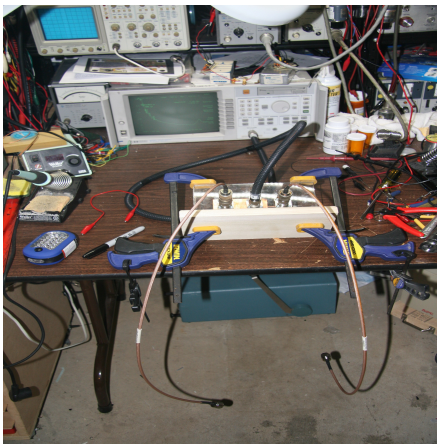
Initiation Date:
5 May 2018

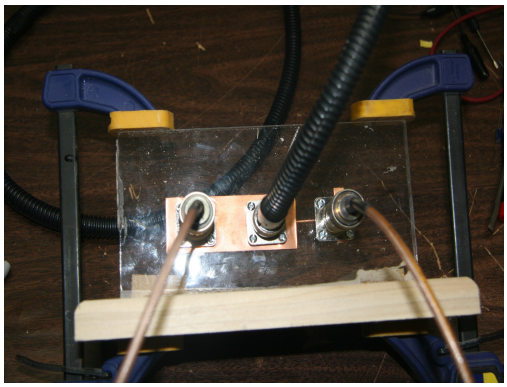
Participant(s):
WB4GCS, N3FB

Initial Symptoms:
Desire to measure performance of various common-mode chokes which have been constructed.

Actions:

1. Construct a jig to allow connection to network analyzer. This jig needs to connect the center conductor to *both* conductors at one end of the choke, and the outer conductor to *both* conductors at the other end of the choke.
    1. Frank used Front Panel Designer to layout the connectors. We used that to drill center pilot holes for the connectors in the plastic.
    2. Those center holes were used to create a wood jig to hold the spade bit for drilling the wood and large connector holes in the plastic.
    3. The wood jig, plastic, and copper were screwed to another piece of wood to create a "sandwich" for drilling. This worked out very well, nice clean holes in the plastic and the copper strap did not tear – the first time *ever* that I've not torn the copper! The connector jig was a piece of scrap, it now lives with my other jigs.
    4. We floated the connectors in the bottom of the sandwich and the plastic and used a center punch to mark the bolt holes. Worked great!



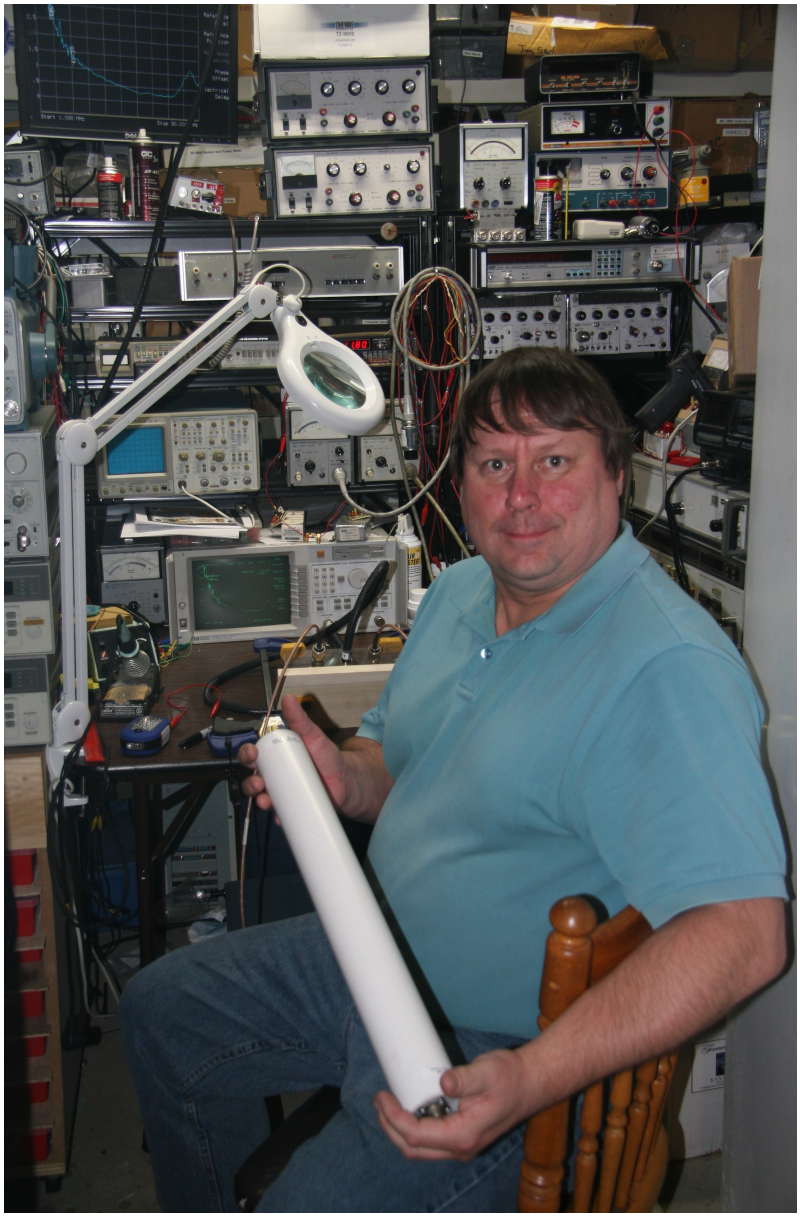


The left photo shows the jig; the cables hanging down are where the choke will connect for measurement. The right photo is a closeup of the jig. The large clamps are holding the two pieces of the jig together while the glue sets up (we were impatient!) The smaller clamps hold the jig to the bench. The whole point is so that cables don't move around and get stretched.

2. Warm up analyzer. Set sweep for 1 to 30 MHz. Calibrate for Reflection.
   Note: Cable used between analyzer and jig is N-m to N-m S/N 1.

Note: Analyzer state and settings are captured in Appendix A of main document, and in "Saved Setup States" folder.

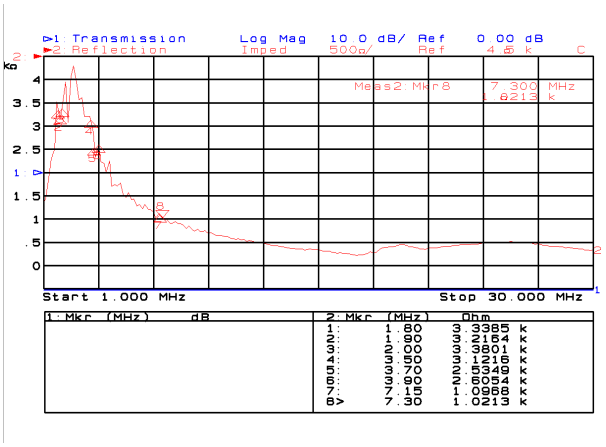
3. Take measurements. These actually went much quicker than expected – which was the whole point of making the jig! Frank drove the analyzer and swapped chokes out while I drove the data capture.



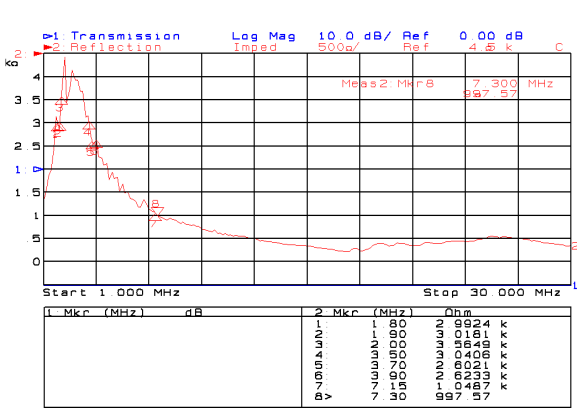
Observations:

Our first measurements only involved a few markers to tell us the impedance at a given frequency; those are shown in Appendix B. Having acquired confidence in the test setup, we established multiple markers for 160, 80/75 and 40.

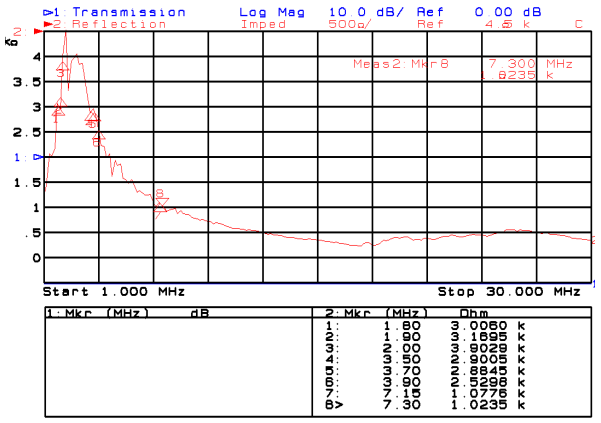
We made several sets of measurements as we acquired experience with the test setup and the various chokes. In addition to the N3SH chokes documented here, we also measured several N3FB chokes. All delivered similar, as-expected, results. Final measurements on the N3SH chokes:



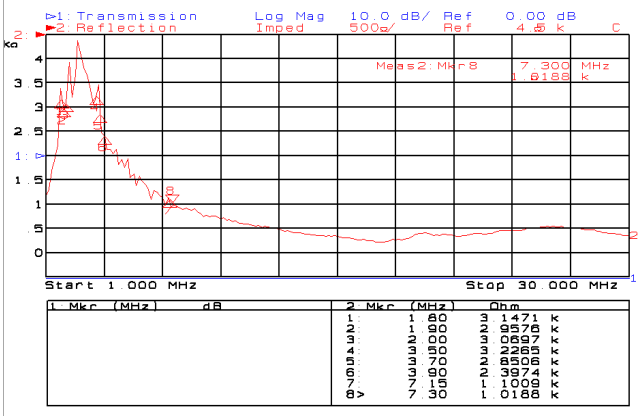
N3SH1



N3SH2



N3SH3



N3SH4

Analysis:

All of these chokes show acceptable performance across 160, 80 and 40 meter bands. Each will do a respectable job of attenuating the common-mode radiation.

Hypothesis:
The literature suggests that additional turns will raise the common-mode attenuation, at the cost of some downward shift on resonance.

In addition, the literature suggests that a choke made up of many close-wound turns on a 5-inch diameter form will make a broadband choke, which will help reduce the common-mode current on the feedline further when used with these chokes than just these chokes alone. This will be necessary for the situation of running high power into a non-resonant antenna with a tuner at the transmitter end.

Plan:
Try both similar chokes with one additional turn and try the coil-on-form chokes.

Results:
As seen above.

Conclusion:
Any of these chokes should help to reduce radiation *from* the feedline and coupling *into* the feedline. They perform largely as predicted and should help reduce cross-station interference at Field Day.