Antennas for Deployment

What to build based on your mission and situation

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Gary Lamunion

Initial Thoughts - Mission

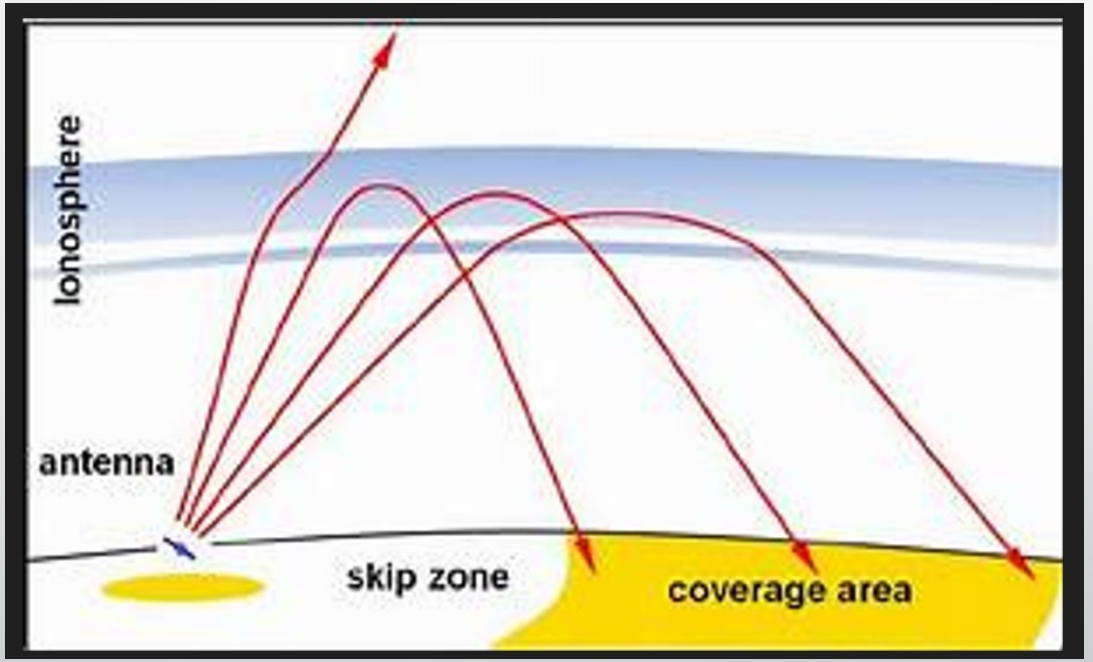
- Mission – what is the purpose and goal for the system
  - Are you staying at home, live in an HOA and need a system that is easily erected and is low visibility
  - Are you going to assist your local community in times of need, but are only able to deploy for a short time
  - Are you going to assist your local community, but can deploy over multiple days
  - Are you able to deploy out of your region and for multiple days
    - You may be moved, once you arrive at initial location

Each of the above scenarios may require different antenna configurations

Initial thoughts - Communications

- What type of communications are needed, or do you plan to use:
  - VHF/UHF
  - VHF/UHF, HF
  - VHF/UHF, HF, digital
- Where/who will you be communicating with:
  - Local
  - Regional
  - Nationwide
  - Local Agencies
  - State Agencies
  - Federal Agencies

Where are you trying to reach



Propagation

- Direct Wave Propagation
  - Wave front is line-of-sight.
    - Limited by terrain, obstructions, curvature of earth, antenna height
- Ground Reflected Wave Propagation
  - Wave front has been reflected off the earth
    - can result in interference due to multiple wave paths
    - direct wave and ground wave interaction

Propagation

- Surface Wave Propagation
  - Wave front travels along the curvature of the earth
    - Impacted by conductivity of earth
    - Energy is absorbed by earth (increases with frequency)
    - Range varies widely

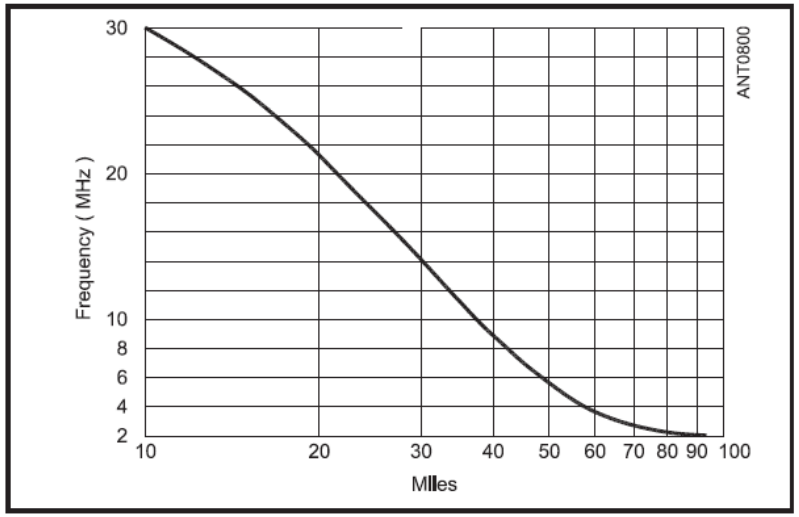


Figure 4.1 — Typical HF ground-wave range as a function of frequency.

Propagation

- Skywave propagation
  - Wave front travels upward and refracts off the ionosphere
    - Dependent on time of day, time of year, solar conditions
    - In general lower frequencies are better
    - Critical frequency (f_c)
    - Maximum usable frequency (MUF)

Critical antenna characteristics to consider

- Gain – local vs national distance
- Directionality – where are you talking
- Bandwidth – will band changes be required
- Portable – lightweight and packable
- Versatile – capable of multi-configuration, DX, NVIS
- Easy Set up – can be set up by one person, in a variety of locations
- Multi-mode – can be used with multiple modes (phone, digital)
- Rugged – will withstand rough handling and harsh weather

Wire Antennas

- Types: Dipole, EFHW, EFRW, End Fed Sloper, Inverted V, and others.
  - General
    - Can be set up in a variety of locations
    - Bandwidth determined by type, narrow banded (dipole) or broad-banded (end fed)
    - Directionality determined by configuration and frequency (for end-fed wire)
    - A wire can be fed at any point without changing the gain or efficiency – what does change is the radiation pattern

Wire Antennas - cont

- Pro:
  - DX and NVIS
  - Directional or omnidirectional depending on configuration
  - Band width, will vary depending on type, dipole, EFHW or EFRW
  - Easy set up, can be done by a single person
  - Multi-mode, SSB, digital
- Con
  - Require elevation – at least one end must be elevated by some means – a tree, mast, building
  - Tuner required if not resonant (end fed's usually require a tuner)
  - Counterpoise

End Fed

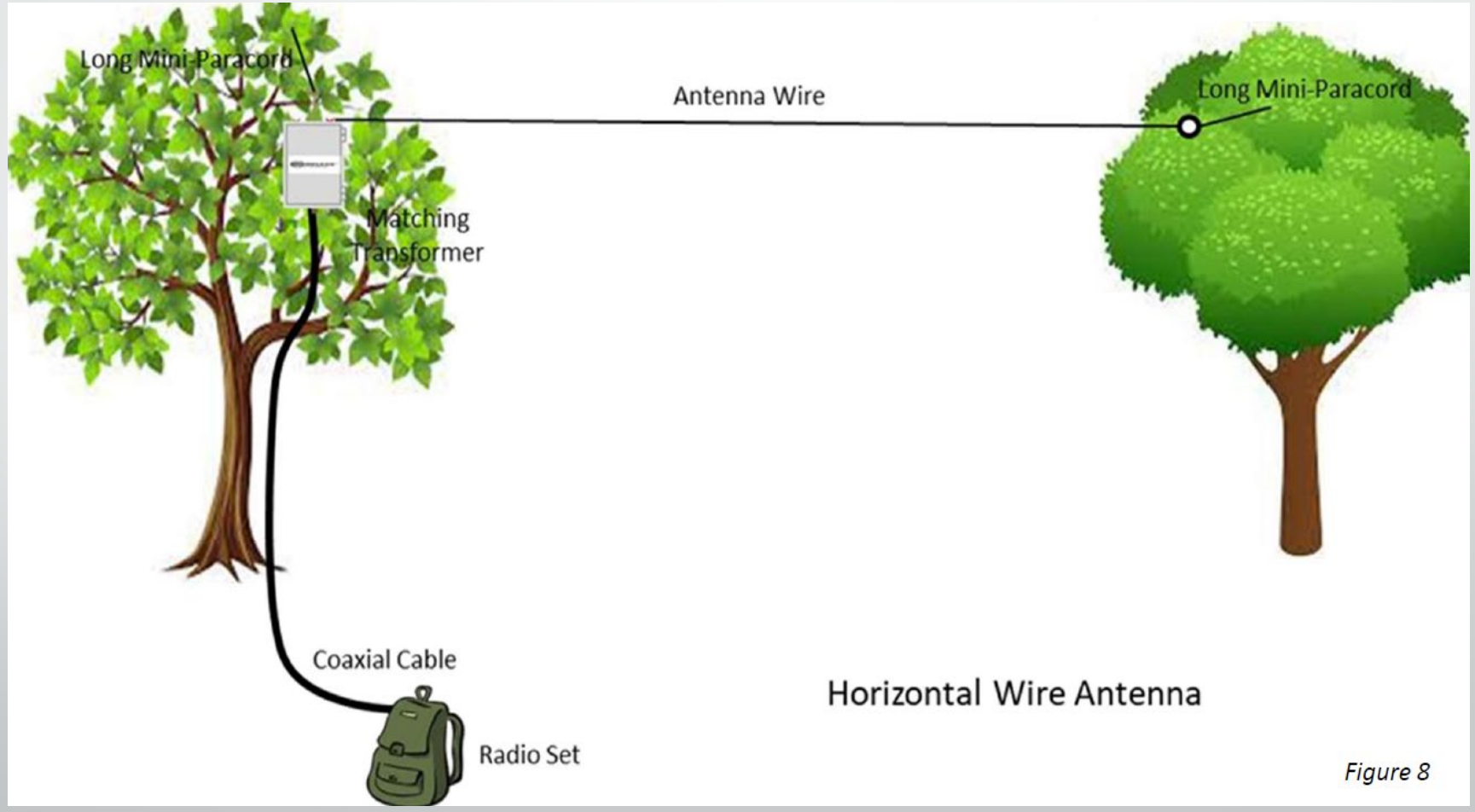
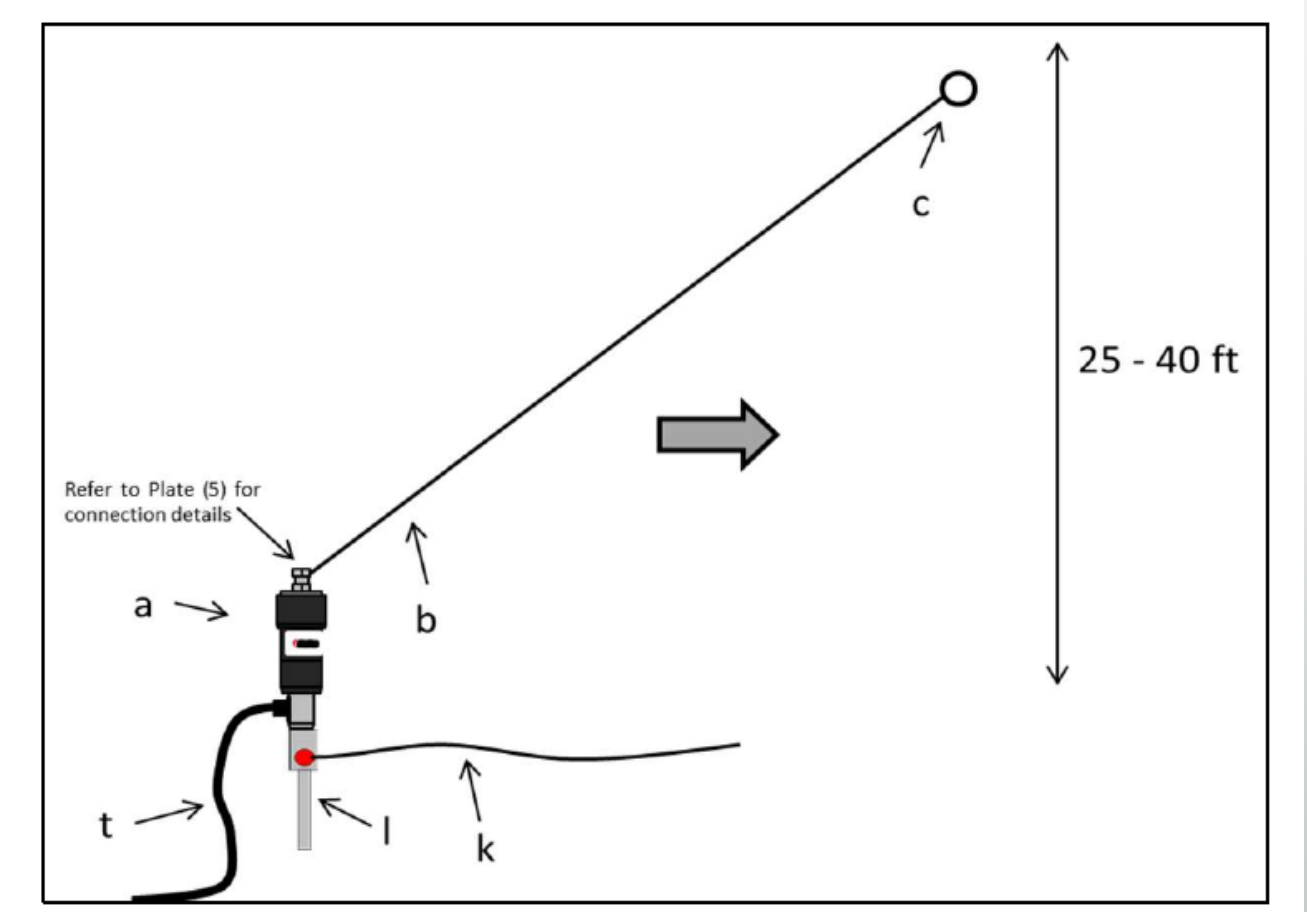
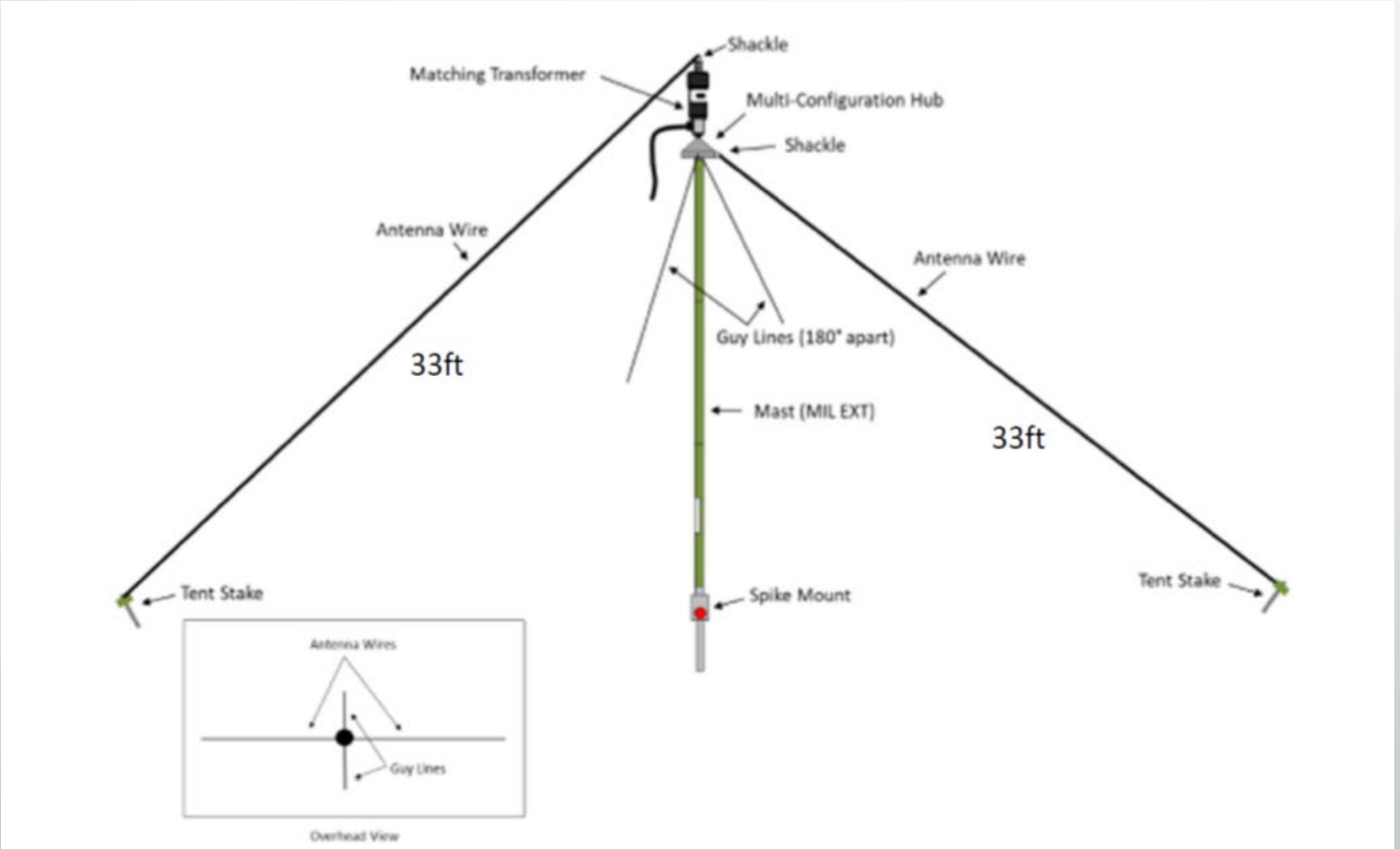


Figure 8

Sloper



Dipole, inverted V



Far Field Plots

- Far field plots show two views of the radiation pattern
  - Overhead – gives idea of directionality and gain (distance)
  - Side view – gives idea of distance and DX or NVIS capability
- Very helpful for visualizing how your antenna will operate in the field

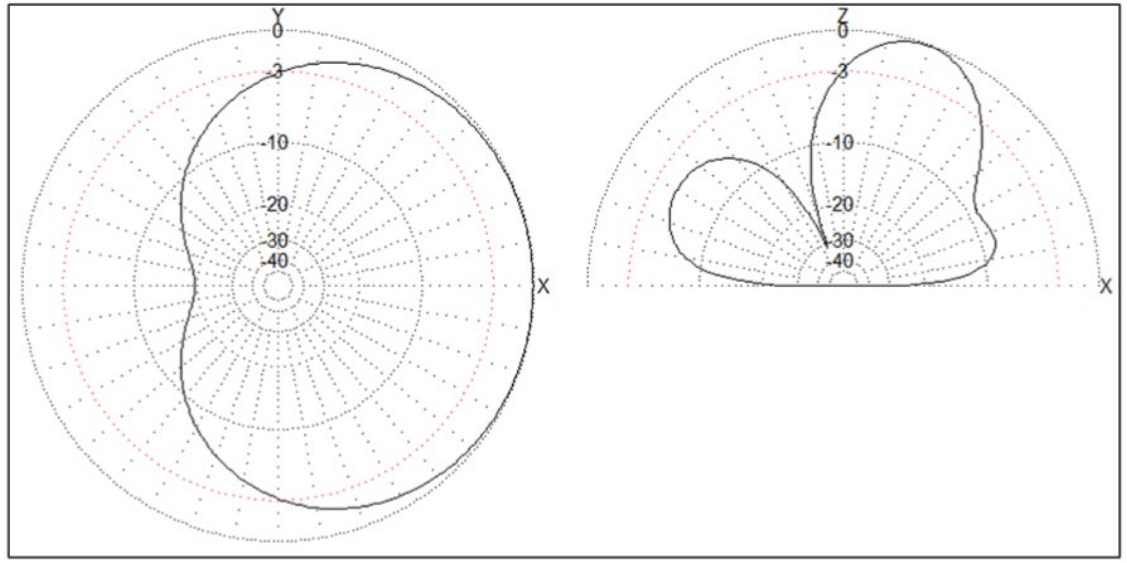
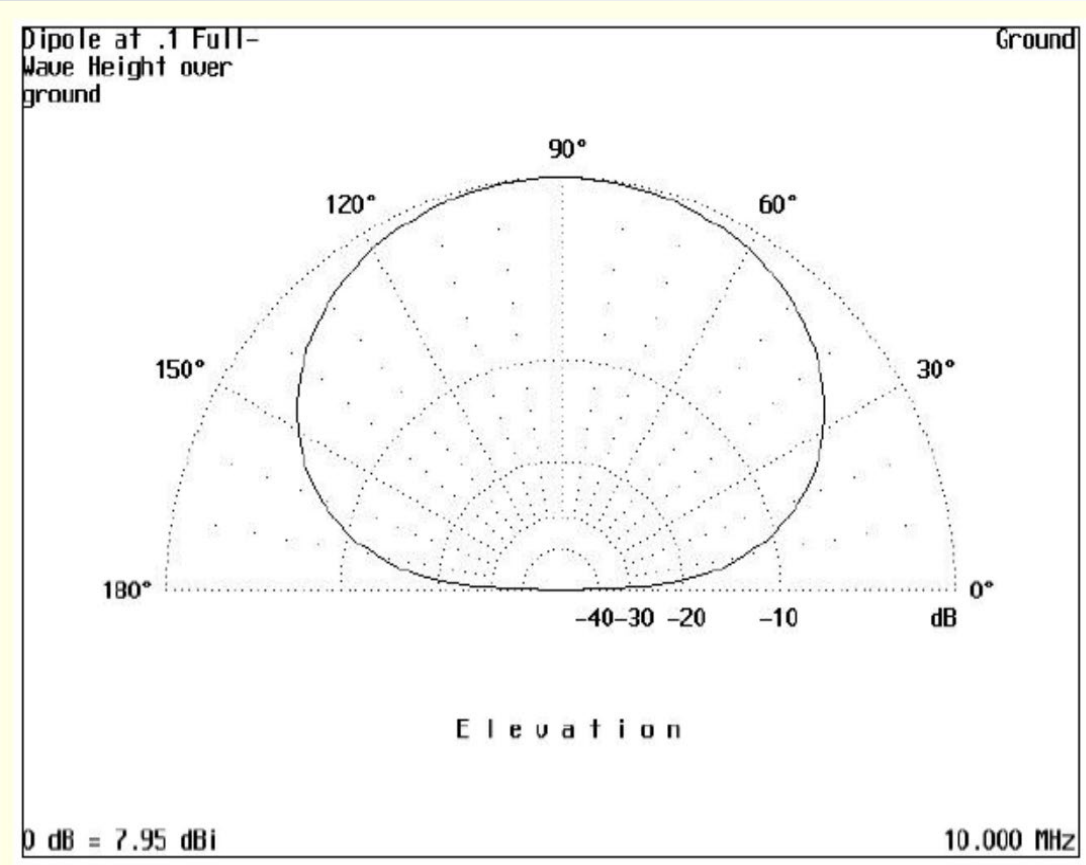
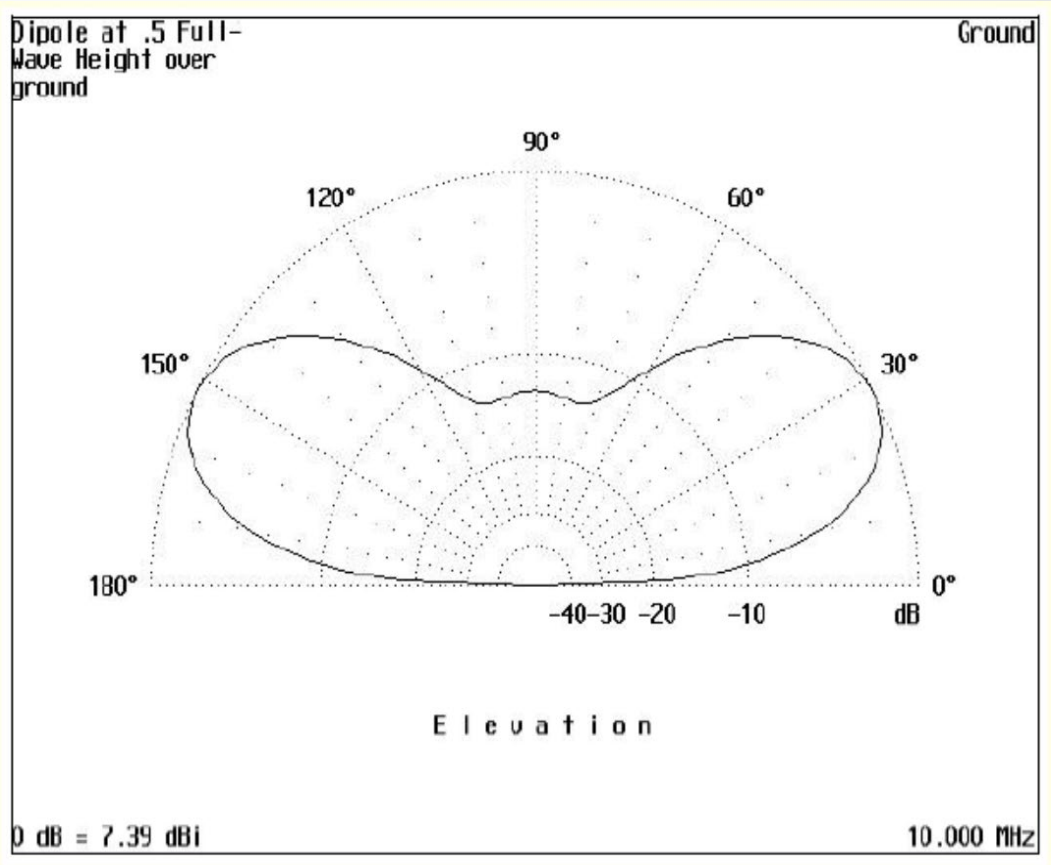


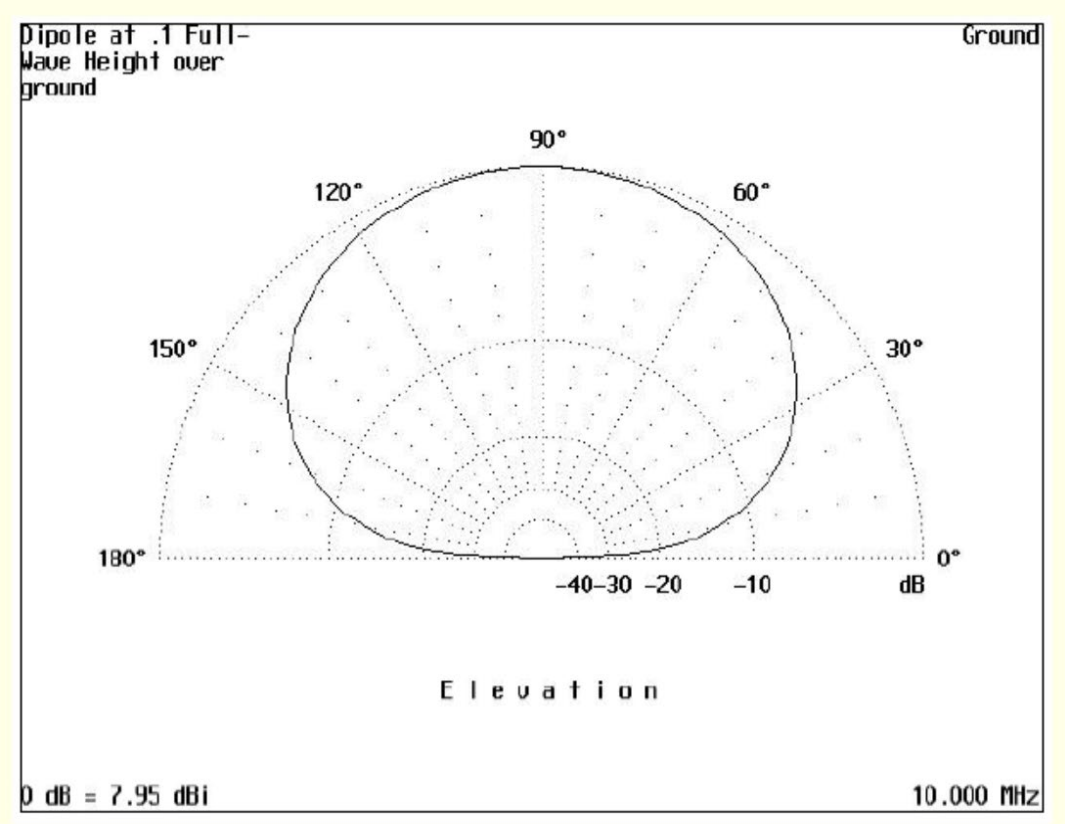
Figure 19. Terminated Sloping Wire, 14.1 MHz.

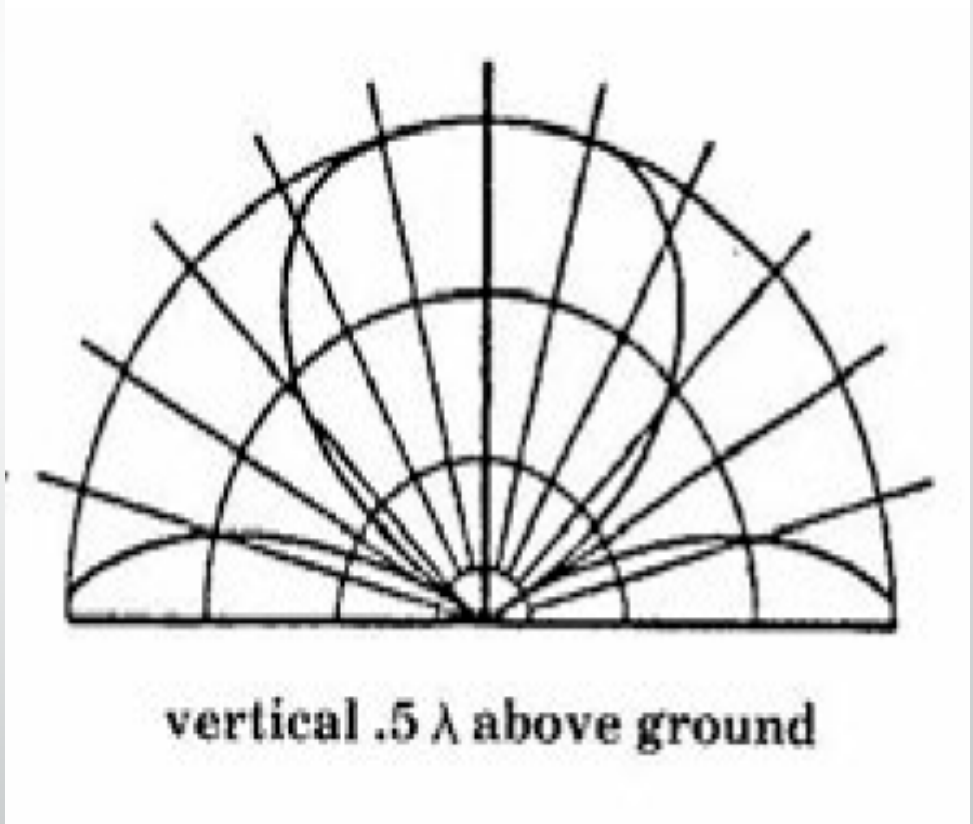
Dipole at 0.1 wavelength (15ft) and 0.5 wavelength (65ft) for 40 meters. Far field plot, side view





Dipole at 0.1 wavelength vs vertical at 0.5





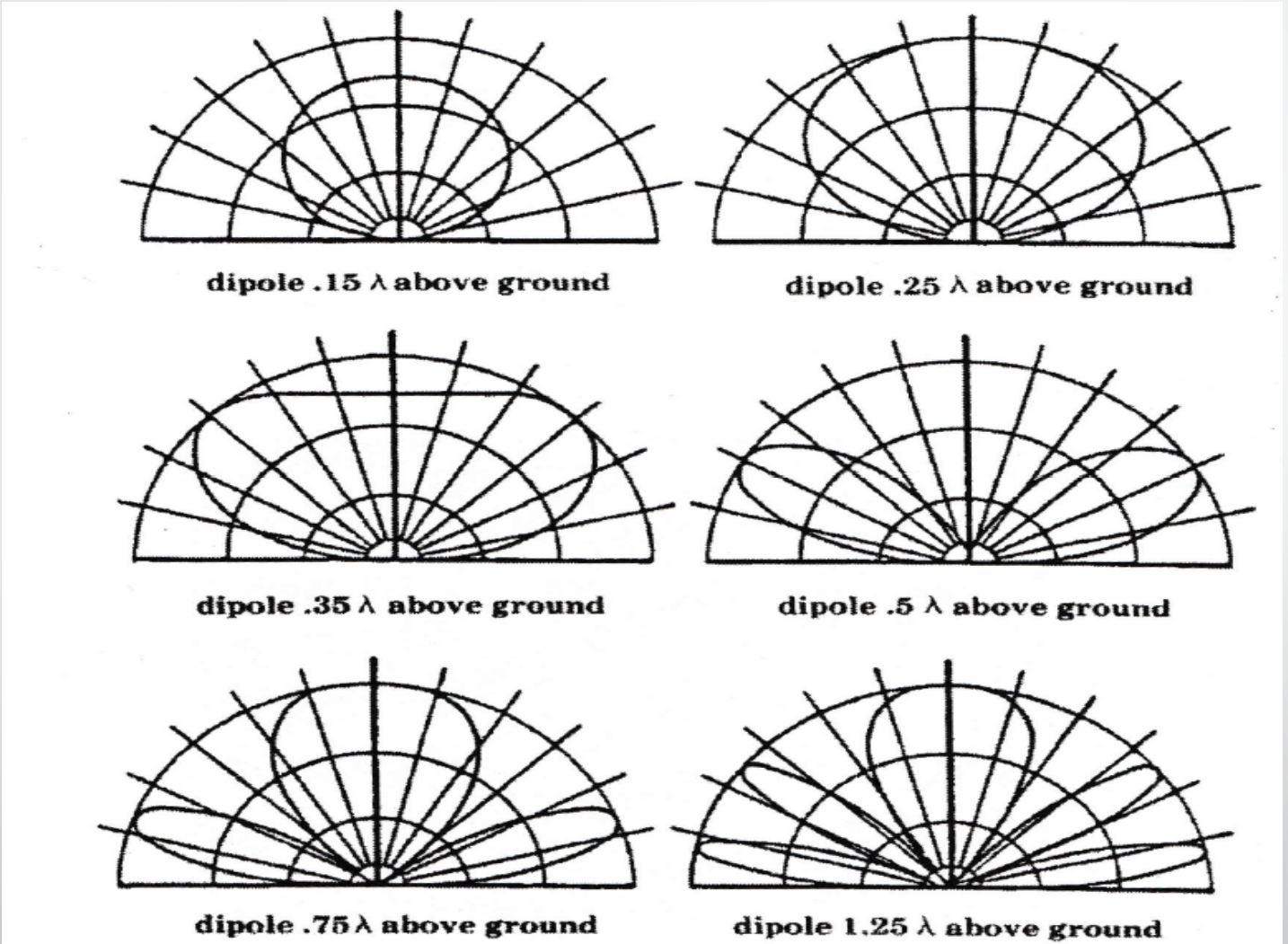
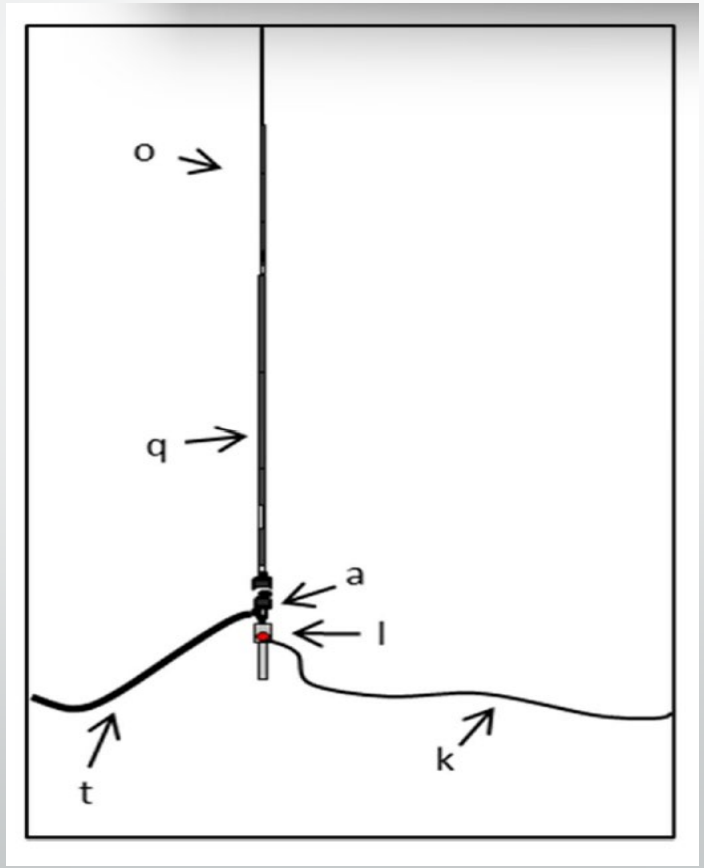


Figure 3. Horizontal dipole radiation patterns at various heights (in wavelengths) above the ground (from Air Force Comm. Pam. 100-16).

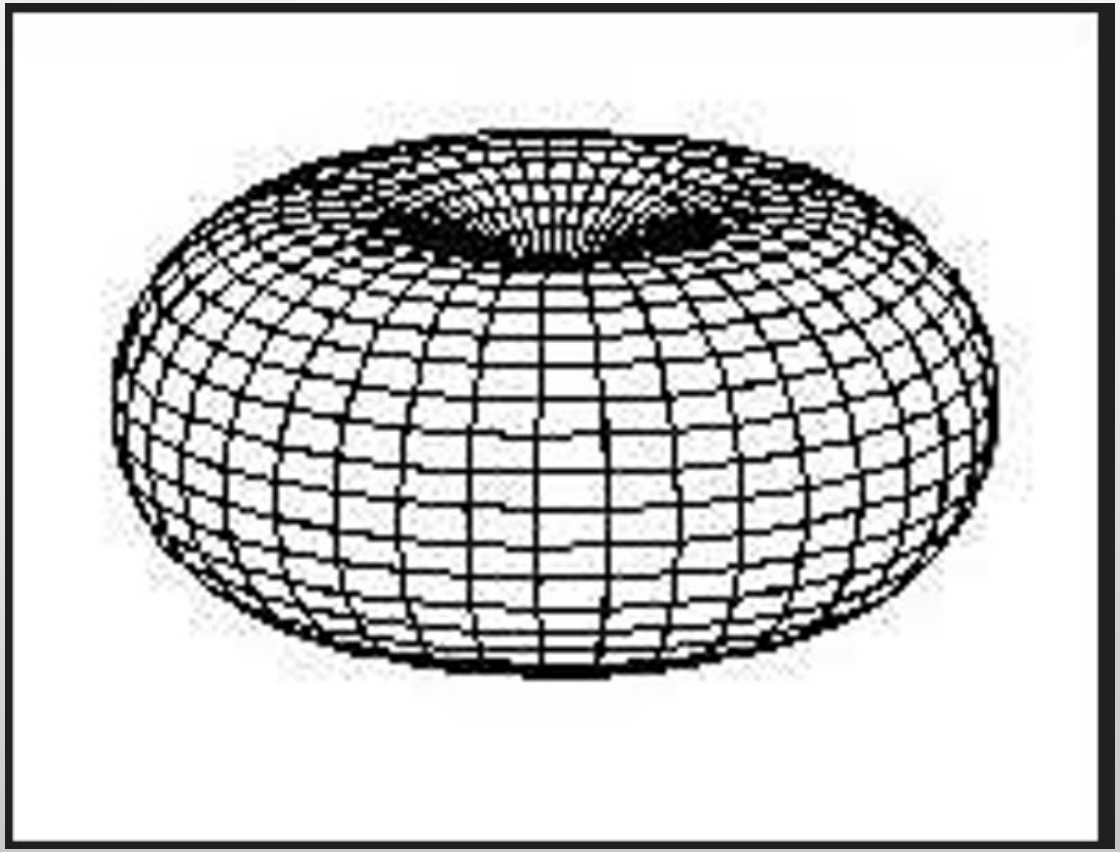
Vertical Antennas

- Vertical
  - General
    - Can be set up in a variety of locations, does not require elevation
    - Broad-banded
  - Pro
    - Easy to set up, does not require elevated mounting point
    - Omnidirectional
  - Con
    - Will not do NVIS when ground mounted
    - Multi-banded if using a whip or transformer
    - May require a tuner
    - Requires a radial system

Typical Vertical



Far Field Plot for vertical



Variations on a theme

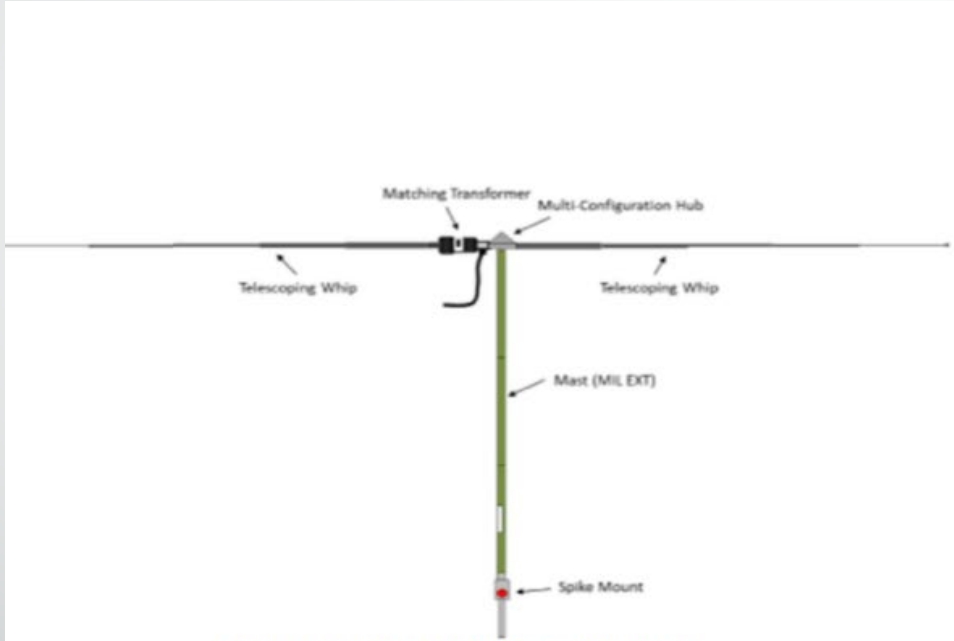


Figure 7. Portable Horizontal Dipole Configuration.

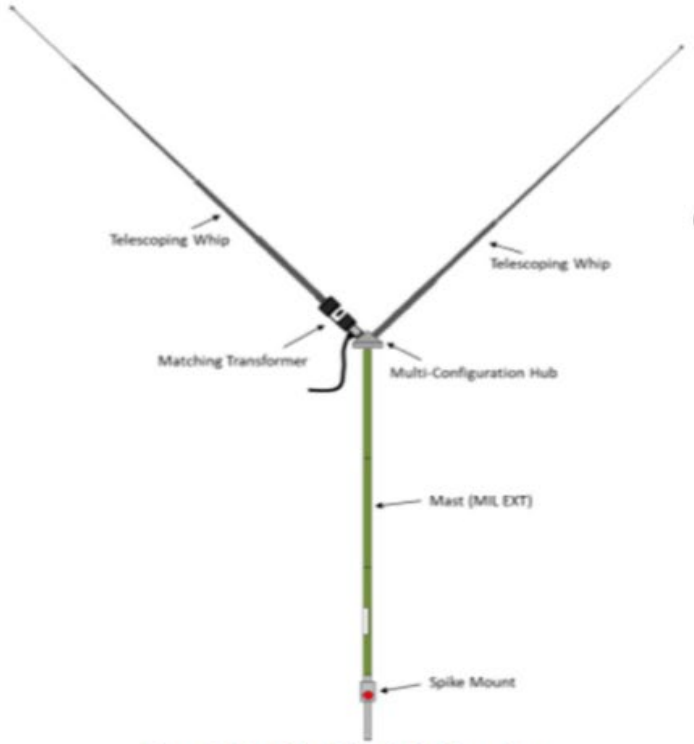


Figure 8. Portable V Dipole Configuration.