An-Ten-Ten-nas

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In each issue of the ***News,*** we shall try to clarify a significant cluster of ideas used in antenna work. Our object is to help you make the best decisions about the antenna you buy or build with out imposing our own prejudices on you. The more you understand,the better your choices will be.

No. 13 K4HJJ's 2-Element Minibeam

Glenn Blackwell, K4HJJ, #66998, presented an overview of his 2-element Yagi minibeam in the April, 1995, *10-10 News*. Numerous 10-10 members have asked him how to build their own. Although he now sells a version of the beam, he encourages home brewing and has provided instructions to several hams. As a service to all 10-10 members, let's turn over the column to Glenn to show you how to build your own minibeam in the K4HJJ manner.

The minibeam is a 2-element Yagi with 8' elements and center loading. Although the gain will be under that of a full size beam, the front-to-back ratio will be a very respectable 15 dB or more. The price of small size combined with a high front-to-back ratio is narrow bandwidth, as Glenn describes below. His design is very transportable, as well as fitting into apartment and RV contexts. Here is how you roll your own, in Glenn's own words.

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Select the element length: I use half-size elements, but you can go as low as 40% or you can go longer than half-size if it fits your junk box or hardware store. Keep both elements the same length. Let's try a half-size beam at 28.4 MHz. This will require elements approximately 8¼' long, or two 4' elements with a 3" insulated mounting plate. Channel 2 TV hardware is excellent, but you can also use PVC pipe fittings to hold the 4' elements and house the loading inductor. PVC also works well for the 4' boom.

Approximate reflector inductor value: Traditional Yagis tune the reflector to about .95 of the beam's resonant frequency, or about 27 MHz. This proved to be too long for the minibeam. See Figure 1 for the reflector layout. Choose a coil to resonate with the loading inductor in place at about 28.1 MHz. The resonant frequency can be lowered with the position of the capacitance loading wires. There are various formulas or charts, as well as computer programs, to find the values. You can also figure a 4' base-loaded vertical and double the inductance for a dipole element. I use ELNEC or ON4UN's software quite often to find the right values. The exact value of the inductance will vary with the length of the element and its diameter. Use two 7" pieces of #10 soft copper wire for capacitance loading, as shown in Figure 1.

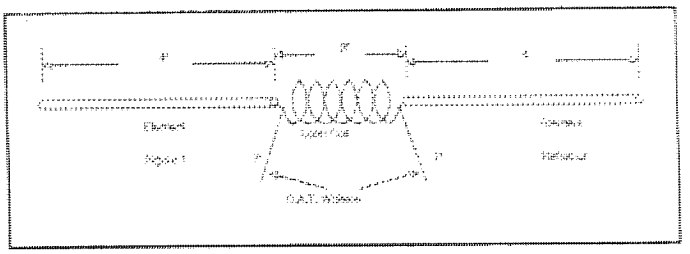

Figure 1

Bend the loading wires away from the element to lower its frequency. Keep the inductor Q as high as possible. With a Q above 250, resistive losses are not great, but they grow quite drastically when the Q goes below 100. Keep the length-to-diameter ratio of the coil close to 1:1. Do not use a toroidal core.

Driven element construction: Repeat the construction process for the driven element. Divide the inductor as shown in Figure 2 to provide a feedpoint. At this time, do not resonate the element, since a matching coil will be added to the assembly.

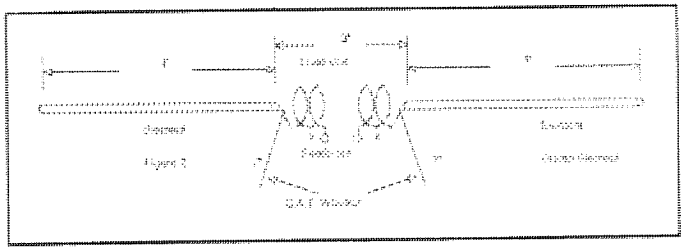

Figure 2

Feedpoint inpedance: Determine the feedpoint impedance of the antenna (point X-X in Figure 2) either by computation or by direct measurement. ELNEC models with a front-to-back ratio of 15 dB show a feedpoint impedance of about 7.5 W. Now we are ready to design the matching network.

The Beta match: Using *The ARRL Antenna Book*, Chapter 26, Figure 32 (on the "hairpin" match), you can determine the reactance necessary to match 7.5 W. Calculate the inductance

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for that reactance at 28.4 MHz. A coil of this value will substitute for the hairpin matching section. The coil, sometimes called a helical hairpin, is described in the *Antenna Book* in Chapter 6 in the description of a "Small Yagi for 7 MHz." See also ON4UN's chapter 2 on "Tuning or Loading the Short Dipole" in *Low Band DXing*.

ON4UN's coil design program calculated that the Beta match coil should be about 3 turns of wire, 7/8" in diameter, and about 1" long. With the coil installed, the driven element looks like the sketch in Figure 3.

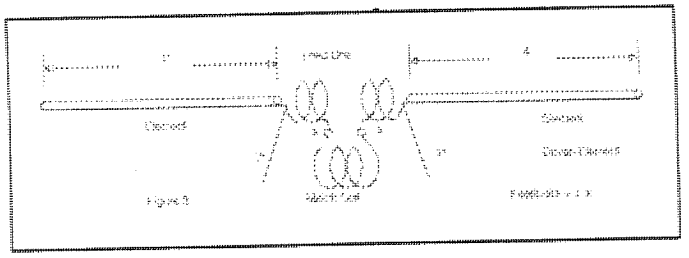

Figure 3

Resonating the driven element: With the matching coil in place, resonate the driven element to 28.6 MHz without the capacitive loading whiskers. You can compress or expand the matching coil and change the electrical length of the antenna by adding the whiskers and changing their position. All the inductors should be covered because rain will change the loading conditions.

The bandwidth can be widened to about 600 kHz by tuning the reflector lower in frequency. You can also narrow the bandwidth: I have narrowed it to about 400 kHz to achieve a higher front-to-back ratio in the Novice-Tech phone band by tuning the reflector higher in frequency. Use a beacon and horizontal antenna at least 100' away and behind the beam to adjust the reflector whiskers for about 20 to 25 dB front-to-back ratio at 28.350 MHz, as determined by your receiver. You can achieve a higher front-to-back ratio, but the match and bandwidth are degraded. At 20 dB front-to-back ratio, I get approximately 350 kHz at less than 1.2:1 SWR.

The whisker loading is my design and shows no degradation in side lobe rejection due to a lack of symmetry. (I call it Capacitance Assisted Tuning or C.A.T. Whiskers after my cat Scooter.) Other types of matching may also be used. I believe that the hairpin coil, in conjunction with the center loading, gives the effect of an unbalanced to balanced transformer. In any event, the element currents are in balance and no feedline or other spurious radiation has been detected.

This may look like a simple project, but expect to spend considerable time getting everything right. If you do build this antenna, good luck, and drop me a line.

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For further information about this antenna or Glenn's 12 meter version, contact him at the following address:

Glenn R. Blackwell, K4HJJ
WaveCat International, Inc.
P.O. Box 2803
Atlantic Beach, NC 28512-2803

He will appreciate both your interest and an SASE.

President Announces Committee Assignments

President Tom Henderson, K4CIH, has announced Committee Assignments effective January 1, 1997. Each committee will be responsible for the area of operation of 10-10 as noted below. It will be the committee's action to determine policy and procedures related the to area assigned and to make recommendations to the Board of Directors for changes in policy in the area of their responsibility.

Members are encouraged to communicate direct with applicable Committee Chairman regarding any problems, changes, suggestions or recommendations for revisions or improvements in 10-10 operations.

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