MERCURY AMATEUR RADIO ASSOCIATION

MARA - NORTH AMERICA - NORTH EAST

MARCH 2008 NEWSLETTER

CONTENTS

E-mail your comments, ideas, or submissions to marane@mara.net

VIEW FROM THE TOP

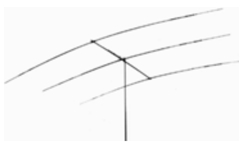
As I drove into the driveway and looked at the doves perched above my house I felt satisfied with my service to the environmental movement. You see, many of us in this neighborhood have domesticated cats and they have disrupted the local balance of nature in diminishing the bird population. Birds perform a wonderful service in keeping the insect population in balance in a natural way. Some also provide a service in cleaning up after some other woodland creature dies.

Well, realizing the value of birds to our neighborhood and the mortal danger from the many cats, I erected a 50 foot high structure and placed three bird perches at the top, thereby giving the bird population a place to rest that is safe and where all of us can observe them and enjoy their presence. This bird perch of course needed to be

Don't forget the 2008 Annual Meeting at Cherry Hill, NJ on May 17th

Join us on the Saturday morning SSB net at 0730 Eastern time on 3.8725 MHz grounded from lightning and also serves another useful purpose in draining the local atmosphere of electromagnetic radiation.

In doing this project I was fortunate to find a couple of companies that sell equipment wonderfully adapted to this important environmental service. Rohn makes a very nice 50 foot metal structure and HyGain has a very nice bird perch.



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TECH STUFF

THE HALF WAVE ANTENNA – PART 1

HALF WAVE DIPOLE

"A **dipole antenna**, developed by Heinrich Rudolph Hertz around 1886, is an antenna with a center-fed driven element for transmitting or receiving radio frequency energy. These antennas are the simplest practical antennas from a theoretical point of view."

Wikipedia

The half wave dipole is an easy-to-build, easy-to-erect, and easy-to-match antenna, requiring only two points to hang it in the air. For a feed line, readily available 50 ohm coax such as RG58 (for low power up to several hundred watts) or RG8/RG213 (for the high power users) is normally used between the dipole and the transmitter. With this, no special matching is required if transmitting on or near the design frequency.

Usable frequency bandwidth (SWR of <2:1) depends on the band (higher frequencies = greater bandwidth). For example, a half wave dipole cut for 3.750 MHz has its 2:1 SWR points at 3.690 and 3.850 MHz or 160 KHz, whereas one centered on 29.5 MHz has its points at 28.685 and 30.270 MHz or 1.585 MHz. Calculations were done with the demo version of EZNEC 5.0 at a height of 50 feet and using #12 wire.

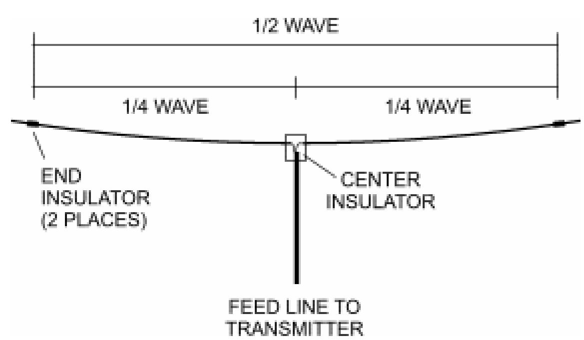

Figure 1 – Half wave wire dipole.

A half wave dipole is made up to two quarter wave sections joined end to end with a center insulator. This insulator provides a convenient place to attach the feed line. Two end insulators allow for attaching the antenna to a pair of supports.

No connections to an actual ground are required, as in the case of a vertical antenna. The dipole is considered to be "balanced".

Typically, dipoles are constructed of copper or copper clad wire. Solid copper wire can be used but it will stretch over time and "work-harden" to the point where it will break. Stranded copper is better as the "stretch" is shared by all of the strands and is much less than a single strand. Copper clad is simple a copper layer over steel, and while more rugged, is also harder to handle and less easily available than copper. Electric fence "wire" made from several conductor stands interwoven with nylon cord can also be used. Some types use aluminum; others are made from stainless steel. Stay away from the stainless steel varieties as the resistance is higher than aluminum or copper. Aluminum wire can be used but there may be problems maintaining a good connection. Use the grease made for connecting dissimilar materials to avoid this and make sure you have a good mechanical joint.

It makes no difference to reception or transmission if the wire is covered or bare. Covered wire will be better protected from the elements. The plastic covering on the commonly available electrical wire found at the home improvement/hardware stores will make a slight difference in the length the wire is cut as compared to the calculated length. The trick is to make it a couple of feet longer than the formula calls for and trim it to resonant length for the actual installation height.

The formula for a practical half wave dipole is

$$\text{LENGTH IN FEET} = \frac{468}{\text{FREQ IN MHz}}$$

If you want your half wave for the MARA net frequency of 3.8725 MHz then 468 divided by 3.8725 equals 120.85 feet and rounded off gives 121 feet. So you cut it longer by a couple of feet to 123 feet, each side being 61.5 feet in length.

Factors affecting the actual completed antenna length compared to the calculated length are height above ground, wire material, wire diameter, and proximity to other conducting objects (e.g. metal rain gutters and downspouts, electrical wiring, other antennas),

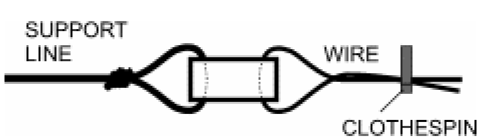

Figure 2 – Detail showing end insulator assembly while tuning.

The end of each of the wires is looped through its insulator and loosely laid back along the antenna and the assembly is lifted into position. Don't let any excess wire hang off at an angle to the main wire or the test readings will be skewed. If you have or have access to an antenna analyzer, connect it to the station end of your coaxial cable. An alternative is to use low power from your transmitter and a Standing Wave Radio (SWR) meter. Whichever method you use, measure the reflected power, shorten or lengthen <u>both ends equally</u> until you see a trend (if you lengthen the antenna and the SWR rises, then shorten the antenna). Always raise the antenna into position before taking the measurement, and if using a transmitter and SWR meter, remember to turn the power "off" when not actually taking readings. RF (radio frequency) burns, even from relatively low power are not pleasant!

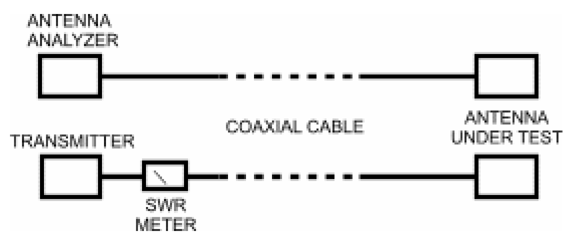

Figure 3 – Test setup.

Continue lengthening (or shortening) the antenna until the measurement passes through the minimum reflected power and begins to rise again, keeping notes as you progress. Change the wire lengths back to the minimum and twist the ends (five or six turns) to permanently fix the installation. Cut off the excess wire.

Figure 4 – Detail showing end insulator assembly after final tuning.

Unless you have a support point for the center insulator, the weight of the coaxial cable will pull it down, more so with RG8/RG213 than with RG58. You can compensate somewhat for the weight by tightening up the end support lines.

Figure 5 shows one possible layout for a center insulator. The sheet material can come from anything handy. I've used a piece of flat sided plastic bucket, and also a piece of clear plastic salvaged from an old storm door. Keep an eye out for something suitable on garbage collection day.

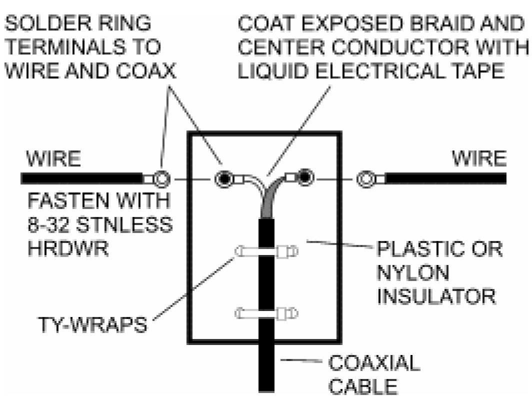

Figure 5 – Center insulator detail.

Solder ring terminals to the wire (if copper) and coax ends. Coat the braid and center conductor liberally with liquid electrical tape. Once moisture enters the braid, RF losses increase dramatically. Use stainless steel hardware as ordinary steel will corrode rapidly with a corresponding increase in junction resistance. Bad junctions mean less power to the antenna and less of the other person's signal to your receiver.

Use nylon ty-wraps as shown above in figure 5. They prevent mechanical strain on the coaxial cable electrical connections. Just don't ratchet them so tight that they flatten the coax.

I mentioned before that the half wave dipole was a balanced antenna. Attaching coax (which is an unbalanced feed line) directly to the antenna will cause radiation from the outer surface of the braid, distorting or skewing the radiated energy pattern. The way to correct this is to insert a balun (**bal**anced to **un**-balanced) between the coax and the dipole terminals. There are many types available, some good, some not so good. A relatively easy and effective one to make is to wind coax into a coil. Use a form of some sort as winding the turns in a random or scrambled fashion is very likely to negate the balancing effect.

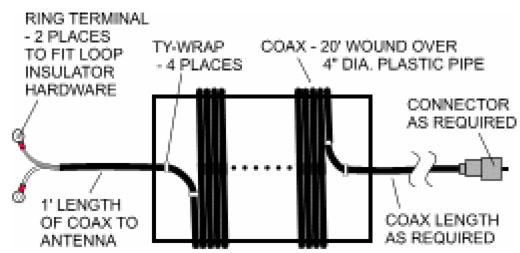

Figure 6 – Making of a balun. This one is suitable for 160 to 10 meters. Use thin-wall, light weight pipe to prevent the antenna from sagging. The length of coax is more important than the number or diameter of turns. Anything from 3 to 5 inches in diameter will do.

Using coaxial cable as the feed line puts limits on how much you may stray from the design center frequency, as mentioned previously. Replacing coax with open or balanced wire line and using a tuner intended for balanced antennas largely removes these restrictions (and the feed line loses due to high SWR). If you go this

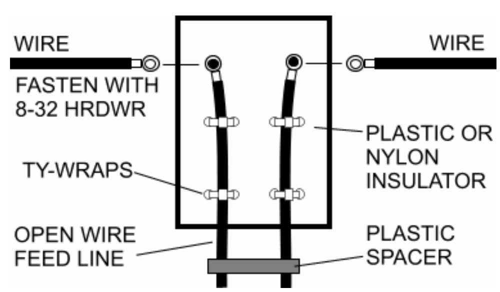

Figure 7 – Center insulator detail for balanced or open wire feed line. This method may put too much strain on the soldered wire joints for antennas cut for the lower bands such as 160 or 80 meters. The same problem exists with figure 5.

route, cut the antenna for the middle of the 80 meter band and use the tuner to match your transmitter to whatever frequency (80 – 10 meters) you wish to use. Open wire line is fairly easy to construct (see next month's newsletter) or you can purchase it if you have the bucks.

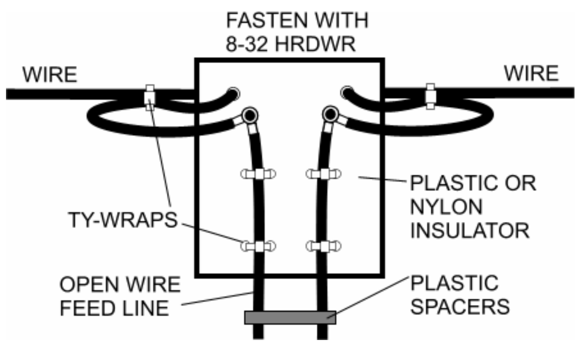

Figure 8 – Alternate center insulator detail with additional strain relief for the antenna wires. You can use the same additional strain relief with a coaxial feed line.

Buildings generally stay put but trees move. Movement causes wire to stretch and eventually break. If you have a support rope passing through or over a tree, it will saw its way into, and may even cut off, a tree limb, or the rope may wear thin and part. To avoid that annoyance use some sort of strain relief such as a spring or a shock cord.

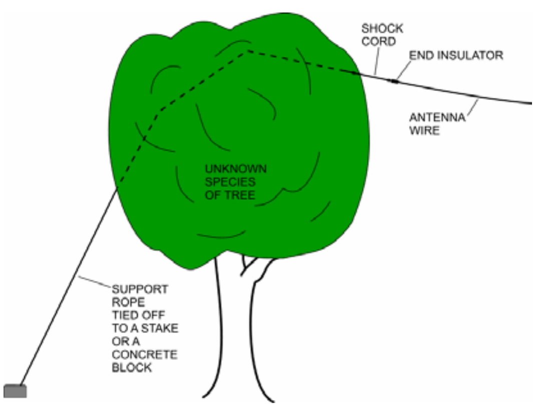

Figure 9 – A tree pretending to be an antenna support.

Use a rope made from nylon for its strength, its low friction, and its resistance to deterioration from the weather and the ultraviolet radiation from the sun. Go with, at least, a ¼ inch (3/8 inch would be better) diameter to avoid cutting into the tree limb. Tie off the other end to a concrete block lying on the ground. If the wind moves the antenna, tree, or support line enough, the block might slide before something breaks. It is also easier to move, than a driven stake, to mow the grass. Check the support ropes and shock cords for wear and for freedom of movement at least once a year. It is a lot easier to use the existing rope to pull up a replacement one or a new shock cord than to start all over from scratch.

I'll leave the "how to get the lines over the trees in the first place" problem up to you. Options range from slingshots, to baseballs, to bow and arrow, to large pop/soda bottles filled with sand or water, to pneumatic tennis ball guns. Use caution and wear safety glasses and other necessary safety equipment.

Can't fit a dipole into your available area? Don't have two trees in the right place? In the May newsletter we'll look at the end fed half wave antenna.

SOME WEB SITES OF INTEREST

Basic dipole information
http://www.k7mem.150m.com/Electronic_Notebook/antennas/dipole.html

Dipole length calculator
http://www.radioing.com/hamradio/antcalc.html

More dipole information
http://www.electronics-radio.com/articles/radio/antennas/dipole/dipole-antenna.php

Coax balun
http://www.hamuniverse.com/balun.html

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NEXT MONTH'S TECH STUFF …

MAKE YOUR OWN OPEN WIRE FEED LINE.

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PART 2 OF THE HALFWAVE ANTENNA WILL BE IN THE MAY NEWSLETTER.

SWAP SHOP

BUY – SELL – TRADE - GIVE AWAY

YOUR AD HERE – NO CHARGE!

TUNER – I AM LOOKING FOR A KW VERSION OF THE JOHNSON VIKING MATCHBOX, A TENTEC 238 OR A PALSTAR AT1500CV, IN GOOD CONDITION. E-MAIL ve1vq@eastlink.ca. I CAN PICK UP AT THE ANNUAL MARA MEETING IN MAY. – VE1VQ

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MAKE PLANS TO ATTEND THE 2008 ANNUAL MEETING AT THE CHERRY HILL CHAPEL IN CHERRY HILL NJ.

INFORMATION IS POSTED ON THE WEB SITE – http://ne.mara.net

UPDATES/CHANGES WILL BE POSTED THERE AND ANNOUNCED ON THE NET AND THE E-MAIL REFLECTOR.

DI-DAH-DI-DAH-DIT

According to an editorial in one of the amateur radio magazines some years back, the most popular issue of the year is always the antenna issue. Obviously, at least to me, this would be so as it is one of the few things that Mr. or Ms. Average Ham can still do "hands-on".

Very little is required beyond basic math, a few simple tools, and some wire or pipe. You don't even have to have a fancy antenna analyser (although it does help!). Instead of the analyser, the simple SWR meter is "good 'nuff" for the HF (high frequency) bands. A multimeter on the resistance (ohms) scale aids in finding poor electrical connections.

When it comes to repairs of antennas there is the instant gratification factor – a simple tightening of a nut or a resoldering of a connection can make an immediate improvement in both your transmit and receive signals.

Perhaps you have a new antenna in mind that you would like to build once the snow melts. Maybe the January article by Stan, N3HS, on his mobile installation has given you the inspiration to go that route yourself; or possibly you are still thinking of that portable antenna for use at the chapel or stake center.

Whatever your thoughts, start gathering the materials for the project, because spring will soon be here.

Until next month,
VE1VQ