Packing a 2 Meter Bell

by

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The title should really be *Packing a 2 Meter 10 decibel Antenna* as this paper is about a portable Yagi and not about shipping a large Gaussian shaped metal object.

The application of this antenna is for two meter band liaison communications during 10 GHz mountaintop activities. The 2M side-band channel is for coordinating activities with other stations. It is beneficial to have some directivity on this 2M channel as the 10GHz station may be over 100 km away. My 2M all mode radio is not high powered.

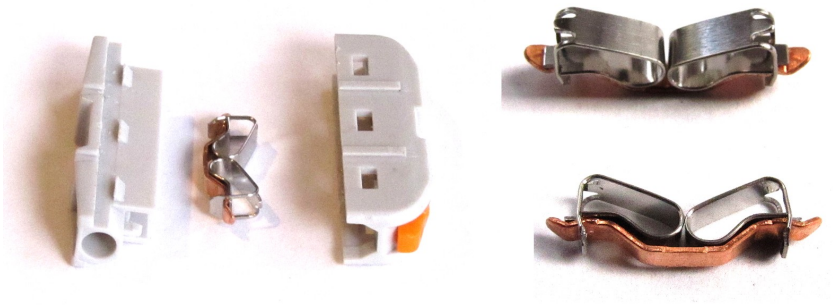
Here are my objectives of the antenna effort:

- A basic 6 element Yagi antenna with 10 dBi of gain
- Portable, pack-able, hike-able
- Assembly is easy, fast and no tools required
- No geometrically complex matching mechanism
- Disassembly in the dark
- Low cost, readily available materials
- 144.260 MHz, horizontal polarization
- Less concern about F/B ratio or bandwidth

These requirements mean that the boom will be about 1 wavelength long. This implies that the boom will need to be in sections for portability. The PVC pipe commonly available at hardware stores was chosen as the schedule 80 ¾ inch and 1 inch pipe can be made to insert or telescope within each other.

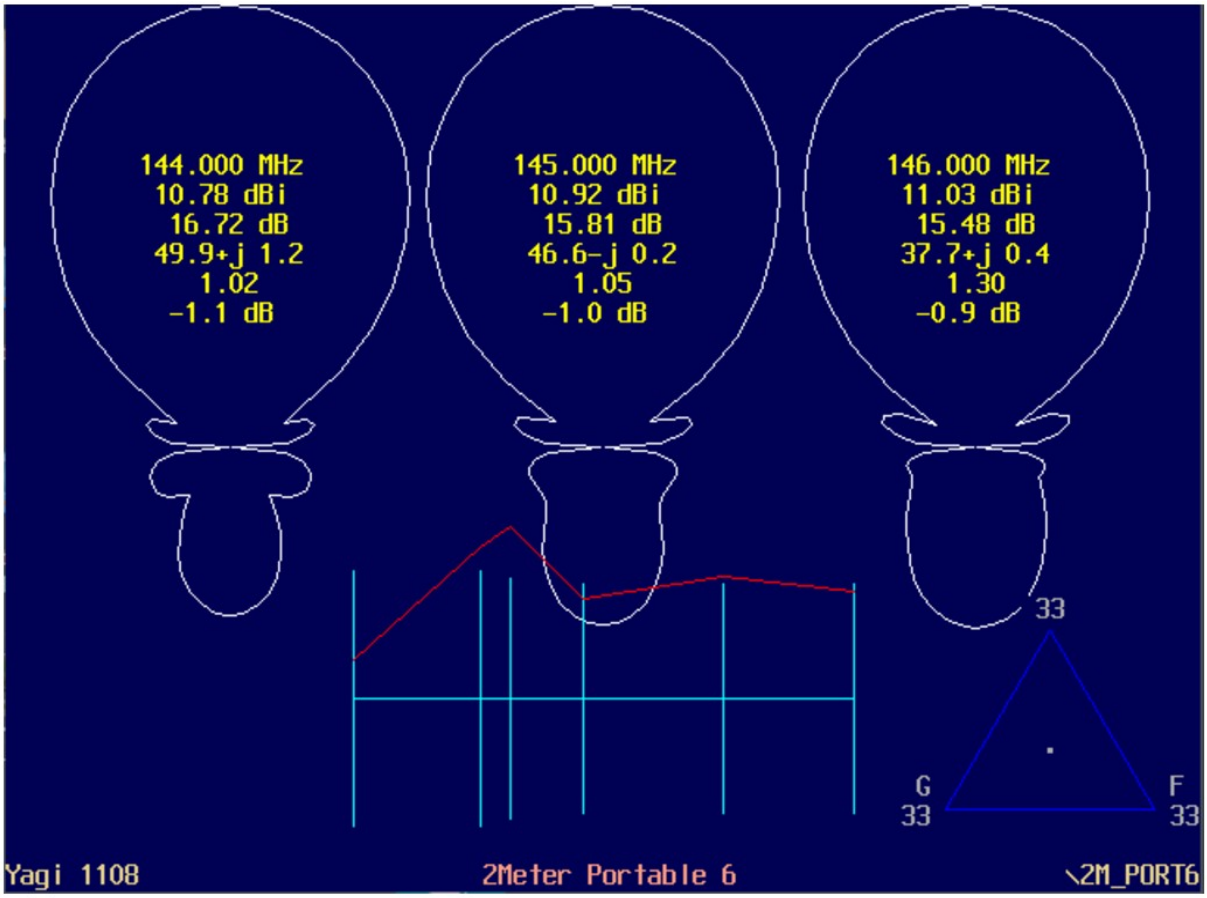
The elements of a Yagi are almost 1 meter long. It was decided that for size constraints each element would be made of two sections that were electrically joined at the boom. A fast and tool-less technique that was chosen is a single pole splicing connector from Wago (or equivalent). These spring loaded through connections are low resistance and low inductance. These devices will accept up to #12 AWG Copper wire, therefore this wire size was chosen for the elements.

Element Connection

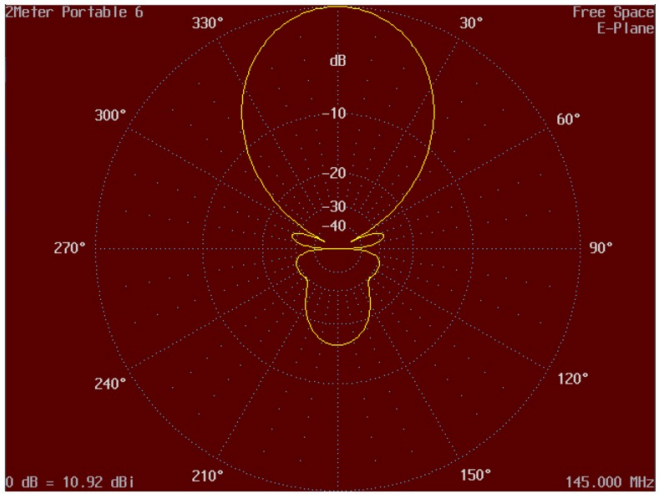


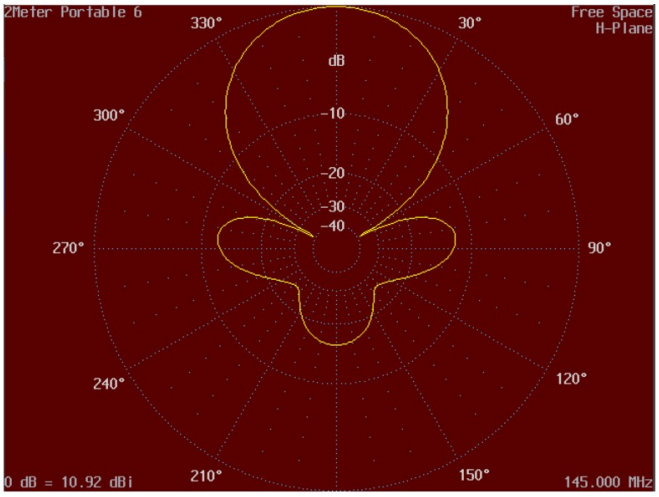
I use a very old Yagi simulation tool from the 1990's, Yagi Optimizer (K6STI). It still seems to do well. The design effort was to meet these goals; 6 elements, 2 meter dielectric boom, 10 dBi gain, #12 copper, 10+ dB F/B, direct feed to 50 Ohms, commonized element lengths.

Analysis Results



Predicted Patterns, E and H Plane

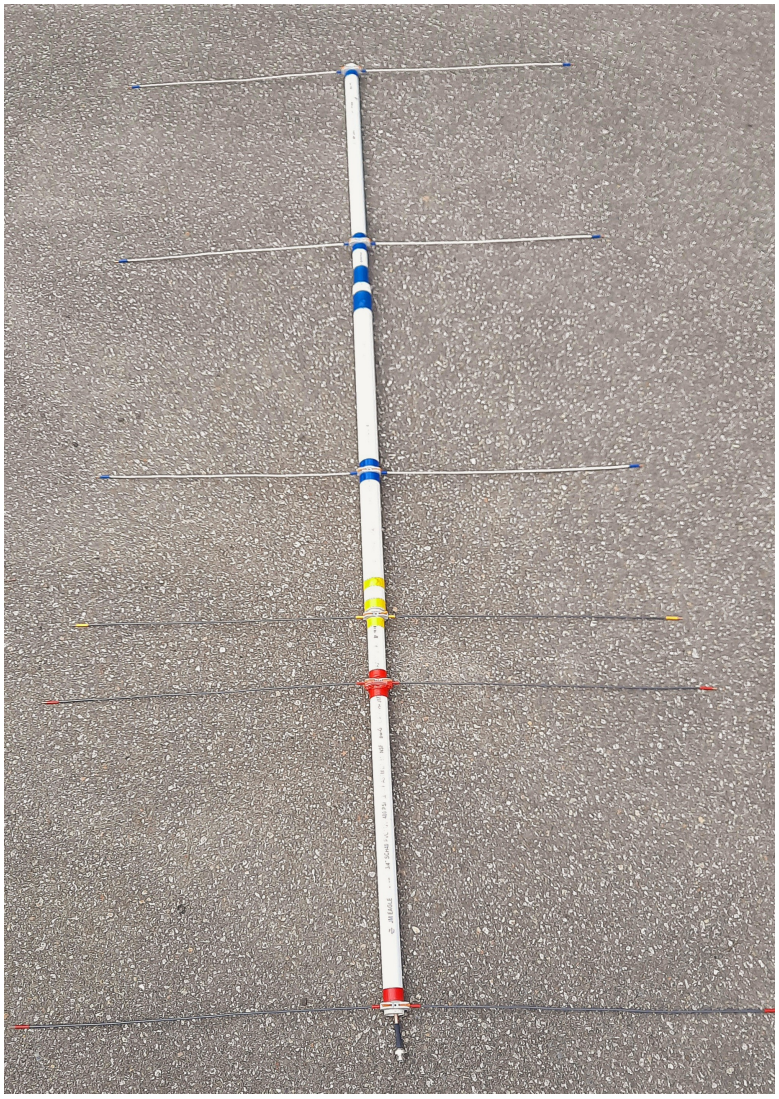




As of this writing I have not used the antenna "in battle".

Some discoveries were made in the building and testing phases
The element length and weight is at (or beyond) the design limits of the spring connectors. The cantilever or pry-bar effect means that contact may become inconsistent. This design concept is much more conducive to shorter elements, maybe for the 220 MHz band.
The alignment precision of these clamps is also not perfect. Sometimes the elements need to be adjusted for parallelism after assembly. This is done visually.
The copper elements are easily bent. However they are easy to bend back into shape. This is actually a good feature if the antenna falls or is bumped as the element don't break and are easily "repaired".
The elements are color-coded for assembly and are in only 3 different lengths.

Assembled Antenna



The connectors are not waterproof so this is not an all-weather antenna. The +/- connection at the feed is particularity sensitive to water. The impedance may change when wet. {Would those then be rain scattering parameters?}
The BNC connector out the back of the antenna makes for easy coaxial connection to the radio.
The VSWR has been measured at an acceptable 1.2:1 at the frequency of interest.