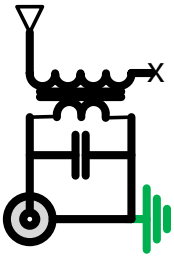
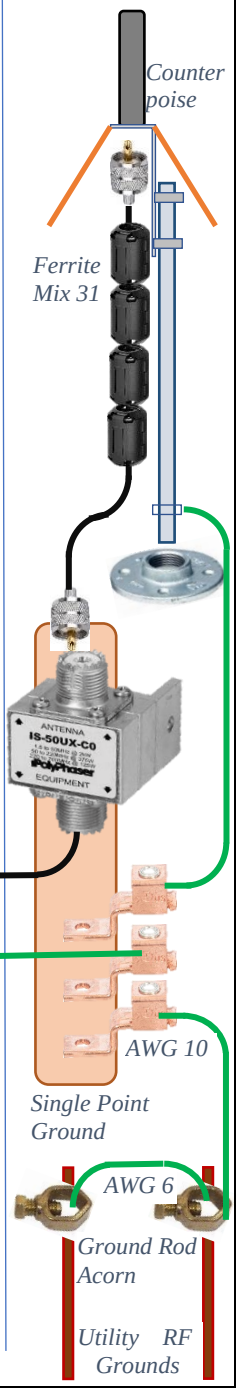
Ham 65 – HF Counterpoise, SPG, & Earth Diagram

Dr. Marc & Rosemary © 230630

1. A High Frequency (HF) antenna installation is identical to the VHF/UHF from the counterpoise mount to the radio. Antennas require a path for the return current to the transmitter.
2. For a quarter wave, dipole type, mount a SO-239 connector. Connect the antenna wire to the center.
   a. Connect radials to the bracket.
   b. Unlike 1/4 wave radials, 1/12λ are adequate if the antenna is lengthened to resonance.
   c. The antenna at lowest frequency should be one-quarter wave up to 0.31λ to obtain a resonant match for 1/12λ radials.
3. For a long-wire, connect a UNUN (unbalance coax : unbalance line) at the counterpoise mount.
   a. The transformer changes the impedance from 50 Ω coax to much larger line as high as 3000 Ω.
   b. The antenna line is simply an end-fed long wire used on multiple bands. Bandwidth is narrow.
   c. A counter poise provides the return.
   d. A counterpoise changes reactance. A length of 0.05λ minimizes the reactance.



4. For resonant length antenna, a transformer can match for SWR <3:1.
   a. Non-resonant antenna requires external tuner.
   b. Resonant means X = 0. X matches, R radiates.
5. *NEC* self-supporting wire size for <150' is AWG 14. Over 150', AWG 12 is needed. Although insulated, still use spacers/insulators from any wood or other support. For 3.57 MHz, quarter wave length is less than 69'. Harmonics may hit 40, 30, 20, 17, 15, 12, & 10M.
6. You can make your own transformer. Twist the primary and secondary wires together.
   a. Make two loops on Mix-43 ferrite toroid, not powdered.
   b. One end of the primary winding is to a SO-239 connecter, the other end is to the housing.
   c. Continue the secondary winding around the toroid, through center, on to other side. Do not overlap. A 49:1 transformer requires 7-times as many secondary turns. So, make 14 turns.
   d. #18 enameled works for lower power ratings.
   e. Alternately, use AWG 12 solid with THW insulation and no tape wrap.
   f. A compensation capacitor goes across the primary windings. Use blue ceramic disk, 100 pf, 3 kV.
   g. The primary inductive reactance runs 88–200 Ω at lowest frequency, 3.5 MHz.
7. The primary of the transformer connects to the coax.
   a. The antenna connects to the secondary.
   b. The other terminal (x) of the secondary is the counterpoise, which suggests experimenting.
   c. A four-inch pigtail is common. Others leave it unconnected. A 0.05λ appears optimal.
8. Connect the counterpoise to ground for a DC and low frequency path.
   a. If the antenna is lower than 2λ (less than far field), then ground-effects dominate.
   b. Make the ground wire a resonant length, so its RF influence is reduced.
   c. The low frequency ground is parallel to the RF frequency counterpoise.
9. Some Unun improperly use the coax shield as a counterpoise. *NEC* requires grounding the shield.
10. The isolated winding very effectively blocks noise. Other parasitic inductance will cause undefined performance. The low-frequency ground provides a path away from the radio.
    a. Use ferrite beads to reduce noise build-up on the coax.
11. Caution: At resonance, the antenna terminal can be >5000V at 100W.
12. RG213 is large and stiff, so reducing to RG8X at radio is common. However, we have found that substantially attenuates very low signals at higher frequencies toward VHF.



13. Life is good. Enjoy!