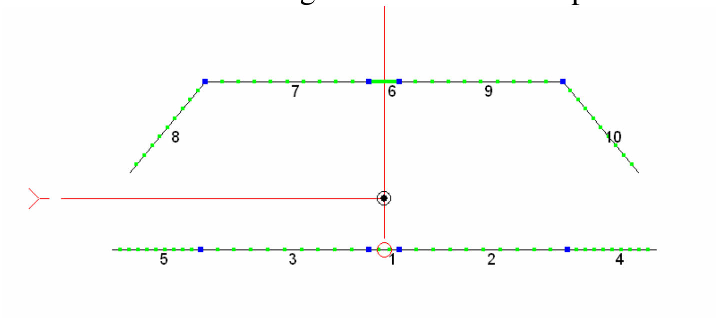
The Moxagi (or Yagoxon if you prefer) - A 2 element Moxon-Yagi hybrid antenna for 12 meters

After I tired of the 6 meter 3 el yagi (described in another note) due to that seasonal propagation thing, I decided to speed up the 12m DXCC effort by getting some gain on that band for a while. The tubing available from the 6 m project consists of 6' telescoping Al tubing - one each of ¾ & 5/8" and 2 each of 1/2 and 3/8". Two tubes together gets a bit less than 12 feet or ~ 3.5 m. A quarter wave at 12 meters (let me get the calculator) is ~ 3 meters. So we have on hand ¾ of a 2 el yagi for 12 meters. This raised a minor problem of the remaining ¼. But there is plenty of stranded wire in the junk box .

It is further desired to have the new antenna be direct feed so avoiding the trials and tribulations of a gamma or hairpin match. Therefore, four of the 6' length sections can make up the driven element with a convenient gap for feeding. The remaining 2 Al tubes together reach only 3.5 m – so obviously we need to some wire to the end of that combination to reach the ~ 6 m to make a reflector (or director). Sadly the stranded wire tends to droop greatly and flap in the wind. Here the Moxon concept of using element ends bent back toward the other element leaps forward. Partly the Moxon 90 degree bend ends are used to make the antenna more compact. But is also provides (mutual) support for the ends. However, no law says all the ends need to be the same. And so arises - The Moxagi.

Since the length of wires that could be strung (but insolated) from the end of the driven element to the runty reflector appeared to be easily enough to bring the reflector up to a appropriate resonance (nominally operating frequency plus 5%), and while using the old boom, it was time to break out EZNEC. An arrangement as shown below was constructed with the angular sections on the planned reflector.

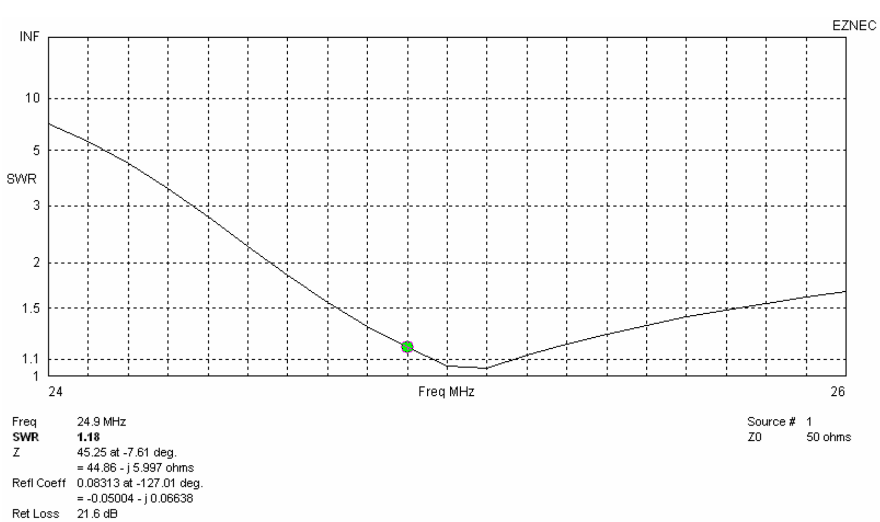


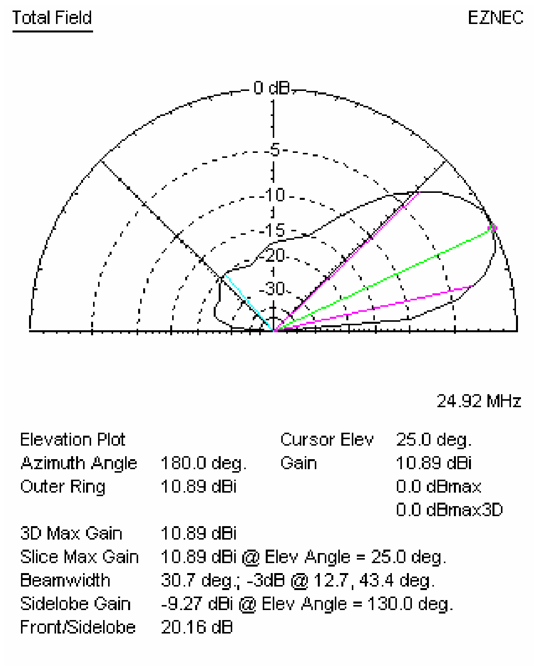
First the driven element alone was evaluated for length required for a 24.9 MHz resonance. Using that drive length, the reflector was added with the wire sections (8 and 10) adjusted in length to get a useful radiation pattern with yagi-like gain. As the length is varied, the antenna pattern changes with passive element being a director or reflector or a bidirectional pattern between. A reflector length was found by trial and error with EZNEC. But you are not done.

The addition of a reflector changes the impedance of the driven element significantly and generally makes it <u>not</u> near 50 ohms resistive. This impedance depends on the length of the driven element, the spacing of the director, and to a rather lesser degree, the director length.

So it is time to make multiple EZNEC runs to find dimensions that give an impedance in the neighborhood of 50 ohms resistive, while not killing the antenna gain, if possible.

For a two element parasitic array this is possible and not terribly difficult. After some numerical experimentation we find the following SWR and pattern. This pattern is close to the optimal available. Happily, a handy boom length works well.





The parameters for this model are -
Height 20'
Driven element 17.8' long
Reflector is 11.66' straight + two 4.3' each wires at ~ 45 degrees forward
Spacing is 5.5'

But we are still not done, this is just the model and it only provides a guide to the real antenna. One approach to making the real antenna is to take the model and remove the reflector – then find the isolated driver resonant frequency (26.4 MHz). Next put up the real antenna driven element alone and adjust the length so the it is resonant at the same frequency as the model. Then scale the real reflector to the model in the same ratio as driven element real/model. This should be a decent starting point for the real antenna.

Finally you will need to adjust the physical reflector wire lengths to assure that you get some reasonable F/B, probably not as good as the model. Verify that the SWR remains sensible as this is done. Tweaking of the driven element length may be required during this iteration – but this should have little effect on F/B. When satisfied with the results in this case, I found the following, which differ somewhat from the model:

Real Antenna:
20' high
Driven element 18.8'
Reflector is 11.66' Al tubes + 2X 4.8' each wires at ~ 45 degrees
Spacing 5.5'
16dB F/B (approx)
SWR 1.7 at 24.9 MHz, direct feed with coax coil choke using a
Pine 2X2 6' boom

The gain is modestly better than the trapped vertical that serves as a comparison.

Later measurement with Agilent Field Fox says SWR min is 1.85 at 24.5 and at 24.9 it is 2.15 but wattmeter SWR still says 1.8 at 24.9.