QRP Antenna Tuner

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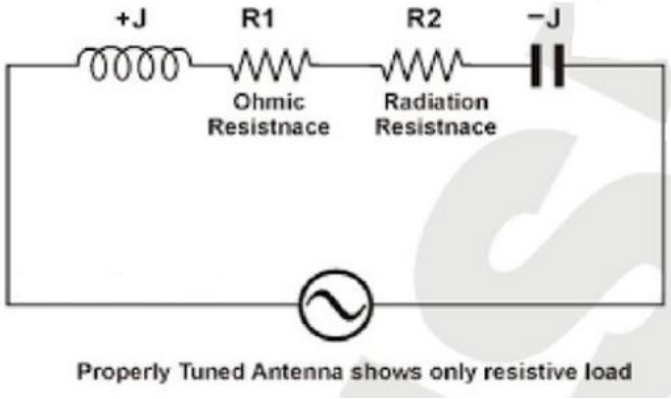
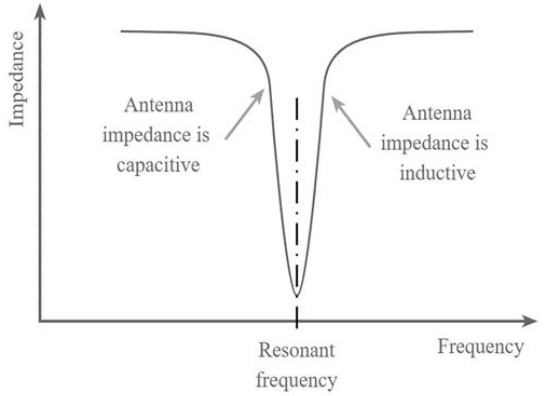
What is antenna feed impedance ?

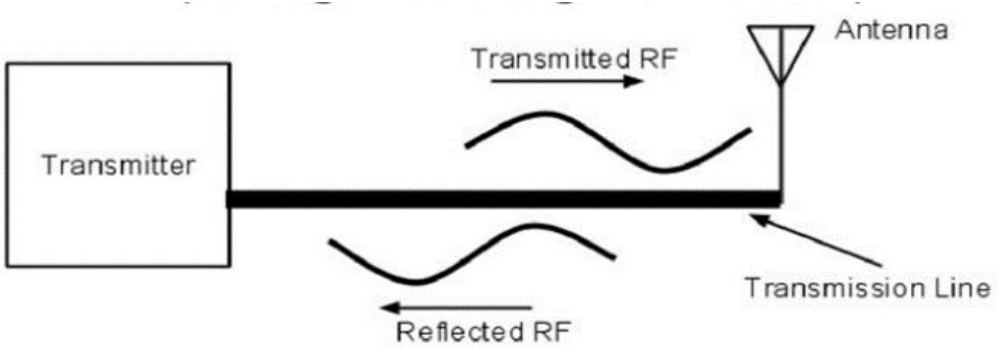
- It is a complex impedance and it is made up from several constituents: resistance, capacitance and inductance.
- At resonance where most antennas are operated the inductance and capacitance cancel one another out to leave only the resistance of the combined radiation resistance and loss resistance.





Problems with Unmatched Impedance

- Whenever there is a mismatch of impedance between transmission line and load, reflections will occur.
- The incoming incident waveform to produce stationary wave forms called standing waves.



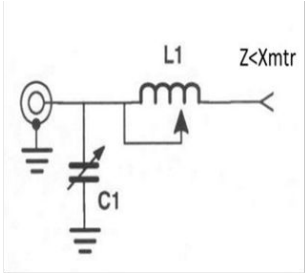
Antenna Tuners

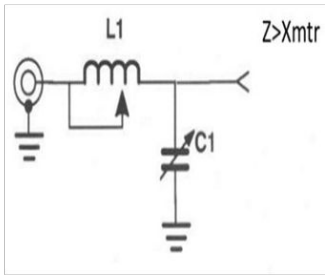
An antenna tuner (coupler is a more correct term) is an impedance matching device which minimizes “mismatch” loss (maximizes power transfer).

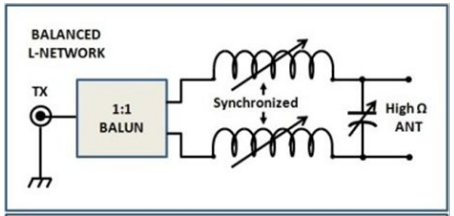
- Not different from any other impedance matching circuit. It does NOT tune the antenna!
- Also referred to as coupler, antenna coupler, transmatch, Matchbox, etc.

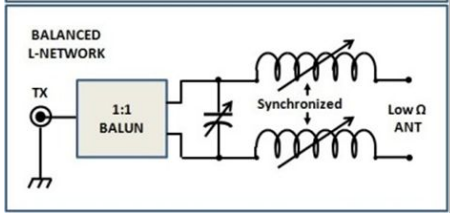
Tuner Designs

L- Match

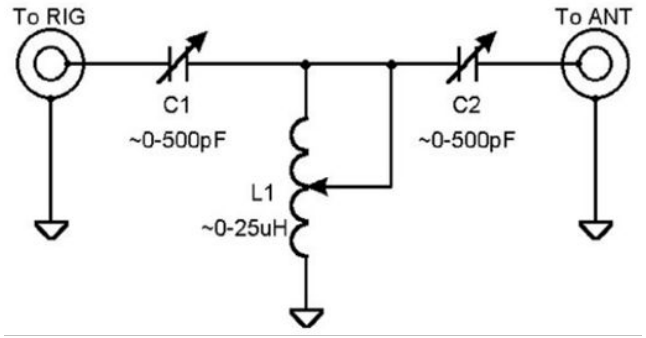


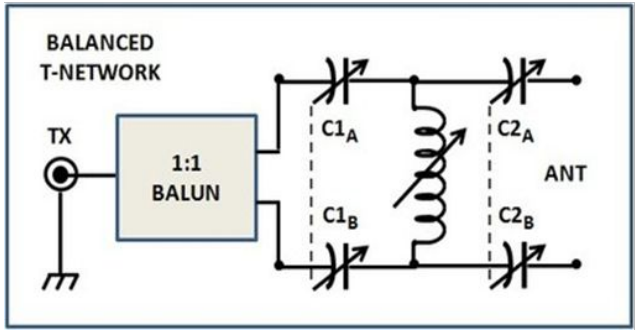




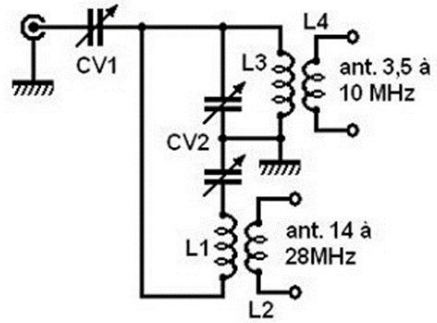


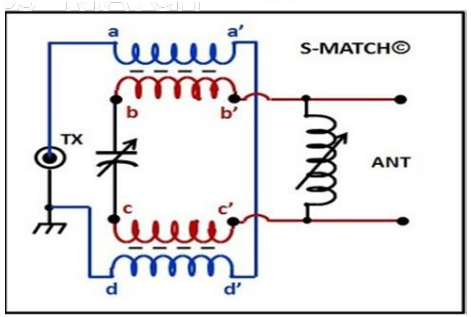
T- Match





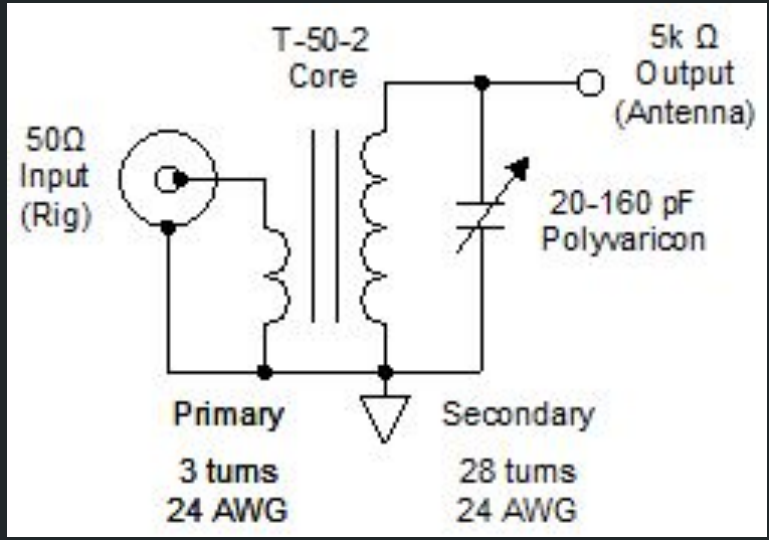
Z- Match





Z-Match Tuner

- Uses a toroidal transformer (coupled inductors) for impedance matching
- Has a tuned secondary (LC circuit) with a variable capacitor
- Matching is achieved through inductive coupling and resonance
- Both windings are grounded, so it is an unbalanced configuration (coax-fed system)
- Type: Unbalanced Z-match (link-coupled antenna tuner)

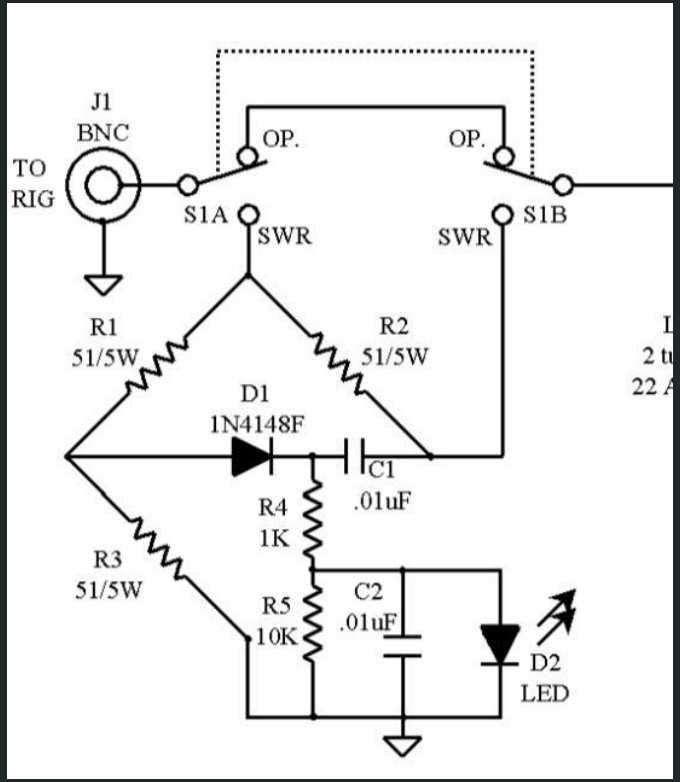


SWR meter

- SWR meter provides valuable feedback on the impedance match between the transmitter, feedline, and antenna.

SWR Indicator

- Bridge (R1–R3) samples RF and stays balanced at 50Ω match
- Mismatch causes reflected power ➜ bridge imbalance
- Imbalance creates RF voltage at detector
- Diode + capacitors convert RF to DC
- LED brightness shows reflected power (higher = higher SWR)



https://youtu.be/k_EVQeTUdVQ?si=Oj8MU-Gt9YGOA3MP

Questions !