MERCURY AMATEUR RADIO ASSOCIATION

MARA - NORTH AMERICA - NORTH EAST

APRIL NEWSLETTER 2008

CONTENTS

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

VIEW FROM THE TOP

Spring has sprung,
The grass is riz,
I wonder where
My antenna is?

It was up there
When last it snowed,
But now it's gone
(*And so's my code!*).

Oh woe is me
I am so blue,
My license renewal
Is long overdue.

(The last two verses should be read with stirring music rising in the background.)

Not all is lost,
Rebuild I can,
And I WILL be
On the net again.

With signal strong
And audio mighty,
No longer will I
Be thought as flighty.

By an anonymous MARA member

TECH STUFF

BALANCED FEED LINE – ROLLING YOUR OWN

This article was written in 2006 for presentation at the 2007 Annual MARA NE meeting, but due to the fact that I didn't make the meeting, it was never presented!

Some years ago, Jeff, KD1WZ, and I had the pleasure of visiting Seab, AA1MY, when he lived in Connecticut, and seeing his 1500 foot horizontal loop and his homebrew feed line made with "whipper-snipper" plastic line as spacers. He demonstrated to us how he made the line using a soldering iron to form the end loops to hold the two wires.

When I first considered making my own feed line to replace the old commercial twin lead with vinyl in the center, and very much showing its age, I gave some thought to Seab's method, but abandoned it when I looked at the cost of the trimmer line around here. My ARRL Handbook gave me the formula for spacing and impedance, as did the ARRL Antenna Book (15th edition), but not much in the way of practical stuff that I could use.

One of my computer friends says, "Google knows all". That might be, but Google didn't seem to know much about making balanced line for RF transmission!

One of the few places where I found any real information was that of L.B. Cebik, W4RNL. His web site has all kinds of good stuff about antennas, tuners and feed lines[1].

Others talked about using cut up wooden dowel, plastic pipe or rod, or coat hangers for the spreaders. Some used heat to force the bare wire into the ends of the plastic, others used the more traditional method of drilling holes and wrapping wire, and still others updated this with tie-wraps (although at greater cost).

Nowhere could I find an actual process, with pictures, to make balanced transmission line.

GETTING READY

Since I have a 500 foot horizontal loop antenna varying in height above ground of from 25 – 40 feet, and feed it from a homebrew balanced tuner [2], I wasn't all that concerned with the actual impedance of the finished line, as long as it was reasonably high (somewhere between 450 and 600 ohms).

I picked up some black plastic hangers (See Fig. 1) from the local Dollar Store (five hangers for a $1) - black, rather than white or blue, the other choices at the store, as it is supposedly less susceptible to break-down from the sun's UV.

The shorter sections near the top of the hanger triangle set the maximum size of spacer I could get. All were cut with a power miter saw. You could use a pair of heavy wire cutters or metal snips as well.

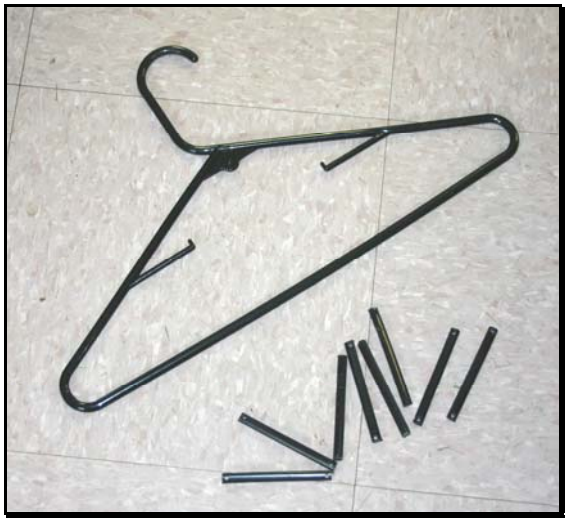


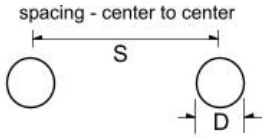
Figure 1 – Before and after spacer production made from cheap plastic coat hangers.

Preferring holes rather than slots, I cobbled together a jig out of a couple of pieces of scrap wood and a pair of clamps and drilled the spacer ends using a drill press. I allowed a distance of about an eighth of an inch in from each end of the plastic. The drill bit was chosen to provide a snug slip fit over the wire. (See Fig. 2)

Figure 2 – Close up of a spacer

The final length of the spacer ended up at 3.25 inches with wire spacing of just under 3 inches. Calculated impedance, based on the formula in fig. 3, was 540 ohms. Note that "D" is the diameter of the copper wire – not that of the outside insulation!

$$Z_0 = 276 \log_{10}\left(\frac{2S}{D}\right)$$



PROPERTIES OF A PARALLEL TRANSMISSION LINE

Figure 3 – You too can calculate impedance! Unless you can do logarithms in your head, invest in a cheap calculator.

The wire I used came from Home Depot. It is #14 THHN stranded copper with a pvc/nylon cover. Black and white are the two most common colors. Look in the electrical section of your favorite supplier.

Using some scrap lumber I had on hand, I built a jig to provide the correct distance between the plastic spacers. (See Fig. 4)

Figure 4 – The spacing jig

GETTING IT TO STICK

I experimented for some time with extra spacers and pieces of wire to get the right means of making them stick together. Plastic cement didn't work. Super Glue didn't work (it never works to glue anything for me, except my fingers!). PVC cement didn't work. RTV didn't work. Heating the end of the spacer and deforming it against the wire didn't work. Nothing I came up with would stick the plastic to the wire covering. I considered epoxy, but I've seen the five-minute variety break down when exposed to moisture. Regular epoxy might have worked but the curing time was excessive. I started this in August and wanted to get it up before the snow fell!

Bruce, VE5RC/VE5QRP, suggested ELMER'S ULTIMATE GLUE [3], a polyurethane, waterproof glue. A trip to the local hardware store got me a 60mL container of my very own.

This adhesive, interestingly enough, requires moisture to cure, but once cured is

waterproof. Setting time is listed as 1-4 hours. I find that in three hours the spacer/wire joint is strong enough to move on to the next pair of spacers.

From the spec sheets, GORILLA GLUE appears to be a similar product but I didn't try it.

ALL TOGETHER NOW

Measure and cut the wires to the length of feed line you need. In my case, it was 50 feet. I coiled each piece separately to avoid tangles and kinks.

Slide the spacers on the pair of wires all at once, as shown. (See Fig. 5) As you glue one, just move the rest along.

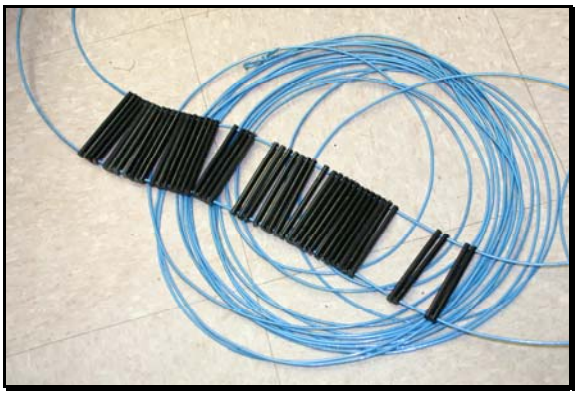


Figure 5 – Plastic spacers on the wire pair prior to being glued.

Using a medium/fine grade of sandpaper, lightly roughen the area of the wire covering surface where the spacer will be glued. If you don't do this, the bond will not be as strong because of the slickness of the outer insulation surface.

With a small artist's brush, or your fingers, wet the roughened area with water. Slide the spacer back and forth slightly to distribute the water on the covering and inside the spacer hole.

Pull the spacer back out of the way and smear a drop of glue on each wire. Again, slide the spacer back and forth to spread the glue over the wire and inside the hole in the spacer end.

Glue the first spacer to the wires, leaving six to ten inches of wire free.

After the glue has set (3 - 4 hours) on the initial spacer, clamp it to the jig (point "A"), move two more spacers into position behind the wooden blocks (at points "B" and "C"), clamp the wires (point "D") and pull them tight and at a slightly outward angle. (See Fig. 6) If you are impatient and the glue hasn't set, the joint will break. Re-position the spacer and apply water and another drop of glue as before, and *wait* this time!

Figure 6 – Production area

Clamp the spacer to the middle block (point "B"). I found the wire spread kept the third spacer in position without a clamp at the last block (point "C").

I realize I could have placed the blocks so that the plastic spacers would all be on the same side, rather than the first one on the left of the block (point "A") and the other two (being glued) on the right sides (points "B" and "C"). The idea was to have the wires tightened against the first spacer and block together, rather than the spacer and clamp alone.

Whichever way you make the jig, ensure that the spacers, when pushed against the blocks for gluing are whatever insulator spacing (center-to-center) you want (in my case - 12 inches).

The four thicknesses of cardboard and three clamps shown on the right side in figure 6 (at “D”) provide tension on the lines while the glue sets. It also lifts the two lines up a bit so any excess glue doesn’t stick the spacer to the base of the jig. If the glue does seep between the plastic and the block or the base it will break free with a little gentle persuasion. Clean the glue off the block or base with a knife before starting the next set.

LETTING IT ALL HANG OUT

Once the transmission line is finished, the next step is to connect it between the antenna and the transmitter [4]. That’s the easy part - the hard part is keeping it there.

Unless you have some form of strain relief at both ends of the line, the copper wire will eventually work-harden and break. Movement and vibration caused by the wind will take its toll.

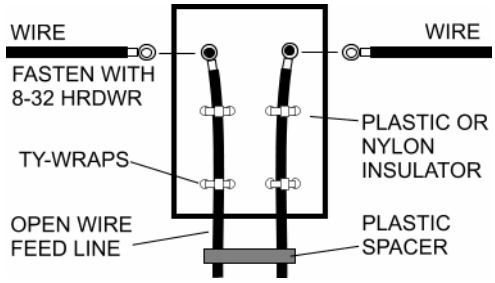


Figure 7 – Drawing of center insulator and balanced/open wire feed line.

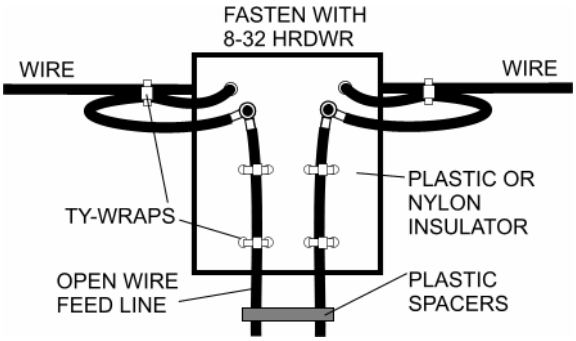


Figure 8 – Drawing of center insulator with additional strain relief for the antenna wire.

The strain relief at the antenna end (See Figs. 7, 8, and 9) is a plate made from some nylon pieces left over from a job. Any insulating material will do. The nylon tie-wraps make sure that any strain is taken off the mechanical junction of the antenna wires and the feed line conductors. They would have been better in black, but these were all I had on hand.

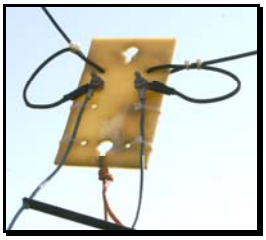


Figure 9 – Antenna end. The thing hanging from the bottom hole is a length of twine used to pull the antenna down to working level.

The same function on the building end (See Fig.10) is performed by a more flexible piece taken from a flat sided plastic bucket.

For a good solid connection at both ends, I used ring terminals soldered to the copper wire.

Figure 10 – Strain relief on the transmitter end. Inside the PVC box are threaded ¼" steel rods in PVC pipe going through the wall to the tuner.

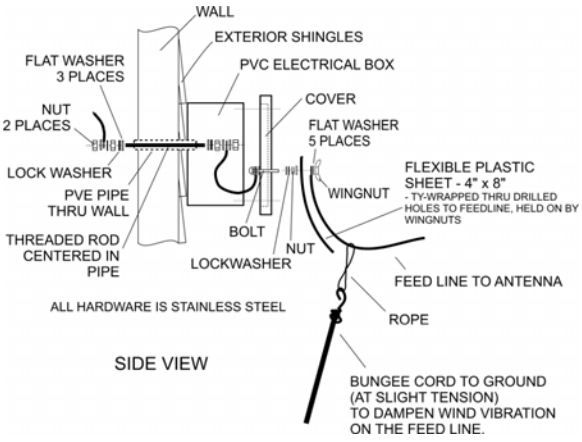


Figure 11 – Drawing showing detail of feeding balanced line through a building wall.

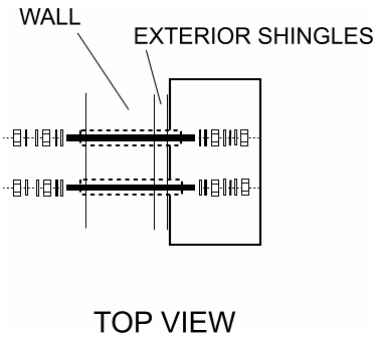


Figure 12 – A partial top view of figure 11 showing the wall and connections to the outside.

SOME THINGS I'VE LEARNED – THE HARD WAY!

A. When cutting plastic rod or pipe with a power miter saw, it really needs to be clamped well. Also, wear safety glasses or other eye protection. Those little plastic pieces really move out when they catch in the blade!

B. Some wire coverings are really hard for any glue to stick to. Bare wire would have been much easier to use. But then, you have the copper exposed to the elements for possible increased failure.

C. Copper wire used for antennas or feed line will break – its just going to happen. Use stranded to make it last longer between failures.

D. Stay away from steel wire, unless it has a copper coating and is free, or someone pays you to take it.

E. Eighteen inches instead of twelve would have still been ok, and saved on spacers.

NOTES:

1. W4RNL' s web site article on parallel transmission line - http://www.cebik.com/trans/par.html
2. AG6K's web site article on balanced tuners - http://www.somis.org/bbat.html
3. Information on Elmer's "Ultimate Glue" http://www.elmers.com/products/product/product_page.asp?pCode=P9411
4. More information at W4RNL's web site on parallel transmission lines - http://www.cebik.com/gup/gup31.html

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WEB SITES OF INTEREST

For those interested in PSK31, tips on setting up your equipment.

http://www.arrl.org/news/features/2008/03/11/10007/?nc=1

I've mentioned L. B. Cebik's (W4RNL) website before. Good info on all kinds of antennas and related things.

http://www.cebik.com/

No antenna because of restriction problems? Try the "grasswire" antenna. Check out stealth antennas at

http://www.ac6v.com/antprojects.htm#STANT

Not into stealth – here's one for you!

http://en.wikipedia.org/wiki/Image:HR_ALLISS_system.jpg

----------MARA NE----------

MAKE PLANS TO ATTEND THE 2008 ANNUAL MEETING NEXT MONTH 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

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 ANNUAL MARA MEETING IN MAY. – VE1VQ

DI-DAH-DI-DAH-DIT

If you haven't figured it out by now, I like working on antennas and antenna related things. I have the good fortune to live in the house that was my paternal grandparent's, on a fifty acre rural piece of land - part pasture, part field, part wood lot.

I'm self employed and my office, a converted two car garage, is only a minute's walk from the house. My station is on one end of the office/shop work bench, and the feed lines go out through the rear wall of the building to the 500' horizontal loop strung on convenient trees around one of the pieces of pasture, or to whatever else I happen to be experimenting with.

My nearest neighbour is directly across the road, about a hundred yards distant. Interference to or from all of my neighbours has been non-existent – not that I've ever gone around and asked about the outbound RF.

My noise level is low – usually in the order of S2 with S5 being a bad day. I can usually hear all of the stations on the

Saturday morning NE net and even many of those on the mid west net!

Life as a ham is good!

I know this is not the same for everyone. Some of you live in areas with severe restrictions and covenants; others have radio unfriendly neighbours, while still others are in apartments or rentals with no room for anything. Some of you may have the ultimate problem – a radio unfriendly xyl. Some of you poor souls even have a combination of several of these!

While I can't do anything about your xyl, your neighbour, or your restriction problems, I can hope that some of the ideas presented in these pages, as the months go by, will give you an idea or two that you can use to get on the air, even if only in a limited way.

And if you have some solutions that may assist others in the same situations, we would love to hear about them.

Until next month,
VE1VQ

NEXT MONTH'S TECH STUFF …

PART 2 – HALF WAVE ANTENNAS – THE END FED.