

The Design, Construction and Operation of the 28 Element OWA 15 meter Stacked Yagi Array at K3LR

Jim Breakall, WA3FET

Tim Duffy, K3LR

Antenna Forum

Dayton Hamvention

May 18, 2007

It All Starts!!!

- **Hi Jim,**
- **It was GREAT to talk to you last night! WOW! Lots of catching up to do!**
- **Here is the plan:**
- **New FET OWA antennas for 15 meters.**
- **7 elements OWA on 47 ft booms (current design is 6 ele gamma on 47 ft booms)**
- **Mount new antennas at 160'/120'/80'/40'**
- **Thanks for putting this together Jim.**
- **Thanks Jim!**
- **73,**
- **Tim K3LR**

Work was also ongoing for 4 stack of WA3FET OWA 6 element 20M Yagis at K3LR (More on that later)

- **Hi Tim,**

-

I know you must be anxiously awaiting the results for the 15M array.

-

So far, I am using 6 element OWA Yagis similar to the K3CR designs at

- **40, 80, 120, and 160 feet. The pattern is not quite as good as the 20M design**
- **yet and the SWR is not quite there either. There are some lobes around 25 dB down**
- **that I am trying to get even lower like I did with the 20M. The SWR is also rising**
- **to about 1.7 at the top of the band. I don't like that.**

-

**I will keep these running all night and then if it doesn't come in by tomorrow, I will play
with the spacings. I am keeping the spacings fixed for now.**

-

**Also, I know you said you wanted 7 elements. I really don't think you need that extra element.
I have included the patterns, etc. for what we have at K3CR on 15M for the 3-stack.**

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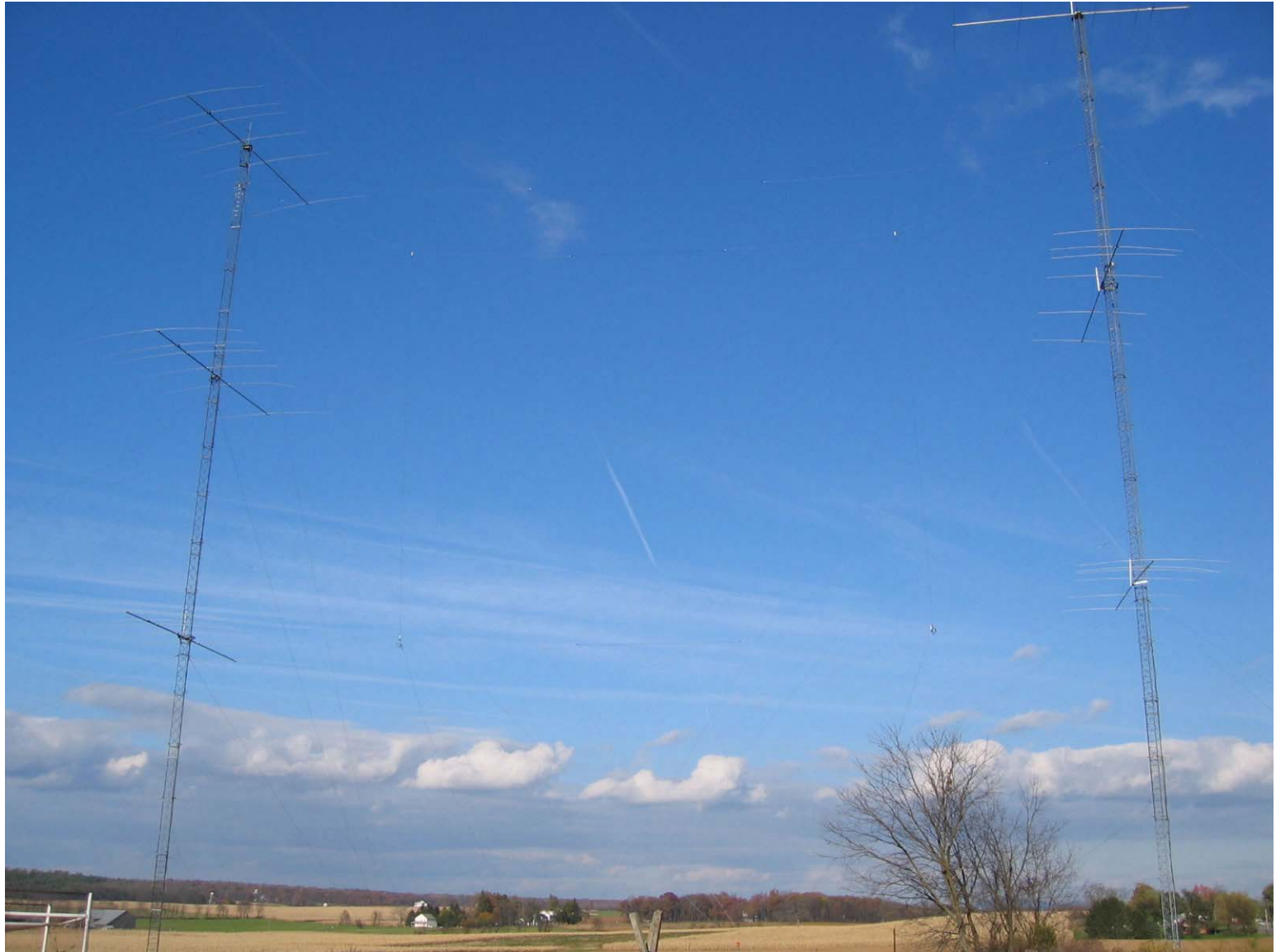
73 Jim

-

**PS: As you know, I will not give you anything until it is perfect. I want this to be perfect, just
like the 20M.**

-

K3CR 6 Element OWA 15 M 3 Stack

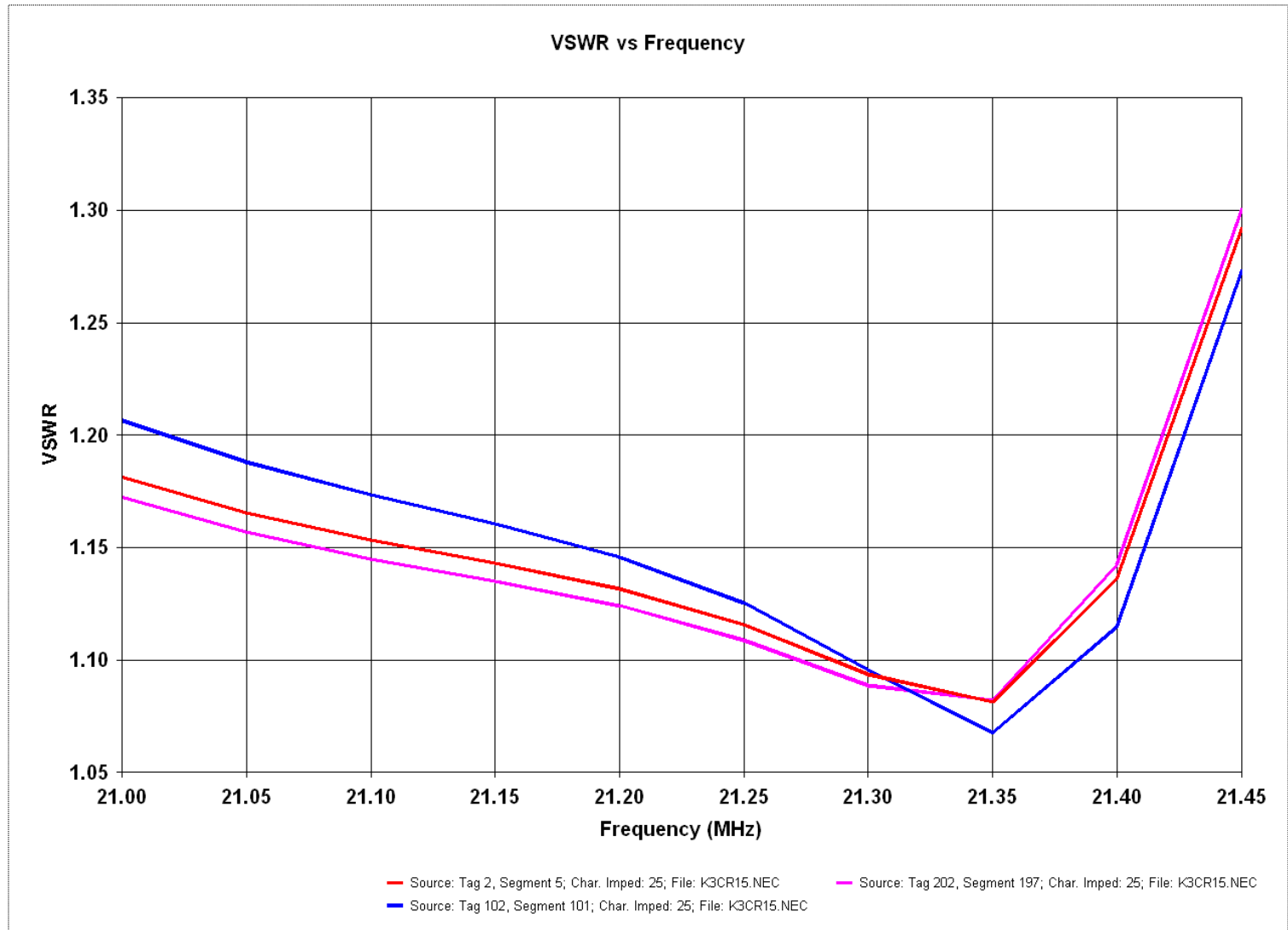


K3CR 7 Element OWA 10 M 4 Stack



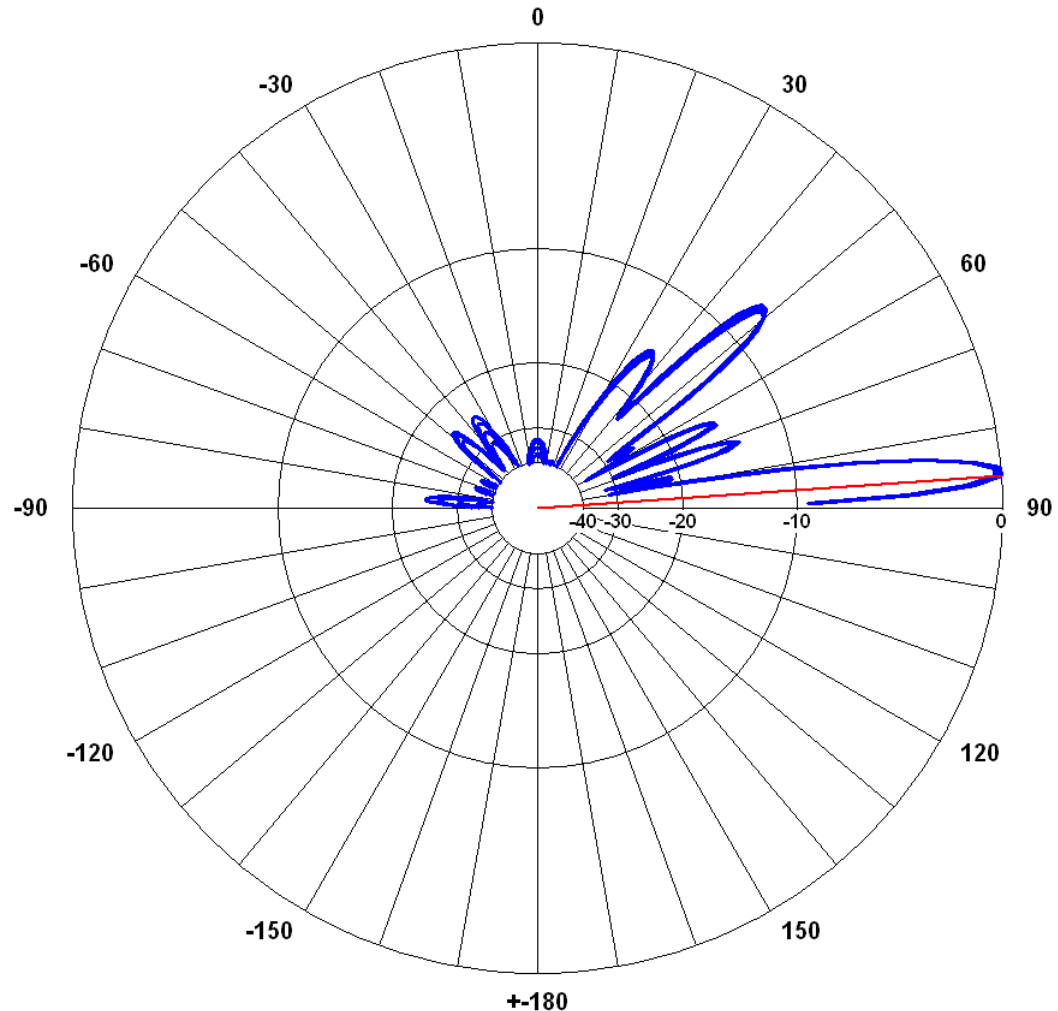
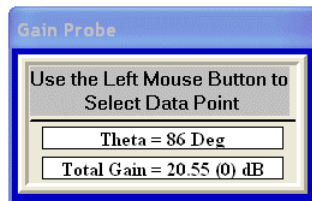
K3CR 6 Element 15M OWA Yagi 3-Stack

(Heights of 62, 124, and 186 feet)



K3CR 6 Element 15M OWA Yagi 3-Stack (Heights of 62, 124, and 186 feet)

K3CR 6 El OWA 3-Stack Top at 186 feet
Freq 21, 21.1, 21.2, 21.3 MHz



K3CR 6 Element 15M OWA Yagi 3-Stack (Heights of 62, 124, and 186 feet)

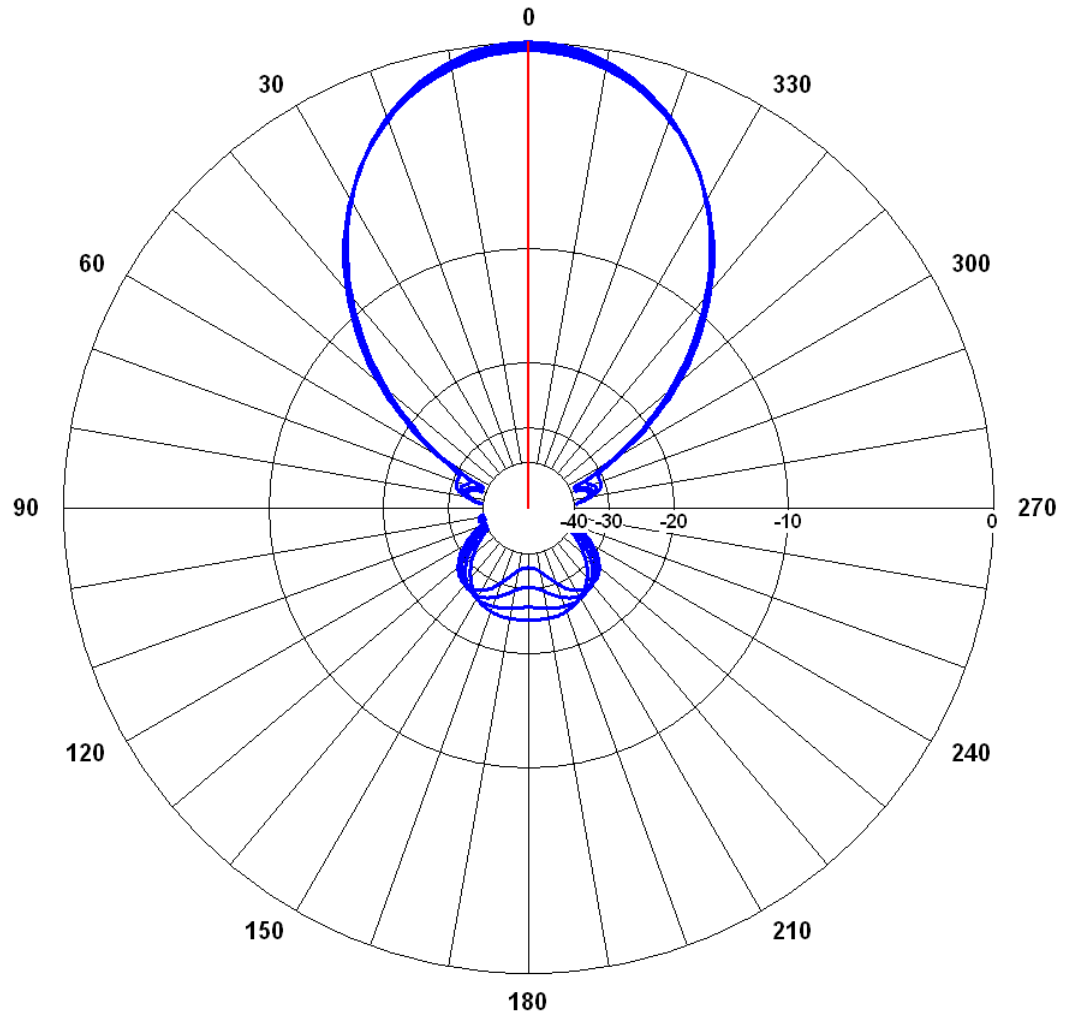
K3CR 5 El OWA 3-Stack Top at 186 feet
Freq 21.0, 21.1, 21.2, 21.3 MHz

Gain Probe

Use the Left Mouse Button to
Select Data Point

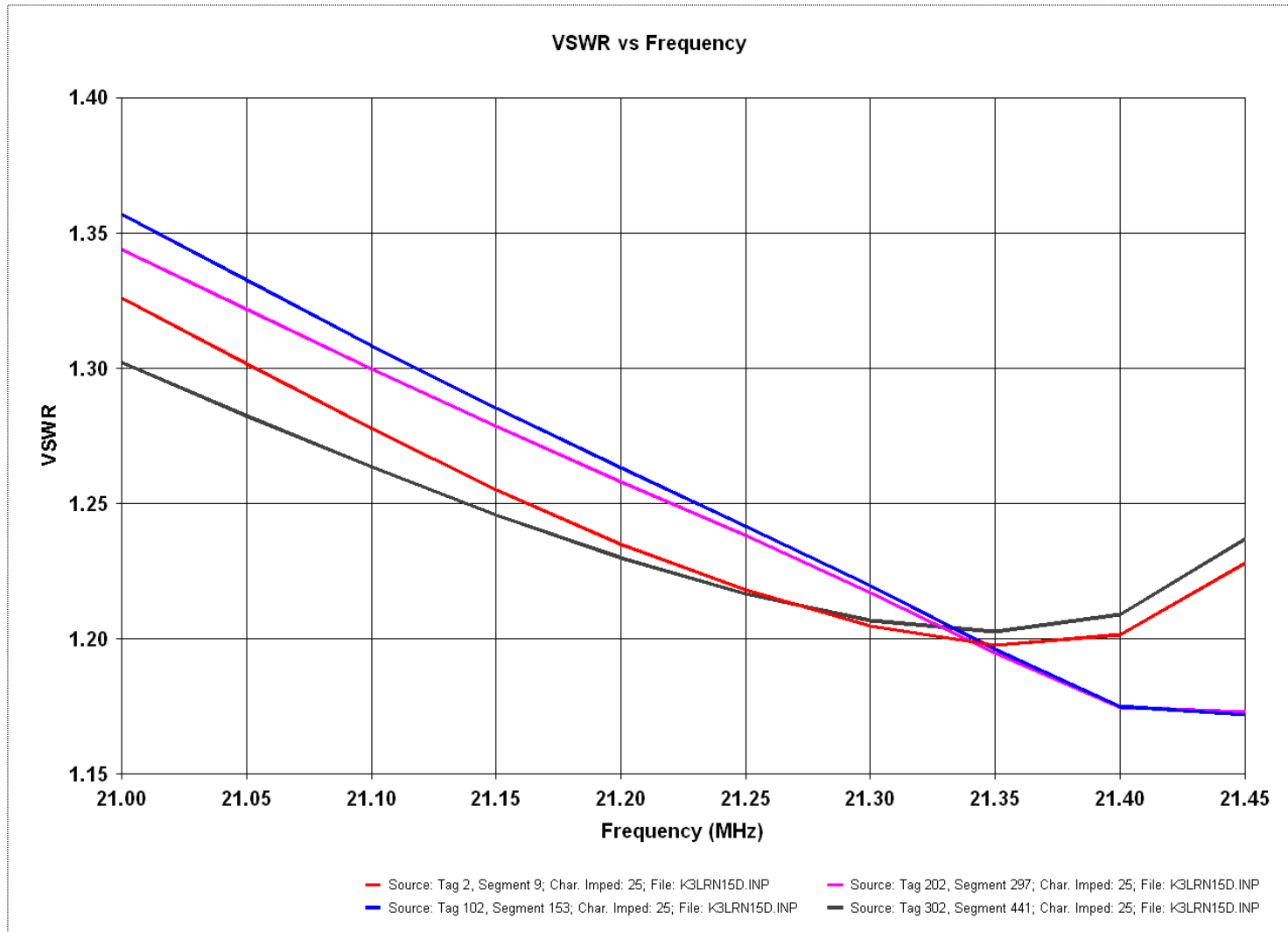
Phi = 0 Deg

Total Gain = 20.55 (0) dB



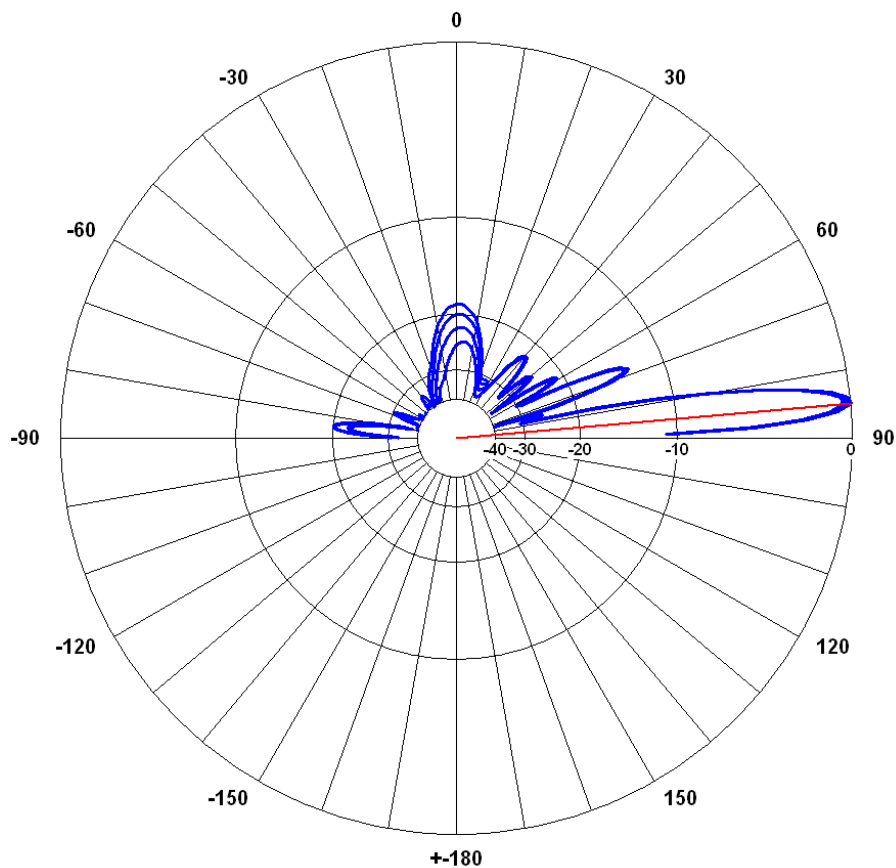
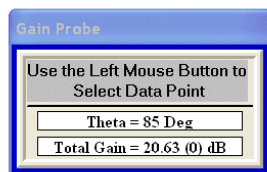
K3LR Preliminary 6 EI 15M OWA

Yagi 4-Stack

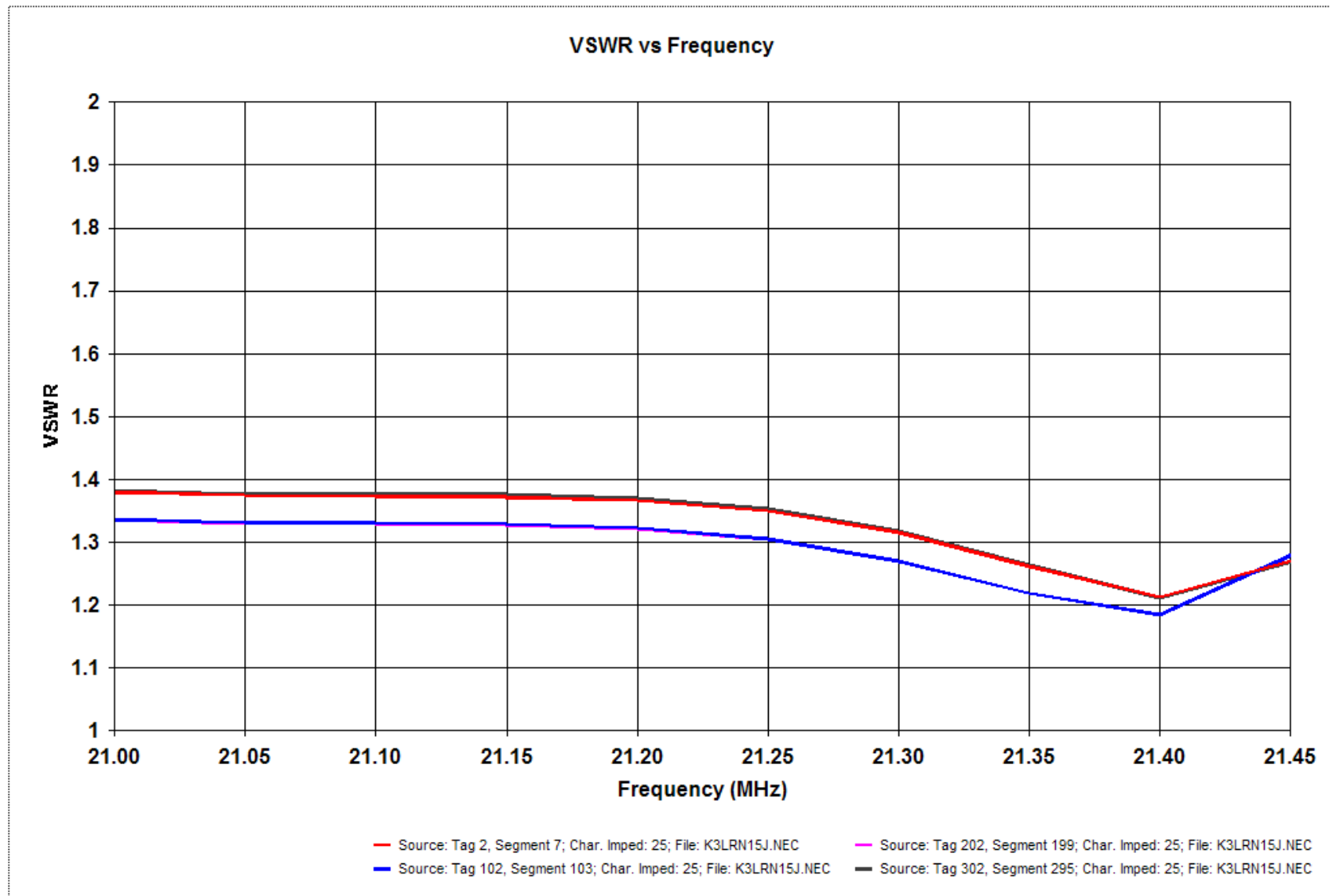


K3LR Preliminary 6 EI 15M OWA Yagi 4-Stack

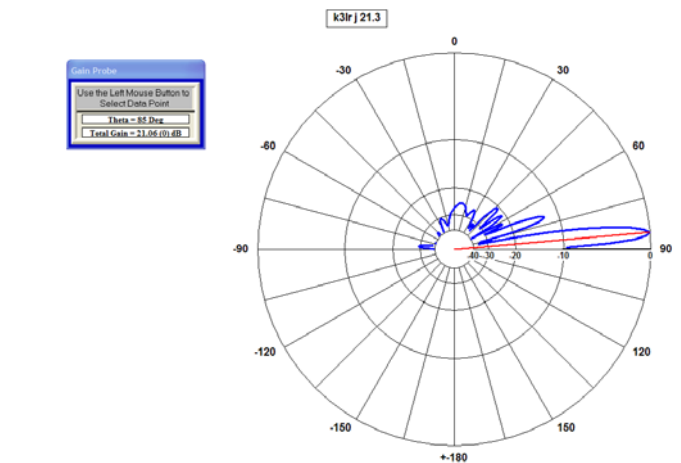
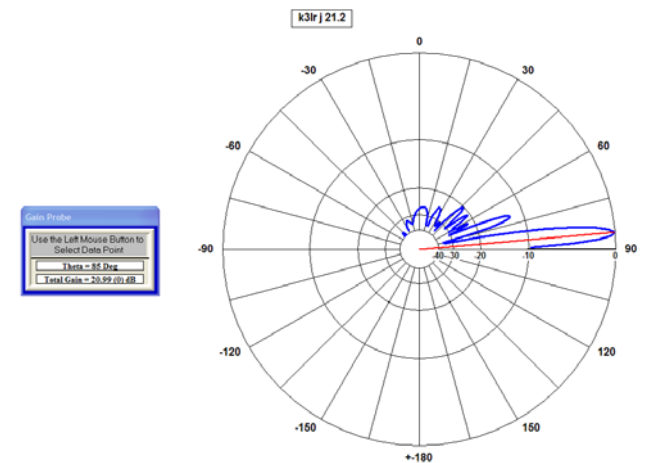
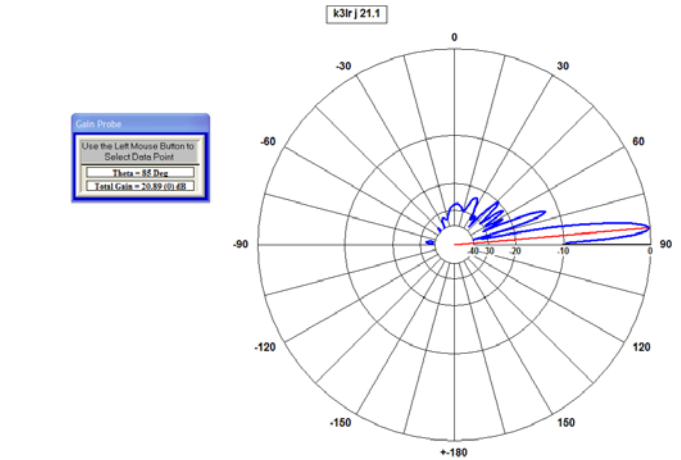
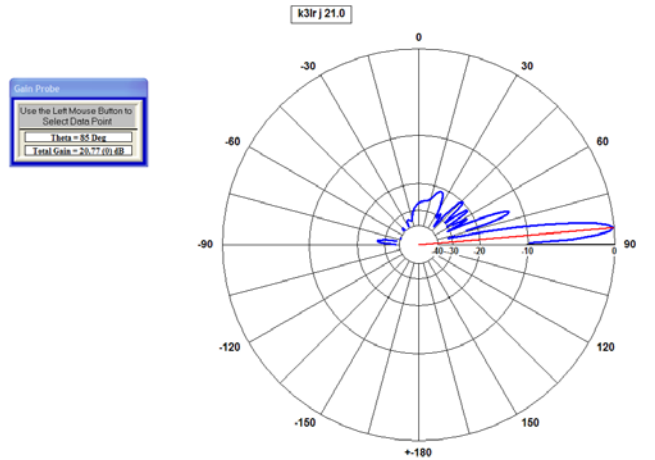
New K3LR 6 EI 15M OWA Yagi Top at 160 feet
40 foot spacing Freq 21.0, 21.1, 21.2, 21.3 MHz



Next Design - K3LR 6 Element 15M OWA Yagi 4-Stack (Heights of 42.4, 87.7, 132.8, 178 feet)



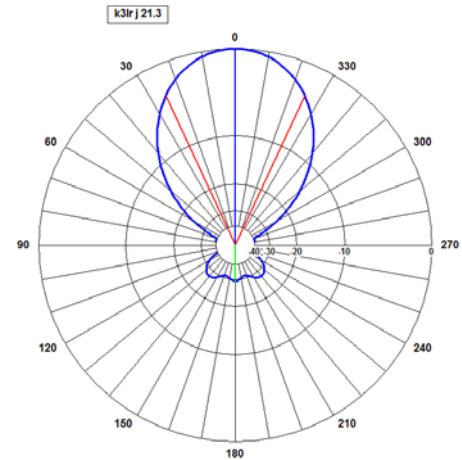
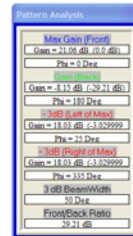
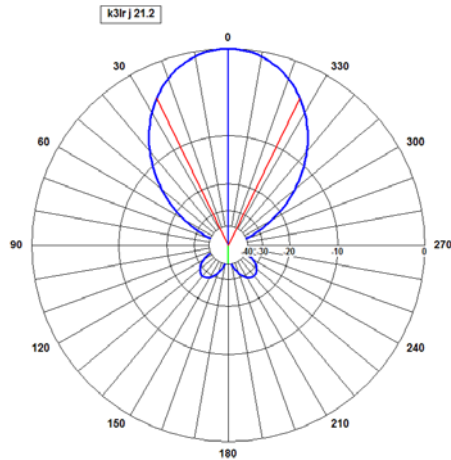
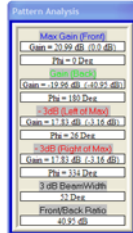
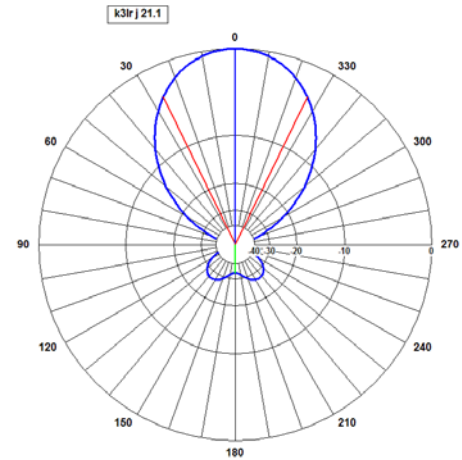
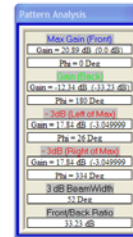
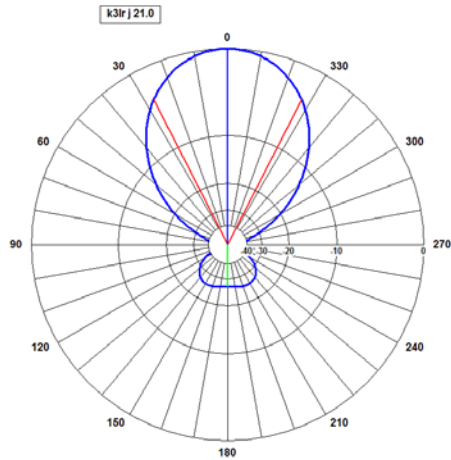
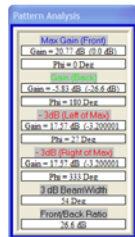
Next Design - K3LR 6 Element 15M OWA Yagi 4-Stack (Heights of 42.4, 87.7, 132.8, 178 feet) Amazing 21 dBi of Gain



Next Design - K3LR 6 Element 15M OWA Yagi

4-Stack (Heights of 42.4, 87.7, 132.8, 178! feet)

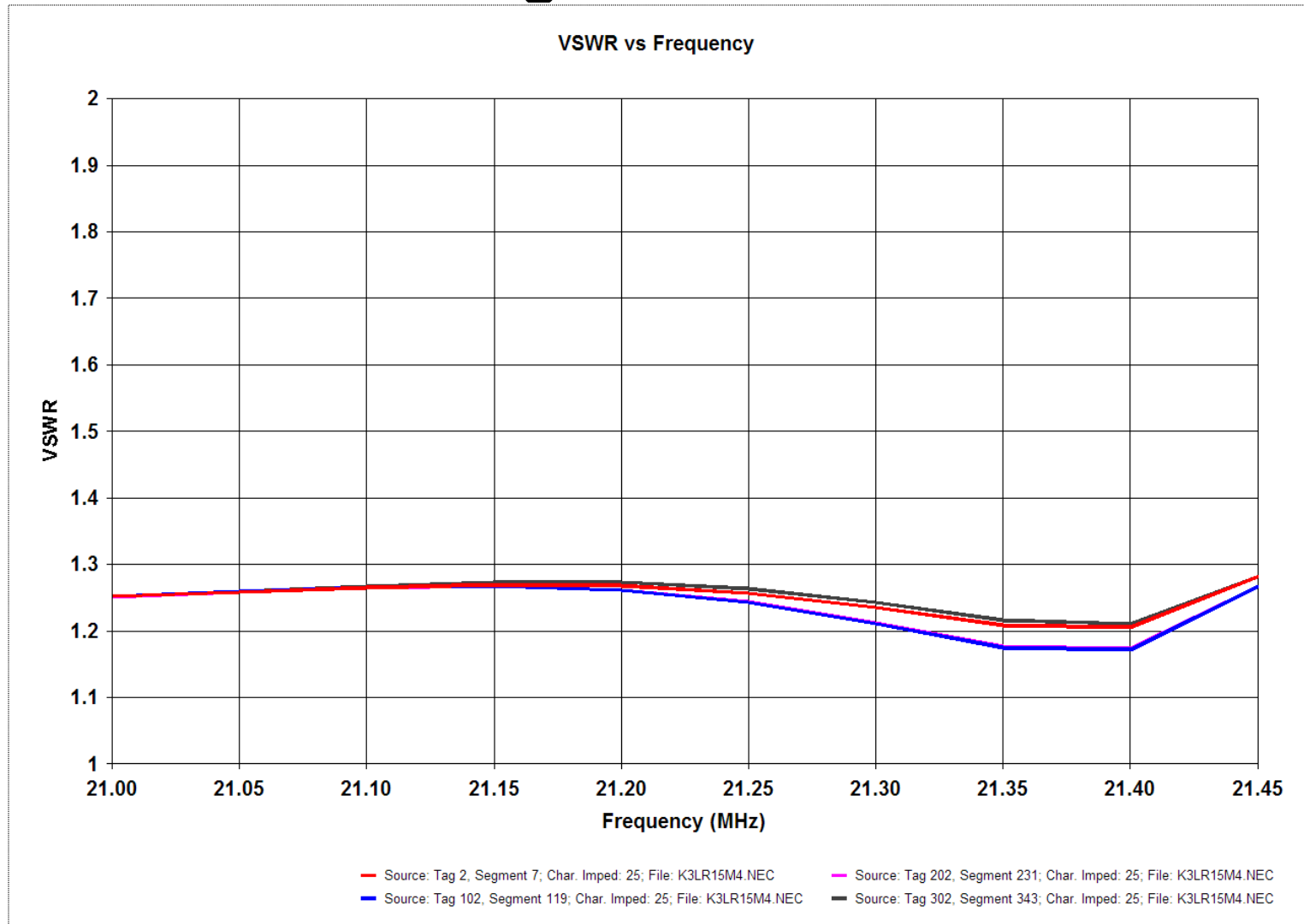
Amazing 21 dBi of Gain



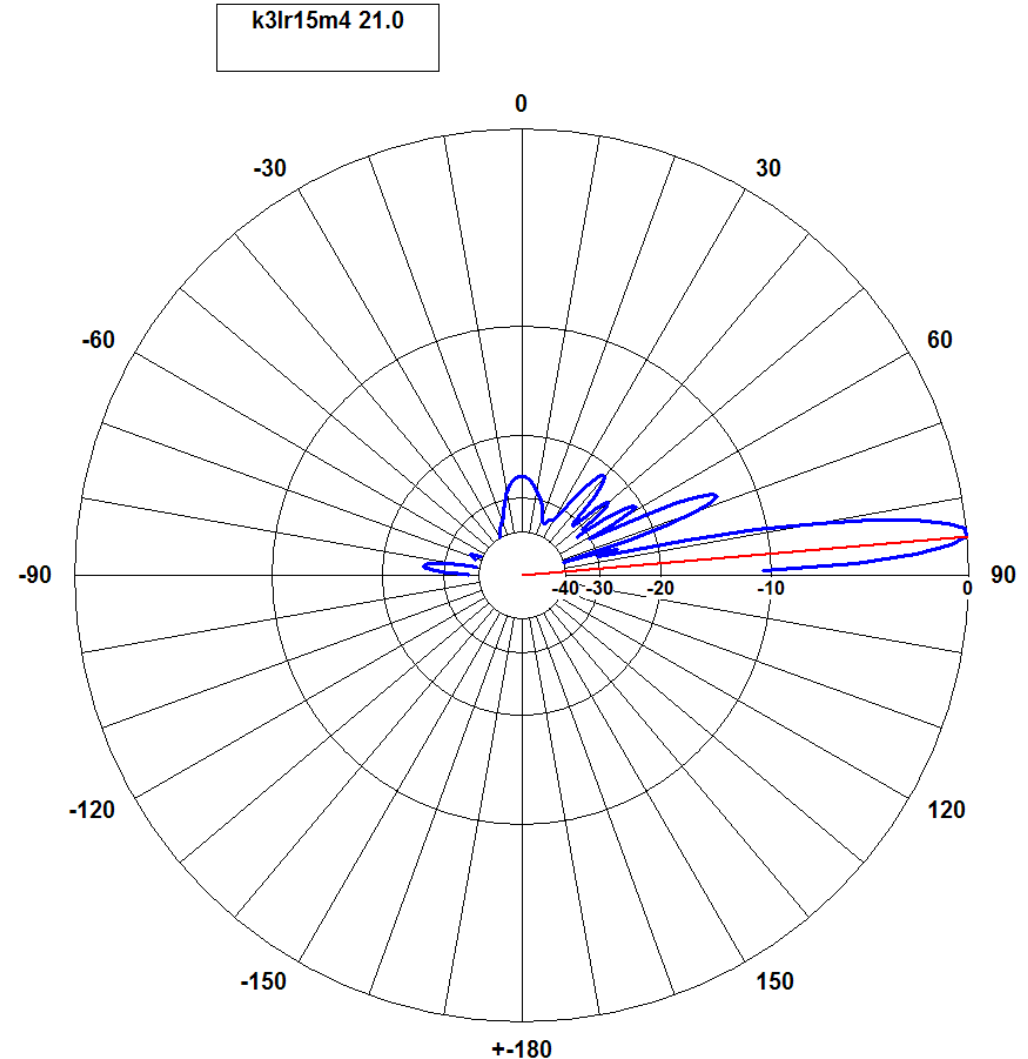
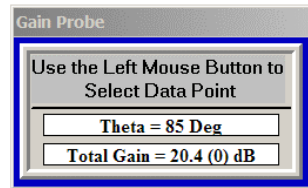
Tim says guy anchor points are welded and have to limit to 160 feet

- Tried some more optimizations with 7 computers running simultaneously on 6 element OWA Yagis.
- Could not get results to come in perfectly for both SWR and Sidelobe Levels desired.
- Decided to give up on 6 elements and move to 7 elements for each Yagi.
- Ran many optimizations trying to get best SWR and pattern performance.

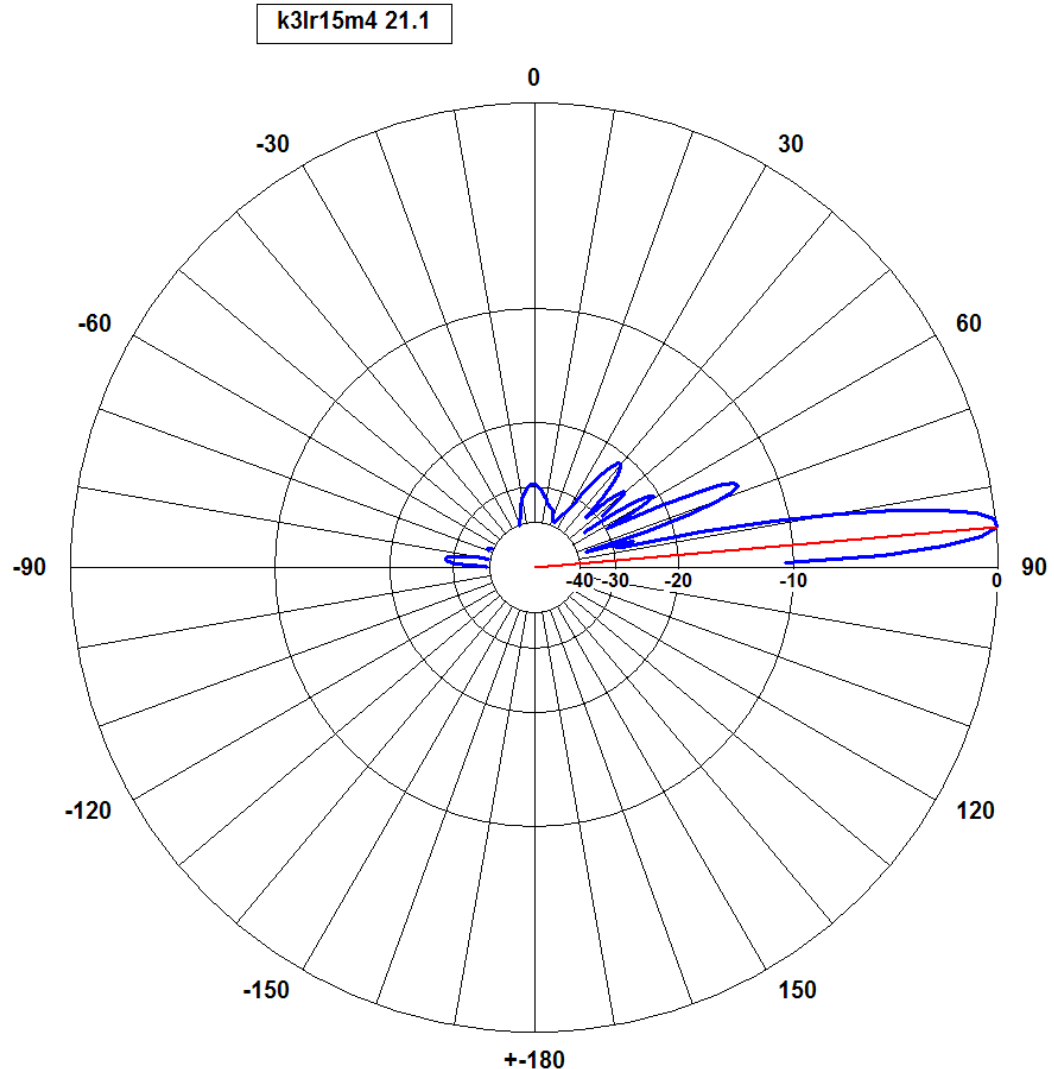
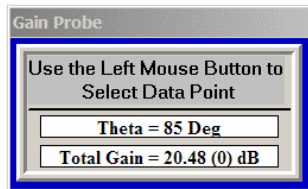
Final Design - K3LR 7 Element 15M OWA Yagi 4-Stack (Heights of 40, 80, 120, and 160 feet) Still Amazing 20.5 dBi of Gain



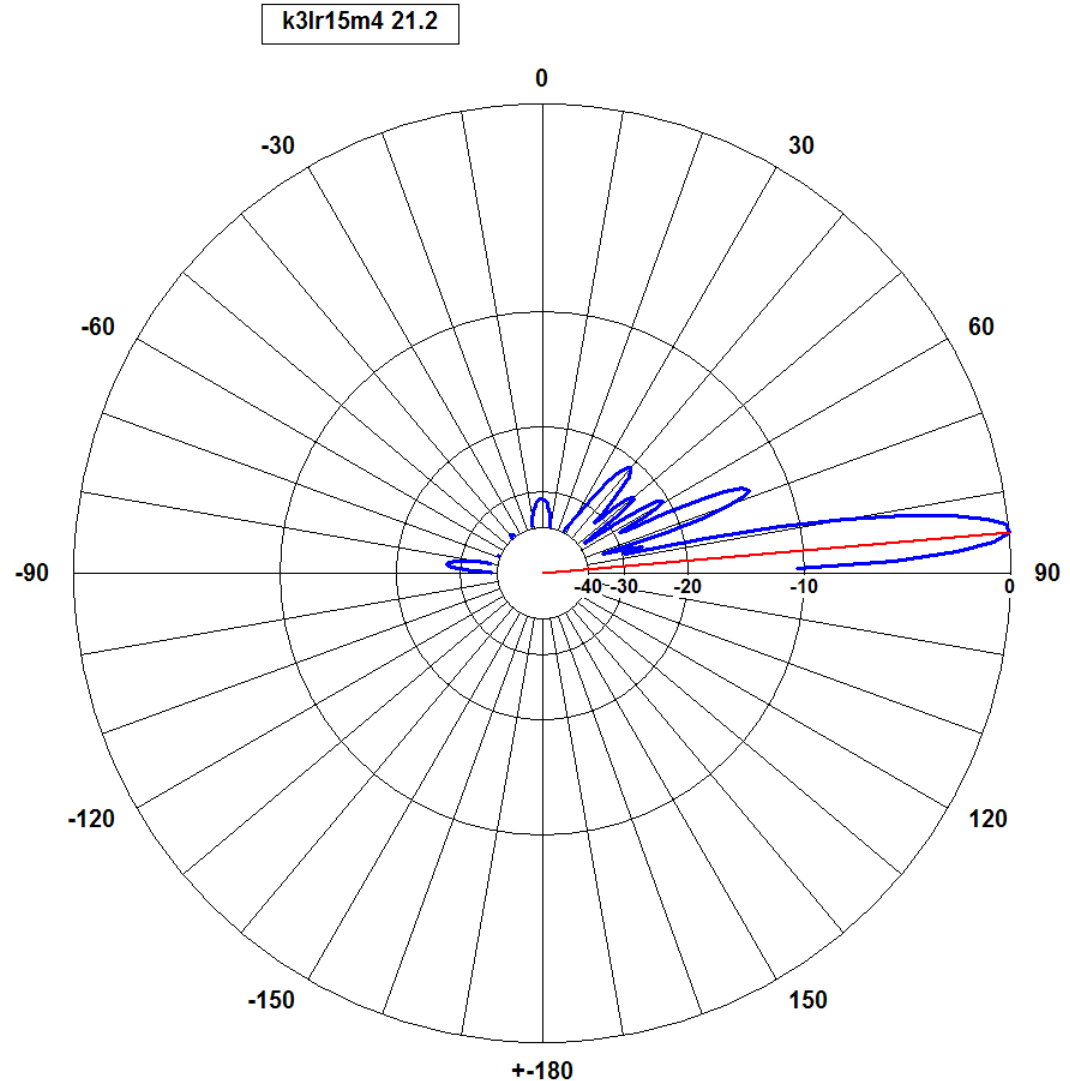
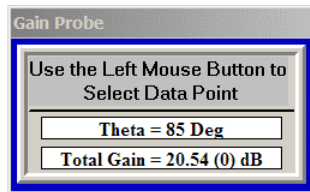
Final Design - K3LR 7 Element 15M OWA Yagi 4-Stack (Heights of 40, 80, 120, and 160 feet) Amazing Patterns Over Band



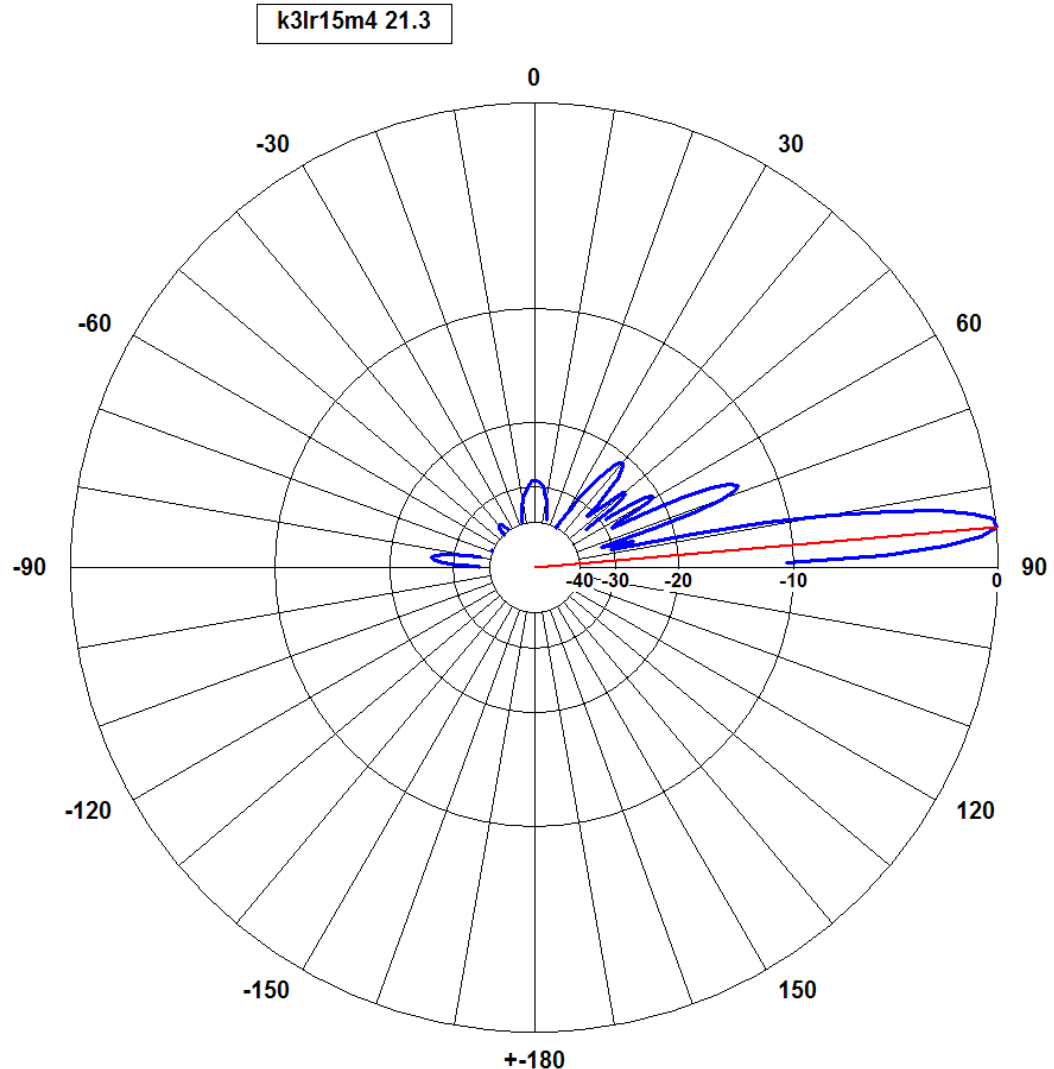
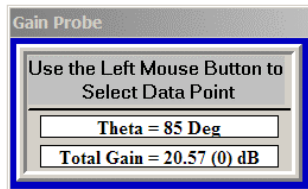
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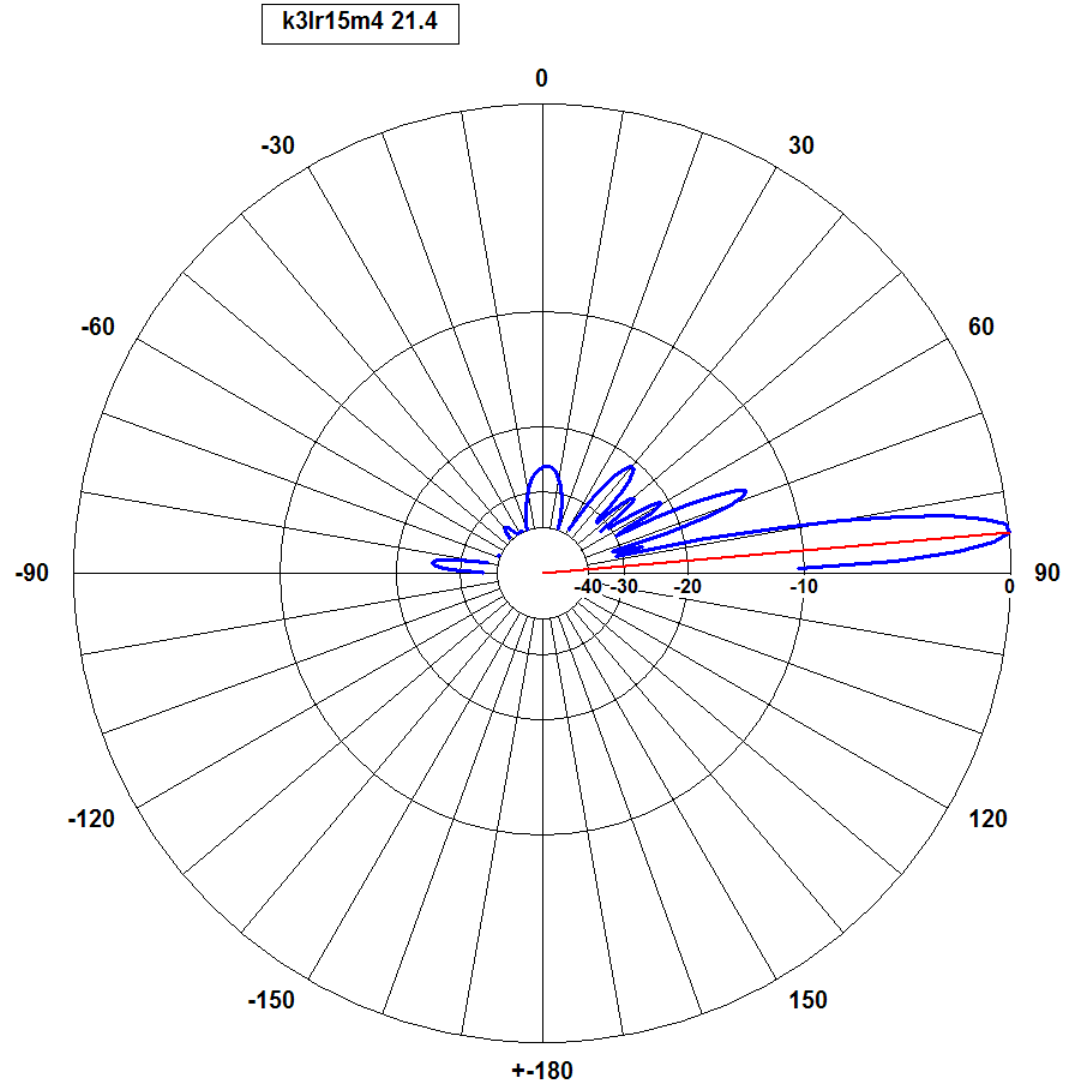
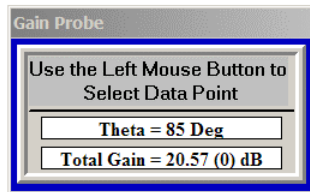
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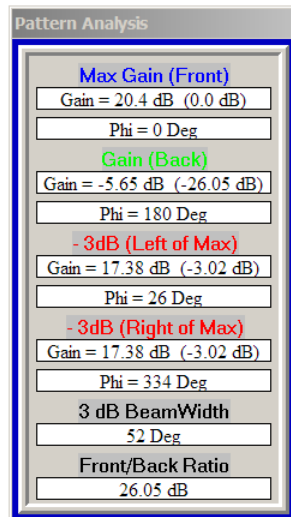
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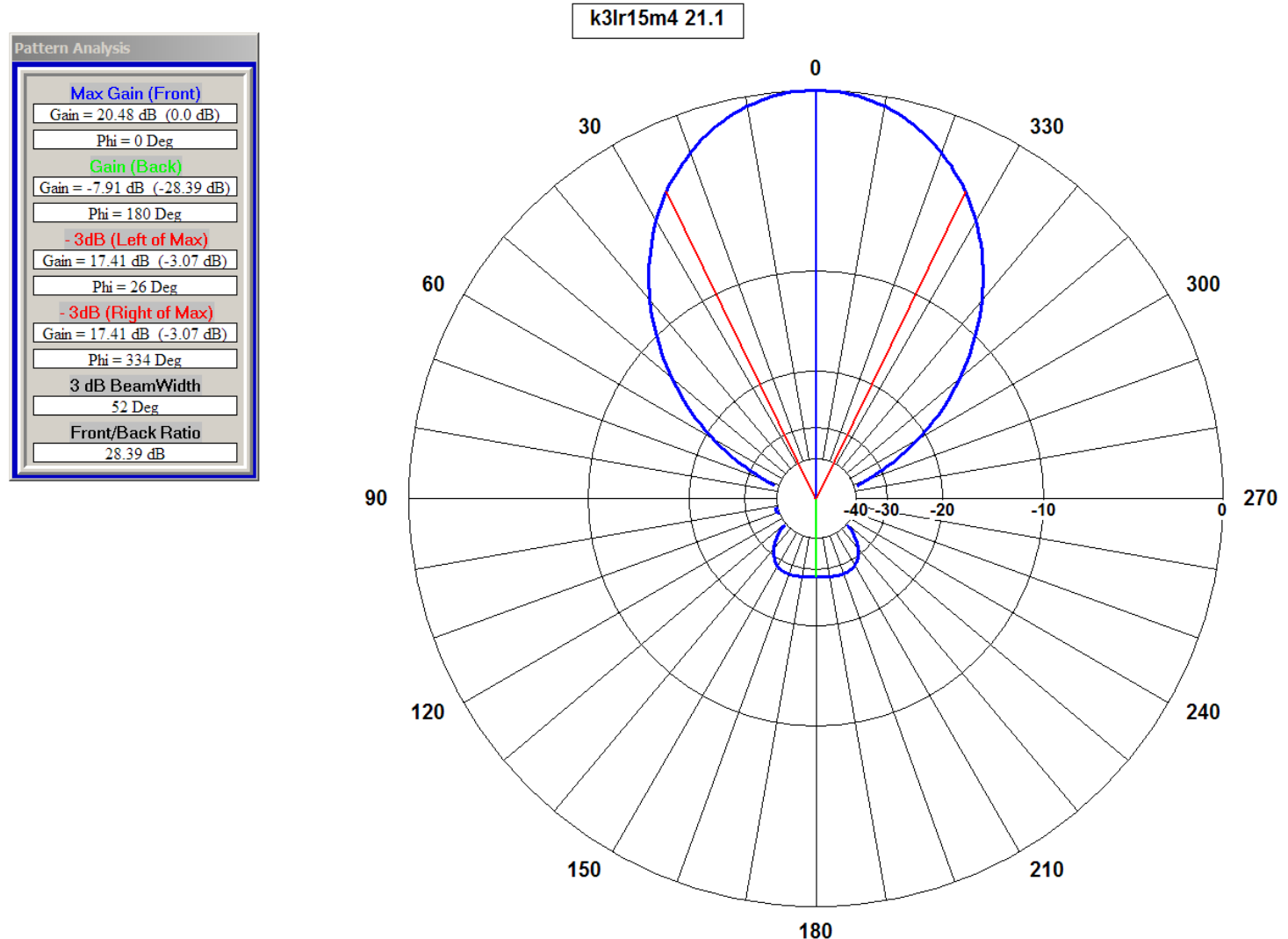
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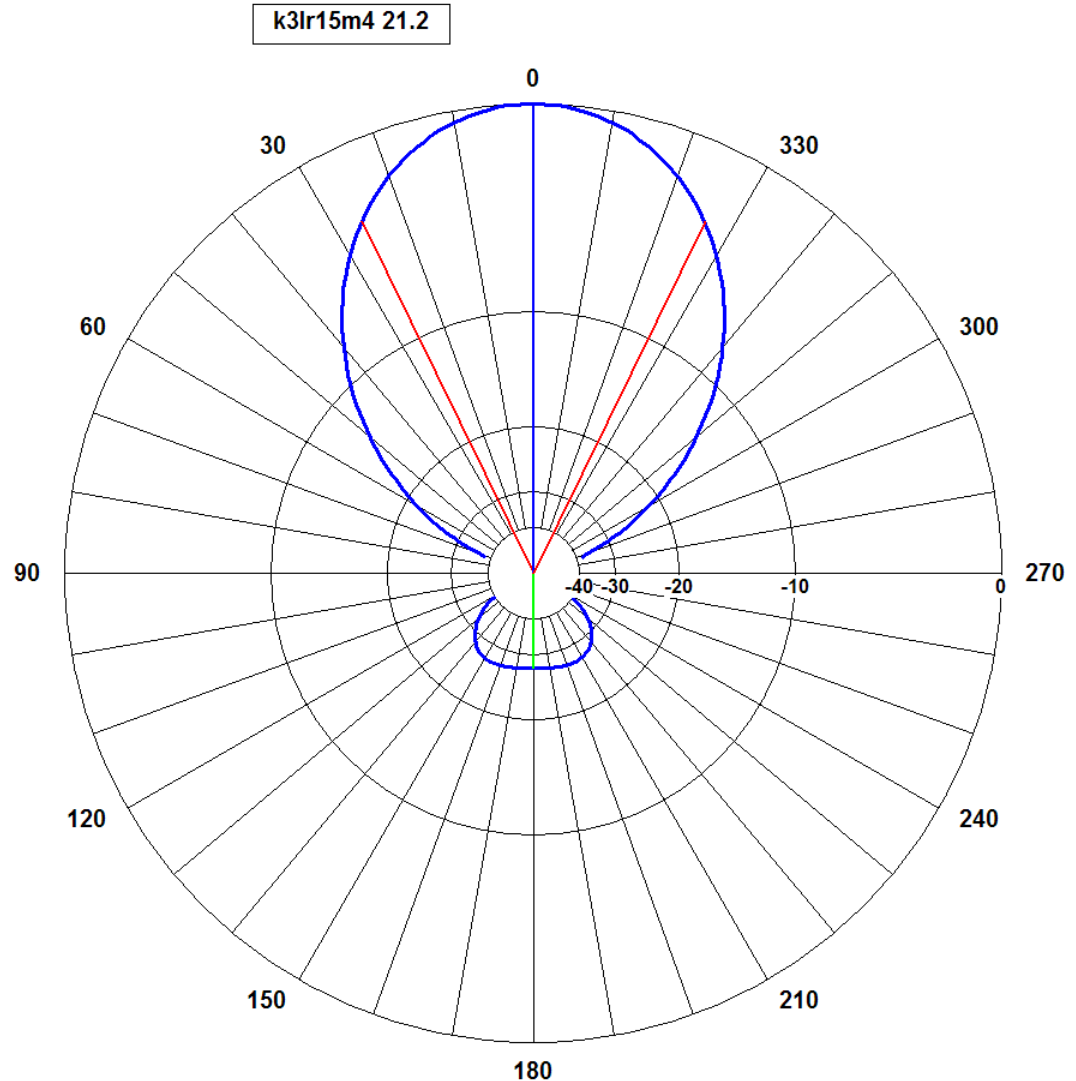
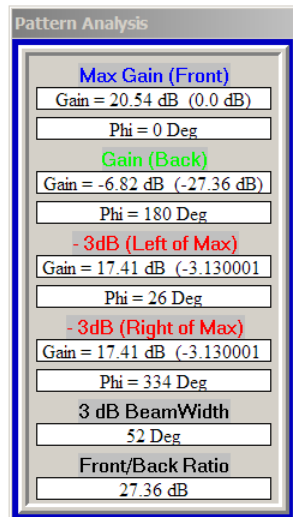
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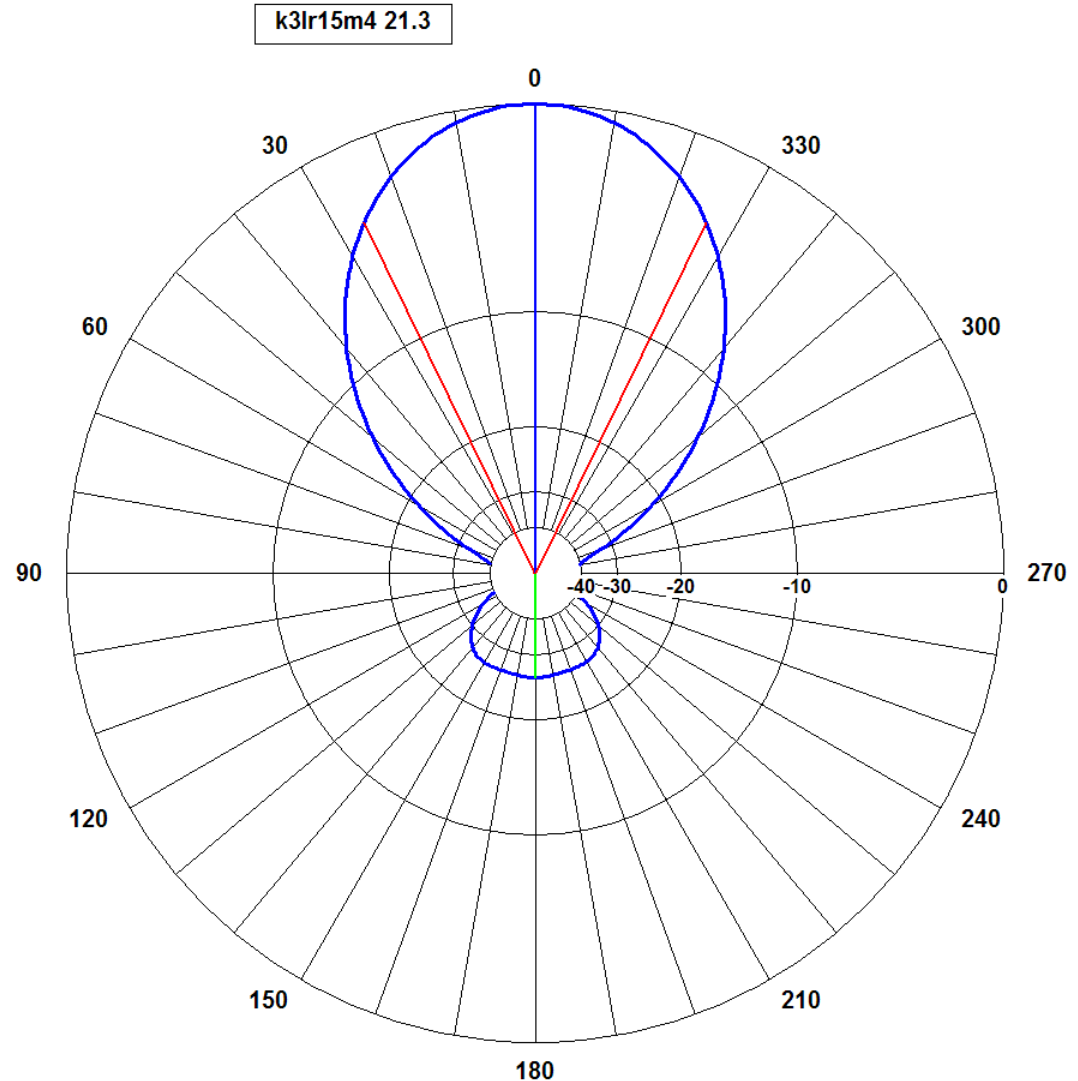
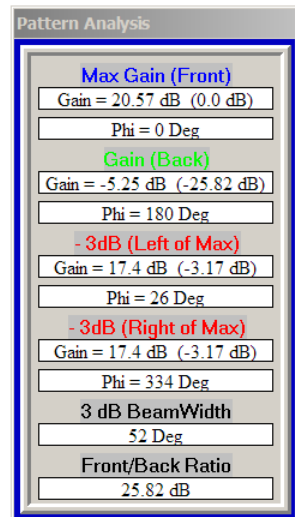
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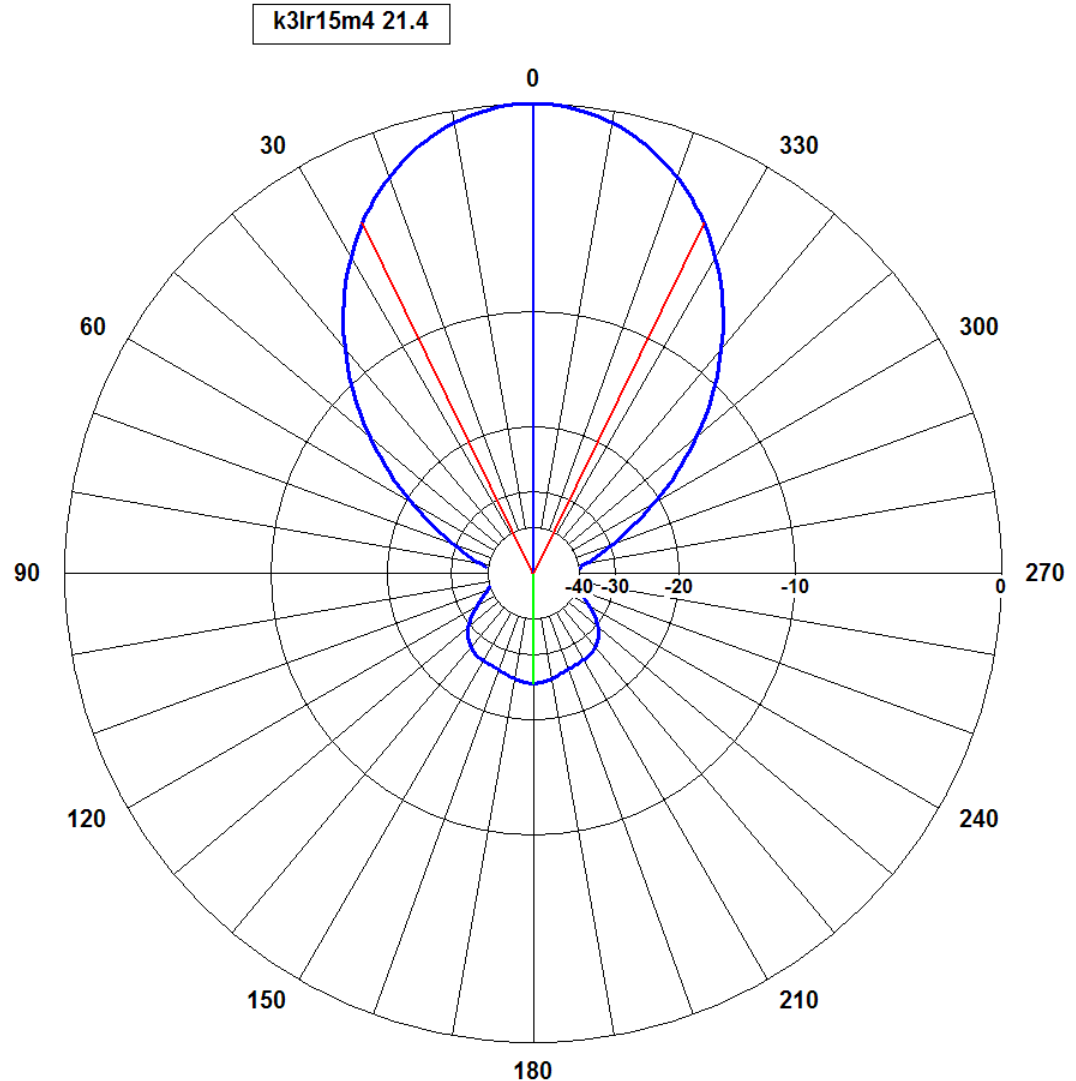
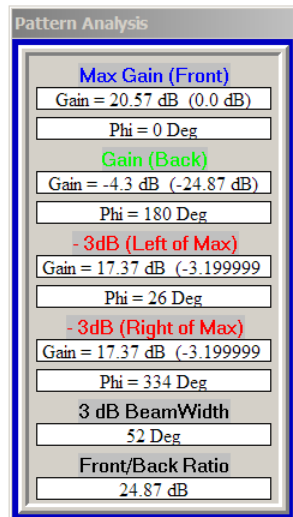
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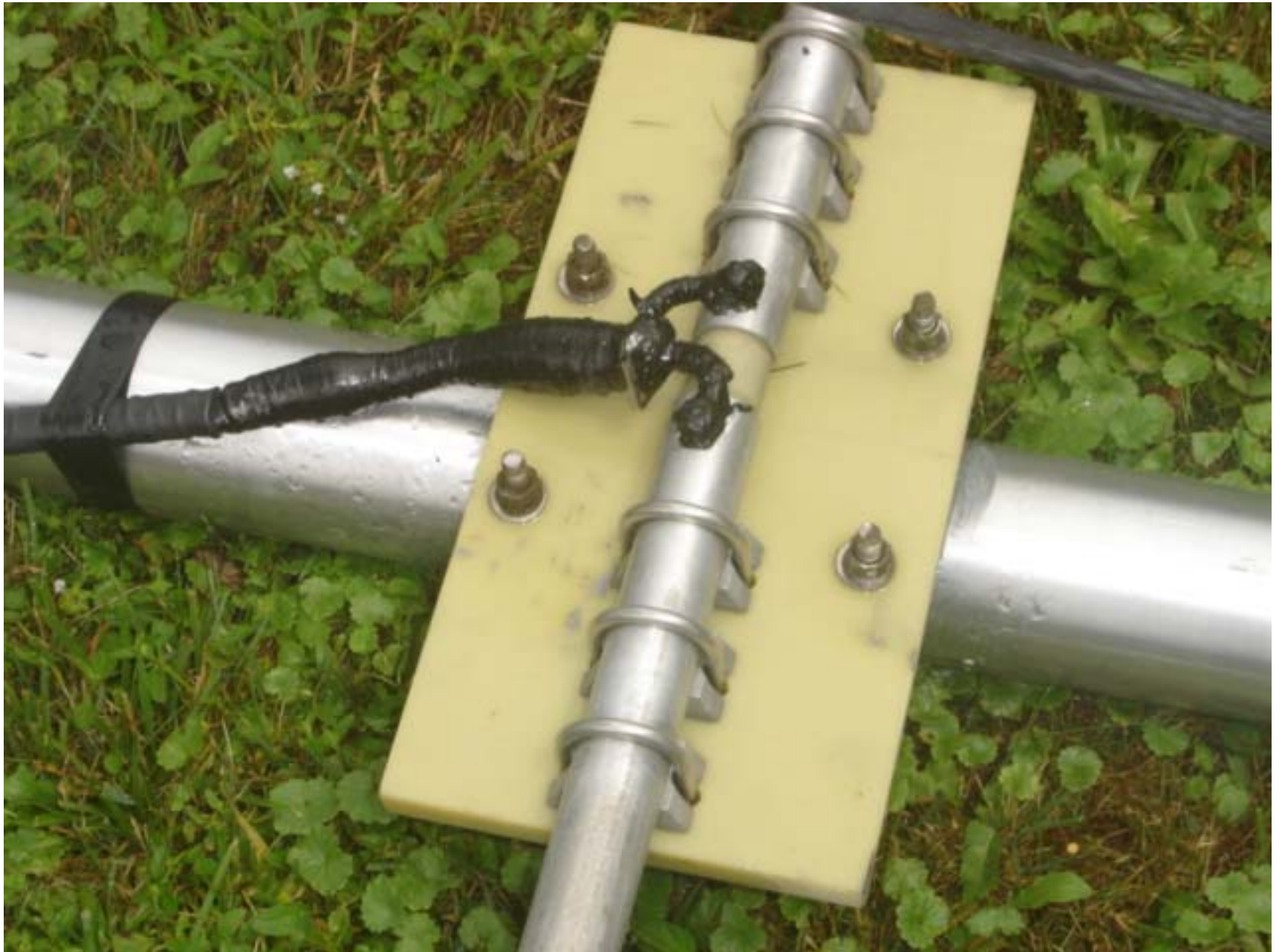


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Final Design - K3LR 7 Element 15M OWA Yagi 4-Stack (Heights of 40, 80, 120, and 160 feet) Amazing Patterns Over Band







Phil, K3UA at the base of the new 28 element Array



15 meter 4 High Switching @ K3LR

10 Combinations to pick from

160'

120'

80'

40'

ALL FOUR

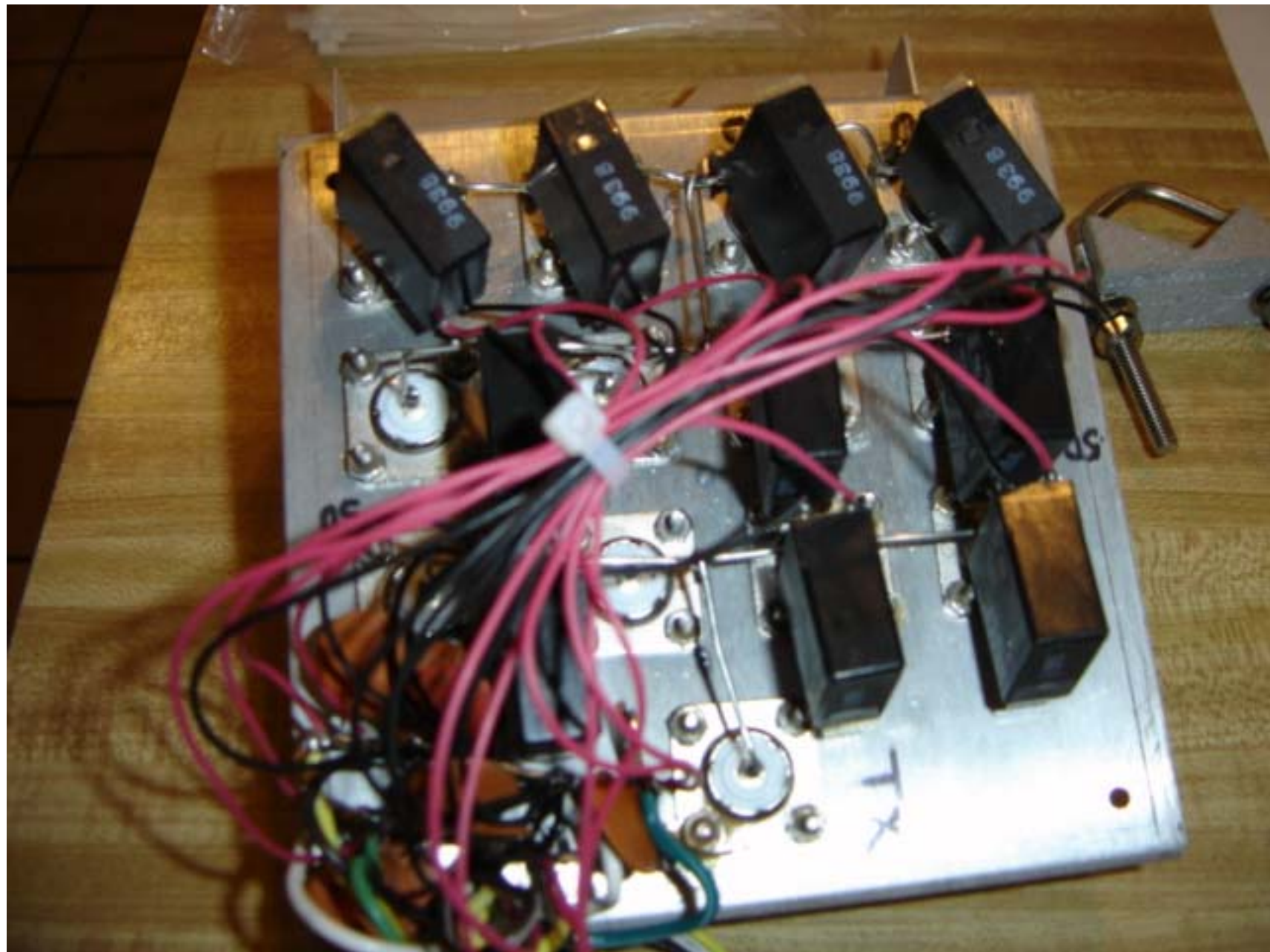
TOP THREE

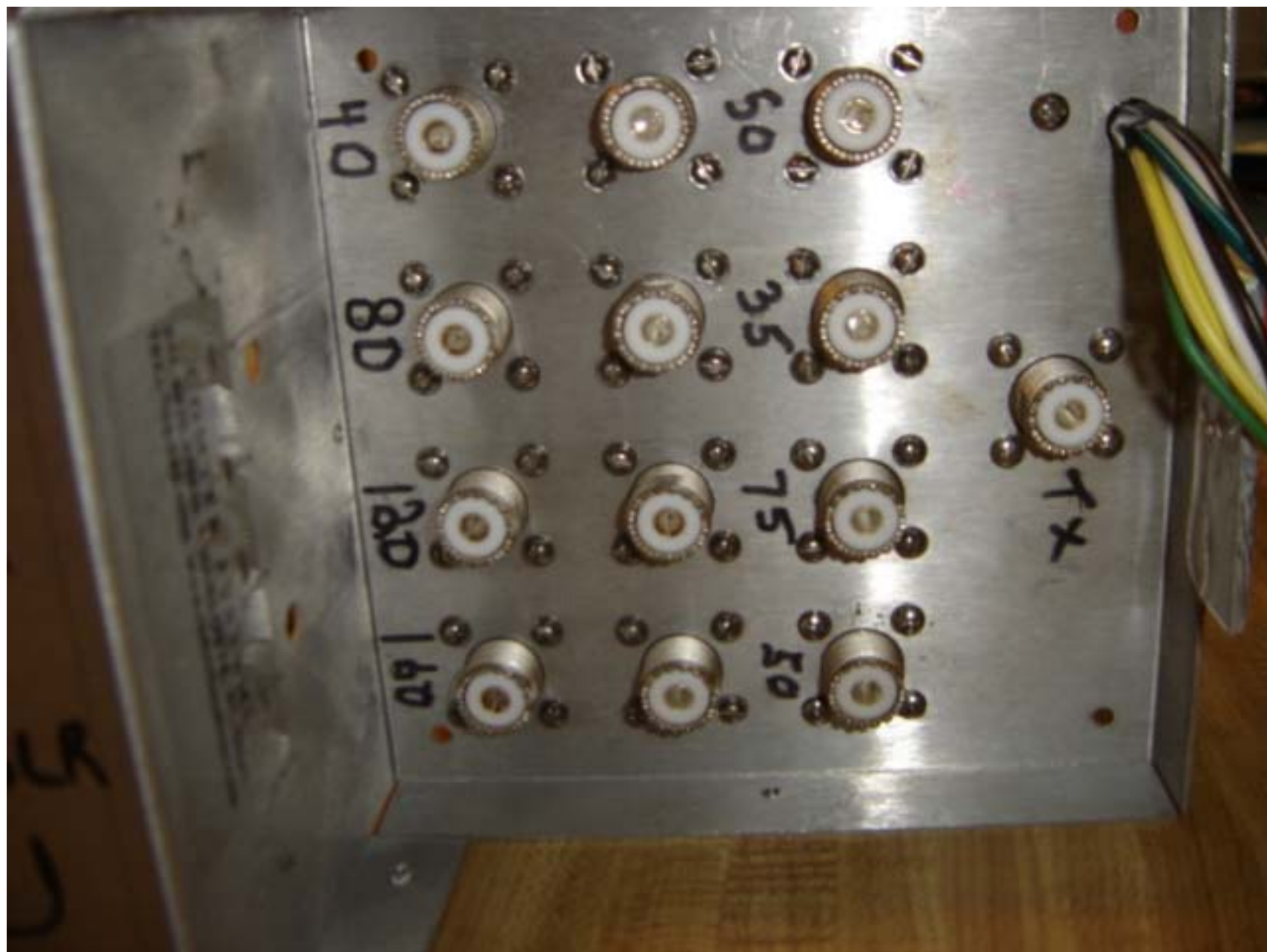
BOTTOM THREE

TOP TWO

MIDDLE TWO

BOTTOM TWO





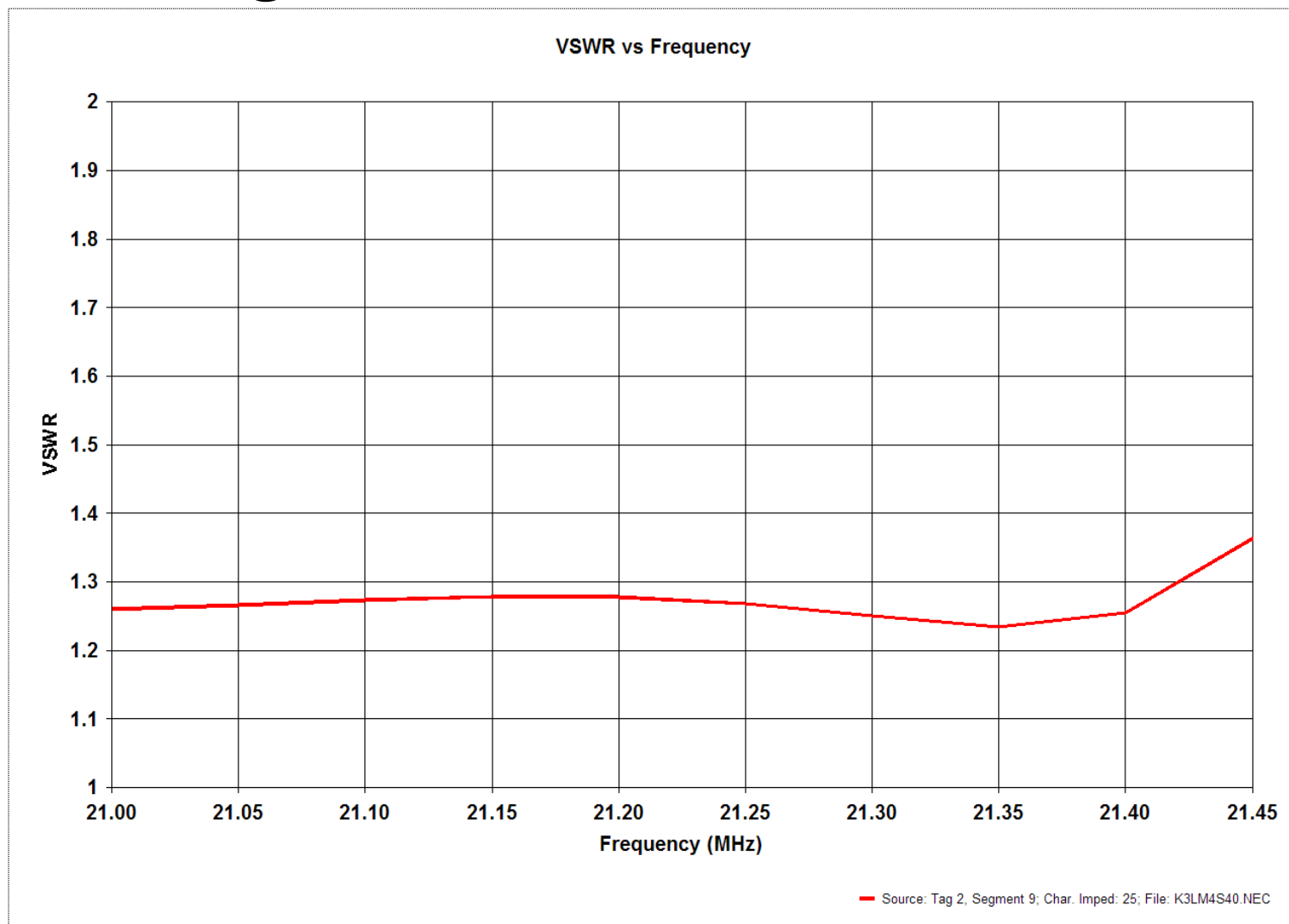
K3LR 7 Element 15M OWA 4-Stack Dimensions Tapers

	1.125	1	.875	.75	.625	.5
0	13	5	39	5	32	51.4
94.36	13	5	39	5	32	48.8
124	13	5	39	5	32	42.5
192.8	13	5	39	5	32	39.5
280.1	13	5	39	5	32	34.8
400	13	5	39	5	32	32.6
570	13	5	39	5	32	22.2

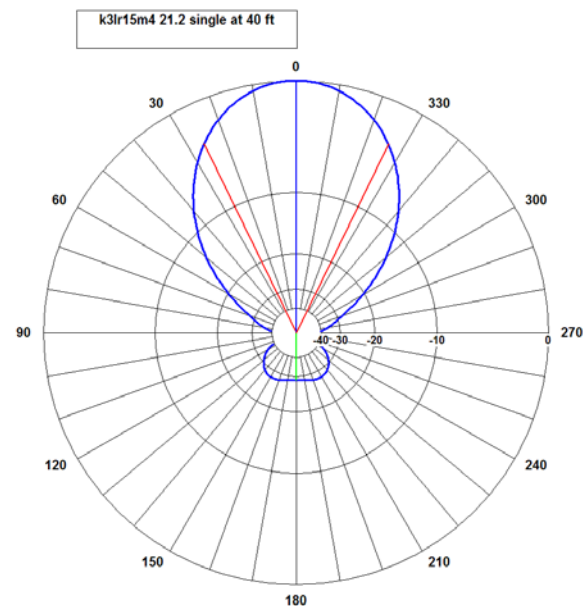
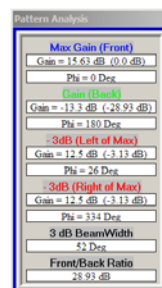
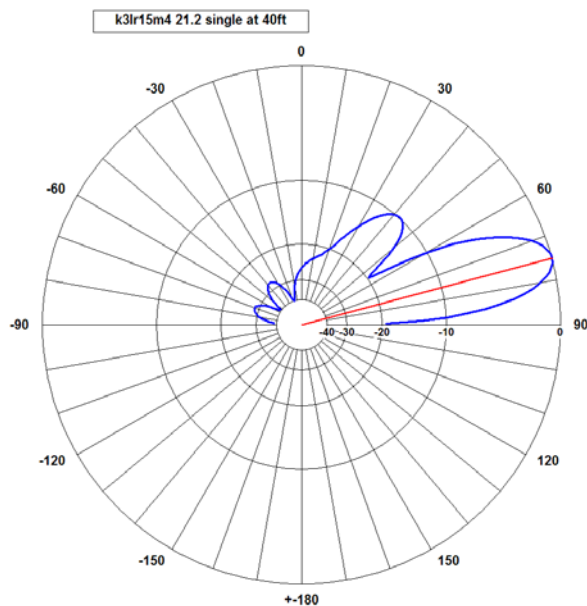
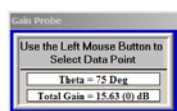
Distance from center of boom out along element

	1.125	1	.875	.75	.625	.5
0	13	18	57	62	94	145.4
94.36	13	18	57	62	94	142.8
124	13	18	57	62	94	136.5
192.8	13	18	57	62	94	133.5
280.1	13	18	57	62	94	128.8
400	13	18	57	62	94	126.6
570	13	18	57	62	94	116.2

Tim tested a single 7 element OWA Yagi at 40 feet for SWR



Pattern of a single 7 element OWA Yagi at 40 feet at 21.2 MHz

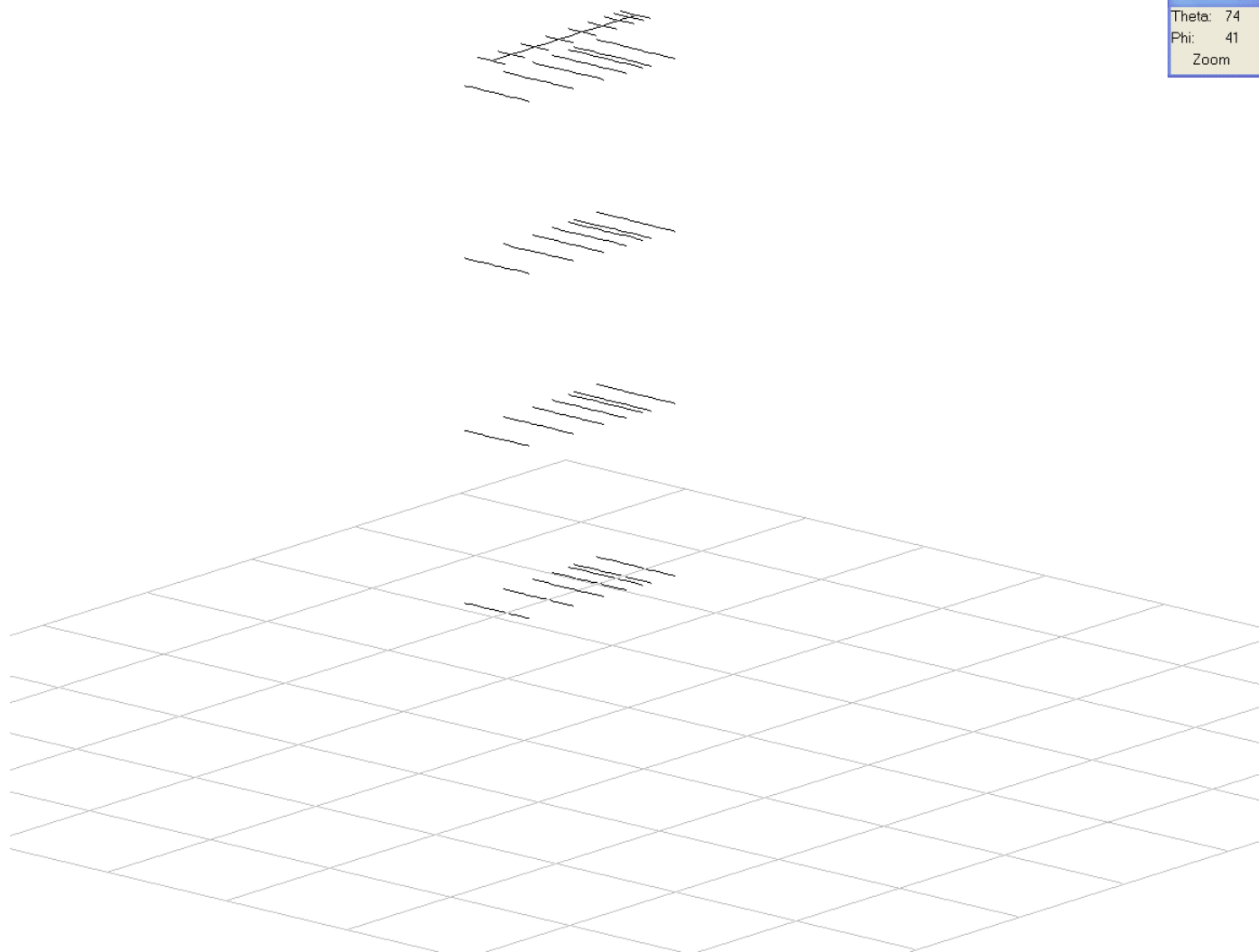


K3LR Measurements of Single 7 Element OWA Yagi at 40 Feet Compared to NEC Simulation

Frequency (MHz)	NEC-TLA 80 Feet Coax	K3LR Measured Network Analyzer	NEC-TLA	K3LR Measured
21.0	62.0+j8.5	54+j7	1.26	1.17
21.1	65.9+j2.7	58+j3	1.27	1.18
21.2	65.8-j3.2	60-j2	1.27	1.21
21.3	63.8-j5.3	56-j6	1.25	1.22
21.4	65.3-j2.0	56-j7	1.26	1.21
21.45	70.3+j.6	56-j7	1.35	1.19

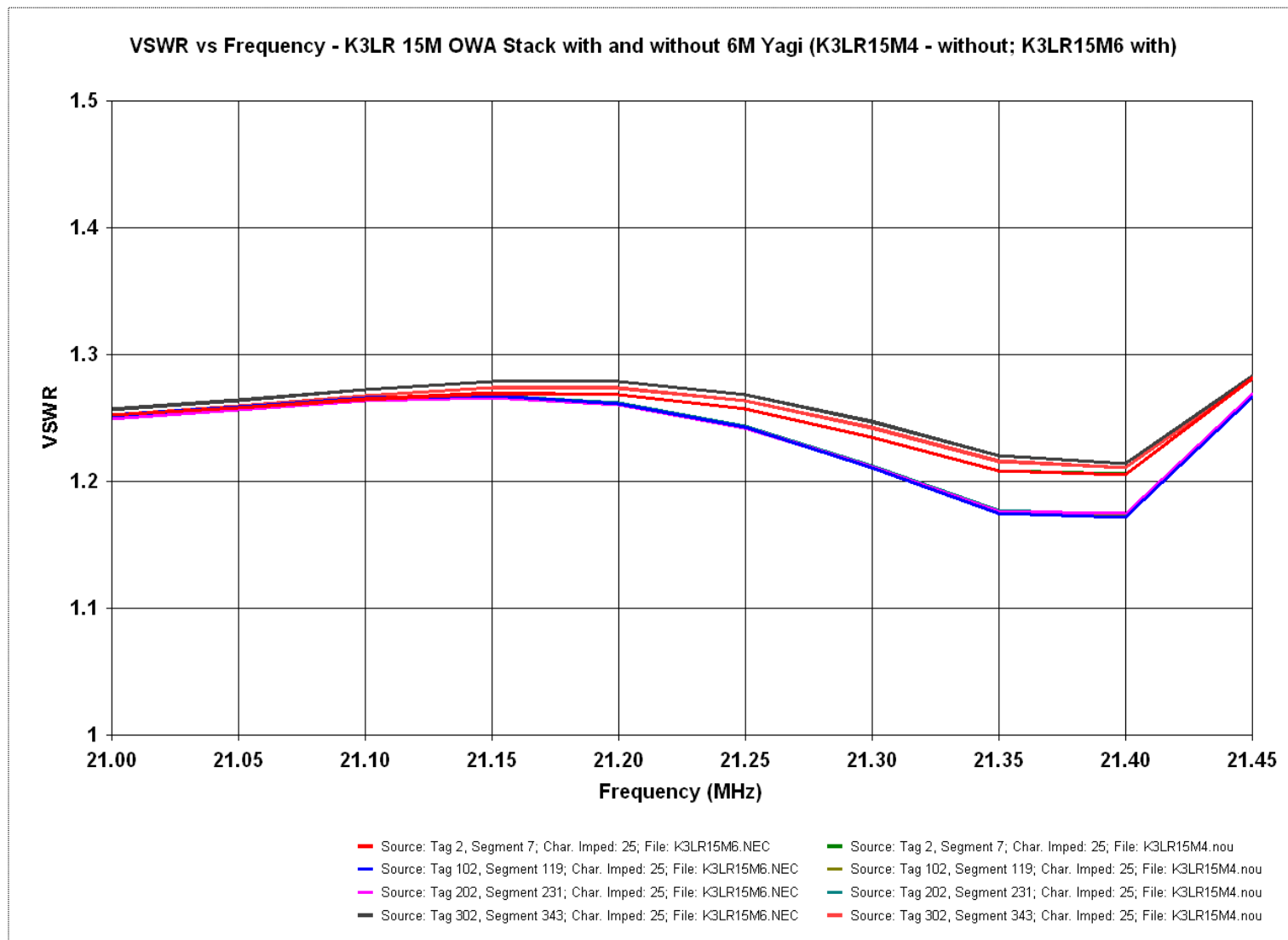
6M M2 9 Element Yagi at 170 Feet

Is there Interaction??



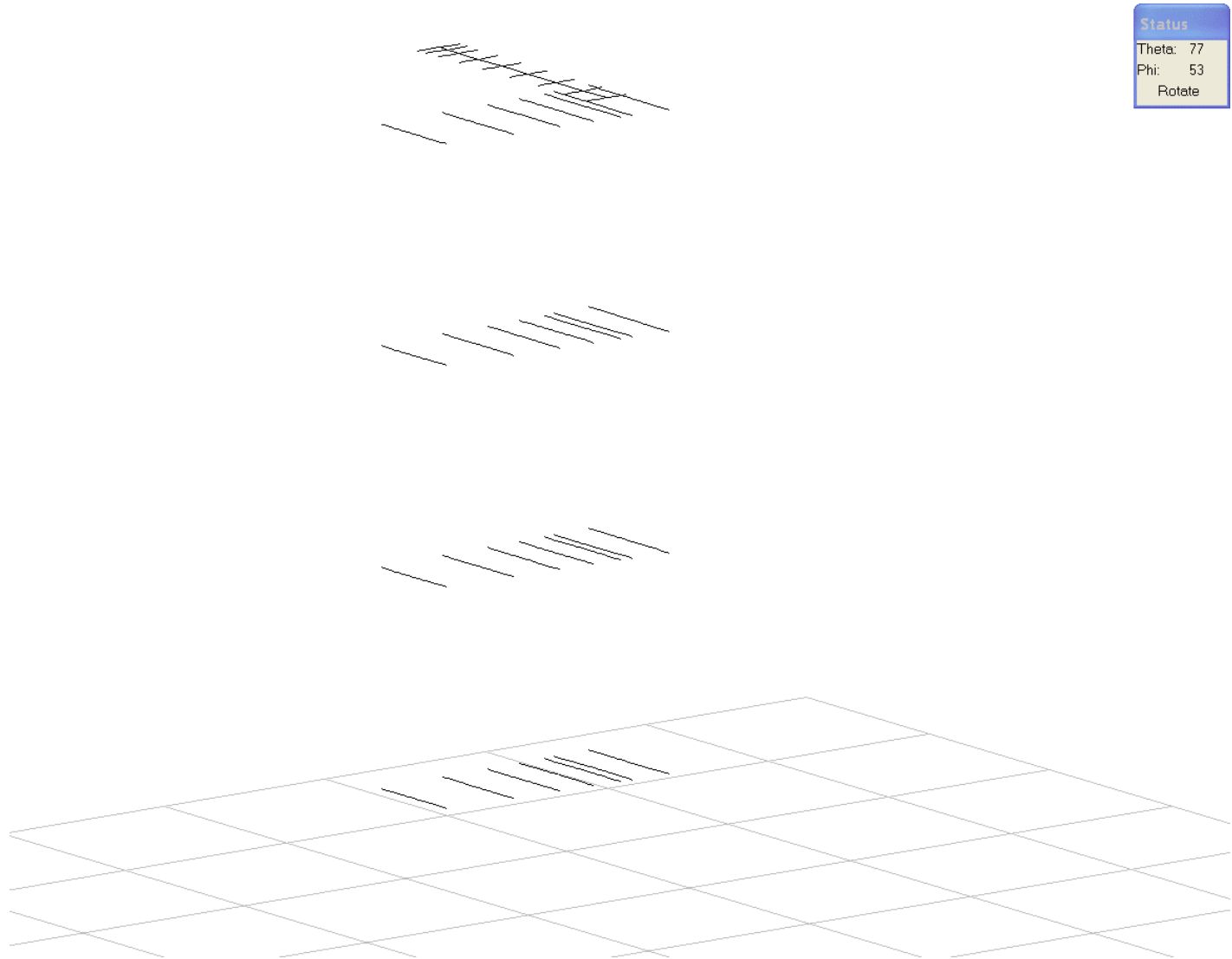
6M M2 9 Element Yagi at 170 Feet

Is there Interaction??



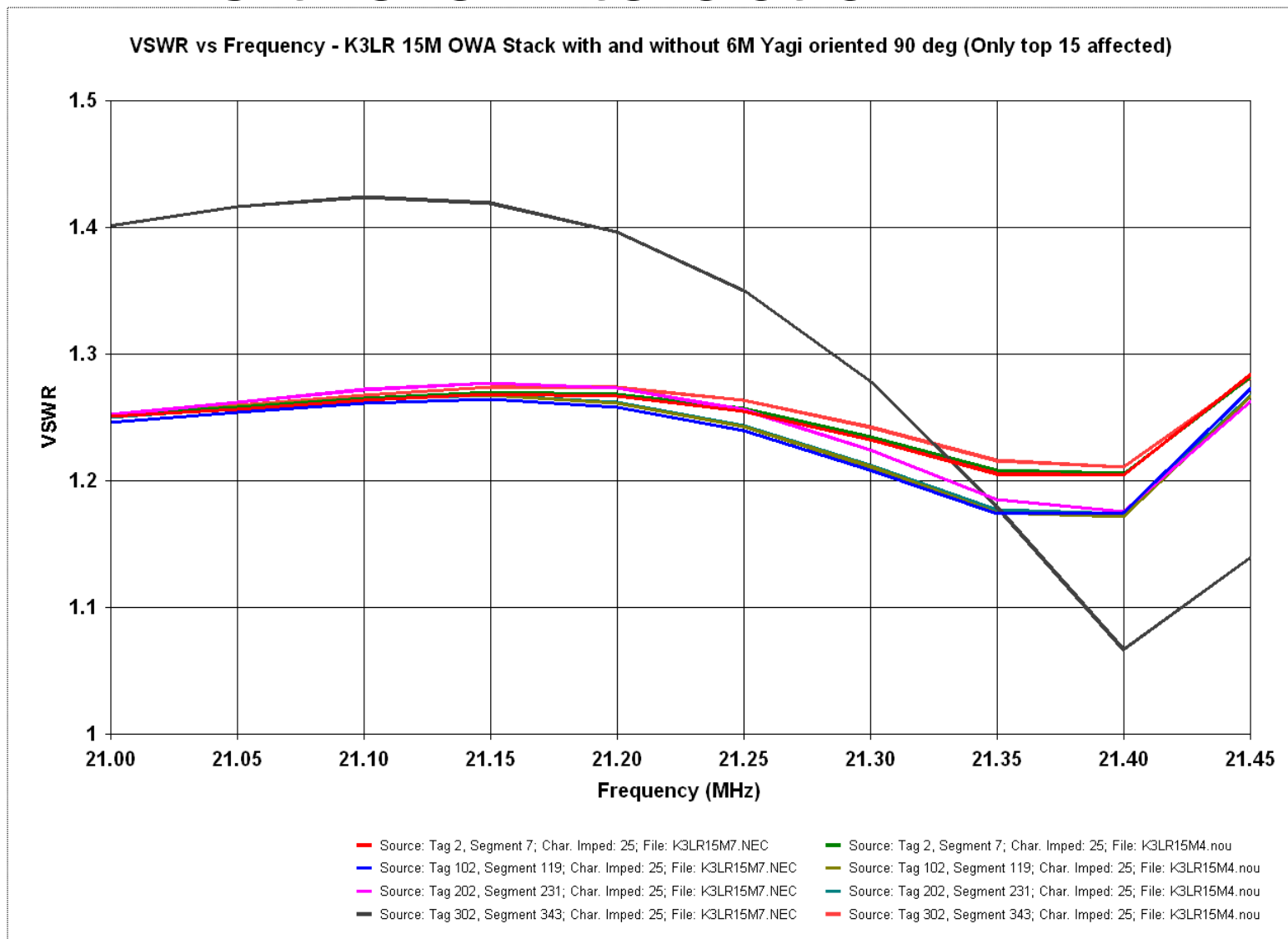
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6M M2 9 Element Yagi at 170 Feet

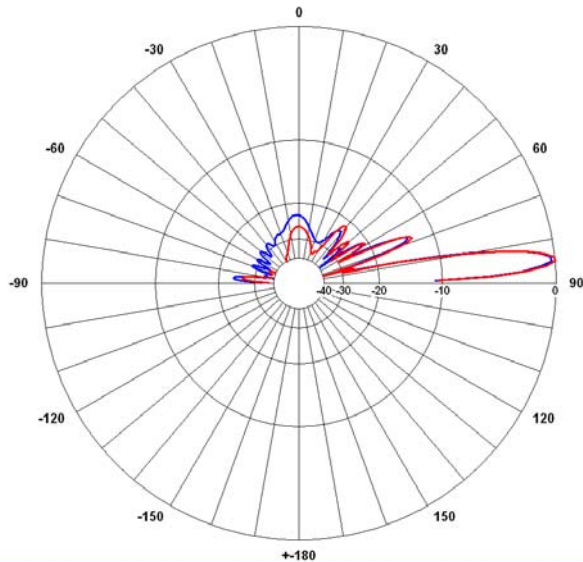
Is there Interaction??



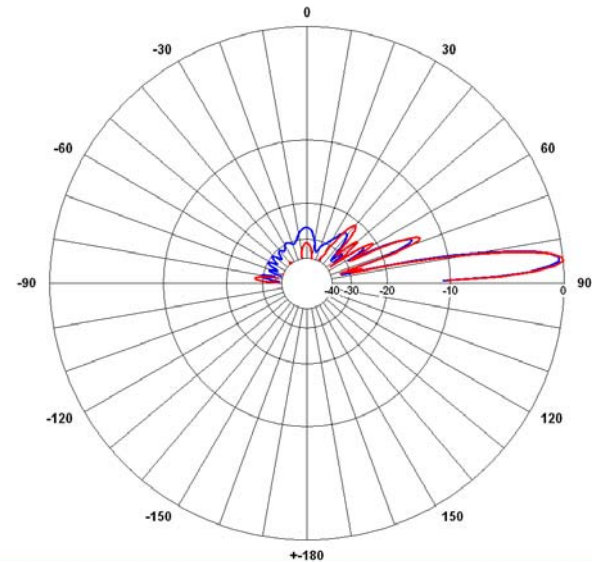
6M M2 9 Element Yagi at 170 Feet

Is there Interaction??

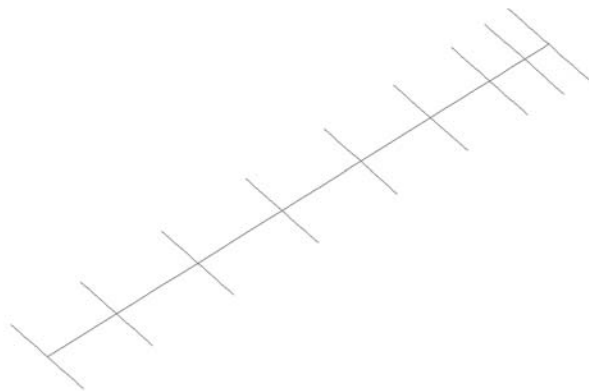
K3LR 15M OWA Stack with and without 6M Yagi oriented 90 deg (sidelobes increased)
21.0 MHz



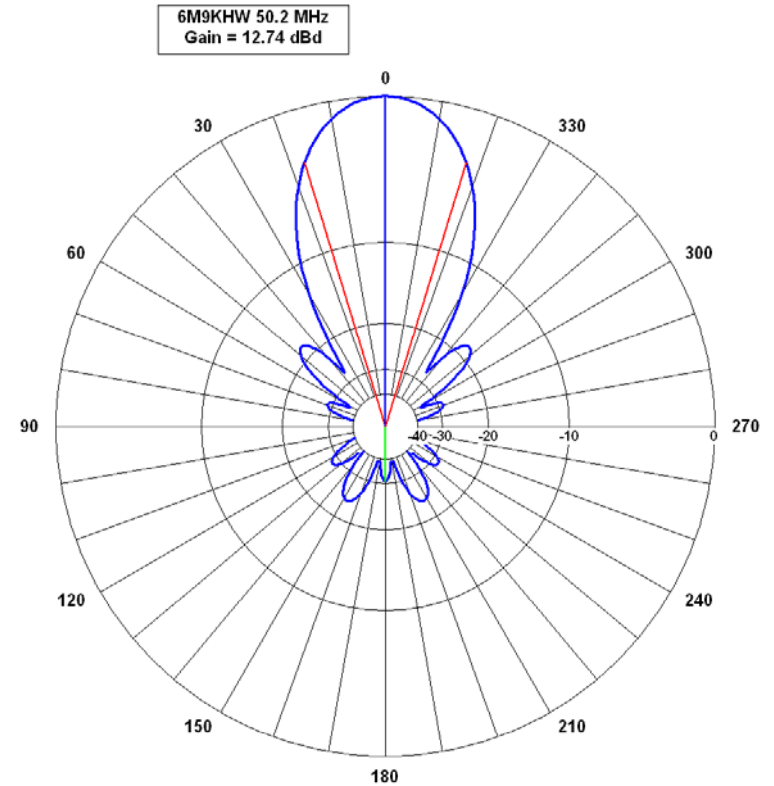
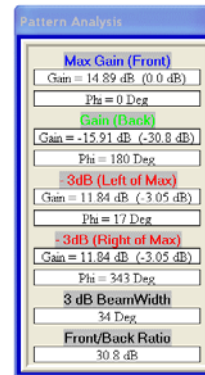
K3LR 15M OWA Stack with and without 6M Yagi oriented 90 deg (sidelobes increased)
21.2 MHz



6M M2 9 Element Yagi



Gain:
Theta: 42
Phi: 50
Polar



4 OWA Yagis on 15 meters with 6 meter beam at 170'

**15 meter
#1 station**

**7L/7L/7L/7L
160'/120'/80'/40'
28 elements**



K3LR.com

K3LR.com

**Bottom 3 seven element
OWA Yagis for 15 meters**

