Antenner

Detta häfte tar upp en del av de antennartiklar som funnits på SWEDX BBS.

Bl.a. finns det

- en lång utläggning om olika antenner.
- Phone Line Antenna
- Tune-A-Stick
- Beverage
- Double Bazooka
- Carpet Loop II

Hoppas det smakar!
JAL ☺

Antenna Articles

Collection of short articles relating to all manners of antennas. These articles are the hard work of Wayne Sarosi KB4YLY (995 Alabama Street, Titusville, FL 32796)

SUBJECT: Circular Polarized Antenna

There has been a request for a series on 'CP' antennas. The term 'CP' eluded me at first as I was not familar with the abriviated designator for circular polarization. At work, we just use the entire words.

I'm going to begin this ten part series with the basics. After researching CP designs with a few engineers and fellow hams, I found that they knew very little about the subject. I also found I didn't know quite as much as I thought I did about circular polarization. So starting at the begining will help all out.

First, let's discuss the circular polarized wave. There seems to be conflicting standards used by the world of physics and the IEEE. I found this to be true in four reference manuals including the ARRL Antenna Handbook. At least it's stated right up front but biased according to which text you read. We will follow the IEEE/ARRL standard in the following series for obvious reasons.

There are two types of circular polarization; right and left. All of us agree up to this point. According to the ARRL Antenna Handbook, the following statement:

'Polarization Sense is a critical factor, especially in EME work or if the satellite uses a circular polarized antenna.
In physics, clockwise rotation of an approaching wave is called "right circular polarization," but the IEEE standard uses the term "clockwise circular polarization" for a receeding wave. Amateur terminology follows the IEEE standard, calling clockwise polarization for a receeding wave as right-hand.'

Confused yet? I read it five times before it sunk in. Physics uses 'right', IEEE uses 'clockwise', the ARRL follows the IEEE and calls it 'right-hand'. Just remember the 'right-hand' or 'clockwise' is for a receeding wave or one that is going away from you.

[You have one minute to flap your lips with your finger and read the above paragraphs again.] ;-)

Ok, now we know a reference that we can base "right-hand circular polarization" on. Now I have an experiment for you to try. Obtain a hard rubber ball from the kids or a neighbor's kid and try this: drop the ball with a "right-hand polarization" spin and watch which way the ball spins as it bounces towards you. You'll find it will spin in the opposite direction [this works great with a super ball]. This is exactly what happens in EME work. The "right-hand circular polarized" signal returns in the opposite polarity. The same holds true for passing satellites using circular polarization. An approaching satellite's circular polarized wave will reverse as it passes.

Another quote from the ARRL Antenna Handbook states that the circular polarized wave and a linear wave are mathmatically special cases of an elipical wave. When the magnitudes are the same and phase angles are 90 degrees in time, we have circular polarization.

One antenna that uses circular polarization is the helical antenna. It comes in two flavors, LHCP and RHCP for left and right hand circular polarized. As stated on the previous posting, RHCP is a clockwise rotation as the wave receeds from the point for transmission. The RHCP helical antenna is phsyically configured this way with the turns of the helix rotating clockwise away from the mounting point.

The LHCP helix is phsyically configured counter-clockwise away from the mounting point. The helix is an end-fed antenna. For satellite and EME work, both LHCP and RHCP helix antennas are required for proper signal reception as the polarization changes when the satellite passes overhead or the returning signal from an EME transmission is received.

Below are some other CP antennas for you to look at that are used at the Kennedy Space Center. For a refernce of Helical Antennas, read the ARRL Antenna Handbook, pages 19-22 thru 19-33 in the 16th edition. To repost the figures here would require several listings, but an overview will be coming in the series.

In general, the helix is very predicable in gain and pattern.
Introduced in the 40s, the helical antenna resembles nothing more than a large air-wound coil with characteristics showing its electrical pattern.

There are other types of antennas with circular polarization such as the cavity backed sprial which comes in the same flavors, LHCP and RHCP. These type of antennas are commercial grade and seldom used in the amateur world. One strange antenna is the 'twisted yagi' of which I am still trying to find some info on. I don't know if the name is correct, but I have heard it refered to that way. The twisted yagi is nothing more than a yagi with the elements offset in a continous rotating fashion. Each element is positioned about 30 degrees from the one before. They can get rather long for the designed frequency.I'll see what I can dig up on this type.

For true CP design, the choice of antennas are limited. Elipical patterns are most used for satellite and EME use. We can look into these antennas also if there are no objections.

HELIX: Well, I promised some figures for all of you concerning the helix antenna as it is probably the most popular CP antenna. After researching the subject of helix antennas, I found the design parameters are all basically the same with the only difference being the variables used to describe the different values. The ARRL Antenna Handbook has a very detailed construction dialog. There are plenty of pictures and easy to use formulas. A couple of technical antenna theory books at work and from college tend to bury themselves in mathmatical theory removed from practical application that we require for working models.

Theory is good, don't get me wrong, but theory at college level for amateurs that have not been to college, is not good for construction. It assumes too much on the average amateur in the area of math.

For now, I will give the basic design parameters for the helix antenna and then conclude with the some information on the cavity backed spiral.

In the ARRL Antenna Handbook, 16th ed, 19-22, provides about the best description of a helix and how to build one.

The Helix has two componets; a ground plane and the helix. It is fed with a coax. The diameter of the ground plane is 0.8 to 1.1 wave lengths in diameter. This section is connected electrically to the coax braid.

Since ASCII does not provide all those neat little greek letters I'll have to improvise here.

C .... is the circumference of a coiled turn.
S .... is the spacing between one coil and the next.
G .... is the diameter of the ground plane.
g .... is the gap between G and the begining of the coils.
AR .... is the axial ratio
D................. is the diameter of a coil turn.
n .... is the number of turns
L .... is the length of conductor in one turn.
w .... is the wave length.
Z .... is the impedance in ohms
Gain .... is the gain of the antenna (now that was a smart statement)
HPBW .... is the half power bandwidth

C = 0.75w to 1.33w where w = 984/fMHz in ft or 300/fMHz for meters

S = 0.2126*C to 0.2867*C

G = 0.8w to 1.1w

g = 0.12w to 0.13w at 45 degrees to the ground plane.
Note: This is similar to the distance between a DE and D1 in a yagi.

AR = 2n+1/2n which should be as near to unity as possible. The closer you can get this ratio to one the closer you will have a pure circular pattern.

D = C/3.1415927 => 0.2387w to 0.35w

n => use AR until you get a balance between a good ratio and a practical length you can handle.

AR = 2n+1/2n => n=6 then 13/12 = 1.083333, n=3 then 7/6 = 1.1666, n=10 then 21/20 = 1.05. As you can see there isn't a vast improvement between 6 and 10 turns. n=15 then 31/30 = 1.03333. Not much more here either.

L = sqrt[(piD)^2 + S^2]

Z = 140*C ohms which is 0.75w*140 to 1.33w*140 ohms

HPBW = 52/(C*sqrt[n*S]) degrees

Gain = 11.8 + 10log((C^2) *n*S))

First nulls beamwidth = 115/(C*sqrt[n*S]) degrees

Pitch angle between the coils should be 12 to 16 degrees or arctan(S/C)

Heres some stats from an antenna we use at the EMLab. The antenna is a broadband cavity backed spiral antenna made by EM systems, model A2200. It's good from 1 to 18 GHz with an SWR of 1.8:1 over the entire band.

Diameter = 6.85-in
gain = 0 dB minimum 5.5 dB max
Polarization = LHC or RHC
axial ratio = 3 dB
3dB Beam width = 80 degrees
MIL-E-16400 class 2 equip.

SUBJECT: Gamma modification for better symmetry & gain

This subject has been discussed before on the HAM echo and will be further discussed here with more detail.

Most gamma matching devices are mounted to the side of the driven element. This technique is good for matching, but does not provide good pattern. The symmetry of the antenna pattern is distorted to the side of the antenna that the gamma match is located on. Several antenna brands were tested with all brands tested showing the same result. The pattern produced by the side mounted gamma is kidney shaped. This shaping accounts for the fact that you can hear a signal on one side of the beam and not the other. The side to side ratio is not consistant. In the case of horizontal beams, the gamma hangs down, wasting gain and affording a loss of signal reception that could otherwise be used.

What would it take to move this lost antenna gain and sensitivity into the area of the pattern that could be utilized? Not a whole lot in fact. The entire modification can be done in under a half an hour and for less than a dollar. What results is that the wasted gain to the side of a vertical beam is moved forward and the wasted gain under a horizontal beam is moved into the horizontal plane forward. The average gain increase is near 1.5 dB over the previous gain rating of the antenna. What this means is that if your antenna produces 10 dBi it will now produce 11.5 dbi. Your Cushcraft eleven element yagi rated at 13.2 dBi will now produce 14.7 dBi. 13 dB is equal to a gain of 20, 16 dB is a gain of 40, so you can see the improvement.

To accomplish this, you will need to remove the gamma match from the antenna. Remove the di-electric innards and replace with a piece of RG-8 foam di-electric about 3-in longer. Pivot the tuning arm 90 degrees so that it faces the first director. Insert the gamma back into the tuning arm. Now, solder to the center pin of the coax feed point. If your coax feed point is a threaded section, crimp or solder on the appropriate fitting, then tighten the nut. You will need to retune the antenna at this point.

Fairly easy? The results are incredible. Increased gain, better symmetry, better side to side and front to back ratios. This modification has been used here for over a year. When I turn the beam to the side of a signal, the results blow away any commercial beam. My nine element yagi can keep up with the commercial eleven element antennas. Try it out. I'm sure you will enjoy the change.

SUBJECT: Hidden Apartment HF Antenna

Bottom floor dwellers have some advantages over dwellers on other floors concerning HF antennas. Single unit condo & PUD dwellers fall into this area.

Dwellers in the mid-floor(s) have it the toughest. And top floor dwellers have other advantages the first two don't.

HF antennas are large and trying to hide one can be like trying to hide an elephant. Many hams try different configurations, snap together antennas, wires, and flag poles to conceal their antennas. Some work out, but most get caught in the end.

First, let's look at what you can and can't have. Most restrictive housing areas have a long list of items you can't have. Clothlines, TV antennas, sheds, flags, BBQ grills, etc. And most of all, the all important HF antenna. It has something to do with nice surroundings.

Make a list of these items and place them in a column on the left side of the page. Next, list what you can have and list them in the center of the page. Next, list the items that are readly available in the area of your home. Such items are trees, gutters, vents, fences, etc. Look closely and don't leave anything out.

A hidden HF antenna must be just that, hidden to the naked eye, even at a point blank range.

Next, list the areas that you have a ready access to. If you can get to the roof, write it down. How about the attic, basement, trees, etc, without much notice by your neighbors. Most HF antennas are discovered not because of their design or placement, but rather a neighbor spies the ham installing the antenna or at least doing something out of the ordinary.

EX: Creeping around on the roof, on a Saturday afternoon, is going to draw attention. Flinging wires over trees is sure to draw some attention.

The big point here is not to install the antenna by looking like your installing an antenna or doing something out of the ordinary.

There are some new designs out on the market such as PVC vent pipe antennas for 2m. But for now we'll stick to HF. Most contracts for condo / PUD dwellers will allow bird feeders. And even apartment dwellers on the bottom floor can benifit from this design.

I'll give a brief description here of the Bird Feeder antenna and discuss it further in later postings. The Bird Feeder HF antenna is a vertical cage wire antenna. A 'What?' you might ask. Imagine if you will eight flexible wires, evenly spaced in a circular pattern, much like a ground plane. Draw these wires vertically to form a wire 'tube' and connect them together with a ring at the top. Now imagine these wires inside a telescoping PVC mast. Top that off with a bird feeder. Now, instead of a ground plane system with radials you have to put in (the neighbors are watching), you have this 'wire tube' constructed as a vertical dipole. At 10m, the Bird Feeder antenna is a mere 17' tall when raised. What would the neighbors say? Or for that matter the manager?

"I raise it up for the birds to get into and it keeps the squirels out too. And look, I can take it out when I'm not using it or the weather is bad. Boy, I really like watching the birds from my window. Did you know that ..."

And then go on about some rare, but not unbelievable birds that frequent the feeder. Buy a book on the subject with some pages tagged to show them what you've seen so far. At worst, they'll think you're a flake and leave you alone. Next, go in and tune up 10m and catch some rare DX instead.

What do you have to actually put into the ground? Your coax and a PVC pipe to hold the mast up. Make it low in the ground and cap it so the mower doesn't take it off. For the most part, you can leave it up.

But do remember to put so seed in the feeder once in a while!

Bird Feeder Antenna II

Now, I admit, this design sounds a bit far fetched, but it works. The vertical dipole, inside the PVC push-up, is invisable. It moves up and down and can be removed without drawing attention to the fact that it contains an antenna. The flagpole design has some problems. Not all PUDs, condos, or apartments allow flagpoles. They represent a permanent fixture.
Not all associations or managers are that patriotic.

Although you can pack a good vertical in a flagpole, there is the problem of radials. You can run the vertical without radials, but that's another compromise.

The design for the Bird Feeder Antenna is very simple. Drawing it here is another problem. ASCII Graphics really do not exist, so a description is in order.

You can build the vertical dipole without much trouble. The dipole consists of up to 16 wire 1/4 wave elements. There are eight on each leg of the dipole.
You may use less, it's up to you. You know the bandwidth of a wire dipole and you know the band spread on 10m. If you are a general or above, you will want the extra wire elements to give you the bandwidth you need.

First, let's look at the PVC tubular mast / bird feeder support. Most hardware and home improvement center have PVC tubing. Like the steel counterparts, the mast will be graduated (large at the bottom and smaller at the top.
I'm not going to recommend any sizes here as availability at your store is going to dictate what sizes you will need. I will state the the top tube should be 2" in diameter or better. You will need that size to support the bird feeder and give the mast some strength.

```
      ___
      | | <-------  Attach upper ring inside
      | |
      | |
      | |
      |_| <-------  Attach next ring inside
     |   |
     |   |
     |   |
     |   |
     |___| <------- Attach feed ring inside
    |     |<------- Attach feed ring inside
    |     |
    |     |
    |     |
    |_____| <------ Attach feed ring inside
   |       |
   |       |
   |       |
   |       |
   |       |
   |_______| <------ Attach bottom ring inside
```

Figure one

The wire elements are attached in a ring format, evenly spaced, in a 360 degree pattern. Locations are noted in figure one. This allows the dipole to be folded up when the mast is lowered. More than eight wires on each leg of the dipole tends toward snags when raising and lowering.

Dipole wire element sizes are calculated by 246 / f Mhz. But I recommend shorter lengths if eight elements are used.

A BALUN can be inserted, but is not necessary. I feeder coax is needed from the dipole feed to the base of the mast. A UHF bullet (female to female) to attach your coax to.

How to lay the coax without looking like you're doing it:

The base piece for the bird feeder mast should be one size larger than the bottom section of the mast. The mast should be able to side in a snug fashion, but not too tight. Since you are installing a 'bird feeder', you shouldn't have any problem explaining what you are doing. Simply lay the bird feeder and mast right out in the open. Your nosey neighbors will know exactly what you're doing (almost). The coax is the tough part.

Trenches are out of the question. Use a sidewalk edger (manual) and make a thin cut in the grass. If you have other obsticles, you will have to deal with that when you come to it. The object is to do it when the neighbors are not going to notice. The thin cut in the lawn will not be seen and will 'heal' quickly. A tricky technique is to use a wheelblade on a handle. It will look like you are using a measuring device. The cable can be laid into the cut at dawn, when you are filling the bird feeder. Stepping on the cut lawn on the way back seals the cut. Now you're in business.

If you have any questions, drop me a line here.

Mobile Resonators as HF hidden antennas

Mobile resonators are small and easy to hide in comparison to a full size HF antenna. They have there own faults as well. They require a good ground plane when not attched to a vehicle.

Experiments done here with mobile HF antennas have shown good results when used as a base station antenna.

The most obvious and easiest install for a mobile HF antenna is the installation it is designed for. Mobile!

To take advantage of the 'no antennas' rule at most PUDs / condos / apartments, the designed mobile installation is best. In addition to this, a coax can be run from the location of the mobile to the dwelling for indoor operation. This provides a mobile/base operation with just the installation of the coax.

This concept also gives the operator the alibi needed if interference is experienced by the neighbors. When they look out to see if you're in the vehicle, nobody is there.

This design is good for bottom floor dwellers in apartments and any 'sneaky' mid-floor dwellers who can weasel a coax to their apartment. Top floor apartment dwellers can hide the resonators in PVC pipe and install the antenna on the roof of the building, if possible. It would need to look like a vent pipe. I've seen some designs that even pop out of drain pipes. This design may be a little too much for most amateurs.

Roof and tree mounting can be difficult at best. Installing these antennas can be next to imposible for most dwellings. If you decide to install a mobile resonators in other than the designed location, a good ground plane is a must. This one factor may be your undoing in the stelth antenna concept.

Painting the antenna to hide it can help. For night operation, flat black or flat dark grey is recommended. Daytime ops require a background blending scheme.

Further placement designs of this antenna is in works.

SUBJECT: Indoor antennas

HF Indoor Antennas:

This can be fun. Imagine packing a 20m beam into an apartment! OW!
Imagine your XYL's reaction! OW! Imagine trying to turn it! LOOK OUT!

Here, I'll discuss some pratical indoor antennas that can be built by anyone.

Antennas include:

- HF foil antennas
- VHF/UHF discones
- Wire beams
- Attic VHF/UHF rotatables
- Tape antennas (TNX Jim, for the idea)
- Telescoping VHF/UHF indoor beams.

HF Foil Antennas

HF foil antennas are too weak in their physical construction for outside use. Foil antennas are just what the title implies, foil. They are made from ordinary aluminum foil, the kind used for heavy duty cooking, such as roasting a turkey.

This antenna goes in the attic of your home or condo. Apartment dwellers may have a time with this antenna depending on their location within their complex.

Materials needed are two to three rolls of aluminum foil, copper tape with electrically conductive glue, a staple gun and staples, and coax with connector.

By stapling the foil in a loop or dipole configuration on the attic rafters, a simple antenna can be formed.

```
========================  ==========================
                        || balun if desired
                        |
                        |
                        | coax to shack
```

```
====================================================
|                                                  |
|                                                  |
|                                                  |
|                                                  |
|                                                  |
|                                                  |
========================  ==========================
                        || Balun if desired
                        |
                        | coax to shack
```

These two configurations are excellent when used with a tuner for the various bands on amateur radio and SWL listening. They are cheap to install and can be made into other configurations, by the amateur, if desired. A relay can be installed to provide dual antenna configurations if needed. With this device you can switch between a dipole and the loop for different propagation conditions. Size and shape is dependent on the attic structure.

Indoor Antennas for HF & VHF/UHF

I thought I would conclude the HF foil antenna here and move on to another subject. Connections from the foil to the coax or BALUN are via the copper tape. There are copper tapes available on the market that are used for EMI applications. These tapes are expensive so if you can get a piece of some of that tape from a buddy, it will work wonders for you.

Otherwise, there is a trick with regular copper tape and the aluminum foil that you can do. It's a simple folding technique that insures a good connection and yet requires no soldering except for the coax / BALUN connection.

```
==========================================  Aluminum foil
     |---------------------------------||
     | ===================================
     |----------------------------------------- Copper tape
```

This folding method insures good contact on more than one surface.
One warning, do not leave air gaps as it will have a capacitive effect.

Solder doesn't stick to Aluminum foil very well. With enough heat, you can solder anything. Too bad the aluminum foil won't hold up at that temperature and neither will the solder.

You now can solder leads to the BALUN or solder the coax direct to the copper tape.

For an indoor antenna, the foil antenna works rather well. It can out perform a vertical and pull in the weak ones with ease. I think you'll find it one of the most inexpensive antennas you can build yourself.

VHF/UHF Discones

The discone antenna is a rather unique antenna for VHF and UHF.
The discone has no gain to speak of, yet can provide the user with a range of ten times the design frequnecy for reception and transmitions.
This means that a discone designed at 140 MHz will work fine up to 1.4 Ghz.

Hiding the discone outside may prove to be quite a feat. Unlike most antennas, the discone has a large skirt and is tall to boot. It's shape can draw attention. If you can place the antenna outside, it will give you excellent coverage over it's range. Inside, the discone works well minus the attenuation caused by the building it's in.

There are many Discones available on the market if you choose not to build one. Building one can be fun if you take the time and lay everything out ahead of time.

There are a couple items I would like to point out about discones.

1) The gap between the top-hat and the skirt is critical.

2) The area under the skirt is a null to the antenna.

Design parameters are easy.

o The top-hat diameter is: (0.1778 * (984/f MHz))*12
EX: at 140 MHz --> (0.1778 * (984/140))*12) = 15-in

o The diameter of the skirt, at the base, equals the length of the skirt elements. This gives the user the closest impedance to 50-ohms. Thus a skirt element length is:
(0.2675 * (984/f MHz))*12)
EX: at 140 MHz --> (0.2675 * (984/140))*12) = 22.56-in

o The gap is: (0.007114 * (984/f MHz))*12)
EX: at 140 MHz --> (0.007114 * (984/140))*12) = 0.6-in

A tin funnel works well as a starting base that brass skirt elements can be soldered to. An SO-239 chasis connector can be fit into the cutoff funnel end and the top-hat soldered to the center pin of the SO-239.
Insullating spacers can be used to strengthen the gap. I've used a brass screw that was soldered between the center pin and the top-hat, but you can use anything that you can solder.

I have a motorized discone in works. The stepping motor will be incorporated to change the gap, to match the frequency, for best SWR.

Wire beams, indoor antennas

For many of us, the antenna is the biggest problem for most hams. Hams have to contend with neighbors and the XYL in order to pursue their hobby. An interesting HF and VHF idea I've seen used is the wire beam.

The wire beam is unrolled and suspended in the direction required for operation. After the operation is complete, the wire beam is rolled up and stored for the next time. This type of beam is excellent for 10m and up to 1.25 m. You may be able to set up a wire beam for frequencies below 10m if you have the space to do so. This antenna is also excellent for suspension in an attic.

A simple model is shown below:

```
               R             DE         D

-----------||--|-------------|----------|--||-----------
           ||  |             |          |  ||
           ||  |             |          |  ||
           ||  |             |          |  ||
-----------||--|-------------|----------|--||-----------
           ||  |             |          |  ||
           ||  |             |          |  ||
           ||  |             |          |  ||
-----------||--|-------------|----------|--||-----------
```

Aside from the elements, the rest of the configuration is non-conductive. Wooden dowel supports are outside the ends of the antenna and string/rope can be used to support the elements. The wooden dowels are not required if suspension is taught.

You can see that variations of this set-up can be incorporated to accommodate most any frequency from 10 to 1.25 meters.

Attic VHF/UHF Rotatables

In many instances, a ham can mount a VHF or UHF beam in the attic, on a rotor. They can achieve good results depending on their location and height off the ground. Antenna size limitations are soley dependent on the available room in the attic that allows rotation of the beam without hindering it's rotation.

To check the attic for the maximum size antenna, the ham must first enter the attic and measure the distances in the area planned for the set-up. Trusses, electrical wiring, air conditioning / heating ducts, and the items that are stored up there, can all play a factor in the actual antenna size.

Finding your antenna with a pair of long johns dragging off the front end is not a pretty sight.

After measuring the area in the attic, the antenna size and height off the attic cross members can be accomplished. Remember to allow for a base to accommodate the rotor. This too must be calculated into the system.

Building a sleek system, to rotate two or three small beams, can be dashed, when the system will not turn because of an oversight in the measured values of the attic area in question.

Turning radius is the important factor. Each antenna forms a rectangle ABCD where the maximum distance is AD or BC.

```
    A-----------------------------------B
     |                                 |
     |                                 |
 ----|---------------------------------|---- BOOM
     |                                 |
     |                                 |
    C-----------------------------------D
```

For horizontal antennas, the turning radius is from the mounting point to the tip (either side) of the longest element. Multiple this figure by two for the turning diameter of the antenna.

For vertical antennas, the truss angle places the biggest problem as the height from the boom to the tip of the refector (B or A). In essence, this will shorten your boom length or require a lower rotor mounting.

These tips will help the Amateur avoid any problem before getting the system in the attic.

Indoor telescoping beams

One problem I have encountered from Hams living in apartments is the space to place a VHF/UHF antenna. This concerns operation of the beam from a bedroom or porch. In these cases, the Ham can not keep the antenna up and must remove the antenna after he or she finishes.

Using telescoping elements can solve the problem. Adding a two or more section boom can further the portablilty fo the antenna making it idea for field day, camping, or travel also.

Dimensions for beams have been discussed earlier, so I won't rehash them here. The best portable and quickest for set-up is the four element VHF antenna. A two section quick clamp boom with mounting flange for a camera tripod provides the base. Each element contains two telescoping units and a snap on fitting for attachment to the boom.

The driven element has shorter telescoping units to preserve the gamma match section as one piece.

The antenna described here can be stored in a briefcase save the camera tripod. A VHF four element antenna can provide 9dB of gain for the apartment dweller.

Tape antennas on sun-film windows:

Using the tape loop, discussed earlier, I tested the antenna on two types of sun-film windows. The first was a plastic film, often used in states such as Florida. There was no significant pattern or gain change for the antenna. The second type of film is the metal film sun screen.

Results here were dramatic. The pattern was severely disrupted as well as SWR. Be sure that your window films are not the metalic type if you plan to use indoor VHF/UHF antennas pointed out the window. The metalic film acts like a reflector to the signal. Attenuation is a strong factor concerning propagation. Some plastic films appear metalic, but may not be.

Tape antennas on screened windows:

There are a three types of screen used as screening for windows. Plastic, fiber, and metal. The first two show some attenuation of the gain and pattern shape is similarly effected. Basically, the addition of the screen frame effect the VHF spectrum greater than the UHF spectrum.
The screen frame size is near the size of VHF loops at frequency.

Metal screen acts similar to metalic film with greater effect. Using the top portion of the window is the best bet unless you don't have windows like the type used in the Northern States.

SUBJECT: Log Periodic Dipole Array (LPDA) Design

This antenna was designed to operate from 13.8 MHz to 28.8 MHz. The antenna was to cover the majority of the USAF MARS frequencies yet give the operator a smaller log periodic than the commercial types, that had reasonable gain, and was cost effective to build. All design formulas are taken from the ARRL Antenna Manual.

The antenna did not turn out as planned. The frequency range actually went from 13.5 MHz to 29.5 MHz with SWR less than 1.8:1. Most SWR readings were less than 1.5:1 across the band. The weight was a surprize also. I expected 100 pounds plus, but actually was under 63 pounds.

SPECIFICATIONS:

```
Boom: 22-ft, 3-in diameter, aluminum.
Number of Elements: 10
Feed: Balanced
BALUN: 4:1
Weight: 62-lb
Windload: near 9 sq.ft.
Cost: About $200.00  Note: $150 for element insulators from HY-Gain.
                           $50 for misc. Tubing, boom, etc from
                            old antennas discarded by fellow hams,
                            CBers, and field day.
Time: 80-hrs, including install.
Design Bandwidth: 13.8 MHz to 28.8 MHz
Actual Bandwidth: 13.5 MHz to 29.5 MHz*, Highest my TS-430S would go.
SWR MAX: 2.1:1
SWR AVE: 1.4:1
SWR LOW: 1.1:1, all taken on an MFJ-986 Differential-T Tuner/SWR/PWR
                meter.
EST GAIN: 6dB
PWR Handling: Max Legal.
```

```
Turning radius: same as 20m, 3 element Yagi
Height off the ground: 35-ft minimum for best results
                       (half wave at 14 MHz).

ELEMENTS: (Half element lengths given and quantity)
          Note: Elements start at rear, longest first.

     L10: (492/13.8)/2 = 17.826-ft, quantity (2)
     L09: L10 * 0.9 =    16.043-ft, quantity (2)
     L08: L09 * 0.9 =    14.439-ft, quantity (2)
     L07: L08 * 0.9 =    12.995-ft, quantity (2)
     L06: L07 * 0.9 =    11.696-ft, quantity (2)
     L05: L06 * 0.9 =    10.526-ft, quantity (2)
     L04: L05 * 0.9 =     9.473-ft, qauntity (2)
     L03: L04 * 0.9 =     8.526-ft, quantity (2)
     L02: L03 * 0.9 =     7.673-ft, quantity (2)
     L01: L02 * 0.9 =     6.906-ft, quantity (2)

ELEMENT SPACING: d(L10-L09) = 2*(.5(L10 - L09) cot(0.5 * apex angle))
                 The cot(0.5 * apex angle) = 2.
                 Thus: d(L10-L09) = (L10 - L09)*2
                 AND: d(L09-L08) = d(L10-L09) * 0.9

     d(L10-L09) = 3.566-ft
     d(L09-L08) = 3.209-ft
     d(L08-L07) = 2.888-ft
     d(L07-L06) = 2.599-ft
     d(L06-L05) = 2.339-ft
     d(L05-L04) = 2.105-ft
     d(L04-L03) = 1.895-ft
     d(L03-L02) = 1.706-ft
     d(L02-L01) = 1.535-ft

     0.5 * Apex angle: 26.565
     cot(0.5 * apex angle): 2
```

Further detail is given in the ARRL Antenna Book under Log Periodic Dipole Array.

```
Mounting: 1/4-in aluminum plate 10-in X 10-in
          (4) U-bolts to fit 3-in boom & mast
          1/2-in stainless steel bolt, spacers, lockwashers and nuts.
```

```
             ---------------------------------
             |                               |
             |        0              0       |
             |                               |
             |   0                       0   |
-----------------|-----------------------|--------------------------
                 |            0          |
-----------------|-----------------------|--------------------------
             |   0                       0   |
             |                               |
             |        0              0       |
             |                               |
             ---------------------------------
```

Bolt through center allows for pivoting of mast for element placement or repair.

Bolt configuration: Nut-L.Washer-Washer-Boom-Washer-Nut-Washer-Plate-Nut

Author's Notes:

I would first like to point out that I am an aluminum tubing pack rat. I have had enough antenna parts to build a set of three element yagis for our team on field day. Antenna tubing is fairly easy to come by if you take the time to hunt it out. Many hams have tubing they are begging to get rid of. There are hams that become SKs and the widow would be more than happy to have you remove the antennas. There are beams that have taken a dive during a wind storm or some that have been replaced because of bad traps or corrosion.

Much of the tubing I have is old. It can be restored to near new condition with the wire wheel on a workbench grinder. This is probably the single factor in which I was able to build this LPDA for under $200. Tubing is expensive and prices vary from state to state. You can beat the system by scrounging the tubing and reconditioning it.

The insulators can be procured from Telex/HY-GAIN at $15 each plus shipping. Anything else can be procured from True Value or Ace hardware. Use Stainless Steel hardware for everything you do. It's more expensive, but saves you in the long run.

Back to the antenna...

I have watched the SWR readings and made notes of some of the propagation features of the antenna.

The antenna's orginal design came from an older ARRL Antenna book and the ARRL Handbook (87). Evidently the design has been around since dirt was invented.

To date, the SWR has had minor changes, some for the better and some worse. There are no SWR readings above 1.8:1 and that is one feature that has not changed. Most of the other changes, in SWR, have had little or no impact on the operation. These changes may be the result of temperature changes as we have had readings in the forties here on occation.

Front to Back notes: The LPDA does not have the FB ratio that a good yagi does towards the bottom of its range, but at high end, the LPDA runs rings around the yagi.

Reception: I've run yagis here for years and I can honestly say that the LPDA 'hears' better due to the capture area of the antenna.

Transmission: With the low SWR across the HF Band, the LPDA works well with or without a tuner. Since I operate MARS Phone Patching for the USAF, I have had numerous oportunities to query operators in South America and the US. All report that the signal is as good as the three element monoband yagi I used before. These operations take place above the 20m band but below the 17m band. When operations take place on bands above 20m, the LPDA shows improvement in gain.

Weathering: The LPDA has been subjected to wind gusts of 50 mph plus with no ill effects. The LPDA is however a great haven for the many birds we have here in Florida. I believe they have a Bar & Grill up there. At one time, there were no less than 63 birds on the antenna. After a quick carrier, there were zero. Lucky for them, they do not roost up there at night. My phone patching output is the legal limit.

Overall, the LPDA is the antenna for me. The design was the hardest and even that can be done with a handheld calcuator and the text in the handbook. Previous postings provide the reader with all the precut values needed for operation from 13.5 to 29.5. The 22-ft boom is about the same size as a 20m monobander. If you can put up a 20m monoband yagi, then you can put up a LPDA. No traps, coils, or power limitation except the balun.

SUBJECT: Tape Antennas

Thanks goes to Jim Grubs for the idea.

Tape antennas seem to be an interesting way for apartment dwellers, travelers, and others who need a quick antenna that can be used locally.

For these experiments I used copper tape, 1/2-in wide for my tests.
The following antenna types were tested:

- J-Pole
- Half-wave Dipole
- Full-wave Loop

Tape antennas are not new. I haven't seen much about tape antennas with the exception of SAREX, used aboard the Shuttle. Even this antenna was quasi-tape-type.

In general, the tape antennas had some interesting propagation results due to the location of testing. Locally, the antenna is excellent.
Within a mile or two, the antenna works as well as an outside antenna. But, due to the single floor building I work in these results may be better if the antenna was located on a higher floor.

Propagation outside the local area was a function of which way the window faces. Generally, the antenna pattern was not omni, but rather an attenuated omni pattern to the side where the building faces.

```
       Figure 1:  Signal levels in dBm.

 -21           -20        -17     1      12     16          18


 -21                                                              21
                       ------------
                       |          |
 -22                   |          |                                 23
                       |          |X
                       |          |                                 24
                       |          |
                       |          |                                 22
 -21                   ------------

                                                              19

-22          -19          -16         2        11          17
```

These were the results of the Half-wave Dipole. Input level was 30dBm, CW, at 145 MHz. I hope FIDO didn't screw up the picture. The distance from the building was taken at 100 meters using an EMC testing dipole and an HP-8562 spectrum analyzer. Coax was a 72" section of Adams-Russell 1999-0072 with precision 'N' connectors.

All readings were taken at ground level (standing there normally).
The transmitter was placed in a window at 4-ft off the ground at the feed.

Further results will be posted after I finish testing a few other designs.

SUBJECT: Tower modifications for redistributing antenna windloads.

Many Amateur Radio Operators are restricted to a maximum size antenna because of the limitations their towers have. The windload rating can cut a dream antenna in half because the tower is rated for something about the size of a ten meter beam. But, that's all you can afford so you take your lumps and settle for something less than you wanted. I had that problem and decided to do something about it.

- I could purchase a larger tower (BTW I finally had one given to me. It's still in the back yard).

- Find a way to get the weight off the tower and on the ground (Put the dynimite away!).

Looking at the lastest ads, then looking in my wallet, then at my wife and kids, then again at my 9-in triangular crank up and 22-ft beam, then back at my wife, I decided to to the latter of the two (gulp).

How in the world was I going to relieve the weight from the tower and still keep my beam up at the same height? That 9-in trangular crank-up wasn't going to cut it in heavy winds. It was an accident waiting to happen. At that point I was working on my "I need a better tower" speech to my wife and remembered some of my statics and dynamics from college.

I checked on a couple of examples in the book and found that my idea would work. The solution? A drive shaft/bearing modification. With the rotor moved to base of the tower and a vertical bearing set situated just above the rotor. The rotor would have no downward thrust upon it. All it would have to do is turn the shaft. The bearings turned out to be easier then planned. Edmond Scientific Catalog had Lazy-Susan bearing sets for sale. I purchased the 1000-lb table type for about $6.50 each. After packing them in grease, I was ready to install them. The drive shaft can be a pair of push-up masts for crank-up towers or water pipe for fixed towers. The shaft is guyed within the tower by PVC tubing. Each tube is about 2-3 feet in length and I used three per forty feet. The shaft pokes out the top for antenna mounting. In my case, two sections of the push-up mast poked out the top allowing me to work and mount a few VHF/UHF antennas.

Here's the basic set-up:

```
         =================== 2m beam
                  ||
                  ||
======================================= HF beam
                  ||
                  ||
                 |||| - PVC tubing over shaft inside tower
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 ||||
                 |BB| - Bearing
                 ||||
                 |RR| - Rotor location
          -------|--|--------
```

- The rotor only turns the shaft - no weight on the rotor.
- The vertical weight is transformed to the bearing near the bottom.
- The weight of the antennas are on the shaft instead of the tower.
- The towers sole purpose is to guy the shaft and the forces directed to the tower are distributed along the tower's length.

This system has been working here for over two years.

SUBJECT: Towers, part two

Towers are an interesting subject where antennas are concerned. We have the commercial types which can cost you a bundle. Then there are the cheap-o second (fifth) hand towers older than most hams, that we buy which, at best, offer a shakey support if not reworked properly.

Antenna supports come in various flavors from trees, to push-up masts, to full blown, motorized, telescoping, hundred footers capable of leaping tall buildings in a single bound. All are good depending on what you use them for. A tower rated for 10 sq.ft windload should be adhered to order to save your equipment. An antenna and rotor system mounted on top of a a tower can put a heavy torque (twisting action) on the tower. Some towers and masts can not take that torque and they crumble. There are ways to by-pass that problem and they will be discussed later.

Guy lines can be a pain in the butt also. Metal guys can play havoc with various bands and ropes stretch. These will be looked into also.

I reposted my first tower article based on some problems I have had here. I won't be able to cover everything but I have a few friends that have some interesting towers that I will share with you.

AREAS TO BE COVERED:

- Trees
- Wooden towers
- Push-up masts
- Tubular towers
- Small Steel Crank-ups (7 & 9-in tri-angulars)
- Rohns
- Commercial Grade
- Monster Crank-ups
- Roof mounts
- Tilt-overs
- Trouble spots

SUBJECT: Tower Series, part 3

TREES: Trees have been used as antenna supports for years. There are some problems though. Trees grow, they have leaves or needles, they sway and are probably the greatest target for lightning than any man made device.

I have used trees for an antenna support many times. In my CB days, I cut the top off an oak tree in Connecticut, thrirty-five feet up, and used chimney straps to hold a mast for a 'Starduster' quarter wave antenna.

Here in Florida, I use a palm and a sycamore for a DX-A (40, 80, & 160) and the same sycamore and a small maple for my 40 IVee. Both are fed from my tower. I have a pulley system to raise the antenna I need for specific operations.

```
                  * sycamore


------------------------------------------
|                                        |
|                                        |
|                                        |
|                                        |X tower
|                                        |
|---------------------|                  |
                      |                  |
                      |------------------|
     * palm
                                            * maple
<--------North
```

Trees must be cared for when attaching support lines. Too tight and you can strangle the branch or worse, the tree. Never use a dead tree. They're an accident in the making.

Beams in trees are not a good idea. Getting them up there is a pain in the butt to say the least save a crane. Constant upward growth interfers with the pattern and the ability to turn them thus requiring pruning. Pray you don't have a problem like bad SWR, bent elements, or a water soaked trap.

I would suggest keeping trees for verticals or tie off points.

WOODEN TOWERS: These can be interesting. They are heavy, can rot, and don't stand much for the weather. Wooden towers are subject to many enemies such as bugs, birds, and rain. The sun can dry on out in two seasons. A wooden tower creaking in a 50 mph storm can give an amateur nightmares. They are expensive to build with todays pricing on wood.

Simple fold-over wooden towers such as a flagpole design, can be done if the materials are availble at a resonable price.

```
  ||
  ||
  ||
  ||
  ||
  ||
  ||
  ||
||||||<--- pivot point
||||||
||||||
||||||<--- Locking pin (bolt)
||  ||
||  ||
```

This set up can be done in a day with the right materials. The main pole can be pulled up with a pick-up or car. A stop bar is recommended so you don't pull the main section over with the vehicle. Place the stop bar just above the locking pin and bolt it into the main section but not the supports. It also can be cranked up with a boat winch from the bottom.

SUBJECT: Tower Series, part 4

PUSH_UP MASTS: This is an inexpensive way to raise small HF beams, HF verticals and HF wire antennas. It is also a good support for VHF and UHF beams and omnis. The best push-up mast I've found for the money is the mast sold by Radio Shack. They may sell different brands of masts around the country, but the ones in Florida are excellent. The masts come with guy tie-off points at each section, cotter pin holes (change the pins out for bolts) and hand operated locking screws.

Some of the good points are cost, ease of installation, easy care, and easy transport. They also make good tower drive-shafts.

Some bad points, they can fold over in a storm with a beam on board, they are good lightning rods, once kinked, they're not worth a plug nickel.

Overall, the push-up mast has probably made it to more field days than any other type of transported support in the history of ham radio. It's a good support that will last many years and serve the amateur well.

TUBULAR TOWERS: You have seen these advertised in many Amateur Radio magazines. They are expensive, especially when a motor drive is added. I know of only one person that owns one of these types and he enjoys it. The tower has some good points as related to me. It's eye appealing to the neighbors, easy to operate, and good for storing the antenna at low heights when not used. It does however require some maintenance and TLC. You can't neglect them or they'll pay you back in spades.

SUBJECT: Towers, part 5

SMALL STEEL CRANK-UPS: I own one of these babys. The tower has two sections, each nineteen feet six inches. The base section is nine inch triangular, while the upper section is seven inch triangular. The upper section is rasied and lowered with a small boat winch.

The tower is a lay-over design, hinged at the bottom. Since I have another 18 foot, 15 inch triangular tower beside it that is used as a work stand, I have a second boat winch and pulley system to lay the crank-up over on it's side.

These towers are stronger than they appear and can raise a large beam to a height of 35 feet safely. To add to that strength, a push-up mast drive-shaft configuration was added to the tower, transforming the weight of the antenna to the base. The rotor is located beneath the tower, as well as a set of vertical bearings (1000-lb lazy susan bearings), in a two foot high steel stand. There is no weight on the rotor.

There are other configurations to consider. Small Steel crank-ups would be excellent for VHF/UHF antennas with the rotor mount on top of the tower. They are excellent supports for wire antennas and verticals.

Some of the draw-backs are:

- They are made from steel and are heavy.
- They rust.
- They require yearly refurbs.

ROHNS: These are probably the most common type of antenna tower used by hams today for QTH set-ups. The ROHN name is actually a company which to my surprize, many hams didn't know. I got a good laugh when a third ham told me it was a type of antenna and not a company. Oh well.

The Rohn tower sections are easy to install but have some draw-backs. They should be greased where they meet. Stainless bolts and nuts are a must. And the tower needs guying past two sections with anything larger than a VHF beam.

A good base is needed for proper support as in any tower and a lay-over hinge is recommended. Two adults can set-up a four section hinged tower in minutes (KB4DCZ & KB4YLY) with guy wires.

The Rohn tower is excellent for shaft-drives as the push-up mast can be replaced with 2-in standard pipe. The Rohn sections come various flavors and can meet most hams needs. Many of these sections can be purchased at local hamfests or you can buy new.

Rohn is the way to go for a first tower.

SUBJECT: Towers, part 6

Commercial grade: There is only one bad point to these type towers and that is the cost of a new one. If you can get a commercial grade tower for your ham antennas at a cheap price, by all means get it.

Many of the Ham towers available on the market today are commercial grade also. And the price reflects it. They are built to last. The base is the most important part of the tower. With a commercial grade tower, be sure to follow all base construction designs to the letter and use the proper hardware.

Monster Crank-ups: The monster crank-up is a ham's dream. Many come with motors to do all the work for you. I talking about the 80, 100, and 120-ft plus models. Awsome is the only word I can think off that fits these towers. Many are self-supporting and can handle beams that would make you drool. For ten grand you can have a 90 footer with motor control, a top notch rotor, and a killer antenna to boot. If you have the money, go for it.

Like all crank-ups, they require maintenance. TLC is the biggest problem with this type of tower. Cables need to be looked at weekly, rollers and pulleys need to be looked over and greased, and if you have a motor on it, that too needs to be kept up. The joys of one are outstanding in DX reports and the ability to lower the antenna during bad weather.

SUBJECT: Towers, part 7

Roof Mounts: There are a few commercial roof mounts available to the amateur. Roof mounts have a few advantages over towers. They are cheaper, they start from 15 to 30 feet off the ground, and the access is easy as walking on the roof.

The disadvantages are the holes in the roof, loading, and lightning protection.

Roof mounting is easy to install verses a tower. Your antenna weight must be restricted in accordance to your home's roof. BEWARE, do not overload the roof! The results are very expensive when the roof mount, antenna, and rotor take a dive in a storm.

Be sure to properly ground a roof mount with the most direct path possible and be sure to properly waterproof the mounting holes in the roof.

Tiltovers: This type of tower is becoming rare, but provides the amateur with the most convience of all the towers given the room to tilt one over. The tower can bring the antenna to you rather than climbing the tower or trying to perform on a ladder with a crank-up in the down position.

I only know a couple of hams with tiltovers and I can say they operate quite well with little maintenance.

SUBJECT: Towers, part 8

Trouble Spots: Towers can present many problems to the amateur radio operator. There are some points to consider when installing a tower that can save you trouble later.

Site location is probably the single most important factor for a tower.
The base must be analyzed completely. Soil conditions, ground water level, seepage, etc must be taken into account. I mistake I made was placing my tower next to the house. In Florida, most homes have an overhang instead of gutters. The rain ran off the roof and ate the ground around my tower. I discover that the tower had tilted almost 15 degrees. While the earth was still moist, I used my pick-up to straighten the tower and then tied it off. After the ground dried, I poured in another 500-lb of concrete to enforce the base. It's been standing on it's own now for five years.

A friend of mine had a beautiful tilt over tower. It worked well until the sapplings his wife planted grew up into full trees. He did not have to tilt the tower over for nearly five years, but when he had too, it was a no-go situation. The trees blocked the tower. Much to his wife's dismay, the trees were removed.

Power lines are a hazzard. Calculate the worst case event, a tower crashing to the ground, and look at what it may strike.

Sometimes the placement of the tower is dictated by surroundings and pitfalls can not be avoided. The current tower I am running is a crank-up base tiltover tower. By itself the tower tilts over nicely, but with an antenna, my neighbors fence restricts how far it can go.

Placement of a ground rod in the center of the base foundation, will save a lot of time and provide a good ground for the tower and antennas.

A protective locking cage around the base will keep the kids off the tower and save you from a law suit.

Drive shafts save much wear and tear on a tower. Do not overload the tower with more than it can handle, especially if your rotor is located on the top.

Never climb a crank-up.

Always use a safety belt when climbing.

SUBJECT: VHF & UHF Hidden antennas for PUDs/Condos/Apartments

These antennas are much easier to hide because of their size.
I'll get into some high level design concepts here and expound on them later.

I'll be discussing the following antennas:

- Stealth Verticals
- Stealth Beams
- Indoor Antennas
- Indoor/Outdoor use of Mobile Antennas
- Field Day / Portable

Stealth Verticals:
This type of VHF / UHF antenna is very popular with amateurs. The are easy to build and install. Many commercial antennas are available, but for the dollar, an amateur can build a superior VHF or UHF antenna for the base or mobile use. For the PUD/Condo/Apartment user, even a simple vertical can be a major problem to install. Location in an apartment may be one of the biggest problems facing an amateur when antennas are prohibited.

There are large multi-element verticals on the market such as Comet and Diamond. The size of these antennas makes these a bit more difficult to install. There are other homebrew antennas that can be installed however.
These antennas will be discussed here.

J-Pole
The J-Pole is an exceptionally good antenna and easy to build if the directions in the ARRL handbook are followed correctly. One modification I recomend for the J-Pole is to solder the tuning connections after the SWR is set. This allows for 'no maintenance' on the J-pole and no surprizes with SWR changes due to corrosion.

1/4, 1/2, 3/4 wave ground planes
These ground planes offer unity, 2dB, and 3dB respecfully. These antennas do not need coils or tuning circuits to accomplish their action.

Discones
This antenna can be homebrewed or bought commercially. The discone is an excellent antenna, but has it's drawbacks in hiding. The antenna has unity gain and can be used on multiple bands.

Vertical Dipole
This antenna can be put together in various configurations with various matching devices. The dipole is a halfwave.

Full Wave Loop
This antenna can be configured to vertical polarization. It is not omni, but exhibits good gain in a bidirectional pattern.

There are many more antennas that exist. Some are larger, some don't have the bandwidth, and still others require coils & capacitors to make them work. The aboved mentioned antennas are easy to homebrew and make for good antennas that can be used by PUD / Condo / Apartment dwellers. All the above antennas are in the ARRL antenna book. The design and construction of these antennas is easy if the directions are followed in the book. What I intend to accomplish here is placing the antennas such that they go unseen by all.

INSTALLATION OUTSIDE

Let's look at the first one: The J-Pole. Gain wise, this antenna does not have a lot of gain on transmit, but the antenna has an easy 3dB gain on receive. If you make your J-Pole from brass rod or like material, placement of the antenna should be accomplished fairly easy. You should remember not to install the antenna near other metal objects or fixtures. Give it about three feet of room from conducting surfaces.

The best hidden J-Pole I've seen was painted to match the chimney brick work. Everything that went with the antenna was matched to the chimney. The coax was painted to match not only the chimney, but the roof and then the paint color on the side of this PUD home. The J-Pole was bent to the contours of the brickwork and masonery. The amateur installed the antenna under the cover of cleaning and repairing the chimney. His plan worked well.

Another J-Pole I've (almost) seen was mounted to side of a tree at thirty feet. It too was painted to match the bark of the tree.

I designed and built a J-Pole for a friend that looked and matched the foliage of a white pine. I used artificial plastic Christmas tree elements to match a branch on the pine tree. If you didn't see where it was installed, you couldn't tell it from the rest of the tree.

Another design was mounted to a swing out arm which was installed under a window sill at thirty feet. The Ham painted the J-Pole to match the natural wood finish on the condo. At night, he would swing the J-Pole out from the window and talk on the local repeaters. The dark color of the J-Pole, helped the amateur, by blending the antenna against the night sky.

INSTALLATION OUTSIDE

Next, I'll discuss the 1/4, 1/2, 3/4 wave ground planes. These antennas have various gains, but all have one thing in common. Each antenna requires no tuning or matching elements. Like the 1/4 wave, the 1/2 and 3/4 wave antennas are built in the same manor except the vertical element is either 1/2 or 3/4 wave. The Quarter wave 2m antenna can be cut so that it is a 3/4 antenna on the 440-450 MHz band. Thus, a dual band antenna. A 1/4 wave on 222-225 MHz can be cut for a half wave on 440-450 MHz, another dual bander. These dual band antennas will not have the complete range over the secondary band, but will give a piece of it at low SWR.

Each antenna will cover the entire primary band it was cut for. I use brass rod for my ground planes. They do not rust and solder easy with a good soldering iron.

Hiding these antenna takes a little more foresight. The ground plane shape tends to make the posibilities of a good hiding spot a bit less. But the thin material tends good for trees. They can be hidden as part of the tree with plastic leaves and a blending color paint job. Their size is a good contributing factor. UHF vertical ground planes (VGP) tend to hide themselves.
A UHF 1/4 wave VGP is a mere 9 inches from the base of the ground plane to the tip of the vertical element. I wouldn't leave them out in the open, but little will have to be done to hide one of these UHF VGPs.

Discones have been used outside in restricted areas. Hiding one can present a problem because of the dimentions. I would suggest using these antennas indoors and will discuss them later.

The Vertical Dipole is an easy antenna to hide. The shape is easy to bend in with surrounding objects and matching can be accomplished by many means as listed in the ARRL antenna handbook. My favorite is the gamma match.

I would recommend this for the 2m and 1.25m antennas. At this point, I must say the gamma match works fine, but at UHF frequencies, a Tee match is better. The gamma tend to loose the bandwidth required up on the 440-450 MHz band.

It can be hidden in the same manner as the J-Pole.

The Full Wave Loop is another favorite. Although this antenna has the best gain of the previously mentioned antennas, it can present a problem in band width and placement. When palced against a building, the SWR goes up. Cutting and tuning a loop to a band may also present some problems. The bandwidth of a loop may not cover all the frequencies desired if operating the repeaters.

The circular loop is the best, followed by the square loop. Triangular loops work well also. The area enclosed by the loop is the main facter in approaching the 50 ohm impeadance required by amateur radio gear today.
Please keep that in mind. Geometric shapes in a natural setting tend to 'stick out' to the human eye. Hiding the antenna will require a crafty plan on the part of the amateur. The bidirectional pattern from the loop my hinder the placement if a specific direction is required. Remember the chimney? Good place to start.

Enough for now. Next, I will discuss the VHF/UHF hidden beam antenna.
I have not discussed 6m, 33cm, or 23cm antennas, but the same application holds.

Here's some info on 1/4, 1/2, and 3/4 wave lengths for the bands 6m, 2m, 1.25m, 70cm, 33cm, & 23cm to give you an idea on the size of the antennas you will be dealing with. The formula use does not always relfect the exact length of the antennas involed, but is to be used for sizing only.

```
       1/4     1/2     3/4         f
------------------------------------------
 6m  | 4.73'   9.46'   14.19' @   52.0 MHz
 2m  | 1.68'   3.37'   5.05'  @  146.0 MHz
1.25m| 1.1'    2.2'    3.3'   @  223.5 MHz
70cm | 0.55'   1.1'    1.65'  @  445.0 MHz
33cm | 0.27'   0.54'   0.806' @  915.0 MHz
23cm | 0.194'  0.387'  0.581' @ 1270.0 MHz
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SUBJECT: VHF/UHF stealth beam antennas

Let's look at a couple of points here first. From my last posting, the relative sizes of the different antennas show that hiding a 6m antenna can be a lot more difficult than hiding a 70cm antenna.

6m beams can be large and hard to explain as a TV antenna. Many PUDs/Condos/ Apartments do not permit TV antennas at all.

For places that allow TV antennas, I have some tricks that you can do inorder to play on the bands. These tricks will be discussed later.

Beams are a necessity in some locations. The gain achieved on a beam can mean the difference between getting in the repeater, digi-node, making a simplex or SSB contact. The easiest installation would be in an attic, but most hams can figure that out.

Unless you only require a fixed position, a beam will require a rotor to fully utilize the quality the a beam can provide. Beams are generally single band antennas when used above 10m. I would recommend a log periodic for use on the VHF/UHF frequencies to provide the ham with multi-band operations.

There are some problem that must be addressed when working with beams.
First, different polarities are required for different operations. FM and packet use vertical while SSB and CW require horizontal. Space communications requires a combination of the two or circular polarization.

Second, hiding a beam and it's associated support equipment can be a pain in the butt when the QTH says no antennas. Anything that must rotate is going to draw attention. Fixed beams can be hidden. Rotating beams are going to require a bit more.

Remember that size plays a big point when stealth is employed. I'll look at the 2m beam for the examples here and the relation can be applied to the other bands.

Horizontal operation: This is the easiest beam to hide. Be sure you know all the rules of your association or apartment before attempting to install a beam. The beam, because of it's polarity, is flat. It can be passed off as a TV antenna for a specific channel. Most people wouldn't know the difference. The outside installation can be accomplished with the basic TV installation. By adding a second rotor, such as an elevation rotor, both vertical and horizontal polarization can be accomplished.
I recommend the vertical operation for night time use only. It eliminates the question; "Why is your TV antenna like that?"

<u>Stealth operation:</u>
You may not be able to put up a TV antenna and must totally hide the beam. Attics are an easy hiding place. Upper rooms are good too. Telescoping elements for portable operation work well. I would like to relate some unique installations to overcome the no antenna rules.

This Amateur had a bad time trying to locate any antenna at his dwelling. He lives in an apartment complex. His apartment is on the inside, second floor, of a four story apartment building that is shaped into a large rectangle.

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|      |                       |     |
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|      |                       |     |
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|                 X                  |
|                                    |
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The X indicates where the apartment is located. There is an apartment on the outside of his. Like I mentioned, he was on the second of four floors. No antennas are allowed outside the apartment. He had a couple of options. One, he could move, but funds weren't there. Two, he could use his noodle to figure out how to beat the system.

This ham enjoys UHF operations from 440-450. He also works 2m packet from time to time. Most people would stick to stamp collecting at this point.

There are additional problems facing this ham. Windows on the upper floors would expose him to masts, cables and devices to raise or lower his antennas. On top of that, the roof of the building is steeply sloped. Mounting anything up there, let alone getting up there was a problem.

A steeply sloped roof means a large attic. The ham in question is an electrician, by trade, and was employed by the owners of the building to rewire part of the top floor hallway lighting. The job was to take place in a weeks time. It was all the time he required to assemble a set of beams, with rotor control. The coax and control cables were to be run down next to the electrical conduit into his apartment. He purchased two beams, a 2m and a 70cm, to facilitate his requirements. A TV rotor was employed to rotate the set and the antennas were mounted side by side. The 2m beam was a simple four element model and the 70cm model was an eleven element model. In addition to the beams, he also installed two omni directional antennas. The total set was mounted to a short mast and base. It took a mere two hours to assemble the system and one hour extra to run the cables. He was in business. He mounted the system over a stairwell and service closet. He also mounted the base over a foam pad to inhibit the rotor noise. This ham is in the Central Florida area. He is a Technician Class operator and has been operating this way for over three years now.

This is an example of fixed beam installation:

This ham lives in a condo complex south of a large city. No antennas are allowed. His unit is on the second floor of a two floor unit. This ham enjoys 2m SSB. Since he owns the condo, this ham was able to modify the roof of his screened in porch to accommodate a unique masting system that can be raised and lowered from inside the porch. He employed a three section mast made from aluminum tubing. The eleven element 2m beam was fitted with rubber feet under all the elements and the boom. After that, the beam was painted a dark flat grey to blend in with the night sky, even under full moon conditions. The upper mast sections were also painted in the same manner. During the daylight hours, the beam was lowered against the aluminum roof and was well out of sight from the neighbors. At night, the beam was raised enough to clear the top of his roof.

Raising the antenna mast took a bit of planning. The roof of the porch was 7'6" above the deck. A pulley system, similar to a patio umbrella device was employed to raise the mast sections. The mast was placed in the center of the roof and a table supported the base. A plastic vine type plant was used to disguise the bottom section along with a planter to finish off the stealth set-up. The coax was run to the planter and then connected to another coax when it was to be used. The ham in question has been operating this way for a few years with good success.

The installation of a beam requires thought and planning. I can not give plans for every installation. This is mostly dependent on the amateur. But these ideas may give you some ideas on how to beat the rules and enjoy your hobby.

SUBJECT: Vertical Beams on VHF and the effect of metal masts
on propagation patterns, gain, and bandwidth (part one).

I have complied some information on vertical beams used in VHF communications. Yagis were used for this test. This information was taken from studies done at the Kennedy Space Center from 1982 thru 1988 and from 1990 thru 1991. Also, the studies include information gathered here, at my QTH, field day 89, 90, & 91, and other amateur stations from 1987 thru 1991.

These studies include the effects of metal support masts to the boom of the beam, past the boom of the beam, and short of the boom by a wave length with a non-conductive support, towers near the antenna, VHF beams above horizontal antennas, below horizontal antennas, side mounted beams, and the effects of metal guys encompassing the beams.

In part one of this series, the discussion will cover the first three studies.

*** VHF beam antennas and metal support masts ***

Metal masting past the beam: (metal mast at earth ground)

```
Figure one->                  || <--  Metal Mast
                              ||
                              ||
                              ||
             |    |    |    | || |   |   |   |   |
             |    |    |    | || |   |   |   |   |
             |----|----|----|-[]-|---|---|---|---| <-- VHF Yagi
             |    |    |    | || |   |   |   |   |
             |    |    |    | || |   |   |   |   |
             R    DE   D1   D2|| D3  D4  D5  D6  D7
                              ||
                              ||

     Testing: Yagi antenna pattern and gain over a vertical
              dipole at the same frequency.

Figure two->
             R                                   D7
             |    |    |    |    |   |   |   |   |
             |    |    |    |    |   |   |   |   |
             |----|----|----|-[]-|---|---|---|---| <-- VHF Yagi
             |    |    |    | || |   |   |   |   |
             |    |    |    | || |   |   |   |   |
                              ||
                              ||
                              || <-- Metal Mast at earth ground


     Testing: Same as in Figure one.

Figure three->
             R                                   D7
             |    |    |    |    |   |   |   |   |
             |    |    |    |    |   |   |   |   |
             |----|----|----|-[]-|---|---|---|---| <-- VHF Yagi
             |    |    |    | !! |   |   |   |   |
             |    |    |    | !! |   |   |   |   |
                              !!
                              !!
                              !!
                              !! <-- Non-conductive mast (PVC)
                              !!
                              !!
                              !!
                              !!
                              ||
                              || <-- Metal Mast at earth ground

     Testing: Same as in Figure one.
```

Results of testing from test set-ups in figures one, two, and three:

<u>1) Figure one results:</u>

- Pattern is mis-shaped, forward lobe is divided and severely distorted. Side lobes are enhanced, back lobe is enhanced, but contains three distinctive lobes.

- Gain over a vertical dipole is 2dB at the lowest central point of the forward lobes, gain is 3.7dB at the highest points of the forward lobes which are at 59 and 124 degrees respectfully from a 90 degree center lobe location. Best gain is to the back center lob at 177 degrees, 5.3 dB.

2) Figure two results:

- Pattern appears near normal with some distortion to the forward lobe.

- Gain over a vertical dipole is 10.2dB at the peak of the central forward lobe which is located at 93 degrees.

3) Figure three results:

- Pattern shows near typical to standard patterns with better shaping than both previous tests.

- Gain over a vertical dipole is 10.9dB at the peak of the central forward lobe which is located at 89.5 degrees.

In each case, the same dipoles, coax, signal, and yagi were used for testing purposes. The distance between the dipole and yagi was 100-ft.
Height off the ground was 20-ft to the antenna feed. Signal was 10mW at 146 MHz CW.

Clearly, this test shows that mounting your yagi mid-mast is not an effective way to achieve the desired results of the yagi. Mounting the beam on top of the mast achieves near commercial results while the insulated mast achieves the best results for performance from the antenna. The discussion will continue, in part two, to elaborate on the effects of figure two vs figure three with a grounding wire.

This test was conducted at the Kennedy Space Center, Spring of 91 using the KB4YLY gamma modification to the yagi and dipoles. All test equipment used was by Hewlett-Packard.

These tests were incorporated into antennas and antenna systems at the Kennedy Space Center and are presented here for public information.

SUBJECT: Vertical Beams on VHF and the effect of metal masts on propagation patterns, gain, and bandwidth (part two).

TOWERS AND THEIR EFFECT ON VHF BEAMS

Towers have a dramatic effect on VHF beam patterns. Many hams mount their VHF beams on separate masts or towers next to their main tower. Many hams also mount their VHF beams on arms extending from the tower.

The tower poses an eclipsing effect on the VHF beam's pattern.
The pattern is attenuated sharply by the tower, especially when the beam is pointed at the tower. This is fairly obvious. The attenuation is greater the closer the beam is placed to the tower.

This does not cover end mounted beams which actually use the tower or mast in their pattern. When a VHF beam is placed to the side of a tower, the area of the beam's forward lobe must be taken into consideration.

figure one:

```
p                 p
 p               p
  p             p
   p     T     p
    p  T   T  p
     p       p
      p     p
       p   p
```

```
X
```

In this example, the T's represent the tower, the X represents the beam, and the p's represent the edges of the forward lobe where the left p's are the right side and the right p's are the left side of the lobe. The area between the edges, including the tower, is the high attenuation area.
The angle formed by these edges is 60 degrees for this example.

Figure two:

```
            p
             p
              p
               p     T
                p  T   T
                 P
                  p
                   p
                  \ p
p p p p p p p p p p pX
                       \
```

In this figure, the designators are the same as figure one. The beam's forward lobe is 60 degrees at the 3 dB points for this example. The minimum angle of the beam antenna, to directly pointing to the tower, is the same as the 3 dB point beam width or 60 degrees. This means that the beam has a 120 degree angle, 60 degrees either side of the tower in relation to the beam, that is an attenuation or eclipse zone.

It can be seen that the farther away the beam is from the tower the smaller the angle of attenuation is in relation to the beam. The ascii representation needs much improvement, but the point can be seen.

VHF BEAMS ABOVE AND BELOW HORIZONTAL HF BEAMS

Normally, you should place the VHF beam approximately one wave length above any HF horizontal with excellent results.
Using the information from part one, best signal propagation can be obtained.

Mounting the VHF beam below the HF horizontal beam can present problems relating to masting attenuation as stated in part one. A solution can be had though. By mounting the VHF beam offset to the mast and counter balancing the arm with another VHF antenna or weight, you can mount the VHF antenna(s) below the HF beam.

figure three:

```
-----------------------[]------------------- HF beam
                       ||
                       ||
                       || mast
                       ||
         _______       ||         |
            o----------[]---------o|  VHF beams on cross boom
                       ||         |
                       ||
                      ||||
                      |||| tower
```

This is a head on view of the configuration discussed above.

The only difficulties observed was the top heavyness of the HF beam on the extended mast (not recommended for high wind areas) and some difficulty on obtaining ducting for 2m/1.25m SSB operation. This is dependent on the proximity of the Horizontal VHF beam to the HF beam. This side mounting configuration rotates with HF beam and maintains a constant distance from the tower and HF beam.

METAL GUYS AND THEIR EFFECT ON VHF BEAMS

There is some effect on VHF beams and their proximity to metal guys. Most of the efect takes place when the beam is mounted to the side of the tower enveloped by metal guys. The effect is not significant unless the beam is close the guys.

If the VHF beam is on a rotor, make sure you have proper clearance for good rotation. Having the last element snag on the guy will send you back up the tower for adjustments. This simple step is often overlooked when installing a VHF beam in this way.

Metal guys can be a serious disaster if they become entangled on the rotatable VHF beam. Take it from experience.

SUBJECT: Wire antennas - part one

Dollar for dollar, the wire antenna is an Amateur Radio Operators best bet when it comes to inexpensive antennas. In the lower bands, 160, 80, and 40m, the wire antenna is nearly the only means for most AROs to work those bands.

Wire antennas perform from great to poor depending on many factors even when the antenna is cut for the frequency desired. I'll discuss some of my findings with wire antennas in this eight part series.
Since most of the wire antennas are published in numerous antenna books, the specifics of most wire antennas will be left to the reader to investigate for the band they wish to operate in. Instead, I will discuss some helpful hints, findings, and misgivings about wire antennas that the ARO can use in overcoming the difficulties encountered with their first wire antennas and some that the old pros may find usefull.

I will be discussing the advantages and disadvantages of wire antennas on different bands, wire diameter, ground height, matching, multi-band wire antennas, and a few other odds and ends.

First, let's look at the capture area of a wire antenna cut as a dipole. We can examine this at 10m for ease of calculations and understanding.

Many hams use a #12 or #10 wire when constructing their wire antennas. It's cheap and easy to obtain. Some wire antennas come as kits and use strained wire verses the solid conductor many hams use in their home construction. Looking at the diameter of the wire, whether strained or not, it can be easily seen that a dipole made from aluminum tubing has a greater capture area, without picking up a calculator to find out the difference.
Larger diameter elements produce greater bandwidths, thus a wire dipole on 10m would have a limited bandwidth compared to it's aluminum tubing counterpart.

How does one overcome this? Through trial and error, and a tight budget when I first got into Ham radio, I found that cutting the wire antenna slightly shorter that the designed frequency and adding some tubing to the end of the dipole, I was able to expand the bandwidth of the wire antenna upto three times the orignal value.

It doesn't take much tubing or a large diameter to accomplish this. I used two of these units (of course, one on each end). There are two parts to the extention. Use a 12-in x 1/2-in diameter tube with an 8-in x 3/8-in tube telescoping inside the former. By placing a vertical cut into the 12-in section, a clamp can be used to lock the two tubes together. Now you have tunable end pieces. Run the support rope through the tubing and attach to the wire then secure the wire to the 1/2-in end of the tubing. A good electrical contact is a must. The rope will support the tunable end piece.

The end pieces are also much greater in diameter than the wire, adding to the capture area. Also they provide a tunable method for zeroing the dipole to the frequency desired or changing the frequency of the dipole later. At 10m, I would recommend an aluminum tubing dipole and save this technique for the 30m and below antennas. For the lower frequency wire dipoles and inverted vees, the tubing can be made much longer for better results. There is a fine line between weight and performance that needs to looked into when using this method and it's a function of the antenna support and support lines.

I stumbled across this technique while putting around with a 40m inverted vee. I just could not get the bandwidth and SWR right. It was either too high for the resonate frequency or too low no matter what the calculator thought. The SWR was 2:1 and I wanted an antenna that did not require a tuner for my solid state radio. I grew tired of soldering and cutting wire and decided to add the tubing extenders.
Not only did I get the Inverted Vee on target, 7.15 MHz, but I covered the entire 40m band and the MARS frequency I was required to attend on.
The SWR was below 1.5:1 across the entire band also! :-)

It worked so well I decided to bring it to field day, 1991. The antenna worked very well and without a tuner. If you have any questions about the modification, let me know on this echo.

SUBJECT: Wire antennaas - part 2

In this posting, we'll look at long wires and random wire misconceptions.

Placing an undertermined length of wire out to a tree or support mast is **not** a long wire antenna. This is a random wire antenna which most of the amateur community calls a 'long wire' antenna. This misconception leads to many discouraging ideas about long wires. A long wire antenna is an antenna that is at least five wave lengths at the lowest frequency.
After five wave lengths, the SWR becomes insignificant to the xcvr for a properly tuned long wire.

Five wave lengths you say. Yes, five wave lengths. So, at 3.75 MHz the length of a minimum long wire would be (984/fMHz) X 5 or 1312-ft.
Not an antenna you can slap in most back yards unless you are a rancher.

When it comes to VHF and above, the longwire antenna can be easily outclassed by numerous other designs, but at low HF frequencies the other designs become too cumbersome to use and the longwire fills the niche.

Let's take a look at the random wire antenna used by so many of us hams. A tuner is a must for any work with a random wire antenna. These antennas usually consist for a wire stretched between here and there.
Dissapointed hams soon find that the easy way out isn't the answer.
That 75-ft wire is not going to get them the performance they invisioned.
Random wires are good for SWLing provided a tuner is used with the antenna.
They're cheap to construct and cheap to buy. But a 75-ft wire in a standard size lot is not much of an antenna for amateur radio use. Granted, it maybe all you can afford or be able to set-up at your QTH, but a ham can do better for transceiving.

Longwires can provide nearly 3dB of gain over a dipole at 4 wave lengths provided the antenna is sufficiently placed above the ground and the wave angle of the antenna is correct.

The formula for longwire length is:

Length in ft= 984(N-0.0250)/fMHz where N is the number of wavelengths.

The longwire is a fixed antenna, so care should be taken where the antenna is to be placed. Your favorite RF stomping grounds such as Europe or the Far East, etc should be kept in mind.

Next posting will have some additional information on longwires and other wire antennas for standard size lots.

SUBJECT: Wire antennas- part 3

In this posting I will be discussing some of the different wire antennas the we use in the amateur world.

These antennas are:

Long Wire, closing remarks.
The long wire antenna was discussed in the previous posting. I would recommend this antenna for those interested in a continued contact postion with a specific station. Long enough, the longwire can provide very good signal in the direction of the antenna for fixed communication.

Wire Dipole
Simple to make and inexpensive to buy. It's the basic design for Inverted Vee. Basically a bidirectional antenna with a balun. Antenna is null of the tips. The dipole is 2.14 dB over isotropic and is and electrical halfwave. Can be arranged vertically or horizontal. It is a linear antenna.

Inverted Vee
This antenna is a dipole with sloping elements. The antenna is omni-directional for the most part. It's overall gain is slightly less than a dipole because of the more omni pattern.

Rhombic
This is a rather large antenna. Rhombics can be various lengths total.
In the UHF range, 19 wavelengths is common. In HF, 4 and up is common. This antenna requires some land depending on the frequency. A rhombic is good to twice it's design frequency, directional, and fixed.

Terminated longwire
Requires some space, but performs well. Directional with a wider bandwidth than the longwire at shorter lengths.

Sloping Vee
Similar to the Inverted Vee, the sloping vee is semi-directional.
Easy to install, inexpensive, and easy to build.

Beverage
Good all band antenna with a tuner. Easy to build and set-up. Requires some space and not suitalbe for small lots.

Marconi
Large antenna requiring some space, but good for the lower HF bands. Semi-directional, the marconi is easy to build and cheap to construct.

Folded Marconi
Cheap and easy to install antenna. Made from 300 ribbon cable (TV). Set up in a 'hockey stick' form. Use a tuner. Works well in the 40-160 range. Requires a ground plane.

Loop
Consists of a full wave length and can be set-up horizontally or vertically polarized with the antenna in the vertical position or set-up parallel to the ground for lower frequencies.

Sloper
Common design for most hams. Antenna is a slooping dipole or sloping quarter wave. Easy to bulid and install. Semi-directional in the direction of the slope.

SUBJECT: Wire antennas - Part 4

Both of the following antennas are using 12 guage wire.

Wire Dipoles: Use the formula 468/fMHz to cut the dipole. String it up in the area you have planned. Attach your coax and a balun.
Check the SWR. If it is within your spec's it's ready to use. If not, do the following:

- Check the SWR from the bottow of the band to the top. Don't step on anyone having a QSO. Use the least amount of power to do this. I'll use 40m as an example.

7.0	1.7:1
7.05	1.8:1
7.1	2.1:1
7.15	2.2:1
7.2	2.5:1
7.25	3.0:1
7.3	3.5:1

This indicates that the antenna is too long and the resonate frequency of the antenna is below the band. This could happen because of the following:

- A thicker diameter wire was used.
- You mis-measured.
- Something near the antenna is resonating with it.
- Too low to the ground.

Solution: trim off about six inches either side and try again.

- Case two: SWR Readings;

7.0	4.0:1
7.05	3.5:1
7.1	3.3:1
7.15	3.0:1
7.2	2.4:1
7.25	2.0:1
7.3	1.8:1

This indicates the antenna is too short. "But I keep cutting off wire and it's still too short." (Raised eyebrows.)

All is not lost here. Solution: add telescoping elements to the ends.
Aluminum tubing, 3/8-in & 1/4-in dia.,secured with a screw should do the trick. 3/8-in dia. = 1-ft, 1/4-in dia. = 11-in in length.

```
             ___________________ wire attaches here
=============___________________
```

Now you can adjust the ends of the dipole until the SWR reaches the desired level at the desired frequency.

This problem can happen when the guage of wire used is smaller than the recommended size.

Remember: Thicker => shorter; Thinner => longer.

Here's some Dipole measurements for HF:

BAND	LENGTH-FT	DESIGN FREQUENCY
10m	16' 5 1/2"	28.45 MHz
12m	18' 9"	24.94 MHz
15m	21' 11 1/4"	21.335 MHz
17m	25' 10"	18.11 MHz
20m	33' 0"	14.2 MHz
30m	46' 3"	10.12 MHz
40m	65' 5"	7.15 MHz
75m	123' 2"	3.8 MHz
80m	130' 0"	3.6 MHz
160m high	240' 0"	1.95 MHz
160m low	252' 10"	1.85 MHz

SUBJECT: Wire antennas - part 5

RHOMBICS

I've talked about rhombics before and in this posting I would like to discuss the rhombic for use in the UHF range. We have hashed over rhombics in the HF range and many antenna books discuss this antennas. Most AROs don't have the room on their property or do not have property to construct a rhombic on. There seems to be very little on rhombics for UHF work.

After looking at some plans for a multi-element rombic on 70cm, I decided to modify the plans and came up with a 23cm, 12 element rhomboid.
The official name is a dual hexamerous rhomboid which is 2X6 rhomboid antenna. The antenna has twelve elements, with a gain of 33dBi, an is no bigger than a TV antenna! On 70cm, the antenna is 19-ft long (apprx) and below that I wouldn't bother unless you have the tower and room.
Unless you can mount a B-52 to a tower, 2m is out of the question.

Testing on the 23cm DHR shows a Front to back ratio greater than 30:1 with front to side ratios about the same. This is a true cannon.
The main lobe is tight at 12 degrees both vertical and horizontal.
Matching is a bit difficult since micro-strip knowledge is a must.
Although the antenna is 50 ohms balanced, the frequency demands exactness.

This involves phasing elements, stripline baluns, and hardline feeds.
But for the 23 experimenter, this antenna packs the punch of a large parabolic reflector and in a small package. I'll be giving the details in the next posting.

SUBJECT: UHF Rhombic

In wire antennas part 5 we discussed the UHF Rhombic antenna.
I have the plans for one here. This antenna is called the Dual Hexamerous Rhombiod or DHR. A stripline balun provides a 50 ohm output for interface with hardline or antenna switch.

The antenna consists of two stacked six element rhomboids.
Each six element rhomboid consists of six rhombics of which each rhombic is 19 wave lengths and four sided. Each rhombic is terminated at the 9.5 wave length mark with a *** 2w resistor.

Each rhombic is geometrically interfaced to a wooden frame with a common start and ending point. Nineteen wave lengths was choosen for gain and front to back ratio.

The actual plans for this antenna are available via the snail mail through me. Please include a legal size envelope and one stamp.
The BALUN is the key to the antenna and I would recommend this for those who are into 23cm and have stripline experience.

Folded Marconi

This is an easy antenna to construct and I recommend this highly for those AROs who have limited room and desire an antenna that performs better than most wire antennas.

The design is easy. Cut a length of 300 ohm ribbon cable (TV line) using the following formula:

246/fMHz

ex: At 7.15MHz the Folded marconi length would be 246/7.15 or 34.4 feet.

Cut back about 1/2 inch and expose the leads in the ribbon cable. Twist them together and solder. Seal with RTV. Punch a hole about one inch down from the soldered end and run a cable tie through the hole and save for later.

At the other end, expose about 3/4 inch of lead and solder one lead to the center conductor of your coax. The other lead is attached to a ground plane system or ... use the roof flashing on your house. You can ground the roof flashing and suspend the folded marconi over the house. This is the setup I have used here at the QTH. The antenna was suspended over the house from my tower to the Palm tree in the front yard. The vertical height was 25 feet and the rest was horizontal. With this antenna, the greater the vertical section the better.

You will need a tuner with this antenna as the impedance is very low.

SUBJECT: Wire antennas- part 7

INVERTED VEE

This antenna is basically a half wave dipole with each leg sloped down at a 45 degree angle from the horizontal, 180 degrees apart.

```
                X  feed point
              / | \
            /   |   \
          /     |     \  element leg
        /       |       \
      /         |         \
                |
                -  tower or mast

      ----------X----------   Top view
```

The overall length of the Inverted Vee is slightly longer than the standard wire dipole. For 10m, the length is only 2 inches longer.

This antenna can be fed directly with 50 or 75 ohm coax, but it is suggested that a 1:1 BALUN be used. The tips of the Inverted Vee should be kept well off the ground as the RF voltage levels are high at the ends.
This is more of a protection for young ones playing around the area.

If you recall the formula c=sqrt(a^2 + b^2) and insert the length of the element leg for c. Use the fact that a = b because of the 45 degree angles between the mast and the element leg and the angle between the element leg and the horizontal, this will equate to:

c = sqrt(2a^2) => a = sqrt(0.5c^2)

This will give you the value of a which is the height of the mast at the horizontal line to the end of the element leg. Add eight feet for protection from the high RF voltage levels and you have the height of the mast required to support your Inverted Vee antenna.

EX: 40m Inverted Vee; 66'2" @ 7.15 MHz
(66'2")/2 = 33'1"
c=33'1" => 33.0833 decimal

a = sqrt(0.5c^2) = 23.39345 => + 8 = 31.39345 => 31'4.75"

Thus the mast height is 31' 4.75" to support a 40m Inverted Vee, minimum.

The Inverted Vee is basically omni although the pattern is not quite but close enough. The gain is basically unity over a good ground. It is an inexpensive antenna to build and performs very well on all HF/MF bands.

BEVERAGE ANTENNA

This is also a basic wire antenna of which is one wave length or longer. Normal designs are one wave and this must be kept in mind when placing one on the property. Once installed the direction is fixed.

The beverage antenna has a low angle of propagation which makes it excellent for the lower bands (30m, 40m, 75/80m, & 160m).

```
            -------------------------------
        __  |                              |
   Rx     }|{                              Zo
        __}|{                              |
            |                              G & radials
            G
```

The Beverage is inefficient as a transmitting antenna and it is suggested that it be used as a receiving antenna only. The pattern of the beverage is similar to a good yagi.

Formulas and specifics for this antenna can be found in the ARRL antenna handbook.

SUBJECT: Wire antennas- part 8

Sloping Vee

The Sloping Vee is basically an Inverted Vee in an equilateral triangle configuration at a 45 degree angle to the vertical mast.
Not as wideband as the inverted vee and also not omni as the antenna shows characteristics towards the sloping elements. Basically unity + in gain. Can be fed with a 50 ohm coax but a 1:1 BALUN is recommended.
Element lengths are similar to the Inverted Vee design.

This antenna is good for AROs with limited space and stay within a specified area of a band. With a tuner the antenna will cover a wider range but will be less effective.

Remember that the same hold true for the Sloping Vee as the Inverted Vee; keep the ends high enough off the ground so that children and adults can not touch them.

Terminated Longwires

Similar to the Longwire, the terminated longwire is usually shorter and terminated with the characteristic impeadance of the antenna. The terminating resistor should be able to handle at least half the intended power levels of the transceiver. This terminating resistor between 500 to 700 ohms when the antenna is 20 - 40 feet above ground.

Similar results can be obtained from the terminated longwire as with the Longwire as far as antenna patterns, directivity, etc.

Marconi Antenna

The marconi is a quarter wave antenna bent over to be parallel with the ground. This model works similar to the Folded Marconi except ... this antenna requires a series LC circuit with the feed line connected to the inductor as a tap. Let'see how the ascii graphics can handle this.

```
         ---------------------------------------
       /
     /               Length = 125 for 160m
   /
 /
|
= tunable cap  700pF
|
}<---0-coax
} L  |      L = 13 uH
|----|
X gound plane
```

Well not too bad.

Check out Orr & Cowan for the details.

Sloper.

This antenna is great for the 'El Cheapo' antenna builders or the poor guy with no room. The antenna consists of a quarterwave componet sloping down 45 degrees from the peak of the support and a grounding lead parallel to the support. The support itself can be used for the downlead provided it can conduct. The second form of the sloper is a dipole suspended 45 degrees down from the peak of the support.

In either case, the antenna is directive and the directivity is as such:

```
    |\ feed point
    |  \  sloper
    |    \
    |      \    ---------> direction of wave
    |        \
    |          \
    |            \
    |              \
    |               |
    | mast          | wooden support
----------------------------------------- ground
```

If you use a tree for the mast, be sure to clear the branches before the sloper actually starts. This is the feed point and your down lead for the ground starts here also. If you look at it, it's nothing more than a dipole with a vertical ground element and a sloping radiator.

Like I promised (oh nooooo) here are some of the wire designs I have built here at the house. Some of these are the common mistake antennas that we all go through or yet to have, and maybe this will discourage some from making the same mistakes.

1) 80m Vee-Dipole: This one was a real hoser. I was a novice and decided that a wire antenna was the answer to all my dreams. With a tuner and this semi-correct design of mine I could work the world.
Wrong. Here it is; one leg was 55'6" and the other was 65'0". The first leg was tied to a palm tree 25 feet off the ground. The second leg was tied to another palm tree at 40 feet. Both legs combined

at the monster tower (26 feet). So, the antenna legs pointed up instead of down and the angle between the legs was 85 degrees.
Needless to say it was a flop and the SWR was near the national debt.

2)40/80m Trap Vee-Dipole: More or less the same results but I could tune in 80m now. It worked short range very well but 40m was dismal.

3)Folded Marconi: Worked absolutely wonderful until the first thunderstorm. I used fishing line to hold it up. The wind left it in my neighbors yard. Following Folded Marconi antennas were supported better and only came down when I wanted them to.

4)Coiled Marconi: Similar to the Folded Marconi, the Coiled Marconi uses a piece of four foot by 3/4 inch PVC:

```
@@@@@@@@@@@@@@@@@==||    Coiled section 20 turns
               /   ||
             /     ||
           /       ||
         /         ||
       /           ||
      |============||    Stand-off, 3 foot insulating
       \           ||
         \         ||
           \       ||
             \     ||
               \   ||
                 \ ||
                  X||    Feed point.
                   ||
                   ||mast
            -------------------------
```

This antenna worked very well with a tuner and on 40m did not require a tuner at all. Cut the 300 ohm ribbon cable (TV) to the same values as for a folded marconi.

5)160m Spider Web Disaster: This was one of those 'Let's see what this old transformer winding wire can do' antennas. Although the antenna was pretty fair and I did talk to Tennessee, the antenna had a habbit of collecting odds and ends like palm frons, leaves, birds, branches, and these items caught the neighborhoods eye. "How is that branch hanging there?" "Is that bird hovering? My God he's dead!!" Needless to say, I took it down and the bird too.

The last part of this series is going to be devoted to wire antennas used on past field days, including all the laughs and disappointments.

- Field Day 89, Draa Field, Titusville, FL. This was the field day of the Osprey. Draa field is a shared football field by the two high schools in Titusville. It has 50 foot tall bleachers, press box, and six 70 foot high lighting towers made out of cement. They also make excellent homes for Ospreys and indeed the one tower we needed was home to a new family of Ospreys. These are no slouch birds mind you don't take kindly to having a brave amateur climb the rebar ladder under their babies. We had to draw straws but our best climber got the job anyhow. What finally was placed up there was apulley system to raise our 80 inverted Vee. This did rather well and was worth the effort and much to the dive bombing and crying of the Ospreys. Too bad it rained the whole weekend. |-(But we did do the best TARC ever did, 3700 points. Too bad the guy that was suppose to turn in the points never did.

- Field Day 88, Draa Field, Titusville, FL. On this field day we used two of the lighting towers and strung out a full wave loop for 80 meters. Well ... it wasn't quite high enough, and it wasn't in the right location, and it didn't do well ... really poor ...it sucked ... and it rained all weekend.

- Field Day 90, Complex 25, Cape Canaveral Air Force Station. We had two wire antennas; a 40m Inverted Vee taken from my tower here and using the mods I discussed earlier and a 'field day' 80m 'bow tie' antenna. The 40m worked fine and we copped more than 500 points on 40m, but the 80m was dismal. And it rained all weekend.

- Field Day 91, Complex 25, Cape Canaveral Air Force Station. We dumped the bow tie and went with an Inverted Vee for both 80 and 40. Too bad 80 was so so as we worked only 200 points worth. But we had no problem reaching the Northeast and the Mississippi area. And it rained all weekend.

- Field Day 92, Complex 25, Cape Canaveral Air Force Station. We had beams on most bands but the Inverted Vees worked fine again. This year we doubled our points and scored well in the 4000s working 4A. Next year they be a 40m yagi in operation. Look for K4FD, Kings 4 Field Day. BTW, it rained all day, ... again.

- Field Day 93: 10m 3e Yagi, 15m 3e Yagi, 20m 3e Yagi, 40m 2e Yagi, 80m Inverted Vee, SAT, PACKET, see you on the air, I'll be on 20m.

The Carpet Loop II -- A High Performance Indoor Antenna

Designed by David Moisan, N1KGH

Introduction:

There are many shortwave listeners who can't, because of location, infirmity or a unyielding landlord, put up an outside antenna. Such people are given two choices--random wire or active antenna. Yet, for the serious listener, neither choice is completely adequate.

Active antennas are expensive, apt to generate as much noise as signal, and are prone to overload. Random wires are cheap (cheapest, in fact) and easy to put up, but are unpredictable performers. Both subject the receiver to intermod, spurious signals and other trash.

The Carpet Loop II is an ideal step upward for the listener who wants something better than a random wire but doesn't want the expensive dice roll of an active antenna.

The Carpet Loop is made up of two components: A tuner, and the antenna cable itself; the cable can be either 5-conductor rotator cable or 4-conductor flat phone cable, both readily available from Radio Shack and elsewhere. The tuner couples the antenna to the radio, forming a (giant!) L-network. To tune the antenna, you turn a switch for best reception. While NO antenna can give a cheap receiver the sensitivity, selectivity, or dynamic range it never had, the Carpet Loop will help you get the last ounce of performance out of your radio.

Two years ago, I was using a random wire. I had severe problems with a local AM station (2 miles away) on 1230 kHz. I was hearing intermod from it all over the 9 to 12 MHz range.

With the Carpet Loop (which was then just the cable), the interference was almost completely gone. Also, the signals I was receiving seemed to be just a little bit stronger. A year later, I built the tuner, with much better results. I'm convinced I have the best possible antenna for my location.

If you're stuck in an apartment, if you have a portable like the Sony 2010, the Sangean 803A or the Radio Shack DX400 or 440, if you have a tabletop receiver, the Carpet Loop may be for you. It's cheap--around $25 in parts from Radio Shack, **much** less if you shop around, and an excellent first project for the technically minded.

CARPET LOOP II

SCHEMATIC AND PARTS LIST

```
                                          From Radio

                                      Gnd.       Ant.
S1  1 pole 6 position                  !          !
    rotary switch                      !    D1    !
    (RS# 275-1386)                     !---->I----!
                            +----------*----I<----!
C1  365 pf variable         !          !    D2    !
    capacitor (see          !          !          !
    text)                   !      o   o          ! #A
S2  SPST switch             !       \             !
                           ---   S2   \          ---  C1
D1, D2  1N914 silicon      |||         o         ---
    switching diodes     (Earth        !          !
    (RS# 276-112)         Gnd.)        !          ! #B
                                       !          !
J1, J2  6-position terminal            !          !
        strip (RS#274-357)          +G-o <---o----+
                                    !
Antenna cable:                      !  o   S1      o
                                    !  !E          !A
5-conductor rotator          J1     !  !  o     o  !     J2
cable (RS#15-1201)                  !  !  !D o  !B !
(see text)                 1 |o|----*  !  !  !C !  !
                           2 |o|-------*--!--!--!--!-----|o| 6
Miscellaneous:             3 |o|----------*--!--!--!-----|o| 7
                           4 |o|-------------*--!--!-----|o| 8
Aluminum enclosure,        5 |o|----------------*--!-----|o| 9
spade lugs, connector        |o| (not used)        *-----|o| 10
and cable to radio                             (not used)|o|
(see text), knobs                   <- To Antenna ->
```

Note on Schematic symbols:

```
 !
-*-   means:  Intersecting wires are connected
 !

 !
-!-   means:  Intersecting wires NOT connected
 !
```

How It Works

S1, C1, and the antenna cable connected to J1 and J2 form an L-network; when S1 is switched between positions A through F, and C1's capacitance is varied, the impedance of the antenna system changes. When S1 and C1 are adjusted for best signal, the impedance between antenna and receiver is matched. D1 and D2 provide protection against static discharges. The G position of S1 grounds the antenna when not in use. S2 disconnects the ground from the antenna, making the antenna into a random wire.

Tuner Construction

Parts Availability:
With the exception of C1, all parts for the tuner are readily available from Radio Shack. C1, the 365 pf variable capacitor, can be gotten out of an old radio.

Subsitutions:
There are no critical parts in the tuner; as long as S1 has at least six positions, it will do. D1 and D2 can be any silicon diode. Use any enclosure that's big enough to comfortably install components in.

The choice for J3, the jack to the receiver, depends on what connector your radio uses for an external antenna. I used an SO-239 (RS #278-201); you could also use a TV antenna terminal strip (RS#274-663).

Step-By-Step Instructions:

1. Mount the components on the enclosure you'll be using--all wiring is point to point. I suggest mounting J1 and J2 on opposite sides, S1 and C1 on top, and J3 on the other end of the enclosure.

2. Wire S1 to J1 and J2. If you use the Radio Shack DP6T rotary switch, you'll be using just one of the poles. The diagram of the switch is below:

```
                                      D  C
  S1  DP6T rotary                  E  o  o  B
      switch                    G  o        o  A
                            |   o              o   |
 Viewing from             P |o                    o|
 bottom of switch           |   o              o   |
                                  o        o
                                     o  o
```

Wire as follows:
(Note: If you're using the Radio Shack terminal strip, you will need to drill a hole in the cabinet to pass the wires through from inside. Use a rubber grommet to keep the wires from fraying)

```
 S1 Term. --to--> J1 term.     J1 term. --to--> J2 term.
   A                #1            #2               #6
   B                #2            #3               #7
   C                #3            #4               #8
   D                #4            #5               #9
   E                #5
```

Connect a wire from J2 terminal #10 to the G terminal on S1, and this step is done.

3. Install and wire C1. Connect one terminal of C1 to the P terminal on S1. Connect the other end to J3. If using the SO239 or phono jack, connect to the center conductor. If using screw terminals, connect to terminal #1 on J3. Skip ahead to step 5.

4. Connect the P terminal of S1 to J3. If you're using the SO239 or phono jack, connect to the center conductor. If you're using screw terminals, connect to terminal #1 on J3.

5. Connect the G terminal on S1 to J3. Connect it to the ground shield if it's an SO239 or phono jack, or to terminal #2 if it's screw terminals.

6. Connect D1 and D2 across J3's terminals; remember that D2 is connected opposite of D1.

That completes construction of the tuner.

Choosing Cable:
The kind of cable you use depends on where you're putting it and and how much you want to pay for the cable. If you plan on running it under carpet, then use the 5-conductor rotator cable mentioned in the parts list. This cable can easily withstand being stepped on; more importantly, there are no exposed wires to trip over. It's also easier to wire than phone cable. If you're not running it underfoot, or if you're cheap, you can use 4-conductor flat phone cable, available nearly everywhere. It's a good choice for running around baseboards, around windows or in attics.

When running the cable around, start at your receiver and go around the room--or the house--and back to the radio. If you're using the rotator cable, you can make corners by folding the cable at a 45 degree angle, like folding paper.

Wiring The Cable To The Tuner:
You should have two ends of the cable next to the tuner. Strip the ends and put spade lugs on all the wires. With the rotator cable, mark the **silver** conductor. Next, connect the wire to the tuner using the following diagrams:

```
    FOR 5-CONDUCTOR ROTATOR CABLE    FOR 4-CONDUCTOR PHONE CABLE

           J1          J2                J1          J2
                             1                             1
        1 2 3 4 5    6 7 8 9 0         1 2 3 4_5   6 7 8 9_0
        ^ ^ ^ ^ ^    ^ ^ ^ ^ ^         ^ ^ ^ ^     ^ ^ ^ ^
 Wire   S C C C C    S C C C C         B Y R G     B Y R G
 colors
                                    (4&5 jumpered) (9&10 jumpered)

 ((S)ilver, (C)opper, (B)lack, (Y)ellow, (R)ed, (G)reen)
```

Grounding:
Run a wire--preferably a large one--from the ground terminal on the tuner (or a mounting screw on the SO239 connector if you're using one) to a suitable ground such as a cold water pipe; I grounded my tuner with a short length of RG58 coax connected to a baseboard heater via an alligator clip. Connect the tuner to your receiver; you are now ready to use it.

Using The Carpet Loop
It's easier to use than to talk about: Tune your receiver to the desired frequency. Adjust S1 and C1 (or the antenna trimmer on the radio) for strongest signal. For most situations, S2 (Loop/Longwire) can be left closed in the Loop position; you may find that setting S2 to Longwire may work better for mediumwave listening.

Conclusion
The Carpet Loop II is an inexpensive, easily built, high performance antenna that can work in almost all apartments.

Contacting The Author
I can be reached at the following addresses:

Mail: David Moisan
86 Essex St. Apt. #204
Salem, MA 01970-5225

Internet: dmoisan@pro-angmar.alfalfa.com
or moisan@silver.lcs.mit.edu
Your comments and suggestions are welcome.

Phone Line Antenna

This article describes how to use a phone line as a shortwave antenna. Performance will vary depending on the kind of line you have. Overhead lines make fairly good antennas, while underground lines generally don't.

A highpass filter is used to remove signals below the shortwave bands. This improves rejection from local AM stations. In addition, a lowpass filter can be used to reject interference from FM stations.

The original credit for the highpass and lowpass filters goes to Paul Blumstein and John Shalamskas, respectively. I have included edited versions of their articles below.

The filter(s) should be connected to the phone line in this manner:

```
Phone line                                             RF plug
   red         --------    center cond.                 / \
    or   o----|        |--------------------------|-o |  To receiver
  green       |        |                            \ /
              | FILTER |  50 ohm coax                |
              |        |                             |
   N.C.  o----|        |-----------------------------+
               --------      shield
```

N.C. = no connect. Alternatively, you could connect this to a ground. I tried the phone line ground (yellow wire) and it worked more poorly than no ground at all. I haven't tried any other ground, because that would defeat the purpose of a portable antenna.

If the highpass filter is used, all phone line voltages, including ringing, are eliminated and thus will not harm the receiver. I should also mention that this filter works very well with random wire antennas.

Someone who wrote asked about lightning protection. I haven't thought much about this because thunderstorms are rare in my area. However, I believe most phone lines have lightning arrestors on them where they enter the house. Anyway, my suggestion would be to unplug the antenna when not in use if you experience frequent thunderstorms.

Okay, here are the articles on the filter designs:

From: paulb@harley.TTI.COM (Paul Blumstein)
Subject: BC Band Hi-Pass Filter

The following ASCII-schematic diagram is a high pass filter that will filter out Broadcast Band (MW) stations. I found it a great boon to my shortwave listening since local MW stations overload my ATS-803A front end & appear in SW, especially with a long antenna.

If you remember my antenna saga, I went from 50 feet to 150 feet & had overload problems causing me to cut back to 50 feet. (Even at 50 feet, I still have some MW interference). I took the advice of Gary Coffman and looked up filters in the ARRL Handbook. With the filter in place, I intend to try to increase my antenna length again.

Anywho, here is the filter, for interested parties.

```
      1500pf     820pf      1500pf
--------||---+----||-----+----||-----------
             }           }
             { 2.7µH     { 2.7µH
             }           }
-------------+-----------+----------------
```

From: bill@videovax.tv.tek.com (William K. McFadden)
Subject: Re: BC Band Hi-Pass Filter

I built the filter that Paul Blumstein posted recently and measured it on a gain-phase analyzer. Here are its characteristics:

100 kHz	-120dB
500 kHz	-68dB
1000 kHz	-38dB
1600 kHz	-15dB
2100 kHz	-3dB

The source and load impedances were 50 ohms. Because the filter has five elements, the attenuation is 30dB per octave. The measurements confirmed this. This filter seems to be a pretty good compromise between interference attenuation and passband response.

There is very little attenuation in the 120m band and above. It could use a little more attenuation at the upper end of MW, which could be done with more stages or a higher cutoff frequency. Alternatively, you could build two of these filters and put them in series. (Since two 1500pF capacitors in series are really 750pF, you could eliminate one cap.)

Just for fun, I decided to put 470 ohms in series with the input to see how the filter performs with an antenna mismatch. The characteristics were:

100 kHz	-105dB
500 kHz	-60dB
1000 kHz	-35dB
1600 kHz	-15dB
2300 kHz	-3dB

These figures are normalized to the passband response of -15dB, which is due to the impedance mismatch between the source and load and would have been there without the filter. Hence, the filter works almost as well in spite of the mismatch, which is good news to those who use longwire antennas.

From: johns@uhunix.uhcc.Hawaii.Edu (John Shalamskas)
Subject: Construction of filters for SW reception

Several people have asked for construction details of the filters I built for my DX-440.

The high-pass fitlter helped some, but in my location the VHF/UHF broadcasters are also causing problems. So, I dug out the ARRL handbook and chose a 7-element Chebyshev low-pass design that is -3 dB at 35 MHz, -20 dB at 43 MHz, and -50 dB at 64 MHz (all calculated; it works well in practice!)

```
        LOW-PASS FILTER  (Rejects FM, TV, etc.)

                0.36 uH  0.42 uH   0.36 uH
signal  -------+--UUU--+--UUUUU--+--UUU--+-------  signal
               |       |         |       |
          82  ___  180___    180___     ___  82
          pF  ---   pF---     pF---     ---  pF
shield         |       |         |       |         shield
 braid  -------+-------+----+----+-------+-------  braid
                            |
                      chassis ground
```

I had to do a little more improvising at this point. I used .33 uH instead of .36, and .66 uH instead of .42, but it works fine.

The 5-lug terminal strips were perfect for these circuits, since there are 4 lugs plus a grounded lug. All "ground" connections go to the lug that is mounted to the chassis, and the other 4 lugs are used for each of the connections on the signal line. One terminal strip is used per filter. Since both filters were necessary to clean up the hash, I am going to put them both into one box when I get the time.

The proper way to connect them is in series, i.e.

signal in ---> filter 1 ----> filter 2 ----> signal out

There is no difference between ends. They are "bilateral" which means you can't possibly hook them up backwards. (In the above schematics, left and right ends are interchangeable.)

Subj: Home Made Loop Plans

Wind 8 turns of wire onto an X frame to form a loop 4ft x 4ft (using 130 ft wire) wire can be as thin as # 24 ga. connect the 2 wires over to a TUNING CONDENSER #cv 230 at Antique Electronic Supply (phone 602 820 5411 to get a free cat) now...wind 1 turn (2nd coil) around main coil and run that to the input jack of yer radio
TOO big? ok use 12 turns on a 2ft x 2ft X frame. If this echo didnt mess up the drawing, I'd go to trouble of drawing up a sketch of it here. (so far, all sketches got trashed....so moch for HI tech...huh!) Need more info? Get hold of me or Peter Keyes.

Subj: "Select-a-tenna" U-Make!

> You might think about spending some money on antenna improvements. Several
>of us on the echo have had very good expereiences with something called a
>"Select-a-Tenna" which costs about $50. It's a passive antenna stage that you place
>next to the radio (no wires), and tune to frequency.
> For more money, you could get a Palomar loop antenna, but I don't know how
>much better you'd do than with the Select-a-Tenna.

You know, it is NOT difficult to BUILD one of these beauties!! I know, because I made one, and it works FLAWLESSLY! I took some styrofoam block packing thingies that formed an 18" square, and taped them together. I wound about a dozen turns of wire around it, and connected the ends to a (SIGH, no longer available) Radio Shack 365 PF tuning capacitor. (You can scavenge one of these from a busted transistor radio, local Ham store, or a local Ham may have one in his "junk box".) The number of turns will need to be experimented with, but it should result in approx. 260 Uhy of inductance. This 18" beauty (not in appearance, mind you, but PERFORMANCE!) picks up stations like gangbusters! Also, because it is a loop, you can use it's directional characteristics to selectively null interference, and pick out some really weak signals!

Calibrate the number of turns to your tuning cap. by finding a station at 540. (If no station, background static will work, too.) When the cap. is ALMOST at full mesh, the signal or static should have a noticable peak. Then, tune to 1600, and check there. (Use the static method for 1700) the cap should be almost fully unmeshed at 1700. If this be the case, you are all set!

This antenna could be easily modified to receive 160 or 80 Meters, etc, by adjusting the number of turns. I would love to try it on the VLF bands, say 100-500Khz! Gotta whip one up soon. Cost? depends on where you get the tuning capacitor! Since I already had one, this baby was a FREEBIE! Works just as good as the $50 and up ones!

For a complete set of construction diagrams, send a S.A.S.E. to :

WFIF attn: Willie
90 Kay Avenue
Milford, CT 06460

and ask for the plans for the "Super antenna". (Or, you can just drop a loose stamp into the envelope, and be sure your name and address are clearly written in your letter.) These plans are FREE, and I will get a copy to you ASAP. :)

73's de N1NKM Willie

Tune-A-Stick

Recently, Don Kimberlin described a wire-wound broomstick antenna he built, and the noise cancelling properties it displayed. Intrigued, I built a similar antenna using about 226 turns of #24 speaker wire around a 1 1/16" dowel. The length of the wound section was about 27".

These materials were what I had on hand, and the speaker wire allowed the start and end connections to be at the same end. The other end of the winding was soldered together. I was surprised by the performance of this antenna, even though it was indoors rather than out. I reckon it had over 100' on it, compared to the 65' random wire antenna I was using outside. I connected an MFJ antenna tuner between it and my DX-440. It seemed to reject most of the noise from my PC (a rather poorly shielded 20MHz 286), and even local AM MW bcs. I am, unfortunately, located in the ground wave of a 50KW AM xmtr, and since the DX-440 is prone to intermodulation, this causes some annoyance <G>!

Even so, I found I still needed my 7-element Chebyshev high-pass filter to attenuate the MW frequencies and the resulting harmonics (particularly from that station on the hill, at 1360KHz). Nevertheless, it was enough to make me want to build bigger and better. So bolstered by the results of this test antenna, I set about designing the outdoor, industrial strength version.

I had some vaguely defined goals to meet:

a) As much wire in one shot as possible, say 1000';
b) Make it compact, even portable (well, within reason);
c) In consideration of item "b", it should be easy to connect and disconnect.
d) Make it weatherproof.

The results culminated in a 10' length of class 125 PVC pipe (2 3/8" diameter) and 1000' of black PVC insulated 20 AWG solid tinned copper wire (Carol C2028-21-01, available from DigiKey as C2028B-1000-ND).

One end has a standard 2" PVC cap, the other end, which was belled, received a 1-1/2" to 2" adapter, into which was cemented a 1/8" thick PVC disk with a gold-plated RCA jack (Radio Shack 274-852).

Assembly

Pipe: Nothing special, just used as it came from the local Ace Hardware. Class 125 is all you need, as this is not a heavy device. I used 2" nominal, which has an O.D. of 2-3/8". One end was belled, but only becuase it was chopped from a 20' length of belled-end pipe. You will need two (2) 2" caps, or in the case of belled-end, one cap and one (1) 1-1/2" to 2" adapter to plug into the bell.

Caps: One cap will be left as is, the other will get a 1/4" hole drilled in the center. In the case of my BE pipe, I intended to cut a PVC disk with a 1/4" hole in the center to fit into the adapter. Lacking PVC, I used a piece of acrylic. Since acrylic and PVC will not bond, I used PVC cement in the adapter. This softened the PVC enough to sort of ooz around the acrylic disk, such that it will never come out. Put a jack into the hole, and make sure you can tighten the nut onto it. Now remove it.

Put the cap(s, and adapter) on, but do not cement them! They will only be pushed on. At a point just beyond the cap, (or bell) on the pipe, drill a hole just large enough for the wire to pass through. For the 20 AWG wire I used, that was 1/16". Drill into the print stripe, to act as a reference for counting the turns.

Wire: Remove the cap (or adapter) with the jack, or rather the hole for the jack, if you've been following the instructions <g>. Now take the free end of the wire from its spool and pass about 6" through the hole and out the end of the pipe.

Strip enough insulation from the end to make a connection to the jack, then slip the nut, and the "chassis" or "shield" washer (the one with the solder-eye), onto the wire. You can omit the lock-washer, if you need to. Now pass the wire through the hole in the cap or adapter from the inside (pipe-wise) and solder it to the center lug of the jack. Now push the jack into the hole, slip the washer over the inside portion and secure it with the nut. Bend the tab on the washer toward the center to facillitate the eventual connection of the other end of the wire.

Push the cap onto the pipe (or the adapter into the bell): You are now all set to wind up a new antenna project! Really! Turn on your SW receiver, your stereo or TV, becuase you will be spending one to two hours on a truly boring task.

I just wound each turn next to each other, snugging it up as I went along. It's easier than trying to spread them out. You can count the turns if you're nuts. I think I put 1532 +/-5 on my stick. It's all academic.

Now, you will have to leave enough wire to return down the length of the pipe to connect at the washer on the jack. When the wire comes off the spool, tape the last turn, and gently stretch the wire towards the jack. If it doesn't reach, unwind enough to pass the end with about 6" to spare.

You should now start at the beginning of the winding and snug it up by twisting the turns in the applied direction while pushing toward the starting point, while working toward the free end. Locate the point where the last turn crosses the print-stripe. Back off a quarter turn. Place your drill bit next to the preceding winding on the stripe and drill a hole.

Now comes a tricky part. Tape the end of the winding to keep it (and your patience) from exploding. Poke the end of the wire through the hole and out the near-end of the pipe. Pull all 8-9' out. Tie the end around a heavy object, like a large screwdriver. Remove the jack-cap, if you haven't already done so, and make sure it is clear of the bore of the pipe. Pick up the end of the pipe, make sure the wire isn't in knots or tied around your cat, and throw the screwdriver down the length of the pipe.

Remove the screwdriver once the wire pops out the jack end of the pipe (it will not be needed for reception <g>), strip some insulation from the wire end and solder it to the washer on the back of the jack. Gently push the cap onto (or the adapter into) the pipe, and cap the other end.

This completes the Tune-A-Stick! To support it, I made a pair of stands out of 1/4" acrylic, each about a foot high, with a hole at the top bigger than the O.D. of the antenna. This allows them to be tilted, creating a pair of splayed feet (like a sawhorse).

It could be suspended by rope, but I would recommend securing the ends about a fourth of the pipe's length in from each end, as PVC is not structural, and will sag if not properly supported.

Since the wire insulation is black PVC, I sprayed the exposed portions of the pipe with a coating of black PlastiDip (sp?), a liquid vinyl product. Orient the print stripe down, to place the wire holes on the underside.

And that wraps it up! I modified my MFJ random wire antenna tuner, but that project can wait. I'm still fiddling with it anyway. The results will follow as soon as my fingers uncramp! You may all, of course, distribute these instructions as you like (or don't like).

To paraphrase (well, SWL wasn't what he was talking about) Dr. Timothy Leary, "Tune in, turn on, and try out!"

Doug Boze

.

Correspondence

Subj: TUNE-A-STICK

MP> Thanks for the info on you antenna but do you have any data (hard or
MP> other wise) on how well it performs? directional pattern? gain? etc?

Mike...
I almost missed this message, save for the subject (I assume line noise corrupted my name? :-)

The antenna seems to work well, not having many things to compare it to, other than some random wire or the house ground <g>. It appears that the directional pattern provides the greatest gain perpendicular to the major axis:

```
                    high gain
antenna axis -->       ==============  low gain
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I have no way of relating the gain to other homemade or commercial antennas, but often bcs from the Pacific or Central and South America register at 20db+ on the meter on my R8.

The upshot is that it works, and like most "random wire" antennas, benefits from a tuner. In this regard, the tuner can help reject interference. Still, I wonder if I could improve on it... probably, but not today <g>!

...Doug

==

DM> Thanks! My friend will be very happy with this!

David...
You're welcome! Say, the R8 arrived this morning, and I've been playing with --er, operating <g> it since. It's great to have a real meter to read for signal strength. I can actually see the difference the antenna tuner makes, and what effect the way the antenna is pointed has.

It appears, at least so far, that the TAS is best oriented broadside to the desired transmitter location. In fact, it seems to reject stations that it is pointed at. Useful if trying to hear a station bcing to the eastern US from Europe, while another from South America is on the same frequency. Let me check something...

It's 21:20, and I'm receiving the VOA USB feeder to Africa at 19261.55KHz, S 8 over 7. A little noisy, but clearly intelligible. Shoot, I'm getting RCI without too much trouble... so something must be working <g>!

...Doug

===

MP>Thanks for the reply, BTW it seems I remember seeing your name at the
MP>top of a message dealing with an antenna you made by spiraling wire
MP>around a broom handle. Was that you? If so, do you know of any technical
MP>discussions of that type of antenna (helically wound) and their
MP>properties?

...The basic technology behind such things is a loop, which electrically has the property of capturing and feeding to its output signals that alternate in the loop, while at the same time displaying the electrical property of "common mode rejection" of signals that impinge on opposite sides of the loop simultaneously.

...That means that AC radio waves will cause a difference of voltage at the terminals of a loop (the desired signals), while impulses like static crashes will hit both sides of the loop equally, and arrive at the terminals equally but out of phase with each other, and cancel out ("rejection" of undesired noises).

...Winding the loop on a stick is a means of making it physically smaller. The effect of different diameters is highly variable and far too complex to put into simple arithmetic. More important is simply to provide a loop with wire of sufficient electrical length to create a reasonable antenna length for the frequency range of interest. That's simple high school math of the circumference of the stick...or plastic pipe...or whatever form you wind the coil on, to calculate the length of the wire, to get something in the range of 65 or 70 feet of wire in the coil.

...If you wind a wire of similar length around a stick or a form, and merely connect one end of it, you have what is simply a compressed vertical antenna, which will also work as an antenna, but does not have the added benefit of common mode rejection for noise.

...Such compressed-length antennas do not have what is called the "capture area" of a full-length antenna, hence they are not as efficient as one stretched out...but they are certainly more effective than merely a three-foot whip antenna. Since a larger capture area is desirable to increase efficiency, the larger the diameter of the form you wind it on, the more efficient your compressed antenna will be.

...As to directivity, when the diameter is small compared to a wavelength, the most sensitive directions will be off the sides of the coil. This is quite different from what you might see of VHF "helical" antennas, where the diameter becomes closer to a wavelength in size, and the antenna is "hot" off its end, so is used pointed at the desired direction. With the lower frequency coiled loop, optimum reception will be broadside to the coil.

...Yes, the "Tune-A-Stick" that's been described here is certainly a more efficient realization of such an antenna, because its diameter is larger. If you mean to develop the idea, I'd suggest using 6 or 8 inch diameter plastic pipe - or even some larger diameter form if you can come up with a way to do it. You'll be increasing the capture area and thus the efficiency. Winding an antenna on a broomstick is merely a convenient, small sized expedient.

...Regardless of what form factor you give such an antenna, its impedance will vary considerable across a range as wide as several SWBC bands, so an antenna tuner is very valuable. Since the major component is a variable capacitor, the "Tune-a-Stick" incorporates one built into it.

...Hope that all helps.

==

MP> Couple more question, have you run comparisons as to the orientation the
MP> antenna works best in (horz/vert)? From what I remember from USAF radio
MP> school using the wrong polarization results in a significant amount of
MP> signal loss.

Mike...

...No, I've only had it horizontal. Being nearly 10' long, it's unwieldy enough in that position let alone vertical. From what I understand, most, if not all SW broadcasts are horizontally polarized, but that this is a moot point once the signal has richocheted around the globe. I also know that most interference (man-made) is vertically polarized. I seem to recall verifying that with the 2' prototype.

Anywho, it's horizontal, and atop a rotator, way up above the roof peak, and I really don't want to scramble around up there any time soon (excuse me while I wipe my palms... this roof is 12 in 12... and since I'm rather more horizontally polarized... well... <g>).

MP> Second, was this design based on any particular engineering experience
MP> or is it a TLAR design? Specifically, do you have any idea what the
MP> effect might be us using different size wire or PVC pipe?

I fancy myself an amateur SWLer, little more. I read stuff in the ARRL handbook, and it was really all Don Kimberland's fault for inspiring me to try this. TLAR?

As for wire and pipe, I think I chose them for practical reasons. If I had used smaller pipe, I would've needed more of it to hold all that wire. The 20ga wire was about .064 OD, which may have made it easier to figure the number of turns or the length of the winding. I forget. All I wanted was to put about 1000' of wire on a form that was sturdy enough to be self-supporting.

As time permits (and when does it? <g>), I will look through my references and think about building the MkII TAS. One idea is to have the far end of the winding free, like a regular longwire, rather than doubling back to form a loop. The connection end would be wired to a Palomar Magnetic Longwire Balun. The rest would be 52ohm coax, with the shield grounded.

That's another project: this old house needs grounded wiring, and a separate ground for the receiver.

I may be able to test both antennas, since the R8 has two inputs, but the MkII would have to be inside the listening room (which is in the finished attic below the present antenna). That could be a problem. I remember having the TAS in the back yard, connected to my DX-440: if I held the TAS, that is, gripped it about the winding, the signal disappeared (WWV, receiving both CO and HI). Presently, in use many stations come in at 20db to 30db. If that isn't strong, I don't know what is.

Before I moved here, I had the TAS indoors once, connected to the DX-440, and could receive Deutche Welle -- from Germany (Julich?), not the Caribbean relay! So we'll see. My biggest problem now is these touch-lamp converters that I like so much: the hash they produce is terrible, to the extent that I've removed them and am back to using the 3-way lamps' switches.

Oh, well...

...Doug

===

MP> So I got thinking and I think I recall reading an article years ago in
MP> the ARRL handbook on a spiral wound antenna that was center feed.

Mike...

I think this is also in the ARRL Handbook. I'm also thinking of a center tapped design. A helical dipole.

BTW, I think you asked about whether to insulate the wire.
According to the Handbook (1990), p.33-2, "It matters not (in the HF region) whether the wire is insulated or bare. However, the wire should be either enameled or insulated to prevent corrosion." It then goes on to say that, due to the insulation's higher dielectric constant, the wire would have to be trimmed shorter for a tuned antenna.

p.17-6 has the center tapped helically wound dipole. Of course, the discussion is about transmitting with it. The text mentions the need of isolating the antenna from conductive objects and away from the earth to prevent severe losses.

...Doug

From: steve@hicomb.hi.com (Steve Byan)

In a recent post, I asked about Beverage antennas on shortwave. Here is a summary of the responses I received.

Many thanks to:

- Jay Kesterson K0GU,
- Jorma Mantyla, and
- Ross Alexander ve6pdq

for their replies.

I've also included a partial bibliography:

"The Wave Antenna", Beverage, Rice, and Kellogg, presented at the Midwinter Convention of the AIEE at New York, February 14-17, 1923 ARRL Antenna Handbook (ARRL)
Low-band DXing by John Devoldere (ARRL)
NRC Antenna Reference Manual, Vol. 1 & 2 (NRC)
Beverage and Longwire Antennas: Theory and Design (NRC)
Memorandum on the Beverage Wave Antenna, Wolf & Anderson (IRCA reprint #A87)
Fine Tuning's Proceedings 1988, "Impedance Matching a Beverage" (FTSP)
Fine Tuning's Proceedings 1989, "Beverage Antennas" (FTSP)
Fine Tuning's Proceedings 1991, "The Wave (Beverage) Antenna" (FTSP)
Beverage Antenna Handbook, Victor Misek W1WCR

I've never read Beverage's original paper, just pulled the citation from other references. I guess the IEEE might be able to provide it.

(ARRL)
Amateur Radio Relay League
225 Main Street
Newington, CT 06111
USA
1-203-666-1541

(NRC) (a medium-wave radio club)
National Radio Club Publications
c/o Ken Chatterton, Manager
P.O. Box 164
Mannsville, NY 13661-0164
USA

The IRCA reprint is of a paper by Wolf and Anderson on the Beverages used for MW at the FCC monitoring station at Grand Island, Nebraska. (IRCA) (a medium-wave radio club)
International Radio Club of America Reprints
c/o Steve Ratzlaff
1885 E. Bayshore Rd. Sp 90
E. Palo Alto, CA 94303
USA

Misek's book is available from CQ's Bookstore; possibly elsewhere. I've never seen a copy myself, but just ordered one today. The fellow at CQ's Bookstore says that a new book "The Beverage Wave Antenna at Low and Medium Frequencies" (I didn't catch the author) is due out in two or three months.

Regards,
-Steve

From: jayk@fc.hp.com (Jay Kesterson K0GU)

Steve Byan (steve@hicomb.hi.com) wrote:
: I'm curious about peoples experiences with Beverage antennas on shortwave.
: If you use a Beverage antenna, how long is it? How high is it?

I have five of them ranging in length from 400 to 700 feet. They start at ground level on each end and go up to around 10 feet high 60 feet away from the ends

: What is the highest frequency that seems to show any directivity?

They have good directivity all the way up to 21 MHz. But they have very low gain at frequencies above 10 MHz. I some times use them on 14 and 21 MHz with a preamp. The preamp also helps on 7 and 10 MHz.

: My 175 meter Beverage at 3 meters height shows good directivity on MW and
: low tropical-band frequencies, up to about 3 or 4 MHz. I haven't yet read
: Mizek's book on Beverages, but I understand that he or some others have had
: some luck with Beverages up to 6 or 7 MHz.

I have his book (barely qualifies as a book, more like a notebook).

: Do you use a matching transformer? If so, what kind?

I use two kinds. The one from Mizek that uses a certain number of turns of wire on a core that is tapped a few turns from the end and a typical 9:1 balun wound on the same type core.

: Do you use a terminating resistor? What value?

Yes. A 470 or 500 ohm resistor, depending on what I have around. Mizek tells you a way to measure the exact value of a beverage. But I think you will find that around 500 ohms usually works well.

: Does the termination seem to make any difference at the higher frequencies?

Yes. I find a terminated beverage works better, at least for my needs.
I mainly use them on 1.8, 3.5, and 7.0 MHz for static reduction.

: Did you adjust the termination value based on F/B ratio, or some other
: criteria, or just take pot-luck?

Mostly experience, mine and others.

: I'm using a remote-switchable 470-ohm terminator. The terminator gives 20dB
: nulls off the back of the Beverage on MW (WBZ-1030), but doesn't seem to do
: much on the higher frequencies. Switching in the terminator doesn't seem to
: show any nulling of the BBC Antigua outlet on 5975 kHz, although it is
: within 15 degrees of the back-bearing of the Beverage. Has anyone had good
: results in the 3 to 6 MHz range?

I get varying results depending on the wave angle of the signal. But I seem to get fairly consistent static reduction. I live two miles due east of WWV. My east beverage (550') drops WWV 20db down from my west (500°) beverage on most of the frequencies they use. In the 30 meter ham band when I switch the beverages from east to west you can hear then noise floor come way up on the FT-1000. WWV has a fairly healthy 10 MHz signal at my house :-).

: I'm currently improving my antenna switching arrangement, as I suspect
: there may be crosstalk that is degrading the directivity of the Beverages.
: -Steve

Good luck, Jay Kesterson K0GU jayk@fc.hp.com

From: tijoma@uta.fi (Jorma M{ntyl{)

I have three antennas: 150 meters, 230 meters and 250 meters. Two first mentioned are Beverages with 450 ohm resistors & grounding while the 250 meter antenna is just a longwire. The height is approximately 3-4 meters.

My rx is Icom IC-R71E + ant.tuner + preselector occasionally on MW.

7 MHz seems to be the maximum but some effect can be found thrghout SW.
The 150 m antenna is directed towards North America. WWV is usually heard on 5 MHz only with this antenna but even on 15 MHz strongest WWV-signal comes from this antenna.

On the tropical bands short Beverages work surprisingly well. The 230 m antenna is directed towards 60 degrees. Radio Tanpa, Japan, is usually heard on 3925 kHz only with this antenna. Australian stations on 2310, 2325 and 2485 are heard almost every evening with this antenna while the other two antennas do not give signals at all or 1-2 S-units weaker signals.
Stn's from Papua & Indonesia are almost exclusively heard with this antenna.

>Do you use a terminating resistor? What value?
>Does the termination seem to make any difference at the higher frequencies?

I have 450 ohm resistors. It is possible that more directivity & sensitivity could be availabe with carefully tuned & measured resistors. Unfortunately I don't have equipments for that.

>Did you adjust the termination value based on F/B ratio, or some other
>criteria, or just take pot-luck?

My instructions were taken directly from Victor A. Misek's book and from the NRC publication about Beverage and longwire-antennas.

Generally I am very satisfied with my two Beverages. They are clearly better than longwires without grounding. On 4920 ABC Brisbane is usually heard only with my Beverage. In the morning latin America and NA on MW is heard better with the 150 m Beverage while the ungrounded 250 m long-wire gives weaker dx-signals and more noise&splash from European power-houses. The difference is about 1 S-unit which is usually what you need to identify weak dx-stns.

Today I'll buy a 450 ohm resistor and copper because I want to ground the 250 m antenna which is very uneffetive if compared with my two Beverages.

Jorma Mantyla
U of Tampere
Finland

From: rwa@cs.athabascau.ca (Ross Alexander)

>If you use a Beverage antenna, how long is it? How high is it?

150m at 3m high.

>What is the highest frequency that seems to show any directivity?

I've never used it above 75m. It does seem directive at that frequency.

>Do you use a matching transformer? If so, what kind?

A home-brew 9:1 ferrite toroid balun.

>I'm using a design similar to the one by (Devoldere?) in the ARRL book
>"Low-band DXing".

The Devoldere design is a Ruthroff. A Guanella design will have greater bandwidth for a given low-frequency cutoff point. Have a look at _Transmission Line Transformers_ by Jerry Sevick W2FMI. It's an ARRL book.

>Do you use a terminating resistor?

No, I want to receive the back lobe as well (I'm oriented NE/SW, Europe and New Zealand (central Alberta QTH)).

>I'm currently improving my antenna switching arrangement, as I suspect
>there may be crosstalk that is degrading the directivity of the Beverages.

It's hard to avoid unless you're in North Dakota ;)

regards,
Ross ve6pdq
--
Ross Alexander,rwa@cs.athabascau.ca,(403) 675
6311,ve6pdq@nebulus.ampr.ab.ca
"Arguably worse, the compiler can produce any result it deems fit, up to and including the start of World War III (assuming the right optional hardware has been installed)." -- Fortran FAQ

Steve Byan internet: steve@hicomb.hi.com
Hitachi Computer Products (America), Inc.
1601 Trapelo Road phone: (617) 890-0444
Waltham, MA 02154 FAX: (617) 890-4998

DOUBLE BAZOOKA/COAXIAL DIPOLE ANTENNA

by Morris Lundberg, K4KEF

Eighty meters is 500 KHz wide, from 3.5 MHz to 4.0 MHz. Your typical, standard dipole antenna will show a bandwidth of about 50 to 100 KHz. That means that you'll have to resonate it at the high or low end of this band, to have a 2:1 or less SWR over the frequencies you wish to operate. So you tune it to the CW or Voice portion of the band. Wouldn't it be nice to have an antenna that was resonant in the center of the band and had an SWR of 2:1 or less across the entire 80 meter band?

Enter the Coaxial Dipole Antenna (alias "Double Bazooka").
This antenna is broadband; it will cover the entire 80 meter amateur band with an SWR of 2:1 or less. The "Bazooka" antenna was developed by the staff of M.I.T. for radar use. The original "Bazooka" used coaxial cable for the entire radiating elements. The adaptation used by most amateur operators uses coax only for the broadbanding portion of the antenna, while the remaining portion of the elements are constructed of twinlead or ladder line (see attached sketch). Ladder line is preferable for its inherent strength.

This is a single band antenna. It will not radiate harmonics of your operating frequency. In addition, there is very little feedline radiation, which is great for those who have problems with TVI. Its broadband characteristic makes it ideal for 80 meters and 10 meters. On the other hand, a seperate antenna is required for each band. The Bazooka antenna consists of a half-wavelength of coaxial line with the outer conductor opened at the center and the feedline connected to the open ends. The outside of the coax and the ladder line operate as a half-wave dipole.
The inside of the coax elements, which do not radiate, are quarter-wave shorted stubs which present a high resistive impedance to the feed point at resonance. Off resonance, the stub reactances change in such a way as to cancel the antenna reactance, thus increasing the bandwidth of the antenna.

In the attached sketch, the SWR curves are shown for two double bazooka antennas; one for the 80 meter version and one for 40 meters. Note that the SWR at resonance on 80 meters (3.75 MHz) is 1.2:1 and that the SWR at the band edges is about 2:1. The curves were drawn from readings taken with the DAIWA CN-620B power meter. The antennas were installed at a height of about 25 feet (unfortunately, I have no trees for supports) and the axis of the antenna elements were at 90 degrees with respect to each other. The 40 meter antenna used TV twin-lead for the ends of the elements. Both antennas used Tandy RG-58/U coax for the broadbanding elements and the feedline. Apparently the Tandy coax I used had a velocity factor of 0.64, since the resonant length turned out to be 84 feet on 80 meters (as compared to the calculated 87 feet). More expensive coax may have a more consistent velocity factor.

At the very center of the coax used in the elements, very carefully cut away about one inch of the outer vinyl jacket. Then cut the exposed shield all the way around at the center of the exposed area. Be careful that you do not cut the dielectric material or the center conductor in the process. Twist the two pieces of exposed shield into small pig-tails. These are the feed-point terminals for the antenna. The center conductor of the feedline is soldered to one and the shield of the feedline to the other. Now solder the center conductor and shield together at each end of the antenna element. Solder the two ladder line wires to the end of the antenna element. At the other end of the ladder line, solder the two wires together. The ladder line now appears to the antenna to be a very thick extension of the radiating element, contributing to broadbanding the antenna.

I've solved the mechanical strength problem by using a square piece of plastic at the antenna center, drilling a small hole on each side of the coax, wrapping a small wire around the coax and through the holes and twisting the wire together on the other side. After this, a small amount of quick setting epoxy secures the coax to the plastic support and prevents the wire from untwisting. Once the antenna elements and the feedline are secured to the plastic square in this way, the plastic square takes the strain, protecting the delicate radiating element feed-point. A thorough coating of silicone rubber or epoxy seals and protects the feed-point from the weather. A similar technique at the point where the ladder line is soldered to the shorted end of the coax provides strength and a weather-tight seal.

I've constructed several of these antennas and they have all performed as expected. The quality of the coax used seems to have little effect on the antenna's performance. I've found that Tandy coax will work well in this application. RG-58/U was the coax of choice for small size and light weight. There is no reason, however, that RG-8 coax wouldn't work as well or better. It's larger surface area would probably provide better low signal level reception. Its large size would make it more obvious to the neighbors and its larger weight might be a problem in your installation. Its larger diameter conductors would, certainly, take more stress and strain than RG-58. Eventually, the outer black vinyl coating on cheaper coax will migrate into the inner dielectric material, contaminating it. As is true with any cheaper coax, this changes the properties of the coax, i.e., impedance, loss and velocity factor. Over the long term, the exposure to the sun's untraviolet rays cause this contamination of coax which hasn't been constructed to prevent it. For that reason, you may wish to use non-contaminating coax, such as RG-141 or RG-213. After several years of exposure to all kinds of weather, however, my Double Bazooka's show little degradation in performance, using Tandy RG-58/U coax (Radio Shack).

K4KEF.