Quagi 8 elements 432MHz

by ik1hge

I like electronics, telecommunications, photography, playing various instruments, programming... There are a couple of recent projects that I'd like to show to you. Let's begin with a 432 Mhz Quagi antenna.

I tried N6NB's project but it didn't work well. Actually, there were some differences from the original project: for the Driven Element and the reflector, I used 1.8mm solid copper wire (the one for coils or transformers) because, at least in Italy, the old insulated #12 TW solid copper wire is too hard to be found. Furthermore, the Directors diameter was 4mm instead of 3mm. Probably these differences resulted in unacceptable Standing Wave Ratio, as you can see here below:

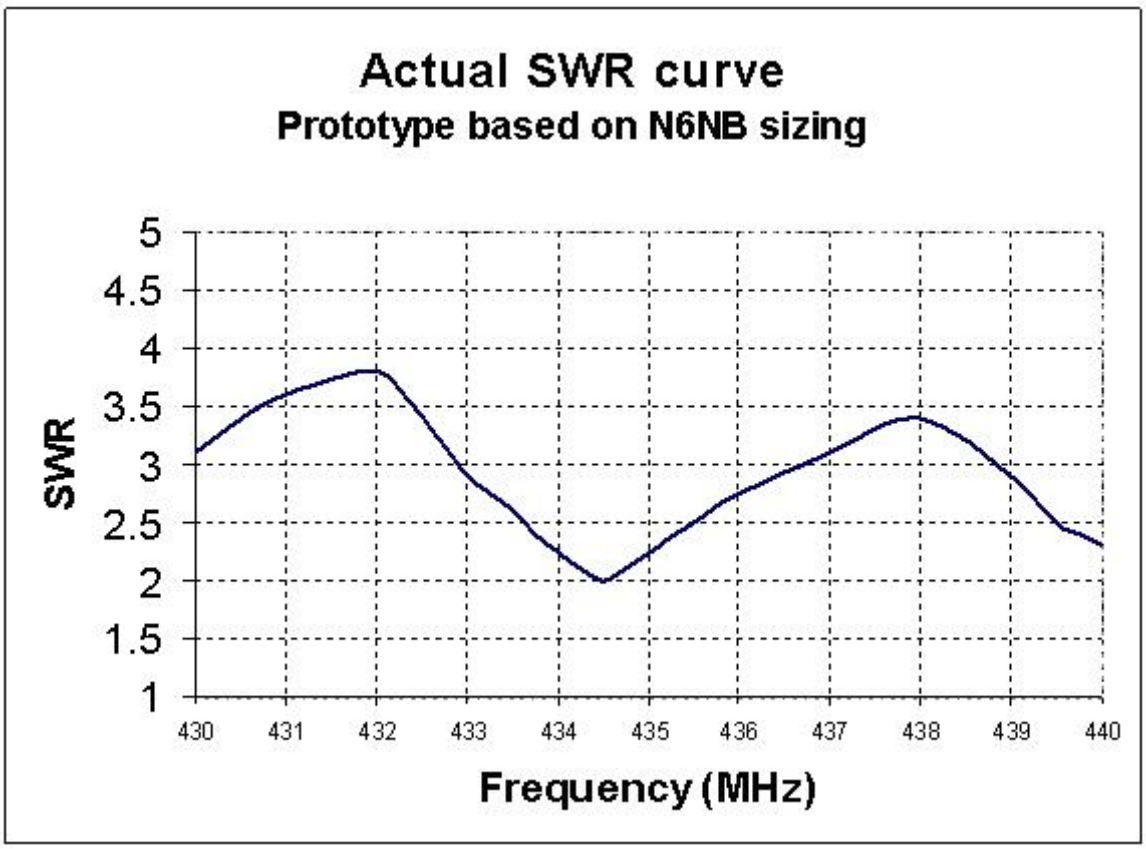

Fig. 1 Experimental SWR curve obtained with N6NB's design (materials as specified in the text above)

Someone suggested me to optimize the antenna through NEC2, and... here you are the first results.

This Quagi is optimized for

432.2Mhz operation, however it works well in a quite wide range of frequency. All following data are obtained through 4NEC2D v. 5.3.2 by Arie.

The protype behaves better than I expected, but it seems that the Driven Element requires a little adjustement due to mounting approximations and to the coating of the copper wire. **In my prototype, the Driven Element required to be shortened of about 3mm**.

I suggest to:

1) Build the antenna by using the design data here below

2) Run a SWR curve

3) Adjust the DE length. An estimation of the new length is: DE(new) = DE(old) * fSWRmin/432.2

where fSWRmin is the new frequency in MHz of minimum SWR. However the actual length depends on your peculiar construction, thus take it easy and don't cut too much!

I put some experimental results and the pictures of the prototype at the bottom of this page. I only regret that I did not record the SWR curves taken when the Driven Element was 741mm and 738mm long, however you can see that with 735mm the minimum SWR is @ 434.5MHz. You can also see the comparison to a simulated antenna with 735mm DE which includes loss due to non-ideal material.

Have fun!

Parameter	Value	Unit (Conditions)
Frequency	432.2	MHz
Gain	13.77	dBi in free space
SWR	1:1.03	(432.2 MHz)
SWR (min)	1.01	(432 MHz)
Bandwidth	430-434	MHz (SWR<1.4:1)
Take off angle	1.8	Degrees above a good ground (antenna height, about 8 wavelengths)

Table 1 Antenna performance (MOM simulation)

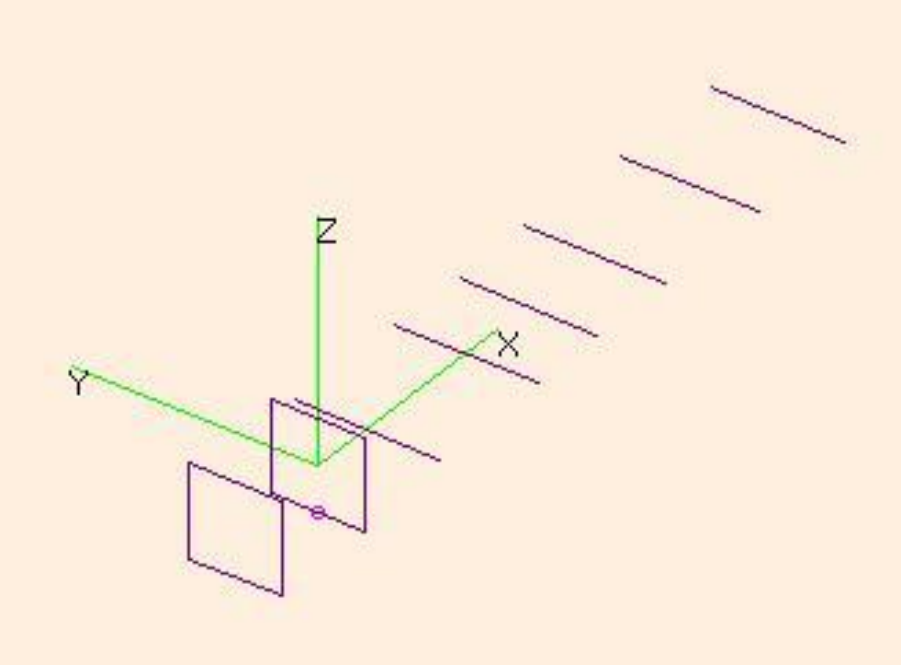

Fig. 2 Structure of the Quagi antenna

Copper wire diameter for the square elements	0.0018	Aluminum directors diameter:	0.004	Boom (wood): 1.50
Element	Length	Position		Spacing
RE	0.76215	-0.22904	DE-RE	0.22904
DE	0.7413	0	DE-DE	0
D1	0.29365	0.13093	DE-D1	0.13093
D2	0.29213	0.40783	D1-D2	0.2769
D3	0.28042	0.57751	D2-D3	0.16968
D4	0.28618	0.7632	D3-D4	0.18569
D5	0.28384	1.0228	D4-D5	0.2596
D6	0.27414	1.2687	D5-D6	0.2459

Tab. 2 Design details (meters)

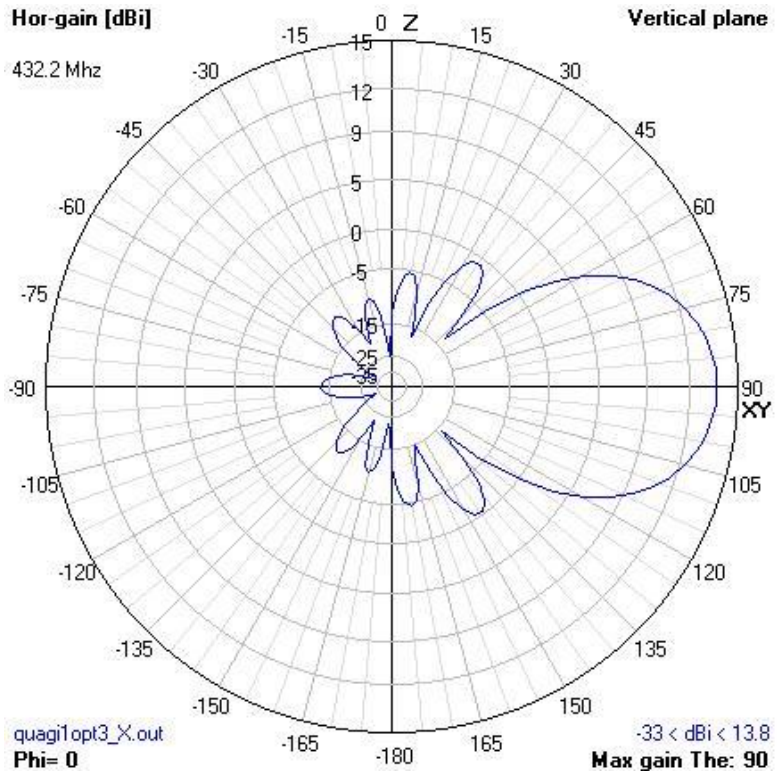

Fig. 3 Vertical (Elevation) pattern in free space

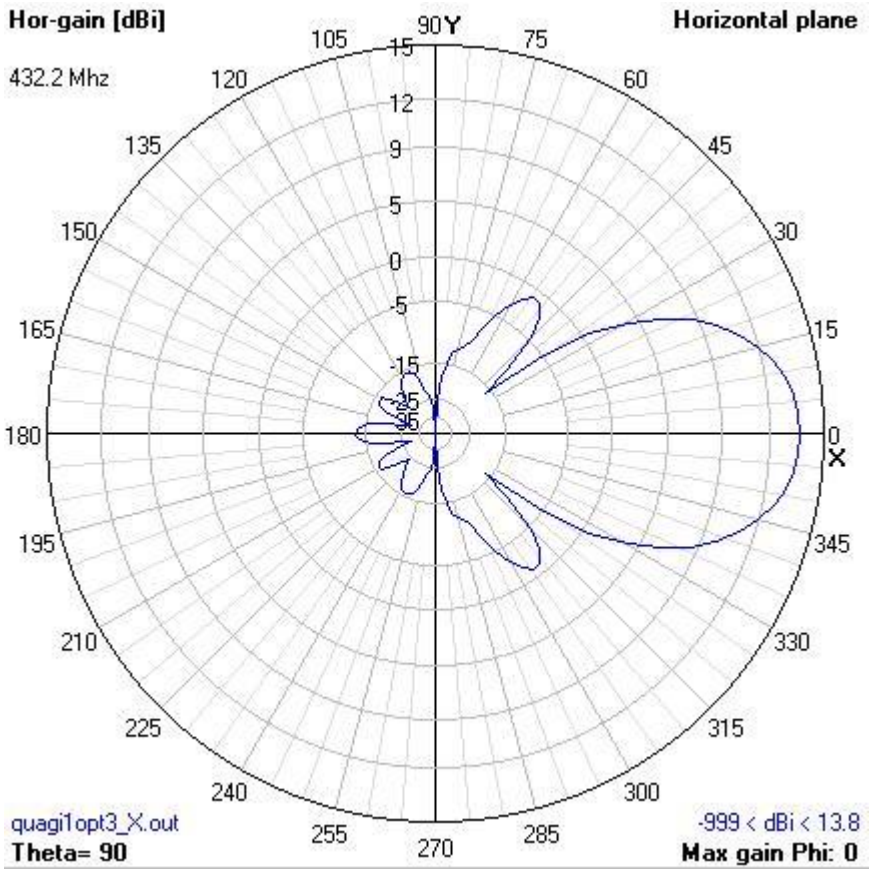

Fig. 4 Horizontal radiation pattern in free space (horizontal component)

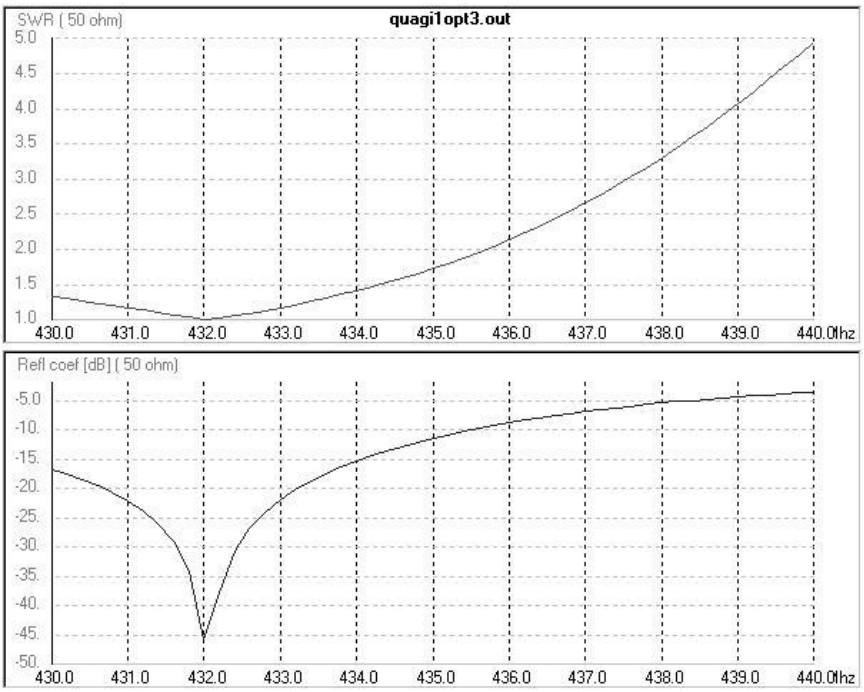

Fig. 5 SWR and reflecttion coefficient charts

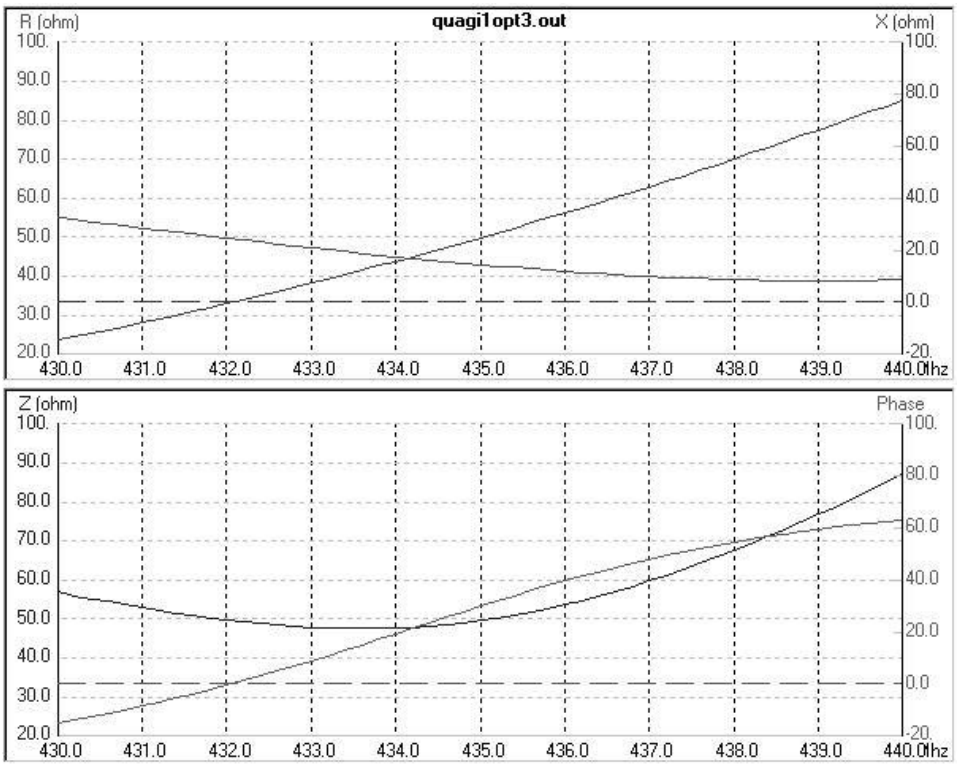

Fig. 6 Impedance charts: Resistance,Reactance (top) and Impedance,Phase (bottom)

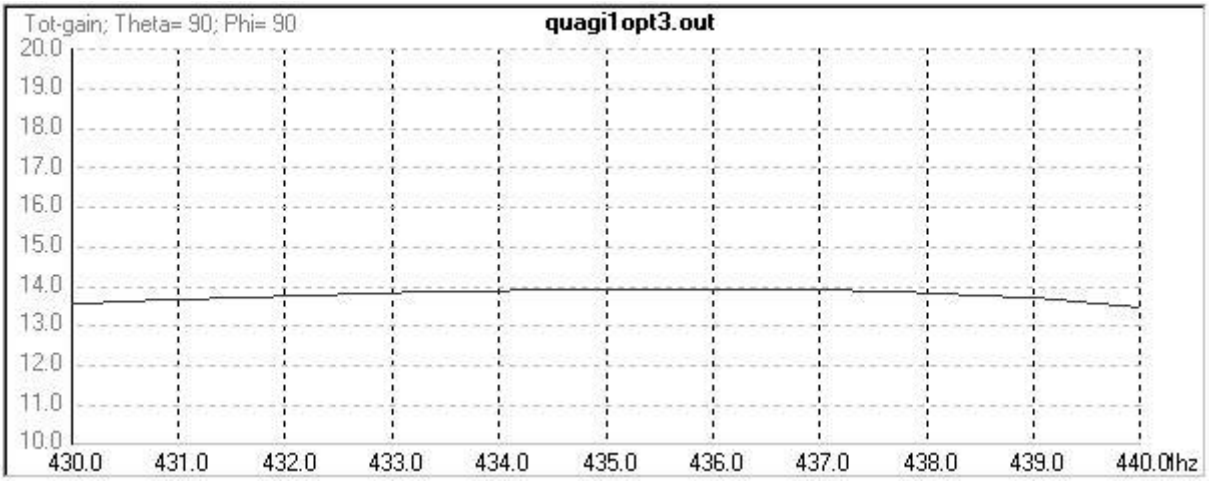

Fig. 7 Total Gain vs. Frequency

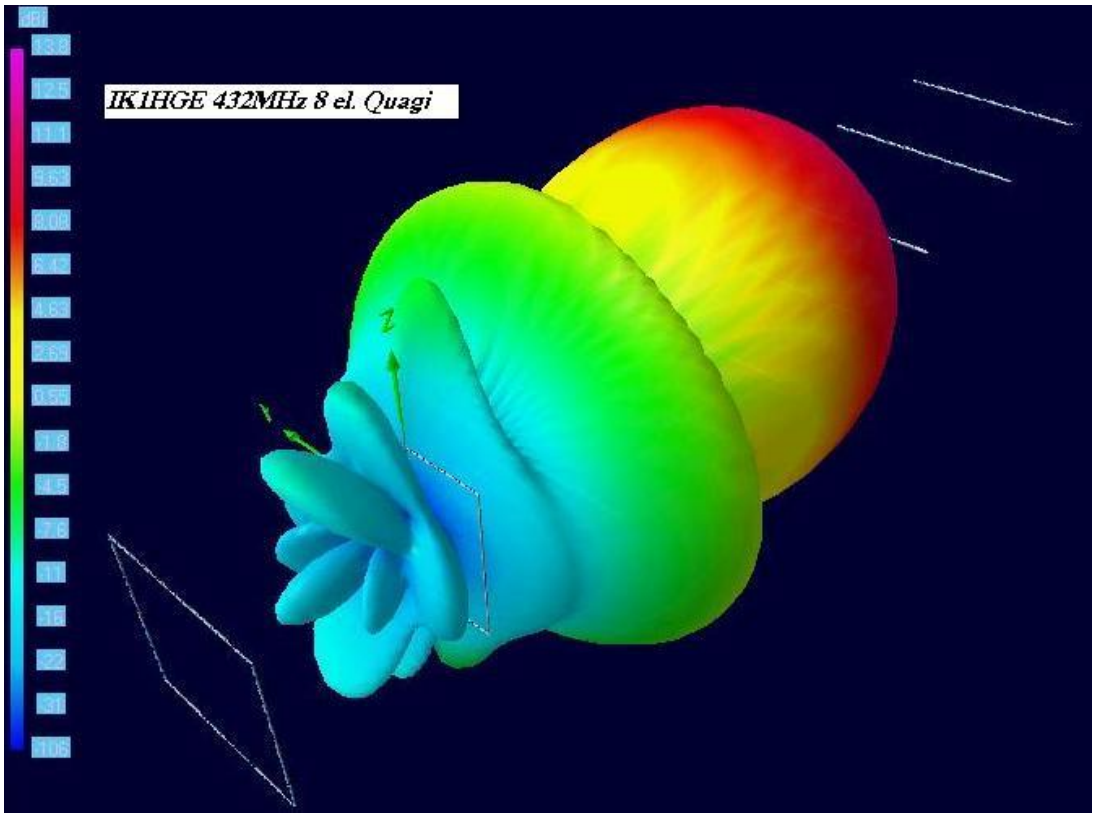

Fig. 8 IK1HGE 432MHz 8el Quagi - 3D horizontal gain plot

The construction details are described in N6NB's article, in the ARRL Antenna Handbook and in many places on the net. Just search for "Quagi".

Here below, find some suggestions and some pictures of my prototype.

- Use some kind of coating to protect the boom from humidity and sun.
- To hold each square, I used two strips of FR4, that is the normal substrate for Printed Circuit Boards (completely remove the copper foils first!)

- The Driven Element is fed trough a female N connector and a short piece of RG213. Protect the connection points to the square. To make the conection more flexible, I suggest to use a thinner coax instead (like the RG58). You can then use the RG213 for the longer line connecting the RTX to the antenna.
- After the directors are perfectly aligned, you can fix them with a drop of glue.

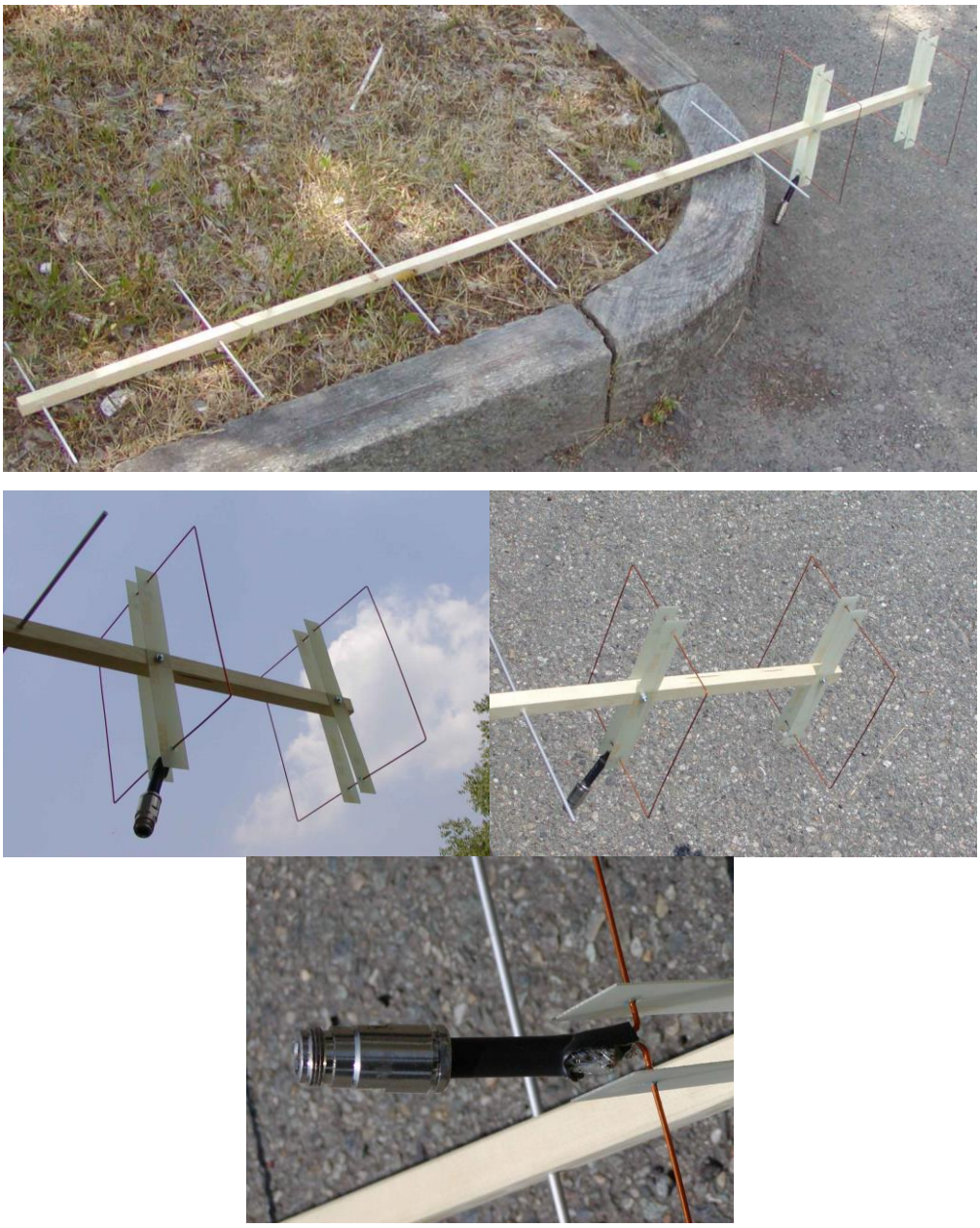

Fig. 9 IK1HGE 432MHz 8el Quagi - Prototype construction details