

K9EQ Flat Top EZNEC Analysis

Antenna Data

EZNEC ver. 3.0

K9EQ Flat Top 7/11/01 3:50:22 PM

----- ANTENNA DESCRIPTION -----

Frequency = 50.1 MHz
Wire Loss: Copper -- Resistivity = 1.74E-08 ohm-m, Rel. Perm. = 1

----- WIRES -----

No.	End 1	Coord. (ft)			End 2	Coord. (ft)			Dia (in)	Segs
	Conn.	X	Y	Z	Conn.	X	Y	Z		
1		0,	46,	35		0,	-46,	35	#14	121
2		0,	-0.15,	4		0,	0.15,	4	#14	1

Total Segments: 122

----- SOURCES -----

No.	Specified Pos.		Actual Pos.		Amplitude	Phase	Type
	Wire #	% From E1	% From E1	Seg	(V/A)	(deg.)	
1	2	50.00	50.00	1	1	0	I

No loads specified

----- TRANSMISSION LINES -----

No.	End 1	Specified Pos	End 1 Act	End 2	Specified Pos	End 2 Act	Length	Z0	VF	Rev/Norm
	Wire #	% From E1	% From E1	Wire #	% From E1	% From E1	(ft)	(ohms)		
1	1	50.00	50.00	2	0.00	50.00	Actual dist	450	0.95	N

Ground type is Real, MININEC-Type

----- MEDIA -----

No.	Cond.	Diel. Const.	Height	R Coord.
	(S/m)		(ft)	(ft)
1	0.002	10	0	0

K9EQ Notes:

The actual antenna is 45' high on one end and 35' high on the other. The center is about 25' off the ground. This model is based on a "flat" antenna at 35' so that a better comparison can be made with the K0ZE loop.

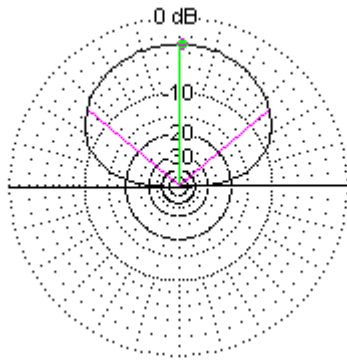
The antenna is fed with an Icom AH-4 wide range antenna tuner mounted at the end of 25' of 450 ohm ladder line. The tuner is then connected to the IC-706 via approximately 175 feet of coax cable.

The antenna tunes to 1:1 SWR (as the radio sees it) on all frequencies on the 160, 80, 40, 30, 20, 17, 15, 12, 10, and 6 meter amateur bands. The antenna has been operated on all except 160 meters with satisfactory performance.

All plots are shown with 10 dBi at the outer ring.

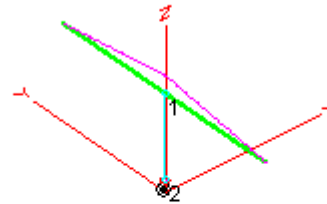
K9EQ Flat Top EZNEC Analysis

1.9 MHz



EZNEC

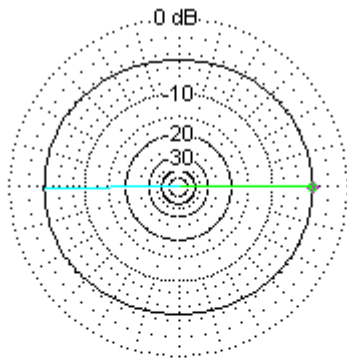
EZNEC



1.9 MHz

Elevation Plot		Cursor Elev	88.0 deg.
Azimuth Angle	0.0 deg.	Gain	7.03 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	7.03 dBi
Slice Max Gain	7.03 dBi @ Elev Angle = 90.0 deg.
Beamwidth	99.6 deg.; -3dB @ 40.2, 139.8 deg.
Sidelobe Gain	< -100 dBi
Front/Sidelobe	> 100 dB



EZNEC

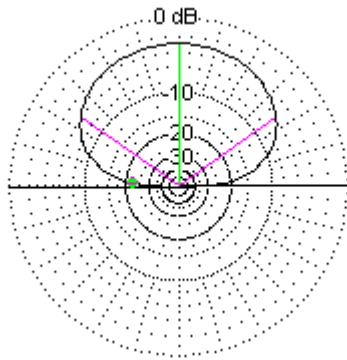
1.9 MHz

Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	60.0 deg.	Gain	6.1 dBi
Outer Ring	10.0dBi		-0.93 dBmax

3D Max Gain	7.03 dBi
Slice Max Gain	6.1 dBi @ Az Angle = 0.0 deg.
Front/Side	0.96 dB
Beamwidth	?
Sidelobe Gain	6.1 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	0.0 dB

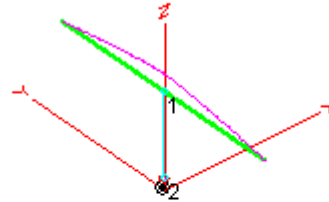
K9EQ Flat Top EZNEC Analysis

3.75 MHz



EZNEC

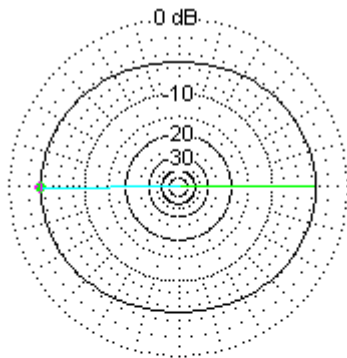
EZNEC



3.75 MHz

Elevation Plot		Cursor Elev	176.0 deg.
Azimuth Angle	0.0 deg.	Gain	-12.7 dBi
Outer Ring	10.0dBi		-19.85 dBmax

3D Max Gain 7.14 dBi
 Slice Max Gain 7.14 dBi @ Elev Angle = 90.0 deg.
 Beamwidth 109.2 deg.; -3dB @ 35.4, 144.6 deg.
 Sidelobe Gain < -100 dBi
 Front/Sidelobe > 100 dB



EZNEC

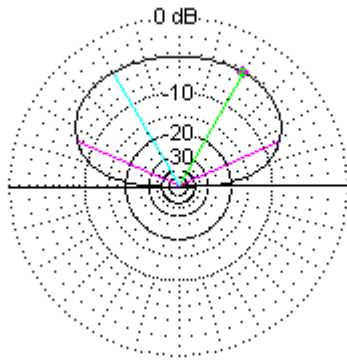
3.75 MHz

Azimuth Plot		Cursor Az	180.0 deg.
Elevation Angle	60.0 deg.	Gain	6.5 dBi
Outer Ring	10.0dBi		-0.64 dBmax

3D Max Gain 7.14 dBi
 Slice Max Gain 6.5 dBi @ Az Angle = 0.0 deg.
 Front/Side 1.64 dB
 Beamwidth ?
 Sidelobe Gain 6.5 dBi @ Az Angle = 180.0 deg.
 Front/Sidelobe 0.0 dB

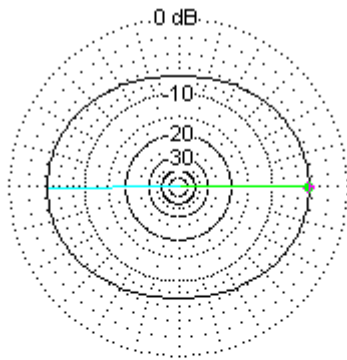
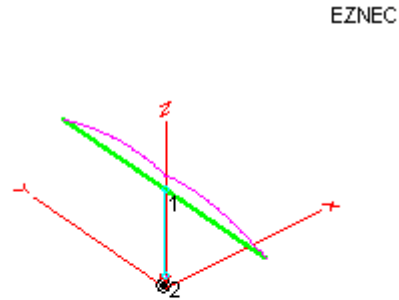
K9EQ Flat Top EZNEC Analysis

7.1 MHz



Elevation Plot	Cursor Elev	60.0 deg.
Azimuth Angle	Gain	5.68 dBi
Outer Ring		10.0dBi 0.0 dBmax

3D Max Gain	5.68 dBi
Slice Max Gain	5.68 dBi @ Elev Angle = 60.0 deg.
Beamwidth	132.6 deg.; -3dB @ 23.7, 156.3 deg.
Sidelobe Gain	5.68 dBi @ Elev Angle = 120.0 deg.
Front/Sidelobe	0.0 dB

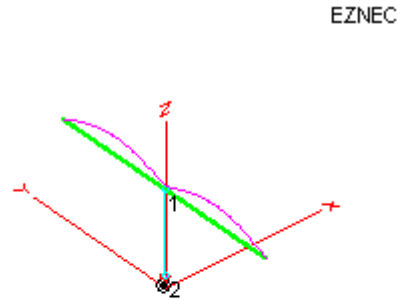
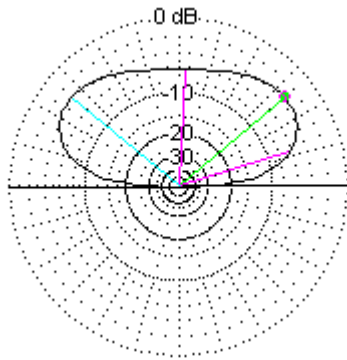


Azimuth Plot	Cursor Az	0.0 deg.
Elevation Angle	Gain	60.0 deg. 5.68 dBi
Outer Ring		10.0dBi 0.0 dBmax

3D Max Gain	5.68 dBi
Slice Max Gain	5.68 dBi @ Az Angle = 0.0 deg.
Front/Side	2.82 dB
Beamwidth	?
Sidelobe Gain	5.68 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	0.0 dB

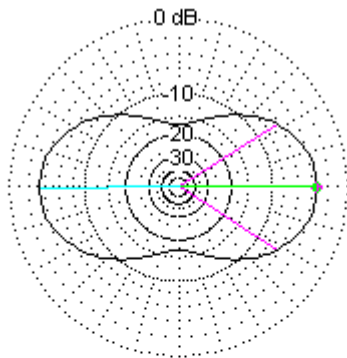
K9EQ Flat Top EZNEC Analysis

10.1 MHz



Elevation Plot		Cursor Elev	40.0 deg.
Azimuth Angle	0.0 deg.	Gain	6.67 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	6.67 dBi
Slice Max Gain	6.67 dBi @ Elev Angle = 40.0 deg.
Beamwidth	69.0 deg.; -3dB @ 17.5, 86.5 deg.
Sidelobe Gain	6.67 dBi @ Elev Angle = 140.0 deg.
Front/Sidelobe	0.0 dB

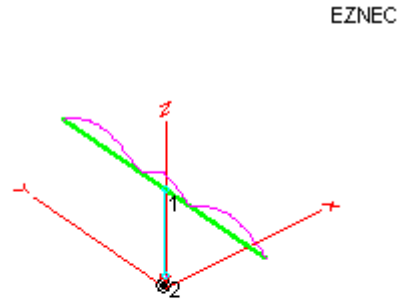
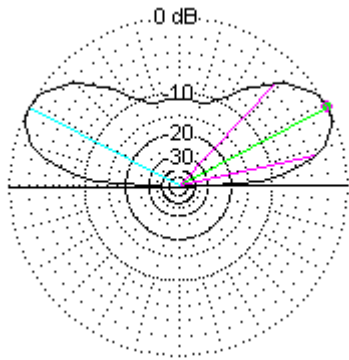


Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	40.0 deg.	Gain	6.67 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	6.67 dBi
Slice Max Gain	6.67 dBi @ Az Angle = 0.0 deg.
Front/Side	13.55 dB
Beamwidth	65.2 deg.; -3dB @ 327.4, 32.6 deg.
Sidelobe Gain	6.67 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	0.0 dB

K9EQ Flat Top EZNEC Analysis

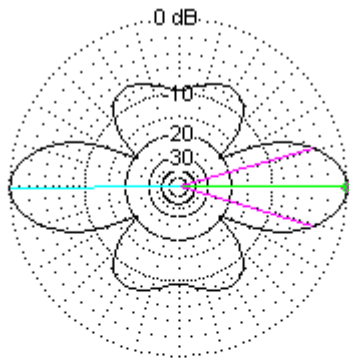
14.1 MHz



14.1 MHz

Elevation Plot		Cursor Elev	28.0 deg.
Azimuth Angle	0.0 deg.	Gain	10.0 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	10.0 dBi
Slice Max Gain	10.0 dBi @ Elev Angle = 28.0 deg.
Beamwidth	33.3 deg.; -3dB @ 13.0, 46.3 deg.
Sidelobe Gain	10.0 dBi @ Elev Angle = 152.0 deg.
Front/Sidelobe	0.0 dB



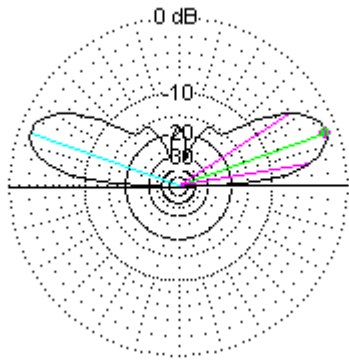
14.1 MHz

Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	28.0 deg.	Gain	10.0 dBi
Outer Ring	10.0dBi		0.0 dBmax

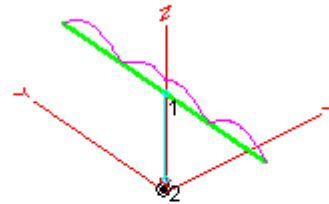
3D Max Gain	10.0 dBi
Slice Max Gain	10.0 dBi @ Az Angle = 0.0 deg.
Front/Side	9.41 dB
Beamwidth	32.2 deg.; -3dB @ 343.9, 16.1 deg.
Sidelobe Gain	10.0 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	0.0 dB

K9EQ Flat Top EZNEC Analysis

18.1 MHz



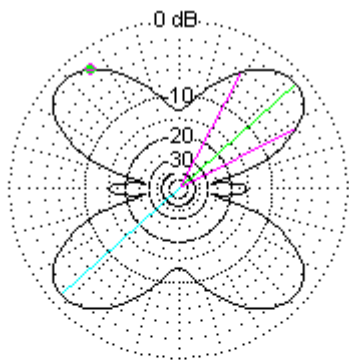
EZNEC



18.1 MHz

Elevation Plot		Cursor Elev	20.0 deg.
Azimuth Angle	42.0 deg.	Gain	8.86 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain 8.86 dBi
 Slice Max Gain 8.86 dBi @ Elev Angle = 20.0 deg.
 Beamwidth 23.5 deg.; -3dB @ 9.9, 33.4 deg.
 Sidelobe Gain 8.86 dBi @ Elev Angle = 160.0 deg.
 Front/Sidelobe 0.0 dB



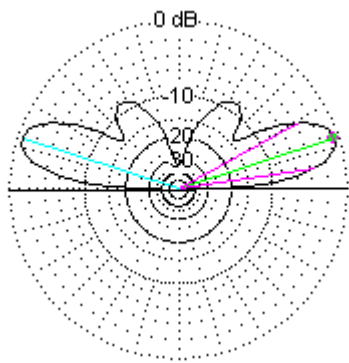
18.1 MHz

Azimuth Plot		Cursor Az	126.0 deg.
Elevation Angle	20.0 deg.	Gain	7.73 dBi
Outer Ring	10.0dBi		-1.13 dBmax

3D Max Gain 8.86 dBi
 Slice Max Gain 8.86 dBi @ Az Angle = 42.0 deg.
 Front/Side 0.27 dB
 Beamwidth 34.9 deg.; -3dB @ 27.1, 62.0 deg.
 Sidelobe Gain 8.86 dBi @ Az Angle = 222.0 deg.
 Front/Sidelobe 0.0 dB

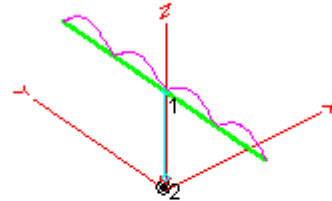
K9EQ Flat Top EZNEC Analysis

21.1 MHz



EZNEC

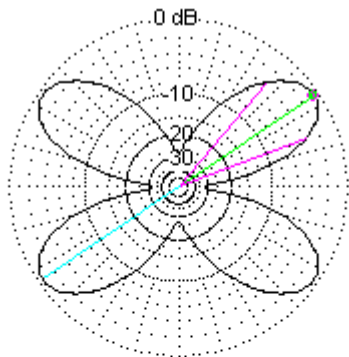
EZNEC



21.1 MHz

Elevation Plot		Cursor Elev	18.0 deg.
Azimuth Angle	34.0 deg.	Gain	9.55 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	9.55 dBi
Slice Max Gain	9.55 dBi @ Elev Angle = 18.0 deg.
Beamwidth	20.0 deg.; -3dB @ 8.8, 28.8 deg.
Sidelobe Gain	9.55 dBi @ Elev Angle = 162.0 deg.
Front/Sidelobe	0.0 dB



EZNEC

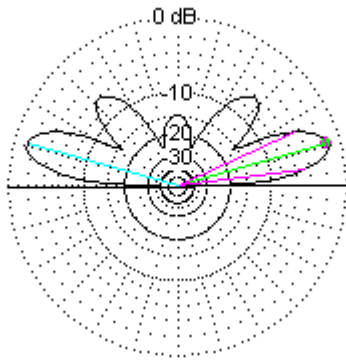
21.1 MHz

Azimuth Plot		Cursor Az	34.0 deg.
Elevation Angle	18.0 deg.	Gain	9.55 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	9.55 dBi
Slice Max Gain	9.55 dBi @ Az Angle = 34.0 deg.
Front/Side	5.74 dB
Beamwidth	28.5 deg.; -3dB @ 21.2, 49.7 deg.
Sidelobe Gain	9.55 dBi @ Az Angle = 214.0 deg.
Front/Sidelobe	0.0 dB

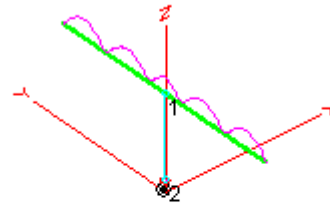
K9EQ Flat Top EZNEC Analysis

25 MHz



EZNEC

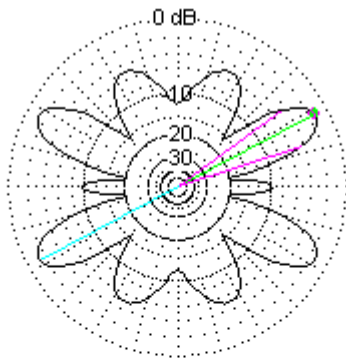
EZNEC



25 MHz

Elevation Plot		Cursor Elev	16.0 deg.
Azimuth Angle	28.0 deg.	Gain	8.68 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	8.68 dBi
Slice Max Gain	8.68 dBi @ Elev Angle = 16.0 deg.
Beamwidth	16.7 deg.; -3dB @ 7.7, 24.4 deg.
Sidelobe Gain	8.68 dBi @ Elev Angle = 164.0 deg.
Front/Sidelobe	0.0 dB



EZNEC

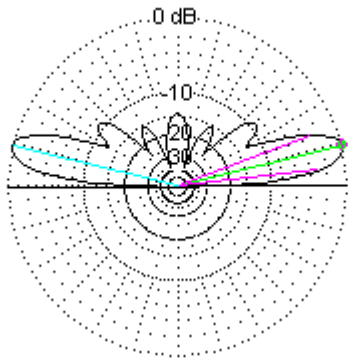
25 MHz

Azimuth Plot		Cursor Az	28.0 deg.
Elevation Angle	16.0 deg.	Gain	8.68 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	8.68 dBi
Slice Max Gain	8.68 dBi @ Az Angle = 28.0 deg.
Front/Side	3.8 dB
Beamwidth	17.8 deg.; -3dB @ 18.5, 36.3 deg.
Sidelobe Gain	8.68 dBi @ Az Angle = 208.0 deg.
Front/Sidelobe	0.0 dB

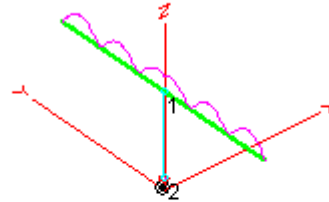
K9EQ Flat Top EZNEC Analysis

28 MHz



EZNEC

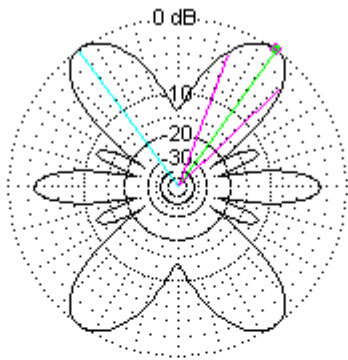
EZNEC



28.1 MHz

Elevation Plot		Cursor Elev	14.0 deg.
Azimuth Angle	54.0 deg.	Gain	10.19 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	10.19 dBi
Slice Max Gain	10.19 dBi @ Elev Angle = 14.0 deg.
Beamwidth	14.5 deg.; -3dB @ 6.5, 21.0 deg.
Sidelobe Gain	10.19 dBi @ Elev Angle = 166.0 deg.
Front/Sidelobe	0.0 dB



EZNEC

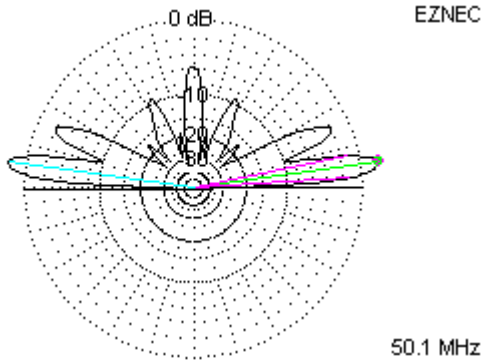
28.1 MHz

Azimuth Plot		Cursor Az	54.0 deg.
Elevation Angle	14.0 deg.	Gain	10.19 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	10.19 dBi
Slice Max Gain	10.19 dBi @ Az Angle = 54.0 deg.
Front/Side	11.67 dB
Beamwidth	26.0 deg.; -3dB @ 43.5, 69.5 deg.
Sidelobe Gain	10.19 dBi @ Az Angle = 126.0 deg.
Front/Sidelobe	0.0 dB

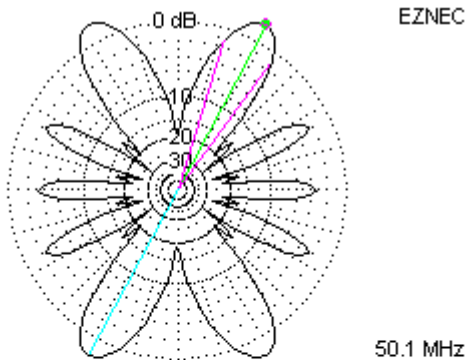
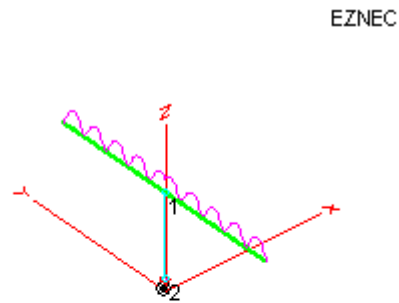
K9EQ Flat Top EZNEC Analysis

50 MHz



Elevation Plot		Cursor Elev	8.0 deg.
Azimuth Angle	62.0 deg.	Gain	11.87 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	11.87 dBi
Slice Max Gain	11.87 dBi @ Elev Angle = 8.0 deg.
Beamwidth	8.1 deg.; -3dB @ 3.8, 11.9 deg.
Sidelobe Gain	11.87 dBi @ Elev Angle = 172.0 deg.
Front/Sidelobe	0.0 dB

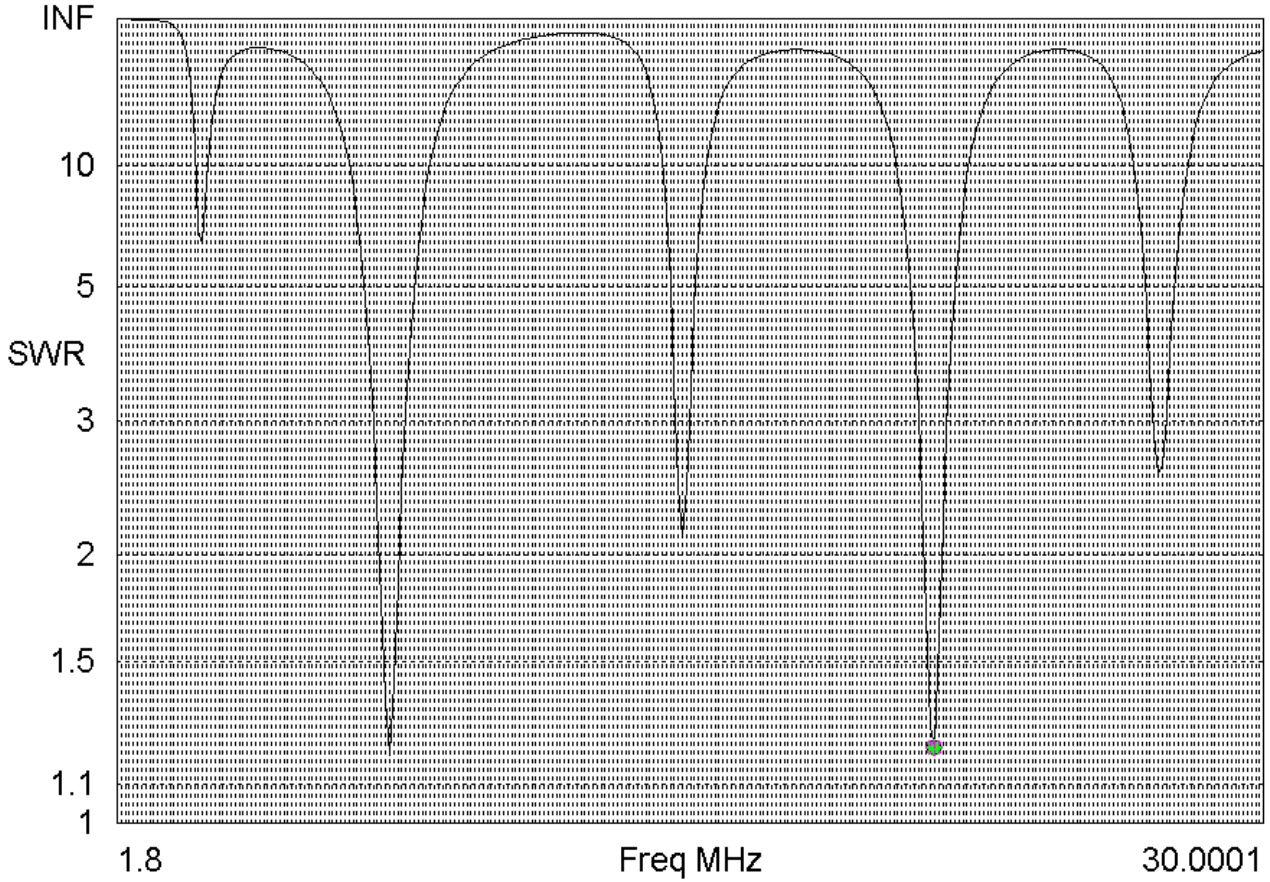


Azimuth Plot		Cursor Az	62.0 deg.
Elevation Angle	8.0 deg.	Gain	11.87 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	11.87 dBi
Slice Max Gain	11.87 dBi @ Az Angle = 62.0 deg.
Front/Side	5.13 dB
Beamwidth	18.7 deg.; -3dB @ 53.7, 72.4 deg.
Sidelobe Gain	11.87 dBi @ Az Angle = 242.0 deg.
Front/Sidelobe	0.0 dB

K9EQ Flat Top EZNEC Analysis

SWR Plot



Freq 21.9001 MHz
 SWR 1.21
 Z 43.59 + j 6.052 ohms
 Refl Coeff 0.09401 at 132.95 deg.

Source # 1
 Z0 50 ohms

Maximum Impedance: 6,000 ohms at 13 MHz

Minimum Impedance: 15 ohms at 3.8 MHz

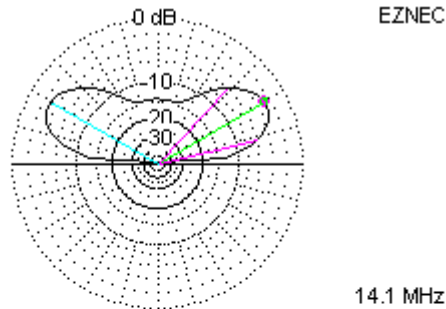
50 ohm minimum SWR at:

- 3.8
- 8.5
- 15.7
- 21.9
- 27.5

But I don't care, I'm using an AH-4!

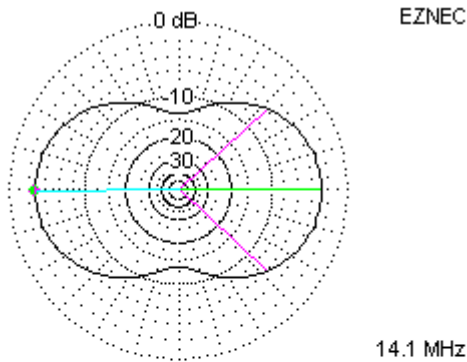
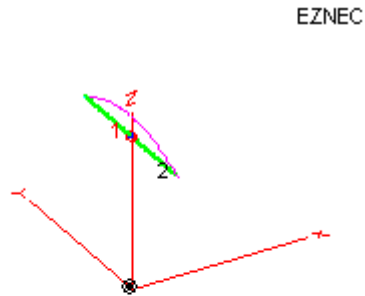
Reference Designs

Dipole



Elevation Plot		Cursor Elev	30.0 deg.
Azimuth Angle	0.0 deg.	Gain	7.2 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	7.2 dBi
Slice Max Gain	7.2 dBi @ Elev Angle = 30.0 deg.
Beamwidth	33.2 deg.; -3dB @ 13.2, 46.4 deg.
Sidelobe Gain	7.2 dBi @ Elev Angle = 150.0 deg.
Front/Sidelobe	0.0 dB

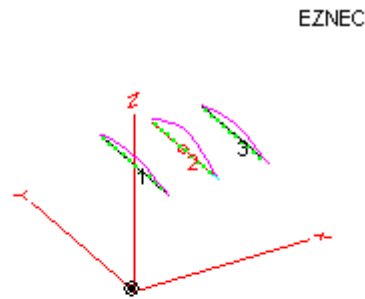
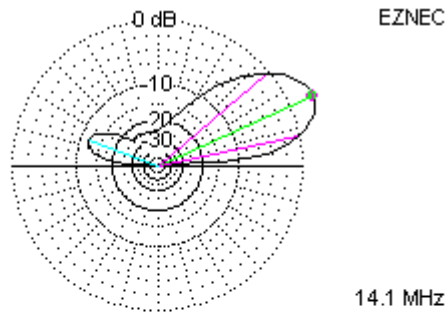


Azimuth Plot		Cursor Az	180.0 deg.
Elevation Angle	30.0 deg.	Gain	7.2 dBi
Outer Ring	10.0dBi		-0.05 dBmax

3D Max Gain	7.26 dBi
Slice Max Gain	7.2 dBi @ Az Angle = 0.0 deg.
Front/Side	10.67 dB
Beamwidth	84.6 deg.; -3dB @ 317.7, 42.3 deg.
Sidelobe Gain	7.2 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	0.0 dB

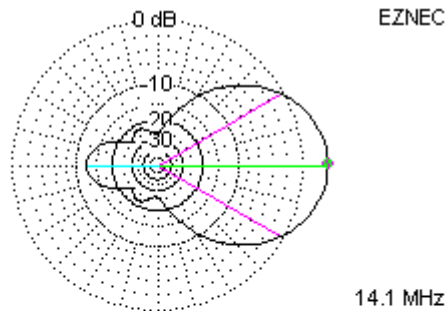
K9EQ Flat Top EZNEC Analysis

3 Element Monobander Beam



Elevation Plot		Cursor Elev	24.0 deg.
Azimuth Angle	0.0 deg.	Gain	12.76 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	12.76 dBi
Slice Max Gain	12.76 dBi @ Elev Angle = 24.0 deg.
Beamwidth	28.4 deg.; -3dB @ 11.4, 39.8 deg.
Sidelobe Gain	-1.75 dBi @ Elev Angle = 160.0 deg.
Front/Sidelobe	14.5 dB



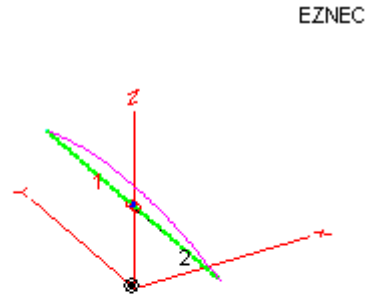
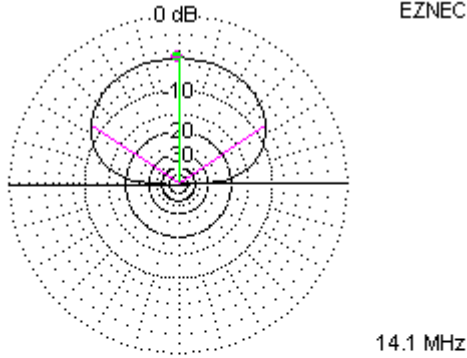
Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	24.0 deg.	Gain	12.76 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	12.76 dBi
Slice Max Gain	12.76 dBi @ Az Angle = 0.0 deg.
Front/Back	15.01 dB
Beamwidth	59.8 deg.; -3dB @ 330.1, 29.9 deg.
Sidelobe Gain	-2.25 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	15.01 dB

Elmer Fudd Reference Designs

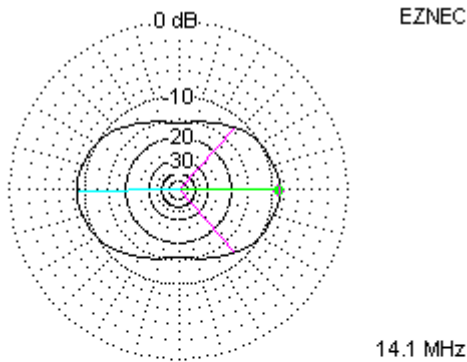
Dipole Too Low

Dipole is 10 feet off the ground – 30 degree elevation



Elevation Plot		Cursor Elev	90.0 deg.
Azimuth Angle	0.0 deg.	Gain	5.04 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	5.04 dBi
Slice Max Gain	5.04 dBi @ Elev Angle = 90.0 deg.
Beamwidth	111.4 deg.; -3dB @ 34.3, 145.7 deg.
Sidelobe Gain	< -100 dBi
Front/Sidelobe	> 100 dB



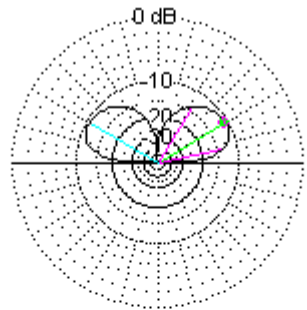
Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	30.0 deg.	Gain	1.28 dBi
Outer Ring	10.0dBi		-3.76 dBmax

3D Max Gain	5.04 dBi
Slice Max Gain	1.28 dBi @ Az Angle = 0.0 deg.
Front/Side	6.97 dB
Beamwidth	94.0 deg.; -3dB @ 313.0, 47.0 deg.
Sidelobe Gain	1.28 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	0.0 dB

K9EQ Flat Top EZNEC Analysis

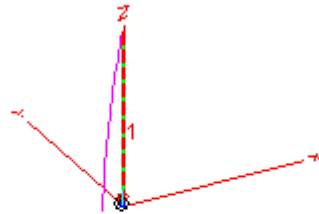
Vertical with poor ground

(but 1.5:1 SWR!)



EZNEC

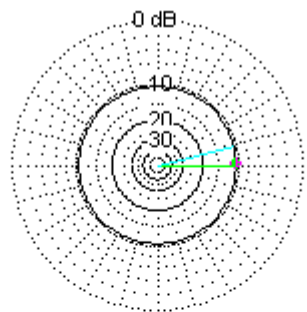
EZNEC



7 MHz

Elevation Plot		Cursor Elev	30.0 deg.
Azimuth Angle	0.0 deg.	Gain	-0.54 dBi
Outer Ring	10.0dBi		0.0 dBmax

3D Max Gain	-0.54 dBi
Slice Max Gain	-0.54 dBi @ Elev Angle = 30.0 deg.
Beamwidth	46.8 deg.; -3dB @ 10.7, 57.5 deg.
Sidelobe Gain	-0.54 dBi @ Elev Angle = 150.0 deg.
Front/Sidelobe	0.0 dB



EZNEC

7 MHz

Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	28.0 deg.	Gain	-0.56 dBi
Outer Ring	10.0dBi		-0.02 dBmax

3D Max Gain	-0.54 dBi
Slice Max Gain	-0.56 dBi @ Az Angle = 0.0 deg.
Front/Side	0.0 dB
Beamwidth	?
Sidelobe Gain	-0.56 dBi @ Az Angle = 14.0 deg.
Front/Sidelobe	0.0 dB

With a good ground, it only gets better by about 2 dB