Transmitting Chokes for VHF and UHF

This application note extends my 2018 Cookbook to VHF and low UHF ham bands. Study that Cookbook for general information on chokes and how they work.

Chokes For 6M

RG8-Size Coax: Two 6-in diameter turns through one 1-in i.d. #31 clamp-on (Fair-Rite 0431177081) yields about 1kΩ resistive impedance. Use multiple chokes in series to achieve the desired choking impedance.

RG58, RG400-size coax: Two turns through two 0.75-in i.d. #31 clamp-ons (Fair-Rite 0431173551) yields about 1.2kΩ resistive impedance. Use multiple chokes in series to achieve the desired choking impedance.

Counting Turns: With ferrite chokes, a turn is defined as one pass through the core, so two turns would have a single loop around the core as shown in Figs 1 and 2.

Installation: A ferrite choke is a parallel resonant circuit, where the capacitance is that between turns and between turns and the core. Chokes should be placed along the feedline starting as close as possible to the antenna's feedpoint. Coax and cores should be spaced from the boom so that capacitance to the boom does not add stray capacitance and lower the resonance. An insulating spacer about ½-in thick should be sufficient. In Fig 2, the ferrites are lashed to the boom, with the spacer in place and turns hanging below the boom.

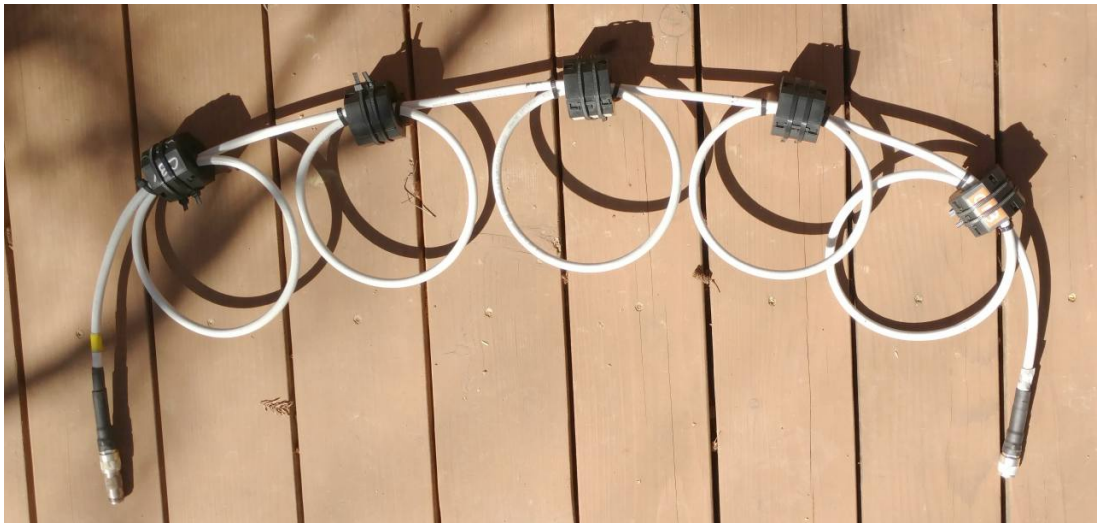

Fig 1 – My 6M choke before installation.

Fig 2 – The chokes mounted to the boom on the ground ready to install.

The coax in the photo is the Teflon version of Commscope 3227, a high quality UHF coax with performance comparable to LMR400, intended for installation in the plenum space in a large data center. The cores are clamped tightly closed to minimize any air gap where their two halves meet; the turns are also held in place on both sides of each core. Most cable ties don't survive UV, so must

be protected with a UV resistant tape like Scotch 88. [I routinely cut cable ties a bit long so that I can tighten them more if needed. They were trimmed before applying the protective tape.]

The chokes are mounted under the boom of a 7-element 6M Yagi, as shown in Fig 2. For spacers, lengths of 1 1/2-in and 2-in PVC conduit were slit lengthwise on W6GJB's table saw. The 1 1/2-in conduit fits snugly to the antenna's 1 1/2-in boom, and the 2-in conduit nested nicely over it. The chokes were built so that, once mounted, there would be a few inches between turns of adjacent chokes. In Fig 2, elements had not yet been mounted.

As shown in Fig 2, the installer went overboard with the tape, which can potentially reduce heat transfer from the chokes. Don't do it that way – use just enough tape to protect the cable ties. Or use metal cable ties to lash the cores (but not the coax).

Chokes For 2M and 220 MHz

RG58, RG400-Size Coax: Apply enough Fair-Rite #31 clamp-ons to achieve the desired choking impedance. Each Fair-Rite 0431164951 provides about 300 Ω resistive impedance on 2M, a bit less on 220 MHz.

RG213-Size Coax: Apply enough Fair-Rite #31 clamp-ons to achieve the desired choking impedance. Each Fair-Rite 0431164181 provides about 360 Ω resistive impedance, a bit less on 220 MHz.

Chokes For 430 MHz

Apply enough Fair-Rite #61 clamp-ons to achieve the desired choking impedance. Each Fair-Rite 0431164951 provides about 280 Ω resistive impedance

Choking Impedance – How Much is Enough? These are common mode chokes, and their primary function is to suppress common mode current on the feedline that in receive mode can couple to the antenna, filling in nulls in the pattern from off-axis signals and noise. For noise reduction on the HF bands, 5K Ω resistive impedance at the working frequency is a good starting point, with twice that value to provide greater power handling. Noise levels at VHF and UHF are usually lower than at HF, so lower values of choking impedance may be sufficient.

Dissipation in chokes is simply I^2R, where R is the resistive component of the choking impedance and I is the common mode current. With multiple chokes in series, dissipation is divided between them in proportion to their resistive impedance. Common mode current is reduced in proportion to the choking impedance, and because dissipation is proportional to the square of current, dissipation falls twice as much as R is increased. Thus, dissipation is reduced, and power handling is increased, by increasing the total choking impedance.

Chokes must be exposed to free air to maximize power handling. While enclosing them can make a neat package and prevent freeze-thaw cracking, it greatly reduces power handling. To address that concern, solid cylindrical cores of comparable size and shape can be used in place of the clamp-ons, with the minor inconvenience that it may be necessary to build the chokes before the last connector is installed. The 1-in i.d. core for RG213-size coax on 6M is Fair-Rite 2631626202 and the core for RG58, RG400-size coax on 6M is 2631101902. For RG213-size coax on 2M, Fair-Rite 2631102002, and for RG58, RG400-size coax, Fair-Rite 2631480002.

Killing Receive Noise: For noise suppression on other cables like power feeds from generators and cables connected to other electronic noise sources, use these guidelines for cables of comparable size. For example, use recommendations for RG213-size coax for power feeds from generators, placing the chokes as close as possible to the generator. Remember that for data circuits, both ends of the cable are potential noise sources, and both should be choked if longer than about λ/4 at frequencies of interest.

Buying Ferrite Parts: Buying in quantity from the usual industrial electronics vendors will yield discounts and minimize shipping costs. Arrow Electronics provides free overnight shipping for a $50 order of parts that are in stock, and they stock a lot of Fair-Rite. Orders for smaller quantities can be built to $50 or more by stocking up for future uses or adding other commonly used parts.