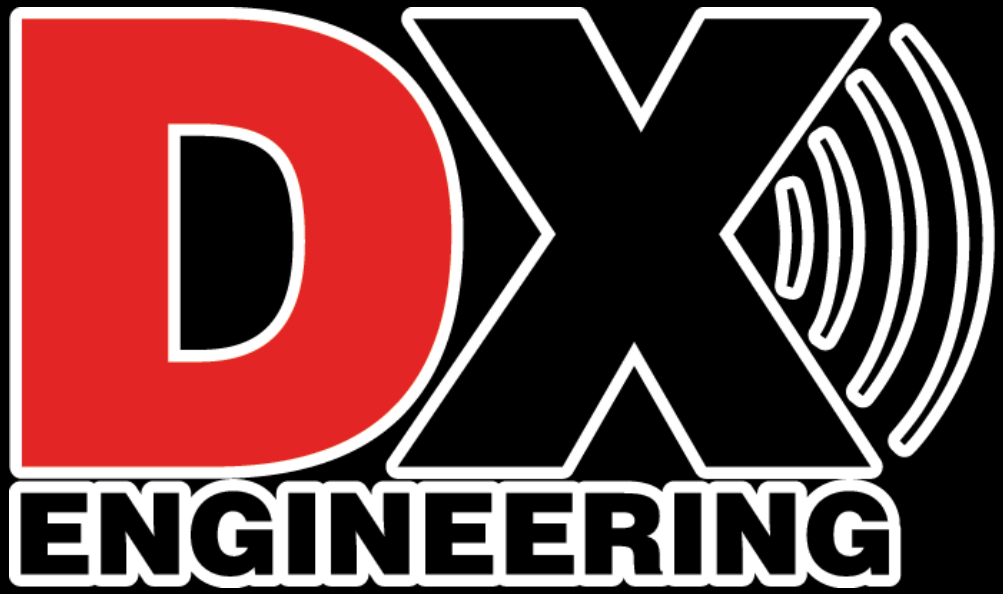
NVIS Antenna Communications



NVIS – What does that mean?

- Near Vertical Incident Sky wave
  - A radio signal that has a high take off angle
- Reliable 200 – 300 Mile coverage (Or greater)
- Great for Emergency Communications

Advantages of NVIS

- NVIS covers the an area greater than that of the ground wave signals, and because of the high angles, terrain is less of a concern.
- Longer distance without a repeater or other infrastructure.
- Easy antenna setup, height isn't as much of a concern. 15 – 30' works great!

Time & Frequency

- During the Day
  - The E layer is densely ionized
    - MUF of the E Layer usually around 10 MHz
    - This allows the layer to reflect signals < 10 MHz
  - D Layer absorbs most signals < 4 MHz
- This makes 40 meters a good daytime NVIS Bands

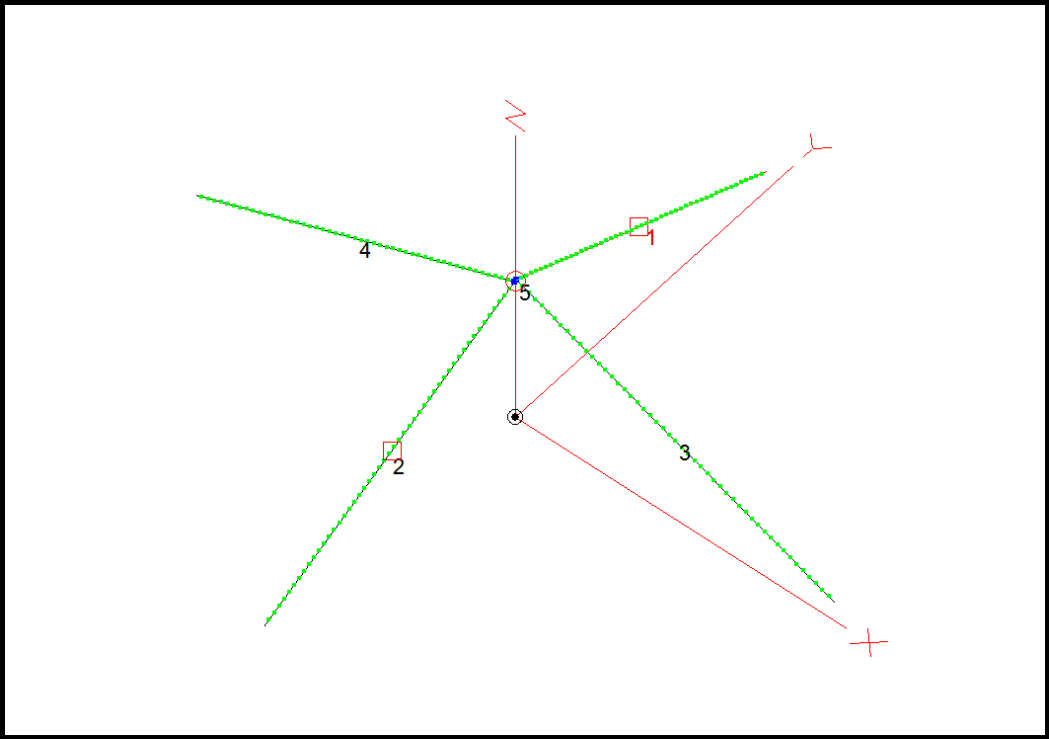
Time & Frequency

- After sunset, MUF of the E layer can drop below the 40 meter band due to the loss of the primary source of ionization
- However the D layer disappears at sunset
  - This is why 80 meters can be unreliable during the day, but good at night.

Antennas

- There are many different NVIS Antenna designs
- I've been modeling and focusing on a loaded Inverted V.

Consists of Full Sized 40 M legs crossed with Center loaded 80 M legs of approximately the same length



Loaded Inverted V

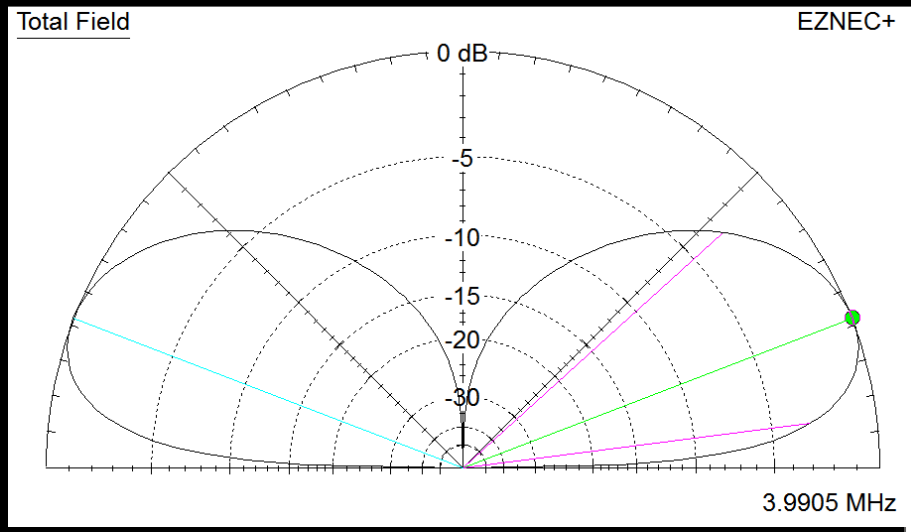
Pros:
Small Foot Print
Easy to deploy
Portable, light weight
Antenna is support,
No additional guy wires

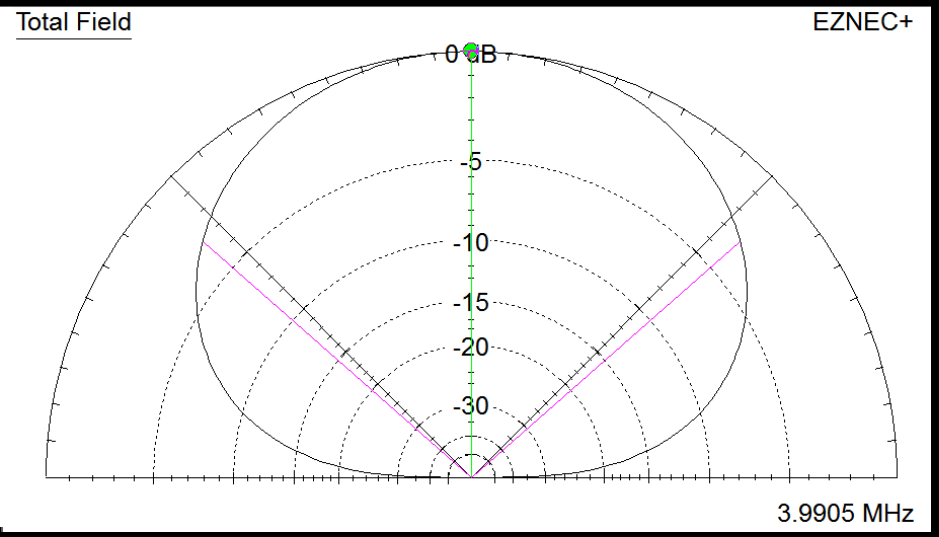
Cons:
Coils are a compromise
Narrow Bandwidth on 80

DX ENGINEERING

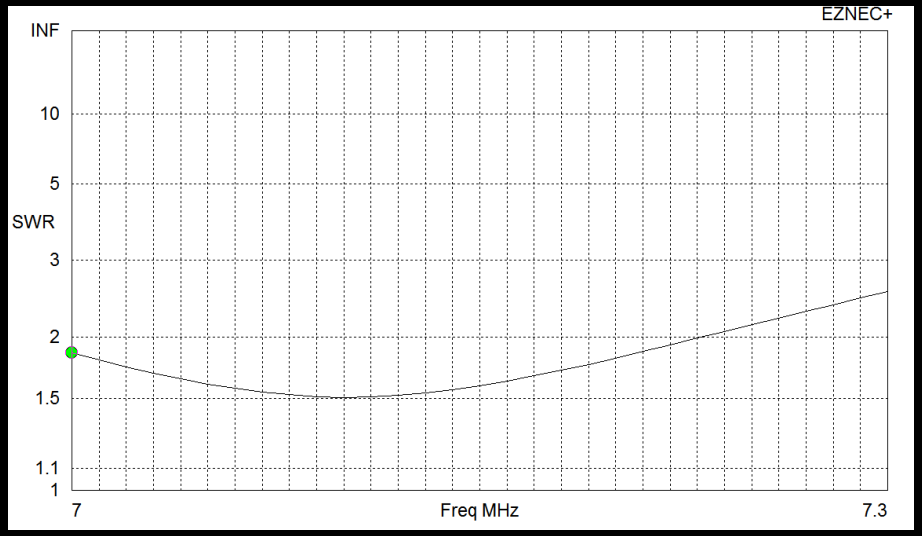
Loaded Inverted V

- Same Antenna / Different Heights
  - Take off angle and beam width
    - ¼ λ: TOA = 21°, BW: 27.6°
    - NVIS (15 – 3 feet): TOA = 90°, BW: 138.7°



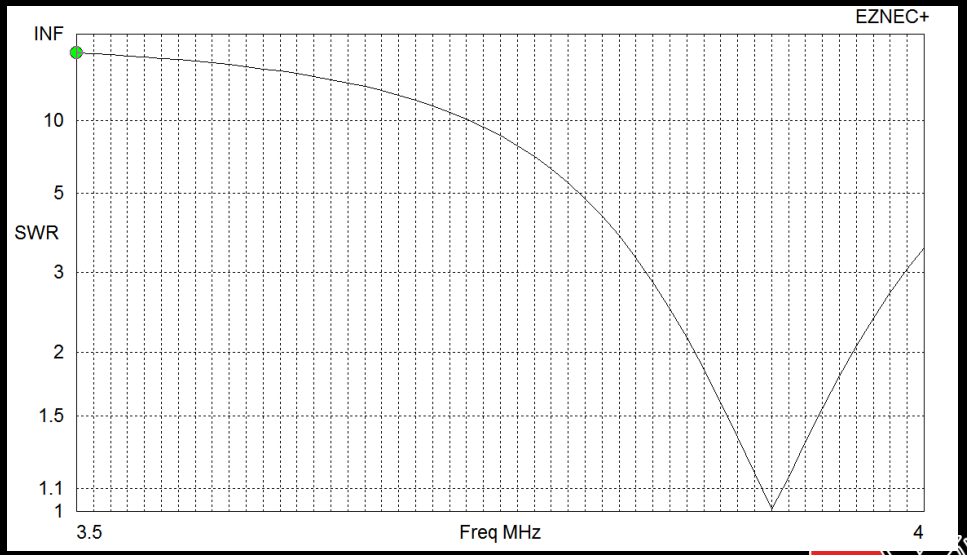


Loaded Inverted V – Models



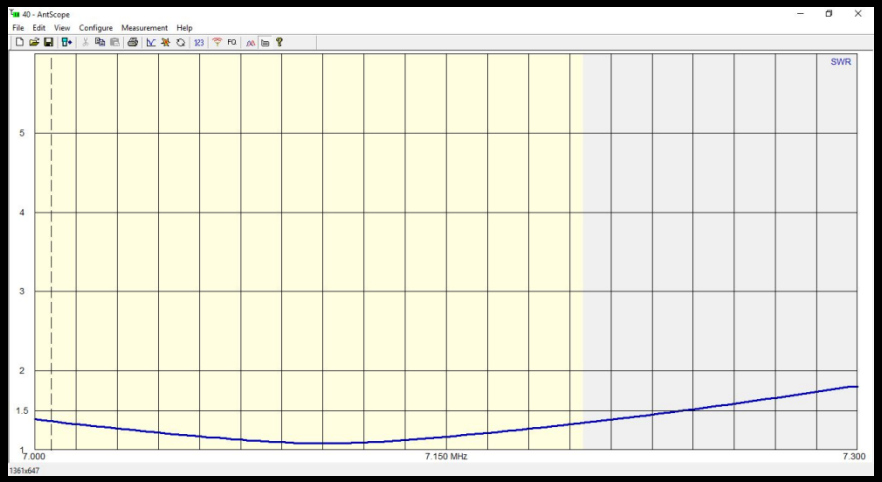
- 40 M SWR < 3:1 across the entire band
- Internal Tuners in most radios can handle this.

- 80 M is a loaded compromise
- 80M SWR bandwidth about 140 kHz



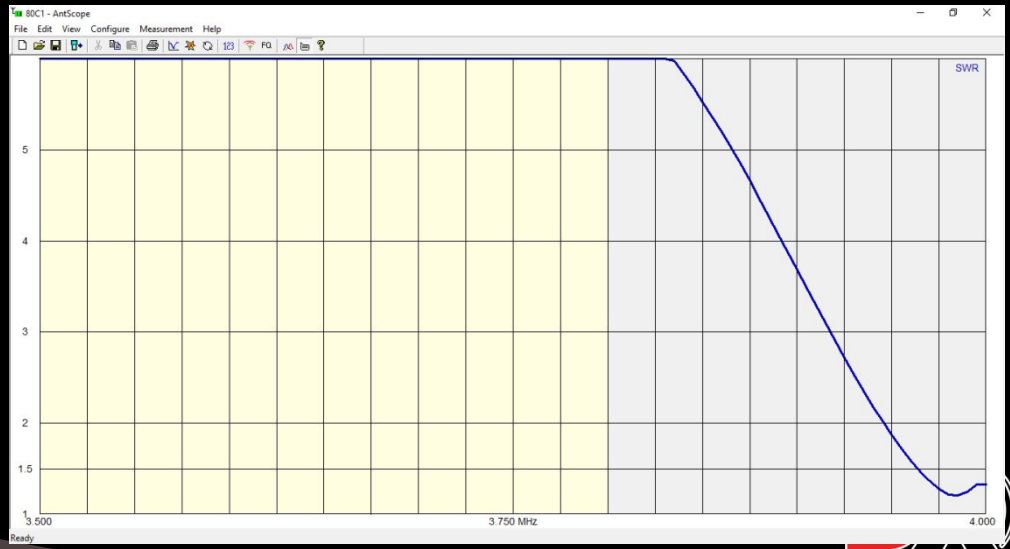
DX ENGINEERING

Loaded Inverted V – Real World



- 40 M SWR < 3:1 across the entire band
- Matches the Model pretty well!

- Tuned a little higher, but still matches the model!
- I love it when math matches the Real world!



Load Losses

```
--------------- SOURCE DATA ---------------

Frequency = 3.91 MHz

Source 1        Voltage = 70.93 V at -0.56 deg.
                Current = 1.415 A at 0.0 deg.
                Impedance = 50.12 - J 0.4892 ohms
                Power = 100.4 watts
                SWR (50 ohm system) =  1.010  (50 ohm system) =  1.010
```

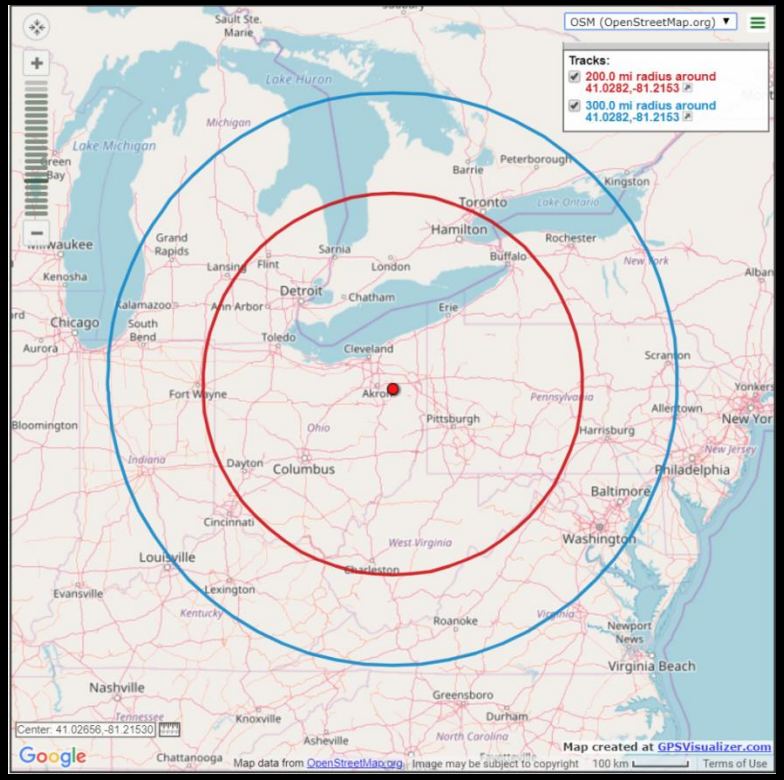
- Trading Size for Efficiency
  - 40m elements full size
  - 80m elements ½ size
    - Match length of 40m
  - 15.25 Watts lost in Coils

```
--------------- LOAD DATA ---------------

Frequency = 3.91 MHz

Load 1          Voltage = 1133 V at 266.14 deg.
                Current = 1.332 A at 176.42 deg.
                Impedance = 4.3 + J 851 ohms
                Power = 7.625 watts

Load 2          Voltage = 1133 V at 86.02 deg.
                Current = 1.332 A at -3.69 deg.
                Impedance = 4.3 + J 851 ohms
                Power = 7.626 watts

                Total applied power = 100.4 watts

                Total load power = 15.25 watts
                Total load loss = 0.716 dB
```

DX ENGINEERING

NVIS Coverage

- The two circles show 200 and 300 miles centered on Portage County, OH.
- 300 miles covers all of Ohio and most of Pennsylvania
- HF Nets on Sat and Sun show this to be fairly reliable.



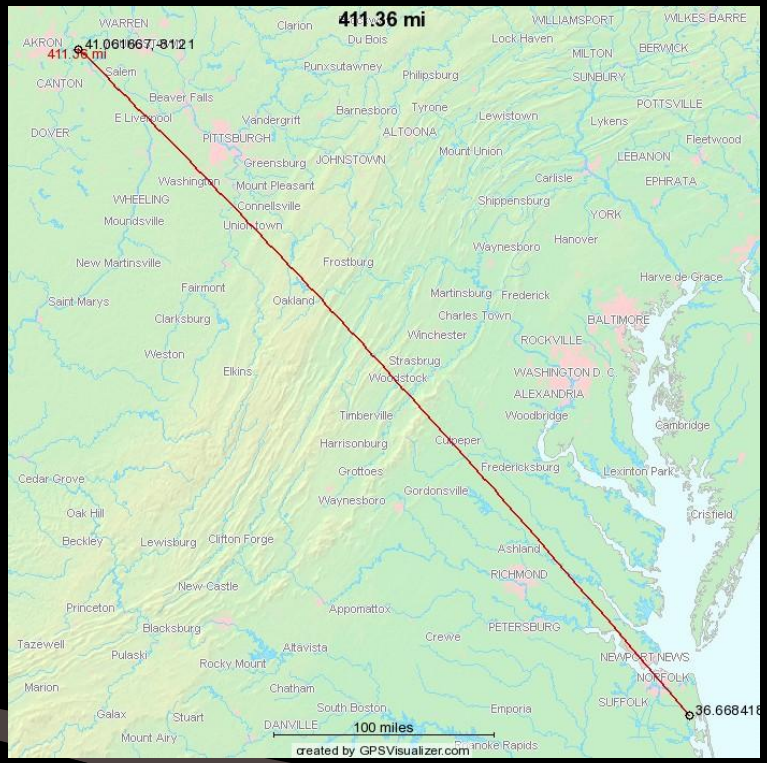
http://www.gpsvisualizer.com/

NVIS vs 6-BTV Examples

FT-8 40M

NVIS
235600 -3 0.3 896 ~ KD4UBM KN4DUF +04

BTV
235530 1 0.1 896 ~ KD4UBM KN4DUF +04



NVIS vs 6-BTV Examples

FT-8 40M

NVIS
235745 8 0.1 718 ~ OH1PH WY1G RRR

BTV
235715 10 0.1 718 ~ OH1PH WY1G -06

NVIS vs 6-BTV Examples

FT-8 40M

NVIS
235400 -24 -0.1 1033 ~ LB4T I1BEP JN34

BTV
235430 -16 -0.1 1033 ~ LB4T I1BEP JN34

NVIS vs 6-BTV Examples

Listening to net control on the Wolverine SSB net on 80 Meters

NVIS vs 6-BTV Examples

Questions?