IOWA QRP JOURNAL

NEWSLETTER OF THE IOWA QRP CLUB

It's that time of year again! Fall has arrived bringing the changing colors and the harvest from much hard labor. The higher bands have awakened bringing many major openings and plenty of DX to work with those QRP signals. Admittedly this is my favorite time of year. The weather is still nice enough to enjoy while ham radio conditions permit many hours of excitement. We all know what type of weather lies ahead so now is the time to do a check of antenna systems or put up that new antenna.

Earlier we established a theme of planting the seeds of QRP to see what our harvest would bring. The club has planted seeds by having display tables at the Des Moines, Sioux City, Amana (thanks to KB0EDE), and West Liberty hamfests. Building events were held in Sioux City, West Liberty, and Des Moines to introduce new builders to the joy of constructing your own equipment. The Fireball 40 transmitter kit was featured in Sioux City and the St. Louis Audio Amp was featured in West Liberty and Des Moines. Ade (W0RSP), Paul (KB0JIT), Jerry (WB0T), and John (NU0V) had QRP related presentations at the Sioux City hamfest. A building contest was held in January with three winners being awarded prizes for their outstanding entries. The second annual building contest will conclude sometime in January 2000.

Meetings were also held in Urbandale, Sioux City, and Iowa City to give everyone an opportunity to attend. The club also arranged group buys on books with Paul Washa books and Tick Keyers from Embedded Research. Plus special promotional prices on QRP kits were offered at some of the hamfests (by various vendors).

It has been a great year for the club and the harvest we have gained is that membership has grown into the 90's. I expect it to continue to increase, as the club remains active in promoting the 'good word' about low power operating. Members are sharing their operating experiences and projects by writing articles for this newsletter (and my thanks to you all for making it a success). Many new builders have been shown how easy and fulfilling it is to pick up that soldering iron and create a functioning station accessory or rig.

The Iowa QRP Club will also be sponsoring several operating events in the upcoming months. More details will follow later but I think you all will enjoy what's in the works.

Over the last few months I've had the pleasure of working with Dave Gauding of the St. Louis QRP Society. The SLQS has donated several sample issues of their newsletter for our display table plus has donated audio amp boards to use as a club project. The boards have been distributed at the West Liberty and Des Moines hamfests and any remaining will be available to members by sending me an SASE (while supplies last). The audio amp is a fun project and is a great project for the first time builder.

Finally I need to correct a mistake I made in the last issue of the Iowa QRP Journal. I incorrectly stated the VE3DNL marker generator kit was being sold through the Arkansas QRP Club. That was not correct and my apologies to Jay Bromley W5JAY of the Ft. Smith QRP Club (Arkansas). The Ft. Smith group is marketing the VE3DNL marker generator and the proceeds

go towards funding QRP related events.

The latest excitement with QRP operating is milliwatting! Several members of the club have been trying to help KJ5TF in working all states using milliwatt power levels. Others have just joined in the fun. I had the pleasure of QSO'ing with W5XE on October 12. He had a nice signal so I answered his CQ (plus I recognized his call from QRP-L). To my surprise he was only running 700 milliwatts (and had a 5/5 to 5/7 signal)! He lowered his power to 300 milliwatts and my report to him was 5/4/9. The report changed to 5/2/9 at the 100 milliwatt level. I would have asked him to lower the power further but family matters called so I had to QRT. Ray did say he has successfully made contacts at the 3 milliwatt level. This hobby is truly amazing!

72, de John NU0V
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Member Profile - John Mc Clun N3REY
By John Mc Clun N3REY

I grew up in Oskaloosa in the fifties and sixties. Graduated from high school there and attended William Penn College for a year and a half. I started dabbling in electronics by building crystal radios and a single tube five-band heterodyne receiver amongst other fun items. Then Uncle Sam called, or at least I thought he was going to invite me, so I joined. Went to Colorado to learn medical electronics and spent 10 years doing that for God and country. But then I found out I could do this for a living and make more money if I was doing it as a civilian. So I went to work for some medical companies installing and servicing CAT scans and eventually MRI machines. At the same time I got involved in computers, building and repairing, then programming. I got my degree in programming but hated sitting at a terminal for 8 hours a day. So I was wondering how I could solve my dilemma when it dawned on me that I could combine my hardware talents and my software and became a systems network administrator. So here I am at the University of Maryland doing just that for the largest research engineering institute on campus. Sorry I digressed there.

I really started in ham radio in the late 70's as a bandit. I was a licensed CB'er but had illegal ham gear I used. Shh.... don't mention it. I never did get caught. Then again in the early 90's I got interested in ham radio. So I got my Technician, then a couple of months later my Plus ticket and six months later my Advanced ticket. Operated solely QRP, always have always will. Why you ask? In the military we have a saying, be the best you can be. I feel that QRP'ers are doing just that. What talent does it take to make a QRO contact at 1,500 watts (or even 100 watts for that matter)? That's also why I build all my equipment (except for the QRP+). It takes a special talent. Along those lines, I belong to ARCI, QRP-L, FIST and IA - QRP and others, just to tweak my talents.

I have built around 50 kits in my time. From a Heathkit HW7, and HK TV kit (remember those?), an oscilloscope and a grid dip oscillator. Then I have built some fine radios including some of Dave Bensons' rigs, S&S Engineering's kits (ARK-40 and 20), OHR-500, two Sierras and many others. Even some of my own design. I also have the most modified QRP+ in existence, I did all of Larry East's mods, Norbert Heiders and mine that are published. What I haven't published is the mod I did for computer control of the synthesizer on the QRP+ and the attenuator

switch. Just recently I built the Elekraft K2, man what a sweet kit!!! I mean it is a full function rig in every sense of the word and built from a kit. And no problems - the rig went together as stated and worked from the minute I plugged it in.

Oh I forgot to mention... I am married to a wonderful woman who puts up with my motorcycle riding, my ham radio and my sailing habit. Five kids, two dogs and a cat. We also ride bicycles and rode our tandem from Seattle to Baltimore last year - 3,255 miles, 70 miles a day. Did I mention I have Muscular Dystrophy? I'm on medication for it and I still have some muscle weakness, but it doesn't keep me down.

If you are in the Baltimore area give me a shout, I would love to talk to you about..... what ever. Hope to see you on the air so. I have applied for my new call sign so I may be NQ3RP or KQ3RP by the time this gets published, but will let you know on the net when that happens.

72, de John N3REY
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Emergency Power System For Your Shack

By Paul Sipes KB0JIT

The following circuit will provide power for your rigs during commercial power failures and also keep your standby batteries at full charge while you are operating normally. During normal operation this circuit is charging your backup battery. With the flip of a switch you have the option to run your rig from normal power or from your backup battery.

There are many types of batteries that can be used for emergency and backup service. A car battery is probably the easiest to obtain. The use of a car battery can be dangerous, as it will outgas when charged heavily. Also acid can be spilled easily. Battery acid will eat almost any kind of material and is very hazardous to skin. The safest kind of battery is the sealed acid cell commonly known as gelled cells. These batteries are now available new and on the surplus and used market. They are available in 2, 4, 6, and 12 volt, with current rating from 1/2 amp hour to 110 amp hour. A 20 amp hour battery will operate an average radio for up to 8 hours of use before reaching a state of discharge.

A sealed lead acid battery should be charged to 13.8 volts. This is an average single cell voltage of 2.3 volts. When the battery discharges to 10.2 volts or 1.7volts per cell it is considered discharged. If the battery is discharged beyond this point it is possible it will be destroyed. Charging a 12-volt battery to more than 13.8 volts or 2.3 volts per cell will cause it to begin to outgas and with repeated charging will decrease the capacity of the battery. Your station power supply should be set for 13.8 volts for proper battery charging and also for proper operation of your rigs.

The basic circuit was taken from CQ Magazine's June 1997 issue page 56. I built the circuit and used it as written in the article. It worked as advertised and was simple to build. After using the circuit I decided it didn't operate the way I wanted it to so I modified it and this is the result of that modification. The components for this circuit are all available at Radio Shack. The parts list will follow in this article.

Figure 1 is a schematic drawing and shows the components and their electrical placement in the circuit. Figure 2 is a line

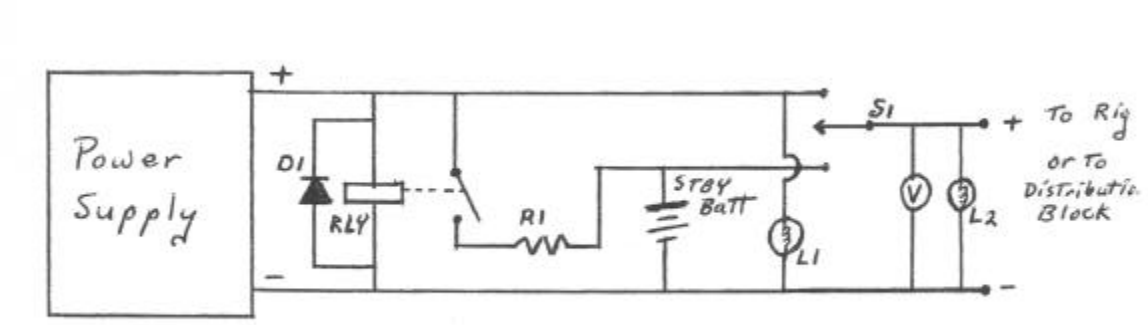

Fig 1

drawing showing the components and their physical layout. The terminal strip is used to hold the components and makes an easy support for everything. For the operating leads I use #10 stranded wire. The lamp and control leads are #16 stranded wire. On the #10 wire I used yellow split spade connectors and for the #16 wire I used blue split spade connectors. For the resistor, diodes, and lamps, I also used the blue connectors. The colors on the connectors are a code for the size wire they will accept. The yellow is used for #10 to #14, and the blue is used for #16 to #22. These are crimped connectors.

For the connections to the rigs I use the Radio Shack Heavy Duty Molded Nylon connector. These are part # RS-274-154 for the female and # RS-274-151 for the male connector. I use the female connector on the batery supply and the male on the radio. The use of a distribution terminal strip and inline fuses allow you to connect several rigs to the same supply and still have them all protected. When using these connectors, I always make the pin on the beveled side of the connector the positive pin. Doing this always sets a standard way of wiring that allows a radio to be connected without concern about reversed polarity. I also use a barrier strip as a distribution point to connect several other radios or accessories to power. On the output of the distribution strip you can use inline fuses to protect the system and your radios. This is shown in the figures.

I use lamps in the circuit to indicate which supply I am using. Lamp L1 indicates any time the power supply is turned on. L2 indicates power going to the distribution block. If L2 is lighted and L1 is dark you then know that your battery is providing power. The voltmeter will indicate when your battery is getting low and needs recharging, or if you are operating only on battery due to power failure it will indicate when you should suspend operation due to a low battery. Running the battery lower than 10.2 volts will damage the battery and possibly cause damage to your radio.

Figure 3 is a line drawing of my power system. The operating position lamp is an auto dome/courtesy bulb in a free standing socket that is available from Radio Shack. This lamp is handy when operating from battery power during a power failure. Also it helps to remind me to turn off all equipment and the power supply when finished with an operating session. My power cabinet is an old Motorola equipment cabinet that was salvaged. My power supply, emergency controller/charger, and backup batteries are in the cabinet.

Figure 4 shows how to wire a barrier strip to use as a distribution block with inline

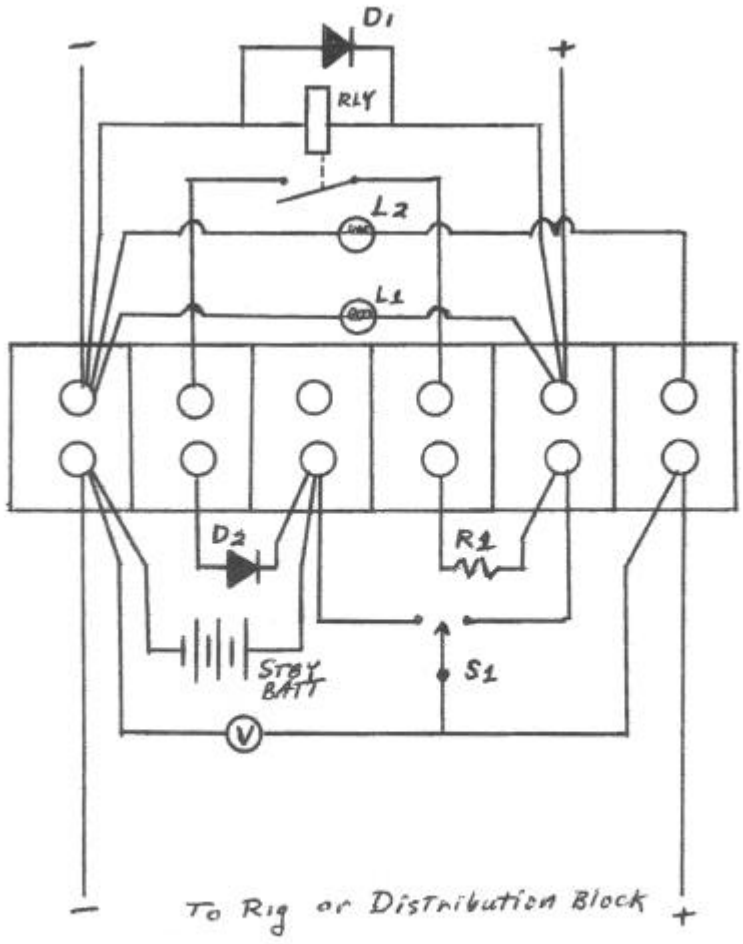

Fig 2

fuses and molded nylon connectors. The barrier strips are also available at Radio Shack in various numbers of connections.

The parts list is as follows:

D1 - IN4001 Diode RS 276-1101
D2 - 6 amp 50 PIV Diode RS 276-1661
R1 - 0.47 Ohm 5 watt resistor RS 271-130
L1 - Green 12 Volt Lamp RS 272-337A
L2 - Red 12 Volt Lamp RS 272-332C
6 Position Barrier Strip RS 274-659
RLY1 - SPST 10 amp 12 Volt coil RS 275-248
Voltmeter - 0 to 15 Voltmeter RS 270-1754
S1 - DPDT 20 amp Switch RS 275-710 **

** The contacts are ganged together to double the current capacity. This switch is a center off switch.

(Editors note: Paul added this addition to me via Email to answer a question I had on his circuit)

The charge circuit is run off a power supply that is set for 13.8 volts. With this circuit you have the batteries connected all the time. Only when the power supply is turned on will there be any activity by the charger. The batteries won't overcharge, as the float value of the batteries is 13.8 volts. You must be sure when

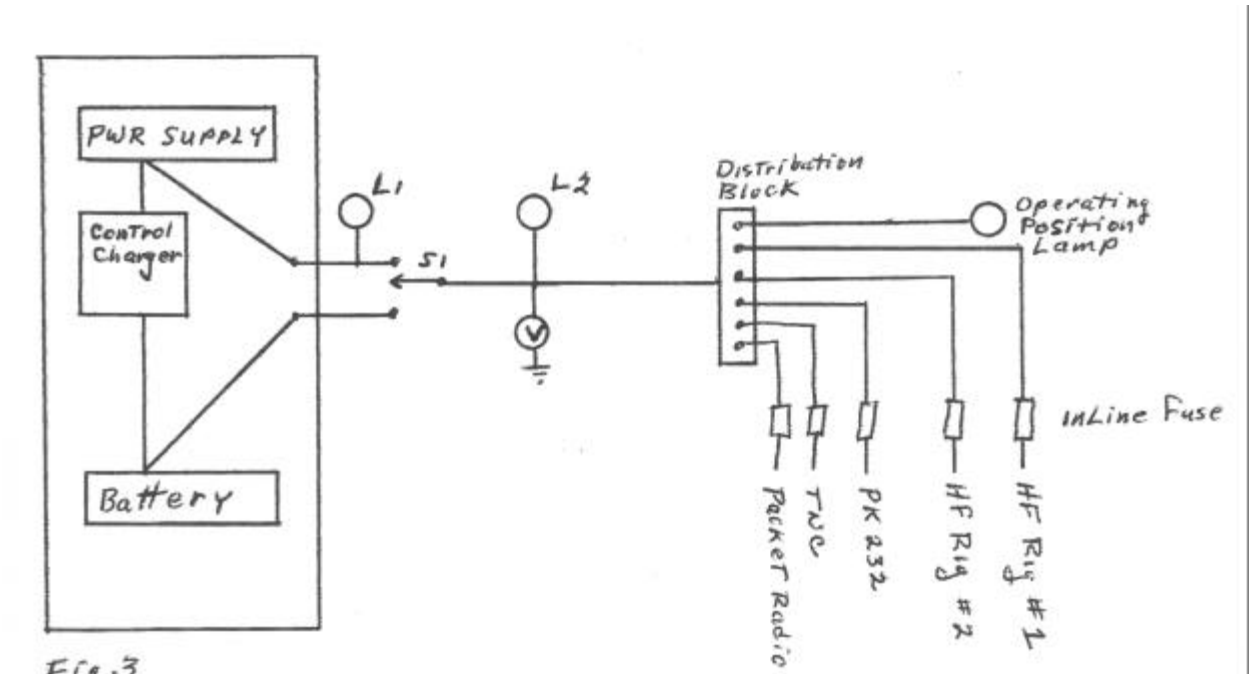

Fig 3

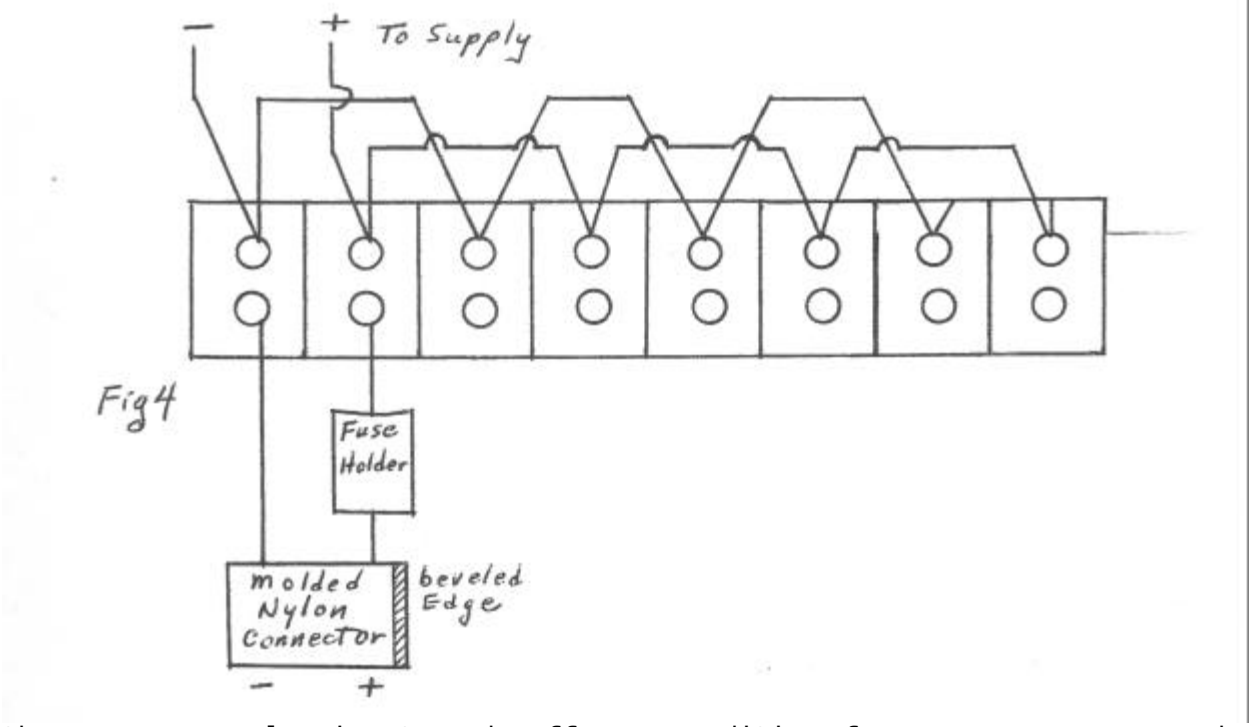

Fig 4

the power supply is turned off there is no equipment turned on as that will run down the batteries when left for an extended time. Any time the supply is on the batteries are being charged at the float voltage. This keeps them topped up and in full charge condition for emergency use. The batteries are only in use when the switch is thrown to emergency position. I hope this clears up any confusion.

72 de Paul KB0JIT

Congratulations to Mark Milburn KQ0I!

Several months ago there was a notice in the ARCI QRP Quarterly that they were looking for a Secretary/Treasurer. Mark applied for the position and was given the job. He officially became Seretary/Treasurer for QRP ARCI on July 1, 1999 (beginning of their new fiscal year). Mark still retains his position as Treasurer for the Iowa QRP Club. Let's all congratulate Mark on his new position and duties!

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A 40 Meter L Antenna
By Tom Upton AD6N

An antenna should be designed to take the maximum amount of voltage and current from the final amplifier of a transmitter. Power (P) equals Current (I) times Voltage(E), thus, P = I * E. It is also helpful if the power envelope can then be radiated in the direction we want it to go!

Since I really enjoy reduced power "QRP", I want my antennas to do their best for me. Sometimes, though, man proposes but the lot disposes.

I have one tree I can play with to help me with my wire antennas. It is straight up over the shack, with a healthy branch about 35 feet. I could, and have, put up an "Inverted V" antenna, but I wanted to experiment with what I call an "L" antenna, because it looks that way.

It is simply a halfwave dipole, with its quarter wave vertical element counterpoised by a single horizontal quarter wave. I had 12 feet of coaxial cable to feed it, so the right angle point was placed at 8 feet above ground. Center conductor to vertical, shield to horizontal.

Of course, if the antenna had more quarter wave radials, it would be a vertical groundplane. Its pattern would be predominately a low angle "doughnut" of power with the power lobe toward all horizons.

With one radial, the antenna's power pokes out toward the horizon, but there is plenty of radiation going up and coming down at much closer distances than would be usual with a groundplane.

Both elements were inductively end loaded. The vertical element went over the branch and bent back towards itself for about 8 feet. The horizontal element lay in a North line on the garage roof, with its final 8 feet coiled around a metal ventilator.

With this end loading, the antenna was essentially flat, with no reflected standing wave through the entire 40-meter band. That surprised me! I could use it at any frequency on the band, with no need to tune the antenna for particular frequencies.

My QTH (location) is in Central California, at 36 North and 119 West. Judge the antenna's pattern for yourself, as I easily talked (QRP SSB and mostly CW) on my first evening on June 12, 1999 with W6VCF in Oregon (north), then with W6INV in Anaheim CA (south), N7DMO in Wyoming (ENE). Then on other nights to Phoenix AZ (east) with K7EIJ, NJ4K in North Carolina (much farther east!), KL7IYD in Alaska, and K0IPS in Nebraska, and lots of places in between.

There is no question that a north laying counterpoise should favor that direction, but the low feedpoint seems to make it pay for its keep in other directions, too.

For those of us on a constricted city lot, just getting a resonant antenna up there, and healthily feeding it with all the voltage and

current it will hold (even at a couple of watts), teaches us how much we can do with how little.

My favorite night was the QSO with KG7MZ in Kalama WA, and the group in Chico, Fortuna and Eureka CA, when my 3 watts SSB was dropped to 1 watt SSB, and they said I sounded better!

72, de Tom AD6N
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Tom Upton AD6N was born and raised in Sioux City, Iowa. He was licensed as a Novice WN6RJL in 1966 in Los Angeles CA. In 1967 he received Amateur Radio License WA6DHD as a Technician. In 1990 he achieved Extra Class, and recently vanitied to AD6N.

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It's New! It's Small! It's at Target!
By Cla Cadmus KA0GKC

The Altoids tin has become part of QRP history thanks to rig designs like the NorCal 49er. Well, history is very likely to be made again. There is a baby brother Altoids tin out there. A recent post to QRP-L sent me to the local Target Store where I found a display on the end of an aisle dispensing "The Tiny Tin" Altoids. This little box is just begging to have a little rig built in it.

I've already started the plans for one including batteries! The working name for the rig is, "The Tiny Tin Two". I found that a battery of three 3volt lithium coin cells will fit in the bottom and provide 250mah @ 9volts. Not bad for such a small battery, although the cost is a bit high at about $2.25 a cell. Still, to get it all in such a small case would be marvelous. SMT construction of course. Now for a good transceiver circuit. Maybe even use a PIC and a really small LCD display. Haven't had any luck finding the latter in the usual catalogs. Maybe a few of you might want to get together and help with the design?

72, de Cla KA0GKC
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Direct Digital Synthesis And The QRP Amateur

By Jeff Woods W0ODS

"Digital" is the buzzword of this computer age. We hear it everywhere. The digital domain has begun to make inroads into the world of QRP homebrewers. Digital technology is focused primarily on keyers and interface circuitry at this stage.

For many, the allure of QRP operating and building lies in its simplicity. A crystal oscillator transmitter can be the most efficient way to transmit a signal, both in terms of parts count and current consumption. The QRP amateur has tended to shy away from implementing the latest in technology in order to maintain this simplicity. Indeed, according to Doug Demaw, "Although synthesizers and digital frequency display represent the modern way of life with expensive commercial ham

gear, we QRPers seldom use these techniques. They contribute to bulky equipment and the associated circuitry consumes substantial power. Neither trait is in keeping with the QRP theme."1

Over the course of the last year, I have built several DDS circuits, and have come to appreciate that use of modern, integrated DDS chips as the frequency determining element is truly elegant, efficient, and (yes, you can believe it...) simple. Imagine having the stability of a crystal controlled oscillator with the tuning resolution and range of your favorite kilobuck commercial rig. Now, imagine this with two integrated circuits and no tuning, save for trimming of the reference crystal oscillator. Imagine it inside your next homebrew project. It really is that easy.

Most people are reluctant to try new technology simply because that technology is not understood. The buzzwords "Direct Digital Synthesis" certainly sounds complicated. The fact is, the concept is quite simple to understand. It is the purpose of this article to explain what is going on inside these new wonder chips.

DDS Basics

So what is a "DDS" anyway? Until two or three years ago, I thought that a DDS was the guy who put braces on me as a kid. My introduction to the DDS world came from a "73 Magazine" article called "The Julie Board." A short time later, I joined the staff of Kachina Communications. Kachina was quite active in their use of DDS devices in both test equipment and new production designs.

In its most basic form, a DDS is simply a look-up table and a D/A converter. A look-up table is a table implemented in digital form. An example of a similar table is a tax table commonly used at retail stores. It lists the sales tax associated with various purchase amounts. So if your morning doughnut is 45 cents, scanning down the table to the 45 cent point you see that the tax is 2 cents. At 50 cents, the tax becomes 3 cents.

For the DDS, the input is a count, starting from one and going to the capacity of the counter. For an example, lets use a counter of 8. This would be the case for a 3-bit digital counter. The maximum count for a given number of bits is 2n, where n is the number if bits. Remember this. We'll come back to it many times.

An 8 entry table would look like this:

```
0     Sine 0 degrees (0)
1     Sine 45 degrees (0.707)
2     Sine 90 degrees (1)
3     Sine 135 degrees (0.707)
4     Sine 180 degrees (0)
5     Sine 225 degrees (-0.707)
6     Sine 270 degrees (-1)
7     Sine 315 degrees (-0.707)
```

Notice that we've started with 0. That's the way computers operate. It appears unusual to us, but we still have 8 entries in the table above.

Imagine our counter is running. It starts at zero, and every so often, at regular intervals called "clock cycles," it increases by one. From 7, the counter automatically returns to 0 and begins again. It's rather like your car odometer turning over 100,000 miles. The leading "1" gets "shifted out," leaving only the zeros. If you look at the table, you'll see that each entry is 45 degrees greater than the prior entry. If you extrapolate beyond entry 7, you'll see that the next entry would be 360 degrees, which is the same as 0 degrees. By design, that

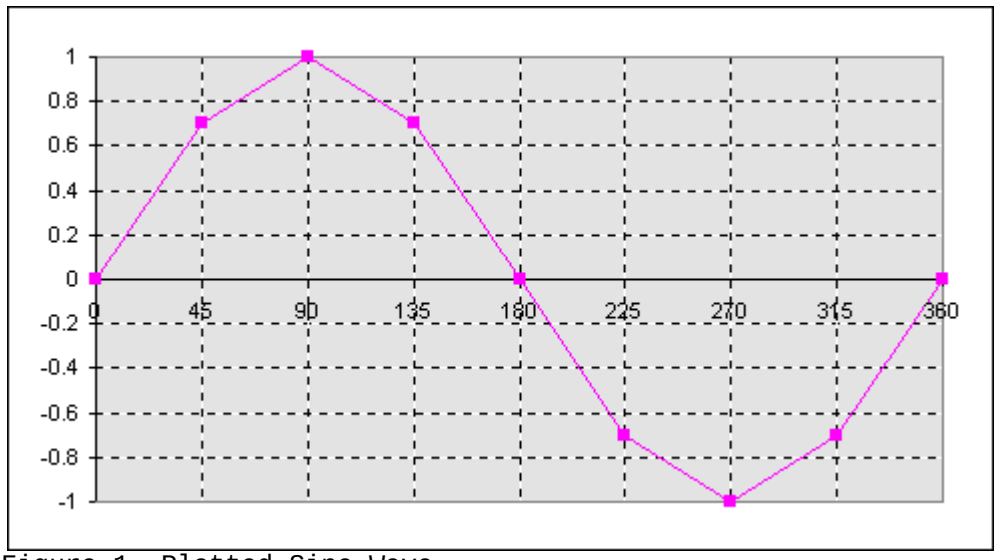

Figure 1. Plotted Sine Wave

correlates with our counter's return-to-zero point.

Why the Sine values in the table? Figure 1 is a plotted sine wave of the numbers in the table.

This is a rudimentary sine wave. By increasing the number of points in our look-up table, the accuracy of the sine wave will increase. A typical DDS chip will incorporate 216 (65,536) to 240 (around one trillion) entries in its look-up table. The sine wave produced is quite smooth, which translates to a very low distortion signal.

Unfortunately, there is one more step remaining in DDS implementation. This involves turning the digital amplitude value back to its analog form, the D/A conversion. Typical D/A converters use anywhere from 8 to 16 bits in converting the data. Since the number of bits used here is generally much lower than the number of bits used in the look-up table, it can be assumed that all of the distortion is induced at this level. The noise floor of a D/A converter is approximately 6 x (number of bits). For the 10 bit converters in use on my designs, the noise floor is about -60 dBc. Measurements with a spectrum analyzer do confirm this figure.

So why all the bits in the look-up table? For better frequency resolution. As an example, the AD9851 uses a 32 bit look-up table and a 180 Mhz clock frequency. The frequency resolution, as given by:

Resolution = Fclk / 2n is 0.041 Hertz.

An interesting note is that by adding a fixed offset to the counter, we can independently control the phase of the signal, too. By adding half the number of bits in the look-up table to the counter value, we instantly implement a 180 degree phase shift. This might be useful for generating PSK signals, for example. By using two DDS chips, one offset 90 degrees from the other, one can generate nearly perfect quadrature signals for use in Phasing type frequency converters. A pair of DDS chips, a pair of mixers and a pair of audio amplifiers can be used as a single signal direct conversion receiver. I think this is pretty nifty!

Limitations

Once upon a time, there was a guy named Nyquist. Now he thought about what mathematicians call 'sampling theory.' And he figured out that you can re-create a signal if you can take a snapshot of it's value every once in a while. It's what we call "digitizing." What Nyquist wanted to do was to define "every once in a while." He did the math and figured out that one must take a sample at least twice as quickly as the highest frequency component in the signal. Any slower, and an effect called "aliasing" occurs, which essentially wraps high frequency components down to lower frequencies.

Limit specified at 150 Mhz here. Now, the Nyquist limit is fine in theory. But like so many theoretical constructs, there are other factors. In this case, it's filter skirts. What the figure above does not show clearly is the spur at 220 Mhz, or Fclk - Fout. As your Fout increases, that first alias product decreases, until they meet and eventually cross at 150 Mhz (Nyquist Frequency). So one must allow for a reasonable low pass filter to attenuate the first mixing alias product. Generally, one can get away with outputs at about 40% of the clock frequency.

Now suppose one was trying to synthesize a frequency in the VHF

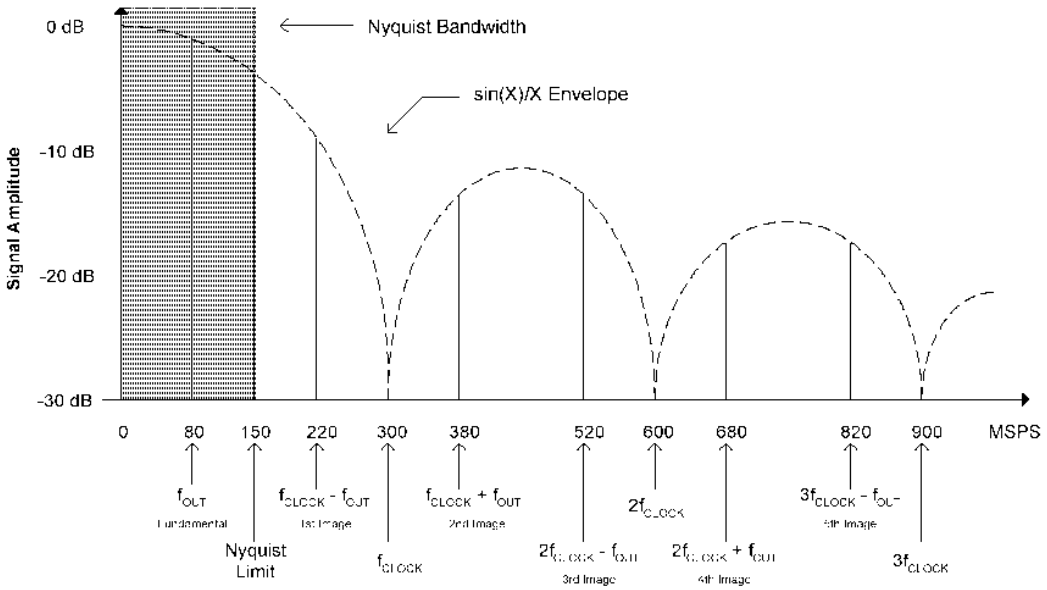

Figure 2 (above) illustrates this effect.

In this case, a 300 Mhz clock is chosen. You can see the Nyquist

range. By constructing a band-pass filter, any of those spurs we try so desperately to eliminate in HF service can be selected. One could pull the Fclk - Fout product, set

the clock at 180 Mhz and Fout for 36 Mhz and have a spiffy 144 Mhz synthesizer. Slick, eh?

One Implementation

Perhaps the most suitable DDS chip for amateur use is the Analog Devices AD9851. This chip contains an on-board clock multiplier and D/A converter. The maximum clock speed of this device is 180 Mhz, allowing useful output up to about 70 Mhz. Programming is done via a 40 bit serial data stream.

This IC does have a couple of drawbacks. First, the package is a SMD SSOP package. The leads are 25 mil pitch, making it somewhat difficult to solder, and virtually impossible to implement without a suitable printed circuit board. Several boards are available for this device, including one from FAR circuits 2.

The second drawback of this IC is its power consumption. At 180 Mhz clock input and 5v supplies this little chip draws around 100 mA. The current drops to 30 mA at 60 Mhz when operated off a 3.3V supply. A 60 Mhz clock is sufficient for clean output up to 20 Mhz, enough to drive a downconversion superhet or Direct Conversion set. Now, this sounds like a lot of current when compared to the parsimonious current draw of a well-designed QRP receiver. However the low operating voltages of the 9851 can be used to our advantage. In applications requiring low current consumption a modern 80 to 90% efficient switching regulator can be employed to convert the 12v supply down to 5v or 3.3v. As an example, a full clock frequency DDS powered off 12v by an 80% efficient switcher will draw only 18 mA. This figure is far more palatable to the designer. The 3.3v, 60 Mhz circuit powered by the same 80% efficient regulator brings the 12v current draw down to just 10 mA! Although a well-designed VFO or PLL circuit can be designed to draw less current, the trade-off in simplicity and multiband operation is often worthwhile.

So much for the Theory...

But what you really want to know is how to actually use this little beast. First, buy a circuit board. Do NOT attempt to breadboard this! You'll get eyestrain. If you don't go insane first. For many of us, insanity is close enough to begin with, so don't push it. As mentioned previously, FAR circuits has a board based on a July '97 QEX article titled "Building a Direct Digital Synthesis VFO." Fred at FAR gets $7.50 per board plus $1.50 for up to 4 boards for shipping. His contact info appears at the end of this article. The QEX DDS had some limitations on board layout, so I designed a new circuit in an attempt to reduce some of the mixing products in the output of the QEX synthesizer. It should be mentioned here that the original QEX article by Curtis W. Preuss used the AD9850 and a 60 Mhz clock input. Since it operated at a lower frequency, the spurious signals were not much of a problem. But I wanted to use the AD9851 (Same pinout, but up to 180 MHZ clocking) as a Local Oscillator for an up-conversion receiver. This particular receiver (exhibited at the West Liberty hamfest) used a 45 Mhz IF. Thus, for a received frequency of 30 Mhz, the LO must run at 75 Mhz. The maximum recommended output frequency of the AD9851 is 72 Mhz, so clearly things would get hairy at the upper end of the tuning range.

My buddy and master PC layout engineer Pete Gianakopolus took a look at the data sheets for the DDS and realized that this chip uses three power supply voltage and return pins. On the Preuss design,

all were tied together. The reason for separate lines is to isolate noise from one section of the IC and keep that noise from corrupting other sections. The three power supplies covered the Logic, PLL and DAC. Since a multi-layer board was not an option, we chose to use RC coupling on each power input pin and tie all the returns to ground. This is implemented by using a small value resistor, typically 10 to 100 ohms depending on current draw, with a capacitor shunting the device power pin to ground. This keeps the power supply noise generated by the PLL and logic from making its way into the critical DAC analog section. We saw around 12 dB improvement in spurious signals by using these methods.

Oh, and we have a few of these boards left over. Pete wants the princely sum of $3 a piece. What a gent! Contact the author for boards. Note that these are bare boards, no silkscreen, and are designed for SMD components. it is possible to use standard leaded components on the board, however. The buyer must also drill the holes for leaded components and ground vias. We wouldn't want to cheat anyone out of the true homebrew experience, now would we?

The basic circuit consists of the DDS chip, a PIC 16F84 (Code available from the author, more on this later) a 30 Mhz TTL clock oscillator and an LCD display. You'll also need to supply a rotary shaft encoder and a pushbutton switch. Or be a big spender and buy the encoder with a built-in switch that activates when you push the knob in, like a car radio.

The PIC is a microcontroller that spends its life worrying about whether you pressed a button or turned the encoder shaft. When it finds that something has happened, it takes action. For encoder rotation, the micro multiplies the value indicated on the display by a tuning constant using some complicated 32 bit math on an 8 bit processor, sends the result to the 9851, then updates the LCD display. If the micro detects that you pressed the button, it flashes a cursor on the active tuning digit. By turning the knob, you can select the digit that will be changed when the knob turns. The micro is also capable of supplying an offset frequency to use this circuit as an LO. This value is hard-coded, so if you want code with an offset, the source code that programs the PIC chip must be changed.

Meanwhile, the DDS is churning out numbers and producing a nice sine wave output. We take the output, properly terminate it and filter and amplify the signal to get the level needed for the radio. There's space on our board for two filters, generally a high pass and low pass to make a band pass. We also provide pads for a MMIC to bump up the signals to a higher level. I've had good success driving level 7 mixers such as the SBL-1 directly from the DDS, but the mixer is starved a bit in that case. Still, it beats an NE602 hands down for performance. A 10 dB gain MMIC will give you some room for slop and filter loss.

Conclusion

Warm up that iron, folks, and start building. The interest expressed in this technology has been overwhelming. This primer provides the basics for building a DDS based circuit and has shown how these devices work on the inside. While the idea of having a microprocessor inside your next radio may not appeal to you, perhaps you'll feel, as I did, that in this case the circuit simplicity is improved, rather than degraded.

I can be contacted via E-mail at mycrocomm@plutonium.net, or the standard 600-ohm service at 319-

435-2303. I pledge to support anyone wishing to get his or her feet wet and build some really fun stuff.

Parts Sources:

The AD9851 can be obtained in small quantities from Allied Electronics at 1-800-433-5700, or www.allied.avnet.com. I also carry a small quantity and will act as a consolidation point for orders. Higher quantities get a significant price break from Allied. Market cost is in the $25 range for this part. Search on the Web at www.analog.com for data on all the Analog Devices DDS chips.

Boards and programmed PICs are available from the author. Boards are $3 each and programmed PIC chips at $10 each. I will provide the source code or those wishing to play with the assembler code. Some of the recent QST articles on simple PIC programmers provide sufficient information for those getting into PIC programming. I also highly recommend the book Easy PIC'n by David Benson, published by Square 1 (www.sq-1.com).

FAR Circuits can be reached at

FAR Circuits
18N640 Field Court
Dundee, IL 60118

FAX: 847-836-9148

Ask for July '97 QEX DDS board. Reprints of the article are also available for an additional $1.50. FAR charges an extra $3.00 for credit card orders.

1 Demaw, "W1FB's QRP Notebook," 1991, ARRL

72,de Jeff W0ODS
mycrocomm@plutonium.net

SST X-10M

By Mike Fitzgibbon N0MF

Most experienced QRP operators are familiar with Wayne Burdick's popular SST transceiver. It is not only available as a kit for 40, 30, and 20 meters from Wilderness Radio, but it also can easily be configured for other bands by simply changing a few component values.

This is mainly accomplished by changing crystals in the variable crystal oscillator (VXO), IF/BFO, and transmit mixer. It is also possible, I have found, to put it on 10 meters by using a 16 MHz crystal in the VXO, followed by a simple diode frequency doubler to attain a 32.0 MHz VXO signal. This VXO signal is then mixed with the same IF frequency as the 15 and 20 M versions (3.93 MHz) to produce a usable frequency range in the 10 meter band which covers the popular QRP frequency and a bit more. In the "experimental" unit here, the frequency coverage is 28.043 to .063 using two different switched varactors in the VXO.

Since the design of the standard SST does not utilize any IF amplification, but relies entirely upon the conversion gain of the NE602/612, the 10 meter version in standard form will suffer from a lack of gain due to the higher frequency. To add some performance to the rig, a simple grounded-gate FET preamplifier was added to the front end of the receiver, along with an equally simple IF amplifier, which is added post-crystal filter, before the product detector. These two little circuits, along with the parts for the VXO frequency doubler, will add about thirty or so components to the current count of about 80 for the standard SST, and their addition is simple to be accomplished.

So, how does it work? Well, signals on ten meters, when the band is up, sound like the 40 meter version of the radio, maybe even a little stronger. Strong signals will readily fire the LED "agc leveling device" and quite often the gain must be reduced to keep one's ears from ringing. A few weeks ago, from here in western Iowa, I worked Goran, EA8YU, in the Canaries, by calling CQ using a simple vertical dipole hung in a tree at 25 feet or so...539 both ways...Goran was running a K2 at 3 watts into a random wire. Also worked Dean, KH6B, in Hilo, a day or so before with the same antenna. The X-10M puts out about 2 watts with a MRF-237 final at 13.8 volts, and about 1.5 watt on a fresh gel cell. With normal "healthy" signals, the gain must be reduced considerably, and very strong signals can be heard with the RF attenuator completely shut down and the AF gain at 50% or so using inexpensive Radio Shack headphones. OK, now for the ingredients...

The frequency doubler, preamp, and IF amp are all proven, published circuits which are available widely. I have not included the schematics here, but will give the sources. They will not be obscure to any experienced qrper.

I might note now...all the circuits in this experimental (hey... that's what the "X" is for!) rig were built on separate single-sided boards. The receiver, transmitter, VXO/freq. doubler, preamp, IF amp, and TICK keyer are each on a different board. Those boards are either attached to the enclosure with small right-angle brackets or to another board, back-to-back (glass-to-glass) with 4-40 hardware. This not only makes it extremely simple to build, but it provides an easy way to alter things. See the accompanying photos, listed below.

Also, I might direct you to the article on building a 15-meter SST in the spring '99 issue of this on-line publication. The pad-and-glue building method, along with a few other modifications (such as the adjustable transmit-monitoring circuitry, dual-varactor tuning, and power mods) are contained within that piece. This radio is built using the schematic from the Wilderness kit, which differs slightly in a few components and component values from the schematic in "QRPp" (Spring issue, '97). Those differences I will try to note below.

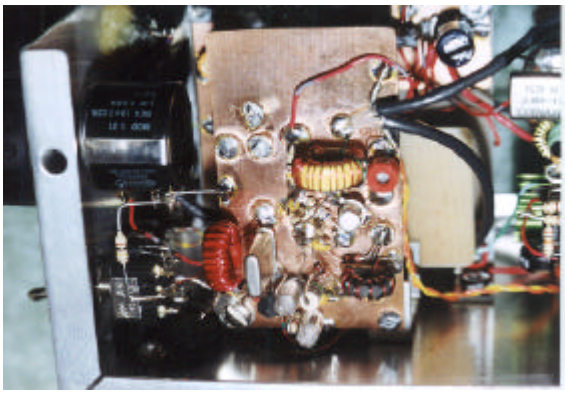

Photo 1. VXO/Doubler board. Varactors are soldered on top and bottom of DPDT switch.

The frequency doubler is simply added onto the standard SST VXO circuitry into which you have put a 16 MHz crystal (Digi-Key X143-ND). It is from the classic "Solid State Design for the Radio Amateur", page 44, figure 24. It contains two diodes and a 2N2222 amp. It is simple to build. I used 26 T (turns) on a T50-2 toroid for RFC3, the VXO inductor. You may have to vary this a bit to get the tuning range you desire. The tuned circuit on the output of the doubler contains a T50-6 toroid with 19 T on the primary and 3 T on the secondary. It is adjusted to resonance (max power out consistent with the best looking waveform on a scope) with a 2-20 pF trimmer.

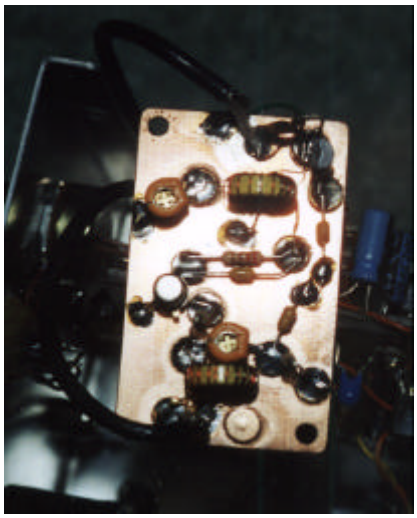

Photo 2. RF preamp board

The receiver preamp is from "W1FB's Design Notebook". It is located on page 61, figure 3-18A. It uses an ordinary 2N4416 FET. The tuned input uses a T37-6 toroid with an L1 winding of 8 T and L2 winding of 16 T, tapped at 4 T up from the grounded end. The output's tuned circuit also uses a T37-6 with 16 T on L3, 8 T on L4. Doug (W1FB) always said to wind the secondaries over the grounded end of the primaries, so I always do... Both the input and output are resonated with 5-70 pF trimmers. Just tune for max band noise/signal.

I tried adding a little input-protection circuitry to the preamp, the same as is on the input of the '602 mixer in the original design. Feed the input signal from the low-pass filter (transmitter) through a 5 pF cap, with an NPM 3700 diode to ground (via a .1 uF cap) on the other side of the 5 pF cap. Also, at the junction of the PIN diode and 5 pF cap, attach a 1N914 with the banded end attached to the keying line with a jumper. I don't know if this is absolutely necessary, I just like to avoid smoke and blown parts. Have enough of them as it is...

The IF amp is also simply stolen. It is from Dave Fifield's NC20, and contains all the parts between and including R34 through C36. There is a 2N5179 and a 2N3904 in there. This is one area of the radio that probably could use a little more development...impedance matching the IF amp to the xtal filter and the product detector input. I left all the original SST parts in there and simply inserted the IF amp at the back end of the xtal filter, between the last xtal and the 12 uH choke. BTW...these 12 uH chokes (one on each side of the filter) are not included in the original "QRPp" article schematic, but are an addition to the kit schematic, in addition to changing C6 and C9 to 100 pF. It seems to work well as-is, but I'd guess there is some impedence mismatch. That's another good reason for the "X". It is certainly a point for further tinkering. The NC20 circuitry can be found in the Summer '99 issue of QRPp, the NORCAL journal (see below), and, of course, the schematic for the Red Hot NC20, which Dave now sells as a kit (and an excellent kit it is).

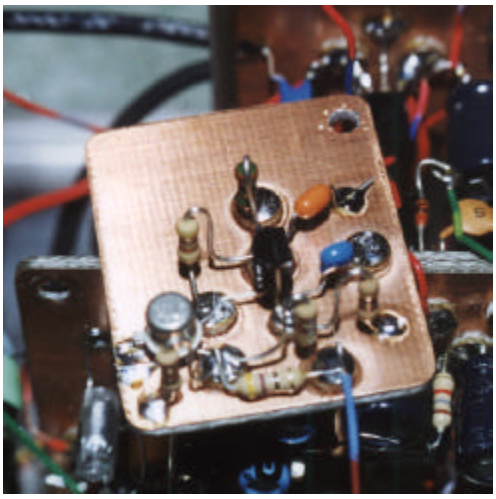

Photo 3. IF amp board

A few additional points...The low-pass output filter is also from a QRP "cookbook". . See "W1FB's Design Notebook", page 160, table 6-1 for 10 meter values. A 2.2 uH choke from the final's base to

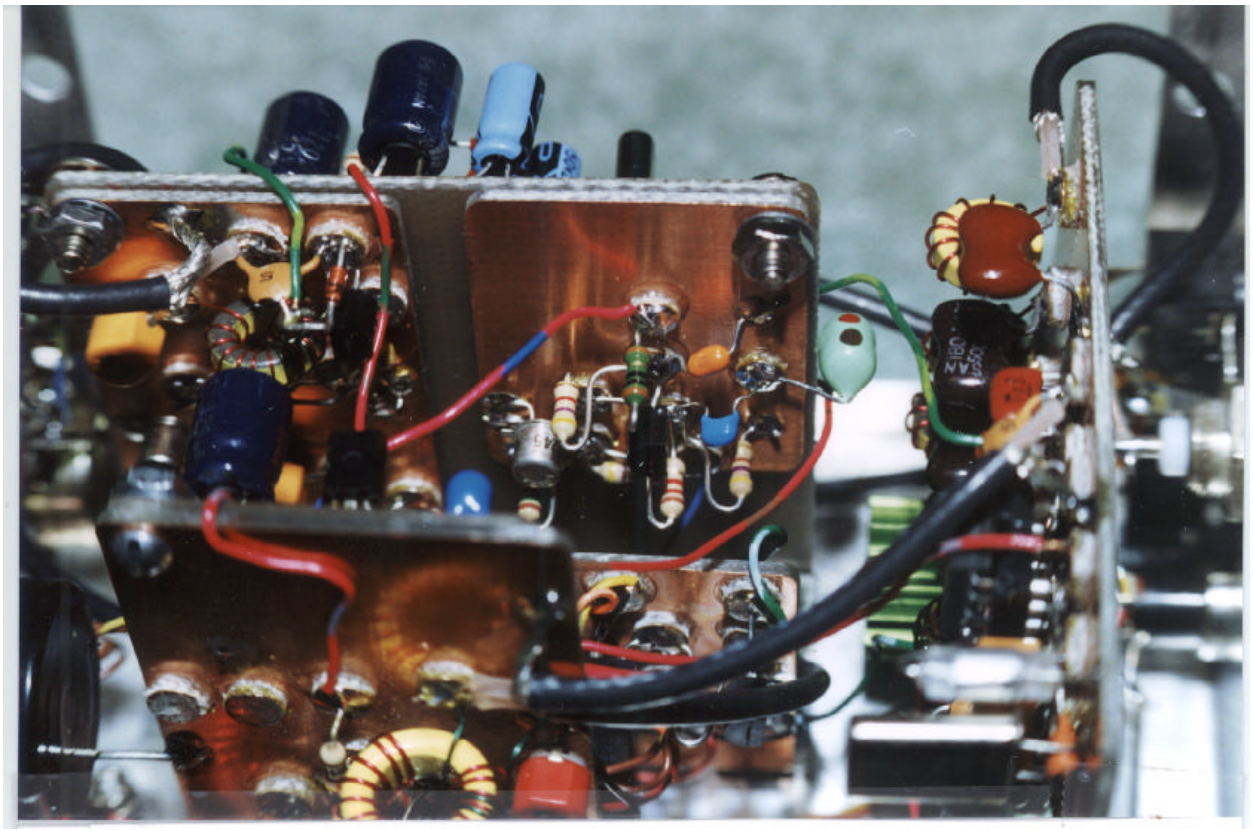

Photo 4. Mounted IF and RF boards.

ground was added to "up" the transmitter output a wee bit. A homebrew TICK keyer board was also added. It is the little board down in between the receiver and VXO boards, at the bottom of the box. A 5/16" hole in the bottom of the enclosure near the front was made to vent the keyer annunciator.

A few more details: L1 in the transmitter is 17T on a T37-6. Omit C27 and resonate the tuned circuit with only a 70 pF trimmer. R10 changed to 120 ohms for increased power output. Also, in the VXO, C19 and C20 have been changed to 100 pF from the 82 pF as indicated in the "QRPp" schematic. Additionally, pin 7 of the audio amp has a 2.2 uF cap to ground (neg. lead to ground, natch!) and C16 is now .022 uF. Also, I find that my LM386 audio amps howl with some headphones, so a 1 uF cap was added (nonpolarized) across the amp's output (to ground) to quell this little tendency. You can also wire the phone drivers in series to prevent this, if you somehow isolate the phone jack ground from the chassis ground.

The transmitter and receiver (sans RF and IF amps) were built on 2 7/8" square boards with plenty of room to spread things out a bit. The RF amp is on a 1 1/8" X 2 1/2" board, and the IF amp is on a chunk of 1 1/8 X 1 1/2" PCB. The enclosure is a 3 X 4 X 5" Bud minibox from Mouser Electronics. It was selected large enough to provide room to "grow".

See the article on building a 15 M SST in the 1999 spring issue of the on-line Iowa QRP Club Journal for additional SST mods and references for mods and materials. I will

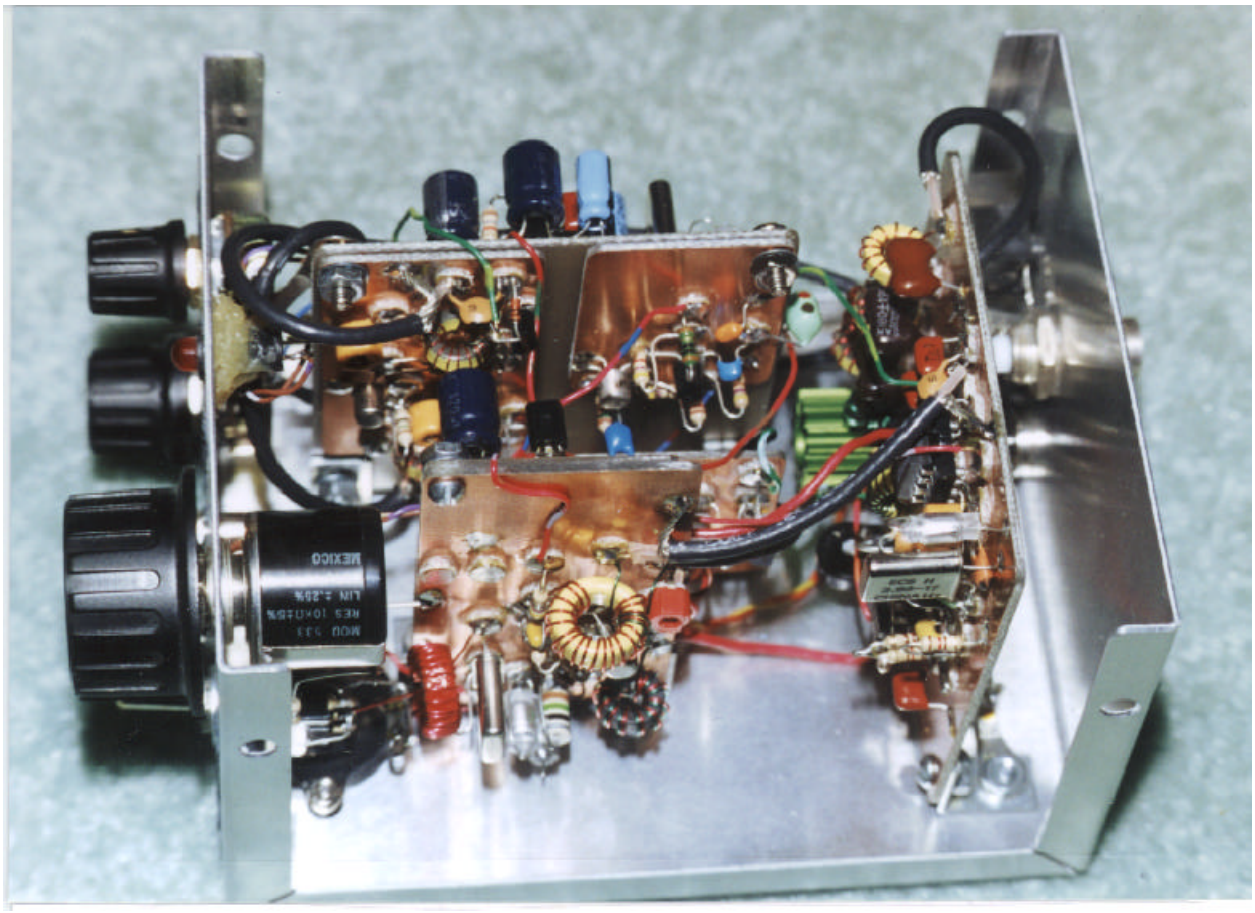

Photo 5. The completed rig.

also try to help anyone who makes a request. My E-mail is mjfitz@uswest.net. I do not have a scanner so I cannot send you any schematics...sorry. If you come up with any mods or improvements (VERY possible...), I would certainly like to hear about them. An E-mail with the details would be greatly appreciated. I just hack away at this stuff, it's always a learning experience and great fun for me.

72, de Mike N0MF
mjfitz@uswest.net

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ELECRAFT K2 Transceiver Kit
By John DePrimo K1JD

(Editors note: This article has also been submitted to FOCUS, quarterly magazine for the First Class CW Operator's Club based in the UK but has not been yet published.)

During a two-week trip to Okinawa last summer, I began thinking more and more about getting a small rig to bring along with me on business or vacation. Affordability, small size and weight were of course important factors. While listening around the QRP frequencies, I heard very positive references to a new rig called an Elecraft K2, a kit designed by several of the guys involved with the highly thought of Wilderness Radio QRP rigs. It is a sophisticated microprocessor controlled, very compact 10w radio, which covers all bands except 160m where an optional board is available. Base price is $549. The web site, www.elecraft.com, plus all the chatter on the Internet and

on the QRP frequencies provided all the convincing I needed. A K2 was ordered back in February with estimated delivery in late May. At that time, there were about a hundred beta test units being built and each of the hundred hams were solicited to provide comments on the manual, the rig, construction problems, etc such that the first production run would be vastly refined.

The kit (SN#139) finally arrived on 6/23 due to various delays in completing the production units. The package itself was much smaller than imagined - very cleverly and efficiently done.

The kit consists of 3 boards: Control, Front Panel and RF, the latter being the largest one with the most components. I have not counted all the components, but there has to be over 500 parts. The project is divided roughly into thirds with testing and alignment at the conclusion of each. Built in test equipment, such as a frequency counter and DVM, provide the tools to do a complete alignment. The kit and manual are so well done that construction is reasonably straightforward; however, according to Elecraft be prepared to dedicate about 30 hours to the task! Mine took almost exactly 30 hours.

I invested in several things up front to make the job easier and the final product better. I found a lamp with a round fluorescent bulb and large magnifying glass built right in. If you think the components themselves are tiny, wait until you try to read the ID markings on them! I purchased a Weller WTCPT soldering station, Kessler IC grade solder with 2% silver, a digital multi-meter capable of measuring capacitance and diodes as well as voltage and resistance (invaluable for verifying component values), and lastly a Pana-Vice to securely hold PC boards during the construction and allow them to be angled and rotated as required.

The total project was completed over a one-week period. Construction time was about 4 hours for the control board and 3 hours 15 minutes for the front panel board. Another 3 hours 45 minutes brought me to the first test of the partial assembly (i.e., the first third was done). Here you assemble the partial unit by plugging the control board and front panel into the RF board and, using 2D modular fasteners, attaching the side and bottom panels. After applying 12v power the display should come up "Info 201" and then "7100.00 c." The c is the mode indicator for cw. You then test the built-in digital volt/current meter, optical encoder, latching relays, keyer and sidetone/audio amplifier, and perform a s-meter alignment and bar meter current test. When I powered mine up, I got "info 080" which in the detailed troubleshooting section meant there was something wrong with the input/output controller circuit on the RF board.

To make a 3-day story very short, tweaking a small trimmer capacitor on the Control board about 45 degrees clockwise from the position specified in the manual completely resolved the problem. The folks at Elecraft were extremely attentive via email and helped me through the difficulty. This would be the only problem encountered during the entire construction effort.

Another 9.5 hours of construction brought me to the second partial assembly alignment and test. At this point you have the front half of the RF board complete and must plug everything back together again. You then work through the PLL reference oscillator, VCO (voltage controlled oscillator), BFO test and alignment, VFO linearization, IF amplifier alignment and 40 meter Band Pass

filter alignment. You actually hook up your earphones at this point and listen to 40 meters. The receiver sounded excellent! Every test and procedure was completely successful, so on with the last part - including winding the vast majority of the toroids.

The most memorable part of the kit's last third was winding, stripping the enamel off the leads and installing all of those toroids, but the manual does a superb job of getting you through it. Final alignment and test follows: 40m transmit alignment, VFO linearization on all bands, receiver pre-alignment, and transmitter alignment on all bands is last. As many bands were open on the evening of 6/30, the transmit alignment took a lot longer as I would stop to work stations as each band was completed! Of special note, the rig's first QSO was on 40m with Puck, W4PM! Final assembly followed with installation of the speaker and all the top, bottom and side pieces. Fully assembled, the K2's modular construction makes it feel solid as a brick. The rig's controls and the microprocessor menu functions are straightforward, and after a brief orientation the manual is no longer needed.

The front panel of the K2 has only 6 knobs including a heavy, machined main tuning knob, keyer speed (programmable Curtis A or B), power level in 0.1w increments, RF and AF gain, and RIT/XIT. The 16 buttons (not including the larger on/off switch) each support multiple functions by "tapping" or "holding" them. In addition, the Band+ and Band- buttons can be pushed at the same time to allow direct frequency entry. Tapping/holding the menu button gains access to many less frequently needed performance or calibration functions. There are two VFO's with split capability, selectable preamp/attenuator/off, fast and slow AGC, memory keyer message capability, and selectable tuning rate to facilitate rapid QSY. You can customize up to 4 I/F filter configurations for each mode. CW reverse is also available.

The scanning function is really slick, moving smoothly from one station to the next between operator-defined limits. The rig's configuration can be optimized for reduced battery operation if necessary.

As I write this on 7/5, I've filled two logbook pages with K2 contacts on all bands including LZ1AF, OZ8RO, K4EF, W3VT, G4PKT, G4KGG, W5FOC (K5NA), G8PG, SV9/G4VXE, K4BAI, K5BGB and DK8EI. Several of these (including Tim in SV9) were using my Hercules II amp driven by the K2 to 150-200w with full QSK. Speaking of QSK, and with all due respect to my fantastic OMNI VI, the Elecraft is subjectively the best sounding QSK I've ever heard. The K2's sensitivity measured up very well to the OMNI VI during A/B comparisons. Selectivity using the K2's programmable filters far exceeded my expectations but can't compete with OMNI's cascaded filters. Of course, the OMNI costs 5 times as much! I understand that Elecraft plans on offering more filter options in the future, as well as a 100w PA module which fits in the same small physical envelope, and a computer interface.

An excellent test of a rig's frequency stability is the new digital mode you've been hearing about: PSK31. Hooking up my PSK31 adapter to this laptop demonstrated the K2's rock-like stability with near perfect phase displays (yes, the person transmitting on the other end must be stable too). I have ordered the K2 SSB option specifically to experiment more with low power PSK31. At last, a use for the microphone connector!

This radio is not a QRP toy; it is a serious radio with a driven and imaginative company behind it. A

multitude of options in the future will further refine performance and capability. If you have an itch to build something substantial and/or want a backup or travel radio, check this out.

72, de John K1JD
K1JD@aol.com

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IAQRP at West Liberty Hamfest Recap
By John Burnley NU0V

(The following is an updated post from IAQRP-L and QRP-L)

What possible fun can there be on a cold and rainy day? Why spreading the good word about low power operating (QRP) of course!

The Iowa QRP Club had a display table at the West Liberty hamfest on Sunday October 3. The weather was chilly and rainy and I was concerned that the outdoor flea market would be impacted.

Well it did rain most of the day and the outdoor flea market was affected, but that sent a lot of people indoors to stop by the IAQRP display to talk about low power operating!

There were lots of QRP goodies that members brought for show-n-tell. Jeff Woods (W0ODS) brought his homebrew general coverage communications receiver and a 49'er. Both are very impressive! Jeff is really an excellent builder. The homebrew receiver has a digital VFO with display. We had fun listening to the BBC and later receiving transmissions from a PIXIE 2 that was also on the table. Walt Holling (N9MZP) brought a Mark II NN1G transceiver (built by Walt but autographed by Dave Benson himself), homebrew tuner, and a Pixie 2 mounted in a radar detector case. Larry Stambaugh (WB0RMT) brought his NWxx transceiver (Dan's), tuner, and power supply. All three are in matching cases and was the subject of a fine article Larry wrote for the IAQRP newsletter earlier this year. He also brought an NC20, super CMOS keyer, NorCal paddles, and a Pixie 2. John (NU0V) brought an MFJ-9017, Emtech ZM-1 (with AZsQRPion LED SWR indicator kit installed), Pixie 2, 38 special, Ten Tec 6 meter receiving converter, Fireball 40 transmitter, KnightSmite, and a SuperTick keyer.
Thanks to all who brought items as they really made the display impressive.

There was also vendor information from Small Wonder Labs, Milestone Technologies, MFJ, Ten Tec, Hands Electronics, Kanga US, and 'Joy of QRP' by Ade Weiss (W0RSP) flyers. Sample newsletters from NorCal, G-QRP, ARCI, St. Louis QRP Society, CW Operators QRP Club, NW QRP, and (of course) the Iowa QRP Club were there as well.

My first surprise of the day was Walt (N9MZP). He stopped by to say hello and talk about QRP. He saw a previous posting (of mine) on QRP-L about the IAQRP participation at the hamfest and sent me an Email. He was there bright and early and stopped by to say hello. Plus he brought some of his goodies for the table (even though he was not a member of the club....but hopefully that will change). Now this is a real QRP'er!

Another highlight of the day was the St. Louis Audio Amp boards donated by the St. Louis QRP Society. The boards were available to anyone who wanted them plus if the kit was built at our display we provided the board mounted parts.

We gave away many boards and had two built at the hamfest. Thanks to Jeff (W0ODS) who brought the soldering station and industrial vise which made things very easy for our builders (best to spoil them early hi). Again our thanks

to the SLQS and Dave Gauding (NF0R) for their support!

NorCal donated an Elmer 101 issue and logbook as doorprizes. Congratulations to Jon Book (KB0EDE) who won the Elmer 101 issue and Randy Swemline KB9KUZ who won the logbook. Once again my thanks to Doug and Jim of NorCal who have always supported our club.

The crowd was a good one and the table seemed to be hopping quite a bit. I finally took a break near lunch time to make a 'quick pass' of the vendor area. It didn't take long before I was at Paul Washa's table(s). Paul as you recall helped the IAQRP Club put together several group buys on books last year. There is another one in the works which should be announced in late October or early November. I always buy a book from Paul as he has quite a inventory that he brings to these events. I picked up a copy of the new ARRL Antenna Compendium when I noticed a familiar book. Paul now carries the 'Joy of QRP' by Ade Weiss (W0RSP). For those of you who needing a copy look Paul up at a hamfest. It is a classic QRP book and many consider it to be the 'bible' on QRP!

Finally the time came to pack up and head back west to the Des Moines area. It was a great day (to be indoors hi) and a lot of fun spreading the good word.

I would like to thank the following people who helped out with the display: Jeff Woods (W0ODS), Larry Stambaugh (WB0RMT), Walt Holling (N9MPZ) and Alex Stambaugh (KC0EBK). You guys made the display a real success!

72, de John NU0V
burnleyia@home.com

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Painless Registration For The ULS

By Jerry Bartachek KD0CA

(Editor's note: The Universal Licensing System or ULS allows expanded electronic filing of Amateur Radio applications. Here Jerry walks us through the process he encountered to become registered to use the ULS. Additional information may also be found in the September 1999 QST pages 85-86.)

In response to my plea for help with ULS registration on the QRP-L, I received the following Emails:

(From Mike Melland W9WIS)

Hi Jerry,

I registered for ULS ID this morning. It's not mysterious..... the Gov't wants to cut costs so many FCC transactions are going to be "self initiated" over the web. Go to the ULS site and register. You will be given a number and you choose your own password and enter your TIN (Tax Payer ID Number aka your Social Security Number). You register your callsign and after that you can renew etc. online. That's all there is to it. And, yes amateur radio is participating in ULS from August 16 on..... There is no seperate ULS license, just the means to perform license related transactions via the web..... renewals, changes of address, etc..... doing away with paper forms....

(From Timothy J. Strong KG2NO)

Hi Jerry,

Yes, any licensed operator (US or foreign) that has a valid US Amateur Radio license will be required to register with the ULS. You will not get another license, it is just a matter of associating your Social Security Number (Taxpayer Identification Number) with any callsign(s) that you have. Anyone who does not have a TIN will be required to obtain one.

Jerry, you have to read the entire page, look under the heading: "Radio Services Currently Implemented In the ULS" and you will see Amateur listed here.

An Amateur with 2 callsigns would list both callsigns when they register.

You do not have to immediately register with ULS, only if you want to do business with the FCC such as upgrade your license, change your callsign, change your address, etc. I believe new licensees and upgrades will be able to register via the VECs.

August 16 is just the date that the FCC started using the system for Amateur Radio.

Using the e-mail exhortations above, I registered under the new Unifor Licensing System (ULS). As the name implies, it is a SYSTEM, but not a separate type of license. Many classes of radio licenses are being included in this program, and in short it is only a system to make license renewals and upgrades EASIER for the licensees to deal with via the internet.

After the QRP-L'ers advised me, I bravely pointed my browser to the FCC ULS site and registered. It was quite painless, and filling out their on-line forms to be intuitive.

Here are the steps in registering for ULS via the internet:

1. Point your browser to: http://www.fcc.gov/wtb/uls. There is a lot of information there about all the details about ULS. You'll only need to click on one of the URLs to go to more information than you can imagine!

2. While you are on the ULS home page, click on the button labeled: "TIN / Callsign Registration" in the left hand column of the screen to register your station with ULS.

3. After clicking that button you will be presented with a form to fill out on line. You will be presented with 2 choices to click on. One is a chance to participate in a survey about your station's Y2K readiness. The other is for the TIN / Callsign Registration (click on this one).

4. You'll see s a sentence that reads, " If you are not registered with the Universal Licensing System:" and just below it there is a little circle field next to the words "Register Now". Click that circle and then click the button labeled "Continue".

5. Next you get more questions to answer. Click on the choice for registering with the ULS as an individual and then click the "continue" button.

6. You will be presented with a large on-line form to fill out and submit. Items on the top of the form for the Licensee Information includes your TIN (your social security No.), first name, middle initial, last name, P.O. Box or street address, city, state, zip, telephone, fax number, and e-mail address. Directly below that is another set of fields exactly as above for the Contact Information. Since hams are not a commercial station with separate licensee, and contact person information, I decided NOT to fill out the contact info. As licensee, I am my own contact person.

Further below on the form you will find fields for a password, verification of the password, and a personal identifier that only you would know. These last three you MUST fill out. I used my callsign as my password, and my userid here at work on our lan as my special identifier. Maybe your mother-in-law's waist size could be used (hi).

When all the desired fields are filled out, click on the submit button. It will prompt you to fill out a huge sheet wherein you can list all your callsigns if you have less than 100 of them. Take it from me, you have less than 100 of them! Just click on the choice for 1-100 callsigns, and put your amateur radio callsign in space number 1, and click on submit.

Before the whole process is done, the registration computer will show you a screen with your password, special identifier, and a computer generated ULS number and a ULS password. You will really WANT to print this screen out on your printer. You will not be able to

see that information anywhere again. And the ULS nubmer they give you will be about 9 or 10 digits long. The computer-generated password, will be wierd like, "AXM9ZT%WW" or similar gobbledyegook. Hey, "gobbledyegook" would be a great password!

When you wish to modify or renew your license in the future, you will use the ULS system to do it on line, and you will then need your passwords, etc.

There are instructions on the first ULS web page for registering via snail mail, but I hope someone else will write that up for the Iowa QRP Newsletter.

72, de Jerry KD0CA
jbartac@max.state.ia.us

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Group Buy With Paul Washa Books

The Iowa QRP Club is pleased to announce a group buy from Paul Washa Books (W0TOK). There are several titles available. Just remember to specify the Iowa QRP Club group purchase when contacting Paul. These prices reflect USA shipping (all 50 states). Any DX orders should contact Paul first to see if he can accommodate them.

Here are the details:

ARRL 2000 Handbook without software $28.00 delivered

ARRL Antenna Compendium 6 with software $17.00 delivered

ARRL W1FB Design Notebook $11.00 delivered

ARRL Solid State Design $14.00 delivered

ARRL Intro To RF Design with software $24.00 delivered

ARRL Antenna Handbook with software (18th edition) $24.00 delivered

Joy of QRP by Adrian Weiss (W0RSP) $21.00 delivered

ARRL Mini Logbook (approx 6'' by 4'') $5.00 delivered (Paul tells me that the minilog is great for mini power stations and will fit a backpack or small case just fine for portable work)

ARRL 1999 Satellite Anthology $13.00 delivered

If you would like to see any other titles please Email NU0V privately.

How to order: You must contact Paul and specifically mention the Iowa QRP group purchase. You may contact Paul at w0tok@email.msn.com or phone (612) 472-8991. His address is:

Paul Washa (W0TOK)
4916 Three Points Boulevard
Mound, MN 55364-1245

He will accept checks or money orders (but no credit cards). This group buy will run 30 days. IAQRP members attending the Des Moines hamfest on Sunday October 31st may purchase books there (prices adjusted for no shipping).

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Upcoming Operating Events
By Mark Milburn KQ0I

Here are some QRP operating events that will be coming up. Turn your power down and join in.

They are fun events and the people you meet will be some of the best hams on the air. Plus you'll be able to pick up a lot of states and work some milliwatters, too!

Adventure Radio Society Spartan Sprint

November 1, 1999
December 6, 1999

The Spartan Sprint will be held as usual on this first Monday of the month). We will be operating on three bands--80, 40, and 20. There are winners in two categories: points (the Tubby Division), and points per pound (the Skinny Division).

1. Start at 9:00 PM EST, 8:00 CST, 7:00 MST and 6:00 PST. Finish at 11:00 PM EST, 10:00 CST, 9:00 MST and 8:00 PST.

2. The frequencies will be 3560 kHz+-, 7040 kHz+- and 14060 KHz+-. (You may operate one, two or three bands--your choice.)

3. Exchange RST, SPC (state, province or country) and power output.

4. If you choose to call CQ, use the format "CQ SP," or "CQ SP TEST."

5. You can take credit for working the same station on a second band.

After the contest, you may use an autolog, which is part of the ARS Sojourner. Just go to www.natworld.com/ars and follow the link for "Direct access to autologs". Or you can speed things up by going directly to the Spartan Sprint autolog page at www.natworld.com/ars/ss_log.html.

If you don't have access to the web, send Russ Carpenter, AA7QU, an e-mail with your total QSOs and the total weight of your station (i.e. the combined weight of all transmitters, receivers, keys, keyers and batteries used during the Sprint). You may also include your comments from the soapbox. Russ' email address is russ@natworld.com.

Results for each Spartan Sprint are published on the Thursday following the Sprint. This may be the world's quickest contest reporting! Please send your log as soon as possible, but in no event later than Wednesday afternoon.

The Spartan Sprint is based on a simple but stimulating concept. The ARS is encouraging all of you to cobble together the kind of station you'd use in a portable environment —lightweight transceiver, keyer, key, and battery. Then put that turkey on the air, and participate in a two hour sprint.

All operators are invited to play, whether or not they are members of Adventure Radio Society. Even if you don't have lightweight equipment, your participation will be rewarding, both for you and the other participants. We'll report the score in two different Formats/absolute scores, and points per pound of station weight. So you can get your kicks from running up a magnificent score, or achieving an remarkable ratio of points per pound.

If you're thinking about becoming a member of Adventure Radio Society, just send Richard Fisher (membership chairman) an e-mail expressing your interest. Richard's e-mail address is nu6SN@aol.com. Membership is free, and the organization has a great group of men and women who combine their love of ham radio with their affection for the outdoors. You don't need to be a macho person; ARS welcomes people of all ages and levels of ability.

Russ Carpenter, AA7QU, Contest Manager russ@natworld.com

CQ WW DX Contest, phone
0000Z Oct 30 to 2400Z Oct 31

Exchange: RS(t) and CQ Zone

Classes: Single op allband/single band/assisted, high power/low power (less than 100W) or QRP (less than

5W) multi single, multi multi. Multi singles have a 10 minute rule. All classes may only have one transmitted signal per band.

Work stations once per band.

Team and club competition

North American stations score 2 pts/qso with stations in different countries on same continent and 3 pts/qso with stations on different continents. Stations in the same country may be worked for zone credit, but no points.

Multipliers are CQ Zones and countries (DXCC + WAE)

Final score is QSO points x multipliers

Awards.

Send logs by Dec 1 to CQ Magazine, 25 Newbridge Rd, Hicksville, NY 11801 ssb@cqww.com See http://cqww.com/cqww/

Ten-Ten International Net Fall CW QSO Party

0000Z Oct 30 to 2400Z Oct 31
Single op only, CW only, on 10 meters only

Categories: Individual, QRP, Club

Contacts must be made in CW sub-bands

Exhange: Call, name, state/country and 10-10 number if member.

Score 1 pt/qso with nonmembers and 2 pts/qso with members

Final score QSOI pts x prefixes.

Awards

Send logs by Nov 15 to: Gateway Chapter, Don Ward W0RTV, 4514 Ferrer Dr., St Louis, MO 63129-3741.

For more info see http://listserv.lehigh.edu/lists/tenten-l/rules.html

The Zombie Shuffle

Friday Night, October 29, 1999; Any 4-hour period you choose from your local sundown to local midnight. You can split it into two sessions if interruptions are unavoidable.

20, 40, and 80 meters CW QRP Only (5 watts or less power out) Suggested frequencies 14.060, 7.040, 7.110, 3.560, 3.710

Exchange: RST, SPC, Name, Zombie number or telephone area code if you do not have a Zombie number

Stations using a Tuna Tin 2, then add /TT2 after your callsign and if you are 18 years old or younger, send your age to.

You may identify stations participating by looking for or calling CQ BOO.

Scoring: Your score is going to be the sum of all Zombie numbers and telephone area codes worked on ALL bands! Stations can only be worked once per band however. Also add in special bonus points

Certificates of participation are available by sending your logs, score sheet and a business sized SASE to:

Jan Medley, N0QT
Zombie Shuffle Contest Coroner
PO Box 1768
Socorro NM 87801

Zombie pins and certificate are available by sending your logs, score sheet, and $2 (US Funds) for P/H to the same address. Please include an address label. To qualify for a pin you must work 13 or more QSO's using any rig at 5W or less; or work 5 or more QSO's using a Tuna Tin 2 yourself; or

work 5 or more QSO's with somebody else that's using a Tuna Tin 2.

Please use plain ASCII text only for log submissions. The minimum information your log should show is: Band, Callsign of station worked, exchange received, exchange sent (at least the RST), and the time in UTC.

Enjoy....

72, de Mark KQ0I
markmilburn@netzero.net

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Announcing the Milliwatt Triple Crown!

The Knightlites, Ft. Smith QRP Club, and the Iowa QRP Club are sponsoring the great Milliwatt Triple Crown. Earlier this fall the noble Knights announced their Holiday Milliwatt contest. At the same time the Ft. Smith QRP Club and the Iowa QRP Club were planning similar contests. It just seemed natural to get the three together in yet another contest! Here are some of the details.

Each individual contest is independent and run by the respective club. Each individual contest will have a winner and the results will be posted to QRP-L. The Milliwatt Triple Crown winner will be determined by combining scores from all three events (the same scoring methods will be used for each independent contest). The cumulative score should prove to be a lot of fun and establish serious bragging rights on just how low you can go.

Details are still being worked out but we can tell you that the first leg of the Milliwatt Triple Crown kicks off in December with the Knightlites Holiday Milliwatt Contest. The Ft. Smith event will be in the March/April timeframe and the Iowa QRP event will follow in the July/August timeframe.

Start honing your milliwatt skills now and be prepared to turn the powerdown!

72, Bob Kellogg AE4IC
Knightlite QRP Association

Jay Bromley W5JAY
Ft. Smith QRP Club

John Burnley NU0V
Iowa QRP Club

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The Fractal Wing Loop
By John Burnley NU0V

Covenants and CCR's are dreaded words most hams do not want to face. In my opinion, the inability to put up an antenna has been more damaging to amateur radio than any other item. When my children were young I would annually give ham radio demonstrations to their classrooms. Even with competition from video games, cartoons, and playing with friends, there was always interest in the hobby demonstrated by the children. But whenever I tried to follow up with the parents about developing the child's interest the door would get slammed shut. "I wish we could let Timmy put up an antenna, but our area has restrictions about antennas so they'll just have to find another hobby". Trying to suggest compromise or hidden antennas fell on deaf ears.

Unfortunately most areas are restricted these days and not many parents will consider a child's possible future interest in a hobby when purchasing a home. My wife and I faced a similar dilemma when we bought our current house. We chose the area for the school district first and then tried to work out antenna privileges. The existing housing market in the Des Moines suburbs was very tight.

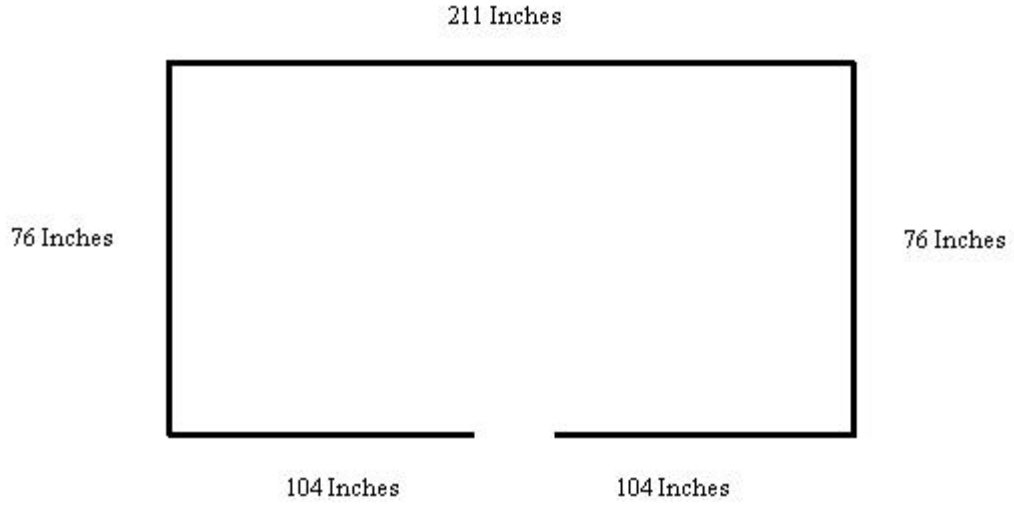

Figure 1. The original loop designed for 15 meter operation.

Some houses sold before we could event get over to look them over a lunch hour. We finally decided to go with new construction, but there were the covenants on the property. Having a spouse who is not a fan of the hobby did not help my plight. The best of a bad situation ended up being allowed to have an antenna as long as it was attached to the house (but could not extend over the yard).

By liberally interpreting the covenants, I tried a variety of low profile antennas. I first ran dipoles under the eaves of the house (two story) without much success. Finally I settled on a vertical that was 3/8 wave on 30 meters (with 1/4 wavelength radials under my deck). The vertical runs up the side of the house and over the roof to a peak. It has performed well allowing many DX contacts. But because of angling up to the roof peak, it shows characteristics of being a sloper (favoring the southeast and Caribbean). The good news was that the antenna performed well on 40 and 20 meters! A simple multiband antenna seemed to allow me to thumb my nose at the developers. All was well until this past summer when 20 finally started opening up into Europe. I could hear a multitude of European stations but just could not raise them running my NC20 at 5 watts into the vertical. I also had very little luck with western and northwestern stateside stations.

After first moving into the house, I installed two indoor loops in the attic over the garage. The inner loop was for 10 meters and the outer loop was cut for 15 meters. I used the standard formula of 1005 / f(Mhz) to determine the length of wire for the antenna. Because the loops are located in the attic, there are many objects within proximity that affect resonance. In other words the antennas were detuned somewhat because of objects being near. The solar cycle was

beginning to head south anyway so I placed the indoor loops on the preverbal 'To Do List'.

After another frustrating evening of trying to work Europeans, I remembered the two loops in the attic over the garage. Could I possibly modify the larger loop to resonate on 14 Mhz? If so would the results be disappointing?

October 12, 1999 was a banner day for me! QRP Quarterly, Sprat, and my NorCal Toroid Kit all arrived the same day! Yahoo! The XYL and children were not home and I began to go through the ham radio 'To Do List' to look for a good project. The loops topped the list. Time for some climbing into the attic.

Rummaging through the garage produced a 22-foot section of 12 gauge solid copper wire. The question was just how to add the wire to the loop. Back in the earlier days I experimented with loops within loops, figure 8 loops, and a variety of others. None worked very well. The larger loop already extended from wall to wall and roof to just above the garage ceiling. Without any room to work with the project did not look very promising.

Several years ago I read some articles written by Nathan Cohen in 'Communications Quarterly' about fractal antennas (see references). Fractal geometry in designing antennas was not a well-known concept and I believe that Cohen received a bit of criticism over his articles. It was very interesting reading though and I recommend that everyone take a look at his concepts.

With fractal geometry, the repeating of a design upon itself creates a complex shape (or structure as Cohen labels it). Thus the term self-similar or iterating is used to describe the patterns. The self-similar patterns induce capacitance and inductance into the design. Since the outside perimeter is patterned, it effectively shrinks the physical size of the antenna (but maintains a resonant structure).

Cohen discovered some interesting properties of fractal antennas. In some cases there is gain exhibited in a fractal antenna over that of it's full sized counterpart (up to a point). Multiple iteration fractals resonate at multiple frequencies (in a non-harmonic fashion). Cohen defined resonance as total impedance that fell between 20 and 200 ohms with medium to high Q. Finally he found that when fractals are shaped into closed loops the radiation resistance does not drop significantly for their size as do with most small loops (at lower iterations). As the number of iterations increases (smaller physical size), the antenna will eventually exhibit the pitfalls that most shortened antennas have (lower radiation resistance and narrowing bandwidth).

Here is a simple example of a fractal design. Iteration 0 is a straight line. Iteration 1 introduces a box upon the straight line. Iteration 2 introduces a box upon each line segment of iteration 1.

Cohen also mentions that there are examples of simple fractals in antenna use today. But he also points out that a true fractal antenna completely contains the self-similar patterns. The fractal wing loop is not a true fractal antenna. Rather it is a hybrid that uses a standard loop design but introduces segments of wire at the load point perpendicular to the plane. The segments protrude from the plane of the loop and resemble small wings (hence the name). The wings are constructed with fractal shaping borrowed from a second iteration Minkowski loop (see

references). My goal was to lengthen the loop with enough wire to resonate on the 14 Mhz band.

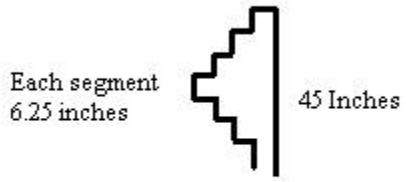

Figure 2. The Fractal Wing

Figure 2 illustrates the basic shape of the wing. It was constructed with a 6 1/4-inch length of 2 x 4 lumber. This was a scrap piece of lumber that was randomly chosen. The wire is bent around the 2 x 4 scrap to form a stair step pattern, which is symmetrical.

Figure 3 illustrates the finished loop. It is important to note that the wings are not self-supporting. Twine was used to provide support and keep the wings from collapsing. The twine was run up to a strut in the attic roof.

Remember that this is an indoor antenna. The existing loop was originally designed for 21.120 Mhz (1005 / 21.120 = 47.583 feet). The modified loop contains 69.66 feet of wire and should resonate at 14.42 Mhz (according to the standard formula). The antenna (bottom) is approximately 12 feet off the ground (or in this case above a concrete slab). The wings contain 31% of total wire length. Because of the attic location, I expected some detuning to take place. And now you are thinking to yourself, 'quit beating around the bush and tell us how it worked'. Well the results are surprising but admittedly I am pleased.

Using an MFJ-259 antenna analyzer I started a sweep at 26 Mhz and tuned downward. The first resonance I found was at 13.974 Mhz. Close enough! I attribute this only to dumb luck. At 13.974 Mhz the SWR was at 2.4.1 - 2.5.1 and the Resistance meter on the SWR analyzer read 100 ohms. This was close to what I would have expected with a normal box loop. Remember the radiation resistance of a resonant one-wavelength loop is approximately 100 ohms and will show a SWR of 2.1.1 on the MFJ-259.

I do not recommend anyone using my exact dimensions to build this antenna. Rather I encourage you to put up a loop with as much wire as possible and then add the fractal wings to reach a desirable resonant frequency. Experimentation will be needed to get the exact dimensions for your location. Each installation will be different (I am assuming you will be placing this antenna indoors) with a variety of environmental factors affecting performance. If you have enough real estate and no restrictions then put up a full sized antenna outside.

How did the antenna work? The loop is oriented north/south (maximum radiation). On air reports have been very good and much better than those received with the vertical. Here is a list of the contacts made with casual operating: CO2SX, AF5Z, UA0BW, CO2RQ, XE3LPV, W7VR, W4HEW, KC0EHS, PP6CW, VE7BXO, FY/DJ6SI, UA0ABK, RW9UMT, KP4BME, N4SO, AF4PP, AB5XQ, K1JD, and N7XI.

I am especially pleased with the over the pole contacts. Granted the reports are standard DX reports (599) but many were made on the first and second calls. I also used this antenna exclusively during the ARCI Fall QSO Party and made 56 contacts with it.

The wings were conceived because I was modifying an existing antenna (that I did not want to take down). Other designs are possible using fractal patterns. Instead of

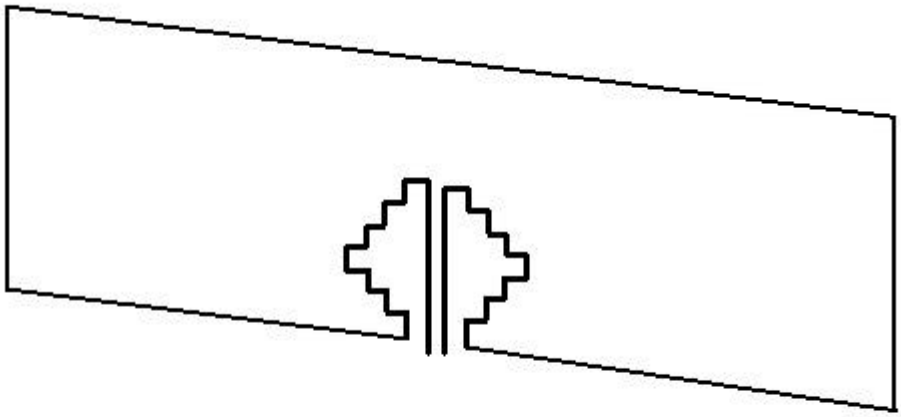

Figure 3. The completed Fractal Wing Loop

placing the wings perpendicular to the plane of the loop, the patterns can be incorporated into the main part of the loop itself. Of course one could also fashion a true fractal antenna (constructed totally with self-similar patterns).

Indoor antennas can be a compromise not only in performance but with the operator's patience as well (hi). The limitations that are now placed on amateurs by covenants and CCR's make operating effectively difficult and sometimes can keep others out of the hobby.

The fractal wing loop is an indoor antenna that has given me good results. More experimentation is needed to determine the real effect of the wings on resonance as opposed to the environmental effects of indoor use. As time permits I will report what information I find. If anyone has modeling software and is willing to model this antenna please Email me privately. I will help you any way that I can and hope that you will report back your results in this journal.
With all indoor antennas, QRP power levels should be used (of course I feel the same with outdoor ones as well hi).

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72, de John NU0V
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The Iowa QRP Club was formed to promote amateur radio low power operations, to hone operating skills, improve building skills, and introduce the hobby to perspective new amateurs.

Membership is limited to current Iowans, former Iowans, those with strong Iowa ties, border states (border counties), and in some cases by invitation. To join, email a request to:

IowaQRPClub@juno.com

or surface mail to:

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8204 Sutton Drive
Urbandale, IA 50322

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