The Three Element Array

Shortened Hi-Z elements

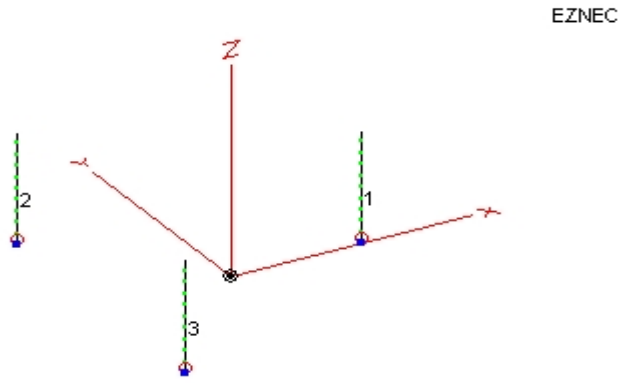
This is one of the arrays I have designed that has been one of the better achievements. It uses 3 each 20-foot shortened vertical elements feeding high impedance amplifiers arranged in a triangle with only 40 feet element separation. It is steerable in 6 directions for full azimuth coverage coverage. The best all around performance is achieved with 50-foot element spacing.

There are two really good reasons why it was such a such a successful design. The first reason is that the array can produce over 9 dB of Relative Directivity Factor (RDF) in such a small area. And the second reason is that it is very insensitive to voltage and phase inaccuracies for such a small array.

Investigation of this antenna was at the extreme urging of a very good friend. Based on his small footprint availability, the Triangular array concept was born. We were rewarded with a bit better RDF than a K9AY loop, really low angle performance, and great front to back ratio. Customer feedback has indicated that customers can hear stations they could not hear with a regular loop, a K9AY loop, or a transmitting antenna.

Refer to the antenna comparison chart:
http://www.hizantennas.com/comparison.pdf

The following graphic is an Eznec View of the antenna layout in the three dimensions.



The Eznec wires description of the triangular array.

Wires

Wire Create Edit Other

Coord Entry Mode | Preserve Connections | Show Wire Insulation

Wires

No.	End 1				End 2				Diameter	Segs
	X (ft)	Y (ft)	Z (ft)	Conn	X (ft)	Y (ft)	Z (ft)	Conn	(in)	
1	20	0	0	Ground	20	0	20		0.75	10
2	-20	22.5	0	Ground	-20	22.5	20		0.75	10
3	-20	-22.5	0	Ground	-20	-22.5	20		0.75	10
*										

0

The Eznec Source description for the elements

Sources

Source Edit

Sources

No.	Specified Pos.		Actual Pos.		Amplitude	Phase	Type
	Wire #	% From E1	% From E1	Seg	(V, A)	(deg.)	
1	1	0	5	1	2	0	I
2	2	0	5	1	1	-205	I
3	3	0	5	1	1	-205	I
*							

The Eznec main page for the triangle array.

EZNEC v. 4.0

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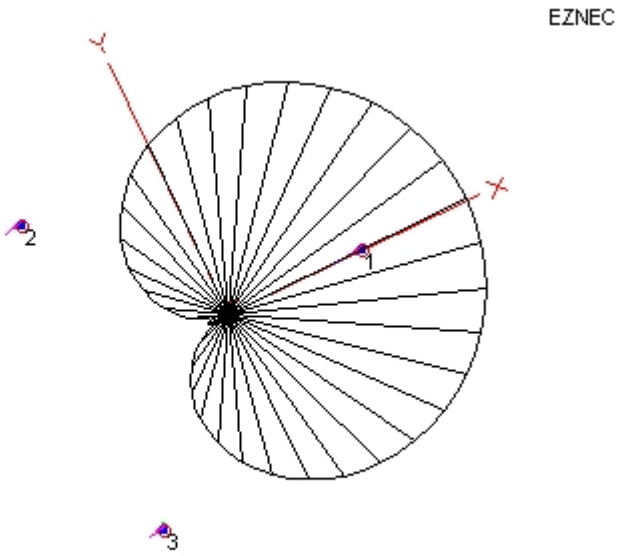
Src Dat
Load Dat
FF Tab
NF Tab
SWR
View Ant
FF Plot

triangle array mini

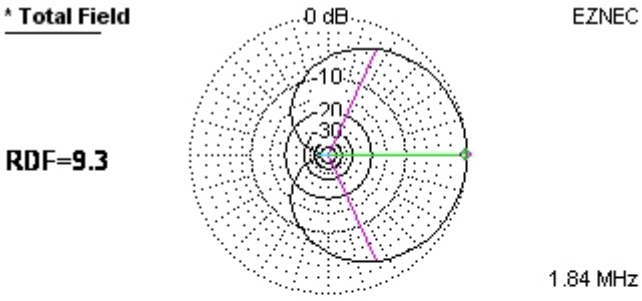
File	zrtri22.5.EZ
Frequency	1.84 MHz.
Wavelength	534.55 ft
Wires	3 Wires, 30 segments
Sources	3 Sources
Loads	0 Loads
Trans Lines	0 Lines
Ground Type	Real/MININEC
Ground Descrip	1 Medium (0.005, 13)
Wire Loss	Zero
Units	Feet
Plot Type	3D
Step Size	5 Deg.
Ref Level	0 dBi
Alt SWR Z0	75 ohms
Desc Options	

Average Gain = 0.470 = -3.28 dB *Model contains loss*

The following graphic shows looking straight down on top the antenna pattern overlaying the physical layout of the antenna array.

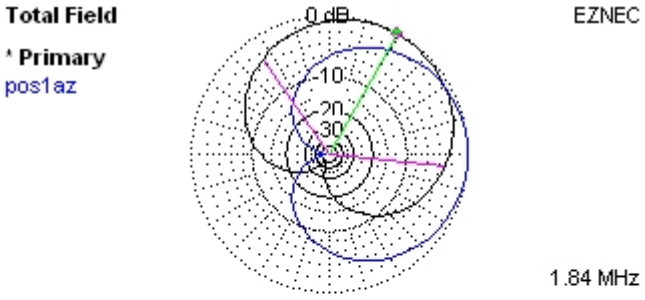


The antennas peak response when installed over average ground is at 20 degrees elevation can also be shown with an Eznec plot as follows.



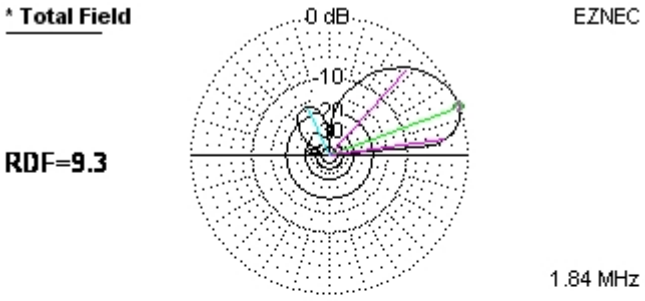
Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	20.0 deg.	Gain	5.95 dBi
Outer Ring	5.95 dBi		0.0 dBmax
			0.0 dBmax3D
3D Max Gain	5.95 dBi		
Slice Max Gain	5.95 dBi @ Az Angle = 0.0 deg.		
Front/Back	42.5 dB		
Beamwidth	131.0 deg.; -3dB @ 294.5, 65.5 deg.		
Sidelobe Gain	-36.55 dBi @ Az Angle = 180.0 deg.		
Front/Sidelobe	42.5 dB		

Two of the 6 positions available overlaid on an azimuth plot.



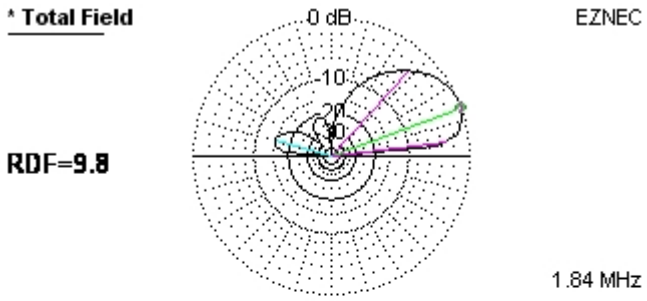
Azimuth Plot		Cursor Az	60.0 deg.
Elevation Angle	20.0 deg.	Gain	5.92 dBi
Outer Ring	5.95 dBi		0.0 dBmax
			0.0 dBmax3D
3D Max Gain	5.92 dBi		
Slice Max Gain	5.92 dBi @ Az Angle = 60.0 deg.		
Front/Back	51.99 dB		
Beamwidth	131.6 deg.; -3dB @ 353.6, 125.2 deg.		
Sidelobe Gain	< -100 dBi		
Front/Sidelobe	> 100 dB		

And the elevation plot follows.



Elevation Plot		Cursor Elev	20.0 deg.
Azimuth Angle	0.0 deg.	Gain	5.95 dBi
Outer Ring	5.95 dBi		0.0 dBmax
			0.0 dBmax3D
3D Max Gain	5.95 dBi		
Slice Max Gain	5.95 dBi @ Elev Angle = 20.0 deg.		
Beamwidth	40.8 deg.; -3dB @ 7.5, 48.3 deg.		
Sidelobe Gain	-10.57 dBi @ Elev Angle = 115.0 deg.		
Front/Sidelobe	16.52 dB		

The array phasing values can be adjusted to reduce the high angle back lobe shown in the elevation plot at a slight penalty of front to back ratio. RDF however is increased.



Elevation Plot		Cursor Elev	20.0 deg.
Azimuth Angle	0.0 deg.	Gain	6.39 dBi
Outer Ring	6.39 dBi		0.0 dBmax
			0.0 dBmax3D
3D Max Gain	6.39 dBi		
Slice Max Gain	6.39 dBi @ Elev Angle = 20.0 deg.		
Beamwidth	39.8 deg.; -3dB @ 7.4, 47.2 deg.		
Sidelobe Gain	-8.5 dBi @ Elev Angle = 165.0 deg.		
Front/Sidelobe	14.89 dB		

Phasing for the skewed notch.

Sources

Source Edit

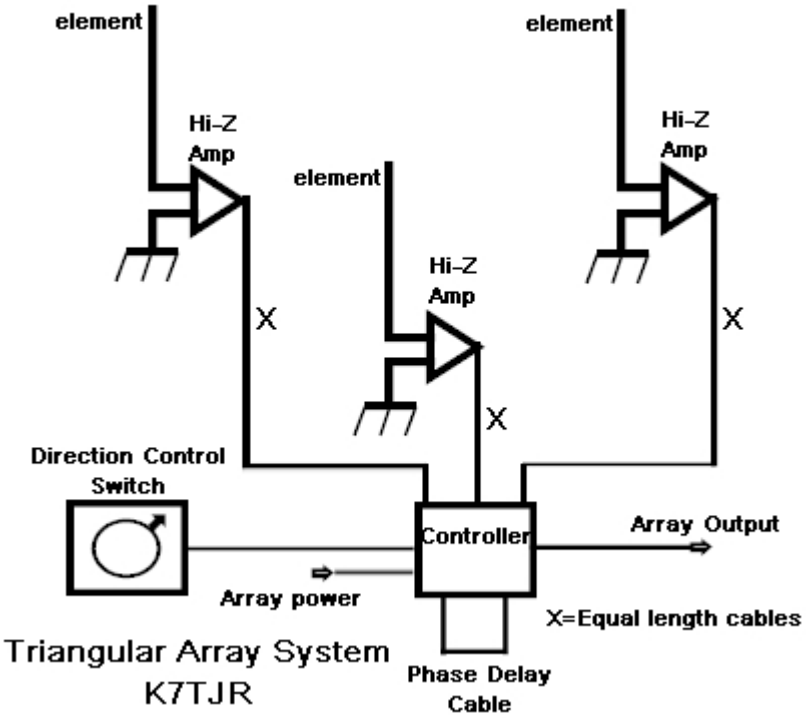
Sources

	No.	Specified Pos.		Actual Pos.		Amplitude	Phase	Type
		Wire #	% From E1	% From E1	Seg	(V, A)	(deg.)	
	1	1	0	5	1	2	0	I
▶	2	2	0	5	1	1	-190	I
	3	3	0	5	1	1	-205	I
*								

When variable phasing and 6 direction control is used, the notch can be aimed any where around the compass.

The elements used in this array are the same construction as used in other K7TJR arrays. They are insulated 20-foot sections of tubing arranged as a vertical element close to ground. A ground rod is needed in addition for connection to the high impedance amplifier. The high impedance amplifiers are described in other K7TJR literature. The high impedance amplifier converts the high impedance elements to 75 ohms to match the cables carrying the signal to the center of the array. The signals are combined in the center by the controller.

Three element Array Block Diagram



The controller in the following diagram is set up to power the Hi-Z amps over their connecting coaxial cable.