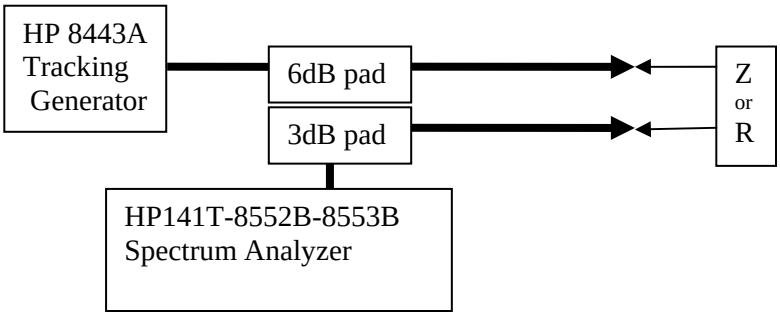
July 28, 2010 Experiments
Estimation of RF Choke impedance vs.frequency

Test set up



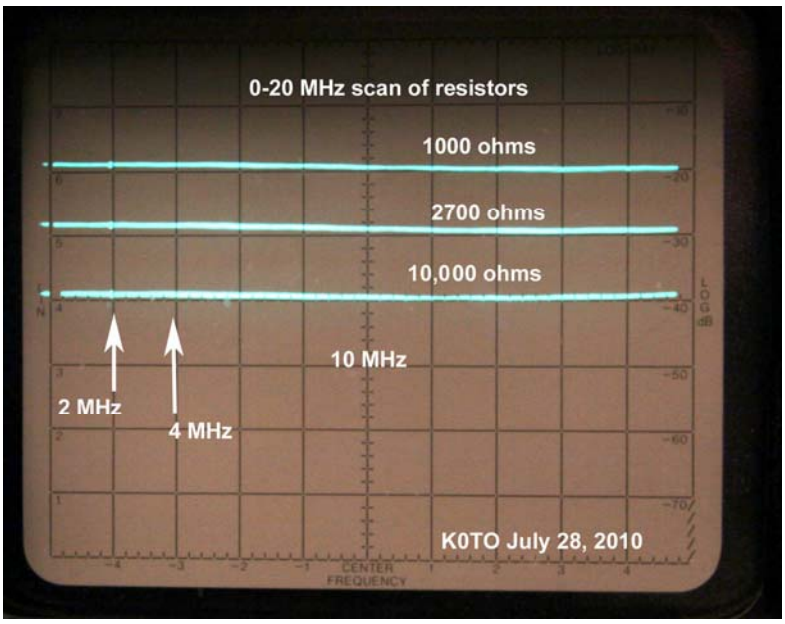
The objective of these experiments was to compare the spectrum analyzer curves generated by a selection of 1/8w metal film resistors with the curve generated by 7 turns of RG400G coax through six 2.4 inch type 31 material cores [Fair-Rite 2631803902]. It was believed that this would allow one to estimate the impedance of the RF choke.

Resistors were selected to produce curves of -20 dBm, -30 dBm and -40 dBm referenced to the curve produced with a resistance of zero ohms (short length of wire)

The -20 dBm curve was generated with a 1000 ohm resisitor
The -30 dBm curve was generated with a 2700 ohm resisitor
The -40 dBm curve was generated with a 10,000 ohm resisitor

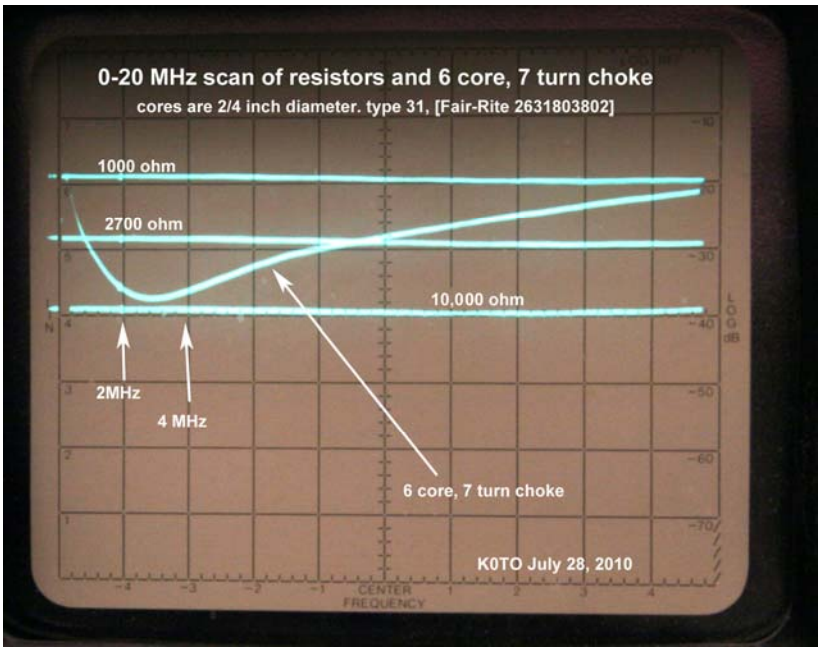
Picture 1 below show the curves produced by the individual resistors. The storage scope feature of the HP141T was used to capture all of the curves on a single display. The center frequency is 10 MHz and the horizontal divisions are 2 Mhz. The vertical scale is 10 dBm per division.

Picture – 1



Picture-2 was also made using the storage scope feature of the HP141T. It shows the curve generated by the 7 turn, 6 core RF Choke over the frequency range of 0 to 20 MHz. Superimposed on that curve are the curves produced by the 1000, 2700 and 10,000 ohm resistors.

Picture – 2

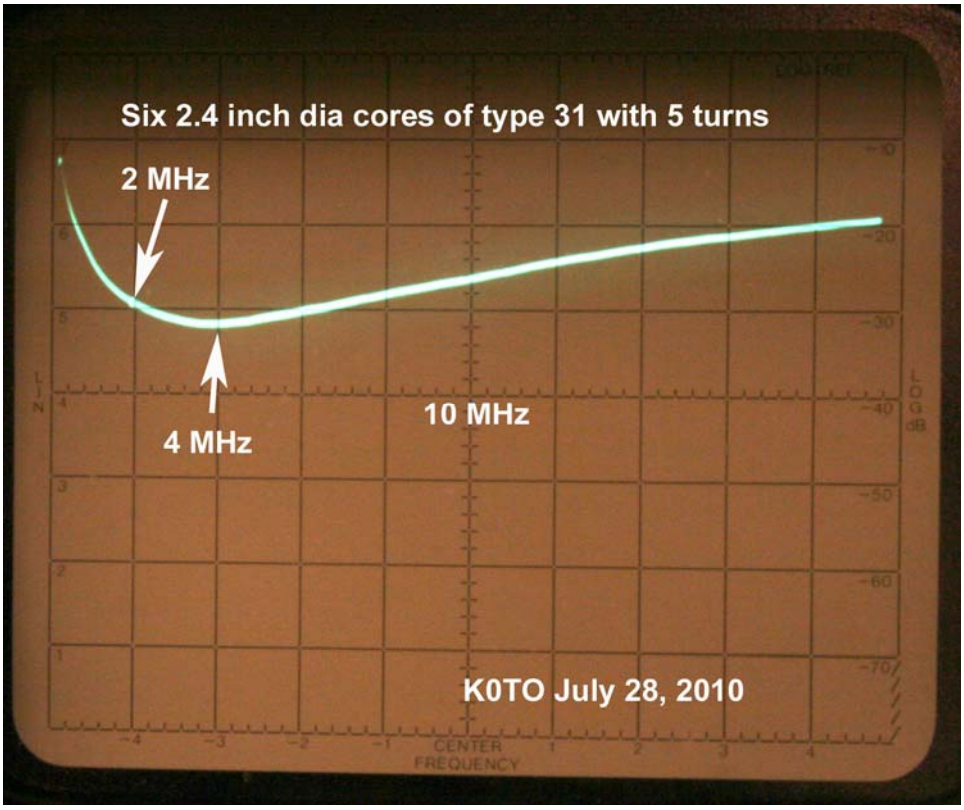


The impedance of the choke is between 2700 and 10,000 ohms over the range of 2-7 MHz. At 14 MHz the choke impedance is between 1000 and 2700 ohms.

The choke impedance is over 5000 ohms on 160 meters and 80 meters.

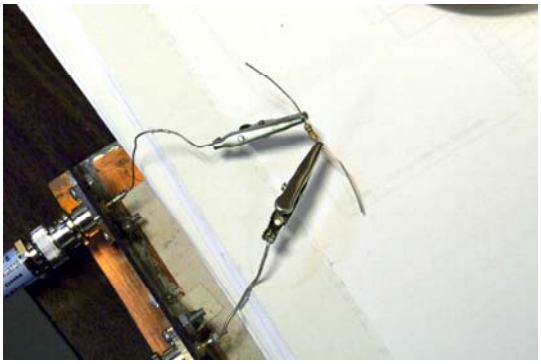
The number of turns on the six cores was reduced from 7 turns to 5 turns. This moves the curve so that the Z of the choke is about 2700 ohms from 2-7 MHz and over 1000 ohms from 14- 21 MHz.

Picture - 3

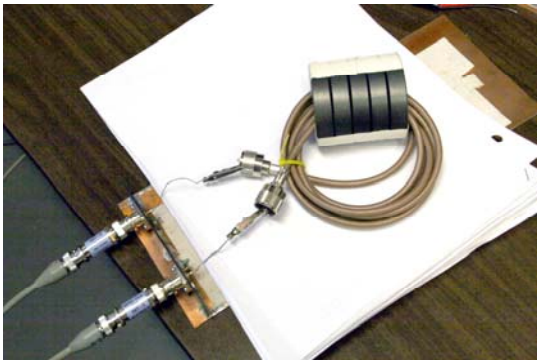


The next pictures show the simple test jig. The first one shows the jig with a 1/8 watt, 1000 ohm resistor in the jig. The second picture shows the RF Choke in the jig.

Picture – 4

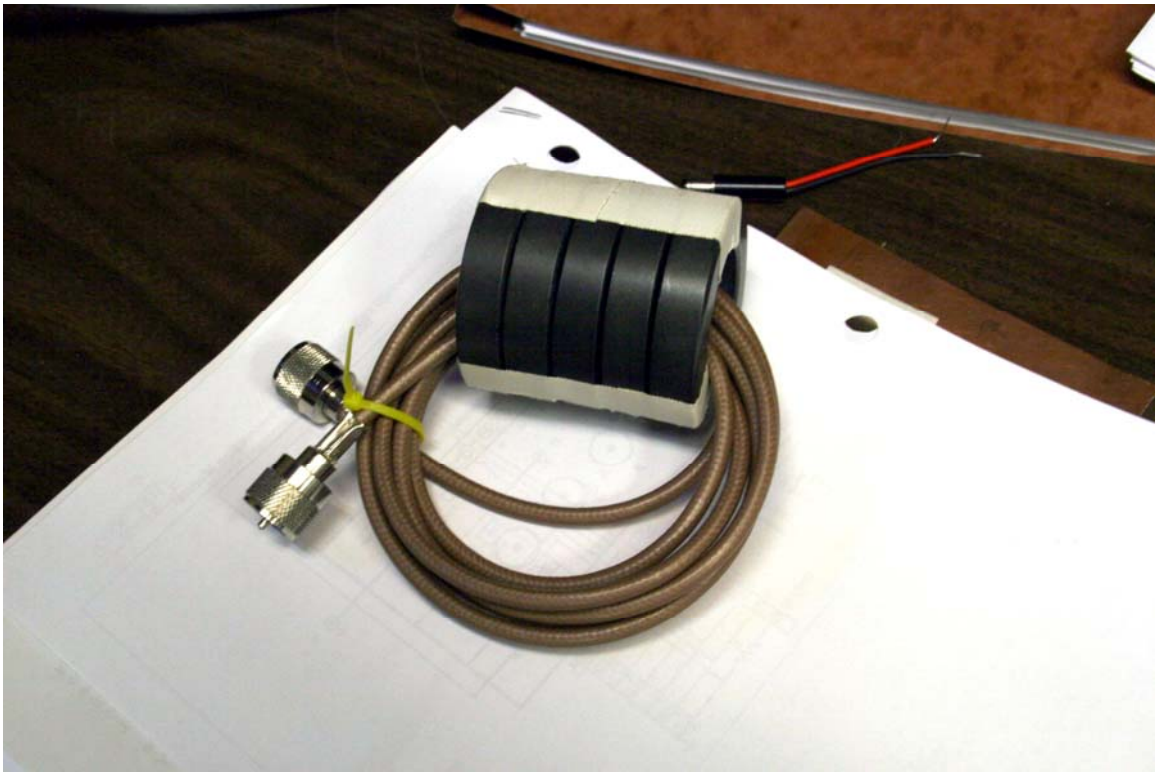


Picture - 5



Picture -6 shows the RF Choke made using six 2.4 inch cores of type 31 material and seven turn of RG400U coax.

Picture – 6



This experiment has shown that over the range of 2-20 MHz the signal reduction produced by the RF Choke in the test jig is more than the signal reduction produced by a 1000 ohm resistor. For the range 2-4 MHz the signal reduction is more than that produced by a 2700 ohm resistor and very close to the signal reduction produced by a 10,000 ohm resistor.

We can estimate that the impedance of the choke is at least 5,000 ohms over the 160 meter and 80 meter amateur bands.

The exact amount of signal reduction that will occur in a specific application may be different from the values found in this experiment due to differences between the test circuit and the actual circuit in which the choke is used. But this testing method permits comparisons between chokes and estimated of the actual impedance of the choke at a particular frequency.

This measurement method seems to me to provide a useful way to estimate the impedance [Z] of an RF choke over the frequency range of interest. Not everyone has access to a spectrum analyzer and tracking generator however.

Similar measurements could be made using only a signal generator and a scope. One would need to read the voltages for various resistors in the test jig relative to the voltage when the resistance is zero. Then mounting the choke in the test jig and looking at the resultant voltages for various frequencies one can get an estimate of the impedance of the choke.

Taking readings for several different frequencies allows one to use EXCEL or a similar program to graph the points and produce best fit curves.

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