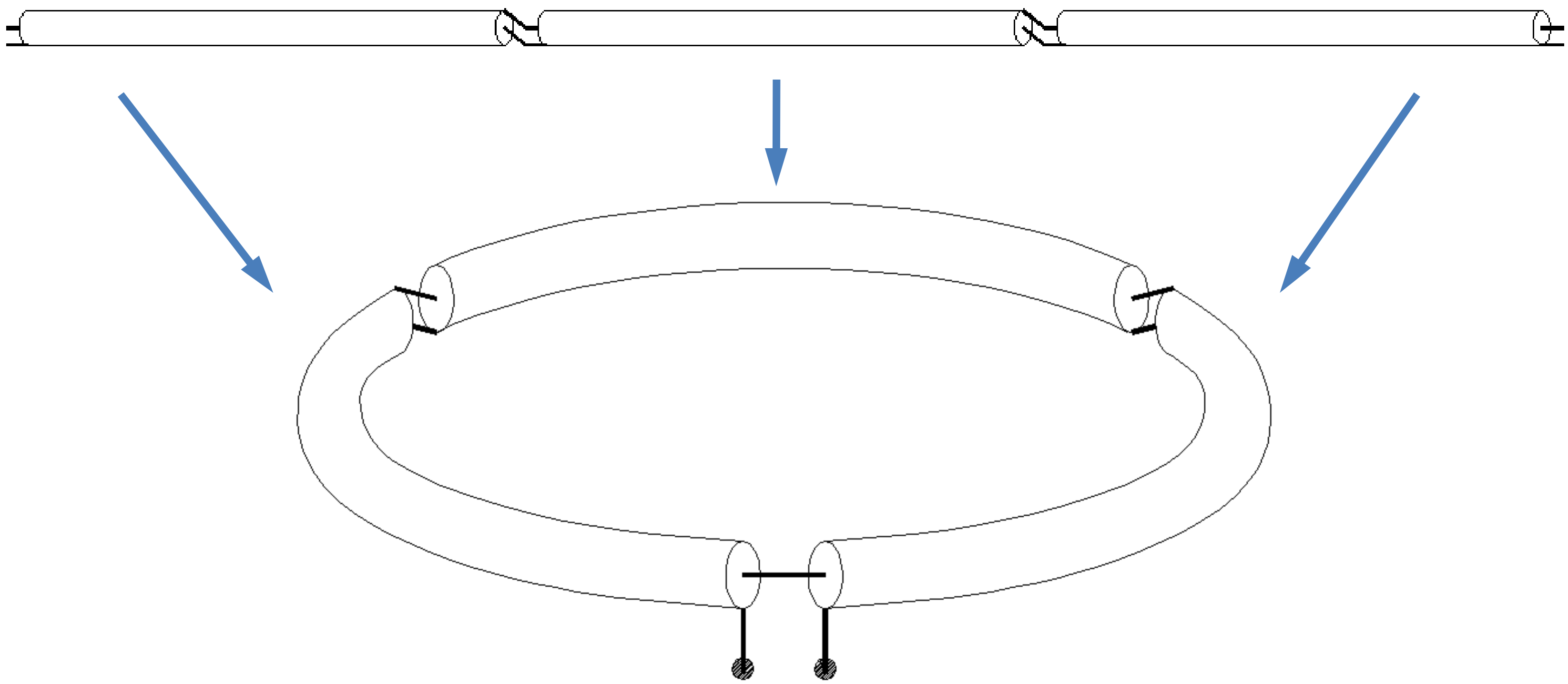

Circular Collinear Arrays
Horizontally Polarized - Omnidirectional

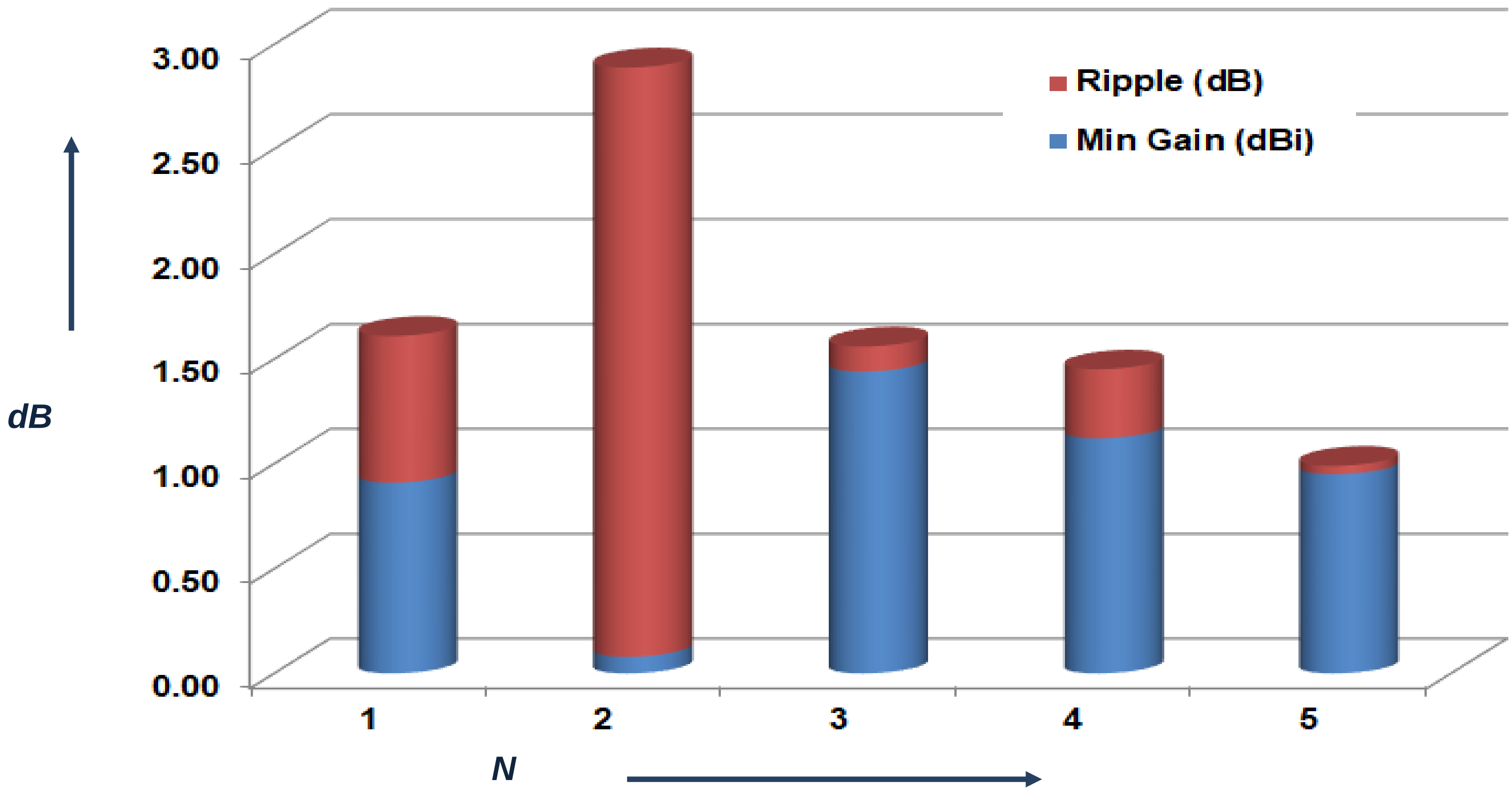
CIRCULAR ELEMENT



- COAXIAL COLLINEAR IS WRAPED INTO CIRCLE
- THREE $\lambda/2$ COAXIAL ELEMENTS PER TURN
- RADIATION PATERN IS SIMILAR TO A “BIG WHEEL”
- SINGLE SIDE FEED IS MUCH SIMPLER THAN 3 RADIAL FEEDS

NUMBER OF ELEMENTS IN LOOP

NUMBER OF IN-PHASE ELEMENTS IN CIRCLE



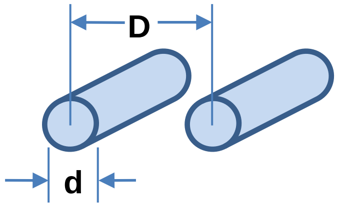
CIRCULAR COLLINEAR $\lambda/2$ ELEMENTS

FREQ (MHz)	$\lambda/2$ (Inches)
432.0	9.170
902.0	4.390
1296.0	3.060
2304.0	1.720

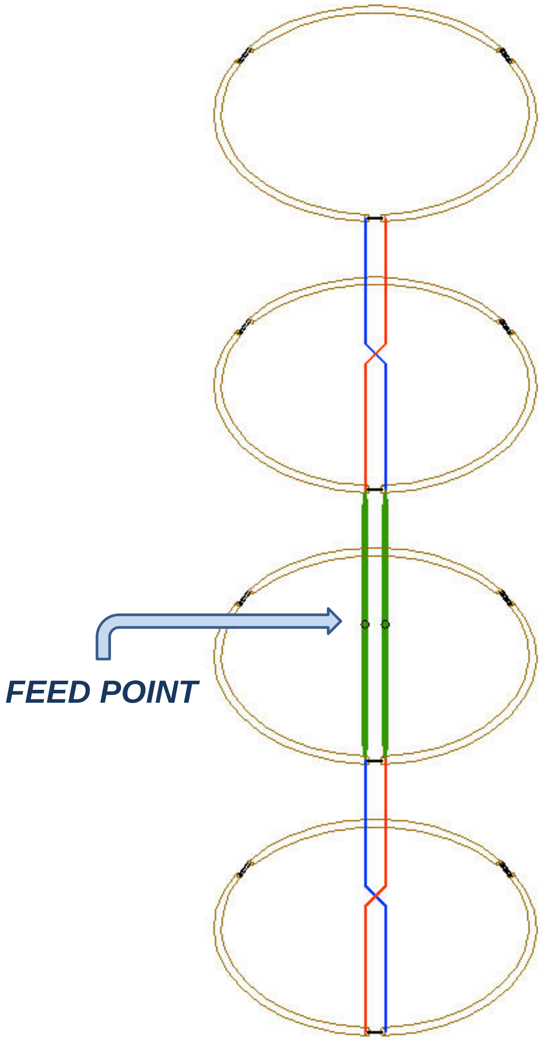
RG-316 ELEMENT LENGTH
Vr = 0.68

ARRAYS OF CIRCULAR ELEMENTS

- Arrays of stacked wheels
- Wheel elements are fed with open wire lines
- Impedance control of open wire lines provide equal load sharing

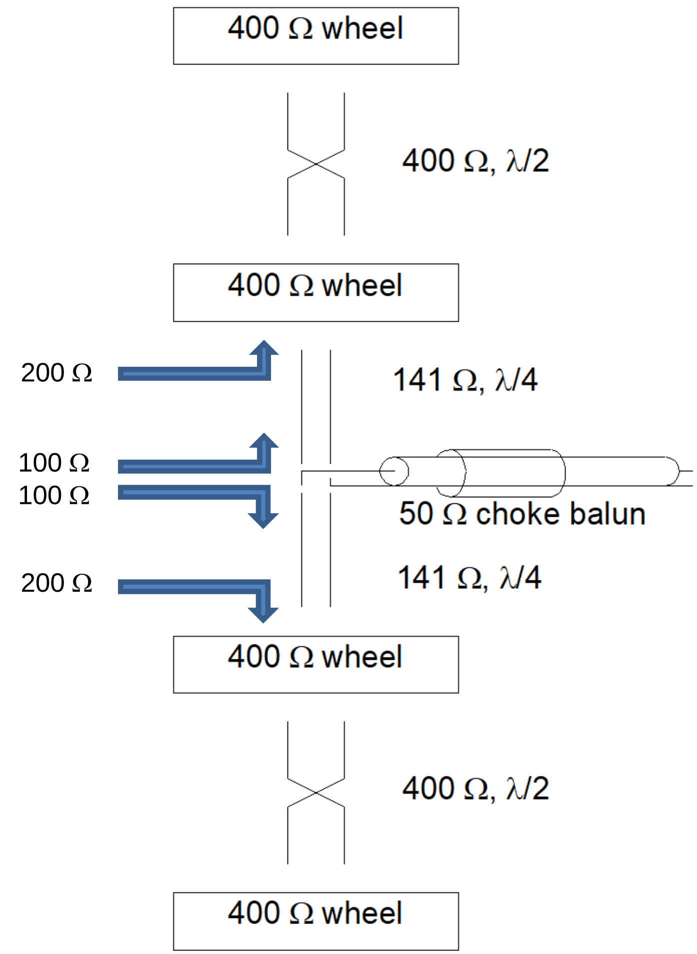


$$Zo = 120\ cosh^{-1}\left(\frac{D}{d}\right)$$



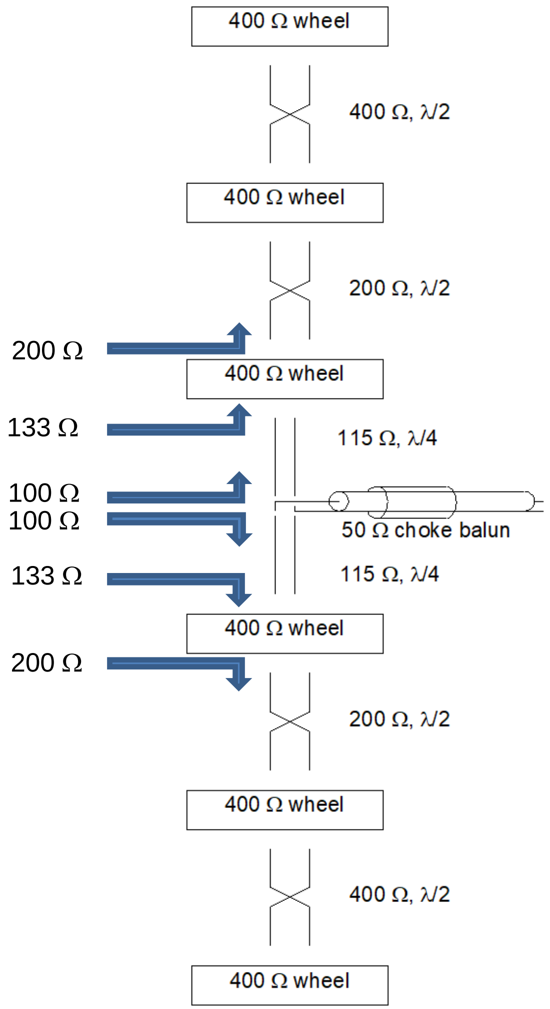
FEEDING THE FOUR WHEEL ARRAY

- Collinear connected RG-316 segments form wheels
- Driving point Z of wheel is approximately 400 Ω
- Four wheel elements stacked
- All elements are spaced λ/2
- Open wire feed line provide equal load sharing
- Impedance control of open wire line is important



FEEDING THE SIX WHEEL ARRAY

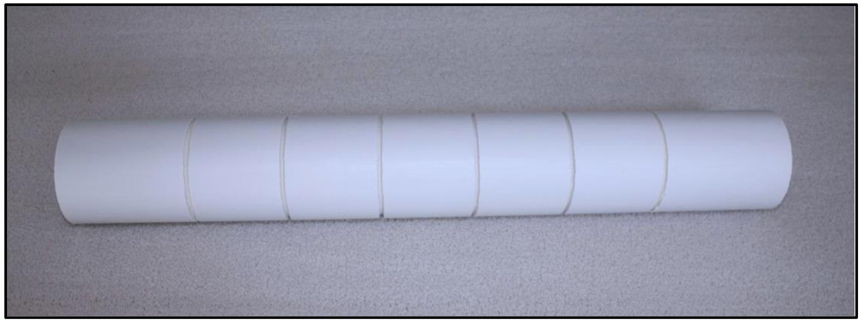
- Collinear connected RG-316 segments form wheels
- Driving point Z of wheel is approximately 400 Ω
- Six wheel elements stacked
- All elements are spaced λ/2
- Open wire feed line provide equal load sharing
- Impedance control of open wire line is important

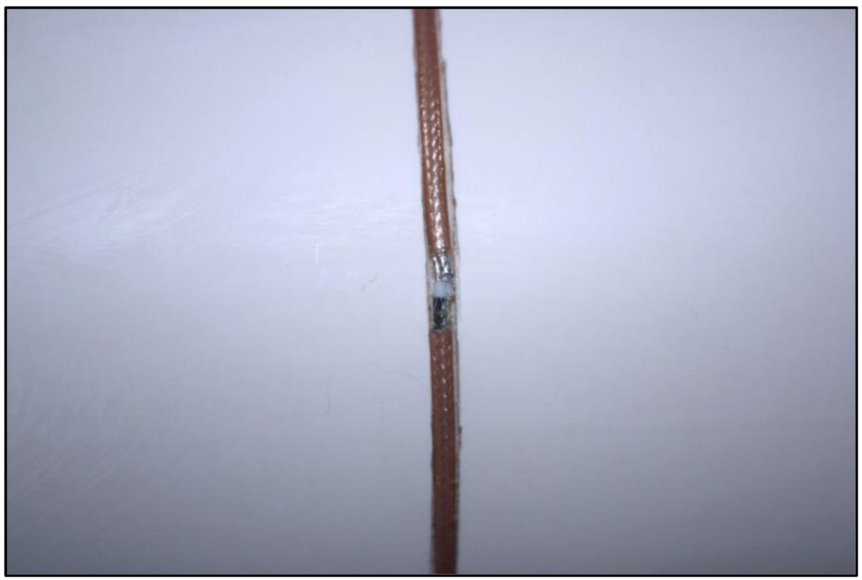


OPEN-WIRE LINE DIMENSIONS

Zo	Diameter	Spacing
400	0.047	0.658
200	0.047	0.129
200	0.094	0.257
141	0.094	0.166
115	0.094	0.140

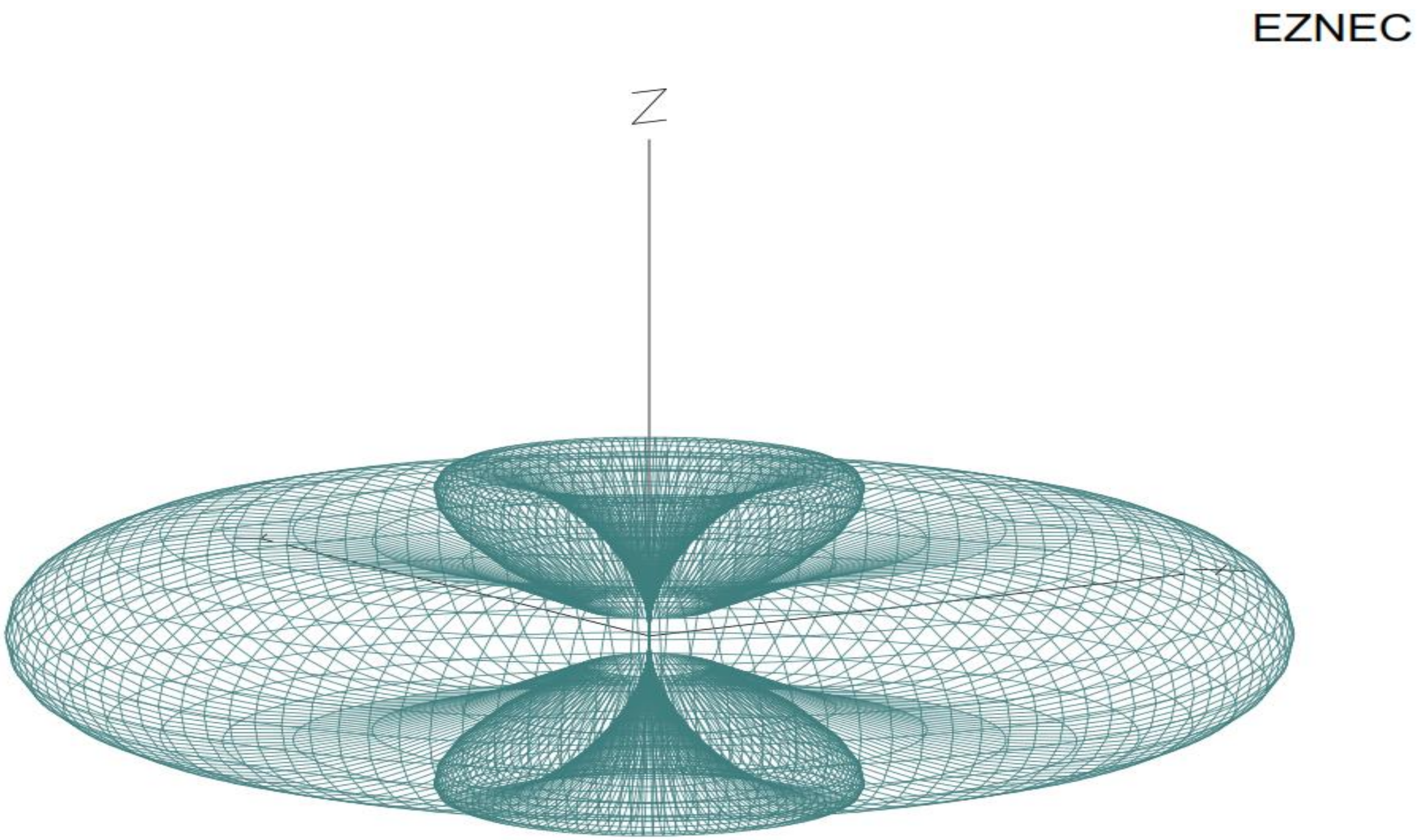
ARRAY PROTOTYPE CONSTRUCTION PHOTOS





1296 MHz – SIX WHEEL ARRAY PROTOTYPE

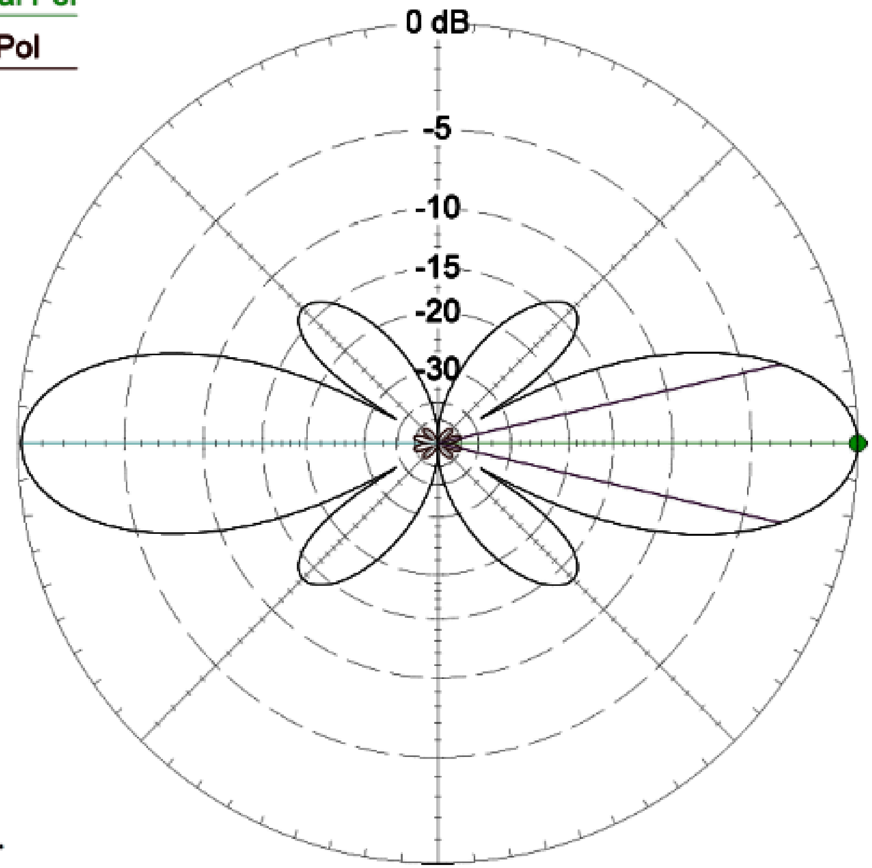
3D RADIATION PATTERN – 4 WHEEL ARRAY



FOUR WHEEL ELEVATION PATERN

* Total Field
Horizontal Pol
Vertical Pol

EZNEC



Elevation Plot	
Azimuth Angle	0.0 deg.
Outer Ring	6.28 dBi
Slice Max Gain	6.28 dBi @ Elev Angle = 0.0 deg.
Front/Back	0.14 dB
Beamwidth	26.0 deg.; -3dB @ 347.0, 13.0 deg.
Sidelobe Gain	6.14 dBi @ Elev Angle = 180.0 deg.
Front/Sidelobe	0.14 dB

Helical Colinear

902 MHz

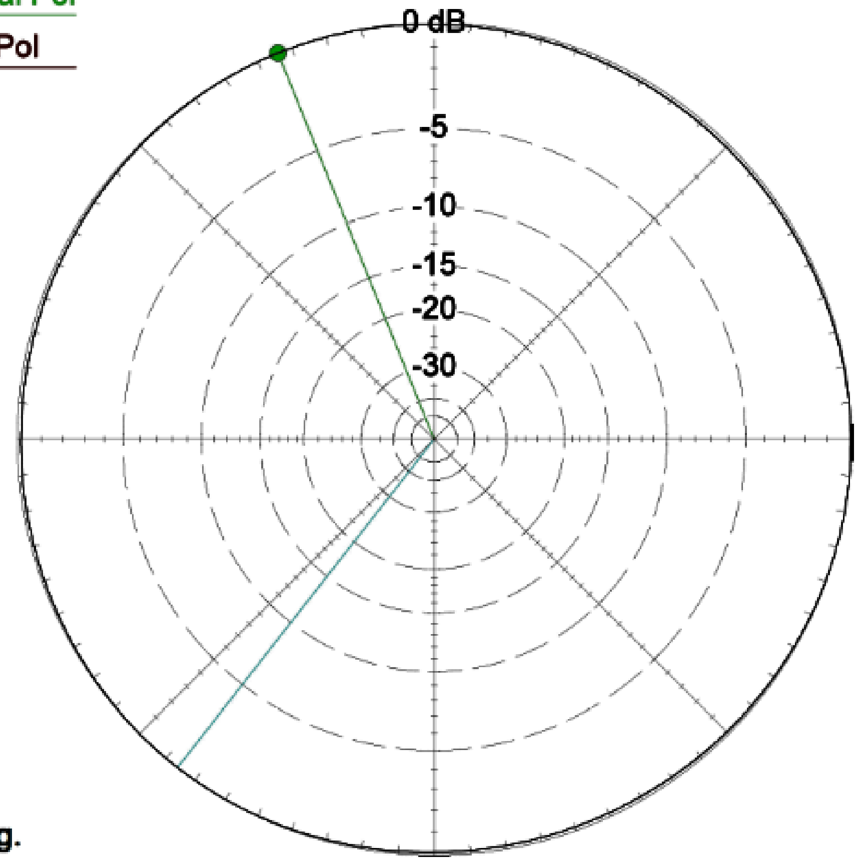
FOUR WHEEL AZIMUTH PATERN

*** Total Field**

Horizontal Pol

Vertical Pol

EZNEC



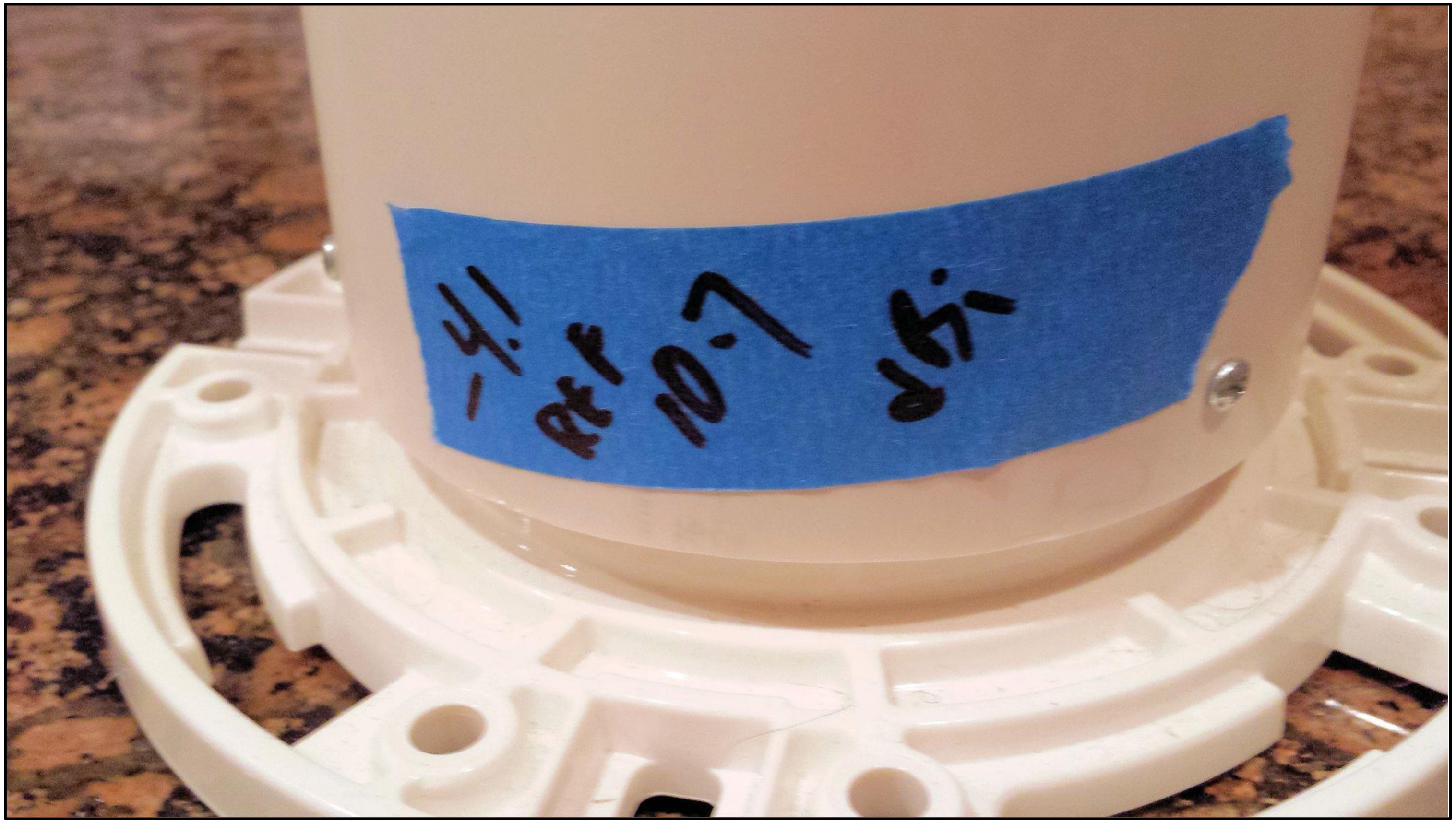
Azimuth Plot

Elevation Angle	0.0 deg.
Outer Ring	6.29 dBi
Slice Max Gain	6.29 dBi @ Az Angle = 112.0 deg.
Front/Back	0.16 dB
Beamwidth	?
Sidelobe Gain	6.29 dBi @ Az Angle = 232.0 deg.
Front/Sidelobe	0.0 dB

Helical Colinear

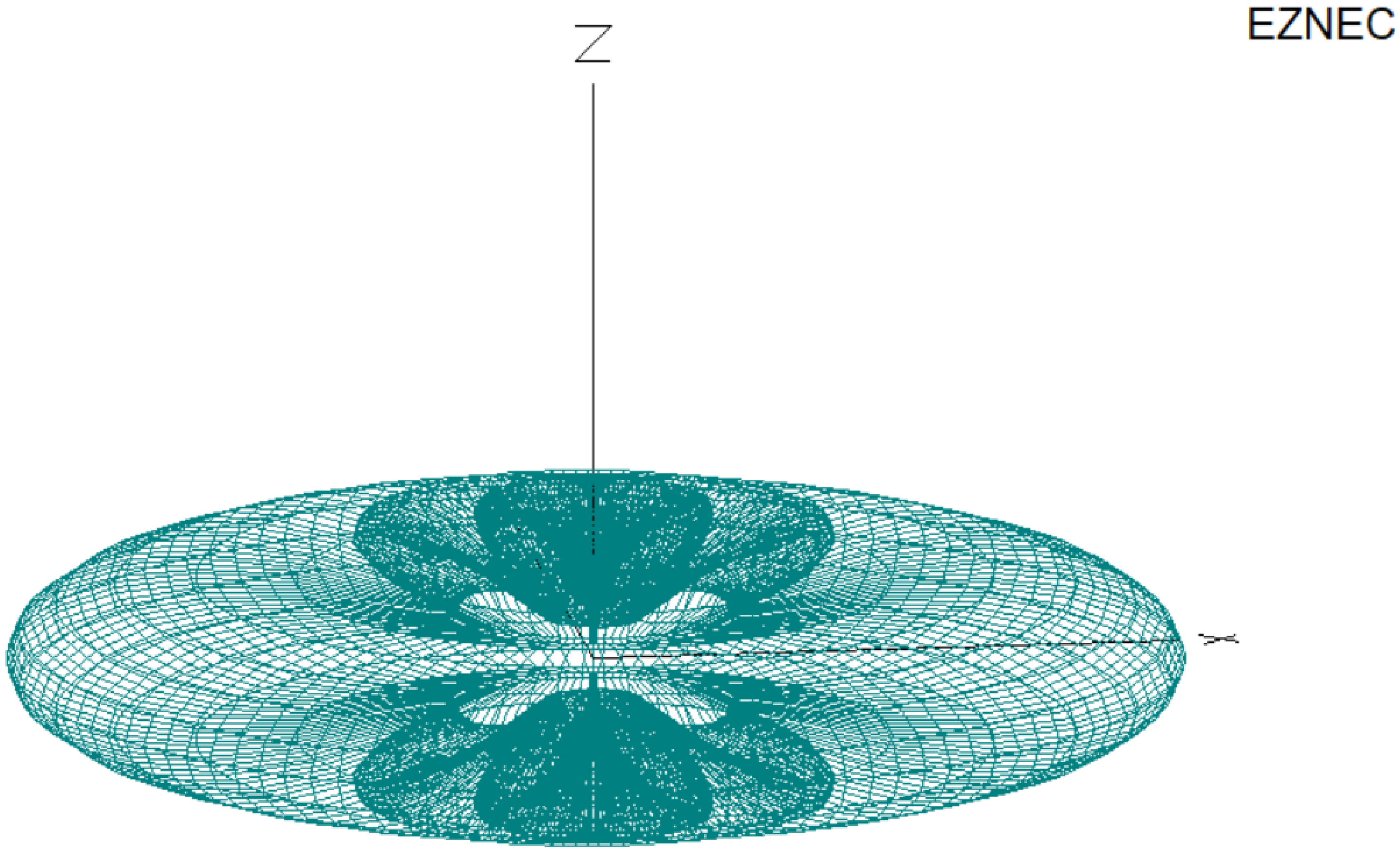
902 MHz

2014 CSVHFS ANTENNA RANGE MEASUREMENT

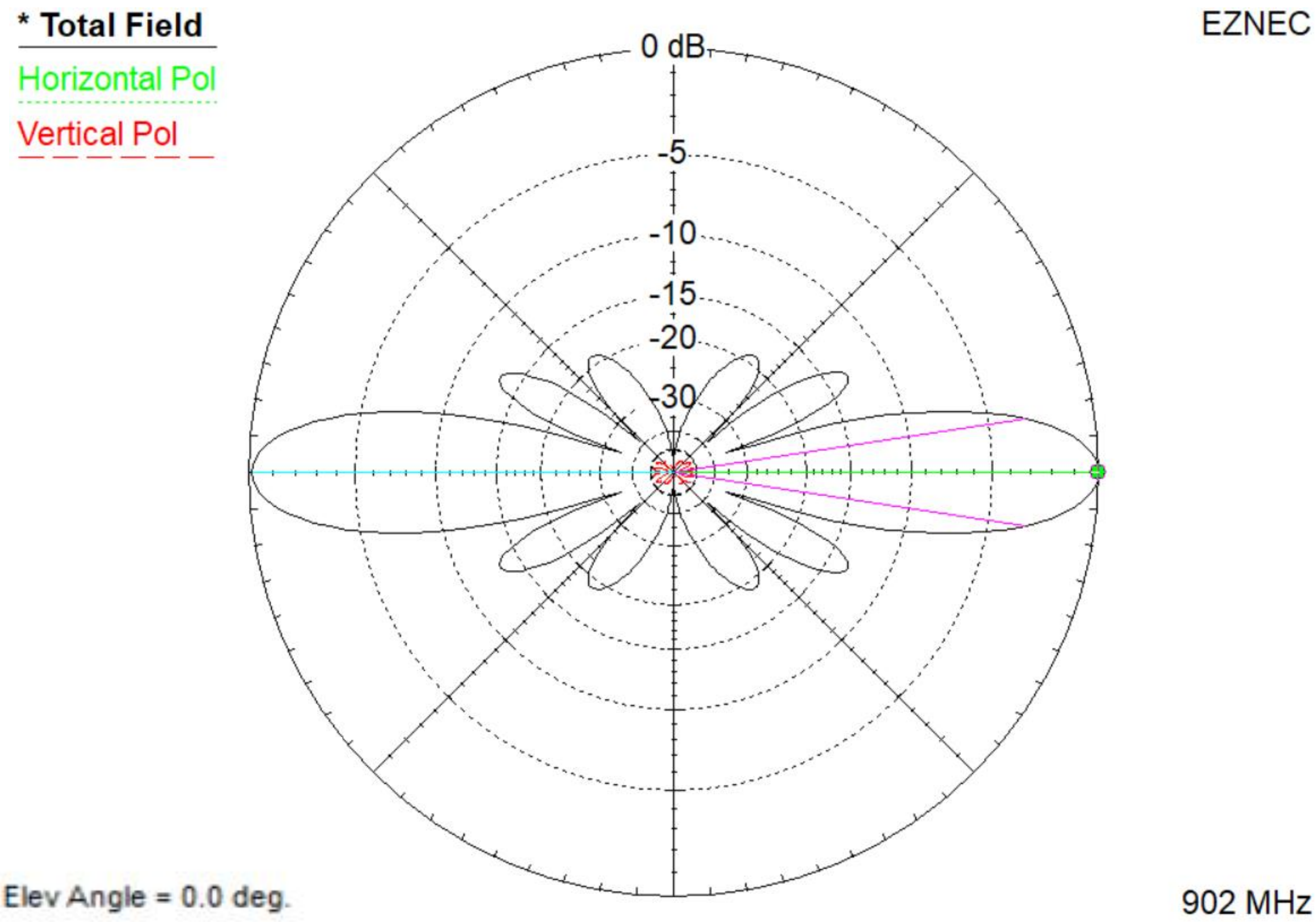


FOUR WHEEL ARRAY: 10.7 - 4.1 = 6.6 dBi GAIN

3D RADIATION PATTERN – 6 WHEEL ARRAY

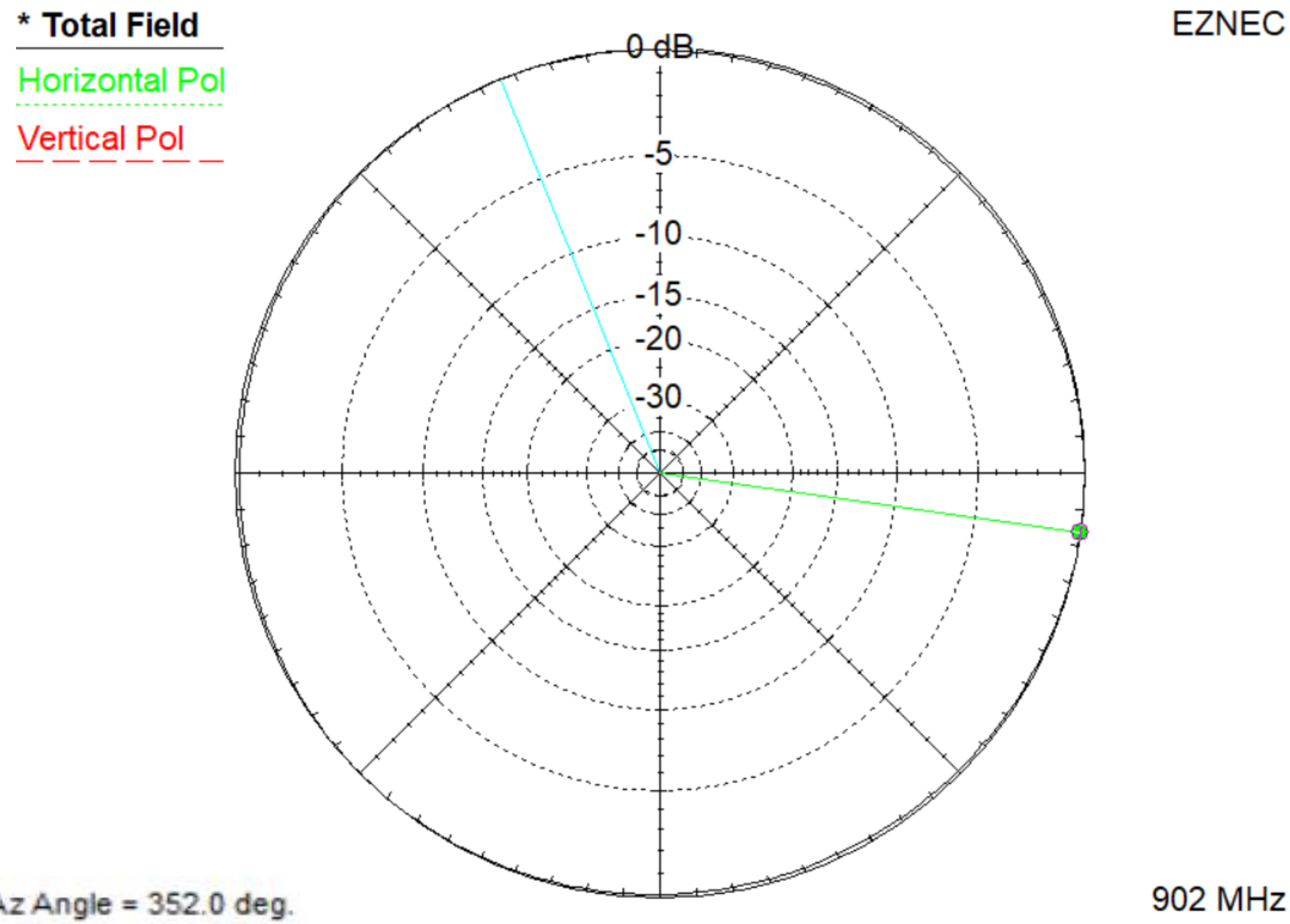


SIX WHEEL ELEVATION PATERN



Elevation Plot	
Azimuth Angle	0.0 deg.
Outer Ring	7.96 dBi
Slice Max Gain	7.96 dBi @ Elev Angle = 0.0 deg.
Front/Back	0.15 dB
Beamwidth	17.2 deg.; -3dB @ 351.4, 8.6 deg.
Sidelobe Gain	7.81 dBi @ Elev Angle = 180.0 deg.
Front/Sidelobe	0.15 dB

SIX WHEEL AZIMUTH PATERN

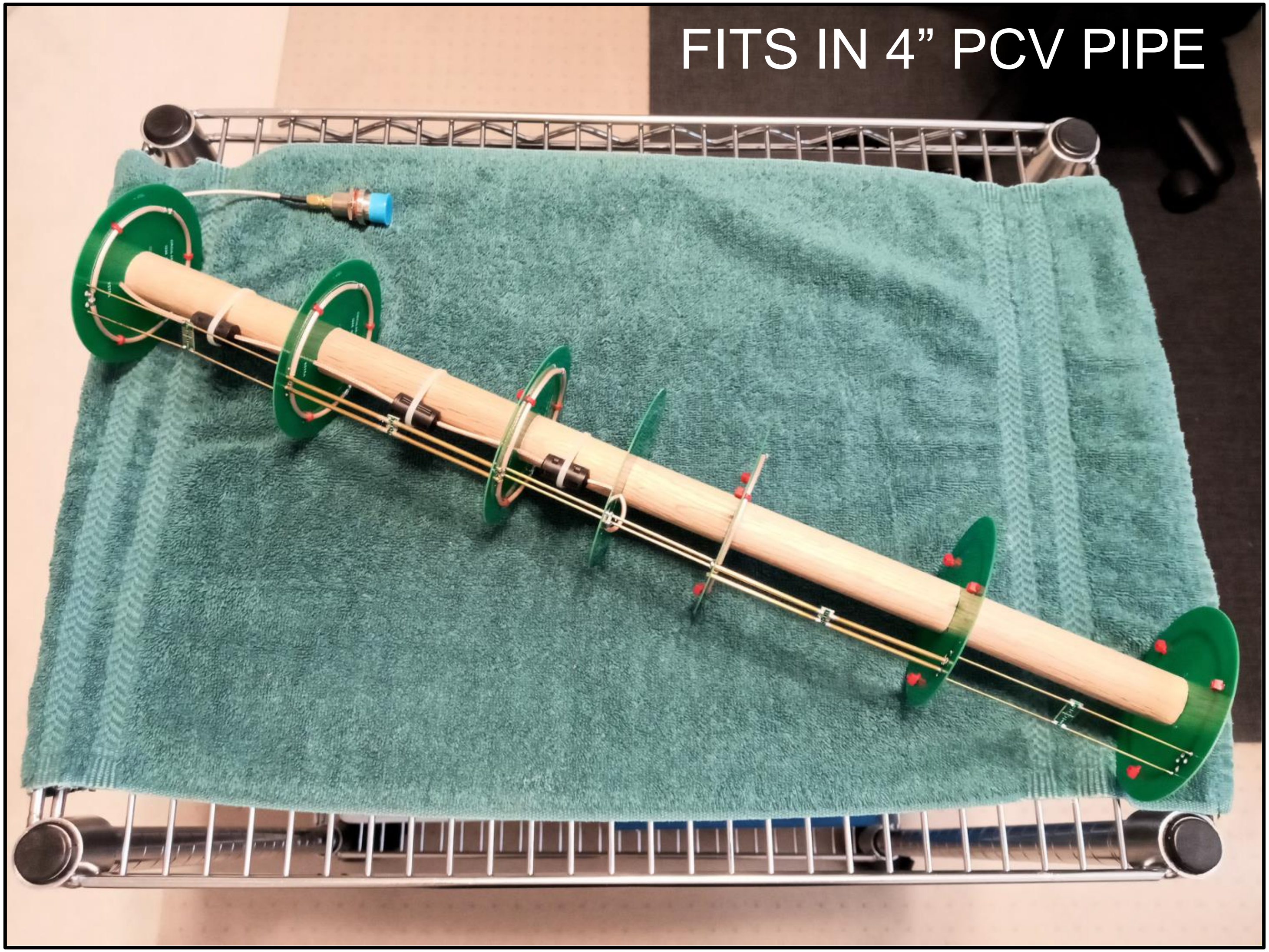


Azimuth Plot	
Elevation Angle	0.0 deg.
Outer Ring	7.96 dBi
Slice Max Gain	7.96 dBi @ Az Angle = 352.0 deg.
Front/Back	0.16 dB
Beamwidth	?
Sidelobe Gain	7.96 dBi @ Az Angle = 112.0 deg.
Front/Sidelobe	0.0 dB

POST PROTOTYPE – $\lambda/2$ ELEMENT SUBARRAY

SIX $\lambda/2$ ELEMENT SUBARRAY DISKS

1296 MHz SIX DISK ASSEMBLY



Summary

- Circular subarrays
- Three $\lambda/2$ coaxial collinear segments in circle
- "Big Wheel" radiation pattern
- Single feed point for each subarray disk
- Subarray disks spaced $\lambda/2$
- Array of elements fed with open wire line
- Impedance control of open-wire line controls element drive distribution
- Good results on air

23 cm 6-WHEEL and 33 cm 4-WHEEL ARRAYS