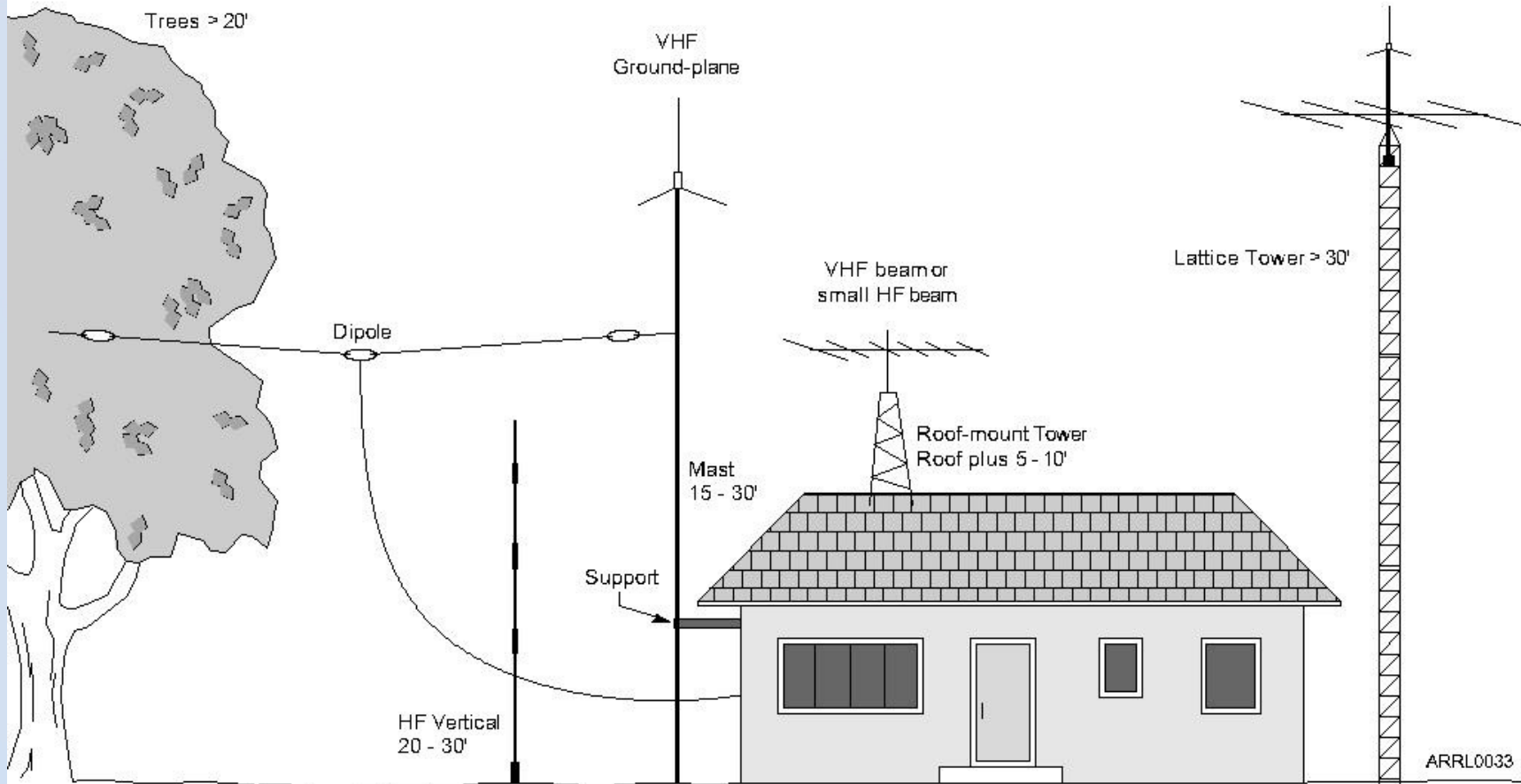
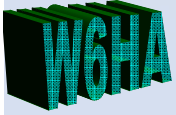


# Antennas ! November 2018



# Agenda

- 6PM Show and Tell plus Demos in the Park
- 7PM Welcome: new members and visitors
- Announcements
- Antenna Overview
  - Alpha Loop Antenna N6IET
  - Vertical Colinear WB6MMQ
  - Whip Dipole MFJ KM6NRL
  - 30' Fishing Pole KK6MAK
  - Dipole Antenna/NVIS N6MDV
  - Budipole N6IET
  - Hustler N6IET
- Next Month – Please come prepared to show and tell
  - December Meeting Hints and Tricks for Ham Ops Prep

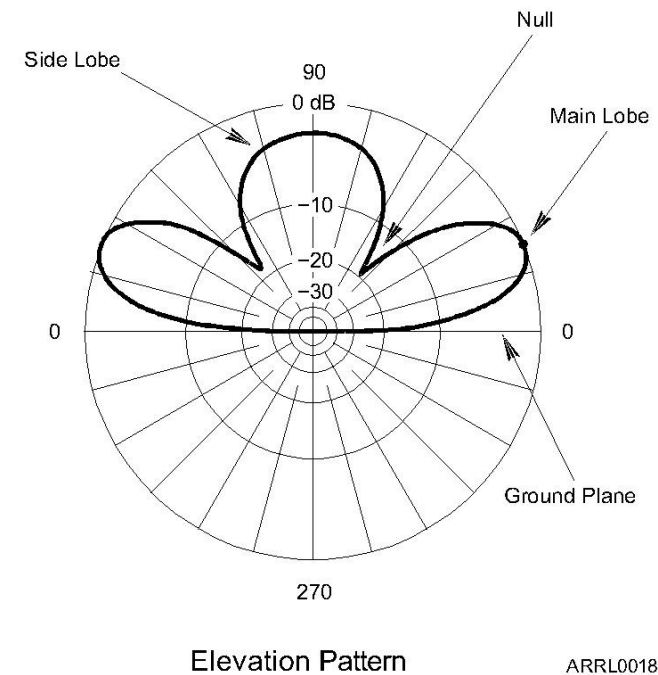
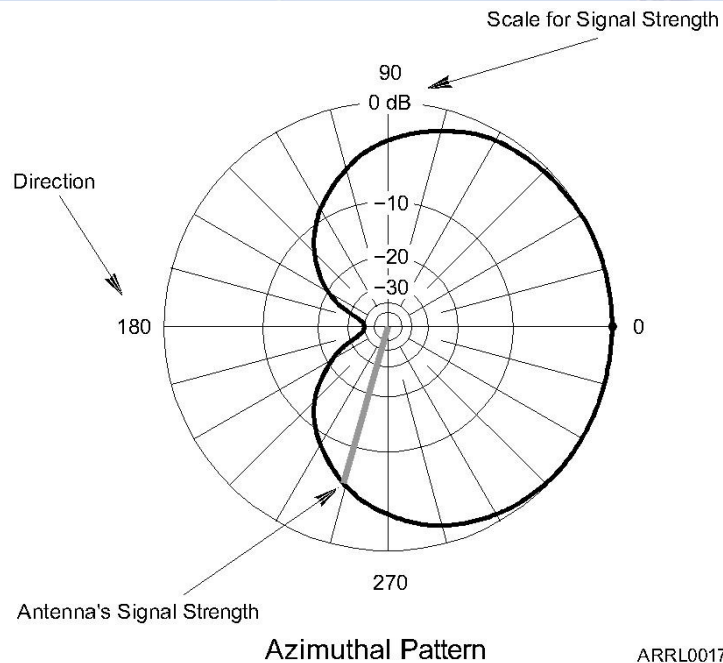


# Announcements

- Ray Miller 50-50 race cancelled due to Woolsey fire
  - Thanks for your support, but no race this year
- December meeting topic
  - Tips and Tricks for Ham radio
  - Be prepared to briefly (<5 minutes) share something you do that helps (e.g., how to coil coax, car mounts, ...)
- January Technician Class
  - Saturdays Jan 9 and 12, location requested still TBD
  - Instructors
    - Volunteer and need to update charts for new question pool
- Weekly club net is continuing at 7:30PM Wednesdays
  - See Raul KM6NRL to sign up as net control
  - Everyone should get the opportunity

# Antenna Energy Radiation Patterns

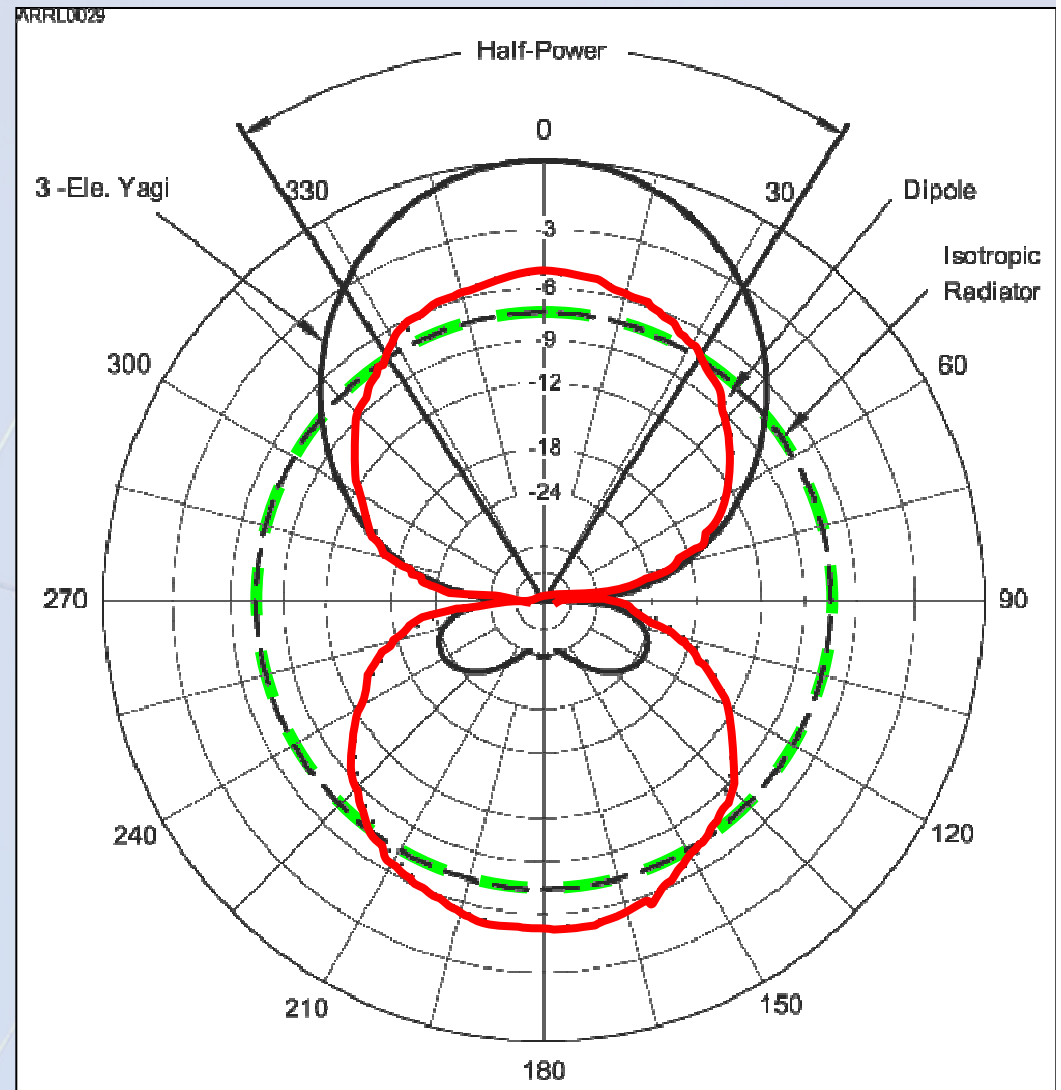
- Azimuth pattern shows horizontally around the antenna
  - i.e., how much energy to North, East, West, etc.
- Elevation pattern shows vertical take off angle for energy
  - Lower takeoff angle better for long distances
  - Straight up radiation is what a Near Vertical Incident Skywave (NVIS) antenna does – great for mountainous valleys and near by communication



# Azimuth Antenna Radiation Pattern Plot

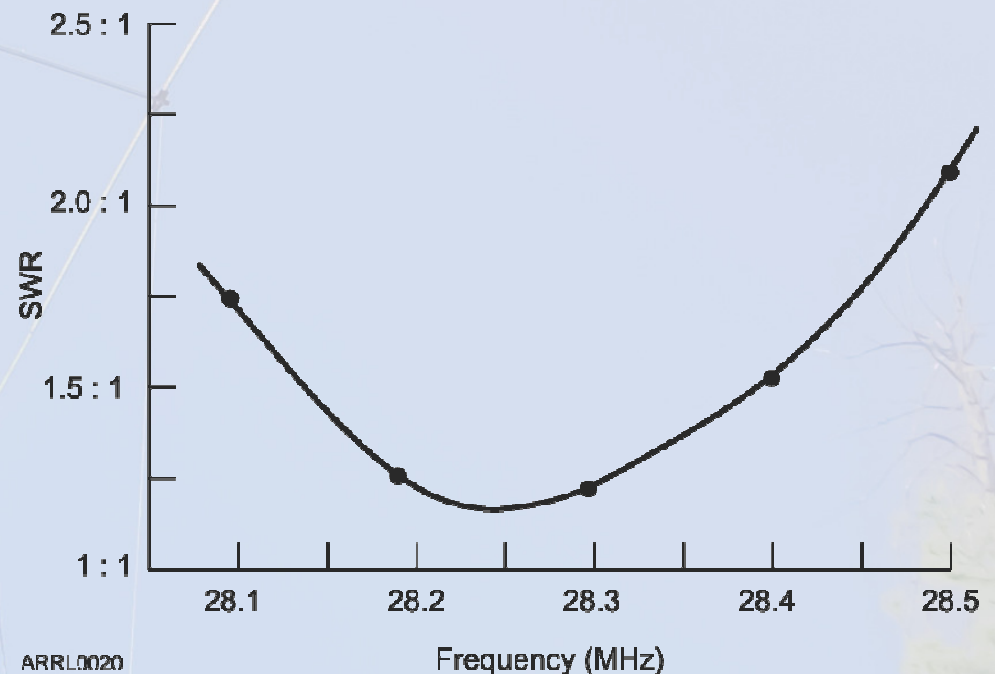
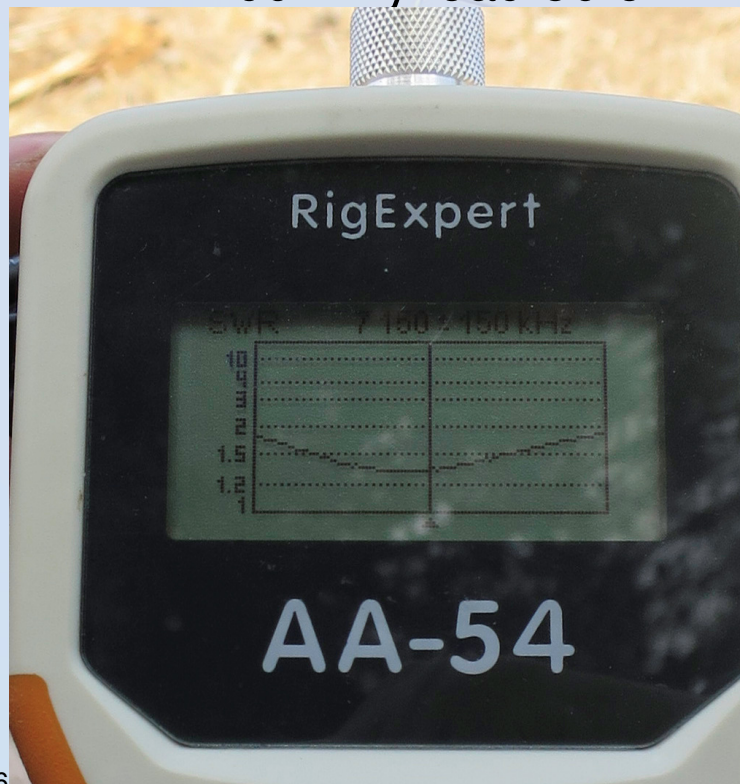
*Can get this from EZNEC modeling software*

- **Azimuth**: towards horizon
- Numbers are degrees around the primary direction of antenna
- Outer ring is normalized to maximum output power
  - Need a dB rating to know how strong the outer ring signal is
- Inner rings show how much power is less at different angles
  - i.e., -3 means -3 dB
  - or half the power of max
- Green isotropic: same energy in all directions
- Red: dipole high above ground
- Black: 3 element Yagi also high above ground



# Standing Wave Ratio Does not Indicate Antenna Radiation Effectiveness

- Poor SWR is not good
  - Radio may reduce signal power to protect itself
  - Much energy lost in the cable
  - Less energy gets out
- Good SWR just means no reflected power
  - A dummy load 50 ohm resistor will have good SWR but little signal



# Antennas All Sizes and Shapes and Performance



**Yagi  
10/15/20M at 55'**



**Mobile tower  
55' when extended**



**Multiple dipoles  
in trees 20' up**



**40M 1/4 wave  
Fiberglass pushup  
With 4 radials**



**5/8 vertical on  
20 foot pushup**



**8 element yagi  
Being assembled**



**Radio van  
ATV microwave**

# Mobile VHF/UHF and HF Antennas

- Car or bicycle





# Satellite Antenna - Robust

- Egg Beater or tracking Yagi
  - Provide auto tracking



# Satellite Antenna - Simple



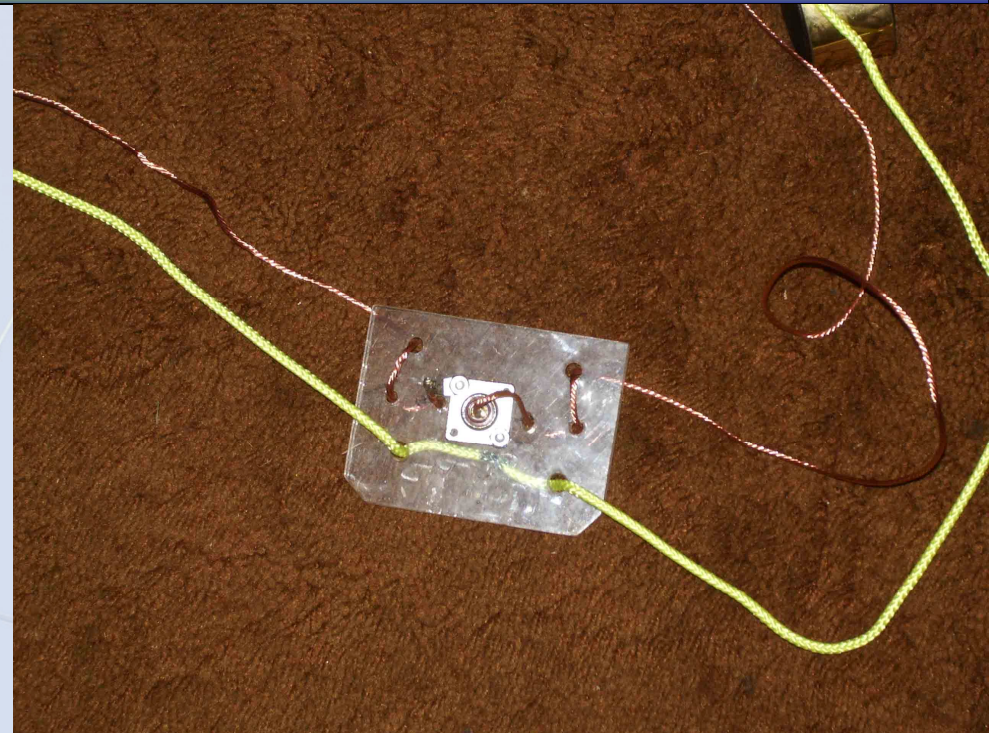
- Elk and Arrow antennas can be used for satellite QSO
- Hand held: point at satellite as it passes
- Dual band VHF/UHF
- Adjust frequency plus or minus 5KHz for doppler

# Antenna Discussions

- Alpha Loop Antenna N6IET
- Vertical Colinear WB6MMQ
- Whip Dipole MFJ KM6NRL
- 30' Fishing Pole KK6MAK
- Dipole Antenna/NVIS N6MDV
- Budipole N6IET
- Hustler N6IET

# Simplest Dipole

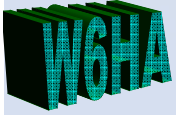
- Wire length
  - 468 feet divided by frequency
  - Examples:
    - 20 meters (14.1MHz) about 33 feet
    - 40 meters about 67 feet
- Small piece of plexiglass
- Add SO-239 connector
- Solder half of wire to center pin
- Solder other half to the connector frame
- In this case, yellow rope is for support
  - Keeps tension off the wire and its connector
- Attach a coax and you are on the air
- Hang as high up as you can – let coax drop to ground



# Simple 40 M nvis dipole used on NPOTA

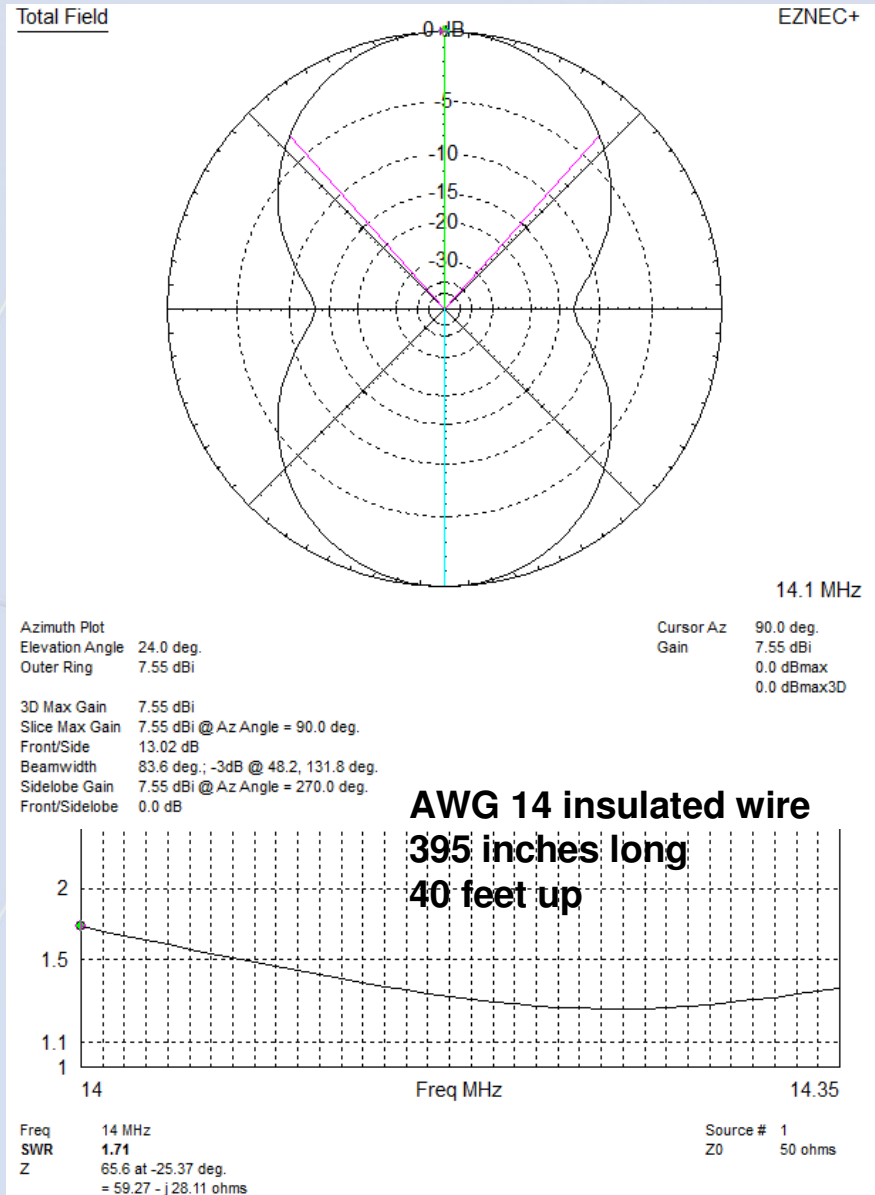
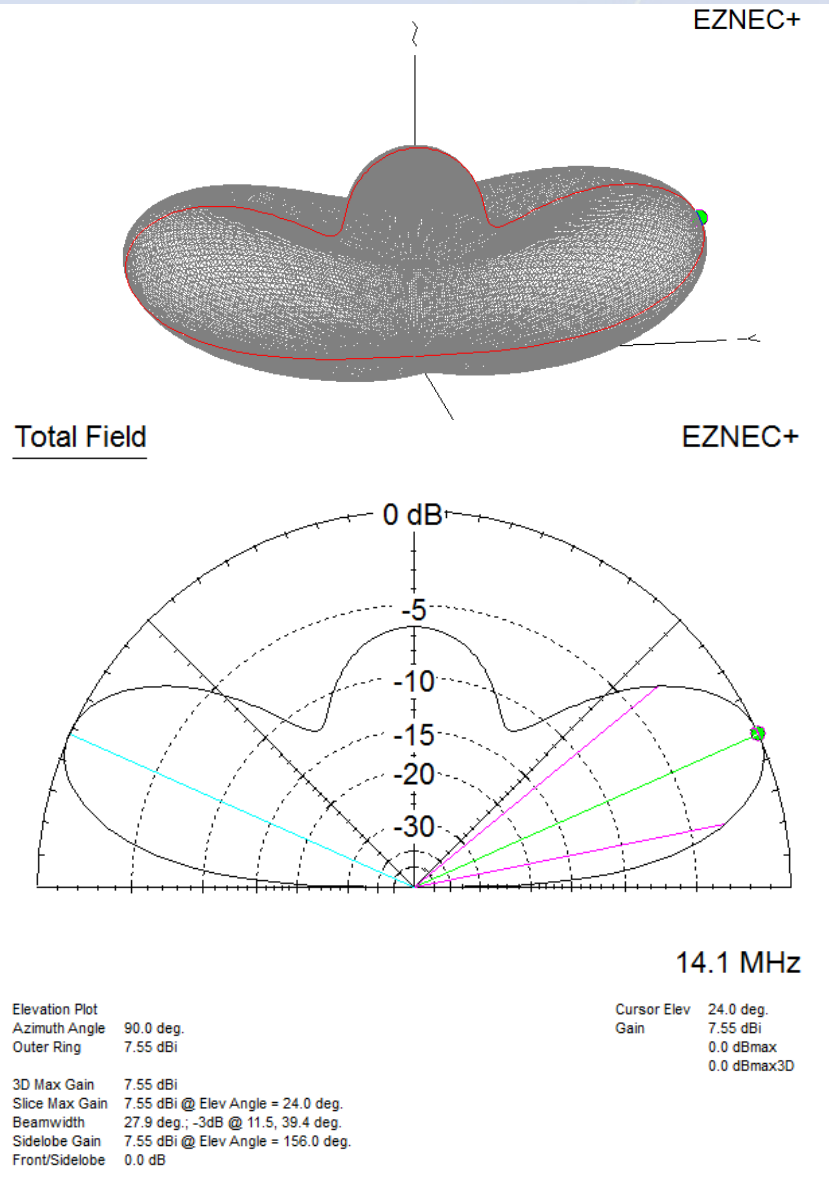
- Just 67 feet of awg 22 wire
- No balun
- Only 7 feet above ground
- Good enough to reach the east coast on 40 Meters





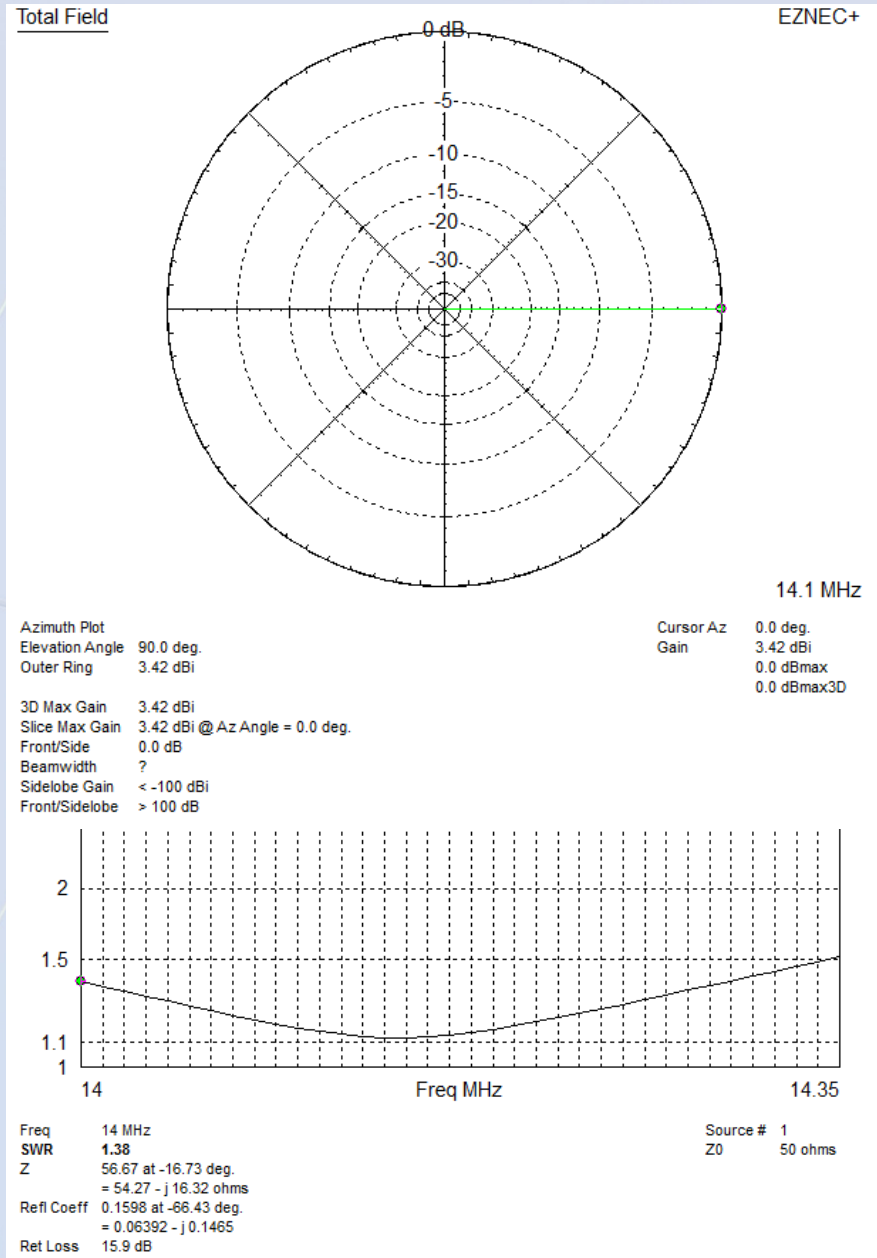
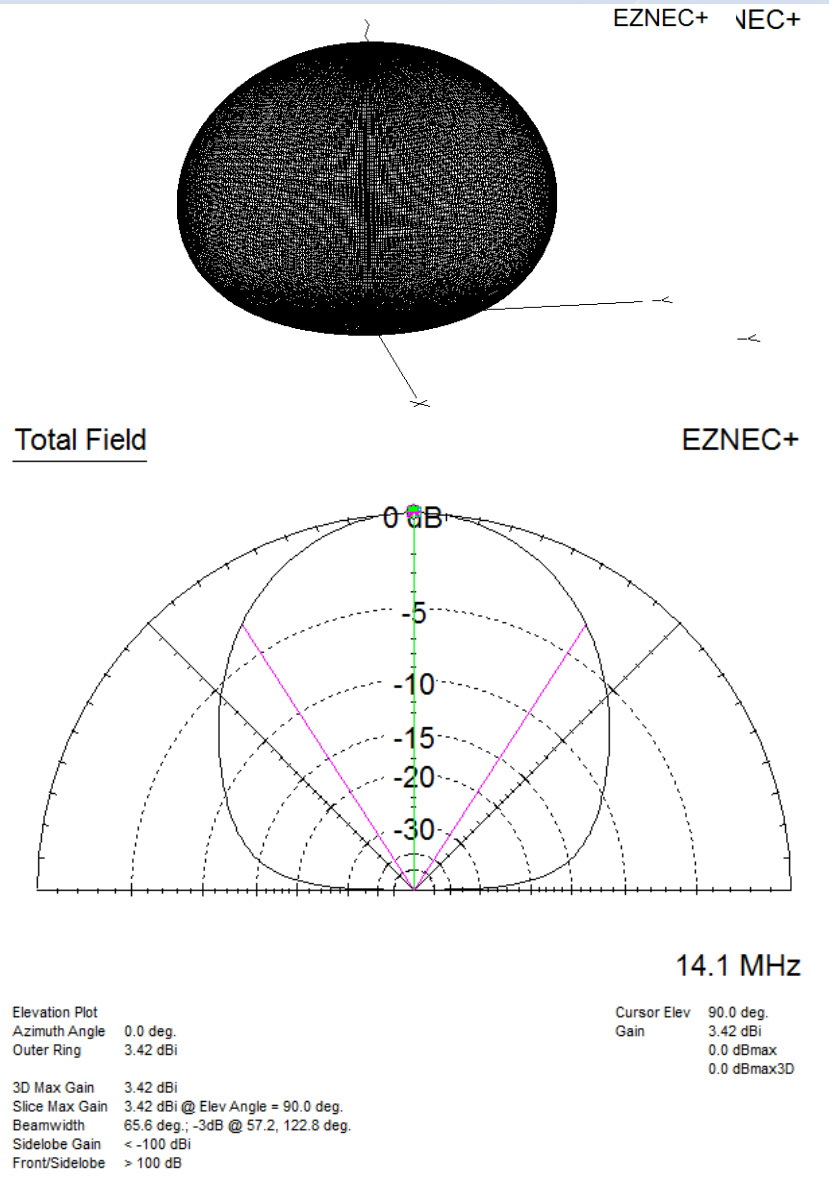
# 20M Dipole 40 feet Above Ground

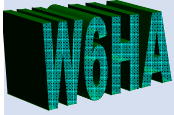
## Gain 7.55 dBi vs the theoretical 2.3dBi in "free space"



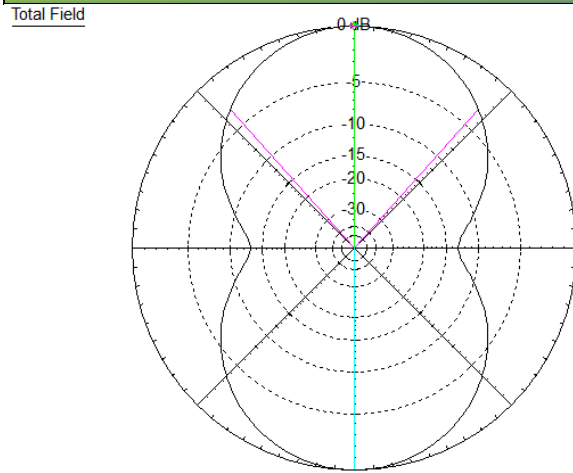
EZNEC modeling

# 20M Dipole 7.4 feet Above Ground (0.11 lambda) Gain 3.4 dBi – Note most energy straight up





# 40' vs 7' Dipole Above ground 4.1 dB more gain up higher

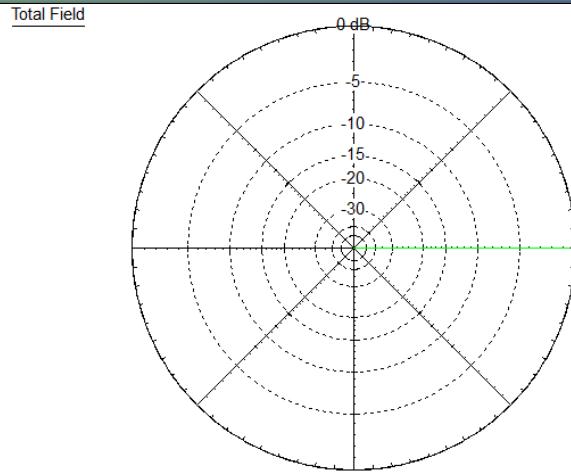


14.1 MHz

Azimuth Plot  
Elevation Angle 24.0 deg.  
Outer Ring 7.55 dBi

3D Max Gain 7.55 dBi  
Slice Max Gain 7.55 dBi @ Az Angle = 90.0 deg.  
Front/Side 13.02 dB  
Beamwidth 83.6 deg.; -3dB @ 48.2, 131.8 deg.  
Sidelobe Gain 7.55 dBi @ Az Angle = 270.0 deg.  
Front/Sidelobe 0.0 dB

Cursor Az 90.0 deg.  
Gain 7.55 dBi  
0.0 dBmax  
0.0 dBmax3D



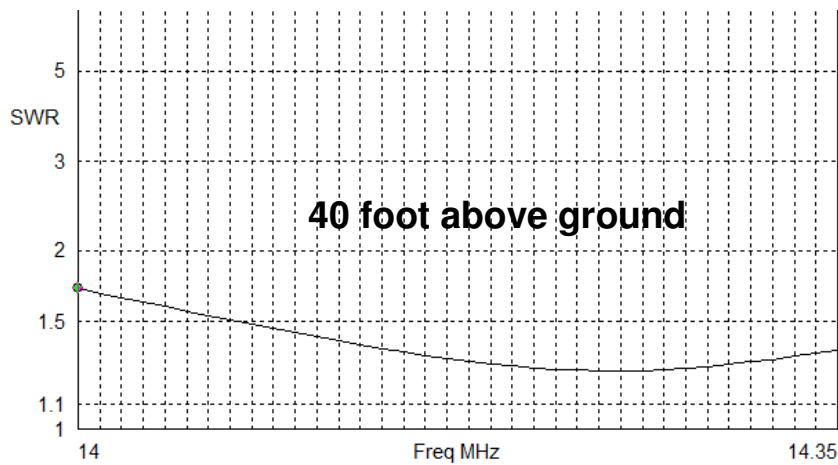
14.1 MHz

Azimuth Plot  
Elevation Angle 90.0 deg.  
Outer Ring 3.42 dBi

3D Max Gain 3.42 dBi  
Slice Max Gain 3.42 dBi @ Az Angle = 0.0 deg.  
Front/Side 0.0 dB  
Beamwidth ?  
Sidelobe Gain < -100 dBi  
Front/Sidelobe > 100 dB

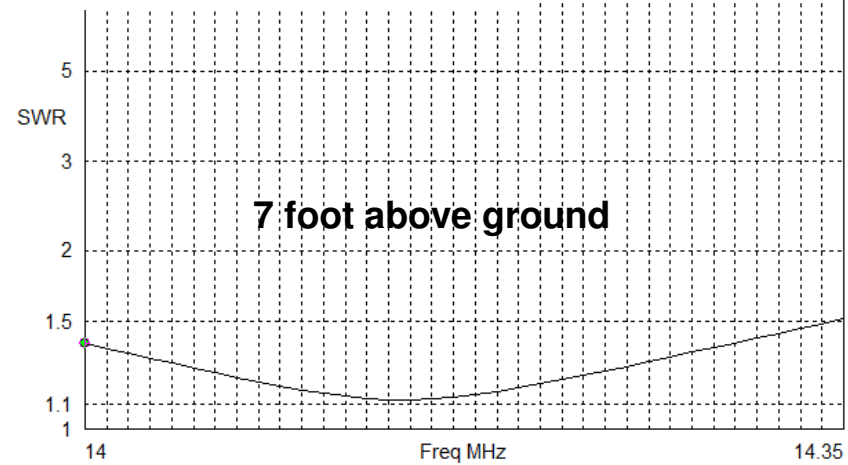
Cursor Az 0.0 deg.  
Gain 3.42 dBi  
0.0 dBmax  
0.0 dBmax3D

- Same antenna just different heights
- Affects SWR, directionality, and gain



Freq 14 MHz  
SWR 1.71  
Z 65.6 at -25.37 deg.  
= 59.27 - j28.11 ohms  
Refl Coeff 0.2623 at -57.32 deg.  
= 0.1416 - j0.2208  
Ret Loss 11.6 dB

Source # 1  
Z0 50 ohms

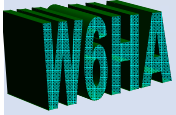


Freq 14 MHz  
SWR 1.38  
Z 56.67 at -16.73 deg.  
= 54.27 - j16.32 ohms  
Refl Coeff 0.1598 at -66.43 deg.  
= 0.06392 - j0.1465  
Ret Loss 15.9 dB

Source # 1  
Z0 50 ohms

EZNEC+

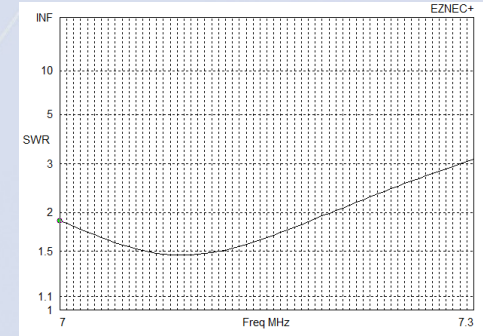
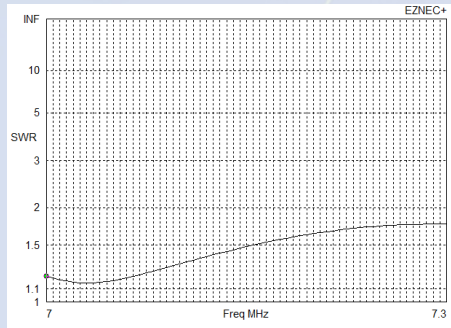




# 40M NVIS Dipole 11.5 feet above Ground 6dBi gain Omni directional Azimuth

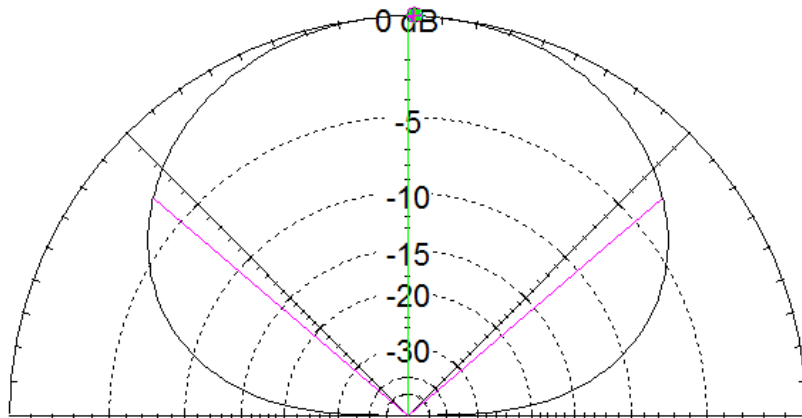
- With director wire at 20 feet
  - Adds 1db gain
  - And flattens SWR curve

- Just the 66.5 foot wire



Total Field

EZNEC+



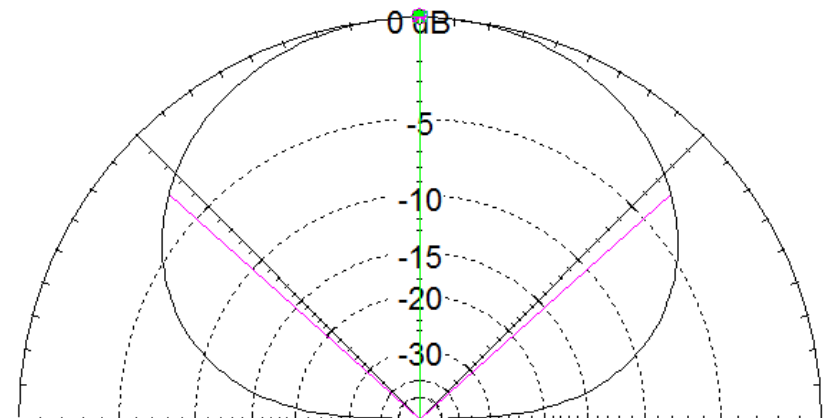
7.1 MHz

Elevation Plot  
Azimuth Angle 0.0 deg.  
Outer Ring 6.18 dBi  
  
3D Max Gain 6.18 dBi  
Slice Max Gain 6.18 dBi @ Elev Angle = 90.0 deg.  
Beamwidth 99.0 deg.; -3dB @ 40.5, 139.5 deg.  
Sidelobe Gain < -100 dBi  
Front/Sidelobe > 100 dB

Cursor Elev 89.0 deg.  
Gain 6.18 dBi  
0.0 dBmax  
0.0 dBmax3D

Total Field

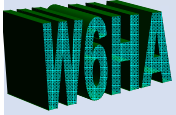
EZNEC+



7.1 MHz

Elevation Plot  
Azimuth Angle 0.0 deg.  
Outer Ring 5.21 dBi  
  
3D Max Gain 5.21 dBi  
Slice Max Gain 5.21 dBi @ Elev Angle = 90.0 deg.  
Beamwidth 96.2 deg.; -3dB @ 41.9, 138.1 deg.  
Sidelobe Gain < -100 dBi  
Front/Sidelobe > 100 dB

Cursor Elev 90.0 deg.  
Gain 5.21 dBi  
0.0 dBmax  
0.0 dBmax3D



# 40M Two Wire Inverted V Beam Nearly 9 dBi gain and Lower Takeoff Angle

- Two inverted V wires peak 35'
- V's 35 feet apart
- Act as driver and director
- Better gain for east coast ops
  - Like on field day

