End Fed Antenna Secrets

Select, Install & Operate

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LAKESIDE - October 2017
This presentation available on website

End Fed Workshop Topics

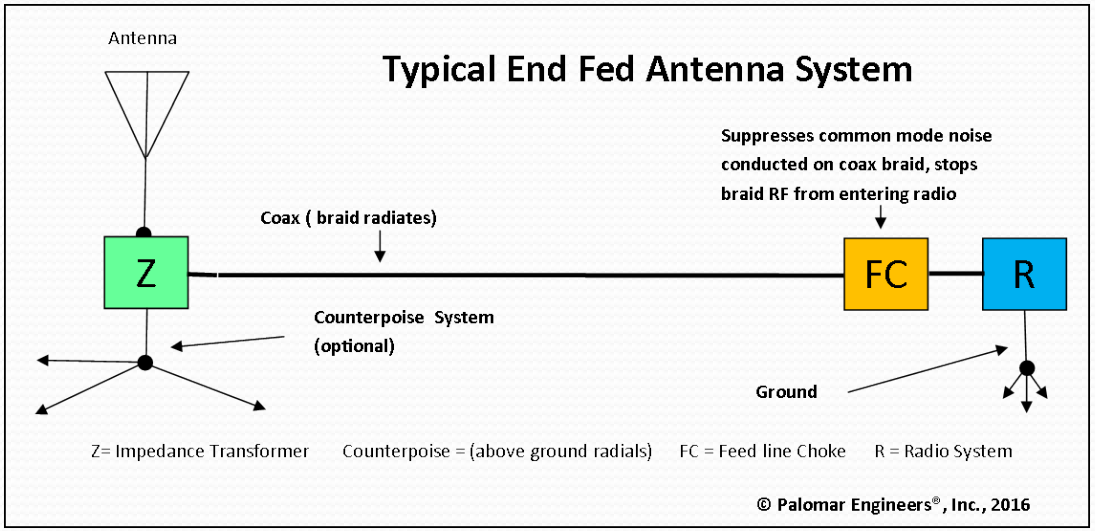
- Popular End Fed Antenna Types
- How to choose an end fed antenna that fits your needs
- Secrets of Non-Resonant End Fed Antennas
- Typical Configurations that work all the time
- Feed Line Chokes, Counterpoises and Noise Filters
- Q & A as time permits

Thinking cap time……

End Fed Antennas 101

Pros and Cons of different end fed antennas for newbies and old timers too!

Anatomy of an End Fed Antenna



Z

The antenna impedance matching components (BOX "Z" above) to match the antenna impedance to the coax line impedance (usually 50 ohms). For non-resonant end antennas, the typical feed point impedance is 300 to 600 ohms and a 9:1 impedance transformer (e.g. 450 ohm average antenna impedance to 50 ohm coax, also know as a 9:1 unun).

FC

With end fed antennas, the coax is meant to radiate as part of the antenna system (serving as the "ground" or counterpoise) and you need to use a Feed line Choke (BOX "FC" above) to suppress the common mode current on the outside of the coax feed line so it does not enter the radio while transmitting and also to reduce common mode noise while receiving. The Feed line (FC) acts as a stop sign for RF current flowing back on the outside of the coax. The higher the choking resistance of the fed line choke, the less the coax braid RFI common mode current and the less noise enters the radio.

R

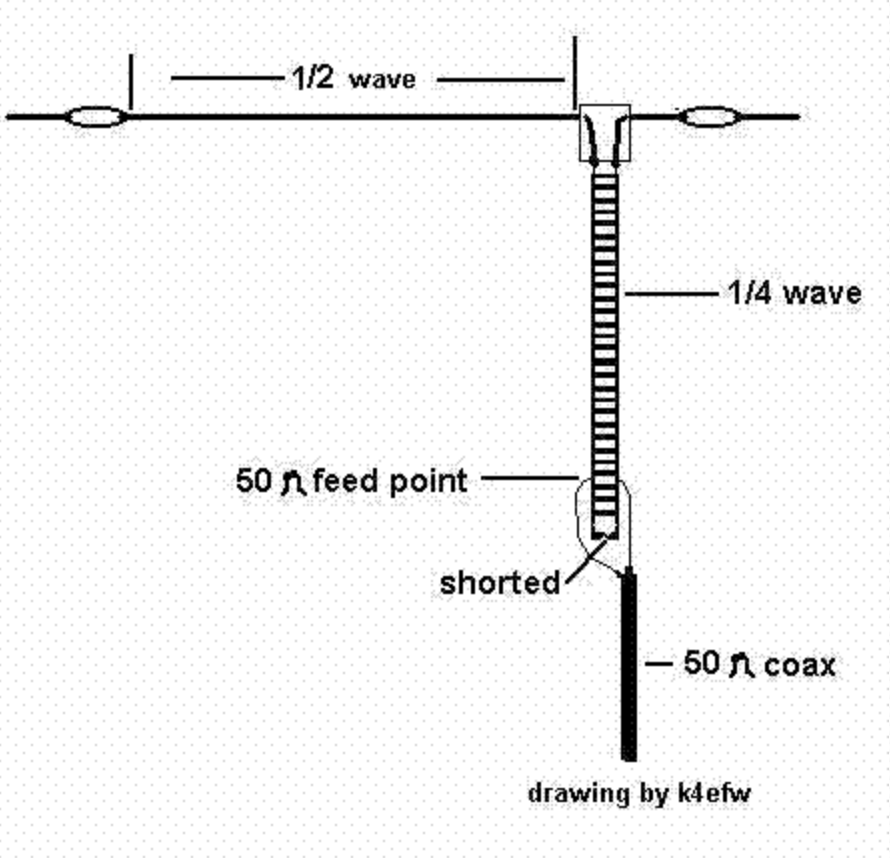
The radio station is also a key component of the antenna system and has two functions: transmit and receive. Matching the transmitter to the coax feed line is often done with an antenna tuner and receiver systems should be installed to maximize signal to noise ratio. Reducing receiver noise is critical for weak signal reception and the use of coax noise filters AND receiver power supply lines (AC or DC) noise filters is usually needed for optimum reception.

End Fed Antenna Types

- End Fed Zepp
- End Fed Half Wave
- Non-Resonate End Fed

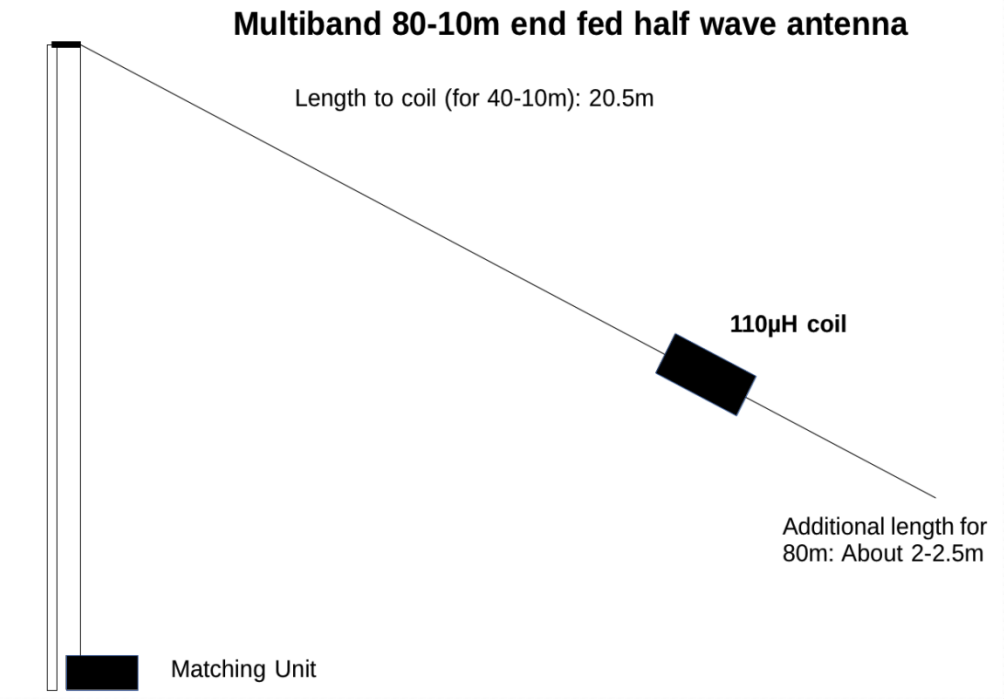
End Fed Zepp

- Pros
  - Low loss
- Cons
  - Uses ladder line
  - Single band w/o antenna tuner
  - High and long
  - Needs feed line choke at antenna



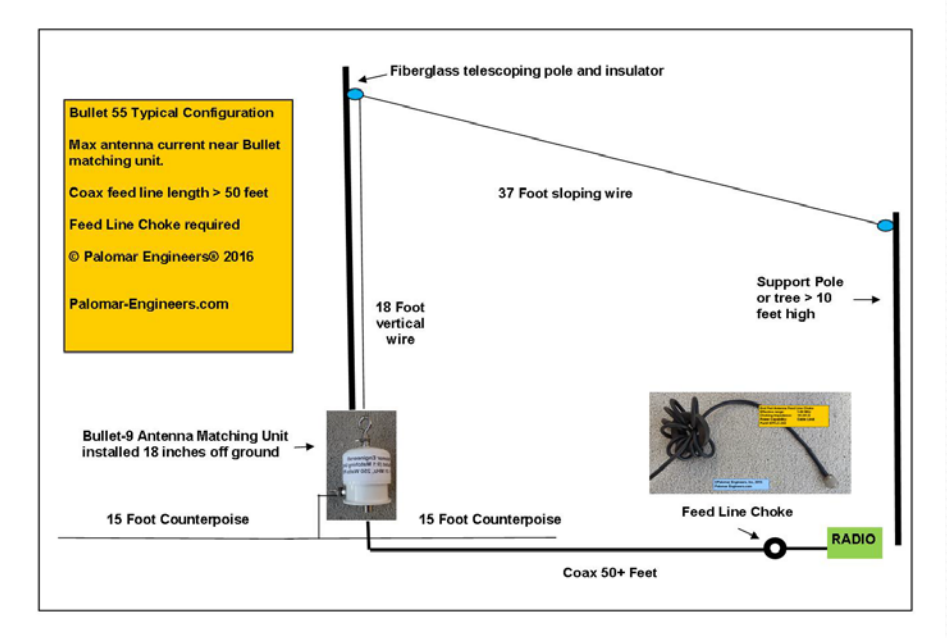
End Fed Half Wave (EFHW)

- Pros
  - Multi-band
  - Efficient over ¼ wave
- Cons
  - Long - requires a coil for multiband
  - Complex matching unit (64:1)
  - Needs feedline choke at antenna



Non-Resonant End Fed Antenna

- Pros
  - Shorter than others
  - Easy to deploy
  - Good bandwidth
  - Non critical length
  - Lots of configurations
  - Simple matching unit
- Cons
  - Coax radiates
  - Counterpoises



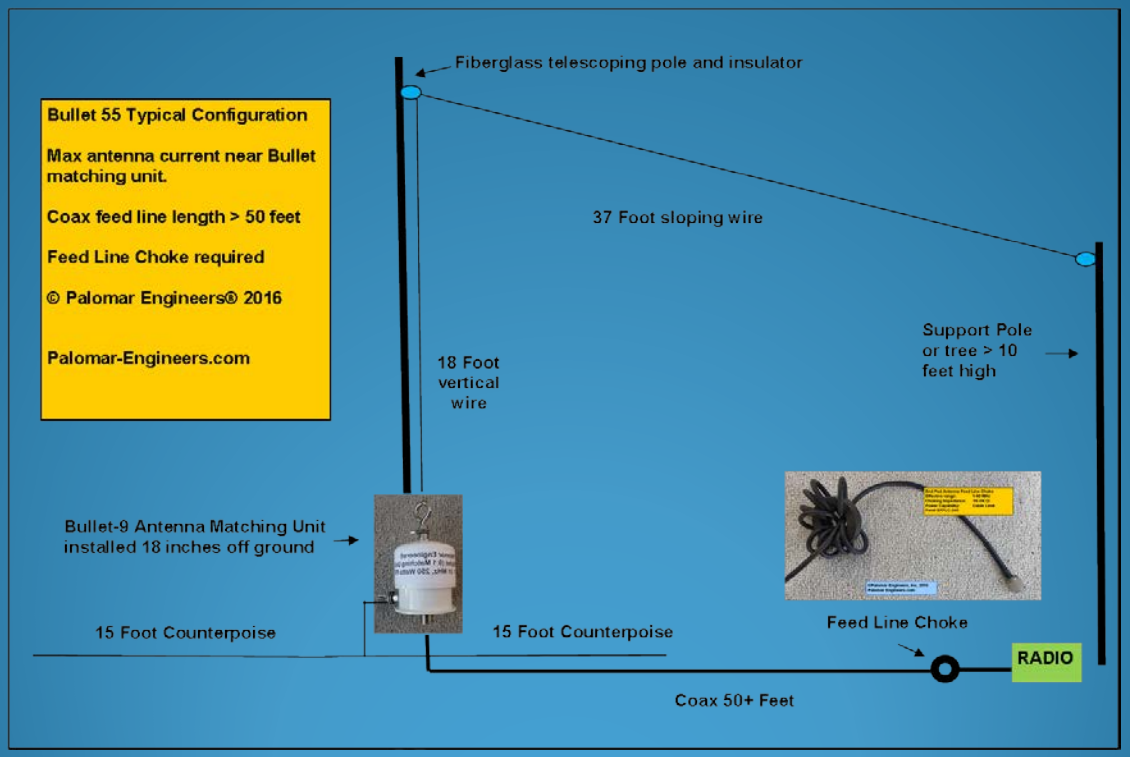
End Fed Antenna Choices Recap

- End Fed Zepp uses ladder line for matching to coax
- End Fed Half Wave is long and requires special high impedance/voltage matching
- Non-resonant end fed is shorter, uses simple matching and works many bands in less space and will work in many different configurations

Most Popular End Fed is the Non-Resonant

Question: How do I set up a non-resonant end fed?

Secrets of Non Resonant End Fed Antennas



Secrets to success with a Non-Resonant End Fed Antenna

1
- **How to determine the wire length to use**
  - (antenna, coax and counterpoise lengths)

2
- **How to match the antenna to coax cable**
  - (matching unit values and placement)

3
- **Choosing a configuration that fits the location**
  - (vertical, sloper, inverted L, horizontal options)

4
- **Choosing a feed line choke or noise filter**

How does these steps apply to your end fed?

How to determine the wire length

- Antenna Wire – longer for better low band operation
- Coax Cable – typically shorter than antenna – 75%
- Counterpoises/radials – use non-resonant length, raised, multiple and a “nail in the ground”

Suggested wire lengths for 1-31 MHz operation (measured from Bullet wire terminal):

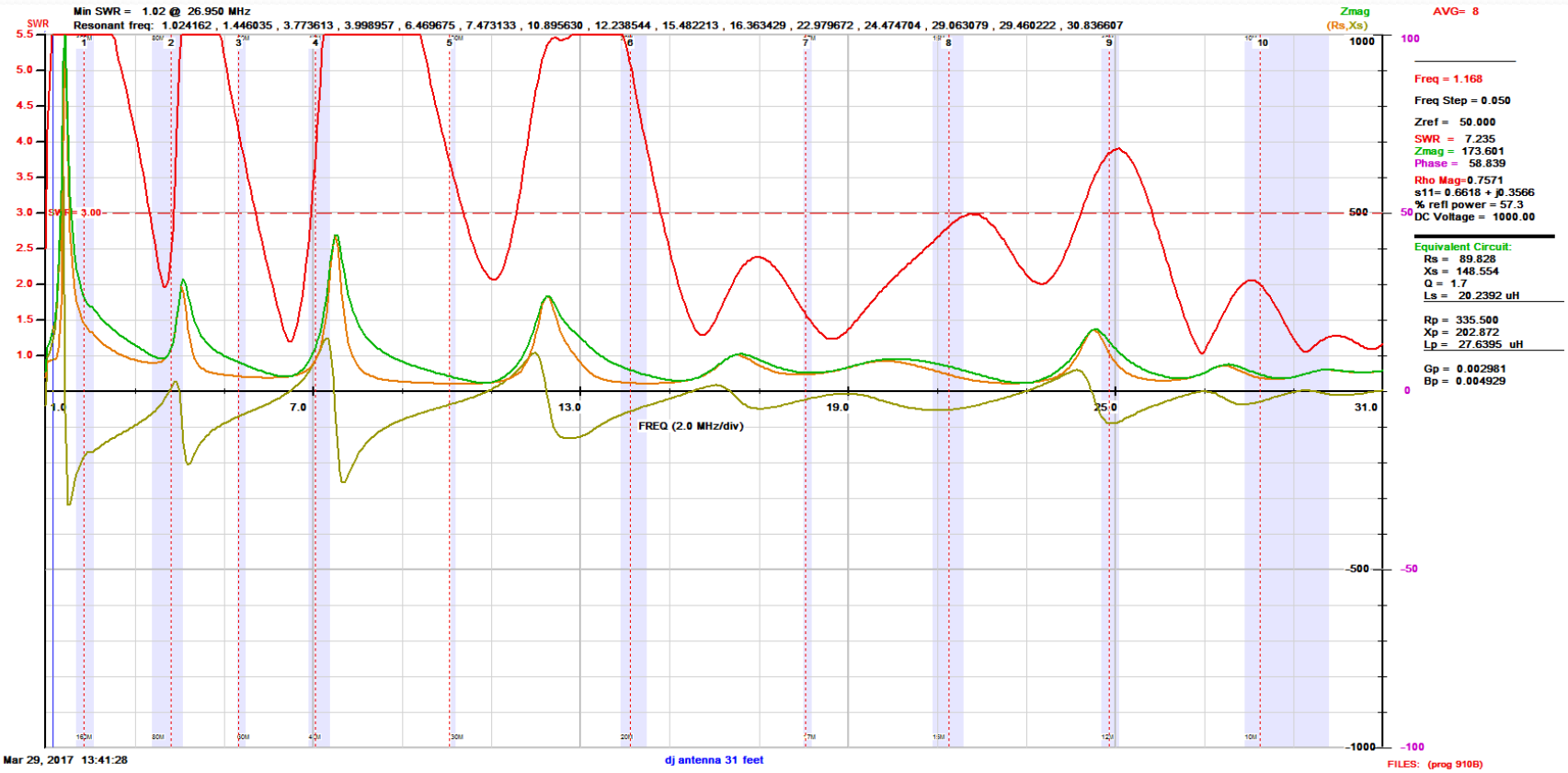
Bands Covered (meters)		Wire Length (feet)	Minimum Coax Length (feet)
40-30-20-15		35-43, 49-63, 70-85	35
40-30-20-17		35-45, 54-64, 67-77	35
80-40-30-20-17-15-12-10		38-44, 55, 60, 68-73	50
80-60-40-30-20-17-15-12-10		55, 68-73, 85, 92, 102, 120-125	65
160-80-40-30-20-17-15-12-10		135, 141, 173, 203	130

End Fed SWR Factors

- Configuration shape (Inverted L, flat top, sloper, etc.)
- Length of coax feed line – use recommended values
- Feed line choke placement – at radio end
- Top feed or bottom feed – feed sloper at top end
- Soil Conductivity – put over salt water
- Length and number of counterpoise(s) – use several with variable lengths, experiment with lengths for bands of interest

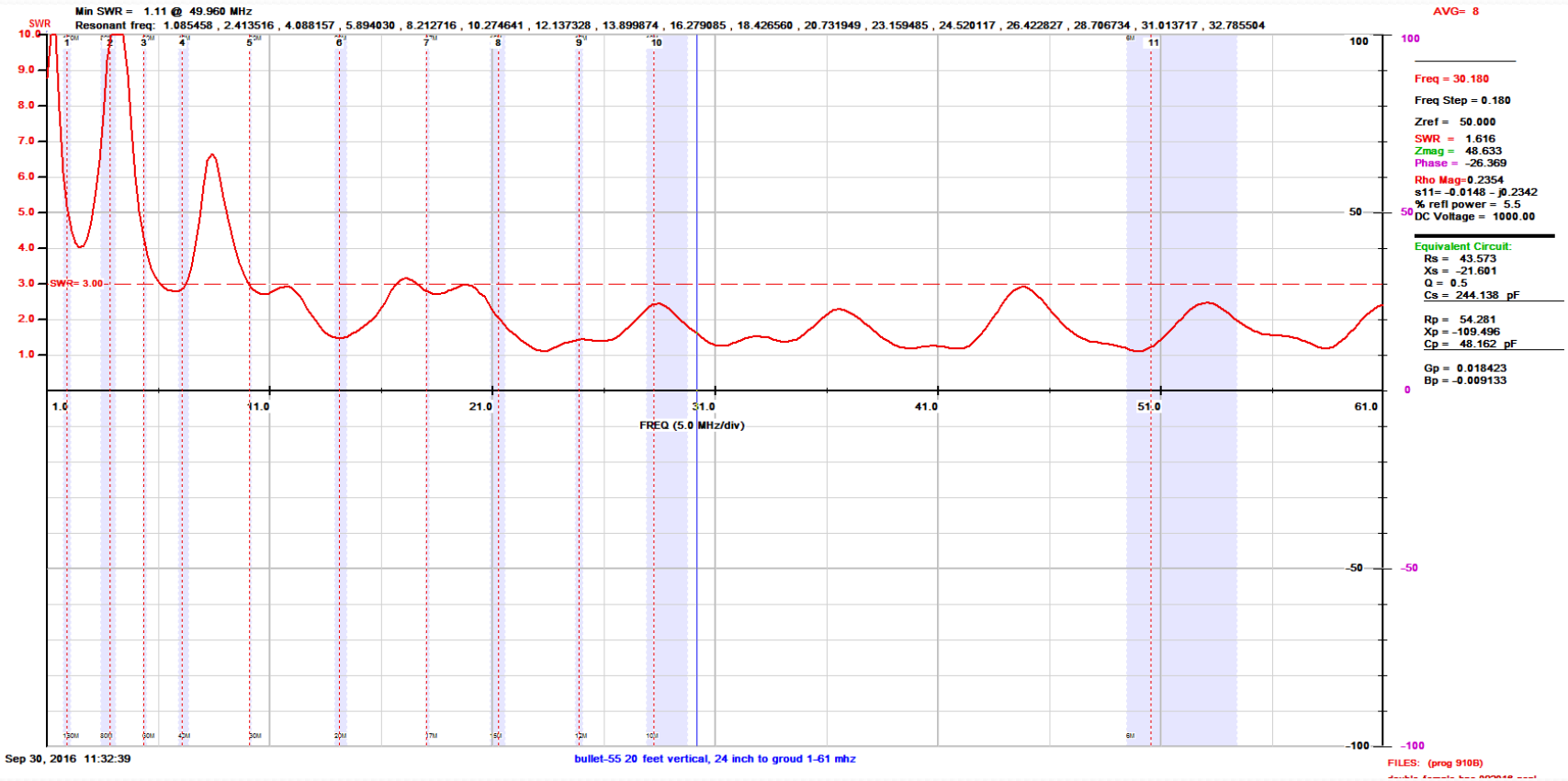
Some SWR plots vs length →

Bullet-31 SWR & Z (after 9:1)



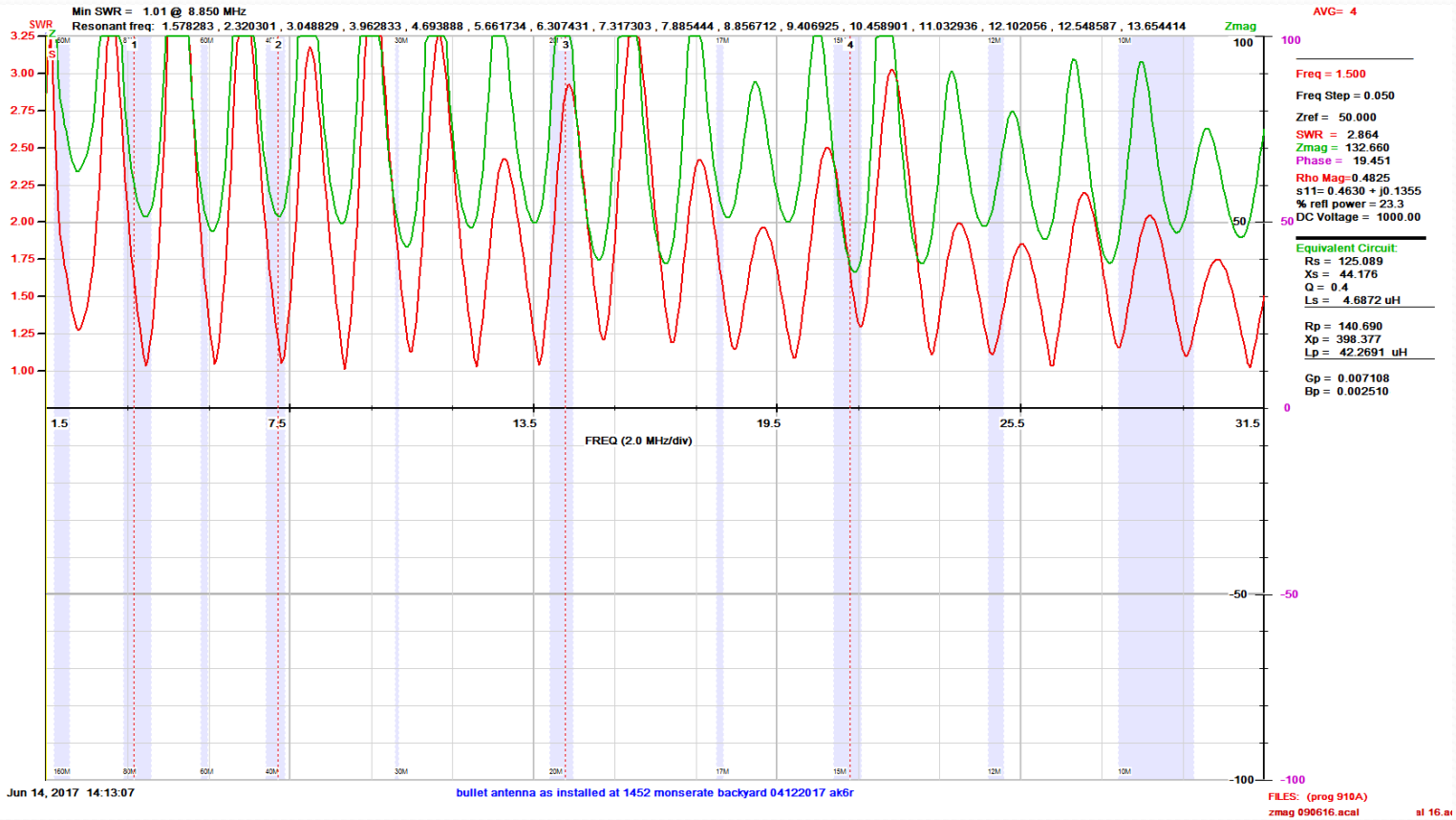
15’ vert, 16’ horizontal, two 15’ counterpoises

Bullet-55 SWR (after 9:1)



20' vertical, 35 horizontal, two 15' counterpoises, 1-61 MHz

Bullet-92 SWR & Z (after 9:1)



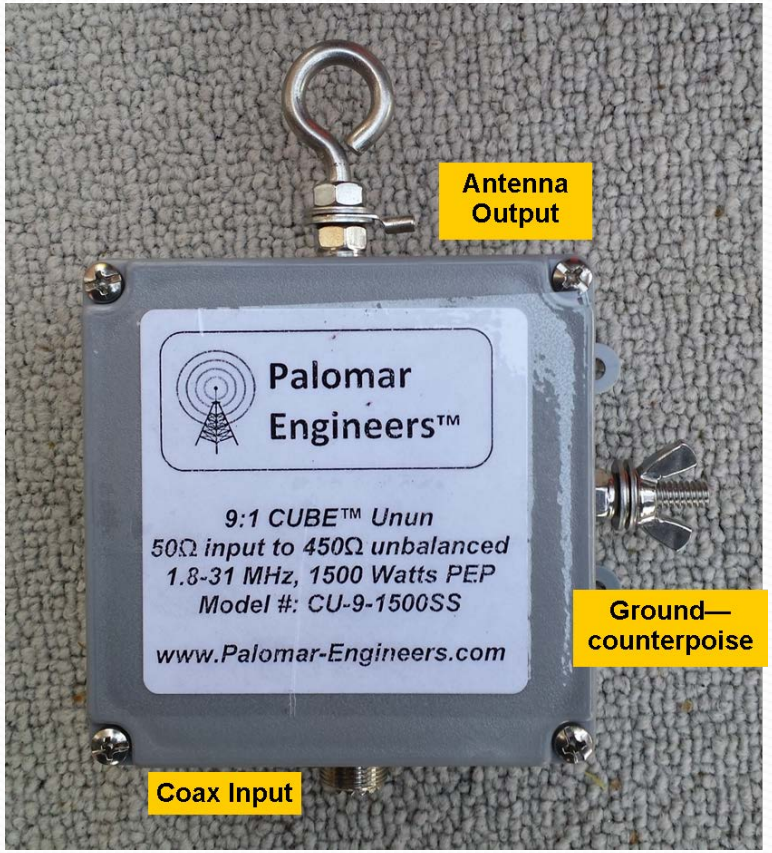
20' vertical, 72' horizontal, two 15' counterpoises, 24" to nail in ground, 1-31 MHz

Matching the antenna to coax cable

- UNUNs are your friend
  - Antenna feed point impedance: 300-900Ω
  - 9:1 transformer gives 33 to 100Ω to coax
- Connections for coax, antenna feed point and counterpoise
- Power Ratings – PEP to match your station

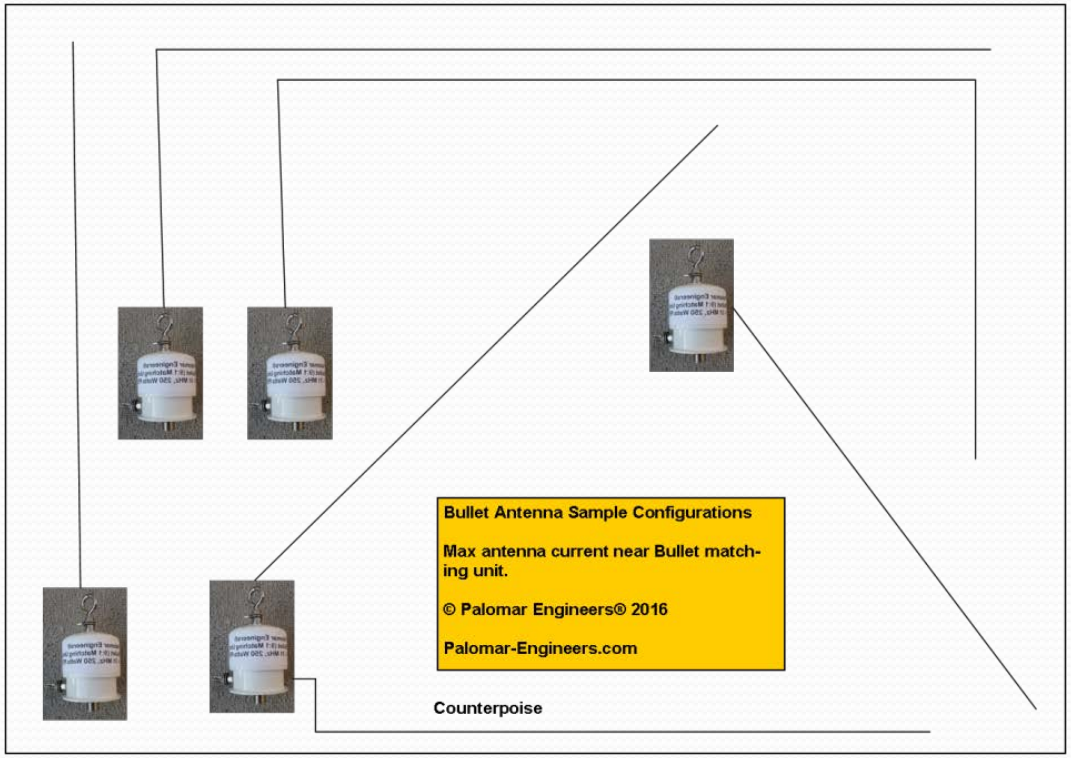
High Power Ununs are available

- 1.5KW Model
- Similar I/O connections
- PEP rating up to 5KW

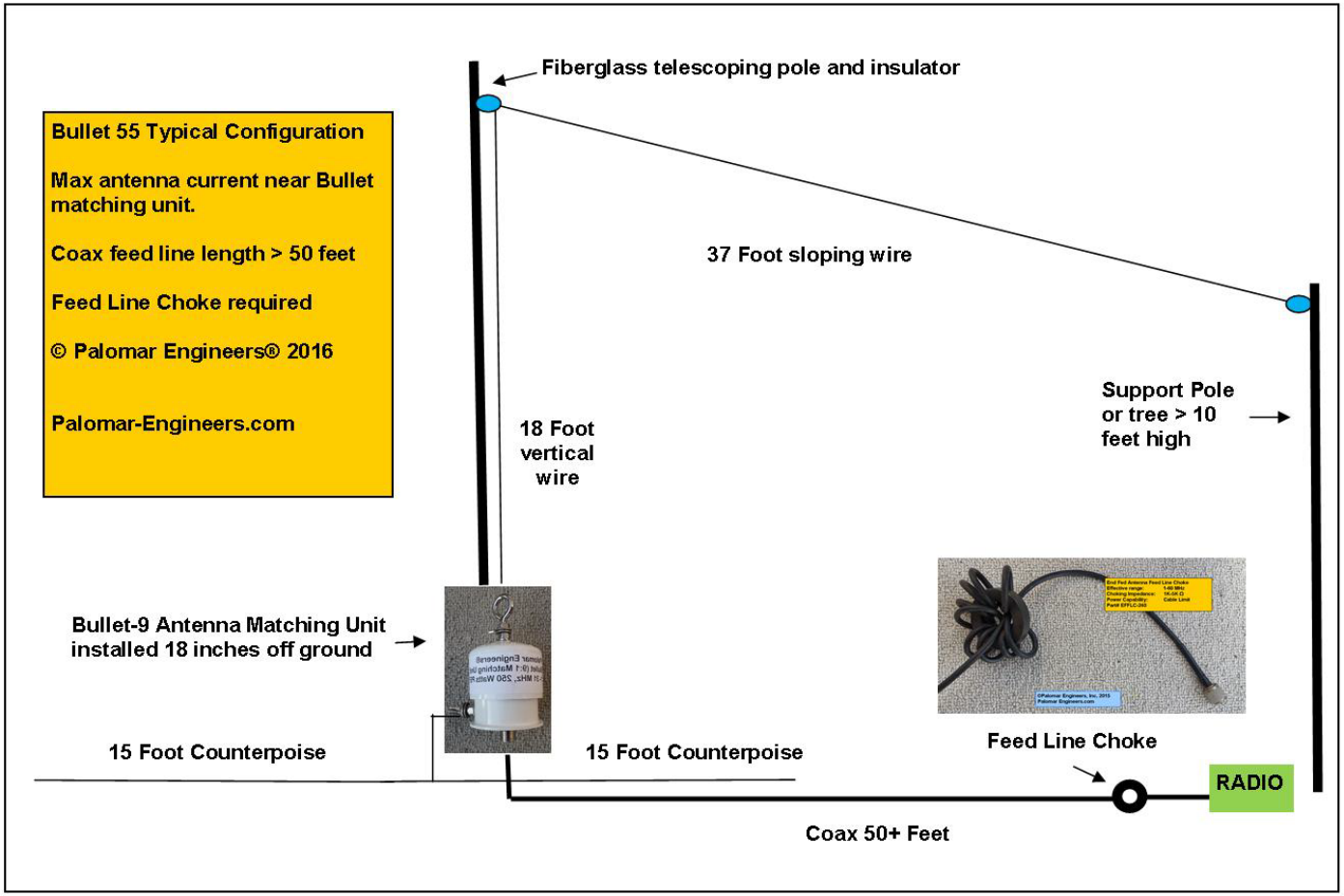


Antenna Configuration Options

- Vertical
- Sloper Up, Sloper Down
- Inverted L, U
- Horizontal



Typical End Fed Antenna Setup

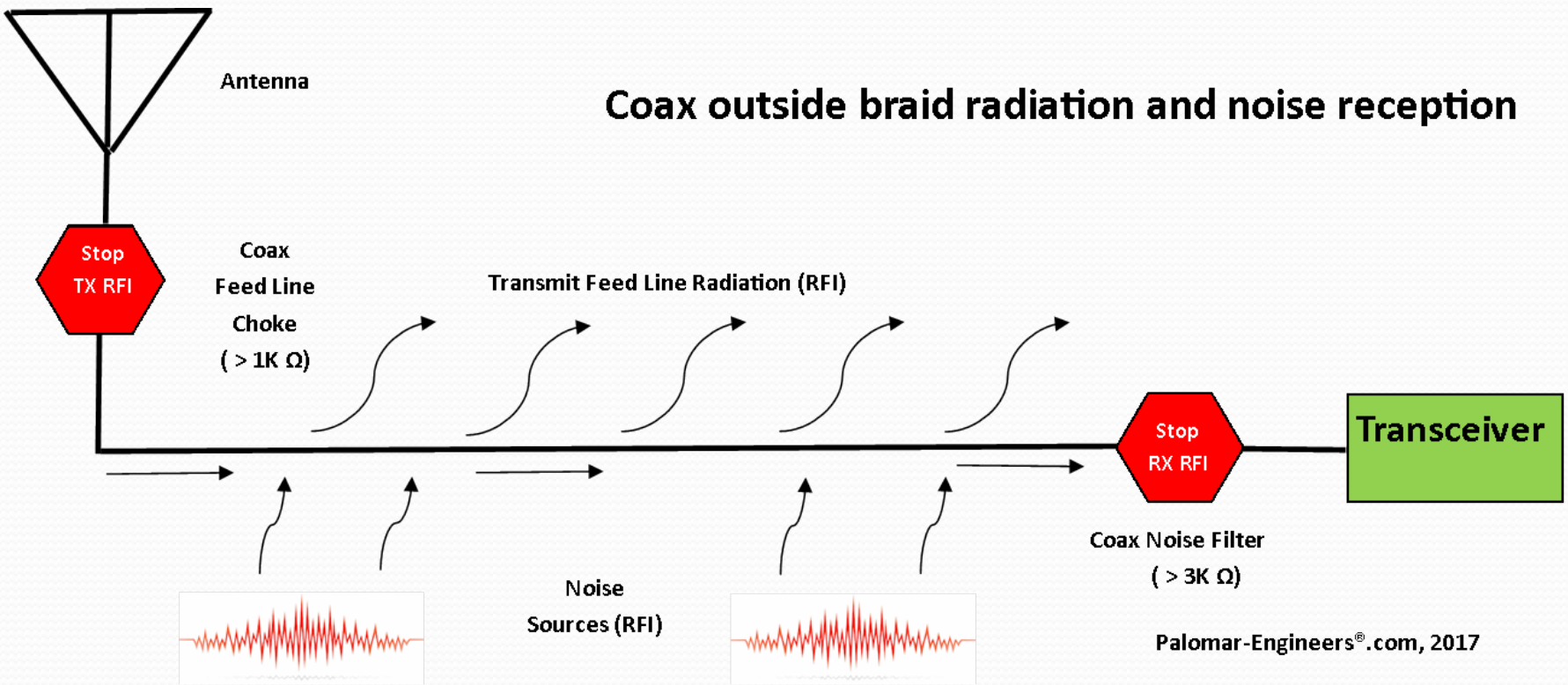


DIY

Coax Feed Line Chokes and Noise Filters

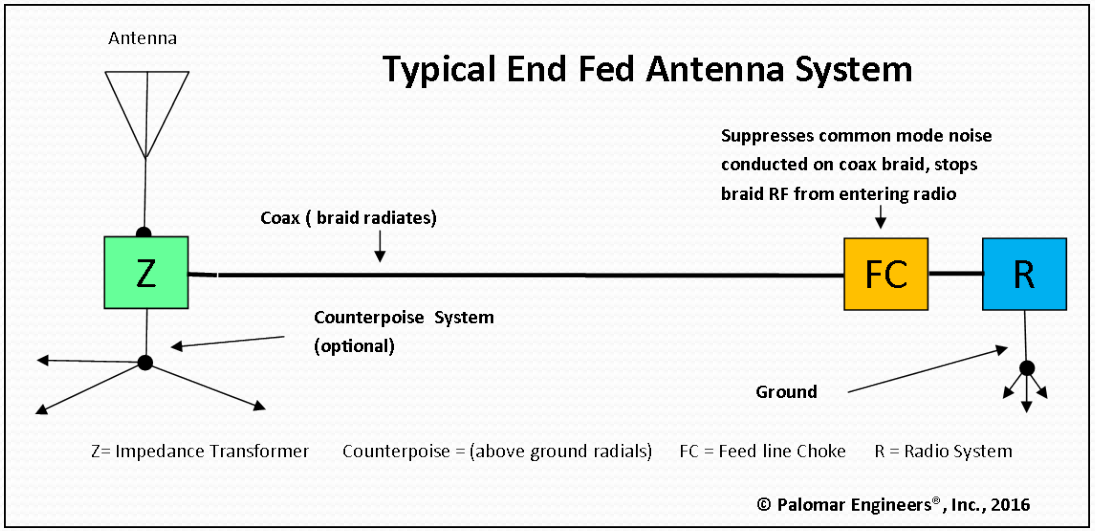
Lower noise floor = Higher SNR = More DX!

Typical Coax Fed Antenna System



How the end fed antenna is different

Anatomy of an End Fed Antenna



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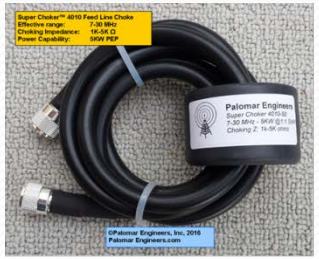
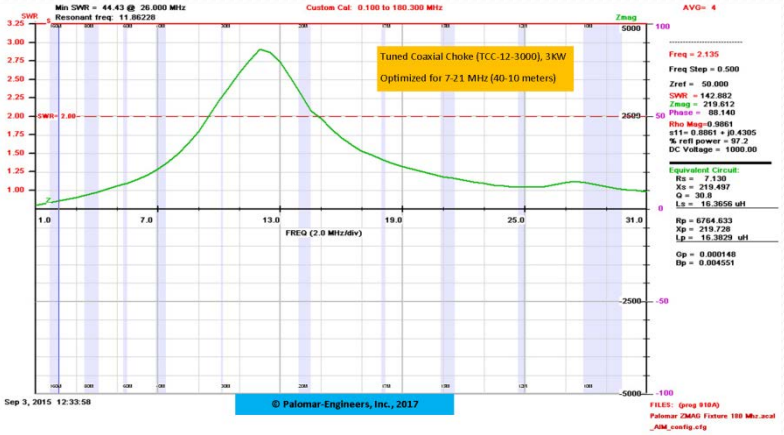
Choosing a Feed Line Choke



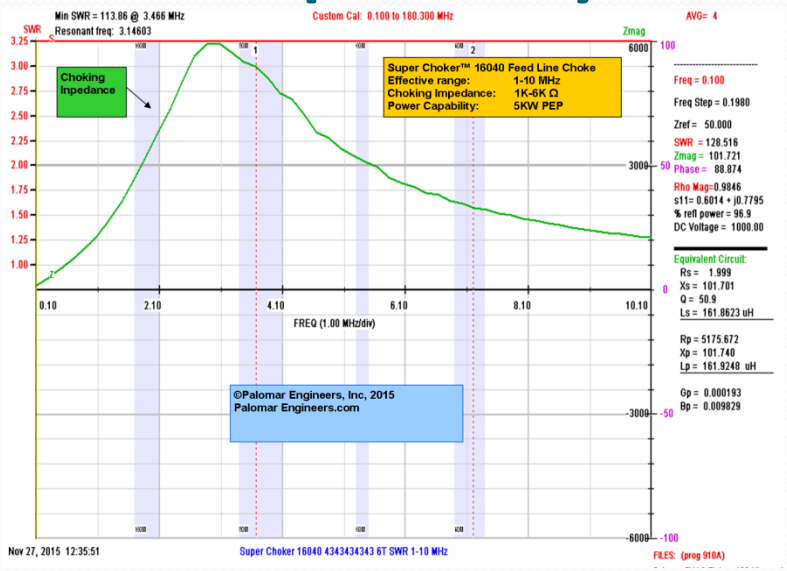
Criteria to Consider

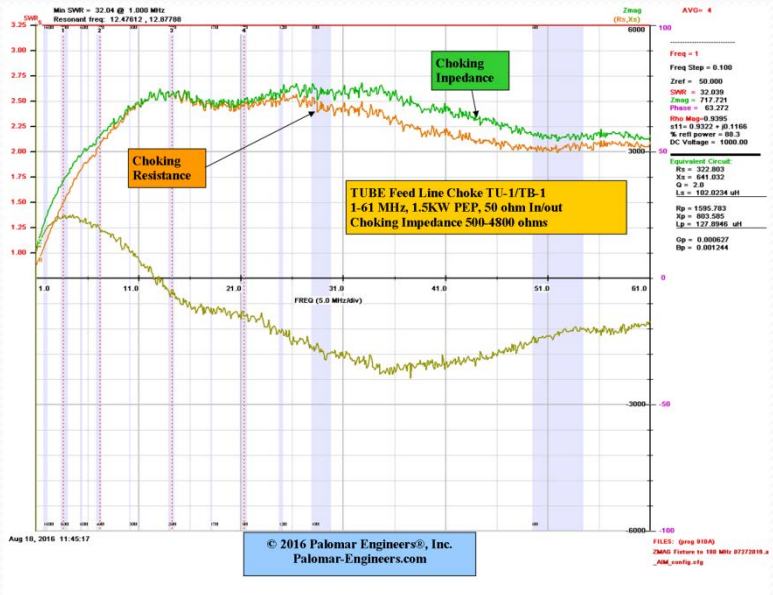
- Effective Frequency Range
- Adequate Choking Impedance > 500Ω
- Sufficient Power Rating
- Physical Size/weight
- Balun or unun output

←

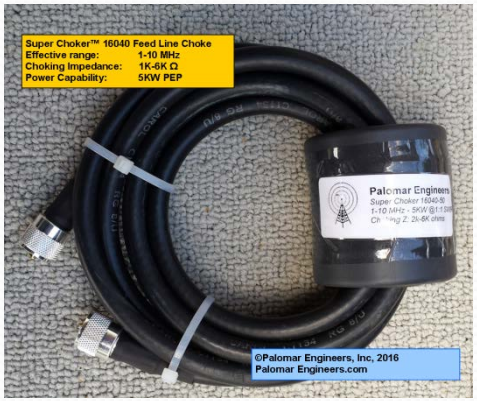


Choose choking impedance > 500Ω at frequency of use





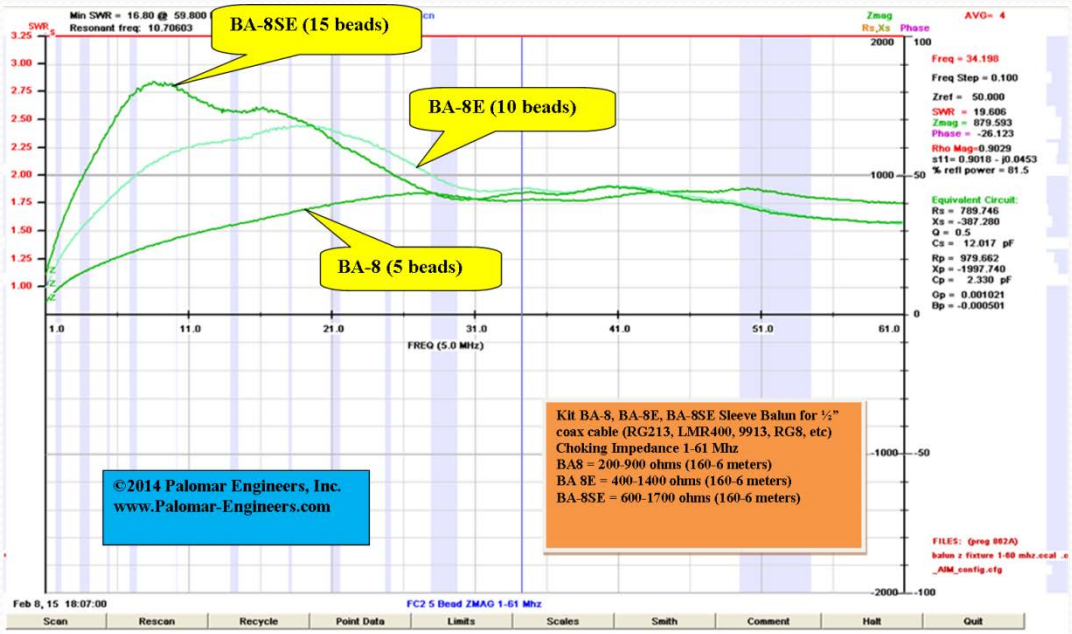
Super Choker
1-10 MHz >2K
5KW PEP
1K-6K Z
3 pounds
Verticals
AM/RTTY
Contesting



Line isolator
1-160 MHz >2K
1.5KW PEP
1K-6K Z
1 pound
All coax lines
Optional ground, static bleeder

Feedline Chokes for all antennas

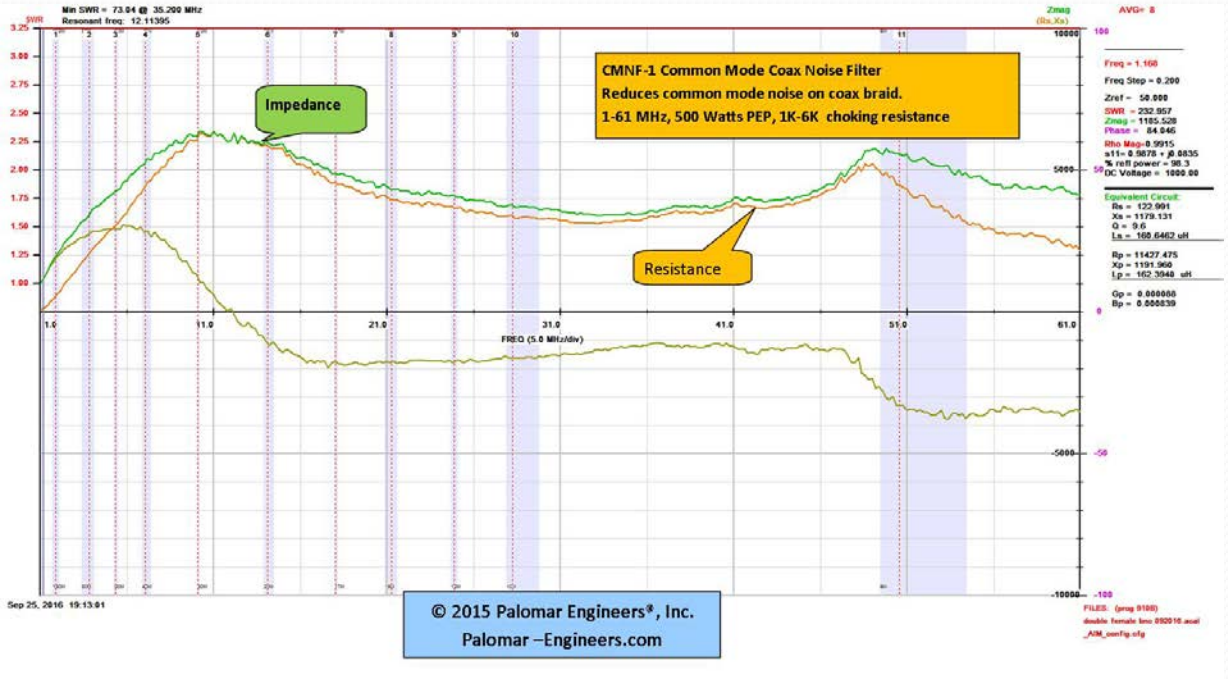
1 MHz 60 MHz



Medium choking Z (500-2000Ω) – 5KW PEP for RG213,
only 5 beads needed over 30 MHz

Coax Feed Line Noise Filters

>>> One of the best kept secrets in ham radio!!! <<<



<u>Placed at RADIO END of coax feed line to suppress common mode current on coax braid between antenna feed point choke and radio</u>

Choke Attenuation

Choking Impedance vs Attenuation

- Palomar Engineers specify RFI/EMI chokes in terms of impedance (in/out), but often the customer needs to know the attenuation to choose which product best suits the application. (1 “S” unit = 6db)

Choke Impedance (Z_{sc})	Attenuation (dB)
200	-9.5
500	-15.6
1000	-20.8
1500	-24.0
3000	-29.8
5000	-34.2
10000	-40.0

Simple DIY Choke

A $10 DIY End Fed Feed Line Choke

+ **C o a x** =

- Ring Ferrite + ¼" Coax Cable = feed line choke – 2-5K ohms
- Use at radio end of coax to stop <u>transmitted</u> signal from entering radio station. Remember the coax radiates in the non-resonant end fed antenna
- Use RG-8X/58 for low power, RG303/400 for high power > 1KW PEP

What about causing RFI?

Solving End Fed Antenna RFI Problems

Unbalanced antennas need a ground to call home

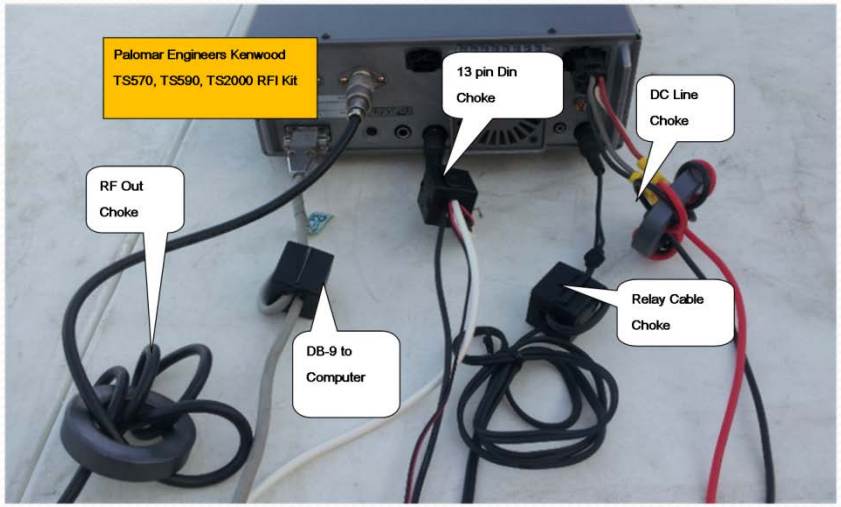
Typical RFI Issues

- Keep antenna away from house wiring including AC power, Cable/Satellite feeds, telephone lines as these wires can act as antennas and overload attached electronics OR transmit spurious signals (and noise) to your antenna.
- Use Palomar RFI kits to solve RFI interference or noise issues in your own home or neighbor's. See website for more details.

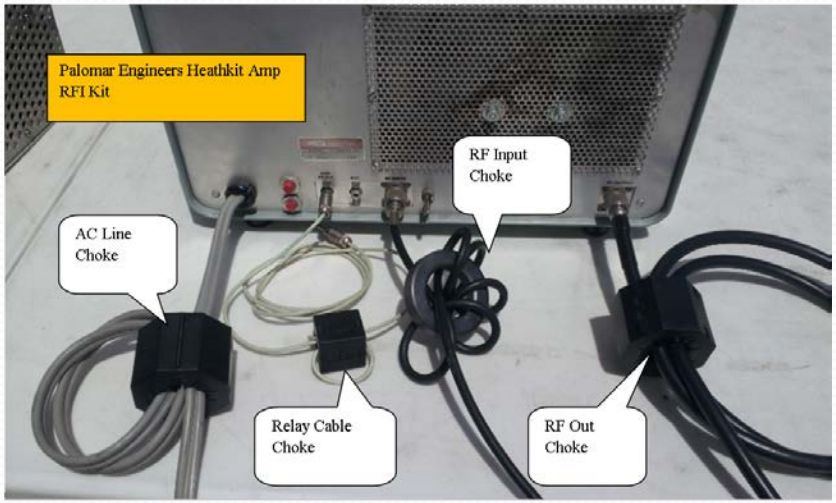
Transceiver/Amp RFI Kits

Palomar RFI kits for all brands of transceivers and amplifiers

Transceiver RFI Kit



Linear Amplifier RFI Kit



Clean up your transmitter RFI first

Ham's Solution to Neighbor's RFI

- Source (transmitter or antenna") – Path – Victim
  - Clean up your transmitter/shack first
  - Assess Neighbor's Problem
  - Faulty device (device acting as receiver when not designed to be a radio receiver – e.g. Telephone, HDTV)
  - Determine frequency of "transmitter" that is causing the problem (may not be on all bands – may not be you!)
  - Find the path (or paths) to the Victim (Receiver)
  - Choose the RFI choke kit for the frequency and path
  - Choke the path, protect the device (externally)!

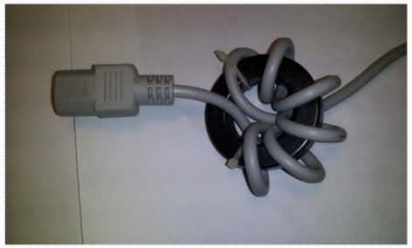
Neighborhood RFI Solutions

MY HOME or NEIGHBOR'S HOME

ALARM SYSTEM RFI

HOME THEATER RFI

COMPUTER RFI



MISCELLANEOUS RFI

GARAGE DOOR

TELEPHONE/DSL RFI

Recommendation: Use RFI kits for specific problems, have neighbor purchase and install – do not make mods to neighbors equipment! MOST problems are RFI picked up by AC power/phone lines so ferrite filters work well.

RFI Solutions Experts

Palomar Engineers

- Website: www.Palomar-Engineers.com
- Email: Sales@Palomar-Engineers.com
- Phone: 760-747-3343
- Bob Brehm, AK6R – Chief Engineer
- This presentation available on the website.