

# JAMES CLERK MAXWELL'S EQUATIONS

$$\nabla \cdot \vec{E} = 4\pi\rho$$

DIVERGENCE OF  $\vec{E}$       CHARGE DENSITY

$\vec{E}$  DIVERGES OUT FROM POSITIVE CHARGES AND IN TOWARD NEGATIVE CHARGES. THE TOTAL FLUX OF  $\vec{E}$  THROUGH ANY CLOSED SURFACE IS PROPORTIONAL TO THE CHARGE INSIDE.



$$\nabla \times \vec{E} = -\frac{1}{c} \frac{d\vec{B}}{dt}$$

CURL OF  $\vec{E}$       SPEED OF LIGHT

CURLS AROUND CURRENTS (FARADAY'S LAW) IN A DIRECTION THAT WOULD MAKE A CURRENT THAT WOULD PRODUCE A  $\vec{B}$  FIELD TO OPPOSE THE CHANGE IN  $\vec{B}$  (LÉNIZ'S LAW).



# The OCEFD A Practical Antenna

$$\nabla \cdot \vec{B} = 0$$

DIVERGENCE OF  $\vec{B}$

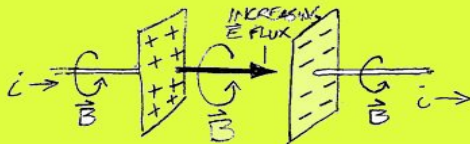
$\vec{B}$  NEVER DIVERGES. IT JUST LOOPS AROUND ON ITSELF.



$$\nabla \times \vec{B} = \frac{4\pi}{c} \vec{J} + \frac{1}{c} \frac{d\vec{E}}{dt}$$

CURL OF  $\vec{B}$       SPEED OF LIGHT      CURRENT DENSITY      RATE  $\vec{E}$  IS CHANGING

$\vec{B}$  CURLS AROUND CURRENTS AND CHANGES IN  $\vec{E}$  FIELDS



# Practical Antenna Definition

- Low cost, easy construction
- Simple to erect
  - Single support.
  - Convenient to feed.
  - Suitable for portable / QRP operation
- Decent performance
  - No lossy elements
  - Multi-band
  - Easy to match.

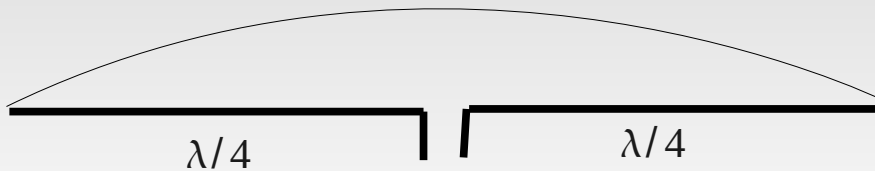
# The OCEFD

## A simple preactical antenna



# Classic Half-wave Dipole

$$I(z) = I_0 \sin\left(\frac{2\pi z}{\lambda}\right)$$



$$R = 75 \Omega$$

$$P = R I_0^2$$

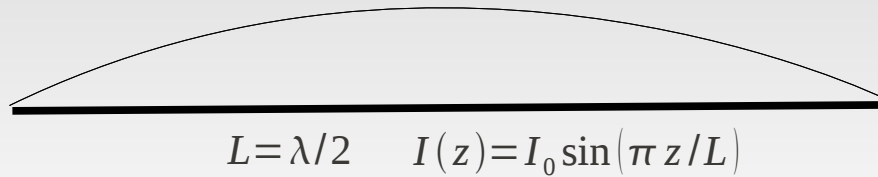
## The Good

- Simple to build
- Relatively easy install
- Low cost
- Works on odd-harmonics
  - e.g. 40M / 15M
  - Low SWR == low loss
  - Easy to match (auto)

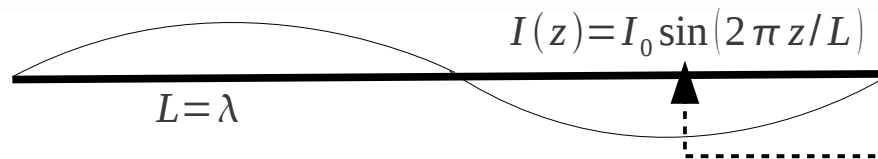
## The Not-So-Good

- Need support at both ends.
- Heavy feed line at center.
- High R on even-harmonics
  - High SWR == high loss
  - Tougher match, good tuner needed

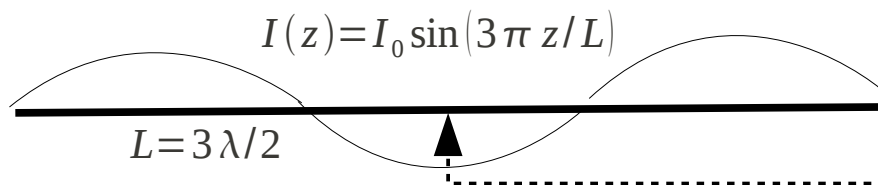
# Classic Half-wave Dipole Operated on Harmonics



$$R_{CF} = 75 \Omega$$



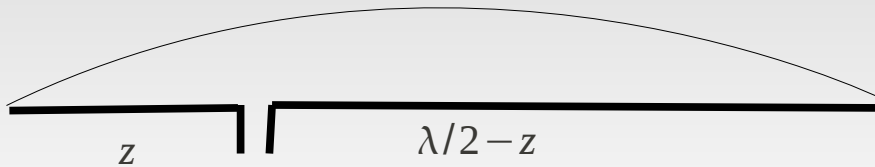
$$R_{CF} = \infty \Omega \quad R_0 = 200 \Omega$$



$$R_{CF} = 100 \Omega$$

# Off-Center Fed Dipole

$$I(z) = I_0 \sin\left(\frac{2\pi z}{\lambda}\right)$$



$$R_0 = 75 \Omega$$

$$P = R_0 I_0^2 = R(z) I(z)^2$$

$$R(z) = R_0 \frac{I_0^2}{I(z)^2}$$

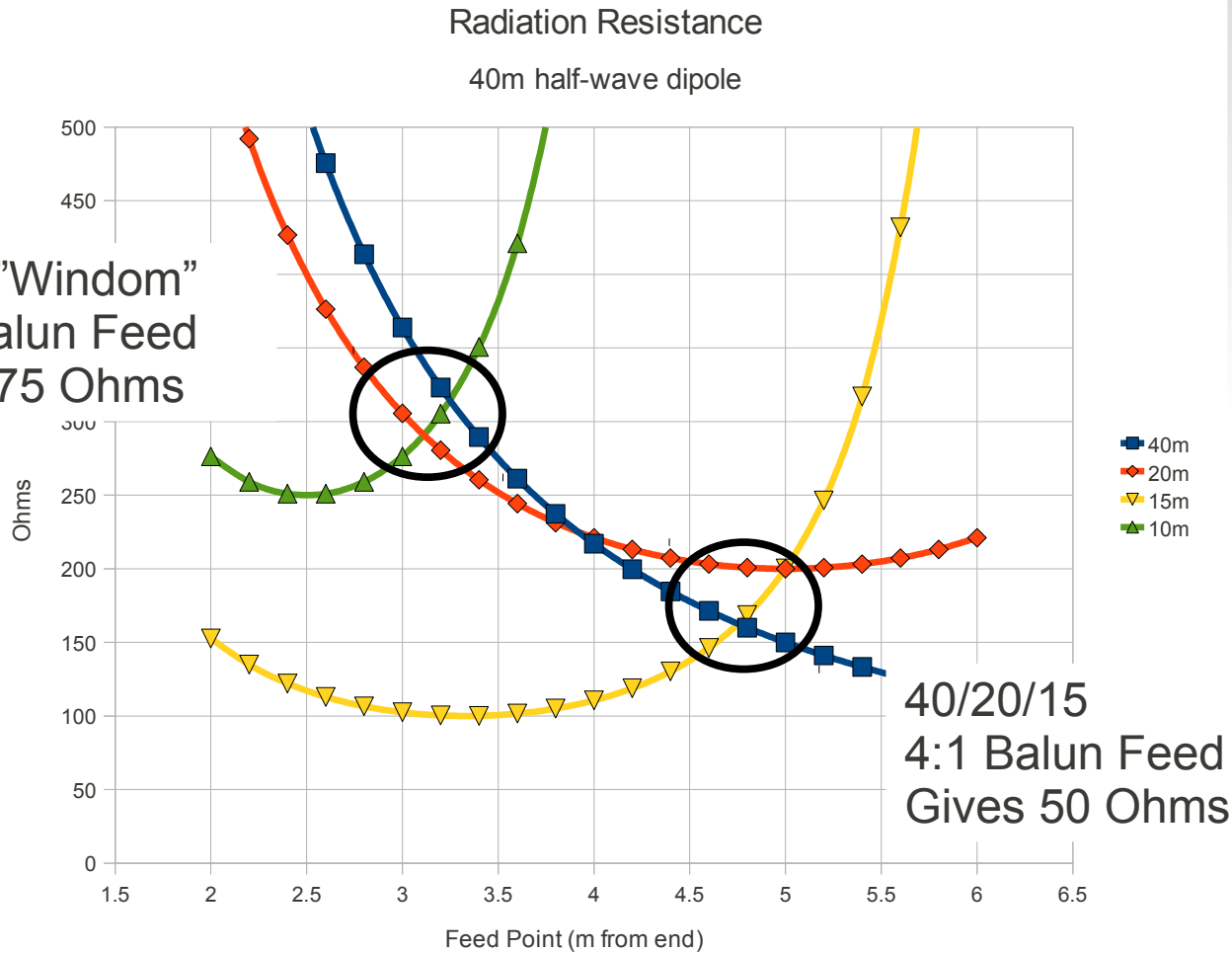
- Off center feed at  $z$ .

$$R(z) = \frac{75}{\sin^2\left(\frac{2\pi z}{\lambda}\right)}$$

$$R(\lambda/6) = 100 \Omega$$

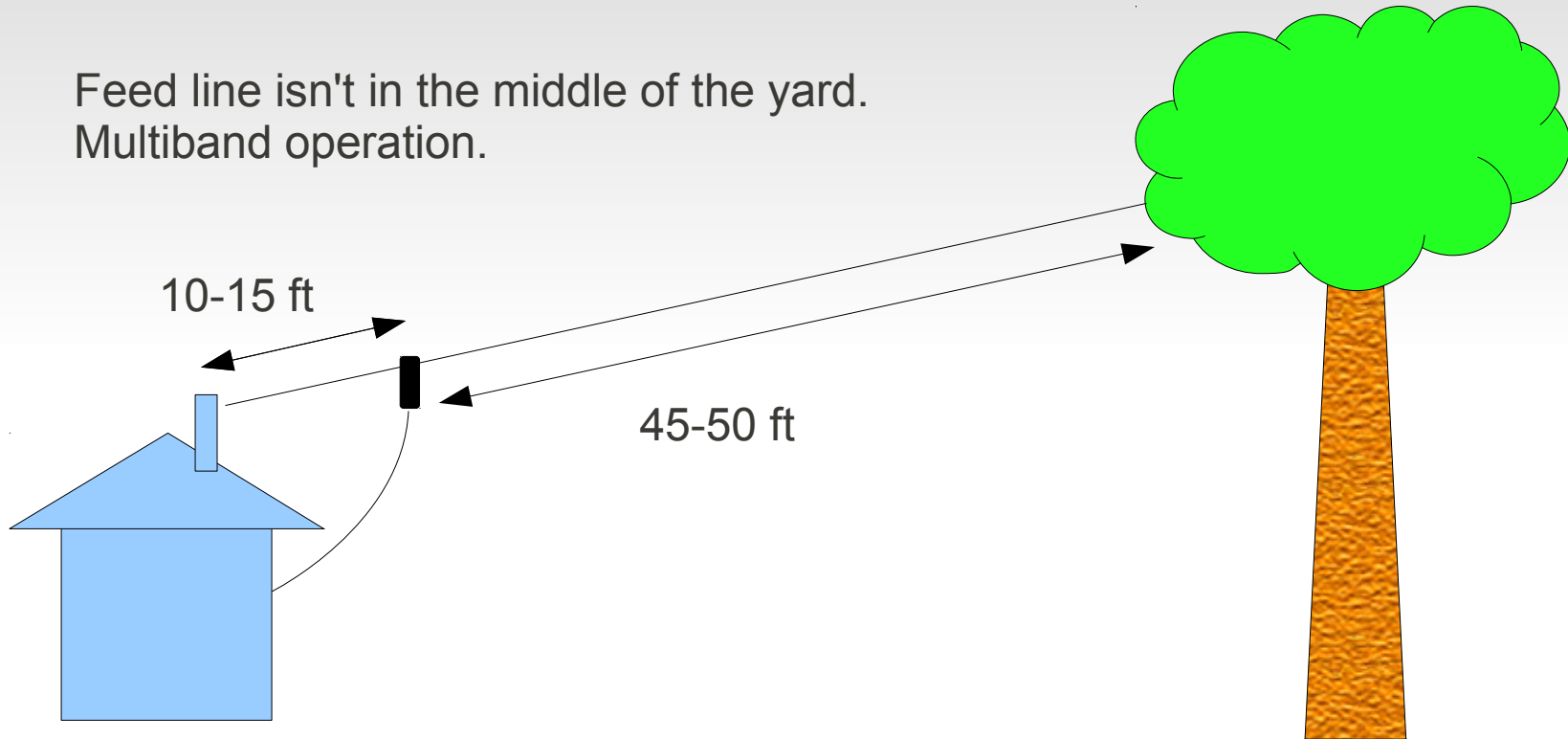
# 40m Dipole OCF Impedance Approx - Ignoring end effects

40/20/10 "Windom"  
4:1 Balun Feed  
Gives 75 Ohms



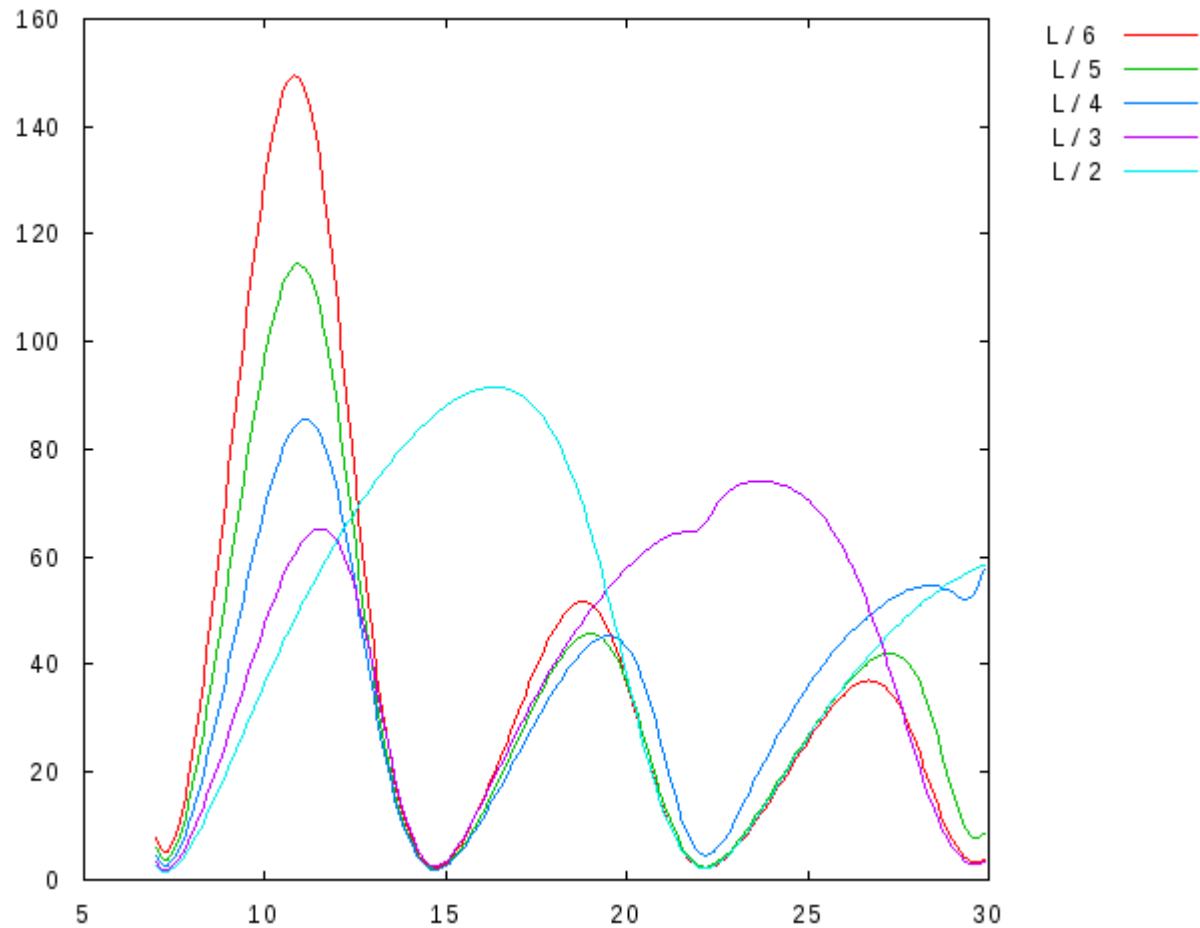
# OCF is Easier to Feed

Feed line isn't in the middle of the yard.  
Multiband operation.



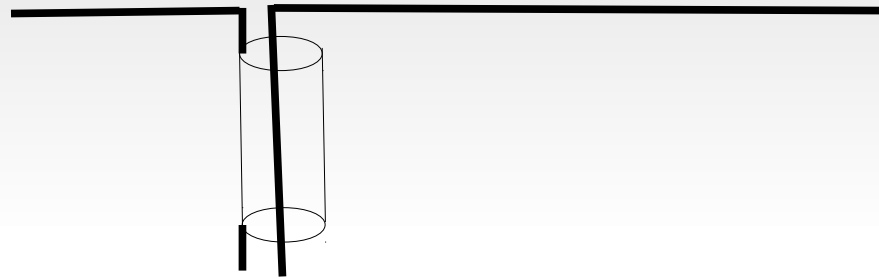


# NEC2 Sim of Various Feed Points

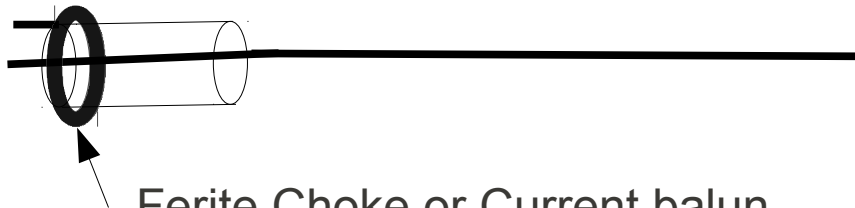


# ... better still ...

1. Remove the balun and feed with CATV cable. SWR < 4.

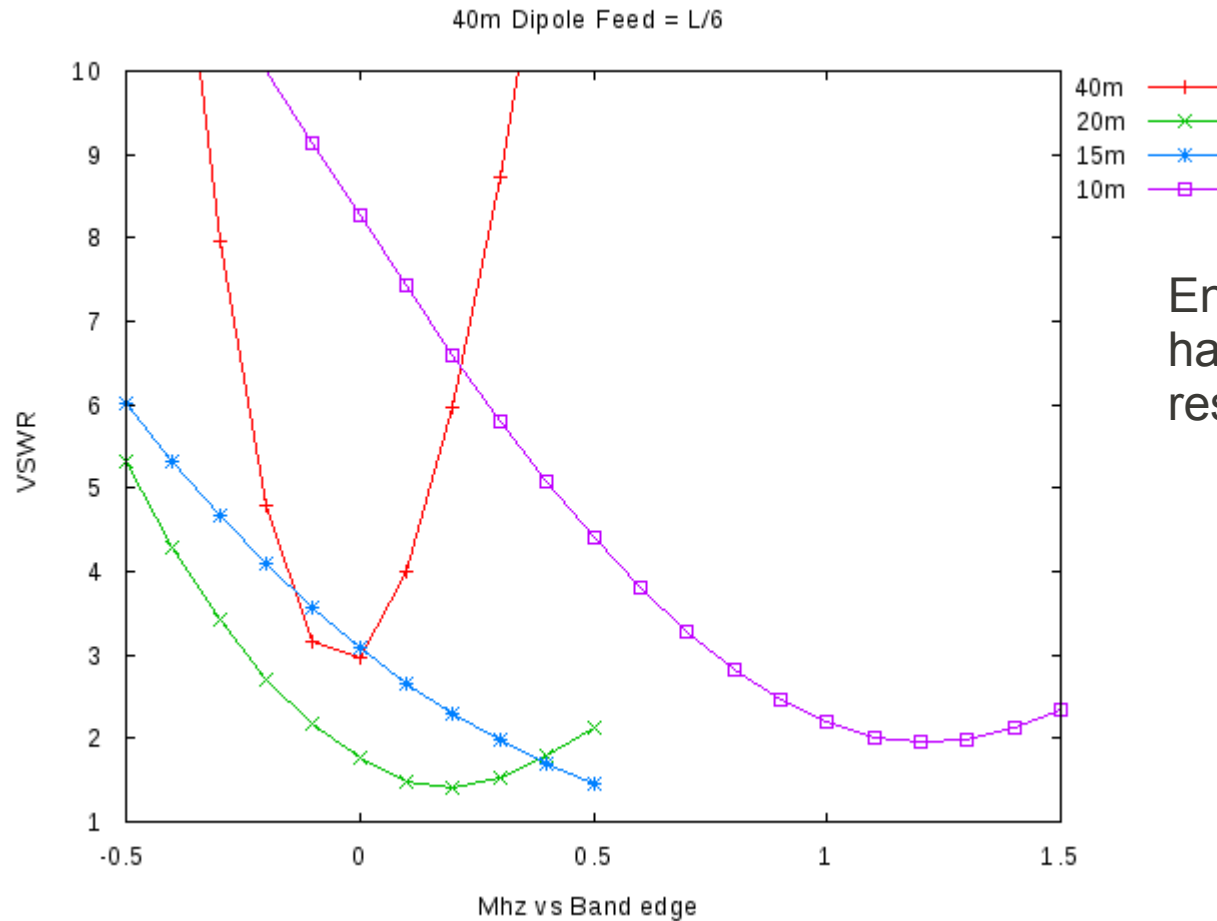


2. Now use the outside of the braid for the short end of the antenna.



Ferite Choke or Current balun  
Choke position can be used to tune antenna.

# NEC2C Sim of OECFD



End effects break the exact harmonic relations between resonances.

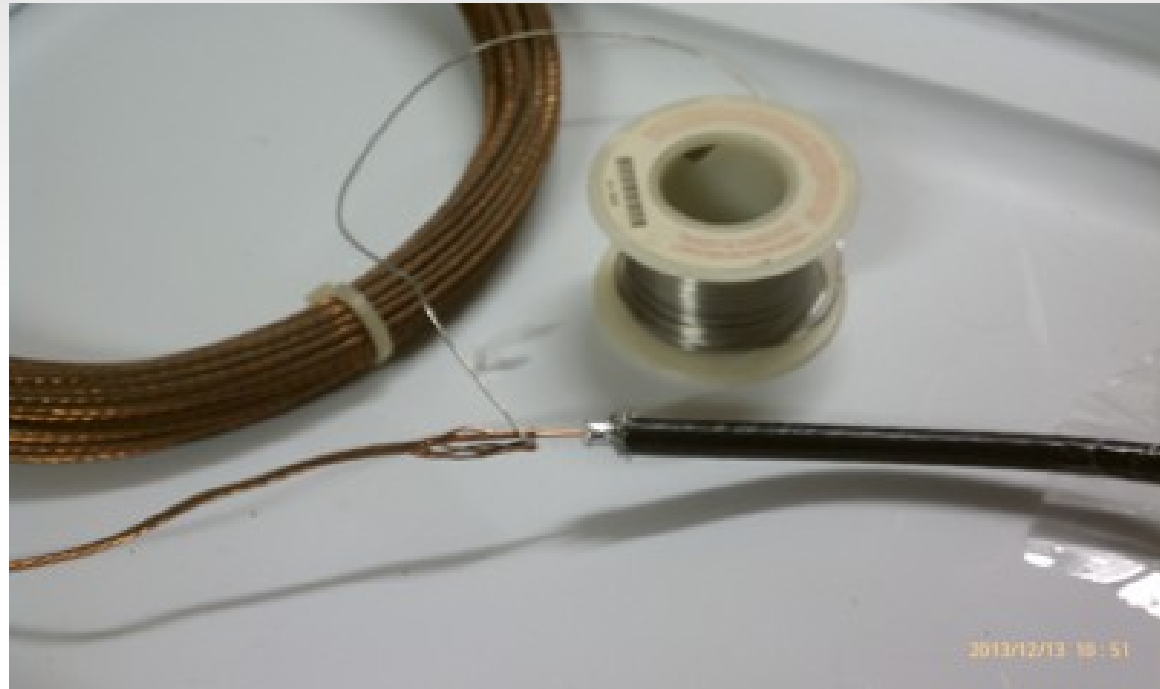
# Does it Work?

- SS 2013 - CW
  - K1 @3.5w
  - 1.5 hr 20/40
  - 11 QSO /10 SEC
- SS 2013 – Phone
  - IC-718 @75w
  - 5 hr 10/15
  - 57 QSO / 31 SEC
  - 24 States (HI, AK)

# Wire Connection to Coax

Solder wire directly  
to center conductor.

Then seal from the  
elements.



# Choke Options at Feed

To the RIG



Antenna end.



# Final Notes

- Choke is *absolutely required*
  - Low freq ferite chokes can be bulky.
- Antenna ends have high RF potentials.
  - Leave room between the rig and feed point.
- Great for camping and vacation.
  - Only one tree needed.
  - No dangling feed to support.
  - Rolls up for storage.