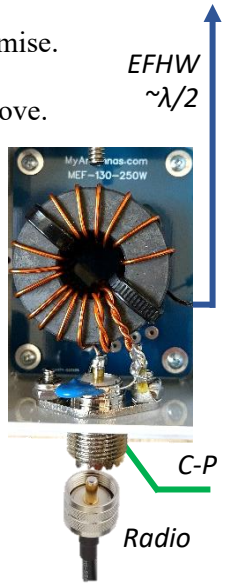
Ham 111 – Antenna EFHW, First Law No Free Lunch

Dr. Marc & Rosemary © 230617

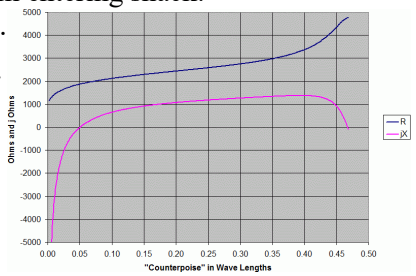
1. An antenna system consists of the radiator, return, and transmission line. All antennas are a compromise.
   a. Grounding, lightning protection, and coax for safer stations applies to all stations.
   b. Vertical antennas with requisite ground planes get most use for higher frequencies, VHF and above.
   c. Dipoles are simple, elegant, single-band antennas, with horizontal and vertical trade-offs.
   d. Multi-band antennas require outside equipment to tune and match for HF longer bandwidth.



2. End-fed half wave (EFHW) is generically about one-half wave long on its lowest frequency.
   a. A dipole is two quarter-wave separated, a vertical is quarter-wave with ¼ -wave ground plane.
   b. The dipole is about 75-Ω, quarter-wave vertical about 38-Ω, EFHW about 2,000-5,000 Ω.
   c. The high Z mismatch requires a transformer to match impedance and help some tuning.
3. EFHW is a kit of long wire, transformer, and perhaps a tuning coil.
   a. Our antenna articles show how to build transformers and cut wire length a little long for trim.
   b. 100pF ceramic disk capacitor shunts coax for leakage inductance to raise SWR at higher freq.
   c. The transformer uses type 43 or 52 ferrite core as UNUN with turns 49:1 to 64:1 to match Z.
   d. Insertion loss should be low ~0.4dB. Ratio 56:1 = 2800:50.
   e. Compensation coil ~1.5µHy is 6T on 1.25”OD PVC to lower resonant point at high freq.
   f. Place 78” from feed-point.

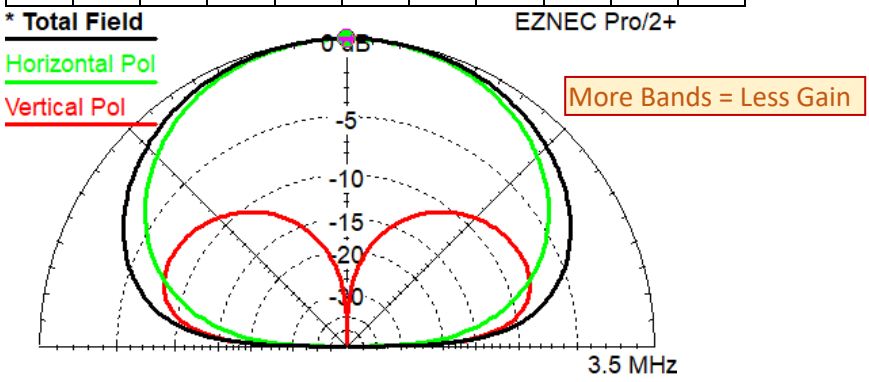
MHz	λ-m	lower kHz
28.0 - 29.7	10	1000
21 - 21.45	15	400
14.0 - 14.35	20	170
7.0 - 7.3	40	57
3.5 - 4.0	80	22

4. A half-wave wire will resonate with ends having low I and high V to overcome the high Z.
   a. Voltage can hit 5,000 V. Cap ends so wire cannot be touched.
   b. Ideal half-wave in free space radiates 3-D donut, but coax is in near field.
5. All antennas will have a return path.
   a. Unbalance creates common-mode, that couples to coax, inducing noise, radiation, & shock.
   b. Add a counterpoise (C-P) of 0.05λ for the return. That length makes reactance near zero.
   c. Ground the counterpoise for a noise path. Grounded at DC gives a lightning path and no static build-up.
   d. Add at least 5 ferrite beads around the coax to block common-mode current from entering shack.
   e. Ideally avoid anything in near field (2λ), but impossible on HF due to distances.

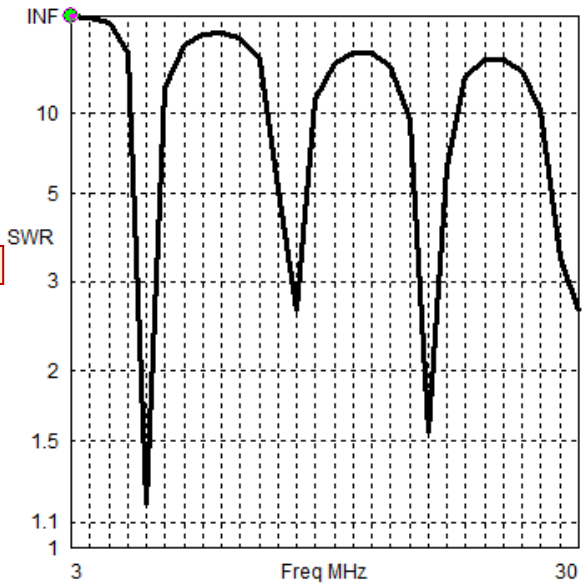


6. What is not to like? Low/no gain vs dipole 6 dB, narrow bandwidth, and large size. I have *MyAntennas.com* and a simple kit by *KM4AC*. *Chameleon* is also good.
7. EzNec model: Set ‘Alt SWR Z0’ as turns ratio*50 to compensate for transformer.
   a. Source is 0% on wire 1. Configuration ‘invert-L’ represents going up and out.
   b. Antenna length = vert + horiz ≈ λ/2. Counterpoise = .05λ.
8. Life is good. Enjoy!

WIRES										
No.	End1				End 2				Dia	Segs
	X (ft)	Y (ft)	Z (ft)	Conn	X (ft)	Y (ft)	Z(ft)	Conn	(in)	
1	0	0	14	W3E1	0	0	24	W2E1	#16	29
2	0	0	24	W1E2	0	56.5	24		#16	99
3	0	0	14	W1E1	0	5	14		#16	17



More Bands = Less Gain



Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 1.03 dBi

Cursor Elev 90.0 deg.
Gain 1.03 dBi
0.0 dBmax

Slice Max Gain 1.03 dBi @ Elev Angle = 90.0 deg.
Beamwidth 118.8 deg.; -3dB @ 30.6, 149.4 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

Freq 3 MHz
SWR **> 100**
Z 4676 at -89.93 deg.
= 5.999 - j 4676 ohms
Refl Coeff 0.9989 at -61.83 deg.
= 0.4716 - j 0.8805
Ret Loss 0.0 dB

Source # 1
Z0 2800 ohms

http://www.gnarc.org/wp-content/uploads/The-End-Fed-Half-Wave-Antenna.pdf
https://aa5tb.com/efha.html & http://w8ji.com/long_wire_antenna.htm