



# Portable HF Antennas

Think Like A  
Backpacker

George  
KJ6VU

## ME... KJ6VU

- Licensed in 1972
- Active in repeater building, portable HF, DIY
- Co-host of the Ham Radio Workbench podcast
- PackTenna - portable HF antennas
- Sierra Radio - repeater control systems

# Ham Radio Workbench Podcast

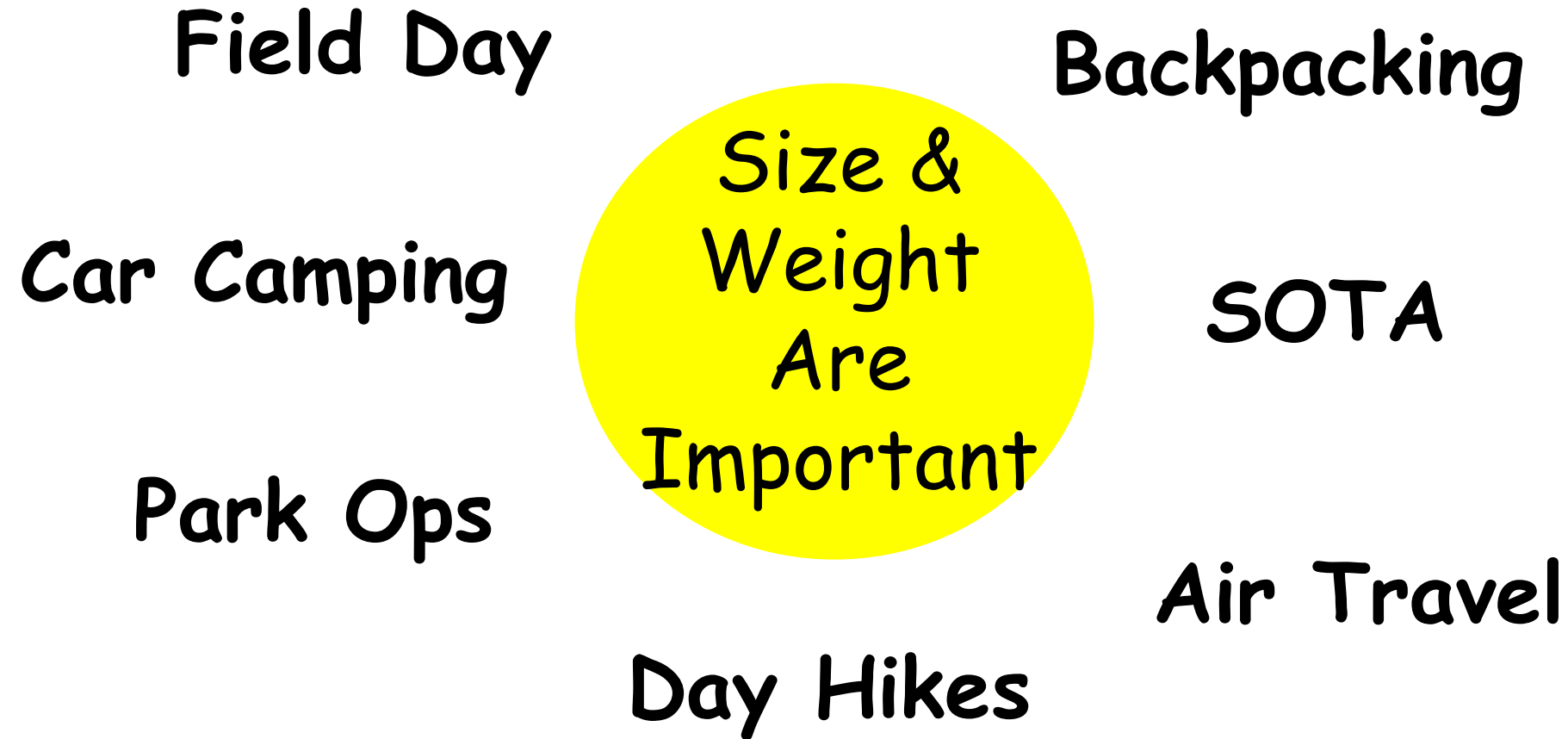
- Jeremy KF7IJZ & George KJ6VU
- Technically oriented topics
- Build projects
- Guest interviews, product reviews & advice
- General BS about radio & tech
- Web site, Facebook page, Twitter feeds

**ham radio workbench . com**



What I wanted was...

*Effective, Portable HF Antenna System for...*









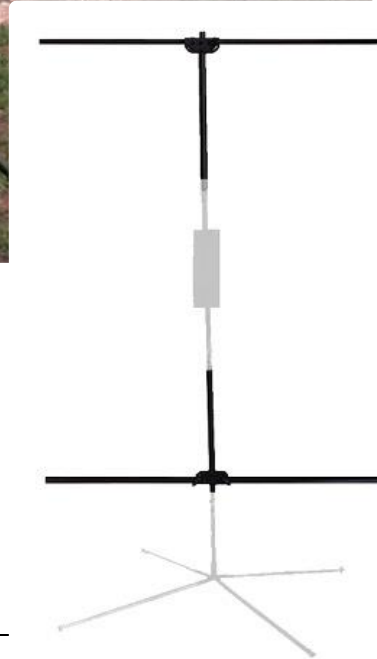
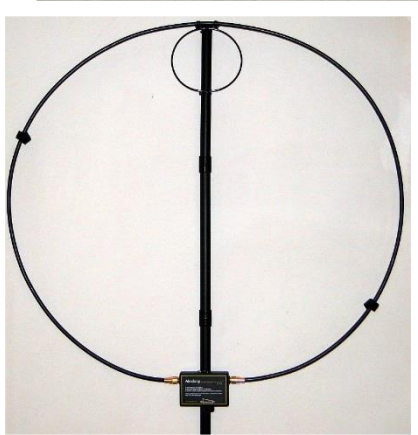
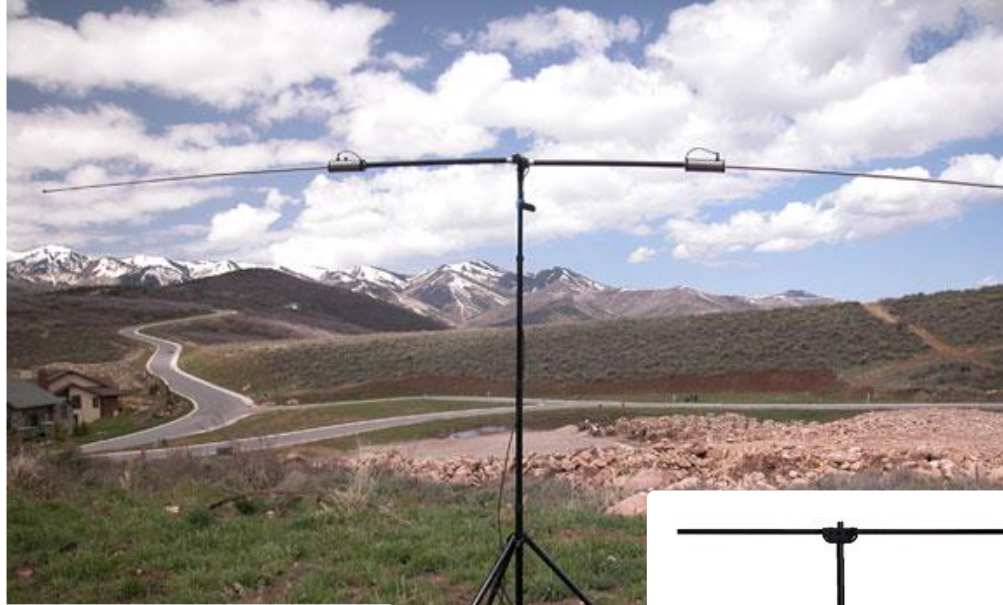








# Popular Portable HF Antennas...

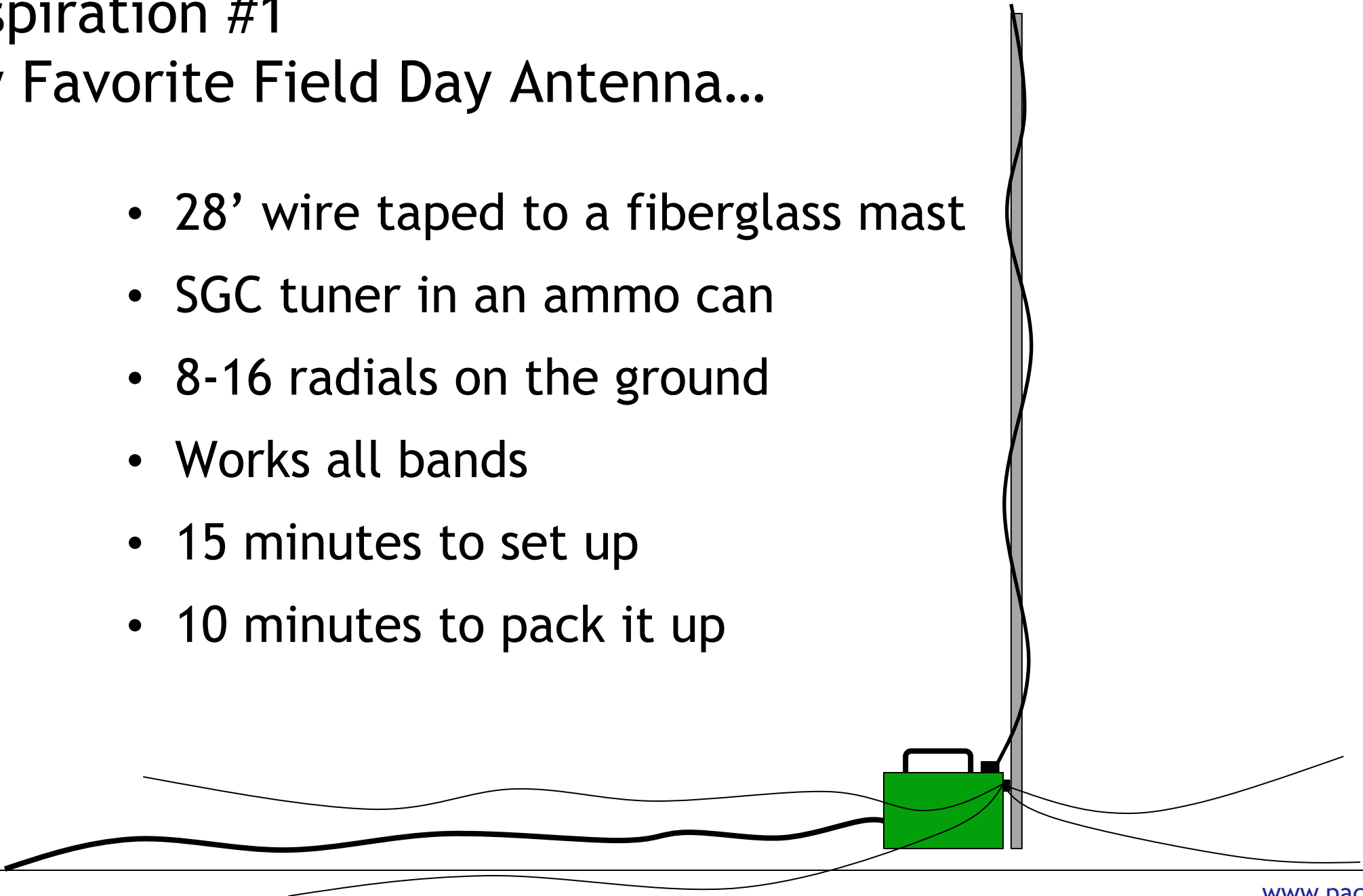




# Inspiration #1

## My Favorite Field Day Antenna...

- 28' wire taped to a fiberglass mast
- SGC tuner in an ammo can
- 8-16 radials on the ground
- Works all bands
- 15 minutes to set up
- 10 minutes to pack it up



# Inspiration #2 - “Think Like a Backpacker”

1. **Weigh** your stuff - Ounces add up to pounds.
2. **Trim the fat**: leave the kitchen sink at home.
3. **Plan** your trip: limit your contingencies.
4. Take the **lightest** possible item to do the job.
5. **Simplify**: take items that serve multiple functions.
6. Don't just take a bunch of stuff: **build a system**.
7. Get back to the basics - **don't over complicate things**.



Backpacking Light 101" By Ryan Jordan  
"Seven Steps to Enlightenment"  
[www.backpackinglight.com](http://www.backpackinglight.com)



# Design Goals

- ✓ Full size / efficient / broad band design
- ✓ Light weight components
- ✓ Robust hardware
- ✓ Modular system
- ✓ Easy setup
- ✓ 5 minutes max



# Key Design Decisions...

## #1 Full size wire elements

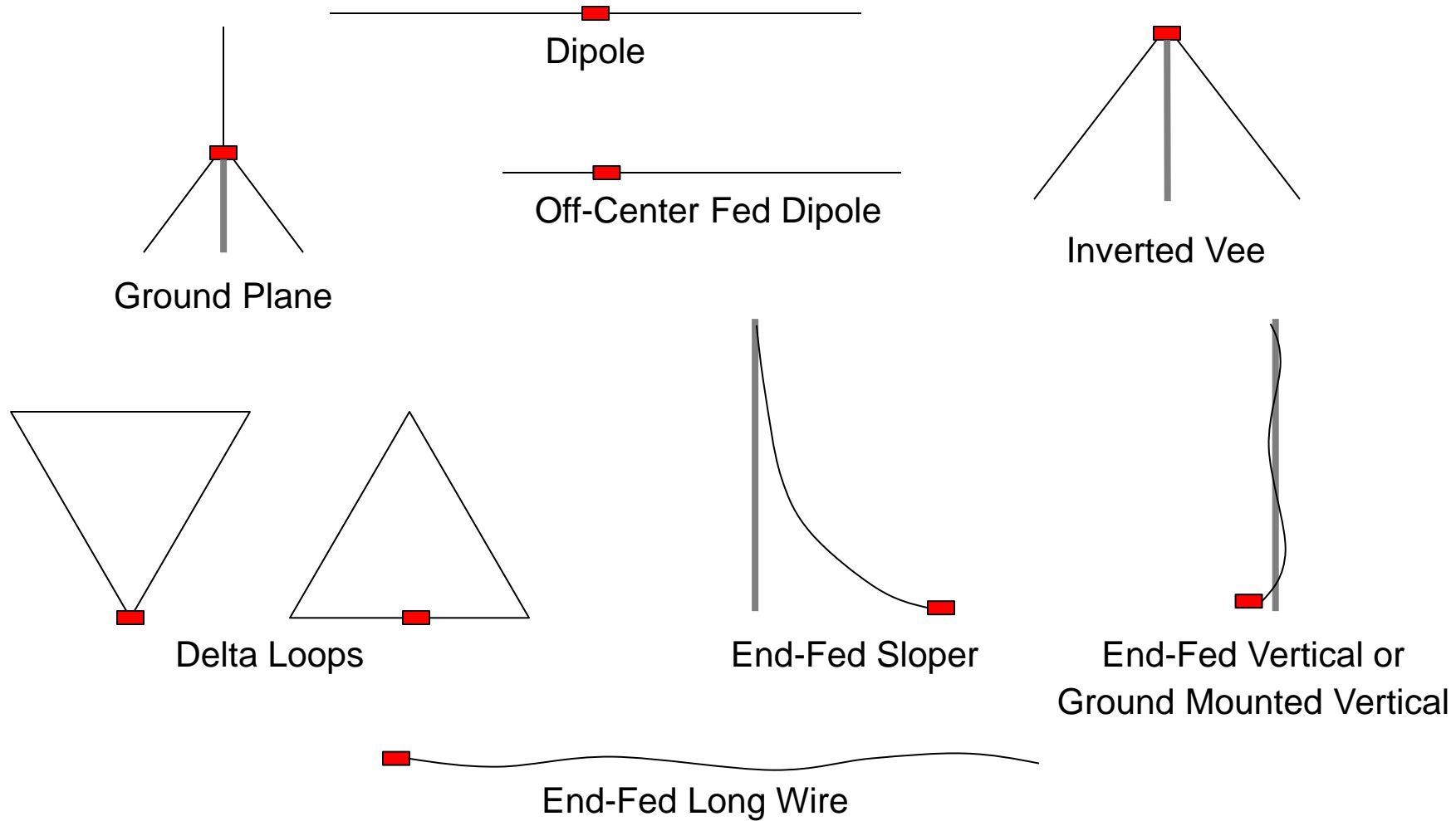
- Good performance
- Very compact

## #2 Fiberglass support pole

- 30' + tall can handle any band down to 40m
- Collapse down to about 2' for packing



# You Can Make Almost Anything...



# PackTenna - First Generation

- Feed points
- Choke
- Mast
- Wire
- Coax
- Guys





# Feed Points and Chokes

1:1 Balun Feedpoint



Inverted Vee  
Dipole

9:1 UNUN  
Feedpoint



End-Fed Wire  
Any Hi-Z Antenna

49:1 UNUN  
Feedpoint



End-Fed  
Half Wave

In-Line Current  
Choke



End-Fed Wire

# Great Resources



Stuart Thomas KB1HQS QST Review  
YouTube video series



VE3IPS Blog



Signal Search  
4.94K subscribers



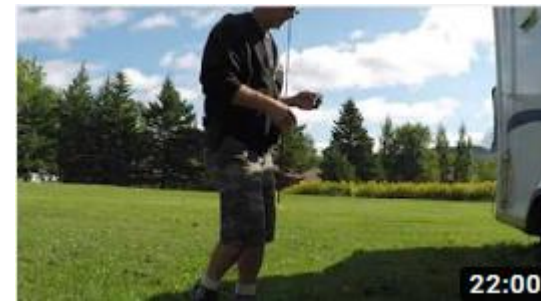
Signal Search  
YouTube Channel



K8MRD  
YouTube Channel



OH8STN  
YouTube Channel



VE3FAL  
YouTube Channel

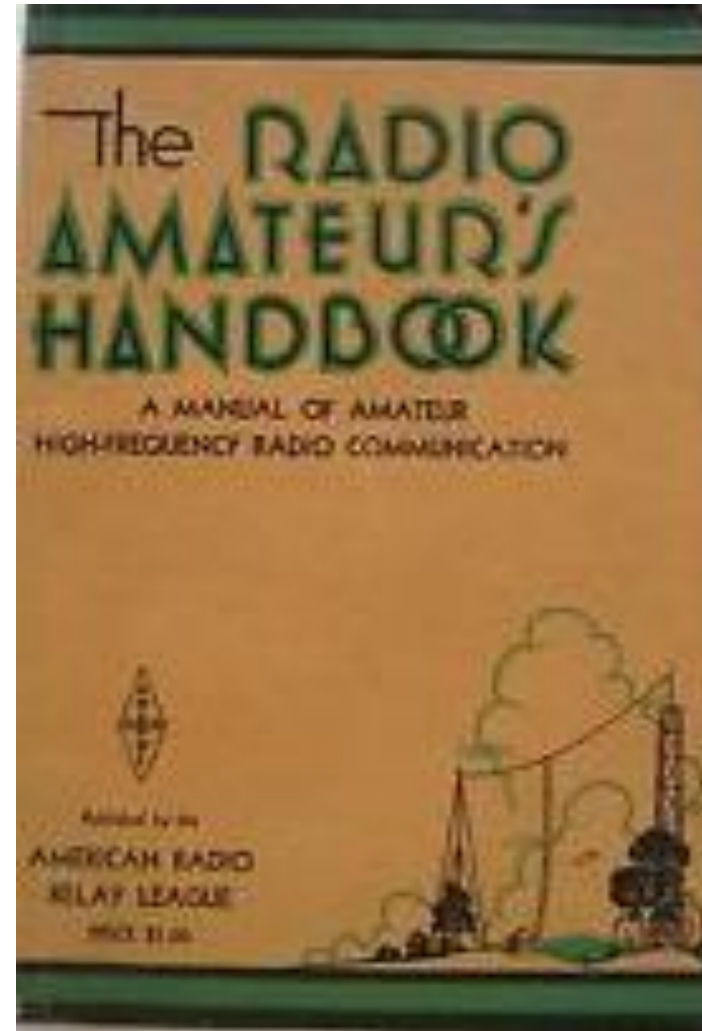


W7DBO  
YouTube Channel

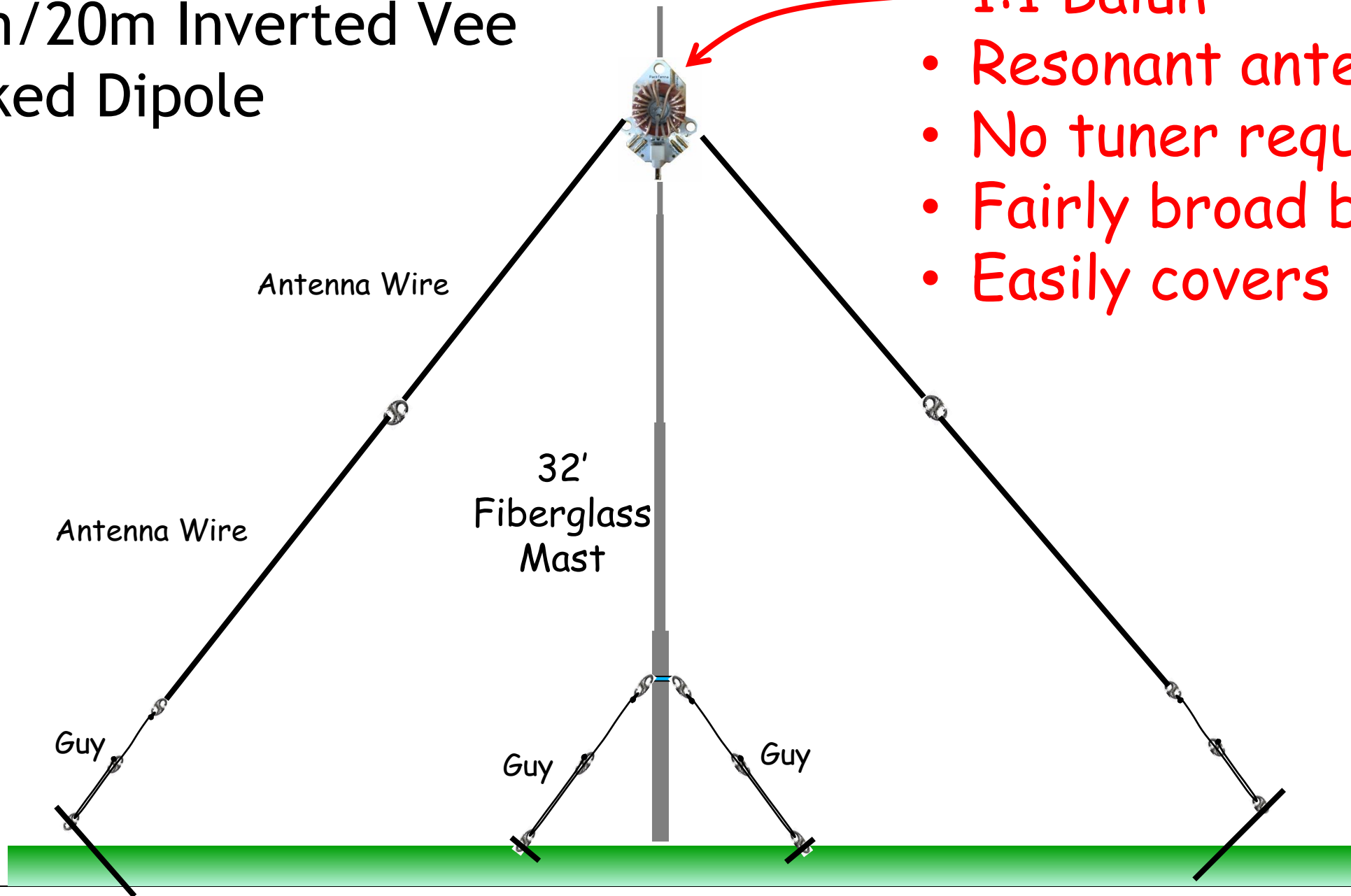


# How Do They Work ?

1935 Handbook !



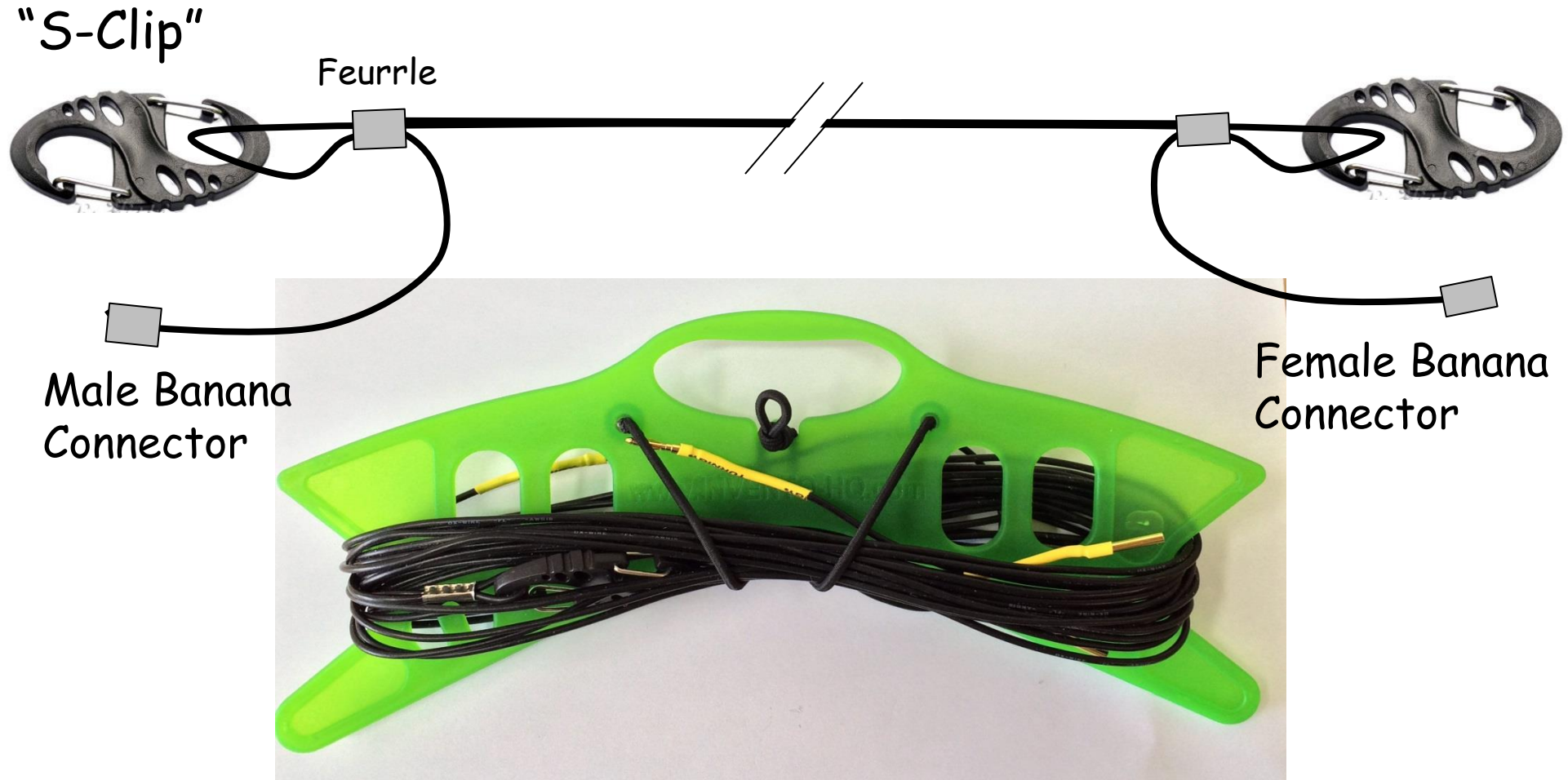
# 40m/20m Inverted Vee Linked Dipole



- 1:1 Balun
- Resonant antenna
- No tuner required
- Fairly broad band
- Easily covers 10-40m



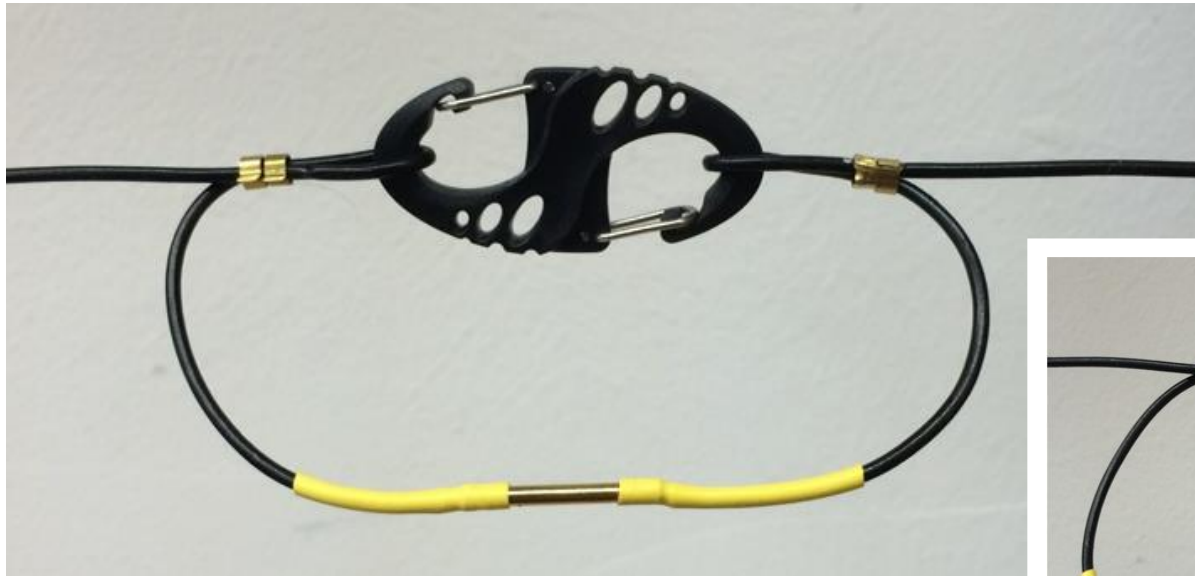
# 20/40 Wire Elements



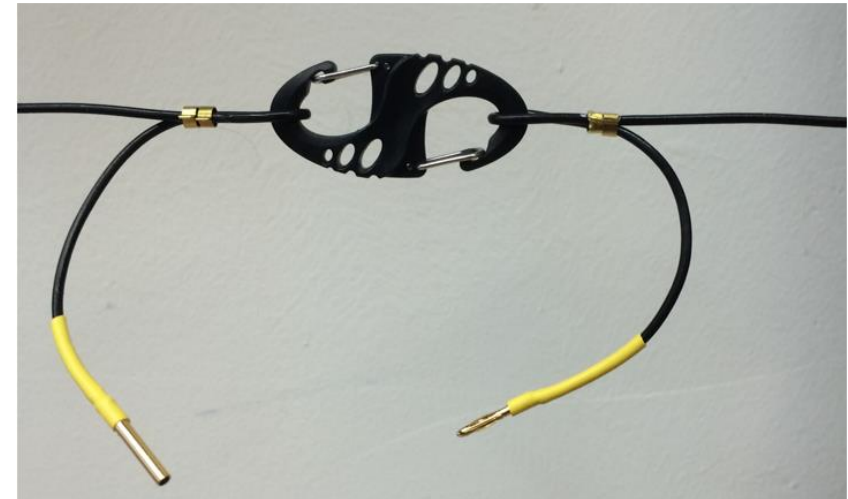
# “S-Clips” & Banana Plugs



Gold plated mini banana plugs

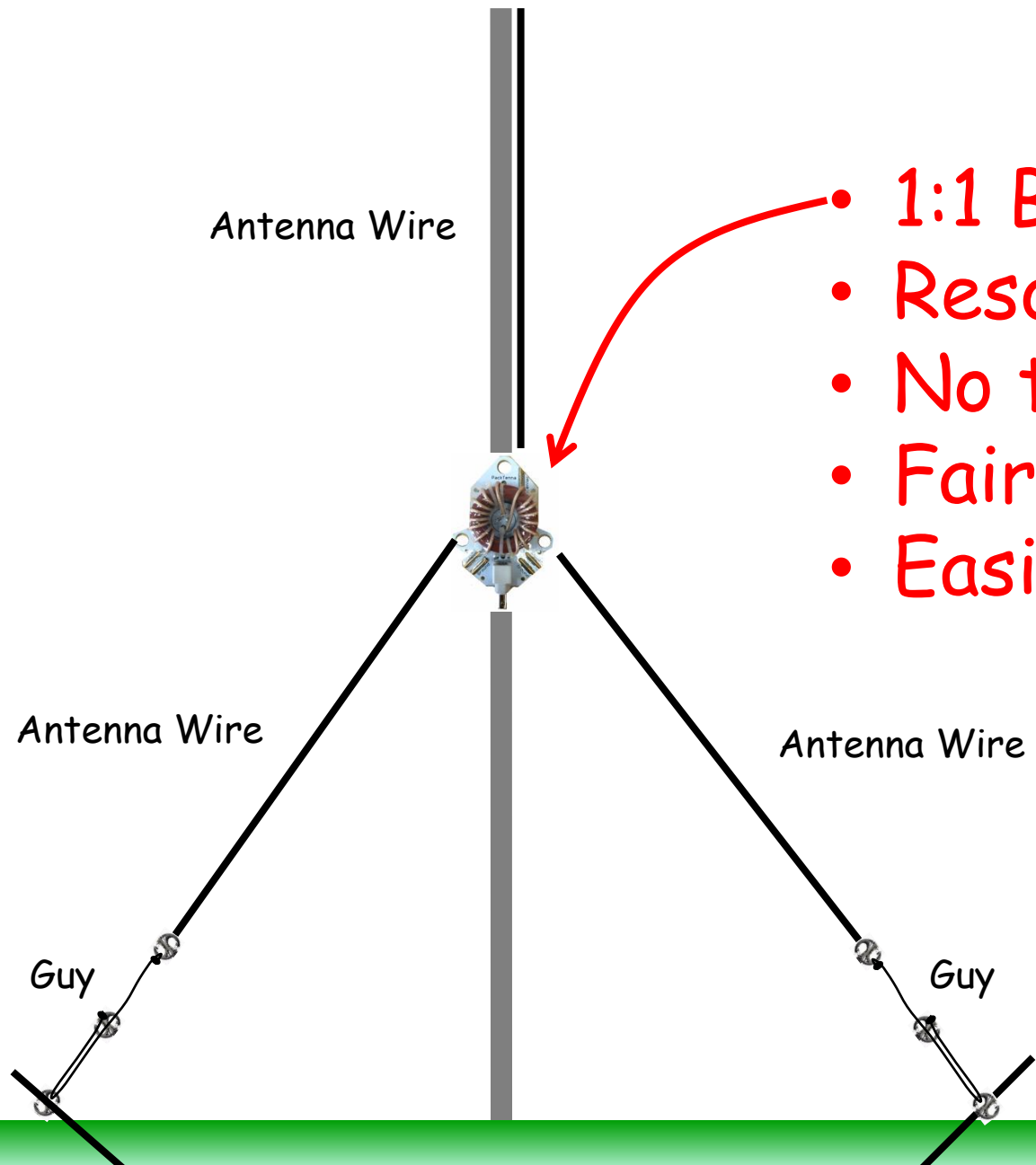


Dipole Link





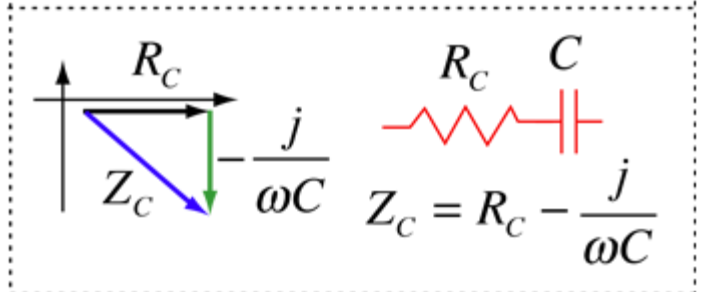
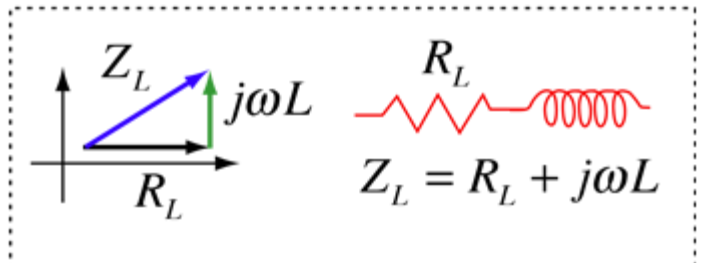
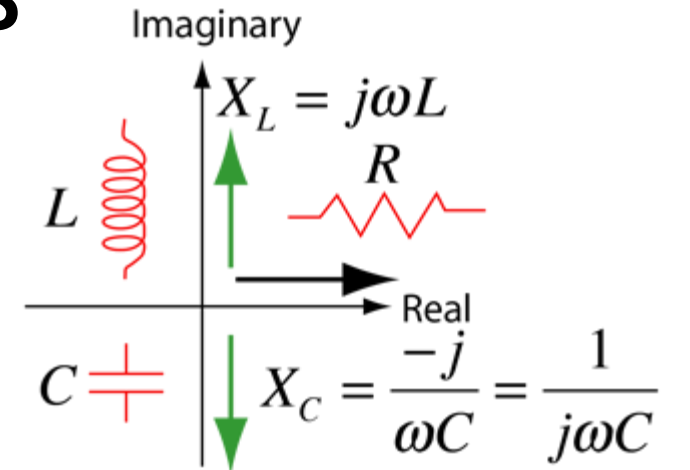
# Ground Plane



- 1:1 Balun
- Resonant antenna
- No tuner required
- Fairly broad band
- Easily covers 10-20m

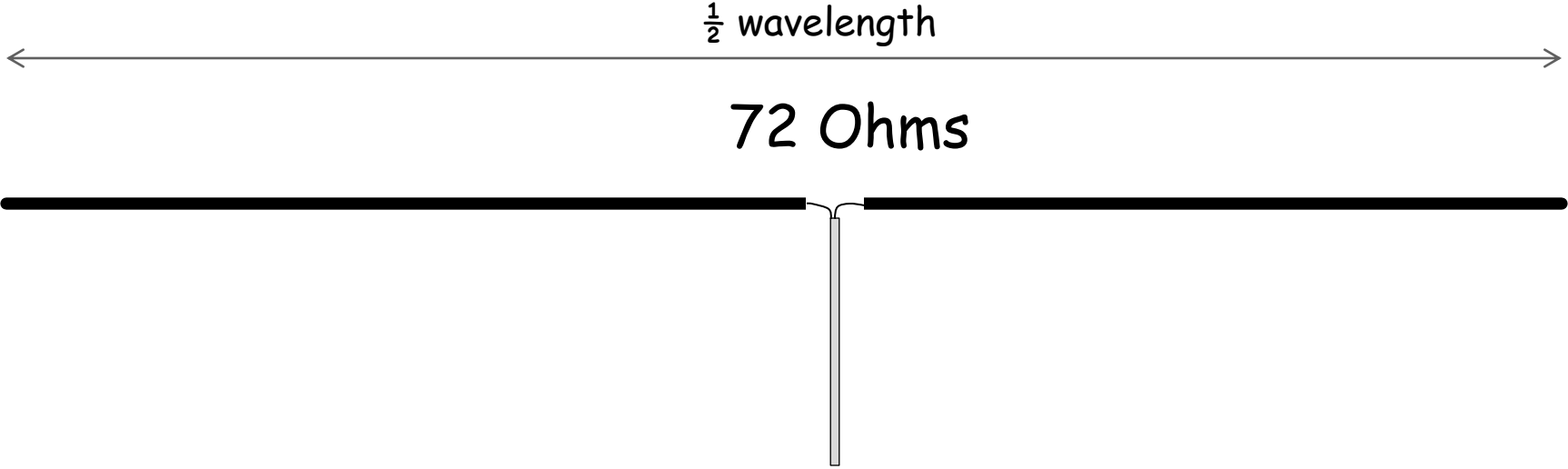
# Understanding End Fed Antennas

...Let's start with Impedance

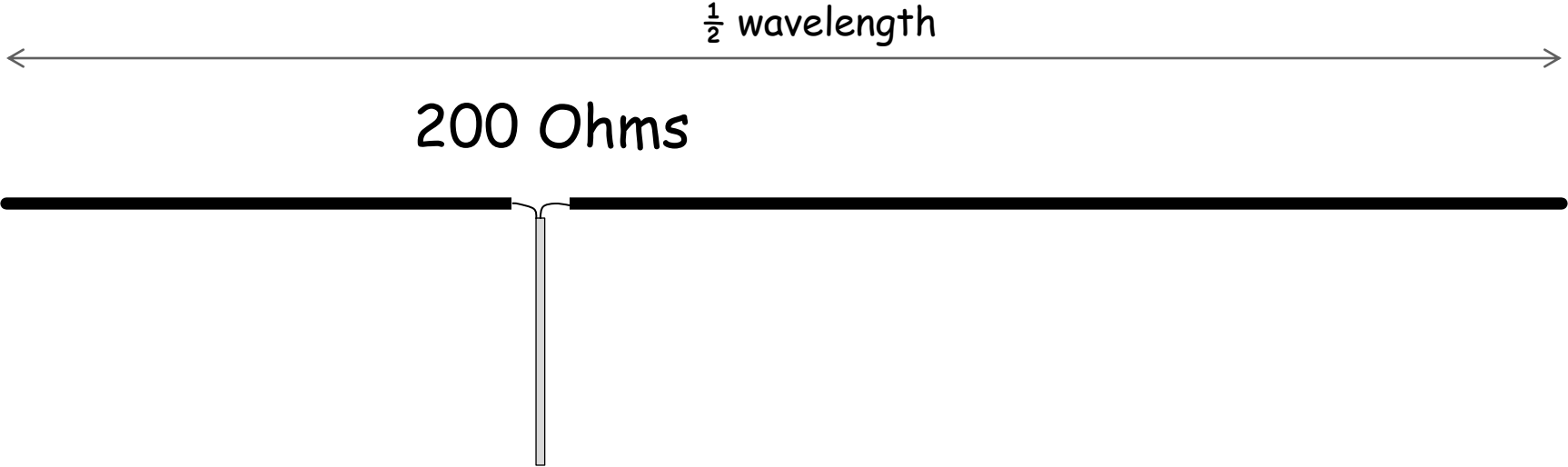




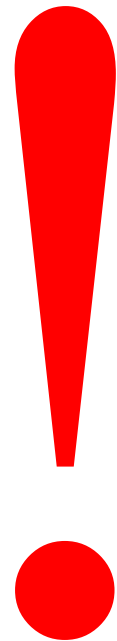
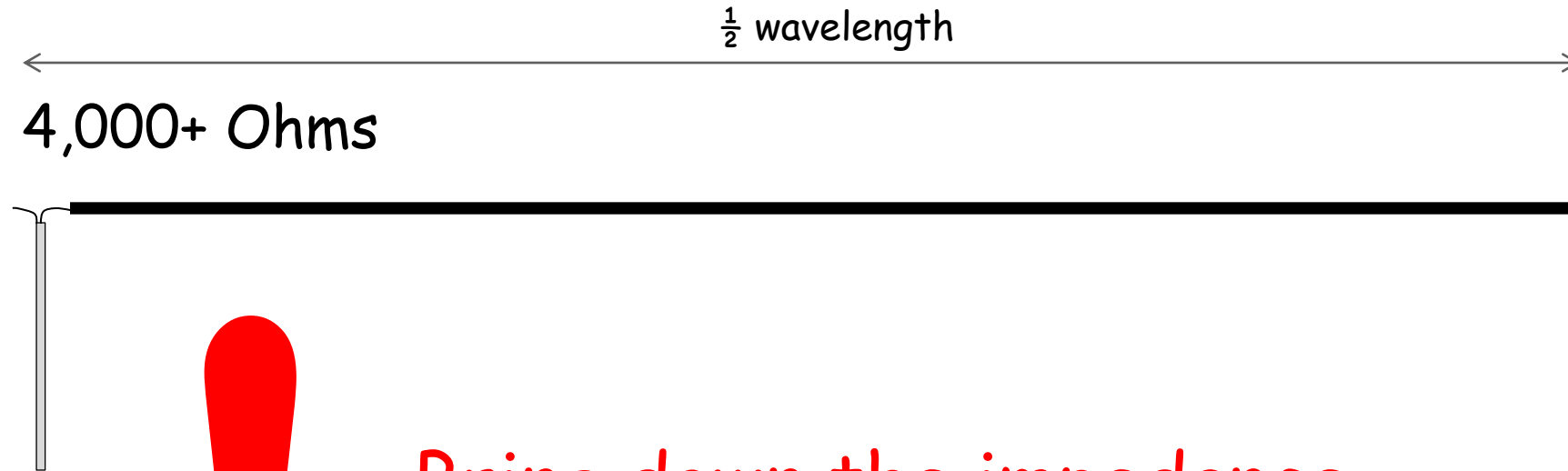
# Center Fed Half Wave Dipole



# Off Center Fed Half Wave Dipole



# End Fed Half Wave



- Bring down the impedance
- What happened to the counterpoise ??!?!?



## End Fed Antennas

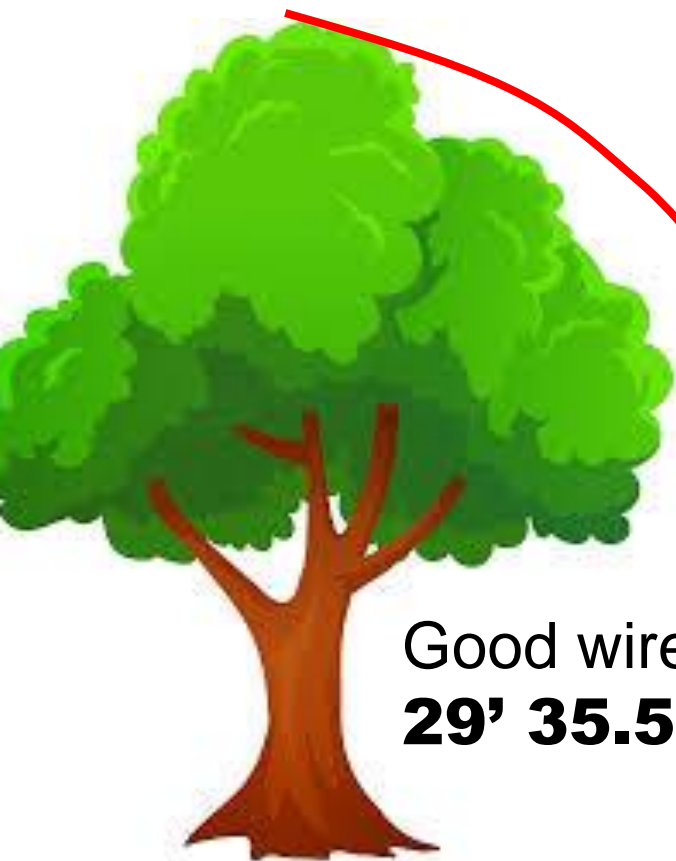
- Bring down the impedance
  - I need a transformer
- What happened to the counterpoise ??!?!
  - Oh, it's there. But where?
  - It can cause problems

# End-Fed Random Wire

- Not resonant - covers all bands
- 9:1 Balun and tuner required

9:1 balun brings the 2000-5000 Ohms down to 250-600 Ohms  
Within the range of broad-band tuners (LDG, MFJ, etc)  
Most internal tuners are limited to ~25-150 Ohm tuning range

WARNING ! Coax shield becomes the counterpoise  
Brings common mode RF current back to the radio  
No big deal at 5 watts, but a problem at 100 watts.



Good wire lengths  
**29' 35.5' 41' 58' 71'**

9:1 Balun

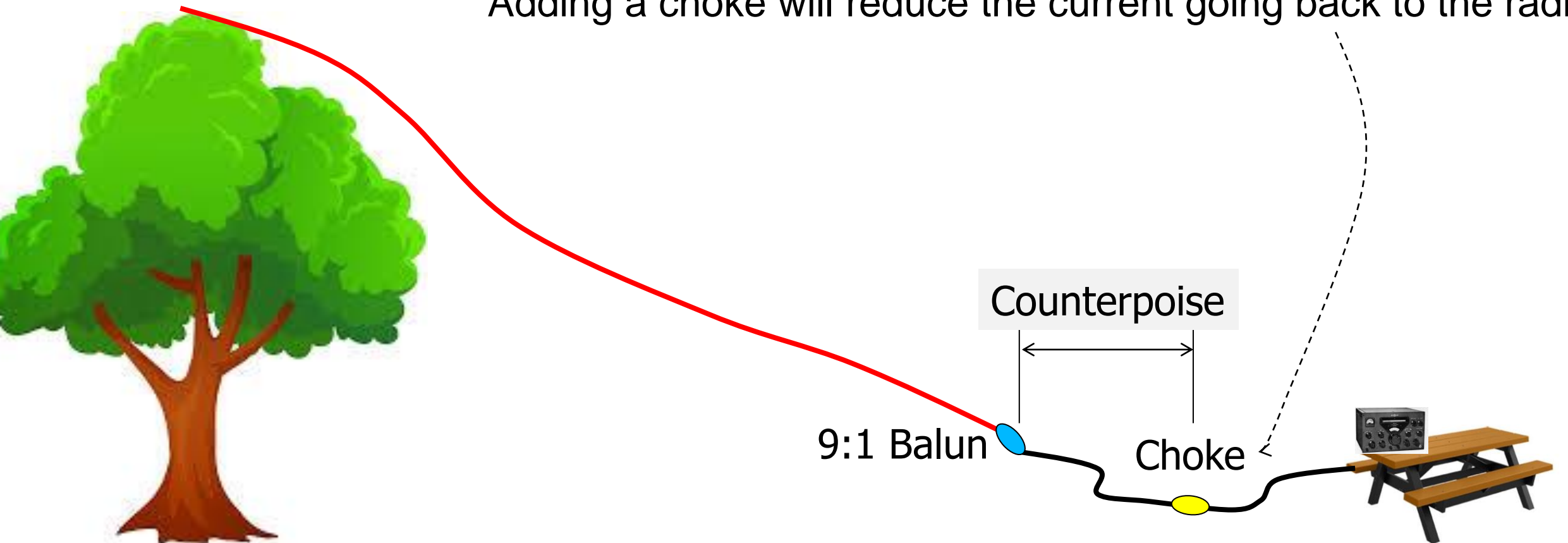
Counterpoise



# End-Fed Random Wire

- Not resonant - covers all bands
- 9:1 Balun and tuner required

Adding a choke will reduce the current going back to the radio

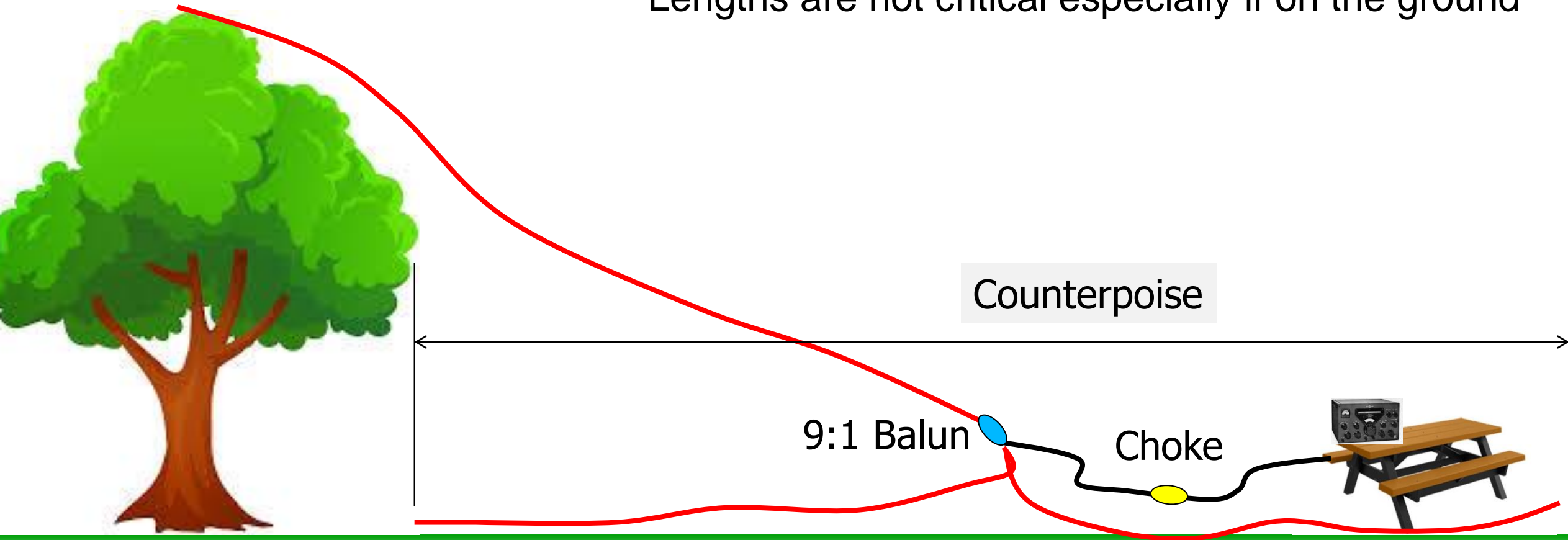




# End-Fed Random Wire

- Adding a counterpoise wire

Adding a counterpoise wire or a few can help  
Lengths are not critical especially if on the ground



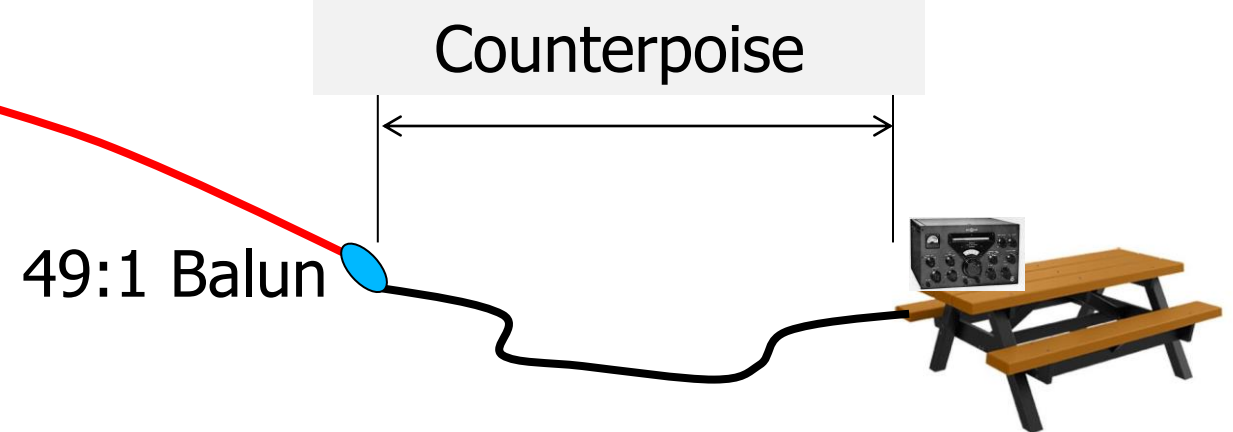
# End-Fed Half Wave Wire

- Resonant - NO Tuner required
- 49:1 Balun tuner required

49:1 balun brings the 2000-5000 Ohms down to 50 Ohms



WARNING ! Coax shield becomes the counterpoise  
Brings common mode RF current back to the radio  
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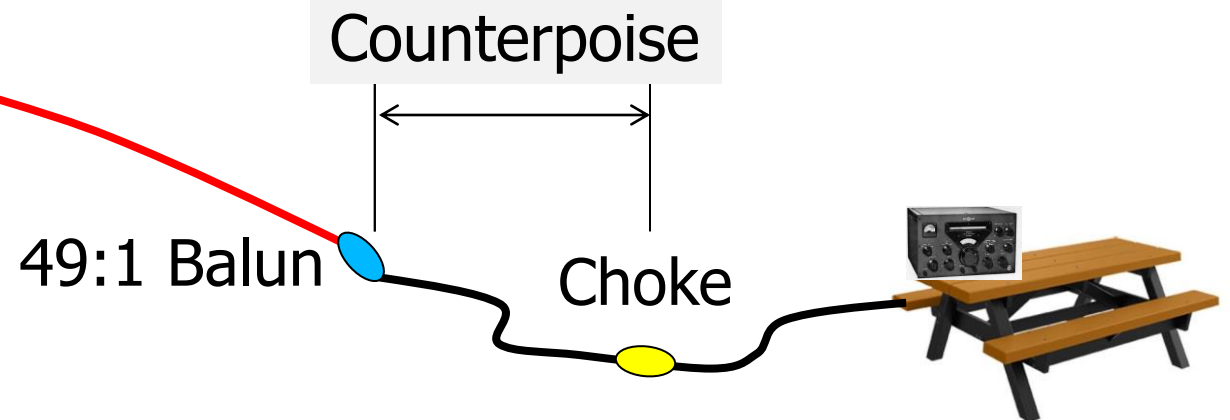
# End-Fed Half Wave Wire

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# 49:1 Transformer Coil

7:1 Turn ratio = 49:1 Impedance

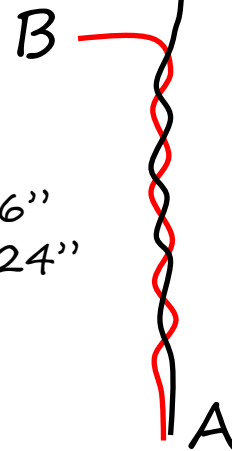
2450 Ohms : 50 Ohms

$$Z = T^2$$

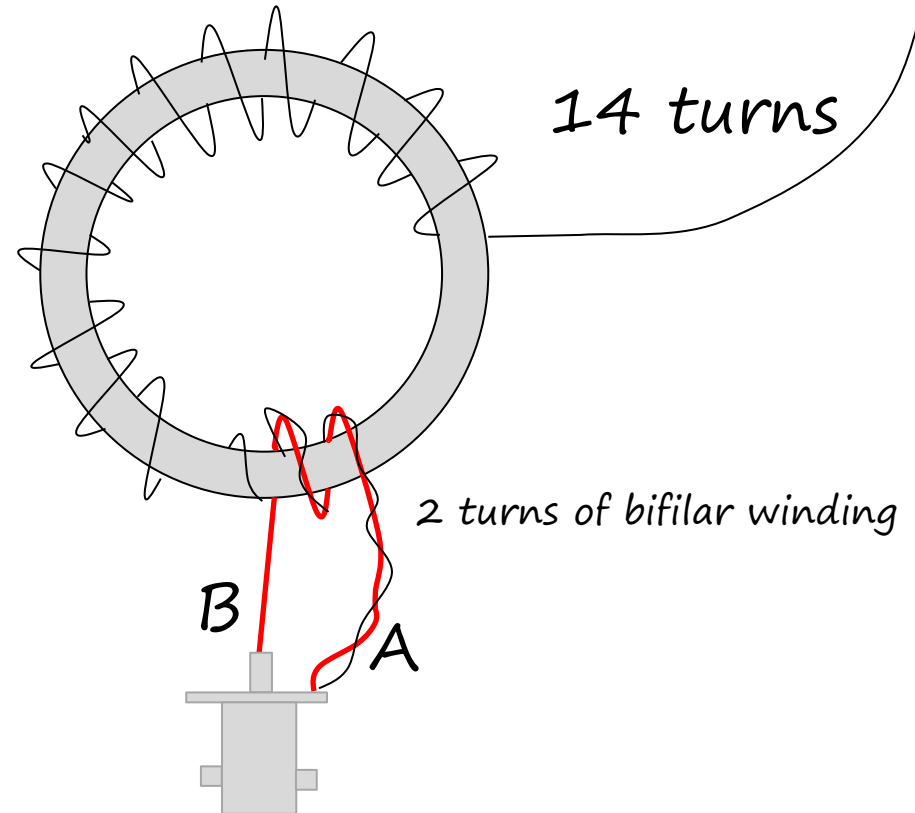
Impedance = Turns Ratio Squared

**NO TUNER REQUIRED**

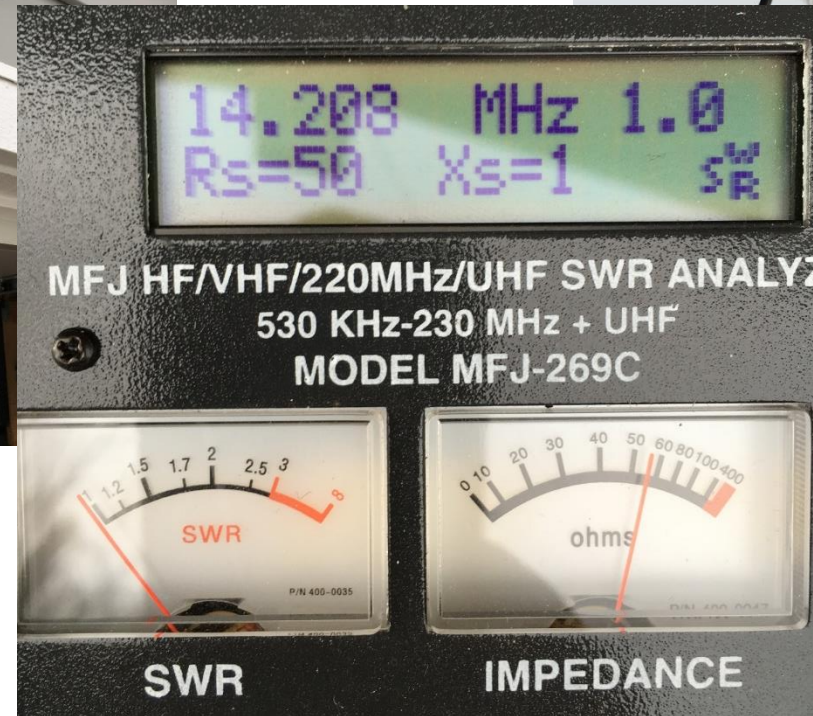
A/B wire length = 6"  
A/C wire length = 24"



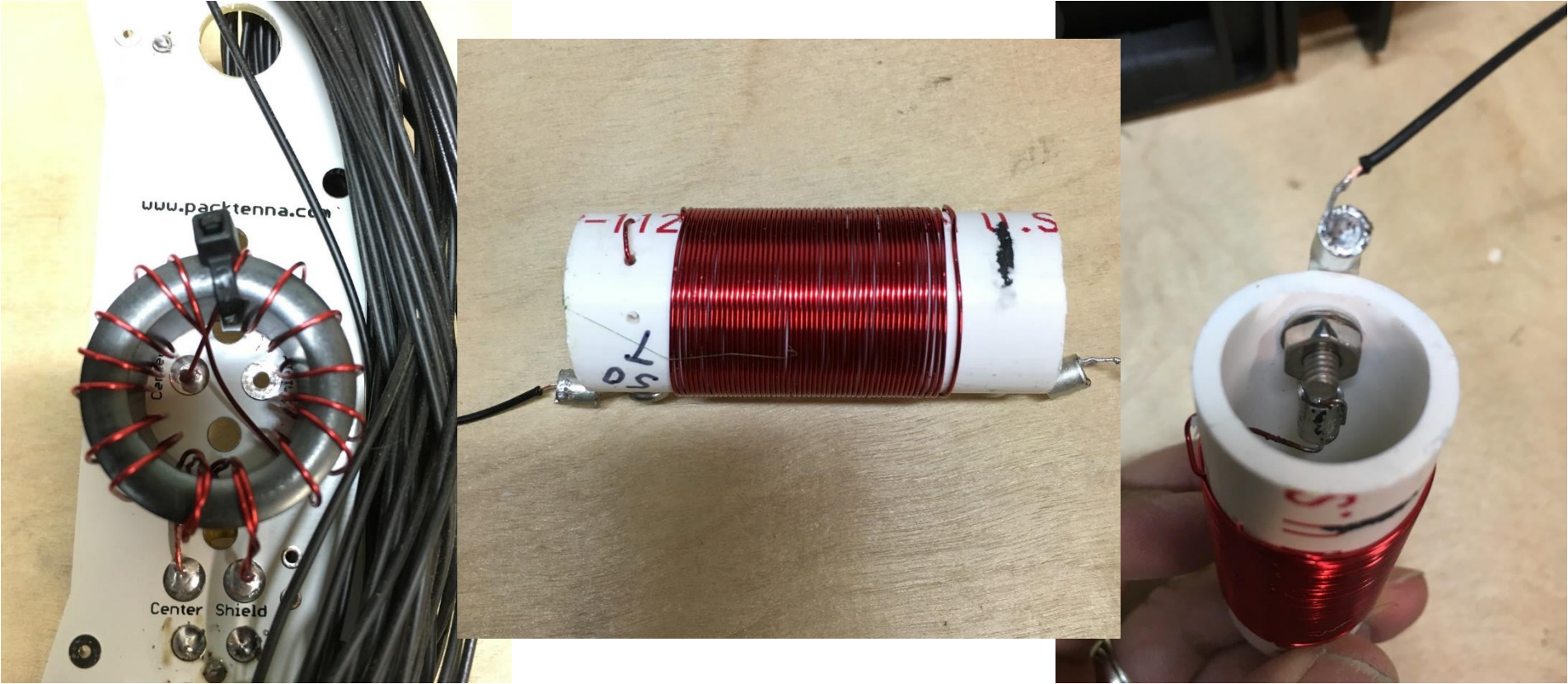
Each time the wire passes through the core it is "1 turn"



# 20m End Fed 1/2 Wave

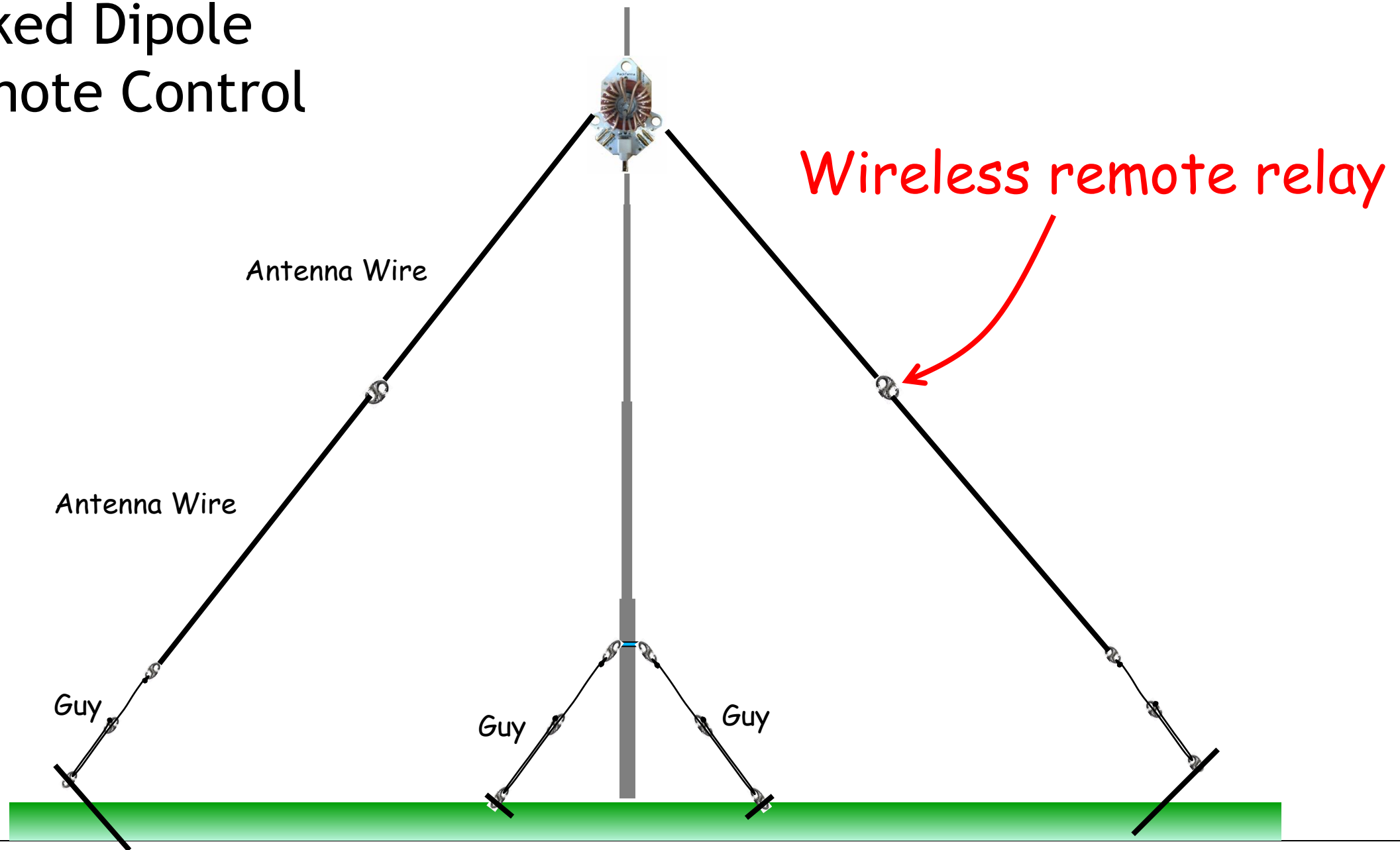


# 20m/40m End Fed 1/2 Wave





# Linked Dipole Remote Control

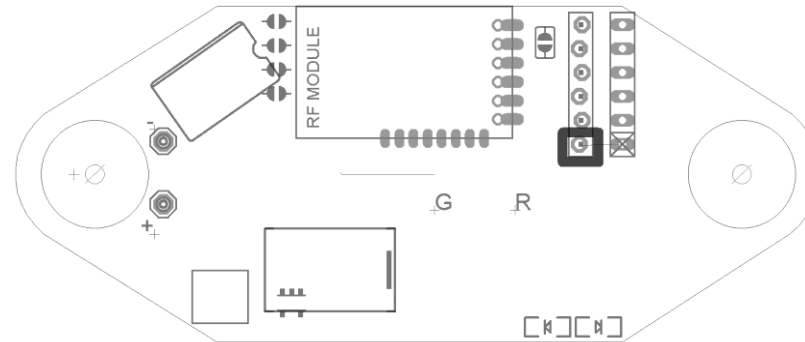


# Wireless Link - Latching Relay, uC, data radio, battery

Prototype – Rev 1  
MicroBit + Relay + Battery








Rev 2  
RF IC + Relay + Battery



Smaller, Lighter



# Great Radio and Antenna Combo Examples

- Elecraft KX2 & KX3  End-fed Random Wire 9:1
- FT-817  End-fed Half Wave
- IC-705  Inverted Vee
- FT-891  Inverted Vee
- IC-7300  End fed with a choke