RADIOACTIVITIES

NEWSLETTER OF THE ARGONNE AMATEUR RADIO CLUB

W9ANL

Volume XLIX, Number 1 **January 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.

Listening Aerials

by Deni W9DS

QRM and QRN have been around since radio got started. Engineers like Edison, Tesla, and Marconi brought us lights, radio, and TV just a short time ago, 100 years, but we are concerned with just reception of radio receiving through the spectrum. QRM and QRN are still with us, although we have many options open to us now, we have overloading in reception. Big strides have been made using digital devices in all regions of our receivers today.

It seems that government pays the bill for a lot of this new technology. They truly can receive communications under extreme situations, and well they must, for our health and welfare. Hams individually have to cope with this noise business. Aerials pick up everything. All the noise form every cause appears on our aerials.

What to do? Make a small, easily rotatable listening aerial. Most books about antennas leave off the listening aerials. Needed is an entire receiving system built into the whole aerial array. Look at noise, all different types, such as man-made electrical, atmospheric, and system internal. The transmission line brings signals and noise. The receiver amplifies and signal and noise and its own internal noise and dumps all into the speaker or transducer.

The goal is to increase the ratio of signal power to noise power at receiver output as well as receiver internal noises output. SNR, signal to noise power, ratio equal S_0/N_0 with S_0 the available signal output and N_0 the noise output power.

Noise is made up of basic types: Atmospheric, cosmic, and man-made. Atmospheric generated electrical discharges all around the earth is between 3 and 30 MHz. This energy is propagated as noise. Cosmic noise is made by stars, which comes to earth from great distances and dominates the spectrum 20 to 200 MHz. Man-made noise is the raw pollution of electro-magnetic spectrum from 10 to 100 MHz.

Aerial theory defines basic antenna theory with direction, gain, power gain, radiation efficiency, and capture aerial area.

Power gain in the receiving sense is the ratio of signal power received from a distant station, with a directive array, divided by power received with a perfect nondirectional (isotropic) aerial, symbol Gp.

Directive gain, Gd, is the measure of the directivity of an aerial. This simply is a measure of the shape of the

radiation pattern. Now, patterns of two different aerials have the same shape, but not the size of their radiation patterns is the same, they both have the same directive gain. But, the power gain of one is four times that of the smaller aerial. The received signal power with noise is burned up in lossy parts due to resistive elements in the aerial make-up, being wire, tubing or traps, and ground with environmental surroundings losses of the antenna. This is called loss resistance, R_1. Now useful power of signal is radiation resistance, R_R.

The resistive circuit of a resonant aerial consists of R_1 in series with R_R. Radiation efficiency of an aerial is η, defined as $\eta = R_R / (R_R + R_1)$. Transmitter output is multiplied by η. The result is the signal radiated power. Power gain and directive gain are related: $Gp = \eta * Gd$.

This size difference accounts for the radiation difference. Now we come to capture area. If an electromagnetic wave has a power density Dp, then the power from the wave which is available at the aerial terminals is Pav = A * Dp where Pav is the available power and A is the aerial capture area, which is the effective frontal area which the aerial shows to the passing electro-magnetic wave and is related to the gain: $A - Gp * \lambda^2 / 4\pi = \eta * Gd * \lambda^2 / 4\pi$, where λ is the wavelength at the working frequency.

Things get more complicated as we go on into higher math, which casts a shadow over me. So, hop and skip over this grey area. Alas, aerial size, radiation efficiency, and bandwidth are confusing since you can't make an aerial with high efficiency using all three. One must be sacrificed. Thus, using a small all band aerial, it must be very inefficient. If efficiency and bandwidth are sacrificed, size of aerial can be very small. Now, aerial noise is greater than receiver noise, aerial efficiency can be traded for small size and wide bandwidth.

If wide bandwidth isn't important, then size can be reduced. Notice we haven't lost directivity, but reduced radiation efficiency. If the system is external noise limited, antenna directive gain governs out SNR and not power gain.

A half wave center fed dipole can be small to get good listening by helically winding the two sides and adding capacity hat and horizontally polarized electrical field sensitive and balanced with respect to ground. The overall length of the aerial can measure six feet for all bands, 160 to 20 meters. The number of helix turns will vary band to band. Capacity hats can be one to three feet in diameter and made of stiff wire and helix can be one to two inches in diameter.

The loop aerial can also be used and is magnetic field sensitive and balanced with respect to ground. For 160 meters to 20 meters use a two to three foot loop diameter.

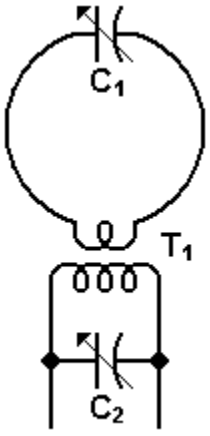


Fig 1A

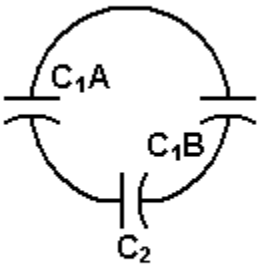


Fig 1B

Fig 1A: C1 resonates loop, C2 tunes matching transformer T1. **Fig 1B:** C1 and C2 are capacitive divider for matching to the feed line and resonate the loop.

Two or more loops can be phased the same as dipoles. This results in a cardioid radiation pattern and increased SNR. Loop spacing can be 0.02 to 0.05 λ. It is wise to use an aerial coupler between the transmission line and receiver aerial then peaked up at band center and coupler tuned for best response as receiver is tuned across the band. Will it work? Hook up the aerial to the receiver. If you hear lots of noise in the receiver output, the aerial efficiency is high enough. If the greatest dimension of a linear aerial is greater than 4 feet or a loop area greater than 2 square feet results in high radiation efficiency. Shush! I'm listening now.

20 Meter Log Periodic Aerial

by Deni W9DS

A short story about building one was written by K1QAR in 73 Magazine. No further information has been found. Ted Robinson was a resident of Block Island, Rhode Island. That's all I have about him.

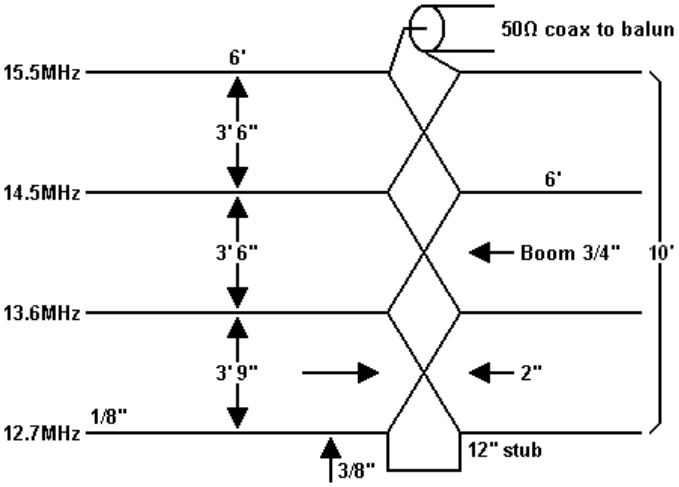
Experimenting with mobile whips, he used 8 solid coke fiberglass fishing pole blanks 6' long, ⅜ at the base, tapering to ⅛" at the tip were obtained from tackle supply house – these dimensions are not etched in stone. So, starting at the tip, wind #20 enameled wire, with adjacent turns touching, for about 18", then for the next 18", the pitch increases to ¼" between turns. At this point, switch to #18 wire. Solder the connection.

Pitch increases smoothly from ¼" to ¾" as the winding is continued to the base. Now grid-dip the whip to the frequency. Add or take away turns from the tip to resonate to the nearest of these frequencies: 12.7, 13.6, 14.5, & 15.5 MHz making sure to always wind in the same direction and varying the amount of wire.

Make all eight whips with two resonant to each frequency. Easiest to wind is rotate the pole and feed wire onto it.

Boom is made from 6' of ⅝ aluminum with 3' of ½" aluminum tubing telescoped in either end. Pairs of holes the same size as the pole bases are drilled in the boom for element mounting. Observe the following spacing; 45", 42", & 39". An aerial feeder supported on top of the boom consisting of #16 wire spaced 2" completes the array.

Varying this spacing will vary the impedance of the aerial. A 75 ohm matching section into 50 ohm line will give good results. Remember that adjacent elements get out of phase and that the lower frequency whips go with the wider spacing. Feed is to the high frequency end and a 12" stub is attached to the lower frequency. End of the aerial feeder measurements indicate F/B ratio 4/5db and a 20db front to back ratio.



ZL Special

by Deni W9DS

This aerial appears in the ARRL antenna book, $2.00 in 1964. What is special about it? It can be hung vertical or horizontal. You can use it for field day. It is broad banded so you can QSY from top to bottom of any one ham band because it uses 2 folded dipole elements. They can be made from 300Ω line or larger. It uses two folded dipoles spaced 0.1λ driven 135 degrees out of phase and can use 72 open or coax line with twisted phase line between the two elements. The forward gain estimated 3 to 5 db depending on stacking of the beams horizontal. It is possible to stack a vertical pair with bottoms up of the ground.

For dimensions are A = 436 / MHz, B = 447 / MHz, C = 101 / MHz, D = 122 / MHz, E = 110 / MHz. A table looks like this:

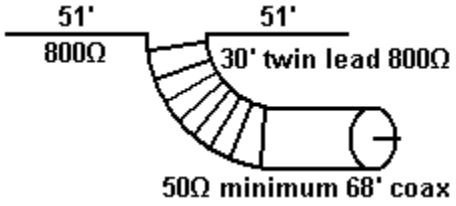
MHz	A	B	C
14.05	31' 2"	31' 10"	7' 10"
14.25	30' 9"	31' 5"	7' 9"
21.1	20' 9"	21' 2"	5' 2 ½"
21.3	20' 7"	21' 0"	5' 2"
28.1	15' 7"	15' 11"	3' 10"
28.7	15' 3"	15' 7"	3' 10"

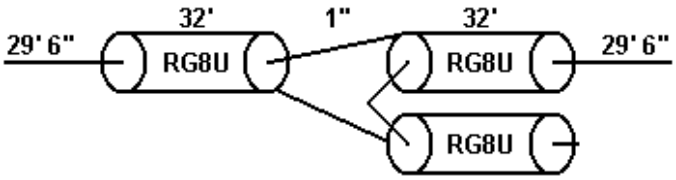
One inch aluminum could be used for the replacement of the driven 300 ohm line.

Another ZL special for 40 meters was in April 1962 73 Magazine by W4AXE. This aerial was used in CW traffic handling not necessarily for DXing. Now in this article the formula was different and it had drooping elements its apex was at 40' and apex angle is 60 degrees and at 30 degrees you are in tuning trouble. Front to back ratio was measured at 25db.

So these aerials are different from the W8JK folded dipoles in that W8JK is fed in the center of the elements making in bi-directional with spacing between elements are 123/MHz and feed line twisted at one end of the elements for feeding line back to radio shack. Gain 4 to 5 db about the same as the ZL beam from down under another W8JK array appeared in 73 Magazine by Tim Soxman, W3ZVT. He uses 2 ½ λ elements separated ¼ λ the center insulators connect ¾ wave phasing line to the center of each dipole using running it into the shack. If you would put a switch in the center of the feed point element you would be able to switch the aerial back and forth between collinear and end fire array.

Major General W7PHO, Bill Bennet, passed along his version of the G5RV he used in Washington state before his passing away in December 1988. It never appeared except to his friends:





80 meter AF9J, Glenn's coax dipole, 123', low noise around voltage lines. I used one here for a while at my QTH. It worked well mounted at 90 degrees to power line. 300,000 volts with 6 lines one a single pole, but they are two abreast. Glenn passed away in 1982.

From Libya With Love
The 5A Special 10/15 Meters

by Deni W9DS

The 1st quad I ever saw anywhere appeared in QST April 1960?? By a Canadian, Fred Vitringa, 5A5TO. I thought it was a joke, but Uncle Bud said no. My first years of getting QST and stayed a member of ARRL until 1964. I'm a member today. It's a 3-dollar, 2-banded 10 and 15 meter diamond vertical quad. It handles rough weather well, handles 200 watts easily, and more if you use #12 copper weld. The length of these Diamonds needs a 35 foot mast and to be mounted on a roof, if possible. Ok to ground mount it too.

The side points of Diamonds are supported on a horizontal X spreader on the mast. The top and bottom halves are slanted backward toward the mast and guyed to it. The driven elements are fed at the points of the Diamonds. Reflectors are similar, but have tuning stubs at both top and bottom. A horizontal spacing between the legs of the X spreader is helped with ropes at the ends of the X and at points about half way out the legs.

The spreader is made of 4 1" wood dowels, 8' 7" long. The inner ends are tied to the mast by shelf brackets or iron angles from the hardware store. Adjacent pairs of arms are put on the mast so that the tips of the arms on the element sides of the mast are 13' 2" apart. The spreader is mounted on the mast at a point 14' below the top anchor of the 15 meter elements.

Driven and parasitic elements have the same dimensions. The 15 meter elements are 11' 11" per leg (23' 10" per side). Ten meter elements measure 8' 5" on each leg (16' 10" per side). Center points of the15 meter elements are hooked up to the outer ends of the spreader legs where the separation is 13' 2" as mentioned above. Center points of the 10 meter elements are anchored to the spreader at the intermediate points where the separation is 9'. The separation between the center of the 15 meter driven element and reflector 10' 11" and between the 10 meter elements 7' 7". Dimensions should be followed closely.

The element wires can be #14 or larger. Egg type insulators are used top to bottom and small stand-off insulators at the sides where the spreader supports the wire. The top and bottom points are put under moderate tension by ropes near the top and bottom of the mast.

The upper tuning stub of the 15 meter reflector is 8" long and the bottom is 1' 2" long, while both 10 meter stubs are 1 foot long. When tuning is complete, the lengths of the bottom stubs will be shorter.

The feed line is 72 ohm coax and it feeds both driven elements. The coax connects directly to the 15 meter driven element, and the feed point of the 10 meter driven element is hooked up in parallel through a section of 300 ohm twin lead 2' 4" long.

Turning the beam turns the mast and aerial done by a guy ring bearing at the top of the mast. The rotor was mounted on the roof and the mast base was simply set in the rotor coupling. Structure being light, showed no trouble in this arrangement.

Here tuning is setup on 15 meters. Use a field strength meter to tune the bottom 15 meter reflector stub for lowest meter reading with a rise either side is found. Then adjust the 10 meter reflector in the same manner.

Go to the front adjust driven elements for maximum reading by adjusting stubs. 5A5TO worked 215 countries, all USA, and 39 zones in 15 months on phone. Ha!

14-27-01
Cumberland or Matthews, 181' long. Built 1877, rebuilt 2000. Across the Mississinewa River in Matthews, Grant County, IN.

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

Officers

PRESIDENT	Bruce Epperson KA9H
VICE PRESIDENT	
SECRETARY	Kurt Boerste KB9ZFR
TREASURER	Charles Doose KB9UMF
DIRECTOR	Dick Konecny K9IB
DIRECTOR	Torben Lauritsen KF9MI
DIRECTOR	Charles Doose KB9UMF
DIRECTOR	
DIRECTOR	Tim Smith N9UEB
DIRECTOR	Dale Travis AG9H

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.

RADIOACTIVITIES is published monthly by the Argonne Amateur Radio Club as a nonprofit newsletter intended only for the use of its membership. Material appearing here does not represent the official position of Argonne National Laboratory or the U. S. Department of Energy. Please give credit to the author and to Radioactivities or the Argonne Amateur Radio Club, when using original material published here. Deadline for submissions normally is the 20th of the preceding month.

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.