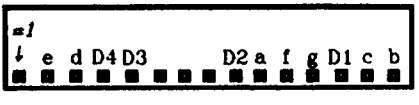
The pc board is available from Far Circuits for $5.00. The parts layout is shown in figure 2 and the schematic is in figure 3. Always be careful when soldering pc boards and watch for solder bridges. Use a magnifying glass to check for them. A bridge can cause you to zap an IC. Before installing any of the IC chips, it is wise to check the voltages present on their respective sockets. When mounting the pcboard, insulate with a piece of cardstock to prevent shorts between the bottom of the board and the main pcboard. Use a QSL Card!!

To assemble the board, the jumpers should be installed first, then the resistors, then the IC sockets and then the remainder of the parts. The display is interconnected with the pc board using #26 wire. Ten wires are required.

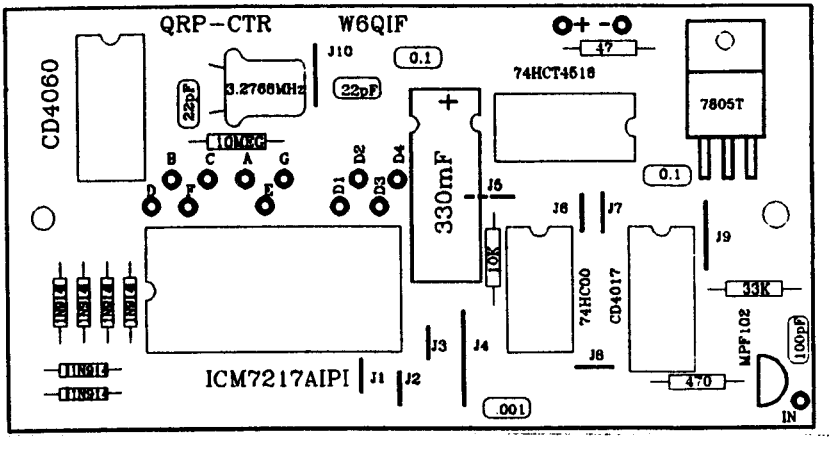
Below I have listed 2 sources for parts, Mouser and DigiKey. Be sure to check catalogs for current pricing. There are other sources as well. If you find a better source, please let the rest of the club members know. The four digit readouts are available from Doug Hendricks, KI6DS, for $3.00 each postage paid. To order send $3 to Doug Hendricks, KI6DS, 862 Frank Ave., Dos Palos, CA 93620. Circuit Boards are available for $5 each plus $1.50 shipping and handling for up to 4 boards from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

ICM7217AIPI
CD74HCT4518E or CDHC4518E
CD4060BE
CD4017BE or BCN
CD74HC00 or MM74HC00M-ND
3.2768 MHz. Crystal
L7805CV 5V Reg.
Resistors: 1/4 watt: 470, 10K, 33K, 10M - 1/2 Watt: 47
Capacitors: 2 - 22pF Disc, 1 - 100 pF disc, 1 - 330/10V Elect., 1 - .01 Mylar Cap, 1 - .1 Mylar Cap, 1 - .001 Mylar Cap
1N914 Diodes (6)
MPF102-ND FET
14 pin socket (2)
16 pin socket (2)
28 pin socket (1)
1/2 x 6/32 spacer M/F (2)
1 x 6/32 spacer M/F (2)

Parts Placement Guide For W6QIF Digital Display



FRONT VIEW



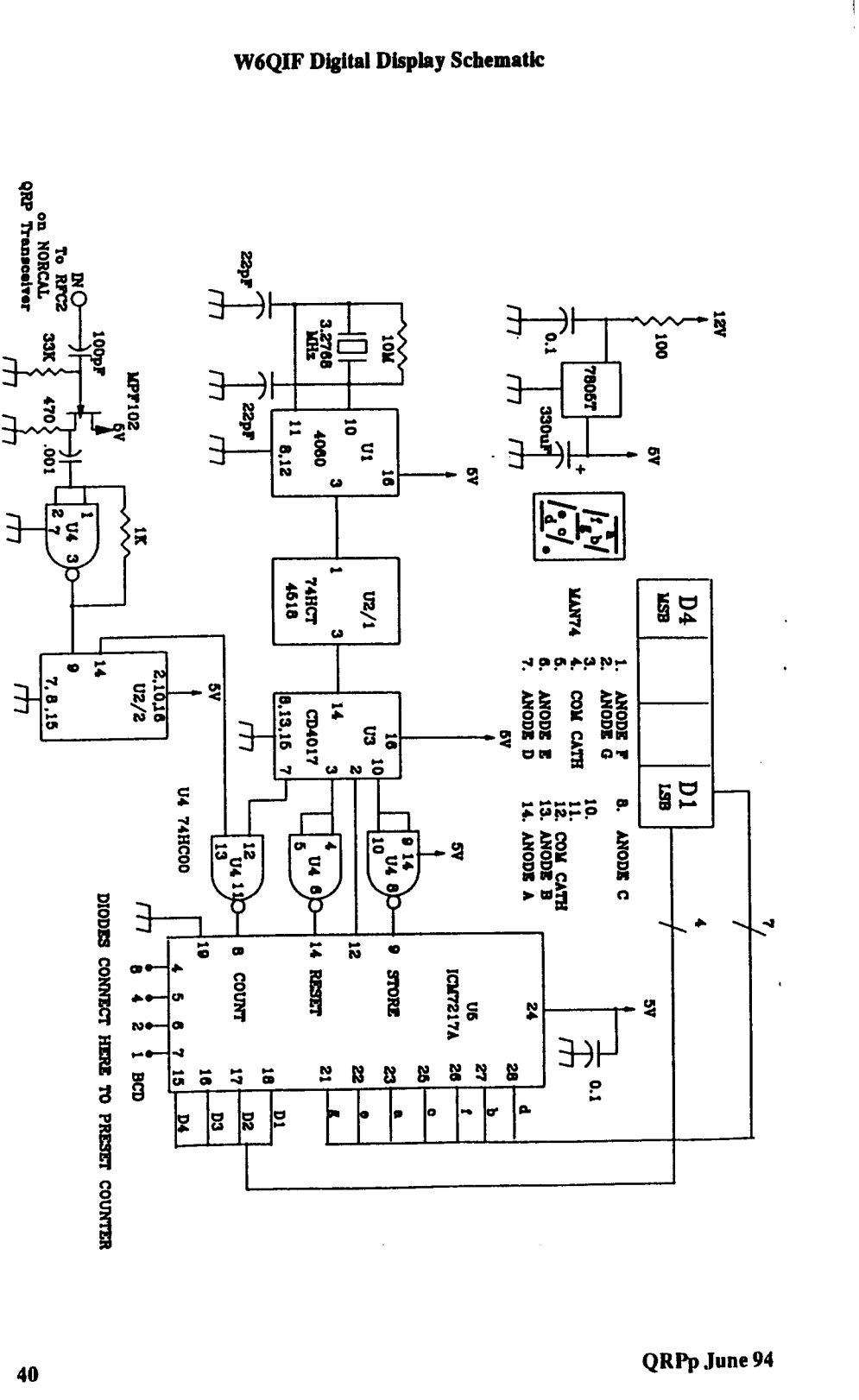

12V
100
0.1
7805T
330uF
5V
D4
MSB
D1
LSB
MAN74
1. ANODE F
2. ANODE G
3. COM CATH
4. COM CATH
5. ANODE E
6. ANODE D
7. ANODE D
8. ANODE C
9.
10.
11. COM CATH
12. ANODE B
13. ANODE A
14. ANODE A
22pF
3.2768 MHz
10M
22pF
4060
U1
74HCT 4518
U2/1
CD4017
U3
U4 74HC00
U5 ICM7217A
STORE
RESET
COUNT
BCD
D1
D2
D3
D4
0.1
DIODES CONNECT HERE TO PRESET COUNTER
IN
To RFC2
on NORCAL
QRP Transceiver
100pF
33K
470
.001
MPF102
1K
U2/2

Figure 1A

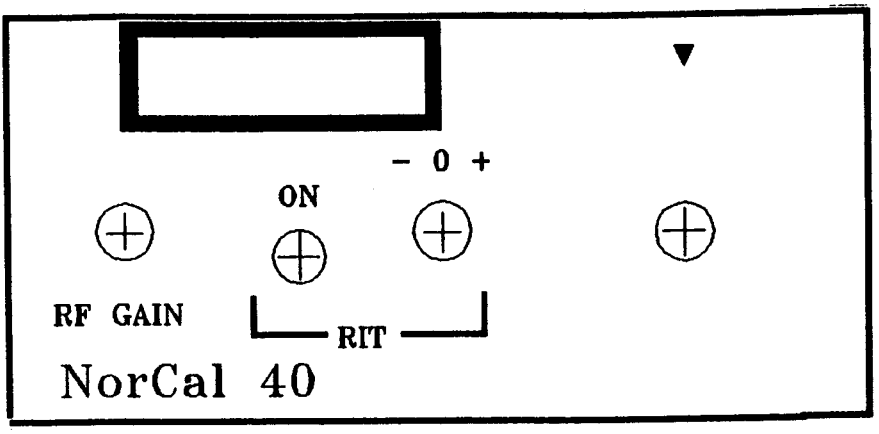
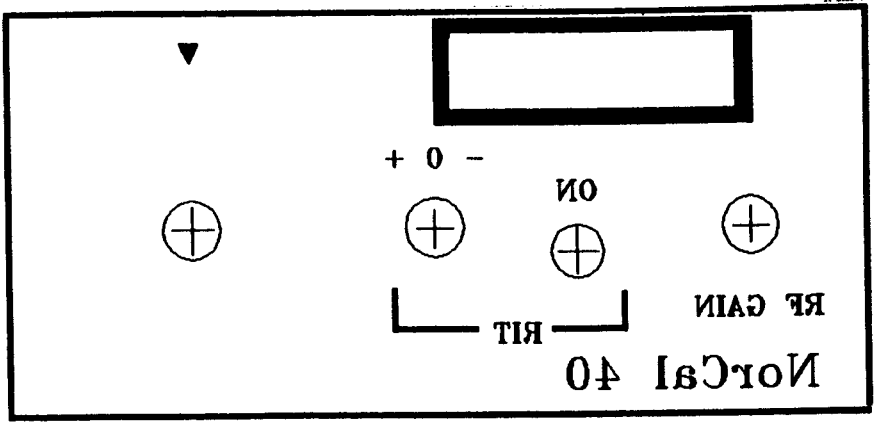


Figure 1B



[Editors Note: This display works fine but there is some noise generated in the receiver. I installed a switch in line with the power lead, turn on the display to find my frequency and then turn it off. It takes care of the noise, and also saves on the battery. Jim also suggests putting the counter in a separate enclosure. If you choose this route, you should use coax to run the input from the NorCal 40 to the Digital Display. I love mine, and am very pleased with it. If someone figures out how to cancel the noise in the receiver, please let me know. Doug, KI6DS]

Increasing the Output Power of the NorCal 40

by Ron Manabe, KN6VO
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San Mateo, CA 94403

Congratulations on the completion of your NorCal 40 project. You've probably logged many QSO's with it and are having a great deal of fun. Through your operating you realize what a great job the creator Wayne (N6KR) has done In my opinion, he has selected a perfect set of compromises to provide a Superhet rig with excellent sensitivity and power efficiency. The rig gets great gas mileage. My particular NorCal gave about 70% efficiency with respect to input power into the final amplifier and output RF power. A great set of operating parameters for a lightweight, highly portable QRP rig. Perfect for the outdoors from backpacking to carrying on trips to far off lands.

Another great attribute of the NorCal 40 is that it lends itself to experimentation. Either from a cosmetic point of view (I have seen some great paint jobs) or from an electronic perspective. Bob(W6CYX) has been a spearhead for modifications of the basic NorCal design to provides enhanced operating features such as an extended tuning range, addition of a ten turn potentiometer for easier tuning, and a modified driver circuit for a flatter power output curve as a function of frequency. He has also designed a series of modifications to convert the NorCal to 30 meters. Look for details of these modifications to be published in QRPp.

Bob's pioneering efforts and encouragement along with guidance from Wayne has prompted me to modify the output states of the NorCal 40 for increased output power. In many ways, this has gone against the wishes of the creator (sorry Wayne) but I can imagine that there are many of you out there that cannot resist the urge to open up the hood of your NorCal and perform some hot rod mod's to gain more horsepower and the heck with poor gas mileage. It is to you brave souls that I dedicate the following.

I do need to caution you that making these modifications will lower the overall efficiency of the NorCal. I leave it up to others to further refine the efficiency of the power amplifier stage. Also be aware that the output transistor will require additional heat sinking to prevent damage. Tolerance of mismatches in the antenna load will also be less. Be sure to attach a reasonable output impedance to the antenna. A tuner of some sort is highly recommended.

Modification of Driver Stage.

In order to increase the output power, the driver stage should be modified with the transformer coupling changes that were outlined in the article by Bob(W6CYX). My particular Norcal 40 had this mod installed prior to changes in the output network.

Changes to the Output Power Transistor.

The assembly manual of the NorCal 40 states that the output device can be changed to provide increased gain and power dissipation. I have chosen to use the MRF-237 made by Motorola. There are other devices that will work. Some of them are outlined in the instructions with the kit. This particular transistor has the case connected to the emitter lead. In the NorCal circuit, the emitter is grounded, therefore it is possible to use a heat sink that is directly connected to the chassis ground without the need of an insulator. Not all transistor are constructed in this fashion, so be careful and know the configuration of the device you are using. Terry (KC6SOC) has fashioned a cute heat sink arrangement utilizing a brass bracket and an aluminum heat sink collar around the transistor. The brass bracket is connected to the back plate of the rig. This bracket conducts the heat away from the aluminum collar and insures a safe operating environment for the MRF-237. The MRF-237 was obtained from RF Parts in San Marcos, Ca.

Simple replacement of the output device will provide a net increase in RF power. The use of a transistor socket does facilitate the replacement of the output device for experimental

purposes. On my particular rig, replacement of the output device from the stock transistor to the MRF-237 does indeed increase the output power from about 1.8 watts to about three watts. All power levels were measured with a Bird 5 watt dummy load. A calibrated RF probe was used to determine the output power by measuring the peak to peak RMS rf volts across the 50 ohm dummy load.

This was a modest improvement, but I wanted more. Sorry I cannot help it. Bob suggested that the middle capacitor of the low pass network prior to the antenna output jack be changed. The value of the center capacitor (C46) in the low pass filter was reduced from the original value of 820 pF to about 560 pF. This provided an increase in RF power to about 3.5 watts. I then lowered the values of the outboard capacitors(C45 & C47)from 330 pF to about 240 pF. These values were in close agreement with the filter alignments described in the ARRL handbook (1). I finally decided on the filter # 101 for the three section pi filter low pass filter. This alignment does not have as steep a slope as the original filter. Suppression of the high order harmonics is probably not as good. After all this effort about 4.0 watts of output were obtained. I was feeling pretty good about my accomplishment until I measured the input current into the PA stage. My overall efficiency has dropped to below 40%. I realized that hopping up my engine would probably reduce the gas mileage but this would be too much of an embarrassment to divulge to a group of QRP enthusiasts. I really needed to seek therapy. A pair of BoB's (W6CYX and N6IP) came to my aid. It was pointed out that the filter alignments described in the handbook assume a 50 ohm input impedance to the filter and a 50 ohm load was connected to the output of the filter.

To estimate the impedance of the output power transistor, the following formula may be used:

$$\text{output impedance} = (Vcc)^2/(2 \times \text{power out})$$

In my particular example the dc volts at the collector during key down was 12.2 volts. The supply voltage was 13.8 V dc. The combined voltage drop across the power cord and the Shottkey diode explains the difference. Shooting for the maximum legal limit of 5 watts output on QRP this results in an output impedance of about 14 ohms.

They suggested that a simple impedance transformer be inserted between the output collector and the input to the filter. This should be a simple by replacing the rf choke RFC1 between the power supply and the collector of the MRF-237. The transformer was constructed from a FT-50-43 toroid material from Amidon Assoc. P.O. Box 956, Torrance, Ca. 90508. To match the approximate inductance of the RF choke the transformer was wound with 6 turns on the primary and 13 turns on the secondary. The wire was 26 gauge enamel magnet wire. The construction of the toroid was the same as T2 in the NorCal kit. If you were frugal with wire that came with the kit you should have enough to make this transformer. This approximate two to one turns ratio should provide a suitable input impedance step up of about 4. The impedance ratio is the square of the turns ratio.

Replacement of RFC1 and the coupling capacitor C44 with the impedance matching transformer provided a significant improvement in both output power and efficiency. The peak output power was now at the limit of 5 watts in the middle of the CW band (7.060mHz) and the efficiency of the output stage was about 50%. Not great, but moving the right direction. However the rig has developed a severe chirp when used in the Novice band. As a few have commented, it barked out of the box. This was traced to the fact that RF was getting into the 8 volt regulator causing it to lose control. It was obvious after the fact because I basically removed all dc coupling of the RF amp to the power supply by eliminating the choke. I found that in the QRP Notebook by Doug DeMaw (2), he discusses the importance of bypassing the power supply to prevent intrusion of RF. After reading about his 40 meter QRP rig, it

was obvious that I needed to reinsert the rf choke RFC1 from the power supply to the primary of the transformer. I also discovered a different form of geometry to use for the impedance matching transformer. DeMaw uses a binocular form for his windings. This form is suppose to be more efficient and requires fewer turns for a given inductance value. A BN-43-202 form was obtained from Amidon Assoc. Figure 1 is a schematic diagram of the completed modifications utilizing the binocular form with the RF bypass components installed. The binocular form requires 3 turns for the primary and 6 turns for the secondary. The wire is passed through the two holes to make the windings. One turn is fashioned by passing the wire through one hole and looping it back through the other. Both the toroid and binocular form fit nicely above the board. I mounted one end of RFC1 into the board at Vcc and mounted it vertically. The bypass capacitor and input to the primary are attached to the opposite end dangling above the board.

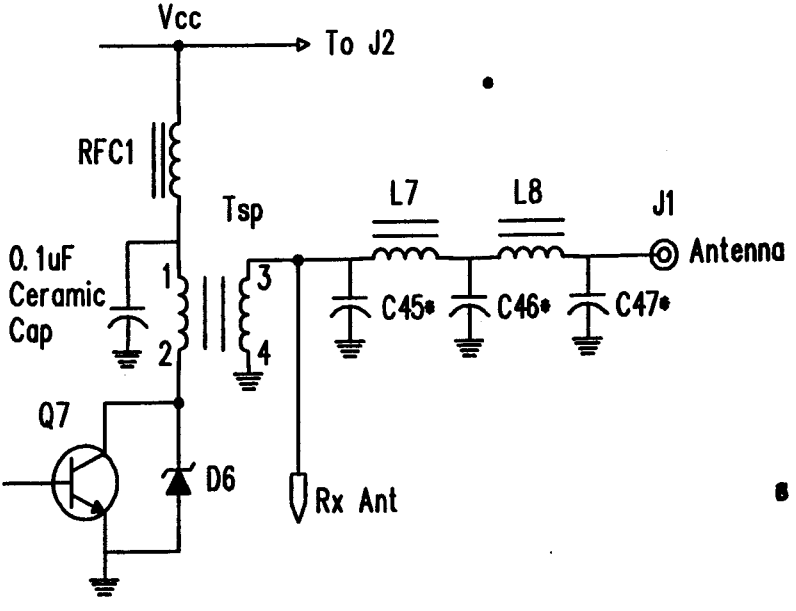
This final arrangement provided an output of 5.0 watts with a supply voltage of 12 volts at the input to the power connector. My NorCal still contains the Shottky diode for reverse polarity protection. I wanted to be able to utilize the increased output power with a gel-cell power system for portable operation. The drive control can be reduced if increased battery life is desired. The final efficiency of the output stage is around 60% give or take on what portion of the CW band you're working on. Adjustment of the drive control will provide an output power level of 7 watts if desired. This, however, is really taxing the power dissipation specification of the output device.

To perhaps increase the output efficiency more, the RFC1 choke may be replaced with a toroid with suitable windings to give the same inductance. This was not tried. I leave this up to some brave soul out there to tackle. Please let me know the results.

Keep in mind that increasing the output power of the rig requires that you pay close attention to proper heat dissipation. Increased heat sinking is required for safe operation. Be careful not to key the transmitter for long periods and be sure that a suitable load is present at the antenna jack prior to key down. So far my NorCal has not failed. I do, however, work with an antenna tuner to insure a good match with the antenna.

I have had fun making the modification to my NorCal 40. It has provided an excellent test bed to put into practice many of the little facts that I had to learn to get my license. In many ways the NorCal has brought Ham radio theory and practice to life for me. My thanks again to Wayne (N6KR) for the creating such a work of art from an appearance perspective and an elegant electrical design and to all the members of the NorCal club for bringing the rig to our hands. Special thanks to Bob, (W6CYX) for the inspiration to carry out this work.
72, Ron, KN6VO

1. The ARRL Handbook (1994), American Radio Relay League, Newington, Ct. 06111, p 2-44, 1993.
2. W1FB's QRP Notebook, Doug Demaw, W1FB, American Radio Relay League, Newington, Ct. 06111, p124, 1991.



*See Article
C45 - C47 should be Silver Mica with 5% Tolerance
Tsp = Binocular Toroid Form
BN-43-202
1, 2 = Primary 3 Turns #26
3, 4 = Secondary 6 Turns #26

Making Laminated Panel Overlays

by Vic Black, AB6SO
18 Sycamore Ct.
Redwood City, CA 94061

Plastic laminated panel overlays are easy to make at home. Use a computer graphics program to design your panel. Print out the panel graphics using a dot matrix printer or preferably, a laser printer. Use the heaviest paper stock your printer will handle. Colored paper can be used to harmonize with your cabinet paint scheme. Now to the secret part!

Go to your neighborhood hardware or variety store and get a roll of clear, adhesive backed vinyl Con-Tact shelf liner. It is made by Rubbermaid company. It is sometimes also available in the house wares section of grocery stores. Remove the protective backing from the vinyl and stick the Con-Tact laminate to both sides of your overlay. Holes for panel mounted controls can be cut out using small scissors or a hobby knife. I use physicians' iris scissors, but manicurists' cuticle scissors also work well.

The overlay is now ready to attach to the metal sub panel. Either glue it down or use double

backed cellophane tape. With the NorCal 40 design the panel edges are protected so the control mounting nuts are sufficient to hold the overlay in place.

If you don't want to go to all this trouble, or if you don't have a computer, just use rub on transfer letters directly on the panel. Laminate the entire panel with the Con-Tact vinyl. Just be careful to put it on in one smooth motion starting at one edge. If you lift it to reposition you'll also lift the transfer letters.

Con-Tact shelf paper is available in 18" widths and various lengths. A three yard roll costs about three dollars. What do you do with the rest of the roll? Laminate your maps, of course. the thin vinyl lamination protects them from water and adds tear and abrasion resistance but doesn't interfere with folding. Use water soluble marking pens to mark on the laminated maps during transmitter hunts or while camping. A damp cloth or sponge will erase the marks without damaging your maps. You can mark your transmitter panels the same way to indicate a favorite frequency, for instance.

Transparent overhead projector foil can be used to make clear overlays for painted panels. Commercial office copy centers have the material available and can help you use it. Make one copy of your computer printout onto the foil. This copy will be on the top surface where it can be scratched easily. Turn the copy over and put a clean piece of white paper behind it so you have a mirror image. Now make a copy of the mirror image on projector foil. This copy will have the image on the backside so you read the markings through the clear plastic. Projector foil is tougher than Con-Tact shelf liner.

An easy way to cut small holes for controls is with a punch. Use a file to sharpen the end of a piece of brass tubing the size you want. Set the overlay on a piece of wood, line up the punch and tap with a hammer. Voila! A perfectly round hole. Transparent double sided cellophane tape is handy for holding down the edges of your overlay. There you have it, an easy way to make nice looking panels. Enjoy. 72, Vic

QRP Antenna Farm

by Randy Rand, AA2U
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Denville, NJ 07834

I have been busy improving my antenna system over the past year. I already had a 89 foot motorized crankup tower installed with a KT34XA, 2 element 40 meter yagi and a 3 element Cushcraft WARC beam. I replaced all coax runs with new Belden 9914 foam coax. I added a TIC ringrotor and a second KT34XA to the top of the second tower section which with the tower fully extended puts the lower XA at 38 feet. The ringrotor allows the lower XA to be fully rotatable. I am feeding both XA's with some Andrews 1/2 inch Superflex Heliax that I picked up at a hamfest for a really low price. This minimizes the losses in the 132 foot run. It also helps to assure that the two XA feedlines have the same characteristic impedance (no poor quality coax). I can feed the XA's separately or both in phase. I am building a relay box with Amphenol coaxial relays, that I picked up at a hamfest, to allow me to very quickly select upper, lower, both in phase or both 180 degrees out of phase. I use an Amidon unun transformer to split the power when feeding two antennas in phase. I will use a phase inverting transformer when feeding both antennas 180 degrees out of phase. Both transformers are broadbanded and easily cover 20 - 10 meters. My final relay box design will include solid state logic to control the relay positions and allow me to select antennas by simply pushing one pushbutton for each configuration.

So, how does it work? It is the best antenna system I have ever used at this QTH. On ten meters the performance is really exceptional. Many pileups were broken on one or two calls in the ARRL DX contests recently. During the CQ-WW CW contest I got the last 10 QSO

rate meter up over 125 QSO's per hour for a short time while search and pouncing on 20 meters in the morning as the band was just opening. 3YOPI was worked on 20 meter CW in a ten KHz wide split pileup with 370 milliwatts in less than 5 minutes from when I first called. During the G QRP Winter Sports many European QRP stations were worked. A few were using indoor antennas and QRP. I am sure they appreciated the chance to make a 2 way QRP DX contact that was made much easier by my big antenna. Primarily, I built this huge array for contesting and serious DXing as I am nearing the Honor Roll with QRP power. Typical QRP operations certainly don't require all this hardware. however, to seriously compete using QRP power with those running a full KW gallon with similar large antennas the array sure helps.
72, Randy Rand, AA2U

General Class License + Norcal 40 + Hamstick... Hot!!!

by Spence Wilhelm, KB7TCY
19023 Via De Arboles
Queen Creek, AZ 85242

Last weekend was very busy for me in ham radio. I upgraded to general class, finished my Norcal 40, and finished installing a 40 meter Hamstick antenna on my car, all during the same weekend. After receiving the radio three weeks ago and not having time to work on it I got inspired and assembled it in about 7 hours over Friday and Saturday.

The instructions were very good and saved me a lot of trouble with the suggestion to visually check the bottom of the board for shorts before starting. I found a two areas near the RIT pot where traces were touching but were easily fixed with an Exacto knife. The board was otherwise very clean and well laid out. Part locations were easily recognized by the silk screen id on the top of the board.

I've heard others complain about winding toroids and have to admit the activity is tedious at best. It also doesn't help to be winding the VFO toroid, which has fifty seven turns, while watching the late show with David Letterman. I had to recount the turns on that sucker at least five times, I can't count and laugh at the same time.

The big moment came on Saturday afternoon when I connected the power and heard the sweetest sounding receiver yet. The audio is phenomenal, the 400 Hz CW filter is perfect for separating weak signals out of adjacent signals. The Norcal 40 is my first rig with a crystal filter, my Argo 509 with the audio CW filter has a much different sound that can't compare to this rig. (Don't flame me, there is still a warm spot in my heart for the 509.) I'm now a convert of IF filtering versus audio filtering.

I also installed the mods that were published in the March issue of QRPp for expanding the bandwidth to ~150KHz. Part of the modification was installation of a ten turn pot in place of the single turn 100K tuning pot, this really improved the tunability, you really have fine control now. Alignment instructions for the receiver and the transmitter are complete and easy to follow. It only took about 5 minutes and the rig was ready to go on the air with two watts across the complete tuning range of the radio.

I finished the Norcal 40 at 3PM on Saturday and took the General written and 13 WPM test at 7:30PM. The written test went fine, but, I thought I was going to throw up during the 13WPM code test. The only thing that calmed me down was to pretend that it was my father Harvey, W7UKK, sending to me. This strategy worked fine until the operator called me by a different name and had nothing close to my fathers name. Oh well, it all worked out and I had my General temporary ticket by 10:30PM that night.

Sunday afternoon, I put the Hamstick on the car and tuned it up with no problems. (I'll write another article about my stupidity and learning curve with my first attempt at tuning a mobile antenna the week before.) My first QSO was with a K5 in TX who gave me a 579,

the second was with an N7 in OR who gave me a 599. What an experience! I've been a ham since 87 with only Novice HF privileges. Now I'm wondering why it took me so long to upgrade. If you are a Novice, go as quickly as you can and upgrade! Don't let the written or the code test bug you. Really, If I can do it then anyone can. I'm surprised at how easy it is to copy 13WPM+ now, mental block or something before.

In summary, I'm delighted with the General ticket, the Norcal 40, and the Hamstick mobile antenna. I thought QRP was fun for six years as a Novice, but really have no idea why I waited so long to upgrade. Many thanks to Doug, Wayne, and Jim, for providing such a great kit and inspiring me to upgrade. 72, Spence Wilhelm, KB7TCY

The Zuni Loop Mountain Expeditionary Force; A Very Brief History

by Cam Hartford, N6GA
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The idea of doing a QRP Field Day was hatched at a gathering of Southern California QRPers one weekend in October, 1984. Fred Turpin, K6MDJ, noticed an upswing in local activity and organized a weekend gathering at his cabin to help bring us together. In attendance were Fred, Bob Spidell, W6SKQ, Jim Holmes, W6RCP (on temporary leave from Norcal at the time) and myself. Not too long into the weekend, the idea of a QRP Field Day arose. We were all without attachment to a local club or FD group at the time, so the idea was pursued with great vigor.

One of the initial obstacles we faced was that of location. Since we all lived at different corners of the map, it would be difficult to find a place that was conveient for us all to access. Bob suggested a campground he was familiar with in the mountains East of Los Angeles, and it proved to be roughly an hour's drive for each one of us, coming from different directions. Centrally isolated seemed to be the best way to describe it. But what a great place!

Table Mountain Campground turned cut to have what we thought the perfect FD site would have. At 7300 feet of elevation and on the North slope of the mountains, it had an unobstructed view to the North and East, and was high enough to be out of the smog and heat of the flatlands. The campsites were surrounded by some of Mother Nature's finest antenna supports — pine trees reaching to 90 feet. The campground is divided into small areas, or loops, off the main access road. These loops were given Indian names, and the loop we occupy for FD is called the Zuni Loop, hence the name of our group. A little research into The Zuni Indians revealed that they had an annual ritual in which the tribe members gathered together for a period of 24 hours to feast, smoke strange things and send off messages to the spirits in the sky (ionosphere?) Sounds like Field Day, doesn't it?

The first year was 1985, and we put forth a modest effort. Five operators, two transmitters, and three antennas. Bob brought his trusty ZL Special for 15 meters, and we leaned the mast up against a dead tree trunk, Iwo Jima style. He also brought along an old Bill Orr handbook which had an interesting design for a 20 meter wire array called a Six Shooter. Consisting of three half waves stacked over three half waves, it was a beast to assemble and string up, but there was a pair of trees just waiting to hold it up and aim it to the East for us. A pair of Delta Loops on 40 rounded out the collection. At about midnight when 40 really came alive, it was obvious that this antenna was good and could easily be made better.

Things change. In 1993 we had 18 operators, seven transmitters, and eight antennas, give or take a few. We firmly believe that Field Day exists for radio fun, and for this reason we try to have as many transmitters in operation as is possible at any given time. This allows a greater number of people to be on the air when they care to be (or are awake, whichever comes first.)

And the list of Zuni regulars has grown to include some fairly long-distance commuters. Costa Mesa, Ridgecrest, Bakersfield, and Arroyo Grande (near San Louis Obispo, a five hour drive) are represented annually. Even an occasional straggler from NoCal has found his way down the state.

Field Day also exists for antenna fun. The Six Shooter still rides high, having been rebuilt a few times to make it stouter and more user-friendly to it s erectors. The 40 meter Delta array grew from two to five elements, then became inverted vees and grew again to seven elements. Last year it shrunk to five, owing to the age and stamina of its owners.

Running 80 meter QRP from the Southwestern corner of the country has its drawbacks. Once you have worked all the locals, there's not much else out there for at least another 1000 miles. To overcome distance and QRN you need gain, and gain is hard to come by on 80 meters. But we have tried. A horizontal loop, a vertical loop, a VK2ABQ Button beam, an inverted vee beam, a W8JK, and even a dipole have been strung in the name of a better showing on 80. Maybe next year...

Many other arrays have been tried on the other bands over the years. One that stands out as an excellent performer is the Lazy H. Last year we used one for 10, 12, 15 and 17 Meters. It has to be well off the ground, but that is no problem at the Zuni Loop.

Friday evenings have been set aside for the ritual eating, drinking, and homebrew show-and-tell sessions. After a long day of antenna stringing, nothing quite comes close to the pleasure of throwing a thick steak on the fire and sitting back in the glow of QRP friendship. All of this assumes, however, that your steak is still intact, and hasn't been purloined by one of the local mountain residents. A few years back, Bob W6SKQ was awakened in the middle of the night by a bear who was rumaging around in his ice chest. The cold morning's light revealed that the bear was particularly fond of T Bones, and Bob's was definitely gone.

Alas, no more ZL Special. As happens in the natural course of events, we lost Bob just 2 weeks before FD 93. This was not a happy turn of events, since Bob was one of the founding members of the group and one of our prime motivators. But happily, there are enough of us immersed in the Zuni spirit that we should be able to keep the RF radiating from the Sacred Mountain for years to come.

[Editor's note: Wayne Burdick, N6KR, Jim Cates, WA6GER, and I were fortunate to be invited to attend the 1993 Zuni Looper Field Day. It was one of the most memorable events of my life. The Zuni's are a competive bunch, as you can attest by their antenna farm that they erect every year, but when we arrived at the site, they all stopped what they were doing to make us feel immediately welcome and part of the group. The thing that really impressed me though, was that when we were ready to leave at 10:00 AM on Sunday morning (it's a long drive to Dos Palos from Wrightwood), all of the Zuni's shut down for 30 minutes to say good bye and wish us a safe journey home. Our friendship meant more to them than a few qso's in a contest. I will always treasure this time that I spent with good friends and good QRP operators. By the way, listen for us again this year. When you hear that booming signal on 40 at night, it is Fred with his 5 element beam up 95 feet!, and yes, he is really QRP. Doug, KI6DS]

NorCal Meeting Notes for February, March & April

by Doug Hendricks, KI6DS
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The February meeting of the NorCal QRP Club was held on Feb. 6 with about 40 members present. And what a meeting it was! The weather was cold and rainy, which caused several members to show up early at the California Burger. Denis Englander, KD6ETI, was there with a treat for all of us. He had his NorCal 40 with a great new mod, Jim Pepper's, W6QIF, digital

display. It is really neat. Denis has his rig set up to tune from 7100 to 7140, and the digital display shows the readout to 1 KHz. It features a 4 digit led display, and is quite an addition to the NorCal 40. Especially for those of you who have made the mods to give extended band coverage, but are using a ten turn pot. Throw away the turns counter, digital display time! The club is going to pay for the pcboards to be developed by Far Circuits, and when they are finished, you will be able to order boards directly from FAR. The club is not going to Kit this project, but you will be able to order the parts from Digikey or Mouser. As soon as the boards are available, a notice will be put on packet and internet. Stay tuned. Thanks to Jim Pepper for his outstanding work on a much requested project.

Several other NorCal 40's were in attendance and the mods are starting to fill up the cases. Terry Seeno, N6YQD, has installed a Curtis Keyer in his NorCal 40, and the next issue of QRPp will have full details on how to do it with an article from Mac McClurkin, W7JDZ. Bob Lai, had his NorCal 40 with a meter for signal strength mounted in the top, plus a speaker, af amp, and a neat little antenna to copy signals without using an outside antenna. Bob gave me part of an article on his mods and promised to send the rest next week. It will be published in the June issue of QRPp. Stan Cooper, K4DRD, brought his NC40 Solar Station! He has just returned from a week in Hawaiia, (tough job, but someone has to do it!), and while he was there, he worked Long Beach with his NC40 solar powered. He has the solar panels, charge controller, and gel cells all in a compact arrangement that is very easy to take along backpacking. Terry Young, KC6SOC, now has 3 layers of circuit boards in his heavily modified rig. The mod for 150 KHz band coverage is in the March issue, and he also put a speaker and additional audio amp plus a keyer in his rig. Terry says he has more ideas but is running out of real estate! Bob Smith, KD6FVI, had his NC40 and it is stock. Bob is a new ham, and this is his first project. He has done a nice job, and can't wait to get on the air with it.

I also met Dara Ea, N6YJS, who told me that he built his NorCal 40 in seven hours. The neat thing about Dara's story is that it is the first time that he has ever used a soldering iron. His first attempt at building anything, and it works! This was great to hear, as one of the design goals was to have a kit that the beginner, the guy who has never touched a soldering iron (Dara) could successfully build. Terry Seeno also had his NC40 packed in a neat carrying case. The case held the rig, antenna, log, tuner, coax, battery pack, and the neatest little key you ever saw, made out of pvc pipe and micro switches. Terry will write an article on the key and the pack for the June issue of QRPp.

I brought proof copies of QRPp to the meeting to distribute to my proof readers, Wayne Burdick, N6KR, Jim Cates, WA6GER, and Steve Cates, KC6TEV can catch my spelling errors before the final run at the printers. The March issue will have 72 pages, 63 articles and the press run is 500 copies. We now have 309 members, and the extra copies will be taken to Dayton to give away at the QRP-QRCI hospitality room. I will mail the March issue the last week of February. The club has ordered a plastic bag sealing machine, and we will seal all of the issues in a protective bag. This should help with the US Postal Service not tearing up the copies. Also, the March issue will be mailed bulk rate, but with return postage guaranteed. That way, if we have someone's address wrong, the post office must return it to us. The cost will be 19.8 cents per issue to mail, as opposed to 98 cents per issue if mailed first class. We figured you would rather have more material in QRPp and take a few days longer to get it.
If you are interested in becoming a subscriber to QRPp, and a NorCal QRP Club member, send $5 along with your name, call, & address to Jim Cates, WA6GER, 3241 Eastwood Rd., Sacramento, CA 95821. Be sure to make checks and money orders out to Jim and not to NorCal or QRPp.

I have saved the best for last. Wayne Burdick, N6KR, brought the Sierra All Band Rig, which is the next club project, with him. YES, he had the actual rig there, in a case, with knobs, etc. The Sierra is the next NorCal Club project, and we do mean to emphasize club project.

It will only be sold to club members, and we will do a mailing to all club members within the next sixty days. The mailing will contain full specs on the rig and details on how to order. We will only do one run of these, so if you want one be sure to respond to the mailer. The rig has coverage of 80 - 15 meters, 150 KHz of the cw portion of the band. It has a better receiver than the NC40, and utilizes plug in modules to change bands. Wayne will post details later. This is not a beginner's project, and has lots of toroids to wind, but they are easy to wind. If you successfully built the NorCal 40, you can probably be successful with the Sierra. What is the cost? We don't know yet, as we haven't priced the components. Those details will be in the flyer. Everyone who was at the meeting had a smile on their face and a gleem in their eye when they looked at the rig. It is exciting!

It was a great meeting. Don't forget that if you are interested in QRP and building and want to have fun, come to our "meeting". But you will be disappointed if you want to sit through minutes, treasurers reports, old business, new business and a boring program. We don't do any of those things. We get together, show and tell, and talk QRP. We meet at the California Burger Restaurant off I-580 at the Santa Rita Exit west of Livermore on the first Sunday of the month. The fun starts at 11:00 AM. 72, Doug, KI6DS

The March meeting of the NorCal QRP Club was held on Sunday March 6 at the California Burger Restaurant off the Santa Rita Exit on I-580 north of Livermore. Over 50 members attended and there was a ton of QRP gear to look at. Attending members all received a beautiful 4 color club logo patch that was donated by Denis Englander, KD6ETI. Doug, KI6DS, handed out small, 4 1/4" x 5 1/2" Mobile/Portable log books that the club will be selling in the future. If you can attend a meeting, there are usually freebies handed out, another reason to attend.

Jim Cates, WA6GER, had the new Index Labs QRP Plus rig, and it is beautiful. Very small in size compared to the Tentec Scout, and sounds really good. Jim also brought his "Ugly" constructed NorCal 40. He has the transmitter and VFO finished, sure will be fun to see if he can get it to work. I knew someone was going to build one of the NorCals the "Ugly" way. Bil Paul, KD6JUI, had a unique rig. It was a 2 band 20 and 40 meter rig that was built from the Oak Hill Research Spirit kits and placed in the same cabinet, one on top of the other. The 20 meter rig was on the front panel, and the 40 meter rig on the back. Nifty job. Kent LeBarts, KK6IU had his Super Cmos II keyer that was mounted in a clear acrylic case with a set of Bencher paddles. Everyone like it and you could see the wheels spinning. Grover Cleveland, WT6P, had a cubic incher rig, a 40 meter transmitter that is built in one cubic inch. The Crystal was bigger than the rig. Doug, KI6DS, brought his "Bob Warmke Modified" NorCal 40. It has all of the mods that were published in the March issue of QRPp in it. Wayne, N6KR, Doug, KI6DS, and Bob, W6CYX all had prototypes of the Sierra, the Club's next project. Bob's was beautifully painted, and silk screened by Stan Cooper, K4DRD, who by the way, silk screened 10 sets of NorCal 40 panels for members. Wayne's Sierra had the keyer and S meter options installed. Really neat. He uses a bar graph for the S meter, and has installed a Curtis Keyer chip with controls on the front panel. He is planning to offer it as an option for the Sierra. Doug's Sierra was a stock model, showing what the basic kit will be. The Club will send a brochure to ALL members when we are ready to take orders. It looks like we should send the brochure out the first of May. As I mentioned above, Stan Cooper had his Screen Printer there, and was busy screening panels. If you would like your NorCal panels screened, send them in a floppy disk mailer, along with a self addressed mailing label, and return postage, to Stan Cooper, K4DRD, 1390 Market St., #2024, San Francisco, CA 94102. Do not send any money, and please send stamps for return postage.

The March issue of QRPp was mailed Feb. 28th but was sent bulk mail. I have learned that it will take several days for it to arrive. The next issue will be mailed the 15th of May, so that it will arrive around the first of the month, or before. By the way, the information provided here is not for business of any kind. It is intended as information for NorCal members

and others who are interested in QRP information. Packet Policemen, please stop sending me flaming packets criticizing my packets. NorCal is a club, and no one is making a profit on anything, everything the club does is non profit, in fact, it has cost some members money. 72, Doug KI6DS

It's Easter Sunday, and all good hams stay home with the wife and kids and have a family day right? WRONG!! It was Easter, but it was also the first Sunday of the month, which is NorCal QRP Club meeting day. 28 members were there, and I won the bet with my wife. She assured me that only 4 or 5 would show up and it would be a waste of time. I bet her that there would be at least 25 members there, and the guys didn't let me down.

Here is a synopsis of what was there. First of all, James, KI6JD and Vic Black, AB6SO, brought some give away goodies. They happened on to some of those reels of parts and gave away a 4 foot strip with at least 2 to 3 hundred parts on a strip. All kinds of resistors, capacitors, diodes, etc. plus they put some IC's in the baggie for good measure. Denis Englander KD6ETI, brought a really neat product. It's called no slip, and is sold in hardware stores and lumber yards. It is supposed to be used to hold a piece of wood while you use a router, but we all are going to use the samples Denis handed out to hold our paddles down and in place. By the way, congrats to Denis on his new General Ticket.

Eric Swartz, WA6HHQ, brought his heavily modified NorCal 40. It has several of the mods from the last issue of QRPp in it, including the keyer and the extended range with a toggle switch that Terry Young wrote about, plus a couple of really neat ones that Eric has done. His NorCal 40 has an S meter that is a LED bargraph, plus XIT, and an offset mod that lets him move the RIT 3 KHz. so he can work DX split. (ARE YOU LISTENING JIM FITTON!!) Eric, and Stan Goldstein, N6ULU, are having a friendly contest working DX with their NorCal 40's. Stan has worked 45 countries with a NorCal 40 from California!! That is impressive. Eric gave me the schematics and will send the article on the mods this week, so they will be in the June issue of QRPp.

Stan Cooper, K4DRD, was there with his newest member of the qrp family, a MINT and I mean MINT HW9 with WARC Bands. I won't tell you what he paid for it, because you will all die, but he got a deal! Stan also had his new set of Jones Paddles, and they are nice. Extremely beautiful brass fittings, and the workmanship is outstanding.

Jim Cates, WA6GER, had his G4PHY miniature paddles that he just got from England. They are made for mobile work and come with a strap to attach to your leg. It also has a magnetic base, and Jim talked me into making him a brass plate with a steel plate attached for the magnet to use on his desk at the home QTH. The base of the paddle is only 1 and 7/8's inches square. If you are interested in a nice set of paddles, check this one out.

Mike Collins, KC6SEG, had his new pickup there, and it really drew a crowd. No, we didn't care about the pickup, but the neat thing was the homebrew antenna in the back. Mike has built the DK3 Allband, auto tune 3 - 30 MHz. antenna that was designed by Don Johnson, W6AAQ, and featured in his book, "40 + 5 Years of HF Mobileering". This antenna will tune any frequency from inside the vehicle. It uses a sliding coil, and a motor from a power screwdriver. What a work of art.

Bob Warmke, W6CYX, was there with his prototype of the Sierra, and band modules for 15, 20, 30, 40, 80, and 160. Wow! I drooled so much, that he let me take it home for a couple of weeks while he does some tests on mine. I have built the band modules for 40 and 20. The Sierra is for real, and a brochure will be mailed (first class mail) by the end of April. Don't send any money yet, but the plan is to offer it for $199 delivered with 2 band modules of your choice from 80, 40, 30, 20, & 15 meters. Band module kits will be available for $20 each for the 5 basic bands, so if you want to order 5 bands with your kit you can. We will also make available the band module boards so that you can put your rig on 160, 17, 12, & 10, but you will have to chase your own parts for those bands. Wayne and Bob have done a ton of work

fine tuning the rig, and it is great!!

I brought my NorCal 40 with a digital display designed by Jim Pepper, W6QIF. The display works fine, but there is some noise generated by the display in the receiver. I put a switch on the display and turn it on when I want to go to a certain frequency, and then turn it off when I want to operate. It will be published in the June issue of QRPp, and boards will be available from FAR Circuits.

Wayne Burdick, N6KR, brought the prototype Sierra and set it up in the parking lot and Chuck Adams, K5FO, who came all the way from Texas for the meeting, made his first Sierra QSO. Chuck is the Awards Chairman from ARCI and also the publisher of the K5FO newsletter which will make its debut in May. If you want to get the first issue, send Chuck $5 for a 1 year subscription. He is good in any call book for the last 5 years.

It was a neat way to spend Easter, although my wife was not pleased that I attended. (She really didn't mind that much, but she did give me a hard time about it.) NorCal QRP Club membership is up to 425 members, the Sierra is about to be born, and we are most of all having fun. If you are interested in QRP, stop by the California Burger Restaurant at the Santa Rita Exit of I-580 north of Livermore on the first Sunday of the month. Meetings run from 11:00 to about 1:30. NO Business meeting, just show and tell and talk with your friends about QRP. Most of the time there are free give aways, and once in a while a celebrity like K5FO shows up. Next month there will be a meeting on the 1st of May, but Jim, WA6GER, and Doug, KI6DS, will be in Dayton. But the meeting will go on because we meet on the first Sunday of the month!! Even on Easter Sunday. 72, Doug

HF Propagation Forecasting

by Vic Black, AB6SO
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If you ask a gold prospector where the gold is located, he'll tell you it's wherever you find it. Of course, experienced prospectors find gold more often than untrained beginners do. Predicting HF propagation often seems like gold prospecting and, like mining, you'll improve your chances of success with experience and the use of some of the available "tools of the trade". Some of those tools are provided by the US. government and are available to anyone with a general coverage AM receiver.

Station WWV began broadcasting frequency tones and time signals in 1923. Over the years more information was added along with sister stations WWVH and the low frequency stations WWVB and defunct WWVL. The National Institute of Standards and Technology operates the stations (I liked their former name, Bureau of Standards, better). They transmit frequency and time standards as well as storm alerts, global positioning system (GPS) navigation bulletins and propagation forecasts. Both stations transmit simultaneously on 2.5, 5, 10 and 15 MHz. In addition, WWV transmits on 20 MHz. Simple dipoles antennas are used at both stations on all frequencies. Station WWVH is located in Hawaii and WWV is located in Fort Collins, near Boulder, Colorado.

Propagation forecasts are announced at 18 minutes after the hour by WWV and 15 minutes before the hour by WWVH. Information is always presented in the same order as follows: 1) solar flux, 2) Boulder A index, 3) Boulder K index, 4) solar terrestrial activity, 5) geomagnetic field activity and 6) forecasts for the next 24 hours for solar terrestrial activity and geomagnetic activity. The information comes quickly so it's easy to miss some of the details. Since it is always presented in the same order, I like to write down the categories ahead of time and fill in the blank spaces as I hear the report

Solar flux is measured at 2000 UTC daily by Canada's Dominion Radio Astrophysical

Observatory and is reported by WWV and WWVH. Solar flux is a measure of background radio noise emitted by the sun and is measured at microwave frequencies. It is indicative of ionizing radiation from the sun. Values range from about 65 during the sun spot low to as high as 250. Recently the solar flux has been around 100 and dropping. The higher the number, the better for HF propagation. This is the radiation which ionizes the refractive F layer of the ionosphere. Radio signals sent at a low angle into the F layer will be refracted, or bent, back to earth.

The Boulder A index is an indication of activity for the past 24 hours in the earth's geomagnetic field. The higher the A index, the higher absorption of radio waves will be in the ionosphere's D layer, especially in the higher latitudes. Consequently, a low number is desirable. A value under 10 is excellent, but can go from 100 to 400 on very rare occasions. Transequatorial paths are not affected as much by high values of A index.

The Boulder K index is similar to the A index, but is a logarithmic number and is always lower than the A index. It is not measured but is calculated from the A index. The Boulder K index is updated every three hours and reflects more current conditions than the A index. It's useful to think of the A index as analogous to a main tuning dial while the K index is analogous to a fine tuning control. Solar terrestrial activity is a sort of wide angle snapshot of solar flux. It is reported as very high down through moderate to very low. High solar terrestrial activity corresponds with high solar flux and is desirable for good DX conditions, especially in high latitudes.

Geomagnetic field conditions should be quiet for best communications. Unsettled conditions will cause absorption of HF signals by the ionosphere's D layer. Active conditions and geomagnetic storms can disrupt all HF communications. Geomagnetic storms are reported as minor or major.

Solar flux, Boulder A index, Boulder K index and solar terrestrial activity all are indications of electromagnetic wave-type radiation coming from the sun. This radiation travels at the speed of light and requires about 8 minutes to arrive on the earth. Geomagnetic field activity is an indication of incoming heavier particles from the sun, especially after a solar flare. These particles, mostly protons, require from 20 to 40 hours to reach the earth. They are attracted to the earth's magnetic north and south polar regions where they disrupt communications by colliding with free electrons and absorbing their RF energy. Because of the long travel time of the particles, a solar observatory can predict changes in radio conditions up to a day or two in advance. Since the particles exhibit mass, it's possible that gravity plays some part in radio propagation as well.

Occasionally you'll hear the term stratwarm. This occurs as summer approaches in either the northern or southern hemisphere. It indicates that the gases that make up the stratosphere are beginning to warm up. Because of this there is a vertical mixing of the gases along with a stirring of the normal layers in the ionosphere. This causes a less dense F layer. Conditions for DX will worsen and the maximum usable frequency will generally be lower in summer as compared to winter. The sun requires approximately 27 days to completely rotate on its axis. Therefore, the Boulder A and K indexes will tend to repeat over that time frame. Because of this periodicity, it's worthwhile to make a daily log with dates down the left side and index values across the top. Fill in the daily values while listening to the propagation reports. Over time you can spot trends in the indexes.

WWV and WWVH can be used directly as DX beacons. Here's how. Listen for a couple of minutes to WWV and WWVH. Try each of the frequencies and note the signal strength. This will help you establish the lowest usable frequency (LUF) and the maximum usable frequency (MUF). DX conditions will be best on frequencies just under the MUF. Just before each minute the time is given by a female voice from WWVH followed by a male voice from WWV. From California if you can hear the female voice only, conditions are better toward

Hawaii. If only the male voice is audible, then conditions are better toward Colorado.

This varies from frequency to frequency. For instance, the Hawaiian signal may be strongest on 15 MHz indicating that 20 meters may be a good bet to the Pacific. On 10 MHz both stations may be equally strong indicating good conditions on 30 meters. Only Colorado may be audible on 5 MHz, so 40 meters might be a good bet across the US mainland. Expect lower signal strength on 2.5 MHz as the transmitter power level is 2.5 KW as compared to 10 KW on 5, 10, 15 and 20 MHz. Note that a band may appear "dead" because of lack of activity, but the beacon is strong. This often happens at the end of a contest weekend when most operators close down and get some rest. Once, after sunset with a "dead" band, I worked a ZL on 15 meters. I couldn't hear anyone else on the band. After a half hour chat, a JA tail ended and worked the ZL for another half hour. A similar thing often happens on 10 meters. I tune down into the citizen's band. CBer's don't seem to know the band is supposed to be "dead". If there's a lot of activity on the citizen's band, a CQ on 10 at that time can sometimes be productive.

Sensitive and inquiring minds stay awake at night pondering the mysteries of the universe. Some important questions to QRP types include "What are sunspots, anyway?", "What causes layering in the ionosphere?", and "Why does the D layer absorb radio waves while the F layer refracts them?".

The sun has an atmosphere somewhat analogous to the earth's atmosphere. Radiation that causes ionization in the earth's atmosphere originates in the sun's upper atmosphere. This radiation increases with increasing numbers of sunspots which are areas of concentrated magnetic fields on the sun. Since the sunspot regions are cooler than the surrounding areas on the sun they can be seen as dark spots on the sun's bright disk when viewed with a solar telescope.

The composition of the earth's atmosphere changes with altitude with heavier gases near the earth's surface and lighter gases farther away. Various wavelengths of solar-produced microwave, ultraviolet and x-radiation interact with the gases. Some radiation reacts with particular gases and other radiation types react with other gases. This creates belts of ionization. Ionization means that one or more electrons have been knocked off the gas atoms so that the atoms carry an electrical charge. These belts of ionization are much like electrically conductive clouds which can bend radio waves. Free electrons recombine with their parent atoms when the ionizing radiation is absent, such as during the winter or at night.

Solar flares occur occasionally. At these times enormous energy is released in a very short time. When this happens lots of high energy x-rays are released. They are energetic enough to penetrate the earth's upper atmosphere and charge the D layer.

Normally, RF signals set free electrons into oscillation when the RF encounters them. The electrons take up some of the RF energy and then re-radiate the signals much like miniature QRP rigs. Signals which are in phase with the original RF signal will add to it. In the high reaches of the ionosphere (F region) this process is fairly efficient. Closer to the earth's surface, in the D layer, the atmosphere is denser. The oscillating electrons are much more likely to collide with other molecules shortly after becoming excited by the RF signal. They give up their RF energy as heat before re-radiating. The bottom line is that most of the signal is absorbed in the D layer.

The "sporadic E" layer is between the D and F layers and becomes charged only occasionally (sporadically). Its effects are similar to those of the F layer but are more prominent on VHF bands. There is some speculation that the E layer is charged by lightning since it is most active during the summer lightning storm season.

What happened to the A, B, and C layers? Early investigators left room for them in case they were discovered. They never existed. No problem. Just like a dog named Spot, the D, E and F layers come when you call them so it doesn't matter what their names are!

NorCal 40 Case Mod

by Doug Hendricks, KI6DS
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I just finished one of the easiest mods to make on the NorCal 40, and it really adds to the mechanical stability of the unit. Terry Young, KC6SOC, came up with the original idea, I just changed it a little.

The front and back panels of the NC40 case are attached to the circuit board with the controls. The back panel is really stable, but the front one tends to wobble just a little. Terry's fix was to put a piece of 1/4" rod from the middle top of the front panel to the middle top of the back panel, sort of a reinforcement bar. I liked the stability, but I did not like the fact that the bar was in the way when you took the top off, and also, I plan on adding the Jim Pepper digital readout, and the bar would be in the way on the top. I thought about putting one in each top corner, but the easiest way was to put the bar on the bottom of the case, underneath the circuit board. It was easy, all that it takes is a piece of 1/4 inch rod, two 4-40 x 1/4 inch pan head screws, a hack saw, file or sander, drill and #43 drill bit, 7/64" drill bit, and a 4-40 tap.

Jim Cates, WA6GER, picked the rod up for me in Sacramento, he was able to get aluminum 1/4" rod a lot easier than I can here in Dos Palos. I measured the depth of the circuit board from front to back, and found it to be exactly 4.25". Note, be sure to measure your board, and add 1/8" to the length. I then cut the rod into a piece that was 4 3/8" long with a hack saw, and used a file to square the ends. I then put it on my electric disc sander and got the ends perfectly square and cut to length. Next, I used a center punch to mark the center of the rod on each end, and used my drill press and #43 bit to drill a hole about 1/2" deep. It was then a simple matter to tap the holes for 4-40 threads and the bar was done.

I found the center of my panels to be 2.25" and measured up .25" and marked the spot with the center punch. I then drilled a 7/64" hole in both panels. Assembly is easy, and when you get finished, the case is much sturdier. Oh, be sure to check that the bar does not short out any of the leads on the bottom of the board. I had to trim the leads on the RIT pot to get enough clearance.

Thanks to Terry Young for the original idea, and thanks to Jim Cates for the aluminum rod. (He made me promise to make him a couple of the rods, so I will have to pay him off, never know when I will need more supplies.) 72, Doug KI6DS

NorCal 40 Notes

by Steve Kubisch, WW7Y
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Centerville, UT 84014

I finally got time to complete the NorCal kit. I used some of the mods from the March QRPp. Rig worked OK on power up and drew 14mA. I installed a 43pf cap in the VFO and had a bandspread of 42 kHz. I changed to a 47pf and got about 47kHz. Tried a 50pf and had 52 kHz and left it there 7.000 - 7.052. Tuning not TOO sharp. On transmit the monitor tone was WAY to loud. Hmmm, something wrong here. On checking the circuit, I found D1 in the mute circuit in backwards, DUH!, and I thought I was careful. Tried TX, lots better. I ended up with the 10 meg resistor in the AGC, seems to be about right. The monitor tone was a little too low for my taste so I added a 10pF cap in parallel with C39 (I think) to bring it up a little. I replaced the 820 pF cap in the transmitter with a 680pF as called for by Bob Warmke in the QRPp for a little extra power. As I turned the output power up the transmitted tone got REAL fuzzy and distorted, and not that much more power. Back to the 820 pf and had my nice clear

tone back, about 1.5-2 watts out. I might try the MRF237 final if I want more power.

All in all the kit worked out great. Great design with NO wiring. Receiver is nice and quiet with good sensitivity. Can't wait to spend more time on the air with it.

73 Steve - WW7Y

QRP + Bicycle Touring = FUN!!!

by Bil Paul, KD6JUI
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After many years of bicycling the Sierra Nevada and the Cascades, I set up a bicycle route from Canada to Mexico called the Pacific Crest Bicycle Trail. It was designed to come as close as possible to the Pacific Crest Hiking Trail, using paved or unpaved roads. Then I wrote a guidebook about the Trail which has introduced it to others (**The Pacific Crest Bicycle Trail**, pub. by Bittersweet Publishing Company of Livermore, CA).

What has increased my enjoyment of riding the Trail tremendously is the addition of ham radio. I got back into ham radio again about three years ago, and about the same time took along on the annual bike tour my first QRP rig (an Oak Hills 20 meter 3-watter). That trip resulted in a grand total of two contacts over a week! Still, I was hooked. The following year (last year) I talked three other hams (and one non-ham) into coming along. There was John Talstad with his HT from Southern California (KD6UKC), Guy Hamblin (AA7QZ) from Salem, OR, with his MFJ 15-meter QRP rig; myself with Oak Hills 20 and 40 meter QRP rigs; and Dan Arbogast (N0DA), who had an HT and used our QRP rigs when we weren't. The non-ham was in his 60s but as fast on the road as anyone else.

Guy and I used 10-watt, .5-amp Solarex solar panels on the backs of our bikes to charge lead acid batteries while riding. We set up ham operations in campgrounds at the end of the day.

Our trip began just south of Mt. St. Helens (the exploded volcano) in Washington and ended at Crescent Lake, Oregon. We camped out, cooked and put in about 55 miles per day. There was one day of rain.

The week began with poor HF propogtion and we were unable to contact anyone. But by midweek we were getting U.S. contacts with regularity. Guy used a dipole fed with RG-174 on 15 meters, while I used a tree-hung wire ground plane with four radials on 20 meters and a tree-hung slinky inverted-V antenna on 40 meters, fed with RG-58. The last night out, when I was about to give up on getting a contact, and Guy was having success, I had a brief contact with Finland on 20 meters — I guess the sky gods were smiling on me.

The adventure on this trip was running into an unexpected snow field on a back road between Sisters, OR and Mt. Bachelor. It was July and the altitude was just over 6,000 feet — who would expect such a massive amount of snow?

We started from Three Creek Lake and ran into piles of snow here and there on the unpaved road, but not enough to make us turn around. After many miles we were committed. However, the snow gradually becvame continuous and we became exhausted pushing heavily-laden bicycles through it (I had 65 pounds of gear). We had trouble following the road and were making slow progress. Frankly, we were getting worried.

However ... with our ham gear, HTs and even a cellular phone, we weren't too worried about being stranded (if only the Donner Party had been hams!). That evening we camped in a dry oasis around some trees, dried out our shoes and got on each others' nerves. Fortunately, we had a water purification unit with us. It was strange, camping in the midst of all that snow. The next morning, we had trouble finding the road again, but once we did, we found we were only a few miles from the far edge of the snow field.

Maybe that experience (in a heavy snow year) is what caused me to set the dates for this year's trip as August 27 — September 4!

Despite that rigorous experience, all the cyclists from last year's trip want to return for this year's, which will begin at Crescent Lake, OR and end at Mt. Shasta, CA. Operating QRP from wooded, mountain areas while cycling and camping — it's an irresistible combination. It's addictive and I'm impatient to do it again. However, this year I think I'll travel just a bit lighter....

Also, each year I like to try out new gear, new antennas and new bands. If you're in shape and like to camp out, consider joining us.

The second annual "QRP-hamming Bicycle Tour" along the Pacific Crest Bicycle Trail will take place on Aug. 27 - Sept. 4. The week long trip will begin at Crescent Lake, Oregon and end near Mt. Shasta, California. QRP operators who have bicycle touring experience are invited to join the group. There are no fees. The group will average 50-60 miles per day in hilly and mountainous terrain, and camp and cook in campgrounds. A monthly newsletter will go to those interested in going on the trip. For more information write to: Bil Paul, KD6JUI, P.O. Box 5183, San Jose, CA 95150, or telephone 415-345-7021.

A Crystal Filter Design Program Plus Results

by John Welch, N9JZW
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McHenry, IL 60050

For the past week or two I have been figuring out how to design crystal IF filters using the technique described in the May 1982 article in QST by Wes Hayward. Rather than duplicate his circuit, I used my TW-1 DDS as the signal generator and read the results with an oscilloscope.

I matched a large pile of surplus 10MHz computer crystals cannibalized from dead boards, and found (from about 60 crystals) 29 crystals that matched within 10Hz (my limit of accuracy in measurement), and they also matched for 3db bandwidth, parallel capacitance (as measured by my radio shack multimeter) and resistance.

Armed with this data, I wrote a simple BASIC program to perform the calculations discussed in the article. As Wes also mentioned the importance of re-resonating each section, I added in the calculations for the series capacitors for each crystal to get them all to resonate more-or-less at the same frequency.

I built a 5 pole Chebychev filter with 2.2kHz bandwidth, and hooked it up (wrongly) to my analyzer (I didn't have the right connector and the antenna in isn't 50 ohms). I got mediocre results, due to improper termination. Then, I found the right connector and re-ran the measurements.

With no tuning at all, using the closest stock capacitance to the calculated values, I wound up with a 2.1kHz 3db BW. Ripple was designed to be 0.1db, but I measured about 1db of ripple. The insertion loss was measured to be 2.3db. The 60:6 shape factor is 3.34. It drops sharply on the low side, and is more rounded on the high side.

There are two steps in making a crystal IF filter that behaves the way you want - measuring the crystals and doing the math to calculate the capacitances needed. Inspired by the May 1982 QST article, I've come up with a way to simplify both.

These simplifications come about due to the wide-spread availability of computers to do the math, and the rapidly-falling prices of DDS chips, allowing a home-built DDS VFO to do double duty as both a radio and a piece of test gear. For details of the DDS VFO I designed (the TW-1), see December 1992 and March 1994 73 magazine.

You'll need some other equipment - an oscilloscope and a multimeter. I used one from Radio

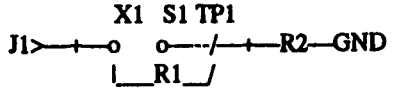
Shack that has a capacitance meter to measure the parallel capacitance, but this is not strictly necessary (most surplus computer crystals I've measured were between 3 and 5 pf).

If you don't have a DDS VFO, you can use your HF transmitter, but the output will need to be *very* low. Use an attenuator to get about .1 to .2 volts peak-to-peak into a 50 ohm load. Much more than this could damage the crystals you're trying to match.

Start by getting a pile of crystals, all at the same frequency. I used a pile of about 50 surplus 10MHz computer crystals. Most surplus dealers have these sorts of crystals cheap, usually under $1 each (for those who beleive in the old ham standard, the 9MHz IF, Hosfelt Electronics in Ohio has 9MHz crystals for $0.69 each. Their phone # is 800-524-6464. Ask for part #23-102, and tell them N9JZW sent you.)

To measure the crystals, make a test fixture as shown in Figure 1. The low-level RF signal comes in from J1, passing through either the crystal (in a socket at X1) or the potentiometer R1, depending on switch S1. The signal then goes through R2, a 50 ohm resistor to ground. The oscilloscope is hooked up to TP1, at the junction of S1 and R2.

Fig. 1



Set S1 to the crystal, and put a crystal in the socket. Adjust the TW-1's frequency near the alleged frequency of your crystal, untill the signal on the scope maxes out (this can best be seen by adjusting the scope so you see a greenish bar across the middle of the screen, not a single sine wave). Use the variable voltage setting to adjust the green bar to be 6 divisions high, and record this frequency. This is the series resonant frequency of this particular crystal.

Next, remove the crystal and select the pot R1 with switch S1. Without changing frequencies or adjusting the scope, adjust the pot untill the signal on the scope is once again 6 full divisions high. Hook your ohm-meter across R1 and measure the resistance. This is the series resistance of this crystal.

Put the crystal back in the socket and re-set switch S1 to select the crystal. If necessary, re-adjust the scope voltage for a full 6 division swing on the signal. Carefully adjust the TW-1's frequency up untill the signal on the scope measures 4.24 divisions (you'll need to shift the vertical position to get this precisely). Record this frequency as the upper -3db point, and repeat by lowering the TW-1's frequency untill you find the lower -3db point as well.

Write the series resonant frequency, the upper & lower -3db frequencies and the series resistance on a small paper, and keep this with the crystal you just measured. Repeat untill either you run out of crystals or have enough crystals for your radio.

Ideally, most of your crystals will have the same frequency characteristics. Use the closest match you have, and average the resistance and 3db bandwidth (the upper -3db frequency minus the lower -3db frequency) if necessary.

Run the XFILTER program provided, and answer the questions with the results you've found for your pile of crystals. The program will tell you the 'natural' impedance of your filter. Pick a number that's equal to or greater than this number, and this will be the impedance your filter needs to see to work correctly. The program will finish some more calculations, and print out a table of capacitances. The values are all in pF.

The first values are the shunt capacitors, those that go between the crystals and ground. In a 4 pole filter, there are two end capacitors (C end) and 3 shunt caps (C12, C23, and C34, for the caps between X1 and X2, between X2 and X3 and between X3 and X4).

Next, it will print out a list of series caps. These should be put in series with the specified crystal, to correct for the change in resonance introduced by the shunt caps. Without these caps, the ripple and shape of the filter will be lousy at best. With them, you should see good agreement between reality and the calculations.

Use the nearest standard value cap to what the program prints out, and you should do fine. If you want the best, use a slightly smaller cap with a trimmer in parallel, and adjust the trimmers for best response.

Go build your filter. To see how it behaves, terminate one end with a resistor equal to the filter's characteristic impedance. Build a matching section to take the TW-1's 50 ohm output up to your crystal's impedance (hint: I made my filter require a 200 ohm impedance and used a 4:1 step-up transformer).

Hook your scope up to the end of the filter, where it goes into the terminating resistor. Sweep the TW-1's frequency from about 3kHz below the resonant frequency up till you lose the signal in the noise, using 100Hz steps, and recording the output voltage. You can graph this (which is voltage), or compute the power from the voltage peak-to-peak and the resistance, and graph the power (power is the right way, but voltage will give you a good idea of the relative performance with less work).

I'd say it was a success, all in all. As I've had quite a few requests for the program to calculate this, here it is. Have fun with it, and I hope to be on the air with my own SSB unit some day soon.

XFILTER.BAS listing

```
10 REM xfilter.bas  by n9jzw  jjw
20 REM absolutely no rights reserved - genuine free public domain software
30 REM calculates 2 through 8 pole 0.1db ripple chebychev or butterworth filters
40 REM for how to measure the parameters this program needs, see May 1982 QST's
50 REM article by Wes Hayward
60 REM and/or a future article by n9jzw on the same subject
70 CLS
80 PRINT "N-pole Crystal Filter designer"
90 DIM Q[10,2],TABLE[10,10,2],C[10],CADD[10],RF[10]
100 GOSUB 790
110 INPUT "Enter 1 for Chebychev 0.1db ripple, or 2 for Butterworth";TYPE
120 INPUT "Crystal 3db bandwidth in Hz";DELTAF
130 INPUT "Crystal series resonant frequency in MHz";FO
140 INPUT "Crystal resistance in ohms";RO
150 INPUT "Crystal parallel capacitance (usually near 5)";CP
160 INPUT "Filter bandwidth in Hz";B
170 INPUT "Order of filter";ORD
180 IF ORD >1 AND ORD <9 THEN 210
190 PRINT "Must be between 2 and 8"
200 GOTO 170
210 FOR X = 1 TO ORD-1
220 C[X] = INT(1326 * (DELTAF/(B*TABLE[ORD,X,TYPE]*FO)) - 2*CP + .5)
230 NEXT X
240 LM = 19.1/DELTAF
250 CM = 1.326E-15 * DELTAF/(FO*FO)
260 REND = (120*B)/(Q[ORD,TYPE]*DELTAF) - RO
270 PRINT "Rend =";REND
280 INPUT "Enter terminating resistance ";R
290 IF R > REND THEN 320
```

```
300 PRINT "Terminating resistance must be larger than";REND
310 GOTO 280
320 CEND = INT((159000!/(R*FO)) * SQR(R/REND-1) - CP + .5)
330 W = 2*3.14159*FO*1000000!
340 CS = (1/(RO*RO)+W*W*CEND*CEND*1E-12*1E-12)/(W*W*CEND*1E-12)
350 C = 1/(1/CS+1/CM+1/(1E-12*C[1]))
360 FEND = SQR(1/(4*3.14159*3.14159*LM*C))
370 RF[1] = FEND
380 RF[ORD] = FEND
390 FOR X = 1 TO ORD-2
400 C = 1/(1/(1E-12*C[X])+1/(1E-12*C[X+1])+1/CM)
410 F = SQR(1/(4*3.14159*3.14159*LM*C))
420 RF[X+1] = F
430 NEXT X
440 Y = Y1 = 0
450 FOR X = 1 TO ORD
460 IF RF[X] < Y THEN 490
470 Y = RF[X]
480 Y1 = X
490 NEXT X
500 CLS
510 IF TYPE = 1 THEN 540
520 PRINT "Butterworth Filter, ";
530 GOTO 550
540 PRINT "Chebychev Filter, ";
550 PRINT "BW =";B;"Hz at";F/1000000!;"MHz,";ORD;"pole with";R;"ohm terminations ."
560 FOR X = 1 TO ORD
570 XL = 2 * 3.14159 * Y * LM
580 RSLT = 1 / (XL * 2 * 3.14159 * Y)
590 IF X = 1 OR X = ORD THEN 620
600 Z = 1/RSLT-1/CM-1/(C[X]*1E-12)-1/(C[X-1]*1E-12)
610 GOTO 630
620 Z = 1/RSLT-1/CM-1/(CS)-1/(C[1]*1E-12)
630 CADD[X] = INT(1/Z * 1E+12+.5)
640 NEXT X
650 PRINT "Cend =",CEND
660 FOR X = 2 TO ORD
670 PRINT USING "C # # =";X-1,X;
680 PRINT ,C[X-1]
690 NEXT X
700 PRINT "Cend =",CEND
710 PRINT "Series caps"
720 FOR X = 1 TO ORD
730 IF RF[X] = Y THEN 760
740 PRINT "X";X;"=",CADD[X]
750 GOTO 770
760 PRINT "X";X;"=",0
770 NEXT X
780 GOTO 1080
```

```
790 FOR Z = 1 TO 2
800 X = 1
810 READ Q[X,Z]
820 IF Q[X,Z] = 0 THEN 880
830 FOR Y = 1 TO 10
840 READ TABLE[X,Y,Z]
850 NEXT Y
860 X = X + 1
870 GOTO 810
880 NEXT Z
890 RETURN
900 DATA 1,1,0,0,0,0,0,0,0,0
910 DATA 1.6382,.7106,0,0,0,0,0,0,0,0 920 DATA 1.4328,.6618,.6618,0,0,0,0,0,0,0
930 DATA 1.3451,.685,.5421,.685,0,0,0,0,0,0
940 DATA 1.3013,.7028,.5355,.5355,.7028,0,0,0,0,0
950 DATA 1.277,.715,.539,.518,.539,.715,0,0,0,0
960 DATA 1.262,.722,.542,.516,.516,.542,.722,0,0,0
970 DATA 1.25,.727,.545,.516,.510,.516,.545,.727,0,0
980 DATA 0
990 DATA 1,1,0,0,0,0,0,0,0,0
1000 DATA 1.414,.7071,0,0,0,0,0,0,0,0
1010 DATA 1,.7071,.7071,0,0,0,0,0,0,0
1020 DATA .7654,.8409,.5412,.8409,0,0,0,0,0,0
1030 DATA .6180,1,.5559,.5559,1,0,0,0,0,0
1040 DATA .518,1.169,.605,.518,.605,1.169,0,0,0,0
1050 DATA .445,1.342,.667,.527,.527,.667,1.342,0,0,0
1060 DATA .391,1.52,.734,.551,.510,.551,.734,1.52,0,0
1070 DATA 0
1080 END
```

—John Welch, N9JZW

The MFJ 20 Meter SSB Travel Radio: A Review

by Jeff Gold, AC4HF
1751 Dry Creek Road
Cookville, TN 38501

Just got my MFJ 20 meter SSB Travel Radio yesterday. Finally wired it up and played with it indoors. It seems to be about the same size as their CW qrp rigs. It has a meter that works as a S meter on Receive and suppose to show speech processing on TX. It puts out about 10 watts, but can easily be turned down. Nice documentation. The receiver seems really good.

I got nothing but excellent audio reports once I had enough confidence in the system to use the mike as directed (keep it away from my mouth and talk normally). The rig really does seem to go through the QRM. I have the mike that is part of the package, think the list for the rig and mike is now $229.00. They are going to come out with a cw module for it, but wasn't ready yet. They also advertise an AC portable power supply for using it in hotel rooms and such. It is a great toy.. wish they would make it into a kit. Maybe if we all wrote them letters.

The rig supposedly has effective built in speech processing and from the reports I got, I can't argue the point. There is a lit combination S meter and speech processing monitor. Both seem to work correctly. I compared the S meter reading with my 850; close enough for what

they do. In TX the meter shows you where you should be setting the level. You need to keep the mike out of your mouth and talk regularly.

I started with it in the house hooked to my Lightning Bolt Quad with 10 watts. Had NO PROBLEM contacting those I heard, in each and every case got good audio reports. And I mean I specifically asked for reports and talked about it with them for a while. Also had good signal strength.. not all that much difference between 10 and 100 watts in my opinion on SSB. There seems to be some difference between 5 and 10 watts on SSB.

There is a tune button to help you tune a tuner, so you can save your whistling. The tuning knob is smooth and works very well and the mike has a nice feel and seems pretty hefty. The reciever has a "clean" sound and seems to do a good job receiving weak signals and seperating out signals that are close together.

I set up the rig in my driveway using my PVC vertical (I can really tell the difference in antennas) but still using a gel cell and the vertical there was no problem. Good audio reports and got out real well to some places. Worked it a good long time with the 4 ah gell cell.

Even thought the MFJ SSB doesn't have RIT, I haven't needed it, or extra filtering, or a place for headphones.

Decided to try it out in the CQ WPX today. Been having a blast. TM1C had a pileup on him. Gave him a call (added QRP.. don't usually).. he came right back to me. After he gave me the exchange, he immediately asked if I was really QRP. I told him what I was using. He chuckled and said "Unbelievable! You had the loudest signal".Guess the old saying the antenna makes the difference has some truth. I've Been having real good luck with DX and US using the Lightning Bolt Quad in the contest with the MFJ. 72,73 Jeff, AC4HF

Spring ARCI QSO Party Reports

by Various Authors

Just a bit of a recap of what it was like from here in Nevada. I Never heard a signal on 10, 15 or 80. Heard one on 20 but it was too weak to copy who it was. Heard one JA on 40 Sunday am. One VK on Sat am. Never heard any east coast stations. Heard W8MVN both days but never could get him to even send a ?. So much for all the bad stuff.

Now comes the fun part!! Worked only 40m. Spent 10.5 hrs operating. Should have been there for all 24 but just got too bored! 45 QSOs. 14 States and one VE. Points come out to 15,750. I worked VE5VA, WB4TPW and W6RCL from the Internet gang.

Found another must for arx. Good noise blanker. The power line noise here would get over S9 at times but the blanker in the little TS 130S did a great job. After the contest I checked the SWR. It's infinite! Guess that might explain part of the trouble. Oh well, soon the tower will be up and I can get a real antenna up.

If any of you "big guns" out there want to have a frustrating weekend, try contesting without an antenna!!! Thanks to all that pulled me out of the mud and that repeated the reports for me till the qsb let me get it! Signals would go from in the noise to a good s6 during an exchange. Weird. 73 & CUL, Ron, KU7Y

Not much of a party really! Condx were absolutely dreadful. Hey Chuck - *we* even had a thunderboomer about an hour before the contest ended. Temp was only about 15C all day. Curious. Anyway - here's the score FWIW. Only 20m and 40m. 31Qs (!) 125 Qpts / 19 SPC / Pwr x10 (0.9W) = 23750 If that didn't beat you Chuck, I have a list of excuses ready. 73 de Pete, VE5VA

Obviously Pete is the Canadian champion.....try as I might I was only able to HEAR 9 staions on 10 thru 160. I worked everybody I heard. Oddly enough, I doubt being QRO would

have helped. What was really strange was that several stations including HP1AC were quite strong.....by the way, my antenna was connected! (tribander at 66 feet, shunt loaded tower) Finally, I worked more qrp stations in two hours on Friday night than I did for the entire contest.....9 qs, 9 spc.....Canadian runner up? Rick, VE6GK

I'll have to agree with Peter...it wasn't much of a party...but, it sure was fun trying to pull those wavering signals in. I had planned to work 15, 20, 40, and 80. I never heard a peep on 15 or 20. 40 and 80 were not much better...but I did make 18Qs, 81 points, 11 SPC, and 5 watts for a grand total of 6237 points. Not to bad for a rookie and a lot better than my botched effort last year!! Hopefully, I didn't pull the INET2 team down too much.

I had about 3 hours of concentrated effort and about 3 hours of semi-concentrated effort while playing with a new satellite tracking program. How do you folks concentrate for extended periods of time through all the static and noise?

From the QRP list I bumped into Bill, N8ET on both 40 and 80, and Howie, WB2CPU on 40. Other notables that jump out from my log were Danny, K3TKS ARCI Net Manager and the ARRL's master of microwaves, Zack, KH6CP/1.

I know I had a good time...but, I do believe my code speed has gotten worse ... I guess that blows Chuck's theory. It must be the fatigue....I'll make sure I get a good nights rest and see how it is tomorrow. Look forward to seeing everybody next time!! Warren KD4YRN

This was the big weekend, the Spring QSO party. I was sooo excited. The Sierra was ready, I had borrowed Bob Warmke's while he tweaked mine up (I'm going to take it to Dayton and want it to be just right). The band's were horrible. Murphy came to visit in a big way at my house. There was just noise on the bands. WWV was even barely audible. Gosh, call Chuck and see how it is in Texas.

The phone rings, and Chuck answers on the first ring. I don't even have to ask, as he tells me the same thing in Texas. Nada for signals on any band. I decide to try the NorCal 40 and just operate on 40 meters instead of all bands. Not a bit better. Still noise. I work 4 qso's in 45 minutes. So, I decide to work on the next issue of QRPp. I shut the rig down and went to work.

My wife came in at 5:00 and made me shut down to go to Mass. We then had a nice leisurely dinner, and then I decided to try the bands again. They were a little better, but not much. Made 9 more contacts. Ok, hang it up and go back to work on QRPp.

The good part is that my station really worked nice. The Super CMOS II keyer is a great aid. I programmed button 1 to call CQ QRP CQ QRP CQ QRP DE KI6DS KI6DS QRP TEST K. Button 2 was programmed to say TU QSO GL 72 DE KI6DS. Button 3 was programmed with CA CA NR NR XXXX (ARCI NUMBER). And Button 4 was programmed with just the number, as it is the most requested repeat.

The NorCal 40 is an excellent contest rig. The receiver is sensitive, I had the power turned down to 1 watt, and made contacts all over the place when they were there, the trouble was, most of the time no one was there. The RIT is a must, and if you are designing a rig, you MUST, MUST include RIT.

Oh, I forgot to mention that one leg of my antenna fell down and had to be fixed before I could get on the air. I also called Jeff Gold, AC4HF, and talked to him about an article for the next issue of QRPp, since the bands in Tennessee were as bad as they were in California. Jeff is a great guy, lots of fun to talk to, and he is one prolific writer. Watch for articles in CQ and 73 in the near future.

Here is a list of the contacts that I made: KE6QF, NU6U, W6JHQ, WA6HYB, WB4TPW, N9FVN, W6EMT (Roy Gregson, famous QRPp author), AA6TR, WA7ZBL, WB5FKC, WX7R, N4TTJ, W0NQS. Worked 7 States, CA, OR, WI, WA, TX, FL, MN on 40. Total

time operating: About 2 hours. Lots of fun, but sure wish the bands were in better shape. CUL, 72, Doug

Hi, from the Los Angeles suburb of LaCanada-Flintridge (home of JPL and about 2-miles NW of the Rose Bowl). I spent a couple of hours on-air during the QSO party and heard no one on 160-80-or-10. The rest of the bands went like this:

40m - W7UAB, N7MFB, KB8N, N8FU, N4OGW, KU7Y, W6SIY, W6JHQ, AB6SO, K8ORD/K7, WB6TZY

20m - AA7KR, WB0SMZ, WA4VQD, K4ADI, W0PRQ (the latter sounds too good to be true——backwards his call is QRP0W!)

15m - HP1AC

It was fun. But not without disappointments: I, too, called W8MVN for 30 minutes without a response. And I first heard HP1AC on 40M Saturday night, while he was working 3's but apparently had no propagation to the West Coast. And at that particular time the skip on 40 was so bizarre, I couldn't hear any stateside! Reflections: In my contest mode, I gave everyone a 599, that was probably a mistake. And would someone suggest to the Software Moguls—K1EA, N6TR, and whoever else is writing contesting software, that because of the QRP exchange we probably need someone to write our contest/QSO party/whatever into their package of contest configs? Come to think of it—anyone who is going to Dayton might ask at their booths!

I'm looking forward to next year—and am hoping to run a complete homebuilt rig for all the bands: I'll be ordering the Sierra when it's available. I do have monobanders for 20 and 10 which are capable of 5-watts. But I used the QRO rig (IC-725) loaded down to about 8-10 watts (there go the power multipliers).

The 80-40 antenna is a Butternut HF-2V (33-feet tall, works better than my Inverted V—apex 37'—on 40). For 20-15-10, I'm using a Cushcraft A-3 at about 43-feet. One final thought: I'd like to see a monoband QRP QSO party on 30 Meters ONLY sometime. The lack of highpower guys on the band makes it appealing. And I think it's a great frequency for QRP! Plus, despite the IARU "gentleman's agreement" not to contest on the WARC bands, I believe the rule was made to keep all-band contesting (CQWW, ARRL DX, etc) off ALL the bands on a given weekend. I don't think the rule should apply to a single band QSO Party (don't call it "a contest" because that has ugly sounding description to some Amateurs)! 73, 72 de Alan-W6RCL

Well after reading KI6DS's report, I did not feel too bad about my report! I worked only 2 hours using my Norcal 40. I ran 2 watts into a Hamstick. (No antenna allowed). Tried the Super Keyer II just to see if it did what I wanted it to. It worked fine, but I had more fun with the straight key. Conditions here on the East Coast were just as bad as on the West Coast. I spoke with W3TS on the phone and his comments were the same. He was on several bands, I was on 40 only. I also was worn out from National Guard duty this weekend. (Not a good combination). W8MVN sounded like a big gun on 40. Heard HP1 and some 6's. (Maybe Doug was one)! Results: 7 contacts, 6 states, total pts - 1092. 72 de Cameron, KT3A.

As everyone has noted, bands were in sad shape. But the NorCal 40 held its own. Really appreciated the great receiver during the last hour when everyone was on the same frequency looking for one more QSO. Worked only 40 meters for this one. On the air, WA1JXR said "condix are "poor." I replied that "poor" was being generous. Really wasn't worth being on before 21 or 2200 UT.

From Central Massachusetts, I only worked two others from MASS, with reports like 339. Worked none others from New England, and none from the second district either. Got three

new states, CO, TX and WV. Did manage 30 QSOs in 16 states in about 7 hours. Furthest was W0FPR in Colorado. Also worked four on the INET list and will send details to Chuck. W8MVN had a booming signal, especially Sunday. Had a hard time getting him to hear me, but he finally did. Was lots of fun and am looking forward to the Fall. Cheers, Mark, NX1K

W1FMR/1 had a ball in the ARCI QSO Party, operating from the car. I grabbed an ancient Butternut vertical and headed for a spot scoped out the previous fall. Located on a salt tide river on the MA/NH border, it is a brackish basin about 1500 ft. across, facing west. I set the vertical in an open fence post and could hardly hold it because of high winds, but I got lucky and it went up without incident. 6 various lengths of radials were attached and the feedline was fed through the car window. I tried to run the NorCal-40 using lantern batteries, but the audio was low and wind noise and QRN so high I could barely hear stations. I switched over to the Argo 509 and a gel cell, and was able to copy stations easily on the rig speaker.

It was a beautiful, peaceful and cozy, sitting in the sun-warmed car, looking across the river inlet at the whitecaps being whipped up from the wind, and following the flight of seagulls hovering and diving at invisible carrion in the river. The mystical and weird shapes of the Seabrook Nuclear plant buildings looked especially calm, and I wondered if the QRN was due to internal atomic explosions occurring within the plant.

Stations were worked at a rate of about 5/hour - Not too shabby considering the portable location and poor miserable conditions. The only INET stations worked were Jan, WA4VQD & Bill, N8ET. Bill and I made a a sked for 80m but I needed time to put a matching coil on the vertical for 80m and after that, the SWR was horrible. I heard and called Bill but could not get him. About the same time, a ham saw the butternut flailing around in the gale, wandered by and we introduced ourselves. Jim, AA1FR helped me put up a long (low) wire for 80m. By that time N8ET had disappeared but I worked WA1OFT, K8AQM and K3WWP on 80. Since Jim and I were spending more time chatting in my car, than operating, we decided to dismantle the station and head for the Blarney Stone Tavern for a couple of Murphy stouts and call it a night. All in all, a memorable time, though not many stations were contacted. Results - W1FMR/1, : Hampton NH, Outdoors, near fishing village. Power: 3 watt, batt., Rigs: ARGO 509, NorCal-40, Ants: Butternut Vert., LW Operating time: 8.5 hours, Sat., 11:30 - 8:00 p.m. EST. # Stations worked: 39. Furthest DX: WY and ND. Bands: 80, 40, 20. SPC: 21 ARCI members worked: 26. 72, Jim, W1FMR

Preliminary count from my log last night: 167 QSOs, 60 SPC, 676 points, 283,920 score. The above numbers are subject to review when I am awake.... I did the 24 hours, and trying to dig signals out of the soup this past weekend was WORK!

I have noticed several comments on Internet about the 40m signal from W8MVN - I heard him in NW Ohio also - sounded like a DX signal from over the pole - he never heard me - I never got OH on 40....

Glad to know from the posts on Internet that CA was on the test - most of the time propagation (when it was there) seemed to stop at Colorado, and leaped over all the midwest states. Missed things like OH, MI, IN, IL, KY on 40.... my best shots on 40 were PA and New England.

Rig was a TR-7 cranked back to 5w. Antennas: Wilson System 36 at 45', Inverted vees for 40 and 80, 18HT vertical for 40 and 80, 130'wire for 160 thrown over some trees and connected to the base of the 18HT. Ground system - 7 acre pond in the back yard....

CW was done by a K9CW keyer with memories, and also by the PC (N6TR's program). sometimes they don't send what you think you asked them to send.... so I did use the paddles a lot.

Logging - used N6TR's 'LOG' program for the first time - also used a paper log just in case...

I am going to drop a note to Tree and ask a few questions about LOG - it did a few things I didn't expect, and didn't do a few things I did expect.... 73/72 - Bill - N8ET

I operated 40 meters for about 3 hours during the weekend from Boulder, Colorado. My thanks to all who helped me with 2-way QRP contacts under less than optimum conditions! I used my Ten-Tec OMNI-5 rig cranked down to 5 watts output. My antenna is a homebrew vertical with 65 radials cut for 40 meters and 3 or 4 longer ones to help on 160m. I only managed about 15 to 20 contacts and gave up after about 3 hours of QRN and poor propagation. I tried to work Bill N8ET on 160m Saturday night but between the freezing rain, QRN, and poor propagation, it just didn't work. '72's Chip Owens, NW0O

New Newfoundland ARCI Spring Party Record? Boy it is so nice to be on the QRP list and receive the encouragement to keep on plugging away at the ARCI contest when things looked (no make that were) so bleak. Thanks to you Chuck K5FO for the updates, thanks to Bill N8ET for my First QRP QSO (ever) as a VO1 on SUNDAY afternoon and thanks to you all who strained your ears to hear my Newfoundland cod tongue whisper during my 4 hours in the contest. Here's my "Rhyme of the Ancient Qrper"..

- Moved to St. John's (the Rock) Newfoundland this past week into my 1 year "vacation apartment" (actually "work" related).
- Ventured down to the Canadian Department of Communications and secured yet yet another call VO1DRB to go along with my VE2DRB and WA6ERB (I know they don't match).
- In preparation for the ARCI Spring Party I unpack my Ten Tec Argosy II, MFJ antenna tuner, Cmos Super Key II, my trusty non-moving capacitance coupled iambic paddle and some disarray of antennas (unpacking radios comes before anything else essential
- where was that toothbrush anyway).
- Out on my third floor corner apartment balcony I lash together a Radio Shack (thank goodness EVERY North American town has a Radio Shack - that's how I let my wife know if a town is noteworthy) 5 foot mast and a 40/20 meter rotatable dipole made of two old Hygain mobile whips.
- I fire up the Argosy II to a full QRP gallon check SWR (not bad) and listen, and listen, and listen... Boy what a bummer. I hear nothing on 40, change whips and still hear nothing on 20. Not knowing anything about propagation from a QTH that is the farthest East possible in North America begins to make me wonder if I'll ever get through the Auroras (or whatever they get up North here). It's Saturday evening - I give up (so easily). I finally do crank up the Argosy to 50 watts and make a few European QSO's - St. John's IS only 2 1/2 time zones away from GMT. To bed I go.
- Sunday is not much better. I jury rig up an old AEA Isoloop on my balcony in the horizontal position. A little better but no barn burner. Work a few more Europeans at 50 watts. Will I ever work (or be able to work) a North American QRP station? I call and I call and I call. I almost made contact with NX1K (good ole New England QRPer) and K4JM - thanks guys for listening. I called W8MVN a thousand times - no answer. Will my career (?) as a QRP contester end?
- I move into a new mode of operation. Set my computer up and got "sucked" into playing Solitaire. Meanwhile I program my Super CMos Keyer II for calling CQ QRP Test. Let it run a while to heat up the ionosphere with my 5 watts - maybe I can punch a hole through... Low and behold but who comes pouncing on my frequency but N8ET with a 559 - Wow First QRP QSO from a super operator - thanks Bill. Maybe there's hope. More CQ's, more Solitaire and yes more QRP contacts.

A GRAND total of 15 Q's in the last 4 hours of the contest. A NEW WORLD'S RECORD FOR THE SPRING 1994 ARCI PARTY FROM VO1 LAND? - And my final challenge was

to fill out my log but I couldn't figure out the GMT time (Newfoundland is 1 and 1/2 earlier than EST and with the daylight savings change I didn't have a clue what GMT was. Turn to trusty WWV - I can't even find it until Monday morning the conditions were so bad.. By the way it is 2 and 1/2 hours later than GMT in case you ever operate from VO1. 73 from CFA (Newfoundland term for Come From Afar) Bob VO1DRB/VE2DRB/WA6ERB

I worked the ARCI QRP QSO Party for about 2 hours 15 minutes total. QTH is Brighton, MI, which is about 45 miles northwest of Detroit. I currently only have an 80m dipole up (I hope to get a Cushcraft R7 at Dayton and put it on one of my roof tripods).

Saturday morning, I quickly turned on the radio and listened around 3560 a little after 8AM (1200z). I heard some activity, but I had to run to a veterenarian appointment. When I got back, the operators had vacated 80.

I ran an hour Saturday evening. I fired up my IC-735 (I had adjusted the output power swing to work QRP levels on Field Day last year). Turned my power down to 5W and got to work. I worked 11 stations in an hour. I used the ole hunt-n-pounce method. I discovered that I have a less-than-optimal callsign for contesting (I already suspected that). Lots of problems with the H and S following each other. I found it most effective if I increased the spacing between the letters of my call.

The band, of course, was noisy. I seemed to be working to the east and southeast pretty well. I only got as far west as IN and WI. 3560 appears to be a popular NTS net frequency, but it seemed for the most part that the "contesters" (partiers?) made room for the net folks.

Later that evening, from 0242 to 0252, I tried again, but the noise was horrendous! I made 2 more contacts. I got involved with other things after that attempt, then checked the band again at about 0420z (12:20AM EST), and the band was vacated.

I got up at 7:30 the Sunday and listened around, nobody was there. I worked again from 2245z until the end of the contest. I got 8 more Qs, but the noise was bad. I could hear NZ8J in Fairborn, OH. He was booming right in. Working him was a snap.

This is the first "contest" I've participated in other than Field Day. It was a most enjoyable experience. I noticed that the people I worked this weekend were patient enough to stick with me and try to get the exchange through the noise. I never really got "jettisoned". Kudos to WD9CTB, Jerry Kitterman, he stuck with me through a long ordeal. He was my last new state. He probably already worked MI, but he gave me one more state in my SPC multiplier. I worked PA, VA, MI, OH, MD, GA, WI, NH, CT, NJ, and IN. In the end, I had 21 contacts (16 members, 5 non-members), 11 states, running 5W. That give me a score of 6930. I'm happy with it. Perhaps I have a shot at the 80m-only Michigan certificate. I'm sending my dues to ARCI to get my own number. It was fun, and that's what it's all about. 72! Steve, N8HSC.

I got hit with some kind of flu Friday nite. I had 101+ F all day Sat and couldn't even think about operating in the contest. I turned on the radio about Sunday noon but still wasn't really coherent enough for much. Finally, by late p.m. I was able to operate a bit. Conditions, as others have noted, seemed poor from here. Only HEARD a couple of contest stations on 20, tho, surprisingly a few Europeans were coming in. 40 was only good for relatively short stuff, 4's and 8's, mostly. Loudest heard were W8MVN and N8ET (guess your antennas doing ok, Bill). From the INET teams I worked only WA4VQD from INET1 and N8ET and KD4YRN from INET2. I haven't figured my score yet but I had 45 Q's in less than 3 hours. Apologies to my INET1 teammates for the paltry score. I'm still not feeling so great — taking today off from work. Hope to see many of you at Dayton. 72/73... Howie, WB2CPU

Well, nearly breaking my foot Friday considerably dampened my enthusiasm for dashing around outside stringing up an antenna. I actually did get the antenna up by early evening,

however, whereupon I discovered that my Ugly Weekender doesn't work. I had planned to get on 17 and 30 Sunday, but since I planned to operate outside, Sunday's rain literally dampened my enthusiasm for that idea...Oh well. Maybe next weekend. 73, John, WB7EEL

I made a 40m only effort from here in southeast Michigan. My time was limited since my brother, N3QXB, surprised us by flying in from American Samoa. The band was poor—lots of noise and moderate fade rates. I ran my Drake TR5 at 5 watts into a quarter wave ground plane at 17 ft. My summary: 33 QSOs in 19 SPCs for 17,556 points, 2hrs of operating time. I worked fellow netters WB2CPU and AC4HF. Also snagged NN1G and KH6CP/1. I missed Chuck. I called W8MVN until my fingers were blue—did anyone work him? Thanks to all —it was an enjoyable QSO party. Onward to a QRP FD! 72/3, Ron WB8RUQ

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An RF Amp for the NorCal 40

by Bob Lai, KM6QP
976 Jackson St.
San Francisco, CA 94133

Why do you need an RF amp for the NorCal 40? You don't if you have a good antenna, but if you are in a small apartment, or in a motel room and want to use it to listen without an external antenna, this mod might be for you. This will give you better agc and help you to pick up weak stations that are down in the mud. I built this RF amp after I built the audio amp for the NorCal 40 and noticed that there was not enough volume or sensitivity to run a speaker. Signals would fade in and out, but I just did not have enough volume. I turned up the volume on the NorCal 40, but all that I got was a lot of noise, but no signals. To get better dynamic range, I built this circuit.

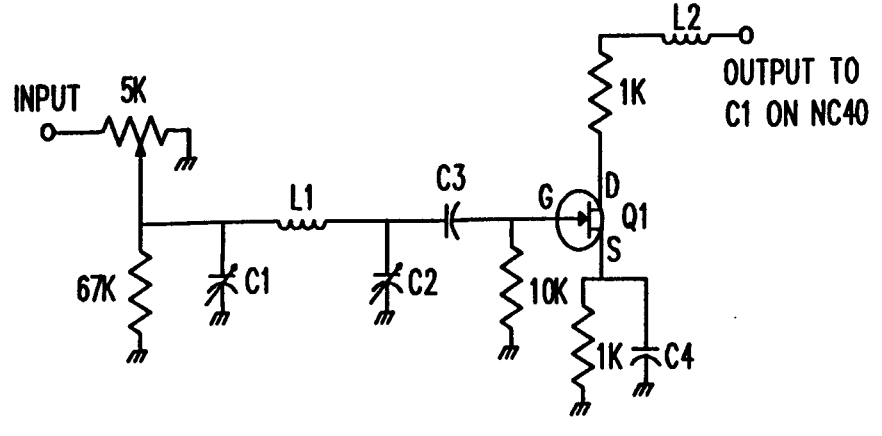
I used some of the parts left over from the NorCal 40 kit, and some from my junk box. Jim Cates, WA6GER, gave me some of the parts that I did not have. I experimented with the circuit and this is the final product. If you have suggestions or improvements, I would be interested in hearing them.

This circuit will allow the NorCal 40 to pick up stations using just a short whip antenna. Of course, you can't transmit using the whip, but you can listen! I use the RF gain control as the volume control for the rig, setting the volume on the rig at a point where there is no background noise. This makes the NorCal 40 a very quiet receiver with no noise. Signals seem to just "jump" out at you. I adjusted it so that when you when you unhook the antenna, there is no change in background hiss.

I have a Kenwood TS50 and hook a small whip antenna to the rig for an antenna. Using the same whip, the NorCal will hear everything that the TS50 does. I am therefore concluding that the NorCal has the same sensitivity as the Kenwood. Remember to tune the capacitors C1 and C2 on the filter circuit for the best sensitivity. There is a lot of gain on the FET, so might get some feedback. Have fun! 73, de Bob KM6QP

Parts List

C1 & C2 - 2 - 24 pF air trimmers (the same as used in the NorCal 40)
L1 - 18 T #26 Enamel wire on T37-2 Toroid (red)
L2 - 15 uH choke
C3 - .01 uF disc
C4 - .01 uF disc
Q1 - 2N4093



The ARCI Spring QSO Party at N8ET

by Bill Kelsey, N8ET
3521 Spring Lake Drive
Findlay, OH 45840

It all started last November when I finally got my crank-up tower up. That happened over the weekend of one of the QRP contests, and a lot of QRP List members posted their score, experiences etc, so I jumped in with my 2 cents and said that I had scored zero points - but now my tower was up, so look out in the next one. Well..... KI6DS took that little post and published it in QRPp. Talk about having both feet in it...!

Spring finally made it to Ohio (sort of) a few weeks ago, and I got my Wilson System 36 Tri- bander in the air. This was in addition to the Hygain 18HT vertical that went up in the back yard earlier last fall. The week before the QSO party I managed to get inverted vee's up for 40 and 80 meters on the tower. When cranked up The antennas are at about 45 to 50 feet in the air. The day before the test I cut 130' of wire and attached it to the base of the 18HT and threw it over a couple of trees so I could get on 160.

In the weeks prior to the contest I had been watching a thread on Internet about two contest logging programs - K1EA's 'CT" and N6TR's 'LOG'. I have used CT for a number of years, and diecided to try LOG to see how it would work out. An old version of LOG was just recently made available on Internet by N6TR, and it sounded like I could configure it for any type of contest. The LOG file was FTPed and set up on the computer, and tried out for a few evenings before the test. It was a good thing I did that, because it is a lot different than CT, and it is configurable.... I never did get it going the way I thought it should run, but I did use it all weekend, and learned a few things on the fly! Fortunately propagation was poor enough that I was able to keep a paper log at the same time

The biggest surprise (during the test!) that LOG gave me was when I found that it would only log on one band.... I had configured it wrong, So.... exit out of the program, change the config file, and off we went again. Then (later!) I found that it was set up to catch a dupe regardless of the band, so exit again and change the dupe parameters.... Then (later again) I found that it had forgotten about the first 50 or so QSO's I had made when it was looking for dupe. Exit again..... This time I had to get the manual out, found what I hoped was the answer, deleted a file called RESTART.BIN, crossed my fingers, and started the program again. It worked! Later I did find a line in the documentation about deleting RESTART.BIN to do what I had done.

For those of you that have never used a computer to log for a contest - It keeps the log, checks for dupes in real time (in fact - it would not let me work some of you twice!), provides a dupe sheet on the screen, keeps track of multipliers, totals the score, and even sends the CW . If I had wanted to have spots from the packet cluster it would have done that too, but not a lot of cluster users are participants in the ARCI tests .... If you have never used a log program in a contest - you should try it. Besides helping with the basic paperwork during the test, it can make life very exciting when you hit the wrong function key and the keyer starts sending a CQ when you want it to send an exchanbe or ask for a repeat! Sure glad the ESC key is by itself on the keyboard -makes it easier to hit in a panic!

Anyway - the TR-7 was cranked back to 5w and tested on 40 the night before the test with the new inverted vee. One CQ netted a call from a W1 in NM. SIgned with him and was called by a W5 in the same town in NM as the W1. He was running the Norcal 40 - so now I can say I worked one! Even worked a 6 in CA before I left the shack. Things were looking up for the test - except for the WWV numbers that were coming in on the Packet Cluster - it looked like someone had turned off the sunspots....

On Saturday I found out they had. Propagation was just not there, and what was there

was REALLY strange. No Europe on 20, no signals at all on 15 and 10, and 40 was not normal either. I never did work my own state on 40, and missed several other states close by. Signals on 40 would fade right out during an exchange - that was one time when the high speed CW was an advantage -you only had a SHORT time before the band changed, so you had to get it all in. I lost a couple of QSO's because the other station just faded into the noise.

80 was another story. I found I have a serious local noise problem. I am not sure what it is, but I will have to chase it down or I can write off any serious 80 meter work. I'll be looking into low noise loop antennas for receive real soon now.... 160 was not much better. I got on at 0400z as advertised on Internet, and work WS8T 15 miles down the road. I did hear one other weak CW signal, but was never able to tell who it was. (post contest note - WT1M says he heard and called me - and heard my QRZ.... guess I do need to work on an RX antenna for 80 and 160!)

I have not yet determined my final score. If I could figure out how to correctly configure LOG, it would calculate it for me, print the log and dupe sheet, and all I would have to do is sign the form, lick the stamp, and mail it - That is what I like best about a logging program like CT or LOG. Years ago it would take me weeks to get a log ready to submit. Now it can be done minutes after the test ends, and with Internet it can even be submitted to the sponsor's computer before the rig has cooled off! I did do a preliminary count last night right after the test, and here are the unchecked figures:

QSO's.....167 Points.....676 SPC.....60 Score..283,920 Not very good compared to the scores in the results from the last two years, However, after looking at the scores and comments that have been making the rounds of Internet, I don't feel so bad about it

So - its time to get ready for the next one. I hope to have the computer logging set up for the QRP tests, I will have a better receive setup for 80/160, and I hope to have tracked down the local noise and have taken care of it. In the meantime - I am looking forward to meeting some of you at Dayton. 72, Bill

TIDBITS

by Mark Cronenwett, KA7ULD
1029 Duncan Ave.
Sunnyvale, Ca 94089

Have any ideas that you would like to share with others? Well here is the place to do just that. Send your ideas to me at the address above, by packet at KA7ULD @ N0ARY.#NOCAL.CA.USA.NA, or by E-mail to mcronenw@pyramid.com via the Internet.

<> NN1G VFO FIX

From: Bob - N3MBY

I finally solved a perplexing problem I had with the 20m NN1G rig I am assembling. It's a problem I've seen reported here before, so this information may be of some help to others.

In my case, the VFO wouldn't oscillate, even through I tried all of the obvious things. Finally yanked the 560 pF cap (C1) and it started to sing. I tacked in a 470pF ceramic cap, one with a blue band on the top, (a Jameco part) thinking it was an NPO. Same thing. It stopped oscillating as soon as the cap was in the circuit. I stuck in a 220 pF NPO (for sure) in the circuit and it worked fine, although the frequency was off.

Next I tried silver mica caps. Beautiful! Worked every time I cycled power. The final component values were thus: total capacitance, excluding the 100 pF film, was 370 pF. This was comprised of 270 and 100 pF mica caps. The number of turns on L1 was 30, with the tap 8 turns up from the cold end, instead of 4 turns. This last suggestion came from Ed, W1AAZ. I tried modifying the inductor first, thinking that it would solve the problem, but it didn't.

I was tired of winding toroids by then, so I left it as is and it appears to be stable.

The only thing I can deduce is that the regular ceramic caps are too lossy (i.e. low Q, high leakage resistance) and cause the oscillator to non-function. I had temporarily fixed this by bridging the 5 pF coupling cap with a 22 pF cap, but this obviously wasn't the ultimate solution. Are there any component specialists out there that can confirm this suspicion?

So, the suggestion is to make sure you use high quality caps in the vfo tank circuit. Silver mica, NPO or film caps will do just fine.

<> THE "FLEA MARKET SPECIAL" CHARGER

From: Mark Cronenwett, KA7ULD

Have you gone to the flea market and brought home that gel cell, only to remember that it is 6 volts, and your charger is for 12 volts? This happened to me recently, and lacking any charger at all, decided to build one. We all know chargers are simple,.... right? Well in all actuality they are not all that bad. This charger was about 4 dollars in components all together.

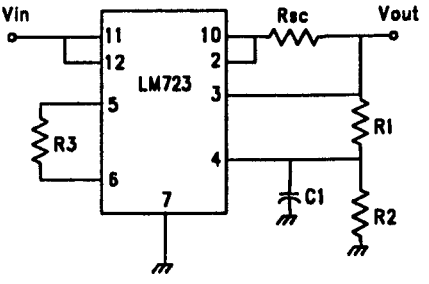
The problem is that the cells that I had were 6 volts. I needed to check to see if they were any good or not. I suppose I could have just hooked 2 together and charged at 12 volts, but I wanted to check each cell individually. Each battery specifies that 7.3 to 7.5 volts be used for cycle use, while 6.8 to 6.9 volts be used for standby. I chose to use the former because I would be using this as a tester mainly. The charger also puts out very low current, about 80ma as measured here, so it will take a few days. It is worth the wait, and I don't worry too much about over charging the battery too much.

The heart of this charger is the LM723 chip, designed just for voltage regulation. It has a maximum current dissapation of 150ma. If you want more current, then an external transistor is added to the circuit. I did not need or want the extra current, so you won't see that used here.

Resistor Rsc is used to set the maximum current, and in this case is 20 ohms. R1 and R2 set the output voltage as referenced to pin 6 of the chip. R3 is for added temperature stability, but is not necessary. I am not quite sure what C1 is there for, but it is in the application notes and all of the circuits I have seen so far.

You can use just about any method you would like for this. The circuit is simple and uncomplicated. I chose to use the perforated board because it was handy. After building, make sure to check that all your wiring is ok, then it is time for the old smoke test. Since there is really not any adjustments to speak of, just check that the output voltage is at or near the 7.4 volts called for. You are now in business.

7-37V Charger for Gel Cells
150 mA max.



$$Vout = (Vref^{*}) \times \frac{(R1 + R2)}{R2}$$

* Vref is measured at pin 6, and with a 13.8V input was 7.2V

R1 = 200, R2 = 10K, R3 = 480

<> 1/8" TO 1/4" SHAFT ADAPTER
From: Mac, W7JDZ

Do you have all of those nifty variable caps that have 1/8 inch shafts and wish they had 1/4 inch shafts? Or maybe you wish you had any variable capacitors at all? We can help on the first problem with a tip that comes from Mac.

If you go down to your local hobby shop and pick up some "wheel collars" you will notice that they are 1/4 inch on the outside diameter. They also have a nifty set screw to hold them on. There you go, an instant adapter.

<> TRANSMIT FIX FOR NN1G RIGS
From: Jim Fitton, W1FMR

Just got a call from Dave, NN1G. He asked me to forward the following information to the QRP Clubs, esp. those with "NN1G" rigs.

In the transmit mixer oscillator, do the following: Change the value of the ceramic capacitor connected from U7 pin 7 to ground, from 47pf to 150pf. Rigs checked with ARRL test bench spectrum analyzer showed a frequency spur to be marginally legal. Changing the capacitor improves spur responses by 15 db.

<> MFJ 9040 AGC SETTING CHANGE
From: Andrew M. Cohn, K4ADI

One of the problems I had with MFJ's factory setting of the AGCpot on the 9040 was that every time there was a noise burst, such as from an electrical appliance being turned on or off, the station I was struggling to hear disappeared for a couple of seconds, long enough to miss a few crucial characters. By turning the AGC pot clockwise, I was able to eliminate the effects of the slow AGC, plus increase the receive sensitivity. Of course, the more you turn the AGC, the more pronounced the initial key click. About midway between factory setting and full clockwise, I found a nice balance between the key clicks (on both transmit and receive) and the original problem of stations disappearing. Plus, I gained some sensitivity.

I wish I could find a fix for the QSK pot. Even at full clockwise position, the unit goes back into receive a bit faster than I like. 73, Andy, K4ADI

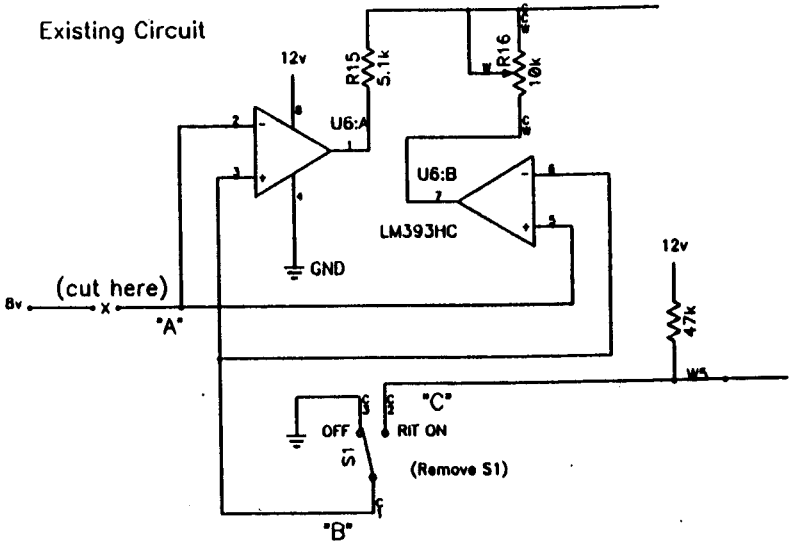
Extended RIT / XIT for the NorCal 40

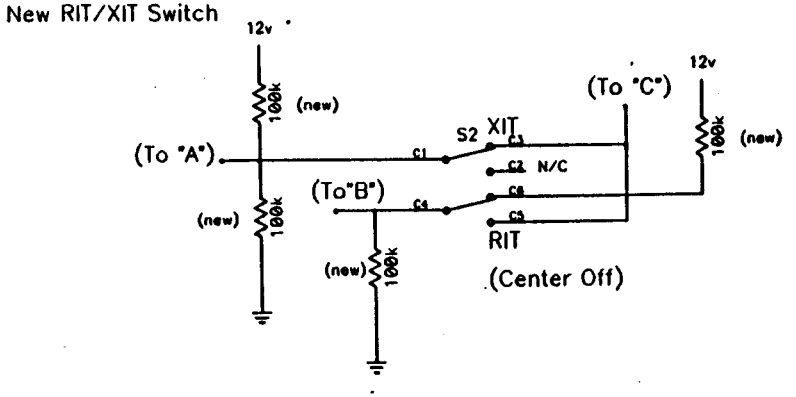
by Eric Swartz, WA6HHQ
434 Vista Del Mar Dr.
Aptos, CA 95003
erics@cruzio.com (Internet) WA6HHQ@KI6EH (Packet)

OK, I admit it - I'm a QRP DX'er. Either that or a masochist - but most likely both. Since building my NorCal 40 and re-discovering the fun of QRP 6 weeks ago, I haven't even turned on the big rig and KW amp, and I've probably already paid for my NorCal 40 with the money I've saved on PG&E bills! This little rig has been a blast. I've even broken a few pile ups with its 3w signal, and that's where this mod comes in.

Many DX op's run split, listening 1 to 3 khz up. The only way to work them is to look for the stations calling them using the main dial, and then re-tuning in the DX station with the RIT. If the DX station moves his receive frequency with each station worked this could get to be a real challenge! To top it off, many times the DX is listening just outside of my +/- 2khz RIT range! No amount of operating skill can fix that problem, so I came up with a easy way to add an RIT/XIT switch, (with center position off), and a wider RIT/XIT shift to the NorCal 40.

The schematic shows both the original RIT circuit and where to make the mod's for the new RIT/XIT circuit.





Instructions:

1. Cut traces on both sides of U6, Pin 5.
2. Jumper around Pin 5 to reconnect the traces.
3. Remove S1, use S1 holes for points "B", "C".
4. Add S2, (Note: Up position uses lower pins).

S2 up = XIT, Center = Off, Down = RIT

Changing R15 to 1 K moves RIT/XIT range to + 4 KHz/ - 0.7 KHz at band bottom.

1. Remove the existing RIT switch, and mount the new DPDT, center off, switch in the same front panel hole. You will use two of the original switch's PCB holes for connections to the new circuit, (points 'B' and 'C').
2. Cut the traces on both sides of U6, pin 5, but leave the trace connecting pin 5 to pin 2.
3. Jumper around pin 5 to reconnect the traces to each other, leaving pins 5 and 2 free.
4. Wire the new switch as shown. (Note: On most DPDT switches the up position uses the lower pins.)
5. To shift the range of the RIT/XIT, change the value of the 5.1k resistor, R15, connected to U6, pin 1. This resistor sets the center point relative to the 10K RIT/XIT pot, R16. Changing it to 1k moves the RIT/XIT range to +4khz, -700hz at the bottom of the band. (Going higher than 5k, up towards 10k, will shift it the other direction.) Since DX splits usually are up in frequency, this does the job while still leaving a little room down for those drifting QRP, (or Cuban), signals! (They must not be using NorCal 40's!)

In addition, an even wider range might be had by replacing R16 with a larger value linear taper pot. 25k would be nice and should widen the range two and a half times. I haven't found one yet that matches the original mechanically - any suggestions?

I've had a great time with this mod, I hope you will too! 72, 73!, Eric WA6HHQ

LED S-Meter for the NorCal 40

by Eric Swartz, WA6HHQ
434 Vista Del Mar Dr.
Aptos, CA 95003 408-662-1973
erics@cruzio.com WA6HHQ@KI6EH

Here's one more bell and whistle for the NorCal 40 Mod. fanatics out there. The rig does a great job in it's stock form, but I guess I'm one of those people who has to see something move or blink before I'm happy! (Plus I can now convince my wife that this little box is actually doing something.....)

The S-Meter makes use of a National LM3915 bar-graph driver, ($3.95 from Digikey), to drive a 10 LED DIP style array, ($2.99 at Radio Shack, PN 276-081). Both parts are also available as NTK equivalents for about twice the price. An MPF-102 FET inverts the negative going AGC voltage from the NorCal 40, scales it and feeds it to the LM3915. The LM3915 is a neat part! It provides switched outputs for each 3db change in input level, which makes it ideal for a simple S-meter. I also put a small 78L08 eight volt regulator on the board to keep the LED switching noise out of the NorCal's audio. The circuit draws about 30ma full scale, so I added an on/off switch for battery operation. (If you prefer a DOT display instead of the power hungry Bar-Graph mode, leave pin 9 of the LM3915 open. This should cut 20ma off its power consumption.)

Set up and Adjustment: Due to the simple audio AGC used on the NorCal 40, matching the range of the S-Meter to the NorCal's AGC range requires a little tweaking. The measured AGC voltage range at the junction of C29 and D3, (NorCal 40 designators), varies considerably from rig to rig, depending upon the gain of the AGC FETs in the NorCal 40 and the value chosen for the NorCal's AGC feedback resistor, R6. On my rig I'm using a 6M resistor for R6, and my AGC ranges from +0.5v for no signal to -0.4v for very loud signals. On another NorCal 40 that had a 10M resistor for R6, the range was +0.5v to -6v. As a result, each S-Meter needs to be adjusted to your particular AGC range.

I strongly suggest that you first breadboard this circuit outside of the rig, so that you can choose the proper component values for your AGC. The values for R3, R4, R6 and R7 on the schematic reflect what was needed to handle the 10M AGC resistor value, which many NorCals are using.

To compensate for your particular AGC range, follow the following procedure:
1. Measure the AGC voltage swing at the junction of D3 and C29 on your NorCal 40. If it swings minus 4 to 6 volts for a very strong signal you are probably in the right range for the current components. The goal is to set up the voltage divider, (R6/R7), at the input to the MPF-102, (Q1), so that the negative swing at its gate is less than -1 volt. For smaller AGC swings, try increasing, or even removing R7. If you AGC is currently swinging -1v or less, R6 and R7 can be eliminated totally, and you can connect directly to Q1's gate. Conversely, for wider negative swings, R7 may need to be reduced to 1M to 1.8M. (Note: Measuring Q1's gate voltage directly with most simple DVMs will produce erroneous readings since the DVM's input impedance is in the same range as this circuit's.)
2. Hook up the S-Meter to your NorCal 40. (Connect to the junction of D3 and C29 on the NorCal.) Measure the voltage at pin 5 of the LM3915 for zero and full strength signals. If it ranges anywhere in the +3v to +4.8v area on the low end and +5v to +6v on the high end, with a total swing greater than 0.5v, you are in great shape. If the voltage swing is less than 0.5v, increase R7, (you may have reduced it too much previously).
3. To set the lower range of the S-Meter, adjust R1 so that the first LED, (S1) just goes off with no signal.
4. To Set the upper range of the S-Meter, adjust R2 so that all of the LED's are just lit for your strongest expected signal.
5. R1 adjusts the low threshold from 0.9v up to 5v, and R2 can adjust the upper threshold from 5v to 6.2v. If you need to shift these ranges up or down, you can change R3. At 2.2k, R3 normally will have about 0.9v across it. Shorting R3 to ground will shift the ranges for R1/R2 down 0.9v, and doubling R3 will move them up by 0.9v.

Construction: The S-Meter was built on a small perf-board, about 1.1" by 1.75". I used a 20 pin socket for the LED array to provide some spacing between the front panel and the other components. I cut a rectangular hole above the existing RF gain control on the NorCal 40 for the LED's, and placed the on/off switch just to the right of the LED's, above the existing RIT switch. By epoxying the switch to the perf-board, I was able to use it as the only mechanical mounting point for the board.

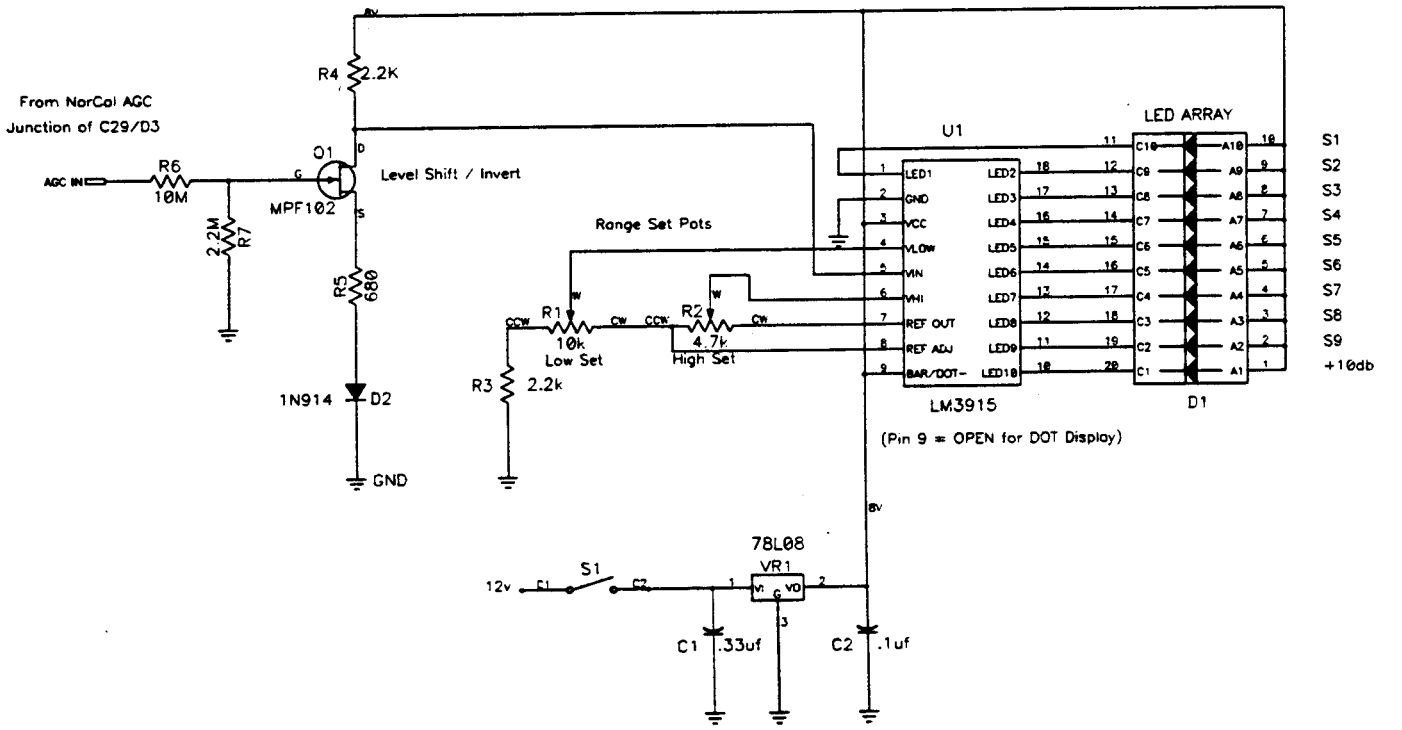
So there you have it. Now you can really see how strong those static crashes on 40 are!

Wanted: If you are buying a new Sierra, and would like to sell your old NorCal 40, I need one for mobile and one for back packing. Please send a postcard to Jim, N6JUG, P.O. Box 881452, San Francisco, CA 94117.

Wanted: Heath HW-9. Preferably with WARC Bands, will consider any and all. Send letter with description of condition and asking price to Jim Cates, WA6GER, 3241 Eastwood Rd., Sacramento, CA 95821.

IMPORTANT NOTICE:

To All NorCal 40 Owners: Stan Cooper, K4DRD has moved. He is still doing the screen printing of the front and back panels for the NC-40. To get your panels screened, specify whether you want white or black ink, pack your panels in a diskette mailer, and send along with a self addressed return address label with sufficient stamps for return postage to: Stan Cooper, 3214 Countryside Drive, San Mateo, CA 94403.


From NorCal AGC
Junction of C29/D3
AGC IN
R6
10M
2.2M
R7
Q1
MPF102
Level Shift / Invert
R4 2.2K
R5
680
1N914
D2
GND
Range Set Pots
R1
10k
Low Set
R2
4.7k
High Set
R3
2.2k
U1
LM3915
(Pin 9 = OPEN for DOT Display)
LED ARRAY
D1
S1
S2
S3
S4
S5
S6
S7
S8
S9
+10db
8v
78L08
VR1
12v
S1
C1
.33uf
C2
.1uf

NorCal QRP Club Membership Application

Name: _____

Call: _____

Address: _____

City: _____ State: _____ Zip: _____

Optional Information:

Packet Address: _____

Internet Address: _____

The NorCal QRP Club was formed in June of 1993 with the purpose of exchanging information and fellowship for and about QRP. There is no charge for membership, but to receive QRPp, the Journal of the Northern California QRP Club, you must pay a $5 per year subscription fee. The $5 is an attempt to break even. It is not the intent nor purpose of NorCal or QRPp to make any money. To join, photocopy this page and send along with your $5 to:

Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

Please make all checks and money orders out to Jim Cates, and not to QRPp or NorCal. Members are encourage to share their knowledge with other members. This is the purpose of QRPp. If you would like to submit an article for publication, it will be accepted in any format, but the prefered form is on 3.5" computer disk, IBM format, ASCII files. Other acceptable platforms are WordPerfect, Works, Typed, or handwritten. If you have a construction article and desire to develope a poboard, NorCal has funds available for this type of project, and will consider underwriting research and developement costs. For further information on this program, contact Doug Hendricks, KI6DS or Jim Cates, WA6GER.

QRPp, Journal of the NorCal QRP Club
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QRPp

Journal of the Northern California QRP Club
Volume II, Number 3, September 1994

Special Construction Issue

3 SSB Transceivers
W6EMT Monoband CW Transceiver for 80 - 20
W7EL QRP AMP
"Lite" Paddles and Antennas
Balanced Line Antenna Tuner
N9JZW Shows How To Build A SSB Filter
More NorCal 40 Mods
Simple Resonant Audio Filter
Tidbits: Hints For QRPers From QRPers

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Back issues of Volume I, Numbers 1, 2 & 3 are available from Doug Hendricks, 862 Frank Ave. , Dos Palos, CA 93620. The cost is $10 and the issues are bound in one volume. Make checks or money orders out to Doug Hendricks, NOT NorCal QRP Club.

From the Editor

by Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93629
Internet address: dh@deneb.csustan.edu

I have just finished editing this issue, and I must say that I have a smile on my face. I am pleased with this issue, because it is a culmination of a long search. This issue has 3 SSB construction articles in it, and the parts are readily available for all of them. The Epiphyte was done by a club member, Derry Spittle, VE7QK. He provided the work, and NorCal provided the funds to develop a PC Board. We thought about kitting this project, but decided against it, as we are so busy with the Sierra. We did the next best thing, though, because we made the pc boards available. This was done much the same way as the digital display was done for the NorCal 40. The other 2 SSB projects, the RXTX system and the Tiny Tim, both have commercially available kits. Now, there is no excuse for you not to have that HomeBrewed SSB rig! I find it strange that I searced for years for a SSB project, and when I found one, I quickly found 2 more.

The Tiny Tim rig is reprinted from an excellent British magazine, Practical Wireless. Rob Manion is the editor, and a wonderful fellow. He was most happy to give me permission to reprint articles from Practical Wireless, and I want to say thank you again to him for that. If you are interested in subscribing, I heartedly recommend Practical Wireless. Here is the subscription information: $45 US Funds to PW Publishing Ltd., Freepost, Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW, England. Or if you wish you may use your VISA card and call 0202 659930. Say hello to Rob when you call, and mention that you saw the information in QRPp.

The construction theme was chosen for this issue because of so many excellent submissions. The only article that has been previously published in the US is the W7EL Amp by Roy Lewallen, and it was published in the Peanut Whistle, the Journal of the St. Louis QRP Society, which has a circulation of less than 100, so it has not been widely seen. Also, for the first time, I was not able to publish all of the submissions. We have a backlog of information, and that is a good feeling for me and shows signs of a healthy club. I will try to get the articles in the next issue.

Dayton was great. Jim and I had so much fun that we want you to go with us next year. NorCal is going to sponsor a Dayton '95 Tour. We have reserved 15 double occupancy rooms at the Day's Inn Dayton South, which is the home hotel of the QRP ARCI group. That is the National QRP organization that you need to belong to. They sponsor the Dayton QRP get together, and also QRP Contests, Awards, and publish a great Journal, QRP Quarterly. The tour will cost about $500 we think, but we haven't nailed it down yet. It will include air fair from San Jose or San Francisco, lodgeing for Thursday, Friday and Saturday nights, Hamvention tickets, QRP Banquet Tickets (Grand prize will be a Sierra Kit!!), transportation from the airport to and from the hotel, and transportation to the Hamfest each day. We will return to the Bay area Sunday evening. There will only be 28 slots, as Jim and I have the first two reserved. If you are interested, send me a SASE and a letter indicating your interest. When we have all of the information, we will mail every one who has sent us a SASE details. That will be the time to send us money. Do not send us any now. It will be filled on a first come first serve basis. To get on the information list send your SASE to me at the address above. Please mark Dayton Trip on the outside of your envelope.

What about Dayton 94? You are seeing the fruits of that trip in several of the articles in this issue. Jim and I were both very busy as we signed up over 50 new members,

demonstrated the NorCal 40 and introduced the Sierra. The response was excellent, and a huge amount of interest was experessed in QRP and NorCal QRP Club. I also spoke at the QRP Forum on Sunday morning. I don't know why Wayne Green declined to speak on Sunday morning, because we had an excellent crowd there. I was priviledged to be on the same panel with Jim Fitton, W1FMR and Chuck Adams, K5FO.

Several events are coming up this fall, including a brand new operating event sponsored by our sister club, the NE QRP Club. It is called QRP Afield and here are the details. It is designed to encourage QRP enthusiasts to field test their radio equipment using temporary antennas and non commercial power sources. It will be held Saturday, Sept. 17, 1994 from 1600Z to 2200Z. The exchange is: QRP NE MEMBERS - RST, State/Province/Country, QRP-NE Number. NON QRP NE MEMBERS - RST, State/Province/Country, Power Output. Definitions: Permanent Location = Any location using commercial power and/or permanently installed antennas. Field Location = Any location using battery/solar/natural power and tempory antennas. Low Power QRP = Less than 1 watt output. High Power QRP = 1 to 5 watts output. Scoring 1 point for each contact from a permanent location using high power QRP. 2 points for each contact from a permanent location using low power QRP. 4 points for each contact from a field location using high power QRP. 8 points for each contact from a field location using low power QRP. All contest contacts must be made using the same location and power output. Multipliers: Each state/province/country worked counts for one point. Multipliers may be counted only once regardless of band worked. Certificates will be awarded to the ten stations with the highest point totals. Complete results will be printed in 72 magazine. Results will be also available by enclosing a #10 SASE with the contest submission. Address for logs: Chester Bowles, AA1EX, RFD 2, Box 335L, Sharon, NH 03458. I will be in the contest and hope to work you.

NorCal is also going to have a booth at the Pacificon Convention in Concord in October. Jeff Jones has kindly provided us with booth space next to the special events station. We will be demonstrating QRP and need your help. Please bring some of your home brew projects to display in the booth. Our goal is to have 100 homebrew rigs in the booth. Help us out and stop by. We will be handing out QRP literature from QRP ARCI, plus Wayne and I will be speaking at the QRP Forum on Saturday morning at 11:00.

And I want to close with the latest on the Sierra Kits. As I write this in late July, we have sold 110 Sierra kits. That is absolutely amazing. Jim, WA6GER is ordering parts and as soon as they are here, we will bag the kits and ship. Wayne, N6KR, told me last night on the phone that the boards are absolutely a work of art. They will be double sided, plated through, solder masked and the band modules will be gold plated with fingers on both sides of the board to ensure good contact and longer life. Wayne also is working on a SSB adapter for the Sierra. It would involve a piggy back board that would mount on the inside of the back panel. You would also need a separate SSB band module for each band. The good news is that it will be the same board that we use for the CW modules.

You will notice that there are no accounts of the monthly meetings. I did not include them because I thought more members would be interested in construction articles. Our surveys that were returned expressed an interest in more construction and technical articles, so we will try to go that way. You can help when you submit an article by providing schematics that will reduce to fit the size of our format and still be readible. If you need help with the schematics, let me know and I will get them done. Enjoy the issue, get on the air, and build something from this issue. When you build that project, let me know about it. That is the encouragement that keeps me going.

72, Doug, KI6DS

The Tiny Tim 3.5 MHz SSB Transceiver

by Tim Walford, G3PCJ
Upton Bridge Farm
Long Sutton, Langport
Somerset, England TA10 9NJ

[Reprinted with permission from Practical Wireless, July, August, October, & November 1993. Rob Manion, G3XFD, Editor]

The "Tiny Tim" is 3.5 MHz single sideband 'phone Transceiver In Miniature (hence Tiny TIM!). My aim was to design a rig which is complete, simple yet effective, low cost, suitable for home construction and with an output of about 10 to 20W PEP.

The rig is a superhet using the filter method of ssb reception/generation. In this way it avoids the main snag of extra QRM inherent in the simple direction conversion method which receives (and transmits) both sidebands.

The block diagram, Fig. 1, clearly shows how simple the transceiver is. You'll also see that the filter is used 'both' ways, another technique towards simplicity.

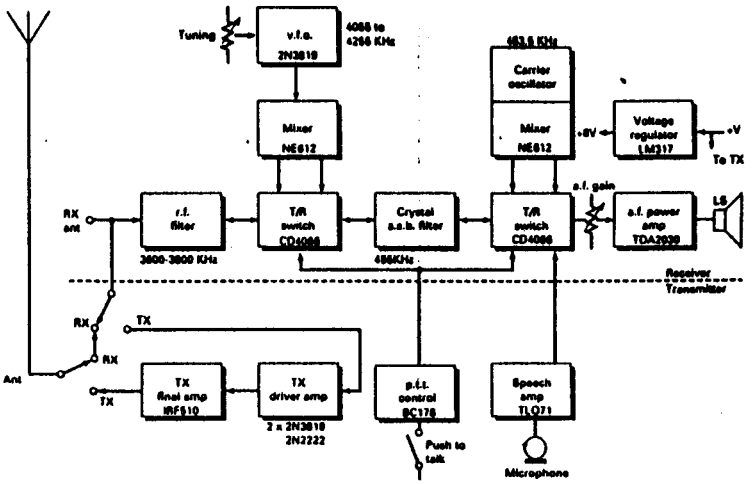


Fig. 1

KEY TO SIMPLICITY

The key to the mechanical simplicity in the 'Tiny Tim' is the use of varactor diodes for tuning. The tuning range is 3.6 to 3.8 MHz, and is provided by potentiometers.

Using potentiometers, allows the use of p.c.b. copper clad material for the front panel. This can then be soldered directly to the main board itself.

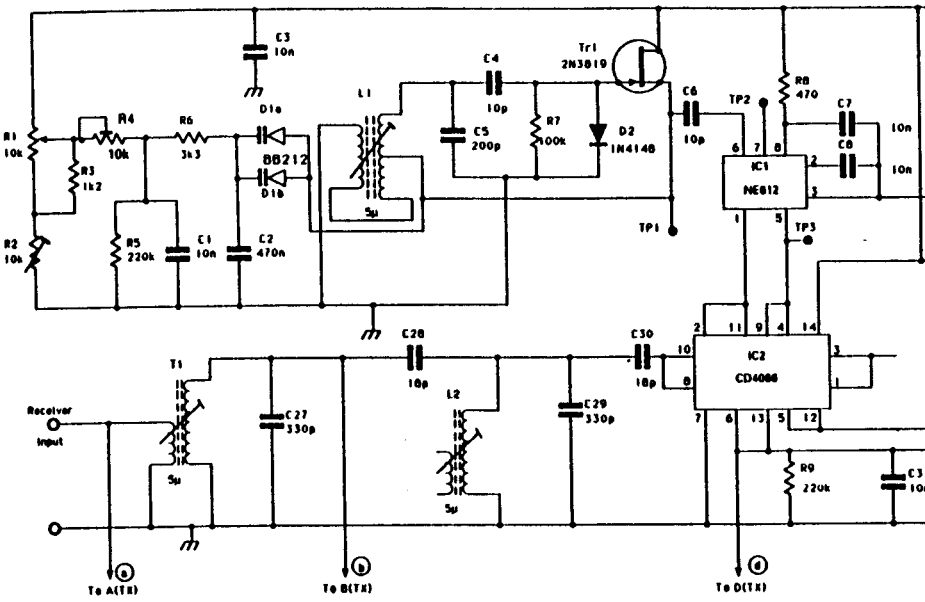
The transceiver provides audio output for a speaker or headphones. In use, it only requires an uncritical d.c. power supply in the range of 12 to 25V at 2A.

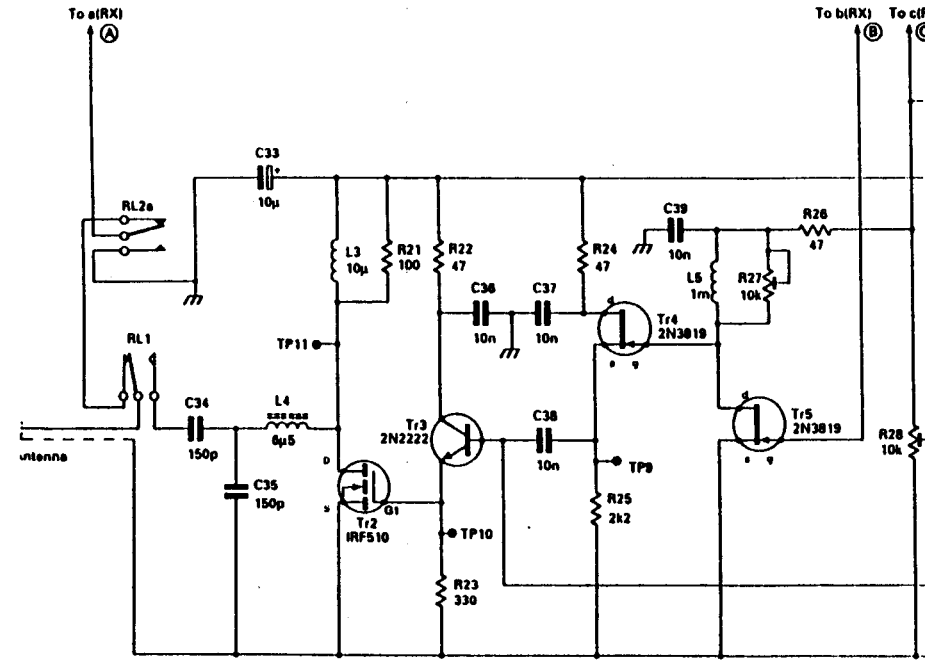
Operating on 12V d.c. the transceiver will provide 10 to 12 W PEP. It's possible to run it with higher voltages, and up to about 35W PEP output can be achieved. The transmitter output uses a robust fet with a high Q tuned matching circuit.

The design is suitable for most types of microphones. The transceiver also has built in r.f speech limiting or processing. Setting up is relatively simple. A frequency meter is desirable, and you'll also need a 2A d.c. meter and an output power indicator.

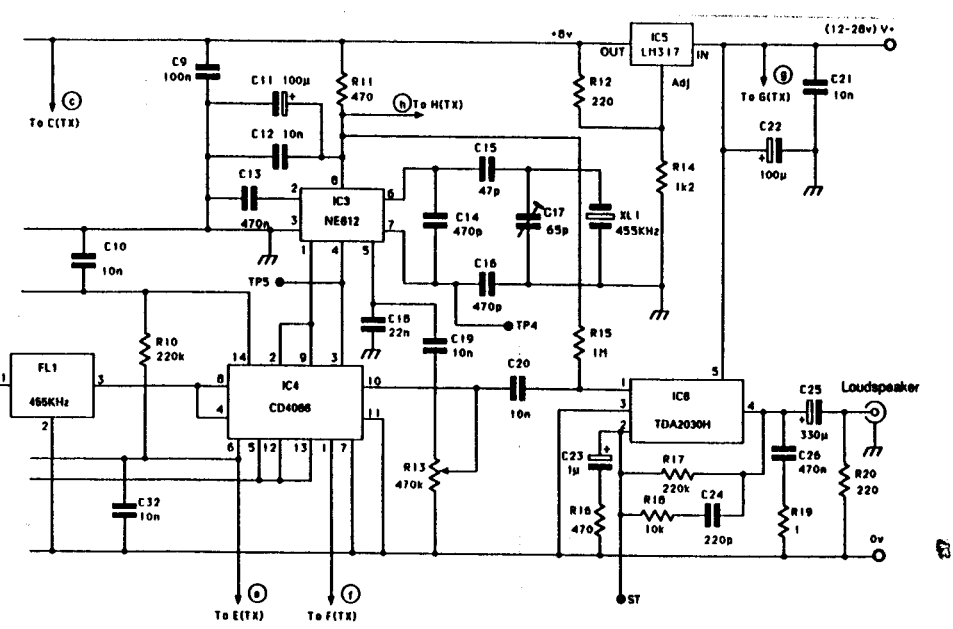
Although primarily designed for SSB 'phone operation, the transceiver can be used on CW. If there's enough interest, this could be the basis of a future modification.

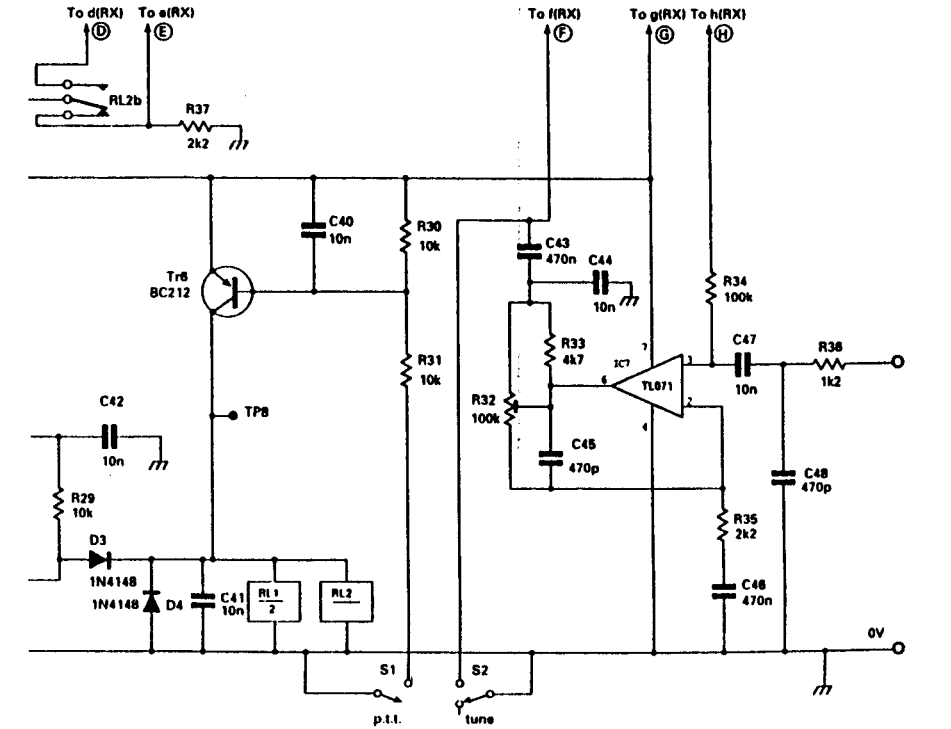
The complete transceiver only uses six ICs, seven transistors and a voltage regulator.





Schematic for Tiny Tim SSB Transceiver for 80M


+8v
IC5 LM317
OUT
IN
Adj
(12-28v) V+
C9 100n
C11 100µ
R11 470
To H(TX)
C12 10n
C13 470n
IC3 NE612
C15 47p
C14 470p
C17 65p
XL1 455KHz
R12 220
R14 1k2
To G(TX)
C21 10n
C22 100µ
To C(TX)
C10 10n
TP5
C16 470p
C18 22n
C19 10n
TP4
R15 1M
R10 220k
FL1 455KHz
IC4 CD4066
C20 10n
IC8 TDA2030H
C25 330µ
Loudspeaker
C23 1µ
R17 220k
C26 470n
R20 220
R16 470
R18 10k
C24 220p
R19 1
R13 470k
C32 10n
0v
ST
To E(TX)
To F(TX)


To d(RX)
To e(RX)
To f(RX)
To g(RX)
To h(RX)
RL2b
R37 2k2
C40 10n
R30 10k
C43 470n
C44 10n
R34 100k
Tr6 BC212
R31 10k
R33 4k7
IC7 TL071
C47 10n
R38 1k2
R32 100k
C45 470p
C42 10n
TP8
C48 470p
R29 10k
R35 2k2
D3 1N4148
D4 1N4148
C41 10n
RL1
RL2
C46 470n
0V
S1
S2
p.t.t.
tune

Schematic of Tiny Tim SSB Transceiver for 80M

My prototype measured 160 x 100 x 80mm.

The Tiny tim is aimed at constructors with previous experience. I suggest you photocopy the circuit from the article, and you can then cross off the parts as you fit them.

THE RECEIVER

I shall depart from the usual PW convention, by describing the receiver first. I'm doing it this way since the receiver can be built and used on its own, whereas the transmitter part of the project can't be used by itself.

The receiver, as can be seen in the circuit diagram, Fig. 2, is actually a simple superhet in which the incoming signals areconverted to the intermediate frequency of 455 KHz. They're then filtered, detected and the audio amplified for either the headphones or a loudspeaker.

The circuit appears more complicated than you might expect. This is because electronic switches are included in the signal path to reverse the flow during transmission (more on this later).

Because of the two way flow, I call the rig a 'bi-directional' superhet. If you only want to build the receiver, this circuit works on its own, provided you connect your antenna to the receiver antenna terminal.

INCOMING SIGNALS

Incoming signals are initially filtered in the double tuned RF filter T1 and C27 and L2/C29. These cover the 3.6 to 3.8MHz band without the need to retune.

Output from the second resonator is capacitively coupled to the NE612 first mixer IC, IC1, at an impedance of 1.5K ohms. It's done through one section of the CD4066 quad electronic transmission gate, IC2.

An LM317 voltage regulator, IC5, is used to provide a very stable +8V supply for the varactor diode and other circuits that can't with stand the intentionally wide range of main transceiver supply voltage (12 to 25V).

In this particular application the first mixer, IC1 , is driven by an external vfo, Tr1, working in a Hartley configuration over the range of 4.055 to 4.255 MHz. Special ceramic capacitors with a negative temperature coefficient compensate for temperature changes in the coil leading to a stable vfo.

The tuning varactor diodes, D1a and D1b, are connected across part of the coil. And to avoid slow motion drives (with all their horrible mechanical complexity) the tuning voltage is obtained from two potentiometers R1 and R4.

The potentiometers provide coarse and fine tuning control, rather like some older rigs had band-set and band spread controls. Without this arrangement it would not be a TIM! However, in practice it's very easy to use.

THE MIXER

The output of the mixer (again at 1.5K ohms) is fed back through another transmission gate to the i.f. filter. The filter FL1, has excellent performance for its price, and removes unwanted signals and the other unwanted sideband.

The filter output is applied (through another transmission gate in the second 4066, IC4) to the second NE612 mixer which acts as a product detector. This NE612, IC3, uses its own oscillator section which is stabilized by the ceramic resonator XL1, which is pulled down from its nominal frequency of 455 to 435.5KHz.

Each NE612 mixer has about 15dB of gain, so this compensates for the lack of an i.f. amplifier. Audio output from the product detector is applied direct to the a.f. gain control. This is set at a higher impedance than normal to improve receiver muting ontransmit.

The audio amplifier, IC6 is a TDA2030H and provides all the audio gain and low impedance output necessary for driving a loudspeaker. It's a cheap and very flexible

device which is used in op-amp fashion.

In this particular application the audio amplifier IC remains active on transmit, so that CW enthusiasts can feed in a side tone signal at ST on the IC6 negative input, while remaining unaffected by the receiver audio gain setting.

THE TRANSMITTER

As you can see from the block diagram there is no separate SSB generator for the transmitter, instead the signal flow through the receiver is reversed and fed to the transmitter r.f. amplifier. This is achieved primarily by the transmission gates, which act as switches between the r.f. and i.f. filter and the two mixer ICs. The input and output impedances of the NE612, IC 1 & 2, are each 1.5K ohms. That is sufficiently close to the 2K ohms impedance of the i.f. filter to allow it to be connected to either the mixer input or out put as required for transmission or reception. Relays could be used to do this, but transmission gates are cheaper, smaller, neater, more reliable and have negligible power consumption!

The speech amplifier, IC7, will work with practically any type of microphone. Output from the speech amplifier is fed to the product detector IC3 that acts as a balanced modulator on transmit. It generates the double sideband carrier at 453.5 KHz. After going back through the transmission gate, IC4, the i.f. filter removes the unwanted sideband from the signal. The single sideband signal then goes to the r.f. mixer, IC1, via IC2. The mixer, IC1, converts the frequency up to 3.5MHz. The r.f. filter, comprising T1, L3, C27, C28, C29 and C30, removes the unwanted mixer image (as it also does on receive). The transmission gates are controlled by the two signals on points D and E.

Resistor R10 keeps line E high (at +8V) on receive whether or not the transmitter parts are fitted. On receive, line D is low at 0V via resistor R9. On transmit, both lines change so that line E is low and line D high.

The p.t.t. switch, which grounds the p.t.t. line, turns on Tr6 thus energizing the two relays used for changing over the transmitter output and changing lines D and E. The transmitter signal leaves the r.f. filter at a high impedance point requiring the use of an fet, Tr5, as the next stage. This operates in the common source mode. Its drain load is the 10K Ohm Drive Level pre-set, R27, that allows the r.f. gain to be adjusted so that clipping does not occur in the final r.f. amplifier.

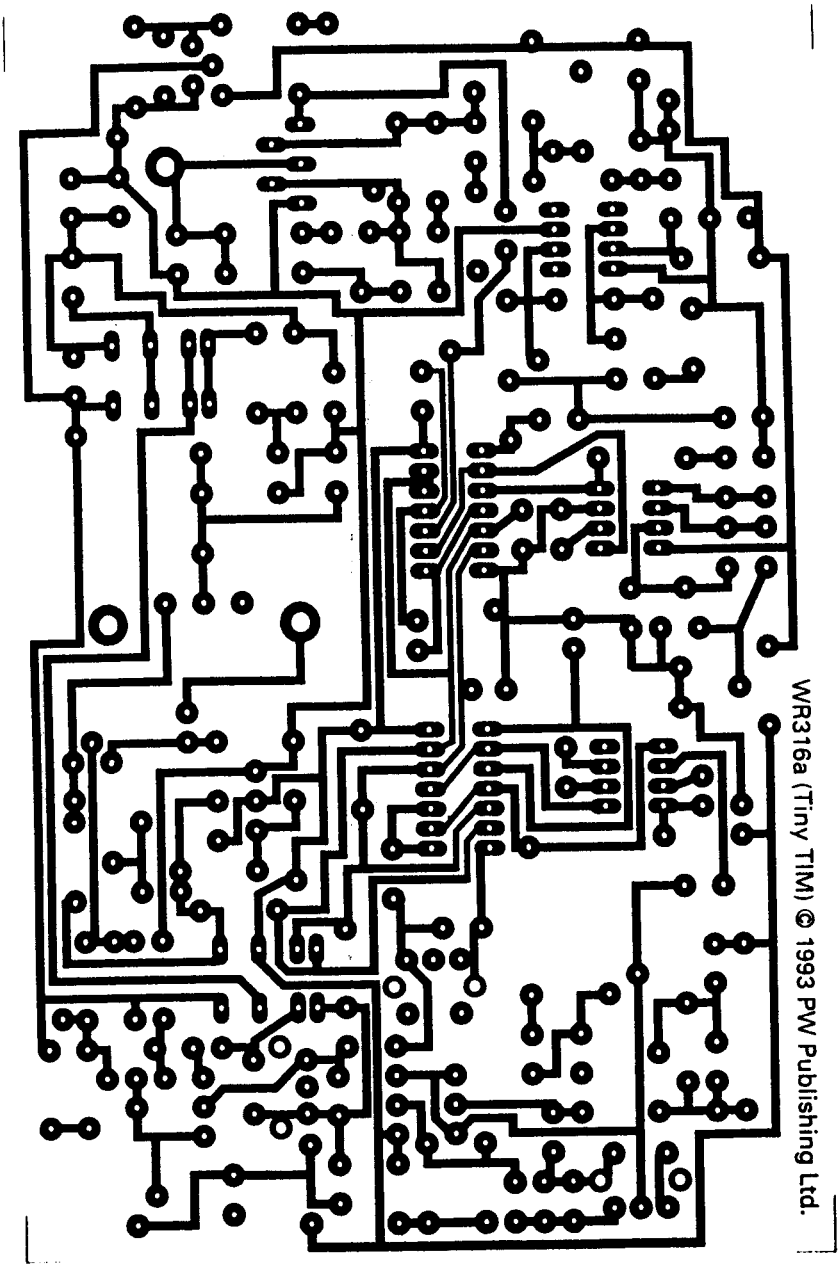
A 1 mH r.f. choke is used in parallel with the pre-set resistor R27 to keep the drain d.c. voltage at +8V. This choke has to be of very good quality (high Q at 3.7MHz) in order to reduce the potential (and required) gain. Again an FET, Tr4, is required to act as a buffer to drive the next stage, Tr3, which is an emitter follower. It is used to give a very low impedance drive to the output FET gate to overcome its high capacitance.

To achieve 10 to 12W PEP on 12V supplies, Tr2, the IRF510 output stage, needs a drain impedance of 12.5 ohms. I wanted a tuned output stage with a Q of 12, so that output low pass filters would not be required. The solution adopted is an LC network. It needs high voltage capacitors that, luckily, come with a 1% tolerance, so there is a very good chance that the output inductance, L4, will have the right number of turns on it the first time!

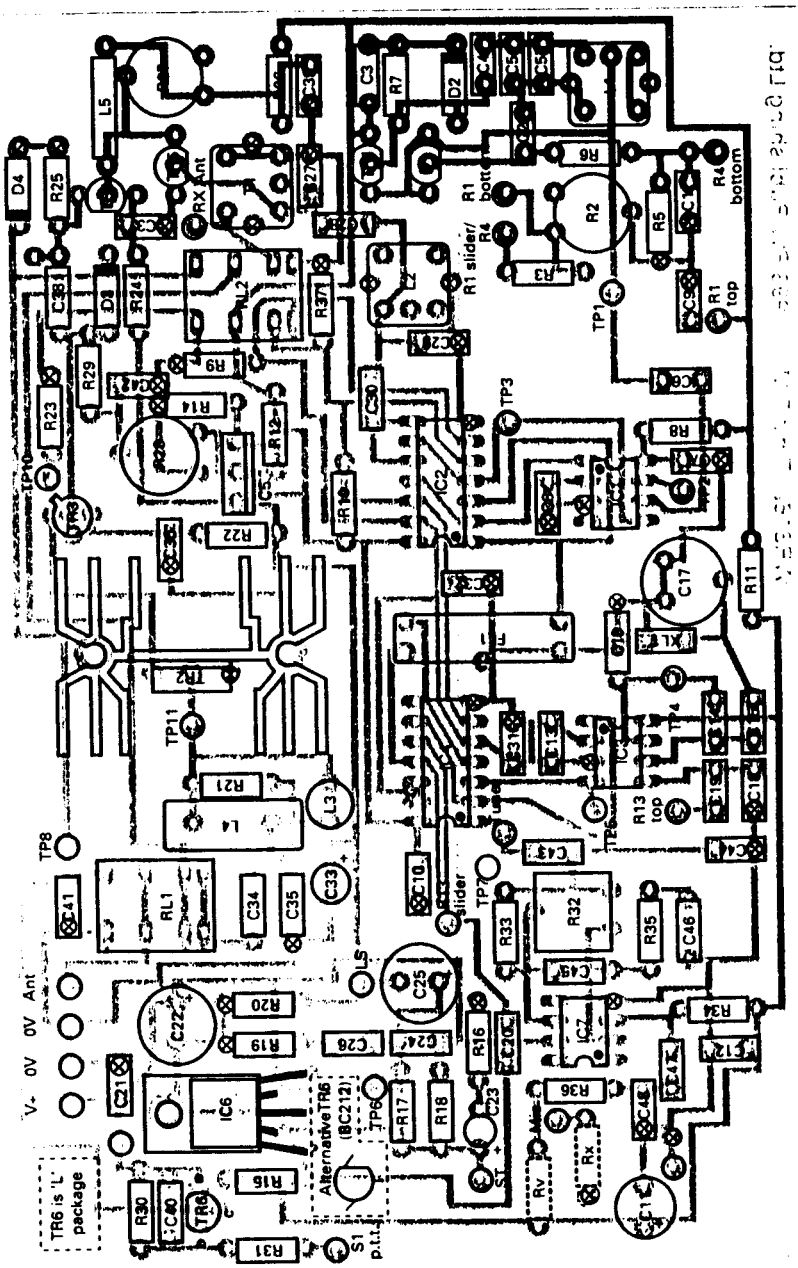
The mic gain control, R32 , in the speech amplifier is advanced to the point where signal clipping occurs in the output of the r.f. mixer, IC1. This provides r.f. speech compression or higher "talk power". The troublesome harmonics this produces are safely removed by the bandpass r.f. filter following the mixer. The drive control is used to make certain r.f. clipping does not occur in the final output stage. clipping in this stage usually causes splatter and a 'wide' transmitted signal that cannot be cleaned up.

The maximum output power increases as the square of the supply voltage, so if your d.c. supply can produce say 20V, then you will be able to obtain about 25W PEP. Bear in

mind, that to get this higher output power, you will need to increase the r.f. drive to the final stages as well as using a 20V supply. Supply voltages of up to 25V can be tolerated, but transmitter output power is really limited by the heat dissipation of Tr2 - 18 to 20V is a sensible upper limit after you have got it going and checked it out on 12V.



PC Board Layout for Tiny Tim



Parts Placement Diagram

CONSTRUCTION

In this section, I'll assume you have purchased a ready drilled main p.c.b. This has a continuous ground plane of copper (0 volts or earth) on the top or component side, with the

tracks beneath.

The rig's front panel also uses copper clad p.c.b. board. It has the labels, etc., printed on the front with a continuous ground plane on the back. The back of the front panel will be soldered (at a later stage) to the front edge of the main p.c.b.

So, let's start assembling the receiver. Don't forget, that when you're inserting components, be careful not to push them too far into the board. The leads, if pushed too far, may make contact with the ground plane at the edge of the isolation holes, and shouldered components, such as integrated circuits need particular care.

It can be difficult to solder some parts to the ground plane, particularly where an earth connection is required. To help, you will find that an earthy track leads to a component that can be soldered to the ground plane easily (such as resistors and disc ceramics).

You should only solder both sides of the board where this is possible. the illustration featuring the p.c.b., shows by means of crossed circle symbols where you should solder on the top as well as the bottom.

The p.c.b. has provision for Veropins to be inserted at the test points. You may also place ICs 1 to 4 in sockets if you wish.

TESTING BY STAGES

I recommend that you build and test by stages. You should always switch off when adding and soldering components.

Start with the +8V regulator IC5 and its resistors R12 and R14 and decoupling capacitors C21, C9, and C22.

Now connect your supply to the V+, being very careful about the polarity. Then use a voltmeter to check that +8V is available on the +8V pad, with respect to 0V/earth.

The next stage is to assemble the audio amplifier stage around IC6. bolt the IC direct to the p.c.b. without any insulating washer.

Now fit R11, R15, R16 to R20, C11, C12, C20, C23 to C26. When you've completed this, connect up your loudspeaker temporarily.

You can now switch the unit on. As you do so, there may be a slight 'thump' in the speaker (this is normal). It's now time to carry out the 'finger' test. Applying your finger to the amplifier input at R15/pin 1 of IC6, should produce a loud hum if all is well.

Next, switch off and install the product detector IC3. Then fit C17, the capacitors C14, C15, C13, C16, C18 and C19. Finally, there's the ceramic resonator XL1 to be fitted.

CHECKING THE OSCILLATOR

If you have a means of checking the oscillator is working, test it with a high impedance probe at test point 4. And if you can measure the frequency, adjust C17 so that it is 453.5KHz, otherwise leave it at mid position.

There's little that you can test easily in the next part until you have the v.f.o. fitted. this requires the front panel, so you might as well install this part while it is easier.

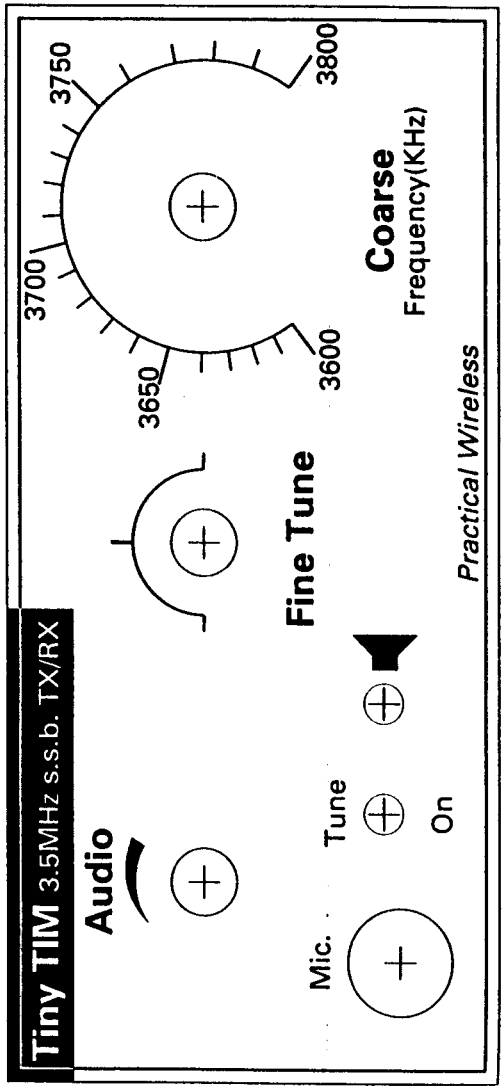
So it'sbest to install both transmission gates IC2 and 4, the filter FL1, the resistors R9 and R10 and C10, C31, and C32. You can also fit the bandpass filter T1 and L2, C27, C28, C29, and C30.

Although the filter can be peaked up with a signal generator, it's quite easy to do on received signals. So, it's perhaps best left until later.

Now you can fit the first mixer chip, IC1, and all of the v.f.o. components. This stage comprises Tr1, D1 and D2, L1, R3, R5, R6, R7 and C1, C2, C4, C5a, C5b, C6, C7, and C8.

FRONT PANEL

Now it's time to fit the front panel as described earlier. Drill out the holes in the front panel p.c.b. material for the various controls and sockets.



Front Panel Pattern of Tiny Tim

The heading photograph and Fig. 3 illustrate the mounting method. Once assembled, you can solder the front panel to the main p.c.b.

You can now install the front panel controls. Start by mounting the controls R1, R4, and R13 and the loudspeaker jack socket.

The next job is to solder connecting wires from the variable controls to the appropriate p.c.b. pads. Don't forget to make holes for the microphone connections and the Tune control switch.

By now, there should not be any receiver components left, if all is well with my instructions and your construction! So, if all is well, it's time to switch the receiver to set the v.f.o. coverage. Fit the large tuning knob so that the cursor mark is opposite 3.8MHz at the top (fully clockwise) position.

Using a high impedance probe on your frequency meter, and connect it to test point 2. First set the fine tuning control to mid position and then put the coarse control to fully clockwise for the 3.8MHz mark. Then adjust the v.f.o. coil for a frequency of 4.255MHz.

Now turn the coarse control anticlockwise to the 3.6MHz mark and then adjust R2 for 4.055MHz. There will be some interaction between these two, soit's best to repeat the adjustments.

Next, you can peak up the r.f. filter, as you should be able to receive signals with the antenna connected to the receiver input pad on the p.c.b. Choose a steady transmission near 3.7MHz and adjust the cores of L2 and L3 for maximum loudness. And again, you should repeat each adjustment in turn.

If you don't have a frequency meter or counter, you might be able to listen to the oscillators on a general coverage receiver. Otherwise, you'll have to adjust the carrier oscillator by C17 by listening to many signals and adjusting it until you obtain the most natural sound for most of them.

SETTING UP THE VFO

If you don't have a digital frequency counter or a calibrated receiver, then you can set up the v.f.o. by ear and by hand. Setting the v.f.o. can be done successfully by listening to stations on the band. You can use RSGB news, known RTTY stations or any known frequency transmissions. Then adjust the L1 and R2 until the amateur (European) phone transmissions just fill the tuning range.

If you have a crystal marker generator this can also be used. But be careful when changing from 1MHz or 500KHz markers to 100KHz once since you might skip 3.9 or 3.6MHz.

It might be best to set the v.f.o. initially to 4.455MHz and using the 4MHz marker (core of L1 well out). You should then work down carefully with the core of L1 to 3.8MHz.

You should now have a working receiver. The next stage is the final completion and setting up of the transmitter.

TRANSMITTER SECTION

Now you've completed the receiver it's time to start work on the transmitter section. But before you begin, I suggest it's a good idea to turn all preset resistors fully anticlockwise before fitting them to the p.c.b.

Fit the microphone socket and the Tune switch and wire them up to the board. Then install the two relays, RL1 and RL2, resistors R30 and R31, capacitors C40, C41, diodes D3 and D4, and transistor Tr6 which controls the change over switching.

Turn on and listen for the relays clicking over as you operate your p.t.t. switch, (it needs to ground the p.t.t. line). The receiver should also be silent while on transmit.

Now install the transmit pre-amplifier R23-26, C37-39, L5, Tr4, and Tr5. If you have another 3.5MHz receiver you can listen to this rig to check this part.

When the Tune switch is closed during transmit (which severely unbalances the balanced modulator) r.f. is produced for tuning up purposes. Advance the drive preset R27 a little and you should be able to hear this rig's carrier on another receiver if its antenna wire is nearby when you close the Tune and p.t.t. switches.

RADIO FREQUENCY COMPONENTS

Install all the other radio frequency components R21-23, C34-36, R28, C42, L3, Tr2 & Tr3. Now wind 33 turns of 24 s.w.g. wire tightly onto the T68-2 toroid for L4.

Leave 50mm spare at each end in case the turns need altering and solder it in place

temporarily. fortunately, the modern enamelled wire (with a slightly pink colored enamelling) needs only a very hot iron to burn off the insulation.

However, take care as the fumes given off by the burning enamel are irritating. Make sure your work place is well ventilated.

The output FET has to have its tab isolated from the heatsink. So to isolate it, put the thin heatsink washer between the tab and heatsink (preferably with a dab of heatsink compound if available). The nut and bolt (if metal) also need isolating by the small shouldered bush that fits snugly into the hole in the FET's tab.

Now you can fit the heatsink, making certain the wide side of the central part can accommodate the output FET Tr2.

The source lead of the FET should only be soldered on the top of the p.c.b. And since a good direct earth connection is required, you should not solder it on the underside in case it has to be changed!

The drain and gate should be soldered underneath as normal. Remember to check whether any earthy part you are fitting needs to be soldered on both sides.

Connect up your power meter (set to read power out) and feed this to your dummy load (or a known 50 ohm antenna feeder). Put a 2A meter in the positive d.c. supply lead. Check the Tune switch is off and that R28 is fully anticlockwise.

Switch on and go to transmit. The supply current will rise a little from the receive value about 50 mA when you press the p.t.t. switch, mainly due to the relays.

Slowly advance the preset R28 (while on transmit) till the supply current rises to 400 to 500 mA. There should be negligible r.f. output and the current should fall back, on going to receive.

TUNE SWITCH

Turn on the Tune switch, then advance the drive preset R27 so that on transmit about 3 to 5 W PEP is being produced. Next adjust the two cores of T2 and L2 for max output at a frequency near 3.7MHz.

Then adjust the drive preset R27 for just below maximumoutput. This should be about 12 W PEP if using 12V supplies.

If you are using a higher supply voltage watch out that the heatsink doesn't get too warm - go to receiver for a while! If you can't get 12W PEP (on 12V) into a known 50 ohm load, you can try one more or less turns on L4, but it's not likely to need altering. If all is well fit L4 with short leads.

You can now fit all the speech amp parts, R32-36, C43-48, IC7 and the wiring to the microphone input (including any extra parts for your type of microphone - see later).

With the Tune switch off, go to transmit and whistle into the microphone. Now adjust the microphone gain preset R32 for the point just below maximum output.

Increasing the microphone gain further will increase the degree of clipping. This is best done in the light of other station's comments or with an oscilloscope and two tone audio generator. Your "Tiny Tim" is now ready for on air use!

Good antenna matching is always important to get the best out of any transmitter. This rig needs a 50 ohm unbalanced load, so if you're connecting it to a dipole, I recommend you use a balun.

It's better to use a link coupled resonant matching unit which will help reduce out of band signals. An output low pass filter should not be needed.

If you become seriously stuck, you'll have to see assistance with more sophisticated test gear. Don't forget tot check for solder whiskers and that devices are correctly oriented! The circuit diagrams contain typical voltages on the test points for guidance.

SPEECH AMPLIFIER

The speech amplifier is designed for microphone impedance of 100 ohms and outputs

down to 1mV. Crystal microphones can be used without extra parts.

Dynamic microphones will need a resistor across the input to earth in the position Rx on the p.c.b. Typical values being 470 to 680 ohms.

Electret microphone inserts sometimes need a few K ohm to a low positive supply. If you don't know the value required try 2.2K ohm in position Rv on the p.c.b. layout.

If your chosen microphone needs a positive supply with no extra resistors, take a lead from the left hand pad of Rv to one of the unused pins in the microphone. No isolating capacitor is needed.

Incidentally, you can use any type of socket to suit whatever microphone you have. But, you need to know its pin connections and modify the front panel to make it fit. (This is best done before it's soldered to the main p.c.b.).

Personally I suggest the DIN five pin 180 degree type because it's the cheapest! Some 'communication's style microphones have their own amplifier. these need a few kilohms to earth, so I suggest trying a 4.7K resistor in position Rx.

Don't use the +6V for microphones with their own amplifier. Invariably they have their own battery (replace it regularly, regularly!!!). However, you can use the +8V supply with suitabledropping resistors, if you have to power it.

PRIMARILY FOR PHONE

Although the "Tiny Tim" is designed primarily for 'phone use, it can be used for CW. For use with the key, you'll need a separate tone oscillator and a means of keying it, the output being applied to the mike input.

Sidetone from the keyer can also be fed into the audio amplifier at the ST pad on pin 2 of the 2030 amplifier. The audio stage remains active on transmit for this purpose.

You should perhaps unplug the microphone and connect the CW circuits instead to the microphone socket. This will avoid what I thought was a serious problem with the keyer. It turned out to be the microphone picking up bench vibrations from my key!!

The v.f.o. and r.f. bandpass filter may need retuning for your preferred band segment. You shouldn't need to do any mods to the p.c.b.

With a bit of ingenuity you can also add receiver incremental tuning (r.i.t.) A narrow CW audio filter can also be added immediately prior to the audio gain control.

SOME EXTRA SENSITIVITY

Anyone using a particularly short antenna may find that some extra sensitivity would be useful. This can be achieved by increasing the audio gain of the TDA2030 stage.

Halving the value of R16 will double the audio gain, etc. But to keep the same low 300 Hz bandwidth you will need to double the value of C23. A value of 2uF should be about right.

I suggest you carry out modifications to the amplifier with caution. This is because it increases the risk of audio breakthrough on transmit from microphone to loudspeaker when the audio gain control is at maximum. You may be able to use 150 ohms for R16 and 3.3uF for C23.

Good luck! I hope that you get as much fun out of your "Tiny Tim" as I have had in designing and using it.

However, I can't close without saying a big thank you to the members of the Yeovil ARC who tolerated my experiments. And thanks to all those numerous article writers who unwittingly contributed many ideas towards the development of the transceiver.

RTX SSB/CW Transceiver System

by Sheldon Hands, GW8ELR
and George Dobbs, G3RJV
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Rochdale, Lancs
OL11 3HE England

The RTX transceiver system has been designed in close consultation with the G-QRP club. The primary intention of the system is to provide an introduction to home constructed ssb equipment. A large number of associated boards are being developed to cater for many uses from HF to SHF and QRP to QRO.

By using a number of large scale modules the system is easy to build and test, and caters to different uses and frequency requirements. no special test gear or tools are needed apart from the shack multimeter and a soldering iron, although access to a general coverage receiver is particularly useful.

A milliwatt transceiver can quickly be built with just three modules, the RTXIF, RTXRF and RTXVFO. The addition of the RTX AMP and RTXLPF will just as quickly turn it into a 10 watt ssb transceiver, and with the RTXAGC, you can also add agc to the receiver and cw with AFSK to the transmit side.

For CW purists a separate keyed xtal oscillator on the IF frequency and electronic change over of the control lines is available from the RTXCO module. This module also adds an RIT control system for the RIT diode on the vfo board.

Further modules are being developed to enhance and extend the system. Two new modules to be released shortly are a high performance 3 watt 50 MHz module and a variable passband and notch system based on our proven ladder filters.

Using RTX System Modules

*Epoxy glass double sided pcbs for main modules
*Silk screened component locations
*Comprehensive build manual with documentation
*Upgradeable to multiband
*Branded components for easy servicing

RTXIF MODULE

Circuit Description:

General: The RTXIF module is designed as a basic 9 or 10.7 MHz transceiver IF system. Diode switched RF input and outputs are available for connection to a companion RTXRF board and RTXVFO vfo system.

Receiver: For the receive system IF input at FL1 filter frequency is routed via D1 to the filter. R4 and R5 provide a resistive termination equal to impedance of the filter, whilst C3,4 isolate R3,6 which provide the dc return for the switching diodes D1,4.

IC1, an MC1350P, is the IF amplifier and is matched to the filter with a broad band transformer T1. IF gain control is by RV1, which should be a front panel control, the system may beupgraded to AGC and the control voltage applied via D5.

Output from the IF amplifier is capacitive coupled to IC2 an NE602A which is used as a product detector. C54 couples the BFO injection voltage from the oscillators TR3 or TR4.

IC3 and LM386 amplifies the AF voltage from the product detector. Link D can be cut and IC3 powered from a permanent 6 volt source for use as a sidetone amp for CW operation. In this case the OPT electrolytic must be fitted to replace C21.

Transmitter: TR1 acts as a microphone amplifier and is well suited to high impedance microphones. C23 protects the input from rf. The stage is capacitive coupled to IC8

which provides the main tx af gain. For low impedance and electret microphones the input connects direct to C27 which is reversed in polarity. *If a low impedance <600ohm or electret microphone is used do not fit TR1, C24, R15, R16. Fit a pcb pin at TR1 drain pad. Make the mic socket connection to the pin. Install C23 between pin and groundplane. Install C27 REVERSED, i.e + to pin 4 of IC7.

IC7 is an SL6270 VOGAD amplifier, it provides up to a 60dB agc range. This can be preset with R19 or RV3 may be fitted to allow variable control.

For conversion to dsb an SL1640 is used this IC is inherently well balanced so no external potentiometers are provided. C53 and C34 couple the BFO and AF signals respectively onto the IC. TR2 a J310 FET amplifies the suppressed carrier signal before it is routed to the side band filter FL1. Signal diodes D2 and D3 route the signal through the filter to the TX out pin.

Two separate switched BFO's are provided on the board. The oscillators are switched by applying +9V from regulator IC9 to the relevant carrier select line, CS1 or CS2. The oscillators use a 2N2222A in a circuit, and are run at the lowest possible level to avoid carrier leakage. The oscillators occupy the center of the pcb and may be screened if necessary. A silk screened box indicates the oscillator limits. TX/RX switching is via a simple PTT switch which grounds the earth side of RL1 coil. RL1 contacts then switch the 12V supply to the TX or RX 12V line as required. IC9 is supplied from the unswitched supply to provide a permanent 8V for the carrier oscillators.

Test and Alignment:

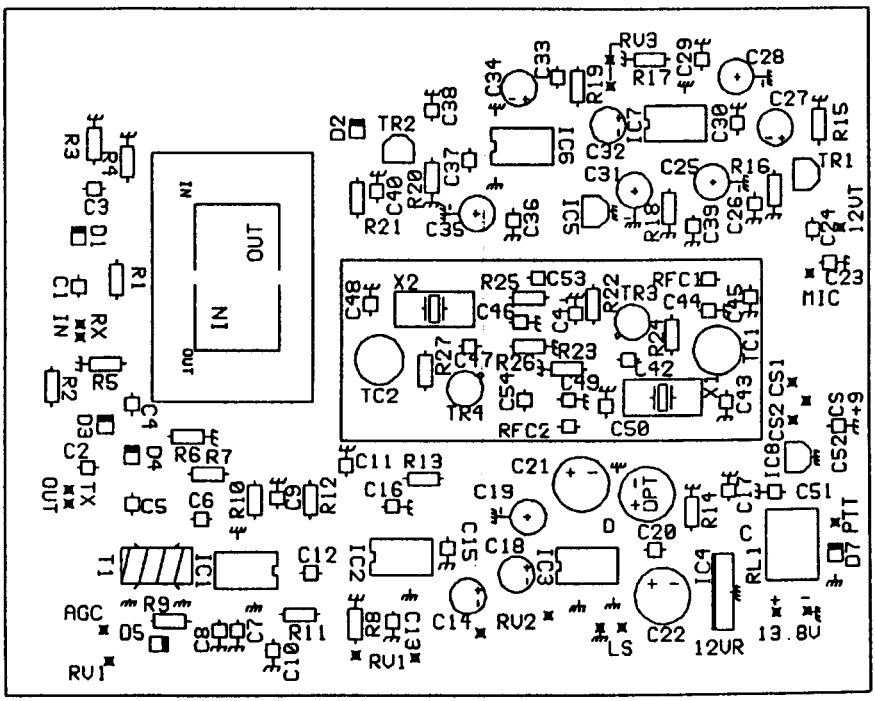
The method of testing will be dependant on the available equipment. A satisfactory scheme is to use a general coverage receiver to monitor the 9MHz transmit frequency and a RF signal generator to provide a 9MHz source for the receiver section. Alternatively, if the RTXRF board has also been constructed this may be used for most checks with an amateur band only receiver. It is important that when testing a collection of boards i.e. vfo, mixer, and IF, that the boards are properly terminated and bonded together.

1. Connect RV1/2, a microphone and a loudspeaker to the board. Temporarily solder a wire bridge from the +9V pin to either CS1 or 2 to activate one of the carrier oscillators.
2. Connect the board to a 13.8V supply via a multimeter on its current range, check that the current drawn is around 50mA. If the current is greatly in excess of this value check the board for possible faults. The three most likely possibilities are; bridged tracks or pads, D1-4 installed wrong, IC or transistor installed incorrectly.
3. Turn up the audio and IF gain controls and check for an increase in noise. Inject a 9MHz test signal at RX IN or connect a mixer board to provide off-air signals and check for demodulation. If a frequency counter is available adjust X1 or 2 to its correct frequency with the trimmer TC1 or 2, the counter is best connect to pin 3 of IC6.
4. If no counter is available use a strong off air signal and adjust TC1/2 for the best audio/filter response. Do not be too critical as the main adjustment is best made in transmit mode.
5. If necessary reconnect the multimeter to monitor supply current and key the ptt line. Expect a reading of 90mA. If the current is greatly in excess of this check the transmit section for faults.
6. Apply audio via the microphone and monitor TX OUT at 9MHz or the frequency of the mixer output. Adjust TC1/2 for best audio versus filter response.

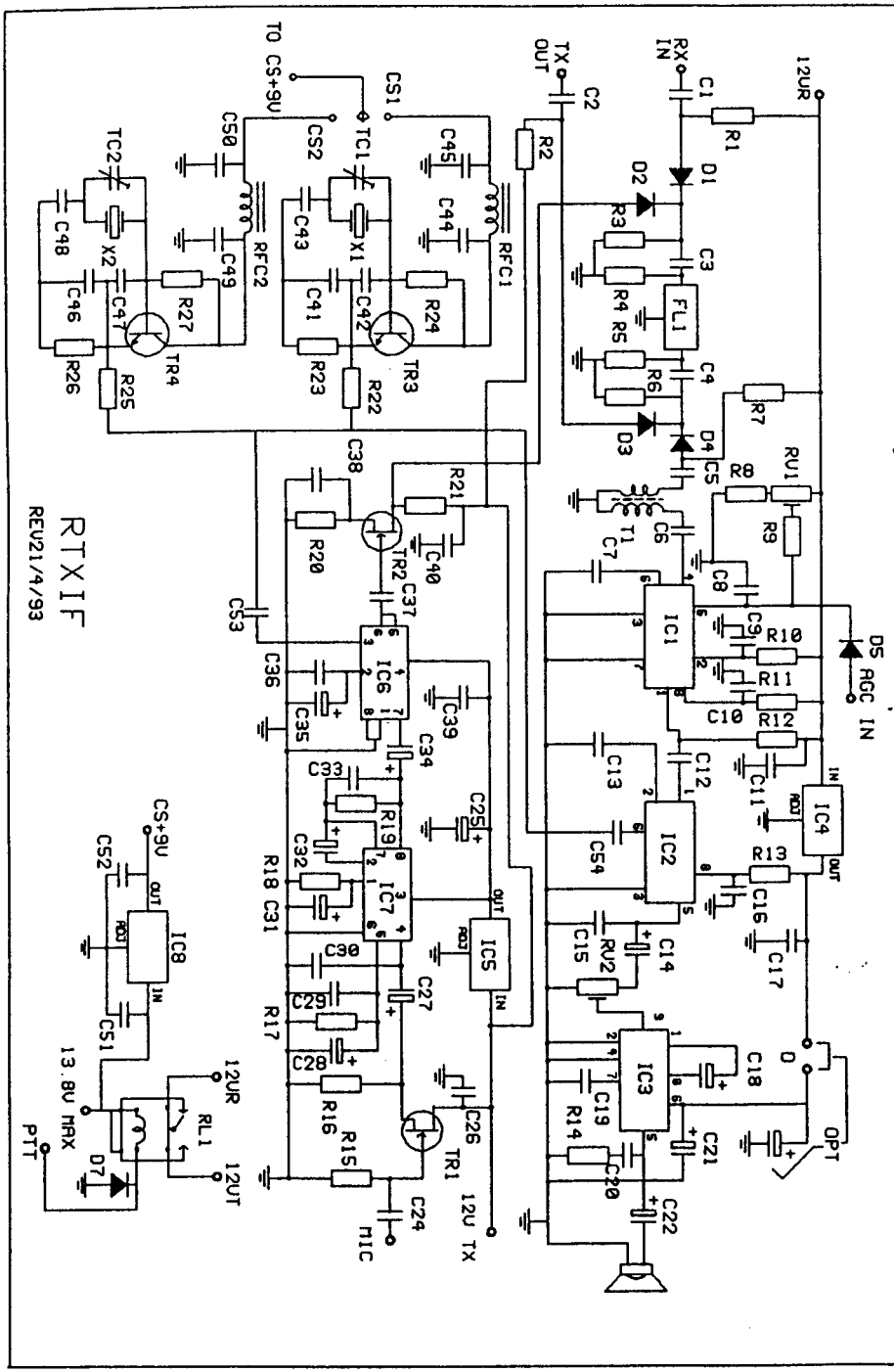
Parts List RTXIF

R1,2,3,6,7	10K	C7,8,9,10,11,16,17,20	0.1uF
R4,5,21,23,26	470 ohm	24,26,36,39,45,50,51,52	
R10,11,12,13,20	100 ohm	C12	100pF
R8,19	4.7K	C1,2,3,4,5,6,13,15,33	.01uF

R9	27K	37,38,40,53,54	
R14	56	C14,34	1/16V El.
R15,17	47K	C18	10/16V E
R16,22,25	1K	C19	Not used
R18	1M	C21,22	100/16V
R24,27	220K	C23	470pF
RV1	5K Pot	C25,31	47/16V
RV2	10K Pot	C27,28,32	2.2/16V E
IC1	MC1350P	C29,30,44,49	.001uF
IC2	NE602AN	C35	4.7/16V E
IC3	LM386	C41,42,46,47	150pF
IC4	7806	C43,48	27pF
IC5	78L06	TC1,2	30pF trim
IC6	SL1640	IC7	SL6270
IC8	78L08	TR1	2N3819
TR2	J310	TR3,4	2N2222A
D1-4	BA244	D5,6,7	1N4148
RFC1,2	1mH	RL1	OUC(blue)
T1	K37X830		



RXTXIF Component Layout



RXTXIF Schematic

RTXRF 14 MODULE

Circuit Description

In receiver mode signals are routed from the RX ANT pin to the 3 pole bandpass filter formed by C16-22 and L3-4. The input and output impedance of the filter is 50 ohms, T5 a trifilar wound transformer matches the filter to the mixer IC2, an SL6440.

The VFO is coupled to the mixer by C24. T6, another trifilar transformer, couples the mixer to the output. The mixer transformers T5 & 6 are broad band and will accommodate both 9 and 10.7MHz IF frequencies.

In transmit mode a signal at the IF frequency is coupled to tx mixer IC1 by T1, another broadband trifilar wound transformer. The VFO is coupled to the mixer by C1. The mixer output is matched to a 2 pole bandpass filter formed by C7-11 and L1 & 2, by T3. The low level tx signal is amplified amplified by TR1, a dual gate mosfet. The stage gain is controlled by the gate 2 voltage which is varied by a divider network with RV1, this may be a panel mounted control.

For multiband operation both transmit and receive mixers may be routed to extra off board bandpass filters. To implement this scheme it is only necessary to cut the track link between the routing pins and make connections to the multiband switch/filter board.

Test And Alignment

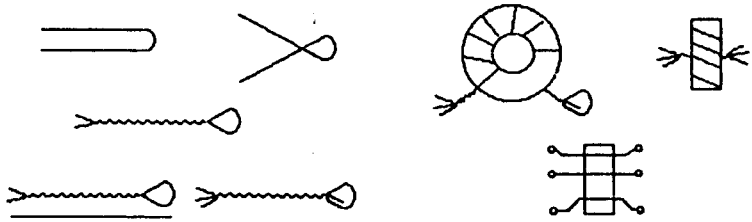
The method of test and alignment will depend upon the equipment available. In the absenceof a suitable IF strip a general coverage receiver at 9MHz and a signal generator capable of 5-5.5 MHz will allow suitable tests to be carried out.

1. Check the completed pcb for solder splashes, bridged tracks or pads and dry joints. If you suspect a dry joint use a multimeter to carry out a restance check between the track and the component lead on the ground plane side.
2. Connect the 12VR line and ground conection to a suitable supply via a multimeter on its current range. Check that the current drawn is less than mA. If the current greatly exceeds this check tht IC2 and D4-5 are correctly installed.
3. Connect a 5-5.5MHz vfo or a signal generator to the vfo input pin and the IF output to an IF strip or a receiver tuned to 9MHz.
4. Connect an aerial or signal source to the ANT pin and tune the vfo until a signal is resolved. Using a trim tool, adjust L3,4,5 for best signal strength. The cores of the inductors are very brittle, a metallic screwdriver MUST NOT be used for adjustment. In the absence of the proper tool an old plastic knitting needle with its end filed may be used.
5. Disconnect the 12VR line and IF strip and reconnect the power supply via a multimeter on its current range to the 12VT pin. Check that the current drawn is less than mA. if the current greatly exceeds this check that IC1 and D1-3 are correctly installed.
6. Make temporary connections to RV1.
7. Connect the transmit output of a suitable IF strip or a signal generator to T1 viathe TX IN pin. Lightly couple ageneral coverage receiver at the RF frequency to T4.
8. With the vfo still connected to the input pin check the receiver for the rf signalat IF + or - VFO according to the mixing scheme.
9. Adjust L1,2 for max signal. Check that RV1 varies the output power.
10. This completes the alignment.

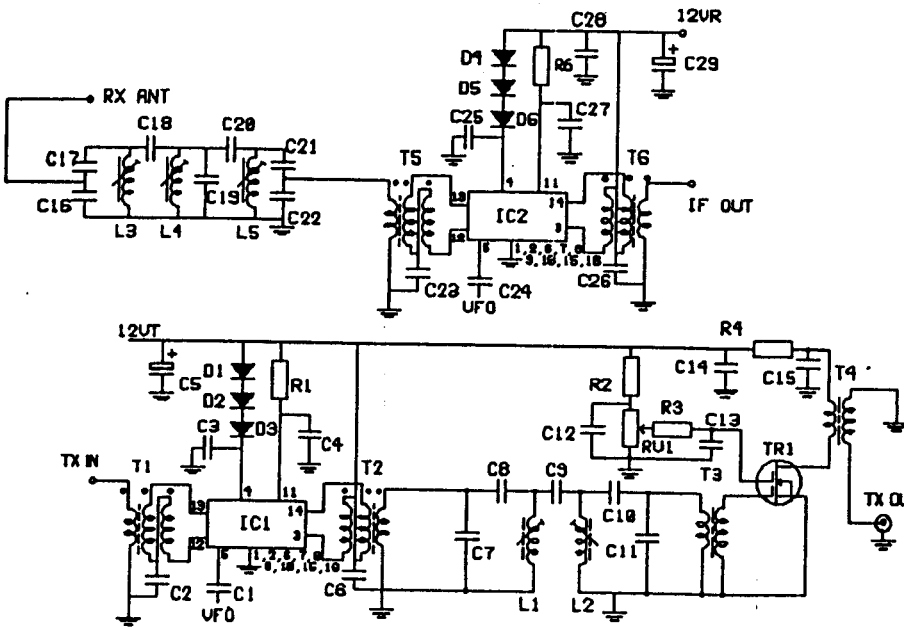
Parts List RTXRF/14MHz

R1,6	330 ohm	C12,13	0.1uF
R2	100K	C18,20	4.7pF
R3	1K	C19	100pF
R4	100 ohm	C5,29	4.7/16V Elec.
R5	Not Used	IC1,2	SL6440
RV1	50K	D1-6	1N4148

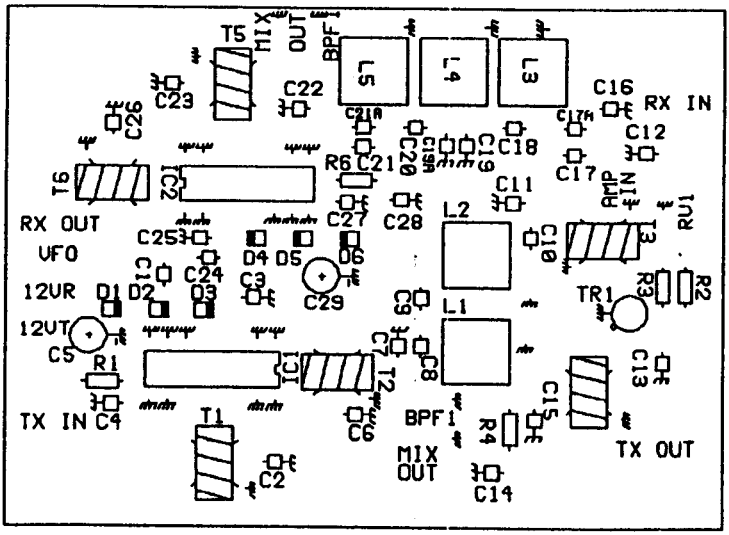
C1,2,3,4,6,14, 15,23,24,25,26, 27,28 (grey)	.01uF	TR1 L1,2,3,4,5 T1,2,3,4,5,6	MFE201 KANK3335 10K(Pink) K37X830
C7,11,16,22	.001	C8,10,17,21	120pF
C9	2.2pF		
Coil Winding Data			
T1,2,5,6	K37X830	8 Turns Trifilar #32 s.w.g.	
T3	K37X830	4 Turns C10/11 to Gnd 26Turns TR1 to Gnd	
T4.	K37X8330	10 Turns R4 to TR1 2T output link	



T1,2,5,6 Winding



RTXRF/14 Schematic



RTXRF Parts Placement

RTX-AMP 1.8-30 MHz Broadband Linear

Circuit Description:

The RTXAMP is a 3 stage wide band linear amplifier designed for ssb/cw use from 1.8 - 30MHz. An onboard dc switching circuit controls the base bias and allows sequenced control.

RF drive is applied via the RF IN pin to the first stage amplifier TR1, a 2N3866 run in class A. Negative feedback via R4 and a peaking capacitor C2 ensure a flat gain response from 1.8 - 30 MHz.

The second stage amplifier is a push-pull pair comprising of TR2 & 3. The transistors are 2SC2166's run in AB1. Operating bias is provided by the circuit around TR8 & 9. TR8 is mounted on the case of TR2 in order that some measure of temperature compensation takes place of the bias voltage. RV1 sets the bias voltage and hence the standing current of the second stage amplifier. The bias voltage is fed to the bases of the amplifier transistors via rf chokes RFC1 & 2.

Drive is coupled to the second stage by T1 which acts as a phase splitter. L1/R9 and L2/R10 connected from base to collector of TR2 & 3 respectively and C8 in parallel with T2 flatten the frequency response of the stage.

The third stage amplifier uses a smilar configuration to the second stage. The transistors are a pair of 2SC1969's originallydeveloped for CB service at 27 MHz where they are rated for 18 watts output each. In the RTXAMP we suggest that they are derated to a max of 18 watts output for the pair.

In order that the amplifier does not cause large surge currents during switching the 1st stage amplifier and the bias supply are separately switched. As the subsequent amplifier stages are effectively cut off when the bias voltage is zero, the 2nd and 3rd stages may be permanently connected to the + Ve line. The switching circuit uses the +12V transmit line of the preceding RF driver to turn on TR6. This pulls the base voltage low on TR7 which then turns on switching the 13.8V line to the bias supply and 1st amplifier.

Test and Alignment

Check the pcb for solder splashes, bridged tracks and cold joints. check carefully the area around the power transistor connections as it is easy to bridge the tracks here. If yoususpect a cold joint you may check the connection with a multimeter on its ohm's range between the track and the component lead on the graound plane side of the board.

Temporarily attach the amplifier to the heatsink. Place the completed amplifier on the flat surface of the heat sink so that the power transistor tabs are above the center channel. Mark and drill the holes for the transistor mnounting bolts. Coat the Mica spacers with heatsink compound on both faces and attach the amplifier to the heatsink using the bolts and the shouldered washers [the shouldered washers center the bolt so that it is insulated from the tab]. Using an ohmmeter check that all 4 power transistor tabs are insulated from the heatsink.

Terminate the RF output pin with a 15W 50 ohm load via a power meter. Alternatively, a simple diode probe may be attached to the load as a power monitor [see diagram at the end of this section]. With RFC3 & 6 disconnected attach a power supply of a maximum of 13.8V to the 12V PERM pin with the negative return connected to the ground plane.

Connect the supply via a multimeter on its amperage range, there should be no current consumption. Switch the amplifier to TX by connecting the +12VT to the 12 volt supply line. The current consumption should be less than 200 mA. If the consumption is greatly inexcess of this, recheck for faults.

Return the amplifier to standby by removing the supply at the +12VT line. Connect normally to the 12V PERM line and install the multimeter still on it's current range between RFC3 and it's input pin. Turn RV1 & 2 fully clockwise, then key the +12VT line. Now set the standing current of TR2 & 3 by adjusting VR1 until the meter reads 20 mA.

The operation of temperature adjuster TR8 can be checked by bringing the tip of a hot iron near to the transistor. As the case warms the current should be driven down. Disconnect the supply and solder RFC3 permanently into the circuit.

Re-connect the multimeter to RFC6 and follow the previous procedure to set the standing current on TR4 & 5. Adjust RV2 for 100 mA. Once the adjustments are completed solder RFC6 permanently into the circuit.

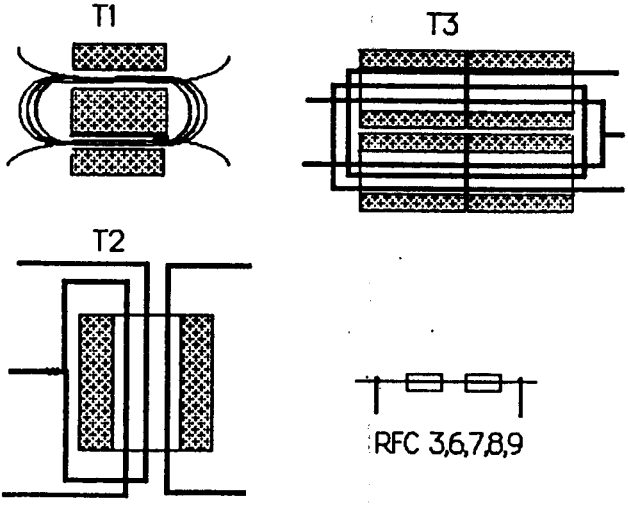
Re-connect the supply via the multimeter on its ohms range and key the 12VT line. Leave on for 10 minutes and check that the current consumption does not rise dramatically. Connect a drive source to the RF input on its lowest power setting, preferably using speech. Modulate the drive and check for power output adjusting the level as required. In the absence of an oscilloscope or analyzer check on a monitor receiver for any distortion or other problems.

If all is normal the amplifier may be place in service. When in service it is important that a lowpass filter follows the amplifier to improve the harmonic attenuation.

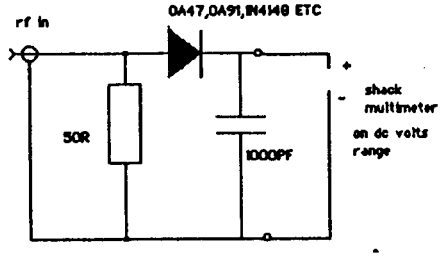
Parts List RTXAMP

R1,5,13,14	100 ohm	C3,9,14,24	0.1uF
R2	680 ohm	C8	68pF SM
R3	Hi Gain 5.6 low 12	C4,10,15,23	10/16V tant
R4	4.7K	C13	220pF SM
R6	56 ohm	C18,21	220/16V
R7,8	33 ohm	C22	not used
R9,10	120 ohm	T1	28-43002402
R11,12	22 ohm	T2,3	26-43006301

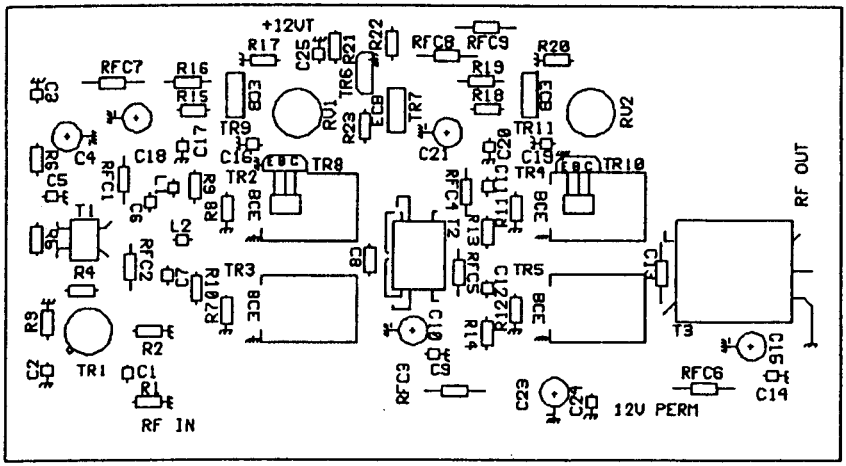
R15,18,21,22	10K	RFC3,6,7,8,9	2x 26-43000101
R16	150 ohm .5W		Ferrite Bead
R19	100 ohm .5W	RFC1,2,4,5	100uH Choke
R20	560 ohm	L1,2	1.8uH Choke
R17	330 ohm	TR1	2N3866
R23	1K	TR2,3	2SC2166
RV1,2	100 ohm	TR4,5	2SC1969
C1,5,6,7,11,12,16	.01uF	TR7	BD140
17,19,20,25		TR6,8,10	BC548
C2	270pF	TR9,11	BD139



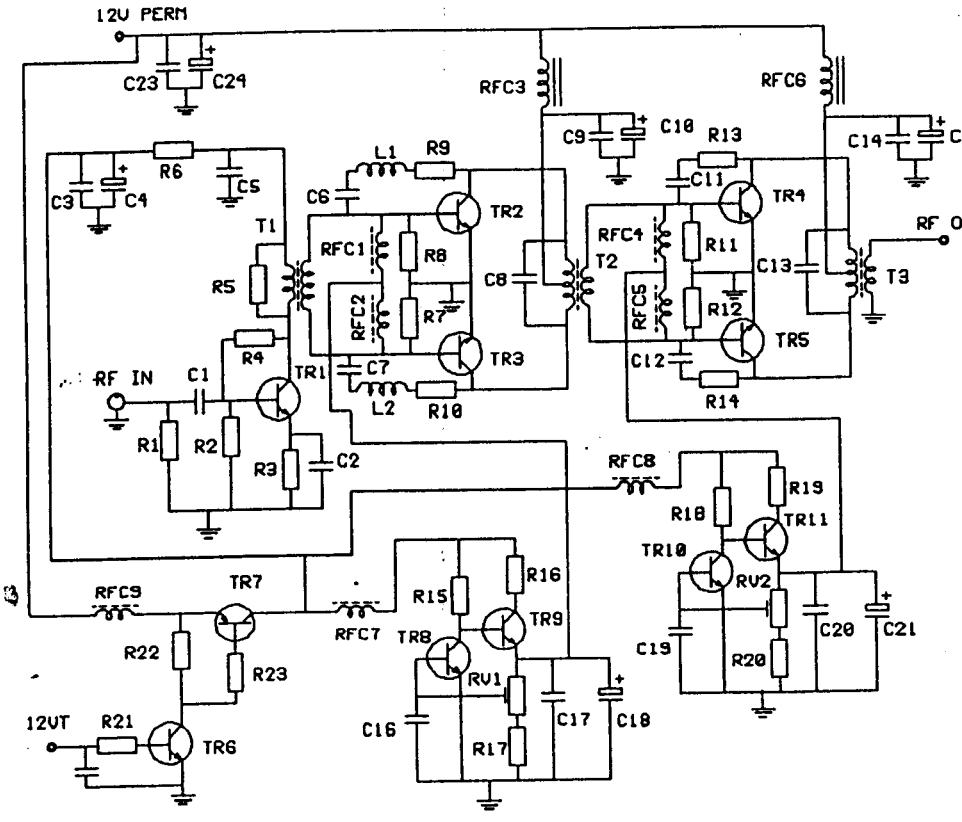
Winding Diagram



Power Monitor



RTXAMP Parts Placement



RTXAMP Schematic

RTX VFO 55

TR1 together with VC1, C1 and L1 form a Colpitts VFO, a capacitive divider C3/4 connected from TR1 source to gate provides feedback. CT2 is a 1.5 to 5 pF trimmer to allow calibration of the vfo. The vfo inductor L1 is wound on type 6 core material, which has been selected for its thermal stability. D1 limits the change in TR1 junction capacitance, TR1 drain voltage is regulated at 8V by IC3. The VFO is lightly coupled to buffer amplifier TR2 by C8, again the drain voltage is regulated, and the buffer output is taken from the source via C11/12. The varicap diode D2 provides an RIT facility, its effect on the tuned circuit may be adjusted by changing the value of the coupling capacitor C15. Higher values cause a larger swing.

C2,3, and 4 may be made up from two values of different pitch, so allowing mixed dielectrics for temperature compensation. C1a,b,c may also be used for this purpose but the pitch is fixed at 5mm.

VFO Construction

* Install the pcb pins as listed below. Insert pins from the track side and press home with a hot iron. Always support the pcb around the circumference of the pin on an old cotton or solder reel during this operation. Finally solder th pins to the pad.
* PCB pins VC1a, VC1b, VFO out TX, VFO out RX, +12V, GND, RIT.
* Fit and solder R1-R7.
* Fit and solder C1-C15.
* Fit and solder D1,2 be careful to observe the correct polarity indicated by the colored band on the diode, which matches the band on the board legend outline.
* Fit and solder TR1,2. These are static sensitive devices, but in practice are quite robust. However it is wise to adopt the standard precautions. Don't wear nylon clothing. Discharge any body staic electricity by touching a water or a central heating pipe. Use an insulatd soldering iron or fit a ground wire back to the pcb ground track. Don't wave the device about or handle the leads directly. Use insulated pliers to spread the leads. When fitting make sure the transistor outline matches the board legend.
* Fit and solder IC1, again making sure the outlines match.
* Fit and solder the blue trimmer at TC2.
* Fit and solder RFC1,2.
* Make up L1 on the yellow core, but do not install.

We suggest that the completed VFO is contained inits own box within the main enclosure of your equipment. The FX1115 ferrite bead should be threaded over the +V supply lead where it exits the VFO box.

TEST AND ALIGNMENT

Clean the enamel from L1 leads and tin them with solder. Install L1 but solder the leads lightly to the track clear of the pad as a temporary connection.

Check the pcb for solder splashes and dry joints. If you suspect a dry joint check it with a multimeter on its ohms range between the comonent lead on the top side and the track on theunderside. Attach a multimeter on its current range in the DCsupply to the module and check that the current consumption is less than 20 mA. If the current is not excessive connect normally to the supply. Connect a frequency meter to the VFO output at C11 or C12 and check for oscillation. In the absence of a counter use a general coverage receiver with a short wire as an aerial laid alongside the module. Check the range of the frequency with VC1 fully meshed, then unmeshed. If the swing is too large, VC1 may be connected to the board via TC1 and later replaced by an equivilent series NPO capacitor. This will reduce the effective capacity of VC1.

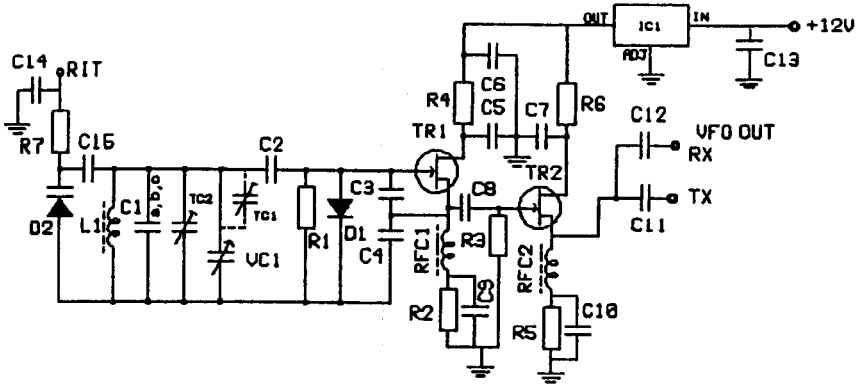
Adjust TC2 for the required calibration point. If you are unable to obtain this frequency, you may remove some turns from L1 to increase the frequency or add extra capac-

ity at C1a to lower the frequency. Once you are satisfied with the coverage you may install L1 correctly lightly glueing the turns to the core with balso cement or similar. Place a small dab of glue on the pcb to hold the completed inductor.

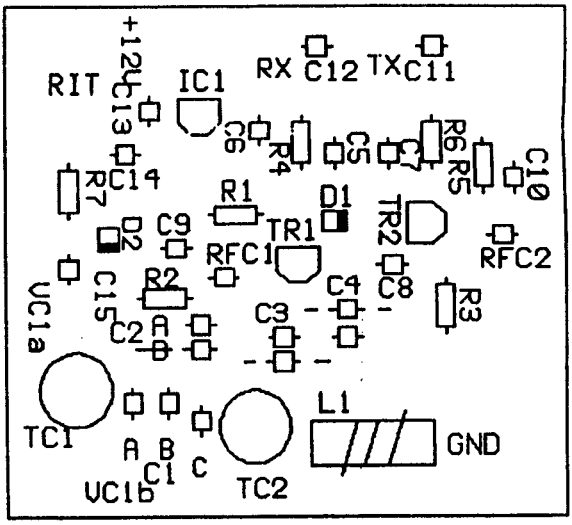
Next check the range of RIT, apply +6 volts dc to the RIT pin and check that you move the frequency, dependant on the operating frequency of the VFO, it may be necessary to increase the value of C2. Typically this rises to 8 pF for a 2 KHz shift with 3 volts at 2.4 MHz.

Parts List

R1,3,7	100K	C8	47 pF
R4,6	100 ohm	C11,12	1000 pF
R2,5	390 ohm	C15	8.2 pF
TC1	60 pF max	TR1,2	J310
TC2	5 pF blue trim	D1	1n4148
C1a	see text	D2	BB105
C1b	39 pF	IC1	78L05
C1c	33 pF	L1	T68-6 (yellow)
C2a	220 pF		32 turns #26
C2b	220 pF	FB1	FX1115
C3	180 pF	VC1	50 pF
C4	220 pF + 220 pF	RFC1,2	100 uH
C5,6,7,9,10,13,14	.01 uF		



VFO Circuit



VFO Parts Layout

Parts Kits for all of the modules in this article are available from Hands Electronics US representative, Bill Kelsey, N8ET. His address is 3521 Spring Lake Dr., Findlay, OH 45840. Phone from 7-11 pm eastern time. 419-423-5643. Email: n8etQdelphi.com. Write to Bill for current pricing.

THE EPIPHYTE: A Simple SSB Transceiver

by Derry Spittle, VE7QK
1241 Mount Crown Road
North Vancouver, BC, Canada V7R 1R9

"It is vain to do with more, what can be done with less" William of Occam (1290 - 1350)

If you are intimidated by the complexity of electronic circuitry, construction of an SSB transceiver is probably not high your list of projects. But it really need not be complicated nor need the signal be QRO. You will be surprised what a simple transceiver running less than one watt of SSB can do. Set an objective. Find a basic circuit upon which you can build and Keeping to Bare Essentials makes the task easy. Have the satisfaction of building something and watching it grow When finished, it might even be useful; portable HF equipment still affords the only practical means of communication from the many wilderness areas throughout North America that lie beyond the range of VHF repeaters. While this article focuses on a specific project, it is written in the hope that it will motivate others to try something similar on their own.

THE OBJECTIVE

To construct a portable transceiver capable of providing effective voice communication with the nightly British Columbia Public Service Net on 3729 KHz from anywhere within the province. It must be inexpensive to build from readily available parts; be small and light enough to backpack; be capable of operating from AA batteries or a very small gel-cell; be tunable over a limited range to enable communication with other stations; be able to withstand rough usage and maintain calibration; finally, it must be easy to replicate.

THE START

It began as a basic crystal controlled double sideband transceiver adapted from circuits in ARRL Solid State Design. Despite the lack of selectivity in the receiver, it did permit reasonably reliable communication with base stations throughout the province. (The design was later published in SPRAT, Journal of the G-QRP Club.) Contrary to popular opinion DSB can be received on a DC receiver and communication between two such units is possible so long as one is prepared to accept a certain amount of phase distortion. Synchronous detection might have overcome this problem but it seemed easier to design and build a simple superhet receiver and later, an SSB transmitter.

WA3RNC's Neophyte receiver provided an ideal base from which to start. Adding a second NE602 mixer was simple. Moreover, a MuRata 455 KHz SSB filter presented a reasonably good impedance match eliminating the need for IF transformers. The prototype was put together one evening on "solderless" breadboard and I was surprised when its performance on 80 meters compared favorably with that of my communications receiver and was a noticeably quieter. A simple VFO for tuning and crystal oscillator for the second mixer were mounted on a separate breadboard rather than use the internal oscillator in the NE602. SSB generation involves little more than reversing the signal path in a superhet receiver. An op-amp speech amplifier replaced the audio amplifier and an RF amplifier was added to provide some useful output. 455 KHz is not the ideal choice for IF but limiting the tuning range and placing a narrow bandpass filter ahead of the RF amplifier permitted satisfactory image rejection on 80 meters. The prototype transmitter was also built on "solderless" breadboard and worked fine once the bugs had been ironed out.

THE KBE-1 & 2

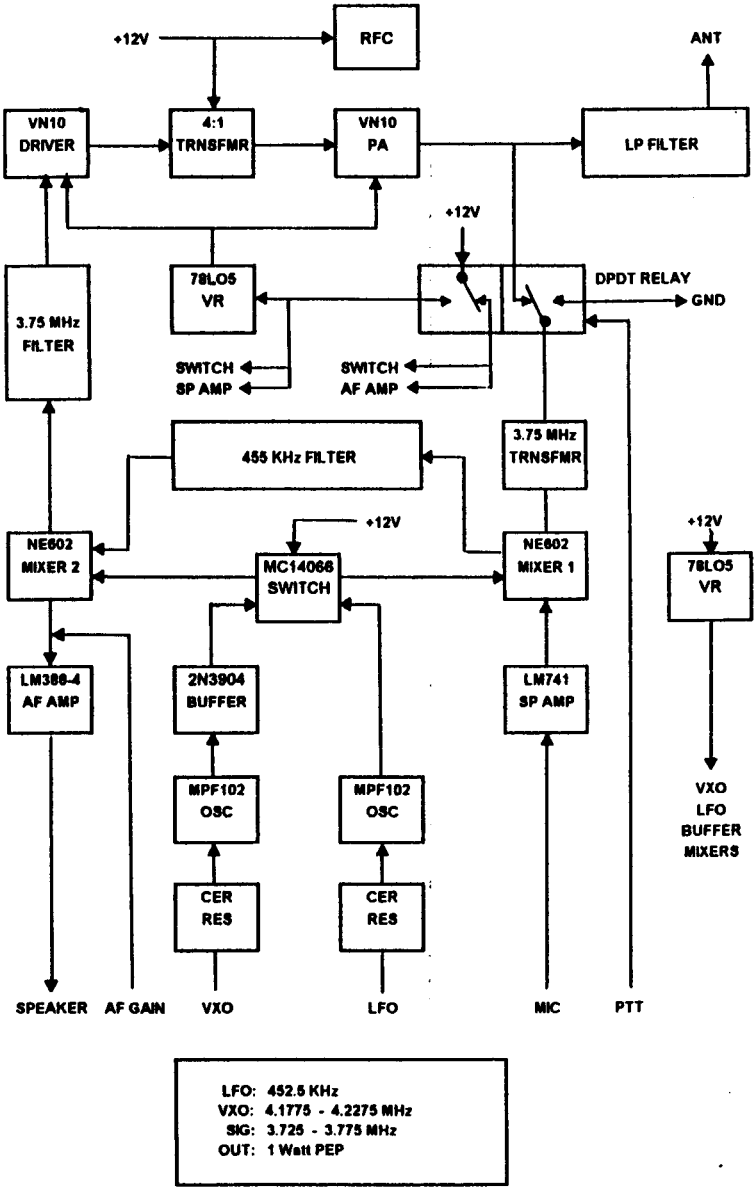
A T/R relay was added and the three breadboards were soon integrated to form a transceiver. The prototype stayed on the air in this form for nearly a year during which time numerous circuit changes were tried. It was only after taking it on a camping trip, packaged in a cardboard box and spending most of the time replacing displaced components, that thought given to putting further modifications on hold and designing a PCB. Once a CAD program had been mastered a PCB was finally produced for the KBE-1 transceiver. It was replaced almost immediately by the KBE-2 board which eliminated one of the SSB filters. Some attenuation was noticeable in the receiver but the transmitter was unaffected by having both pairs of mixers paralleled across the filter. Diode switching was added later.

THE QRP CLUB OF BRITISH COLUMBIA

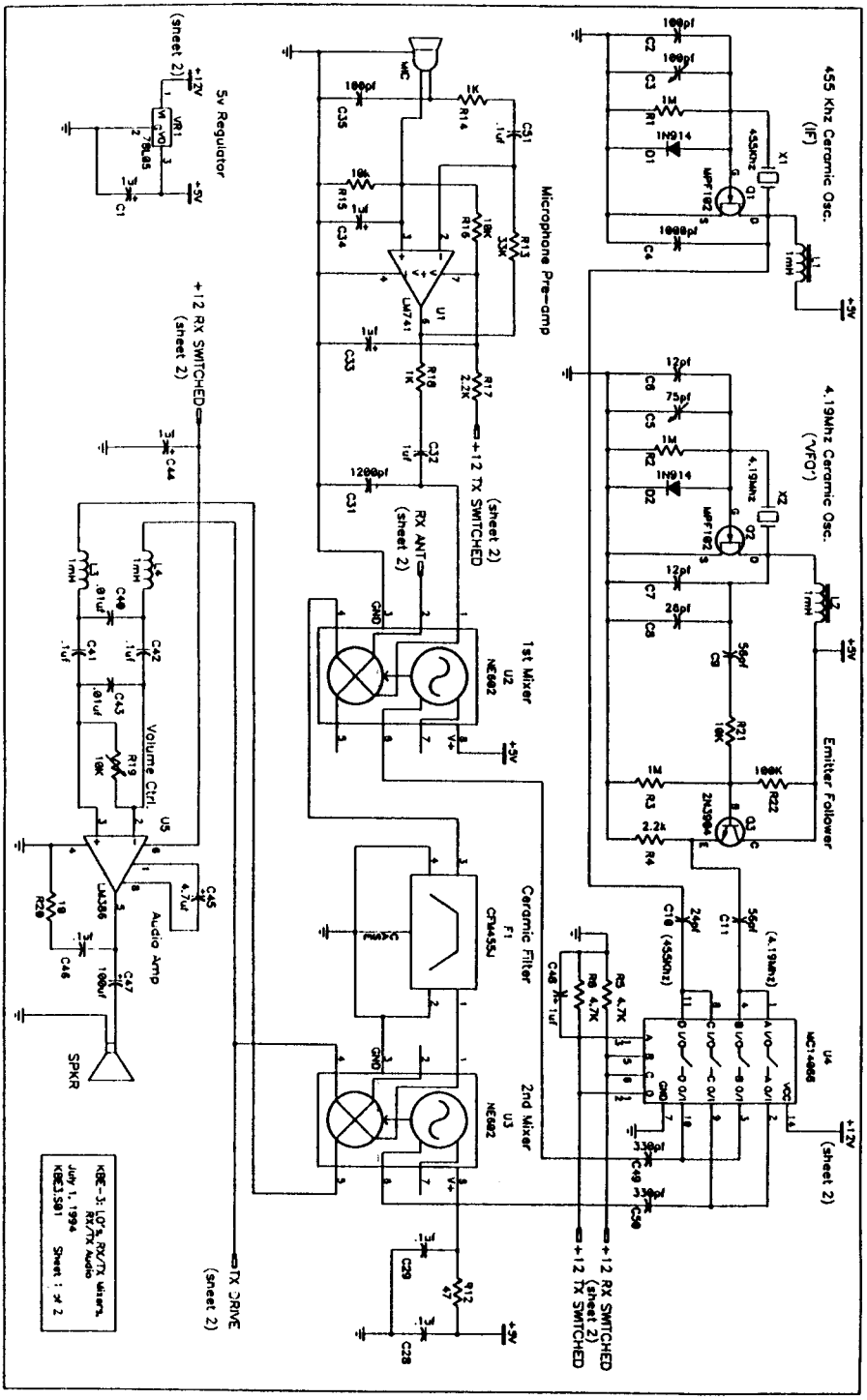
Meanwhile, interest in QRP SSB was rapidly growing and a group of us had got together to form a club. Some twenty KBE-2 boards were eventually produced and about half of these were actually completed as intended. The remainder were immediately redesigned, modified and improved upon by other enthusiastic members to the extent that most soon bore no resemblance to the original.

One of the first, and certainly the most innovative, transceivers to come out of BC was The Neomyte. Designed by VE7TX it was built into an empty cigarette package along with VFO and microphone. The PCB had been manufactured using nail varnish and a pin! Nevertheless, along with several other QRP transceivers, the Neomyte has worked coast-to-coast in Canada under ideal conditions. One of the original KBE-2s made news when the operator effected his own safe rescue by Air Force helicopter after becoming stranded on a mountainside while hiking. Today, members are actively designing and making new boards which embody 9 MHz filters, S-meters AVC, AGC, IF and RF amplifiers. Several are now operating on 160 and 40 as well as 75 meters. The competition is fierce and no two are identical. British Columbia may well be on its way to becoming recognized as the North American center for homebrewed SSB transceivers!

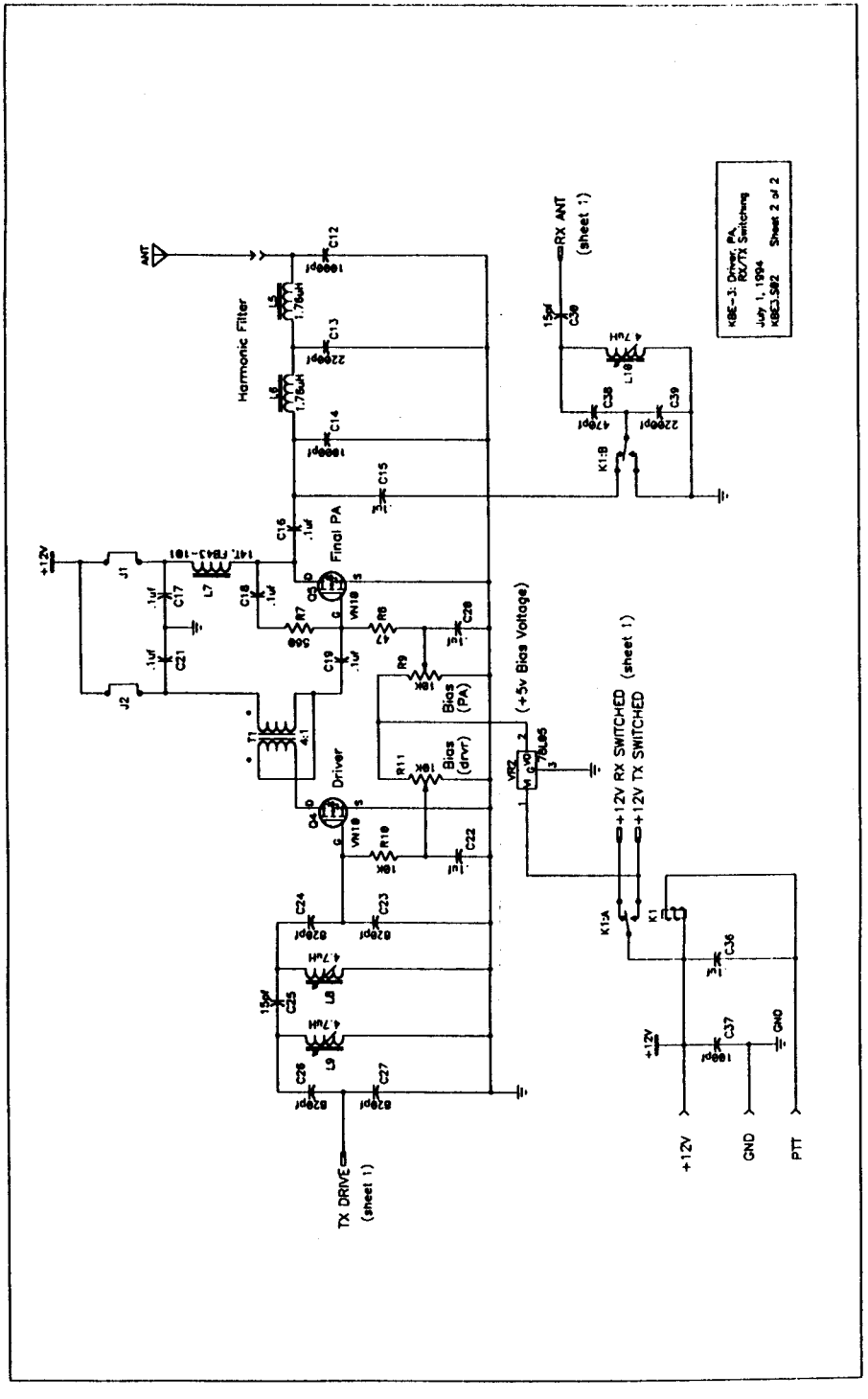
Figure 1



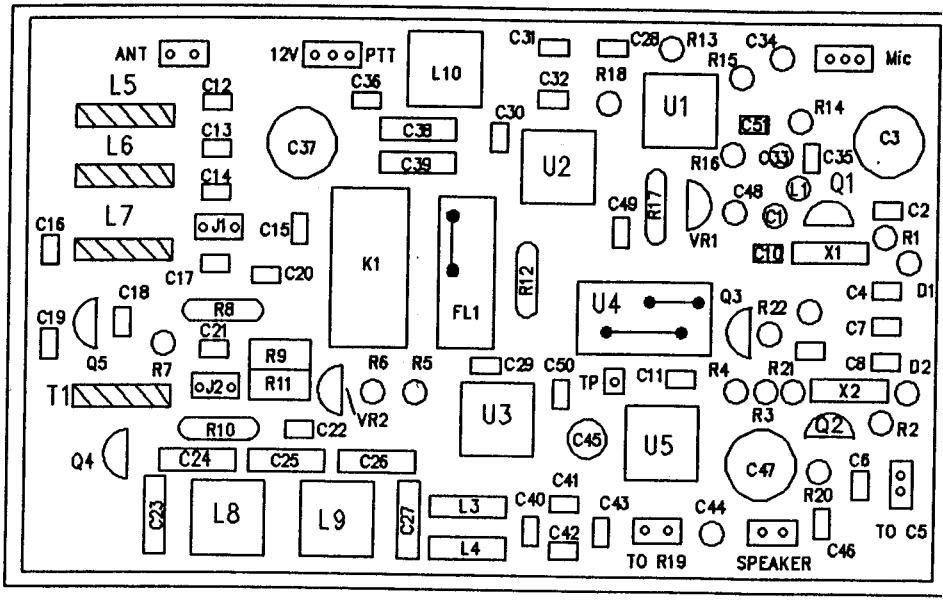
Epiphyte Block Diagram



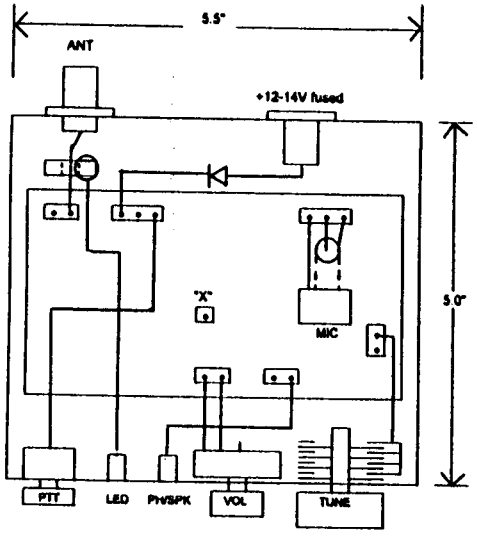
Epiphyte Schematic



Epiphyte Schematic



Epiphyte Parts Layout



"X" - connector for external VFO and/or digital display
1.5" panels front and back
Twist wires to LED
Feed wires to PTT & LED under PCB

Epiphyte Chassis Wiring

THE KBE-3 or EPIPHYTE

Few, if any, of the new units were designed with low power consumption, rough usage and duplication in mind. Since I had no wish to abandon these criteria, a new board, the KBE-3 was produced. The oscillators are switched between receive and transmit thereby eliminating two of the mixers. To improve mechanical stability and at the same time reduce cost, ceramic resonators are employed in both oscillators. Fortunately, 4.19 MHz is a standard frequency which permits the transceiver to tune 3720 to 3800 KHz with the LFO at 452.5 KHz. The bandpass filter has been improved and the output level maintained at around 0.5 watt PEP to minimize IMD. The RF amplifier has a VN10 operating in Class A driving a second VN10 operating in Class AB. The bias on each is adjustable and jumper connections are provided to meter the current. An inexpensive electret microphone mounts directly onto the board. A 2.5" speaker generally provides more than adequate audio but phones are needed for weaker signals. Provision is also made for connecting a digital readout and/or external VFO. The on-board oscillator may be inhibited by replacing the tuning capacitor connector with a jumper.

ASSEMBLY

Table 1 lists the components. Figure 3 shows their placement and external connections. A color print of a completed board would be a great help and one could possibly be made available.

Regardless of the final packaging, it is recommended that a simple chassis, formed from a small sheet of aluminum be used for testing and alignment. (Figure 1) While pads have been provided for external connections it is recommended that Molex connectors be used to facilitate removal. The board is drilled to accommodate them. With the exception of the microphone, negative leads can be omitted. No problem has been experienced with ground loops when the PCB is attached to the chassis with metal spacers. Install the tuning capacitor, audio gain potentiometer, PTT switch, antenna socket, phone jack and power connector on the chassis panels. Mount two LEDs in the panel. The first indicates power. The second indicates antenna current and modulation. Be sure to solder in the two wire jumpers before installing the MC14066 socket. Remove or cut off eight of the contacts on the sixteen-pin relay socket. Solder a short wire to the ground tab on the muRata filter case, fold the tab under and feed the wire through the PCB to the off-center ground pad before installing the filter.

Mount the remainder of the IC sockets, filter and smaller components and leave the toroids and inductors to last. Observe the correct polarity of tantalum capacitors as they are difficult to read after installation. Fasten the board securely to the chassis on 1/4" metal posts with 4-40 machine screws. Make the external connections with stranded wire and Molex connectors.

TESTING & ALIGNMENT

Remove all ICs and metering jumpers leaving only the relay in place. Connect a 12 - 14 V fused power supply and include an "idiot diode" in the line if you like to play it safe. Verify with a VTVM that both oscillators are functioning. Adjust the LF oscillator to 452.8 KHz. Install U2, U3, U4 and U5. There should be 100 - 300 mV RF at pin 6 of U2 and U3. The receiver can now be tested and L10 adjusted. Install a dummy load. Set the bias voltage on Q4 and Q5 to 1.5 before attaching the meter or installing the jumpers. Readjust the bias for a standing current of 30 mA in Q4 and 10 mA in Q5. Remove the meter and replace the jumpers. Install U1 and the electret microphone.

The preferred method for aligning the RF filter and checking performance is with a calibrated oscilloscope, frequency counter, two-tone audio oscillator and spectrum analyzer. While some of us have become quite adept at generating a 1200 Hz tone with our vocal chords, talking to oneself in order to evaluate speech quality and making adjust-

ments with nothing more than a receiver S-meter, it is a practice to be frowned upon. Moreover, your family will very soon begin to question your sanity. Mine did a long while ago and is now resigned to it. Find a friendly ham who has lots of test equipment.

PERFORMANCE

The assembled PCB was constructed for less than $50. MuRata filters and 4.19 MHz resonators have been difficult to find in North America but are readily obtainable from Britain. The remainder of the parts should present no problem. The PCB measures 4.8" x 2.8". It could have been made smaller but fine traces and double-sided board have deliberately been avoided to simplify both etching and soldering. It draws a maximum of 35 mA on receive and 170 mA on transmit. Provided the tuning capacitor is stiff, it can be hard dropped on the bench without any significant change in frequency. An inverted-V dipole antenna at around 50 ft in a fir tree is used at the home QTH; for portable operation it rarely gets to 20 ft. above ground - limited by my inability to throw rocks. No antenna tuner is used. Operating barefoot it gave a good account of itself in the ARCI Fireside Sprint. A simple 5 watt amplifier has been built for QRO operation under poor band conditions, but Q5 copy is generally possible without it. Reports on the audio quality have been complimentary but such simplicity has not been achieved without some compromises having been made. There are inevitably some spurious responses but these fall within the limits established for QRP operation. It was never intend that it should be used to drive a kilowatt linear! FAQs

How can it be made to operate 3.9 - 4.0 MHz? (a) use a simple external VFO and retune the RF filter, (b) a 4.4336 MHz modem crystal will put you pretty close to the International SSB QRP frequency but the oscillator circuit will require modification. A VXO circuit cannot be expected to provide much band coverage at this frequency, (c) acquire a 4.35 MHz ceramic resonator (MuRata will make them for any frequency - at a price!). Can it be adapted to other bands? Yes. It may easily be built to operate on 160 meters. You are unlikely to find a suitable HF ceramic resonator but an external VFO can be used. The low IF makes it unsuitable for operation on 40 meters or lower.

Will it work if the 455 KHz filter is replaced with a 9 MHz filter? Yes. However, (a) the filter won't fit on the present PCB. (b) Both oscillators must be changed and (c) the impedance of most 9 MHz filters is 500 ohms. Without matching transformers the receiver signal is significantly attenuated. All the transceivers homebrewed in BC using 9 MHz filters include an IF amplifier stage.

ACKNOWLEDGEMENTS

Much of the circuitry has been adapted from designs which have appeared in Sprat, Radcom, ARRL Solid State Design and QST. Any claim to originality lays solely in the PCB layout. I thank all members of the QRP Club of British Columbia for continual offers of advice and uninhibited signal reports which never require solicitation if anything is amiss; Eric Swartz, WA6HHQ, for the splendid job he has done in re-drafting the circuit and other diagrams; George Dobbs, G5RJV, for condoning the use of his e-mail signature - the quotation from William of Occam; the Vancouver Sun crossword puzzle editor and the O.E.D. for EPIPHYTE, a plant growing on another [f. EPI + Gk. phuton]. 72, Derry,

VE7QK EPIPHYTE [KBE-3]PARTS LIST

C1	1mF axial tantalum	C2	100pF disc cer
C3	100pF trimmer (10mm)	C4	1000pF disc cer
C5	7- 75pF air-spaced variable	C6,7	12pF NPO cer
C8	26pF NPO cer	C9	56pF NPO cer
C10	24pF NPO cer	C11	56pF NPO cer
C12	1000pF disc cer	C13	2200pF disc cer

C14	1000pF disc cer	C15-22	0.1mF rad mon cer
C23, 24	820pF axial poly (MOUSER)	C24	15pF NPO cer
C26, 27	820pF axial poly (MOUSER)	C28, 29	0.1mF rad mon cer
C30	15pF NPO cer	C31	1200pF disc cer
C32	1mF rad mon cer	C33, 34	1mF axial tantalum
C35	100pF disc cer	C36	0.1mF rad mon cer
C37	100mF electrolytic	C38	470pF axial poly
C39	2200pF axial poly	C40	0.01mF rad mon cer
C41, 42	0.1mF rad mon cer	C43	0.01mF rad mon cer
C44	1mF axial tantalum	C45	4.7mF electrolytic
C46	0.1mF rad mon cer	C47	100mF electrolytic
C48	1mF axial tantalum	C49, 50	330pF disc cer
C51	0.1mF rad mon cer		

All radial monolithic capacitors 0.2" lead spacing

R1, 2, 3	1M	R4	2.2K	
R5, 6	4.7K	R7	560	
R8	47	R9	10K	vertical multi-turn trimmer pot
R10	10K	R11	10K	vertical multi-turn trimmer pot
R12	47	R13	33K	
R14	1K	R15, 16	10K	
R17	2.2K	R18	1K	
R19	10Kminiature pot [log]			
R20	10 ohm			

All fixed resistors 1/4W

L1, 2, 3, 4	1000uH miniature molded choke (MOUSER)
L5, 6	21 turns Amidon T-37-61
L7	15 turns Amidon FB-43-2401
L8, 9, 10	4.7uH Toko 154ANS-T1005Z (DIGI-KEY)
T1	7 bifilar turns Amidon FB-43-2401
F1	455 KHz MuRata CFM455J1 (CIRKIT)
X1	455KHz ceramic resonator
X2	4.19MHz ceramic resonator (RADIO SPARES)
K1	DPDT 12V Omron G6-A-2H
MIC	electret 270-092B (RADIO SHACK)
D1, 2, 3	1N914
Q1, 2	MPF102
Q3	2N3904
Q4, 5	VN10KM
U1	LM741
U2, 3	NE602
U4	MC14066
U5	LM386-4 16V version
VR1, 2	78LO5

0.1" SPACED JUMPERS & POLARIZED MOLEX CONNECTORS

2 x shorting jumper	[MOUSER 151-8010]
1 x short piece of breakaway header	
4 x 2-circuit terminal housing	[MOUSER 538-22-01-3027]
2 x 3-circuit terminal housing	[MOUSER 538-22-01-3037]
4 x 2-circuit mating header	[MOUSER 538-22-14-2024]
2 x 3-circuit mating header	[MOUSER 538-22-14-2034]

14 x crimp terminal [MOUSER 538-08-50-0114]
4 x 1/4" brass hex spacer 4-40 [MOUSER 534-1450A]
4-40 machine screws (cut to length as required)

If you have questions, please feel free to write to me at the address above, or via the internet. My internet address is jds@freenet.vancouver.bc.ca I hope you enjoy building and experimenting with this rig. 72, Derry

[Editors Note: A circuit board for this project is available from Far Circuits for $7.50 plus $1.50 shipping and handling per 4 boards. The address is: Far Circuits, 18N640 Field Court, Dundee, IL , 60118. NorCal QRP Club paid the R & D costs for the boards, another membership service. The Murata Filters are available from Cirkit Distribution Ltd., Park Lane, Broxbourne, Hertfordshire, EN10 7NQ. Their telephone number is 0992 444111. The simplest way is to call and have the order placed on your VISA card. If you find a US source for this filter, call me and let me know. Doug, KI6DS]

Another NorCal 40 Lives!

by Jason Penn, N9RPT
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Madison, WI 53711

I just finished the assembly of my NorCal 40 Partial Kit. I did the bulk of the soldering and inductor winding over the July 4 weekend. The only snag I ran across was a dead transmitter section. After some signal tracing and head scratching I found a tiny solder bridge shorting the VFO to ground near the input of the xmit mixer. It puts out 3 watts according to my 'scope or 2.5 according to my questionable old Swan watt meter.

I did a few things different than specified, but not by choice. Since the MVAM108 varactors have not come in I went to the local electronic "odds-and-ends" dealer (mostly "odds". He dug up a box labeled "varactors" and told me they were something like 42 pF at 4.1 volts. He gave me one. In addition, Mouser was out of stock on the 39 pF mica cap in the VFO, so I used a 33 pF mica cap. The VFO was about 200kHz low. I took two turns off L9 for a total of 57 turns. C50 varied the VFO over a range of 260 kHz (wow! the manual says it should vary about 75 kHz) and the tuning pot covers a range of 68 kHz (which would seem about right). I set it up to tune from 7.082 Mhz to 7.150 Mhz. Oh yeah, I used 4.9152 MHz crystals because that's what I found cheap at Dayton. I figured a 200 Hz change in the IF wouldn't matter.

It turns out that the above tuning ranges are hogwash. I (initially) used my HF rig to "listen" for the tx/rx signals. I accidentally fell upon what must have been the third harmonic of the VFO. The third harmonic explains the ridiculously large apparent tuning range. A quick rewind of L9 with 62 turns got it down to 7.108 MHz with a high end of 7.131 for a range of 23 kHz. I verified these frequencies with the big HF rig *and* a frequency counter. By the way, an oscilloscope probe makes a nice frequency counter probe. Just be careful that the signals you connect to the counter won't fry it. My counter isn't very sensitive and will take up to a few volts. Your mileage may definitely vary.

I welcome anyone's comments on the use of the 33 pF cap and the unknown varactor. The varactor looks like a glass diode with several funny bumps, not a 2 leaded plastic transistor pack. I think the box they came from were labeled with a part number, but I didn't write it down. If it is deemed "acceptable" by Wayne, et. al., I might offer to send units to any takers on this list building NC40 partial kits. I say "might" because the local "odds-and-ends" dealer was going out of business the day I stopped in for the varactor. It is unknown if I can still get them from him or if he can still find them after his move. He is switching to strictly mail order, no retail store front and moving to a smaller place that

will only hold about a third of his (then) inventory of "stuff". The MVAM108 is the hot setup, but substituting another varactor can get you started until the real thing arrives.

Now to (still) make that first NorCal 40 contact.....

I decided to compose this while the adrenaline was still flowing. A few minutes ago I had my first NorCal 40 QSO. Since I can still count my total number of CW QSOs with the fingers of both hands it was especially exciting. I had a QSO with a radio *I* had just built. What fun! Would it work? Would I be heard? Would I still be able to copy at all? It had been about 6 *months* since my last bout of CW. I tuned around the noviceportion of 40m. I listened to a QSO for a few minutes to warm up. I jotted down phrases to send so I wouldn't get flustered or lose my place. So... take a deep breath, pick a quiet spot and go, "CQ CQ de N9RPT N9RPT K". Drat! I forgot to go "QRL?" first. Oh well. Too late now. Nothing heard. "CQ CQ de N9RPT N9RPT". What's this? Somebody sending my callsign? Yipee! It works!

Jim, N9UVJ, called me. He was loud. I turned down the RF gain a bunch. I was 579 in Kingston, IL. I live in Madison, WI. I told Jim I was running a NorCal 40 at 3 watts. He hadn't heard of a NorCal 40 before, but he said it sounded very nice. I am quite pleased. I can't wait to get a card from Jim commemorating my NorCal 40's first QSO. Excuse me I have to fill out the entry in the log book and lick some stamps...

73 Jason

Modifying the NorCal 40

by Jim Chandler, N0VAH
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Rocklin,CA 95677

I had just finished building my NorCal 40 and received my March 1994 QRPp. I am always amazed at the quality of the submissions to the quarterly newsletter and can't wait to get the next one. Anyway, I saw the modifications from both W6CYX and KC6SOC. I wanted to get the full band out of the rig but when I went to price 10 turn pots ($18.00), I decided to combine the mods from both Bob and Terry.

I first did Bob's mods that improved the keying, T/R switching and AGC recovery. I must say that I like the new 'sound' of the rig. I next implemented Terry's version of the frequency expansion. Jim Cates graciously gave me a couple of extra trimmer caps and a trip to Radio Shack netted a subminature DPDT switch for $4.00. I changed C49 to 51 pF silver mica (HSC, 20 cents) which gave me a 44 KHz tuning range. I drilled a 1/4 inch hole directly above the tuning knob for the switch and soldered the trimmer caps to the switch. The switch was then wired to ground and C49 as described by Terry.

I found that my NC40 would not tune above about 7.130. I guess the oscillator can't handle it on mine. I then tuned the trimmers and C50 to give me three ranges, 7.000 - 7.044, 7.044 - 7.086, and 7.085 - 7.130. Because the switch has a center off position the ranges on the switch are low range, high range, mid range. A minor inconvenience that I can live with. When I powered up the rig I noticed that I could get about 2.5 watts in the center of the band, but the power would drop off to about 200 mW on the ends. I pondered this problem for a couple of days and then looked over Bob's mods again. I went down and bought another 51 pF cap from HSC and a FT37-61 core from Quad A's (75 cents). I wound 12 turns of #26 on the core and replaced L6 and C38 as described. I should also mention that I have 59 turns on L9. Now after retuning C39 I get about 3 watts from 7.000 to 7.130! Thanks to N6KR for designing a great rig. All my friends who see and hear it wish that they were still available. Also thanks to W6CYX and KC6SOC for the mods.

Can't wait for the Sierra. 72 and see you on 40. Jim, N0VAH

A QUICK FIX FOR TWO MINOR NC 40 PROBLEMS

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Walnut Creek, CA 94595

The NorCal 40 is a great little rig, by far the best kit I've ever built, but everything can be improved on. I found two areas of the NC 40 most in need of help, and I know others have addressed these same two items.

First is the front panel which tends to tweak, cause QRN and put stress on the pot connections to the circuit board. Second is that my rig was just crying for an internal keyer. I addressed both problems with one solution.

Probably the best keyer kit on the market comes from Oak Hills Research (616-796-0920 or 616-796-1460). It's a little over priced, but they have great support if you need it, and I guess you get what you pay for. It works better than the factory keyers in my "big rigs". It goes together in about a half hour on a 1.75 X 2.0 inch circuit board which is a perfect fit in the NC 40 once you replace the supplied giant R2 trimmer pot with one of more reasonable size (or find the setting that gives you the keying weight you like and substitute a fixed resistor). One other thing on building the keyer: for a cleaner finished project, install the wire leads (that connect the keyer to the rig) on the bottom side of the board (circuit trace side), and you probably won't need a lead to S1.

I say it's a perfect fit because in my mounting method, the OHR board becomes the stiffener for the front panel. It goes between the front panel and the left standoff (behind Q1, see fig.1), and the front panel becomes as rigid as the back. You'll need 4.25" of aluminum angle (3/4 x 3/4 x 1/16, mill finish, available from any good hardware store or home center - see fig.2). You'll also need two 3/4" aluminum standoffs, or you could cut, drill & tap the one that's already in the NC 40, but it's hardly worth the effort. Get them with the same thread as the ones on the rig (#6-32) and you won't have a problem finding a matching cover screw. Any electronics store should have them, I got mine at Al Lasher Electronics in Berkeley. Pacific Valley Electronics has them too. You'll need a couple little screws, and matching nuts if you don't have a tap for cutting threads in the aluminum angle. Simple tools will suffice: hacksaw, electric drill (drill press makes it a little easier) and a couple of small files.

Take the front panel off the rig and measure up from the top surface of the circuit board to the center line of the pots. Scribe a line this same distance up one leg of the angle, and use the front panel as a template to mark the hole centers. Drill the holes to match the front panel and if you did it right you will now have a shelf exactly 3/4" off the circuit board that will fit behind the front panel over the top of the pots. One minor problem, before you can install it you will need a few clearance cutouts in the shelf to clear the air variable cap, the tops of the pots and part of the traces on the OHR keyer board. These are easily done with the hacksaw, drill & files.

You don't have to make the shelf full width either, but it makes a nice mount for any future add on board. Actually, you could almost install a complete second deck inside the NC 40. Back to the project. Lets put it together. Remove the left 1.5" standoff from the rig (behind Q1) and replace it with one of the 3/4" standoffs. Trim off the other 3/4' standoff the thickness of the OHR board, and mount the board between the two standoffs. Use a shim washer between the OHR board and the upper standoff if necessary to get the total standoff height the same as the original (1.5"). I mounted mine with the corner near R11

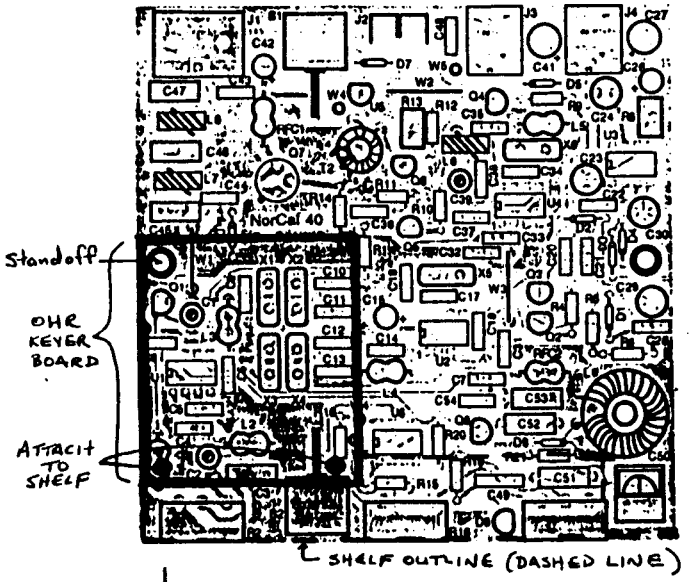


fig. 1

NorCal 40 Rev. B, 9-8-93
W. Burdick, N6KR
Component Side View 1:1

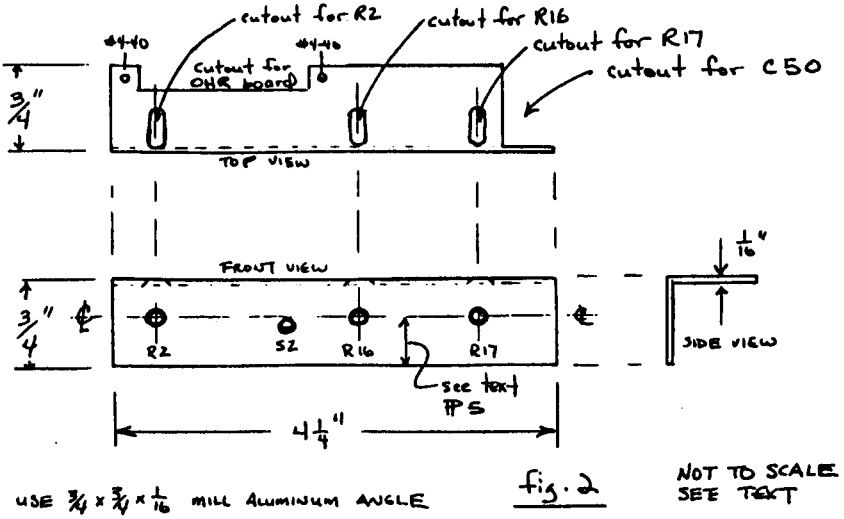


fig. 2

NOT TO SCALE SEE TEXT

between the standoffs so I would have maximum room to get a screwdriver into R2 (the keying weight adjustment). Now use the OHR board to mark the shelf for the two holes that will be used to attach the other end of the keyer. I drilled and tapped them so no nuts would be needed, but there's room for nuts if you don't have a tap (#4-40 is a good size). You now have the keyer supported at three corners, and that's all you need. Once every-

thing is tightened back down it's all nice and rigid The nuts that hold the front panel on the pots do a super job of holding the shelf and front panel together, and it's all neat and sanitary. Route the wires (dot, dash, R12 speed control, xmtr and +12 from the under side of the OHR board around the left side and under the NC 40 board. Resist the temptation to get +12 from the front end of W4 on top of the NC 40 board (which appears to be in a perfect location). You can get +12 from W4, but get it from the rear end on the bottom side of the NC 40. From here on it depends on how and where you want to install the speed control, and how you want to connect the paddle.

I replaced the OHR supplied speed control (R12) with a smaller pot and located it 3/4" directly above the phones jack. They give you a large audio taper pot, but I used a linear taper and it works fine. I installed a small DPDT switch next to it directly above the NC 40s key jack, and wired it so that in one position the jack (which is already a stereo jack, it just has one contact that doesn't go anyplace) works with an iambic paddle, and in the other position the key jack works with a straight key (or lets the paddle become a straight key which gives you the tune function of S1 on the keyer in case you have a tuner).

You'll have to make a minor modification to the NC 40 circuit to do it this way. You could also install a second jack instead of the switch and have one wired for the paddle and the other for the straight key. A lot of this is personal choice, and that's what makes it so much fun.

One other thing I did to make for easier future disassembly was to take a 12 pin molex connector (WMF-3906PRT), cut it in half the long way (so it becomes a very thin 6 pin molex connector) and install it in line with the wires running under the NC-40 board. Now the two boards can be easily and completely separated (This is why I didn't drop straight down to pick up +12 off W4.). The keyer could even be moved easily to other rigs. That's it. It works great, looks great, and best of all it was a lot of fun and very satisfying. Feel free to call me if you have any questions (510-944-1420), and please call me if you hear KC6EIJ/QRP on the air. - 73 SK

Building the NorCal 40 "Homebrew"

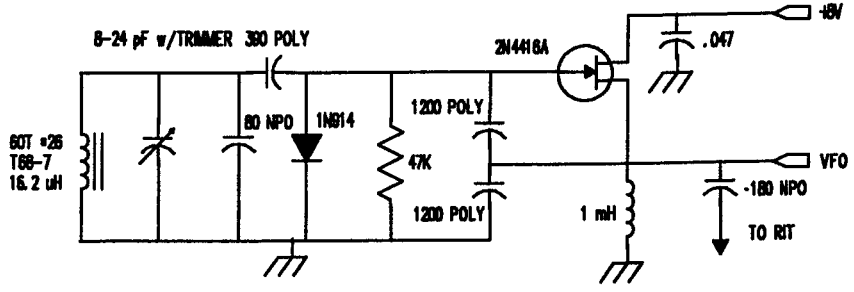
by Dave Anthony, W5NOE
145 Milentz Street
Columbus, TX 78934

Last winter Fred Bonavita, W5QJM, introduced me to the NorCal Club and QRPp. I was much impressed with what the club was doing. The NorCal 40 project intrigued me too. So, with the schematic, I set out to scratch build one. The result has been a fun project and a little rig which is a delight to use.

The circuit design was changed only to use air variable tuning instead of the varactor diode. For 25 or 30 years I had been promising myself that I would put to use a jewel of a silver plated differential capacitor that had cost me a whole buck back then. (I wonder how many North Texas readers recall the much-lamented Collins Radio surplus shack in Dallas?) My circuit board design must have been adequate as I was able to use sockets with the NE602s without instability. My only problem arose with the MPF102 AGC/MUTE circuit. Even after substituting 2N3819s and 2N4416s from the junk box the no-signal AF output was still very low. Increasing the resistance at R6 as suggested in March QRPp brought the AF levels up nicely but AGC action on strong signals was poor. The solution for me, was 2N3824s with 1.0 uF at C29 and 8.2 M at R6. The 2N3824 is a more remote cutoff device screened from the 2N3823 production line. Unfortunately, I doube if they are available these days. Beware the NTE "equivalent" as it's the same as for the 2N3823. As shown in the schematic, the unit tunes

2105 - 2145 KHz which translates to 7020-7060 KHz.

The unit went into one of my favorite TenTec Constructo Series enclosures, 6" x 2.5" x 5". That gave enough room to include a keyer and AC power supply components (except for wall plug in transformer.) The rig is a joy to operate and my hat is off to Wayne Burdick, N6KR, for such an innovative design. I look forward to his next NorCal project. 72 es GL, Dave, W5NOE



Schematic of Capacitor Tuned NC40 VFO

Simple Resonant Audio Filtering

by James L. Kretzschmar, N4HCJ
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Fairfield, CA 94533

A couple of years ago I read a short article in QST about resonant pipes/speakersused to enhance the copying of CW. foregoing the mathematical calculations I decided to tinker with the concept and was very impressed with how one particular frequency would seem to jump out leaving all other frequencies behind..... a filtering effect.

A heavy cardboard tube or plastic pipe (PVC) can be used for the pipe, and a speaker is epoxied to one end. Tune a CW signal and at some point you will hear a significant increase in the amplitude of the signal. Also vary the distance from the table to the open end of the tube until you find the best sound. Support the tube at this distance with nails glued to the sides of the tube. My resonant pipe is a 13" x 2" (inside diameter) heavy cardboard tube with a small speaker glued to one end supported by nails 3" off the table. This one resonates at approximately 780 Hz. A nice addition for your home station.

The NW 8020 Transceiver

by Roy Gresson, W6EMT
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Bellevue, WA 98005 Phone: 206-747-6810

At long last I have completed the transceiver that I have been promising myself that I would design. If you look at the schematic, you've seen it before, but with subtle little differences. (Rick Littlefield started the whole thing and deserves recognition. The name comes from the fact that this rig may be put on any band from 80 through 20 meters, the builder selects the band and changes a few key components. The band table in this article does not contain information for 80 meters, that will be a subject of a later article.

The features of the 8020 are:

* May be built for 80, 40, 30, & 20 Meters

* Superhet receiver with crystal filter
* No relays, quiet operation
* Full QSK
* Drives a 5" speaker
* RIT
* 5 Watts adjustable to 0 (can be from the front panel)
* Sidetone built in
* Optional meter circuit for transmit
* Optional Active Filter
* Optional AGC with "S" meter

The AGC is audio derived AGC, and although mine is different than some of the others like MFJ, it still thumps, and that bothers me. I use a manual RF gain control on the bread boarded version that works fine for the few times the strong guy down the street comes on with his KW.

The optional meter circuit is unusual in that it is used as an alignment tuning indicator during assembly and test.

The active filter option is the usual 8 pin dip op amp vanilla flavor type that has worked so well in the past. But I've made a few optional changes to it too! By changing some resistor values, the center frequency can be changed. Some of us (many) like a somewhat lower tone than 700 Hz. Also, the gain can be changed to where a weak barely perceptable signal is Q5. There is some ringing, but to me it's not a problem.

The crystal filter is not as sharp as some competitive units, but that is just a matter of capacitor values. I felt that the receiver was much more pleasant to listen to with my choice of capacitor values. Band width? Heck, I don't know. Sharper than my Icom in normal CW mode. Guess I need some better equipment to do some measuring.

One of my tests is to put a "T" connector in the coax and feed the transceiver and my Icom720A at the same time. [Editor's note: Be sure to NOT transmit with this arrangement or you will do some serious damage!] This is very enlightening. The ICOM is always just a wee bit better, (expected) in receiver sensitivity. Just barely, BUT..... from certain types of noise, the Icom suffers, while the 8020 transceiver makes good copy. I can't explain this. Perhaps a newer Icom would be better.

I think the bottom line is that the 8020 transceiver is a pleasure to operate. It is quiet, no relay clicks. When calling a station, my keyed signal sounds just like the one I'm receiveing. Very smooth transition. The other outstanding feature is the assembly. I've tried to make it simple, straightforward, check things off as you go. You will test each completed section, which helps in trouble shooting. There are very few toroids to wind, as the design tises IF transformers where possible for better repeat-ability. The PCB is not crowded. And yes, there are wires. To me, when controls or connectors are board mounted, it somewhat limits the individual to his choice of panel layouts.

ASSEMBLY AND TESTING

You will find this kit much easier than most, because we'll use a method of assembly that will eliminate many of the frustrations.

Check your tools and equipment. Radio Shack carries a good selection of soldering irons, (use a 15 watt iron), soldering aids, plus desoldering aids. No matter how much experience you may have, there is always a need to remove a part. For test equipment you will need:

*Volt-ohmmeter
*Calibrated station receiver or transceiver
*Wattmeter
*50 ohm dummy load

*Short clip leads from Radio Shack

And these would be nice.....but not necessary.

*RF Signal Generator

*Oscilloscope

*Frequency Counter

*Capacitance Meter

For hand tools I find that good wire cutters and needle nose pliers are what I use mostly.

Read the instructions completely. Do an inventory of parts to make everything is there. An old egg carton or muffin pan for separating the parts while doing the inventory is helpful. If you find something missing or wrong, you'll need to get a replacement part right away. Note, save the leads cut from parts after soldering.

If you are ready, let's begin.....

Since winding toroids are what most of us dislike to do, let's do them first and get them out of the way.

******Note: improper toroid preparation is one of the "gotcha's". This is usually from a no-connection connection.....from not properly stripping the varnish insulation. There are several ways to do the job, scraping, using sandpaper, burning the varnish off then sanding. Something that is by far the best is common household paint and varnish remover. Use a toothpick to spread the stuff on the wire to strip, wait several minutes and wip clean with a kleenex. Repeat if necessary. The result is bright copper ready for tinning.

Winding Toroids

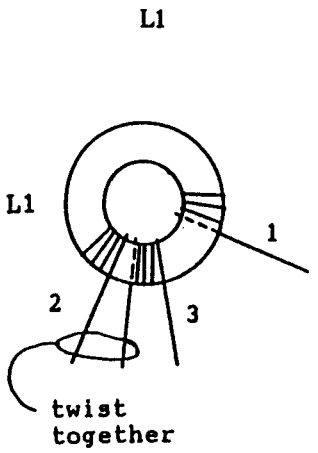


Fig. 1

Use the yellow T-37-6 core, and wind with the number of turns for the specified band using the small #30 wire with a tap 4 turns from the ground end. If the band table says 48T/4, that means there are 48 turns total, with a tap 4 turns from the ground end, 60T/4 would be 60 turns total, with a tap 4 turns from the ground end. At best, this is not easy. Wind all but the remaining 4 turns. Trim the remaining wire leaving about 1 inch on L1. From the wire just trimmed off, cut a piece about 5" long, and strip about 1" of the varnish from it and the 1" from the end of L1. Twist these two ends together, remembering that the wires must go through a PCB hole. Solder lightly. Wind the remaining 4 turns on L1. Trim the wires at the start and finish stripping the wires as before. Set L1 aside for now.

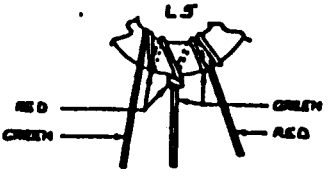


Fig. 2

Twist together two 14" lengths of the #26 wire to about 8 turns per inch. Wind 7 turns on the black FT50-43 core evenly spaced for the 80,40,30 meter bands, or for 20 meters wind 5 turns on the small black FT37-61 core. Trim the wire ends to 3/4", untwist, and strip off the varnish close to the core. With an ohmmeter, find one wire on the start and finish of the winding where no continuity is shown. By connecting the remaining wire ends you should obseve continuity. Prepare as shown.

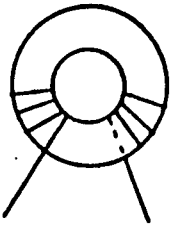


Fig. 3

L6, L7 - Per the band table, wind turns evenly on the red T37-2 cores and strip the ends as above.

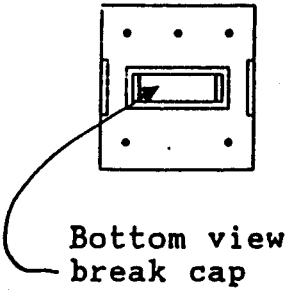


Fig. 4

T1 through T5. The transformers are modified per the Band Table by removing the internal capacitor if required. The cap is located on the bottom of the transformer and is easily removed or disabled just by breaking it, it is thin ceramic.

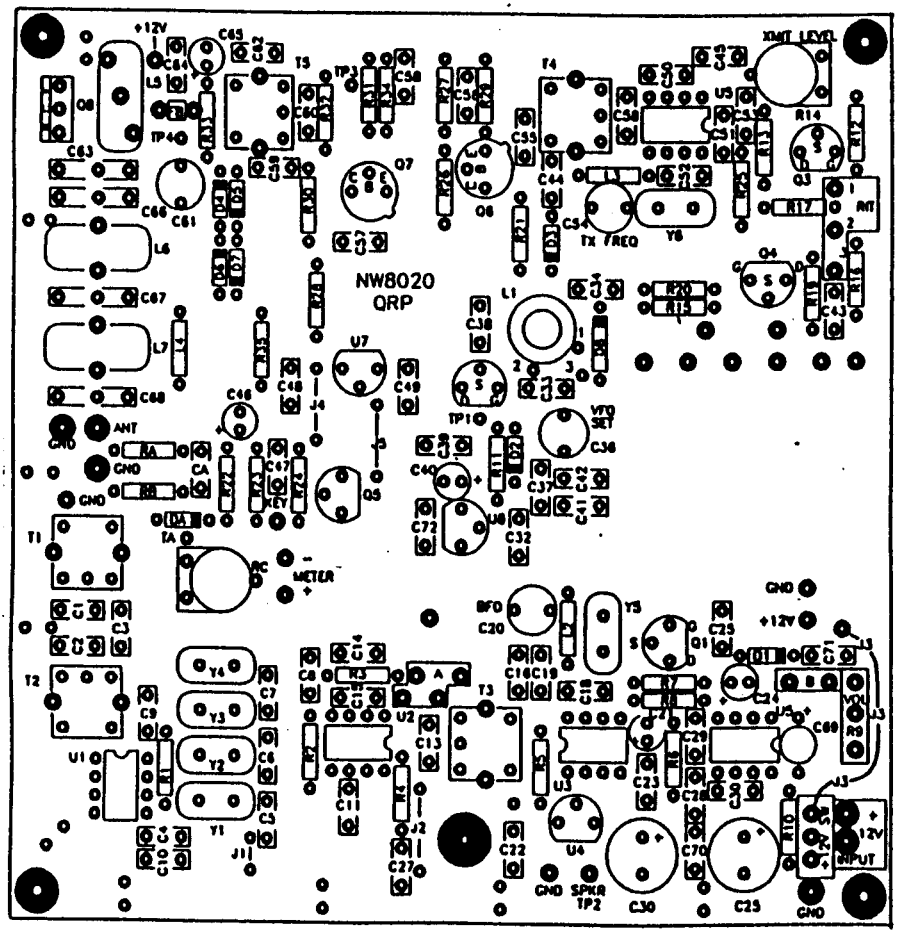


Fig. 5 Parts Placement Overlay

We have now completed the hard part, and the fun is about to begin. Refer to Fig. 5, the parts placement diagram as you begin to stuff the parts.

We will build the VFO section first.

Install the following:

Q2	2N5486
D2	1N4148 or 1N914
R11	1 meg resistor, brown, black, green
C33	5pF NPO ceramic capacitor
C41	NPO ceramic capacitor from Band Table
C42	NPO ceramic capacitor from Band Table
C37	NPO ceramic capacitor from Band Table
C38	22pF NPO ceramic capacitor
C36	30 pF Trimmer capacitor, yellow
C39 .	1uF ceramic or mylar capacitor
C32	5 pF NPO ceramic capacitor
C72	.1uF ceramic or mylar capacitor
C40	10uF electrolytic capacitor, observe polarity
L1	The tap wires got to hole 2, end to 3, top to 1. Do not glue L1 down.
U6	78L05 voltage regulator, observe polarity.

C35 Main tuning capacitor. Cut two 2" lengths of hookup wire and remove 1/4" of insulation from each end. connect the frame of the capacitor to one of the 6 ground pads, and the stator part of the cap to one of two pads as indicated in Fig. 6.

J3 Use a 2" length of insulated wire, strip 1/4" from each end. Connect as indicated.

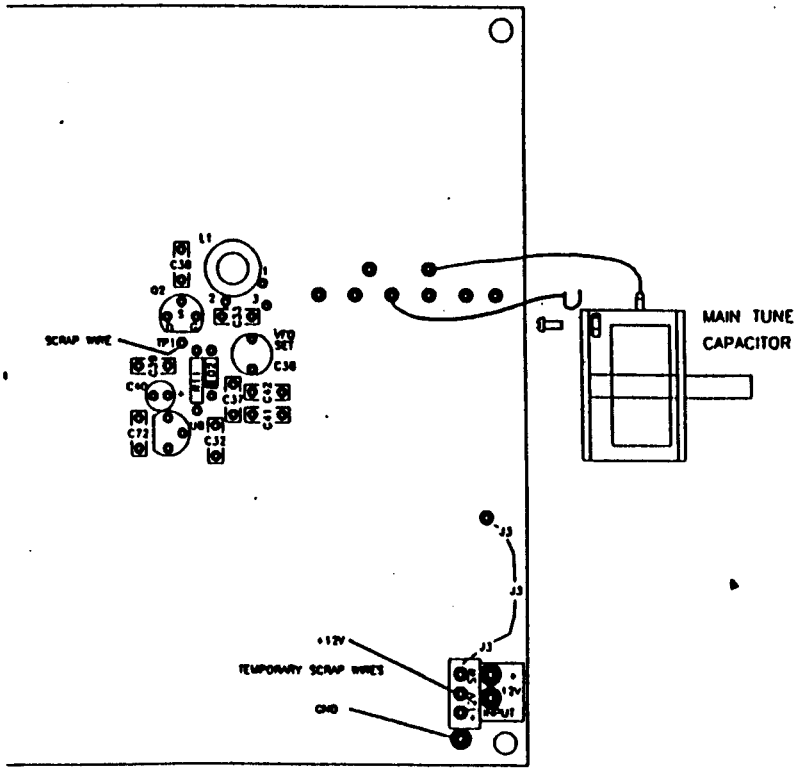


Fig. 6

Using scrap wire pieces, solder short temporary connections to the "+12V SW" and "GND" points. Connect a frequency counter to Q2 source TP1. Set C36 (yellow trimmer) to midrange. Apply +12V to the "+12V SW" connection and ground. Observe the frequency to be within the range as specified on the Band Table, and varies as C35 (Main Tune) is adjusted. If a counter is unavailable, listen for the VFO on a receiver tuned to the approximate frequency. A test lead clipped on the source of Q2, TP1 may be necessary for a louder signal. If the frequency is too far removed from the range specified, adjustment of L1 will be necessary by squeezing or spreading the turns. It usually doesn't take too much to move the frequency. It is only necessary to to et the frequency in the "ball park", fine adjustments will come later. The frequency counter or clip lead will pull the VFO frequency some, so super accuracy is not important at this time. If a problem occurs, check for soldershorts, bad connections, parts in wrong place, or backwards. Measure +5V DC on the drain of Q2. Measure +12V DC on the input side of U6. Check for proper instal-

lation of L1, and that polarity of D2 is correct. If it all checks out, proceed to the next stage.

KEYING CIRCUIT

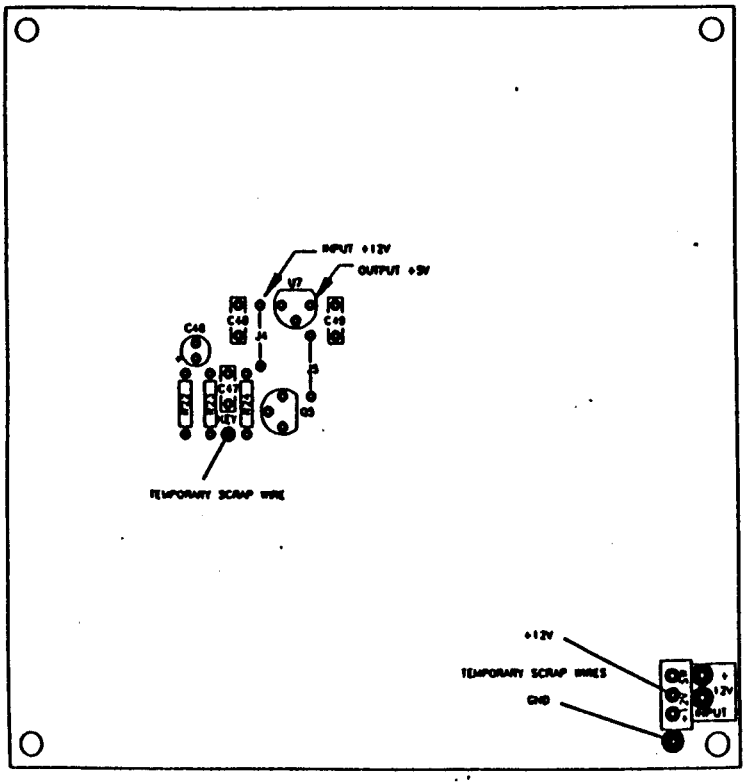


Fig. 7

R22	4.7K resistor (yellow-violet-red)
R23	1K resistor (brown-black-red)
R24	1.5K resistor (brown-green-red)
C47	.1uF ceramic or mylar
C48	.1uF ceramic or mylar
C49	.1uF ceramic or mylar
Q5	2N3906 PNP transistor
U7	78L05 voltage regulator, observe polarity
J4,5	Use scrap component leads

Temporarily solder a scrap wire to the "Key" point. Connect a voltmeter to the input side of U7, apply 12V, the meter should be zero. With a clip lead to ground, touch the other end to the "Key" point, and observe the +12V on the meter. Move the VOM to the output side of U7. Ground the Key point again and read +5V on the meter. If a problem occurs, check as you did on the VFO. If all is OK, proceed.

RIT CIRCUIT

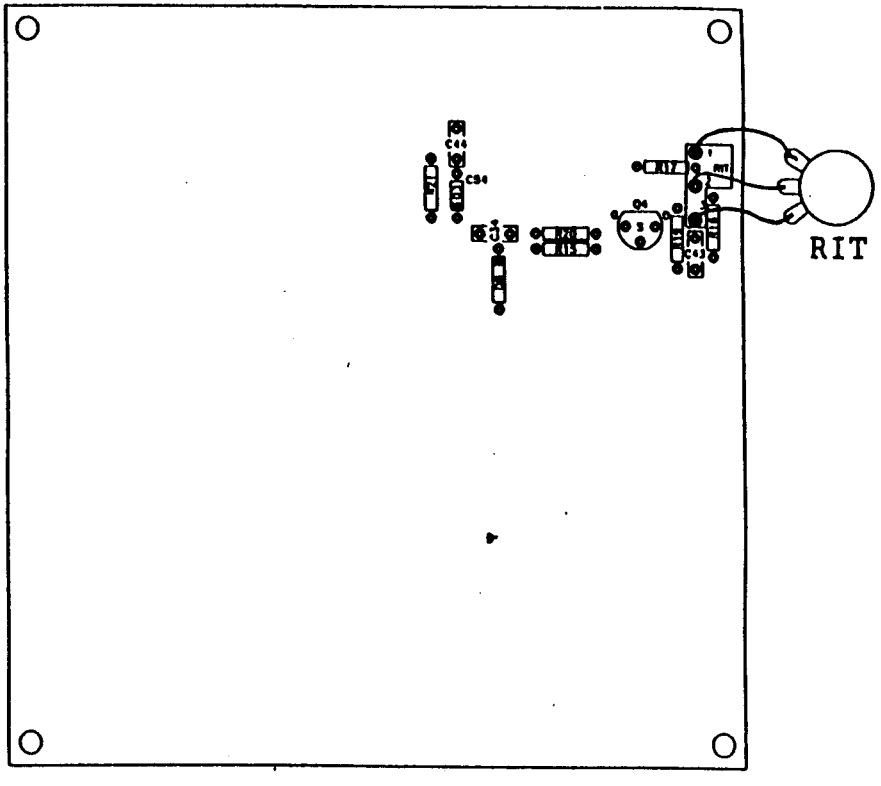


Fig. 8

C34	12pF NPO ceramic
C43	.001uF ceramic or mylar
C44	.1uF ceramic or mylar
R15	100K resistor (brown-black-yellow)
R16	47K resistor (yellow-violet-orange)
R17	10K resistor (brown-black-orange)
R19	10K resistor (brown-black-orange)
R20	47K resistor (yellow-violet-orange)
R21	1K resistor (brown-black-red)
R35	1K resistor (brown-black-red)
D3	1N914 or 1N4148 Diode
Q4	2N5486 transistor
R18	10K RIT control, solder short wires from the RIT control to the points on the PCB marked RIT.

Connect frequency counter to the VFO, or monitor on a receiver as in the VFO assembly. Apply 12V and observe the VFO frequency. Adjust R18 (the RIT) and note the frequency change. Set the RIT to midrange and note the frequency. Move RIT to full CCW, and note frequency. With a cliplead, ground "KEY" point and note the frequency change to the RIT's midrange setting. If a problem occurs, trouble shoot as you did in the VFO. When it all checks out, remove R18 (it will be reinstalled later) and proceed to the

next step.

AUDIO AMPLIFIER

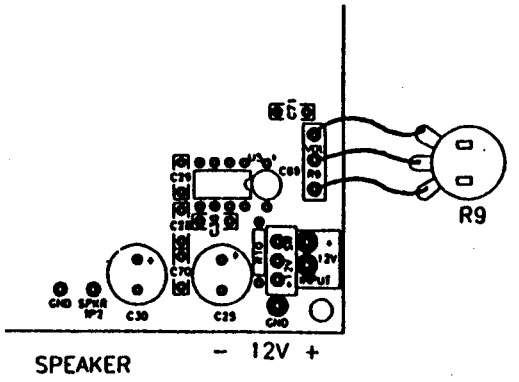


Fig. 9

C26, 17	220uF electrolytic, observe polarity
C28, 29, 30, 71	.1uF ceramic or mylar
R10	10 ohm resistor (black-brown-black)
U5	LM386 audio amplifier
R9	10K volume control. Connect to points on PCB as shown.

Temporarily solder scrap wires into the SPKR and GND points. Connect a speaker or phones to these points temporarily with clip leads. If you have an audio generator, inject a 700Hz signal at the top of the pot R9. Adjusting the pot will vary the volume. Lacking an audio generator, touch the pot connections with your finger, you should hear a hum.

RECEIVER

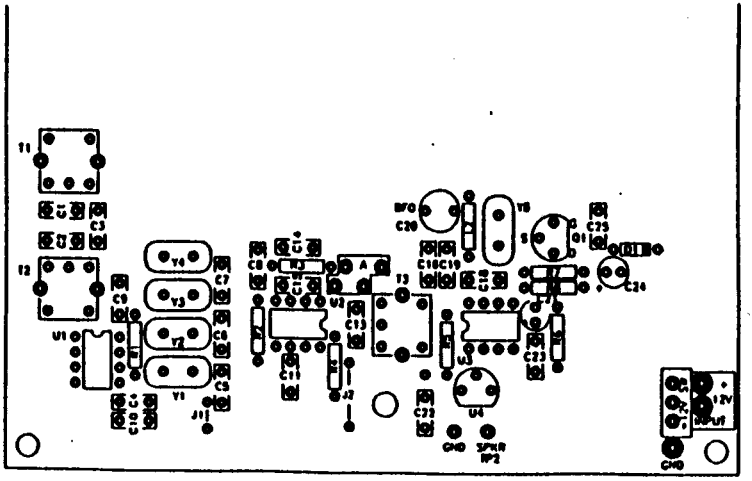
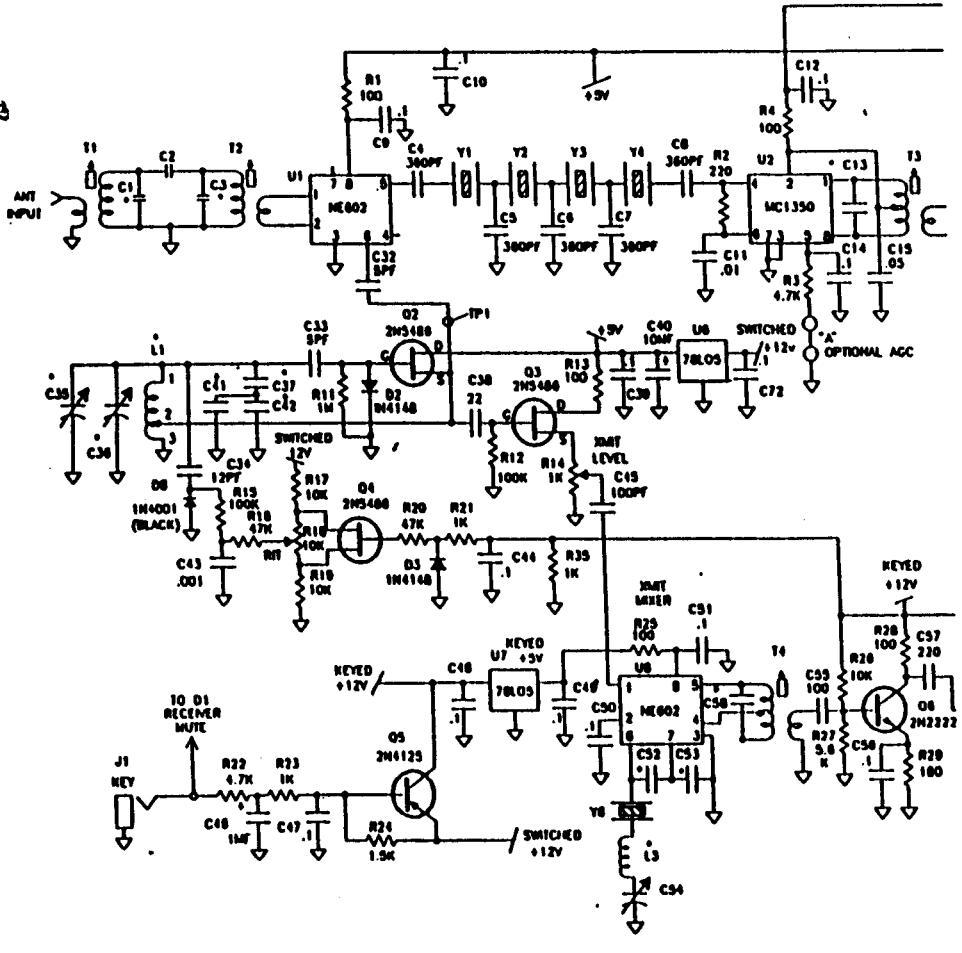
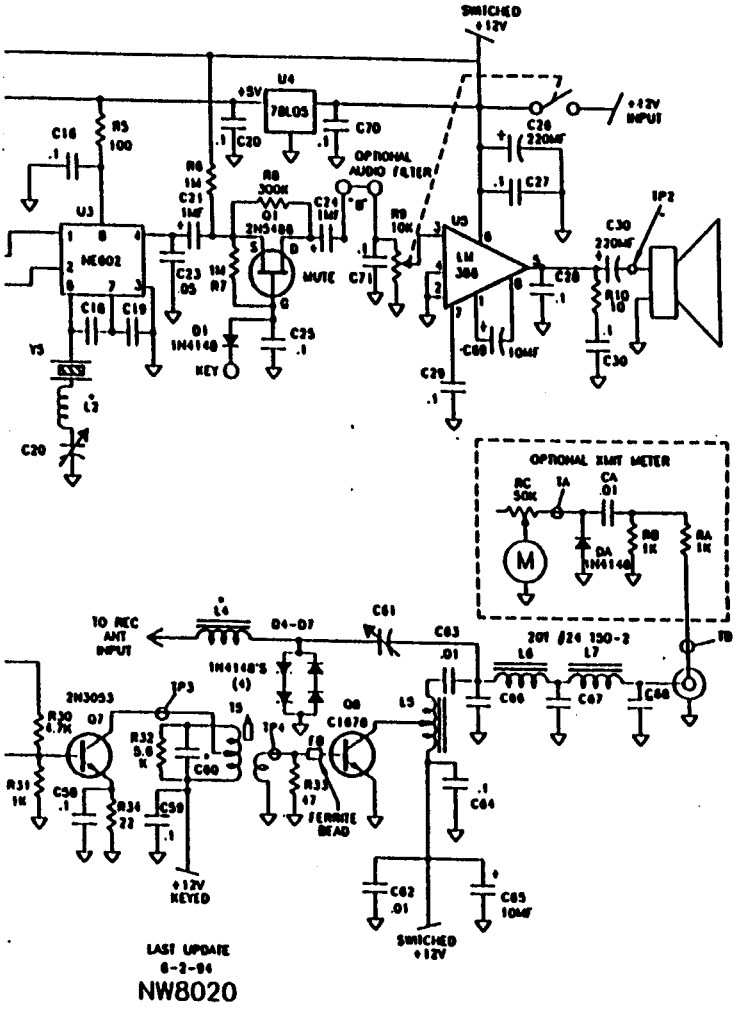


Fig. 10

C1,2	From Band Table, select proper capacitor
C3	5pF NPO ceramic capacitor
C4, 5, 6, 7, 8	360pF ceramic or mylar
C11	.01uF ceramic or mylar
C9, 10,12, 14, 16, 22, 25, 27	.1uF ceramic or mylar



8020 Schematic



8020 Schematic

C15, 23	.05uF ceramic or mylar
C18,19	47pF ceramic or mylar
C20	50pF trimmer
C21, 24	1uF electrolytic, observe polarity
C13	From Band Table, select proper capacitor
Y1, 5	Crystal from Band Table
T1, 2	Modify per Band Table
T3	Modify per Band Table
U1	NE602 observe pin 1 location
U2	MC1350 observe pin 1 location
U3	NE602 observe pin 1 location is different from other IC's
R1, 4, 5, 13	100 ohm resistor (brown-black-brown)
R2	220 ohm resistor (red-red-brown)
R3	4.7K resistor (yellow-violet-red)
R6, 7	1Meg resistor (brown-black-green)
R8	300K resistor (orange-black-yellow)
L2	Select proper value from Band Table
L4	Select proper value from Band Table
U4	78L05 voltage regulator
D1	1N914 or 1N4148 Diode
Q1	2N5486 FET transistor

Since almost the whole receiver was just assembled, very carefully check for solder bridges, bad connections, parts in proper places, etc. With a VOM, measure the +12V input to ground, for shorts, it should be no less than 15 ohms. Connect the speaker or phones as in the AF test. Set the volume control to midrange, set C36 to midrange. Apply 12V as in the other tests. You should hear receiver hiss in the speaker, and no smoke. Adjust the slug in T2 for a peak in the noise. If an RF signal generator is available, connect to receiver end of L4, set to the proper range and tune across the band until you hear the signal. It may be out of the band at this point. If the signal is on the high side, squeeze the turns of L1 together slightly. If the signal is on the low side, spread the turns slightly. Ideally, try to get the sisgnal as close to the QRP frequency as possible. Fine adjustments will be made with C36 later. Connect an antenna to the receiver end of L4 and if the band is open, find a readable signal and peak T1 and T2.

Note: If you chose the meter option when you ordered your kit, install:

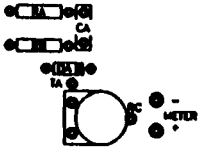


Fig. 11

RA,B	1K resistors (brown-black-red)
CA	.01uF ceramic or mylar capacitor
DA	1N4148 or 1N914 Diode
RC	50K potentiometer
TA	Solder a scrap component lead to test point

Temporarily connect the meter to the + and - pads near the pot. connect a clip lead on test point TA near diode DA, to the speaker output. Tune in a steady signal or the signal

generator, and peak T1 and T2 for max meter reading. It may be necessary to adjust pot RC for a proper indication. Disconnect the clip lead. If all is ok, proceed.

TRANSMITTER

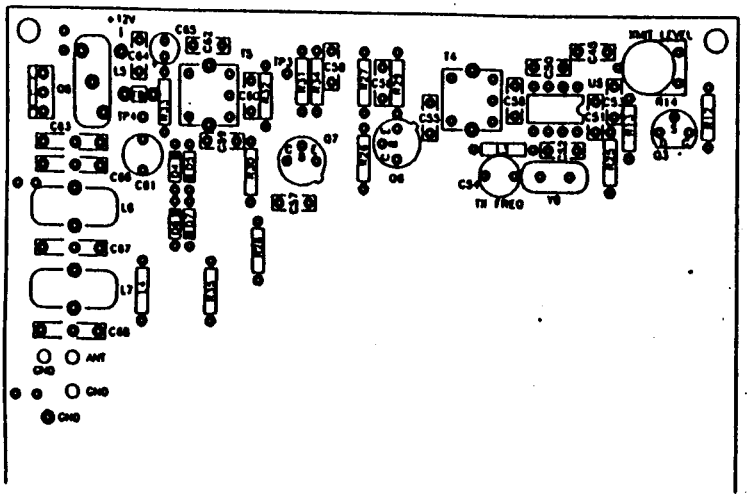


Fig. 12

R12	100K (brown-black-yellow)
R13, 25, 28	100 ohm (brown-black-brown)
R26	10K (brown-black-orange)
R27, 32	5.6K (green-blue-red)
R29	180 ohm (brown-gray-brown)
R30	4.7K (yellow-violet-red)
R31	1K (brown-black-red)
R33	47 ohm (yellow-violet-black)
R34	22 ohm (red-red-black)
R14	2.5K Potentiometer
Ferrite Bead	Insert scrap lead through bead, bend wire and solder as indicated near R33.
C38	22pF NPO ceramic
C45, 55	100pF ceramic
C50, 51, 56, 58, 59, 64	.1uF ceramic or mylar
C52, 53	47pF ceramic or mylar
C57	220pF ceramic or mylar
C60	From Band Table
C54, 61	50pF trimmer
C62	.01uF ceramic
C63	.01/100V ceramic
C65	10uF electrolytic, observe polarity
C66, 67, 68	From Band Table
Y6	From Band Table
L3	Molded Choke, from Band Table
T3, 4	Prepare per Band Table
U8	NE602 observe pin 1 location

D4, 5, 6, 7 1N914 or 1N4148 Diode
Q6 2N2222
Q7 2N3053

Let's test the xmit mixer and driver circuits before proceeding. Connect an RF voltmeter to the junction of R33 and the ferrite bead TP4, or if you have the meter option, connect a clip lead from the antenna output to the R33, bead junction. Be sure Q8, the PA transistor, has not been installed yet! Connect the temporary speaker or phones. Set R14, the transmit level pot, fully clockwise. Connect the 12V power. The receiver should be working as before. Key as during the keying tes, and observe several happenings:.

1 - The receiver mutes,

2 - A tone in the phones or speaker,

3 - A reading on the RF voltmeter. (You may need to adjust pot RC for proper meter reading.) If an RF voltmeter is unavailable the station "S" meter may suffice.

4 - Tune T3 and T4 for max reading on the RF voltmeter.

5 - If no tone was heard in the receiver, adjust C55 for a 600 to 800 Hz tone.

Unkey, and touch the keying lead several times to verify proper keying happenings! Disconnect the RF voltmeter.

CHASSIS WIRING

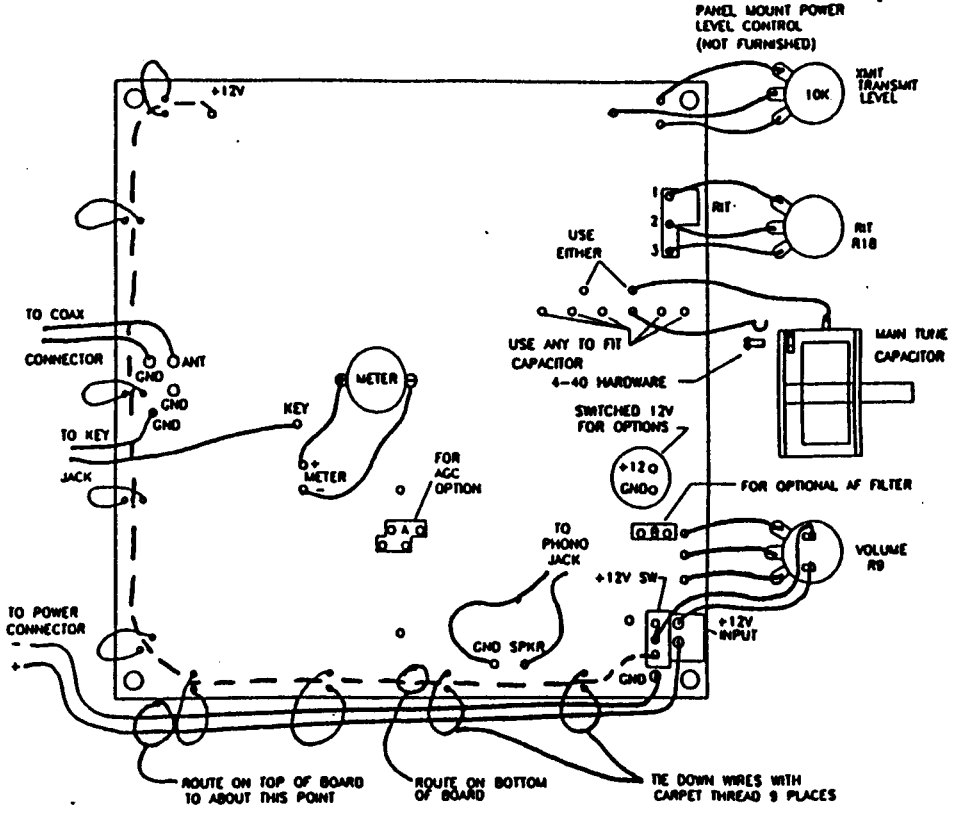


Fig. 13

Cut a 10" length of hookup wire, and remove 1/4" of insulation from each end. This wire will be routed on the bottom of the PCB. Connect oneend of this wire from the "+12V

SW" point near the volume control R9, to the +12V point near L5 as shown.

Cut eight 2" lengths of hookup wire and remove 1/4" of insulation from each end. Use these wires to connect the RIT, R18, the main tune capacitor C35, and the volume control R9.

Cut two 2 1/2" lengths of hookup wire and remove 1/4" of insulation from each end. connect one wire from the "+12V INPUT" point to one side of the switch of R9. connect the other wire from the "+12V SW" point to the other side of the switch on R9.

Cut two 4 1/2" lengths of hookup wire and remove 1/4" of insulation from each end. connect these wires from the "GND" and "SPKR" points to the phone jack.

Cut two 6" lengths of hookup wire and remove 1/4" of insulation from each end. Connect one end of one wire to the "+12V INPUT" point. connect the other ends of these wires to a power input connector of your choice. Be careful to observe polarity.

Cut two 3" lengths of hookup wire and remove 1/4" of insulation from each end. Connect one of these wires to the "KEY" point on the PCB. Connect the other wire to a "GND" point near the rear edge of the PCB. Connect the other ends of these wires to a key connector of your choice.

Cut two 2" lengths of hookup wire and remove 1/4" of insulation from each end. Connect one end of one wire to the "ANT" point on the PCB. connect one end of the other wire to the "GND" point near the "ANT" connection. Connect the other end of these wires to a coax connetor of your choice.

Install L5, the black core toroid with the twisted wire.

Install L6, L7 the small red core toroids.

Install the PA transistor. A 2" x 2" metal or double sided PCB material will suffice for a temporary heat sink. See note on type of PA transistor supplied.

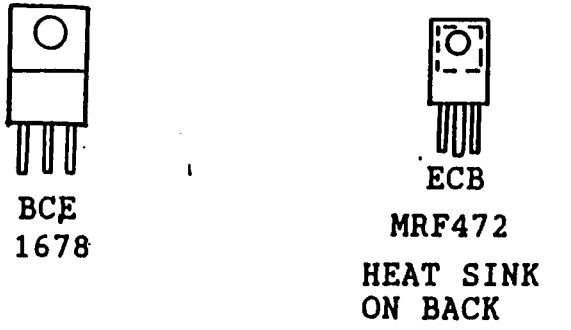


Fig. 14

Set the xmit level control fully counter clockwise. Remember that the heatsink on Q8 will be carrying +12VDC, so keep clear from other objects. Basic assembly should now be completed. So let's give it the final big test. Connect a 50 ohm dummy load and watt meter to the antenna output connections. Connect 12V to the power connector. Turn on the power and observe the normal things happening. Plug in your key and key the transmitter. Observe receiver mute, tone, but nothing on the wattmeter. Slowly turn the RF level pot clockwise until RF appears on the wattmeter, and your meter option. NOTE: you may have to adjust pot RC for proper reading. Repeak T3 and T4 for max reading. If all looks ok, turn R14 fully clockwise. If power out is exceeding 5 watts, back the pot off to the 5 watt level. If 5 watts is not showing, check to see if your 12V supply is delivering at least 12.6V to 13.6V under load.

That should complete the assembly and test of the transceiver. Mount in a case of your choice and all that is left is that first "on the air" contact. So connect an antenna and

have at it!

Parts List

CAPACITORS	
5pF NPO	C3, 32, 33
12pF NPO	C34
22pF NPO	C38
47pF disc	C18, 19, 52, 53
100pF disc	C45, 55
220pF disc	C57
360pF disc	C4,5,6,7,8
30pF trimcap	C36
50pF trimcap	C20, 55, 61
.1uF disc/mylar	C9, 10, 12, 14, 16, 22, 25, 27, 28, 29, 30, 39, 44, 47, 48, 49, 50, 51, 56, 58, 59, 64, 70, 71, 72
.01 disc/mylar	C11, 62
.01/100V disc	C63
.05 disc/mylar	C15, 23
.001 disc/mylar	C43
1uF Elect.	C21, 24, 46
10uF Elect	C40, 65, 69
220uF Elect	C26, 17
RESISTORS (1/4 watt)	
10 ohm	R10
22 ohm	R34
47 ohm	R33
100 ohm	R1, 4, 5, 13, 25, 28
180 ohm	R29
220 ohm	R2
1K	R21, 23, 31, 35
1.5K	R24
4.7K	R3, 22, 30
5.6K	R27, 32
10K	R17, 19, 26
47K	R16, 20
100K	R12, 15
300K	R8
1M	R6, 7, 11
1K Trim Pot	R14
10K Pot	R18
10K Pot w/Switch	R9
SEMICONDUCTORS	
NE602	U1, 3, 8
MC1350	U2
LM386	U5
78L05	U4, 6, 7
2N5486	Q1, 2, 3, 4
2N2222	Q6
2N3906	Q5
2N3053	Q7
C1678 or MRF472	Q8

1N4148	D1, 2, 3, 4, 5, 6, 7
1N4001	D8

OTHER

5 Mouser 421F-128 Green Core 10.7MHz IF's	T1 - 5
1 Ferrite bead	FB
1 Keyjack	J1
1 Finned heatsink for Q7	

BANDS TABLE

Component	40	30	20
C1, 2, 60 disc ceramic	47	22	15
C13 disc ceramic	none	39	15
C34 NPO ceramic	12	22	5
C35 Main Tune	40	40	25
C37 NPO	270	JMP	820
C41 NPO	150	56	470
C42 NPO	470	820	82
C58 Ceramic	50	22	27
C60 disc	50	15	27
C66, 68 disc ceramic 100V	330	270	150
C67 disc ceramci 100V	820	560	330
L1 (T37-6 Yellow) #30 wire	60T/4	48T/4	31T/4
L2 Molded Choke	12uH	18uH	18uH
L3 Molded Choke	12uH	18uH	12uH
L4 Molded Choke	18uH	8.2uH	8.2uH
L5 FT50-43 Black Core	7T bif.	7T bif.	
L5 FT37-61 Black Core			5T bifilar
L6, L7 T37-2 Red Core	18T	13T	11T
Y1-Y6	10MHz	12MHz	9.6MHz
T1, 2, 4, 5	As is	As is	Remove cap
T3	As is	Rem. cap	As is
VFO Range	2.81-3.0	1.85-1.9	4.40-4.48

Parts kits for the 80-20 are available from Dan's Small Parts for $69.95 + $3.75 shipping in US. Canadian orders add $8.00 shipping. All other Foreign orders add 20% for shipping. Dan's Small Parts & Kits, 1935 S. 3rd West #1, Missoula, MT 59801 Phone /Fax 406-543-2872.

Lite Gear for the NorCal 40

by Terry N. Seeno, N6YQD
2354 Cork Circle
Sacramento, CA 95822

The NorCal 40 is small, light weight and designed with hikers and backpackers in mind. But unless you have some "lite" accessories to go with it, you might just as well take your base station rig along and hire a pack mule. This point was sorely driven home the first time I took the NorCal hiking when, about 5 miles into the trip, I realized I was

carrying more than I needed.

The following is, by no means, a bare bones package. There are always ways to cut down the weight. True, you could eliminate the paddles by keying the rig with two bare wires, but that's impractical (we're going "lite", not primative!) Adding a Curtis chip keyer to the NorCal 40 allows more flexability at a small weight penalty. A resonant dipole antenna and coax seems easier to use than a long-wire and is probably lighter in the long run because you don't need a tuner and counterpoise.

Here's the list:

1. The NorCal 40, with a keyer installed, weighs about 15 ounces.
2. The key, whether straight or paddles, presents a problem. If you strap it to your leg, then you should be in the sitting position which is not always possible. Holding the device with one hand while operating with the other is unsatisfactory. To this end, I manufactured a "lite" handkey made from PVC pipe. It's inexpensive, and weighs only 1.5 ounces.
3. A dipole antenna resonant in the frequency range of your NorCal 40 means that you do not need a tuner or counterpoise. It should be tuned realistically, not with both ends 65 feet off the ground. 18 or 20 gauge Teflon coated wire is slippery, light weight, and abrasion resistant. The whole assembly, including the antenna, center connector, insulators, reel and handle weighs 11.5 ounces.
4. Placing a sloping dipole with one end 30 feet in the air is not all that easy. At this height, you need only a minimum of 15 feet of coax. Realistically, you may want to operate in a spot other than directly under the center connector of the antenna. There are a couple of ways to go here. RG-174/U is a spaghetti size, 53 ohm coax that is easily fitted with BNC connectors. Although ideal in size, it is said to be lossy at lengths over 40 feet. A 40 feet length of this coax seems adequate and, with connectors, weighs only 5.5 ounces. Another possibility is RG-58/U coax. It s a larger, more rugged and less lossy. The same configuration for RG-58/U weighs 17 ounces.
5. Battery size depends on how much you plan to operate the rig. Rechargable 1.2 amp/hour gel-cells are handy to use, easy to maintain and inexpensive when purchased at your local ham swap. Weight, however, is about 20.5 ounces. An alternative to the gel-cell is a AA alkaline battery pack. The eight batteries plus the case weigh about 10 ounces. I haven't tried this power source yet, but plan to soon.
6. Folding, 17 ohm headphones are available from Radio Shack for about $15. Radio Shack also has a small splitter which permit two sets to be used at the same time. Using two headphones lowers the impedence to about 8 ohms. A single set of folding headphones, complete with 1/8" stereo plug, weighs less than 1 ounce.
7. There are two hook-up cables for the NorCal 40; a 12 inch power cable for thebattery and a 48 inch cable for the key. These cables weigh less than 1.5 ounces.
8. Miscellaneous items include two 50-foot lengths of 1/8" nylon cord, insulated clips for the battery (I hate it when my backpack catches fire), and a small cloth bag for the entire mess. Weight, about 3 ounces.

Total for the above items run about 59.5 ounces (3.7 pounds).

A "Lite" Handkey

When hiking or backpacking, every ounce counts. Most straight keys and paddles require more space than the NorCal 40 itself and weigh at least as much. My miniature G4ZPY paddles are great, but I don t want to take an expensive, beautiful, and delicate instrument into the field to get beat-up.

Another problem is one of ergonomics. Keys that strap to your leg are fine if you have a place to sit comfortably. The site where you stop to set up a station may not even have a place to sit, let alone a surface on which to operate a key or rest your elbows. The alternative is to hold the device with one hand and operate with the other. For this purpose, I

made a light weight handkey that can be held and operated with one hand. Like paddles, it takes a little practice to get the hang of it but, the advantages outweigh the disadvantages. The entire unit weighs about 1.5 ounces.

I went to Alaska at the end of May to do some hiking and fishing and, naturally, took the NorCal 40 along with me. I stopped during a late afternoon hike to put up the dipole and try to make a contact or two. Fortunately, I had a mosquito hat and some shell style mittens that left little of my body exposed. The mittens were large enough to easily accommodate the small PVC handkey. I was able to operate the "lite" weight key with one hand and use the other to swat, scratch and wave (in case of bears). When I stood still to tune up, mosquitoes (Alaska sized) were all over me in a black cloud. Even if I found a place to sit down, I would have lost the "baggy pants" effect, thus allowing the mosquitoes to drill through.

The key is constructed from a six inch piece of white, thin walled 3/4" PVC sprinkler pipe. It is rugged and the total cost is about $3. The momentary button switches are NKK brand (mfg.. model no. JB-15) purchased from HSC Electronics (they are out of stock, so I'm looking for another source). The wooden screendoor molding used to hold switch/ perfboard assembly in place was serendipitous. Not only was it just laying there in my junk bin, but the edges on one side of the molding are rounded and it fits the tubing quite well.

List of Parts (Metric and English measurements are used):

1- 6" piece of 1/2" thin-wall, Schedule 125 PVC sprinkler pipe
2- 1/2" PVC pipe caps
2- momentary pushbutton switches (10 mm square bases with 7 mm flat buttons)
1- 1/8" stereo jack (3-connector)
1- piece perfboard (1/16" x 1/2" x 2-3/8" with hole spacing .100" x .100"), available at Radio Shack
3- 6" pieces of hookup wire
1- piece of screendoor molding 1/4" x 3/4" x 2-3/8"
1- piece of screendoor molding about 1/4" square, about 2-1/2" long
2 or 3 dabs of 5 minute epoxy to anchor switches and wires

The following instructions are for both left and right hand users; the index finger for dits and the middle finger dahs.

Center one switch at the end of the perfboard. Place the second switch so that the button centers are 3/16" apart. This may be too close for "ham" fisted guys, so consider using the next set of holes. Attach switches to the perfboard with a spot of epoxy or by bending the contacts outward.

Solder the common ground wire to one side of both switches. Next, solder the remaining two wires, one to each switch, to the terminals opposite the ground wires.
You are now ready to attach the stereo jack to these three wires. Cut the wires so that the center of the jack hole is about 3-1/4" from the center of the button switch nearest to it. This will give you some plug clearance when holding the key.

Now comes the difficult part. Two 10 mm square pieces must be cut out of the pipe to accommodate the square switches. Make a pattern with some tracing paper, mark the pipe, and cut the square holes with an Exacto-style blade by repeated scoring of the plastic pipe. This is not as bad as it sounds (besides the pipe is cheap and comes in 10 foot lengths).

This entire perfboard assembly can now be slipped into the PVC pipe. The hole for

the stereo jack will be drilled later. Line up and press the square buttons through the holes until they snap firmly into place. Slide the large piece of molding into the tube behind the perfboard and wedge the 1/4" square piece of molding behind it. This should provide enough pressure against the assembly to anchor the button switches firmly in the holes. Practically anything can be used as a wedge.

Drill a 1/4" hole in the PVC pipe for the stereo jack. In order for the plug to clear your hand while using the key, the hole for the jack should be drilled 90 degrees from the button holes (see diagram). Insert the jack into the hole and secure. Place the pipe caps on the ends, and it's ready for use.

A "Lite" Dipole System

This final contribution to the world of "lite", is a set of instructions on building a 40 meter dipole and a small reel to hold it. I am assuming that you know how to figure the length of a half-wave dipole for the frequency you are using. The emphasis here is on the construction of the insulators and the reel assembly rather than the measurements of the antenna itself.

I've tried to consider the weight of the components versus the serviceability. No sense in having a feather weight antenna system that breaks if a robin decides to rest on it, especially when repairs are not readily available.

Parts List (Metric and English measurements are used):

2- 5" square pieces of 1/8" plywood (hardwood is best)
1- 12" length of 1" doweling (not all of it will be used)
1- 6" length of 1/2" doweling
1- 6" square piece of 1/8" polycarbonate plastic
1- BNC chassis mount connector (3/8" diameter)
1- soldering lug with a 3/8" hole (some of the BNC conductors have a lug already on them)
Enough 18 or 20 gauge wire for your 40 meter frequency, some 5-minute epoxy,spray can varnish, and soldering equipment

Thus far, an 18 or 20 gauge, Teflon coated wire has proven ideal. It is tough, slippery and has some abrasion resistance. At some point during its use, the antenna will get dragged over tree limbs or rocks.

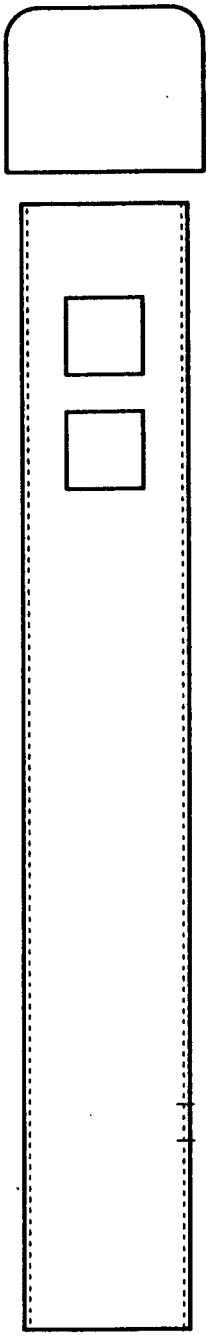
Center and end insulators are made of a 1/8" polycarbonate plastic. This is tough stuff and will hold the strain easily. The small holes are 1/8" and the center hole is 3/8". Tape or glue the templates directly to the paper covering on the plastic. Drill the holes first while the piece of plastic is large enough to hold on to then rough cut out the three pieces and sandpaper the edges to the template lines. Put the BNC connector and lug washer on the center insulator and tighten it down. Bend the end of the lug up a little.

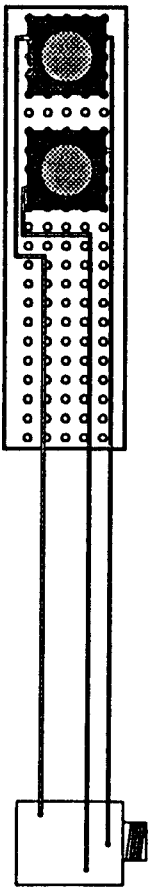
Cut two pieces of dipole wire for your frequency. Be sure to leave a little extra for hook up waste on the center connector. Strip about three or four inches from the end of each of the wires. Thread one wire through a center insulator strain relief hole, leaving about 5/8" of bare wire past the notch in the end of the insulator. Put three or four tight wraps on this bare portion and bend the remainder back towards the lug or center pin of the BNC connector. Repeat the process for the remaining wire and connection. Solder the two wraps and two connections. Connect the end insulators, tune the antenna and solder the connections.

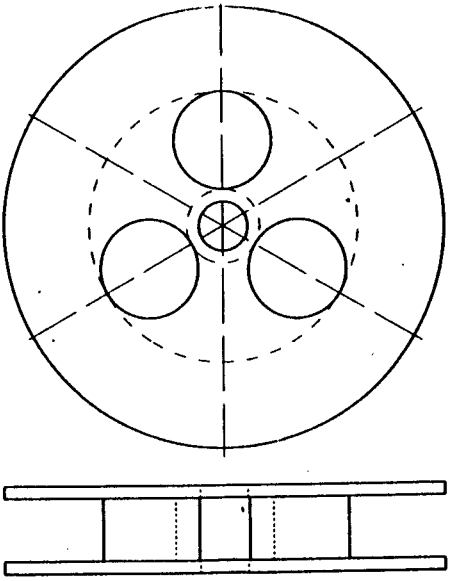
The reel is constructed of two 1/8" hardwood plywood side pieces. The hub is formed from three pieces of 1" doweling, each cut 5/8" in length. Getting the three pieces of doweling equal length and square may be tricky unless you have a miter saw.

When working with the sides of the reel, it is best to cut and drill both pieces together. Tack the two 5" square pieces of 1/8" plywood together temporarily. Using one of the faces of the 5" square as a template, draw four circles: 1/2", 3/4", 2-3/4" and 4-1/2".

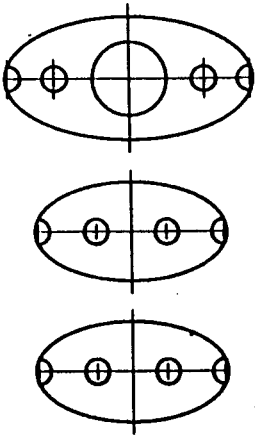
'Lite' Handkey Diagram
(actual size)







'Lite' Antenna Templates
(actual size)



Divide the outer edge of the 4-1/2" circle into six parts (use the compass to scribe the 2-1/4" radius on the circumference of the circle to roughly divide it into six parts) and lightly connect the marks on the opposite edges through the center of the circle.

Cut out the 4-1/2" circles, sand the edges smooth, and drill a 1/2" hole in the center. Separate the two 4-1/2" circles. On the template piece, arrange the three pieces of 1" dowel equal distance from each other using the six equal radials and the edges of the 3/4" and 2-3/4" circles.

Epoxy (don't over-goop) the three pieces of doweling to the inside face of the reel and let dry. Put epoxy on the three dowel stubs and press the other side of the reel evenly against them. Hold on to it firmly and slip the 6" piece of 1/2" reel handle into the center holes of the two sides and align the circle edges against a flat surface. When dry, coat with a spray varnish or polyurthane.

Use the 6" piece of 1/2" doweling as a reel handle. A reel stop can be made from a scrap of 1/8" plastic from the antenna project. Start a hole with a 7/8" circle saw (just enough to get the groove established). Drill the 1/2" hole for the reel handle using the circle saw pilot hole. Finish the cut with the circle saw; use the plug as the reel stop. Slide the plug onto the 1/2" dowel about 1-1/2" from one end and epoxy into place.

Doug suggested that a knob for the reel could be made from some flat-headed 4-40 screws and short spacers. Practically anything will do if it is flush on the inside and does not pull through the plywood.

To wind the antenna onto the reel, slip an end insulators between two of the hub dowels. Place the 1/2" handle through the center holes against the stop and reel it in. The three piece hub allows you to anchor one of the end insulators between two of the dowels when you start the reeling-in process. When you reach the center insulator/BNC connector assembly, slide it loosely to the outside of the reel for about 1/4 turn and continue winding with it on the outside of the reel. When the entire antenna is reeled in, slip the center insulator assembly back onto the center of the reel. If you left enough slack, it will easily slip over the edge. Secure with a fat rubberband

I have some stick on templates for the center and end insulators. Pick them up at the next meeting or send a SASE. Good luck. 72, Terry

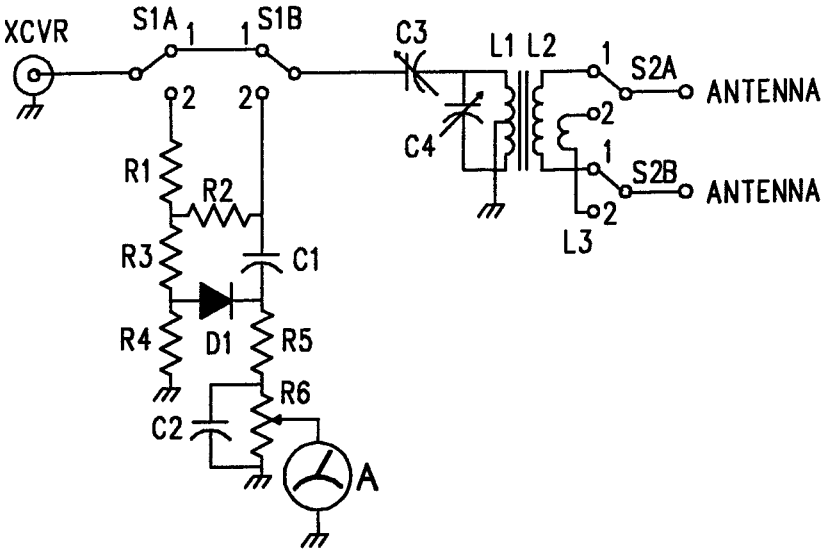
Charlie Tuners's Balanced Line QRP Tuner for 30/40 Meters

by Cam Hartford, N6GA
1959 Rosemount Ave.
Claremont, CA 91711

This tuner was designed by "Charlie Tuner", which is what we call our good friend Charlie Løfgren, W6JJZ, who likes to design antenna tuners. Many of his designs have been in use for years at the Zuni Looper Field Day site. This one is easy to build and as you can see from the schematic, very simple. It features a resistive load so that you will not harm the final during tuning. This tuner is rated for QRP gear. Doug Hendricks, KI6DS, and I located a source for the tuning capacitors, C3 and C4 in Dayton. These are miniature 365 pF broadcast type with mica wafers, but they should work fine at QRP levels. The original used mica compression trimmers which also work well. R1 - R5 should be carbon composition type and not wire wound. R3 always equals R4 and R2 should be approximately 50 ohms. 47 and 51 ohm resistors will work fine.

To adjust the meter level, disconnect the antenna, adjust for full scale at thepower level you are going to use, and forget it. Build the tuner in any small case, and have fun!

BALANCED LINE ANTENNA TUNER



NOTE: S1 POSITION 1 = OPERATE
POSITION 2 = TUNE
S2 POSITION 1 = HIGH IMPEDANCE (300 – 3000)
POSITION 2 = LOW IMPEDANCE (30 – 300)

Parts List

S1, S2,	DPDT Toggle switch
C1	.01 uF disc
C2	.01 uF disc
C3	30 - 260 pF mica trimmer (365 pF Broadcast Variable OK)
C4	15 - 150 pF mica trimmer (365 pF Broadcast Variable OK)
R1	24 ohm/2 watt carbon
R2	50 ohm/2 watt carbon
R3	17 ohm/1 watt carbon
R4	17 ohm/1 watt carbon

R5	4.7K/.25 watt (10K if using 0-200uA meter)
R6	10 or 20K trimmer
L1	14T #22 WIre on FT-114-63
L2	12T #22 Wire interwound with L1
L3	4T #22 Wire interwound with L1 & L2
M1	0-500 uA meter

Note: You may also substitute two 100 ohm/1 watt resistors in parallel for the 50 ohm/2 watt resistor. This tuner may be built in a very small case, and is ideal for back packing. Remember that it is a balanced line tuner, so must be fed with balanced line and not coax!! It is ideal to put in one of the plain NorCal 40 cases, along with other accessories that you might want to have, such as a keyer, battery, digital readout, etc.

TIDBITS

by Mark Cronenwett, KA7ULD
1029 Duncan Ave.
Sunnyvale, Ca 94089

Have any ideas that you would like to share with others? Well here is the place to do just that. Send your ideas to me at the address above, by packet at KA7ULD @ N0ARY.#NOCAL.CA.USA.NA, or by E-mail to mcronenw@pyramid.com via the Internet.

NORCAL 40 TO CASSETE ADAPTER

From: Vic Black, AB6SO

Radio Shack and other suppliers sell a gadget called a CD -to- Cassette Adapter (RS# 12-1951). The adapter looks like an audio cassette with a connecting cable attached. It loads into an audio cassette player just like a tape. It is designed to allow operation of a portable cd player wiht your car stereo amplifier in place of head phones.

I used the $5 discount coupon from my Radio Shack catolog and picked one up (pre-discount price $19.99). The connecting cable plugs right in to the NorCal 40 and allows me to listen to 40 meters mobile via the car sterio amplifier and speakers. The adapter operates head-to-head rather than tape-to-head. In some installations it may be necessary to run the stereo volume a bit higher than for a tape. The adapter expects an input level similar to what you would use when recording, so do not overdrive it. Let the car stereo amplifier do the work.

As a bonus, you can also use the adapter with your VHF/UHF handie-talkie. Since the HT output is monaural and the adapter is stereo, you will need to make or buy a stereo-to-mono adapter to fit your HT. Running the drive volume lower on the HT helps to lengthen the time between charges for your HT battery. Give it a try, it works like a champ
73, DE Vic, AB6SO

K6LV PADDLE UPGRADE

From: Will Webber, KF8XC

If you built a homebrew K6LV paddle and your hacksaw blade is a little flimsy, try using a blade for those demolition reciprocating saws (mine is a Milwaukee all purpose 'sawzall' for a $1.00 at the hardware store). For me, it's stiffness makes for a much better feel.
Will—KF8XC

10:1 DIAL DRIVE FOR YOUR RADIO

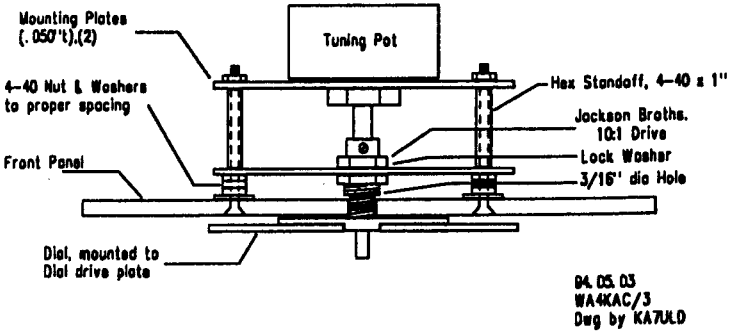
From: Walter Thomas, WA4KAC/3

While waiting for the circuit board and case to construct a NorCal-40 (I wasn't lucky enough to have gotten a club kit), I was thinking about how to mount the tuning potentiometer. I plan to extend the tuning range to cover 7.00 to 7.15 MHz, so a reduction drive seemed appropriate. I'll use a 10:1 Jackson Brothers epicyclic drive (purchased several years ago from Dan's Small Parts) with a 1 or 2 watt potentiometer. Details are shown in the CAD drawing, prepared by Mark, KA7ULD, from the sketch I sent to Jim Cates. The drawing shows a 2W potentiometer, but the idea can be used as well with a capacitor. (I've used a similar scheme to install a 36:1/6:1 dual ratio drive on my HW-8.)

The purpose of the mounting plate nearest the front panel is to space the dial drive assembly back so the dial will be close to the panel and "look nice". Use either aluminum (minimum 0.050 inch thickness) or PCB stock for the mounting plates. I'm using 4-40 washer and nuts to space the first mounting plate behind the front panel. Mounting the drive assembly directly to the front panel would be easier, it you don't mind the dial or pointer sticking out about 1/4 inch in front of the panel. In that case, the large mounting hold needs to be only 0.368 inch diameter (number "U" drill). If you want to have the dial mount plate clear the case, you can use a 13/16 inch hole. This is not indicated on the drawing.

The earlier "easier" method would allow the use of pan head screws instead of the countersunk ones in the drawing if the mounting plate allows the clearance. The stand-off and screw lengths may be different for another installation using different panel and mounting plate thicknesses: use 4-40 washers to obtain the proper spacing. They are available in 0.016, 0.032 and 0.040 inch thickness. I recommend putting a lock washer between the fixed nut on the drive assembly and the mounting plate or panel to prevent rotation: use a thin, inner tooth lock washer from an old 1/4 inch phone jack or a 3/8 inch bushing potentiometer.

Finish the installation with wither a dial or a pointer mounted to the dial drive plate, per the NC-40 manual. You can expect tuning resolution of 6 to 30 khz per turn of the tuning knob, depending on your frequency range and tuning method.



Note: 1) The most important part of this installation is to have the mounting plates parallel to the front panel to prevent binding of the tuning device. Thus, insure the spacer lengths are equal and that they are perpendicular to the panel.

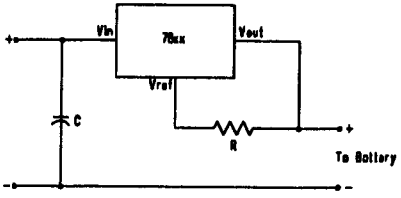
2) My drive has a 5/32 inch input shaft; I used a 1/4 O.D x 5/32 I.D. sleeve to accommodate the 1/4 inch hole in the knob.

72/Walt, WA4KAC/3

SIMPLE NICAD CHARGER

From: epacyna@auratek.com (Edward Pacyna)

You can build a simple NiCd charger with 3 parts (78xx regulator, capacitor and resister).
Wire it as shown below.

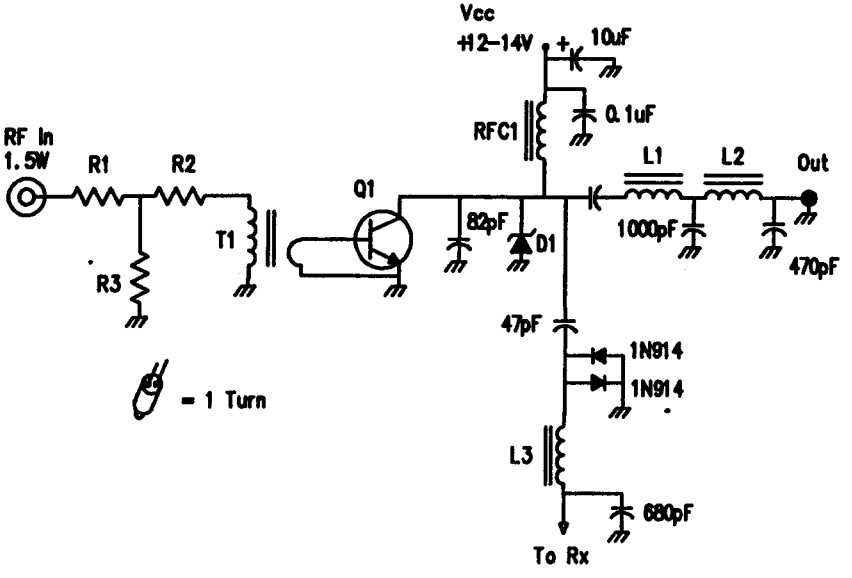


In this configuration, the 78XX regulator is a constant current source. The current to charge a NiCd is typically 10% per hour of its full amp-hour capacity. It will take 12 hours to charge a NiCd on this basis due battery losses.

In your exapmle (A 15V 2A NiCd), use a 7815 regulator and set R to produce a 200mA constant current. R = 15V / .200A = 75 ohms. From I^2 x R, R should be able to handle over 3W. C is a .33uF capacitor. Just connect the above circuit to a DC power source that can provide a couple of volts more than the voltage regulator chosen.
73 Ed W1AAZ

40 Meter Brickette

by Roy Lewallen, W7EL
5470 SW 152 Ave.
Beaverton, OR 97007
[Reprinted with permission from Feb. 1994 Peanut Whistle, St. Louis QRP Society]



R1 = 16 Ohm, 1/2 watt
R2 = 16 Ohm, 1/4 watt
R3 = 68 Ohm, 1/2 watt
T1 = Pri. 3T, Sec. 1T, BLN-43-240Z Core
RFC1 = 25 uH, Not very critical, but if a toroid core is used saturation must be avoided. I used15T on Fair-Rite 5961001103 Toroid core. This is equivalent to two FT50-61 cores stacked together.
L1 = 710 uH 13T on T-44-6
L2 = 1.05uH 19T on T-37-6
L3 = 9-10uH (not very critical). About 12T on FT-50-61 will work
Q1 = GE D42C9 Power Transistor works nicely, and is used in W7EL rig. Several other GE power transistors (e.g., D44C6) and Motorola MRF 475 will work also. The 82pF capacitor between Q1 collector and emitter can be varied to maximize efficiency with other transistor types. R1, R2, and R3 make up a 3dB Pad. It is highly recommended, without it, exciter/final stability problems may occur.

The power output at +12V will be about 8 Watts. This amplifier was designed originally in 1979 and redrawn in 1988. Finally, thanks to Wes Hayward, W7ZOI, for coming up with the name, "Brickette".

Build and Design Your Own SSB Filter

by John Welch, N9JZW
1307 H N. Richmond Rd.
McHenry, IL 60050

Ok, last month I gave a quick run-down on a method for matching crystals and designing crystal filters. You may even have been tempted to try it. Well, have I got a project for you....

I've heard many hams grumbling about the dearth of kits for SSB operation. It's almost as though running QRP or homebuilt meant it *had* to be CW. The problem has been in getting a filter good enough to pass your voice with minimal distortion while chopping off the un-wanted sideband. Nobody seems to carry such filters cheaply anymore.

So who cares about commercial stuff anyway!?! Make your own! I did, and the filter's as good as or better than most commercial units (tho it is a tad bigger). Elsewhere in this QRPp there are supposed to be SSB plans just dying for such a filter...

Having explained the technique I've used to successfully design crystal filters with known, predictable performance, let's embark on a Project - to build a 9MHz SSB filter using some crystal obtained from Hosfelt Electronics (mentioned in the first article).

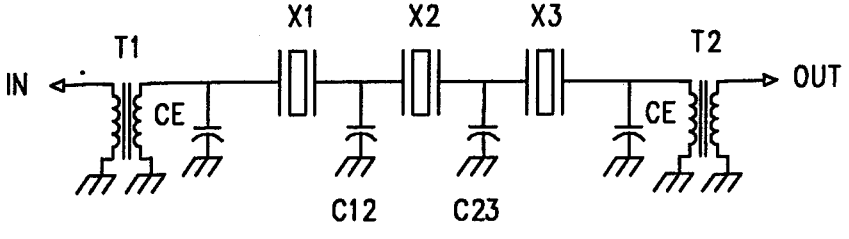
First step was obtaining some crystals. I ordered 40 of them from Hosfelt Electronics (they have 9MHz crystals for $0.69 each. Their phone # is 800-524-6464. Ask for part #23-102, and tell them N9JZW sent you). That turned out to be a large enough sample to get 8 very closely matched crystals. As 40 of them cost about $30, and this will provide you with enough for at least one filter plus probably enough for another 2 or 3 smaller filters, this really isn't all that expensive.

I measured the 40 crystals as explained in the previous article, and found 16 on one frequency (8.995560), and 14 on another (8.995780). Of the first lot, I took the 8 that matched closest for resistance, and found them to be about 12.4 ohms. These also matched well for -3db bandwidth, being 1100 to 1110hz wide at the -3db frequencies (these appear to be very high quality crystals for surplus - usually I've found cheap surplus crystals to be 2000 to 3500 hertz wide).

We want to design a SSB filter that can be used to both receive and generate SSB, so that means as many poles as we can get. The XFILTER program can do a design with up to 8 poles, so let's do that. Feeding in the numbers for an 8-pole Chebychev filter resulted in a minumum impedance of 223 ohms. Since I needed to be higher than this (and I wanted an easy matchto 50 ohms), I chose to use 450 ohms, which is a simple 9:1 step-up from 50 ohms and a 9:1
step up to a MC1350 IF amplifier's output. The program's run looked like this:

N-pole Crystal Filter designer
Enter 1 for Chebychev 0.1db ripple, or 2 for Butterworth? 1
Crystal 3db bandwidth in Hz? 1100
Crystal series resonant frequency in MHz? 8.995827
Crystal resistance in ohms? 12.4
Crystal parallel capacitance (usually near 5)? 5
Filter bandwidth in Hz? 2700
Order of filter? 8
Rend = 222.9539
Enter terminating resistance ? 450
Chebychev Filter, BW = 2700 Hz at 8.995827 MHz, 8 pole, 450 ohm terminations.
Cend = 35
C 1 2 = 73
C 2 3 = 100
C 3 4 = 106
C 4 5 = 108
C 5 6 = 106
C 6 7 = 100
C 7 8 = 73
Cend = 35
Ok

Now comes the solder slinging. The schematic of the filter looks like this:



CE is the end capacitor (Cend from the programrun above), C12 is the cap between crystal 1 and 2, C23 is the cap between crystal 2 and 3 and so forth. The values given for these caps are in picoFarads. The xformers are to bring the source and load impedances to 450 ohms (this *IS* important - if it's not at 450 ohms the filter won't behave well at all, with lots of ripple and poor rejection).

I have a nice multimeter from Radio Shack that also measures capacitance to 1pf

resolution. I used this to get the capacitance as close as possible to the values computed (if you're ordering new parts, order about 10 of each value and take the closest match - I've found silver mica caps at hamfests running 12 for a buck so I stocked up a long time ago...).

So I soldered up the filter, as shown. Since both my source and load needed a 50 ohm termination, I used a 9:1 step up/down at each end, constructed with a 10T primary and a 30T secondary on a FT50-43 core. (note: for terminating when testing with a scope, use the above 50 ohm 9:1 step-down into a 51 ohm resistor to ground. Attatch the scope probe to the 'hot' end of this resistor.)

I hooked the finished filter into my TW-1, attatched a scope (as described above) and tuned till I found the signal maximum. Adjusting this to be 6 divisions on the scope, I tuned up and down to find the upper and lower 3db points (4.2 divisions on the scale). The filter I built had a -3db bandwidth of 2560Hz.

During tuning, I also watched for any change in the signal level within the passband (this is ripple). It changed only about 1/4 of a division or so, meaning very little ripple. I cheated a bit here, and hooked into a Comm analyzer I have lying around, and found the filter to have a whopping 0.4db of ripple, and 3.8db of insertion loss, with a 60:6db shape factor of almost 2:1. Not too shabby for a homebuilt, no-tune filter!

So, I now have a filter capable of both creating and receiving SSB with very low ripple, *very* selectively. Better still, it's at the most common ham frequency around. 5MHz VFOs can often be found at hamfests, and these gems will give you a dual-band 80/20 meter SSB transceiver with just a little more work. (or you can use your TW-1 VFO for an all-band SSB transceiver without too much more work too, but that's another story...)
72, John

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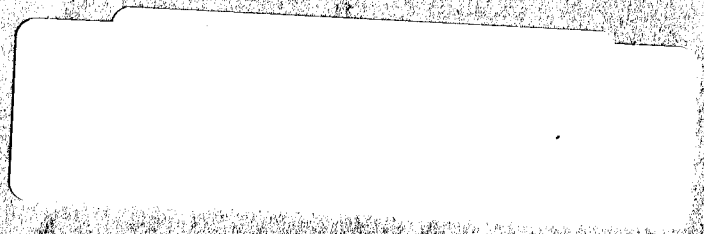
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QRPp

Journal of the Northern California QRP Club
Volume II, Number 4, December 1994

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From The Editor

By Doug Hendricks, KI6DS
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This is the pre-Christmas issue of QRPp and I would like to take a little space and wish all of you a happy holiday season. 1994 has been very good to me, and I hope to you also.

This issue has some exciting articles, including the Sierra description by Wayne Burdick, N6KR, a 5 watt Amp for the Epiphyte, by Derry, VE7QK, two great articles on the R2/T2 transciever that was published in QST, 1994 Field Day reports, QRP Afield reports, a unique way of learning the code by Vic Black, AB6SO, a Sierra Frequency Counter by Jim Pepper, a product reveiw comparison of the NorCal 40 and the NE 40-40 by Rich Arland, K7YHA, a statement of the goals and purposes of the NorCal QRP Club by Jim Cates, WA6GER, and of course, Mark Cronenwett's Tidbits column. I hope that you enjoy it.

Maybe the most exciting news in the issue is the announcement of the NorCal 40A. The club has decided to do another run of the NC40, but in an improved version, called the NorCal 40A. See page 68 for all of the exciting details.

Membership is climbing steadily, as we now have over 900 members!! Many of these came at the ARRL Pacific Division Convention from signups at the QRP booth sponsored by ARCI and manned by several NorCal members. We signed up 76 new NorCal members and 36 ARCI members. The interest in QRP is growing by leaps and bounds. The convention has asked me to find speakers for 2 sessions next year, and yes, they have promised us a larger room. Wayne Burdick, N6KR, spoke on the evolution of the Sierra and there was a standing room only crowd of around 350 in attendance. It was nice to meet so many of the members and to have you in attendance at the QRP Forum. ARCI also sponsored a hospitality room Saturday night that was very well attended.

Jim Cates and I are still planning on the trip to Dayton. The best estimate that I have is that the package will be about $450, including airfare, motel, banquet tickets, hamfest tickets and transportation during the weekend. If you are interested, you must contact me before December 15th. Write me a letter confirming your intentions and we will make plans.

There has been some discussion on the internet and in other QRP journals about the upsurge in local and regional clubs. Is it good or bad? I think that it is good, and the only reason that the local clubs are so successful is that there is a need for them. Does NorCal want to become the National QRP power? Of course not, that is ridiculous. We have a very fine National QRP Club, ARCI, and NorCal supports it 100%. We have put our actions behind our words too. NorCal members staffed the ARCI booth at Pacificon, but ARCI paid the bills. It was a win/win situation for both groups, and that is how I see things happening for the local clubs and the National group. ARCI puts out a fine journal, and they have full permission to reprint anything that appears in QRPp. They know that. NorCal is trying to offer more information to QRPers, information that has not been published in the QRP press before. Jim, Wayne and I are big believers in NorCal, and big believers in QRP ARCI. I hope that you are too!

You will note that the schematic of the Sierra is the foldout in this issue. I am trying a new method of solving an old problem, readibility of schematics in QRPp. Hopefully this will provide the answer. You will have to remove the schematic to read it, but at least it is legible. 72, Doug, KI6DS

A BUILDER'S REVIEW OF THE KK7B R2 RECEIVER

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I am a mix of professional musician, audio nut, and ham radio nut. That gives me special interest in the design being reviewed here: the R2 receiver by Rick Campbell, KK7B, now available in kit form from N8ET at Kanga US.

Though I read my ARRL Handbook and tons of construction articles over my 26 years of hamming, and even serviced broadcast equipment, I never got round to homebrewing more than a few small circuits. That is, until KK7B's first article, "High-Performance Direct Conversion Receivers" in August 1992 QST. My eyes opened wide as I read about the "R1's" claimed audio dynamic range approximating an audio CD player, low audio intermodulation distortion, and high RF dynamic range. This I have to hear, I thought.

Even better: at the end of the article, he referred to a spinoff of his work, the "R2" single-signal direct conversion receiver. Now THIS tripped my trigger! It later appeared in January 1993 QST: "High Performance Single-Signal Direct Conversion Receivers." As I thought, it was a phasing SSB exciter in reverse, implemented with stable modern components. The basic board contained everything from the mixers to the audio amps; it's good for whatever the diode ring mixers will handle (for SBL-1's, 500 kHz to 500 MHz). All you need is a speaker/phones, +7 dBm local oscillator, 90 degree RF phase shift network, input filter, and (for higher bands) RF preamp for a nice clean receiver.

Promises of boards and even kits were made. While waiting for info and courage to begin, I built up a 40 meter VFO and transmitter (my first!) that I used portable with a battery-powered SW receiver. After 3 SASE's were not returned, and word came on Internet newsgroups that even delivery time on boards was slow, I finally decided to roll my own.

My crude circuit board, etched with the pattern ironed on from photocopy paper, worked OK with some knife work and solder tinning! A few hours of assembly, even with a few missing parts. Then the moment of truth: the VFO hooked up to one mixer, jerry-rigged input filter, speaker... PRESTO, a marvelous clean sound on the 40 meter band. A quick spin into the phone band, and the broadcast voices were clean as a whistle. I was transfixed. What a sound, like floating out a window into the ether on a surfboard...

Over the months following, I finished the complete circuit, and worked on other elements of a modular multiband station: filter/phasing boxes for various bands and transistorization of a T-368 exciter to serve as a wideband VFO (an article in itself). As I used the setup at each stage, I never regretted taking the homebrew plunge with this unique circuit.

THE DESIGN

The board begins with a splitter for the RF input into two SBL-1 mixers. You have to provide a splitter and phase shift network outboard for the required 0 and 90 degree local oscillator injection for the mixers.

The mixer IF ports feed a real work of art: two matched, audio-frequency diplexers that correctly terminate the mixers at 50 ohms from DC (the leakage of the VFO) to UHF and higher (the other mixer products, such as the sum of the VFO and input), and pass only the communications audio range of 300-3000 Hz. This is the key to the high dynamic range (third order intercept in the region of +12 dBm). When was the last time you worked with inductors in the range of 3.9 to 27 MILLIhenrys, and metalized polyester film

capacitors in the range of 5 microfarads?

These diplexer components have to be MATCHED in the two mixer channels, or your sideband suppression is not uniform throughout the audio range. This was a stumbling block for me initially, not having measuring equipment for this range and not wanting to shell out money for 5 or 10 each of seven components that cost $2-3 apiece just to find matched pairs. I used simple networks (from W7EL's "Optimized QRP Transceiver") for some time, until N8ET sold me a set of these matched components from his stash for the kits.

These feed a pair of 50-ohm audio preamplifiers with active decoupling transistors, aiding stability and keeping the hum sensitivity remarkably low.

Next is a 90-degree audio phase shift network, implemented with 1 percent metal film resistors, 1 percent polyester film capacitors, and Signetics NE5514 quad op amps. They are summed at an amplitude balance pot/opamp, and passed on to an LC lowpass filter of your choice (or more than one switch-selectable if you wish). Yes, no active filters here — the dynamic range would be limited, says Rick. (I bet there could also be various other distortions you wouldn't want, of the kinds we don't usually think about in communications audio work). Rick's filter designs are remarkably sharp 1 or 3 kHz elliptical filters, and a 4 kHz Butterworth filter for "hi-fi" voice listening. (You can actually get the last with no filter at all — see below.)

The volume control,the only gain control element in the whole rig, comes next. Yes, no AGC — this rig comes only with a "manual transmission". But that's what race car drivers (and sharp radio ops) use, right? It feeds an LM387 low-noise audio preamp, between whose sections is a 300 Hz LC highpass filter. Finally, you get a real hi-fi amplifier, a pair of transistors in complementary symmetry operating class AB. This is responsible for the high current drain he recommends — 100 mA, with a lot of heat on those final transistors. It is also responsible for the cleanness of the audio. Bias is adjustable with a trimpot. I changed a resistor to experiment with lower bias, but found I could go no lower than 50 mA total board current without audible crossover distortion. (You could eliminate the audio power stages for headphone only portable operation, of course).

INTUITIVE PERFORMANCE EVALUATION

How does it perform in my setup? I use a power splitter, and a pi-network phase shift network (one for each band) with the capacitive legs adjustable. With these adjustments and the amplitude balance control in the circuit, I can null the opposite sideband to inaudibility at one audio frequency (his specs are about -40 dB). As you tune around, you do begin to hear the image carrier a little ways away from the frequency at which you nulled it. That's with a pretty strong test signal, and you really have to listen for it. In actual use, on a moderately crowded band, you'd be hard pressed to hear any images under the pile of noise and desired signals. Amazing, and not a crystal filter in sight!

The cleanness of the audio extends to audio intermodulation distortion — a much more intrusive distortion for CW than the usual harmonic distortion specs you see. Rick provided no percentage measurements like the hi-fi magazines, but he did show a spectrograph of two strong CW carriers within the passband, and all noise and IM products were down 62 dB! He compared that with one of the common low-cost direct conversion receivers based on the NE602 and LM386, where IM products were (at best) 34 dB down. You would hear this difference in the sound of a big CW pileup. As Rick said, with the R2 it sounds like music — albeit avant-garde music! You hear pure tones at many frequencies at once, with no grittiness generated by intermodulation between them.

This "sanitary" audio could well account for an interesting phenomenon: for weak signals buried in static crashes, my ears "like" the sound of the R2 better than my Argosy,

even with its nice narrow CW crystal and audio filters. This is all the more remarkable because the audio filtering on the R2 is not quite as tight as you might like for extremely crowded bands: its sharp rolloff at 1 kHz is a little high if you listen at 750 Hz, and its low end rolloff is not very steep at all. Perhaps this pure listenability gives your ears and brain less "garbage" to process, freeing up the resources of your own built-in "cranial/synaptic signal processor" to help you discriminate. Perhaps it shows the limitations (ringing, distortion, or whatever) of crystal IF or opamp audio filters.

In pursuit of a cheap path to better selectivity, I changed the high-pass filter capacitors (.47 uF instead of 1 uF) to give me a higher cutoff frequency suitable for CW. This helps, but the rolloff is still not very sharp. Also, a correspondent on Internet gave me a design for a lowpass filter cutting off at about 850 Hz. I have not tried this yet, but it looks like it has promise.

As a contrast to this pursuit of selectivity: my particular set of brain/ears even likes the sound of this receiver WITHOUT A LOWPASS FILTER! Something about having that bandwidth is pleasant to my ears; on an uncrowded band, it's great to hear a nice signal at 750 Hz, and a nice broadband noise level behind it, with maybe a little peeping signal up around 6 or 7 kHz to add a little spice to the sound. When I ran the unit without the fancy diplexers, I had a reasonably flat response down to 100 Hz and up to 15 kHz or higher, as read on my scope. What an amazing sound! With the diplexers installed, there is less of this presence, but still enough to sound more "wide open" than any other RX you could find — down 20 dB at 10 kHz (still audible to these ears). So to this day I have in my unit the option of switching the 1 kHz filter, the 3 kHz filter, or NO FILTER AT ALL. I also chose to make the highpass filter removable, giving me a remarkably flat bass response for shortwave broadcasters and evaluating the audio of a SSB station.

Other quirks: The units have a relatively high noise figure — 18 to 20 dB. This means you need a preamp for bands above 40 meters. Mine is a little broadband surface mount unit based on the MAR-6 MMIC from "Electronic Rainbow" — 20 dB gain, a 3 dB noise figure. That gain is a little higher than needed, but I have not heard much evidence of overload during our recent "average" propagation. I probably could attenuate the output by 5 dB or so. The preamp is switchable, right at the input to the R2, and after the input bandpass filters.

If you do multiband operation, you have to re-tweak the amplitude balance for each band. There are lots of reasons for this — amplitude variations in the mixers at different frequencies, in your phasing networks, or heaven knows what. I made this convenient by replacing Rick's trimmer with a front panel pot. The differences in null point are relatively small; you can usually get tolerable rejection by just resetting it from memory. If you have time, it's nice to null it on a nice strong signal, but again you have to listen pretty close.

Don't forget that DC receivers CAN directly detect strong nearby AM signals. Rick found AM sensitivity of 2.5 to 3 millivolts at 40 meters. I hear no AM detection on 40 meters in my location, with a 350-foot horizontal loop, no preamp, a 2-section bandpass filter, and a resonant antenna tuner. When my tuner is off resonance, I sometimes hear a tiny bit of a 50 kW AM station 5 miles away! On 20 meters, with the preamp in, I find occasional slight bleedthrough from an extremely strong domestic SW broadcaster in the 22-meter (13.6-13.8 MHz) band. Moral: use the minimum preamp gain and good input selectivity!

Don't forget there is 102 dB of gain at one frequency on this board, which calls for a few precautions. Connect the power supply ground directly to the negative lead of the output power stage. Neglect this, and the miniscule voltage drop through ground from the audio output current appears at the audio preamp! I found that even connecting the speaker

ground lead to this point, and not to a random point on the chassis, reduced my feedback. Speaker leads likewise should be well away from the inductors at the input. I get very little feedback when using headphones; a certain amount at high levels with a speaker. Feedback increases with increasing frequency, probably because I have not done another standard precaution in DC receivers: tight shielding of the VFO! My T-368 is pretty big, and I haven't gotten round to making a shielding enclosure. Even so, I get enough gain before feedback for adequate reception on 15 meters.

A corollary of this is increased microphonic sensitivity as you go higher in frequency. This might be a consequence of my unshielded VFO again, plus the gain of the preamp on the high bands. This microphonic characteristic seems to be associated with my input filter/phasing network boxes that plug into the back of my R2. It could be that I need better isolation between input filter and LO signals, and a few dabs of glue or caulk on my parts!

Finally, those audio inductors are sensitive to magnetic fields. This can be a feedback factor for your speaker; or it can contribute to hum pickup. I heard some hum with a power supply 18 inches away; moving it 2 feet further reduced it significantly.

Is all this worth it? It is for this experimenter. I can receive any frequency I can generate with an oscillator or signal source. With the same receiver, I could go from 160 to 3/4 meters with appropriate filters, preamps, and phasing nets. I get the cleanest audio I have ever experienced. And I get a unique design that's always a conversation piece. Never before have I heard such subtle differences in CW signals: ripple/hum, attack/decay of keying elements, etc. Every QSO counts with this setup.

And YOU now have the privilege of getting the basic board in kit form. Kanga provides the R2 kit for $105 (PC board only for $20); audio filter component sets range from $10 to $14. A "miniR2" is also available for $90, a smaller board with some revisions and headphone-only output. Write KANGA US; Bill Kelsey, N8ET; 3621 Spring Lake Dr. Findlay, OH 45840; telephone 419-423-4604; e-mail n8et@delphi.com. He also markets the T2, a phasing SSB exciter that was described in April 1993 QST. My review focuses on the circuit design as I have experienced it, so I have no firsthand comments on Bill's kits.

John Seboldt, K0JD, began hamming as WN0QXG some 26 years ago. Music, electronics, and ham radio grew side by side in his youth, leading to work in the broadcast industry while studying music at Luther College, Decorah, IA, and The University of Iowa, Iowa City. He now serves as music director at Church of the Annunciation, Minneapolis, and does as much soldering and CW ragchewing as he can.

QRP Expertise from a Beginner

by Dara Ea, N6YJS
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I read the June issue of QRPp yesterday and saw a little article about me. I would like to thank Doug for it. There have been many times that I have sat down and thought about the NorCal 40. It was the first complete project in electronics that I have done. It is amazing what a dummy can do.

My friends and I were at the flea market at Foothill College one day and saw the display of NorCal 40's on the hood of someone's four wheel drive. We stopped and took a look at it. Brian, KK6FJ is an engineer, and I am an engineer follower. I believe all that

they tell me about what something can do and how well it works. It looked simple and cute to me. When we got back home we discussed the little rig some more. I heard a little more about the rig on Bob's, W6CYX, machine. Then Brian, Bob WA7OVU, and I decided to order the thing. At that time I wanted to build it to use mobile since I have always wanted to do mobile cw. I had no idea how the thing would work mobile, but I ordered it anyway. Brian took the iniative to order three kits for all of us. It was a long wait. My patience ran out so I decided to look for a commercial rig. I saw this Kenwood TS50S for sale on Compuserve and decided to call that gentleman to inquire about the rig. After a couple of phone calls, I decided to buy the rig. It took him about a month to ship the rig, but it finally came. I was so happy to be able to go mobile cw and I didn't have to wait on th NorCal rig anymore. This was in November, and things seemed to happen at the same time. The NorCal 40 finally arrived a few weeks later.

I didn't start building it right away because I really didn't know how to approach it. It didn't take Brian and Bob that long to finish theirs and get them up and running. Finally I decided to break open the package. The first thing I saw was a whole bunch of little things and a manual. I hate reading manuals. So, I decided to skip it except for the last two pages where I found the parts layout and parts list. I looked at the parts list and said "How in the world am I going to do this???" There are a lot of numbers and letters on the list and the components but none of them say resistor, capacitor, diode or anything like that. How do I know which is which? I scratched my head and told myself that there was no way that I would be able to get this to work. On the other hand, I also knew that no one was going to build this for me. I was at a dead end, with no solution in sight.

A few days later, I opened the package again and decided to build it. I pulled out my soldering iron and other things that I could think of. I figured the only way that I was going to be able to do this was one component at a time. I started by looking at the list trying to match the number of components on the parts list with the actual number of parts that I had. I did this, because I had no idea what a resistor, capacitor or diode looked like. I started with the big green things. I got all of them and matched them to the pcboard layout. Then the big monster metal cases. What are those things? Who cares? They match the layout. So, I put them in and soldered them to the board. I did this with all of the components that I could. Now it was time for those things with no numbers or letters. I knew that I would have to guess at this point. I looked at C45, C46, and C47. They were all the same, so I looked at the parts until I found only 3 that were the same. Voila, I found those white things and put them in. Things were getting tougher and tougher. Those parts with the color bands around them were left. I knew a little bit about those but didn't know how to tell the color values. The only way I could do it was to find a list of the color code values. Oh, yes, Allen, N6PFL, wrote me some of those things on a piece of paper one time. I knew exactly where they were. After two hours of going through my library, I found the paper. I sat down and tried to figure out which ones had which value. This process took me a while. One at a time, I managed to get all of those resistors on the board. Now come the big resistors with 3 legs. I found a place on the board where they fit perfectly, so I soldered them in. I kept this up until I had finished the board, and I only had one component left. Hmmn, must be an extra! Hope so. All of this work took six and one half hours.

Now it's time to turn it on and see if it works. I expected it to work just like a new radio that I buy from one of those ham radio outlets. I hooked it up to the power supply and turned it on. I tried to listen to it carefully and heard no noise. Nothing at all. I was so disappointed and didn't know what to do. It was time to give up. I came on Bob's machine as usual. Bob asked me how my project was coming along, and I told him that I finished it but it did not work. Bob, W6CYX encouraged me at that point by offering some assis-

tance. He gave me several little hints on things to do. The next afternoon, I hooked up the rig and did the things that Bob suggested. There was a mistake. I didn't bend one of those legs on the resistor like they said in the manual. Of course I didn't read the manual at all except for the last two pages. Now I know why they print manuals. I read about the resistor and did some resoldering.

The big moment had come. I switched the power on and heard some noise. Bob said I should be able to hear some CW signals on the band. I tuned my big rig and heard a lot of CW qsos, but nothing on the NorCal 40. What was wrong now? Oh! the jumpers. I didn't put any jumpers in. I saw something about that in the manual, but didn't understand what it meant. Finally, I got the rig to receive some signals after tweaking it a little bit. Now it is time for me to transmit. Again, nothing on transmit. What is wrong now? I sat down for hours trying to figure out what was wrong now. I went through the parts list and matched them with the layout again and again. It seemed like everything was in place correctly. Oh! yes, I made another mistake. The size of wire on the coil. I didn't put them in the right way like it said in the manual. However, people on the machine said that it shouldn't make any difference. They are right, because those coils are still the same, as they weren't the problem. After three frustrating days, I finally decided to take the rig to Brian and have him look at it.

Brian opened up the rig, hooked up an ohm meter and took some readings. He found one bad solder joint. I would have never been able to figure that one out because I don't know how electricity runs. It took Brian no more than 5 minutes to make the rig work!! Now I was happy.

I then decided to do some modifications on the thing. I made the tuning range go from 7.025 to 7.150, I changed one of the resistors, I worked on the AGC, etc..... I still don't have the AGC working like I want it to. Maybe I have pushed the thing to the limit. Finally, I glued a battery case to the top so I can use 9 AA batteries for power.

I use the NorCal 40 to talk to many people. You can't imagine what kind of signal report and the admiration that I get from them. It was a success. I congratulated myself and then become a member of the NorCal QRP Club. It's a lot of fun. I have been going to the meetings for the last 5 months and have met a lot of nice people there. Doug, KI6DS, knows me well now. Have fun guys and thanks for reading the story of a "beginner".

[Editors Note: This is a unique story that gives Wayne, Jim and I great pleasure. Dara was a ham who had never built anything before, and he was able to build a NorCal 40 and get it working. That was one of our primary goals when we decided to have club projects. We wanted to have projects that beginners could build and get working. As I read Dara's story, I thought back to the first time that I built a project, and it brought back pleasant memories. Yes, I too remember the bewilderment that I faced when I tried to identify parts for the first time.

I admire Dara for his tenacity and problem solving skills. He obviously learned a lot from his experience, and had fun besides. Thank you so much Dara for sharing your story with us. NorCal is very proud that you are one of our members. Doug, KI6DS]

Field Day Antennas

By Rich Arland, K7YHA
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Over the last several years I have used Radio Works antennas at my home QTH and on

Field Days. I have come to depend upon Jim Thompson's creations and have never been disappointed in any of his products. Without a doubt, the best performer out of all the antennas we had erected for FD '94 was the Carolina Windom 160. This huge off-center fed wire dipole antenna (over 284 feet long!) with it's 22 foot vertical radiating coaxial element was the star of the show. The configuration of the CW-160 results in the operator having both a vertical and horizontal radiation pattern from one antenna. Using the CW-160 on SSB was an unforgettable experience. All the phone operators agreed that they had few repeats on exchanges and were able to secure a contact with a DX station with only one or two calls. Propagation was not all that good (Flux: 73, A Index: 0 and K Index: 3) so it had to be the antenna that was doing the superior job. If I had the property space and could erect only one antenna it would be the Radio Works Carolina Windom 160.

The New All Band Super Loop worked very well on the Novice/Tech station. The antenna was very quiet and that was a plus for the operators. This antenna was switched around to the phone and CW stations at various time and performance was outstanding. It was a nice feeling (using only 4 watts on CW) to snag QSO after QSO with only one or, at most,two calls. It was almost like shooting fish in a barrel.

The 40 meter BigSig loop had seen service several times during past Field Days. The first time was in 1988 when I did a 1B Battery entry from a lake in Wyoming County. This antenna was suspended as an inverted delta loop with the feedpoint only 3 feet above the ground. Using my TenTec Argonaut 509 I worked 83 40 meter phone qsos! This antenna works like gang busters.

Our 40 meter VRD (vertical radiating dipole) went out with the QRP Commandos last year (1993) and proved its worth by providing over 200 CW QSOs on 40 meters. Made to sit low to the ground, this standard 40 meter dipole with a 22 foot vertical radiating element and line isolator is a real "live wire". This is the answer to those QRPers who need a smaller antenna that can be erected close to the ground. Face it, we all can't get our antennas several wavelengths in the air. For those of us who need to be concerned with nosy neighbors, restrictive zoning ordinances, or wives who HATE the hobby, the Radio Works VRD series of mono banders might be just the ticket.

The Wyoming Valley QRP Commandos and FD 1994

By Rich Arland, K7YHA
25 Amherst Ave.
Wilkes-Barre, PA 18702

FD '93 found the WVQRPC (all four of us!) in the woods at a local state park working a 2A-Battery all QRP effort. Our efforts yielded a masive 2K points (or thereabouts). We all vowed that FD '94 would be better. Little did I know exactly how much better!

Several of the group started talking FD '94 up just after the first of the year on our local 2 meter simplex frequency. By April, we had a total of 14 people interested in doing an all QRP event! This is an increase of over 350%! I was stunned.

The WVQRPC FD '94 crew consisted of Fran, KA3WTF, Paul, KA3JZS, Jim, N3DCG, Lou, KA3ICD, and myself, K7YHA, all long time QRPers. Add to this: Walt, KB3QW, Joe, WA3WMI, Tom, WB3FYU, Mike, KA1RIX (fellow dittohead). Jenny, KB3ATG, and her husband, Dave, N3PBV and you have quite a little group of people. Several others came by our FD site including: Alice, KA3KMH, Ed, WB3HRU, and Joe, N3IKP.

Our location was provided by the U.S. Navy (courtesy of KA1RIX). We set up at the Naval Reserve Training Center adjacent to the Avoca International Airport. This year we again tried a 2A-Battery entry (all QRP). The CW station consisted of a TenTec Argonaut 509 with an Index Labs QRP Plus transceiver as back up rig. The HF SSB/CW swing

station consisted of a Kenwood TS-130V with a TenTec Argonaut 515 transceiver as back up rig. The satellite/packet/VHF FM station consisted of a Yaesu FT-726R (Mode A). Antennas were procured from Jim Thompson, W4THU, and the Radio Works. We erected the New Super-Loop for 80-10 meters, a Carolina Windom 160 for 160-10 meters, a 40 meter Big-Sig Loop and a 40 meter Vertical Radiating Dipole (VRD). A Cushcraft R-7 vertical furnished an additional HF antenna as well as the RS-10 Mode-A downlink antenna. A diamond dual-band V/UHF vertical for 2 meters and 70 Cms. was the Mode-A uplink antenna and doubled as primary antenna for the VHF FM/packet station. Logging was done on three laptop computers running Dave Pruett's (K8CC) outstanding NA Contest Software.

Our site was 940 feet ASL (yeah, you Zuni-Loopers laugh, go ahead...) providing an unrestricted view of the entire valley, horizon to horizon. This was ideal for the SATCOM station and later packet and VHF FM QSOs.

Field Day kickoff found the QRP Commandos still erecting antennas. What's that adage about "Proper Prior Planning...."? Mike, KA1RIX and Fran, KA3WTF started off on the SSB and CW stations respectively. Paul, KA3JZS and Tom, WB3FYU fired up the Novice/Technician station as soon as they got their loop antenna erected.

Twenty six minutes into FD '94 found me in front of the FT-726 trying to grab a quick SATCOM QSO for our 100 bonus points. Having learned a bitter lesson last year about waiting until the last pass of FD before trying to net a SATCOM QSO, I had vowed that I would be in front of the SATCOM rig on each pass until I had bagged the obligatory QSO. It had been decided that our best bet was to snag a QSO on RS-10 and then reallocate the R-7 vertical back to the HF stations. This would provide the HF operators with more versatility in their antennas.

On the first pass, I heard the RS-10 beacon at 29.357 about 45 seconds prior to the time RealTrak said the bird should break the horizon. This is not all that unusual, given the propagation characteristics of 10 meters. As soon as RS-10 broke local horizon, I started calling "CW FD"! Interestingly, with the bird only one or two degrees above local horizon, I was getting ainto the transponder reasonably well running only 5 watts output from the FT-726. Obviously the extremely low angle of radiation on the Diamond omni antenna worked to my advantage. As RS-10 climbed above 25 degrees, I found that the 2 meter omni was not putting a good signal into the transponder at all. Needless to say, the first pass was a bust. So was the second! As I entered the room and sat down at the FT726R in prparation to try again on the second pass of RS-10, I immediately noticed that someone had stolen my keyer and paddles! After frantically searching the immediate area and not finding them, I resigned myself to try a SSB contact. Using only 5 watts on the 2 meter uplink in SSB mode was a true waste of time. The transponder was extremely crowded and I was unable to get into it reliably.

The next pass found me ironing out problems in one of the HF stations. Finally, about Oh-Dark Thirty on Sunday morning, I made a CW QSO with K1BG on a very low pass (only about 9 degrees maximum elevation). Here the low angle of radiation of the Diamond omni antenna coupled with a similar radiation angle on the R-7, allowed me to snag the necessary SATCOM QSO to ensure our 100 bonus points! My thanks to the SATOPs at K1BG for the privilege of the contact!

With the SATCOM QSO in thebag, I was free to get the packet station on the air for a couple of the other ops. Then it was time for my stint on the CW station, spelling Fran and Joe, WB3WMI, for a while. This was followed by a stretch on the SSB station, slugging it out on 75 meter phone. It is truly amazing what 5 watts of RF will do during Field Day. True, we had our hands full going head-to-head with the QRO types, but all of us enjoyed the time spent in front of the radio honing operating skills and bagging QSOs using flea

power. Both local Wilkes-Barre, PA papers came out to get stories. We made headlines two consecutive days in the local papers! Not bad for PR, huh? Score a big PR coup for the low power dudes.

How did we do? Well, all things being equal, not bad. Our score of 5100 points was over twice that posted in 1993. To make things interesting we collected money for coax and food, and found that we had some money left over. This money was used to buy a NorCal-40 QRP transceiver mini-kit from the NorCal QRP Club, and memberships in the QRP ARCI and the NorCal QRP Clubs. After we took down the antennas and packed up the gear, we drew names for the "prizes". Lou, KA3ICD won the NorCal 40 kit. Since Lou just completed his own home brew 80/40/10 meter SSB/CW QRP rig (designed and built from scratch!), the NorCal 40 went to a good home. Jim, N3DCG won the 500 feet of coax we had purchased. Tom, WB3FYU and Joe, WA3WMI won the one year memberships to the NorCal QRP and QRP ARCI clubs respectively.

Did we have fun? Absolutely! Will we do it again next year? Without a doubt? 72, Rich, K7YHA

Logger Revisited and Revised

By Bruce Milne, WB2QAP

A few years ago, I wrote an article for the QRP Quarterly describing a computer program called "Logger" that I wrote using GW-BASIC, and which was designed to use in the ARCI contests. The program logged stations, checked for duplicate contacts, and printed out a ready to mail log in ARCI format. A year or so later, a few "revisions" were made to the original program which included a database for entering the first name of people worked, etc. Logger has been very well received by the ARCI group, and was recently reviewed in the Quarterly by Jack Coster, WF8X.

I have just completed a major revision of Logger, with the following improvements:

1.) You no longer have to worry about setting the CAPS key on. The computer takes care of it.
2.) An on screen running clock and calendar are displayed at all times.
3.) The program, while written in GW-BASIC, has been compiled using Microsoft Quick Basic and now is distributed as a stand alone EXE file. That means that you no longer have to first load GW-BASIC and then the Logger program. The program also runs faster now.
4.) Instructions are now on the disk in a special instructions menu, which is accessible from the main menu. The "names" data base was deleted from this version.
5.) The bottom of the screen now shows a constantly updated chart of how you are doing in regard to multipliers and points for each band!
6.) A new main menu option (Update multiplier screen) has been added. Selecting this option provides you with a visual display of what multipliers you have worked (or not worked) on each band (North America only.)
7.) On the disk provided, versions of Logger for the Michigan QRP Club contests and the NW QRP club contest are provided.
8.) For those "hackers" out there who like to play with these programs, a copy of the source code in GW-BASIC is provided.

My thanks to all who have written to me expressing their appreciation for this program. Particular thanks go to Harry Maddox, KE8DC, who in conjunction with Ross (Ed) Weston, WA8HQO, made some significant suggestions for ways to improve the pro-

gram.

Copies of "Logger" are available on 3.5" or 5.25" disk. I prefer 3.5" disk format. Send a formatted disk (without the label please) and $2.00 to one of the two following addresses.

Mid April to Mid October:	Bruce Milne 2350 Clark Road Penn Yan, NY 14527
Mid October to Mid April:	Bruce Milne 3701 Baynard Drive Punta Gorda, FL 33950

Please enclose a self addressed mailing label. 72, Bruce.

The Zuni-Loop QRP Mountain Expeditionary Force

By Fred Turpin, K6MDJ
Box 9145, 373 Lookout Lane
Cedarpines Park, CA 92322

Friday night, high atop the 7300 foot Table Mountain in the San Gabriel Mountains of Southern California, the Zuni-Loop QRP Mountain Expeditionary Force were poised and ready for the grand-daddy of all Amateur Radio contest; FIELD DAY 1994!

The Zuni-Loopers, as we've become affectionately known, compensate for our pint-sized power with truly killer wire antenna arrays, the likes of a 20 meter "Six-shooter" for example; that's three phased half wave dipoles, one half wave over three more! Our 40 meter cannon will be a four element "Quagi" ie; a full wave driven diamond loop with half wave inverted "V" reflector and directors up about 80 feet. To our knowledge, this antenna was untried on 40 meters. Eighty meters, our old nemesis would be taken-on with a 700 foot sloaping delta-loop. We get serious about our antennas!

Silence and slumber gradually fell over our pristine mountain top in those wee-hours prior to the contest and little could we know that contesting would be the least of our concerns the following morning!

Dawn broke beautifully in the cool mountains while the California interior cooked in an unusually hot heat-wave. The morning was spent putting final touches to our preparation and then Field Day 94 was underway.

Suddenly, just 45 minutes into the contest, the alarm rang out from our 40 meter site, Fire! An awsome plum of black and orange smoke covered the sky off the eastern end of our 40 meter array. We had often mused about setting the forest ablaze with our milliwatts and 12db arrays - this was not funny.

We quickly accessed and cleared the Table Mountain 2 meter repeater where our "CQ emergency" was answered by an operator in Ridgecrest, California some 70 miles to the north who quickly had us linked with the local State Forestry Service personnel who, ironically was also a Ham. We stood-by when the coordinator advised us that he was diverting a spotter aircraft from the other side of the mountain range where tankers were working another wild fire. Within minutes the aircraft appeared making several circular passes which helped to define the fires perimeter for us - this fire was right in our laps! Moments later our contact came back advising us that the fire was two to three miles from us in rugged terrain and burning out-of-control, that it had already consumed 300 to 500 acres and was moving rapidly towards us being driven by the hot thermal up-drafts from the desert floor far below.

We were advised to prepare to evacuate on a moments notice. Our troops quickly fanned-out notifying other campers who by the week-ends number in the hundreds. The word spread rapidly as other Hams on the mountain for Field Day and monitoring the

repeater, spread the word to other arteries of the campground and then, reluctantly, we began to break-down our Field Day operation. The decision was made to abandon our large wire arrays as they were too labor intensive to take down in a hurry, likewise, several large tents would be the last thing down as time allowed.

The first aerial tanker arrived on scene in less than thirty minutes after our initial report, coming in low over the trees and dropping its load of fire retardant in harms way. This scenario would be repeated over and over throughout the afternoon and by 2:00 PM it appeared that the good guys were winning, at least on the high side of the fire. This was confirmed shortly by campground personnel who reported that the campground and ski lodge were no longer in eminent danger as the fire was now moving around the south eastern side of the slope and away from our location.

Cautiously, our band of die-hards began to recover enough equipment to get back on the air on a limited basis all the while keeping a wary eye on the orange glow throughout the evening and night. The following morning this not to be denied nemesis made another run on our mountain, this time with vengeance - that did it! Antennas came down in record time and everyone made tracks!

The Wrightwood fire as it became known, went on to threaten the mountain community of Wrightwood and would consume thirteen homes and some 3000 plus acres before finally being contained two days later.

Ultimately everyone and everything got off the mountain safely but not without the indelible memory and teaching of Field Day 1994. The root purpose of public service are still alive and well in Field Day, especially on the Zuni-Loop of Table Mountain where everyone around knew a little bit more about Amateur Radio and those "radio guys with all that wire".....de K6MDJ

The above story pretty much describes a Field Day disaster, however, when one factors in the numerous learning experiences that this year provided as well as a much slower paced social atmosphere it has to qualify as unique and certainly one of the more memorable of the Zuni-Loop Field Days.

Those attending Field Day 94 were the Ralph Irons family from Bakersfield, Ralph AA6UL, Kim KD6WJK, seven year old Sarah and five year old Carl. Myself and Ralph were the advance party this year with Kim arriving later in the week. Ralph anchored our 40M SSB and 80M CW and SSB effort. Bill Young WF6D and his grandson/prospect eleven year old Chris, visiting from Virginia, held down the 15M SSB operation. Rob Roberts N7FEG from San Bernardino didn't even get unpacked before the fire struck! Rob's scanner proved invaluable.

Keith Clark W6SIY from Ridgecrest and Wayne Burdick N6KR from San Carlos have become a pretty tight CW team and all but carried the Zuni CW attack this year. Clark Turner WA3JPG and Belinda Morrill KC6TKO from Irvine; that's Doctor Morrill now, congratulations Belinda. Clark and Belinda can usually be found operating anything that's idle. All the way from NorCal country was Doug Hendricks KI6DS and of course, Wayne. I apologize to several visiting QRPers who's names and calls were lost in the smoke and flames of the weekends.

Our mission this year was to be a mix of contesting, socializing and ringing-out all the home brew rigs represented; Wayne's personal copy of the NorCal "Sierra" with built-in keyer and metering. An Oak Hills Research "Classic" duel bander, several NorCal 40's including Doug's highly modified digital version and several QRP New England club rings. I regret that I did not get a picture of all the rigs lined up, however I did get a brief opportunity to try them all out and Keith W6SIY the co-NCS of the WSN-40 Net used Doug's "40" to check everyone in on the net.

I had been looking forward to operating the "Sierra" on 40 CW for weeks and believe

me Saturday night was a pleasure. If you've built a "40" just take it out another generation and you'll have the "Sierra". Wayne has filled in the performance voids of the "40" and produced a slick little all-band CW rig that has us all chomping at the bit. For those of you who missed out on the first run of the "Sierra" and providing there is a second opportunity, I suggest that you run, don't walk to your nearest NorCal Sierra store. I'm already compiling a priority list of accessories and options for mine. Word on the grapevine has it that some of the above may be available from NorCal in the future, however, no amount of torture could drag this information out of Doug at Field Day, we could see the resolve in his eyes! After Field Day I went to my top secret source of underground QRP information; Rich Arland K7YHA and he too was hearing rumors of something salubrious coming out of NorCal QRP headquarters.

Speaking of accessories; anything can happen when great minds come together. Keith and Wayne teamed up to solve a mismatch problem when using the "Six-shooter" on 15M. Our team researcher, designed and built the ultimate RF transformer, dubbed the Zuni-Loop Agrinomic RF transformation device. Our duo ripped a dead branch off a wood-be redwood and wound it with a hank of wire that was going nowhere in Keith's engine compartment. Adjustment consisted of moving the coils over the numerous worm holes which Keith assured me, became RF highways, they did get a 1:1!

Had the fire not put a damper on our performance, the antennas surely would have. Unlike in the past when just about everything we've put up worked fine, this year the worm turned! Even our old reliable W6SKQ "ZL Special" was lethargic even though we were experiencing the lowest "A" index in months. It turned out that unbeknownst to us, old Bob had rebuilt the antenna and had hard-wired the 180 degree roll in the phasing line so when we installed it and physically rolled it as we had in the past, we effectively neutralized it! I'll bet Bob is still chuckling at us.

Our 700 foot sloping delta loop on 80M proved far inferior to Doug's "Skeleton Cone", rivaling our 1988 full wave square loop on 80M. Both of these loops were worse than poor and both of them were horizontal loops! We know from experience here that vertical loops work quite well on 40M. Perhaps therein lays the answer.

The 40M "Quagi" was a personal let-down for me but not really a surprise as I had a gut feeling that something was not right with the antenna right from the start. This was confirmed Friday evening when I worked two Hawaiian stations off the back of the beam, which was unprecedented. After Field Day I re-measured everything and found the reflector to be one foot short, or just about resonant with the driven loop and was probably acting more like a director than a reflector. The "Quagi" although unique has all the qualities to be the superior antenna; the quietness and ground independence of a loop and the gain of a yagi.

For 6M we had three phased half wave dipoles which were hung behind the 40M reflector and firing North/South which was perfect for California. We made 6 contacts with a Mizuho MX6 at one watt on SSB and then the fire came!

This was the first year that I've taken our 17 foot travel trailer to Field Day and I suspect it might be the last. If the fire had continued its course towards us and cut off the only road on and off the mountain, the only way out would have been a fire road which my 4W/PU can handle, but not pulling a trailer. The trailer would have to be abandoned! That was a sobering thought.

So, for next year I'm sorta thinking "total mobility". I would like to do a QRP Field Day with an emphasis on compactness and light weight; Field Day in a backpack! Everything needed to participate in the contest and contained in a backpack. Yup! zip it open and you're on the air, zip it up and you're out of there. That's me next year, Mr. Mobility.....de K6MDJ

The NorCal Sierra

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

Well, we actually did it: NorCal designed, prototyped, kitted and shipped a multi-band QRP transceiver—the Sierra. To those who mortgaged a major chunk of their summer and fall to this project, thanks—let's relax for a few months!

This article is mostly for the benefit of those who didn't build the Sierra. It is derived from the Sierra manual, covering the design history and circuit details.

History

Since I built my first multiband rig, the Safari-4 (QEX, Oct-Dec 1990), I've wanted to design an efficient multiband rig that could be more easily duplicated. The Safari-4 was a 4-band rig that used a 4-pole bandswitch with 12 small coax cables snaking their way over to a stack of transverter boards. Hooking up all that coax took me days, and was clearly not the right way to go!

I tried various electrical bandswitching schemes, each with its drawbacks. PIN diodes require way too much current when switching any amount of power, especially at 40 meters and below. Relays are too big and power hungry, and latching relays are too expensive. Multi-hump band-pass filters and those tuned with varactor diodes require tedious alignment.

I had thought about using plug-in modules many times. In discussing this idea with Doug and Bob, the compatibility of this technique with portable QRP operation became clear: no unreliable bandswitch, no current-hungry switching diodes or relays, and no temperamental filters. With this insight, we began sketching out the Sierra design.

Features

If you're new to NorCal and completely in the dark about the Sierra, this list of features will get you caught up (you might also want to borrow one and try it out; let us know what you think):

- uses band modules—bring just the bands needed for an outing
- low receive-mode current drain of around 35mA for long battery life
- pre-mixed design features a low VFO frequency of about 3MHz
- one of the smallest and lightest all-band transceivers available
- an .060" aluminum case you could park a Trooper on
- reliable single-board construction with almost no chassis wiring
- extra space on front and back panels for customization
- quick-release latches on top cover for easy interior access
- gold-plated, redundant contact fingers on band modules for reliability

The club is offering 80, 40, 30, 20, and 15 meter band modules as complete kits. A couple of us have also built modules for 160, 17, 12, and 10 meters, so we know it can be done.

Design Overview

Here, we'll take a look at the overall Sierra design, with emphasis on signal sources and how they're derived (refer to the Block Diagram). The nitty-gritty, component-by-component tour comes later in Circuit Details.

The Sierra is a multi-band transceiver; however, since it makes use of band modules,

we can think of it as a single-band transceiver. It has none of the circuitry usually associated with band-changing, such as switching diodes, multi-pole switches, and relays. The block diagram shows what signals are present in the Sierra when it is operating on 40 meters.

Three different kinds of blocks are used in the block diagram. Transmit and Receive blocks are self-explanatory; Common blocks are used on both transmit and receive. Arrows indicate the direction of signal flow, which is mostly left-to-right on receive and right-to-left on transmit. Finally, note that the blocks with asterisks (*) are located on the band module.

Signal frequencies at various points are also shown (in MHz). This block diagram differs from most in that it shows not only the desired signals, but also the images and other undesirable signals. You'll see how the Sierra handles these as we go.

VFO and Pre-Mix Oscillator (PMO)

There are many ways to build a multi-band transceiver. One way is to use direct-conversion (DC), using a multi-pole switch to swap in tuned circuits that place the VFO, receiver input, and transmitter output at the desired operating frequency (e.g., Heath HW-8). At the other end of the spectrum are schemes that use direct digital synthesis (DDS) and "up-conversion" to cover a very wide range with excellent stability.

The Sierra design is a compromise that falls somewhere in the middle. We generate a Pre-Mix Oscillator (PMO) signal that is used to convert each band of interest down to an intermediate frequency (IF) at which good receiver selectivity can be obtained.

To generate the PMO signal, a fixed-range, low-frequency VFO (2.935 to 3.085 MHz) is mixed with a different crystal oscillator frequency on each band. This is where the term "pre-mix" comes from: the injection oscillator for the first receive mixer has been mixed—or frequency shifted—once already.

The Sierra's IF is 4.915 MHz. This may seem like an odd choice, but it solves several design problems: (1) this frequency is low enough to build simple crystal filters adequate for CW use; (2) it is high enough to provide good image rejection; (3) cheap crystals are available for this frequency from many vendors; (4) with an IF that isn't a multiple of 1 MHz, it's easier to build a multi-band receiver without band-edge spurious responses.

—> If you're not convinced about that last point, try inventing a Sierra conversion scheme using 5.000 MHz instead of 4.915. (Don't forget that all mixer stages have outputs at the sum and difference frequencies of each of its inputs and—to some degree—harmonics of those inputs.) At the very least, you'll have a large birdie on top of WWV at 10.000 MHz.

On 40 meters, the crystal oscillator operates at 15.000 MHz, so we'll get two primary outputs when we mix it with the VFO: 11.915 to 12.065 MHz (difference) and 17.935 to 18.085 MHz (sum). The difference output is the one we're after for our PMO signal.

To verify that we need a PMO signal of 11.915 to 12.065 MHz on 40 meters, subtract the desired signal range (7.000 to 7.150 MHz) from the PMO. The result is the IF (4.9150 MHz). This subtraction is the job of the receive mixer, which will be described later.

Note that the VFO tunes "backwards" because we're using the difference output of the PMO mixer. For example, for a dial reading of 7.000 MHz, the VFO is at its highest frequency (3.085 MHz), yielding a PMO signal at 11.915. The VFO tunes this way on all bands, so it isn't a problem.

We've analyzed the Sierra on 40 meters, but Table 1 lists the crystal oscillator and PMO frequencies for all bands. It's instructive to try to derive the PMO range given in the table, especially on 10 and 12 meters where the PMO has to be below the RF range.

Table 1. Crystal Oscillator and PMO frequencies (MHz).

RF Range	Xtal	PMO Range	RX Mixer Formula
1.800-1.950	9.800	6.715-6.865	IF = PMO - RF (USB)
3.500-3.650	11.500	8.415-8.565	IF = PMO - RF (USB)
7.000-7.150	15.000	11.915-12.065	IF = PMO - RF (USB)
10.000-10.150	18.000	14.915-15.065	IF = PMO - RF (USB)
14.000-14.150	22.000	18.915-19.065	IF = PMO - RF (USB)
18.000-18.150	26.000	22.915-23.065	IF = PMO - RF (USB)
21.000-21.150	29.000	25.915-26.065	IF = PMO - RF (USB)
24.800-24.950	22.970	19.885-20.035	IF = RF - PMO (LSB)
28.000-28.150	26.170	23.085-23.235	IF = RF - PMO (LSB)

We should pose the question, "how the heck do you decide what VFO, BFO, IF, etc. to use in a multiband design?" Here are some heuristics that apply to any rig that uses a conversion scheme like the Sierra's:

1. Make a chart showing all of the RF ranges you intend to cover (e.g., 3.500-3.650, 7.000-7.150, etc.). Adding bands or increasing the tuning range will make choosing a birdie-free conversion scheme harder.

2. Make a list of IFs that you're willing to use. Usually this is a short list that includes cheap microprocessor frequencies such as 4.194, 4.915, 5.000, 5.062, 6.553, etc. You'll use the same crystals for both the IF filter and the BFO.

3. If you're computer-savvy, write a program that takes as input the list of RF ranges, possible IFs, and acceptable VFO limits (e.g., somewhere in the range of 2000 to 5000 MHz), then generates as output a list of workable PMO and crystal oscillator choices. You define "workable"; in my case, I had the program calculate where all of the spurious products fell, report what their approximate amplitudes were, and reject combinations that yielded "strong" birdies. You can also factor in image ratio, etc., as criteria for rejection. You can also work this stuff out by hand, but it's a real chore if you consider, say, the first 7 harmonics of all signal sources!

4. Breadboard the chosen IF and BFO, the premix oscillator, and an AF stage. Then use two signal generators: one to simulate the crystal oscillator and one to simulate the VFO, and try out the receiver on each band of interest.

5. If you're building a transceiver, you'll have to build a transmit mixer and bandpass filter (as in the Sierra), and test the transmit strip. At this point it helps to have a spectrum analyzer and a 100 MHz oscilloscope, but you can also check things by ear with a general-coverage receiver.

6. When you find a working scheme, order the needed crystals for the PMO, and build the VFO. With any luck, substituting these for the signal generators will result in a working design. However, PCB layout can radically affect certain spurious signals. Use a lot of ground plane around all signal sources, and low-pass filter the VFO.

Receiver

On receive, we begin at the antenna and go to the right. The block diagram shows "Everything (IN)" because that's what comes in from the antenna: potentially everything from VLF to VHF. In practice, we usually have some kind of resonant antenna and perhaps an antenna tuner. For example, with a 40 meter dipole, you might see a broad range of signals centered around 7MHz, 21MHz, etc. On top of that, really strong broad-

cast stations well outside the desired band will sneak through.

The low-pass filter (LPF) block removes many of the signals above the 40-meter band. The most important signal to remove is the receive mixer's input image; more about that later. The receive band-pass filter (RX BPF) is a fairly narrow-band filter that removes most of the remaining out-of-band signals before they get to the RX mixer.

As mentioned before, the RX mixer subtracts the RF input (7.000 to 7.150) from the PMO (11.915 to 12.065) to produce a difference output at the I.F. (4.915). But there are two complications.

The first problem is that there is another RF input range that could produce a strong output at 4.915MHz: 16.830 to 16.980. This is usually the strongest image. Depending on the mixer and input filtering, there may be images that are derived from the 2nd, 3rd or higher harmonic of the mixer's injection! Without adequate filtering, signals in such ranges would appear as you tuned across the dial. In some receiver designs, an image is placed at a useful frequency so that two ranges can be received with one local oscillator and IF.

The second problem is that the RX Mixer produces a sum output at around 19MHz for each 7MHz-range signal at its input. Fortunately, the crystal filter which follows the RX Mixer does an excellent job of removing the sum component.

The main purpose of the next block—the crystal filter—is to provide IF selectivity. In the Sierra, the filter bandwidth is about 400Hz, centered at approximately 4.915MHz. The exact center frequency isn't important, but the crystals should all be well-matched. For the kit, NorCal does this matching for you.

—> To match the crystals, NorCal uses a simple parallel-resonant oscillator circuit and an accurate frequency counter. This method is adequate for the Sierra because the parallel-resonant frequency is an adequate predictor of the series-resonant frequency for the tolerance we need (+/- 40Hz). Series-resonant matching techniques may do a better job, especially if the tolerance required is tighter.

The IF amp stage has two inputs: the signal from the crystal filter, and a control voltage. In the Sierra, the control voltage is AF-derived, as shown in the block diagram (AGC detector). We'll go into the IF/AGC circuitry in more detail later.

Transmitter

To get the desired transmitter output, we have to do things backwards from the receiver: mix a 4.915 MHz signal with the PMO and take the difference as the operating frequency. For example, if the VFO dial reads "000," this is what's really happening: the VFO signal is at 3.085; this is subtracted from the 15.000 MHz oscillator to yield 11.915; the TX Mixer subtracts 4.9150 from this to give us a difference output at 7.000 MHz and a sum output at 16.830.

Since we don't want the 16.830 MHz signal, we must follow the TX Mixer with yet another band-pass filter (TX BPF). This is especially critical in the Sierra because the buffer, driver, and PA stages are all broad-band. The low-pass filter (LPF) is the last stage in the chain, removing harmonics and attenuating spurious signals generated by all those mixer stages.

There's one other important subtlety to mention. Note that there are two crystal oscillators in the Sierra in the vicinity of 4.915 MHz: the BFO at 4.915700 (approximately), and the TX Mixer oscillator at 4.915000. Because the two differ by some audible amount (in this case 700 Hz), we can monitor the transmitter signal with the receiver, eliminating the need for a separate sidetone oscillator and VFO shift circuit. The other benefit from this is that by listening to the TX monitor pitch, you know exactly what pitch to listen to when answering another station.

To clarify the relationship between these two signal sources and the receive crystal filter, let's suppose that the crystal filter is centered at exactly 4.915000 MHz. If the BFO is at 4.915700, we'll hear a 700 Hz pitch for a received signal in the center of the crystal filter passband. But when we transmit, we'll be right on frequency, because the TX BFO is set for exactly the same frequency as the receive crystal filter—4.915000.

Circuit Details

Here we look at each stage of the Sierra circuitry at the component level, starting on page one of the Schematic and moving left-to-right and top-to-bottom, or thereabouts.

Receiver

C1/L1 form a series-tuned circuit that couples the antenna signal to the receive mixer with very little loss. J5 is the edge connector into which we plug a band module (see note 1 on the schematic). C1/L1 are on the band module, as are T1/C2 and all other components that are shown connected to male pins that plug into J5.

On transmit, Q1 shorts the high-impedance point of C1/L1 to ground, limiting the signal into U2, an NE602, to a few hundred millivolts. R2 is fairly small which improves Q1's limiting action. It is important that Q1 have a low collector capacitance so it won't disrupt the Q of the circuit. A 2N2222 would be much worse than a 2N4124 here; the latter has a collector capacitance of just 2 pF or so. Two other approaches commonly used at this part of the circuit were rejected: (1) back-to-back diodes can cause detection and cross-modulation when signals are very high, such as on 40 meters; (2) a diode bridge requires quite a bit of current to keep signal loss low.

—> An important thing to keep in mind is that the Sierra was optimized for low parts count and low current drain on receive, and hence small size and long battery life. A number of compromises were made to achieve this, sometimes at the cost of higher performance. The best example of this philosophy is the choice of the NE602 as a receive mixer and product detector: you need almost no parts and no current, but it can't handle really big signals. For times like this, there's an RF gain control!

T1/C2 form a parallel tank that provides the balance of the receiver's front-end selectivity. U2 mixes the signal from T1/C2 with the PMO signal to yield an output at the IF, 4.915 MHz.

C73/L10 and C74/L11 are broadly resonant L-networks that transform the output and input impedances of U2 and U5, respectively, to around 300 or 400 ohms to match the crystal filter (X1-X4). Q2 is included in the circuit to provide additional limiting of large signals present on transmit.

U5, the IF amp, is followed by a single-crystal filter, C12/X5/C14, that helps remove wideband noise. Note that the output of U5 is not tuned, and that U5 is running on 8.0 rather than 12.0 volts. Both of these techniques keep the gain of U5 low; in the Sierra, we don't need the full gain that an MC1350 can provide. This minimizes the amount of decoupling required. (For example, the +8V DC is shared by all ICs in the receiver without any isolation resistances, yet the receiver is quite stable.)

+3V DC is borrowed from U5 pin 6 as an intermediate voltage for the RIT comparator (described later). This has no ill-effect on U5, since the input current to the comparator is negligible. Pin 6 is bypassed by C11 because we're using single-ended feed to U5 from the crystal filter.

The product detector, U4, is bypassed with 2.2uF at pin 2. This is a good compromise between AF and RF bypassing that is used elsewhere in the design as well; only one capacitor is needed. C16 trims the BFO frequency, allowing the user to set the receive signal pitch.

C19/C20 couple the product detector output to the AF amp, U3. C18 and C21 are smaller than C19 and C20, and are used to remove all RF from the AF input, as well as to provide a bit of high-AF rolloff. C22 and C25 shunt RF noise to ground to improve U3's stability. After extensive tests, it was determined that the usual 10 to 20 ohm resistor in series with C25 was not necessary; no degradation in any performance parameter was noted.

The AF amp output is DC-coupled to the AGC detector, D1, and AGC buffer, U1. This is possible because both the output of U3 and the no-signal AGC voltage of U5 (when running at 8.0 volts) is 4.0V. The AGC time constant set by R5/C26 is, as others have pointed out, a matter of taste. The time constant is actually much shorter than you'd get by multiplying C26 * R5, because the input impedance of the LM358 comes into play. R6 slows down the charging of C26 on large noise spikes. R7/C76 are need to filter out the last remnant of AF on the AGC signal.

D2 and D4 route a muting signal to U5, and C27 sets the mute delay. D3 is needed to isolate C27 from R7, which would otherwise provide a fast discharge path through U1. R3 forms a voltage divider with R7 to set the no-signal voltage into U5. However, it also sets the discharge time for C27, so it is a compromise.

Transmitter

Q4 (in the upper left-hand corner, page 2 of the schematic) is a DC switch that provides the +8V TX signal. This signal is used for muting and for turning on the transmit mixer and buffer. Note that there is no ON delay for the +8V TX voltage; it is not needed, because the rising edge of the transmit signal is already slowed down by the turn-on delay of the crystal oscillator on the transmit mixer. C42 keeps Q4 turned on long enough to hold the transmit mixer oscillator ON through the entire key-down cycle.

U8 is the transmit mixer. The NE602 oscillator startup time is slower than usual because of L2, which is used to lower the frequency of X7. C38 is used to set the offset between transmit and receive frequencies, and hence the transmit monitor pitch.

C31 couples the transmit mixer output to the band-pass filter, whose components are all on the band module. Q5 follows the band-pass filter, establishing a low impedance to drive Q6.

Q6 is emitter-keyed because of the DC bias relationship between Q5 and Q6; other keying schemes took more parts or caused more distortion of the keying envelope. Recall that the risetime of the transmitted signal is caused by the start-up delay of the transmit 4.915 MHz oscillator; C51 sets the fall time, approximately 1 to 2 milliseconds. D10 must be a shottky diode, because the voltage drop of a standard silicon diode would reduce the gain of Q6.

The driver-to-final coupling transformer, T2, is a compromise. Its 12:3 turns ratio allows operation on all bands from 160-10 meters, with a bit of rolloff on the highest and lowest bands.

The rolloff on the low end occurs because of the small number of turns and the small core size. The rolloff on the high end is caused by inter-winding capacitance, and by the simple fact that the broadband buffer/driver doesn't have quite the "oomph" at 21 MHz and above that it has at lower frequencies. (This tradeoff—operation on 160-10 meters while keeping component count low—was the one of the bigger challenges in designing the Sierra. If you're so inclinced, please experiment with alternatives and send your results to N6KR directly or write something for QRPp.)

The power amp (PA), Q7, is a 2N3553. Many other transistors were tried here, including the MRF237, 2SC799, 2N3866, etc., but the '3553 performs well and is quite inexpensive. The MRF237 may provide a bit higher gain on 21 and 28 MHz, but the gain of all of these transistors varies slightly from unit to unit, so there are no guarantees.

The Sierra is intended to be a 2-watt rig, i.e., at a collector voltage of 13.5 volts and 2 watts out, you get a collector impedance close to 50 ohms. However, the simple buffer/driver stage, coupled with variations in components (particularly how you wind the toroids) results in power outputs ranging from 1 to 3.5 watts. In any case, at these power levels, final amp efficiency is quite good, averaging around 65%.

—> When the first 3 prototypes were built, Bob Warmke, W6CYX discovered that by squeezing the turns of L6 and expanding the turns of L5, he could get five watts or even more output on every band. He also tweaked the components in some of the transmit band-pass filters, where needed, to boost drive. However, his tweaked Sierra has never been put to the spectrum analyzer test, so it is unclear just what effect all of that has had on his signal purity or PA efficiency. Others are welcome to experiment in this area!

A standard 5-element low-pass filter is used (C47/L5/C48/L6/C49—on the band module). Those who want improved harmonic rejection might consider adding two capacitors—one across L5 and one across L6—to obtain nulls at the second and third harmonics. Just be aware that the other components in the filter will have to change to accommodate this; a filter synthesis program would be helpful here.

The RIT circuit is simple but effective: on receive, R17 is switched into the circuit, while on transmit or when RIT is OFF, R16 is used. Comparator U6 makes use of a +3V DC level stolen from the MC1350 to keep component count low. R19 forms a voltage divider with either R16 or R17; this voltage is RF-isolated from D8 by R20.

C77 was added to the RIT circuit to swamp the output capacitance of U6, which otherwise would cause a small amount of frequency shift via R17 even when the RIT was OFF.

The VFO is a conventional series-tuned Colpitts type, except that the reactances are a bit different from usual to get the desired tuning range from the 5-40pF main tuning cap. Because of this, a 2N4416 (or its plastic counterpart, the PN4416) is used, rather than an MPF102, to make suer the VFO starts oscillating reliably. Because of loose manufacturing tolerances (some '4416 drop-outs are labeled as '102s), not all 102's have enough gain to let the VFO start reliably.

R22 and C61 form a lowpass filter ahead of the PMO mixer, U7. U7 is followed by a band-pass filter, all of the components of which are on the band module. Also on the band module is X8 and the associated frequency set trimmer, C70.

Q8 is the PMO buffer. It exhibits a high-pass characteristic due to C71 and RFC2 (which is quite small in value). This is necessary because the PMO mixer, U7, puts out a higher-amplitude signal on the lower bands.

Conclusion

The Sierra is optimized for simplicity and low current drain, consistent with good performance. To accomplish this, I used low-current-drain mixers and signal sources and moderate amounts of signal filtering. You'd have to use different techniques if you were optimizing for spectral purity, including large signal levels, beefy mixers, shielding, etc. This would have been overkill for the Sierra, not to mention making it considerably more complex and expensive. On the other hand, I encourage all QRP home-builders to experiment with such techniques (if you don't have a copy of Solid State Design on your shelf, you don't know what you're missing!).

I hope that the Sierra proves to be easy to get up and running, as was the NorCal 40. I've heard complaints that NorCal was making it too easy—that builders wouldn't learn as much as they would by doing it from scratch. Not! Experience suggests that the Sierra will actually get more builders involved, and that many of them will go on to design their own gear. That's why I put so much emphasis on design techniqes in this article as well as in

the manual.

Where do we go from here? One look at QRPp gives a hint: we have members designing SSB rigs, antenna tuners, digital readouts, and many other neat projects. There's a possibility that we'll be designing an SSB adapter or other accessories for the Sierra, too, but we encourage you to roll your own. If your Sierra sounds hollow when you tap on the cover, you haven't built enough new stuff into it yet!

Please write to me with your comments on the Sierra design (1432 6th Ave., Belmont, CA 94002; or wayne@interval.com). Also be sure to document your success (or otherwise) in building and modifying the rig and send your reports in to QRPp.

Acknowledgements

I'd like to thank the following club members who helped make this project possible: Jim Cates and Bob Dyer (kits); Doug Hendricks and Bob Warmke (prototype testing and P.R.); Stan Cooper, (silkscreening); Vic Black (mechanical components); Bob Korte (PC boards and other components); and Eric Swartz (technical consultation).

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Back issues from 1994, the second year of QRPp are now available. They are bound in a single volume, and have a heavy cardstock front and back cover. The binding is the plastic finger type and is quite durable. This volume contains 296 pages from the March, June, September and December issues of QRPp. Please do not ask for individual issues as they are not available. The price is $15, and includes shipping in the U.S. Canadian orders are $17.50 and DX orders are $20. Please send US funds only, and make all checks out to Doug Hendricks and not to NorCal. Send your orders to:

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Dos Palos, CA 93620

Please include your name, call and mailing address.

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Sierra Block Diagram

Weeknd Swap Activities

By Paul Valko, WB8ZJL
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Our local club had the annual swap-n-shop today so the weekend was busy with that. I worked the "club" table selling items for the other members who were out giving exams or talk-in or cooking etc. One of the local OMs went silent key recently and the table was jammed with old and new gear/parts that we were selling for his XYL.

This was quite sad (to me). Perhaps I'm too sentimental, but I scowered the bags and boxes to find a memorial that I could buld to honor this departed brother ham. He was a real OT, had boxes of OLD caps, wire, coil forms... all the good stuff this generation of appliance ops rarely see or need. (I'm quite the appliance op myself, this is no flame) I secured a steel BUD box and a nice Miller coil that would make a fine QRP tuner.

On the lighter side: There was a pristine TenTec Corsair 1 in his estate with the matching P.S. that a gent took for $575, all the filters and boxes included. I thought he got a pretty good bargain. For the QRO ops, he also owned and Ameritron L-80 amp that he had never even installed the tube in! It was marked $975 and still on the table as I left.

Out in the trunk sales I found a couple more TenTecs, a decent C-21 and a fairly beat up Triton II w/PS and mic. The C-21 was sold for $130 and the T-II was still available at $240.

M-QRP club was present (besides myself) with K8DD, N8CQA (Buck replaced my busted M-QRP lapel pin for free and had the new and sexy M-QRP coffee cups for sale), WA8LZV (Byron pulled himself away from QRP-Afield for a swing through the swap!) One wag had a complete HW-9 station available priced at $500.

Also got to "show off" my completed NN1G kit. After all the compliments the swap committee called the fire department and they used the "jaws of life" to widen the school entrance door so my head could fit through so I could go home. Happy Hunting! es 73
Paul, WB8ZJL

QRP Club of BC - September Meeting

By Derry Spittle, VE7QK
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V7R 1R9 Canada

The Quarterly meeting of the QRP Club of British Columbia was held at the Coast Bastion Hotel in Nanaimo on Saturday 10th September. Eleven members attended. We also had five visitors from the Nanaimo ARC, two of whom became members. Three of us travelled from the Mainland to attend.

The meeting as usual focused on "show and tell". Bill, VE7JO brought along his 80M SSB transceiver together with a recently completed 5W amplifier and SWR meter. He continues to provide one of the strongest QRP signals from Vancouver Island.

Bruce, VE7ZM, showed us his 80M and 40M SSB transceivers along with a recently completed dual-band 5W amplifier. He also brought a tape recording of SSB transmissions on the QRP net. Bruce will be attending the meeting in Concord next month to ensure representation from BC.

Joe, VE7TX, impressed the visitors with his Neomyte 80M SSB transceiver built into a cigarette package. His 950mW signal with excellent audio quality continues to

amaze everyone on the band. Joe announced that he is embarking on a new project - the construction of an ultra-light plane. We look forward to working him QRP aeronautical mobile one of these days!

Dick, VE7GC, showed us his 40M SSB transceiver with 5W amplifier along with a VXO tuned 80M CW transceiver. Dick and Ted, VE7AKA, who was unable to join us, regularly operate QRP/MM from their boats. Both have been having great success in loading up the entire rigging for an antenna rather than the usual backstay alone.

Ted, VE7PA, brought along his 80M QRP SSB transceiver, and a trunk load of test equipment in anticipation of some "hands-on" help in trouble-shooting. There appeared to be no shortage of advice being offered so hopefully his problems are on the way to being solved. We all thank Ted for arranging the splendid accommodations for this meeting.

I brought along an Epiphyte transceiver assembled using the PCB manufactured by Far Circuits. It was certainly a pleasure to work with and the rig was completed and on the air in two evenings. I also brought a 5W amplifier which is to be the subject of an article in the next issue of QRPp. I will be taking them with me to the G-QRP Club Convention in Rochdale next month.

Rather than attempt to attempt to produce a magazine/newsletter at this time, members agreed that we would begin by mailing a brief report following each quarterly meeting to all members. Any other items of interest for enclosure should be mailed to Jack, VE7DZO. At the same time, I agreed to upload it to QRP BBSs on Packet and the Internet

The next meeting will be on the Mainland and is tentatively set for November 26th. Time and place are yet to be decided. 72, Derry, VE7QK

QRP AFIELD: A New England QRP Club Activity

by Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620

Last Spring, the New England QRP Club decided to have a fun activity that would encourage all QRPers to get out and use their kits that they had spent the winter months building. The NorCal 40's, New England 40-40s and other kit rigs were sprouting all over the place and the New England Club wanted to have an activity that would encourage homebrew construction and operation. QRP Afield was the result of this brainstorming by our friends on the East Coast. Jim Fitton, W1FMR and Chet Bowles, AA1EX were the main forces behind this event, and they are to be commended for an excellent job. Basically the idea was to operate for 6 hours in the field, using QRP equipment, hopefully homebrew. The following are accounts of the event and give a good indication of the fun that was had by all involved. The NE Club is planning on making this a yearly event and QRPp will publish the date for next year as soon as it becomes available.

QRP Afield (from Maine)

By Chet Bowles, AA1EX
RFD 2, Box 335L
Sharon, NH 03458

I set up at my cabin in Oquossoc, Maine which is on the shores of Mooselookmeguntic Lake (don't you love those names?) Had a little problem getting the dipole to stay up in the trees, so I ended up using a 130 foot long wire which worked "OK."

My station wasn't lightweight, but it was portable: I used my Ten Tec Scout and a 12V car battery. That, plus a Dentron tuner, my keyer and paddle meant that this would

certainly not take the prize for small size!

Had lots of good contacts on 40 during the early going, but things really "dried up" at about 4:30. Now that I've read Jim's message, I know that thunderstorms came through the area about that time, so the folks in Southern New England packed it in.

I ended up with 33 contacts and 16 states. At 4 points/contact (High power, non-permanent antenna and non-commercial power), that gives me a net score of 1980.

It was fun and I certainly enjoyed myself, but I had good weather. Like Jim said, please let us know what you liked/didn't like about the contest. We'd like to make it even better next year. 72, Chet, AA1EX

QRP-Afield. KK6ZC

By Glenn Menard, KK6ZC
6264 Plymouth Ave.
Richmond, CA 94805

This QRP afield was my first portable effort with my NorCal 40. I didn't make a lot of QSOs, in fact NONE with another QRP station, but I did have a great learning experience.

I was up at 7500 feet near Blue Lakes south of Lake Tahoe. I discovered that getting a dipole up into pine trees, while simple in principle, is in actuality more difficult than I imagined. The 4# test fishing line on my ultra-light spinning reel didn't help either!

Finally got set up and listened for 'QRP TEST'. When nothing was heard I sent out my own CQ, and got a reply after the first one! Unfortunately he was not QRP, and just wanted a rag chew, but I was happy for any reply.

So that was how it went, no QRP QSOs but several contacts. I did hear Jeff, AB6MB in QSO with KB6OB, but when I called them after their QSO, there was no reply. I missed my chance for an Internet Mailing List QSO!

I've got everything ready to go now, so I'll be QRP portable for at least a few more weekends until the weather gets cold! 72 de Glenn, KK6ZC

KT3A NE QRP AFIELD

By Cameron Bailey, KT3A
P.O. Box 173
Mount Wolf, PA 17347

I packed my bag with my NorCal 40, plenty of AA batteries, and my 40 meter wire antenna and walked to the nearby elementary school. (Some thought I was running away). It's a quiet place, no people or RFI, where I've had good signals before.

I started at 1900Z by setting up an inverted vee. My apex was up about 40 feet in a tree. (Got the cord right where I wanted it, first time!) Power was set beforehand using a rf probe and DVM. With the NorCal set back to 900mW, I proceeded to work 9 stations in the next hour and half.

I used my paddles for the first time in a contest. My keyer locked up on me and it took a while to figure out the paddles were to blame. I had contact spacing to short. (Next time, the straight key will be there as back up).

Then it started to rain. I was truely QRP Afield, with no table or chairs guys! I was prostrate on the grass with two place mats to rest my arms on. My XYL called me on 2 meters and asked if I wanted an umbrella. How nice! Then with umbrella over the equipment, and a hat over me, I pressed on.

Results: N1QYZ KX1E VE2DRB N4AOX VE3TTV KR4DR(Booming into PA! Where was W8MVW?) W1MWL NG1G NT1V. 8 multipliers. I shut down at 2130Z. Good thing I did. It began to downpour. Thanks for the contacts, 72 de Cameron, KT3A

Low Budget Hamming?

By William (Dave) Redfern, N4ELM
1784 Quail Ridge Rd.
Raleigh, NC 27609

I tend to group QRP operating and getting a new ham's station set up as separate challenges. There are aspects which are common to both, simple equipment, homemade equipment, and low power operation but the largest difference is in the operators themselves. Generally QRP operators are hams who already have experience in setting up and running radio gear and in making contacts "on the air".

On the other hand most new hams are "NEW HAMS". Generally they have just passed the test or just received their license from the FCC and do not have much experience in actually operating radio gear and making contacts. It may be kind of like being dropped into the "Ham Radio Twilight Zone" with all the new language to learn, the variety of equipment to buy, and the confusing array of rules and regulations. The "QRP Twilight Zone" is an entirely different place but I'll save that for another time.

Here are some general guidelines that I suggest to new Hams trying to get a station set up and on the air.

1 - Find an ELMER, a person (or persons) who is an experinced ham who can answer questions and help get your station set up. Your ELMER's advice will save you time and money.

2 - Set a budget. Know how much you can spend and spend it wisely.

3 - Decide exactly what you want to do and limit yourself to that. Amateur Radio is a large and complex hobby and has may different areas, modes, priviliges, and bands. Try to limit yourself to one or two different interest areas and work on them. In our area most new hams start with 2 Meter FM, 2 Meter Packet, or some basic HF operation. Later they will move into some of the other areas in the hobby.

4 - Whenever possible, build instead of buy. Homebuilt equipment and accessories work just as well as commercial stuff, sometimes better plus you'll learn something along the way (sometimes all I learn is not to do THAT again). Your ELMER is a valuble resource, use his knowledge and experience.

5 - Whatever type of station you set up, get on the air and use it. Yes, you are going to make mistakes, that is part of the hobby. Every ham on the air was a beginner at one time or another and made his/her share of mistakes. That may be the only absolute thing that all hams everywhere have in common. So jump on in there with everyone else and enjoy the hobby.

This is not a fixed recipe for putting together a ham station on a budget but mainly a collection of thoughts that I have used as a guide over the years. I make no claim to be an expert on this subject (but I have d noticed some people following me around at hamfests as I scrounge... er.. shop).

Hamming on a minimum budget usually means you'll be building your own equipment or buying it used. Buyer Beware is the watchword for used gear. If you require that a used piece of gear work, then test it carefully before buying it. If you can't test it don't buy it. I can tell you the story about the Ten Tec 509 that I bought for $50 and only had to restring the dial or the one about the Ten Tec Triton that I bought for $50 that was "only missing the top and bottom covers" which actually had every active device in the transmit stages blown.

If you can only buy one piece of gear, then get the very best ham band receiver that you can afford. It is usually beyond the reach of a newcomer to build, test, and align a

stable multi-band receiver. While a consumer type general coverage receiver can be used, they generally don't have good enough selectivity for serious ham band use (just check 40 Meters during a contest). However, with some help a simple transmitter can be built and provide many hours of use.

Antenna tuners can be built with hand wound inductors and tuning capacitors liberated from old broadcast radios. These have been getting kind of rare lately but I can usually find good capacitors at good prices by hunting through the "junk" boxes at hamfests. A power/SWR meter is the one piece of test gear that you may need to buy. However an old CB type SWR meter will usually work with 100 watt HF rigs and there are a couple of good meter kits that are easy to build and calibrate.

Usually antennas and feedline can be easily constructed from scrounged.. er.. recycled wire. Insulators can be fabricated from several different household sources. Any of the common wire antennas (dipoles, loops, verticals, and long wires) can be built. Open wire transmission line can be made from wire and insulators.

"Roll ends" of CATV coax can be gotten for free and makes good coax for HF antennas. Most manufactors rate their radios to operate into a 50 -75 ohm load so using 75 ohm coax is no problem.

So, based on these guidelines how much should it cost to get a Ham HF station set up and running? Generally I say that depending on what you know and what you have, expect to spend around $300 -$500. Too expensive for a school student without a full time job you say? Well, compared to other things like a video game with several cartridges connected to a color TV, or a personal CD player with deluxe headphones and a stack of CDs, or a boom box, or the super deluxe sneakers with the gravity assisted air expansion system and built in four way flashers which seem to be a necessary part of today's culture maybe $300 - $500 is not all that much money. The good part is that you don't have to buy everything at once. Start with a good receiver and antenna to work on code practice. Then add a transmitter, tuner, and power meter later as you need them. Sometimes you can borrow equipment to use for a while.

Again, know your own skills, consult with your Elmer, and make your best decision. Above all this is a fun hobby, so have fun! 72, Dave, N4ELM

The NorCal Sierra on the Pacific Coast Bicycle Trail

By Bil Paul, KD6JUI
337 Estrella Way
San Mateo, CA 94403

Thanks to Doug Hendricks and Wayne Burdick for letting me borrow one of the Sierra prototypes for my bicycle tour along the Pacific Crest Bicycle Trail August 28 -September 3, 1994.

I want to report that the trip itself was near perfect - including the weather, the participants (10, including two women), and the scenery. Crater Lake never looked more beautiful and being in the woods was like being in church.

There were four hams along: Dan Arbogast (N0DA) of Corvallis, Oregon, who operated packet and FM on 2 meters; Russell Dwarshuis (KB8U) of Ann Arbor, Michigan, who operated bicycle mobile (often while in motion) on 40 and 2 meters; Gottfried Kloyer (DL2MFJ/AA1JQ) of Wessling, Germany, who also operated on 40 and 2 meters; and myself, operating on 20, 40, and 2 meters.

I received the prototype Sierra only several days before the trip, and the auspicious first contact in my home shack was with an American ham in Mexico City, who gave me a 559

report on 20 meters!

I completed my main trip antenna, a lightweight, fanned inverted-V for 20 and 40 meters, just before leaving. Unfortunately, I hadn't had tome to cut the antenna to resonance. This turned out not to be the best choice for an antenna (because the arms would get tangled together and it took too long to deploy or take down and store), so I eventually cut off the 20 meter arms and made it purely a 40 meter antenna, where it had a low SWR.

I built an SWR meter specifically to use with the Sierra, following Wayne's recommendation (see pages 64-66 of the September, '94 QRPp) and it performed Quite well. I also had an end fed 20 meter dipole, and an HT with a homebrew roll-up J-pole.

I was pretty pleased with the Sierra's performance. Selectivity was quite sharp and (once I obtained quality Sony stereo headphones) audio volume was sufficient. There was occasionally a ringing, or feedback problem when both AF and RF gain controls were at full throttle, but I assume that will be cured before the final kit is released. QSK break-in is better than on my TenTec Scout.

The band modules went in and out easily. I think when I make my own kit I'll put in a little window so I can see which module is in use. Wayne and I weighed the uinit and it came in at about two pounds. The power consumption is so low I could've taken a battery half the size of the 3.5 AH one I had along. I charged it with a 10 watt Solarex solar cell mounted on the back of my bike.

From near the California/Oregon border (mostly on 40 meters) I had contacts in Canada, Washington, Oredgon, California and Hawaii. Gottfried did me better DX wise, contacting Japan, Hawaii and Alaska on 40 meters, using a handsome homebrew QRP rig and 5 watts into a half-wave vertical antenna.

I hope Doug forgives me for Q-doping the freestanding toroids in the rig and all the toroids in the band modules. I knew from past experience that the vibrations of gravel roads might jar the toroids, and I wanted to keep that rig working. On one jolting, long downhill on a gravel road my bike's welded water bottle cage and rear luggage rack both broke. Fortunately, Russell came to my rescue with teflon ties. I packed the Sierra in a pannier (saddlebag) wrapped in a big towel, with a foam pad underneath.

The most trouble that Gottfried Kloyer and I had was in getting our antennas up in trees. Using our slingshots, it was easy to shoot our lines over high branches. The trouble is, our weights wouldn't come back down, due to sticky pine wood, moss, and/or thick foliage. The best solution was to find a dead tree with smooth, dead branches. Next year I'm going to look into taking a helium balloon!

There was also strong interference at first when Gottfried and I were operating at the same time. We ended up apportioning our operating times, - the early and mid-evening for me and the early morning for him.

I can see that the Sierra will be my regular companion on bicycle tours. It proved itself. I just need to work more on multi-band antennas that go up and come down (and store) easily. The multiband capability of the Sierra calls for multiband antenna capability.

I'm looking forward to building my own Sierra. By the way, if you'r interested in joining next year's hamming tour from Jamburg, California to Lake Tahoe, please write me now and I'll put you on the mailing list. This year's group of 10 was perfect, so I'm going to limit next year's group to that number. You need to be in excellent mountain cycling shape, be used to camping out, and able to travel 50 or more miles per day over passes and along gravel roads when necessary.

There's something fun about being in a sleeping bag in a ten under brilliant starts on a 7,000 foot ridge, sendin Morse to the rest of the world. 72, Bil Paul, KD6JUI

The Resonance Meter

By Ray Megirian, K4DHC
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QRPers are the last of a breed and if it were not for them, the art of homebrewing would be all but dead. I have spent my life with a soldering iron in one hand and a very understanding XYL in the other. When I was 10 years old I had to heat my iron on a burner of my mother's gas range, so you may assume I've been doing a lot of soldering. Over the years I've built almost everything you can name from ideas of others to those of my own design. The most appealing, however, have been little gadgets taking only a day or so to construct and the item presented here is such a project. It is not new or unique and, in fact, I based my updated version on one described in Electronics World for January, 1960, by Joseph L. Reiffin.

Trying to match up odd coils with capacitors to resonate at some desired frequency is a snap with the resonance meter. The original circuit of this particular unit used vacuum tubes and all I did was substitute solid state counterparts. The circuit is very simple and requires few parts. A printed circuit board is hardly necessary and your favorite method of breadboarding should suffice. A plastic case may be more suitable than metal, which might influence operation of the device. I used one of several sloping panel types I had on hand and had been feverishly trying to find a use for.

The operation is quite straight forward. The output from a calibrated signal generator is fed into a broadband amplifier to whose output the inductor is connected. A built-in 100 pF variable capacitor is connected across the coil when its associated switch is closed. A calibrated front panel scale reads out values for various settings. A variable capacitor with a straight line characteristic is employed so calibration is simply 10 equal divisions of 10pF each over 180 degrees. Energy from the tank circuit is coupled to an emitter follower having a diode rectifier in its output for driving a meter. When the signal generator is tuned to the resonant frequency of the L-C combination, the meter will deflect. Terminals connected across the variable capacitor allow fixed capacitors to be added when more than 100 pF is required.

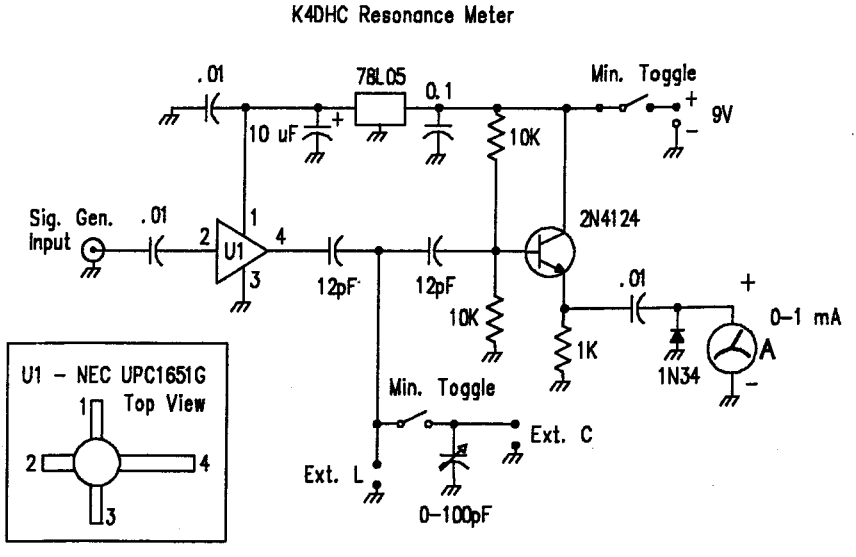
For the input amplifier I used a NEC UPC1651G monolithic wide band IC. I had purchased a bunch of these a year or two ago from a west coast surplus house. They no longer list them but substitutes are available. One possibility being the Mini-Circuits MAR series.

A 9V battery powers the instrument. The monolithic IC used here requires 5V which is supplied by a small regulator. The type of terminals used to mount external inductors and capacitors is up to your preference or what is on hand. Spring loaded compression or squeeze types are most common.

Because the output of the monolithic amplifier is low impedance, small values of coupling capacitors are used to prevent excessive loading of the tank circuit. The unit I built worked well from a few hundred KHz to over 50 MHz. The switch connecting the variable capacitor to the inductor, when open, allows resonance to be measured with only stray capacitance in the circuit. I estimated my unit had about 15pF of stray capacity.

Relative "Q" of coils and capacitors as well as bandpass characteristics of tuned circuits can also be estimated from readings of the resonance meter. By far the most useful application, however is determining resonant frequencies of L-C combinations. Be aware that harmonics of the generator signal will cause meter deflections though generally of much lesser amplitude. Always select the highest frequency that gives a reading as this

will be the fundamental. If your generator has poor calibration accuracy, a counter can be used to pin down the exact frequency involved. I hope that you find this project interesting enough to add to your collection. 72, Ray, K4DHC



MAGIC HAM WORDS

By Vic Black, AB6SO
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Many hams have trouble learning Morse code, but once they learn the code they find that it stays with them for life. I decided to find an easy way to teach others to learn and remember the alphabet, hopefully in less than fifteen minutes.

Since we are communicators, most of us find it very easy to remember words and phrases. For instance, if I asked you to remember a message composed of a few common words you could probably do so with no trouble at all. Let's look at an example. "I love to eat ice cream on hot days". That sentence is easy to remember and contains nine words. Three sentences of that length would contain 27 words, more than the number of letters in the English alphabet.

Hmmm! Maybe the answer is to create a list of words or short phrases which, by themselves, will tell us the Morse code equivalent for each letter of the alphabet. It would be a list of MAGIC HAM WORDS. We could then make a dictionary from the list with a pronunciation guide for each word.

An example is the word "appeal". When we pronounce the word we emphasize, or accentuate, the second syllable by holding it longer than the first syllable. Also, the voice rises in pitch on the second syllable. One way to show the emphasis would be to use capital letters for the emphasized syllable or word in a phrase. So our sample word would

become "ap-PEAL". In our dictionary of MAGIC HAM WORDS we could also indicate pronunciation by placing "di" under the syllable without emphasis and "DAH" under the emphasized syllable. So our word "ap-PEAL" would SOUND LIKE "di-DAH' which, coincidentally, is Morse code for A, the first letter of the word. If you can remember the word "ap-PEAL", think to yourself "ap-PEAL (di-DAH: A)". If the "di" is at the end of a MAGIC WORD we would say "dit".

All we need to do now is to make our list of words or phrases and indicate the pronunciation. If you have favorite words that fit then use them in your own dictionary. Otherwise use the following list. Just remember to slowly read the words aloud and pronounce each syllable. This will tell you both the sound and rhythm for each letter. Let's give it a try.

A: "ap-PEAL". I think this method will appeal to you. Think "ap-PEAL (di-DAH: A)".

B: "BUL-le-tin board". You may want to tack a copy of this list on your bulletin board so you can refer to it. Think "BUL-le-tin board (DAH-di-di-dit: B)".

C: "CAN-dle-POW-er". Snuggle up next to a lamp that provides enough candlepower to read and repeat "CAN-dle-POW-er (DAH-di-DAH-dit: C)".

D: "DAIR-y-man". If you get thirsty while studying your code, get a glass of milk from a dairyman and say, "DAIR-y-man (DAH-di-dit: D)".

E: "end". Don't worry. The end of the list is not far off. Say "end (dit: E)".

F: "fed-er-A-tion". You Star Trek fans know all about the federation. That's "fed-er-A-tion (di-di-DAH-dit: F)".

G: "GLAZED DOUGH-nut". If you want a bit of pastry to go with the dairyman's milk just reach for a glazed doughnut and remember, "GLAZED DOUGH-nut (DAH-DAH-dit: G)".

I: "it-chy". By now you're probably getting itchy to learn the entire alphabet. "it-chy (di-dit: I)".

J: "just LEARN MORSE CODE". So go for it and just learn Morse code. "just LEARN MORSE CODE (di-DAH-DAH-DAH: J)".

K: "KANG-a-ROO". Now you're progressing by leaps and bounds, just like a kangaroo. "KANG-a-ROO (DAH-di-DAH: K)".

L: "li-BRAR-i-an". If you have trouble with pronunciation, just ask a librarian for help. "li-BRAR-i-an (di-DAH-di-dit: L)".

M: "MA-MA". Your mama would be proud of you for your progress in learning Morse code. Think, "MA-MA (DAH-DAH: M)".

N: "NAUGH-ty". Don't be naughty. Study your code! "NAUGH-ty (DAH-dit: N)".

P: "per-FORM BET-ter". Once you learn the code you can perform better on the air. Remember, "per-FORM BET-ter (di-DAH-DAH-dit: P)".

Q: "QUEENS, KINGS and JACKS". These are the face cards in a deck of playing cards. Just remember "QUEENS, KINGS and JACKS (DAH-DAH-di-DAH: Q)".

R: "re-PEAT-er". The next time you use a 2-meter repeater think of the letter R. "re-PEAT-er (di-DAH-dit: R)".

T: "TOAST". Soon you'll be able to toast to your success. "TOAST (DAH: T)".

U: "un-der-STAND". Think of how much fun you'll have when you can understand CW. "un-der-STAND (di-di-DAH: U)".

V: "vis-it the QUEEN". On your next trip to Great Britain you may want to visit the Queen. "vis-it the QUEEN (di-di-di-DAH: V)".

W: "we KNOW CODE". We're almost there. Soon we can say that we know code. "we KNOW CODE (di-DAH-DAH: W)".

X: "X-ray the BONE". This is what your doctor may do if you fall and hurt your arm. "X-ray the BONE (DAH-di-di-DAH: X)".

Y: "YES we KNOW CODE". Another few letters and you can say "yes, we know code". "YES we KNOW CODE (DAH-di-DAH-DAH: Y)".
Z: "ZSA ZSA did it". The actress Zsa Zsa Gabor was accused of hitting a police officer. She said she was innocent, but the jury said that "ZSA ZSA did it (DAH-DAH-di-dit: Z)".

OOPS! Three letters are missing. That's because I couldn't think of any staccato words or phrases to express them. Perhaps you can do better than me on those three. Fortunately, they are really easy to remember. They are "di-di-dit: S", "di-di-di-dit: H" and "DAH-DAH-DAH: O".

Well, that's all there is to it. Just a few words or short phrases to remember and you automatically know the alphabet in Morse code. Now get a code practice oscillator and practice a bit. In no time you can let your fingers do the talking.

Simple Modifications for WM-1 QRP Wattmeter

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For those of you not familiar with the WM-1 wattmeter, it is a compact little unit available as either a kit or fully assembled from Oak Hills Research[1] (and some dealers) specifically designed for QRP work. It has three power ranges: 100 milliwatts, 1 Watt and 10 Watts full scale. But nothing is "perfect" and I have made the following modifications (additions, actually) that might be useful to other WM-1 owners:

- Low current drain "power on" indicator.
- Provision for external power.
- "Peak Power" reading for SSB operation.

I decided to look into some sort of power-on indicator after killing my second 9V battery because I forgot to turn the unit off. However, since the unit draws very little current (about 1 mA with no meter reading and a little less than 4 mA at full-scale meter deflection), I wanted to keep the indicator current drain less than 2 mA or so. I thought about using some sort of LED flashing circuit, but then I discovered that most small red LED's give off a significant amount of light even when operating at 1 to 2 mA. Problem solved! I installed a 3 mm LED on the front panel (between the two knobs just above the "WM-1" lettering) and connected it through a 4.7K resistor to pin 4 of S2. The LED ground lead is connected to the metal tab of the frame of S1. The current drain of the LED is about 1.5 mA; this will certainly impact the 9V battery life, but not as much as accidently leaving the unit on for several days (or weeks)!

If you make this mod, the meter should be removed from the front panel before drilling the LED mounting hole, but with a little care you can get by without removing the circuit board or the rotary switches. NOTE: Check the LED you plan to use BEFORE installing it to make sure it emits sufficient light at this low current.

Since one of the rigs I use the wattmeter with (a TenTec 509) has an auxiliary 12 V connector on the back, it also occurred to me that it would be useful to be able to power the meter from an external DC power source. I added a 2.5 mm ID DC power jack and SPDT switch on the back panel above the battery holder and used an LM78L09 voltage regulator[2] as shown in Figure 1. With this arrangement, any source of DC between about 11 and

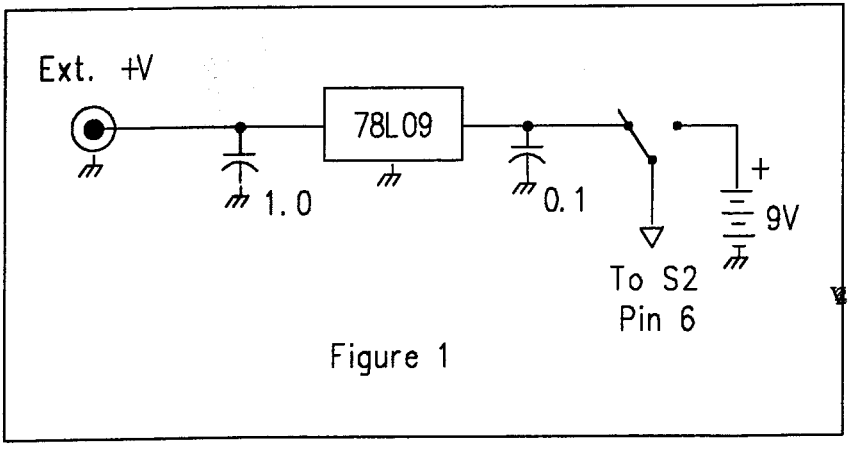


Figure 1

capable of supplying at least 10 mA can be used to power the WM-1.

The voltage regulator and two bypass capacitors can be mounted "spider web" style on the back of the power jack. Be sure to keep the lead from the SPDT switch and S1 on the front panel well away from the RF transformers! Because of the very low current drain, no heat sink is required for the LM78L09.

Attempting to determine the power output of an SSB rig involves a bit of guess work without the use of special equipment. Probably the simplest way to measure SSB power output is make the measurement while feeding two audio tones into the mike input -- but then there is always the problem of determining if you are really getting the same power output when speaking into the mike. Note that the term "peak envelope power" as applied to a SSB transmitter is a bit misleading; what we are really trying to measure is the "peak average power", averaged over several audio cycles.

Noting that there was an unused operational amplifier (U2-B) available in the WM-1, I decided to use it for a simple "sample and hold" circuit to determine "peak average power". The required circuit changes are fairly simple -- although some minor surgery must be performed on the PC board. The modified circuit is shown in Figure 2 and operates as follows: The DC output of U2-A (which originally drove the meter) charges a capacitor through a diode to prevent it from discharging back through the low impedance of the op-amp. U2-B is now used as a high input impedance voltage follower and drives the meter. A one megohm resistor supplies a discharge path for the capacitor. With this circuit, the meter will indicate the peak power averaged over some number of cycles and return to zero when the source of RF is removed. Both the "averaging" time constant and the time for the meter reading to return to zero are determined by the RC value at the input of U2-B.

I found it convenient to provide two time constants via a small switch mounted in the front panel just above the LED described above. The fast time constant provided by the 0.1 ìF cap allows the meter to be sufficiently responsive when making power adjustments, etc. and still do a pretty good job of indicating "peak" voice power. The longer time constant provided by the 0.1 and 10 ìF caps in parallel causes the meter to "hang" on peak power readings -- even when using CW -- but the long decay makes the response to power decreases very sluggish. You might want to consider using a single capacitor in the range

0.33 - 1.0 ìF; this would probably be adequate for measuring SSB power and still allow the meter to be sufficiently responsive for use in making SWR and power output adjustments. Another approach would be to use a switch to connect the meter circuit to the output of U2-A for "normal" and U2-B for "peak" readings; in this case a capacitor value of at least 4.7 ìF should be used at the input of U2-B.

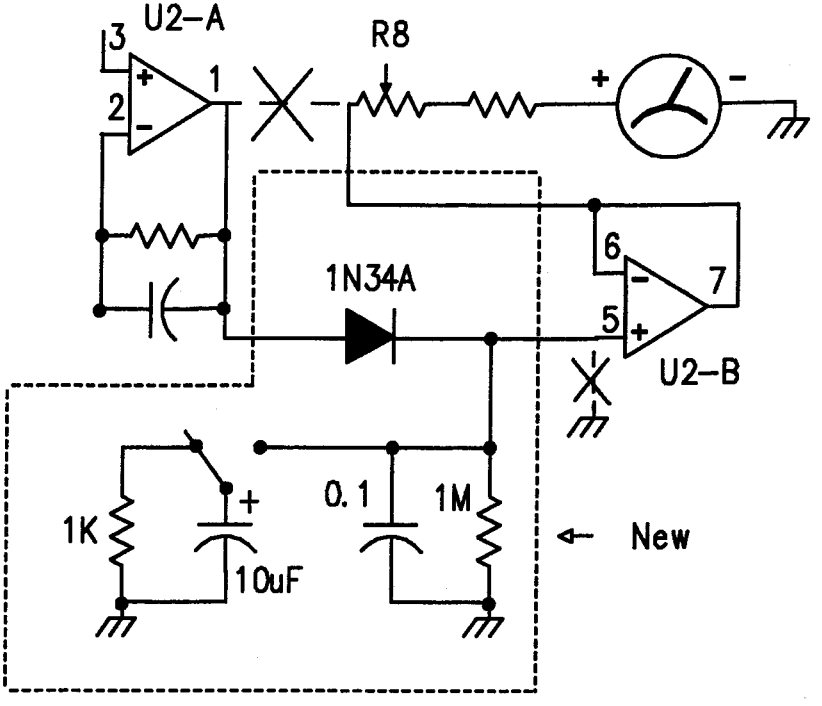


Figure 2

This "peak power" modification can be made as follows:

1. Unsolder the wires from the RF connectors on the rear panel.
2. Remove the meter from the front panel.
3. Remove the five screws holding the PC board, and carefully remove the board.

If you want more room to work, you can also remove the rotary switches from the from panel and disconnect the wire from the battery holder.

4. Find the solder pad on the bottom of the PC board to which pin 1 of U2-A, R10, C5 and two pins of R8 are soldered (refer to the pictorial drawings in the WM-1 manual for help).

5. With a small sharp knife, carefully cut a slot in this solder pad to isolate R8 from the other components. Use an Ohm meter to make sure it is isolated.

6. Solder a piece of small gauge insulated wire between the part of this pad to which the two pins of R8 are connected and the pad to which pin 7 of U2-B is connected. Be careful not to create any solder bridges.

7. Find the pad to which pin 5 of U2-B is connected; carefully cut the PC trace to the adjacent pad. Again, check your work with an Ohm meter.

8. Solder a diode (on the bottom side of the board) between pin 1 of U2-A and (the now isolated) pin 5 of U2-B; make sure the anode end is connected to pin 1 of U2-A. I used a 1N34A, but any diode with a peak current rating of at least 60 mA and an inverse voltage rating of at least 10V should work.

9. Solder a one-megohm resistor and small 0.1 uF capacitor between pin 5 of U2-B and a convenient grounding point. Make sure that the wires do not touch any other solder pads and that the components will clear the bottom of the cabinet when the PC board is re-installed.

10. Solder a 2 to 3 inch length of insulated wire to pin 5 of U2-B; this will be connected to a front panel switch. Things are getting pretty congested on this solder pad, so be careful not to create any solder bridges.

11. Drill a mounting hole for a miniature SPDT switch on the front panel between the two rotary switches, and mount the switch. Mount a grounding lug, if you have one, under the switch.

12. Solder a 10 ìF cap (rated at 15 V or higher) between the center switch contact and ground; if you didn't mount a grounding lug, you can use the metal tab on the frame of S1 for a grounding point. Observe the proper polarity!

13. Solder a 1K resistor from one of the outer switch contacts and ground; this is used to discharge the 10 ìF cap when it is switched out not of the circuit.

14. Remount the rotary switches (if removed) and the circuit board.

15. Solder the wire from pin 5 of U2-B to the remaining SPDT switch contact; re-solder the wires to the rear panel RF connectors. Also, don't forget to re-solder the wire from the battery holder (or external power switch, if you made that mod) if you removed it.

16. Re-install the meter (watch the polarity).

You now have a peak-reading QRP wattmeter! Re-calibration should not be required, but you should go through the calibration procedure in the manual just to make sure (you might have moved one of the pots while handling the PC board). Enjoy...

[1] Oak Hills Research, 20879 Madison St., Big Rapids, MI 49307.
[2] Available from mail order houses such as Digi-Key and Mouser for less than $1.00.

QRP Afield - WB3GCK

By Craig LeBarge, WB3GCK
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One of the things I enjoy most about ham radio is operating QRP-Portable. So, needless to say, I was pumped for this event. However, after weeks of planning and anticipation, my XYL took sick and we took a trip to the doctor instead.

So, I spent QRP Afield at the home QTH trying to contact all the stations I could hear and give out some points to those lucky folks who made it into the field. Those I worked include:

VE2DRB	KR4DR	AA1EX	KX1E	AA4XX
WK8S	N1CUU	WA8LCZ	KA9HAO	W1FD
WA2BQI	N4ELM			

My congratulations to you all. Everyone sounded great here in Pennsylvania, especially VE2DRB and KR4DR who were coming in loud and clear all afternoon. Hopefully with a little luck, I will be able to join you out there next year. This is absolutely the greatest QRP operating event of the year!
73, Craig, WB3GCK

Thoughts of a Born Again CW Aficionado

By D.J. "Mac" McDonald, K6AGN
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Reborn? CW aficionado? You bet! As St. Augustine said, (or was it Shakespeare? I get the two confused) "Confession is good for the soul."

Back in 1957 I became a Ham. I passed the required CW portion and promptly proceeded to put away my hand key. Note, I did not throw it away, that would be against my Scottish heritage. In the ensuing 22 years, what time I was on the air was with SSB or 2 meter FM. During those years I probably spent less than 10 hours on CW.

Why, you ask? Very simple. I was sure every ham in the country was tuned in on me (though very few ever answered my CQs) and was rolling on the floor in laughter over my mistakes and poor fist. That the whole world could hear me make a fool of myself was intimidating to say the least.

Then one day in 1987, I was looking at my Icom 701 and suddenly realized that I was utilizing only one-third of its capability - SSB. CW and RTTY were being ignored. I didn't have any RTTY gear, but all I had to do was to turn a knob and I could double my operating capacity.

Oh, but what about your fist and having the whole world listen as you make a fool of yourself? Ah, soul searching time! After listening to the Novice portion of the CW bands

I decided there were a lot of hams on CW who had no more skill than I, some even less - and they were on the air! Ok, try it. You might like it. I did and I liked it.

What does this have to do with the NorCal 40? Lots. I received a lot of encouragement from other hams I met on the air. I have kept at it and in the course of events have discovered some universal truths with which I am about to bless you.

Of all the Hams in the world, 200 are especially lucky - we who have and operate a NorCal 40. We are the envy of the Ham world and who knows, maybe the whole galaxy (can you prove there aren't Hams out there?) This, of course, results in the operating techniques of NorCal 40 operators coming under close scrutiny - I mean like serious! So it behooves (I love that word - has sort of a moral tone) we lucky few to exercise an acute perspicacity to the needs of those less fortunate.

Yes, I know this is a big commitment. Big? I mean like Major! Hey, if you can't cut it, turn in your NorCal shoulder patch!

I know it is going to be tough, but whoever said leadership was easy? Remember what Descartes said, "I operate (a NorCal 40), therefore I am (a standard setter)". Well, he would have said it if he had had a NorCal 40.

So what should we be doing to lead the way - to set the example, to help those so unfortunate as to not own a NorCal 40? Hey, you built your 40. You are obviously a scholar, and a gentleman, a man of integrity, tack, high intelligence, good looks, modesty, a connoisseur of fine radio equipment, and the personification of the finest operating skills. Ok, maybe you're not so good looking.

All right already, I'll get to the point. For now I will mention just four items that distinguish us from the hoi polloi.

Firstly, when we operate in the Novice portion of the bands, we keep our speed down to under 15 wpm. The best operators send the characters at 13 wpm but with lots of spacing between letters so the actual speed is under 13 wpm. This gives the other operator (novice?) the experience of hearing/copying characters at the general license level but at a lesser wpm speed.

Second, we match the other operator's speed. If it is eight words a minute, we don't come back at a speed that would pass the Extra Class exam. That most likely will result in the other person reporting QSB, QRM, QRN, signing, or just not coming back at all. Yes, I know, QSOs may be conducted at any speed; that there is no FCC regulation relative to maximum speed. But coming back at a speed beyond the other operator's CURRENT capability can only frustrate the slower operator and spoil the chance for an enjoyable QSO. The end result - both operators lose.

Please, those of you who are high - speed operators (the Olympians of Hamdom) go play with the big boys in the General, Advanced or Extra class portions of the bands. You may inspire a few, but also intimidate as many if not more. It is also a questionable use of that portion of the band. Yes, I know you can operate any place in the ham bands where CW is permitted, but Novices have only 50KHz on 40 meters while generals have 125KHz, advanced 125KHz and Extras 150KHz. I know that you want to be sensitive to fellow Ham needs and problems.

Our third item also concerns operating technique. This one is so obvious we often overlook it. But first we have to promulgate or postulate a CW premise. (Please not the use of a philosophical/mathematical term here and the alliteration, obviously making this a scholarly work.)

The premise is very simple and applies to most if not all Novices as well as Generals, Advanced, and Extras who haven't used CW in years. What is it? Why it concerns anxiety! Anxiety about one's ability to copy CW. The degree of anxiety differs with each operator and that operator's skill level and experience.

What does this have to do with anything? Why as NorCal 40 owners and operators whom the world watches with envy, we can show how they too can help the Novice CW operator enjoy our hobby more by reducing operator anxiety. The reduction in anxiety will assist in enabling him or her to become more comfortable with CW and so enjoy an important facet of amateur radio.

How do we do this? Very simple. Use the same format in the QSO he or she does. If he gives the RST first followed by QTH and name, reply in the same format. This is what is paramount in his mind. Being able to anticipate what is coming reduces anxiety and makes copying easier. In time, we all learn to anticipate words, numbers e.g., RST, 599, 73, etc. Make it easy on the inexperienced CW operator by using his or her format.

Last but not least, when sending CQ and your call, slow down at least for your call. There is no doubt that most of us can send our calls a lot faster than we usually send during the QSO. There is a distinct tendency for some operators to double or triple their speed when sending their call. Think about it. Your call is the most important part of the CQ. If you are too fast for slower operators to copy, he can't call you. It is that simple. The real gauge of one's CW skills.

See, I told you it would be easy. It doesn't cost you anything, doesn't modify the content of the QSO and it helps the new Ham or the inexperienced CW operator. It is a courtesy extended to a fellow ham. One way of helping that isn't all that obvious. Isn't that the best kind?

To end this erudite discourse, I will share with you a discovery I made of a philosophical UNIVERSAL TRUTH: The enjoyment of Amateur Radio is the fun and pleasure BOTH operators get from the QSO. 72, Mac

Optional Frequency Counter for the NorCal Sierra

By Jim Pepper, W6QIF
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For those that want a few more bells and whistles for your new Sierra, I have modified the frequency counter designed for the NC40 (QRPp June 94) so as to meet the changes of the new rig. A rotary switch will have to be positioned for each band when you change the band pc boards. Because there is no room in the Sierra enclosure, the counter board must be remounted. An NC40 enclosure could be used and it could also house an antenna tuning network. I am also thinking about a directional power meter similar to the one I built (QRPp March 1994) to be in the same enclosure. I will be experimenting with LED arrays in place of the analog meter. In this case it would be possible to have both the forward and reverse LED arrays to show the forward and reverse readings simultaneously.

Modifications to the Counter PC Board

First, there will only be three diodes on the pc board. Other diodes will be placed on the rotary switch, so when you change bands, you can select the correct reading to be shown on the read out. On the pc board layout drawing, locate the four diodes mounted together -left side of the board. Mount two diodes in position 2 and 4 from the left side of the board. This takes care of D1. D2 requires an 8. Connect a diode between pin 17 and 4. Anode to 4. You can mount the diode on the wire side of the board. Trace the pin 17 and 4 wires that go to the old diode location. You can put the diode here at the correct spot.

Second, two jumpers are required on the pc board. The first is to correct the counter action for the oscillator change in frequency. In the Sierra, as the capacitance increases

the frequency goes up. This is opposite to the normal action. This is a result of the requirement for multiple frequency bands and the various crystals needed for this operation. To allow the counter to operate in a count down mode, pin 10 must be grounded.

The display is the same as used on the NC40 and will show four digits. For example:

80 meter band will read 3500 to 3650
40 meter band will read 7000 to 7150
30 meter band will read 0000 to 0150
20 meter band will read 4000 to 4150
15 meter band will read 1000 to 1150

The 10MHz band will require the second jumper to show leading zero's to be displayed. this requires a jumper from pin 20 to ground.

The parts list for the board is the same as listed in the June 94 issue of QRPp. When requesting the pc board from FAR Circuits, ask for the QRP-CTR board 201B by W6QIF. You can get the ICM7217AIPI from the following sources:

Digi-Key	PN# ICM7217AIPI-ND	$10.50
Xtal 3.2768 MHz	PN# X022-ND	$1.37
Jameco	PN 43801	$8.95
Xtal	PN 14525	$1.09
Mouser	PN 570-ICM7217AIPI	$9.83
Xtal	PN 332-1033	$2.39

In addition, a 3 pole 4 position rotary switch will be needed. One of the poles will be used to terminate the diodes. This will allow you to select 4 bands for counter read out. If additional bands are desired, then a 2 pole 6 position can be used but some other method will be required to terminate the diodes.

3 Pole 4 Position Switch		
Digi-Key	PN EG1956-ND	$3.75
Mouser	PN 10YD034	$1.67
Jameco	Not available	

The required diodes can be mounted on the rotary switch. One of the poles will be D4 and the other will go to D3 going to the PC board. The anode ends of the diodes go to D3 and D4 positions on the switch. See figure showing diode mounting on switch.

Power Requirements

Power is derived from the Sierra's 12 volt source. Because the LED's draw considerable current, you will probably want to switch off this circuit and only use the counter to establish a desired frequency. The rf signal to the counter from the Sierra's oscillator also comes over the same power line. See the power connection drawing.

Diode Selection Chart

Binary code Pin 4 = 8, Pin 5 = 4, Pin 6 = 2, Pin 7 = 1

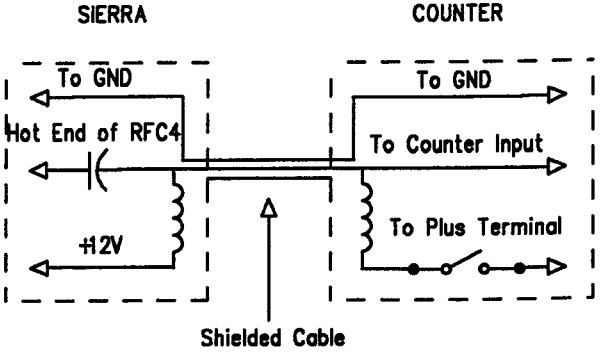
Band	MSB	D4	D3	D2	D1
80 Meters		4+2	4 + 1	8	4 + 1
40 Meters		None	None	8	4 + 1
30 Meters		2 + 1	None	8	4 + 1
20 Meters		4 + 2 + 1	None	8	4 + 1
15 Meters		4	None	8	4 + 1

Note: The diodes for D1 and D2 are mounted on the counter board.

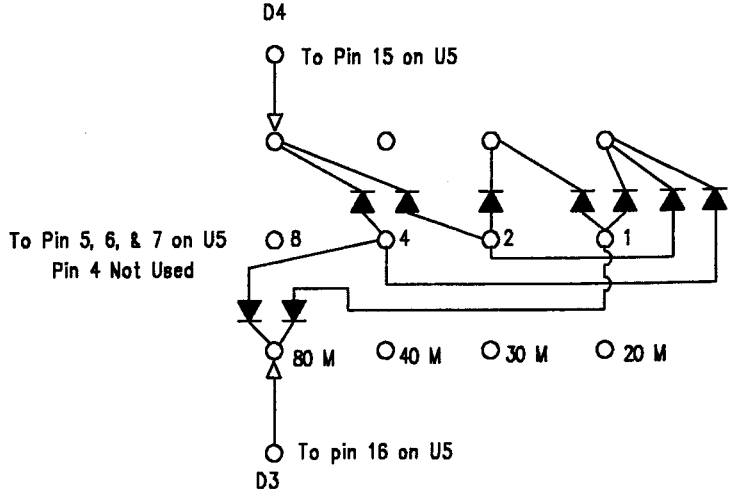
You will note that only the 80 meter band requires an extra pole on the switch. This because the second frequency digit is a 5 whereas all the others are zeros at the bottom of the band. So if you don't want this band you can use a 2 pole switch and use the second pole to terminate the diodes.

Five wires must be brought from the switch to the pc board. D3 (pin 16), D4 (pin 15), BCD 4 (pin 5), BC2 (pin 6) and BCD 1 (pin 7). be careful when wiring to the pc board. It is easy to develop solder bridges. Check soldering with a magnifying glass.

It is really great to see all the interest in building and modifying that is still going on today. I became a ham 56 years ago and at that time almost every one built all or part of their station. To me that is "Ham Radio". So keep building and learning. 72, Jim, W6QIF



Diode Connections



PRODUCT REVIEW: NorCal 40 & NE 40-40 Compared

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Initially, this review started as an in depth look at the NorCal-40 transceiver kit, offered by the Northern California QRP Club. Having built and used one of these delightful little rigs for six months, I wanted to share my findings with the QRP fraternity. Then, Dave Benson, NN1G, provided me with the "original" 40-40 rig he designed as a club project for the QRP Club of New England. Having the opportunity to test these two rigs side by side was too much of a temptation. There had to be an article here, somewhere! So, now you know. What started as a review of the NorCal-40 has evolved into a dual review of two of the hottest little rigs in today's low power arena. At the end of this article there is a chart comparing the various features of both transceivers.

First of all, the NorCal-40 and the NN1G 40-40 are not your run of the mill homebrew QRP transceivers that we have become so accustom to building and using. The NC-40 and the 40-40 both feature a true superhet receiver, complete with crystal filtering in the IF strip and a varactor tuned VFO circuit, that does not require the patience of Jobe to align and use. In reality, both of these rigs are a quantum leap in homebrew QRP transceiver design and performance. The parts count versus cost versus performance is absolutely astounding.

I know, "Big Deal, so what?". Well, thanks to the NorCal Club and QRP Club of New England in general and Wayne Burdick, N6KR, and Dave Benson, NN1G, in particular, we no longer have to suffer mediocre designs with performance that matched. Nor do we have to be sucked in by designers/authors who publish construction articles which use hard to find parts and often yield substandard performance. Many of us "old timers" remember the infamous Two-Fer project the QRP ARCI offered a few years ago. This VXO controlled 40 meter rig was fun to build and sorta fun to use. However, like all rigs that use DC (direct conversion) receivers, the Two-Fer suffered from the maladies associated with it's lineage, not to mention a very narrow tuning range. Then came the plethora of NE-602 based receiver and transceiver designs, which gave us only marginal performance using the "miracle chip" from the cellular phone industry.

We have now crossed over into a new dimension of QRP homebrewing that features kits with elegantly simple design, excellent performance and relatively low cost. To many of you this may seem inconsequential. However, we have, made a quantum leap in the homebrewing arena.

I built the NorCal-40 from the mini-kit plus parts furnished by Jim Cates, WA6GER. This tiny transceiver begs to be modified. In my particular instance, I added an MRF-237 final and BIG heat sink in place of the 2N3137 I originally had in the PA circuit. There was very little improvement in RF output power (only about .25 watts). I had juggled the values of the PI network prior to adding the MRF-237, and with the 2N3137 final in place, was able to get about 2.75 watts output from the rig (using a 13.8 VDC power supply). Upgrading to the MRF-237 added only 250 milliwatts of RF output power. Since I received the 2N3137 from Lou, KA3ICD, I have no idea what they cost. Jim Cates, WA6GER, ordered my MRF-237s (since he was already placing an order with RF Parts, Inc., I piggybacked my order onto his) at a cost of $7.95/ea! If the 2N3137s are cheaper and easier to procure, I would not recommend spending the extra money for only 250 milliwatts of output power. NOTE: 3 watts on my rig is attainable only by using a 13.8 VDC power supply. When the rig is powered from a 12 VDC gelled electrolyte battery, the maximum power output is only 2.25 watts.

I have decided not to modify the PA circuitry any further (as some have outlined in back issues of NorCal's newsletter, QRPp) in hopes of obtaining a full 5 watts output. It has been my experience that anything I can do at the 5 watt output level, I can also do with 2 to 3 watts output. In reality, going from 2.25 to 5 watts output is only slightly more than a 3dB increase in power OR only about 1/2 of an S-Unit! This is hardly enough to make the difference between making a QSO and not making a QSO. The increased current draw from the battery is not a good trade off. It represents a BIG increase in power budget that cannot be justified when using a small gelled electrolyte battery in the bush!

One of the most practical mods that I performed on the NC-40 was the addition of two 5/32" (OD) X 4.25" long pieces of brass rod connecting the front and rear panels beneath the PC board to add strength to the rig. Doug, KI6DS, outlined this mod in the June issue of QRPp (pg 56) and it is worth doing. I originally used 1/4 inch rod tapped for 4-40 screws (black, of course to match my paint scheme). Unfortunately, I drilled the holes in both panels about 1/8" too high and the brass rods shorted out underneath the PC board. After adding a layer of electrical tape, I still had problems. It seemed that the additional metal detuned the VFO circuit, since it ran very close to some of these components.

Since I keep the VocEd Machine Shop instructor's VCR and TV running, he quickly turned down some 1/4 inch rod stock to 5/32", tapped them for 4-40 screws and I had my solution. (It's nice to have a good machinist handy in this business!)

I use a set of Nova 42 Radio Shack headphones. They are small, extremely light weight and cost only $12.95. They work very well with the NC-40 and the 40-40. You can explore padding the headphone jack with various sizes of capacitors to tailor the high frequency roll off to your specific taste. Padding the headphone output with a 3.3 microfarad (electrolytic) capacitor provides me with the kind of audio I enjoy. This is a cut-and-try modification, so experiment until you find the right size capacitor that offers you the best compromise in high frequency roll off.

I tried several different values of C49 in my NorCal-40 to vary the tuning range. After finally settling on a 59 picofarad NPO cap the rig tuned from 7000.1 Khz to 7062.8 Khz. Tuning rate is somewhat non-linear and requires a fine "touch" on the main tuning knob in order to correctly tune in a station. If you just want this rig for QRP only type action (centered around 7040 Khz) then reducing C49 to around 30 picofarads and re-aligning the VFO circuit would yield an excellent tuning rate with out resorting to a vernier drive.

Since I originally started this article for QRPp in July (94), I have had the pleasure of using Dave Benson's (NN1G) original 40-40 transceiver. Dave had submitted the rig to the ARRL for an article in QST. I had contacted Dave about getting a 40-40 loaner for a couple of weeks and including the rig in my new book: "Low-Power Communications Vol-III, QRP Hardware". Dave enthusiastically agreed and shipped me the original 40-40 when the ARRL finished evaluating the rig.

After positioning the NorCal-40 and the NN1G 40-40 side by side on the operating bench, I set about the task of operationally evaluating the two radios. This task was not as easy as originally anticipated. These two 40 meter rigs, while being geared for the same prospective audience, are actually quite a ways apart in cost, features and performance.

The cost of the NC-40 (now available as a complete kit from Jim Cates, WA6GER) is $94 including shipping in the US, Calif. $99 (sales tax), DX orders are $99.

The NN1G 40-40 rig costs only $45, including shipping. All the builder must provide is a case, controls, jacks and knobs. Not bad value for money. The small PC board (2.8 X 4 inches) allows the builder to package the 40-40 into a smaller enclosure, further enhancing portability.

The two rigs' performance was very good, considering the simplicity of design, low parts count, and overall cost. Both receivers feature an RF Gain control and no AF Gain

control. Using a set of stereo headphones, like the Radio Shack Nova 42s, (which features an in-line volume control on the headset cord) will allow you to run the RF gain wide open (except for those instances of an extremely loud station) and control the receive audio via the headphone volume control.

Receiver performance, as mentioned earlier, was very good. Some IF filter "blow-by" was noted on both rigs, mainly due to the simple IF filtering scheme. On very loud stations, you could hear the receive signal on both sides of zero-beat. This condition is to be expected on simple superhet designs and is not really all that objectionable.

The NN1G 40-40 does not feature any Receiver Incremental Tuning (RIT) or AGC circuitry. This means that you have to ride the RF gain control while tuning around the 40 meter band. This increases "operator interaction" when using the 40-40 rig. While RIT circuitry is nice to have it is not essential. I worked over 20 stations using the 40-40 (6 of which were European DX stations) and never once needed to use RIT.

The NorCal-40 does feature both RIT and AGC circuitry and this means that the receiver is a lot less operator intensive. RIT is very useful when band conditions are crowded and you need to select the opposite sideband to overcome interference. Also, RIT is nice for contesting, when you want to sit on one frequency and tune above and below your transmit frequency to look for other stations who might be calling.

Tuning on the 40-40 was very non-linear, which is something one must learn to live with when using varactor tuning. Possibly, if the varactor diode (D-1) was changed from the stock MV-1662 to a MVAM-108 that Wayne Burdick (N6KR) used in the NorCal-40, the tuning could be made more linear.

Tuning range on the 40-40 went from 7010.1 Khz to 7045.2 Khz while the NorCal-40 tuned from 7000.1 to 7062.8 Khz. The added 27.6 Khz of tuning range on the NC-40 makes tuning much more critical on the NorCal rig. As originally built, neither radio had a calibrated dial. Tuning ranges were established with the aide of an external frequency counter. A rudimentary tuning dial can be added to either radio to keep track of where you are in the band. Tuning on the 40-40 would be much easier with a larger knob.

The NorCal-40 is a much more pleasing rig to operate owing to the very "mellow" sidetone in the receiver. This sidetone almost lulls the operator to sleep, it is so nice. The 40-40, on the other hand, has a very harsh sounding sidetone, that needs some work in order to reduce operator fatigue.

The keying on the NorCal-40 and 40-40 transceivers is absolutely great! Both feature full break in keying (full QSK) with no pops, thumps or bumps during key-up/key-down transitions.

These two tiny rigs are designed for portable operation. Their small size (4.4 X 4.4 X 2.25 inches for the NorCal-40 and 4.25 X 4.25 X 1.5 inches for the NN1G 40-40), makes them ideal for backpacking, camping trips and, of course, Field Day.

With portable operation is mind, let's look at the current draw associated with both rigs. The NN1G 40-40 draws 22.5 milliamps on receive with no signal input and 25 milliamps at comfortable listen volume with a signal. Transmit current at 1.0 watt output (that's maximum RF power for this rig when using a 12 volt gel-cell battery) is 310 milliamps. The NorCal-40 draws 19.6 milliamps with no signal input, 26.5 milliamps at comfortable listening volume with a signal, and 450 milliamps at 2.25 watts output. The voltage source for these tests was a 2.3 amp/hour 12 volt gelled electrolyte battery with a terminal voltage of 12.6 volts DC. Using a 13.8 volt DC power source (from a power supply) the RF output on the NC-40 can reach a full 3 watts output with a whopping total current of 510 milliamps! The NN1G 40-40 can achieve a full 1.5 watts output using the same power supply with a total current draw of 370 milliamps.

Final amplifier efficiency was calculated at 40% for the NorCal-40 (2.25 W output

divided by 5.67 W input X 100). The NN1G 40-40 didn't do as well with a PA efficiency of only 26% (1 W output divided by 3.9 W input X 100). The 2.3 Amp/Hour 12 Volt gel-cell was used for these tests. Power input was calculated using Ohm's Law (P=I x E) and data taken from testing both radios into a dummy load and measuring RF power output using a calibrated RF wattmeter. These figures indicate that some tinkering with final amplifier circuitry is in order to improve the efficiency of both radios. Interestingly, when the 13.8 Volt DC power supply was used and final amplifier efficiency was calculated, the NC-40 achieved 43% and the 40-40 reached 29% efficiency.

RF power output from the NorCal-40 was fairly steady through out the entire tuning range, varying only 250 milliwatts: from 2.25 watts at 7000.1 KHz to 2 watts at 7062.8 KHz. This is very good linearity considering the simplicity of the design.

The NN1G 40-40 exhibited more erratic power output variations, varying up to 300 milliwatts for only 35.2 KHz tuning range. As with the NC-40, the 40-40's maximum RF output occurred at the low end of the tuning range: 1.0 watt at 7010 KHz. Power dropped off to only 700 milliwatts output at 7045.2 Khz. Although both rigs exhibited an RF power drop over the tuning range of the VFO, the 40-40's performance suggest that if it's tuning range was extended by roughly 27 KHz (to match the NC-40's tuning range) the power output variations on the 40-40 would be much greater.

The 40-40 needs to have some kind of heatsink on the PA transistor to help dissipate heat build up. After keying for 25 to 30 seconds, into a dummy load, the final transistor was extremely hot to the touch. A small heatsink and a liberal application of heatsink compound would reduce this overheating condition.

The bottom line on the NN1G 40-40 and NorCal-40 transceivers: both are fun to build (I have since built a 30-40 kit) and operate. Their simple design and low parts count offers the beginning home constructor a chance to build a quality QRP rig that performs extremely well. Both radios have limitations and would be well suited to modifications and experimentation. This is not to say you cannot have a lot of fun using either (or both) of these rigs built up stock from the kit. Personally, I like the NC-40 only because of the sweet side tone and extended tuning coverage. I have used both radios extensively and both are worth the investment of money, time and effort.

As stated earlier, these two radios have proven to be a quantum leap forward in home brew QRP transceiver design. The NorCal-40 and NN1G 40-40 transceivers are proof of a better way of doing business on the QRP bands. Dave Benson (NN1G) and Wayne Burdick (N6KR) should be commended for their unique designs and dedication to their craft.

On a personal note, I have purchased a NN1G 30-40 (the 30 meter version of the 40-40 transceiver) for my own use. The NorCal-40 still has a place on the list of rigs I grab when I go camping or make a business trip. These two radios have put the fun back into QRP for this low power communicator.

My thanks to Wayne Burdick, N6KR, Dave Benson, NN1G, Doug Hendricks, KI6DS, and Jim Cates, WA6GER for their help and cooperation in making this article possible.

The NorCal-40 versus NN1G's 40-40

NorCal-40	**40-40**
Overall Size: 4.4 X 4.4 X 2.25 Inches	4.24 X 4.25 X 1.5 Inches
PCB Size: 4.25 X 4.25 Inches	2.8 X 4.0 Inches
Tuning Range: 7000.1 KHz to 7062.8 KHz	7010 KHz to 7045.2 KHz
RX Type: Single Conversion Superhet	Single Conversion Superhet
VFO Freq: 2.085 to 2.1478 MHz	3.000 to 3.0452 MHz
Freq Readout: None *	None **

IF Freq: 4.915 MHz	4.000 MHz
IF Filter: 4 Pole Crystal Filter	2 Pole Crystal Filter
Controls: RF Gain, RIT, Tuning, Power	RF Gain, Tuning
RX Current: 19.6mA (No Sig)	22.5mA (No Sig)
RX Current: 26.5mA (With Sig/Nml Volume)	25.0mA (With Sig/Nml Volume)
TX Current: 450mA (2.25W Out @ 12.6VDC)	310mA (1.0W Out @ 12.6VDC)
RF Power Out: 2.25W @ 12.6VDC	1.0W @ 12.6VDC
AGC: Yes	No
RIT: Yes	No (optional PCB available)
QSK: Yes	Yes
Sidetone: Yes	Yes
Cost: $94 (complete kit, NorCal 40A)***	$45 (complete kit)****
Skill Level: Beginner/Intermediate	Beginner/Intermediate

* NorCal offers a digital readout counter kit for the NC-40. Otherwise builder must fabricate a calibrated dial.
** Builder must fabricate calibrated dial.
*** Kit has all parts including case, controls, knobs and jacks. Price includes shipping.
**** Kit has all parts EXCEPT case, controls, knobs, and jacks. Price includes shipping.

A 5W Amplifier for the Epiphyte

by Derry Spittle, VE7QK
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North Vancouver, British Columbia
V7R 1R9, Canada

The Epiphyte 80 M SSB transceiver was designed primarily to enable backpackers to communicate with the nightly BC Public Service Net. In this respect its performance has lived up to expectations. Still, in deference to those who wish to run a bit more power, which means just about everyone, here is a simple 5 W amplifier which uses an inexpensive IRF510 Mosfet. It is designed as a "stand alone" unit which may (a) be left connected to switch in or out as desired, (b) be used with any other 80 M transmitter or transceiver in the 1W class, or (c) be left at home whenever you wish to remain "true to the cause".

During receive, K1 bypasses the amplifier leaving the Epiphyte connected directly to the antenna. During transmit, the relay closes to connect the Epiphyte and the antenna to the amplifier RF input and output respectively. At the same time the PNP switch, Q2, applies B+ to VR1 to forward bias Q1.

LED1 lights when the amplifier is on. LED2 lights when Q1 is forward biased. LED3 lights with RF current to monitor the modulation. LED1 and LED2 may be mounted on the panel or directly on the PCB. The Epiphyte PTT switch also controls the amplifier. D1 and D2 prevent DC from feeding back through a relay coil when either unit is switched off.

Before attempting to monitor the current in Q1, remove the shorting jumper and set the bias to around 2.5V with R4. Then, with a meter installed, adjust the bias for an idling current of 20 mA. The current will rise to 500 or 600 mA with modulation. The amplifier board is drilled to accommodate Molex connectors if you so wish to use them, and, as in the Epiphyte, negative leads may be omitted if the PCB is securely mounted on a metal chassis. Once the components and PCB are on hand it can easily be put together in a couple of evenings.

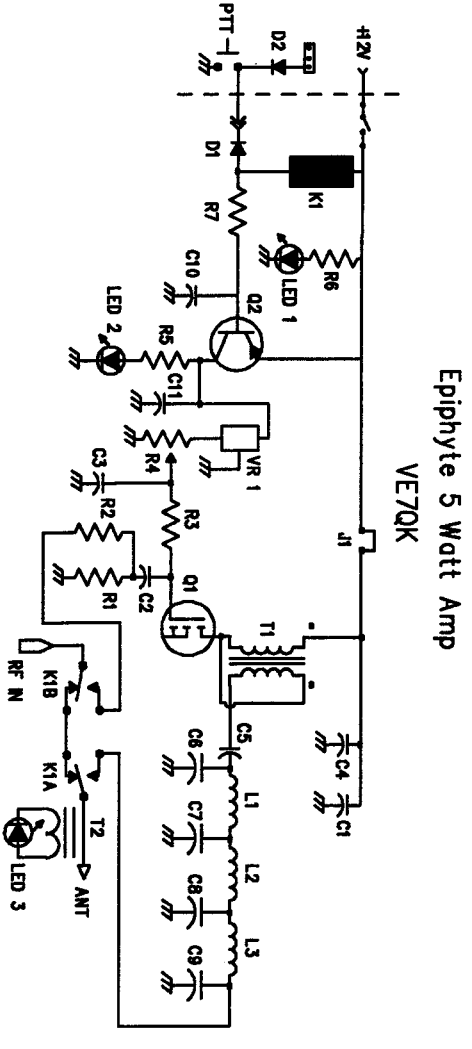
While the 7 element Chebyshev LP filter will further attenuate any out of band spu-

rious responses it will do nothing to reduce IMD within the passband. The input signal must therefore be free of distortion. The amplifier output should be monitored with an oscilloscope to verify that it is not being over driven. It requires about 0.5W drive to give an output of 5W. A 2 amp AC power supply will comfortably handle the Epiphyte, amplifier and an LED digital readout. With normal useage, a 7 Ah gel cell will provide a week or more of portable operation between charges. Have fun. 72, Derry, VE7QK

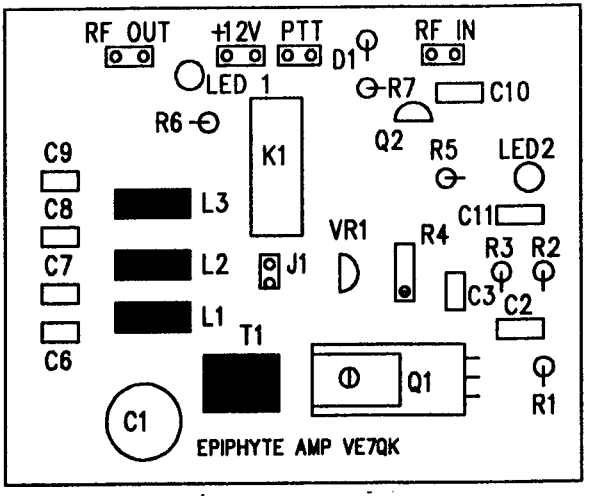
Epiphyte Amp Parts List

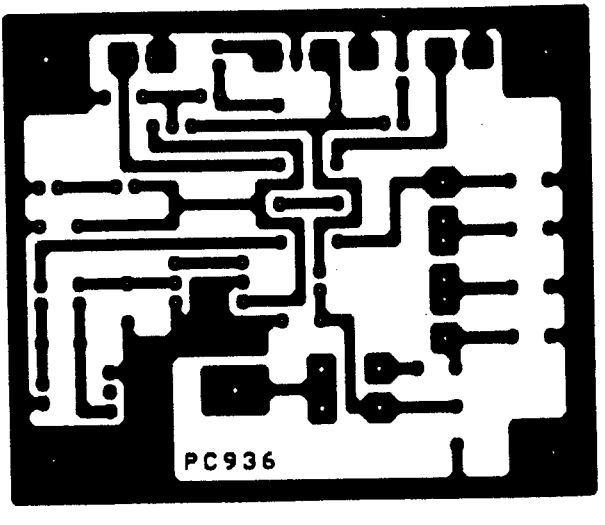
T1	1:4 step up transformer (5 bifilar turns #26 enamel over a pair of FB43-2401 beads)
T2	3 turns #26 enamel wire on FT37-61 Toroid
L1	2.62 uH (23 turns #26 enamel on T50-2 Toroid)
L2	3.14 uH (25 turns #26 enamel on T50-2 Toroid)
L3	2.62 uH (23 turns #26 enamel on T50-2 Toroid)
Q1	IRF510 + Heat Sink
Q2	2N3906
VR1	78L05
D1	1N914
D2	1N914
R1	47 ohm
R2	10 ohm
R3	10K
R4	10K miniature trim pot (inline, top adjust)
R5	330 ohm
R6	330 ohm
R7	1K
C1	100 uF/25V
C2	0.1 uF
C3	0.1 uF
C4	0.1 uF
C5	0.1 uF
C6	560 pF
C7	1200 pF
C8	1200 pF
C9	560 pF
C10	0.1 uF
K1	DPDT Relay (Clare LM44D00 or equivalent)
J1	0.1" shorting jumper and header
LED1	Red LED
LED2	Gold LED
LED3	Green LED coupled to the antenna lead with a 2 turn lind around an FT37-61 core
SW1	SPST Switch

Power Plug and socket, Fused lead, BNC Connectors, Chassis (3.5" x 6" aluminum sheet with 1" panels bent front and back along the short side.



Note: Circuit boards for the Epiphyte Amp are available from Far Circuits for $5 plus $1.50 shipping and handling for each 4 boards ordered. Ask for the Epiphyte Amp by VE7QK from the December 1994 issue of QRPp. Order from Far Circuits, 18N640 Field Court, Dundee, IL 60118.





Epiphyte AMP PCB Layout Viewed from bottom of board

A VFO for the Epiphyte

by Doug Hendricks, KI6DS
862 Frank Ave.
Dos Palos, CA 93620

The September issue of QRPp contained one of my favorite all time QRP construction articles. It is one of my favorites, because it satisfies a goal of mine, to build my own SSB rig. I enjoy building, and it has always been my dream to build a VFO controlled SSB QRP rig. Derry Spittle, VE7QK, has made that possible through his design and publication of the Epiphyte, a 75 meter SSB rig. (QRPp Sept. 94)

The only problem with Derry's rig was that it used a ceramic resonator and a VXO circuit for tuning. The ceramic resonator is at 4.19 MHz. and you are able to pull it about 50 KHz. That is fine, except that you are at 3725 to 3775 MHz, which is not the part of the band that I want to operate on. When I published the article, I was in high hopes that someone would send a VFO modification for publication. I kept waiting, but it never happened. So, I contacted Eric Swartz, WA6HHQ, who is the technical editor of QRPp and asked him to design a VFO. He was swamped with work, building his Sierra, and other projects. Eric did agree to work out the values for a VFO based on the NorCal 40, but he warned me that I would have to do the debugging. Basically he would point me in the right direction, and I would get back to him with any questions. It sounded good to me, so I accepted his offer.

The NorCal 40 VFO was designed by Wayne Burdick, N6KR, to be stable, and easy to build. It succeeds wonderfully in both cases, in the NorCal 40. But, I wanted a VFO to run from 4.355 MHz. to 4.455 MHz, which is more than twice the operating frequency of the NorCal 40 (2.085 MHz). Eric warned me that I might have stability problems at that frequency, and he was right.

My first attempt used the "Ugly" method of construction. It wouldn't oscillate, looked horrible, and was terribly frustrating for me. I decided to design my own board and did so using KeyCad software, which cost $19.95 and comes complete with an electronic symbol library. You can get it at Egghead Software and Costco.

The first try resulted in a VFO that covered the right frequency range, but was prone to drift. So prone, that you could tune in a signal, and in about 15 seconds, it was off frequency. This clearly wouldn't do. I called Eric and he suggested replacing the varactor diode we were using with a NPO fixed value capacitor to see if the varactor diode was the culprit causing the drift. It was replaced, and the VFO was stable. This meant that we would not be able to use the varactor diode that we were planning on. I would have to use a variable capacitor in its place. One of the treasures in my junk box is an OHR variable with built in 8 - 1 reduction drive that covers 5 - 40 pF. It was perfect. I mounted it in the case that I had the Epiphyte in and tested it.

The first thing that I was concerned with was stability, then band spread, and finally frequency. It passed the stability test. I then checked the band spread and had 312 KHz of coverage, which was way too much. I reduced the value of C3 until I had a band spread of 87 KHz. which was close enough for me. Then, I looked at the frequency. I was at 5.2 MHz with a 330 pF capacitor at C9, so I reduced it to the final value of 68 pF to get the VFO at 4.355 to 4.420, which gave me coverage of 3.9 to 3.987 MHz when it was mixed with the 455 KHz IF.

The output of the VFO needs to be at 350 millivolts or less, so C9 is added to the circuit to drop the signal to that level. That is all there is to it. The board is simple to build, I used a resist pen to do mine, and it came out fine.

Construction:

After you have your board made and the holes drilled, the rest is simple. Populate the board, leaving the toroid for last. It is mounted to the board using a 6/32 x 1/2" nylon screw and nut. I found mine at the local hardware store for a dime. When all of the parts have been mounted you are ready for testing. Apply 12 volts to the board and test the output of VR1 for output. It should be around 8 volts. If you have a scope, connect the probe to the output and you should see a nice sine wave. If that happens, you are in business. The next step is to set it on frequency. Remember, the Epiphyte has an IF of 455 KHz, so the oscillator must run 455 KHz higher than the frequency you want to operate. If you want to operate at 3.9 to 4.0, you must have the VFO running from 4.355 MHz to 4.455 MHz.

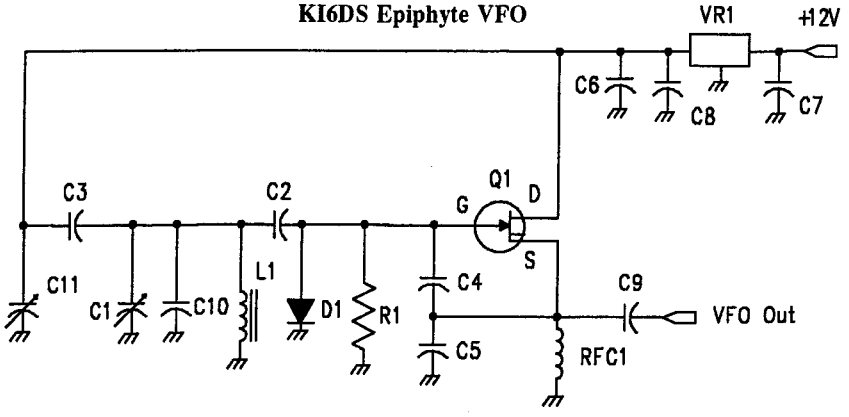
I use my Icom 735 as a frequency standard, by connecting a wire to the antenna jack and draping it over the vfo. Adjust the tuning capacitor, C11 so that it is fully meshed. Apply power to the vfo, and tune the receiver to find the "tone". Make sure that you have the right tone by turning the power on and off to the vfo. When you find it, use the set capacitor, C1 to adjust the frequency to 4.353 which will put you at 3.900 MHz on the Epiphyte. Adjust the C11 for fully unmeshed to check the high side of the vfo. Make sure that it is below 4.453 MHz so that you will not be out of the band (above 4.0 MHz). If you are above 4.0 MHz, adjust C1 so that you are below. Then go back to fully meshed and see where your VFO starting point is. Make a suitable dial for the Tuning Cap, and that is all there is to it.

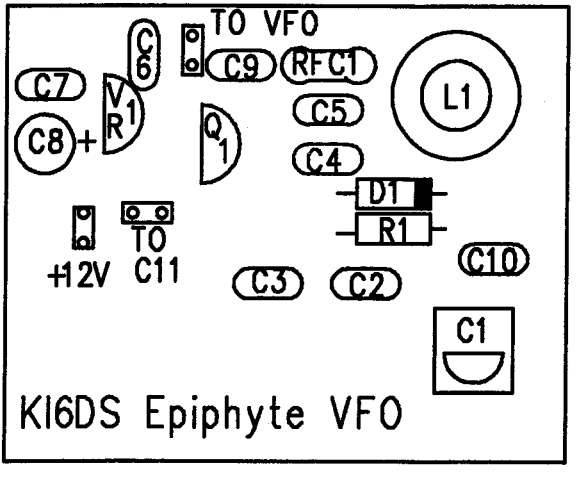
Here is the circuit, pc board pattern and parts layout. The parts are readily available, with L1 coming from Amidon, and C11 from Oak Hills Research. I used strip line connectors for the connecting pins and molex connectors so that I could test the board. These make the board much easier to remove for all the changes that I had to make in my cut and try method of testing.

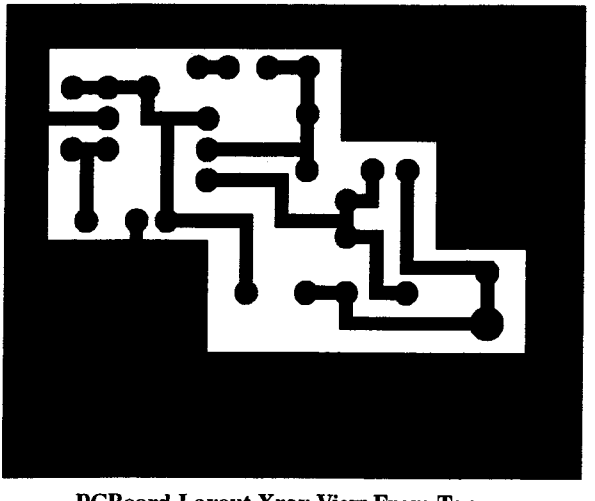
Thanks to Eric Swartz, WA6HHQ, Wayne Burdick, N6KR and VE7QK, Derry Spittle. Eric was my cheerleader and gave me the confidence to go ahead with the project. Wayne designed the original circuit that I stole most of this from. And of course Derry is the designer of the original Epiphyte, which made the VFO necessary to build. 72, Doug, KI6DS

Parts List

C1 2 - 24 pc mounted air variable
C2 180 pF silver mica
C3 30 pF NPO
C4 1200 pF Polystyrene or silver mica
C5 1200 pF Polystyrene or silver mica
C6 .047 uF Mylar
C7 .1 Mono or Disc
C8 1 uF Tantalum or Electrolytic/25V
C9 100 pF disc
C10 68 pF NPO
C11 5 - 40 pF air variable with 8:1 vernier drive (Oak Hills Research)
R1 47K
D1 1N914
Q1 J310, MPF102, 2N4416
VR1 78L08
RFC1 1mH miniature choke
L1 32 turns #26 enamel wire on T68-7 Toroid (white)







PCBoard Layout Xray View From Top

Northern California QRP Club: What are we about?

by Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

Welcome to NorCal, a group of, as of this date, some 900 QRP enthusiasts, mostly in Northern California (hence the name), but now with members in some forty states and a dozen countries.

NorCal was started in June, 1993, and while its growth has been remarkable, there is no effort being made for the sake of numbers themselves; rather, our interests focus on the promotion of QRP fellowship, by means of our monthly meetings, our club quarterly, QRPp, and our club projects, such as the NorCal 40 and the Sierra.

Taking these in order, let me preface a description of our meetings by addressing the organization of the club itself. First and foremost, there are no officers, directors, constitution nor bylaws. Nor are there any dues; membership is free. That puts you on the mailing list and makes you eligible to participate in club projects. You don't have to be a member to attend meetings, but if you want to receive the quarterly, QRPp, that is five dollars per year for 4 issues.

Having no officers nor structure of any significance, every member is equal to every other one. This means that, for example, if you want a QRP net, start one. no permission nor approval is required; as a member of NorCal, you have the authority to start and run an Official NorCal net. Same with club badges. If you want one, have it made. Any style you want. It is an official club badge.

We like this lack of structure and ensuing equality. It avoids the usual club problems of personalities, politics, factions, and at least one other pitfall of conventional club structure, tedious, boring business meetings at club get togethers. Moreover, our egos do not require that the club even continue to exist, much less flourish. If it serves a need and carries its own weight through our meetings, quarterly, and club projects, that is fine; if not, it ceases to exist. Dies, as well it should.

As with any organization, however, there is a need for housekeeping. Three of us have volunteered to carry the major responsibilities. Doug Hendricks, KI6DS, is editor of QRPp. Assisting him are Eric Swartz, WA6HHQ, technical editor, and Mark Cronenwett, KA7ULD, Tidbits Editor. In addition, Steve Cates, KC6TEV, is awards chairman. Wayne Burdick, N6KR is technical director, designer of our NorCal kits, and I am coordinator.

The meetings themselves are something else! Different, to say the least. We meet the first Sunday of each month at the California Burger, Pleasanton, Ca., at 11 AM local time, which follows the wind down of the Livermore Club ham swap, which is only a couple of miles away. This in effect gives our members a "double pinochle." Hi Hi.

The meetings feature no speaker, no secretary nor treasurer's reports, because we have none of these. Ergo: no business meeting! Instead, members bring what ever is of interest to them and therefore of interest to other QRP'ers, an informal show-and -tell. These items are put on various tables and members gather around, moving from table to table, asking questions, discussing, eyeballing, and even making careful hands on examinations. If something is of sufficient interest, you sit down, stay as long as you want. Get up, check out the other tables, talk to other members. If you find a group of continuing interest to you, join in. Spend the entire meeting time there if you want to; otherwise, mill around and see everything and meet everyone.

This goes on for at least a couple of hours, usually more, and quite often ends with everyone in the parking lot, where someone has set up a QRP station and is on the air. The meeting ends when everyone has gone. Hence, never a "captive audience." Come and go

as you like, leave whenever you want. Come early and/or stay late, whatever your time permits.

Members seem satisfied with this format, featuring lack of structure. But if we get tired of it, we will try something else, maybe even quit coming to meetings. Chuck the whole thing. That is our meeting philosophy, as well as our meeting formula.

QRPp is printed four times a year, March, June, September, and December. It is 72 pages and is bulk-mailed in plastic bags, twenty days before issue date, to ensure timely arrival and in perfect condition. The more-or-less break even cost is five dollars for four issues, so that is the annual rate. Canadian members pay ten dollars because their issues are mailed first class, and overseas subscriptions are fifteen dollars, because they are sent air mail.

I should interject here to say that NorCal is a non-profit endeavor. If our cost estimates are low, then the deficiency is made up by the housekeepers. If there is an overage, the money is used to finance other club activities, such as the bagging machine, research and development costs for our club projects, etc.

QRPp is seventy two pages per issue, one hundred percent QRP. No paid ads, although we do accept messages from both commercial and individual sources, as long as they are strictly QRP related, but there are no layout type ads. Members are welcome to list QRP items wanted or for sale. The decision of the editor to any and all the above is final. He does the work; he makes the call.

Each issue is a mixture of technical and non-technical articles, ranging from the complex to the whimsical. Many, if not most, are previously unpublished, and no article is reprinted without the permission of the author and publication. These reprinted articles are those of interest to all QRP'ers, and not everyone has access to all the club bulletins and journals. Members are encouraged to submit articles and tidbits, how to hints. Writing skills are not essential; so don't permit any negative opinion of your writing ability to deter submitting an article or hint, be it operating, building, product review, anything of interest to QRP'ers.

Our first club project was the NorCal 40, a small forty meter transceiver featuring custom designed case, silk screened circuit board, QSK, RIT, AGC, and more. Output was a couple of watts. We did a run of one hundred of these kits, and demand was so great we did another hundred. The first run sold in six weeks; the second in three. The demand continued (and still does), and although we had already moved to our second major club project, the Sierra, we did a run of a hundred partial kits. Perhaps in the future we will do another run so that newer members may have the opportunity to build and use this outstanding QRP rig. But we are at this time totally involved in the current project, the Sierra. This another design from the genius of N6KR. It is a multiband transceiver, via plug in modules, expandable from 160 through 10 meters. Modules are available for eighty through fifteen, with blank boards for those who want to roll their own modules for other bands. This transceiver is also diminutive, with all the featues of the NorCal 40, and more. Originally it was planned to do one hundred of the Sierras, but prepaid orders exceeded that figure, so we are doing one hundred and twenty kits this first run. If members' demand continues, and this kit is available only to members, another run will follow. This rig, as was the NorCal 40 is CW only. But look for a plug in SSB module later; it is on Wayne's design breadboard.

A word about QRP-ARCI, the Amateur Radio Club International, our national QRP organization. We encourage everyone to join and support it. The new member dues are twelve dollars for one year, which includes your membership certificate; thereafter, annual dues are ten dollars, which includes four issues of a very professionally presented Quarterly. To join and subscribe, make check payable to QRP ARCI, and mail it to Michael

Bryce,, 2225 Mayflower, N.W., Massilon, OH 44647.

While on the subject of checks, permit me to add here that any check to NorCal should be made payable to Jim Cates. Our club has no bank account in its own name. Too much hassle and too many fees; instead we use a separate sub-account in my name. It's free, both hassle and monetarily.

Finally, let me speak about QRP activities at Dayton; ARCI has a booth at the Hamvention center, sponsors at least two QRP forums, and has an evening hospitality room at the Day's Inn South motel, where fifty motel rooms are reserved for QRPers. Each evening everyone gets together in an informal atmosphere of QRP fun and convivial-ity. Most of the QRP kit manufacturers are there, displaying their products, and always one or more QRP stations operating. Just a whole lot of good QRP fun and fellowship. Having been there the past two years, I can attest that this is a worthwhile adventure; so much so that NorCal is sponsoring a 1995 Dayton tour from the San Francisco area, to provide discounts for our members.

Thank you for joining and being a member of our group of QRP enthusiasts, to me the cream of the ham fraternity; not easily frustrated, not frantic to be at the top of the pile, mellow and laid-back, a great group of friendly and helpful people, and perhaps the last of the home brewers. 72/73 Jim, WA6GER

NE602 Spurs in the NorCal 40

by Dave Meacham, W6EMD
206 Frances Lane
Redwood City, CA 94062

Because I'm a relatively new member of the NorCal QRP Club I was too late to get a full kit NorCal 40. Had to settle for a "mini-kit". What a pain getting all the parts.

The rig worked right off the bat, but when measuring power output I noticed a fuzzy waveform on my my 'scope. The cause was revealed on the spectrum analyzer - close in spurious signals ("spurs"). I traced the spurs to pin 5 of the transmit mixer. When I told Wayne Burdick he said my crystals were more active than most, making the pin 6 voltage levels too high. This condition caues the NE602 to be overdriven. I also found the pin 1 level to be too high. So, I changed C35 to 220pF, and C31 to 5pF. These gave U4 at pin 1= 0.18V, pin 6 = 0.90V, and pin 7 = 0.35V, all peak-to-peak. I also changed C18 to 220 pF, giving pin 6 of U2 = 1.0V, and pin 7 = 0.3V. The final change was C7 to 10pF giving pin 6 of U1 = 0.85V.

Now the output is super clean. At 2W, spurs are all -50dB and the second harmonic is -38dB. I just wanted to share this information with all of the other NorCal 40 owners in case someone else has "spurs" too. What a GREAT RIG! I salute Wayne Burdick, Jim Cates and Doug Hendricks for making it possible. 72, Dave, W6EMD

TIDBITS

By Mark Cronenwett, KA7ULD
1029 Duncan Ave.
Sunnyvale, Ca 94089

Have any ideas that you would like to share with others? Well here is the place to do just that. Send your ideas to me at the address above, by packet at KA7ULD @ N0ARY.#NOCAL.CA.USA.NA, or by E-mail to mcronenw@pyramid.com via the Internet.

IDENTIFYING FERRITE TOROID CORES

From: Wayne Burdick, N6KR

Ferrite toroids often look identical even when their core materials are radically dif-

ferent. With a bit of effort, you can determine which is which.

First, breadboard a simple oscillator circuit, perhaps using a JFET or an NE602. Use the highest fundamental crystal you can find—maybe 20 to 28 MHz—because a higher value crystal will move more when you change circuit impedances. Next, take a couple of known good cores and insert each of them onto one lead of the crystal. Note the amount of frequency shift you get, as well as any decrease in amplitude.

With these figures in hand, you can now test a bunch of unknown cores of the same size. I've had good success identifying -43, -61, and -67 cores. The -43 material lowers the Q (and hence the output of the oscillator). The -61 material pulls the frequency lower without affecting the Q much. The -67 core does this to a lesser degree.

To avoid the problem in the first place, put some kind of identifying mark on them. I suggest using a dot of paint or nail polish that corresponds to the last digit of the material (e.g., orange for -43, etc.).

"TACKY" TRANSMITTER BUILDING

From: jeffrey@math.hawaii.edu (Jeffrey Herman)

I build all my qrp transmitters on pieces of wood. Thumb tacks make great solder points IF you first sand off the shiny chrome finish - they'll take solder very well then. Also, copper tacks make even better solder points since no sanding is necessary. Jeff NH6IL

MORE NC-40 FRONT PANEL LETTERING

From: Jim, WA6GER for Jim, N0VAH

Jim, N0VAH, showed me his NorCal-40 with what I thought was a painted whiteinsert on the front panel. It had a black border, and all the controls were lettered black also. Turned out that is was a piece of paper. Yes, paper. He did it on his computer, covered it with the sticky plastic material which comes in sheets; availale at stationary stores. Did it ever look sharp! Sure fooled me. And heck, I even had my glasses on. Get my Congress person on the phone, get a law passed making this illegal, before the word gets out. Better yet, get my patent attorney on the phone. Heck, I'm not proud. Jim, WA6GER

PROTECTING YOUR SCHEMATICS

From: Robert Finch, N6CXB

I always seem to need to photocopy the complete manual and schematics that I get with the various qrp kit rigs because I am somewhat sloppy and need a copy of the paperwork to damage.

I have found that laminating the diagrams and drawings with stuff I have been buying at Sam's Club.....it's clear, tough, and three to four sheets makes it stiff enuf to stand up to the abuse at the bench. I make multiple fotocopies of the drawings and glue them up back to back, and can genrally get all of the drawings and charts in 3 or 4 sets of laminations. Careful planning of what are paired back to back minimizes flipping and maximizes utility. As a bonus, all of my wallet bourne stuff is now laminated, and it remains sans-dogeared for a LONG time now.....

QUICK SORT PARTS BIN

From: Robert Finch, N6CXB

Tired of spending up to a 1/2 hour each time you want to build even the most simple circuits, casting about trying to find parts? For me trying to organize with plastic bins seemed either expensive and depending on the unit(s) sspace intensive. I had been looking for a solution for quite some time, being a pack-rat and scrounger, I had picked up

some years ago several thousand envelopes after a political campaign effort, all #10 and all sporting a nifty 'party' logo in the upper left corner. Of no further use to the office I got them from, I had been using them by covering up the 'offending' corner with the 10 to a penny 3 and a half by 15 sixteenth inch printer fed labels.

By cutting these envelopes (after sealing) in half from top to bottom, placing parts in the resulting halves, and folding them in half again, you have a nifty little envelope holder. Labeling the envelope appropriately, and placing in order in old cardboard boxes, your entire small parts inventory of thousands is now at your fingertips.

In fact I just needed a transistor relay driver, and got all the parts together in record time, under a minute!!!!..... This solution should appeal to the cheap, gotta do it myself, attitude I seem to be afflicted with...hi....hi....73's ...Bob.....N6CXB

T2/R2 QRP SSB TRANSCEIVERS

John Liebenrood, K7RO
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Portland OR 97229
503 626 7745 Internet: k7ro@nwcs.org

Interest in QRP single sideband continues to grow! Building a SSB transceiver that's fun to operate is no longer an insurmountable project.

This article describes how a low power SSB rig can be assembled using readily available circuit boards. The circuits shown are proven and easily duplicated. I and my neighbor, NB7W, have both built rigs this way. This article isn't a step by step construction article, but it does cover the circuitry needed, to put a high performance SSB rig on the air.

Rick Cambell [1,2,3,4] KK7B recently published a series of SSB construction articles in QST. Rick designed two high performance modules to generate and receive single sideband. Rick split the design into two circuit boards; a T2 board and a R2 board. The T2 board generates SSB using the phasing method, without crystal filters. The R2 board is a complete SINGLE SIGNAL direct conversion receiver. Bill Kelsey, N8ET [11] now offers inexpensive T2 and R2 kits, including professionally done circuit boards for both the T2 and R2/mini. This modular approach lets you build a high performance SSB rig. Then expand it later as your interests and needs change. The audio quality of the R2 is amazing. Everyone that listens to the R2 comments on the clarity and "presence" of the direct conversion audio. It's a fun rig to operate.

In addition to the T2, R2 boards you'll need: VFO, T2 buffer amplifier, power amplifier, and an antenna change over circuit with filtering. You'll need to decide how you want to package it as well. The photos at the end of the article show three different single band R2/T2 ssb transceivers. Unless compact size is important, an over-sized cabinet leaves room to experiment, troubleshoot, or add features later. Figure 1 shows the block diagram of K7RO's 40m R2/mini T2 rig for bicycle mobile. Yes, this rig is used to operate QRP HF from a bicycle. There's actually a group of hams that do this! (Hartley Alley, NA0A writes a quarterly newsletter for the Bicycle Mobile Hams of America [13]. Drop Hartley a note if you'd like to find out more.) The 20w pep rig is built in a 2.5" deep, 1.5" height, and 8" long box. The rig has three controls, main tuning, volume, and PTT.

K7RO 40m T2/R2 Biker

Size: 2.5"deep, 1.5"high, 8"long
DC 12V: 50mA Rx, 4Amps Tx
KK7B Boards: T2 R2mini
Pep Output: 20watts LSB
VFO: 7.150MHz to 7.300MHz 3Turns
Audio: Headphones only
RIT: none
AF Bw: 1.300KHz to 3Khz
Controls: Freq,PTT,Vol

NB7W 75m T2/R2 BandBlaster

Size: 4"tall, 10.5"wide, 7"deep
DC 12V: 100mA Rx, 4Amps Tx
KK7B Boards: T2, R2
Pep Output: 20watts LSB
VFO: 3.5MHz to 4.0MHz 20turns
Audio: 8ohms 1/2watt
RIT: CW offset only
AF Bw: 3 Bandwidths
Speaker: Internal
Metering: V, I, P, SWR, S-meter
Controls: Freq, PTT,Vol,AF Bw, Cw/Ssb,Meter

IS 75M A GOOD BAND FOR QRP SINGLE SIDEBAND?

One of the first decisions to make is, which HF band to use. Given the current solar conditions, I'd recommend 40m or 75m. Both John, NB7W and I started with a single-band 75m transceivers. Building a multi-band T2/R2 rig was more than we wanted to take on for our first home-brew SSB transceiver. The second R2/T2 rig I built was also a single band transceiver, but this time I set it up for 17m. I've since moved it from 17m to 20m to 40m. During the summer months, I didn't find a lot of strong 17m band openings. I've also tried to operate QRP SSB on 20 meters from the field without success. A dipole at 15 feet doesn't work on the crowded 20m phone band. If you are going to operate portable or use the rig in the evening hours, I'd recommend 75m or 40m. I've had great success operating my T2/R2mini rig on 40m.

A 75m T2/R2 makes a great rig for portable use. I had mine along on a week long bicycle tour in Eastern Oregon. After pedaling 60 to 80 miles each day, I'd set up the T2/R2 rig in camp at night. I had a lot of fun chatting with my friends back in Portland Oregon each evening. Reports of S9 plus 10dB were common on 75m, this was with a dipole only 15 feet off the ground.

I've also used my 40m R2/T2 rig on a week long bicycle tour of Arizona. This bicycle tour covered 570 miles in seven days. It starts at the Grand Canyon and ends in the Mexican border town, Nogales. Each night I strung up an antenna to worked back into Portland Oregon with S8 reports. A simple 40m dipole, 15' up in a juniper did the job. By chance the California QSO party occurred while I was camped at the at the Grand Canyon. I passed out 10 quick QSOs on 40m SSB with the rig. One QSO was with W6RO on the Queen Mary. Once you've tried QRP SSB from the field I think you'll be hooked.

STABLE SINGLE BAND VFOS FOR 75M, 40M, 17M

What can be said about VFOs that hasn't been covered before? It's critical you start with a proven design that can be duplicated with good results. Locate a copy of W7EL's "An Optimized QRP Transceiver for 7MHz", Aug 1980 QST, or 1993 ARRL Handbook Chapter 30, page 37. Roy covers a number of guidelines to insure stability. I'd recommend using Roy's circuit if you plan to operate 40m. Make sure to package the VFO section in a separate shielded compartment. We used pieces of unetched circuit board material to form a metal box around the VFO circuitry. Adequate shielding is need to keep the PA currents from coupling back into the VFO. This undesired coupling causes FM-ing on the transmitted audio. Stable VFO construction starts with good ceramic NP0 caps (Panasonic from DigiKey), and brass plate main tuning capacitors. Another excellent technique is to boil the type-6 powered iron toroidal inductor to anneal it after wind-

ing. I've achieved good stability with Roy's LC based VFO at frequencies as high as 14MHz.

If you'd like to set up the T2/R2 on 17m SSB you'll need a stable 18.1MHz VFO. Achieving adequate stability with a 18.1MHz LC VFO can be tough. I decided to use a crystal based VFO to insure clean audio and low drift when operating the rig in the field. The 17m SSB band edges are 18.110 and 18.168MHz. Wes Hayward, W7ZOI published a broad-band oscillator circuit that starts reliably, and places one end of the crystal at ground potential, a useful feature when pulling the crystal with a variable capacitor. To insure the widest tuning range the crystal's motional cap acitance should be as high as possible. I purchased HC25 18.135MHz crystal from JAN Inc. with a Cm = 0.02pf, Co = 4pF. One crystal costs about $8. You'll want to select a variable capacitor with a low minimum value of capacitance ie 5pF. This insures the widest pull range. The tune rate is nonlinear, mine varied about two to one. Build the VFO with point to point wiring over a ground plane of copper foil, ugly construction.

Some DC transceivers exhibit a pulling of the VFO when going from receive to transmit. This isn't due to inadequate VFO buffering or inadequate VFO supply regulation. A small amount of the transmitter energy is coupled into the VFO tank circuit. If the coupling is excessive the transmitted SSB audio will be distorted. The most important thing to do is to connect the ground side of the VFO inductor to exactly the same point as the VFO tank capacitance. The best approach is to run the VFO at half the transmitter output frequency and double it. Roy Lewallen ,W7EL published a simple circuit to do this. Roy's design uses few parts, has low current consumption, and is repeatable. Schematic 2 shows the VFO/doubler for 40m. My compact T2/R2mini 40m rig puts out 20watts pep, before I used Roy's VFO doubler technique the transmitted audio exhibited FM-ing due PA to VFO coupling. I'd encourage you to start with the doubler approach right off! Roy also points out that using a oscillator which runs at 1/2 the receiver frequency and doubling it also greatly reduces audio feedback, which causes hum or audio squeal.

To complete the VFO section we'll need to select a 90 degree phase shift network. We started with the simple R/C network shown in Rick Campbell's Jan 93 QST article. The SSB rejection measured >30dB across the SSB portion of 40m. To align the phasing network, I installed temporary variable trimmer capacitors. Once the correct value was found I replaced it with a fixed capacitor. The Toko splitters appeared to work fine on 75m although the published spec indicates >20MHz. Schematic 3 shows the circuit values for 75m. KK7B describes how to construct an in-phase home-brew splitter in the Jan 93 QST article.

Try and find an old copy of (before 1965) "Single Sideband for the Radio Amateur", ARRL. This book has several articles on phasing SSB generation. One 5 page article "How to Adjust Phasing Type SSB exciters" is still quite informitive! I purchased my copy for 25 cents at a swap meet.

The VFO will require a buffer amplifier to drive the T2/R2 diode ring mixers. The two transistor buffer amplifier by W7EL is more than adequate, see figure 3. Recall you'll lose 3dB of LO power in each phase splitter network. Each T2/R2 diode ring mixer needs at least 5mW of LO drive power, or 1.4V peak to peak into 50ohms

In a future installment I'll share some ideas on multi-band LO alternatives. Drop me a note if you've worked up a cleaver approach. I'd like to hear from others who pursue this. You'll need a broad-band quadrature phase shift network that maintains less than 1 degree phase error. A "no tweak" digital phase shift approach was published in QEX recently. Take a look at Peter Anderson's work in QEX September 93 " A Different Weave of SSB Receiver".

T2 / R2 TIPS AND TWEAKS..... PART I

The T2 / R2 circuit design is solid, and well documented in QST. [1,2,3,4]. We did find a few places to tweak the design a bit. We encourage you to read and re-read these articles, Rick packs a lot of valuable information into his R1, R2, T2, and R2/mini QST articles. KK7B's R2/mini article will be published in QST this fall, the circuit board is 2.5" by 5".

The 1993 T2 parts placement diagram for C10, C3 is wrong. Double check these for the correct polarity since they are electrolytic capacitors. On the original R1, I adjusted the value of R20, nominal 5.6K, to lower the output quiescent voltage from 7.5V to 6V. Wes Hayward originated a simple change to improve the R1/R2 sensitivity. The circuit change improves the noise figure from 20dB down to 12dB, see schematic 4.

If you notice a LO feedthru glitch when the T2 is keyed this is due to the sequencing of the 6V and 12V supplies. On the T2, R3/C3 delays the 6V from coming up with the keyed 12V line. I haven't come up with a simple fix yet. The LO glitch isn't annoying on the air, but it's noticeable when probing the circuit with a scope.

POWER AMPLIFIER ALTERNATIVES....STOKE IT UP OM!

The T2 board ouputs a low-level 2 milli-watt ssb signal. We used a proven buffer amplifier circuit published by Wes Hayward, W7ZOI to boost the 2 milli watts to 1/2watt Pep. The buffer amplifier circuit was published in "QRP SSB/CW Tranceiver for 14MHz Dec 89 QST". For a Power Amplifier, we purchased the CCI [7] HF 20w amplifier kit, at a cost of $75. This solid Motorola design uses two MRF433's in Class AB, quiesent bias in each device is 200mA. The CCI PA draws 4 amps peak for 20w PEP out. You'll need to follow this with an output lowpass filter. A 20w PEP P.A. draws 4 Amps peak current. In the field a 4A/hr lead acid battery will keep you on the air for several hours.

Make sure you use a output lowpass filter after the T2 MAR-2 device, remember this is a broad band amplifier. We used W7EL's QSK antenna change over circuit to switch the antenna between the PA and R2 input. I had to break the speaker line with the PTT switch to prevent speaker squeal on transmit. To conserve battery power I switched off the 12V supply to the PA during receive. A PMOS device (Digi-Key IRFF9130-ND) carries the 4 amps needed by the PA, refer to the first block diagram. This saves 1/2Amp on receive!

FUTURE INSTALLMENTS OF T2/R2 TIPS

Rick, KK7B has given the QRP community an excellent design for QRP SSB. This is a fun rig to build and a thrill to operate, well worth the effort to put it on the air! John, NB7W and I had a great time collaborating on the construction of our T2/R2 rigs.

If you would like to contact me, I can be reached in the evenings at 513-625-7745. I can also be reached via my e-mall internet address: k7ro@nwcs.org. I'd like to hear from you! I'd like to share some of your ideas in a future installments of " R2/T2 Tips and Tweaks ". Drop me a note describing your efforts.

KK7B's T2 / R2 Articles:

[1] R Campbell, "High Performance Direct Conversion Receivers" QST Aug 92

[2] R Campbell, "High Performance Single-Signal Direct Conversion Receivers" QST Jan 93

[3] R Campbell, "A Multimode Phasing Exciter" QST Apr 93

[4] R Campbell, "Single-Conversion Microwave SSB/CW Transceivers" QST May 93

Related Articles, T2 / R2 Part sources:

[5] Wes Hayward, "A QRP SSB/CW Transceiver for 14MHz", QST Jan 90

[6] Wes Hayward, "A Progress Communications Reciever" QST Nov 81

[7] Wes Hayward, "Stable HEXFET RF Power Amplifier" QST Nov 89

[8] Jim Wyckoff, "30Watt Power MOSFET PA for 80m" QST Jan 93 page 50

[9] Roy Lewallen, "An Optimized QRP Transceiver" QST Aug 80

[11] T2, R2, R2mini Kits: Kanga US, 3521 Spring Lake Dr, Findlay, OH. Bill Kelsey,

N8ET 1-419-423-4604
[12] CCI Communciations Concepts, Beavercreek, OH 513-426-8600 Sells a line of HF PA amplifer kits.
[13] BMHA Bicycle Mobile Hams of America, Editor NA0A P.O. Box 4009 Boulder CO, 80306 quarterly publication

K7RO T2/R2MINI Block Diagram Parts List

L1, L2 1 uH, 19T #28 Enamel on T37-6 Toroid
L3 9.4 uH, 58T #34 Enamel on T27-6 Toroid
C1 470pF
C2 910pF
C3 390pF
C4 51pF
All diodes 1N914

17 Meter Crystal Oscillator Parts List

X1 18.135MHz HC25 crystal, Cm=0.02pF, Co=4pF $8each Jan Inc. 1-813-936-2397
L1 40Turns on Amidon T36-6 #28 guage wire
C1 5pF to 56pF Main tune capacitor
C2 0.01uF ceramic
C3,C4,C5 0.1F ceramic
C6,C7 180pF adjust for min LSB content
C8,C9 180pF adjust for min LSB content
C10 .01uF ceramic
R1 270
R2,R6 1K
R3 4.7K
R4,R8 100
R5 10K
R7 150
R9,R10 49
R11,R12 49
T1 Broadband Transformer 5:1 ratio Pri 20T #26, Sec 4T #26 FT37-43 Pri: 13T collector side, 7T base side
T2 Broadband Transformer Pri 15T #26, Sec 3T #26
T3 In-phase spitter TOKO TK2518 Power combiner, Digikey
Q1,Q2,Q3 2N3904

W7EL 40M VFO/Doubler Parts List:

L1 37T #28 on T44-6 core Tap 10T from gnd end
C1 6 - 80pF Main Tune
C2 1.5 to 5pF Lower Limit set
C3 4.7pF NP0 ceramic
C4 15pF NP0 ceramic
C5 650pF NP0 cermaic
C6 680pF NP0 ceramic
C7,C8 0.1uF
C9,C12 0.1uF
C11 9 - 45pF trimmer
C10 150pF NP0 ceramic
C15,C16 470pF adjust for min USB content

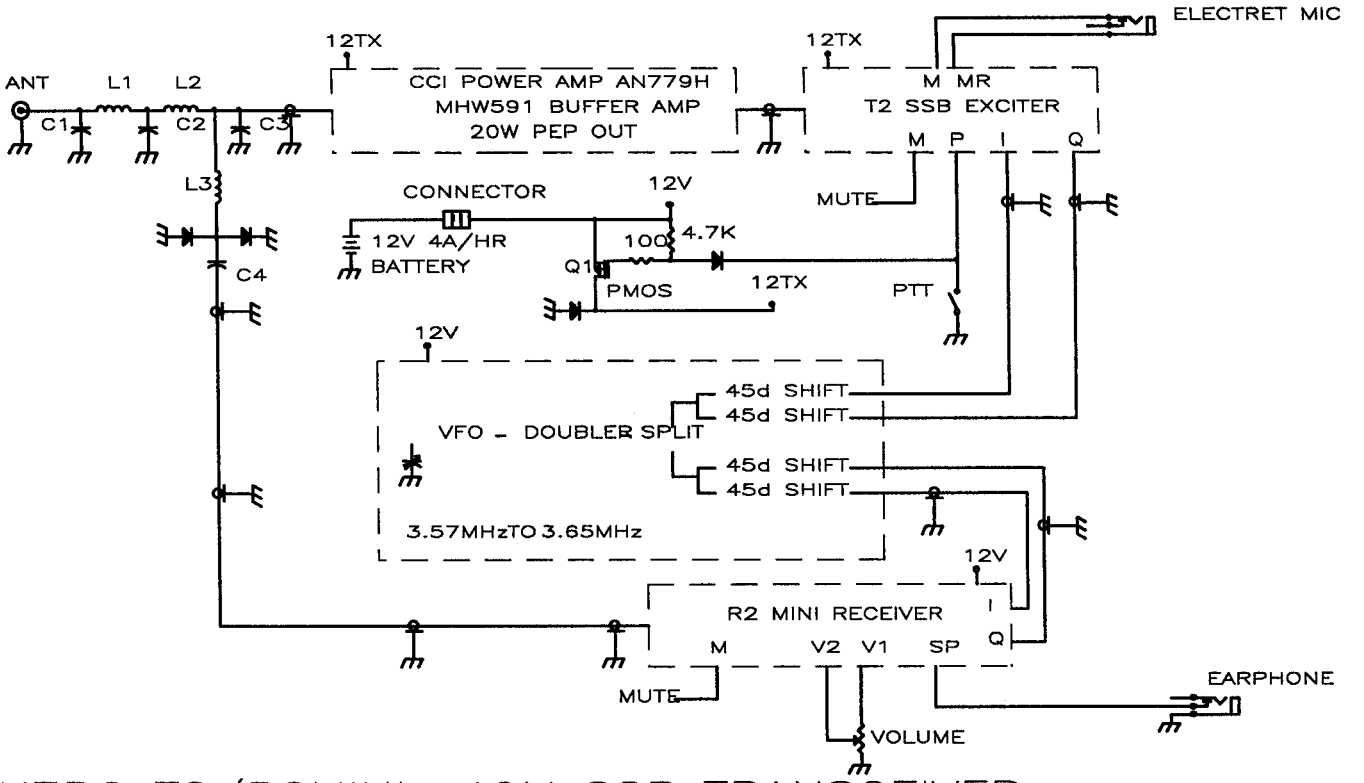
C17,C18 470pF adjust for min USB content
R1 1MEG
R2 100
R3 150
R4 100 Trimmer
R12 100
R8,R9 49
R10,R11 49
T1 Twist two #26 wire together, 10T on FT37-72 core
T2 Pri 25T Sec 5T on T44-6 core
T4 In-phase spitter TOKO TK2518 Power combiner, Digikey
Adjust R4 for minimum Oscillator Freq output from TX Adjust C11 for maximum at 7.1MHz

75M VFO Parts List

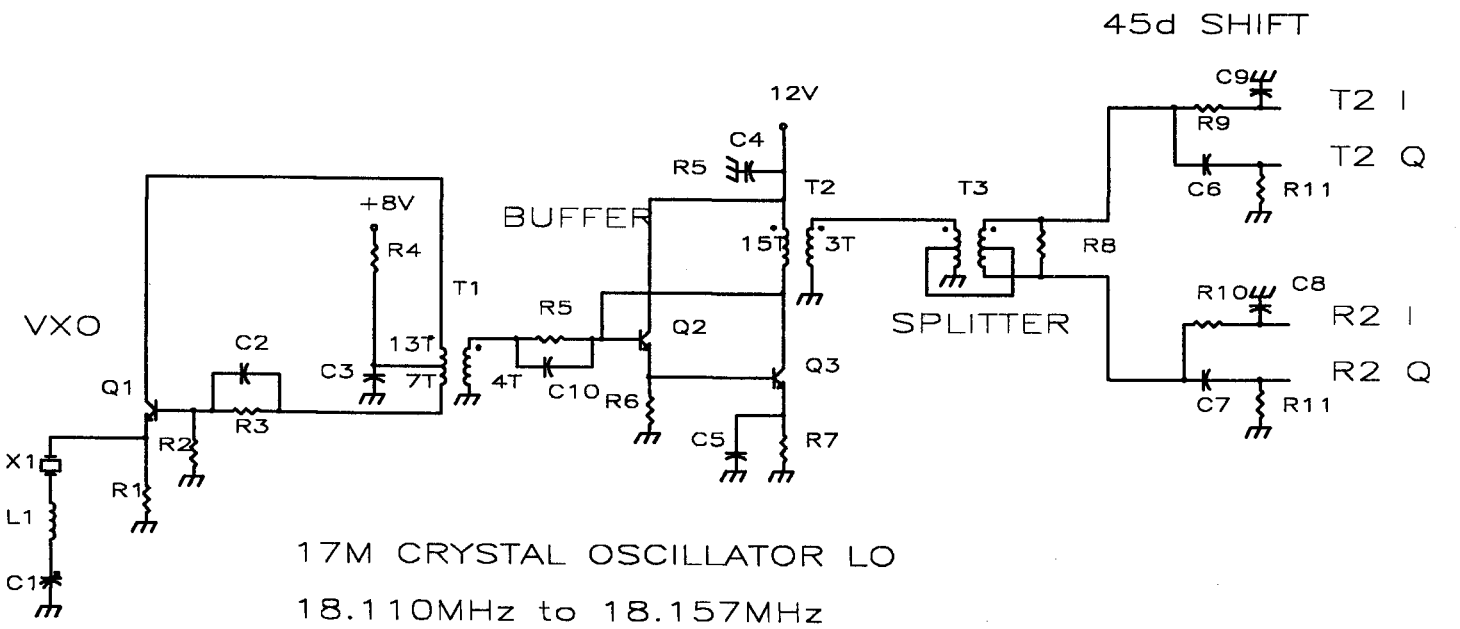
L1 9.25uH
L2 2.26uH Adjust for min USB content
L3 2.26uH Adjust for min USB content
C1 6 - 80pF Main Tune 200Khz tune range 3.7 to 3.9MHz
C2 1.5 to 5pF Lower Limit set
C5 4.7pF NP0 ceramic
C6 15pF NP0 ceramic
C3 517pF NP0 cermaic 470pF + 47pF
C4 270pF NP0 ceramic
C7,C8 0.1uF C9 0.1uF C10,C12 903pF C11,C13 903pF
R1 1MEG
R2 100
R3 10K
R4 27K
R5 1K
R6 100
R7 100
R8 100
R9 150
Q1 2N4416
Q2,Q3 2N3904
T1 Pri 25T Sec 5T on T44-6 core
T2,T3,T4 In-phase spitter TOKO TK2518 Power combiner, Digi-Key

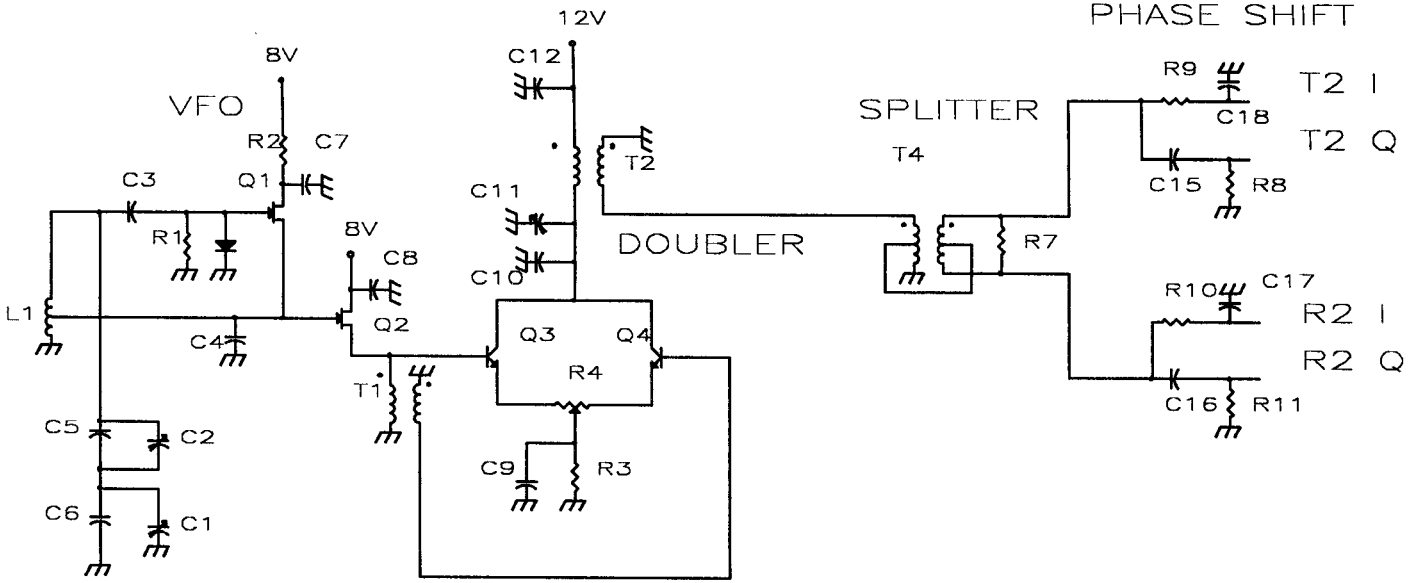
W7ZOI Buffer Amp Parts List

R1 1.5K
R2 470
R3 47
R4 4.7
R5 22
Q1 2N5859
C1,C2,C3 0.1uF Ceramic
T1 Broadband 10T bifilar #28 on a T37-43 core, observe phasing

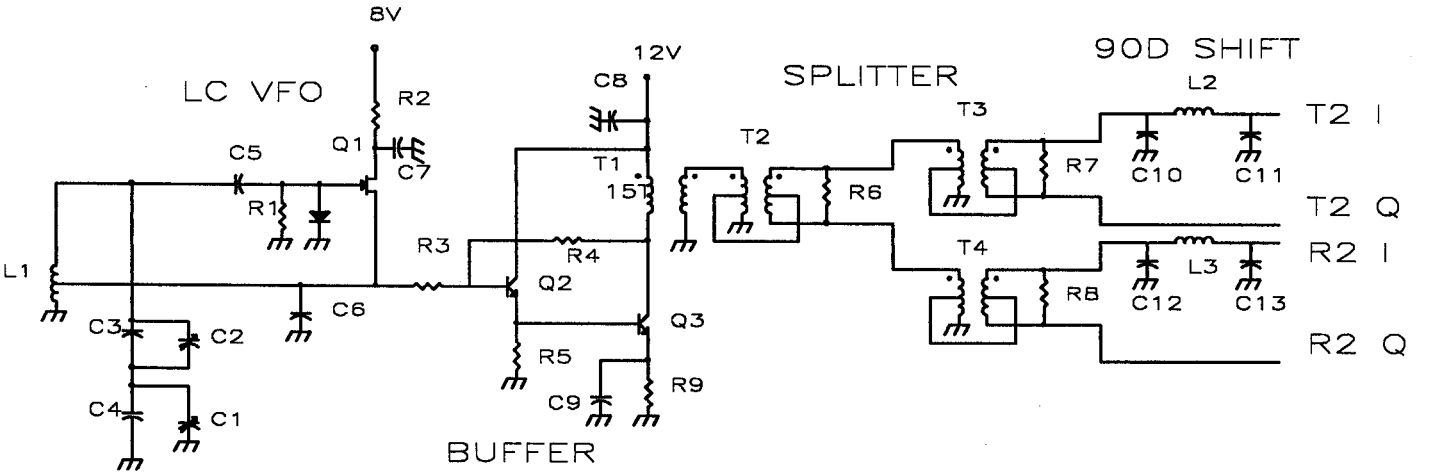


K7RO T2/R2MINI 40M SSB TRANSCEIVER

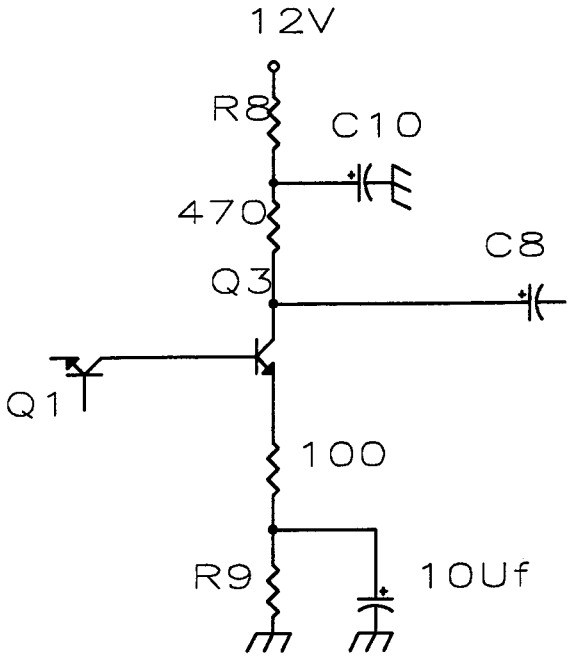

45d SHIFT
12V
C9
T2 I
R9
T2 Q
C6
R11
C4
R5
T2
T3
+8V
BUFFER
15T
3T
R8
R4
T1
R5
C10
R10
C8
R2 I
VXO
C2
13T
Q2
SPLITTER
Q1
C3
7T
4T
Q3
R2 Q
C7
R11
R3
R6
X1
R2
C5
R7
R1
L1
C1
17M CRYSTAL OSCILLATOR LO
18.110MHz to 18.157MHz



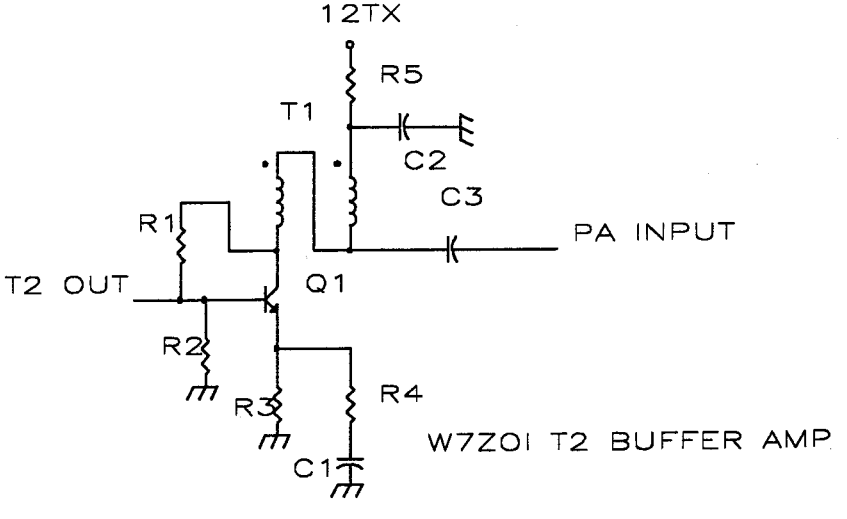
W7EL 40M VFO / DOUBLER



75M LC VFO , PHASING NETWORK



R2 / R1 W7ZOI PRE-AMP MOD



W7ZOI T2 BUFFER AMP

The NorCal 40A

Guys, here it is, more exciting news from NorCal QRP Club. Wayne Burdick sent me this article in response to a discussion that was held at our regular club meeting in October. Jim Cates, Eric Swartz and I have finally convinced Wayne that the club needs another run of NorCal 40's. Wayne agreed that we needed to, but he wanted to make some improvements and fixes. The club is taking orders from now until Jan. 1, and the price will stay the same, $94.00 including shipping for US residents outside of California, $99.00 for California residents (includes shipping and California State Tax), $99.00 US Funds only for DX orders, which will be shipped airmail. Send your checks and/or money orders made out to Jim Cates to:

Jim Cates, WA6GER
3241 Eastwood Rd.
Sacramento, CA 95821

This offer is only for NorCal members. We need to do that because we are not a commercial venture. To become a NorCal member, send an additional $5 to Jim Cates at the above address. We are looking at a Feb. shipping target. But again, we are at the mercy of our suppliers.

The NorCal 40A: Solid Evidence that Darwin was Right!

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

As predicted, NorCal members modified, molded, prodded, painted, tweaked, torqued and tested thier NorCal 40s during the past year and a half. The result is that we've learned a lot about how to improve the basic design.

Does this provide evidence for the Theory of Evolution? You betcha! A small number of NorCal 40s mutated or mated their way into superior fitness, and the new generation—the NorCal 40A—is ready to squirm out of its shell and into the sunshine.

The NorCal 40A will have a number of improvements over the original design, including a few ideas borrowed from its cousin, the Sierra, but the price will stay about the same. I hope the kit will appeal to some of our newest members, many of whom missed out on the limited run of the NorCal 40 and Sierra.

Here's a partial list of improvements that I expect to include in the new design:

1. New PC board layout—cleaner, with solder mask to reduce shorting, etc.
2. Toggle switches for RIT and ON/OFF will have threaded bushings, making the front and rear panels MUCH more stable.
3. RIT circuit from the Sierra will be used—fewer parts, and easier to convert to RIT/XIT if desired.
4. Better grounding around the crystal filter will yield less filter blow-by on strong signals.
5. I'll include a pot for adjusting the AGC level, eliminating the infamous "R6" problem. (High 5's all the way around!)
6. There will be more space available to put in a ten-turn VFO pot.
7. The VFO and RIT resistors will all be scaled to allow the use of a 10K VFO pot. It's

easier to find a 10-turn 10K pot than 100K (thanks, Doug).
8. The TX mixer's 4.915MHz crystal oscillator will use a 270pF rather than 150pF cap to reduce the signal amplitude into the NE602, which will in turn reduce output harmonic content. (The product detector NE602 crystal oscillator will get the same treatment.)
9. The TX monitor pitch and RX BFO pitch will both be independently adjustable as it is on the Sierra.
10. The DC power connector will be a standard 2.1mm barrel, as on the Sierra, rather than the RCA jack. This will prevent power supply shorts.
11. I'll try to include 80-meter modification instructions. This will involve changing around 10 to 15 component values.
12. The long standoffs on the top of the PC board will (hopefully) go away, in favor of Sierra-style plastic latches. (One thing we learned from attending NorCal meetings is that people like taking the covers off of their rigs and showing them off!) The latches will mean no more lost screws, and will also allow easy access to interior controls and modifications, as in the Sierra.
13. TX keying will be improved using the keying circuit from the Sierra.
14. Most of the high-frequency hiss from the audio amp will be removed with a 1.8 K resistor in series with a .01uF capacitor, connected between pins 5 and 8 of the LM386. This and other receiver tweaks will result in a +9 dB improvement in overall receiver gain.
15. We'll switch to an LM386N-4 so you can optionally run the AF amp directly from a 12 to 15V supply. This may improve AF output. (The LM386-1 can stand 12V, but just barely—see the National databook.)
16. With any luck, Eric Swartz will write an article on how to build a noiseblanker for the little critter. Of course he already wrote an article on how to add an S-meter to it using a bargraph LED.
17. The manual will be updated, of course, and will include some features from the Sierra manual, such as the DC voltages chart. We will use the same binding and cover format as the Sierra Manual.

The NorCal 40A schematic will be reprinted in a later issue of QRPp so that anyone can, if they wish, modify the NorCal 40 in the same way. You can get an early start on this by studying the Sierra schematic, elsewhere in this issue (particularly for items 8 and 13 above). Also try item 14 if you think your NC40 has high hiss.

Thanks again for all of your help in refining our first club rig, which refuses to roll over. Who knows? Perhaps another year of field testing by new members will culminate in a NorCal 40B. If this keeps up, we'll have to honor Mr. Darwin with a QRP DXpedition to the Galapagos Islands....73, Wayne, N6KR

Sierra Problems: Q & A

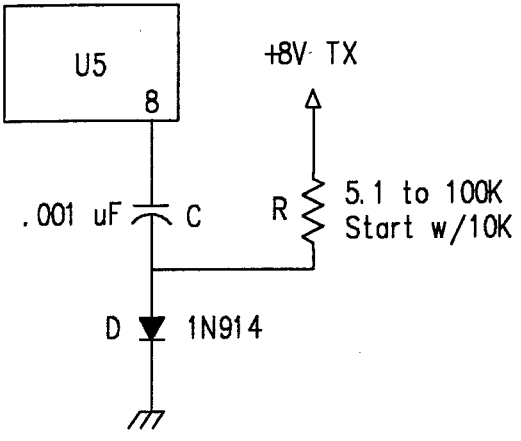
By Wayne Burdick, N6KR
1432 6th Ave.
Belmont, CA 94002

(NOTE: If you read an earlier version of this on the Internet, please read this version since it has been expanded and rewritten).

As expected, some problems emerged during field test. If you are still having any trouble with your Sierra, this note may clear it up. On the other hand, most of the rigs have worked first time, with almost zero assembly errors or solder spashes! Thanks, everyone, for doing such a good construction job.

Here are the answers to the most frequently heard questions:

Q: What if the VFO doesn't cover 150KHz as specified in the alignment section, even after tweaking the turns of L7?
A: This is due to a chance combination of capacitors that are low and a toroid core that's high, or vice-versa. In extreme cases you may have to add turns to or remove turns from L7. If you get burned out on this, you can always flip the dial over and add your own calibration markings to the unused egde. Some of you might want to do this anyway in conjunction with changing the VFO range (e.g., some prefer a 70 or 100 KHz range rather than 150KHz).
Q: How can power output be improved?
A: If you're getting less than 1.5 watts on 14 MHz or lower, or less than 1 watt on 18 MHz and up, here are some things to try: (a) re-peak the premix oscillator and TX trimmers (slowly! they're touchy); (b) squeeze the turns on L6 in the output low-pass filter a bit; (c) substitute 5% capacitors for C47, C48, and C49. Any kind that fits on the band module will do, but be sure to use caps with 5% tolerance and at least a 50 volt rating. (d) We discovered that some of the PMO crystals (X8) from ICM have lower activity than the ones used in the prototypes. If you suspect yours, try changing C69 to 39pF, which will increase the PMO output.
Q: How can the sidetone volume (transmit monitor level) be reduced?
A: Excess sidetone volume is due to the TX 4.915MHz oscillator signal over-coupling into X5, the post-IF-amp crystal filter. It may in extreme cases be high enough to cause clipping. Things to try: (a) adjust C38—the TX monitor pitch trimmer—so that the TX monitor tone is just a bit out of the center of the receive crystal filter's pass-band; (b) if this doesn't do it, try this circuit (on the bottom of the board, with short leads):



Don't cut any treaces or remove existing parts: just add these three (R,C, D) to the existing circuit.
Q: Can the sidetone pitch range be increased? It won't go low enough.
A: Things to try: (a) make C39 larger — e.g. 330pF; (b) make L2 larger, e.g. 22uF (using an RF choke or toroid—doesn't matter which); (c) as a last resort, you can parallel a 27 to 33pF cap across C38.
Q: Why is the 10-meter band module so hard to get aligned? [May also apply to 12 meters.]

A: The bandpass filters have a higher than expected Q on 10 meters, resulting in signal levels that are too high. To tame these filters: (1) put an 8.2K resistor across L4 (or across the corresponding trim cap); (2) put a 13K or 15K resistor across L9 (or its trim cap). If you still have instability or if you've killed the transmit output altogether with these resistors, measure the corresponding transmit RF voltages and compare them to those in the Troubleshooting section of the manual. You may have to vary the size of the damping resistors. (The Sierra was originally intended to cover only 80 through 15 meters, so 160, 12, and 10 are a bit experimental! Thanks for your patience.)

Q: Should I use sockets on the ICs?

A: Better not to; the sockets are usually less reliable than the ICs you put in them. Also, because of the close proximity of the gain stages in the receiver section, sockets might actually cause some receiver instability. You might even hear an audible oscillation that gets worse as AF gain is increased. If you DID use sockets and don't want to take them off, here are two things you can do to improve receiver stability: (a) make SURE you used a 220K resistor, not 47K, at R3, as specified in the addendum; (b) as a last resort, add a 22uF electrolytic from pin 1 to pin 3 of U5 (the MC1350) positive end to pin 1. This may be added to the next production run to lessen the possibility of instability even with sockets.

Q: Since there are exposed pads on the top of the board, do I need to be careful when installing metal case parts like crystals and transistors?

A: YES!!! The solder mask leaves the pads exposed on top AND bottom, so keep metal components spaced slightly above the pads.

That's it for now. Please let me know how your Sierra kits are coming together. If you get really lost and can't find help in your area, write to me or call me at (415) 592-2700. My goal is to have all the Sierras up and running. Thanks and 72, Wayne, N6KR

How Do I Join NorCal?

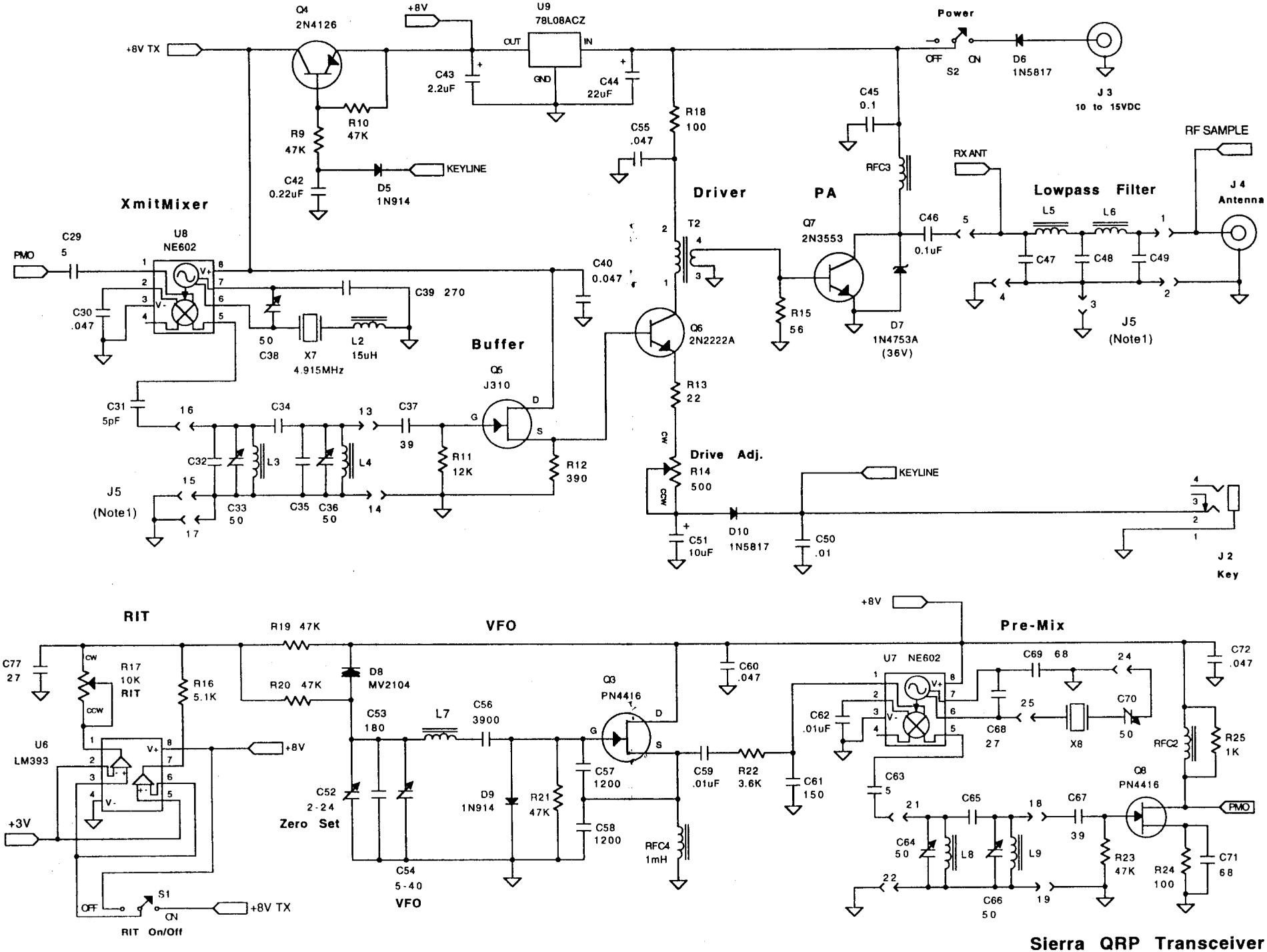
The NorCal QRP Club was formed in June of 1993 with the purpose of exchanging information and fellowship for and about QRP. There is no charge for membership, but to receive QRPp, the Journal of the Northern California QRP Club, you must pay a $5 per year subscription fee. The $5 is an attempt to break even. It is not the intent nor purpose of NorCal or QRPp to make any money. To join and subscribe, send your name, call, address and $5 to Jim Cates, WA6GER, 3241 Eastwood Rd., Sacramento, CA 95821. If you send a check or money order, be sure to make it out to Jim Cates and not to NorCal.

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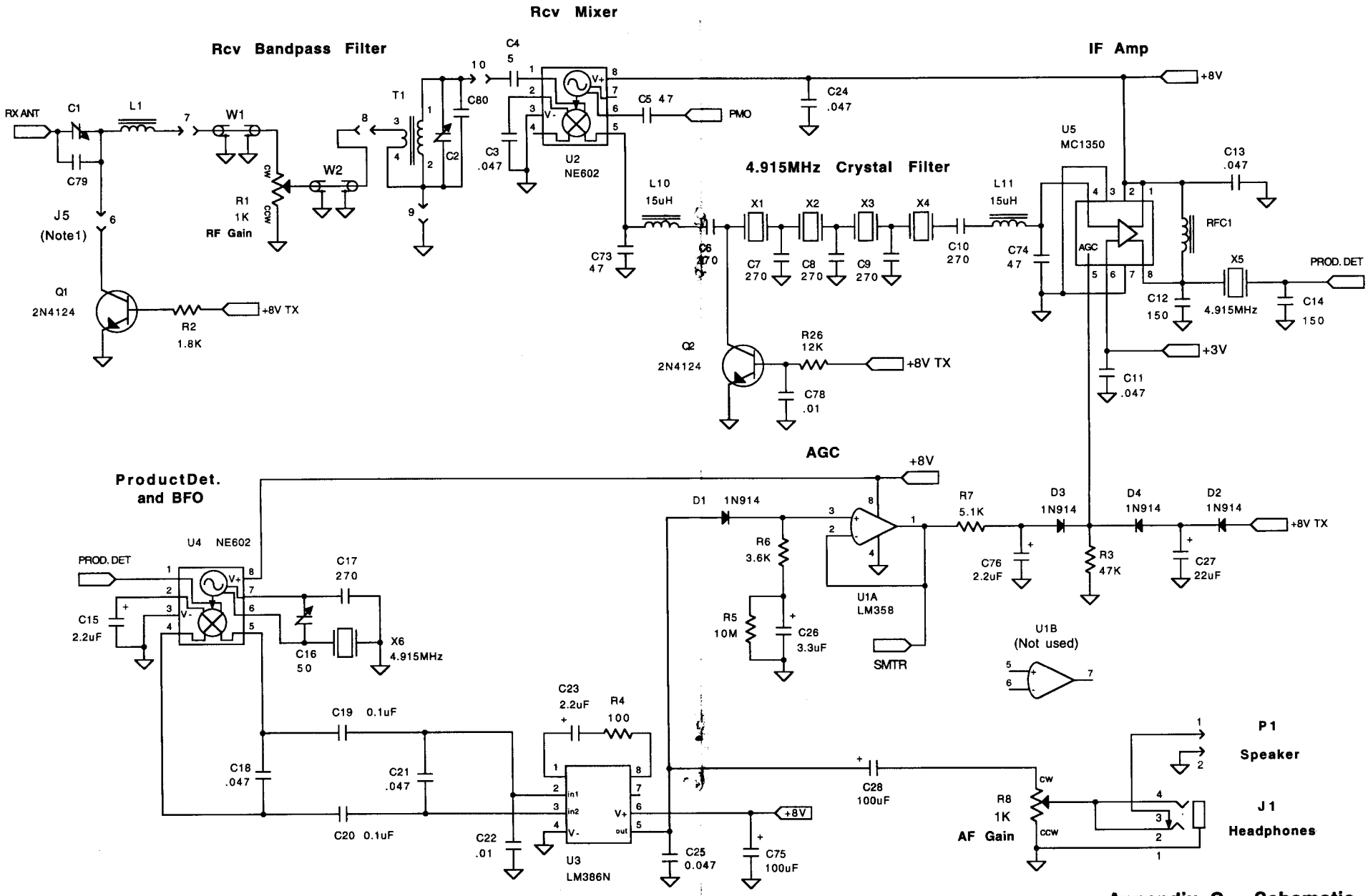
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Sierra QRP Transceiver

Rev. C, 9-3-94 Sheet 2 of 3



Note1: Band Module connections are shown by the symbol → ← where the male contact is on the Band Module and the female contact is part of J5 on the main PC board.

Appendix C - Schematic
Sierra QRP Transceiver

Rev. C, 9-3-94 Sheet 1 of 3

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