Space Challenged NVIS Antenna

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What is NVIS?

• Near
• Vertical
• Incident
• Skywave

• Cloud Warmer
Propagation Theory
Propagation Theory

F-layer at about 250 miles

D-layer at about 30-60 miles

(Not to scale. All numbers approx.)
(Assumes a 10db loss in D-layer)

200 Miles -22db

850 Miles -54db
NVIS Effect
Radio Wave Goes Straight Up

And Reflects Back Down To Distant Stations
3 Element Horizontal Beam Antenna Now Aimed Straight Up. Installed on top of Building
Remove Director Element and you have a Two Element Horizontal Beam Antenna Aimed Straight Up. Installed on top of Building.
Remove Reflector Element and you have a NVIS Antenna Almed Straight Up. Installed on top of a Building.
Propagation Considerations

- "D" layer losses
- Ionospheric scattering for vertical propagation
- Importance of critical frequency

(Not to scale. All numbers approx.)
(Assumes a 10db loss in D-layer)
1 ATU

- Equals installation of NVIS antenna
Does this look like your neighborhood?
Can you spot the antenna?
Left side of dual band
Top down view

Fence line

Feed point
75 Meter SWR

Freq | 3.96 MHz  
SWR  | 1.42  
Z    | 35.42 + j 2.23 ohms  
Refl Coeff | 0.1726 at 169.81 deg.
Bandwidth 75 Meters

- 4050 – 2:1
- 3960 – dip
- 3860 – 2:1
75 Meter Vertical Pattern
75 Meter Current Flow
40 Meter SWR

Freq | 7.25 MHz
SWR | 1.11
Z   | 55.26 - j 0.8609 ohms
Refl Coeff | 0.05065 at -8.82 deg.

Source # 1
Z0 | 50 ohms
40 Meter Current Flow
Bandwidth 40 Meters

- 7190 – 2:1
- 7250 – dip
- 7370 – 2:1
40 Meter Vertical Pattern

7.22 MHz

Elevation Field
Azimuth Angle: 90.0 deg.
Outer Ring: 2.72 dB

Slope Max Gain: 2.72 dB @ Slope Angle - 90.0 deg.
Dipole Width: 103.1 deg., -3dB @ 36.5, 141.0 deg.
Ski-Jump Gain: -4.00 dB
Front/Side Ratio: > 100 dB
Omni Pattern
Fig 11—Depths at which the current density is 37% of that at the surface for different qualities of earth over the 1.8- to 30-MHz frequency range. The depth for fresh water, not plotted, is 156 feet and almost independent of frequency below 30 MHz. See text and Table 2 for ground constants.
Feed Point Impedance vs. Height

Fig 1—Variation in radiation resistance of vertical and horizontal half-wave antennas at various heights above flat ground. Solid lines are for perfectly conducting ground; the broken line is the radiation resistance of horizontal half-wave antennas at low heights over real ground.
How It Went Together

- Materials
- Construction
- Modifications
Parts List

- 1 Center insulator
- 1 1.5” PVC Slip coupler
- 2 or 3 Hose clamps
- 14 ga. Insulated wire
- 1 10’ TV mast
- 1 5’ TV mast
- Tie wraps as desired
- 1 Fence stake
- Coax to the shack
Feed point is at 15’
End of 75M wires are 6’ above ground
End of 40M wires are 4’ above ground
Element Lengths

- 75 Mtr legs = 57 ft
- 40 Mtr legs = 39 ft
- Prune these lengths to meet your ground conditions
Beamwidth

- 75 Mtrs  41 deg. To 139 deg.
- 40 Mtrs  39 deg. To 141 deg.
Hints & tips

- Solder wires at the feed point
- Solder feed point pigtail to all other wires
- Coax should be perpendicular to the antenna
Hints & tips (cont.)

- Ground conditions will drive element lengths
- Wet vs.. dry
- Use an antenna analyzer!!!
- Tune 75M first, then 40M
- Minimize the catenaries in the wires but not too tight – the wire will stretch
- Maintain the spacing between the 75 & 40M elements
Too big?

If that doesn’t work for you, try this
40M wire Tunable on 75M

40M wire

32.25'

4.5'

15'

32.25'

4.5'

EZNEC+
40M SWR

Freq  7.24 MHz
SWR   1.16
Z     57.88 - j0.5715 ohms
Refl Coeff  0.07322 at -3.85 deg.
40M wire tuned to 75M

Freq MHz
3.8
Freq MHz
4.15

Freq 3.99 MHz
SWR 1.057
Z 47.32 - j 0.2223 ohms
Refl Coeff 0.02764 at -175.13 deg.

Source # 1
Z0 50 ohms
40M wire tunable on 75M in 90 deg. configuration
Buddipole

Will do 40 thru 2 meters
Although there is an 80M mod
Maximizing the Received Signal
Thanks to Bill Balzarini, KL7BB

for all the drawings!
QUESTIONS?
Questions are welcome

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Thank you!
de Ed & Tom