The End-Fed Half Wave Antenna

Rogue Valley Amateur Radio Club

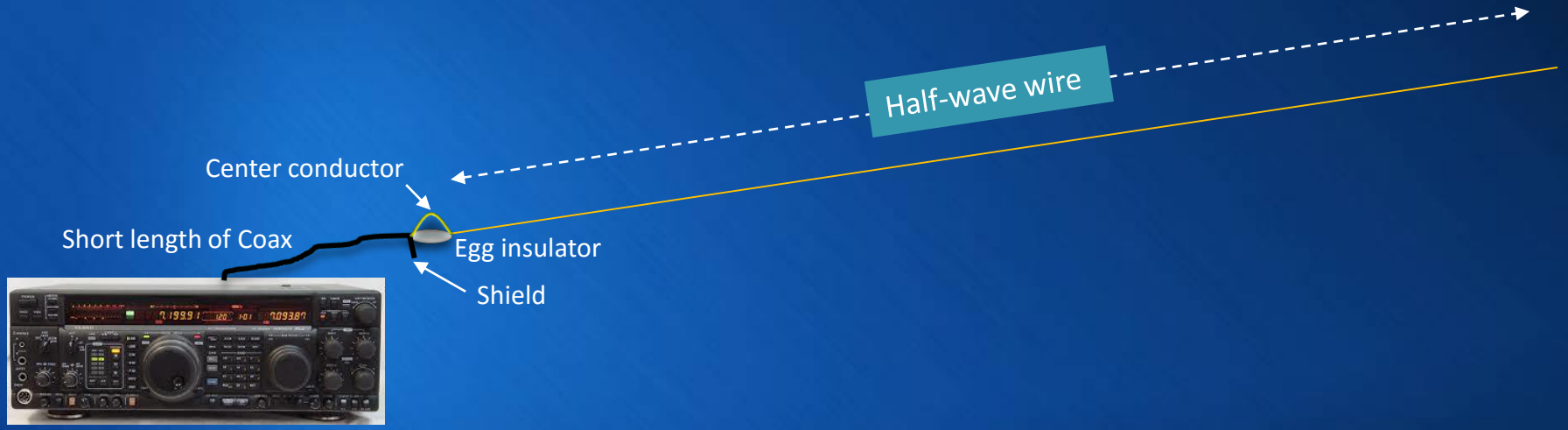
Tom McDermott, N5EG
October 6, 2016

Outline

- The End fed antenna is very convenient.
- Where did all that RFI come from?
- How come I’m getting RF bites from my equipment?
- Kirchhoff's current law.
- Antennas obey the law (not your opinion).

Diagram

- It’s very convenient.
- Run the feedline to your window.
- Run a half wave of wire out to a single high point (tree).



The Magical End-Fed Half Wave Antenna

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Diagram

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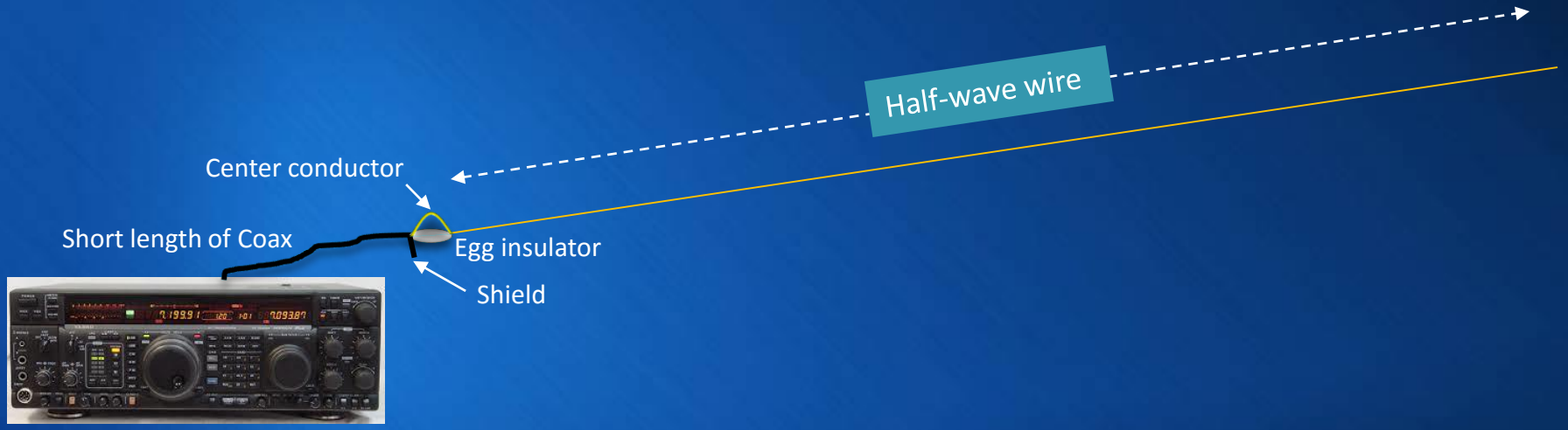
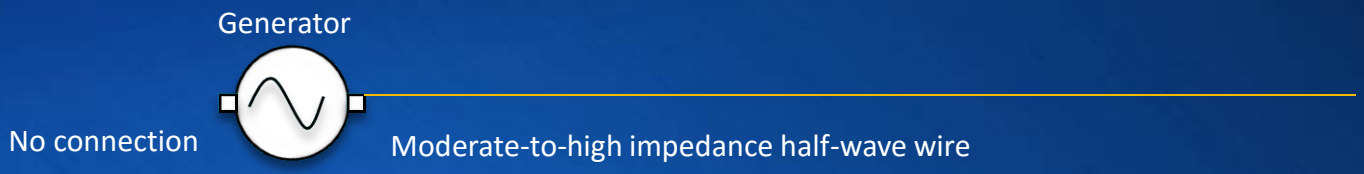


- Weird stuff happens…
  - Terrible RFI, RF feedback into my MIC.
  - RF burns when I touch the radio chassis.
  - SWR changes as I move my hands.
  - What the heck is going on ?

Circuit Diagram



- Kirchhoff's current rule:
  - The sum of currents into a node is zero.
    (As much current flows into a node as flows out).
- How much current flows into 'no connection'?
  - How much current does the generator supply?
- What's the SWR seen by the generator?
- Does it defy the laws of physics?

The Mystical End-Fed Half Wave Antenna

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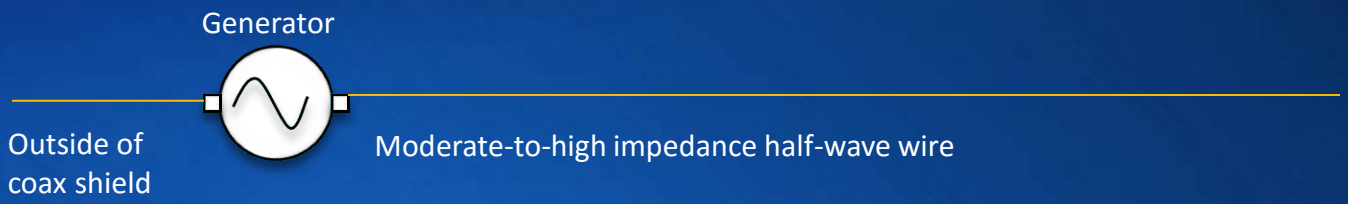
Circuit Diagram



- It’s impossible to completely isolate one generator terminal.
  - Direct Cable feed:
    - The outside of the coaxial cable shield is tied to the generator terminal.
    - Completely different currents flow on the outside vs. the inside of the shield !!
  - Balun feed:
    - No balun has perfect isolation.
    - Any real balun has losses.

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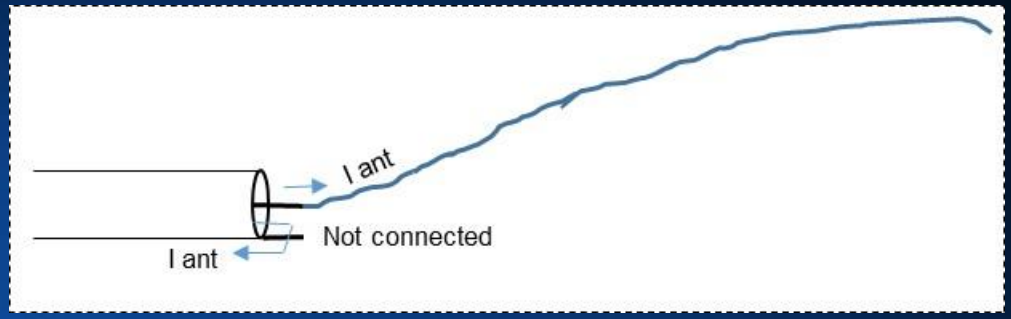
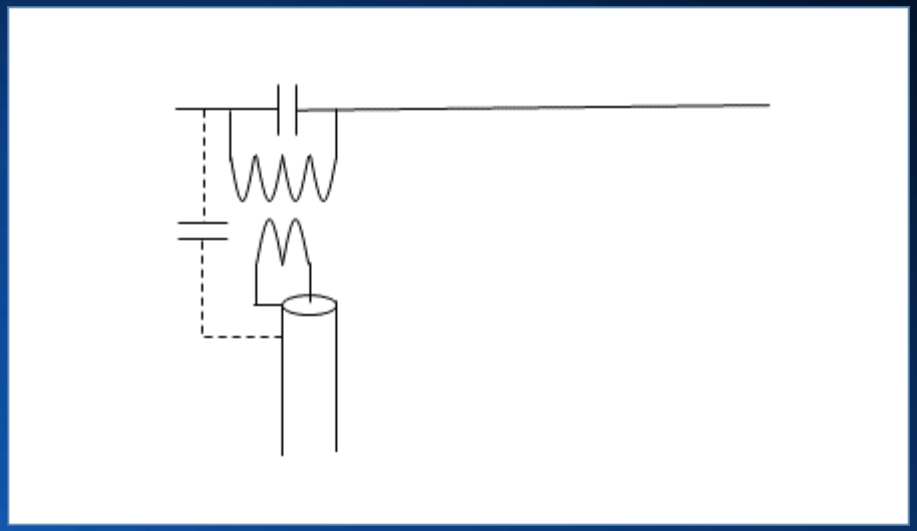
Cable Feed



- The cable inside shield current returns back on the cable shield outside.
  - The cable shield forms the ‘other half ‘of the antenna.
  - The antenna is actually off-center fed.
  - The shield (hot part of antenna) is probably wired to the transmitter chassis.
    - Tx is ‘hot’ with RF (ouch).
    - Touching the transmitter changes the antenna capacitance – the SWR changes as you move around.
    - RFI everywhere !!

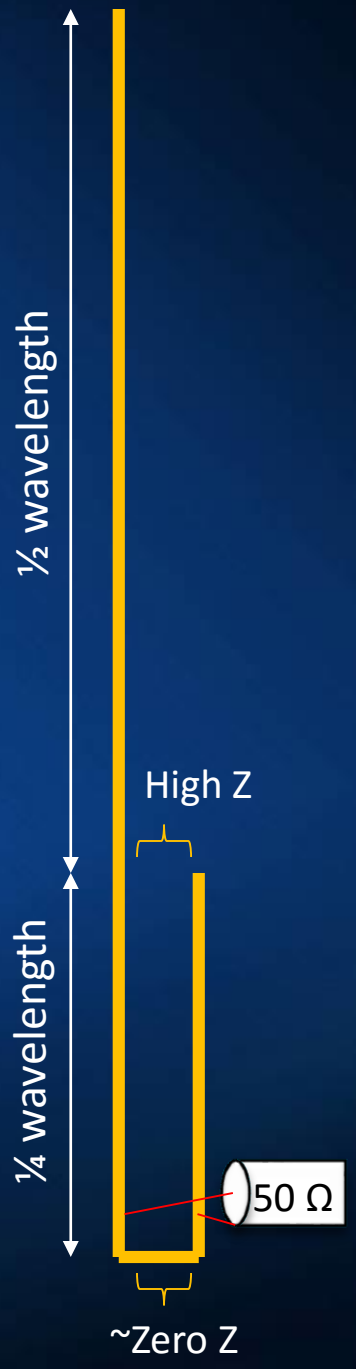
Balun Feed



- Iant must flow through the balun stray C.
  - If the balun Z is high, then large voltages can appear across the balun. Arc arc…
  - If the balun is lossy, then it can dissipate a lot of power. Ferrite dust…
- At 100 watts the voltage can be thousands of volts RF.
  - Using QRP you may never notice.

Stub Feed

- Use a ¼ wave stub to transform High-Z to Low-Z.
  - Commonly called “J-pole” antenna
- Stub does not solve common mode problem.
  - No current into top of short stub leg.
  - Current into stub legs must be equal and opposite or else the stub radiates.
  - Feedline shield still radiates.
  - Antenna pattern is strongly dependent on feedline, and placement.



Quarter Wave Wires

- A ¼ wave (or ¾, 5/4, etc.) wire is an impedance inverter.
  - If it is ‘open’ at the far end, the impedance is low at the near end.
  - Current wants to flow into a low impedance.
  - If it is ‘shorted’ at the far end, the impedance is high at the near end.
- Above applies when in free space.
  - When buried in the ground, its effective length changes a lot.
- It is only a quarter-wave on one band.
- Counterpoise can be in the same plane as the antenna (i.e. dipole).

How to make EFHW work?

- How could we make an EFHW antenna work?
  - Need a finite impedance at both generator terminals.
    - A short connection to good ground is one way.
    - A ¼ wave wire (counterpoise) is another way.
    - A grounded ¼ wave wire is not a good way.
    - If the antenna is ½ wave, the feed will be unbalanced unless the counterpoise is also ½ wave.
      - A balun could deal with this provided the impedance is reasonable.