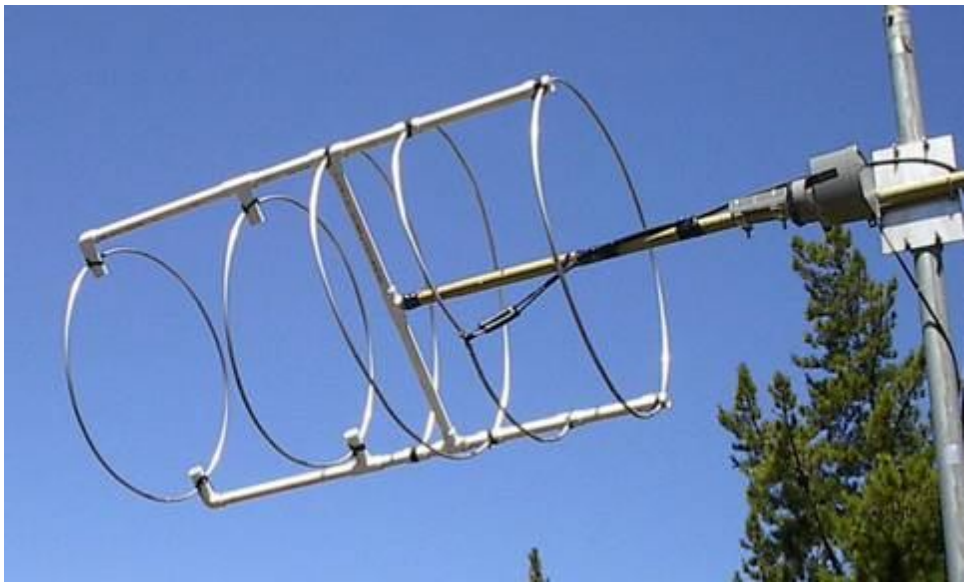
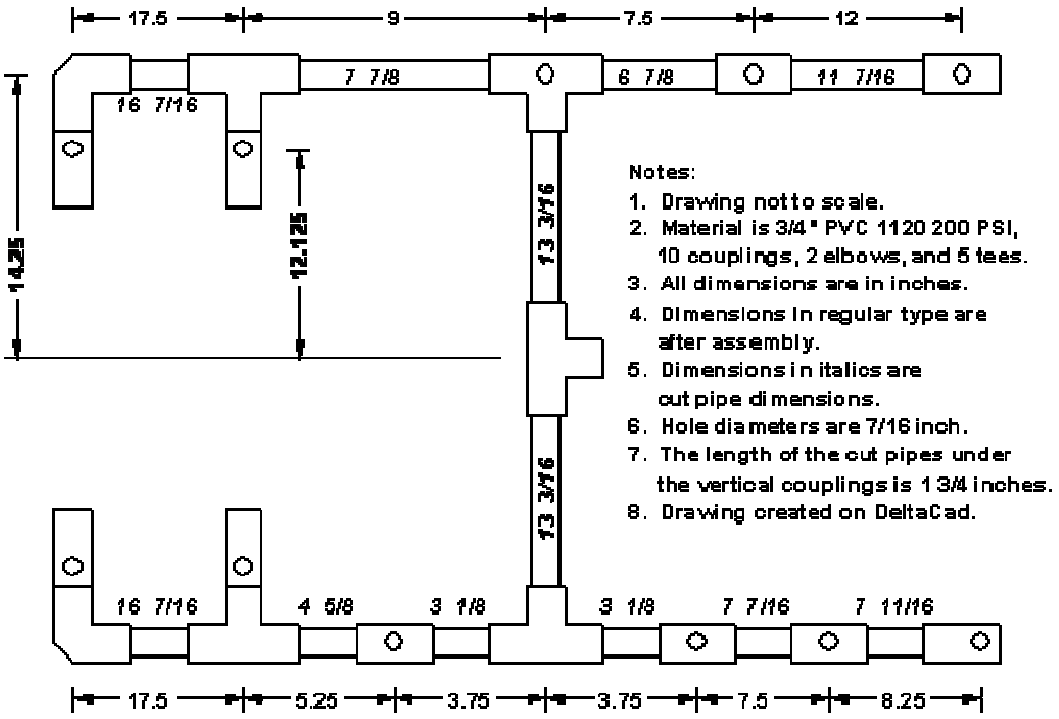
The Quadix



The Quadix is a circularly polarized parasitic array, a hybrid between a helix and a quad (or loop yagi). As is the case with other yagi type parasitic arrays, it has a reflector and as many directors as desired. A two turn helix is used as the driven element. The helix is driven ¼ turn from the end of the helix closest to the reflector. Its impedance is a nearly constant 300 ohms across a wide band for a conductor size of 3/8 inch. As with off center fed antennas, the feed point is not balanced, so a current balun is required. A tv/fm balun works well. Or there are many other balun possibilities (see below). I will now describe a 4 element 2 meter quadix.

Its bandwidth exceeds 144 – 148 MHz. Over the 144 – 148 MHz band, its free space gain is simulated to be about 10.5 dBi, and axial ratio less than 2 dB. The SWR is measured to be less than 1.2 when used with the 300 ohm to 50 ohm balun transformer described below, and axial ratio measured to be less than approximately 1 dB across the repeater output band 145.2 – 147.4 MHz, the source of my test signals.

The support structure is made from 3/4 inch PVC pipe.



Notes:

1. Drawing not to scale.
2. Material is 3/4" PVC 1120 200 PSI, 10 couplings, 2 elbows, and 5 tees.
3. All dimensions are in inches.
4. Dimensions in regular type are after assembly.
5. Dimensions in italics are cut pipe dimensions.
6. Hole diameters are 7/16 inch.
7. The length of the cut pipes under the vertical couplings is 1 3/4 inches.
8. Drawing created on DeltaCad.

The elements are made of 3/8 inch aluminum refrigerator tubing, obtained locally from Orchard Supply Hardware. If aluminum refrigerator tubing is not available, you can use copper refrigerator tubing.

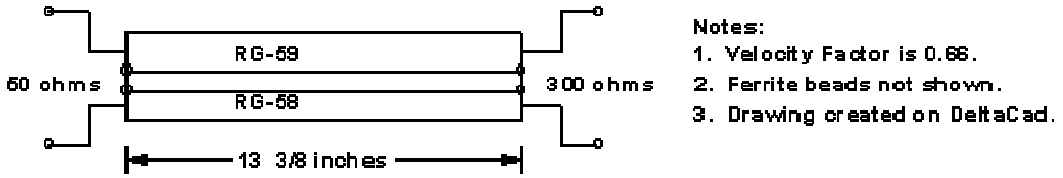
The total length of the helix driven element is 179 3/4 inches. Mark it at 44 15/16 inch intervals to show where it passes through the PVC pipe. Also mark it 22 ½ inches from one end. This will be where the balun is attached. The total length of the reflector will be 89 9/16 inches. The total length of the directors is 76 3/16 inches. Mark each of them at the halfway point.

Before assembling the antenna, temporarily connect the ends of each of the elements together and shape them into circles. The driven element should be shaped into a two turn circle.

Assemble the antenna by feeding the elements through the holes drilled in the PVC assembly. The ends of the directors and reflector can be connected together by flattening and securing with bolts, by slotting one end and squishing it down to fit into the other end and securing with a bolt, or by fitting a sleeve over the two ends and securing with a pipe clamp. If one of the overlap methods is chosen, don't forget to allow for this when cutting the tubing.

Before assembling the helix driven element, cut out a ½ inch section of tubing at the feed point and replace by an insulating material. An insulator fashioned from a piece of PVC coupling works well. For right hand circular polarization, feed the helix clockwise through the holes in the PVC assembly as shown in the picture. Secure the elements to the PVC structure. Connect the antenna to a boom, and the balun and feed line to the antenna, and you are ready to go. If you want to measure the axial ratio against a friend's linear polarized signal (or local repeater signals), you need to attach a small rotator to the boom.

A 300 ohm to 50 ohm quarter wave balun transformer that is simple to make is shown.



It consists of a quarter wave transformer made from RG-58 and RG-59 in series. The impedance of the quarter wave transformer is 53 plus 73 equals 126 ohms, which transforms 300 ohms to 53 ohms. About 8 ferrite beads, Amidon FB-43-5622 or equivalent, are put on each of the coax lines of the transformer. Also a few beads should be put on the 50 ohm transmission line near where it connects to the transformer.

The original computer simulations and optimizations were done using MININEC. Simulations using NEC give slightly lower gain (10.2 dBi), and slightly higher impedance (320 ohms). The program, written in 4nec2, can be found at quadixD1.htm. 4nec2 is available for free; see link below. Plots of gain simulations--total gain and right hand circularly polarized gain--are at quadixD2.htm.

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