

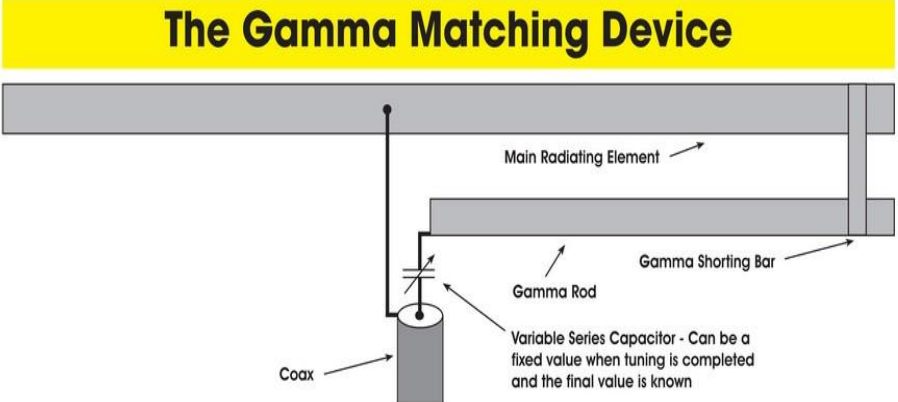
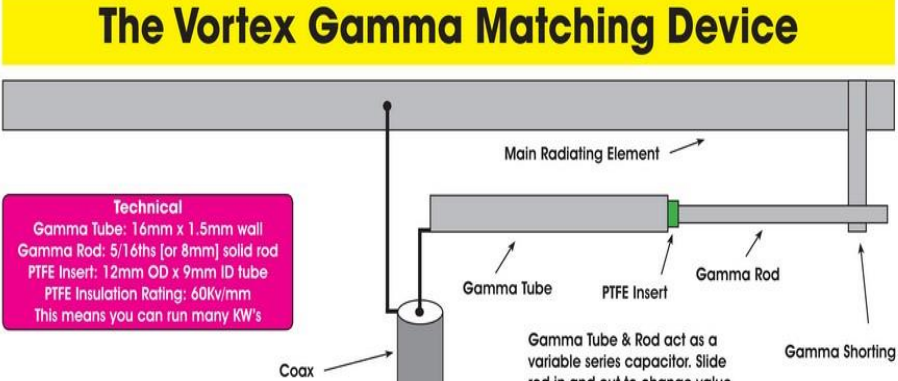
Matching Antenna Impedance To The Feedline

NCAR Meeting 8/14/2024

Using a Transmatch or Antenna Tuner

- Capable of getting a good match between the coax and transmitter
 - Makes Tx happy but turns a little energy into heat.
 - Coax to Antenna is still bad and you get a much bigger loss as heat.
- What you really want is the Antenna / Coax / and Transmitter to all be 50 ohms
- Two ways of doing this
- Put the antenna tuner remotely at the antenna (BEST OF ALL ALTERNATIVES)
- Match the antenna and Coax using an impedance transform of some sort

Gamma Match – most used in Yagi antennas

The Gamma Matching Device	
 <p>Coax</p> <p>Main Radiating Element</p> <p>Gamma Rod</p> <p>Gamma Shorting Bar</p> <p>Variable Series Capacitor - Can be a fixed value when tuning is completed and the final value is known</p>	In the first device an actual variable capacitor is used to feed the gamma tube.
The Vortex Gamma Matching Device	
 <p>Coax</p> <p>Main Radiating Element</p> <p>Gamma Tube</p> <p>PTFE Insert</p> <p>Gamma Rod</p> <p>Gamma Shorting Bar</p> <p>Gamma Tube & Rod act as a variable series capacitor. Slide rod in and out to change value</p>	In the second case, a short tube covers part of the gamma tube. This forms a capacitor. The gamma tube and shorting bar slide in and out of the tube to adjust capacity.

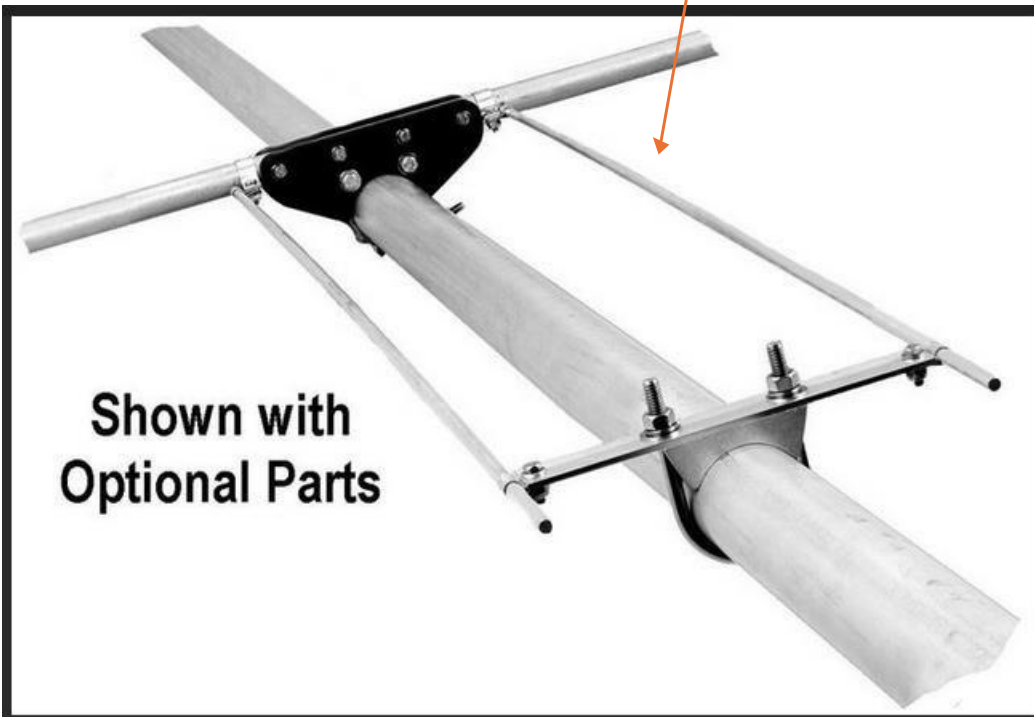
Technical
Gamma Tube: 16mm x 1.5mm wall
Gamma Rod: 5/16ths [or 8mm] solid rod
PTFE Insert: 12mm OD x 9mm ID tube
PTFE Insulation Rating: 60Kv/mm
This means you can run many KW's

1/4 wavelength hairpin or inductive matches



All of these are
ELECTRICALLY 1/4
wave length.

Hair Pin
Matches



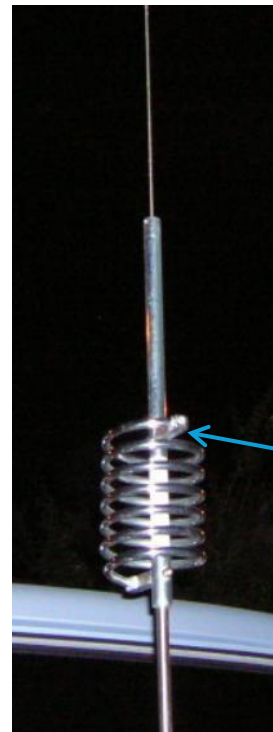
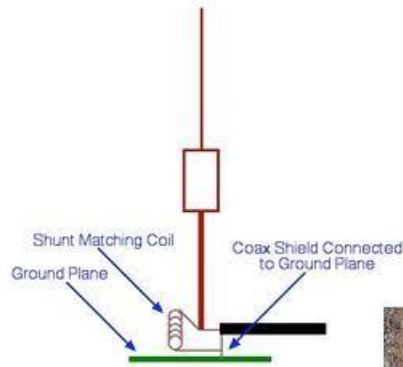
Shown with
Optional Parts

Length can be
straight or coiled
and made from solid
or coax material.

Inductively Coupling.
There are multiple
on line Calculators
for designing the coil
(turns vs diameter)

Base Loaded Verticals – inductive matches

- Inductive matching works by borrowing a small amount of capacitive reactance from the antenna (by tuning the antenna slightly above the actual transmitting frequency).
- This borrowed capacitance, and the shunt matching coil's inductance, form a highpass, LC network which transforms the antenna's low impedance (typically 25 ohms or so) to that of the 50 ohm feed line.
- Installed and adjusted properly, shunt matching will provide a decent match (<1.6:1) over several octaves. Enclosing the matching coil, even in plastic, will affect the frequency versus reactance of the coil, effectively reducing its bandwidth.
- You can also use uninsulated wire and an alligator clip to achieve multiple matches. (usually base mount verticals on HF frequencies).



Coil Tap

Mixed Impedance Coax Matches

- Different antenna types have impedances above or below 50 ohms.
- Very few actually match the various coax types.
- Common Coax impedances:
 - 52 Ohm RG-8, RG-213, LMR 400 etc.....
 - 75 Ohm RG-59, RG-6,. Etc.
 - 95, 100, 300 and others are available but not common.
- Antenna Types
 - ½ Wave dipoles: 72 ohms (50-50 length split) to 300+ if end fed
 - Long Wire: 300 to 900 ohms
 - Verticals: about 150 depending on ground plane and height.

Antenna and Coax *Magic* numbers

- $\frac{1}{2}$ wavelength of coax has the same impedance looking from each end....
 - Coax impedance repeats (looks like a open or perfect match) in multiples of $\frac{1}{2}$ wavelength.
- Electrical length depends on wave propagation percentage
 - Depends on INSULATION type not diameter
 - SOLID Polypropylene is about 64% of the speed of light.
 - FOAM Polypropylene is about 84% of the speed of light.
- Impedances in parallel are the averages of the two impedances.

Antenna and Coax *Magic* numbers

- TWO separate 50 ohm ELECTRICALLY $\frac{1}{2}$ wavelength of RG8 soldered in parallel (shield to shield and center to center) produces a $\frac{1}{2}$ wavelength of 25 OHM coax
 - Matches most Yagi antennas reasonably well.
- One 50 coax plus one 75 ohm electrical $\frac{1}{2}$ wavelength
 - $x = \frac{50+75}{2} = 62$ Ohms About right for a fan dipole.
- Generally you will use an unun or balun for antennas with higher impedance.
- Two 50 ohm $\frac{1}{2}$ wavelength can be used to feed two identical 50 ohm antennas