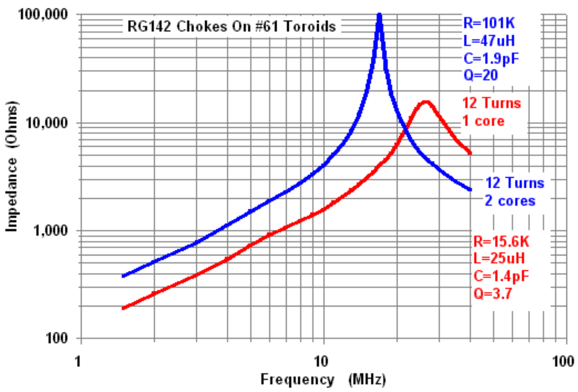
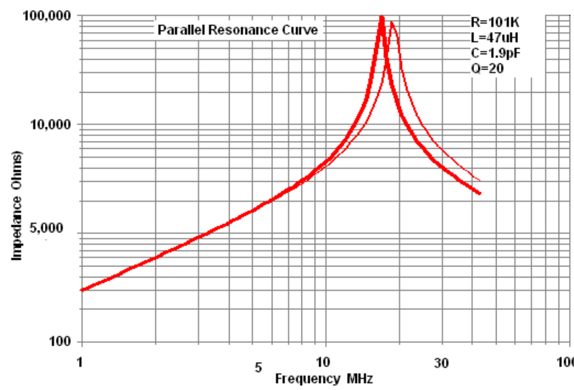
Up to now, I had not measured coaxial chokes on #61 material. This weekend, I wound two 12-turn chokes on #61 cores using a continuous winding style. While these are certainly not "pretty" chokes, the stray capacitance is relatively low for the number of turns. The coax, RG-142, which has a center conductor of silver plated copper coated steel. This makes the coax rather stiff, so that it is difficult to wind turns in a manner that minimizes stray capacitance.

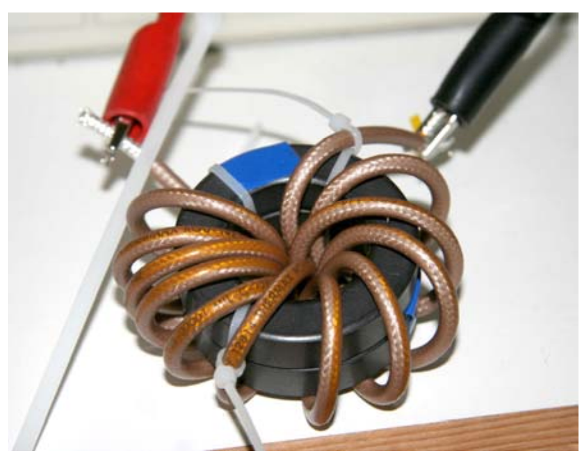
This data clearly confirms that coaxial chokes wound on low loss materials like Fair-Rite #61 are strongly inductive below resonance. If the resonance occurs in the region where the material has low loss, the Q of the choke will be quite high. The principal shortcoming of chokes having a predominantly reactive impedance and low loss is that when they resonate with the reactance of the line they are choking, they are ineffective as chokes. Thus, the single core 12-turn choke would be quite effective between about 24 and 42 MHz (applying the correction for the 0.4 pF stray capacitance of the measurement system), but could be problematic below 18 MHz. Likewise, the 2-core 12-turn choke would be quite effective on the 18 and 21 MHz ham bands, but would be increasingly ineffective below 15 MHz and above 24 MHz.

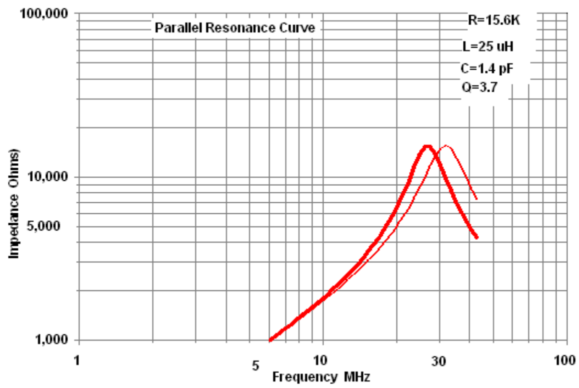


Raw Data Plotted – No correction for 0.4 pF stray capacitance of test setup



Parallel resonance curve plotted for values shown. Thinner curve subtracts 0.4 pF (stray of test setup) from data, so the 2-core choke is really 1.5 pF, F_R=19MHz





Parallel resonance curve plotted for values shown. Thinner curve subtracts 0.4 pF (stray of test setup) from data, so the single-core choke is really 1 pF, F_R=32MHz

There are several obvious questions.

1) ***What if the stray capacitance could be reduced (a "better" winding)?*** The answer is simple – the resonance simply moves up in frequency, so that the choke remains inductive to a higher frequency.

2) ***What happens with fewer turns?*** There is less inductance and less capacitance, so the resonances move up in frequency.

3) ***What about more turns?*** It would be difficult to wind more than about 14 turns on these 1.4" i.d. cores using RG-142. RG-303 is a bit smaller (0.17 o.d. compared to 0.19 o.d.), but electrically quite similar. Increasing the number of turns will in crease the inductance by about 35% (N^2); capacitance is likely to increase by 10%-20%.This will move the resonance down in frequency – an inverse proportion to the number of turns would be a reasonable first approximation. Because the resonances are in a region where the loss tangent of the ferrite material is increasing substantially with frequency, the Q at resonance will also increase with more turns.

4) ***What happens with more cores?*** Again, both L and C increase, lowering the resonant frequency and raising the Q.

5) ***What about W1JR's reversed winding style?*** It's hard enough to wind 12 turns of RG142 on a toroid as a straight coil, let alone in Joe's style. I did, however, try it with #12 THHN solid (insulated house wire), which is much easier to shape and hold in place. In rather cursory testing, I couldn't see any significant difference between that and a straight winding, but it's worth looking at when I have more #61 cores to play with.

In summary, nothing about these measurements change my thinking about or analysis of common mode chokes wound on low loss cores like Fair-Rite #61 or #67. While these chokes can be quite compact, inexpensive, and quite effective over a narrow range of frequency in the HF spectrum, their reactance away from resonance can resonate with the reactance of the feedline and render them ineffective as chokes. And even with no feedline interaction, the largest of these chokes has insufficient choking impedance below about 5 MHz to make much of a dent in receive noise.

73

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