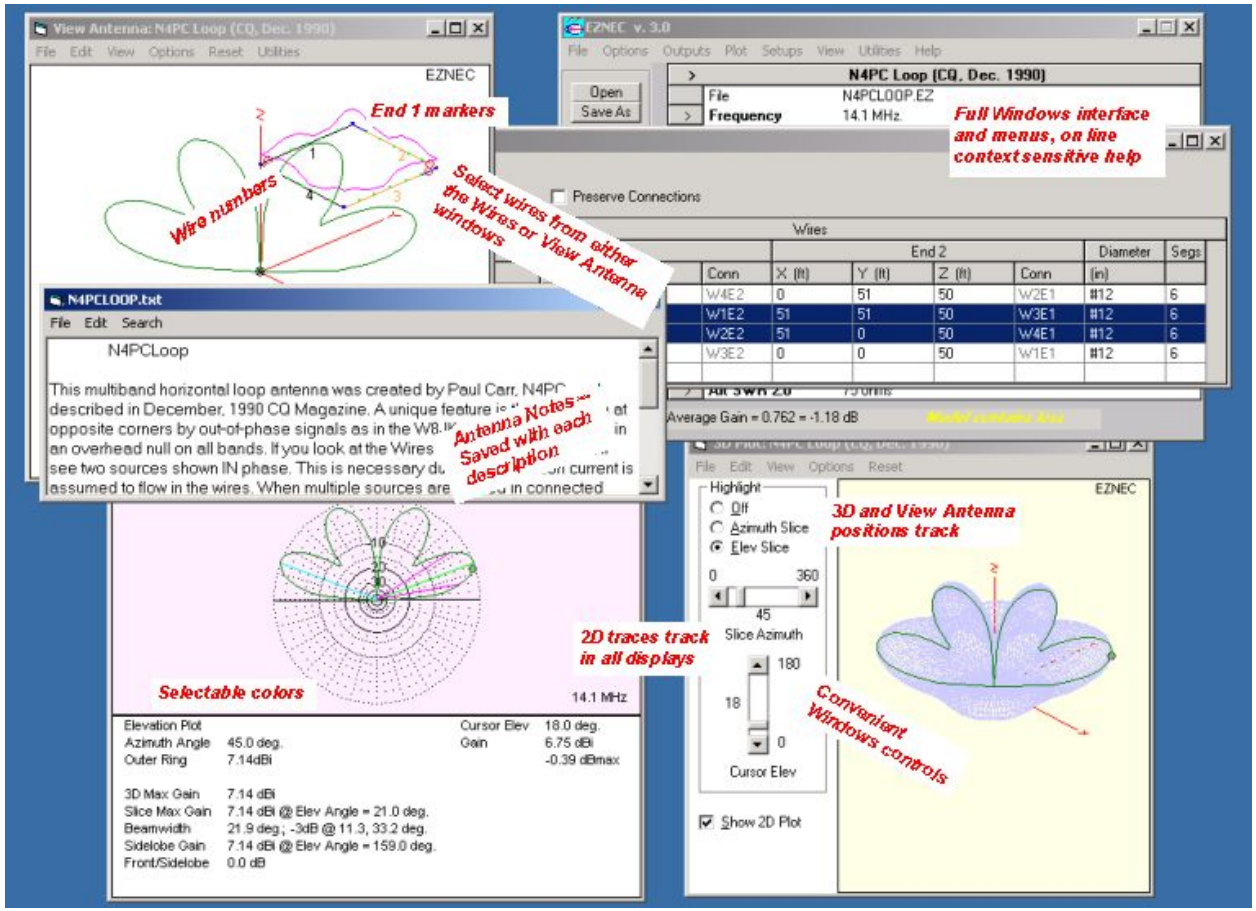
EZNEC Antenna Modeling

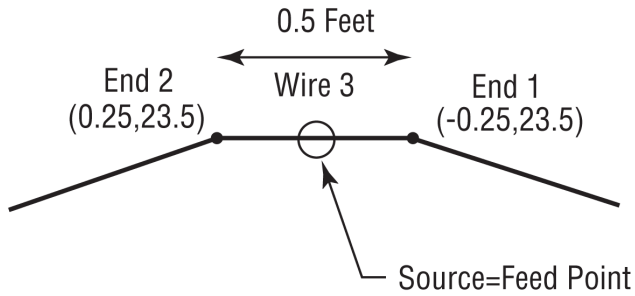


EZNEC Antenna Modeling

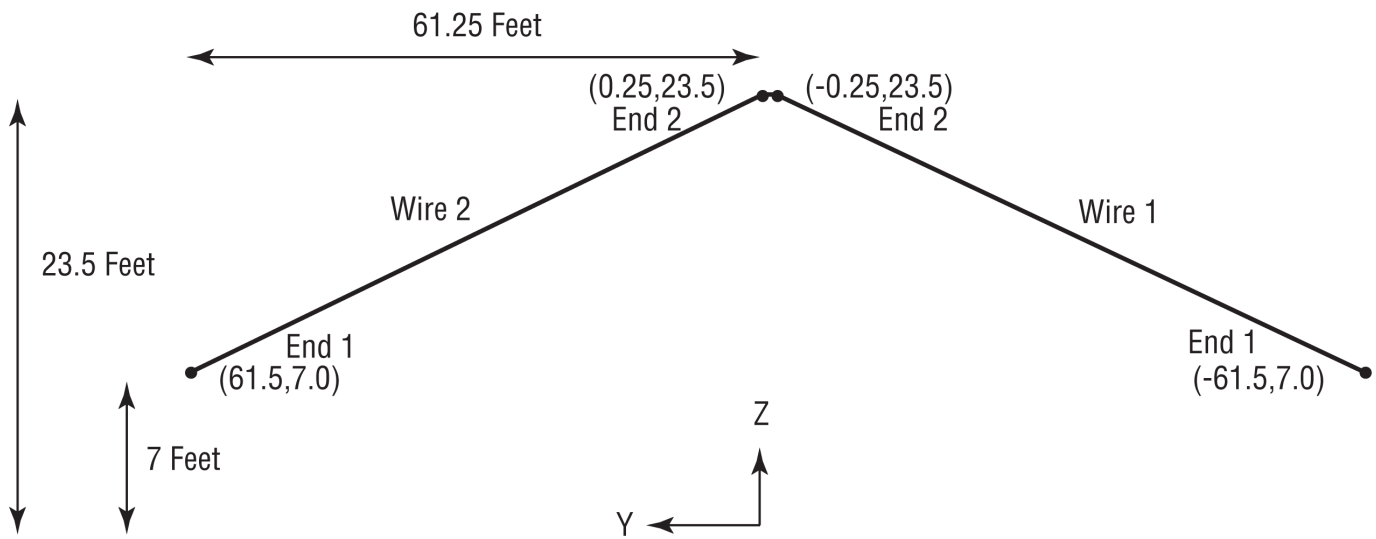
- Models and analyzes nearly any kind of antenna.
- Includes a model of the ground.
- Plots elevation and azimuth patterns.
- Shows feed point impedance, SWR, and current distributions.
- Describe antenna as a group of straight conductors.
- Add sources at the feed points and loads to simulate coils and traps.

EZNEC Antenna Modeling

- We're going to start by modeling an 80-meter inverted vee.
- Then we'll add two traps (called "Loads") to create a 40-meter resonance.
- Next we'll add two more "fan dipoles" for 17-meters and 12-meters.



Detail near Feed Point



80-Meter Inverted Vee

EZNEC Wire Table

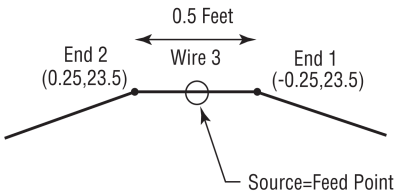
Wires

Wire Create Edit Other

☐ Coord Entry Mode ☐ Preserve Connections ☑ Show Wire Insulation

Wires

No.	End 1				End 2				Diameter	Segs	Insulation	
	X (ft)	Y (ft)	Z (ft)	Conn	X (ft)	Y (ft)	Z (ft)	Conn	(in)		Diel C	Thk (in)
1	0	-61.5	7		0	-0.25	23.5	W3E1	#14	101	1	0
2	0	61.5	7		0	0.25	23.5	W3E2	#14	101	1	0
3	0	-0.25	23.5	W1E2	0	0.25	23.5	W2E2	#14	1	1	0
*												

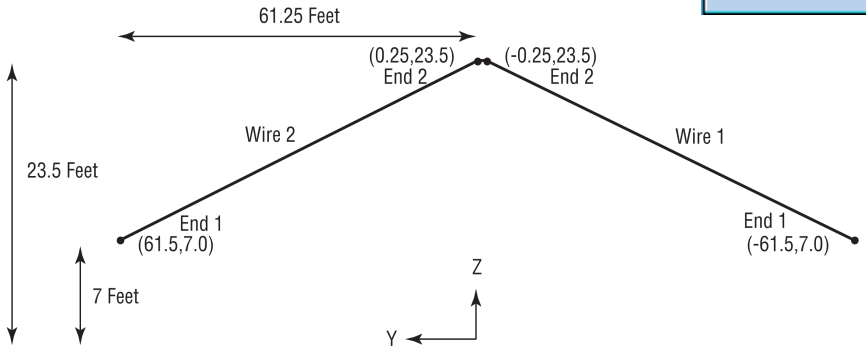


Sources

Source Edit

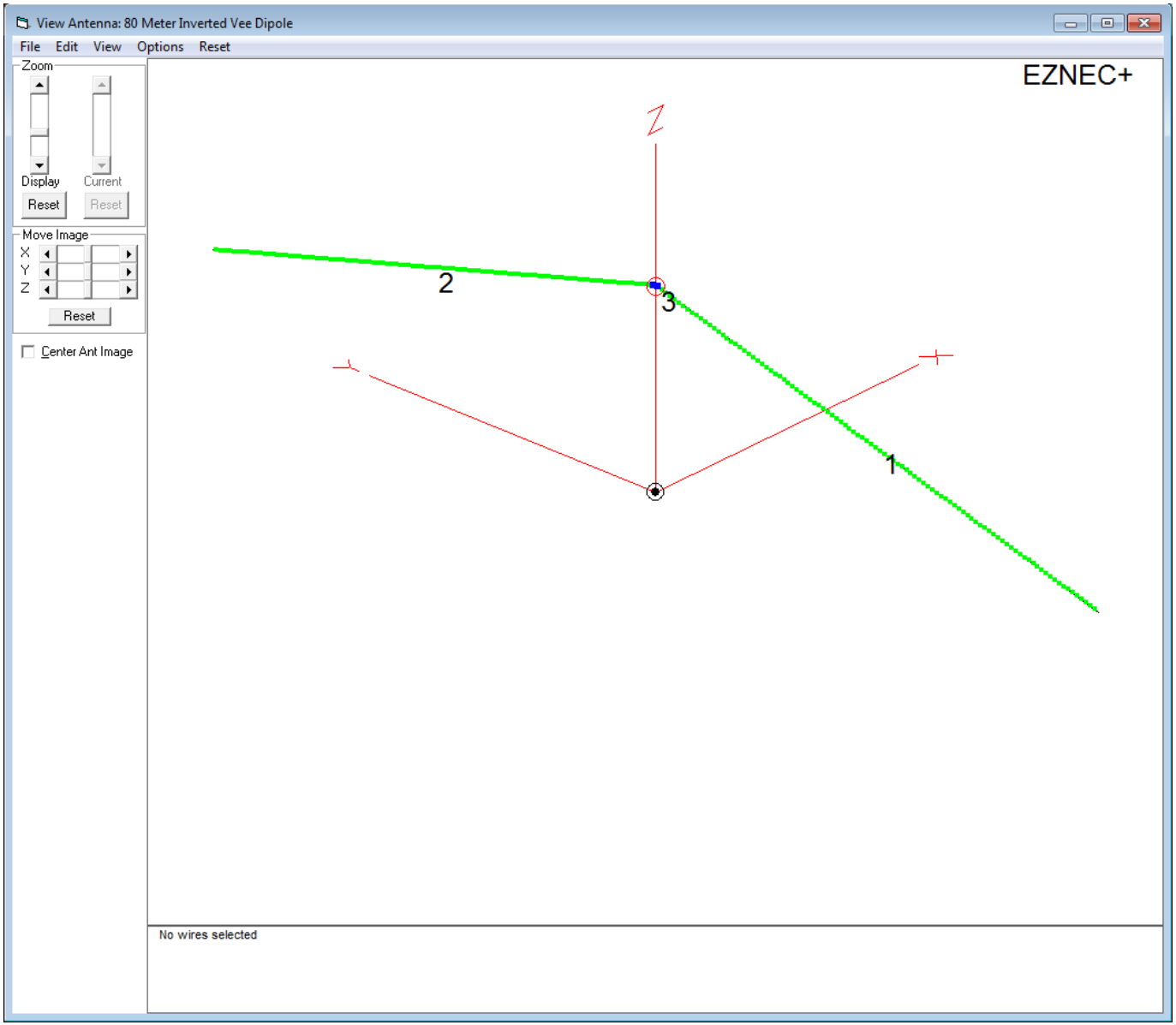
Sources

No.	Specified Pos.		Actual Pos.		Amplitude	Phase	Type
	Wire #	% From E1	% From E1	Seg	(V, A)	(deg.)	
1	3	50	50	1	1	0	V
*							



80-Meter Inverted Vee

EZNEC Wire Picture



EZNEC Description

Antenna Description

File Edit Search

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                    EZNEC+ ver. 5.0

80 Meter Inverted Vee Dipole                3/4/2012     12:15:57 PM

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

Frequency = 3.7 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        Insulation
      Conn.      X       Y       Z     Conn.      X       Y       Z                          Diel C  Thk(in)
1                  0,  -61.5,      7    W3E1        0,  -0.25,   23.5       #14   101         1       0
2                  0,   61.5,      7    W3E2        0,   0.25,   23.5       #14   101         1       0
3      W1E2        0,  -0.25,   23.5    W2E2        0,   0.25,   23.5       #14   1           1       0

Total Segments: 203

              -------------- SOURCES --------------

No.      Specified Pos.     Actual Pos.      Amplitude    Phase    Type
       Wire #  % From E1  % From E1  Seg       (V/A)     (deg.)
1       3        50.00      50.00    1          1          0        V

No loads specified

No transmission lines specified

No transformers specified

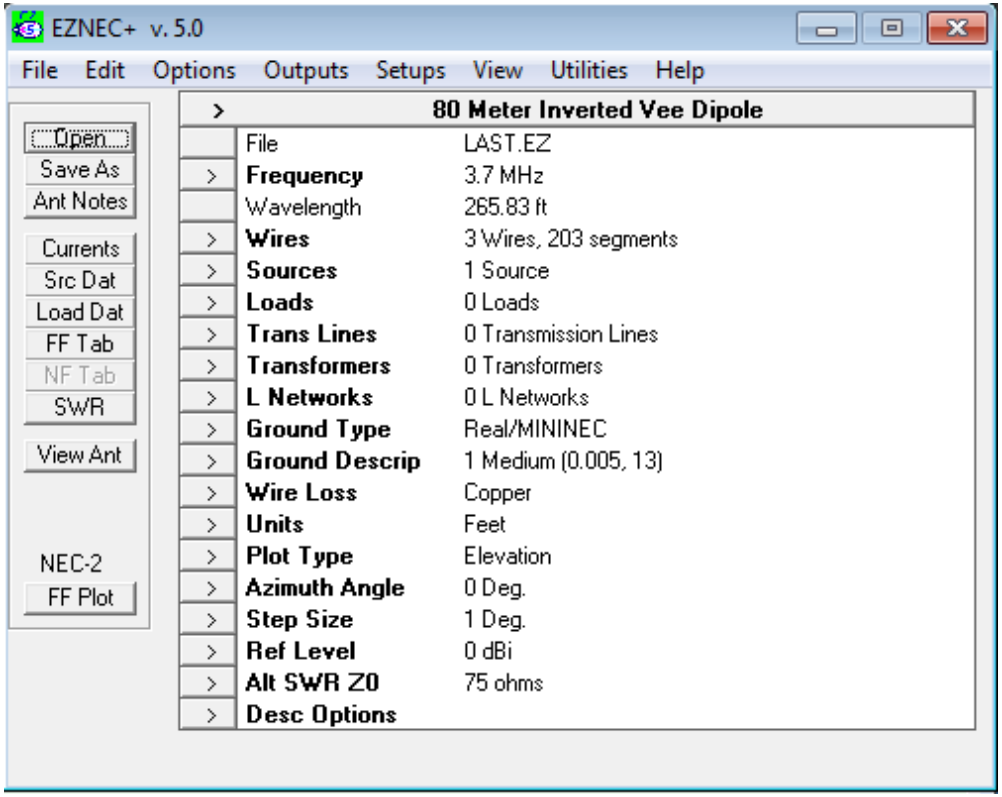
No L Networks specified

Ground type is Real, MININEC-Type

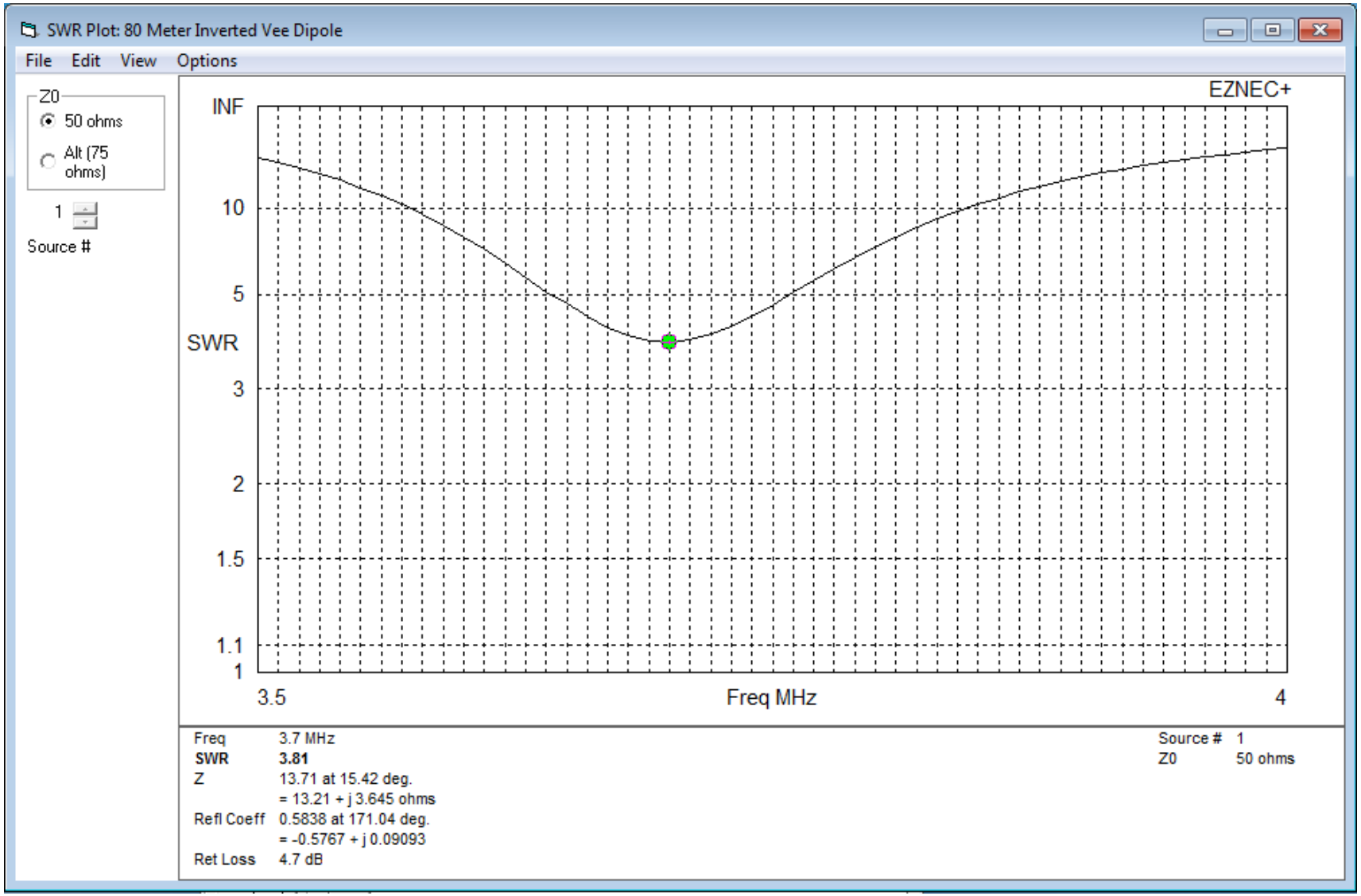
              --------------- MEDIA ---------------

No.    Cond.    Diel. Const.  Height    R Coord.
       (S/m)                  (ft)      (ft)
1      0.005     13           0         0
```

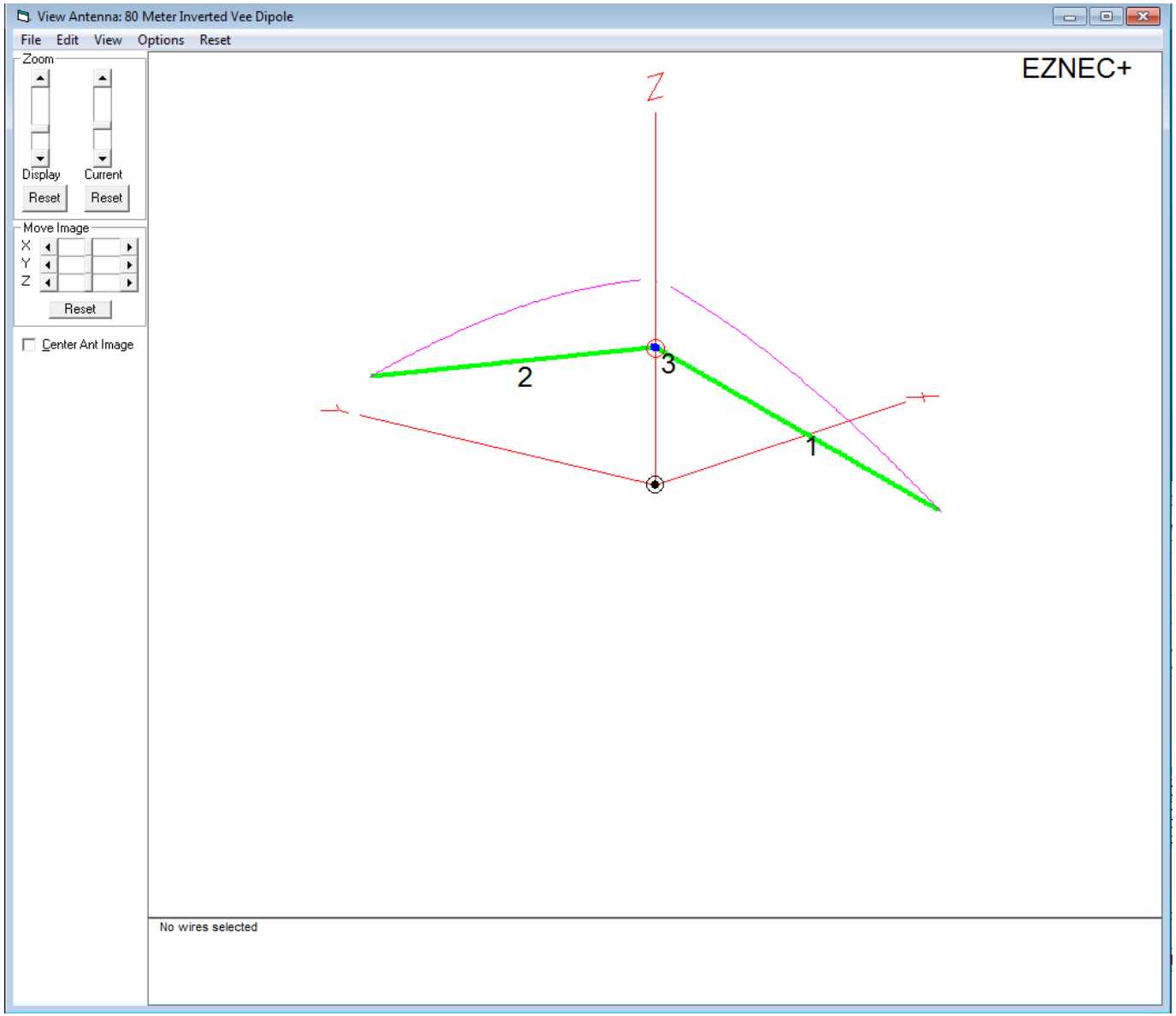
EZNEC Antenna Modeling



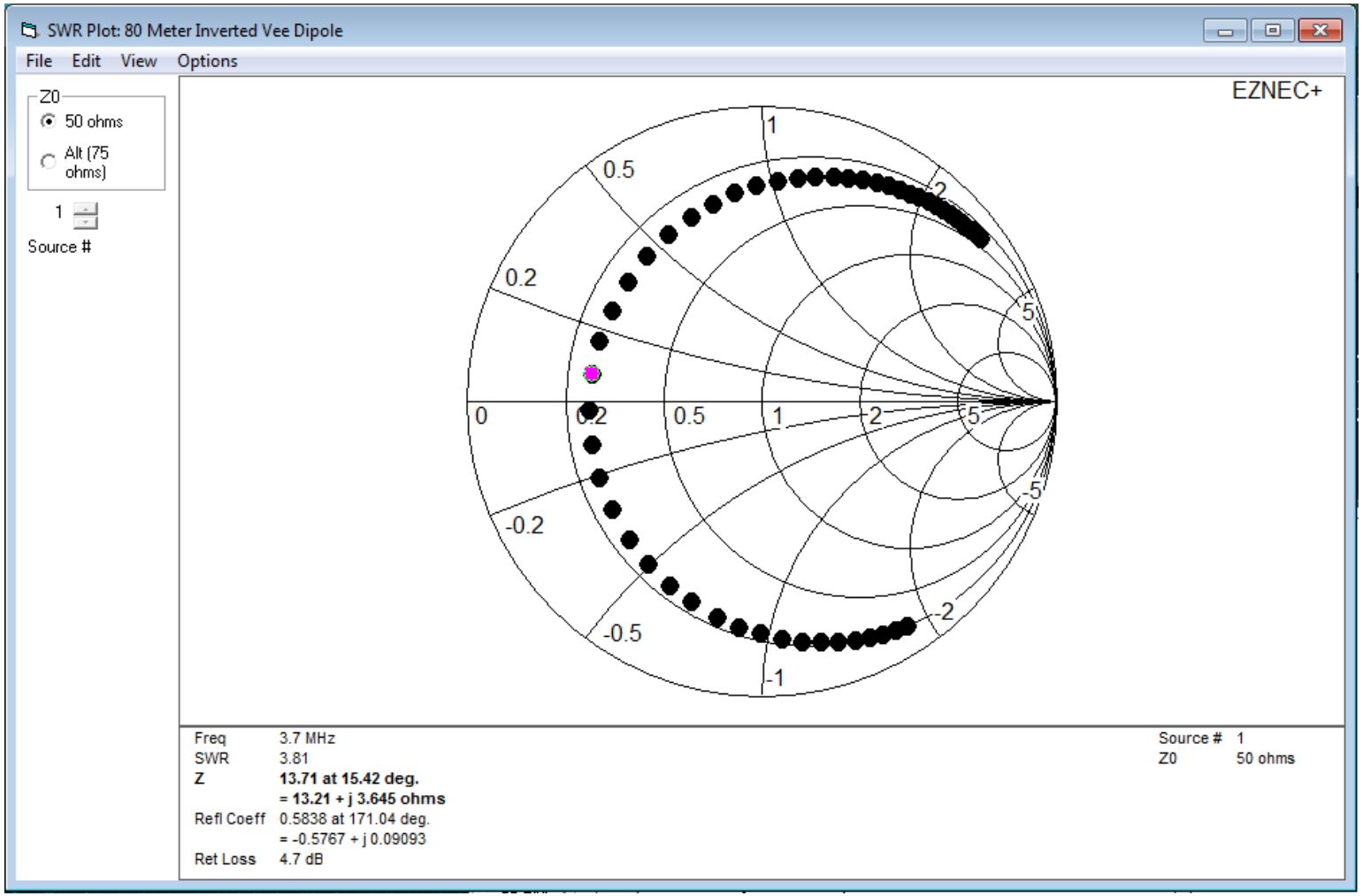
80-Meter SWR Plot



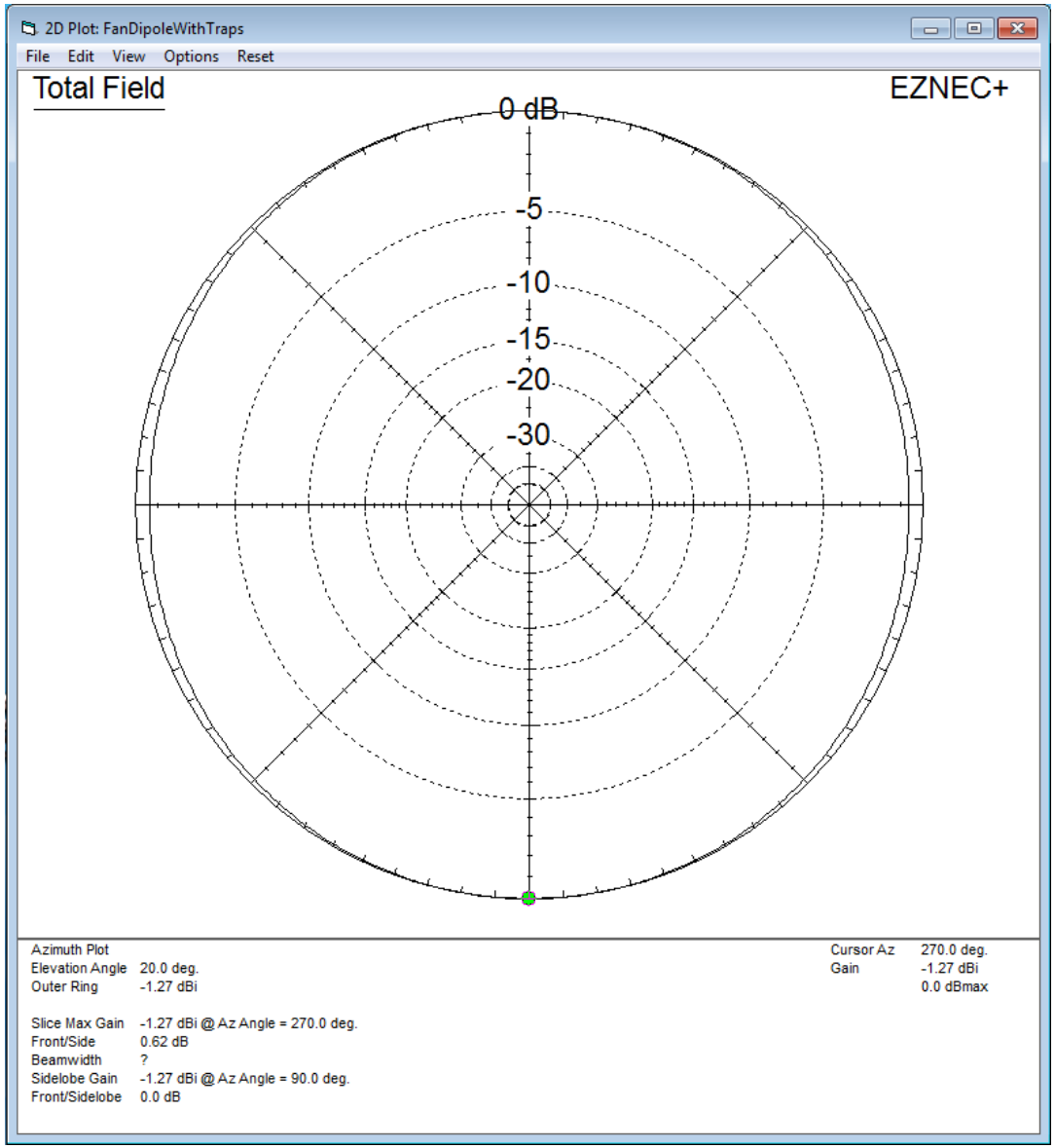
80-Meter Current Plot



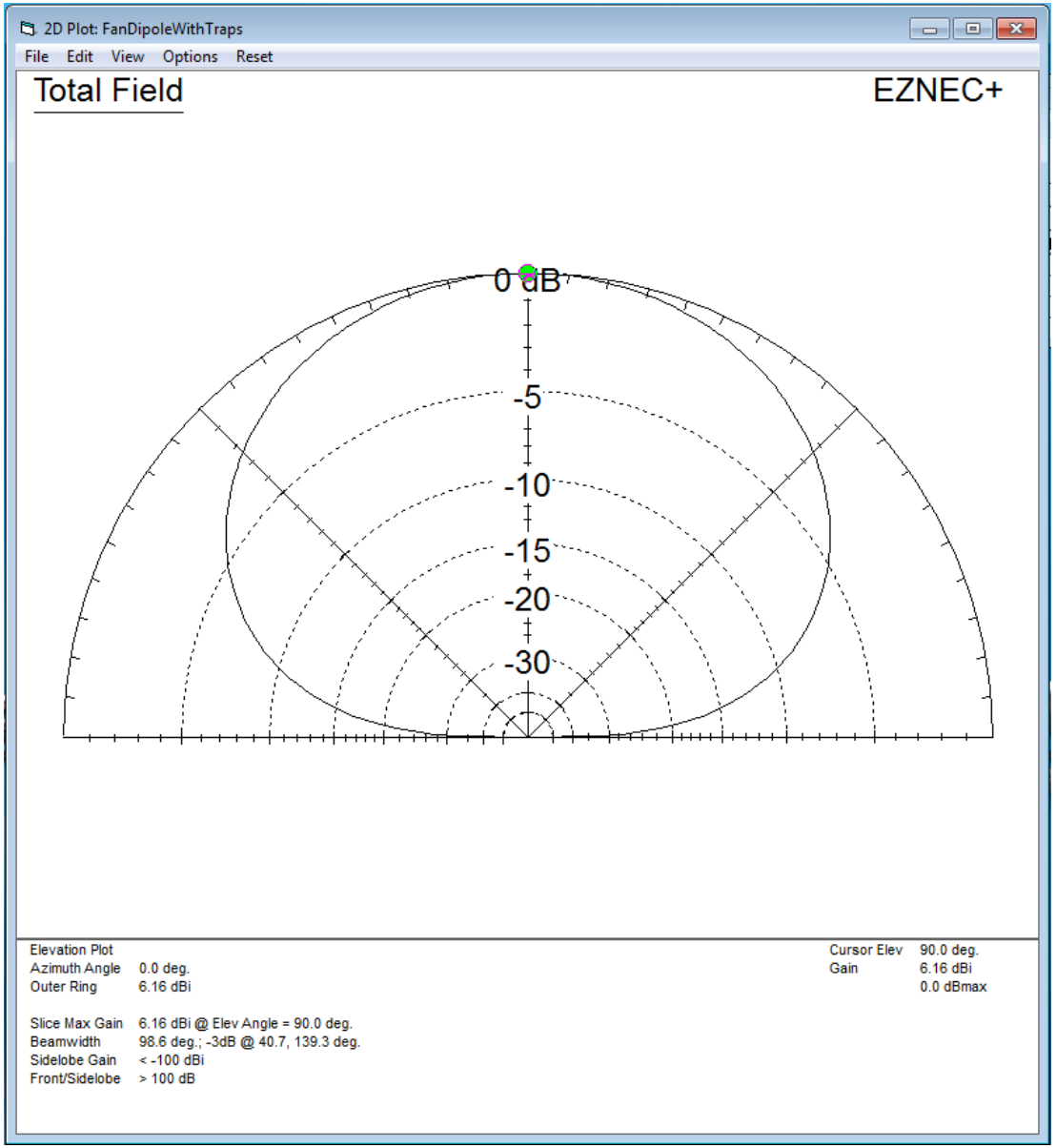
80-Meter Smith Chart Plot



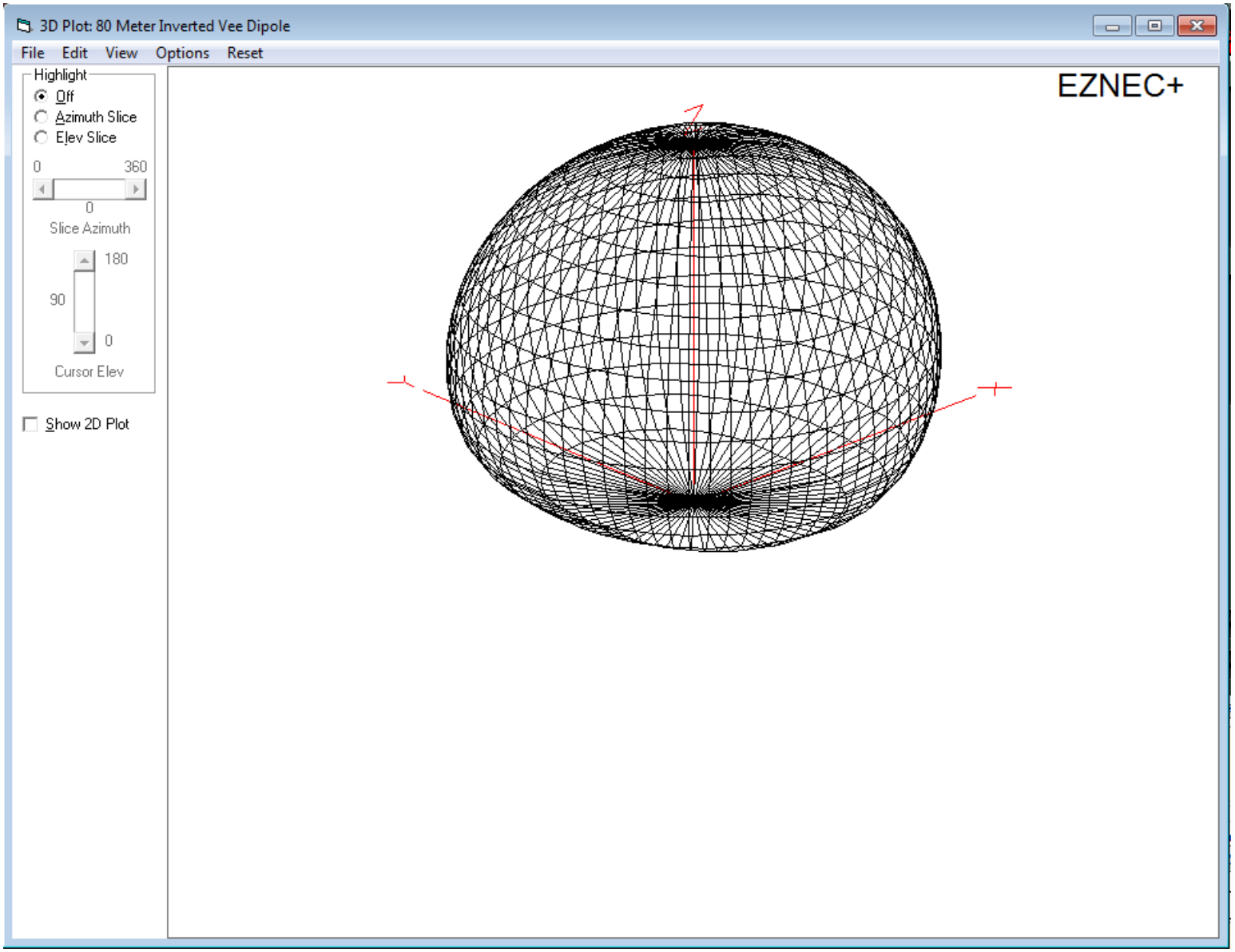
80-Meter Azimuth Plot



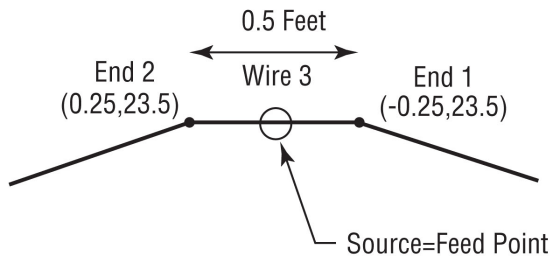
80-Meter Elevation Plot

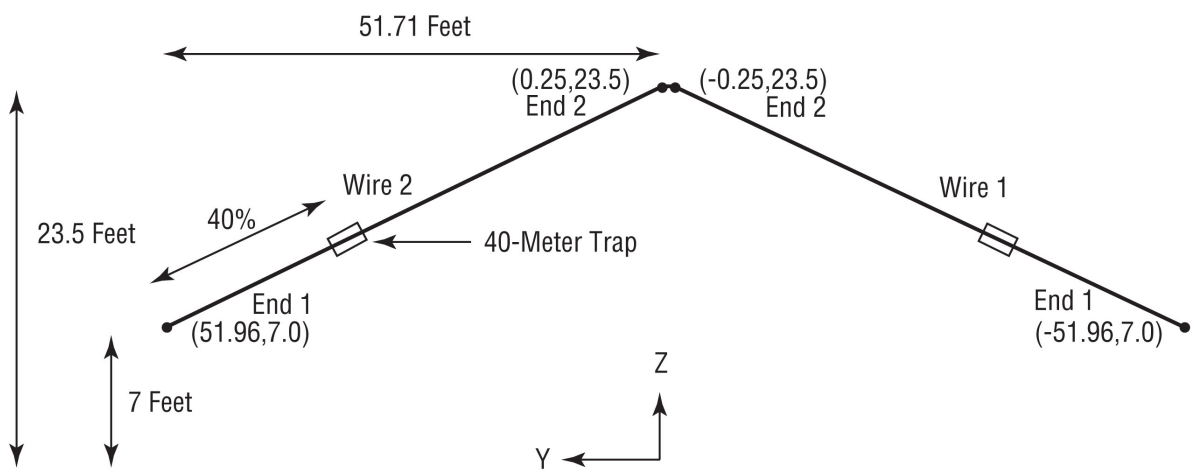


80-Meter 3D Plot



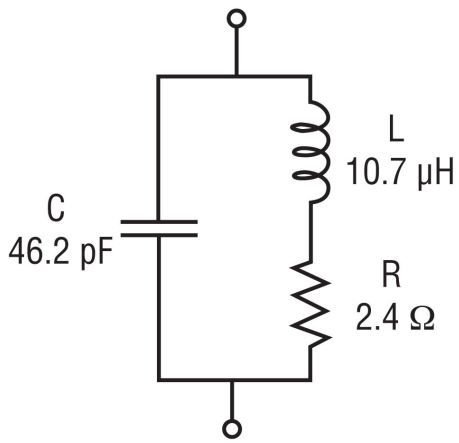
Add the 40-Meter Trap





80-40 Meter Trap Inverted Vee

Model of the 40-Meter Trap



$$f = \frac{1}{2\pi\sqrt{LC}}$$

$= 7.16$ MHz

$$Q = \frac{2\pi f L}{R}$$

≈ 200

Laplace Transform of the circuit impedance $s = j\omega = j2\pi f$

$$Z = \frac{(R + Ls)(1/Cs)}{R + Ls + 1/Cs} = \frac{R + Ls}{1 + RCs + LCs^2}$$

$$Z = \frac{2.4 + 1.07 \times 10^{-5} s}{1 + 1.11 \times 10^{-10} s + 4.93 \times 10^{-16} s^2}$$

Model for the 40-Meter Trap

Changes for the 40-Meter Trap

Wires

Wire Create Edit Other

☐ Coord Entry Mode ☐ Preserve Connections ☑ Show Wire Insulation

Wires

No.	End 1				End 2				Diameter	Segs	Insulation	
	X (ft)	Y (ft)	Z (ft)	Conn	X (ft)	Y (ft)	Z (ft)	Conn	(in)		Diel C	Thk (in)
1	0	-51.96	7		0	-0.25	23.5	W3E1	#14	101	1	0
2	0	51.96	7		0	0.25	23.5	W3E2	#14	101	1	0
3	0	-0.25	23.5	W1E2	0	0.25	23.5	W2E2	#14	1	1	0
*												

Loads (Laplace)

Load Edit Other

Loads

No.	Specified Wire #	Act Pos Seg	0 Num	1 Num	2 Num	3 Num	4 Num	5 Num	Ext Conn
	% From E1	% From E1	0 Den	1 Den	2 Den	3 Den	4 Den	5 Den	
1	1	41	2.4	0.0000107	0	0	0	0	Ser
	40	40.099	1	1.1088E-10	4.93E-16	0	0	0	
2	2	41	2.4	0.0000107	0	0	0	0	Ser
	40	40.099	1	1.1088E-10	4.93E-16	0	0	0	
*									

$$Z = \frac{2.4 + 1.07 \times 10^{-5} s}{1 + 1.11 \times 10^{-10} s + 4.93 \times 10^{-16} s^2}$$

80/40-Meter Dipole Description

Antenna Description

File Edit Search

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                    EZNEC+ ver. 5.0

80/40 Meter Trap Dipole                    3/4/2012     11:55:12 AM

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

Frequency = 7.16 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        Insulation
      Conn.      X       Y       Z     Conn.      X       Y       Z                          Diel C  Thk(in)
1                 0, -51.96,      7    W3E1        0,  -0.25,   23.5       #14   101         1       0
2                 0,  51.96,      7    W3E2        0,   0.25,   23.5       #14   101         1       0
3      W1E2       0,  -0.25,   23.5    W2E2        0,   0.25,   23.5       #14   1           1       0

Total Segments: 203

              -------------- SOURCES --------------

No.      Specified Pos.     Actual Pos.      Amplitude    Phase    Type
       Wire #  % From E1  % From E1  Seg       (V/A)     (deg.)
1       3        50.00      50.00    1          1          0        V

          -------------- LOADS (Laplace Type) --------------

      Specified  Act Pos
No.    Wire #     Seg        0 Num     1 Num     2 Num     3 Num     4 Num     5 Num
     % From E1  % From E1    0 Den     1 Den     2 Den     3 Den     4 Den     5 Den
1     1           41         2.4       1.070E-5  0         0         0         0
       40.00      40.10      1         1.11E-10  4.93E-16  0         0         0
2     2           41         2.4       1.070E-5  0         0         0         0
       40.00      40.10      1         1.11E-10  4.93E-16  0         0         0

No transmission lines specified

No transformers specified

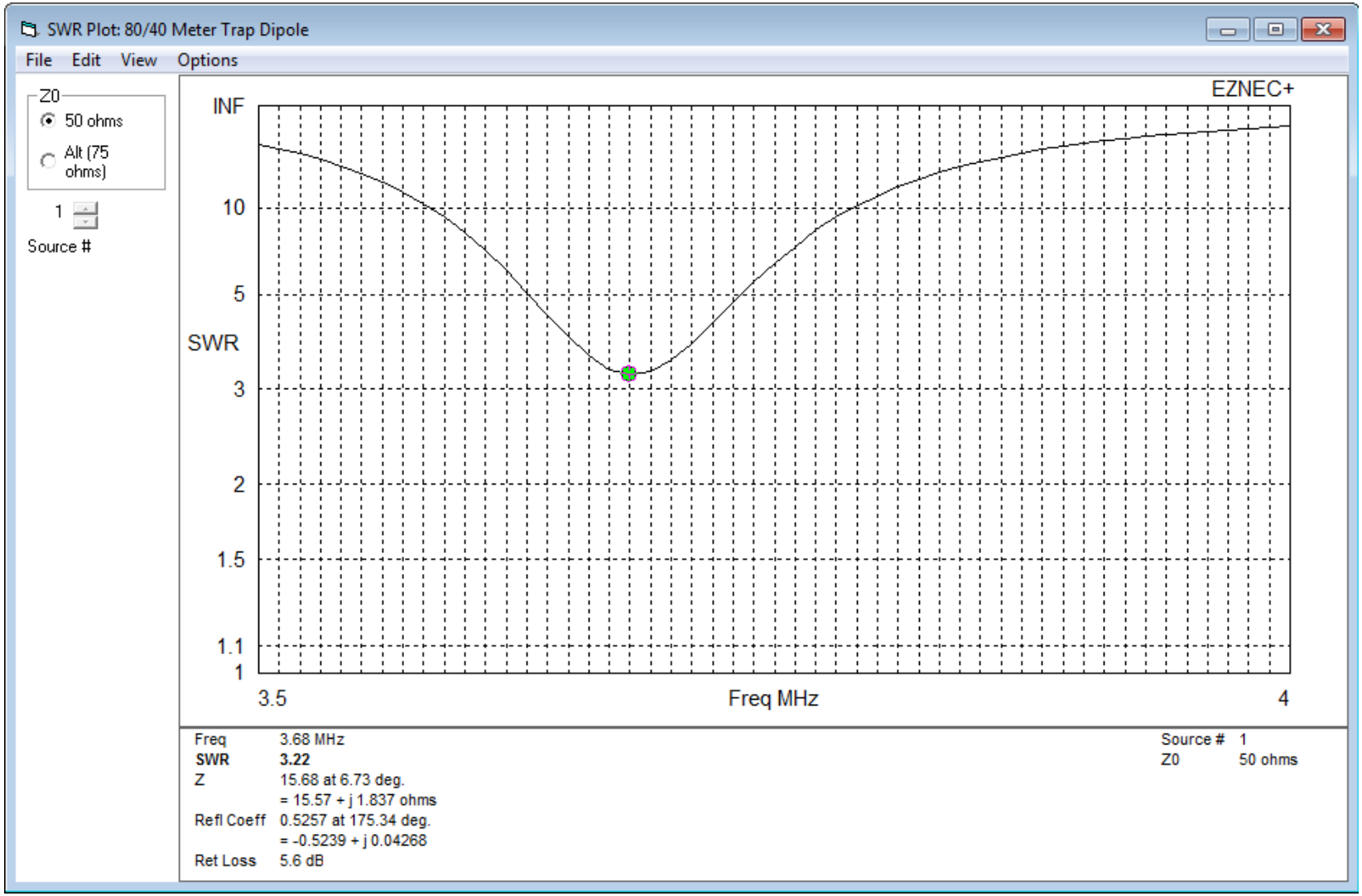
No L Networks specified

Ground type is Real, MININEC-Type

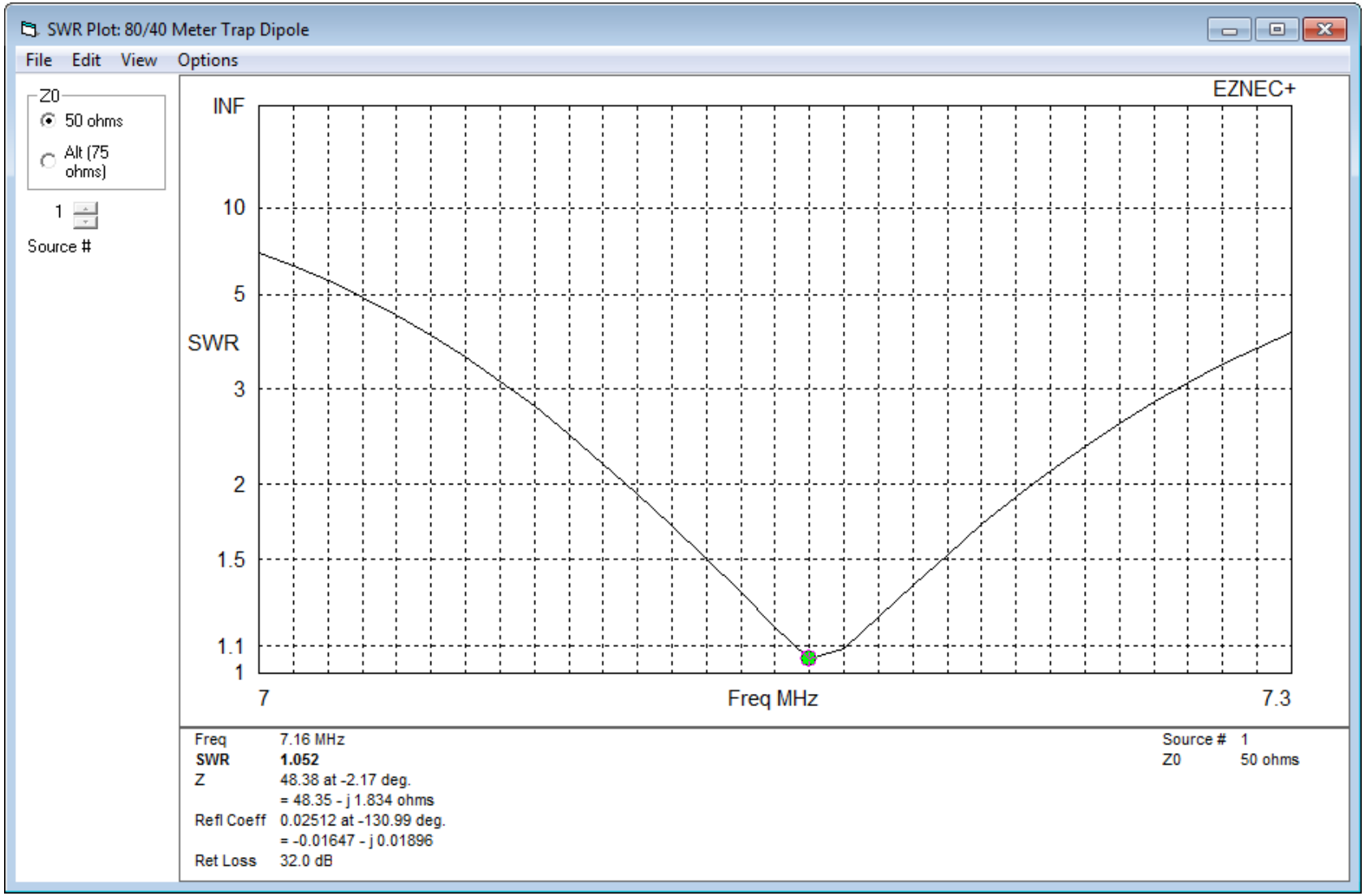
              --------------- MEDIA ---------------

No.    Cond.    Diel. Const.  Height    R Coord.
       (S/m)                  (ft)      (ft)
1      0.005     13           0         0
```

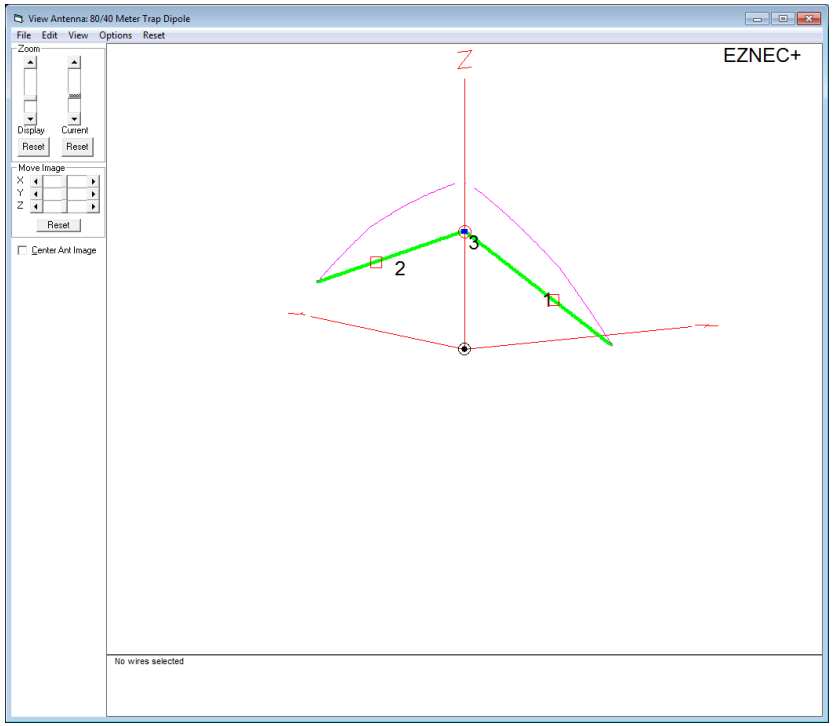
80-Meter SWR


SWR Plot: 80/40 Meter Trap Dipole
File Edit View Options
Z0
50 ohms
Alt (75 ohms)
1
Source #
EZNEC+
INF
10
5
SWR
3
2
1.5
1.1
1
3.5
Freq MHz
4
Freq 3.68 MHz
SWR 3.22
Z 15.68 at 6.73 deg.
= 15.57 + j 1.837 ohms
Refl Coeff 0.5257 at 175.34 deg.
= -0.5239 + j 0.04268
Ret Loss 5.6 dB
Source # 1
Z0 50 ohms

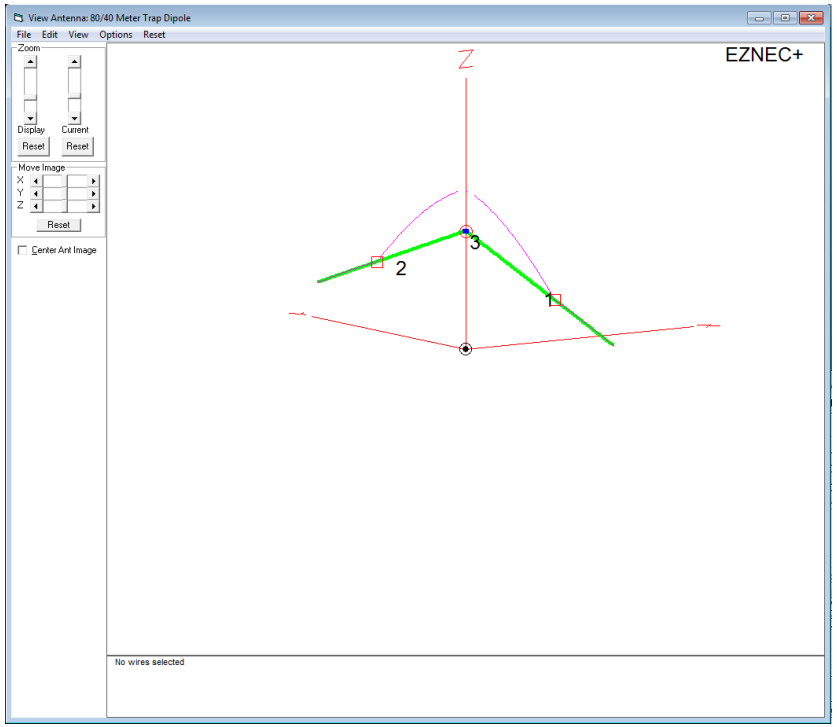
40-Meter SWR


SWR Plot: 80/40 Meter Trap Dipole
File
Edit
View
Options
Z0
50 ohms
Alt (75 ohms)
1
Source #
EZNEC+
INF
10
5
SWR
3
2
1.5
1.1
1
7
Freq MHz
7.3
Freq 7.16 MHz
SWR 1.052
Z 48.38 at -2.17 deg.
= 48.35 - j 1.834 ohms
Refl Coeff 0.02512 at -130.99 deg.
= -0.01647 - j 0.01896
Ret Loss 32.0 dB
Source # 1
Z0 50 ohms

Current Plots

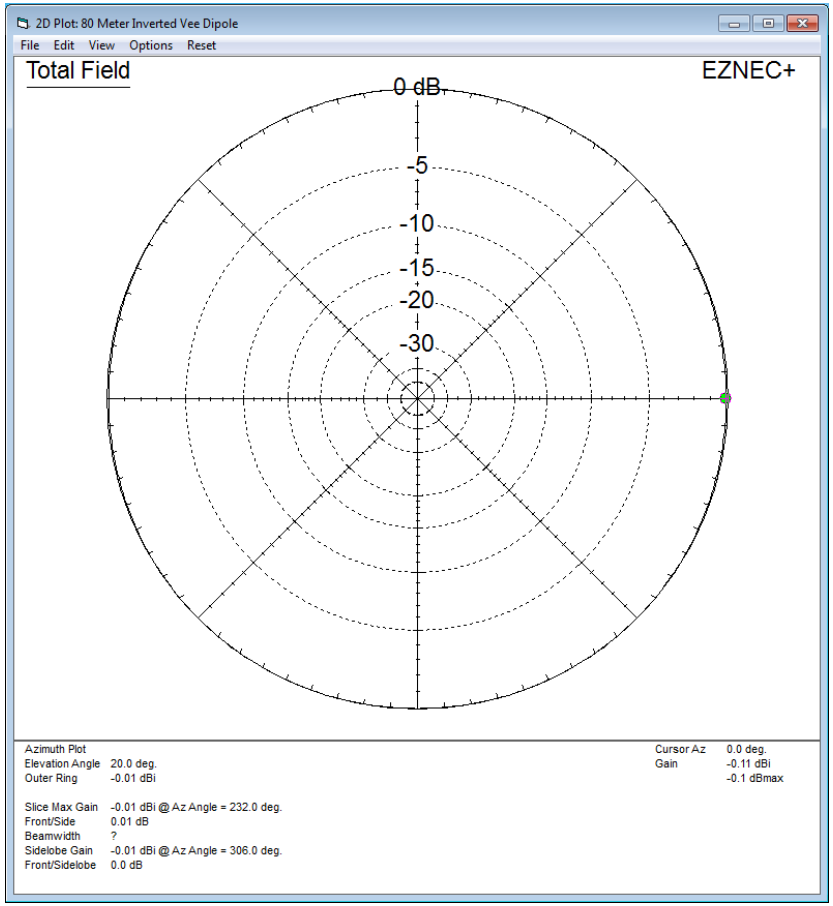


80-Meters

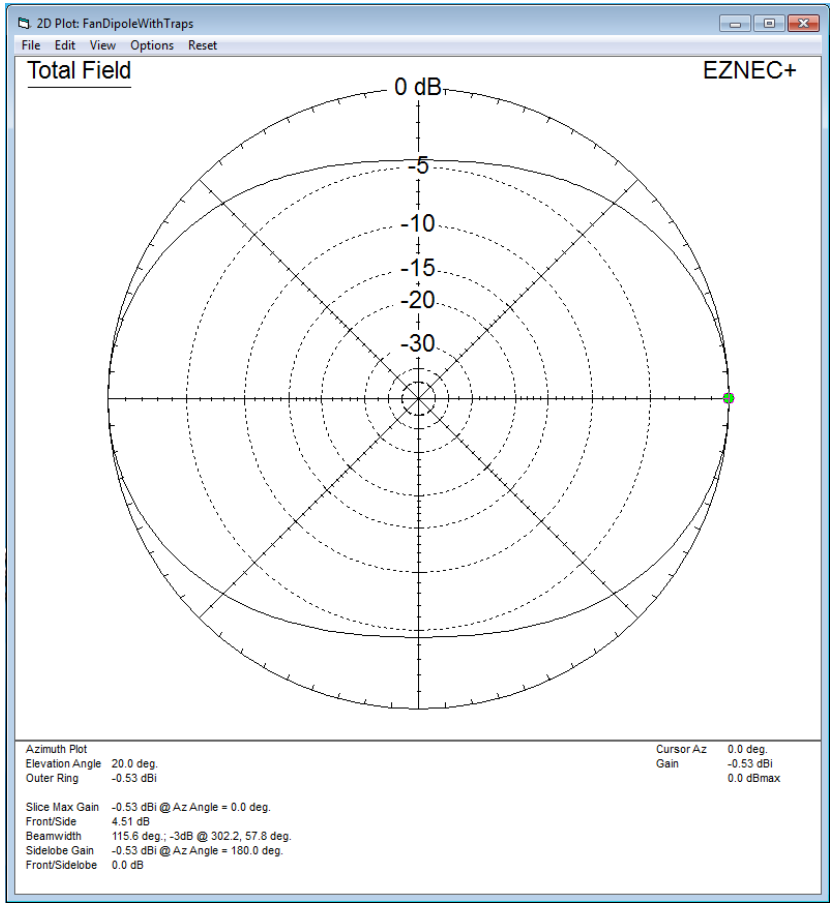


40-Meters

Azimuth Plots

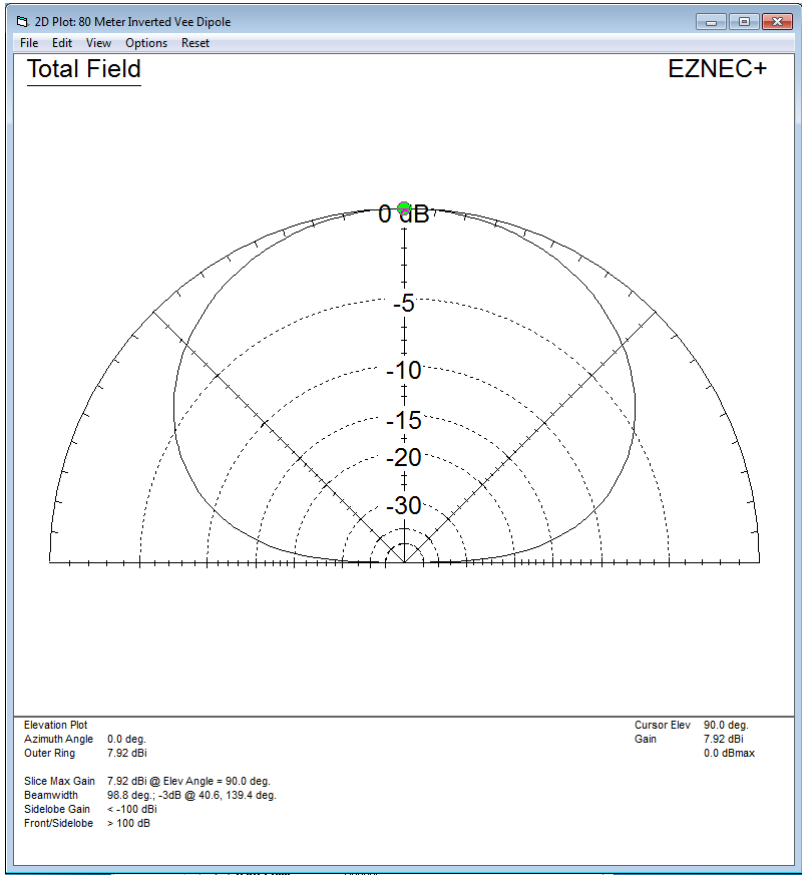


80-Meters

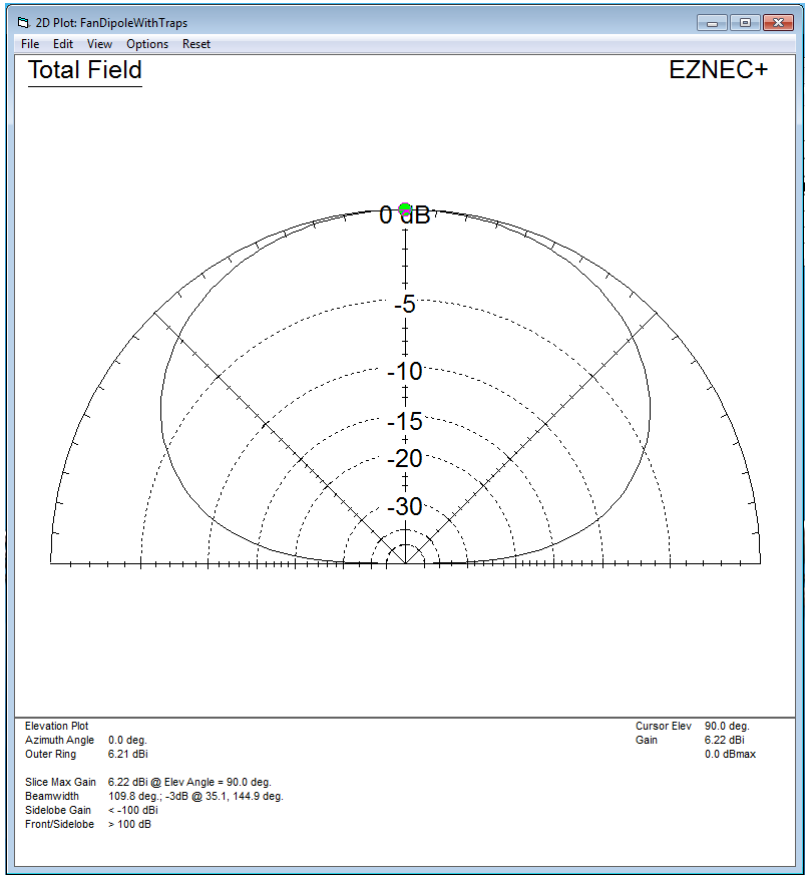


40-Meters

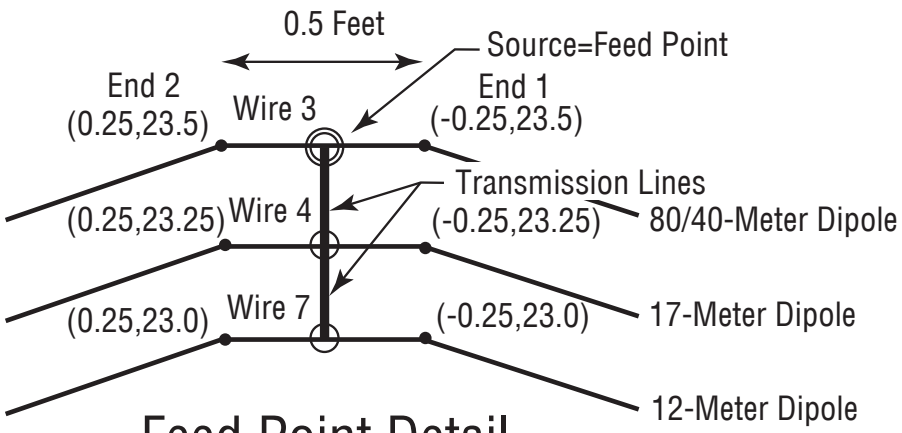
Elevation Plots



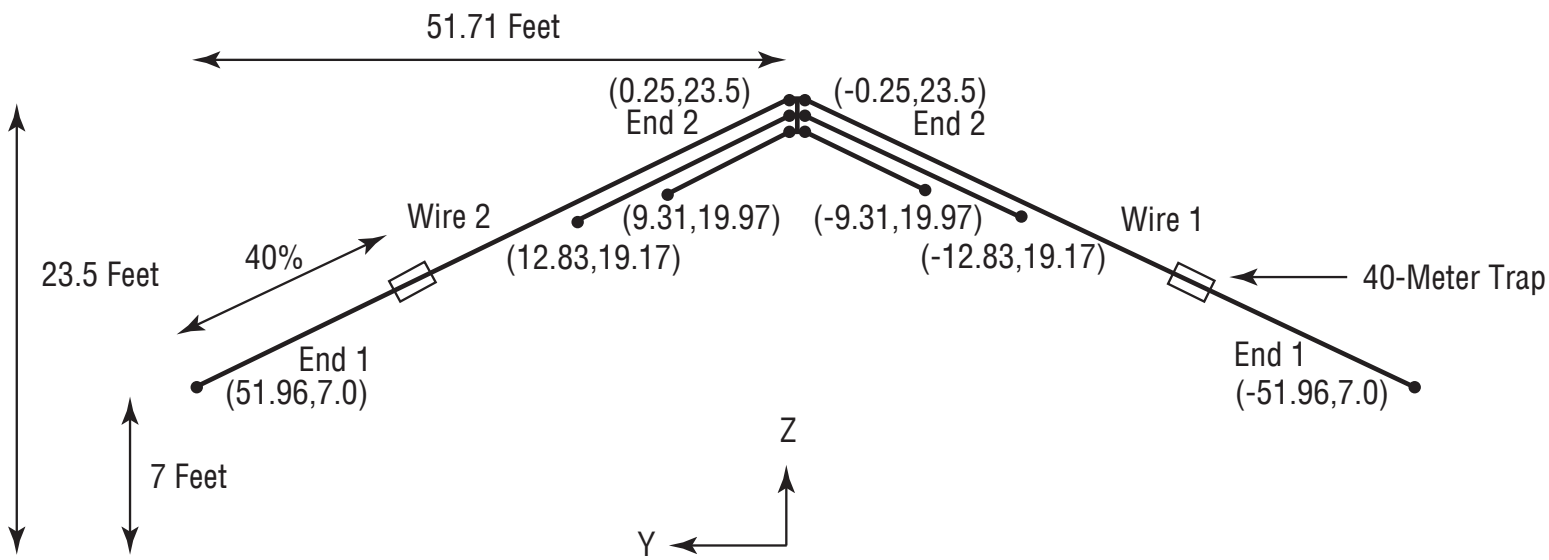
80-Meters



40-Meters



Feed Point Detail



4-Band Fan Inverted Vee

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                    EZNEC+ ver. 5.0

FanDipoleWithTraps                          4/23/2012     1:35:42 PM

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

Frequency = 18.1 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        Insulation
      Conn.      X       Y       Z     Conn.      X       Y       Z                          Diel C  Thk(in)
1                 0, -51.96,      7    W3E1        0,  -0.25,   23.5       #14   101         1        0
2                 0,  51.96,      7    W3E2        0,   0.25,   23.5       #14   101         1        0
3      W1E2       0,  -0.25,   23.5    W2E2        0,   0.25,   23.5       #14   1           1        0
4      W5E2       0,  -0.25,  23.25    W6E2        0,   0.25,  23.25       #14   1           1        0
5                 0, -12.83,  19.17    W4E1        0,  -0.25,  23.25       #14   33          1        0
6                 0,  12.83,  19.17    W4E2        0,   0.25,  23.25       #14   33          1        0
7      W8E2       0,  -0.25,     23    W9E2        0,   0.25,     23       #14   1           1        0
8                 0,  -9.31,  19.97    W7E1        0,  -0.25,     23       #14   33          1        0
9                 0,   9.31,  19.97    W7E2        0,   0.25,     23       #14   33          1        0

Total Segments: 337

              -------------- SOURCES --------------

No.      Specified Pos.     Actual Pos.      Amplitude    Phase    Type
       Wire #  % From E1  % From E1  Seg       (V/A)     (deg.)
1       3        50.00      50.00    1          1          0        V

         -------------- LOADS (Laplace Type) --------------

      Specified  Act Pos
No.    Wire #     Seg        0 Num     1 Num     2 Num     3 Num     4 Num     5 Num
     % From E1  % From E1    0 Den     1 Den     2 Den     3 Den     4 Den     5 Den
1     1          41         2.4       1.070E-5  0         0         0         0
       40.00      40.10      1         1.11E-10  4.93E-16  0         0         0
2     2          41         2.4       1.070E-5  0         0         0         0
       40.00      40.10      1         1.11E-10  4.93E-16  0         0         0

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

No.   End 1 Specified Pos End 1 Act  End 2 Specified Pos End 2 Act  Length      Z0       VF      Loss     Loss Freq  Rev/Norm
       Wire #  % From E1  % From E1   Wire #  % From E1  % From E1  (ft)       (ohms)          (dB/100 ft)   (MHz)
1       3        50.00      50.00      4        50.00      50.00      Actual dist 50      1       0          0         N
2       4        50.00      50.00      7        50.00      50.00      Actual dist 50      1       0          0         N

No transformers specified

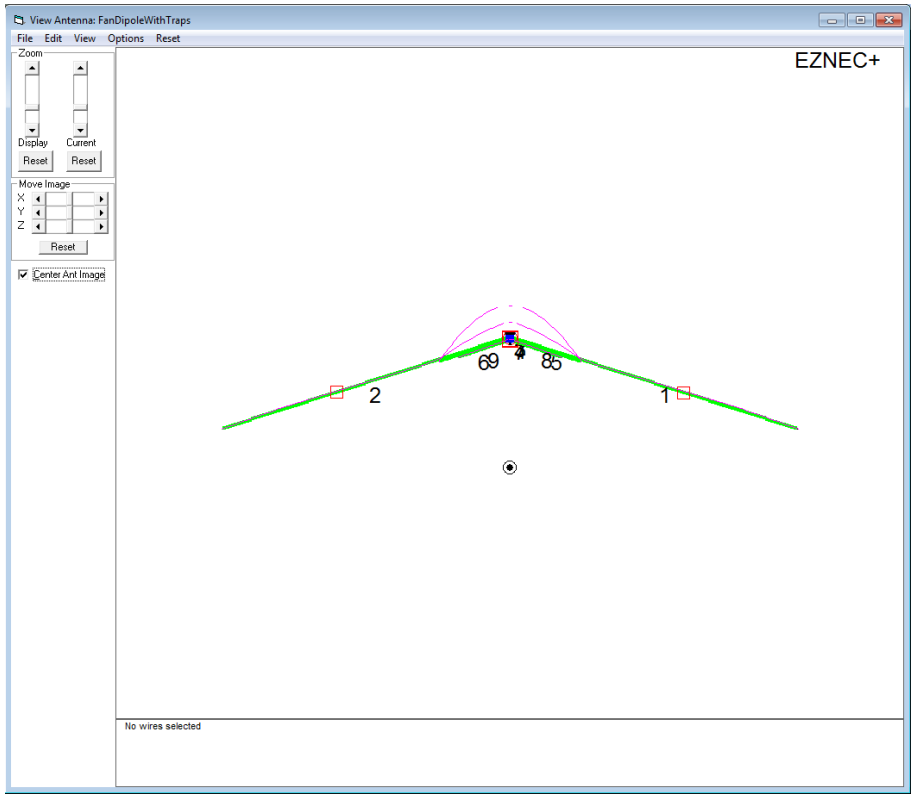
No L Networks specified

Ground type is Real, MININEC-Type

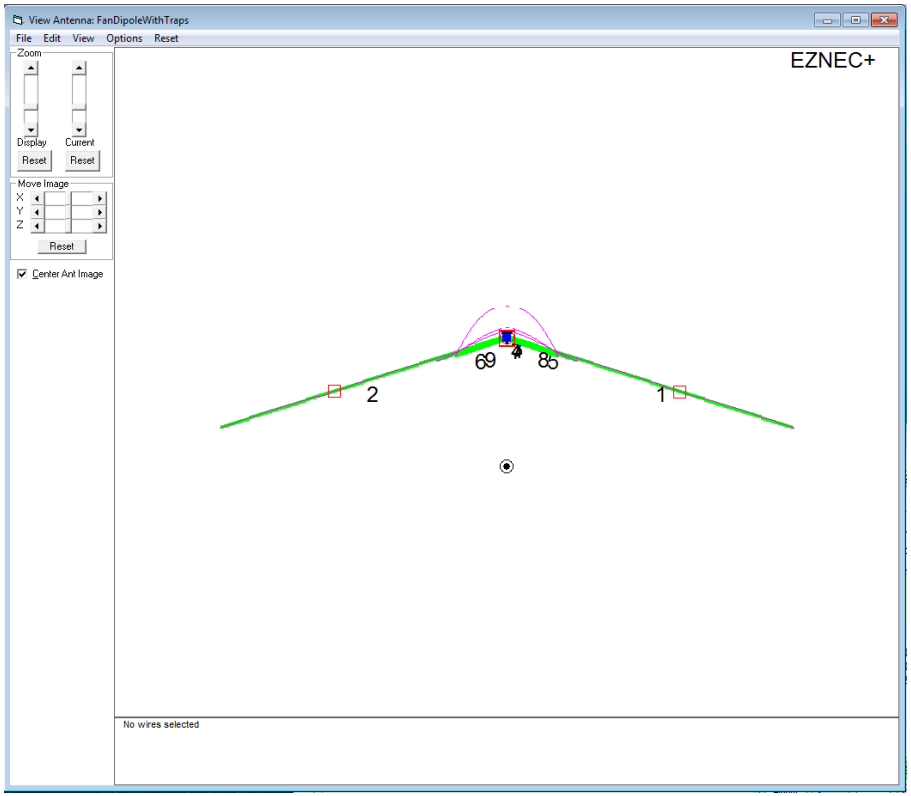
              --------------- MEDIA ---------------

No.    Cond.    Diel. Const.  Height    R Coord.
       (S/m)                  (ft)      (ft)
1      0.005     13           0         0
```

Currents

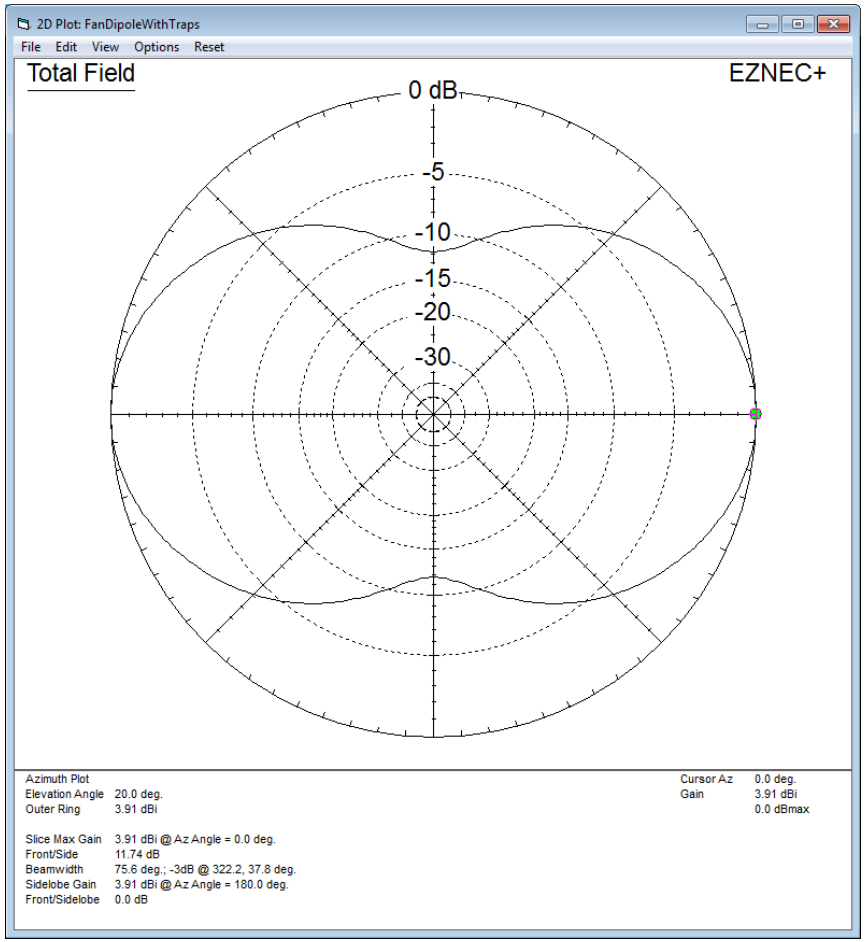


17-Meters

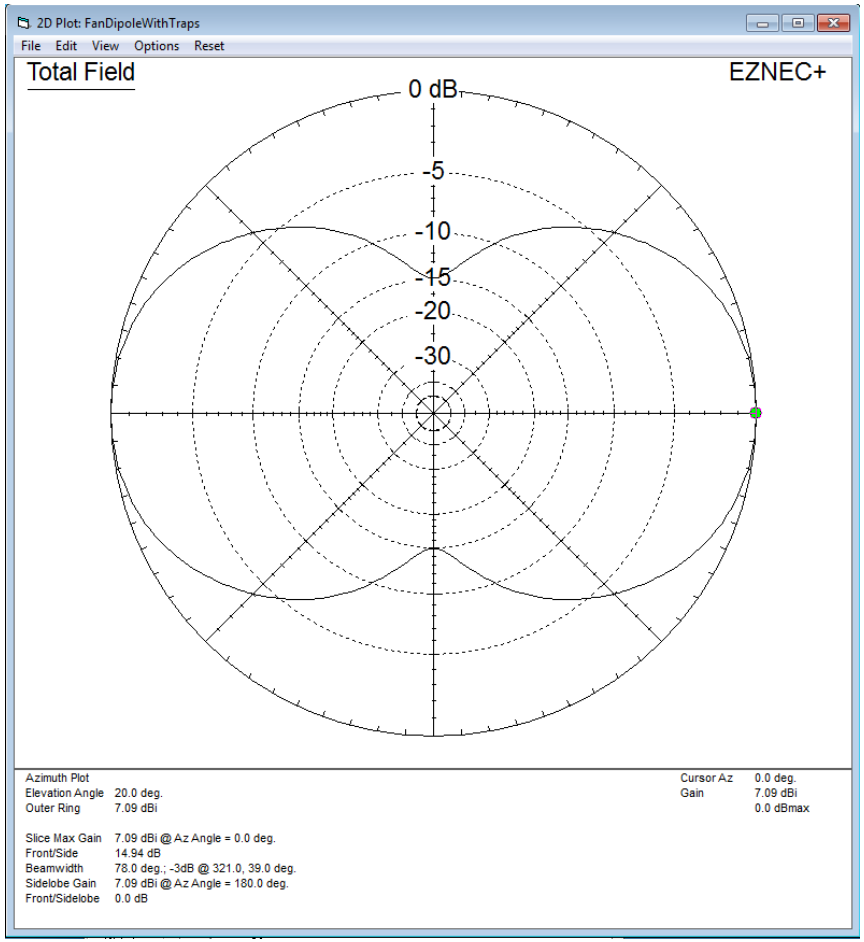


12-Meters

Azimuth Plots

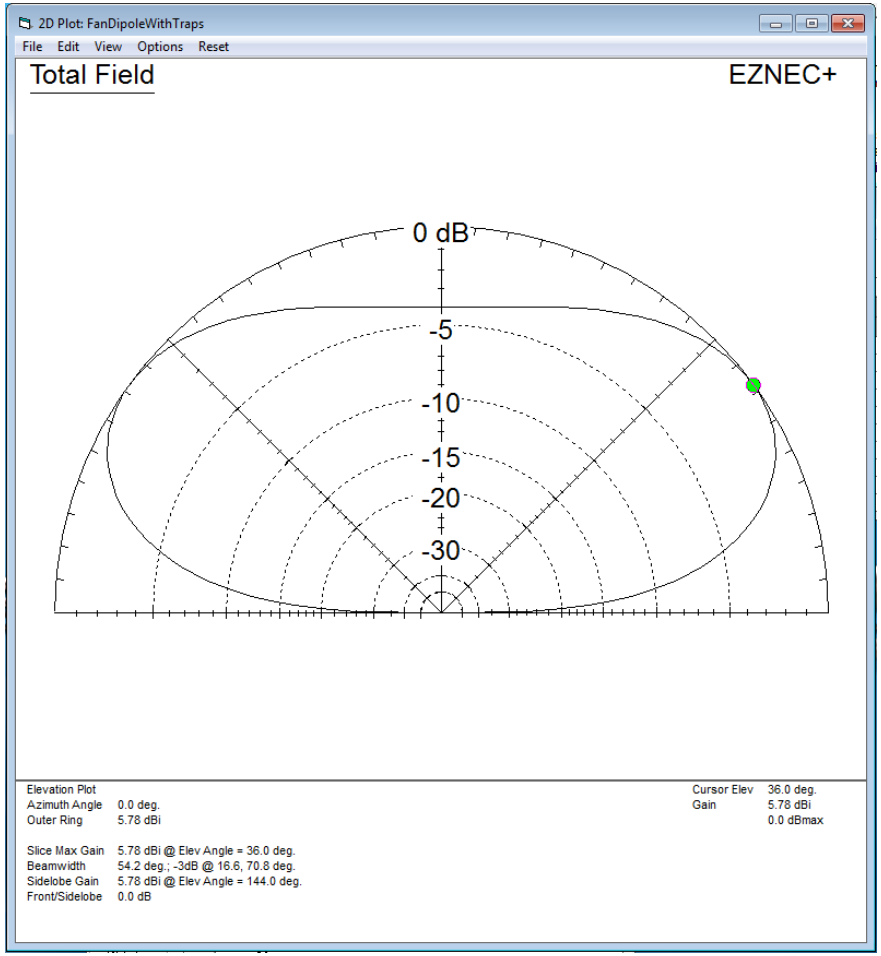


17-Meters



12-Meters

Elevation Plots



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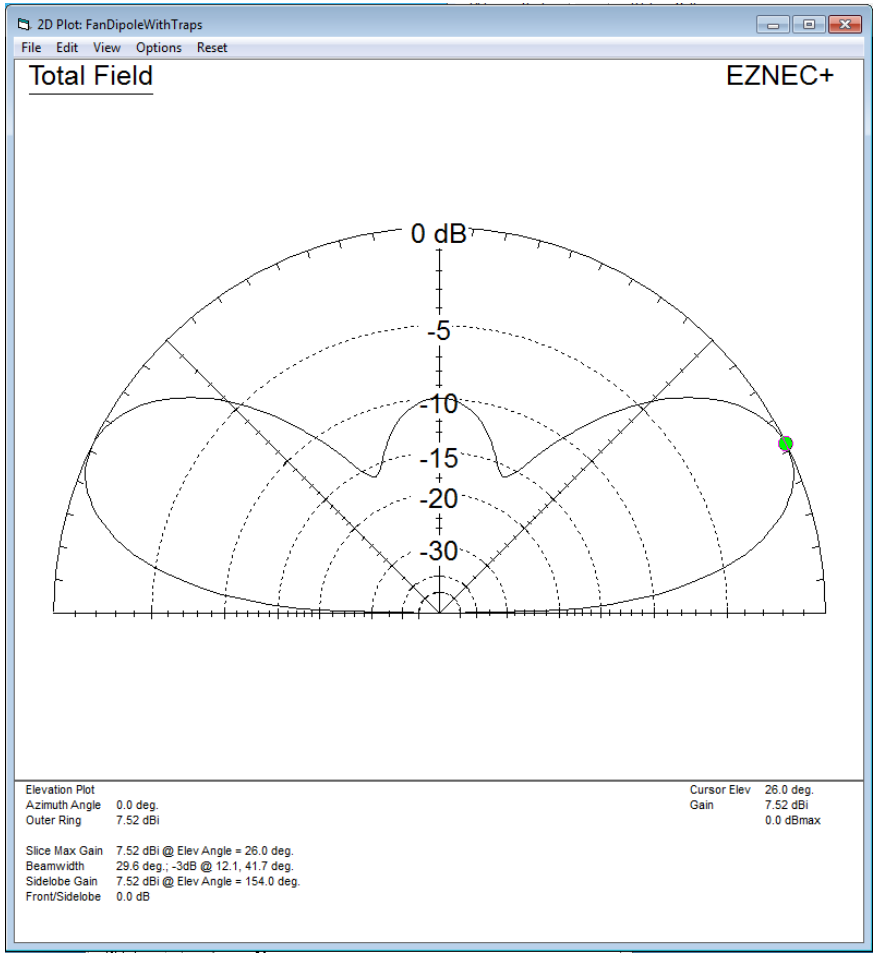
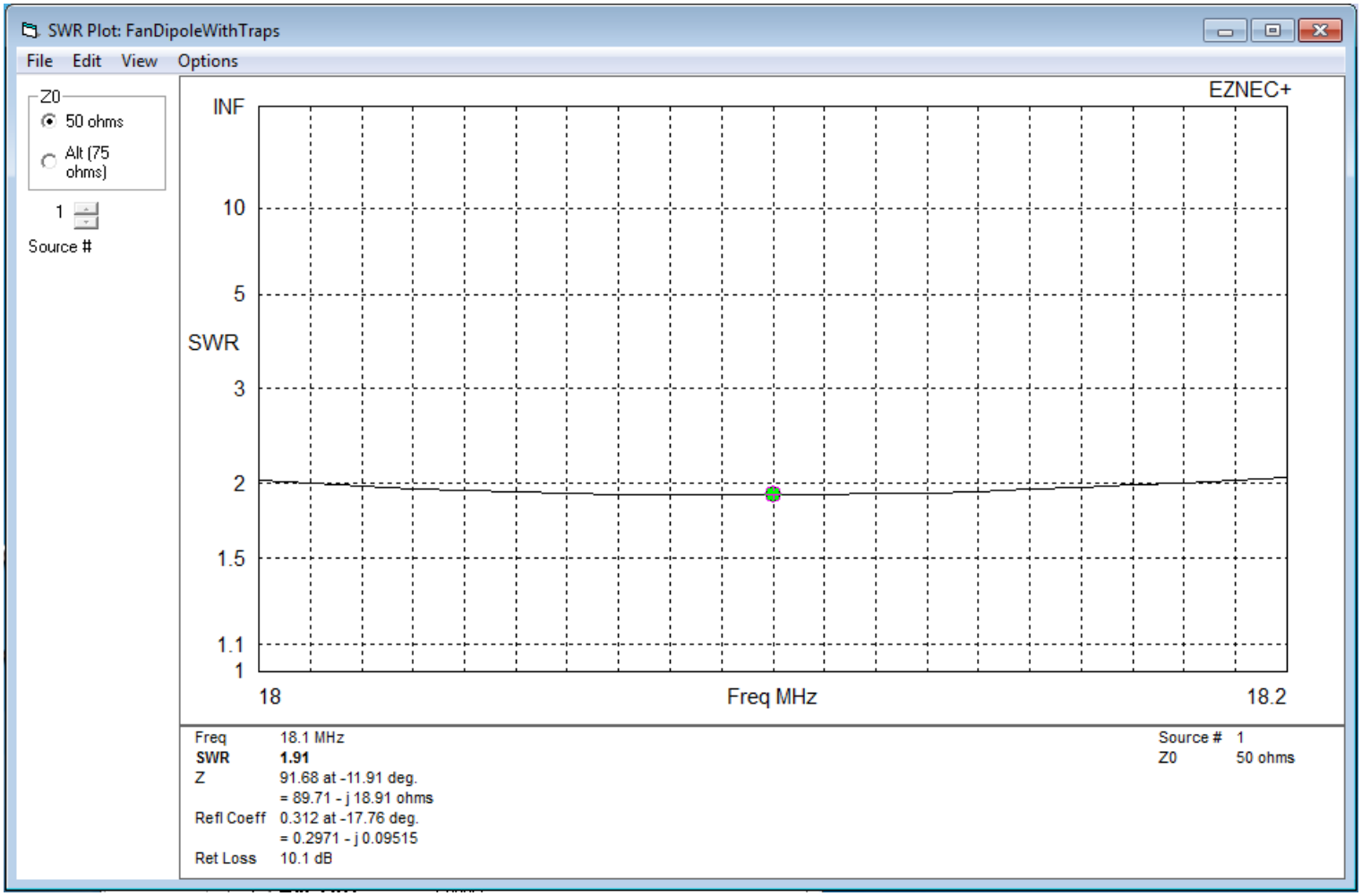


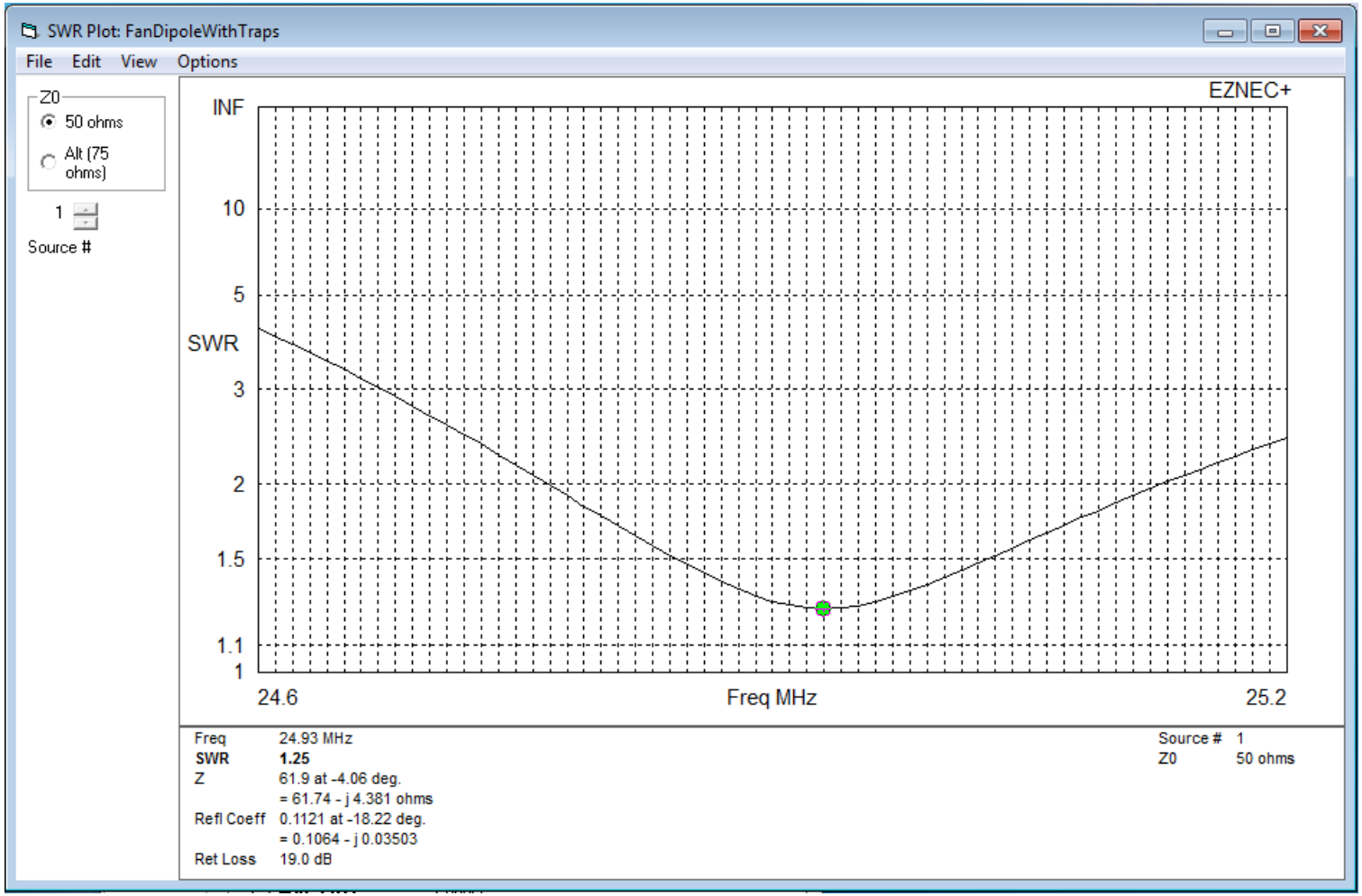
12-Meters

SWR Plots



17-Meters

SWR Plots



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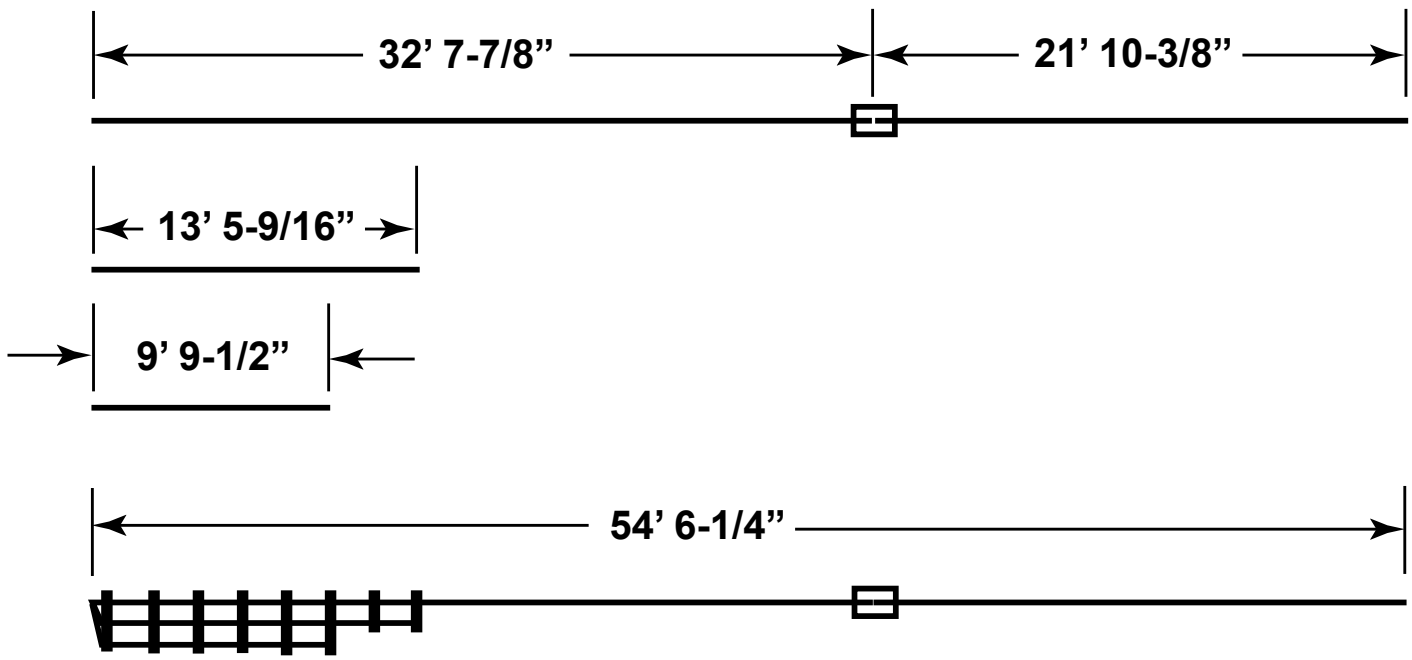
Final Design