

# REGIONAL ECOMM NVIS

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Special thanks to original work by

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[Near Vertical Incident Scattering Antenna \(vcars.org\)](http://vcars.org)

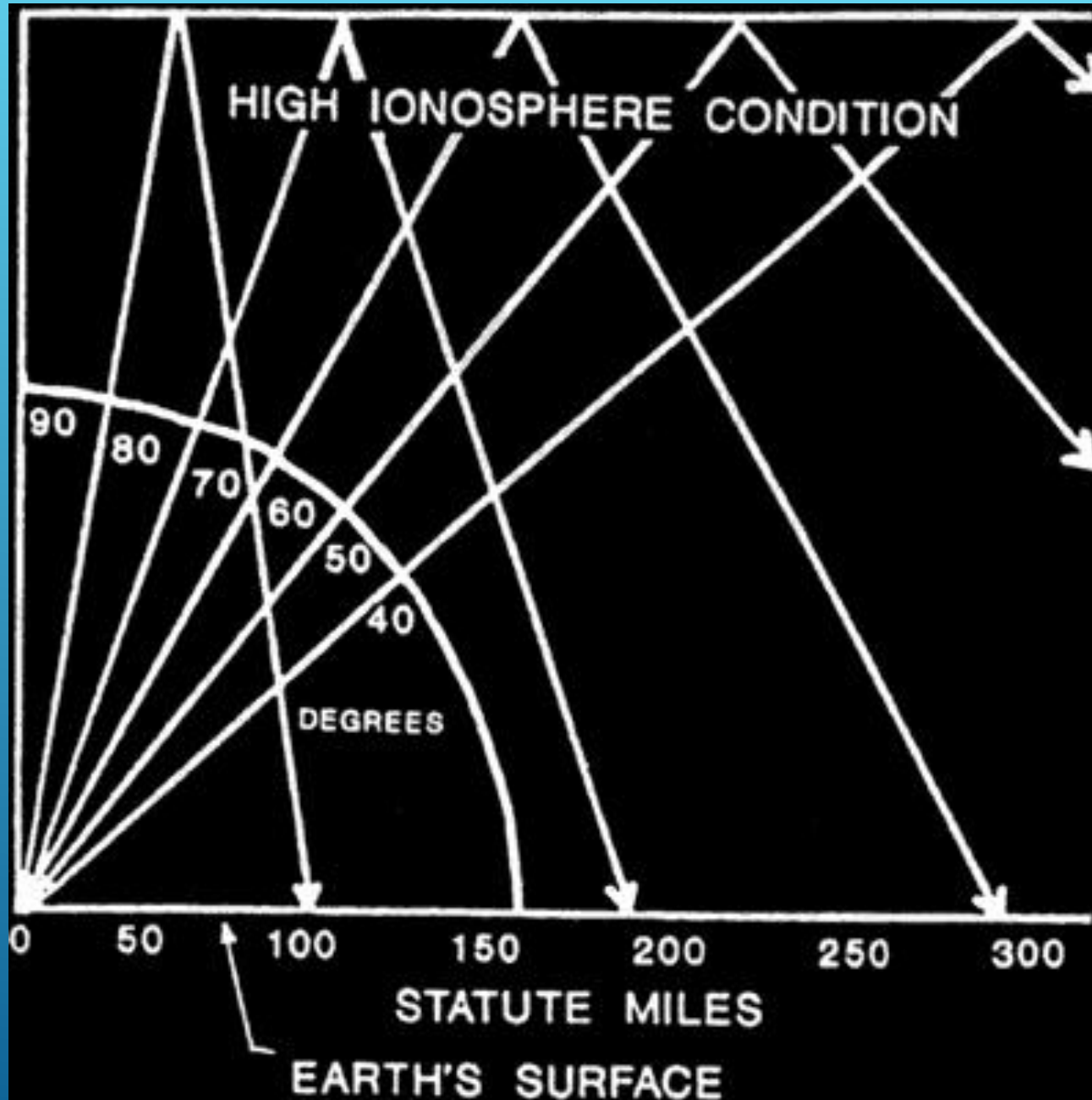


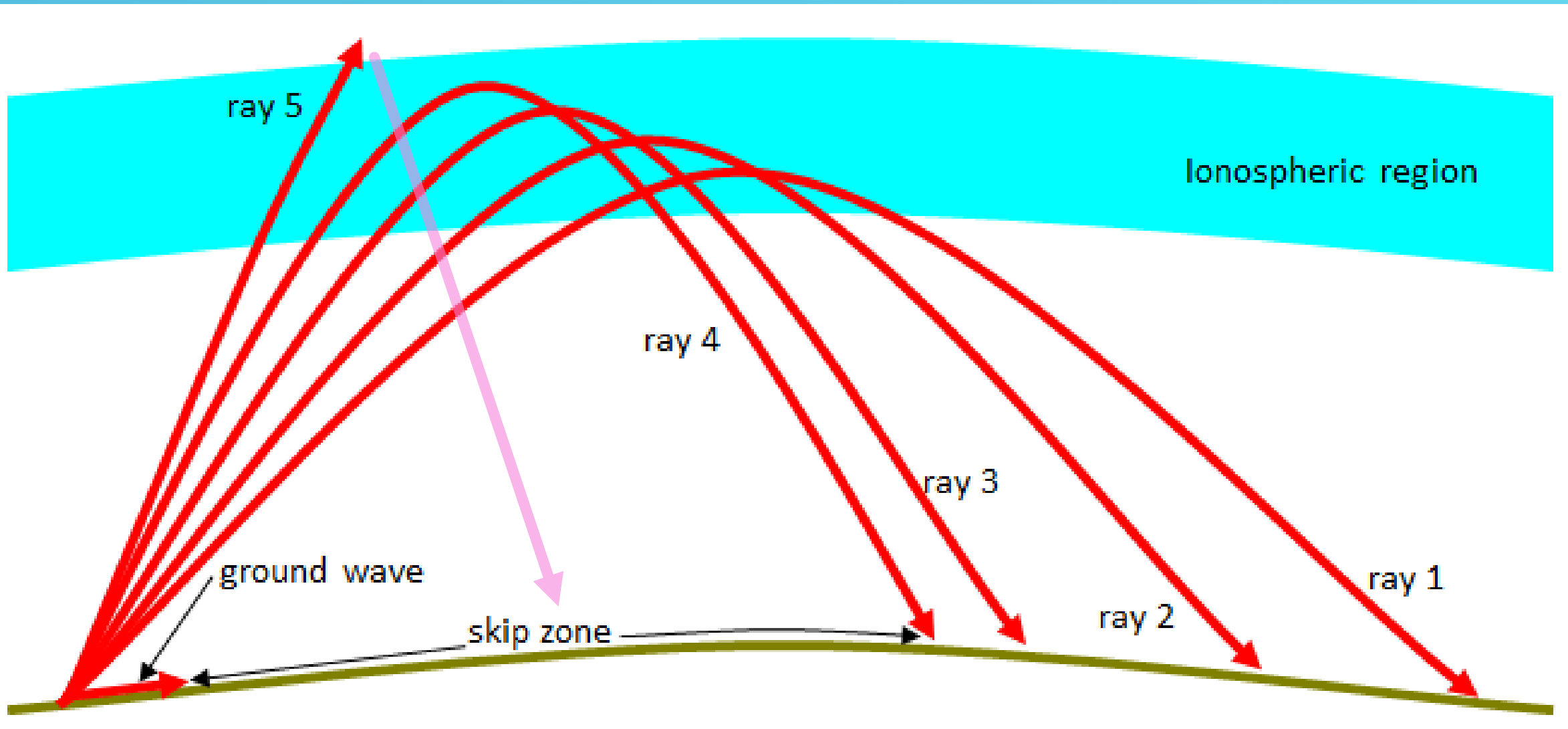
- ▶ Show the basic principle of operation
- ▶ Review the propagation concepts
- ▶ Antenna patterns and SWR plots
- ▶ Bill of materials
- ▶ Pictorial review of components
- ▶ Operational issues when deployed at various locations
- ▶ Additional resources
- ▶ Closing

## OVERVIEW OF PRESENTATION

- ▶ VHF-UHF mobile or base simplex 5-20 miles
  - ▶ Square root of antenna height times 1.2  
(20 feet = 6 miles) (100 ft = 12 miles)
- ▶ VHF-UHF repeater operation 50-90 miles
- ▶ HF 80m-40m-60m **0-400 miles**
  - ▶ Ground wave (very terrain dependent) 0-35 miles depend on frequency
  - ▶ Near Vertical Incident Skywave (NVIS)
  - ▶ Configuration of antenna determines concentration of radiated power
  - ▶ Refraction a function of incident angle and ionization concentration
  - ▶ Back Scatter (even if most of the signal penetrates some will be reflected)

## EFFECTIVE COMMUNICATION RANGE IN ECOMM



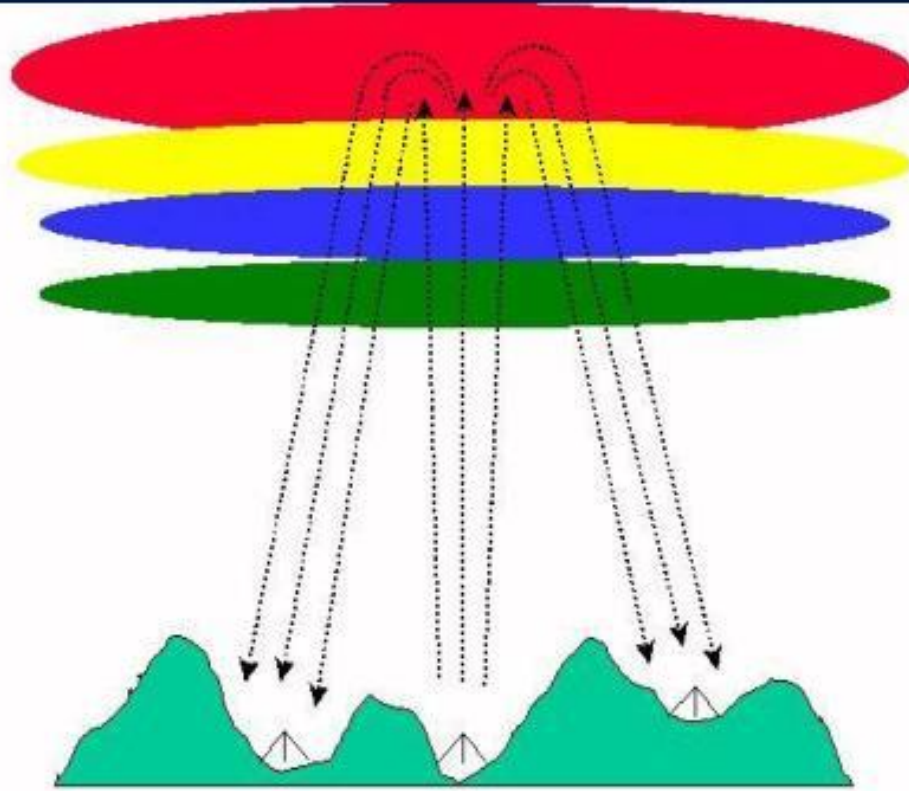


- ▶ At some critical angle most of the radio power will penetrate the ionization layer and travel in to space. (Most but not all)
- ▶ Some of the energy will be reflected back to earth and this is often referred to as back scatter.
- ▶ It is just like looking at a piece of glass. You can often see a weak reflection of your self in the glass and this is exactly the same phenomena that is being utilized in NVIS

RAY 5

# The Ionosphere

Layered  
ionosphere



F2: 250-320 km

F1: 150-210 km

E: 100-120 km

D: 70 - 90 km

Remote  
station 1

Remote  
station 2

Base  
station

Illustration courtesy of the University of Ulster Communications Centre

DIPOLE\_0.1

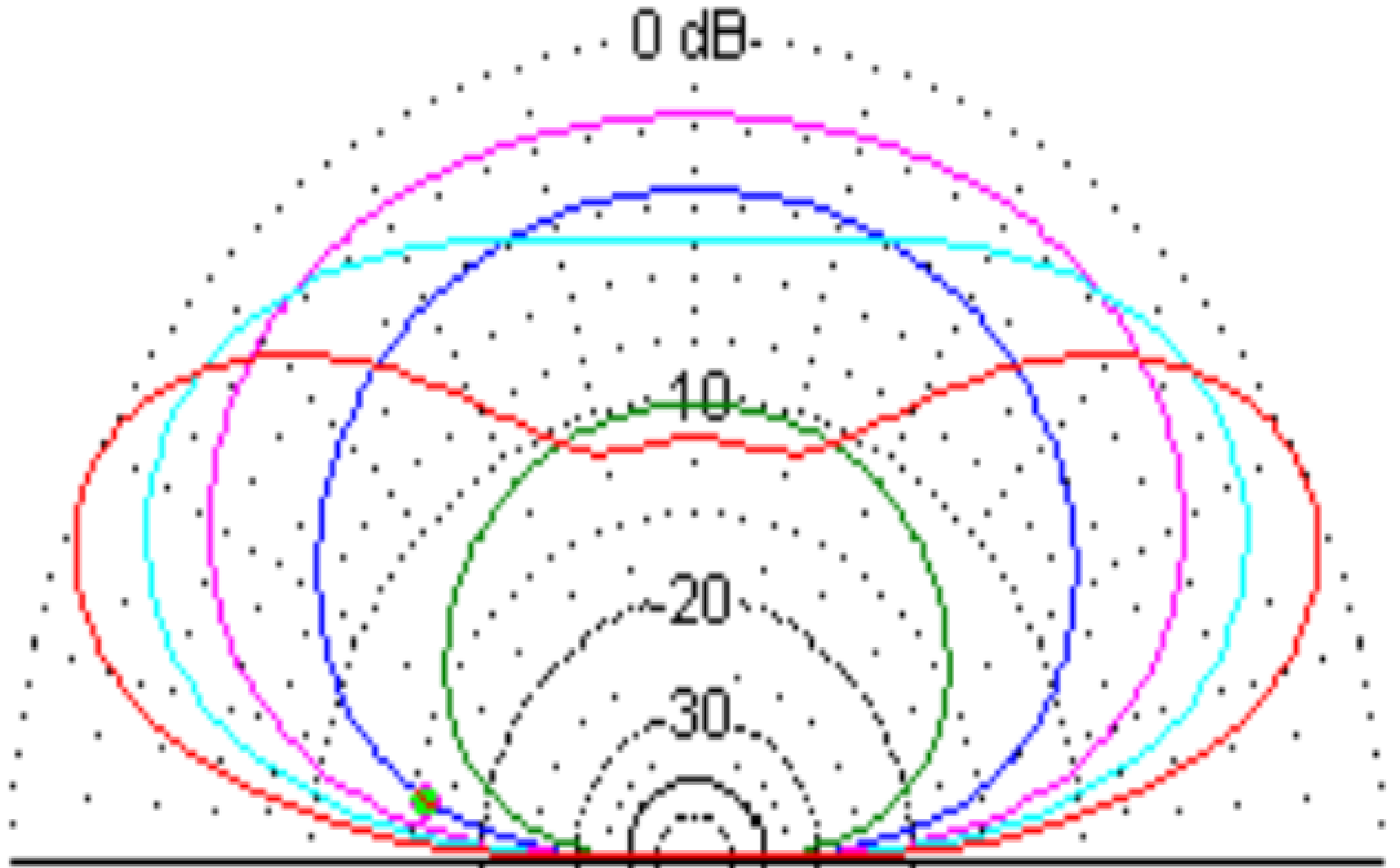
DIPOLE\_0.03

DIPOLE\_0.25

DIPOLE\_0.37

DIPOLE\_0.5

As the dipole gets closer to the ground most of the energy is directed at high angles





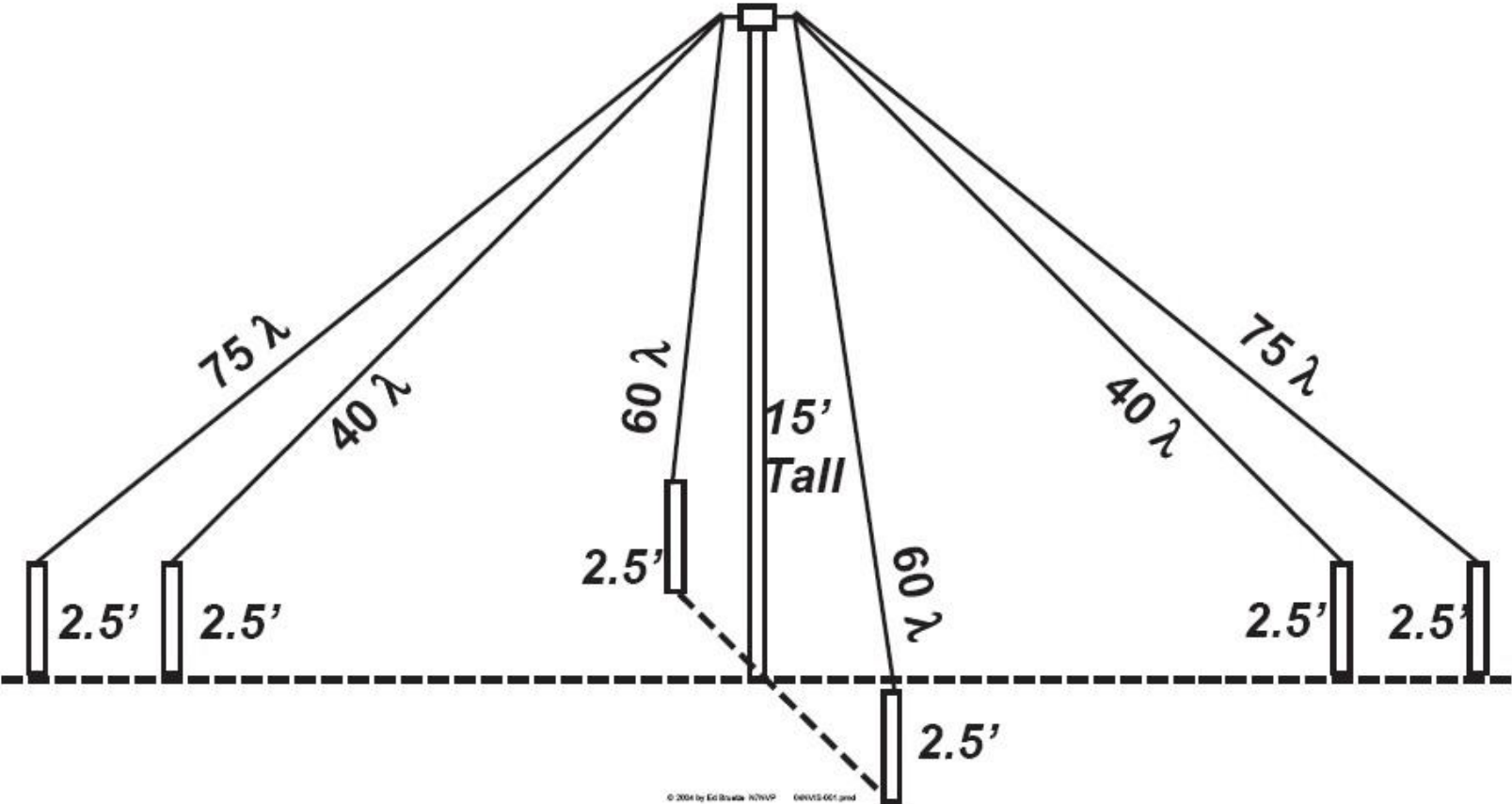
- ▶ Dependent on refraction critical frequency, ionization and angle
- ▶ Some back scatter signal even if most penetrates the layer
- ▶ Ground wave limited based on terrain
- ▶ RF radiated power verse angle from the horizon based on height
- ▶ SWR band width and dip affected by soil, trees, and buildings in near proximity (with in 40 meters)

## CONCEPT REVIEW

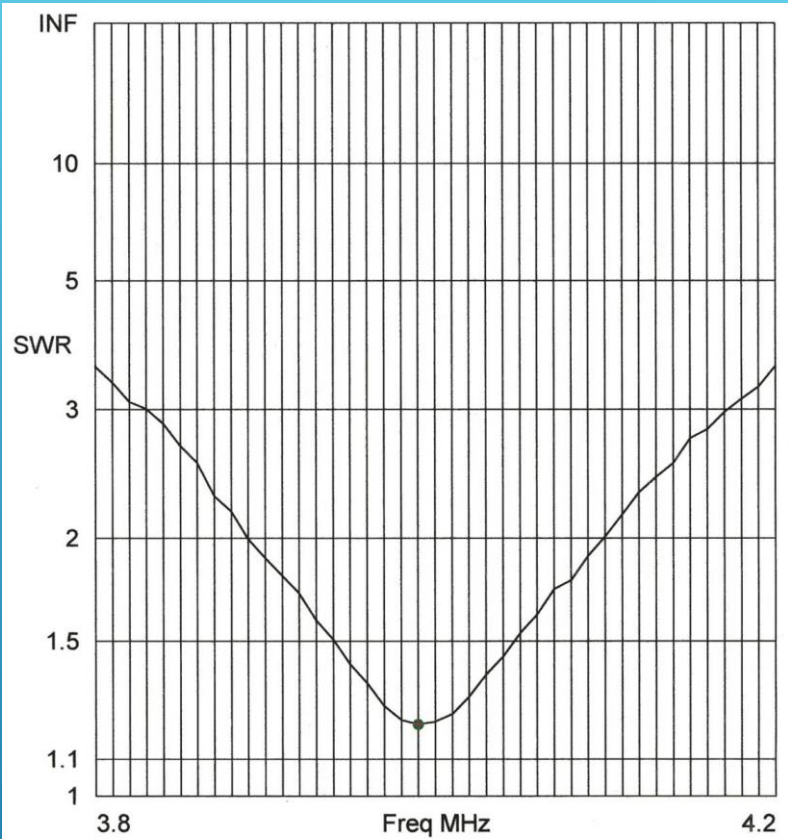
- ▶ Great design by W6QJI, N7NVP
- ▶ 80 meters, 60 meters, and 40 meters (all ECOMM frequencies)
- ▶ Some directionality as a cross between dipole and inverted V
- ▶ Mostly omni directional
- ▶ Very good SWR band width and tuning dip at key points in band
- ▶ A single person can erect the antenna in about 15 minutes
- ▶ Most of the time untangling the wire ends

## PRACTICAL 3 BAND NVIS

# NVIS Tri-Band Antenna for 75, 60, & 40 Meters. Side View

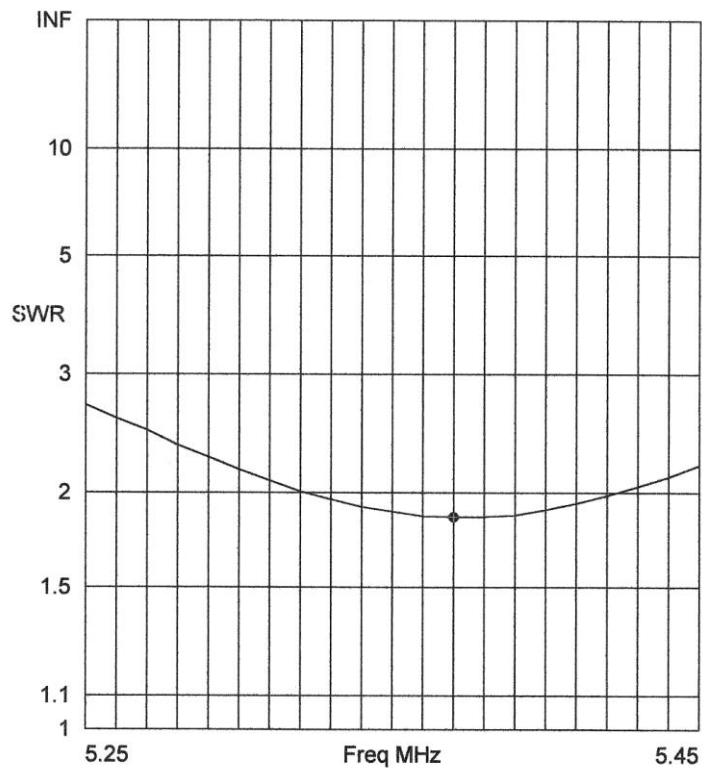


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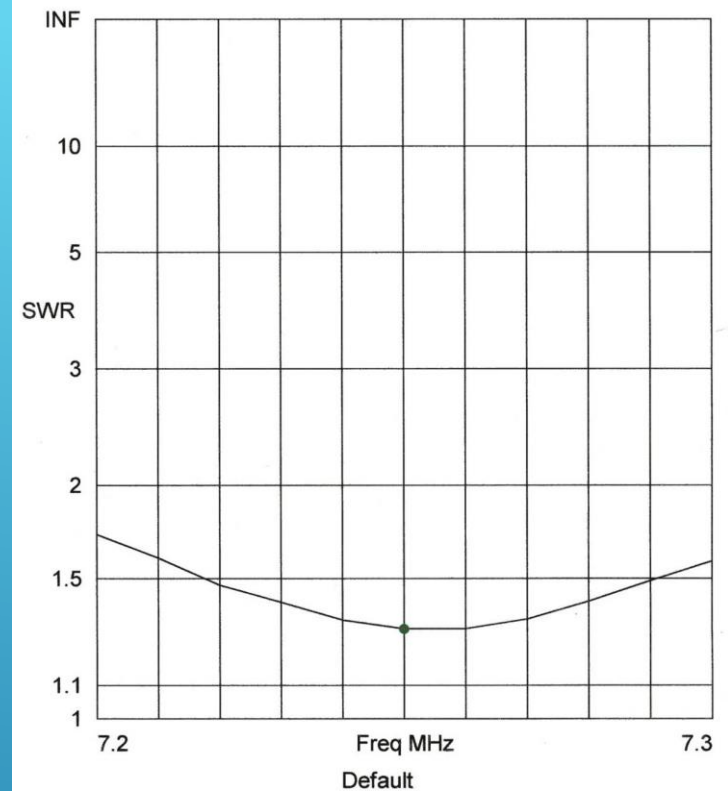
Freq 3.99 MHz  
 SWR 1.21  
 Z 59.72 - j 3.177 ohms

Source # 1  
 Z0 50 ohms



Freq 5.37 MHz  
 SWR 1.85  
 Z 92.71 + j 0.5452 ohms

Source # 1  
 Z0 50 ohms



Freq 7.25 MHz  
 SWR 1.3  
 Z 64.62 - j 1.904 ohms

Source # 1  
 Z0 50 ohms

Item	Quantity	Cost
Wire any gauge stranded 10AWG-18AWG 2 pieces 68 ft, 2 pieces 50 ft, 2 pieces 37 ft	300 ft	\$40.00
2 inch PVC pipe 10 ft lengths	2	\$36.00
1 inch PVC pipe 18 inches	6	\$8.00
Stakes 24 inch ½ inch diameter	7	\$35.00
PL259	1	\$1.50
Insulated cord 4 ft	6	\$8.00
Coax 50 ft	1	\$35.00
Ring lugs	2	\$0.10
Splice	1	\$0.20
Total		\$163.80

- ▶ Cutting the wire
- ▶ Cutting 7.5 ft 2 inch dia pipe
- ▶ Cutting 30 inch long 1 inch dia pipe
- ▶ Coupling the two 7.5 feet vertical support
- ▶ Cut notch in bottom of vertical support
- ▶ Building the pl239 connection
- ▶ Wire end supports

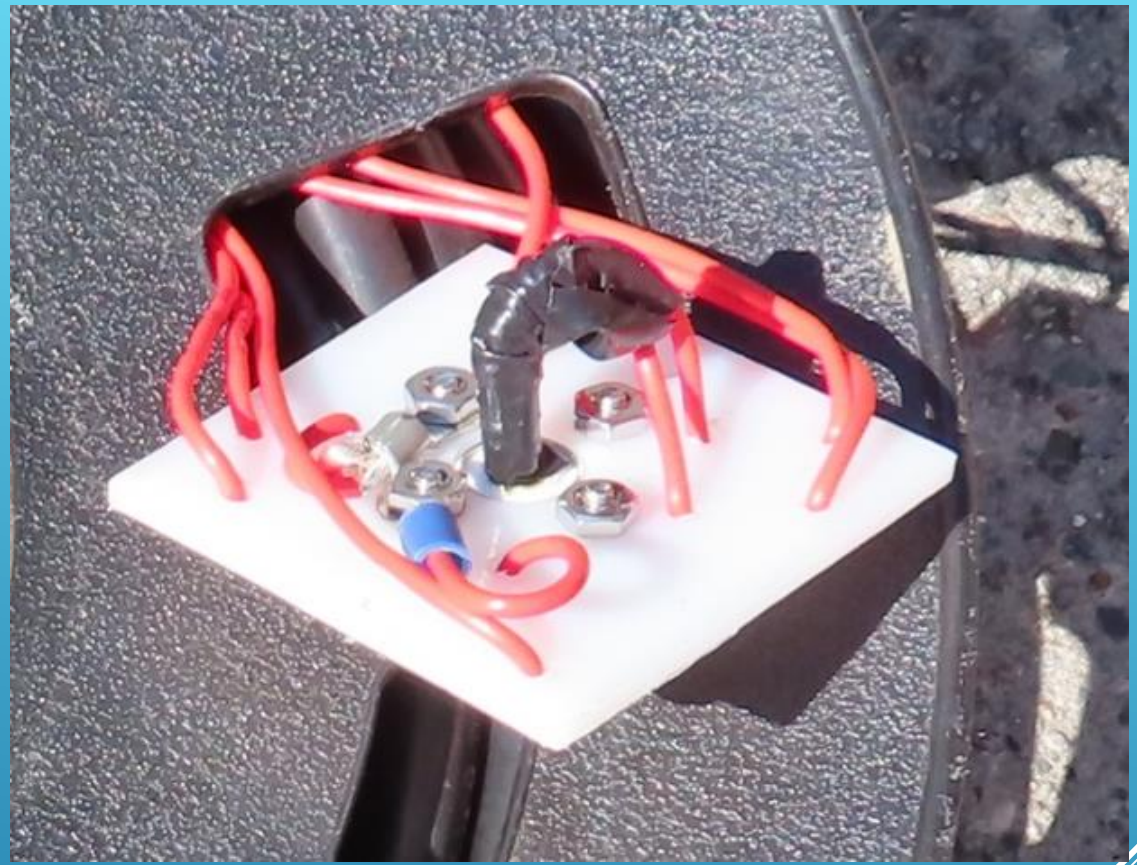
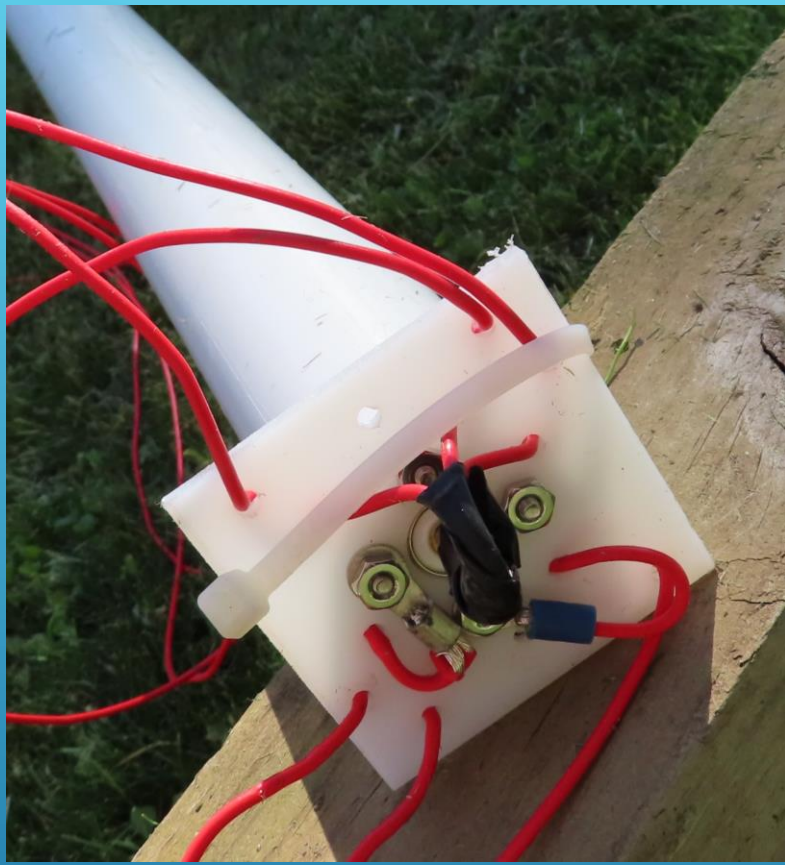
## BUILDING THE ANTENNA





# WIRE MANAGEMENT





## WIRE CONNECTIONS



VERTICAL SUPPORT



WIRE END SUPPORTS



ADJUSTABLE WIRE END CORD



DEPLOYED ANTENNA

- ▶ Cut the wire long so it could be tuned up
- ▶ Had to tune the individual bands by trimming the ends
- ▶ When set up at new location the SWR curves shifted a small amount
- ▶ The radio built in tuner was more than able to tune into the shifted SWR
- ▶ Made contacts on all three bands while field deployed

NOTHING WORKS PERFECT FIRST TIME



- ▶ [nvis\\_antenna\\_tri-band\\_web\\_ver.ppt \(live.com\)](#)
- ▶ [NVIS \(dxengineering.com\)](#)

ADDITIONAL LINKS



- ▶ Pretty effective on all three bands
- ▶ Simple build methods
- ▶ Easy for one person to put up
- ▶ Will vary based on location conditions
- ▶ Moderate cost \$170.00
- ▶ Stores in small space and transports using luggage rack, truck or van
- ▶ No special tools required to build

## SUMMARY