# RADIOACTIVITIES

**NEWSLETTER OF THE ARGONNE AMATEUR RADIO CLUB**

W9ANL

**Volume XLIX, Number 4** **April 2008**

## Club Meeting

Unless otherwise noted, AARC general meetings are the second Tuesday of the month at the Argonne cafeteria at a table on the north end of the room. Any club member is welcome. To arrange for a gate pass contact Bruce Epperson at epperson@aps.anl.gov phone 630-252-3495 or Chuck Doose at doose@aps.anl.gov phone 630-252-6037.

## The Treasurer's Report

by Chuck KB9UMF

Nothing Received.

## REMINDERS

CLUB BREAKFAST: Always the 2nd Saturday of each month, 8:30 AM at:

*Old◆Country Buffet◆*

**59th Street and LaGrange Road in LaGrange**

CLUB NETS: Thru our Club Repeater 145.19.
SKYWARN NET: Mondays in season at 7 PM with Deni, W9DS.
THE CLUB'S 9PM NET: every Monday with Jack WA9FVP.
THE NIGHT PATROL: every night at 10:30 PM with Paul, W9FNM.
THE BREAKFAST CLUB: every morning at 8 AM.
THE NOONTIME NET: every weekday at noon.

## Mil's Corner for November

Nothing Received.

## Farewell to our good friend and coworker Bill Karraker W9AVE

by Fred Propper WB9VUT

I first met Bill in the early 1960's when I went to a radio club meeting at Argonne Park. In those early days Bill was one of the club organizers and sometimes wrote the monthly radio club newsletter. Bill liked the two meter fm band and wrote many articles on two meter FM building projects for the newsletter. I joined the club for a while but I didn't have a ham license. In 1966 I transferred from reactor physics to communications (radio shop). Bill originally worked in the radio shop but had transferred to the instrument and control group that was right next to the radio shop where I worked. We had the same supervisor. I got to know Bill quite well over the years as his shop was usually in the same building as ours. In 1974 the radio club was giving code classes to recruit new members and they talked me into taking a code class! Well, I passed the novice test and then 6 months later upgraded to advanced class. I started going to meetings and field day events. Bill was always there at meetings, field day and special event stations. Bill loved the radio club and put his heart and soul into it. Bill loved to set up and operate the two meter FM station at every field day! Bill and his wife, Doris, made it their job to always get coffee and snacks to the field days and outside club meetings! After Bill retired from Argonne he stayed an active member of the club, volunteering for projects and writing the back page of the club newsletter, until health problems took its toll on him! I have so many good memories of Bill helping out with communications for bicycle races, great sailplane races, special event stations, field days etc. Bill will be missed dearly by everyone that knew him! Bill was also a devoted family man and my condolences go out to his wife Doris, his son Ross and his daughter Dana! W9AVE, a silent key, but not forgotten!

Bill Karraker, W9AVE, SK March 3, 2008. He was 89 years old. He was in the hospital for a while with pneumonia, then transferred to hospice, and he died two days later.

## The Folding Technique Aerial

by Deni W9DS

Well, February 2007 rolled around and along came my issue of World Radio and on page 16 and 17 appeared an article by N4FWD; a zipcord emergency aerial was presented to subscribers.

N4FWD's "zipcord loop" is nothing but our Bill Orr XQ quad, but in an entirely different loop configuration. This is like a wired type of folded dipole. After all, remember

the quad is a pulled out folded dipole. The author used zipcord for aerial wire. Zipcord is a 75 ohm transmission line which I have used as a transmission line in the past for aerial to rig connections only 200 watts though. Don't think you can put over 300 watts into this AC line stuff. It will heat up too much, melt, and short out. The author was thinking of low power!

Now my thinking is to use 450 ohm transmission line that has a 1 inch gap between wires. This can be a better stabilized aerial to be out into stormy weather. How will the aerial react then? Well, charges by heavy lightning can be dangerous in any case of ground aerial. This one is no different.

The feed point will be closer to 50 ohms than 70 ohms, but I'm not sure. I have built a 2 meter aerial out of 450Ω line, but haven't experimented with it yet. Who will be the first? I haven't read about anyone using one on any band. Should be great for the, six, or two meters. Well, I should have said any band you could get it up for.

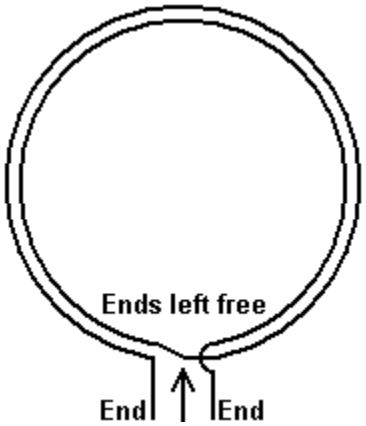
The author claims very low ambient noise level because it is a loop. This loop will be two wave lengths long with 2 turn coil circumference and at one wave length with 1 inch between them. Wire will have a linear loading effect because the one wave length RF fields of each turn will be in phase at resonance, with an effect upon impedance. But, the mismatch is forgiven by the linear load effect.

The question arises; How well will it transmit and receive? Now using a single turn quad on receive that point A makes a signal of 15 microvolts. Now using our 450 ohm double loop will induce 300V signal and doubling the input amounts to 6db or 1 S unit. Formulas to put this critter together or how do we make one? Try 887 / 1.9MHz = feet long. This aerial is monoband unless you use an aerial tuner to get a conjugate match for other bands. That's the way I look at all aerials. An SWR analyzer is of great help and comfort.

Making this monster a 1.9MHZ you keep in mind which wire you are working on. Mark one wire "A" and the other "B". The feed point is below the top and at the bottom of the loop are 2 ends, 4 wires should be seen. Mark end of a wire to be soldered to the beginning of the B wire to be soldered. Take insulator tie coax around it solder shield to one lead A or B. The solder center wire to the one that connects to the other loop. So that the coax has soldered to each end of a loop and feed point is at the center so 1 wavelength of wire is at both ends which are not touched left free. You might cap ends by tape but keep them apart.

N4FWD says this balanced aerial should have a current balun at feed point to suppress any RF current that may come down outside shield of cable. He used W2DU choke.

He says mount horizontal for NVIS operation or vertical for normal use. Author compiled a list of impedances for various bands HF.



Connection to arrow feedpoint balun 75Ω coax tiepoint.

| | Low | Center | Higher |
|---|---|---|---|
| Freq | 7.000 | 7510 | 7300 |
| R | 52.000 | 42.000 | 41.000 |
| X | 28.000 | 11.000 | 4.000 |
| SWR | 1.700 | 1.300 | 1.200 |
| | | | |
| Freq | 10.100 | 10.125 | 10.150 |
| R | 25.000 | 26.000 | 28.000 |
| X | 55.000 | 57.000 | 60.000 |
| SWR | 4.000 | 4.000 | 4.000 |
| | | | |
| Freq | 14.000 | 14150 | 14.300 |
| R | 41000 | 62.000 | 101.000 |
| X | 49000 | 60.000 | 60.000 |
| SWR | 3.100 | 3.200 | 3.200 |
| | | | |
| Freq | 18.068 | 18.110 | 18.168 |
| R | 58.000 | 63.000 | 69.000 |
| X | 32.000 | 34.000 | 35.000 |
| SWR | 1.900 | 1.900 | 2.000 |
| | | | |
| Freq | 21.000 | 21.225 | 21450 |
| R | 34.000 | 58.000 | 95.000 |
| X | 45.000 | 53.000 | 40.000 |
| SWR | 2.600 | 2.400 | 2.200 |
| | | | |
| Freq | 24.000 | 24.930 | 24.990 |
| R | 27.000 | 29.000 | 34.000 |
| X | 45.000 | 48.000 | 52.000 |
| SWR | 2.900 | 2.800 | 2.800 |

| | | | |
|---|---|---|---|
| Freq | 28.000 | 28.850 | 29.700 |
| R | 28.000 | 47.000 | 83.000 |
| X | 6.000 | 48.000 | 60.000 |
| SWR | 1.800 | 2.300 | 2.500 |

## Long Wire Precursor of V's, Rhombics, and The Like

by Deni W9DS

The only way to simply radiate is the use of wire. Oh! We can radiate aluminum gutters and communicate with light bulb filaments or solid metal with holes cut into the metal called a slot aerial. How these radiate is covered in lots of math. ERST, ERGO, the aerial can be any shape or form, but losses must be considered. Lets stick to wire.

In consideration of using wire for aerials, I now 66 years of age, the 10th of December 2007, have discovered an article rejected at first, and now seeing the light. I was growing up and having loads of fun on the first floor apartment at 1409 Harvey Av. in Berwyn, IL. At the age of 4 ½ years, when W3CHO, Walter Van B. Roberts, article found its way into the ARRL publication QST June 1946. Like the quad aerial was brain stormed, W3CHO chose to explain how this old fashioned aerial works.

W3CHO, as a pioneer, used mathology, common sense, and reasoning through complex mathematics formulas. These engineers dreamed up their own math to fit their problems. For example, take Nicola Tesla; he had his own calculus geometry, trigonometry, math short-cuts devising eccentric way of seeing things in his head. He wrote little worked mostly in his head. Unfortunately his life, spirited away by arsenic poison by a scatter brained arch demon refuge servant ended in 1943.

The use of math analysis is one way to look at the whole picture of how things work. We start with a simple long wire terminated non-reflectively so purely RF waves glide along it. Let our long wire set at angle θ with respect to direction in which transmission is desired. Imagine current waves at a moment along our wire at a set frequency with current waves every half wave showing W along the wire a 3 samples W1W2W3 which radiate waves 1, 2, 8 on way to desired receiving point. All various waves add up at the receiving site to produce a resultant field, however, they are not all in phase on arrival and must be added vectorially. Nine points are marked off. Using nine causes the wire to be too long to make the most signal possible, and if there were only 7 half waves gives us also not maximum signal, so 8 is the correct number. In any case it is all right. This wire accounts for our wide frequency range of rhombics and V's.

The maximum values occur when waves from the 2 ends of the wire are 180 degrees out of phase. It occurs when the wire is half wave longer than its projection along the line to the receiver. By the way, exactly the same condition gets the best length of microwave horn for a given flare angle. The first fresnel zone in wave propagation studies.

So now we have free space equation 1: $L = \lambda/2 + L * \cos(\theta)$. To get optimum wire length: $L = (\lambda/2) / (1 - \cos(\theta))$. So now what's best vale θ to use? Our perfect world math.

Now the total wire length is always made to satisfy equation 1. Radiation from each part of the wire is proportional to the length of the part multiplied by the sine of θ. The field at receiver will depend on $L * \sin(\theta)$. Putting value of L given by equation 1 the field at receiver will depend on $L * \sin(\theta)$.

Putting in value the field is thus the quantity $\sin(\theta) / (1 - \cos(\theta))$. However it turns out this doesn't have a maximum value for any value of θ, but gets bigger the smaller θ is made. All we can say is that θ is made as small as possible considering that L becomes very large as θ is very small which puts practical limits on reducing θ.

The real world has wire hanging over ground. This is a reflector, old Mother Earth from which we have all come. Ground reinforces radiation at certain elevation angles that depends on aerial height. This elevation angle is called Δ. Now we want to know the best length for sending out signals on wire not to the receiver but at an angle above this line Δ. Radiation is reinforced at this vertical angle as well to work best in the same direction.

Now consider θ replaced by the angle between wire and an elevated line by angle Δ above direction to receiver. Using spherical trigonometry it will be found that cosine of this new angle is the product $\cos(\theta) * \cos(\Delta)$, where θ has the same meaning as in prior discourse; that is the horizontal angle between wire and direct line to receiver.

Equation 1 now is: $L = (\lambda / 2) / (1 - \cos(\theta) * \cos(\Delta))$. The field at elevation angle Δ is proportional to $\sin(\theta) / (1 - \cos(\theta) * \cos(\Delta))$. Now there is a best value θ, so $\theta = \Delta$. This definite values to L and θ means radiating maximum signal at elevation Δ. Thus object is to find Δ at which direct and reflected waves combine in phase. Know this horizontal polarized waves are reversed in

phase by reflection and find angle that makes path reflected wave a half wave longer than that of direct ray so H = λ / 4 * sin(Δ). These formulas for best values of L, H, θ for signaling are: H = λ / 4, L = λ / 2 * sin(Δ)2, θ = Δ.

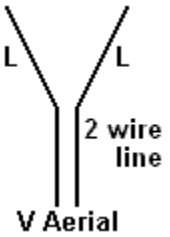


Fig.3

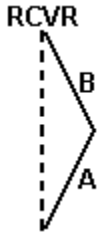


Fig.4

2 wires form half rhombic

Vs and Rhombics

Vs use right and left wires at once drive them push pull signals will add we have optimum design. As Fig.3 The V has a gain of 2 over a single wire. The 2 wires of V are fed in series the impedance doubles and so twice as much power is needed to make a current in the 2 wires as one alone. Now the field at receiving point is doubled and doing this equates to quadrupling the power. V has power gain of 2 over single wire. Adding two more wires to form a rhombic is doubling the receiver field and this quadrupling power without doubling transmitter power, the rhombic has a power gain of 4 over the V. The rhombic has gain ten times the gain of a half wave dipole and then times the impedance. The objective here is to give physical picture of their operating of long wires and different relationship between Vs and rhombics. About other rhombics using tilt angles 90 degrees minus θ makes no difference which angle is used.

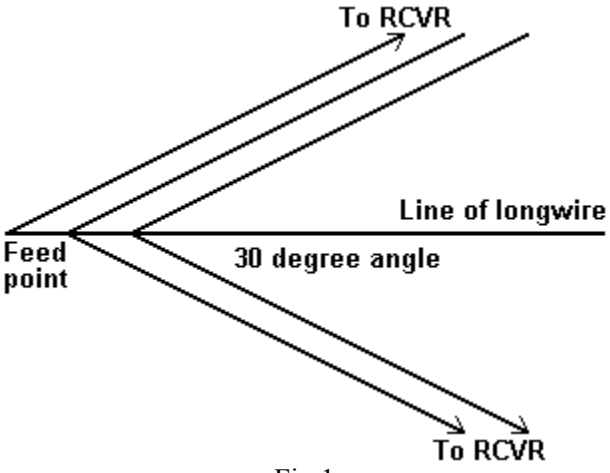
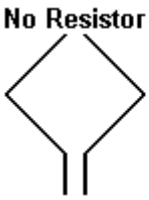
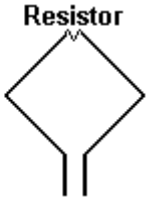


Fig.1



Bidirectional
Rhombic
Unterminated



Rhombic
Feedpoint
720 ohms

## Try A 12-Meter Quad

by Deni W9DS

I found Doug DeMaw, W1FB, made a quad loop exactly like a double delta for 20 meters. Doug hastily placed in QST 1985 October issue Hints and Kinks section. Not much to tell about that band. I worked on there years ago. I never liked it so I should give it another try.

Anyhow, the double quad can be strung up between 2 trees or poles or 2 poles in the back yard. Well, the design has two loops spaced one half wave length will get you 6db over isopole, or a non radiating dipole dbd.

Full wave is 40 feet 4 inches so you need two of these spaced 20 feet apart at 30 feet or more. One side is 10 feet and at least 20 feet above earth. Each quad has 115Ω impedance. So, impedance is 58 ohms at both loop feed points. Length of coax line for each quad is one electrical wavelength is 26 feet 5 inches each side of the tee coaxial connector to feed line to rig can be any length RG8U or 9913.

Radiation is maximum broadside to the array and can be scaled for any band using 1005 / mHz to get the total length in feet of each loop.

Adding more parallel elements will increase gain, 3 elements 5db and add one db for every element up to 6 elements 8db, using ¾ wavelength spacing adds about 2 more db per element over the half wave spacing. That's a monster array very very sharp lobe I would guess 20 degrees, and it is a bear to rotate. Watch out for tripping over those coax lines!

ARGONNE AMATEUR RADIO CLUB
P.O. Box 741
Lemont, IL 60439

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e-mail: w9anl@bigfoot.com
www.bigfoot.com/~w9anl

MEMBERSHIP is open to all who are interested in amateur radio. This club is sponsored by Argonne National Laboratory. Employees of ANL or DOE-Chicago are eligible for full membership. Auxiliary membership is available to non-employees.

W9ANL/R is an open repeater, coordinated on 145.19 MHz (-600 input). The AARC repeater has been in operation on this frequency pair continuously since February 5, 1982.

CLUB NETS: 2 meter fm 1) Regular, every Monday evening at 9:00 and 2) the Night Patrol every night at 10:30, both on W9ANL/R. The Peanut Whistle Net (PWN) every Sunday at 1:30 p.m., and many evenings at 8:30 p.m. on 1932 kHz (cw/am/ssb), QRP.

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EDITOR Dale Travis AG9H
EVENTS
SKYWARN ACTIVITIES Deni Lamoreaux W9DS

Please send club and editorial correspondence to the club address, or to travisdj@bigfoot.com Please include "AARC" in the subject.