

END-FED HALF WAVE

Mult-Band HF Antenna

80 / 40 / 30 / 20 / 17 / 15 / 12 / 10 Meters



**Fredericton Amateur
Radio Club (FARC)**

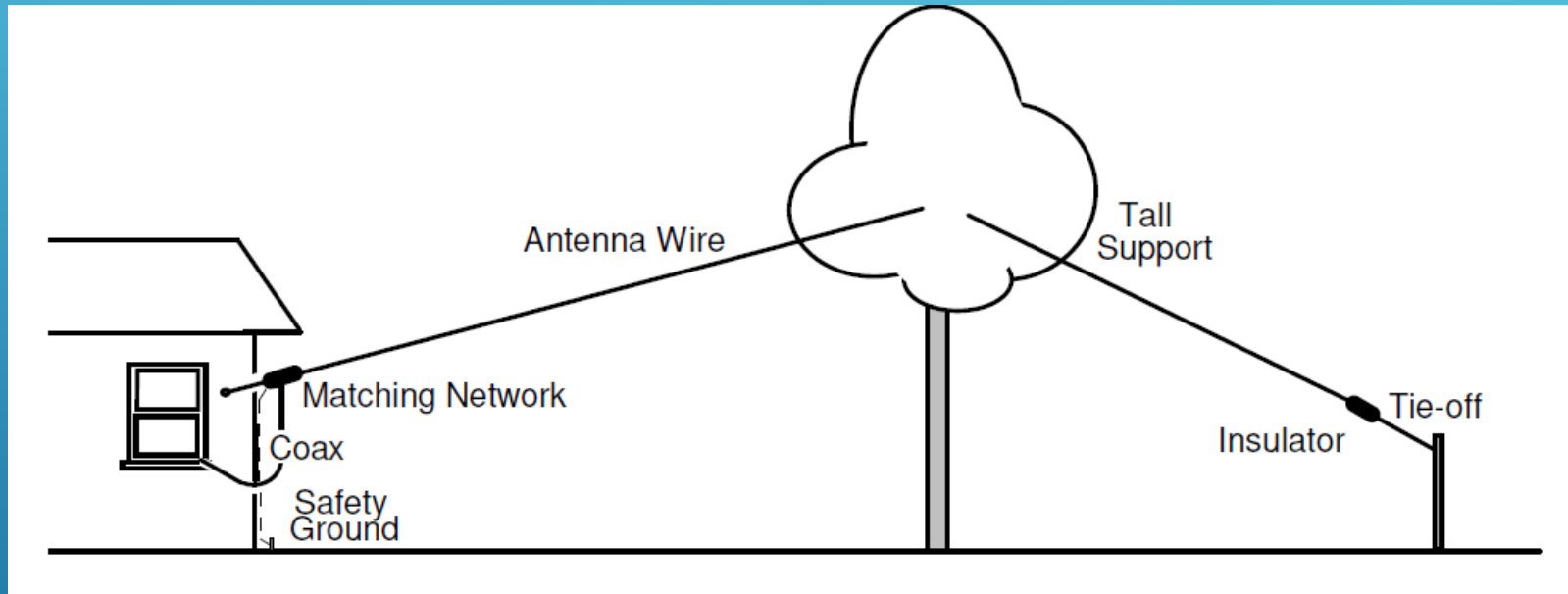
VE1TE
Murray Gordon
June 14, 2021

What is an End Fed Half Wave Antenna (EFHW)?

- ❑ The end fed or “long-wire” wire antenna, or commonly known as a ZEPP antenna, consists of a length of wire that is as high and reasonably long as possible. (This name came about because the first documented use of this sort of antenna was on the *Zeppelin* airships.)
- ❑ The wire antenna is usually approximately $\lambda/2$ long at the lowest operating frequency. The wire is then connected to the transmitting and receiving radio communication station via a tuning or matching system.
- ❑ The antenna can be used for multi-band operation provided the length is cut properly. For 80 to 10 meters, the length would be 130 feet. The design and layout of the antenna can take several different shapes. If the wire cannot be installed in a straight line, it is acceptable to zigzag the wire.

END-FED HALF WAVE ANTENNA

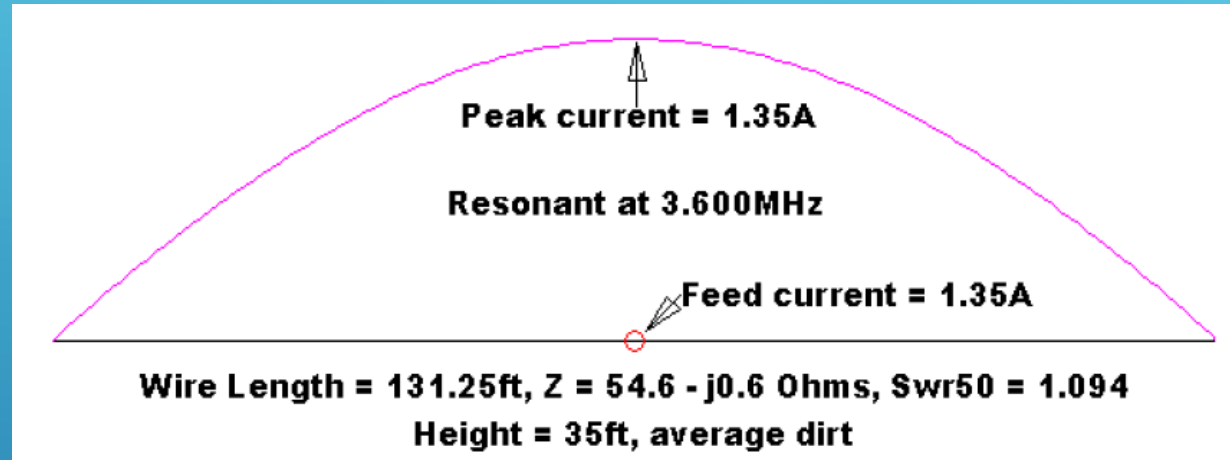
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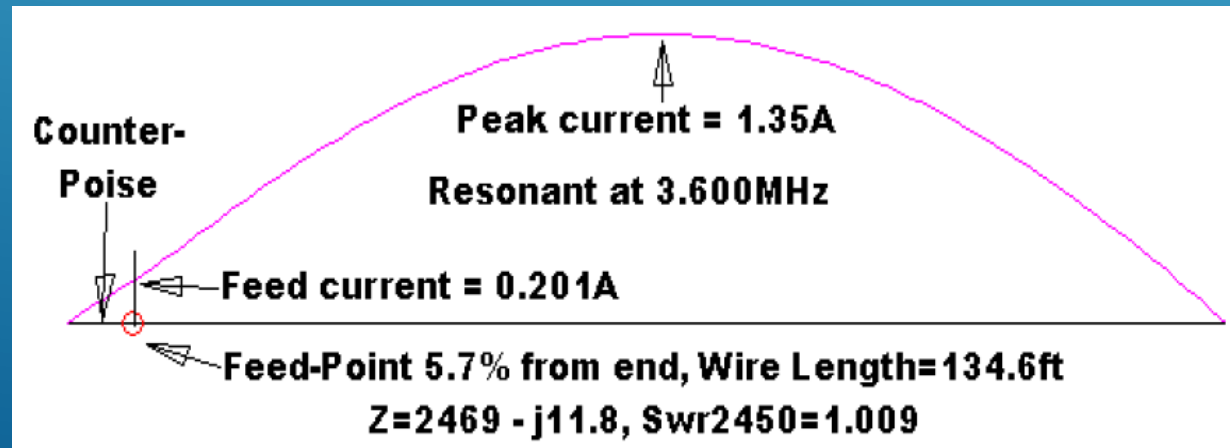
END-FED HALF WAVE ANTENNA

Characteristics:

Center-fed Dipole Current Distribution

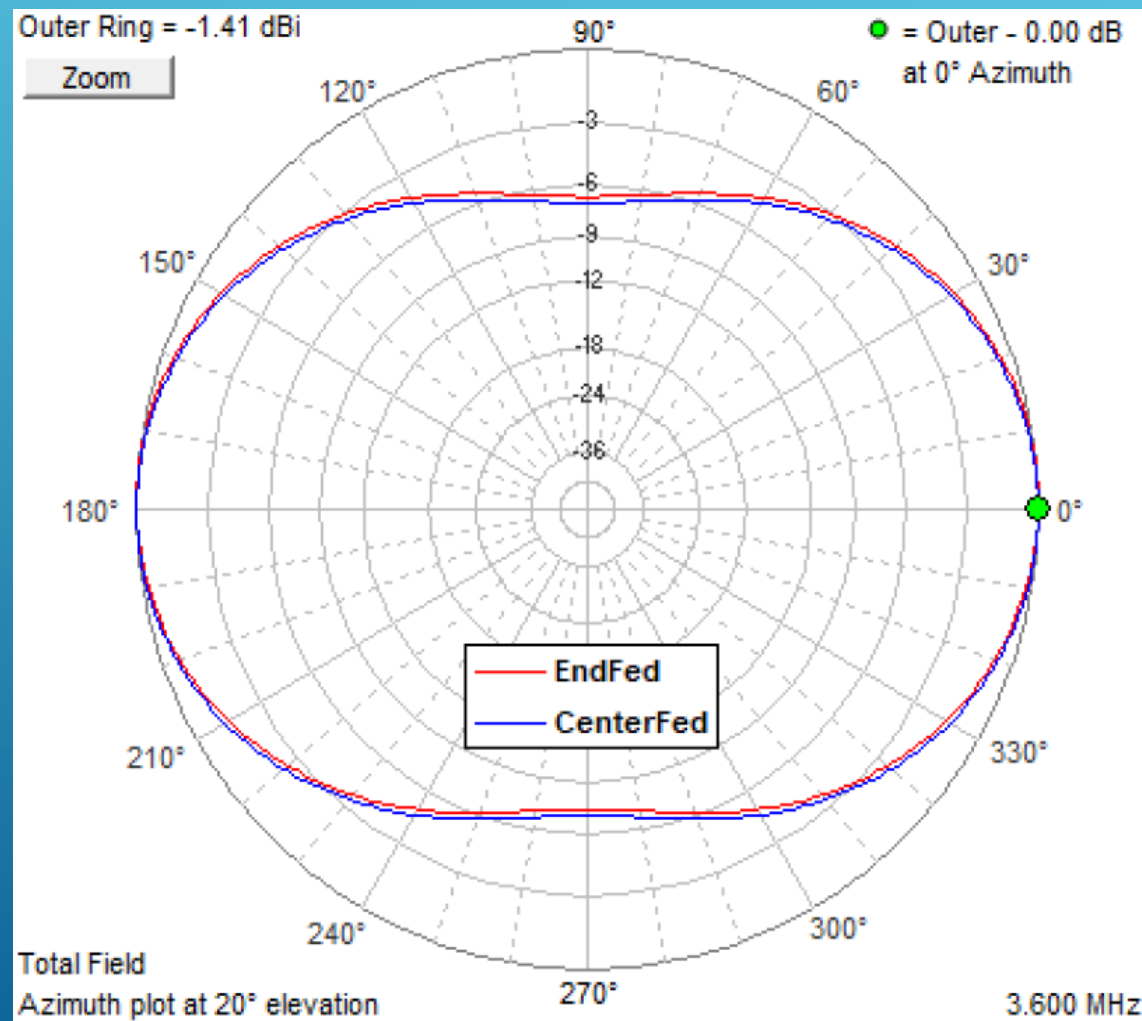


End-fed Half Wave Current Distribution



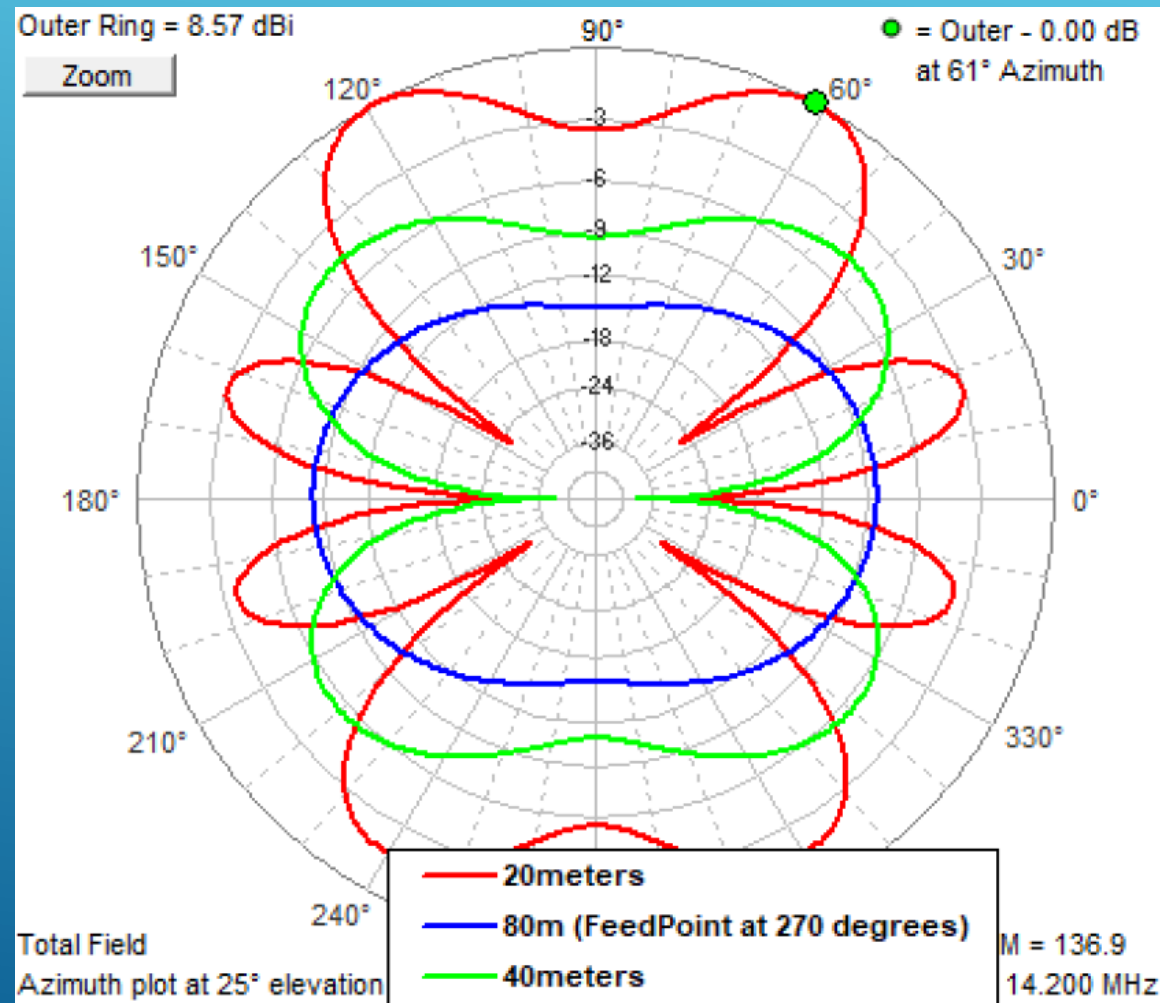
Characteristics:

Radiation Patterns



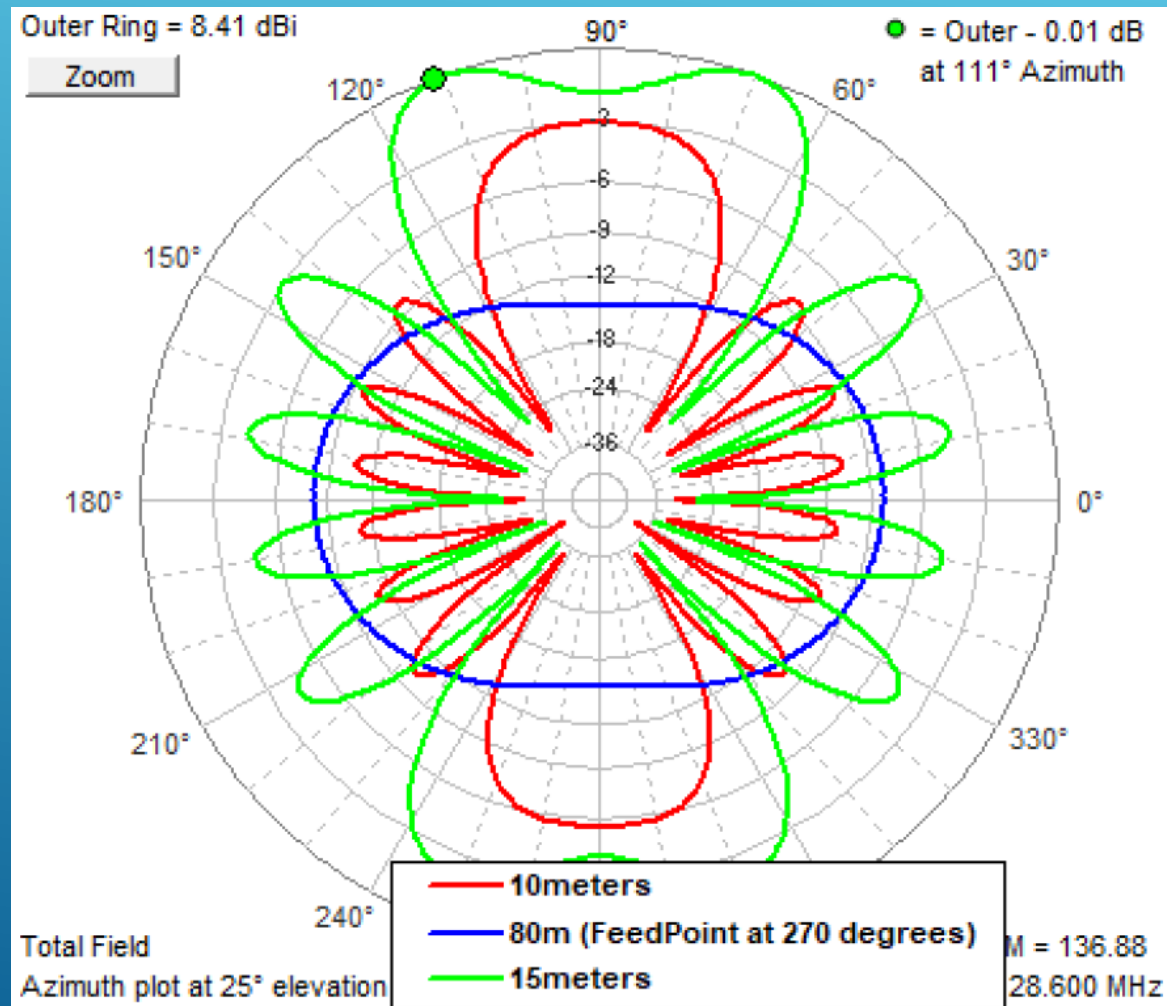
Characteristics:

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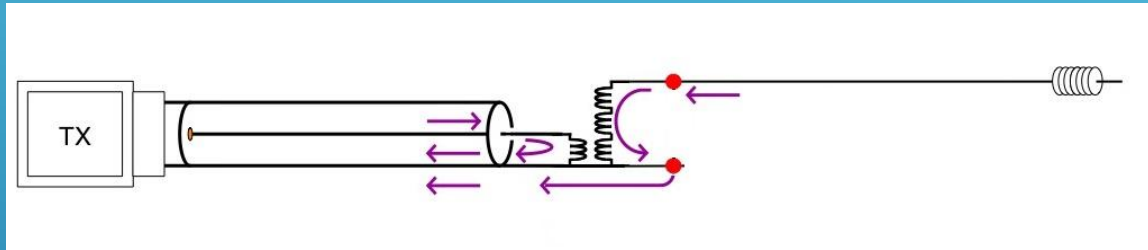


End Fed Half Wave Antenna (EFHW)

- ❑ Basically a half wave antenna feed at the end, rather than the middle
- ❑ Length of Wire Antenna = 130 feet (before trimming)
- ❑ Wire Gauge = #16AWG PVC Coated (black)
- ❑ RF Transformer Unit - 49:1 Impedance Ratio rated at 1 KW (PEP)
- ❑ Counterpoise of 12.5 feet of #16 AWG PVC Coated wire
- ❑ RF Choke or Isolator to remove any CMC (Common Mode Current) RF interference
- ❑ Advantages:
 - ✓ Multi-Band operation on one antenna
 - ✓ Tunable on all bands
 - ✓ Easy to install (fed from one end)
 - ✓ Useful for limited space, RV, Portable Operation (IOTA, LHOTA, SOTA), FD
 - ✓ Home-brewable

Issues with an End Fed Half Wave Antenna?

- ❑ Common mode current over the coax cable and therefore imbalance in the feed line can cause RF issues in the shack.



- ❑ Because the currents are not in balance, the coax cable will also radiate.
- ❑ Unfortunately, this also applies to reception. Thus the antenna has an increased chance of picking up all kinds of interference in the near vicinity of the coax cable.

Solutions for CMC

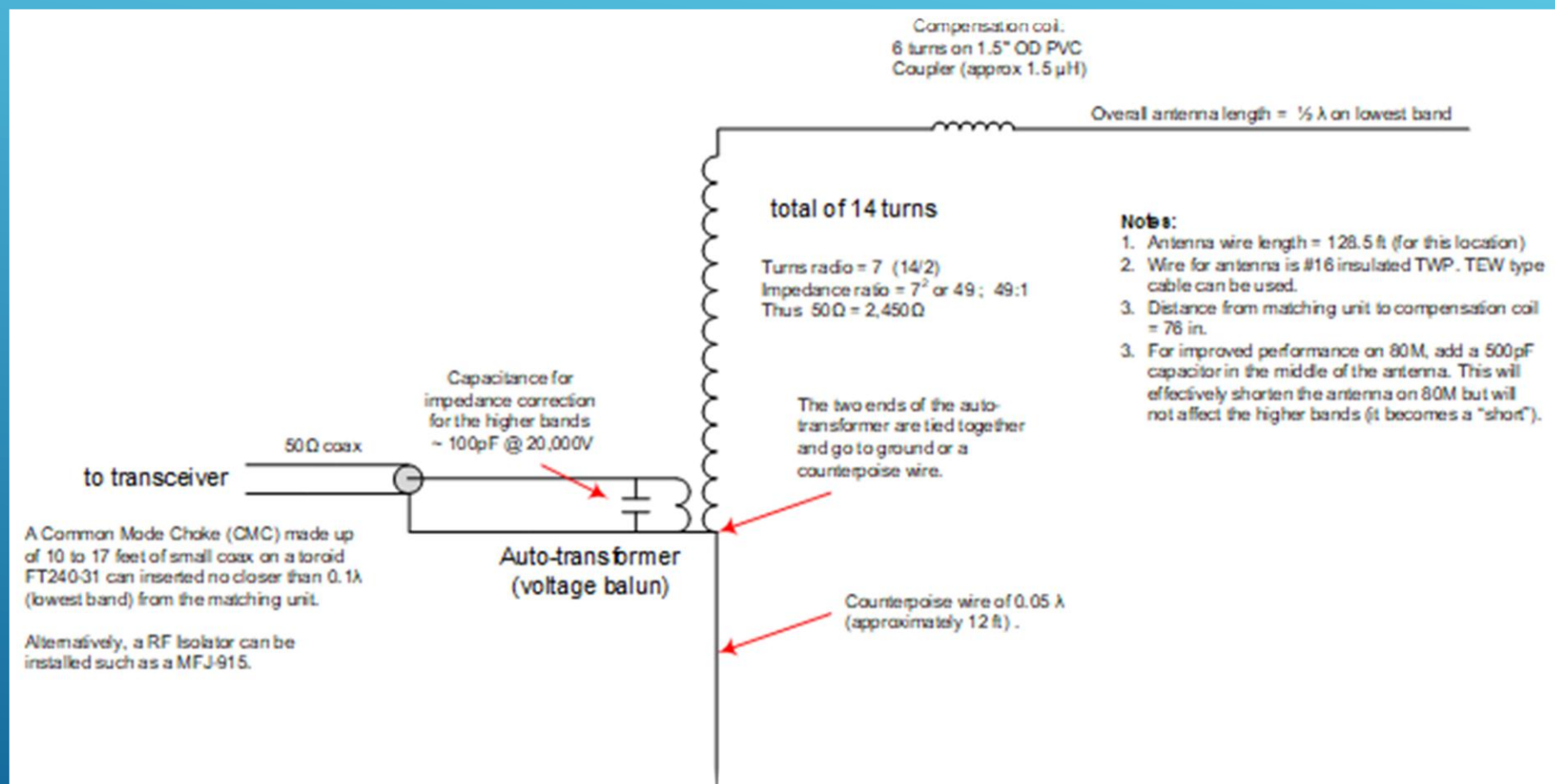
❑ Common mode choke

- ✓ A common mode choke filter placed a quarter wavelength from the feed point.
- ✓ At this point, the impedance is low enough, for the filter to work optimally.
- ✓ A simple ferrite ring (Part# EFFLC) with 8-10 turns of the coax line will work very well on RG-8X (1/4" cable) typically used for low power operations.
- ✓ Another option is a RF Isolator (i.e. MFJ-915).

❑ Counterpoise

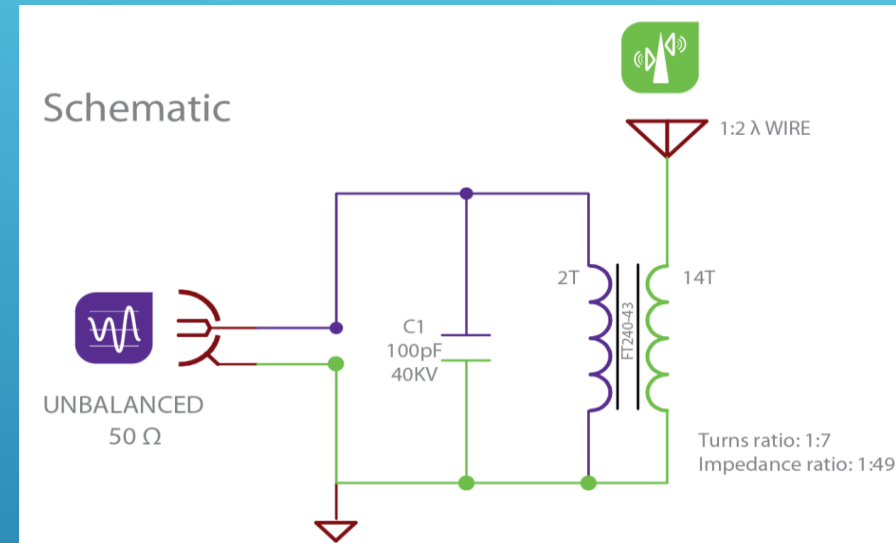
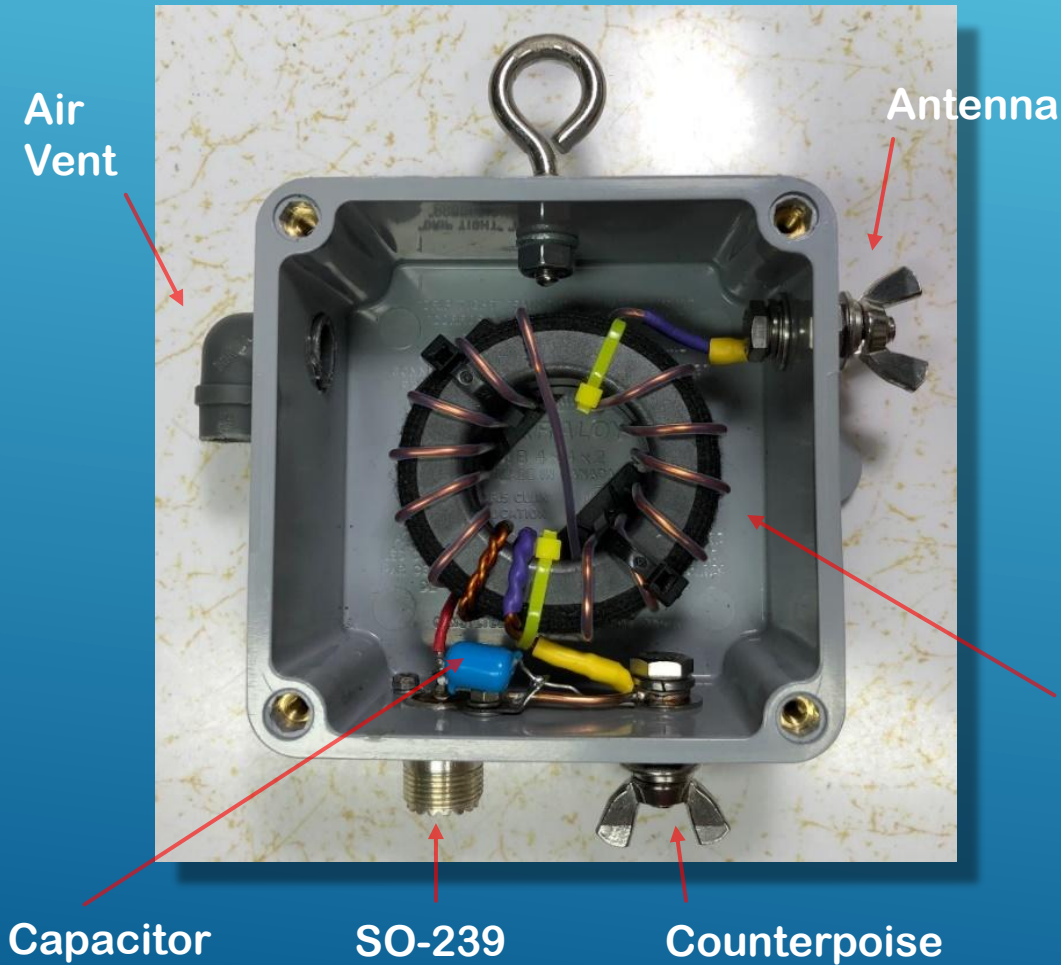
- ✓ At end fed antennas a certain current flows into the antenna, but according to “Kirchhoff’s current law” a proportional amount of current must flow somewhere else.
- ✓ Without counterpoise, current can flow on the outside of the coax cable.
- ✓ The counterpoise length should be in the order of 0.05λ

End Fed Half Wave – Antenna Schematic



END-FED HALF WAVE ANTENNA

End Fed Half Wave – RF Matching Unit



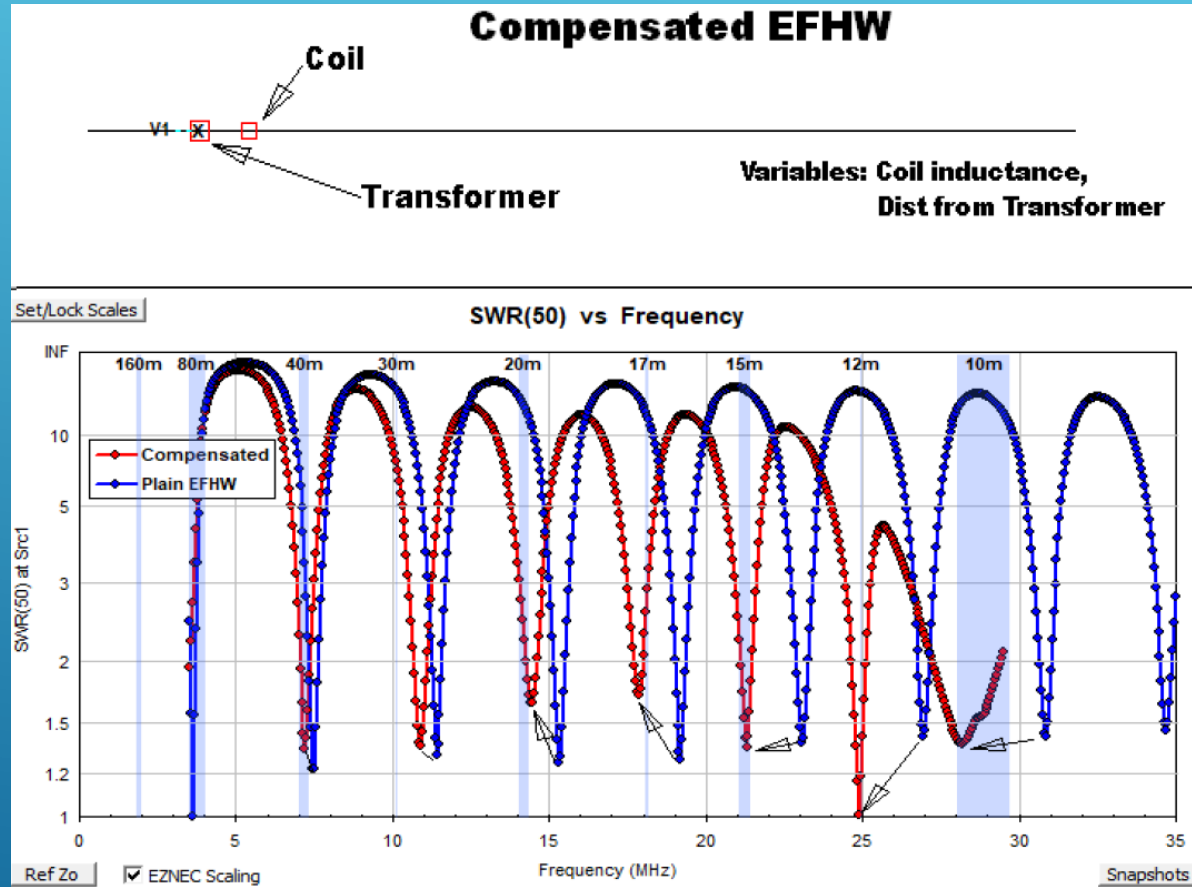
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End Fed Half Wave – Compensation Coil

The compensation coil effectively reduces the antenna's resonance points on the higher bands without adversely affecting the lower bands.



6 turns of the antenna wire
on a 1.5 diameter PVC coupler.
 $L = 1.5 \mu\text{H}$



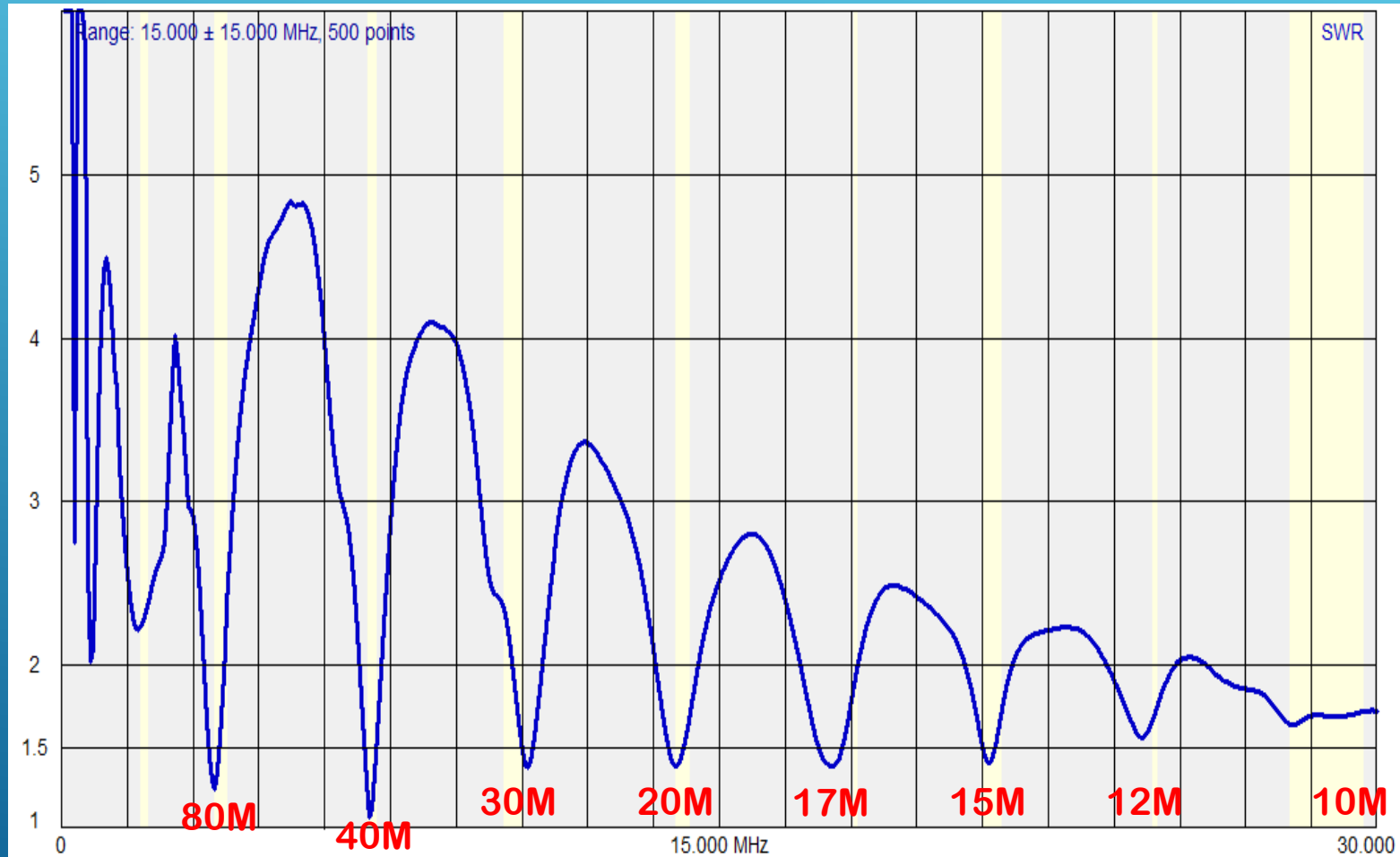
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End Fed Half Wave – Pics



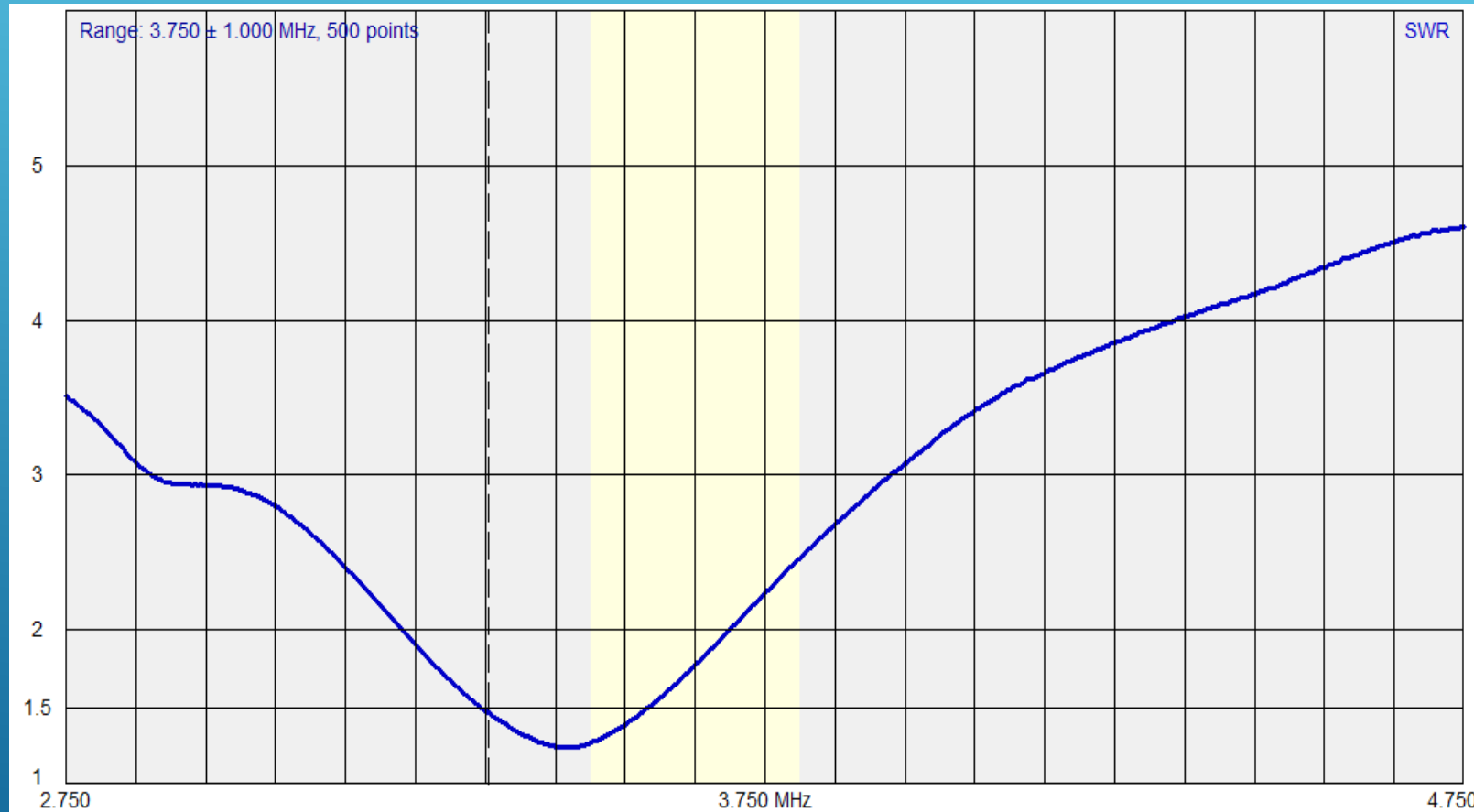
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RF Sweep of the EFHW: 0 to 30 MHz



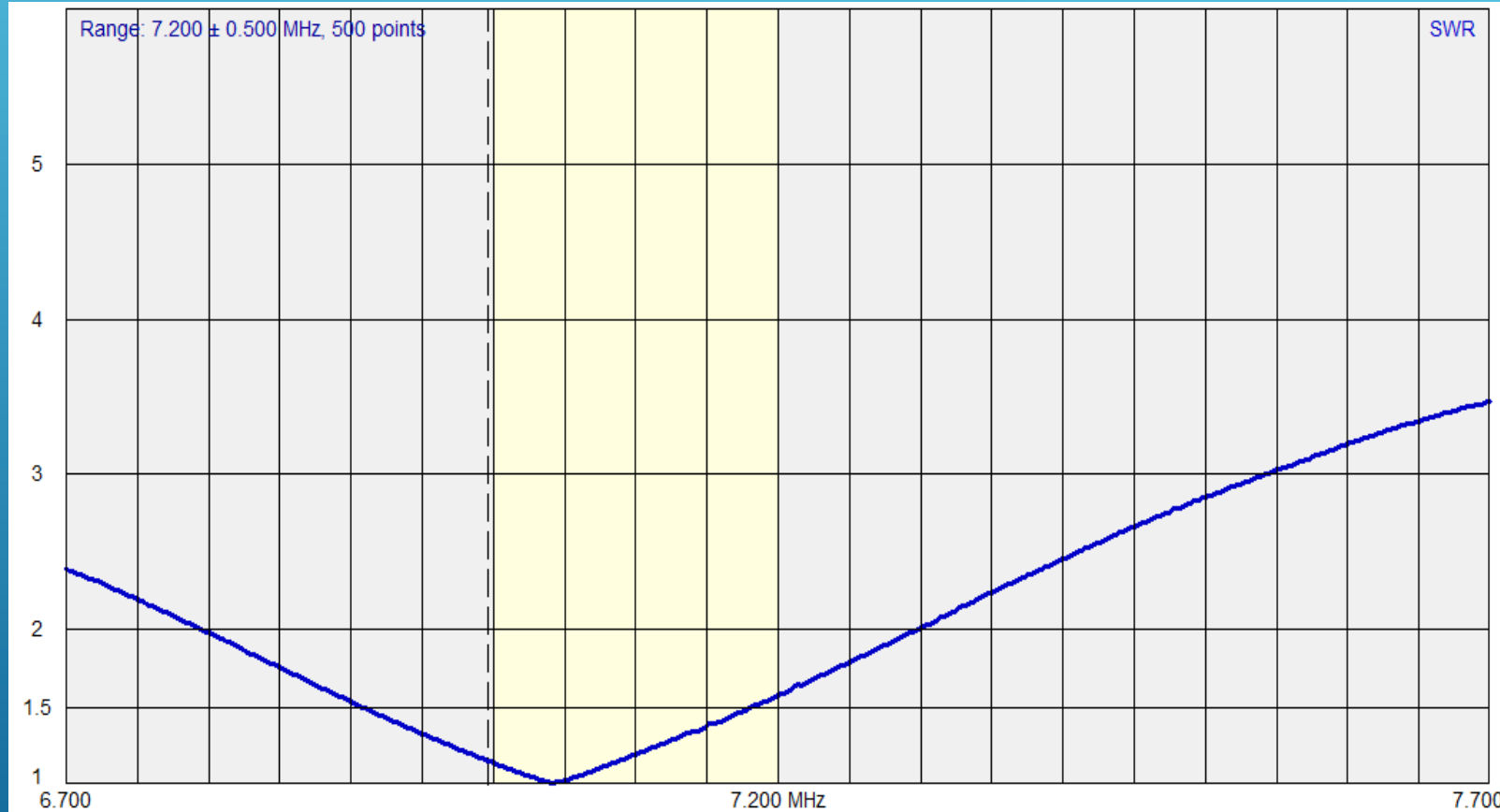
Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

RF Sweep of the EFHW: 80 Meter Band



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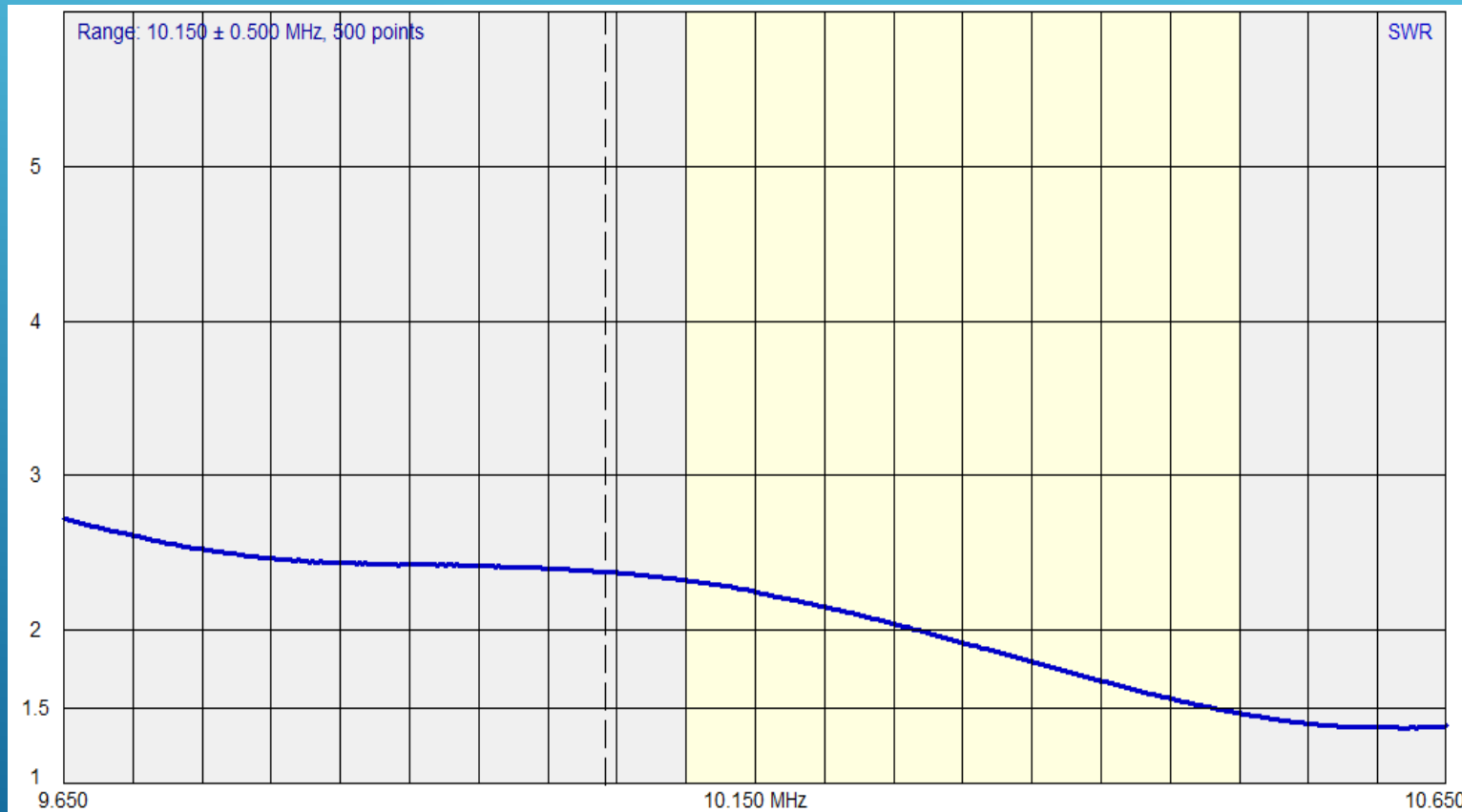
RF Sweep of the EFHW: 40 Meter Band



Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

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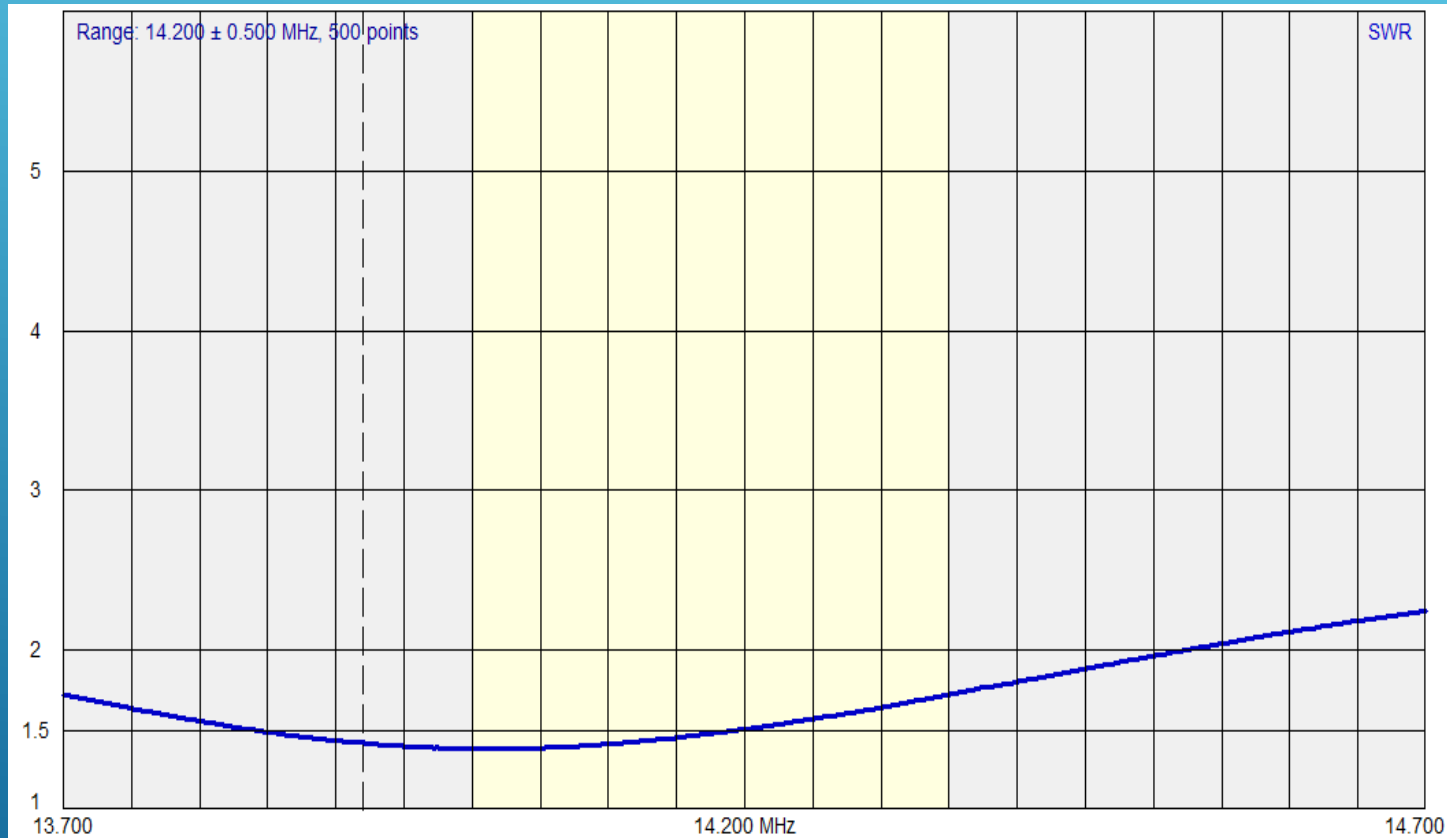
RF Sweep of the EFHW: 30 Meter Band



Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

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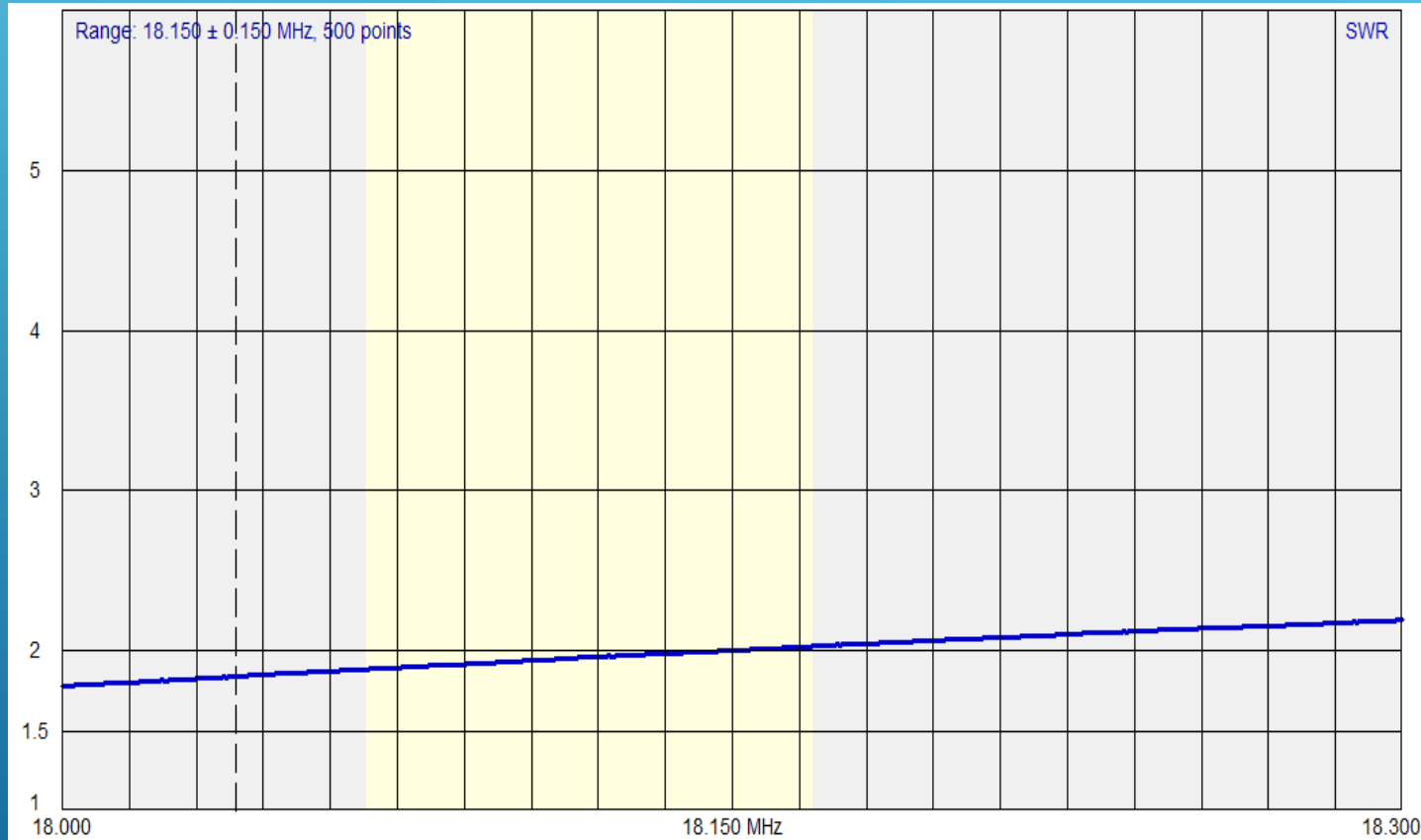
RF Sweep of the EFHW: 20 Meter Band



Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

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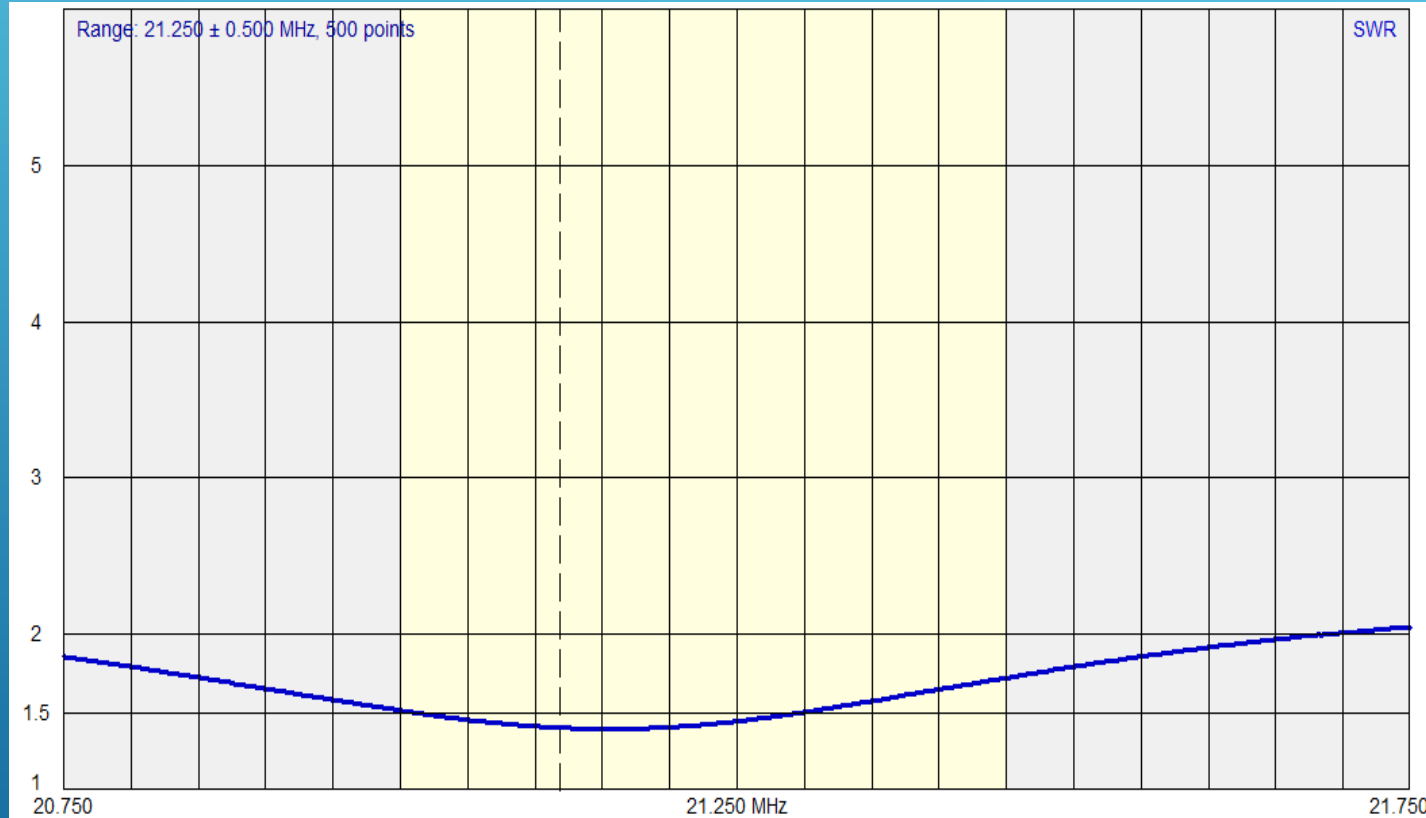
RF Sweep of the EFHW: 17 Meter Band



Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

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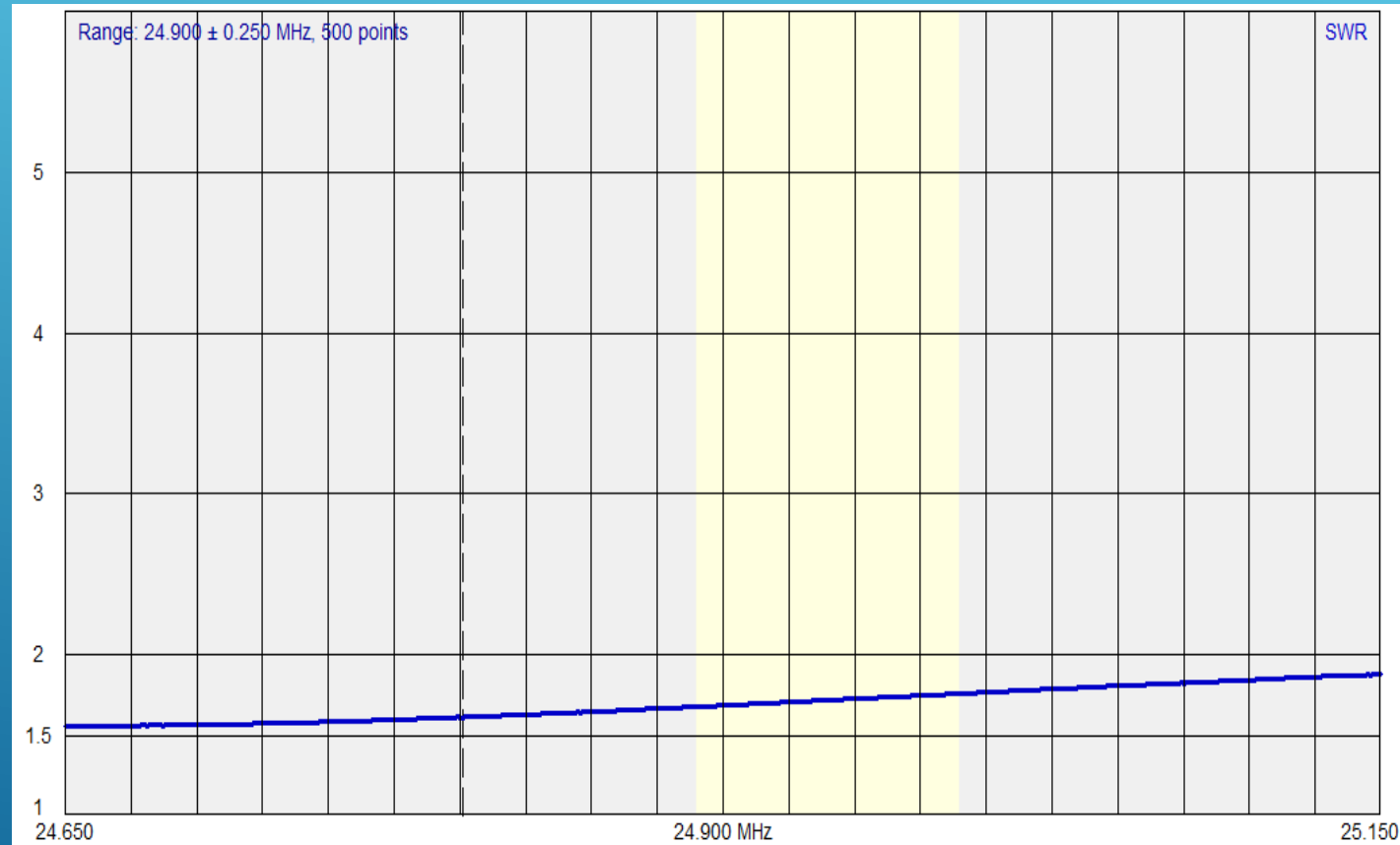
RF Sweep of the EFHW: 15 Meter Band



Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

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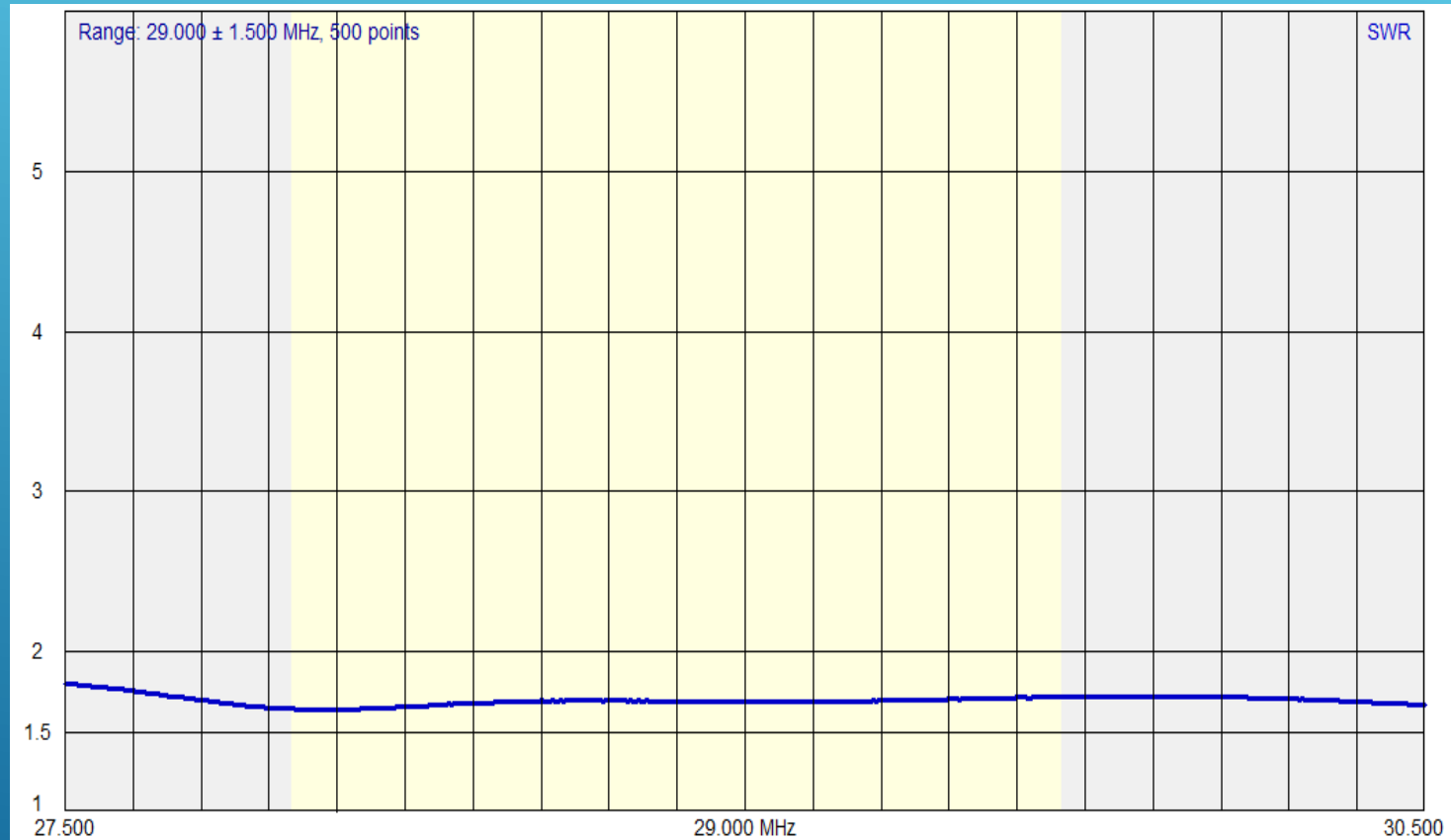
RF Sweep of the EFHW: 12 Meter Band



Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

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RF Sweep of the EFHW: 10 Meter Band



Measurements taken with RigExpert AA-600 Antenna Analyzer (FARC)

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Bill of Materials:

Item No.	Description	Part No.	Cost	Quantity	Cost	Supplier
1	49:1 RF Transformer /1K		\$46.00	1	\$46.00	Ebay
2	PVC Box: 6" x 4" x 2"	SKU 499982	\$13.97	1	\$14.00	Home Depot
3	Air Vent	563-NBX-10911	\$ 5.52	1	\$ 5.52	Mouser
4	SO-239	523-83-1R	\$ 7.15	1	\$ 7.15	Mouser
5	PVC 1" Coupler		\$ 1.78	1	\$ 1.79	Home Depot
6	3/16" x 1" SS bolts			2		Home Depot
7	3/16" SS lock washers			4		Home Depot
8	3/16" SS wing nut			2		Home Depot
9	3/16" SS nuts			4		Home Depot
10	3/16" SS washers			4		Home Depot
11	1/4" x 2" SS Eye Bolt			1		Home Depot
12	1/4" SS nut			2		Home Depot
13	1/4" SS lock washer			2		Home Depot
14	Cable Tie Mounts	8619-872 (black)	\$ 0.45	2		Kents
15	Cable Tie			2		Kents
16	#16 AWG XLPE Black Wire			150 feet		Princess Auto

CONCLUSIONS

- ❑ For my QTH, the noise floor has been reduced significantly (due to location)
- ❑ Great alternative for a multi-band operation
- ❑ Workable on all HF bands (VSWR less than 2.5 to 1)
- ❑ Easy to built
- ❑ Got me back in the hobby (after 25 years)
- ❑ Enjoying a reduced-noise HF band experience

Acknowledgements:

- Myantenna.com web information
- Steve Ellington N4LQ web information
- Mike Mladejovsky WA7ARK web information
- Thanks to FARC for the use of the RigExpert