The Monitor

The official newsletter of the Brantford Amateur Radio Club

SEPTEMBER 2006

VE3TCR – VHF repeater – 147.150 +
VE3TCR – UHF repeater – 443.025 +

A WORD FROM YOUR PRESIDENT

It's been a long time since being president of this club. I would like to thank everyone that has put their faith in me for this year. I will definitely try my best to keep the club interests first and foremost. We have suffered as a club with declining membership through silent keys, lack of interest, and lack of new blood. This is an issue that I would like to concentrate on this year. If we all put our heads together, we should be able to come up with a solid plan to rebuild the club to a respectable size. This could mean anything from workshops to golf tournaments!

Everyone has to remember that WE are the club, and WE are the ones that will have to do what it takes. If everyone does their part, the job won't rest on only a few shoulders. With this in mind, we all will be able to have a sense of accomplishment when we start to see the results of our work. If you don't contribute, you don't have the right to complain!

That's it for now, enjoy this year and I'll see you at the meetings!

EDITOR'S RANT

It is interesting to note, that at the moment, the editor and the club president are one and the same. While being the editor, I have a goal for this newsletter. I would like to see it become something that rivals the G-QRP club booklet. I don't see it as something too difficult to accomplish. I have no intention of writing all of the articles all of the time though. Every one in this club has at least one thing that they can contribute to the *MONITOR*. I am setting it up in similar fashion to a regular magazine. You will be able to decide quite easily, which areas interest you, and which areas that you can contribute to. If I have missed an area that you would like included in this newsletter, feel free to tell me and I will add it. This is YOUR newsletter, so let's have some fun and make it something to be proud of!

IN THIS MONTH'S ISSUE

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- Phased ¼ wave verticals for 20 meters
- Circuit board making – Part 1

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- MFJ-269 HF/VHF/UHF SWR analyzer

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Phased ¼ Wave Verticals for 20 meters

de VE3SIC

Background

This years' field-day competition prompted me to follow my own FD tradition. That is to build a unique antenna that is easy to build and tune, and that has good gain over a dipole. This years' creation was a pair of ¼ wave vertical antennas set up as a broadside array.

Since originally I was using my QRP rig, I wanted to get as much bang for my buck as possible. According to the information that I found in an older Amateur Radio Handbook (everyone has a collection of these books right?), a pair of antennas spaced 5/8 wave apart and fed in phase will have a gain of over 5 dB. Wow! That is almost a full S –unit. That would make my 5 watts appear as if I was running 15.8 watts into a dipole! Unfortunately, one of the gel cells that I was using developed a short. We switched radios and went high power. We used an Icom 751 with an output of 100 watts for an equivalent power of 316 watts +!

The reason that I chose to use ¼ wave elements was because to make a horizontal curtain out of wire was going to cost a lot of money. 14 gauge wire was going at $130 for a spool! I only had $100 to spend. While Scott (VE3QU) and I wandered around Home Depot wondering what we could use as a substitute, we stumbled upon some aluminum extension poles for attaching paint rollers to. The label said that they extended to 16 ½ feet (does that sound kinda familiar?) and they were on sale for $24 ea. I took 2, grabbed some hose clamps, and some twine. Then we went to Canadian Tire and got some tent pegs, the ones that are a giant nail with a plastic hook attached. I went to Gilbert Communications the next day and bought 150 feet of twin lead. All total was just under $100 bucks!

Building the antenna

We started by making the ground planes. We cut some scrap wire into 18ft lengths. I soldered three wires to one of the tent pegs and did another three the same.

After extending the poles to their maximum length, I used some hose clamps and some short pieces of wire to jump the insulated locking mechanisms. I also made some guy lines for the poles. We stood up the poles, and anchored the guy wires to the ground with tent pegs. The spacing was 44ft 4ins between the two poles. (5/8 wave for 20 meters) We positioned the poles so that their line was E to W. That would result in a broadside direction of N and S.

Feeding the antenna

I used equal lengths of twin lead (25 ft) to make a large "T" with the balance of the twin lead that I had bought. I made sure that the phase was correct and attached one of the conductors to the pole with a hose clamp. The other conductor was soldered with the ground wires and I drove that peg into the ground at the base of the pole. The same was done at the other pole. We unrolled the balance of the twin lead and brought it to the tuner. I used my SWR analyzer and adjusted the tuner.

Results

With the Icom rig doing it's thing, we were asked by several stations what we were running because they said that we were one of the loudest stations on the air. We found that we could work just about everybody with only a few tries. I believe that was because we were using verticals (low angle of radiation) with gain as opposed to the average field day contester using just a dipole. Also, the terrain elevated behind us (the North side) by another 100 ft. This also creates a bit of a reflector effect, so our gain may have been higher!

The future

I do intend to experiment with this setup. I want to come up with a phasing arrangement to move the lobe around. Or perhaps another pair of elements 1/8 wave behind for higher gain and phasing possibilities. I think that this antenna is worth experimenting with just because it is something different!

Circuit Board Making – Part 1

de VE3SIC

Making printed circuit boards at home is relatively easy. The first step is to get access to a laser printer, a scanner and some board design software. I use **ExpressPCB**, it is free and relatively easy to use. The program can be found on the net at www.expresspcb.com . They also include a schematic drawing program called **ExpressSCH** that mates with the PCB program. Both of these programs are fairly good for the average amateur to use. (did I also mention free?)

We will start with instructions for a single sided board because there is a little trick to doing the double-sided ones. Also, I will be making reference to the **ExpressPCB** program throughout this tutorial. The board drawings may be done using other drawing programs or by hand if you desire.

Step 1 - Draw the board layout/copy the image

Drawing the layout - If you are doing a single sided board, use the default green layer that shows the bottom. The view will be as if you were looking through the board from the component side. This does make it fairly easy to envision where everything is. Also, it is very important for the next steps. Draw the complete board as needed and size it accordingly.

Copying the image – If you are taking the image out of a book, scan the image. Make sure that the image appears as if you were looking through the board. Also, make sure that the size is correct. If you need to adjust either property, use a photoshop type program to correct it.

Step 2 – Print the layout

Before you print a user drawn board, you must do the following:

- Goto view->Options…->Colors
- Select Backgound – WHITE
- Select Bottom layer – BLACK
- Select Board edges – BLACK

Now you can print the layout onto photo glossy paper (for inkjet) using the laser printer. Be sure that you set your laser printer pier to the highest contrast setting and the highest white setting. The reason for the laser printer is that toner is made up of fine plastic! This toner will be transferred directly to the board from the photo paper using heat. Cut out the layout to the size of the board. (I use Staples photo glossy paper, orange box, 100 sheets 4x6 in. $12.00)

Step 3 – Prepare the board for transfer

This step is nothing more than cleaning the board as clean as possible so that the toner will transfer properly. Scrub the board with synthetic steel wool. This can be found at Canadian Tire. Use #0 first going in orthogonal directions, then finishing it with #000 so that it is very clean and very smooth. (Do NOT use REAL steel wool, since it would cause RUST/oxidation, after it's embedded in the copper.) Next wash the board with soap and water. Rinse well and towel dry. Next clean the surface with brake cleaner and paper towel to get any remaining residues from the surface. Do not touch the surface with your fingers after this step!

Step 4 – Transfer the layout

This step requires the use of a regular clothes iron. Be sure to clean the surface before using it. It also wouldn't hurt to clean it after, so that the XYL doesn't freak out! Set the temperature to maximum. Place the board onto a solid heat resistant surface. Place the layout face down onto the board, centering it as required. Place the iron onto the layout and press down for about 10-15 seconds (the layout will stick to the board if there has been enough time), then you can move the iron over and press again. Keep moving and pressing in a way to ensure that the holes in the iron do not sit in the same place.

After doing this for about 2-3 minutes, remove the iron and carefully put the board (with the paper still on it) in warm soapy water to cool the plastic down. Use a pair of pliers or something like that so you don't burn your fingers. Let this soak for at least 10 minutes, then, you can start peeling the paper off of the board. You may only get a couple of layers off at first. Re-soak the board for another ten minutes and try again. I generally let the board soak overnight if I'm not in a hurry. After you get most of the paper off, you can scrub the board gently under running water with a soft toothbrush. If you have the toner properly transferred, the traces will not scrape off with your fingernail. When all of the paper is removed from between the traces and the holes in the pads, let the board dry, then inspect it.

If there are a few spots that need touching up, use a black Sharpie marker. If you made a mistake, or it turned out like crap, you can just clean the board off with acetone, repeat the washing procedure and start over. You may have to experiment with heat temps, transfer times,

and soak times a little bit. If you get everything just right, the paper will eventually peel off and leave all of the toner on your board!

Step 5 – Etch the board

REMEMBER – ANY ETCHANT SOLUTION USED IS DESIGNED TO DISSOLVE COPPER, THIS INCLUDES YOUR HOUSHOLD PLUMBING! BE SURE TO DISPOSE OF ACCORDINGLY!

You can use any of the following for etching the board:

- Ferric Chloride – a very dark liquid that stains everything yellow! Takes about 30 min. or more to etch an average board at room temperature. Some people add hydrochloric acid to it to speed up the process. I like that mixture myself, as it cuts the time in half without heating the mixture.
- Ammonium Persulfate – a more or less clear solution. This makes it easy to watch the process. I have never used this etchant.
- Home-made – 1 part Muriatic acid (28% Hydrochloric acid, found in hardware stores) poured into 2 parts Hydrogen Peroxide (3% found in drugstores) This is a cheap etchant to make, and it's easy to get! I haven't used it yet, but I will be on my next boards.

Use a shallow plastic container and pour 3/8" – 1/2" of etchant into it. Place the board into the solution face-up. Gently rock the container to keep the solution moving over the board. After a bit you will start to see the base material of the board as the copper dissolves. As soon as you see that everything is etched, pull out the board and rinse it under running water. Check the board visually. If there are spots that still need to be etched, put the board back in and etch a little bit more.

Step 6 – Preparing the board for soldering

Now is the time to drill the required holes in the board. You will notice that the holes have been etched already, this makes it easy to locate the drill. I use a Dremel tool with a 1/32" drill bit for most parts. Some parts may require larger bits. If you are using the standard glass-epoxy board, you will find that the drill bits get dull very quickly. This is because you are drilling through fiber-glass. I buy my drill bits in packages of 10 at the local industrial supply store. You can use carbide bits, but they are designed to be used at very high speeds and with coolant. Also, they are quite expensive for the amount of boards that I make. You will know that your bit is getting dull when there are burrs around the holes.

After you are done drilling, sand the board with #320 grit sandpaper to remove any burrs. Clean the leftover toner off of the traces with acetone, then immediately wash the board with soap and water. Once dry, the board is ready for soldering.

Step 7 – Populating the board

This is the fun part. Start populating the board with the components, taking care to place them in the proper position. Use a pair of needle-nose pliers to bend the leads. Refer frequently to the parts placement diagram. Use a 30 Watt iron with a fine tip. Make sure the iron is hot and that the tip is clean. Place the tip of the iron onto the copper and touch the side to the component leg. Be quick with the solder, as soon as it flows, remove the iron. With practice, you will be able to make solder joints that rival the commercial board makers.

Step 8 – Final touches

Double-check your work. When you are satisfied that all of the parts are in their proper place, clip off the component leads as close to the board as possible.

Clean the flux off of the solder connections with brake cleaner and an old toothbrush. Get a can of clear spray lacquer and spray a fairly heavy coat onto the solder side.

Step 9 – Stand back and admire your work

Really! You deserve it!

Step10 – Hook it up and give it a try!

If all went well, you will have a professional looking board that works.

Part 2 will deal with double-sided boards, ground planes and surface mount boards. I will also include a small project that you can try.

Product review – MFJ-269 HF/VHF/UHF SWR analyzer

de VE3SIC

If you are into building ANYTHING having to do with radio, this is probably the most useful piece of equipment that the ham can own. Since I do a fair amount of experimenting, I decided to buy this unit to make my life easier. And it does. This unit is easy to use and can be used to adjust, test, or measure the following:

Antennas:……	SWR, impedance, reactance, resistance, resonant frequency, and bandwidth
Antenna tuners:……..	SWR, bandwidth, and frequency
Amplifiers:……	Input and output matching networks, chokes, suppressors, traps, and components
Coaxial transmission lines:…….	SWR, length, velocity factor, approximate Q and loss, resonant frequency, and impedance
Filters:……..	SWR, attenuation, and frequency range
Matching or tuning stubs:……..	SWR, approximate Q, resonant frequency, bandwidth, and impedance
Traps:……	Resonant frequency and approximate Q
Tuned circuits:……	Resonant frequency and approximate Q
Small capacitors:……	Value and self-resonant frequency
RF chokes and inductors:……..	Self-resonant frequency, series resonance and value
Transmitters and oscillators:…….	Frequency

The operating frequency range is 1.8 to 170 MHz and includes SWR measurements for 415 to 470 MHz.

The unit uses 10 AA alkaline or rechargeable batteries. A switch inside the battery compartment has to be changed depending on battery type. A 12VDC wall wart can be used for operation or recharging.

So far, I have used this unit for about half of the items in the list above. Even though it is fairly expensive, the ease of operation, and only needing one tool for many tasks, I believe this to be an excellent purchase. You can easily spend more than that for a separate frequency counter, RF generator, AC bridge, voltmeter, and calculator! Now I wonder how I lived without one!

Club News

2006 Hamfest Report

Ebe Habing VE3EBH

When writing this report, our 2006 Hamfest is history. At the beginning of the year 2006, Jim Maloney VE3CQM, and myself, Ebe Habing VE3EBH took the task to tackle the Hamfest set-up, such as obtaining a contract with the Burford Agricultural Society for their fair grounds. The next step was to print 200 flyers, to be given out at the St. Catherines Hamfest. The weatherman was not co-operating and a snow storm was active that weekend and we cancelled that trip. Our next 4 hamfests we distributed approximately 600 flyers. They were in Burlington, Milton, Brampton, and Fergus. Also, we mailed our Hamfest 2006 flyer to 44 clubs in Southern Ontario. At this point, our advertising campaign was pretty well over. Peter Baker VE3OCN and I had regularly mentioned the event on the Amtar net for 3 weeks prior.

I would like to thank Peter VE3OCN for his time and effort to promote our club. Peter, you did a nice job! Well done!

On Friday, Aug 18 at 6 o'clock, a group of club members were ready to set up the Lions bldg for the next day. On Saturday, the vendors and tailgaters were waiting at the gate to come in and set up their tables or outside stands. At 11 o'clock, the last door prize ticket was pulled for our grand prize. After that, it was time to start cleaning up and another Hamfest was history.

George Horvath VA3GLH took the whole group by surprise and bought 6 large pizzas and a cooler full of cool drinks which everybody enjoyed. Thank you George for the delicious treatment.

I would like to take this opportunity to thank everybody that pitched in to make this years Hamfest a success.

Ebe Habing VE3EBH – Chairman
Jim Maloney VE3CQM – Co-chairman

Special Events

There was one special event that was quite the occasion over the summer. It was "Al Sass night". I was present at this occasion and found it to be quite interesting. Maybe I can talk Marvin into writing a little something about this for our next issue. How about it Marv?

QRP Corner

de VE3CQM

Brant QRP Group

The Brant QRP Group has been in existence for about 3 years and was started by myself, VE3CQM, and Richard LaRose VE3RLX. The group is made up of a group of ten or twelve local amateurs interested in the construction and use of low power radio.

In 2005, the QRPr's made a group purchase of Small Wonder Labs 40m kits and most have been completed with some mods and additions. Mike VE3MBX was of great assistance in the design of the ATU, SWR bridge, and audio amp. All of this was placed into a Hammond case for a very professional appearance. It works great too!

The group has been involved in various construction projects and will try to display photo's of them for you to see. I have personally assembled one of the kits. I found the surface mount parts to be very small. I also found that a very steady hand, a great deal of patience, and a lighted magnifier are a must have to work with such mall parts.

There are plans in the works for a "Sprint" in the warmer weather. Maybe on one of our regular Saturday afternoon gatherings if there is enough interest.

I will try to add more in the future, but I would like some input from the rest of the group and from the readers.

Best 73,
Jim VE3CQM

Some of Jim's QRP homemade QRP stuff

"It's real! Let me show ya!"

Back to School

Subject – The decibel and how to calculate it

In this month's issue, there was reference to power expressed in decibels. Knowing how to work with the numbers will really help you to have a grasp of power relationships for antenna building. I like to know whether a small change in an antenna is worth doing, and what results to expect.

In radio, we usually convert our received signal into sound. So it stands to good reason to determine the relative strengths of these signals in terms of relative loudness. The human ear responds to an increase or decrease of loudness as a ratio of power. This ratio is almost totally independent of the absolute value of that power. If a person estimates that a signal is "twice as loud" when transmitter power is increased from 10 watts to 40 watts, he will also estimate the same if the power went from 100 watts to 400 watts! This is called a *logarithmic* response.

This is why we use the relative power unit called the **decibel**. A change of 1 decibel in power level is just detectable as a change in loudness. The formula most commonly used for amateur radio work involves the change of power. One can also use voltage or current, but the formula is slightly different. The power ratio and decibels are calculated with the following formula:

$$Db. = 10 \log \frac{P_2}{P_1}$$

Thus, when I was referring to our 100 watts becoming like 318 watts with our 5 Db antenna, I calculated it as follows:

$5 = 10 \log \frac{P_2}{100}$ becomes:

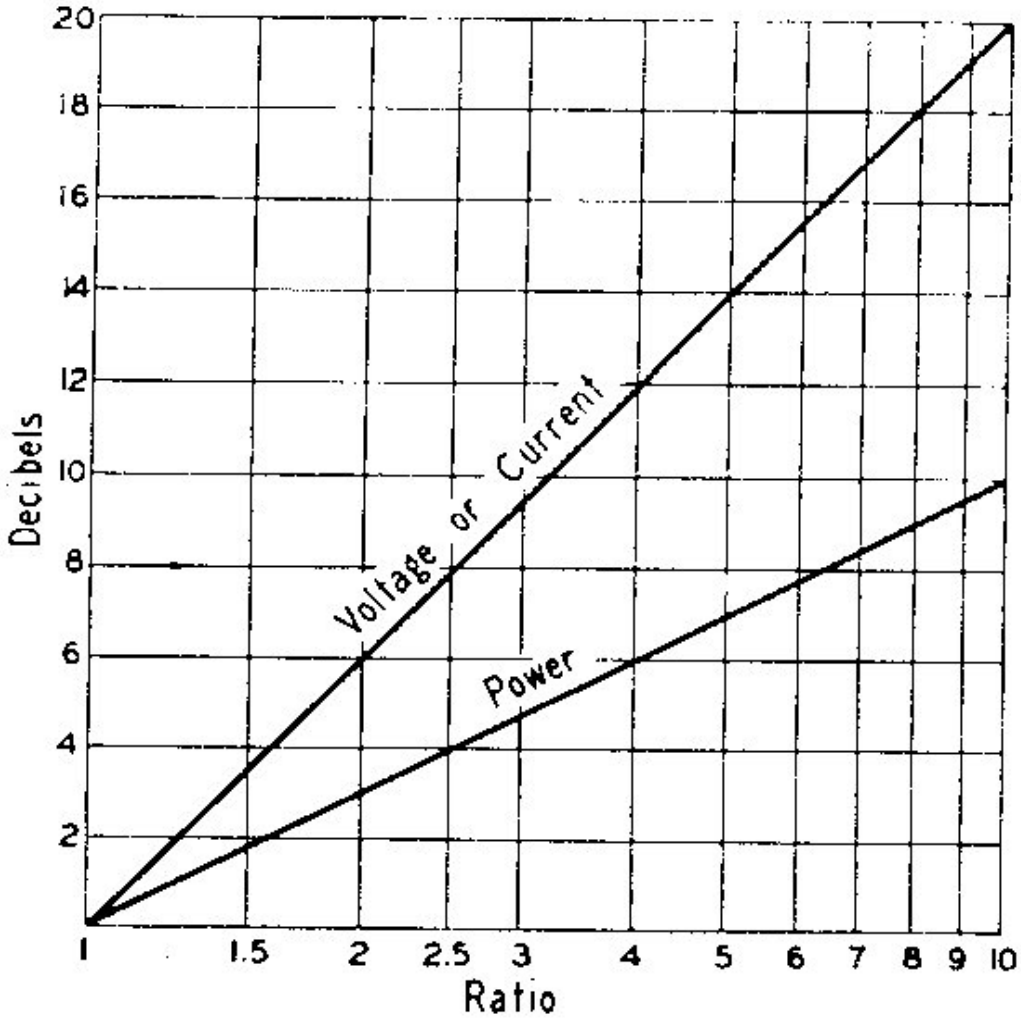
$\frac{5}{10} = \log \frac{P_2}{100}$ becomes:

$.5 = \log \frac{P_2}{100}$ becomes:

$P_2 = \text{anti-log } .5 \times 100$ (anti-log is done on your calculator by pressing INV log)

$P_2 = 3.16 \times 100 = 316$ watts!

I know that the math can be difficult if you're not used to it so I have added a handy chart gleaned from one of my handbooks to help you out.



The Classic Ham

This column will be for stories about the old days of ham radio. I am waiting for some submissions guys!

Barter 'n Buy

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