The End Fed Half Wave Antenna

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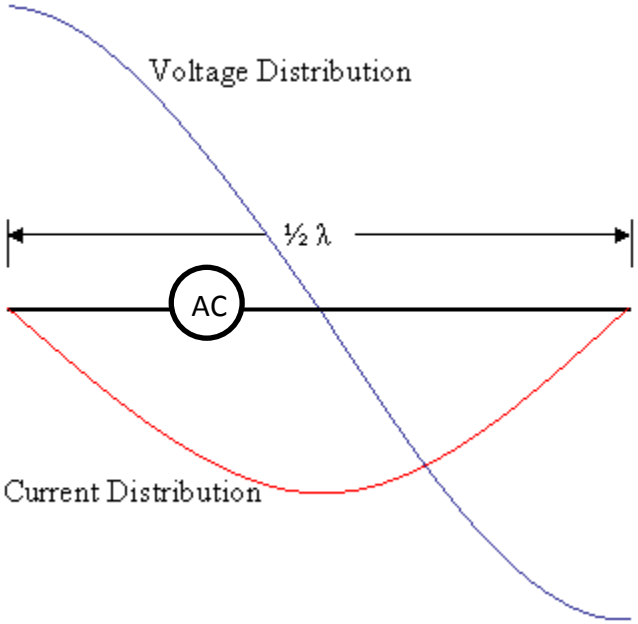
7 Jan 2017

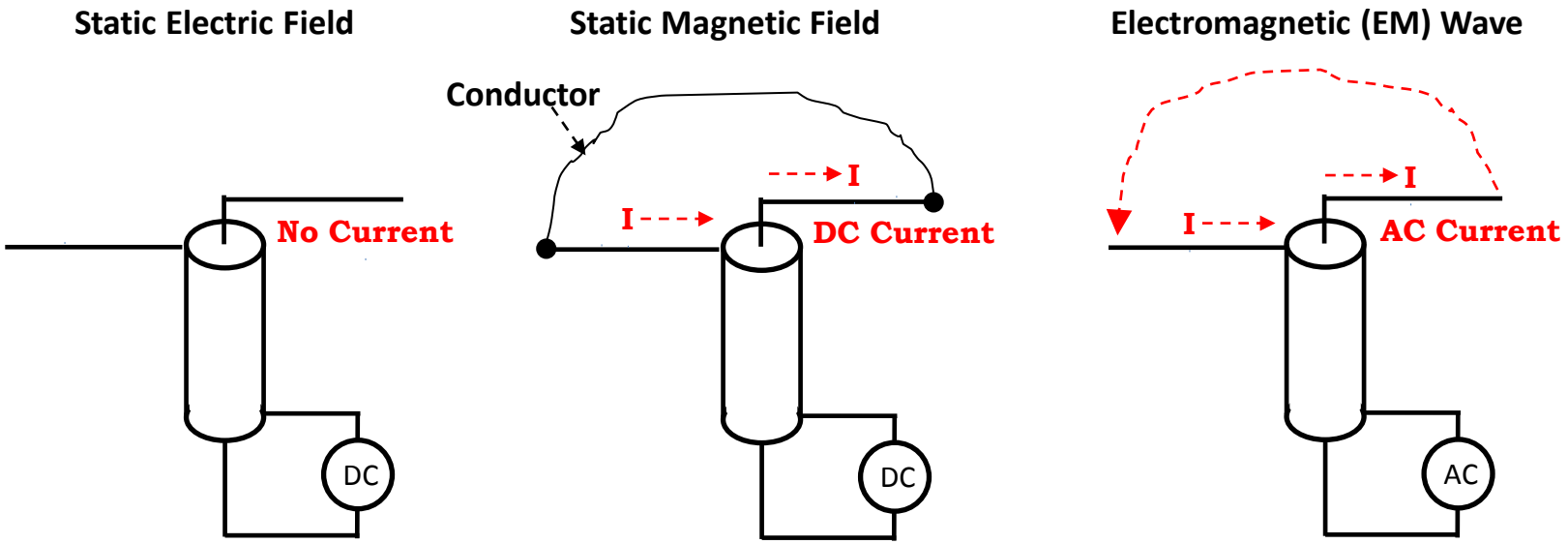
Voltage and Current Distribution on a Half Wave Antenna

"Standing Wave" pattern =>



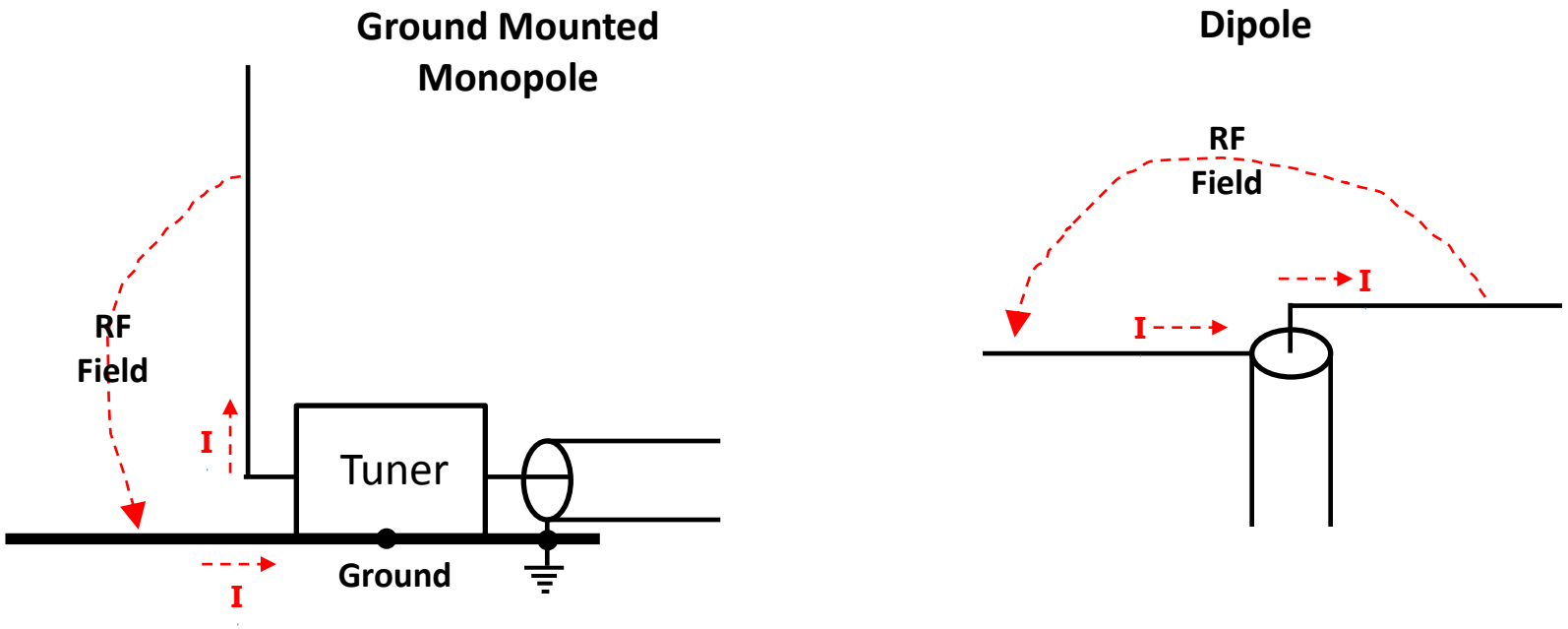
- To get EM radiation, we need to ***accelerate*** some electrons
- At end => Voltage max & current min
- At center => Voltage min & current max
- Feed impedance changes as the feed point moves
  - Min Z at center (typically 50-75 ohms)
  - Max Z at ends (typically 2-5K ohms)
  - Off Center Fed Dipole (OCFD) (typically ~200 ohms)

For Radiation to Occur the RF Circuit Must Be Closed



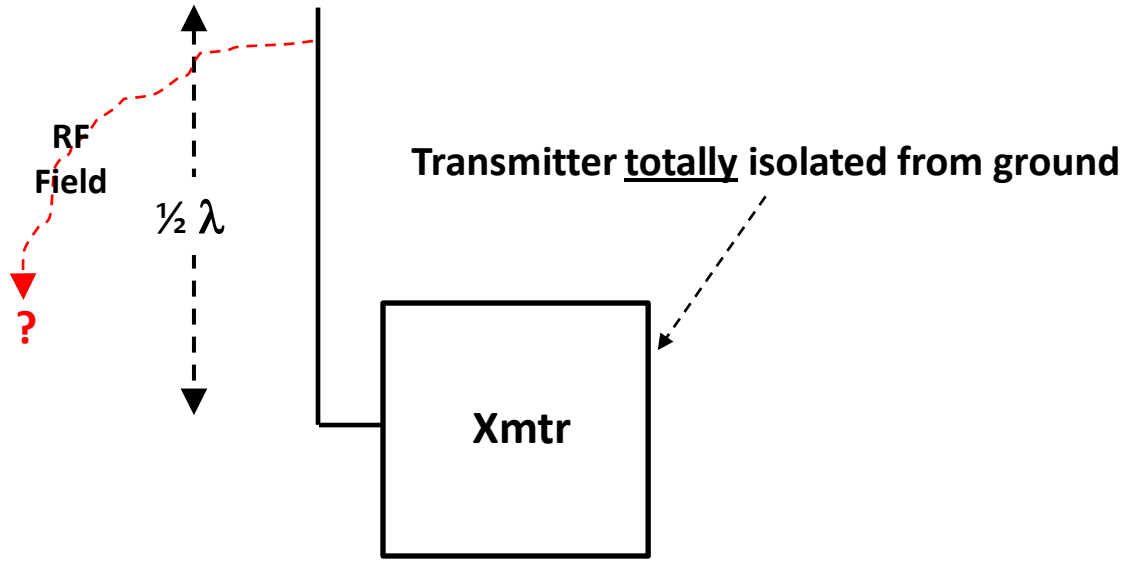
1) ***Accelerating*** electrons (ie., AC current) create an RF field
   - The larger the current => the larger the field
   - DC voltage creates an electric field (not an electromagnetic wave)
   - DC current creates a magnetic field (not an electromagnetic wave)
2) Every antenna must have a place for a field to originate ***AND*** terminate
   - If there is no place for the EM field to originate AND terminate, no RF current will flow, and no EM field will be generated

Examples of a Closed RF Circuit



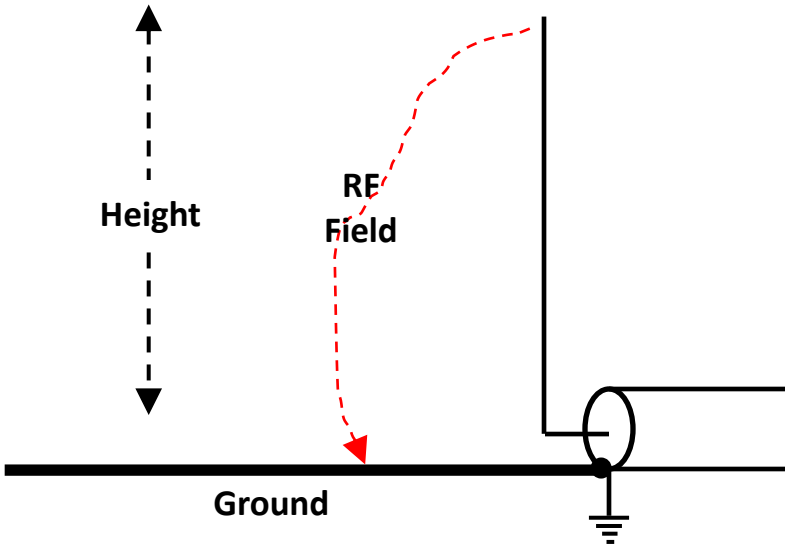
- **Both of These Can Work Well as Antennas Because:**
  - **RF circuits are CLOSED**
  - **SWR losses are low**
- **Note: a lossy ground will reduce the current flow => smaller RF Field**

Example of an Open RF Circuit



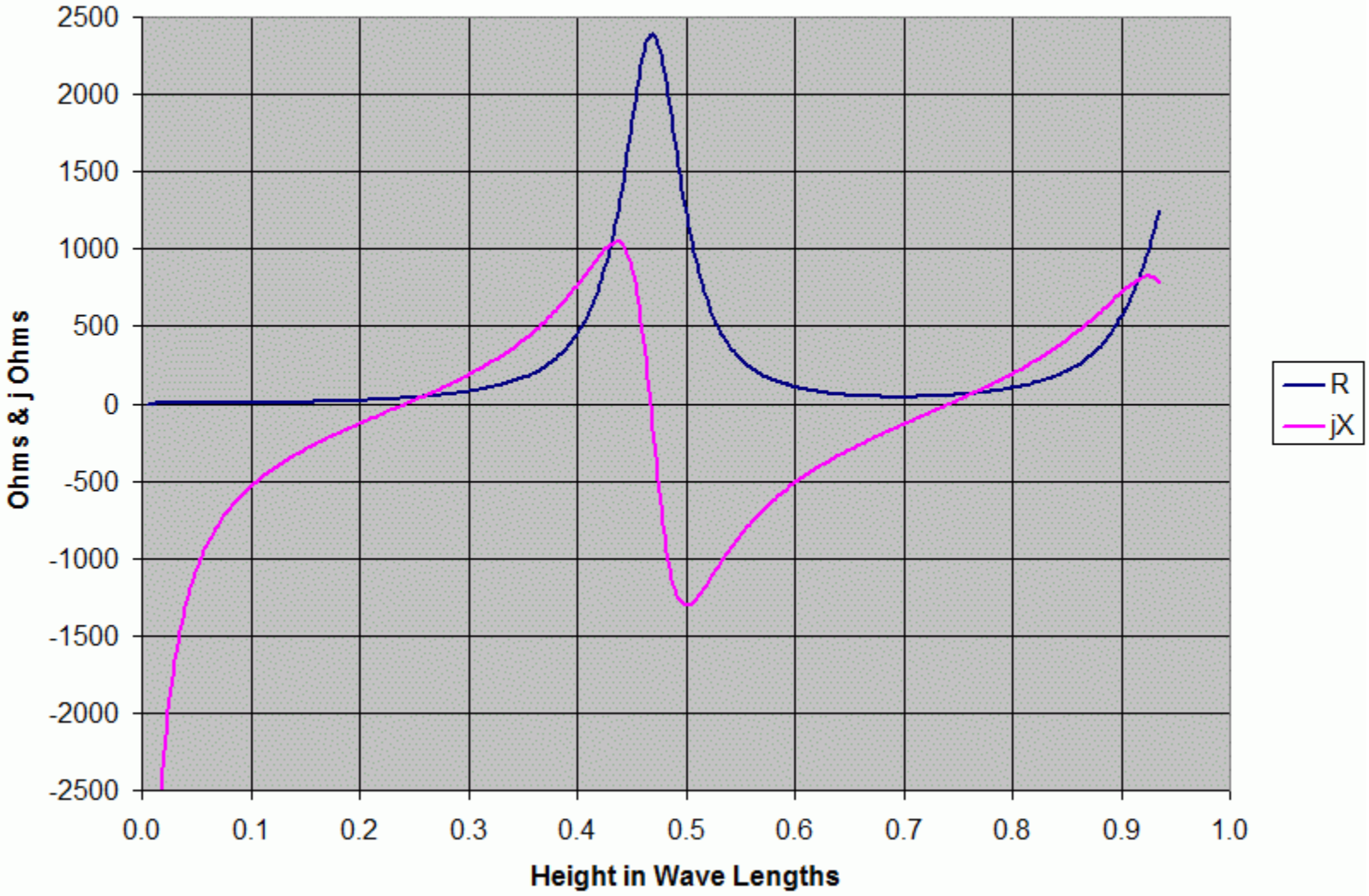
- Theoretically, there will no radiation for this setup
- Many hams believe that no counterpoise is required for an end fed half wave antenna to work ***well***
  - In many cases , radiation can occur with no ***physical*** counterpoise

The Ground Mounted Monopole Antenna

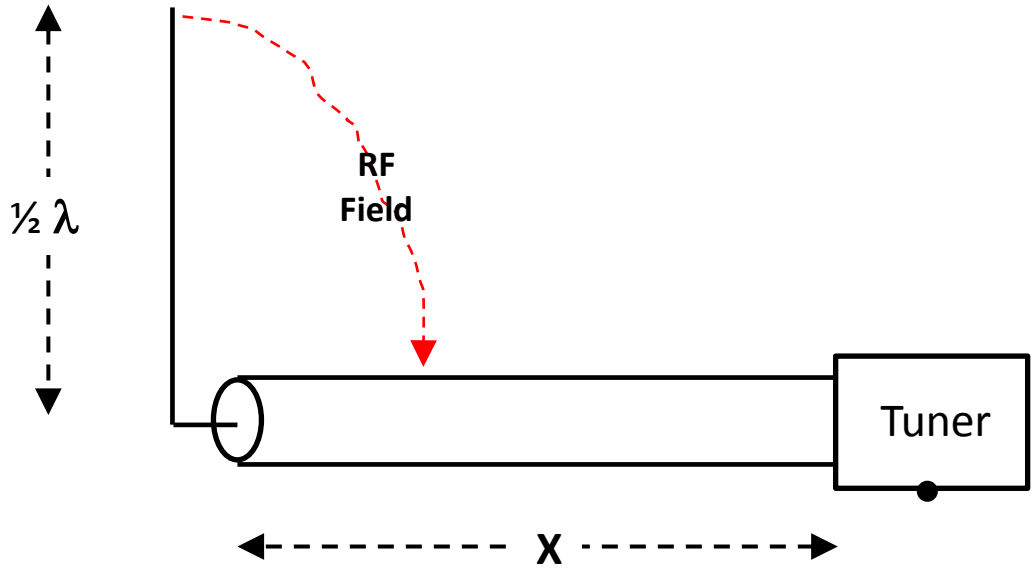


- **Won't work very well when Height = ½ wavelength:**
  - **Circuit is closed, but SWR > 50:1**

Impedance Versus Monopole Height

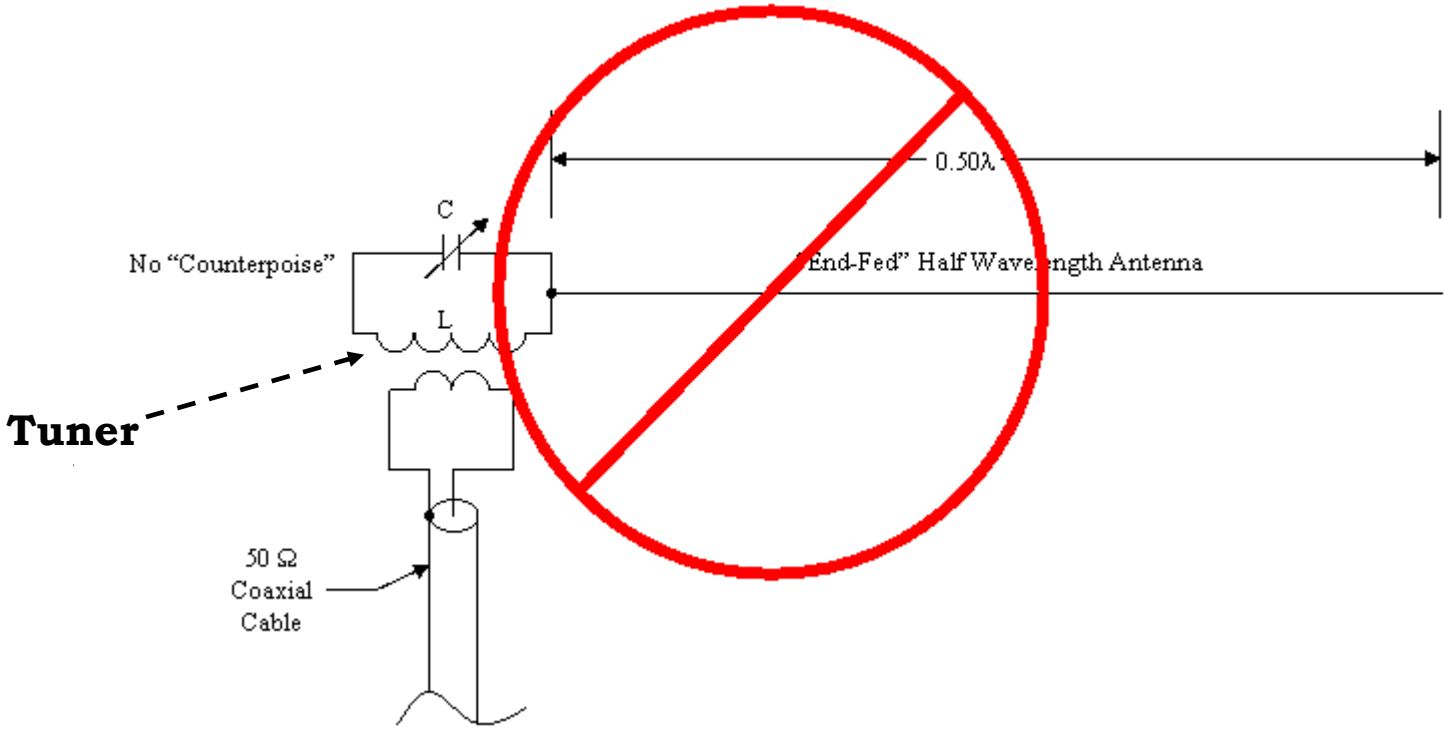


Feeding an End Fed Half Wave Antenna



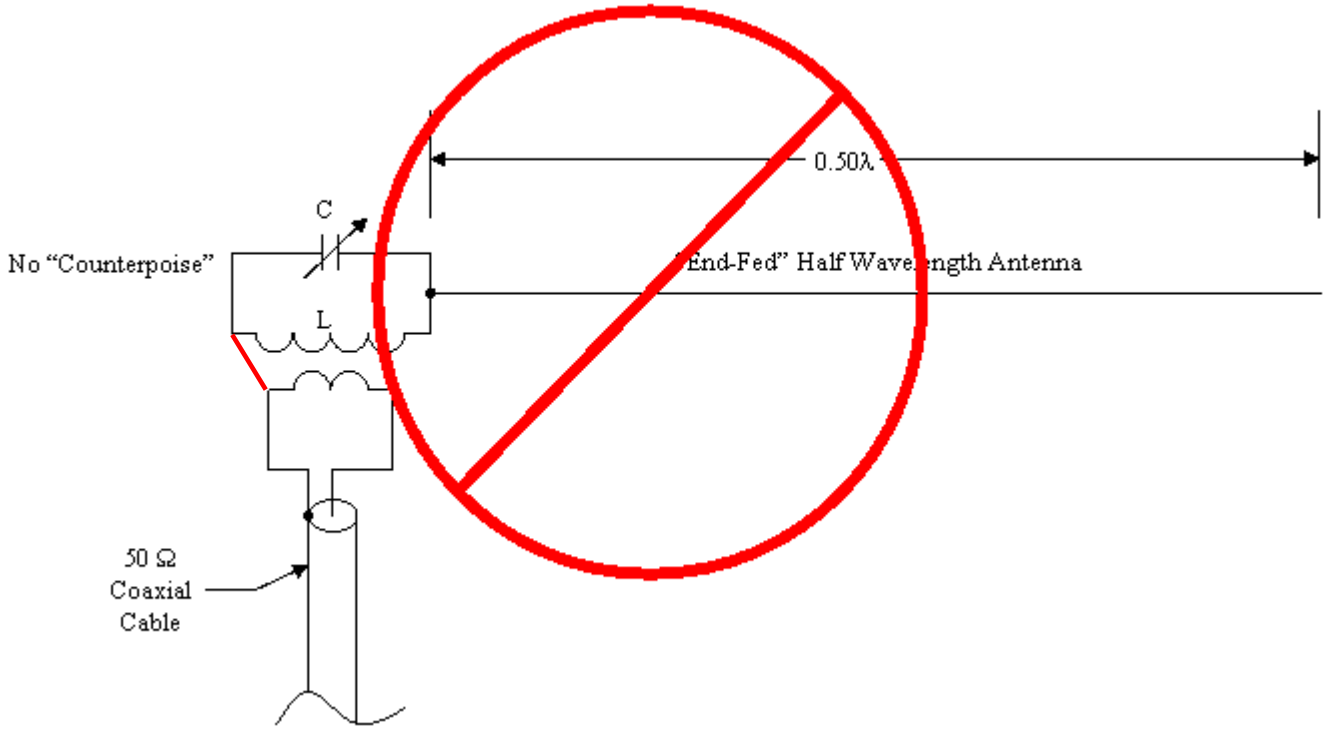
- **May work (somewhat) since the coax shield acts as a counterpoise:**
  - **Coax shield provides the return path for the RF field**
  - **Performance will vary with X, proximity to ground, etc**
  - **SWR losses on the coax can be a problem**
    - **Tuner needs to be at the base of the antenna**

Typical Tuner for an End Fed Half Wave Antenna



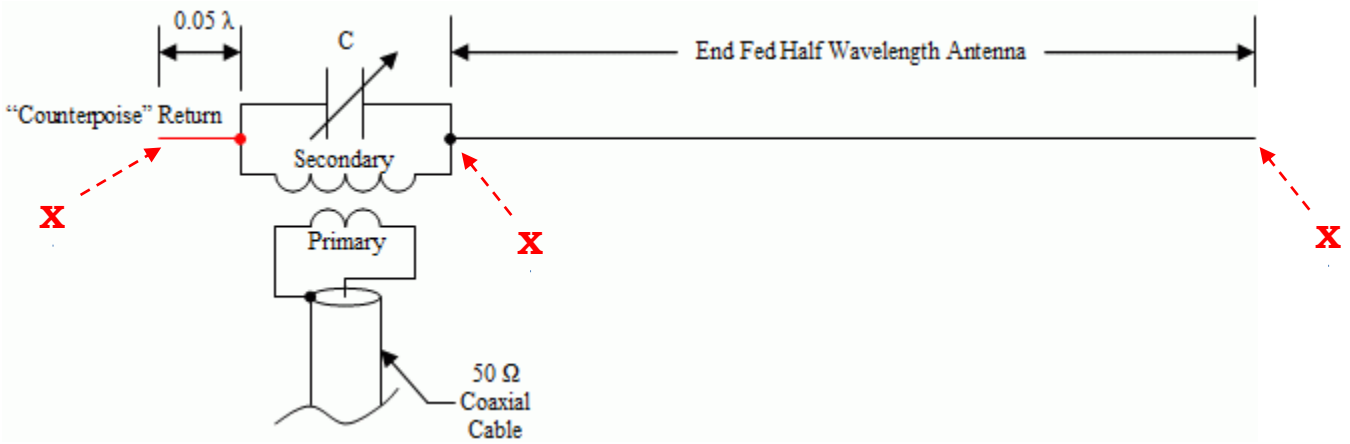
- **Theoretically: this antenna will *not* radiate**
  - **No counterpoise**
- **In practice, it might radiate (somewhat) depending on *parasitic* coupling to coax shield**

Typical Tuner for an End Fed Half Wave Antenna



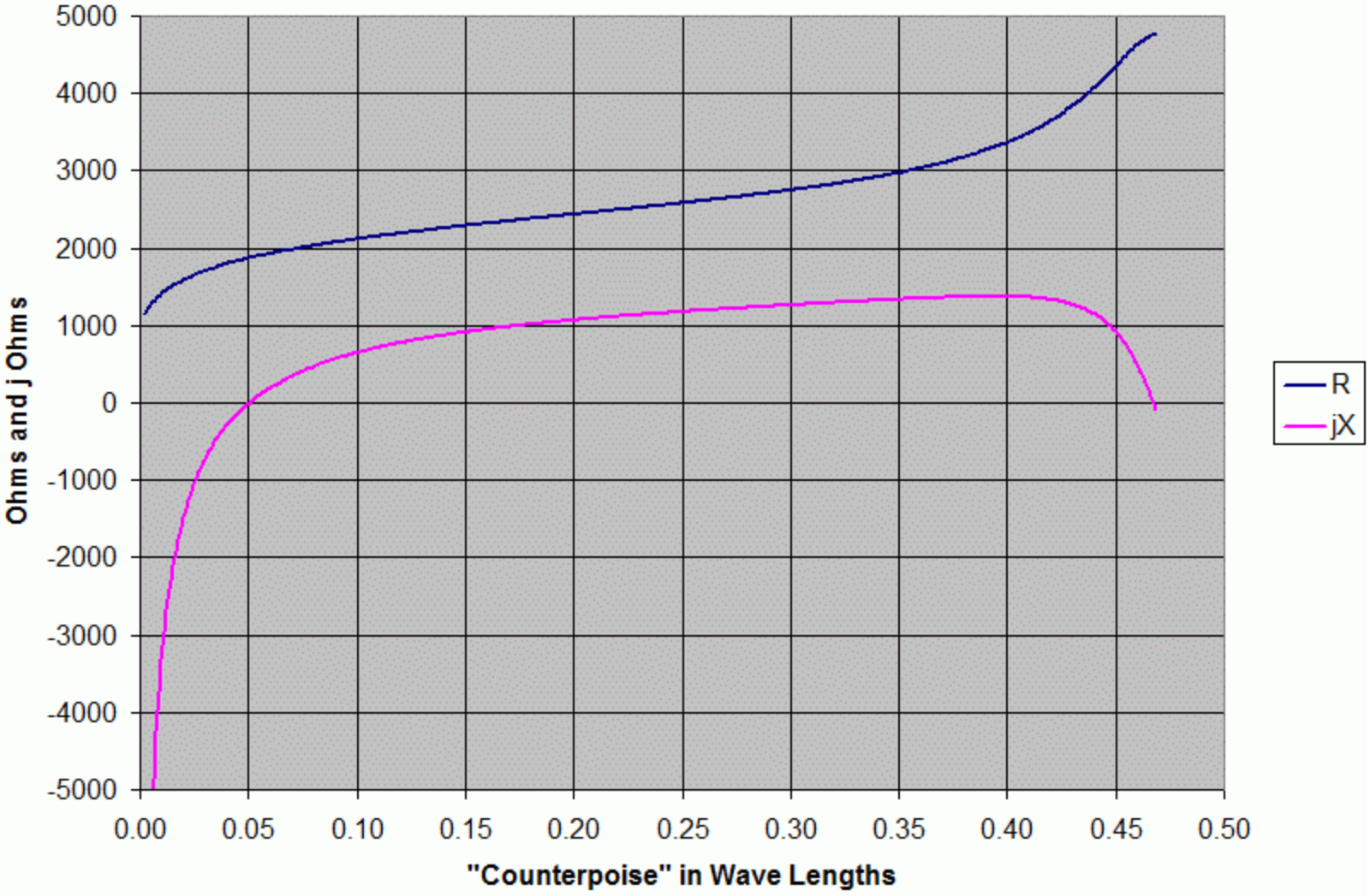
- Not the best approach, but might be ok for some applications
- Coax shield is the counterpoise

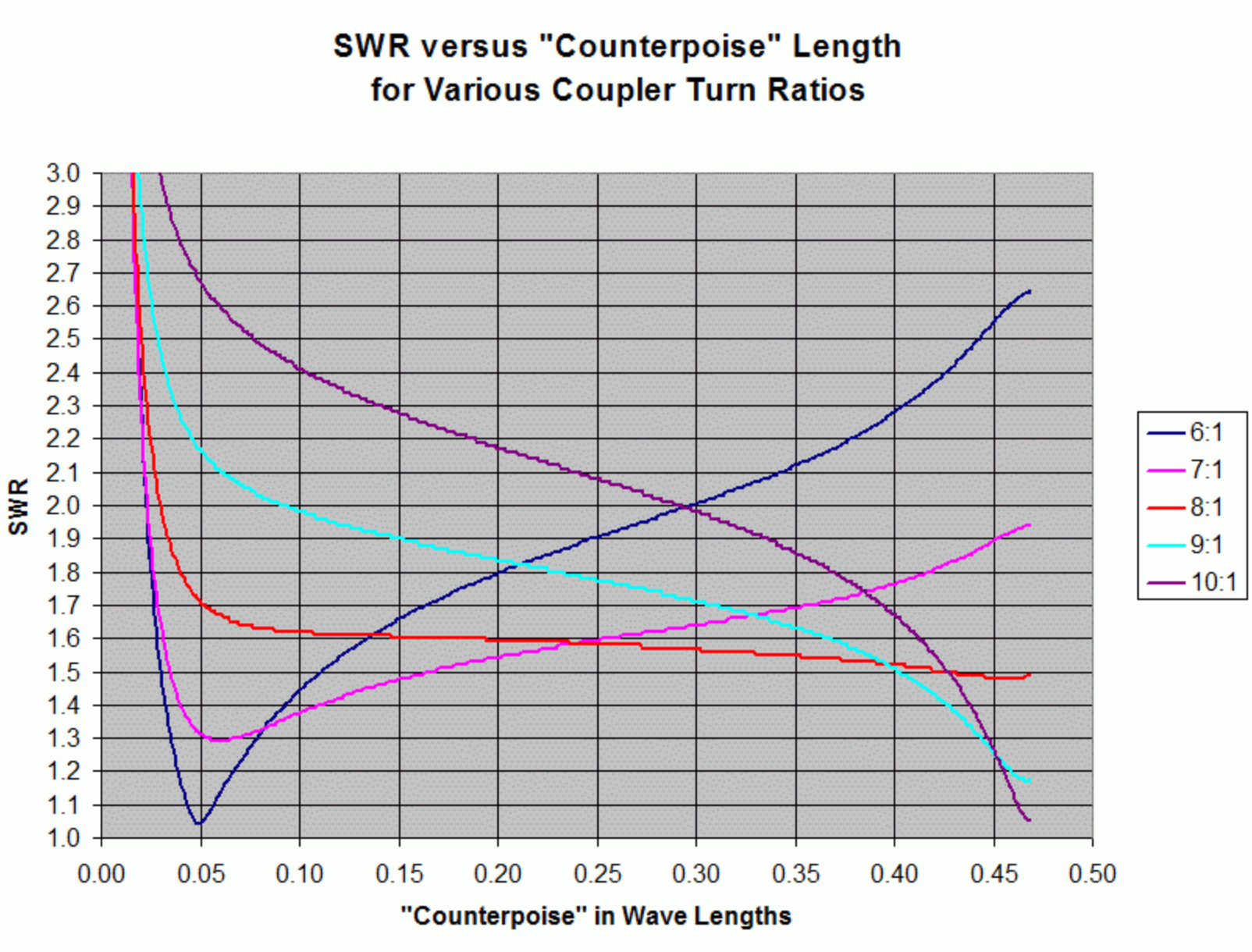
Recommended Way to Feed an End Fed Half Wave Antenna



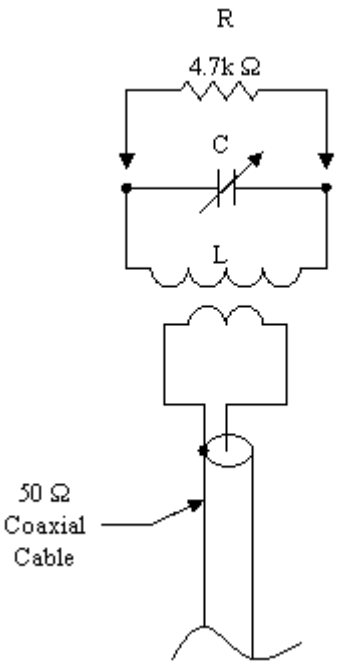
- **With proper choice of components, can achieve an SWR ~1:1**
  - **The capacitor simplifies tuning, but is not necessary**
- **Counterpoise:**
  - **Important to have for stable, predictable performance**
  - **Length isn't critical, but little/no benefit for lengths > 0.05 wavelenth**
    - **Don't go >0.25 wavelength**
- **Watch out for the high voltages (at X)**
  - **At 5 W (and 2000 ohms), V_{CAP}(Peak) = 100 V**
  - **At 100 W (and 2000 ohms), V_{CAP}(Peak) = 450 V**
  - **At 1500 W (and 2000 ohms), V_{CAP}(Peak) = 2400 V**

Feed Impedance Versus Counterpoise Length

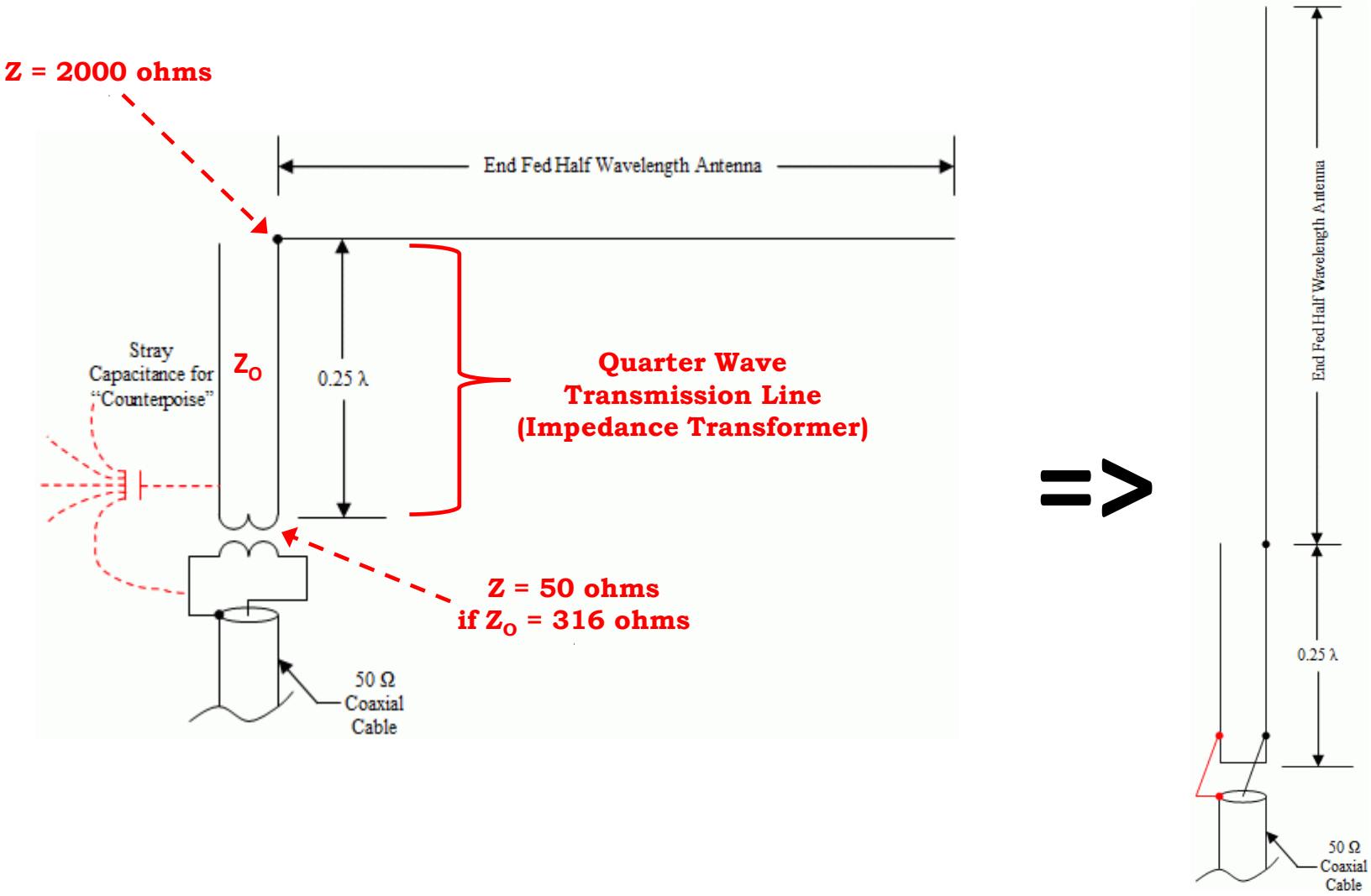



SWR versus "Counterpoise" Length
for Various Coupler Turn Ratios
SWR
3.0
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
"Counterpoise" in Wave Lengths
6:1
7:1
8:1
9:1
10:1

Example Transformer (not for high power)



The J-Pole Antenna



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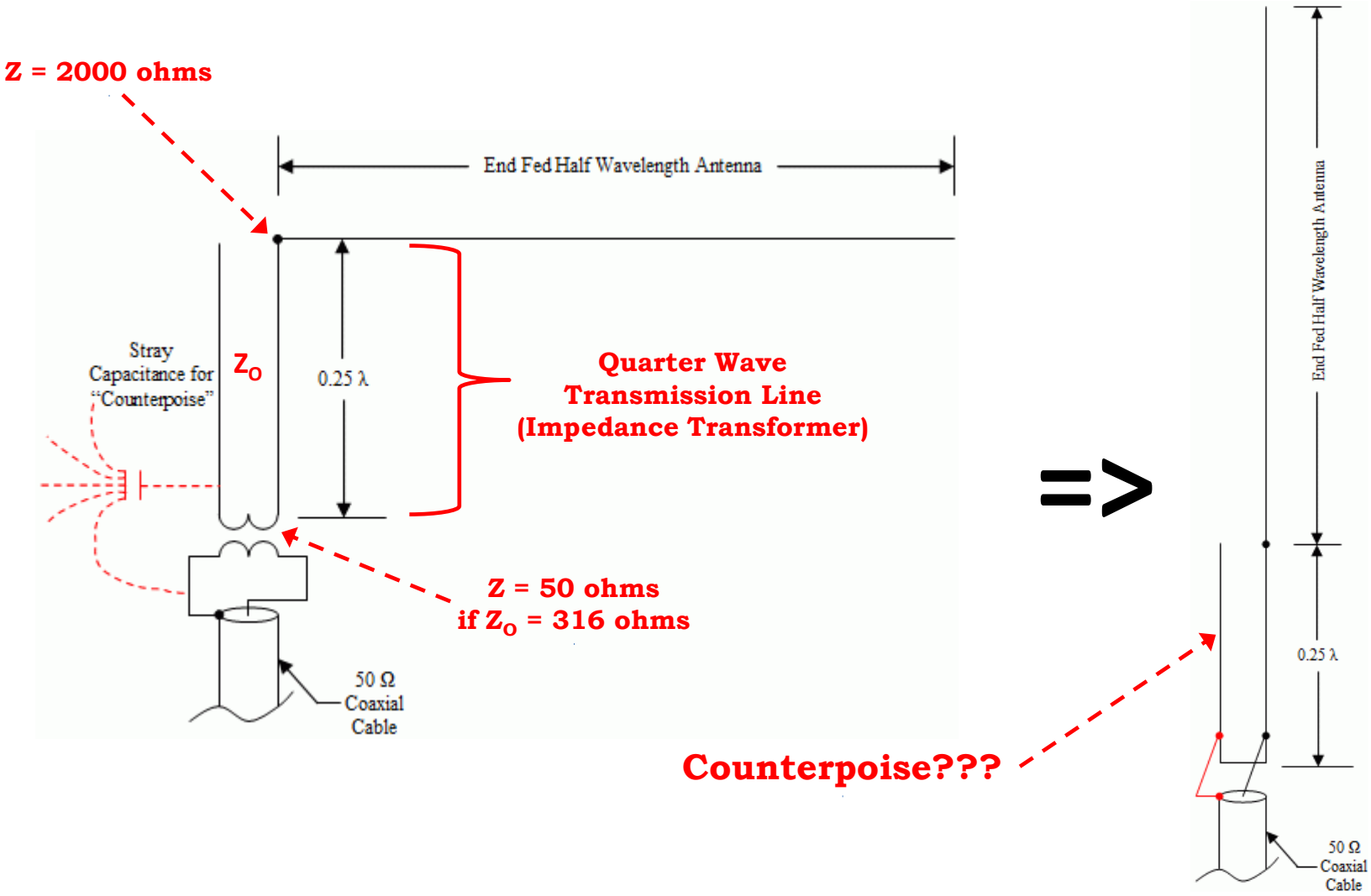

Problems With End Fed Half Wave Antennas

- **#1 Problem: Common mode currents on feedline**
  - **RF in shack**
  - **High noise levels on receive**
  - **Feedline and grounding can affect SWR and tuning**
  - **Isolating the feedling from the antenna can be difficult, even with a common mode choke**
- **High voltages, even at low power**
- **FCC RF exposure limits can be exceeded at low power levels**

Bottomline

Tom Rauch (W8JI):

End fed half wave antennas are a good option for a temporary antenna when using low power and battery operation, far from power mains and noise sources.