Employment

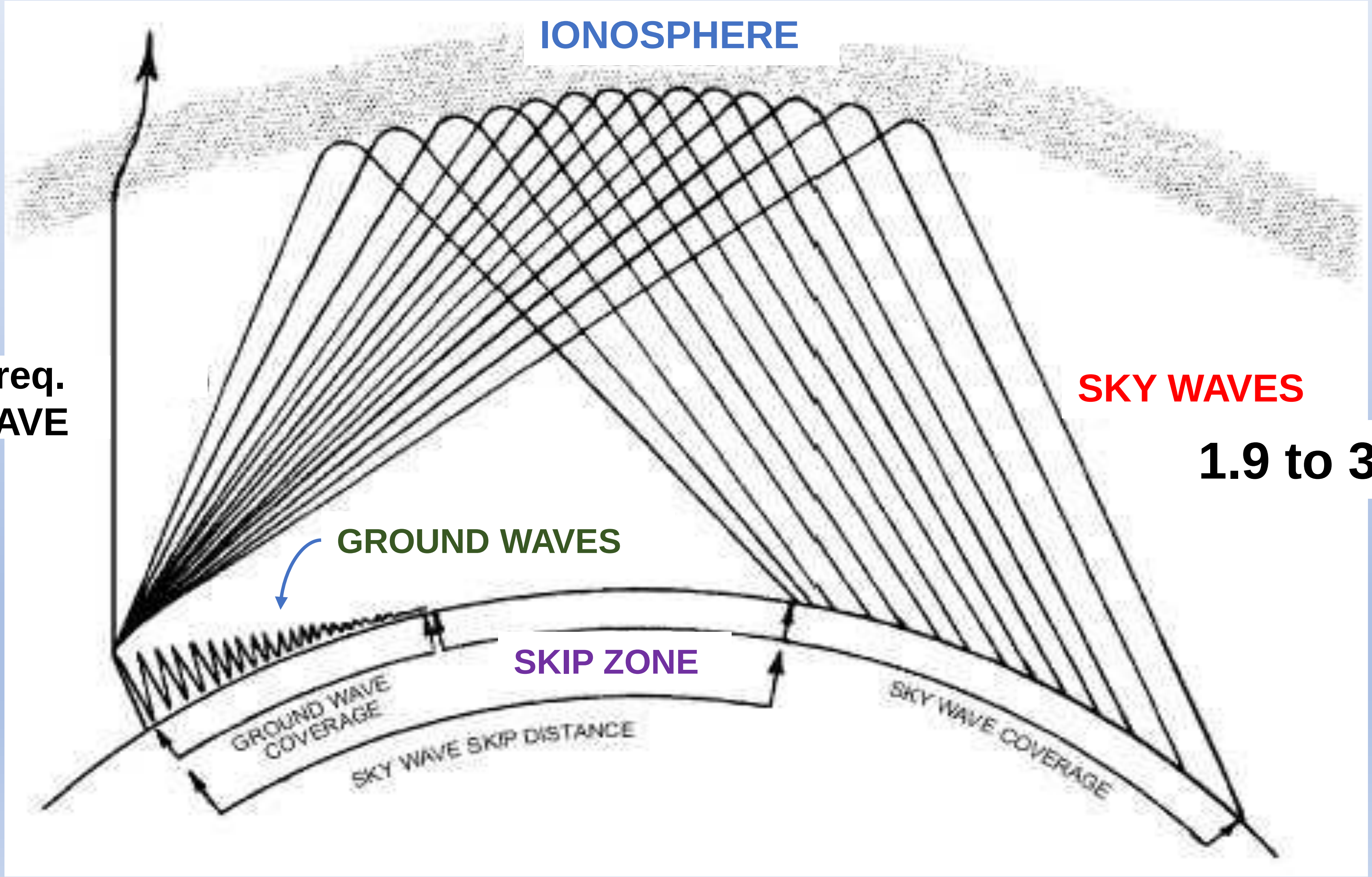
B2 Bomber

B-1 Bomber

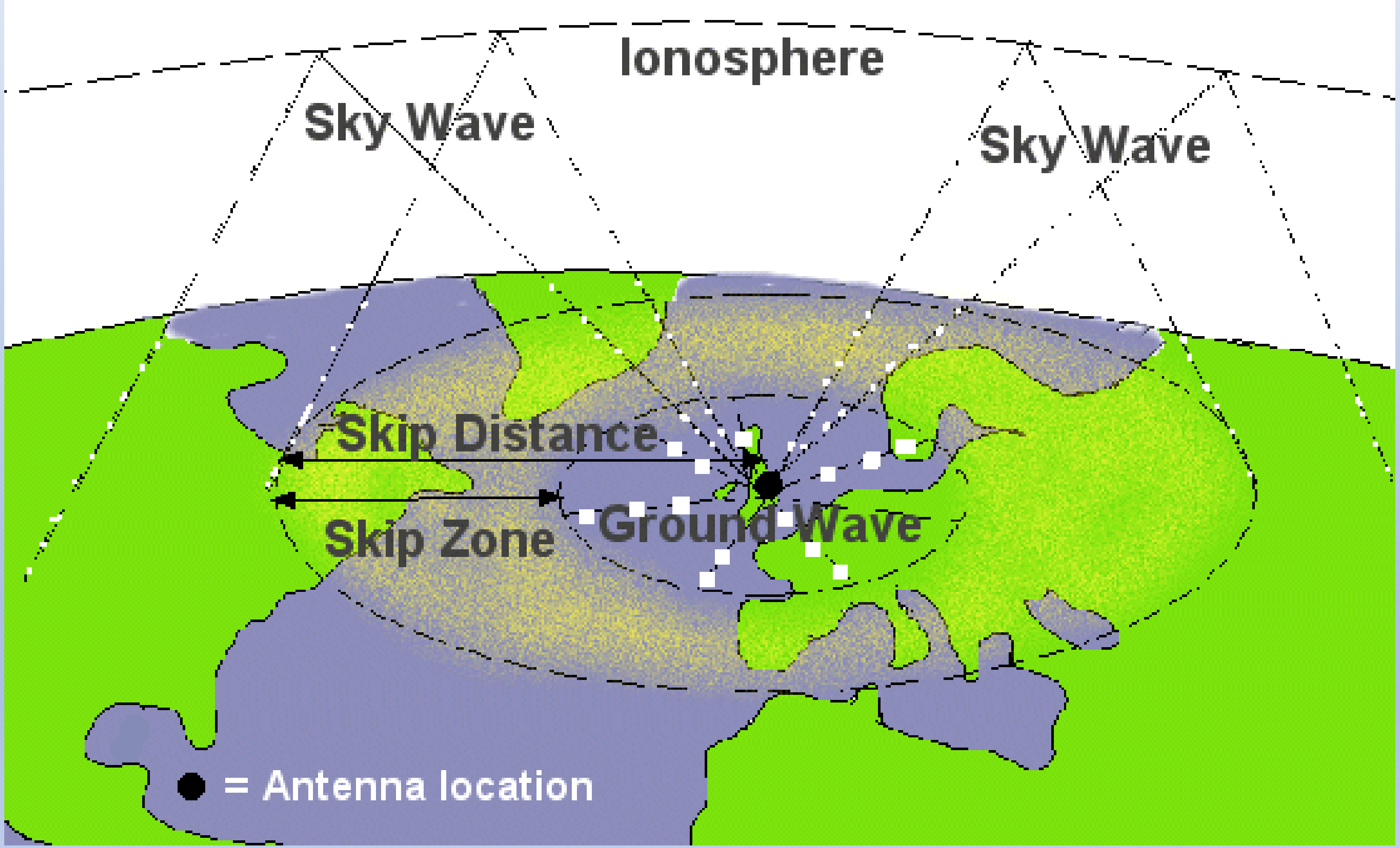
Antennas
N V I S

Near Vertical Incident
Skywave

Sky Waves & Ground Waves



Normal HF Propagation



Frequency Band Characteristics

Band	Range		Power
Shown in MHz	Ground Wave Miles	Sky Wave Miles	Watts
HF 1. to 30	0 to 50	1000 to 8000	100 to 1500
VHF 50.0 to 225	0 to 30	50 to 150	50 or less
UHF 420 to 1300	0 to 50	Xxxx	50 or less

Emergency Communication

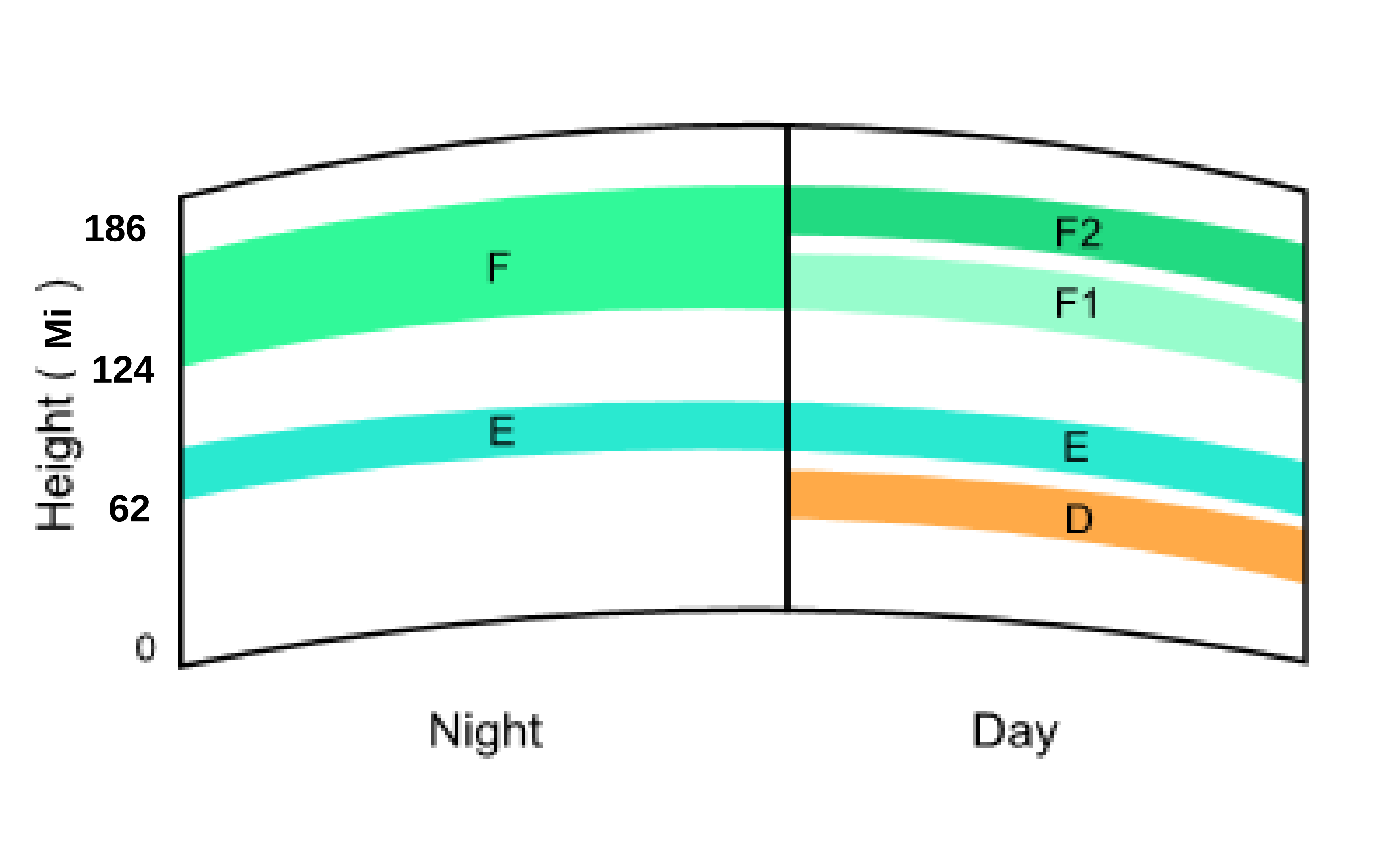
During disasters, communicators need to be able to reliably communicate with other stations, EOC & other sites via HF

- 75/80 meters
- 60 meters
- 40 meters
- 160 meters (Not Good NVIS Freq)

Near Vertical Incident Skywave

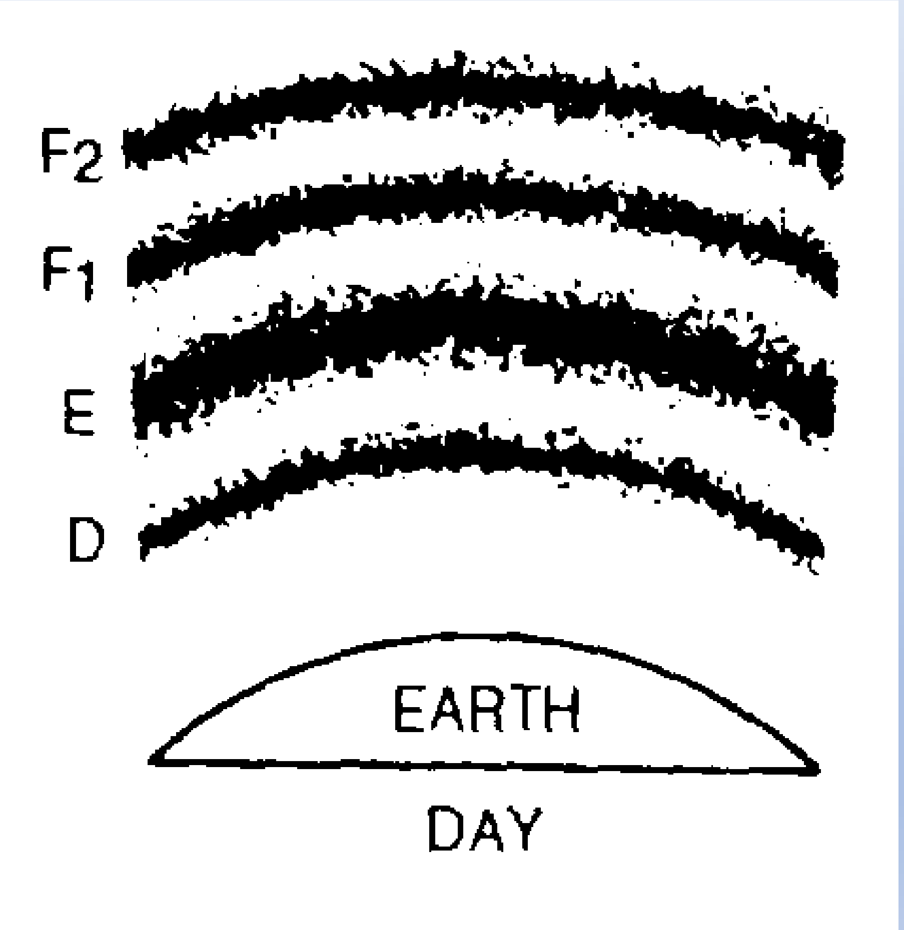
- **What is NVIS?**
  - It is an operating Strategy Not an Operating Mode
  - It involves;
    1. Choosing an appropriate frequency
    2. Choosing an appropriate antenna for that frequency
- During the Day time 40 Meters works well
- During Night time operations 80 Meters is a good choice

Ionospheric Layers

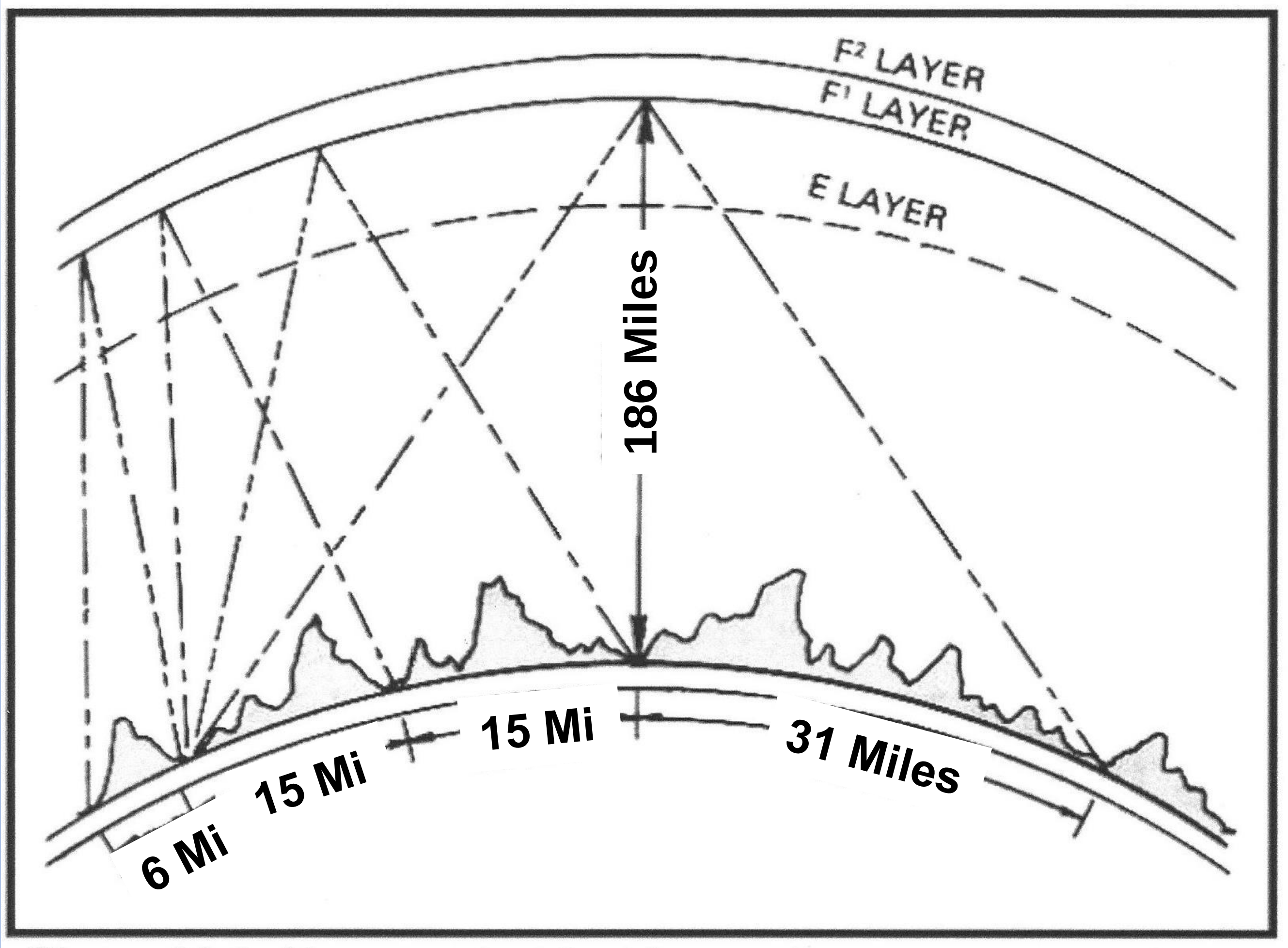


Ionospheric Layers

F2 LAYER: provides long-range HF communications; very variable; height and density change with time of day, season, and sunspot activity.
F1 LAYER: density depends on the angle of the sun; its main effect is to absorb HF waves passing through to the F2 layer.
E LAYER: depends on the angle of the sun: refracts HF waves during the day up to 20 MHz to distances of 1200 miles: greatly reduced at night.
D LAYER: reflects VLF waves for long-range communications; refracts IF and MF for short-range communications; has little effect on VHF and above; gone at night.



N V I S



How to get saturation coverage in the skip zone

CHEROKEE AMATEUR RADIO SOCIETY
WX4CAR

NVIS Range

N V I S

- GA ARES HF frequency's are ;
  1. 80M = 3.975 MHz (pri),
  2. 40M = 7.287.5 MHz (sec),
  3. 60 M = 5.330.5 MHz &
  4. 160M = 1.975 MHz (Night time, Long Antenna, High Power Not good NVIS)

Conductivity of the Terrain

- **The type of terrain determines ground conductivity.**
  - Flat prairie country has high conductivity and there is little absorption of the ground-wave by the earth.
  - Large bodies of water also have high conductivity.

Conductivity of the Terrain

- Mountainous, rugged, and broken country usually has low conductivity
- In areas where there are large mineral deposits, and in deep ravines and valleys, the signal may be absorbed completely by the soil

The Good and The Bad of NVIS

- **The GOOD**
  - NVIS techniques can dramatically reduce noise
  - A good NVIS antenna is erected easily
  - NVIS covers the area which is normally in the skip zone
  - NVIS requires no infrastructure such as repeaters or satellites.
  - Pure NVIS propagation is relatively free from fading.
  - Low areas and valleys are no problem for NVIS propagation.
  - With its improved signal/noise ratio and low path loss, NVIS works well with low power.

The Good and The Bad of NVIS

- **The Bad**
  - For best results, both stations should be optimized for NVIS operation. If one station's antenna emphasizes groundwave propagation, while another's emphasizes NVIS propagation, the results may be poor
  - NVIS doesn't work on all HF frequencies and bandwidths are relatively small for digital transmissions
  - Due to differences between daytime and nighttime propagation, a minimum of two different frequencies must be used to ensure reliable around-the-clock communications

N V I S

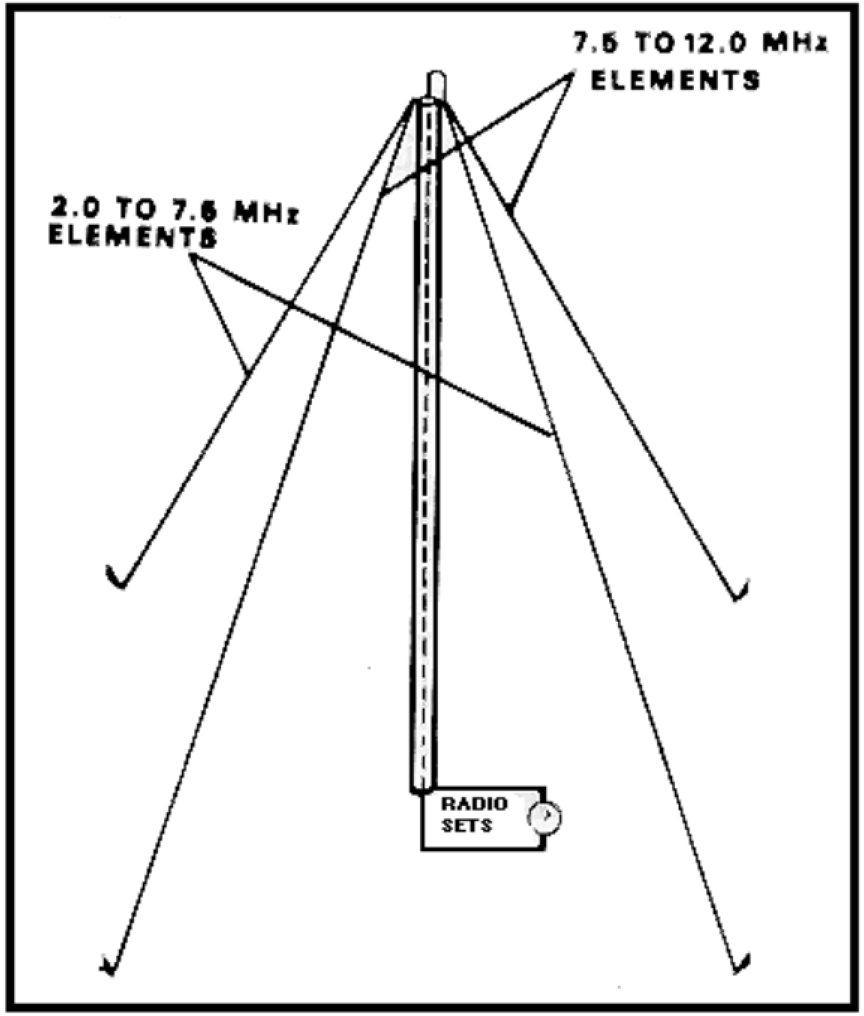
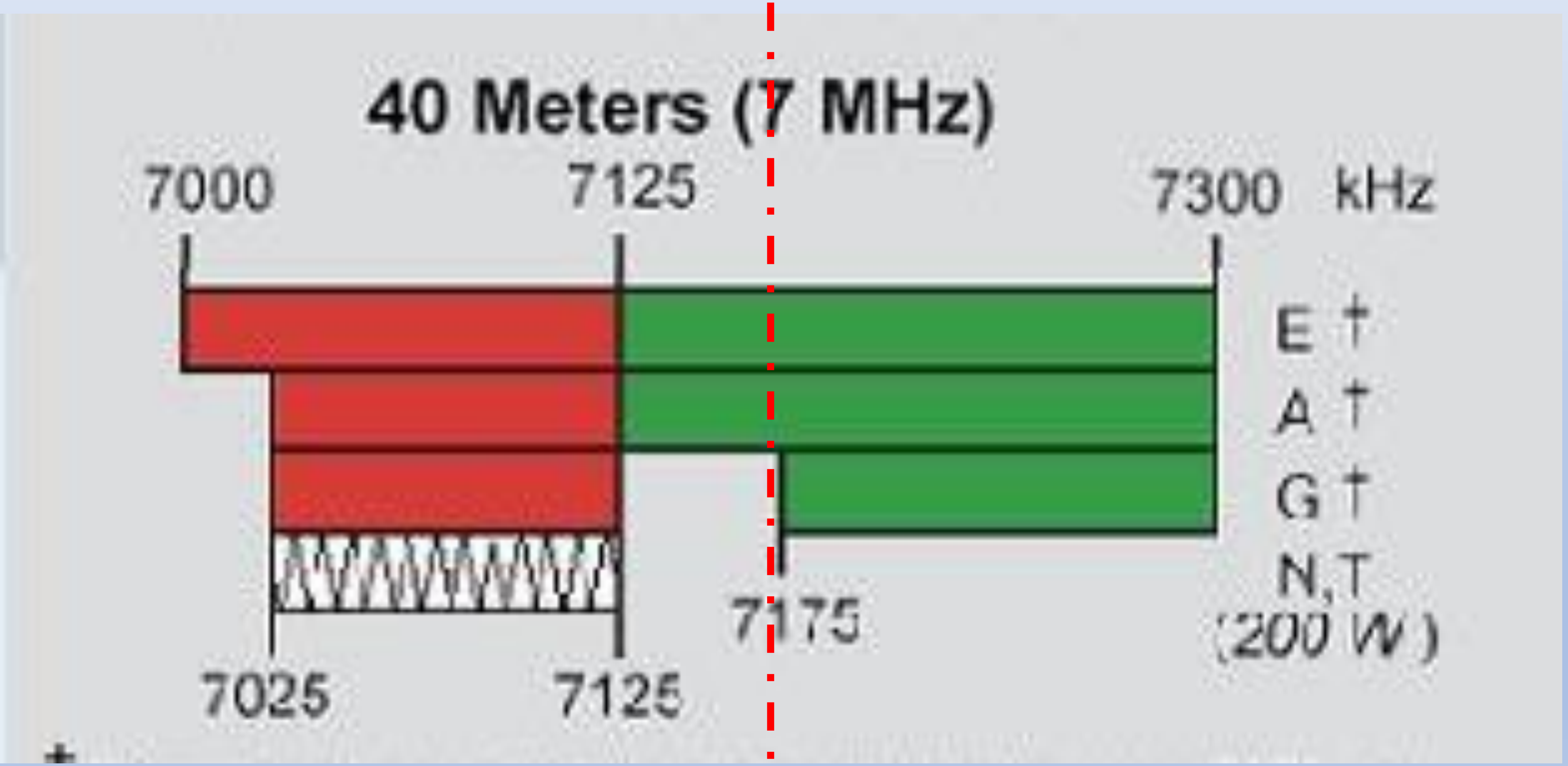


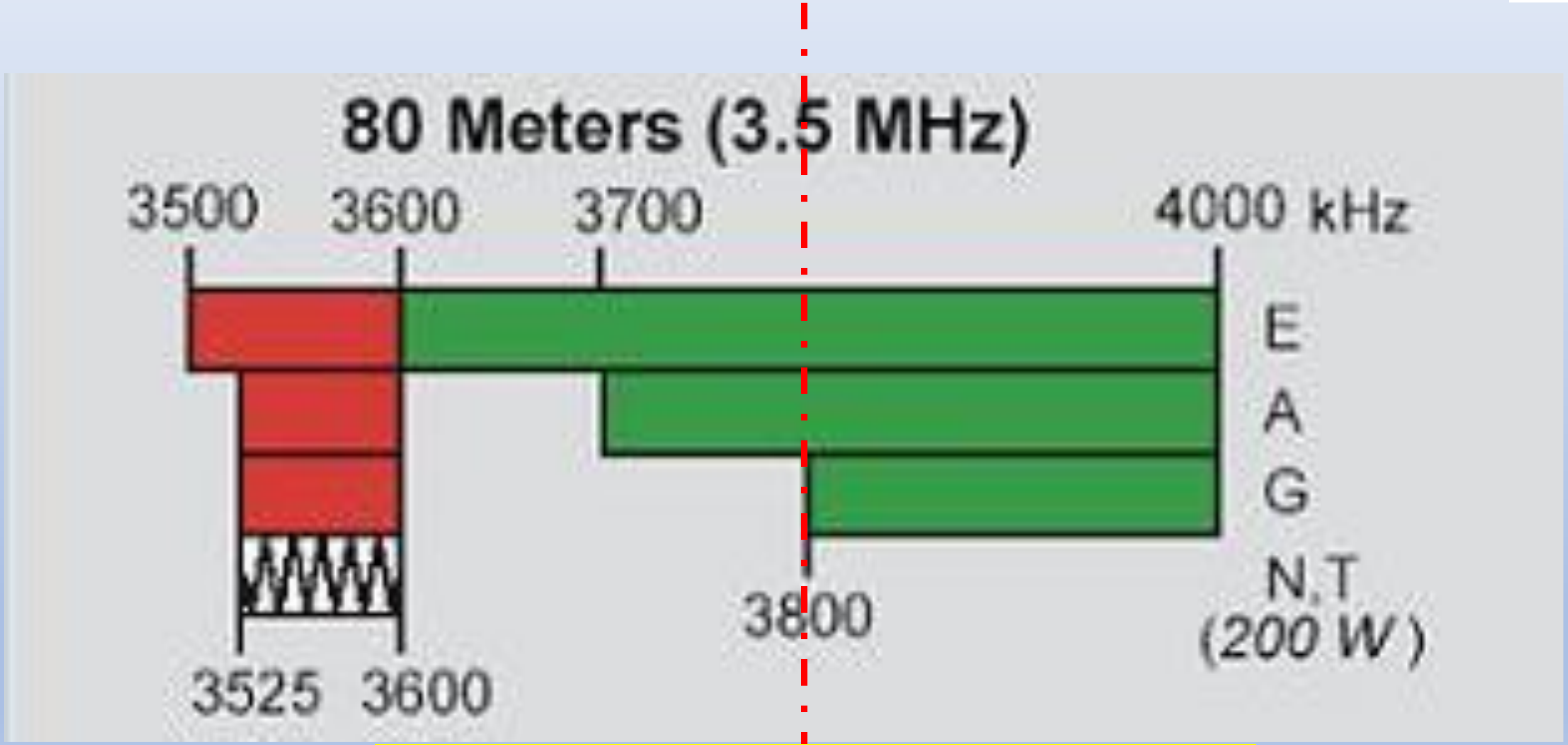
Figure 3-23. NVIS antenna, AS-2259/GR.

B. P. Amateur 40 Meter Freq.



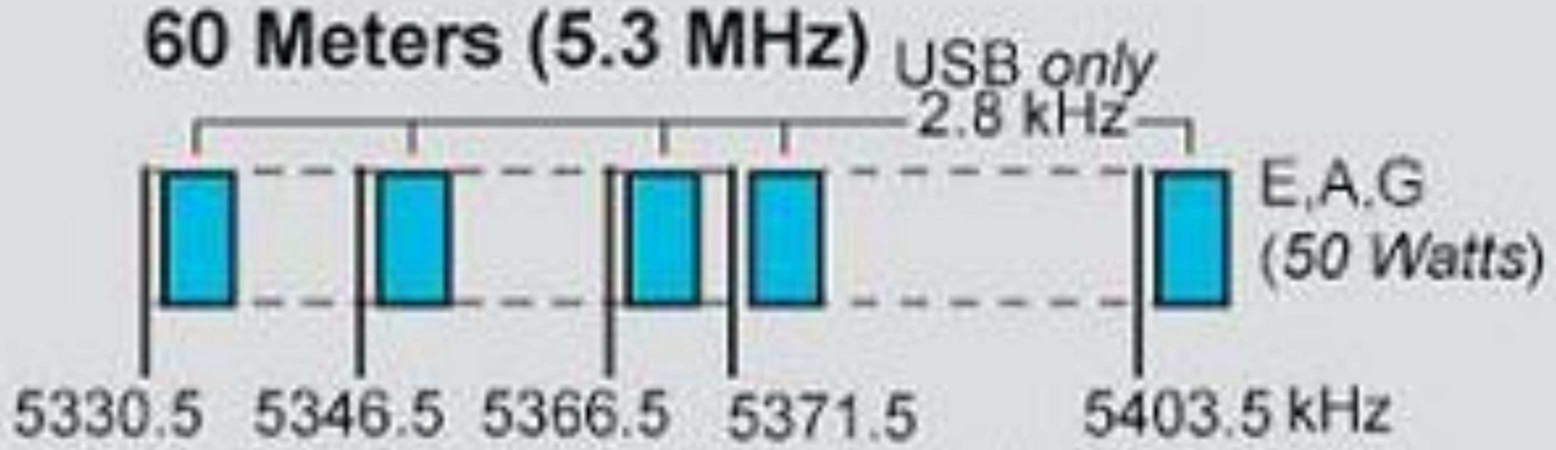
¼ Wave Dipole = 32 Ft. - 7.3”

B. P. Amateur 80 Meter Freq.



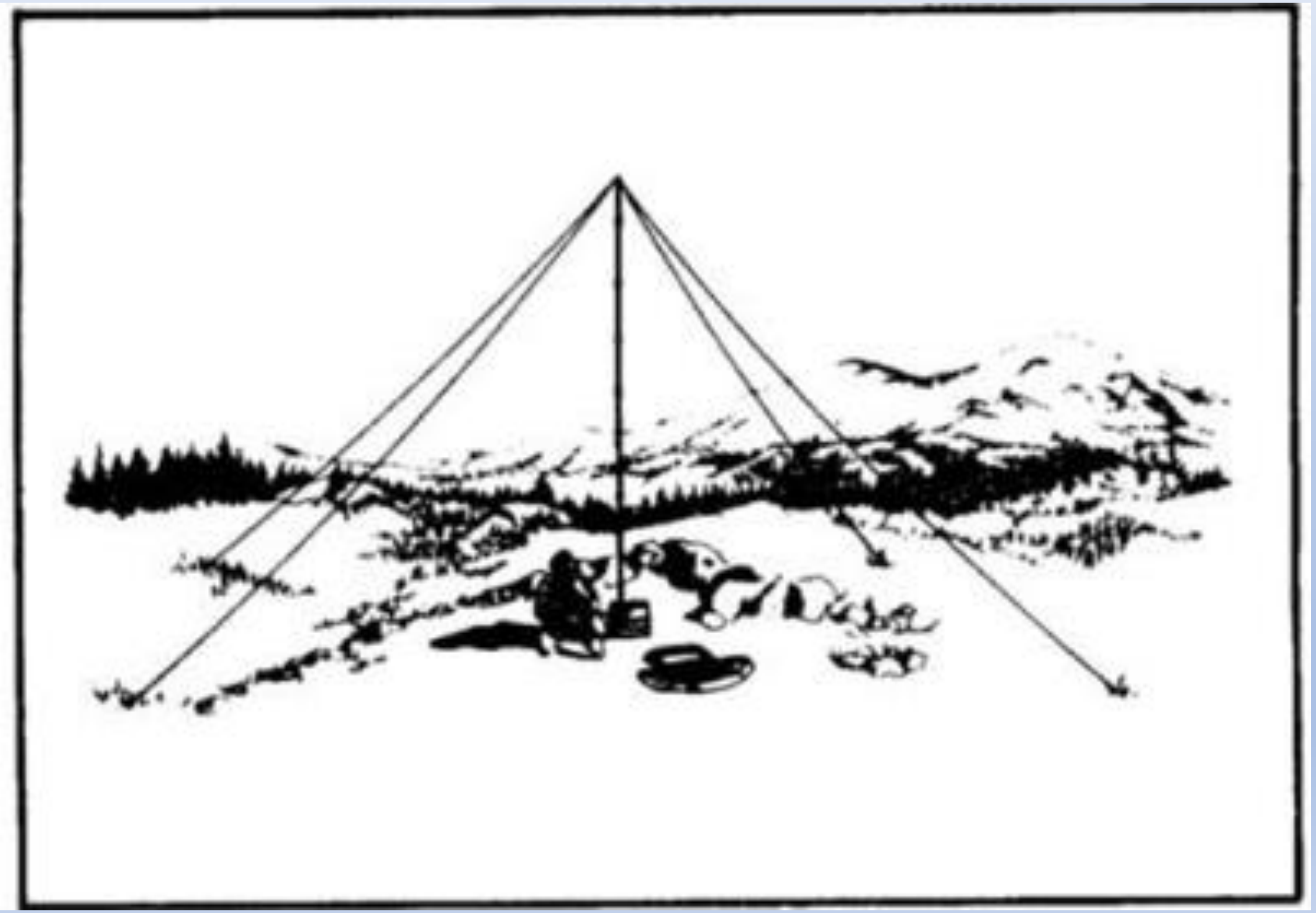
¼ Wave Dipole = 66 Ft. - 10.3”

Ham 60 Meter Frequency



General, Advanced, and Amateur Extra licensees may use the following five channels on a secondary basis with a maximum effective radiated power of 50 W PEP relative to a half wave dipole. Only upper sideband suppressed carrier voice transmissions may be used. The frequencies are 5330.5, 5346.5, 5366.5, 5371.5 and 5403.5 kHz. The occupied bandwidth is limited to 2.8 kHz centered on 5332, 5348, 5368, 5373, and 5405 kHz respectively.

US ARMY NVIS AS-2259/GR

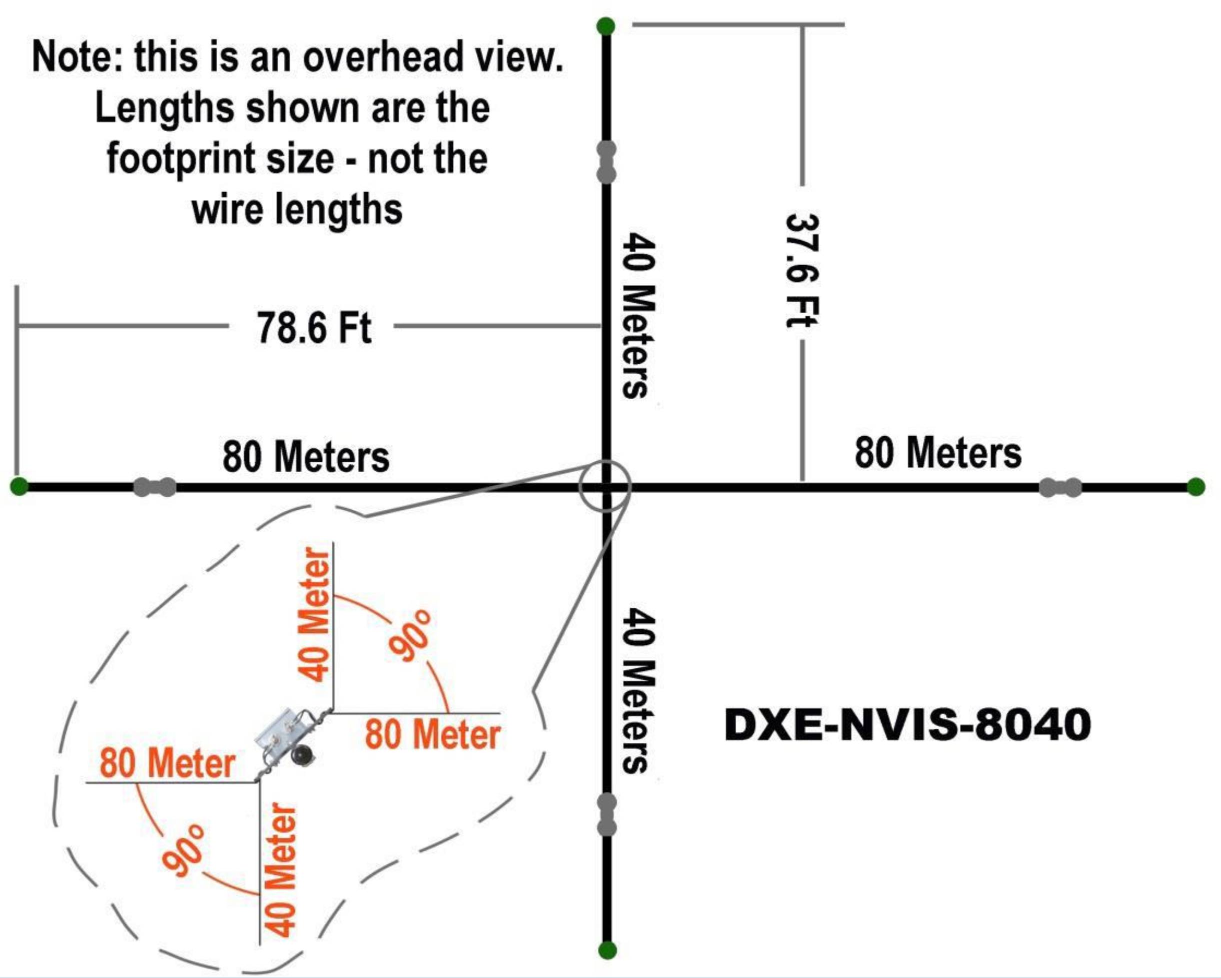


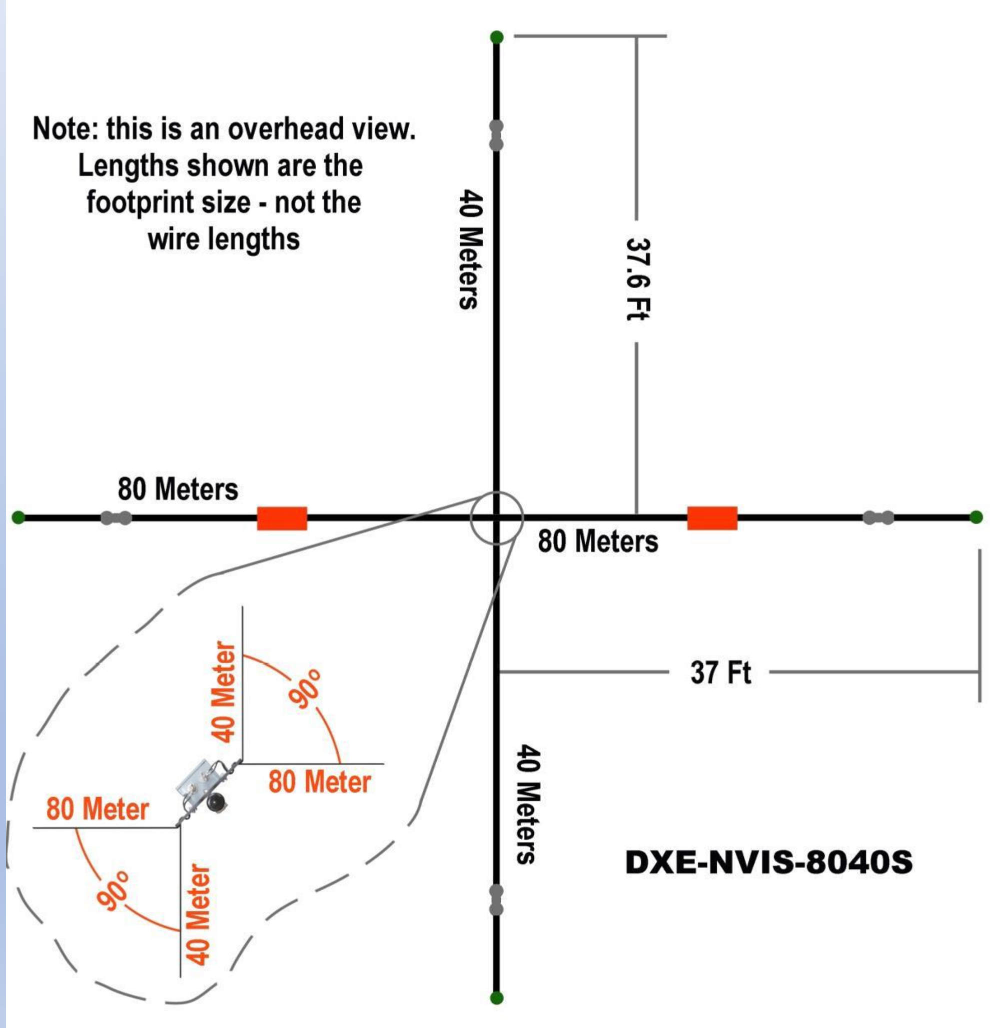
DX Engineering N V I S

Near Vertical Incidence Skywave (NVIS) Antenna

DXE-NVIS-8040 $363.60
DXE-NVIS-8040S $430.64

N V I S


Note: this is an overhead view. Lengths shown are the footprint size - not the wire lengths
78.6 Ft
37.6 Ft
40 Meters
80 Meters
80 Meters
40 Meters
40 Meter
90°
80 Meter
80 Meter
90°
40 Meter
DXE-NVIS-8040

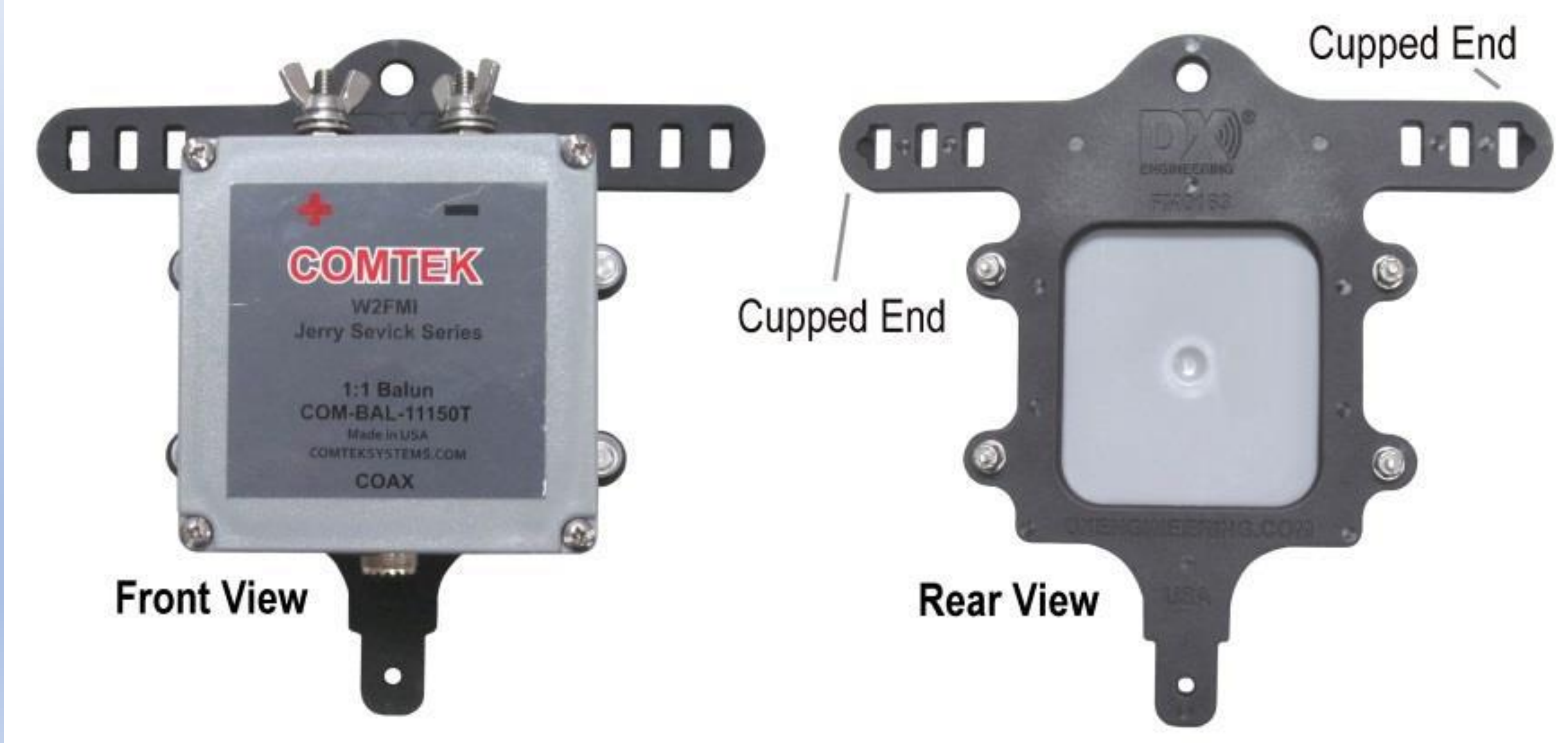

Note: this is an overhead view. Lengths shown are the footprint size - not the wire lengths
40 Meters
37.6 Ft
80 Meters
80 Meters
37 Ft
40 Meter
90°
80 Meter
80 Meter
90°
40 Meter
40 Meters
DXE-NVIS-8040S

N V I S

COMTEK Jerry Sevick W2FMI Series Current Baluns COM-BAL-11150T

Balun, W2FMI Series, Coax/Single Core, 1:1 Ratio, 1.8-54 MHz, Weatherproof NEMA Box, Each $104.99

N V I S



Cupped End
Cupped End
COMTEK
W2FMI
Jerry Sevick Series
1:1 Balun
COM-BAL-11150T
Made in USA
COMTEKSYSTEMS.COM
COAX
Front View
Rear View

Antenna Design

Dipole

- 2.15 dB gain over an Isotropic Radiator
- Balanced design
- Resonant on one band
- Traps can be added to make it multiband
- Fan Dipole
- Nominal 50 ohm impedance
- Gain increases with height (true for all antennas)
- Formula for calculating dipole length 468/F (MHz)

Let's Make a NVIS Antenna

Dipole Length Calculation

Wave Length Constant ***468*** */* ***Freq*** *MHz = ½ Wave Total Feet*

468/3.5 *MHz =* ***133.714/2*** *= 66.8571 Feet =*

66’-10 ¼” Per Side & Rounding Up = ***67’-0”***

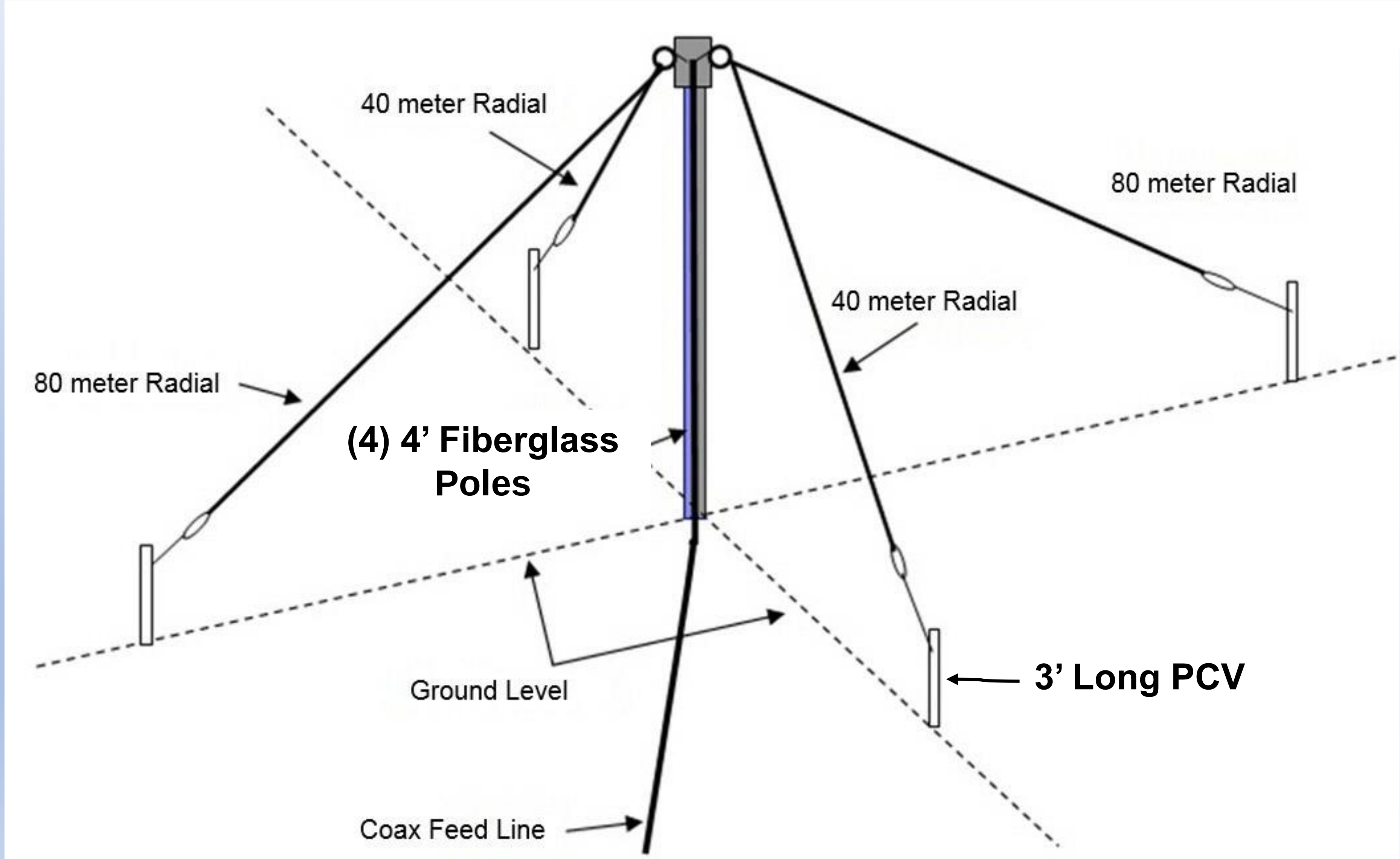
468/7.175 MHz = ***65.226****/2 = 32.613 Feet =*

32’-7 ¼” Per Side Rounding Up = ***33’-0”***

Fast - Easy Up - Antenna

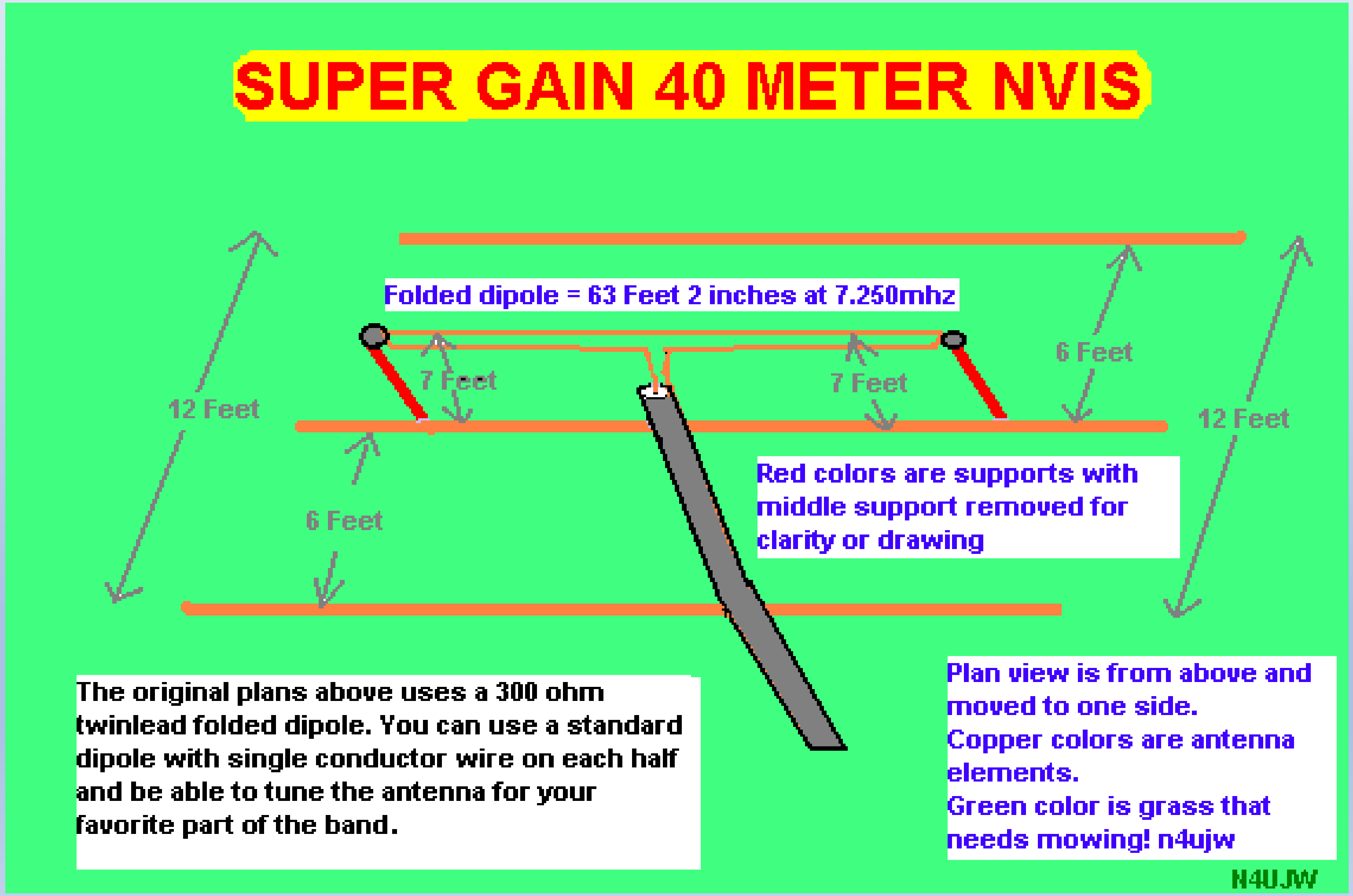
- Dipole, Packable,
- Length – Depends on Freq. and Antenna design
- Height – Depends on Radiation and Ground Effect

NVIS



40 meter Radial
80 meter Radial
40 meter Radial
80 meter Radial
(4) 4' Fiberglass Poles
Ground Level
3' Long PCV
Coax Feed Line

N V I S



From 73 Magazine
October 1969

CHEROKEE AMATEUR RADIO SOCIETY
WX4CAR

VSWR Readings and Power Loss

SWR Reading	% OF LOSS	ERP*	Power Output in Watts	Power Loss in Watts
1.0:1	0.0%	100.0%	100	0.0
1.1:1	0.2%	99.8%	99.8	0.2
1.2:1	0.8%	99.2%	99.2	0.8
1.3:1	1.7%	98.3%	98.3	1.7
1.4:1	2.8%	97.2%	97.2	2.8
1.5:1	4.0%	96.0%	96.0	4.0
1.6:1	5.3%	94.7%	94.7	5.3
1.7:1	6.7%	93.3%	93.3	6.7
1.8:1	8.2%	91.8%	91.8	8.2
2.0:1	11.1%	88.9%	88.9	11.1
2.2:1	14.1%	85.9%	85.9	14.1
2.4:1	17.0%	83.0%	83.0	17.0
2.6:1	19.8%	80.2%	80.2	19.8
3.0:1	25.0%	75.0%	75.0	25.0
4.0:1	36.0%	64.0%	64.0	36.0
5.0:1	44.4%	55.6%	55.6	44.4
6.0:1	51.0%	49.0%	49.0	51.0
7.0:1	56.3%	43.8%	43.8	56.3
8.0:1	60.5%	39.5%	39.5	60.5
9.0:1	64.0%	36.0%	36.0	64.0
10.0:1	66.9%	33.1%	33.1	66.9

SWR Readings & Power

	SWR Reading	% OF LOSS	Power Output in Watts	Power Loss in Watts
1	1.0:1	0.00%	100.00	0.00
2	1.1:1	0.20%	99.80	0.20
3	1.2:1	0.80%	99.20	0.80
4	1.3:1	1.70%	98.30	1.70
5	1.4:1	2.80%	97.20	2.80
6	1.5:1	4.00%	96.00	4.00
7	1.6:1	5.30%	94.70	5.30
8	1.7:1	6.70%	93.30	6.70
9	1.8:1	8.20%	91.80	8.20
10	2.0:1	11.10%	88.90	11.10

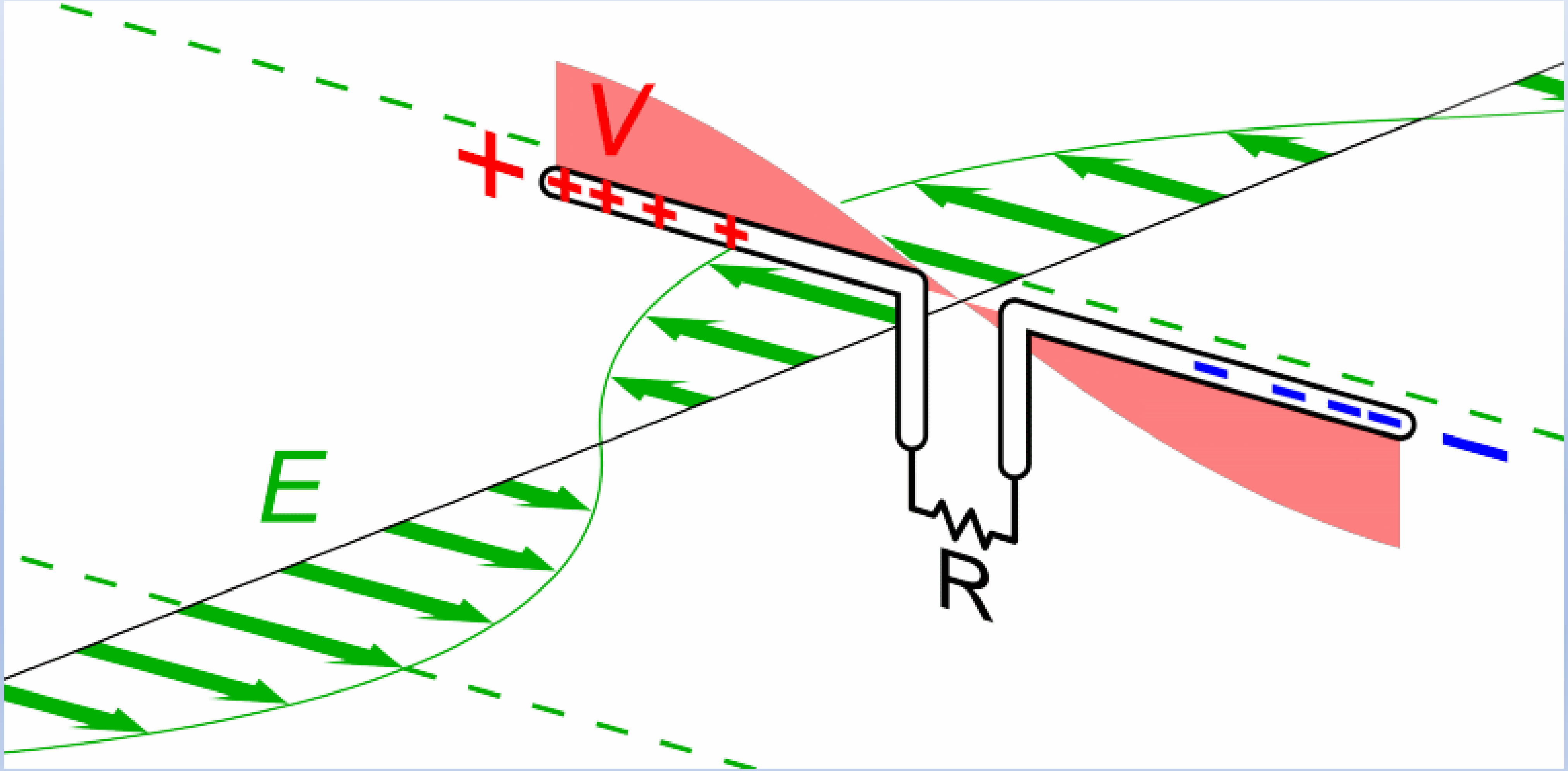
SWR Readings & Power

CHEROKEE AMATEUR RADIO SOCIETY WX4CAR

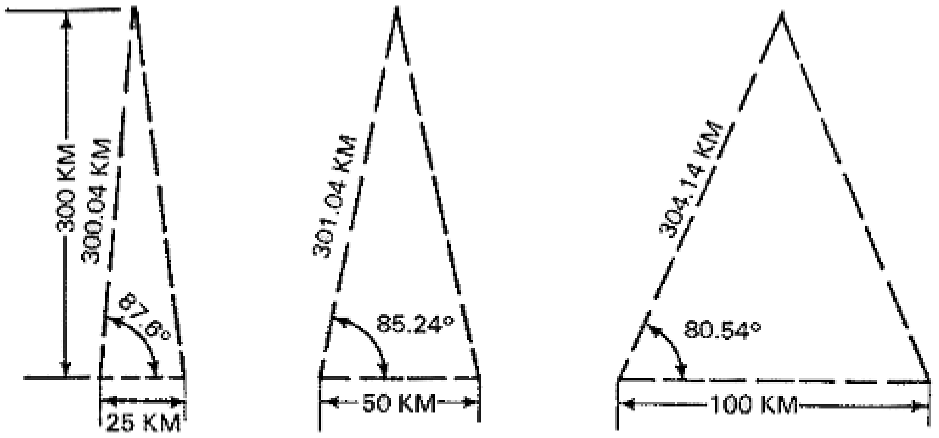
	SWR Reading	% OF LOSS	Power Output in Watts	Power Loss in Watts
11	2.2:1	14.10%	85.90	14.10
12	2.4:1	17.00%	83.00	17.00
13	2.6:1	19.80%	80.20	19.80
14	3.0:1	25.00%	75.00	25.00
15	4.0:1	36.00%	64.00	36.00
16	5.0:1	44.40%	55.60	44.40
17	6.0:1	51.00%	49.00	51.00
18	7.0:1	56.30%	43.80	56.30
19	8.0:1	60.50%	39.50	60.50
20	9.0:1	64.00%	36.00	64.00
21	10.0:1	66.90%	33.10	66.90

Sky Waves & Ground Waves

A Half-wave Dipole Antenna



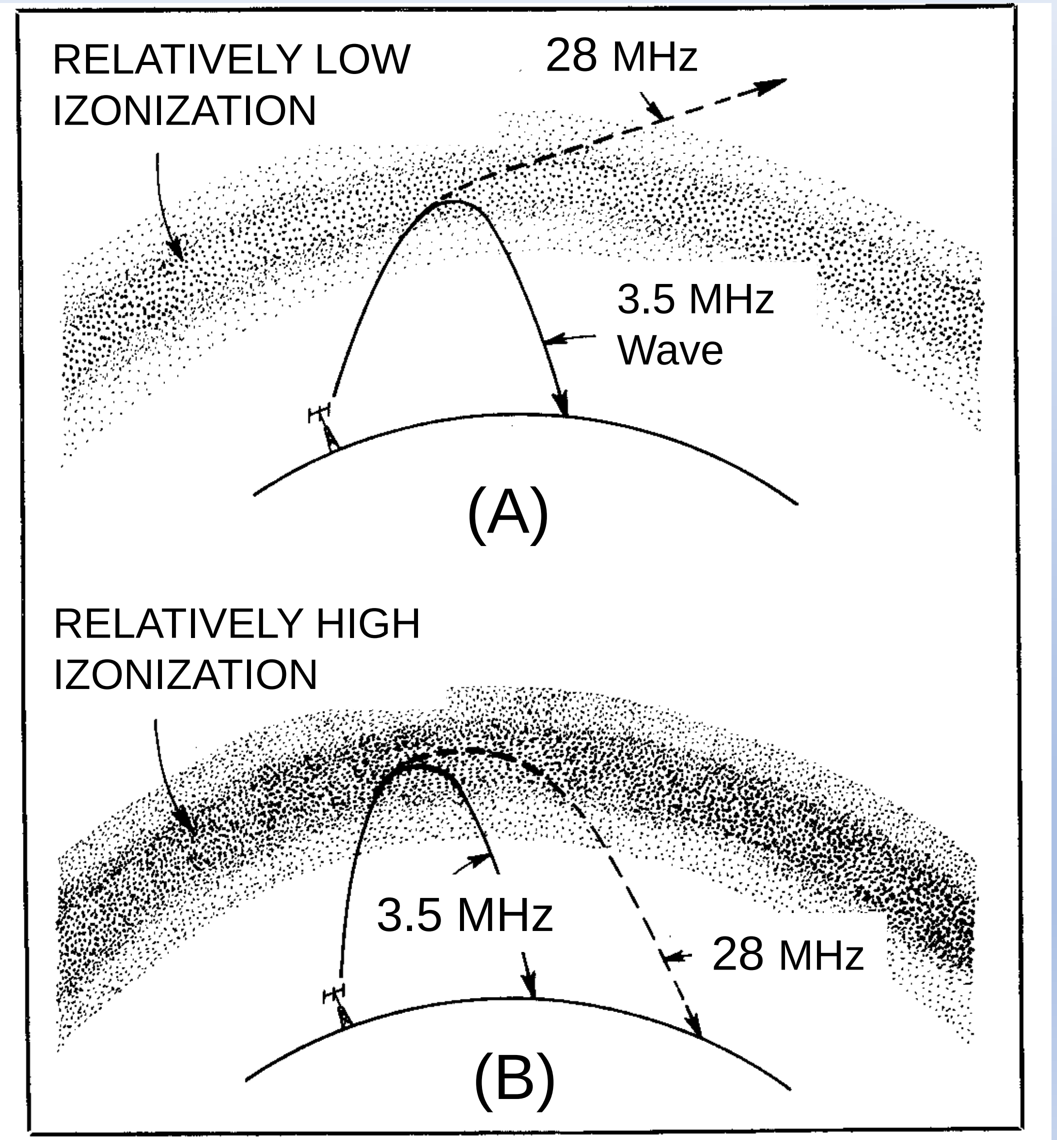
N V I S



GROUND RANGE Km	RADIO PATH LENGTH Km	RANGE VARIABLE 20 LOG d	V LOSS dB
25	600.5	55.57	0
50	600.08	55.59	0.02
100	608.28	55.68	0.11
NIGHT OR DAY ABSORPTION, TURN-AROUND, NORMAL ATMOSPHERICS. AVERAGE PATH LOSS (3 TO 5 MHz) = 110 dB + 10 dB.			

Figure M-3. Path length and incident angle (near-vertical incidence sky-wave mode).

N V I S



In A the low-level ionization is insufficient to bend the 28 MHz wave back to earth; the level is high enough for 3.5 MHz propagation. Higher level ionization in B is sufficient to refract the 28 MHz wave to earth.