My 2 Meter 6 Element Super Duper Moxon Antenna

By Stepehn Binns WB8AHT

A Modified HAARP Antenna by Phil Simpson M0PXS
A Modified Super Moxon Antenna by GW3YDX

This 2 meter antenna has 2 characteristics that make it a very favorable antenna to have. The boom length is a very short 40 inches. The 4NEC2 forward gain is reported to be 15 dbi. That is a mighty big punch for a very small package. If only it is true!!

I found two articles about the development of this antenna. The first article is about the Super Moxon Antenna by GW3YDX. It describes a 4 element Moxon antenna for 6m, 4m and 2m. This antenna consists of 2 Moxon style rectangles mounted on a boom similar to a yagi antenna. The back rectangle was the reflector and the driven element. The front rectangle was director 1 and director 2. Antenna software 4NEC2 graphs were included. It reported a gain of about 9 dbi. I was interested in the 2 meter version.

The second article I found is about the HAARP Antenna by Phil Simpson M0PXS. It describes a 6 element Moxon antenna for 2m. This antenna consists of 3 Moxon rectangles mounted on a boom. The back two rectangles were reflector, driven element and 2 directors like the Super Moxon Antenna. The third rectangle is director 3 and director 4. Antenna software 4NEC2 graphs reported a gain of 15 dbi.

I decided to build one of these antennas and see if it really would live up to these claims. Before I bought the parts I needed to make a list of what I needed. This meant calculate the lengths of 1/2 inch and 3/8 inch aluminum tubing. To my dismay I quickly discovered that dimensional information about the different rectangles were not consistent with each other. The HAARP article contained a different arraignment of dimensions than what

M0PXS website contained. The two director rectangles were not the same. I also noticed that the reflector/driven element dimensions were not the same as the Super Moxon reflector/driven element dimensions. I had assumed that they would be since the HAARP article mentioned it was an extension of the Super Moxon antenna. See the three different sets of dimensions at the end of this article.

I emailed Phil Simpson about the differing dimensions and asked what was correct. His reply was simple: The dimensions found on his website were the correct dimensions. So now I had correct dimensions and I could calculate what lengths of tubing I needed. I found all the aluminum tubing, nylon rods, stainless steel hardware and insulated tubing standoffs online and ordered everything. In a week I had all the materials I needed and I started building. My finished antenna is pictured above.

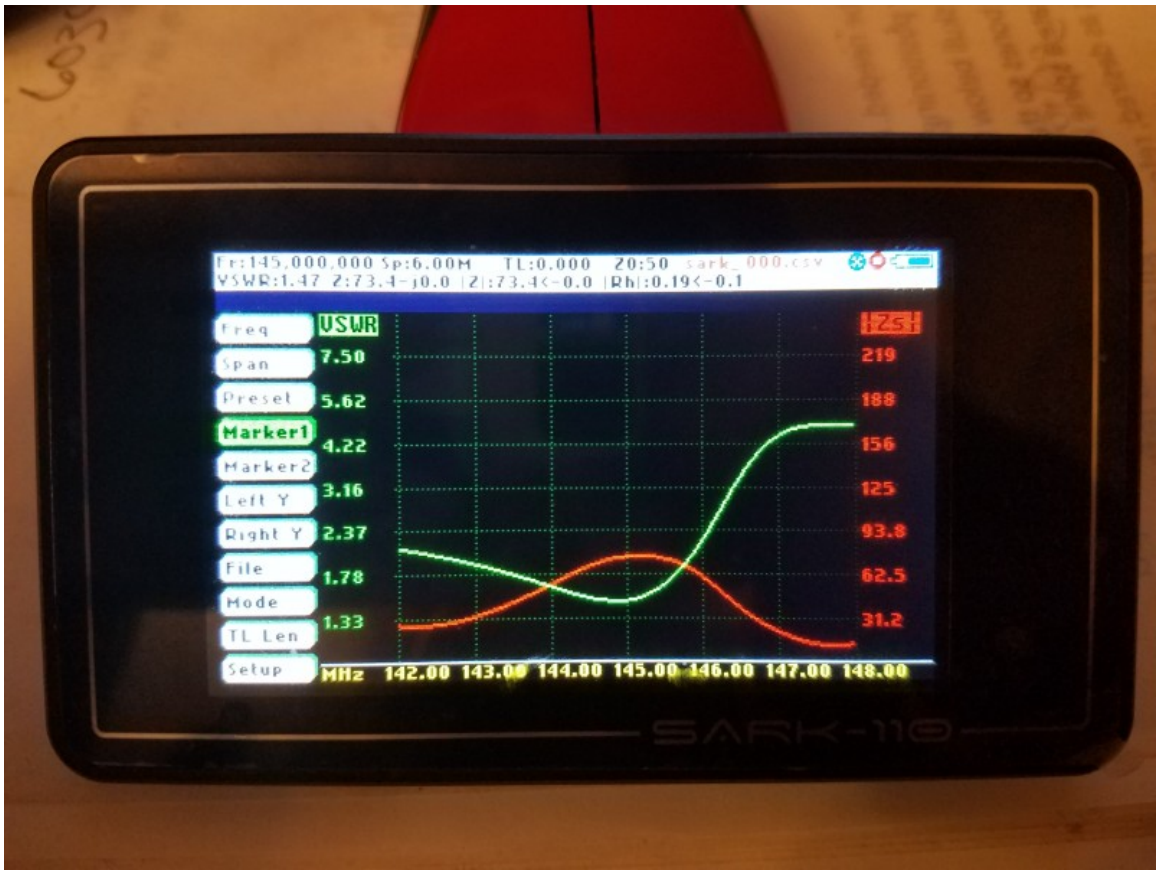
I mounted my antenna on a temporary mast that was only 16 ft high. It sure was little.

I quickly learned that things were not quite right. SWR was showing 2.75:1 at 144.200 mHz. And I wasn't hearing much when compared to my other 2m antennas. I rechecked all the dimensions and verified that they were what the M0PXS website had. But SWR was still way high. So I thought about it.

I concluded, a purely hypothetical conclusion, that I needed to change my reflector/driven element rectangle dimensions to match what the Super Moxon article had specified. And my third director rectangle should match the dimensions from the M0PXS website. This was also the easiest change to make. All that was required was to shorten the lengths of the back two rectangles.

I made the changes and put it back in the air at 16 ft. It now showed an SWR of 1.35:1 at 144.200 mHz. And stations being heard were stronger than before. Not as strong as my 7

element yagi but the yagi is at 20 ft which might make a little difference. I took out my SARK-110 Antenna Analyzer and captured a frequency scan. Here it is:



Maybe not as perfect as it should be but definitely better than before. I started using it to see if it worked. I've made many contacts at the 200 mile range. I only use 50 watts on 2 meters. I later mounted it at 24 ft to see what it could do there. Contacts were made at 350 miles and one contact was at 500 miles. And signals sounded a little stronger than with the yagi. My conclusion is that this antenna does indeed work. And it may have gain close to what the reported 4NEC2 graphs showed. I am going to put it up at 24 ft in a more permanent location and continue testing. Time will tell on how consistent it performs.

A few notes about my antenna construction are needed. Long tubing lengths were 660mm 1/2 inch aluminum tubing. Inside diameter was a little greater than 3/8 inch so that 3/8 inch tubing could be used for the radius ends. The radius ends were 210mm 3/8 inch aluminum tubing. Inside diameter of these radius ends was a little greater than 1/4 inch so that 1/4 inch nylon rod could be used as end separators. Ends of the 1/2 inch and 3/8 inch tubings were slotted so a stainless steel hose clamp could be used to tighten the elements together. The driven element was two pieces of 1/2 inch aluminum tubing at 325mm long and spaced at 10mm apart with a 3/8 inch nylon rod at the center. A #10 clearance hole was drilled through the tubing and nylon rod at 20mm from the tubing ends in the middle. This created a feedpoint spacing of 50mm. The green insulated tubing

standoffs are 30mm wide so this left a 10mm clearance on each side for the coax connections. There was a lot of tube cutting involved which also meant a lot of cleanup. I had bought 6 ft long pieces of 1/2 inch and 3/8 inch tubing and each piece had to be measured, cut and cleaned. I will build another antenna and this time I will buy 2 ft long pieces of 1/2 inch tubing and not cut them. I will buy 1 ft long pieces of 1/2 inch tubing for the driven element halves and not cut them. I will also buy 1 ft long pieces of 3/8 inch tubing and not cut them. I will just have to adjust their overlap to get the proper lengths. Hopefully it will perform as well as this one.

The HAARP Moxon article is very handy in showing the construction techniques for this antenna. I highly recommend reading this article. I also recommend reading the Super Moxon article as well. The HAARP Moxon would not have been developed if the Super Moxon wasn't developed first. In each article you will find the dimensions that they supposedly used. to construct their antenna. You will also find those dimensions at the end of this article. Lastly I also show the dimensions that I finally used. Since my dimensions are different I decided to call my antenna the 2m Super Duper Moxon Antenna.

Right now I am sitting here writing this and listening to a 2m QSO of 2 hams that are located 175-200 miles away using this antenna that is only at 16 ft high. I think it works!

PHOTO 2: The 2m version of the Super Moxon is just 30" x 25".

practical models have been fed with 50Ω cable and VSWR plots that follow the model graphs have been obtained with just slight adjustment of the driven cell element lengths. VSWR bandwidth is probably a little narrower than comparable Yagi designs, but at below 1.5:1 for the most-used part of 6m is very acceptable. The author has quite extensive knowledge of Yagi designs and so far (this tempts fate of course) has seen no 6m antenna design with comparable performance on such a short boom. A regular Yagi with the same gain would need a boom length of nearly 50% more and a turning radius nearly double of this design. One can truly say that this design packs more dB into its size than anything else so far realised.

BUILDING THE PROTOTYPE. The next stage was physical implementation, which was done with aluminium alloy for the elements and fibreglass rod for the split driven element and the element-end insulators. This is a lightweight antenna, easy for one person to manage, and only a 1" square boom was required.

Construction of the antenna was principally with ½" aluminium alloy, with the bent corners in 3/8" material. 3/8" fibreglass rod was used for the element insulators both at the driven element centres and at the element ends. The 6m antenna has been tested with 1000W from an ACOM1000 without complaint. (The insulators on the directors on the 2m version are only 12mm long but at the 50W power level no arcing or instability was noted. Unfortunately no greater power was available on 2m for testing.)

Table 1 gives constructional sizes for 6m, 4m and 2m versions, the dimensions relating to Figure 5. The front part of the driver element is of course split at the centre and 50Ω feedline connected there through a balun.

Although the final dimensions are as set out in the table, it is useful to slit the ends of the main element tubes and install stainless hose clamps for fine adjustment, particularly if other antennas are nearby. It would be most interesting to hear of constructors using this design on other bands. 10m is currently in the doldrums, but a 10m version of this antenna or of the basic Moxon rectangle would be the most space-saving means of achieving a good 'gain' antenna on the HF bands.

TABLE 1: Tubing lengths for 6m, 4m and 2m versions of Figure 5. All dimensions in mm, measured to tubing centres.

	A	B	C	D	E	F	G	H	J	K	L	M
6m	2160	395	280	105	290	310	60	2140	0	780	1201	1861
4m	1572	275	175	110	195	202	43	1572	0	560	860	1310
2m	730	135	86	55	82	90	12	730	0	276	434	615

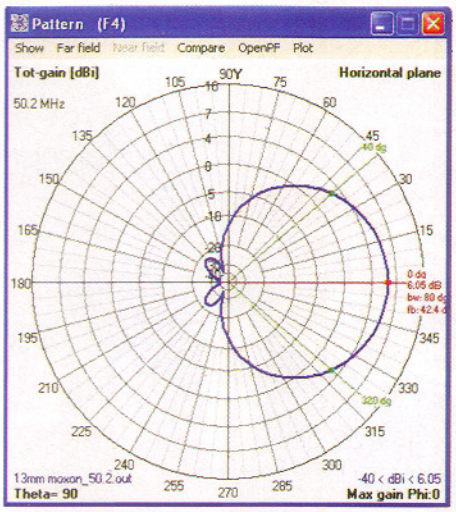


FIGURE 2: *4NEC2* plot of Moxon rectangle showing fairly broad frontal lobe and 80° 3dB points.

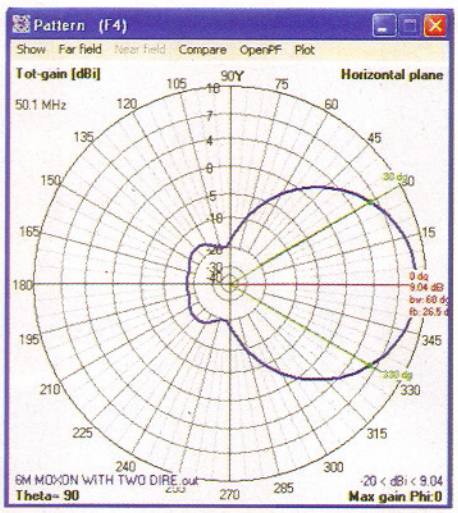


FIGURE 3: *4NEC2* plot of Super Moxon radiation pattern. Note narrower frontal lobe and improved forward gain with very smooth rear pattern.

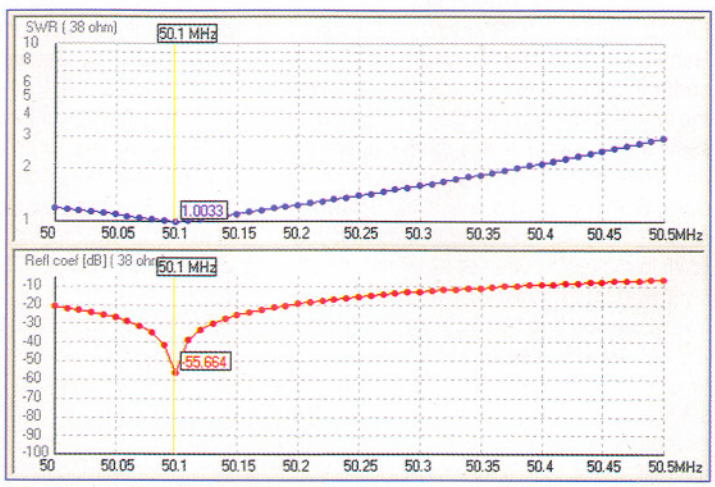


FIGURE 4: *4NEC2* plot of Super Moxon SWR and reflection coefficient.

REGISTERED DESIGN. This design is being registered and therefore commercial manufacture is not permitted without permission of the design owner. However, radio amateurs may freely construct and use this antenna for their personal amateur stations. Commercial versions of the antenna are available from Vine Antennas Ltd [2].

WEBSEARCH
[1] www.moxonantennaproject.com/design.htm
[2] www.vinecom.co.uk

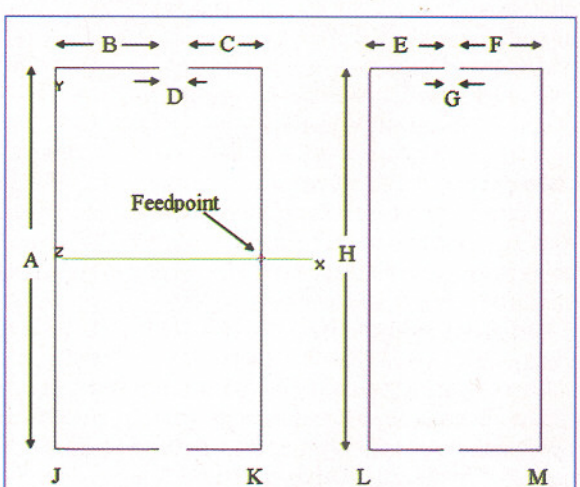
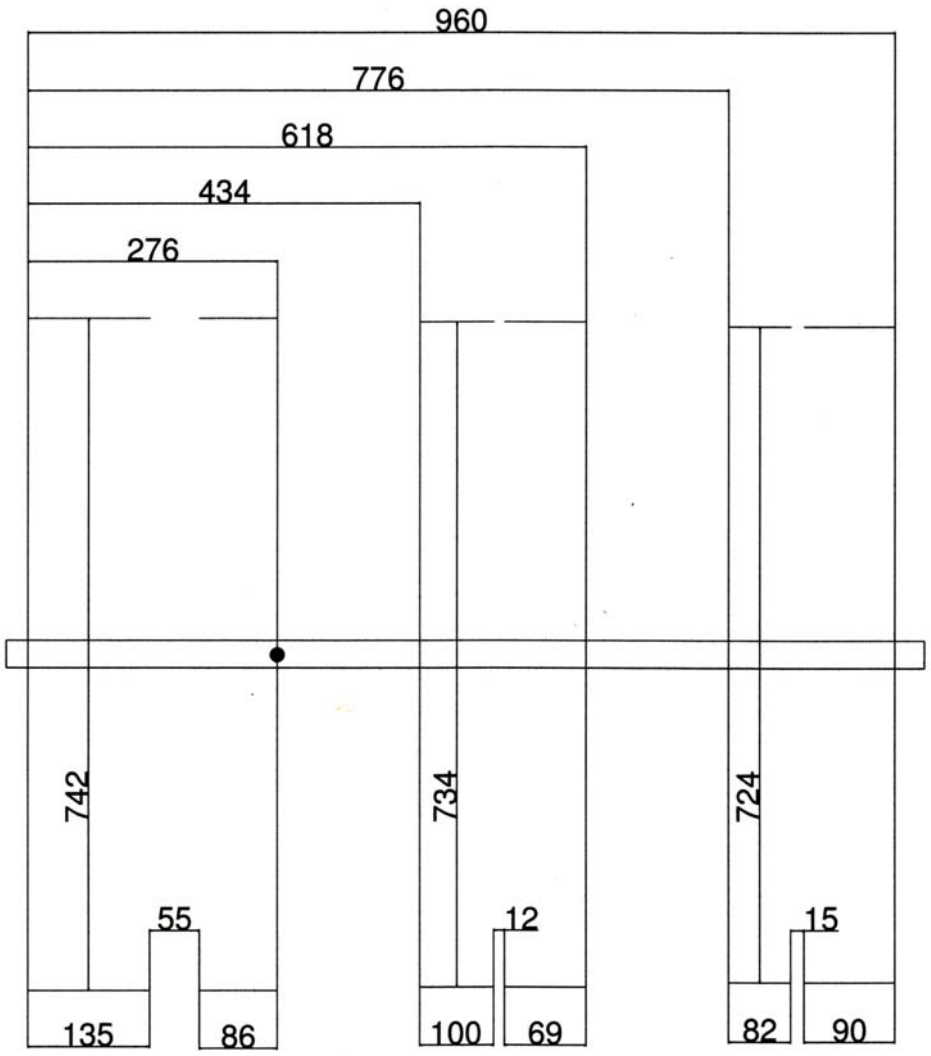


FIGURE 5: Basic design of the Super Moxon. See Table 1 for 6m, 4m and 2m version dimensions.

144.300Mhz HAARP

The dimensions found in the HAARP article "The HAARP - by Phil Simpson M0PXS



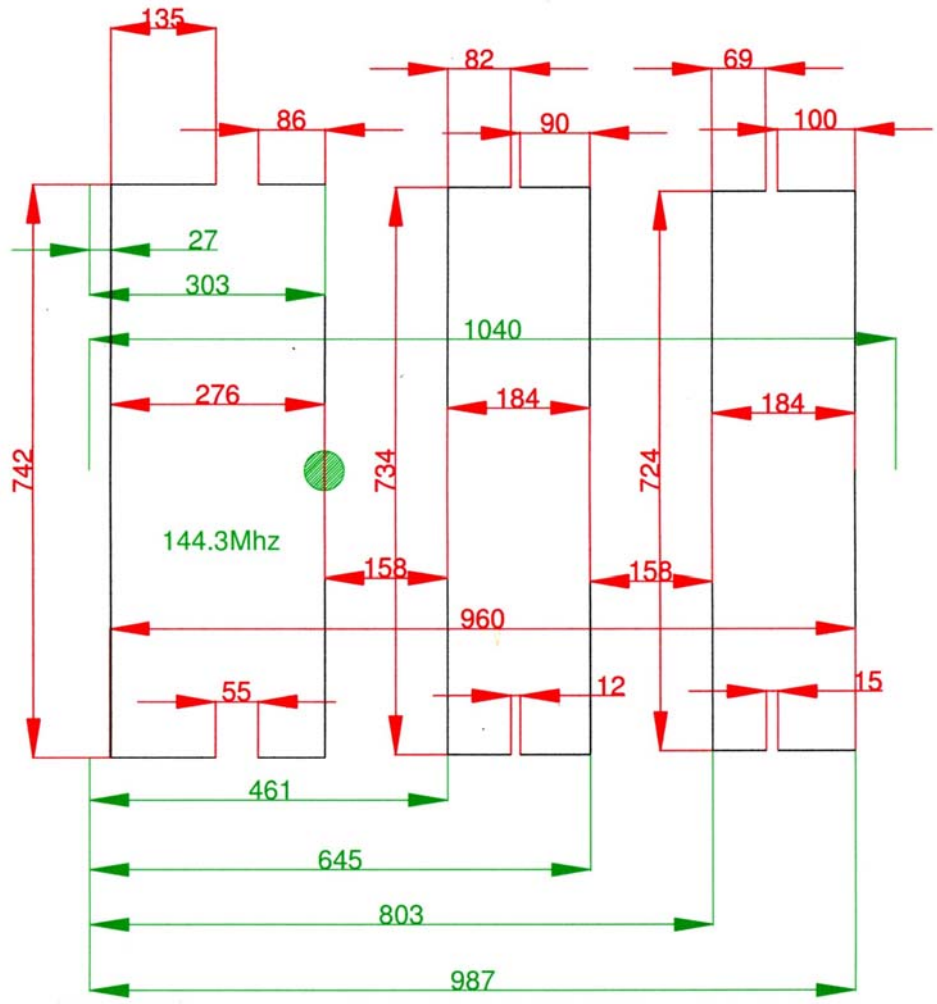
Long Elements - 18 gauge 1/2" aluminium tube

Short Elements - 14/16 gauge 3/8" aluminium tube

Boom 32mm Square aluminium tube

144.300Mhz HAARP

These dimensions are the dimensions found on M0PXS website, in the Build section:
http://m0pxs.co.uk/



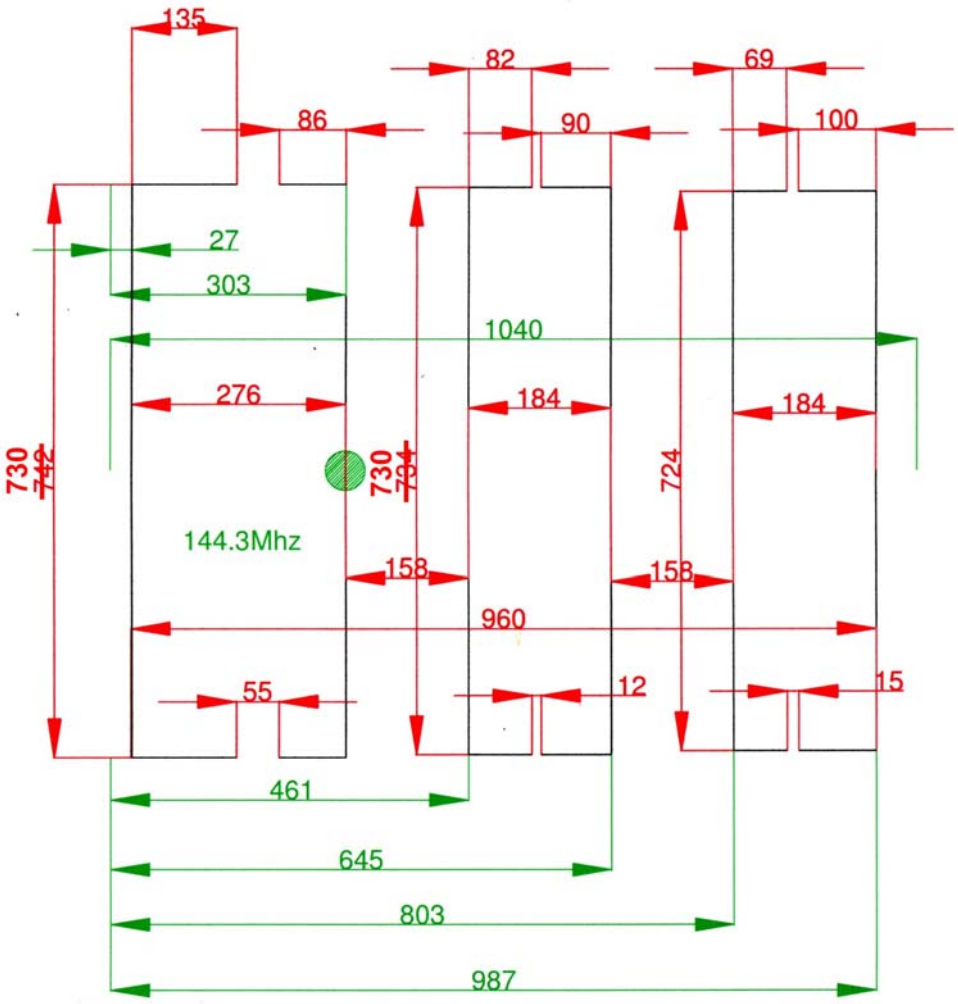
Long Elements - 18 gauge 1/2" aluminium tube

Short Elements - 14/16 gauge 3/8" aluminium tube

Boom 32mm Square aluminium tube

144.300Mhz HAARP

These dimensions are the dimensions used to create the WB8AHT version of this antenna.
Per the Sark-110 Antenna Analyzer resonant frequency is 144.300 mHz at SWR 1.35:1.



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