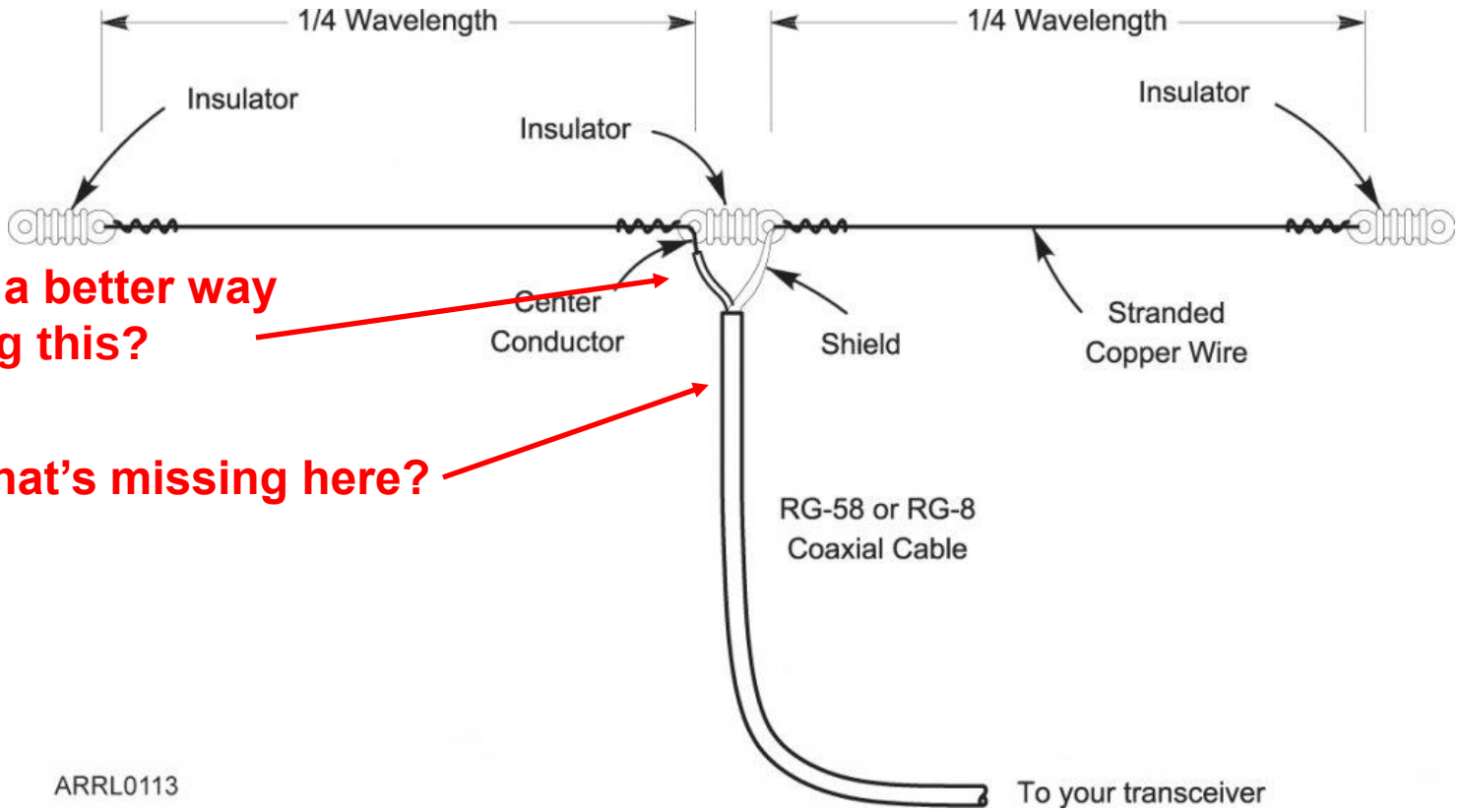
ANTENNA TYPES

dipole

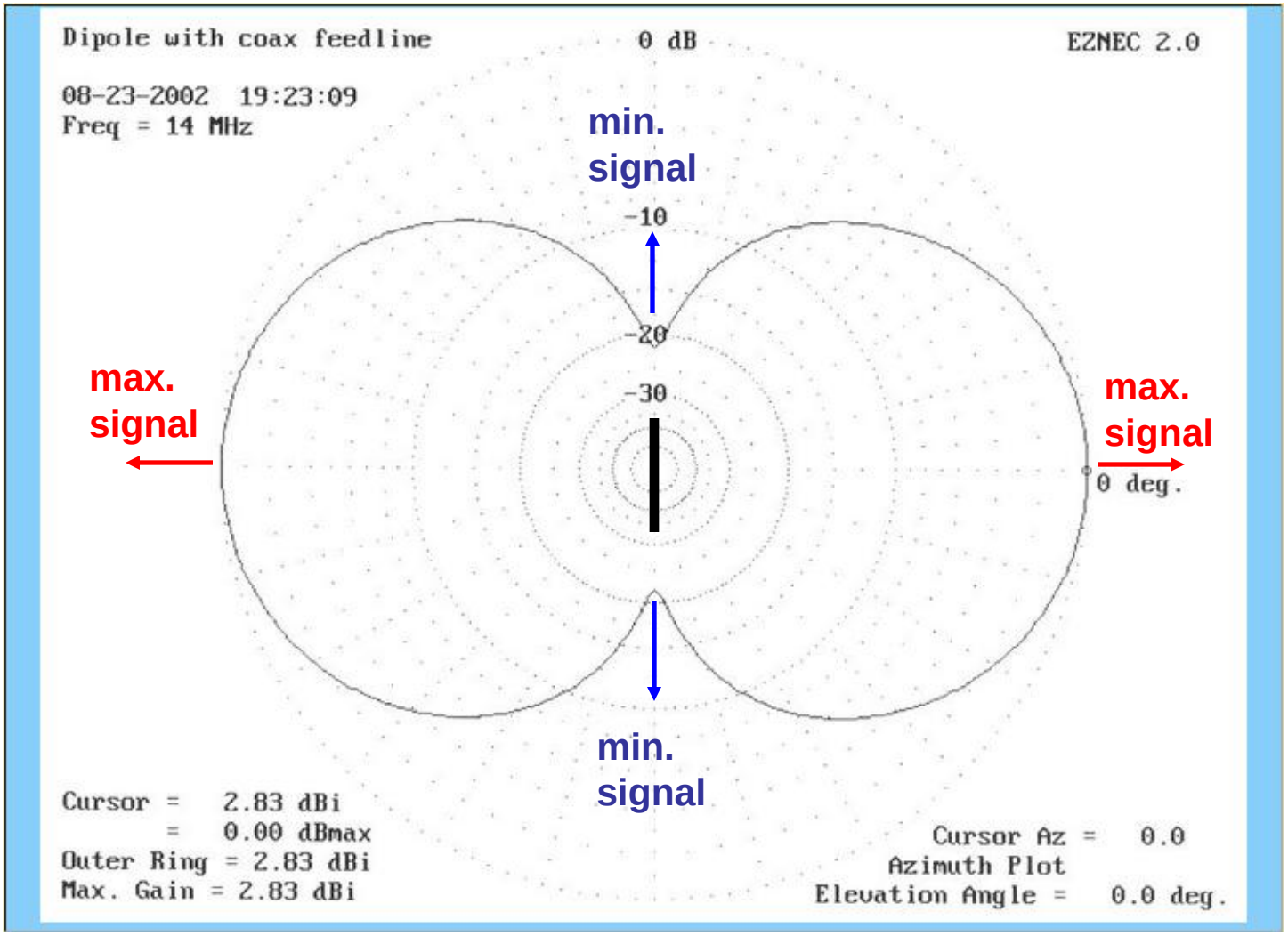


What's a better way of doing this?

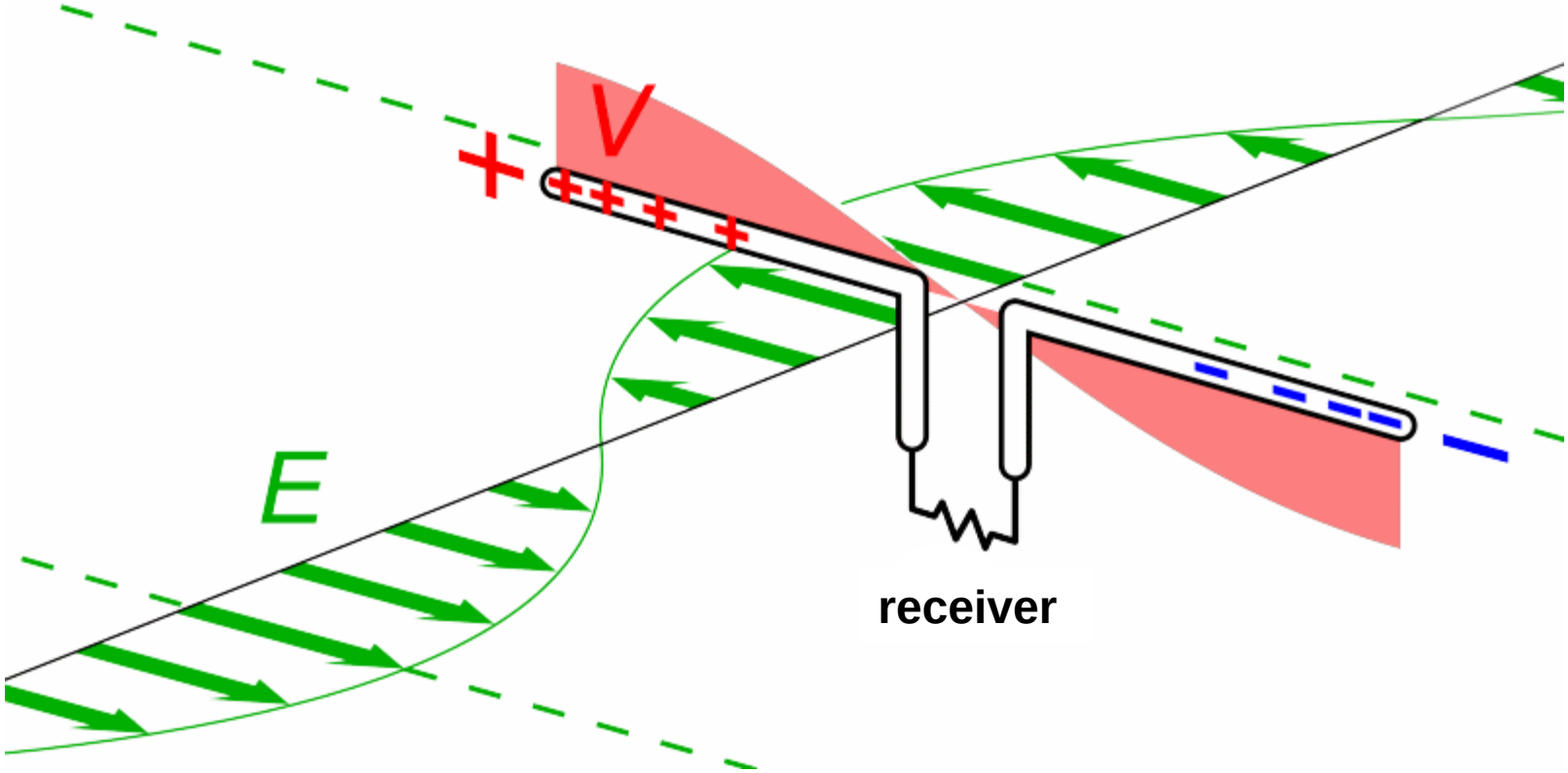
What's missing here?

½ λ dipole radiation pattern

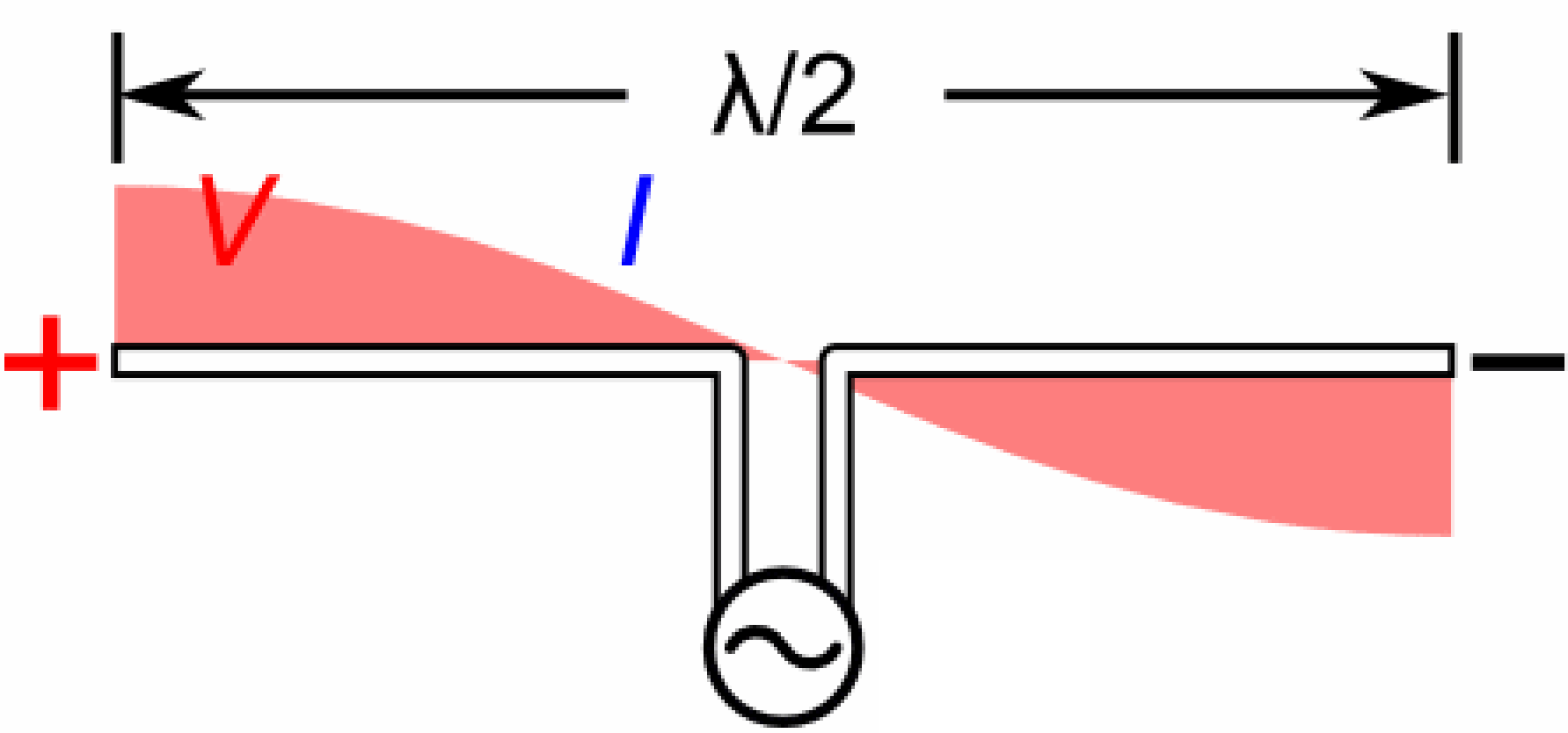
(looking down)



Dipole voltage & current - receiving



Dipole voltage & current - transmitting



How long should the dipole be?

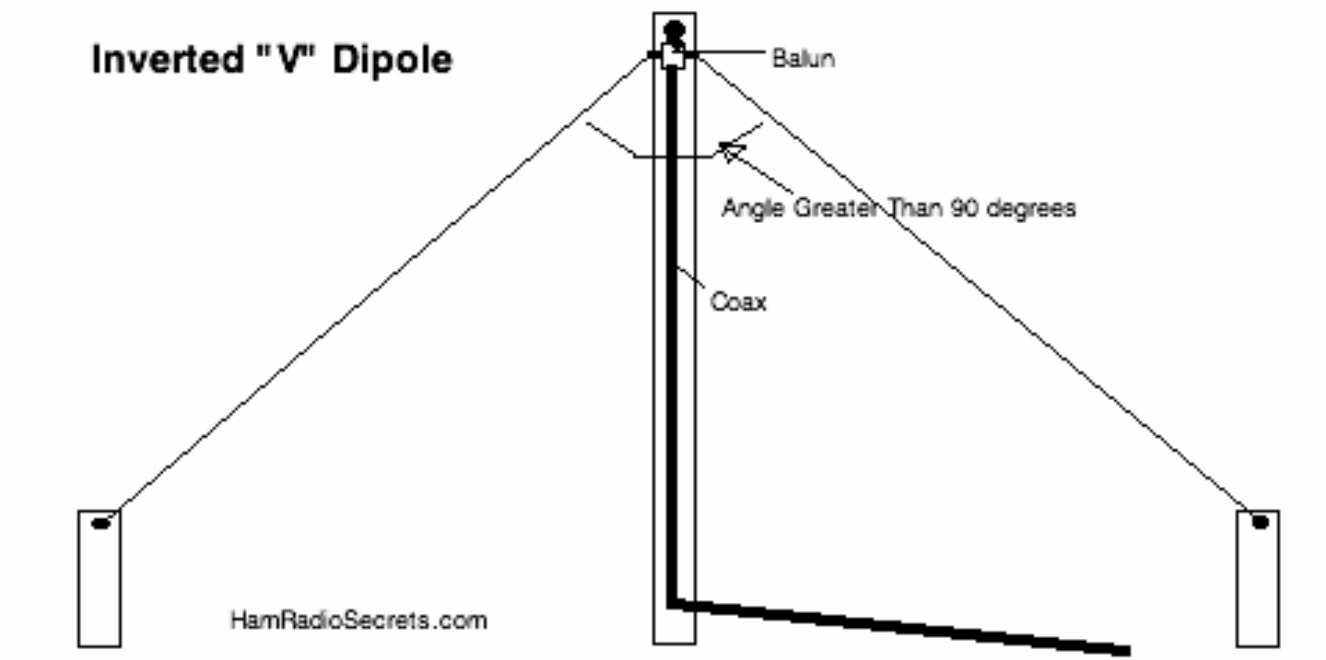
- From prev. slide: ½ wavelength (2 x ¼ λ)
- If I want my dipole to resonate at 7.100 MHz, how long should it be?
- Formula:
  - Below 30 MHz: ½ λ dipole should be 468/f (MHz), in feet
  - Why is this shorter than a half wave in space?
  - effects of (a) wire thickness & (b) end capacitance
- My antenna should be 468/7.1 = 65.915’ = 65’ 11”
- What is a good practice when first measuring the wire?
  - Cut it a little long – easier to trim than lengthen

Dipole Impedance & SWR

- **What is the approximate impedance of a ½ λ dipole (at resonance)?**
  - **Theoretically 73 Ω**
  - **In practice, depending on height, proximity to buildings, etc. it could be closer to ~ 65 Ω**
- **If the impedance of my dipole is 65 Ω, and I feed it with RG58 coax, what will my SWR be?**
  - **SWR = $Z_{antenna}$ / $Z_{feedline}$ = 65/50 = 1.3**

Dipole variants

- **Inverted Vee**

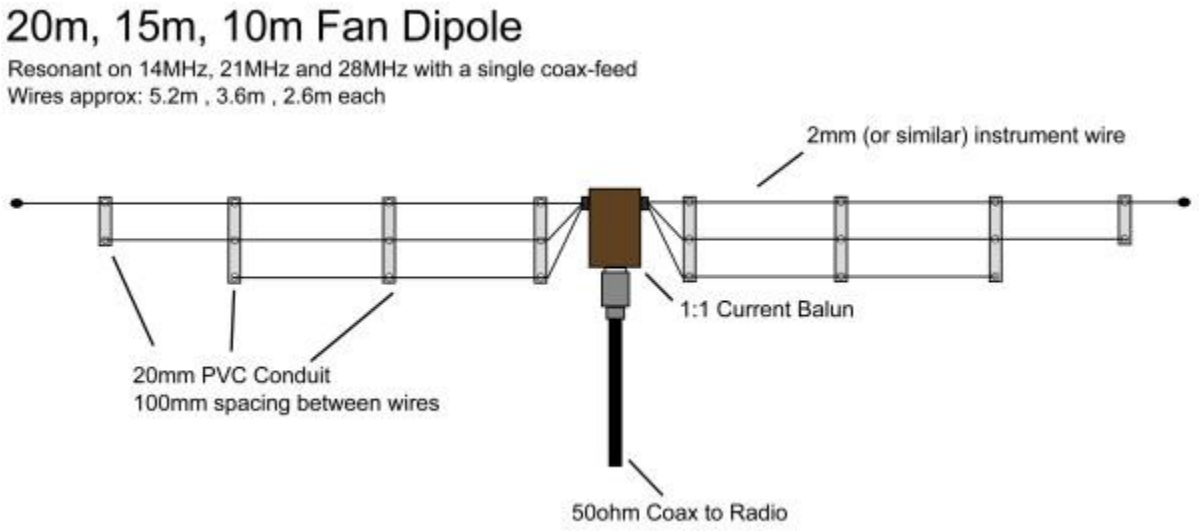


Dipole variants

- **Inverted Vee**
  - Big bonus: only needs one support
  - Radiation is more omni-directional than dipole
  - Drooping the legs
    - brings impedance closer to 50 Ω
    - makes end capacitance effect larger
      - Antenna needs to be SHORTER than dipole (~ -5%)
      - (note: App 2 in study guide is wrong, says +5%)
    - can cause hazard to people on the ground so keep ends ~8' above ground
  - Leg angle should be > 90° to avoid interference between field from each leg

Dipole variants

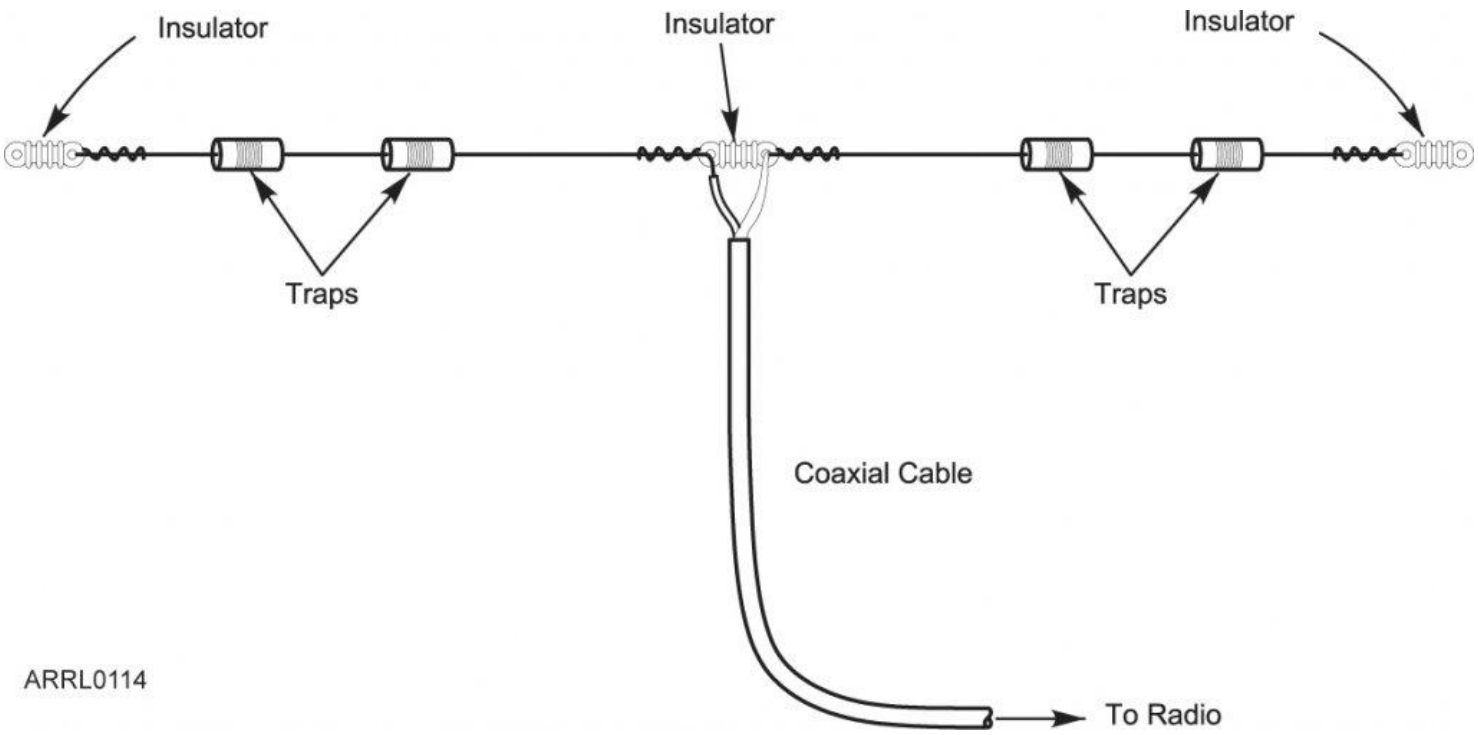
- **Fan dipole**



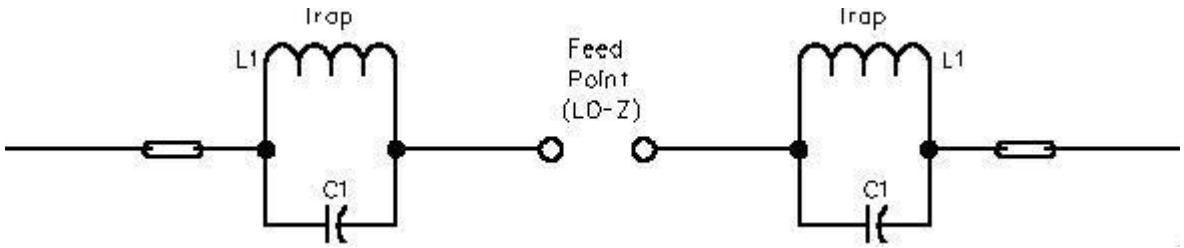
- **multiband with only one feedline**
- **off band dipoles have high impedance – transmitter current flows to desired dipole**
- **some interference between dipoles – makes adjusting lengths difficult**

Dipole variants

- **Trap dipole**



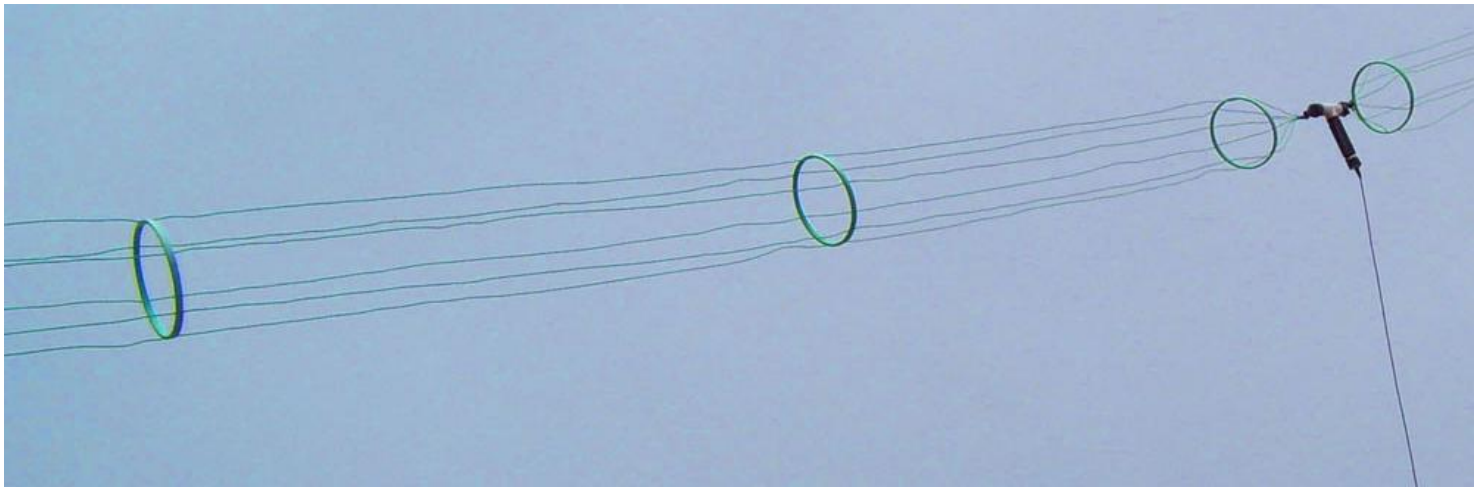
Dipole variants



- **Two band trap dipole**
  - **Traps are parallel L-C circuits**
  - **They resonate near the lower edge of the higher band**
  - **At resonance the trap has very high impedance & acts like an open circuit so only the inner portion of the antenna is active. It is cut for the higher band**
  - **Below resonance, the traps act like loading coils, so by using proper length of the outer portion, the antenna can be resonated in a lower band**
  - **Trap dipoles can cover several bands**

Dipole variants

- **Cage dipole**



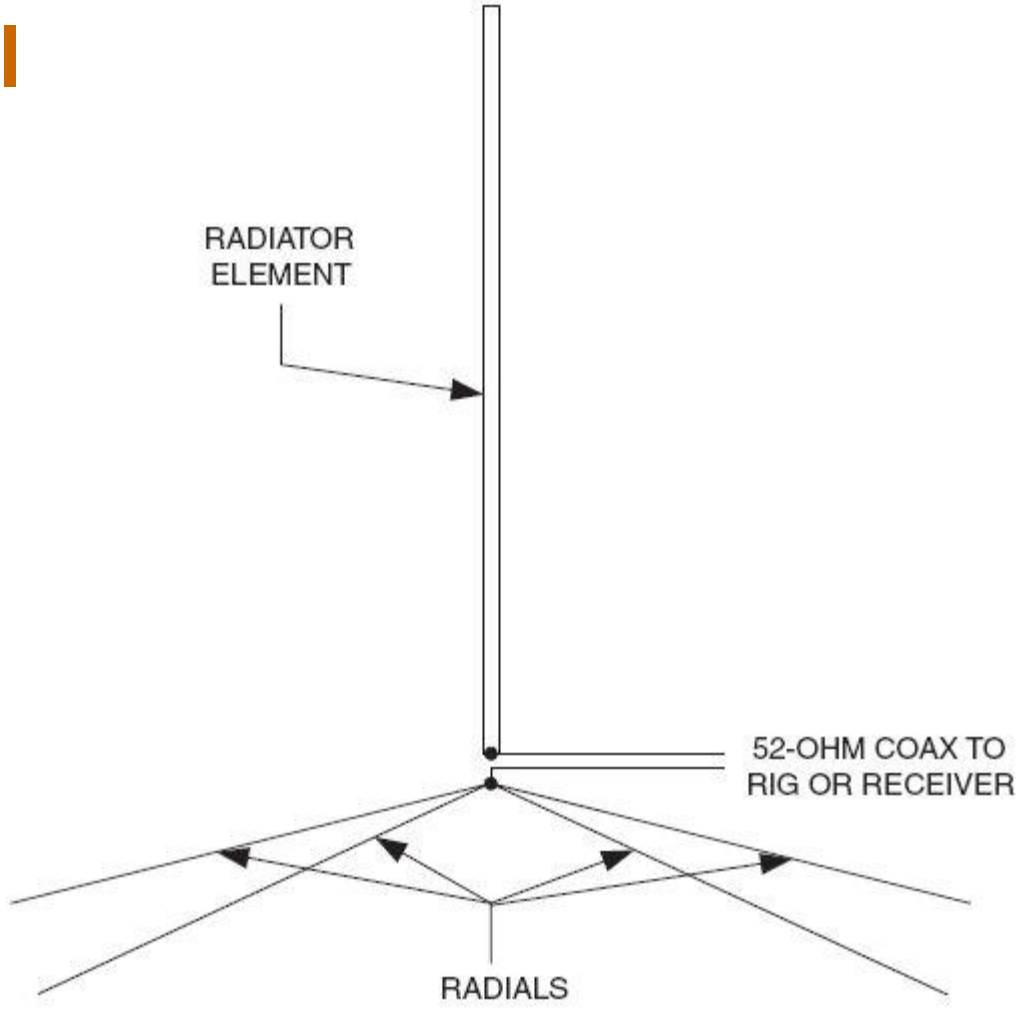
- **“Cage” of wires simulates large diameter element (remember skin effect?)**
- **Gives more usable bandwidth**
- **Larger effective dia. requires shorter ant. for same resonance**
  (At ARRL HQ, a cage dipole with 4’ spreaders covers the entire 80m band!)

Dipole variants

- **Others**
  - **Sloping dipole (“sloper”)**
  - **Off Centre Fed dipole**
  - **Folded dipole**
  - **Staggered inverted vee**

Vertical Antennas

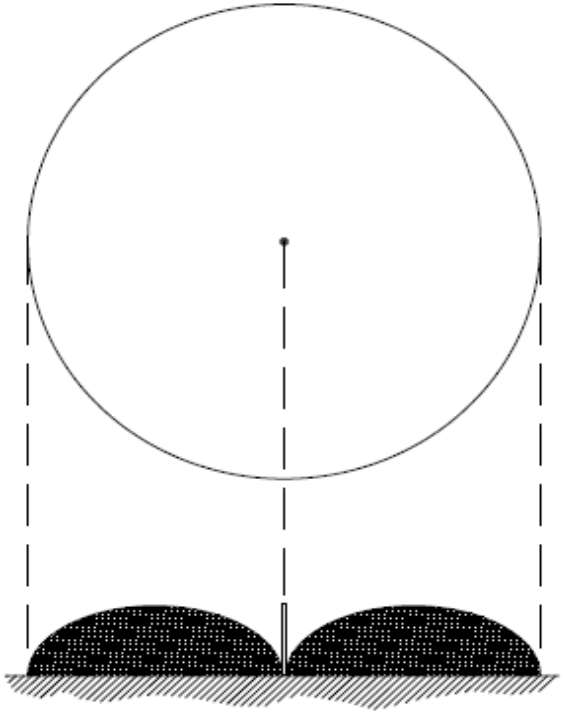
- ¼ λ Vertical Antenna



¼ λ vertical radiation pattern

view looking down:

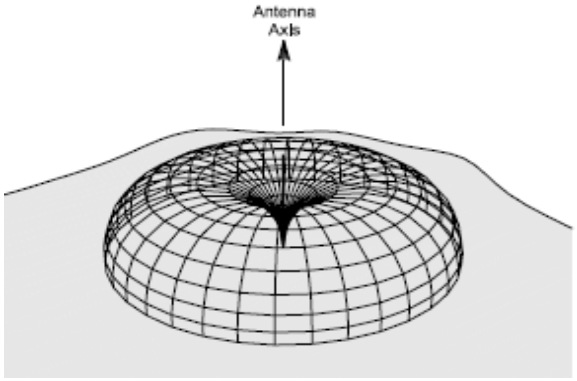
omnidirectional



side view over perfect ground

over real ground, elev. angle is higher

3-D view



Vertical Antennas

- ¼ λ Vertical Antenna
  - Needs either ground radials or elevated radials
  - Ground radials
    - can be random length
    - either bare or insulated wire is OK
    - can be shallow buried or laid on the surface
    - Impedance of vertical with ground radials is ~ 36 Ω
  - Elevated radials
    - must be resonant ¼ λ length
    - must be insulated from ground
    - drooping radials will raise impedance closer to 50 Ω

Vertical Antennas

- **Variants**
  - **Short Loaded Vertical**
    - **loading coil resonates antenna on desired freq.**
    - **coil can be at antenna base or midpoint**
    - **popular for HF mobile (e.g. screwdriver antenna)**
    - **mobile CB antennas are this type**
    - **loading can also be done via a capacitance hat at top – not too popular these days**
  - **Trap Vertical**
    - **theory same as described for trap dipole**

Directional Antennas (Yagis & Quads)

- x