A 6 Meter Stealth Antenna

Gary (III) DePalma
AC8NE
A 6 Meter Stealth Antenna

or

You never know what's lurking in the woods

Gary DePalma
AC8NE
Ham License + HOA = Trouble

- 2009 – Moved to the area
  - With expired ham license
- 2013 – Re-licensed as AC8NE
- 2013 – Read the HOA agreement
  - NO ANTENNAS ALLOWED except for TV
- 2013 – 40-10 M dipole and 2M J-pole in attic
  - Situation OK but no DXCC etc.
- 2015 – HF antenna stopped working
Faraday Cage
Switch to a Stealth Antenna Farm
Stealth Antenna Farm

20-6M Vert dipole

40-10M dipole

Remote Ant Relay
Needed Ant for 6 Meter Sporadic-E

- “A 10/17 Meter Hanging Loop Antenna”; Sam Kennedy, KT4QW; QST, October 2004
- Horizontal polarization
- 3dB gain and rotate-able
  - arm-strong
- Single support (hangs down)
- Resonant, 50 Ohm, Hi Q
- Almost stealth

Can it be adapted to 6M?
Sam's Original Design

Total Wire Length:
17 meters = 55.4 Feet (Approximate)
10 meters = 35.3 Feet (Approximate)

PVC Pipe
Feed Point is a Protected SO-239 Connector (See Text)
Rotator Cord

- 70.5"
- 141"
- 218.4"
- 114"
Just Need Values for X and Y

- Start with
  - \( X = 70.5 \times 6/10 = 42.3 \)
  - \( Y = 141 \times 6/10 = 84.6 \)
- Try +/- to get results
- Physical Design Risks
  - Cut wire too short
  - Excessive Exercise
  - Lurking dangers
    - Snakes, bears,...
... Wild Cats
NEC to the Rescue

- Numerical Electromagnetics Code
  - NEC-1 and NEC2 open source
  - NEC-4 big bucks and hard to use

- EzNEC Antenna Design SW (based on NEC2)
  - by W7EL, Roy Lewallen, eznec.com
  - Free demo version or $99

- 4NEC2 – free NEC2 and NEC4 by Arie Voors
  - qsl.net/4NEC2 - 4NEC2 plus Gnuplot
  - Some problems with 4NEC2X version
NEC Design Cycle

- Enter dimensions of element(s) [Wires]
- Set parameters (Source, freq range, gnd. etc.)
- Request a plot (SWR vs. f or field strength)
- Analyze results
- Modify design, plot and analyze again
  - Wash, Rinse and Repeat
EZNEC Main Control Panel

File: hanging6Mloop-best.ez
Frequency: 50 MHz
Wavelength: 236.057 in
Wires: 4 Wires, 44 segments
Sources: 1 Source
Loads: 0 Loads
Trans Lines: 0 Transmission Lines
Transformers: 0 Transformers
L Networks: 0 L Networks
Ground Type: Real/MININEC
Ground Descrip: 1 Medium (0.005, 13)
Wire Loss: Zero
Units: Inches
Plot Type: 3D
Step Size: 5 Deg.
Ref Level: 0 dBi
Alt SWR Z0: 75 ohms
Desc Options: 
Wires

- “Straight” pieces of wire, tubing, rods, etc.
- Defined by endpoints \((x,y,z)\), diameter
- Wires automatically connect if same endpoint
- Can import from spreadsheet for experiments
Add Source(s) (feed point)

- Sources can be phased (phased array)
- Can be voltage or current
  - Irrelevant if only one feed point
View Antenna Window

Feed Point (source)
SWR Plot
SWR Plot Results

- CW
- DX
- SSB
- AM-FM
Azimuth Gain (20 Degrees Elevation)

9.02 dBi = 6.87 dBd
9.02 dBi = 6.87 dBd

50 MHz

Elevation Plot

Azimuth Angle  0.0 deg.
Outer Ring  9.02 dBi
3D Max Gain  9.02 dBi
Slice Max Gain  9.02 dBi @ Elev Angle = 20.0 deg.
Beamwidth  21.3 deg. -3dB @ 9.4, 30.7 deg.
Sideobe Gain  9.02 dBi @ Elev Angle = 160.0 deg.
Front/Sidelobe  0.0 dB

Gain  9.02 dBi
0.0 dBmax
0.0 dBmax3D
Height of Feed Point

Elevation Plot
Analyze the Data

- Plot Resonant Frequency vs. total length \((X+Y)^2\) at various aspect ratios \((Y / X)\)
Analyze the Data

- Plot impedance vs. Aspect Ratio (Y / X)
Built First Antenna Making it Stealth

- Black wire and black poly rope
- Remove center rope support
- Camo paint for the PVC pipe
- Grey electrical box for coax
  - May be adding a 1:1 Balun
- Built to Specifications
- Suspended it in a clearing in the forest
Actual Results

- “Essentially, all models are wrong, but some are useful”
  - George E. P Box 1919-2013 British Mathematician
- Antenna Resonated at 48.9 MHz (not 50.1)
  - Estimated the length was 6” too long
- Only had to take antenna down once
  - Cut off the 6” & reset aspect ratio to 1.93
- Rehung and Ran VNA on the antenna
Final Measurement

Fr = 50.197 MHz
SWR = 1.15:1
Desired Band 50.0 – 50.4 MHz
SWR < 1.25:1

<table>
<thead>
<tr>
<th>Freq. (Hz)</th>
<th>RL (dB)</th>
<th>RP (°)</th>
<th>TL (dB)</th>
<th>TP (°)</th>
<th>Z (Ω)</th>
<th>Rs (Ω)</th>
<th>Xs (Ω)</th>
<th>SWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50.197</td>
<td>-23.31</td>
<td>-119.98</td>
<td>0.00</td>
<td>50</td>
<td>46.7</td>
<td>46.4</td>
<td>1.15</td>
</tr>
</tbody>
</table>
Practical 6M Results

- Between 6/14/17 and 7/1/17
  - Caught 7 days of sporadic E openings
    - 26 States Worked
    - + Canada and Mexico
- Farthest Contact 2256 Miles (KG7P)
- All contacts <40W using JT65, JT9 or FT8
- I was happy but...
- What about the HOA?
Mr. HOA, What Antenna?

- 20-6M Vert dipole
- 40-10M dipole
- 6M Rectangle
- RCS-4 emote Ant Relay
NEC Help

- AutoEZ: a spreadsheet front end
  - AC6LA.com/autoez.html $79
- 4NEC2 Definitive Guide
  - by KA6WKE Mark Schoonover
    leanpub.com/4nec2definitiveguide
Live demo

• Questions?