

Introduction



While searching the web I came across some cheap yagis HDTV antenna, which claim to operate from 45 to 860MHz, have a 150 miles range (22-38dB gain) and come with a rotator. All this for for \$32.99 including shipping. I wanted to see how well would these antennas work on the 2m/70cm band, and see if I could modify them to work better on these bands. The particular model I got is the Esky HG-981 from [amazon](http://amazon.com).

Here are the specs for this antennas:

- Frequency: 45-860 MHz
- Gain: 22-38dB
- Rotation: 360°
- Channel: VHF1-12 UHF21-69
- Impedance: 75Ω
- Power: 3W
- Power Supply: AC110V

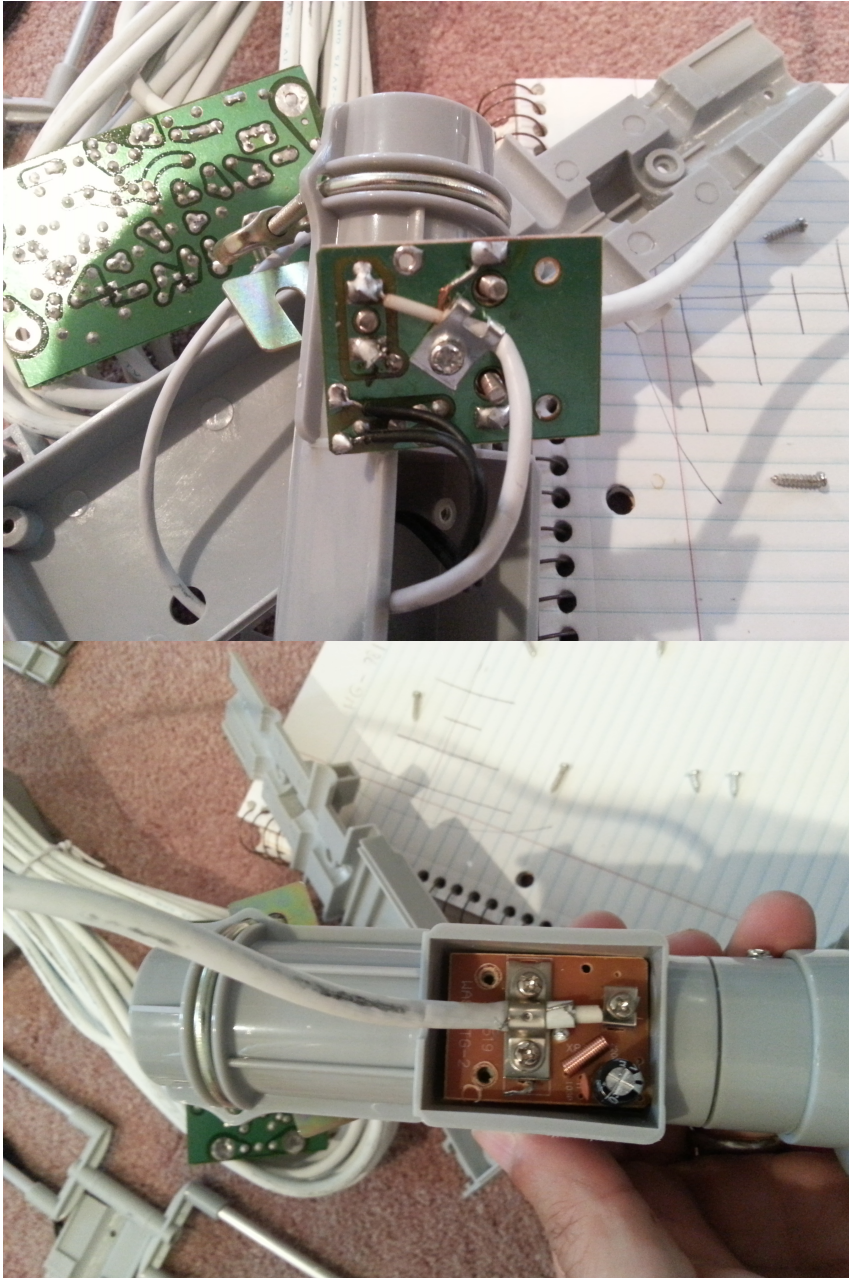
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- Rotation speed: 2-4 rounds/min

Before assembling it, I took it apart and measured everything on it so I can replicate it in an antenna simulator to see what I need to change.



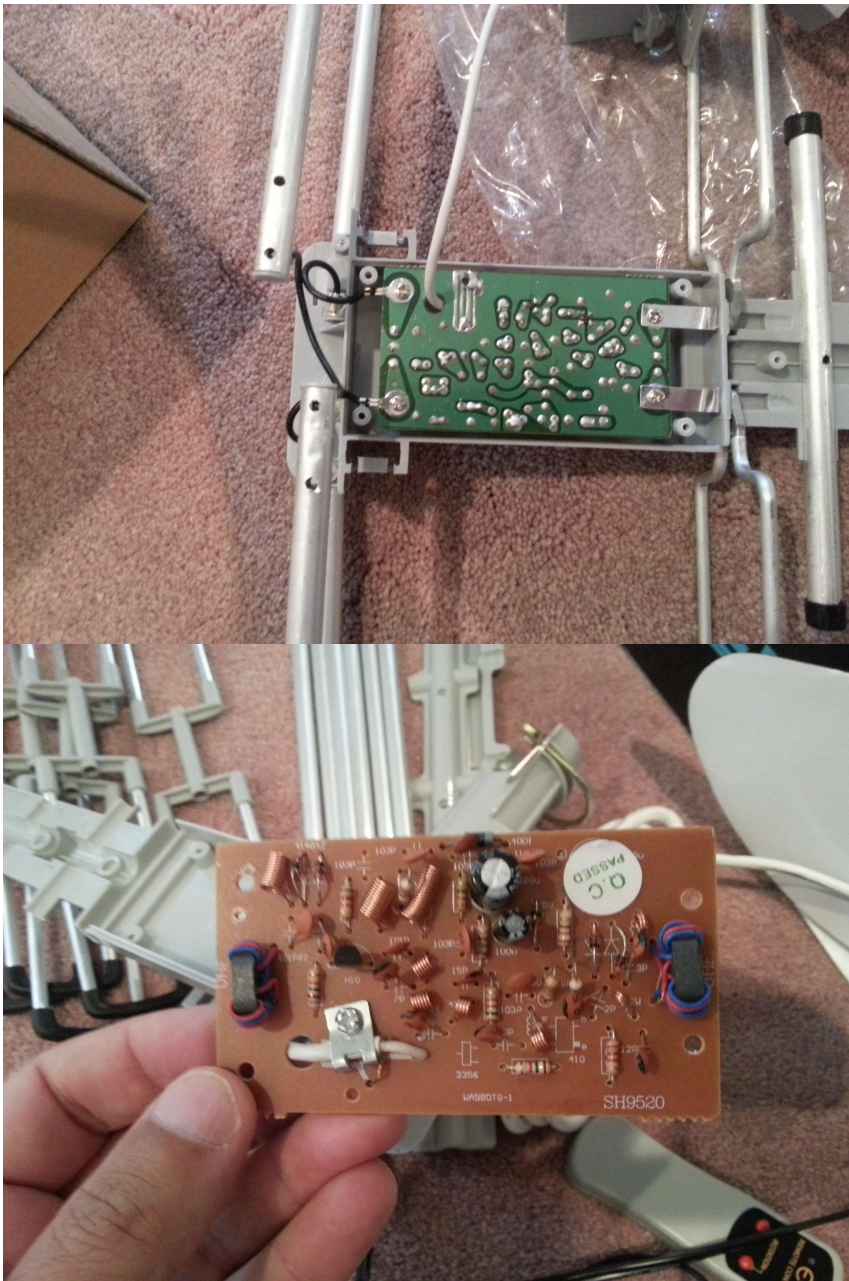
There is only a single coaxial cable leading into the antenna, which contains a filter to pass 12V

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AC into the motor, and filter out all other higher frequencies into the antenna.



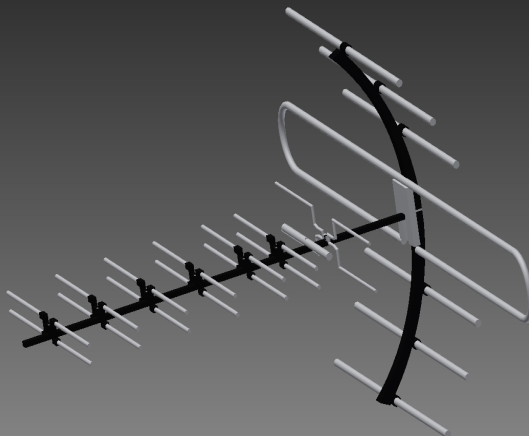
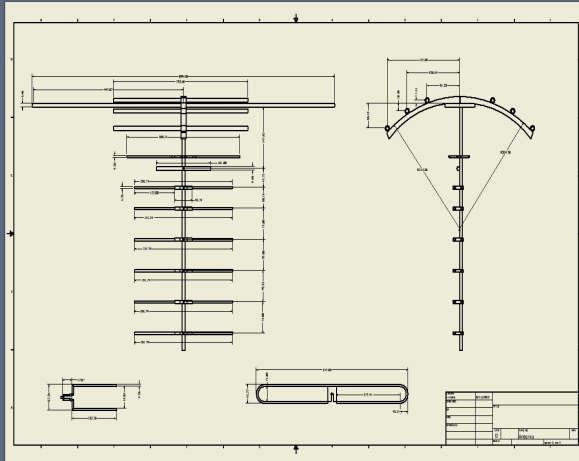
Before going into the radiating elements, the signal goes through another filter (a diplexer) which seems to split VHF and UHF signals into separate radiating elements from the signal feed line.

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The VHF radiating element is a folded dipole, while the UHF looks like a dipole with two fingers for radials.



I then reproduces the antenna in Auto-desk Inventor to capture all of its parameters. [Here is a PDF file with all the dimensions.](#)

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The antenna seem to be composed of a reflector dish for 2M and a yagi for 70cm.

Testing

{youtube}gxRcYO6uhJM{/youtube}

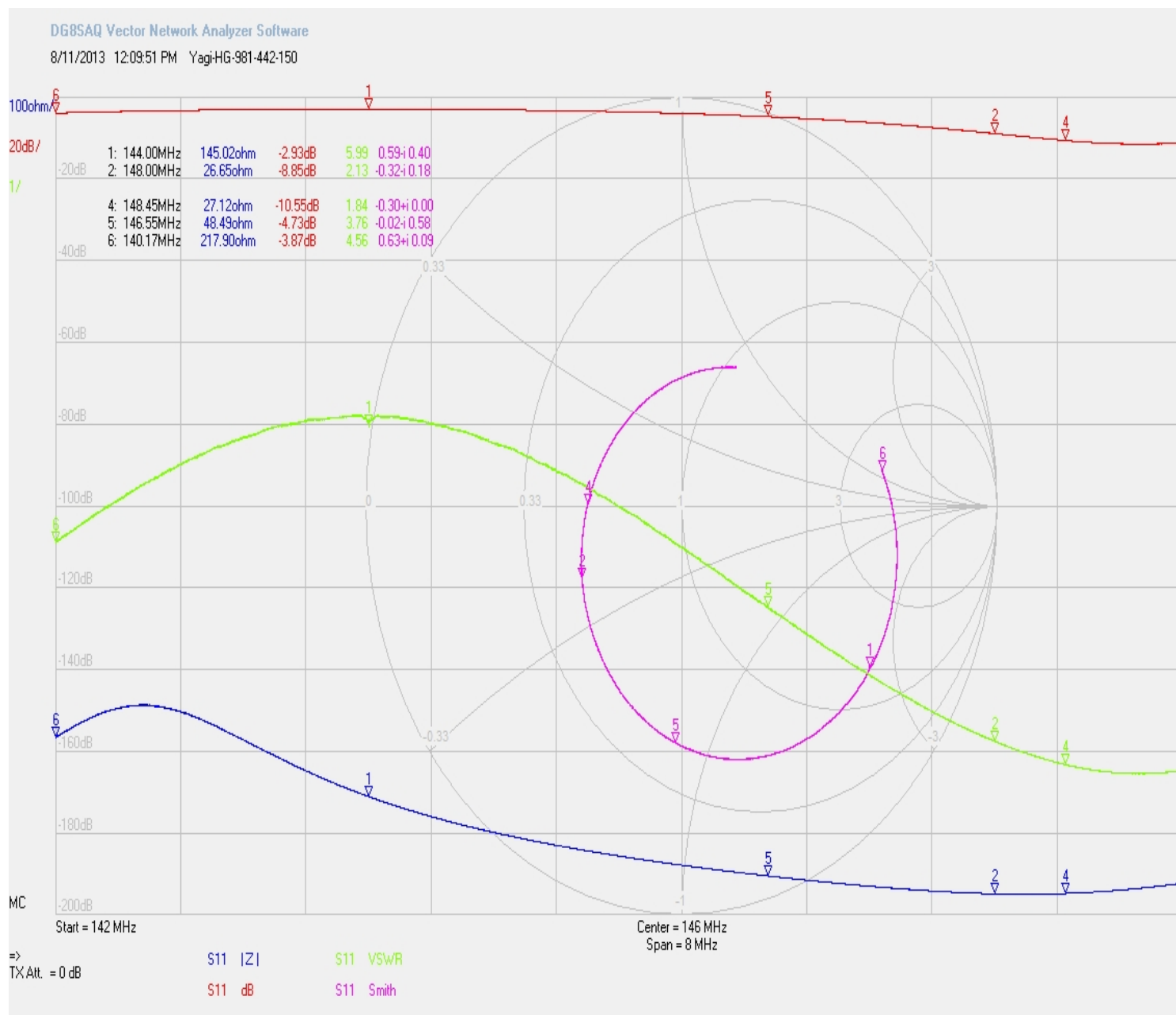
Here is the antenna mounted on a test pole I have on the balcony. I took some preliminary measurements using by [VNA](#) as well as having some people from the CVARC ham club send some test transmission (Thanks for TIM-K6POI Todd-KD6RCM and Zak-N6PK for helping out). Since the impedance is 75 Ohms I tried a quick transmission but did not measure anything (only Tim was able to hear me on 2M).

Here are the results from the VNA on 2M and 70cm.

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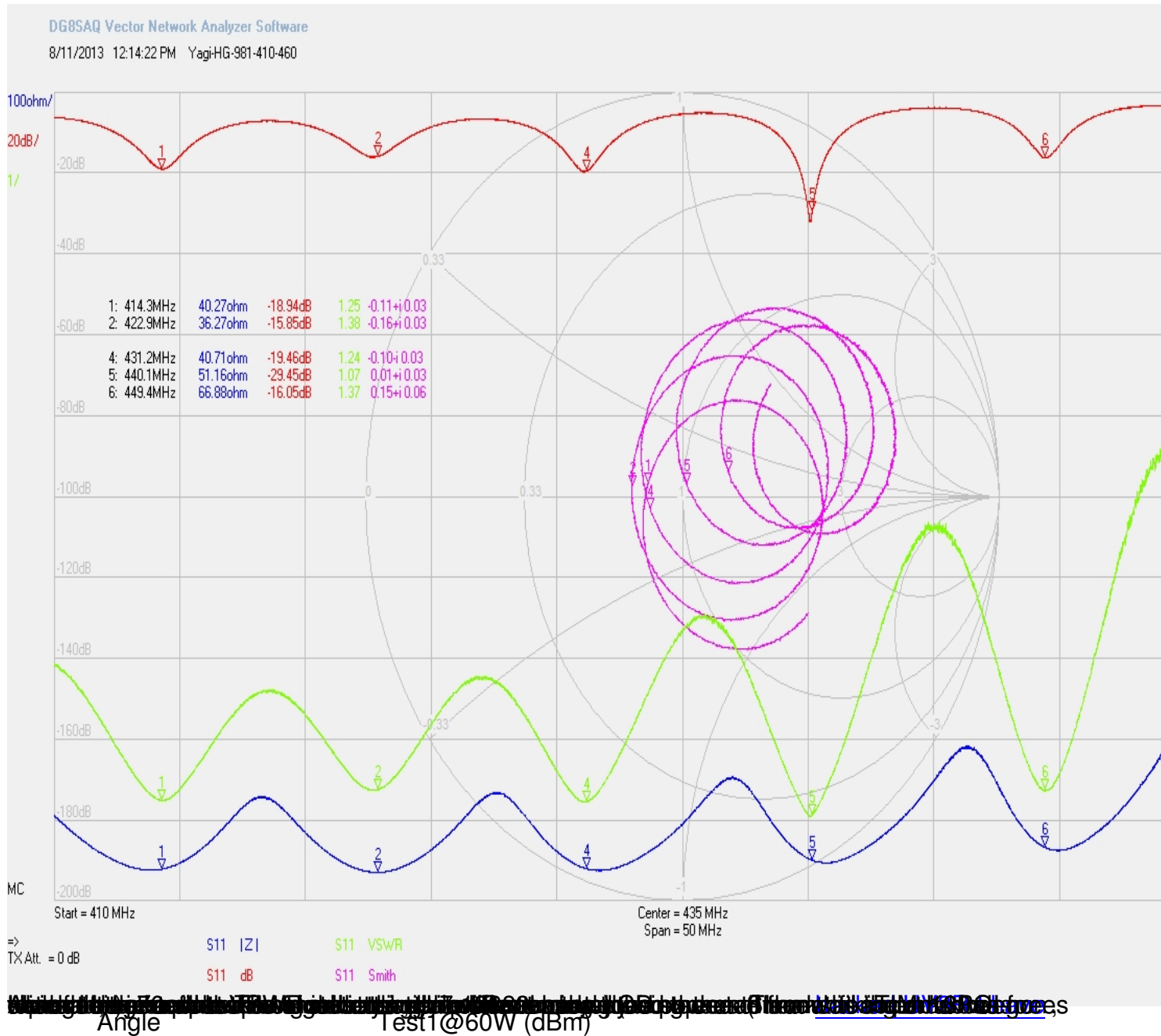
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Normalized (dBm)

Test2@60W (dBm)

Normalized (dBm)

Test3@20W (dBm)

Normalized (dBm)

0

-104

-5

-105

25.7143

-104

-5

-105

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51.4286	-103	-4	-104
77.1429	-102	-3	-103
102.8571	-100	-1	-101
128.5714	-99	0	-100
154.2857	-100	-1	-98
180	-103	-4	-99
205.7143	-113	-14	-103
231.4286	-115	-16	-108

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257.1429	-111	-12	-116
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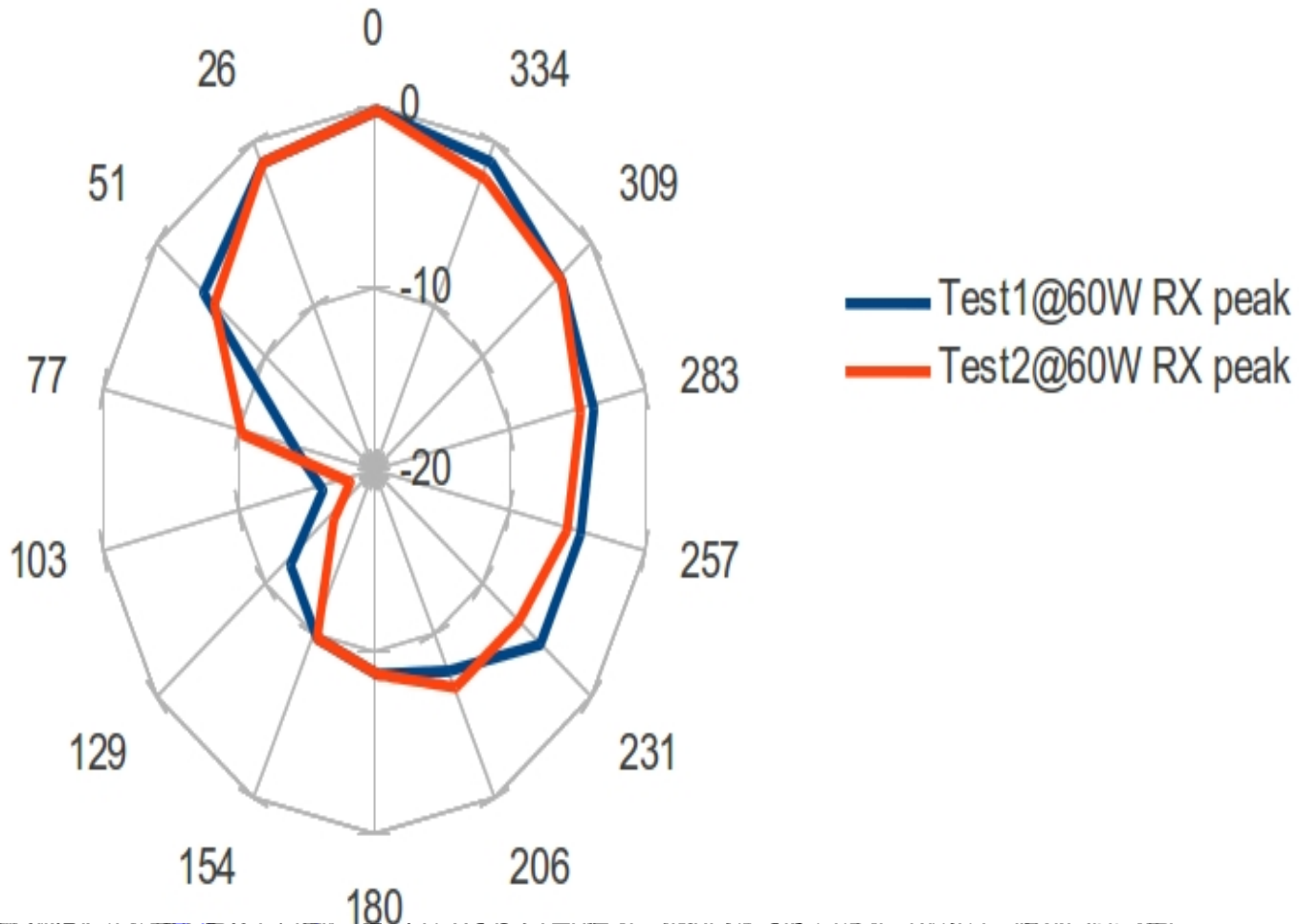
282.8571	-109	-10	-114
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308.5714	-108	-9	-108
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334.2857	-107	-8	-107
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Here is a normalized polar plot for the 60W transmission.

HG-981 Normalized Received Power TX: 146.550MHz,X-50A 4.5dB gain, distance 7.12889 km



Simulation

The next step is to simulate this antenna using [NEC2](#) so I could determine what I would need to adjust in order to improve the antenna for use on the 2M/70cm band.

Here are some preliminary simulation results, which I am still working out to see if they are correct.

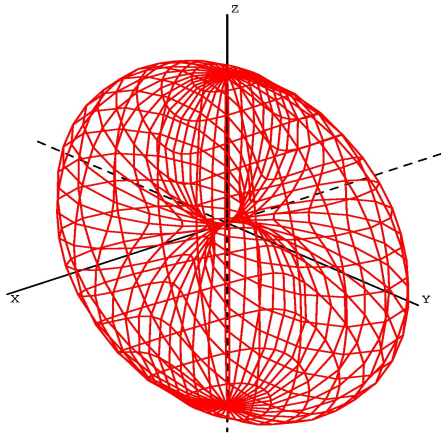
Here is the [NEC file I am using](#).

2M simulations results

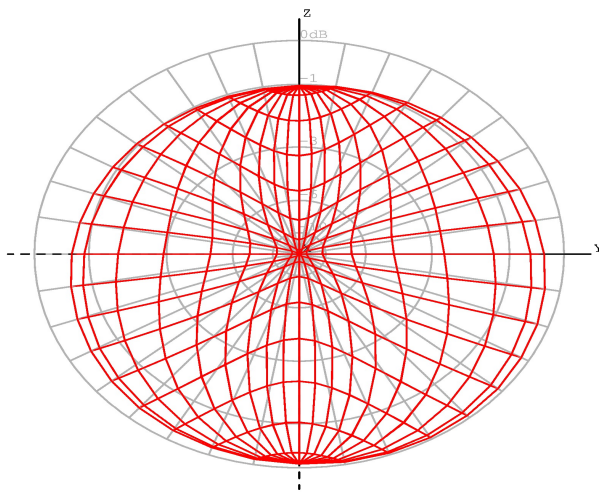
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f = 140 MHz maxgain = 2.46 dBi vgain = -0.25 dBi

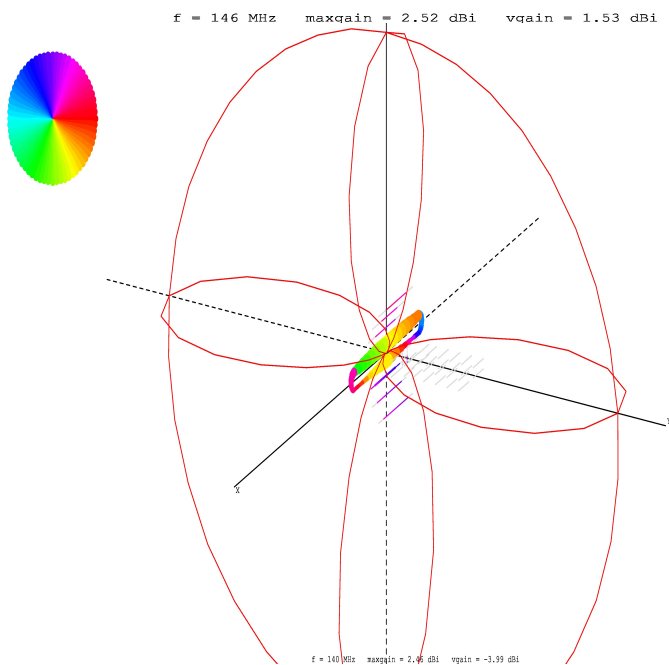
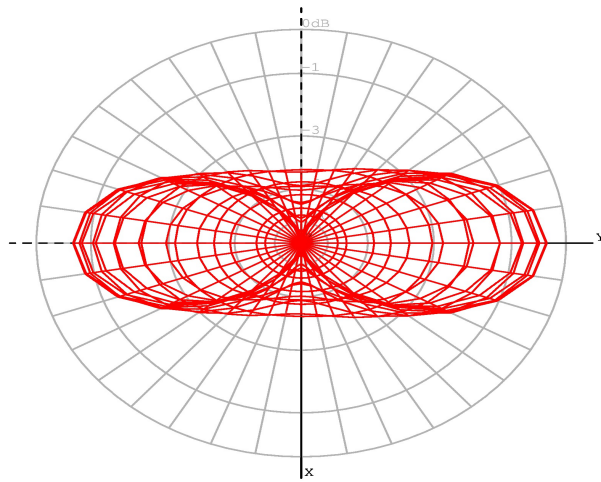


f = 146 MHz maxgain = 2.52 dBi vgain = -22.39 dBi

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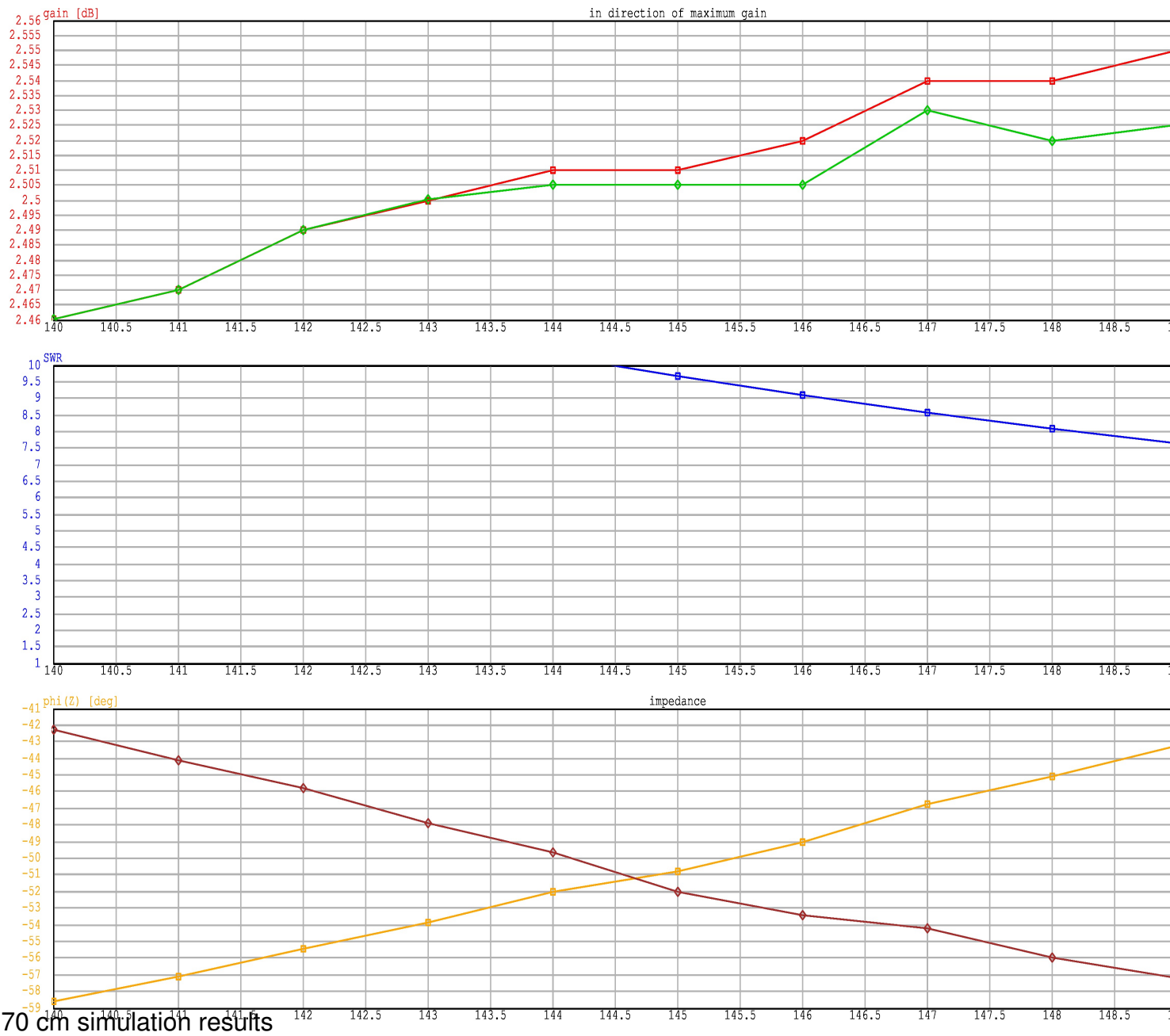
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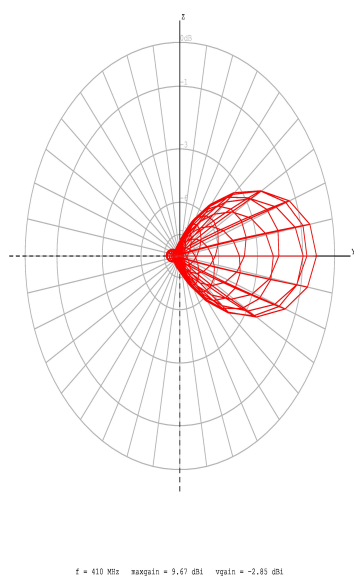
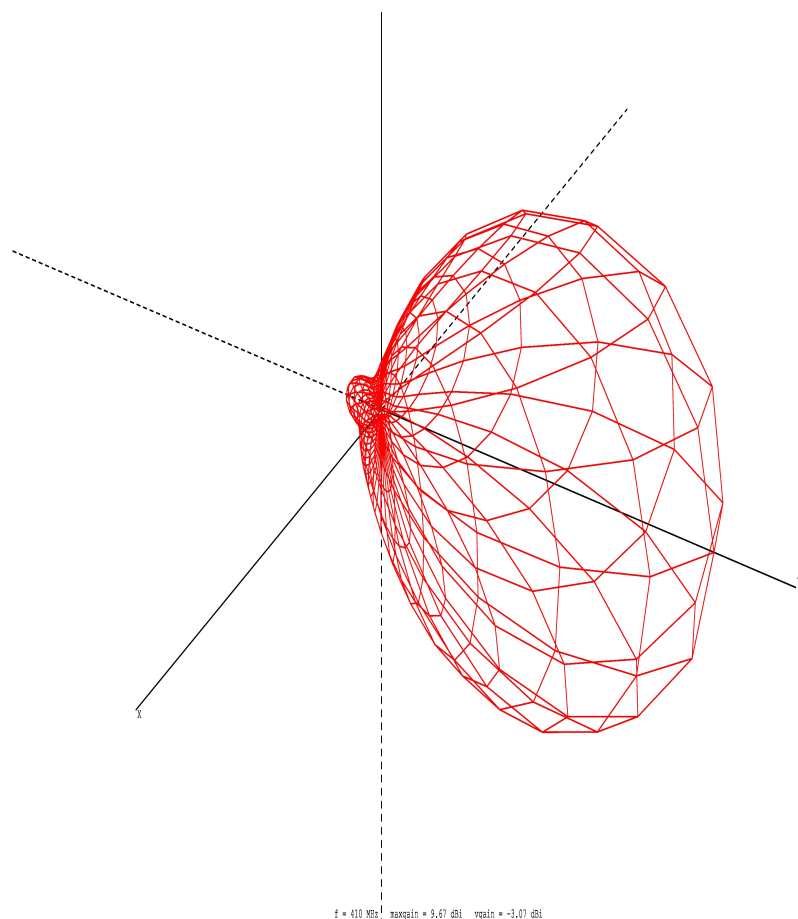
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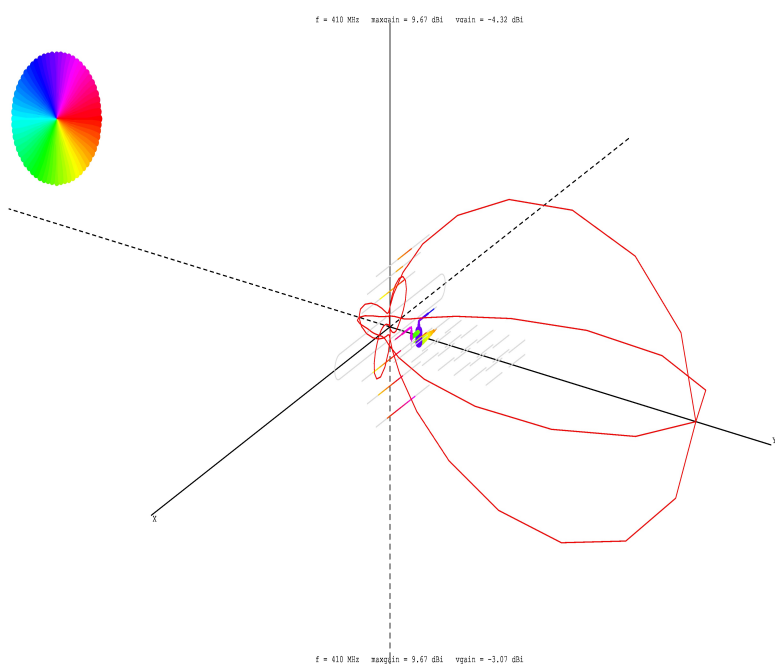
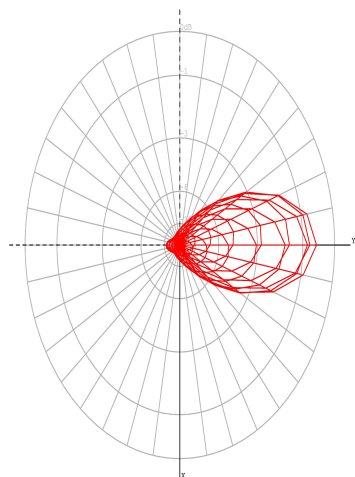
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