Homebrew Group Newsletter
#51 June 2018

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VK3MQ

The well attended June meeting of the group was given an informative presentation on magnetic loop antennas by Dr. Dieter Pelz VK3FFB. He made several important points regarding the construction of a magnetic loop to ensure a successful outcome.

In summary they are:

- Use only copper tube of the largest practical diameter
- Do not solder joints as the lead/tin content has high resistance. Instead use the compression of a nut and bolt.
- Use a coupling loop rather than the gamma match seen in some designs.
- Keep the resistance of leads to the tuning capacitor as small as possible

His preferred on line calculator is:
http://www.66pacific.com/calculators/small_tx_loop_calc.aspx

Other links:
https://amrron.com/2015/07/24/home-made-high-power-magnetic-loop-antennas/
http://www.kr1st.com/magloop.htm
https://www.k4vrc.com/uploads/1/0/1/5/10156032/small_transmitting_loop_antennas.pdf
http://users.tpg.com.au/users/ldbutler/VHFLoopAntenna.htm
http://w6nbc.com/articles/2005-08QSTwxvane.pdf

- Whilst operating portable with your loop antenna you might consider an arduino project to reduce the amount of equipment in your kit.

https://hamprojects.wordpress.com/2018/06/07/standalone-ham-modulation-generator/
http://www.m0pzt.com/arduino/

- A practical VHF antenna handbook
  http://www.n5dux.com/ham/files/pdf/Practical%20Antenna%20Design%20VHF.pdf

- In audio literature and sometimes in amateur circles the term “RMS power” is often quoted. This article puts the subject in perpective.
  http://www.eznec.com/Amateur/RMS_Power.pdf

- Return loss is a term more commonly heard in professional radio spheres to describe the quality of an impedance match. But how does it relate to SWR?
  http://www.ab4oj.com/test/docs/dg03_111.pdf

- dBm volts and watts!
  http://www.ab4oj.com/test/docs/dg03_110.pdf

- With lower sunspot numbers 80 meters can be an attractive option. The hand drawn circuit says everything you need to know about this project.
  http://www.intio.or.jp/jf10zl/3.5mssb.htm

- A homebrew tilt-over mast for portable operation.
  http://www.n1gy.com/tilt-base---mast.html

- Solar power you shack .
  http://www.vk5sw.com/Battery.htm

Eric Christer VK3AEC continues his series of Weekend Projects

Two Noise bridges for (R + /- jX) impedance measurements.

This is a continuation of a previous noise bridge article and the two bridges to be described will be able to null out the reactance components and also could determine the R and jX impedance values. The schematics are shown in Figures 1 and 2. Figure 1 was built many years ago and is used in VK3EAC’s shack to obtain parallel equivalent impedances. The noise bridge shown in Figure 2 is for series equivalent impedances. Both circuits are easy to make up and for this article, assumes the noise generator with amplifier had been made up for the previous article.

A snag with Fig. 1, for parallel impedances, is that extra calculations are required to provide the normal series presentation of (R +/- jX). But a spreadsheet program is a convenient way to do the conversion. For a parallel equivalent impedance, the impedance measured is like a circuit having a resistor with the reactance (X_C) or (X_L) in parallel.

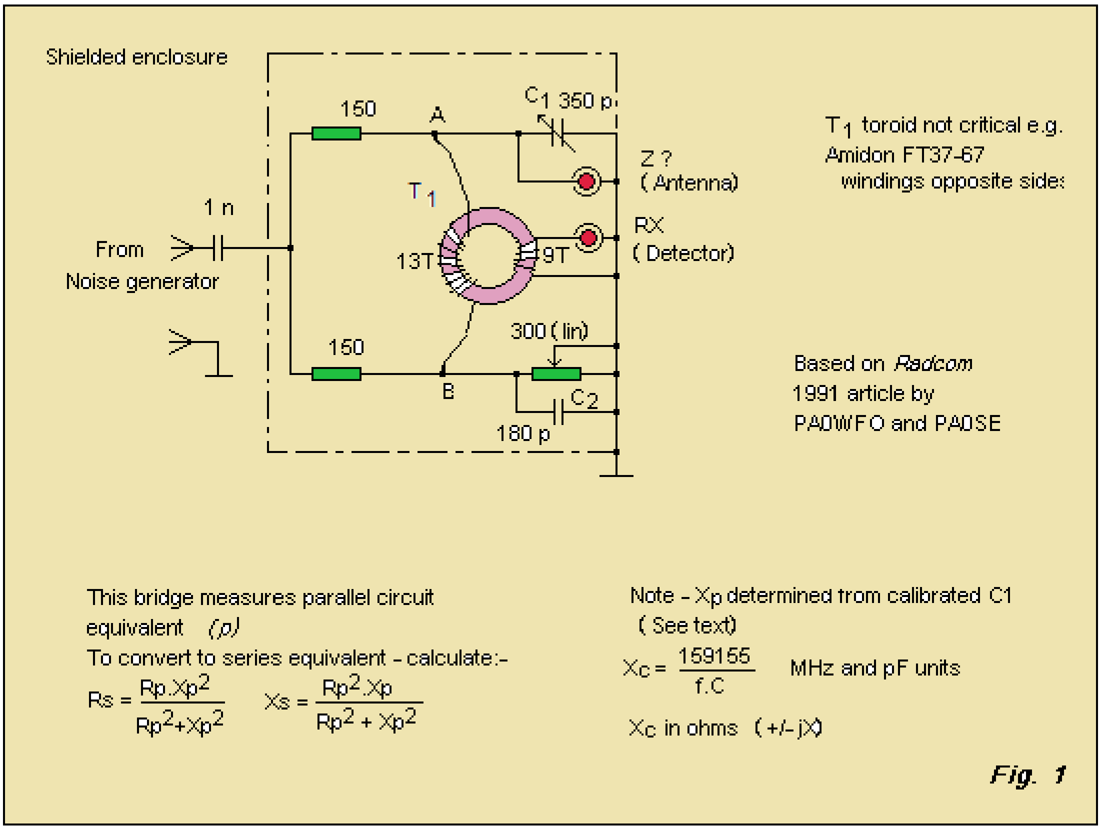
Parallel Equivalent Bridge (Figure 1)
Construction - The two 150 ohm resistors should be matched carbon composition ¼ watt and the capacitor C_2 is selected to be half the value of whatever is available for C_1. The wire ends of the 150 ohm resistors should be about 20 to 25 mm so that adjustments can be made during calibration. (This involves Taps A and B). T1 is not critical – perhaps an Amidon FT37-67. The primary is close wound and the secondary winding is positioned on the opposite side of the core. The secondary leads are soldered directly to the detector (RX) socket. The potentiometer should be a good small linear carbon type and if possible the metal cover can be removed to reduce capacitance. Bridge wiring should be symmetrical, short and that includes the connections to the common ground.
Calibration – The dial of the potentiometer can be marked in the same way as in the previous article after obtaining a null using the variable capacitor C_1. It is also possible to mark at say 10 ohm intervals using an ohmmeter (digital) by measuring the circuit through the "Z?" socket. (It is a good check that all is well with the calibration using a 50 ohm dummy load)

The capacitor null will be about half way and can be marked "0 pF". This is to be done at the lowest frequency of interest with a 50 ohm dummy load. A check can then be made at the highest frequency and if the C_1 null is not at the same position, then the A and B taps on the 150 ohm resistor leads should be adjusted, by trial and error, so that there is no shift of the "0 pF" position at higher frequencies. To mark the C_1 dial, disconnect the 150 ohm lead and measure capacity through the "Z?" socket marking up and down from the "0 pF" mark at say 10 or 20 pF intervals.
Operation – In use, the bridge will be balanced (Resistance and Capacitance nulls) and the following interpretations are applicable with examples.

1. When the bridge is balanced (nulls for R and C) and if: R = 50 and C is at the 0 mark, then the impedance of the antenna or circuit being measured is purely resistive, Z = 50 +j0 Ω
2. If R = 40 and if C is 60 pF <u>below</u> the 0 mark (less capacitance of C_1) then the circuit is equivalent to a 40 ohm resistor in parallel with a 60 pF capacitor. (The bridge C_1 was compensating for the 60 pF found in the circuit or antenna impedance). A calculation can be made for the Xc in ohms and further calculation will provide the series impedance R + jX Ω using the formula in Figure 1
3. If R = 40 and if C is 60 pF <u>above</u> the 0 mark, then Z = 40 Ω in parallel with an inductance having the same reactance (Xc) value of a 60 pF capacitor but now insert a negative sign. The series impedance is then R – jX Ω

If the measurements above, were taken at a frequency of 7.100 MHz, then, for the above readings the 60 pF reactance (Xc) would be 374 Ω.

Example 2, after conversion to a series presentation, the impedance would be 39.5 +j4.2 Ω.
Example 3 would be 39.5 – j4.2 Ω.



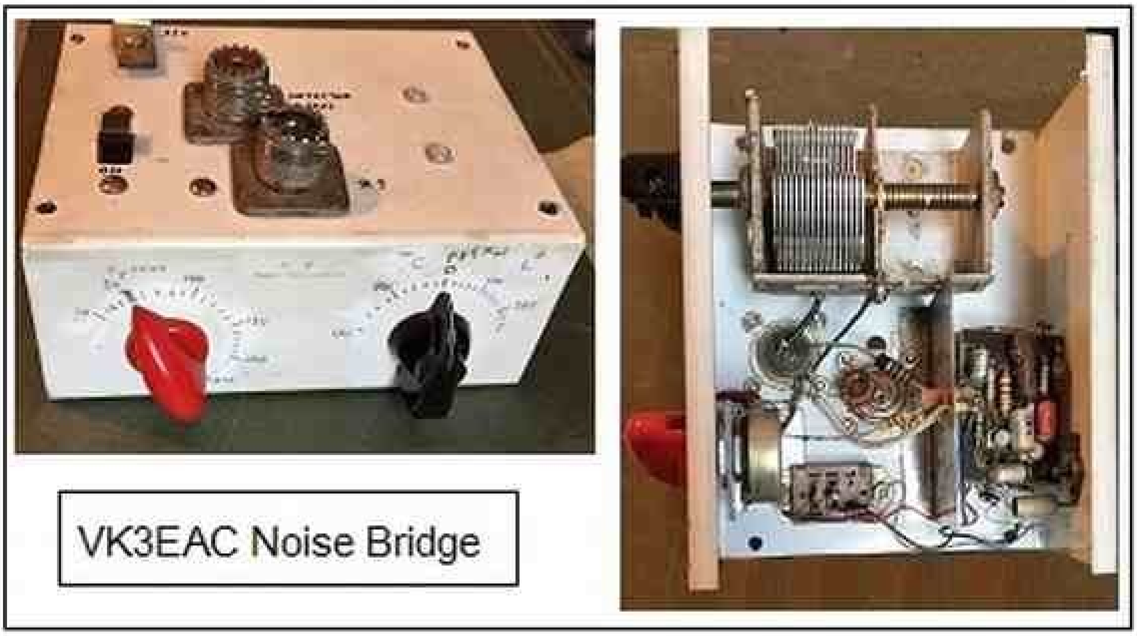


Photo 1. Noise Bridge for parallel equivalent impedances. (See Photo 3 for connection detail)

Series Equivalent Bridge (Figure 2)

Construction – Similar construction techniques should be used as for Fig. 1 such as short leads etc. A difficulty during trials with various toroids for T_1 resulted in some peculiar calibration points when trying to calibrate. The best toroid was a binocular type, an unknown type, but probably a ferrite mix 43. It was found that a capacitor bigger than 100 pF was more difficult to null. The 47 pF capacitor should be a mica type and is half the value of the variable capacitor to get the "0 pF" mark mid-scale.

The original article (ARRL) and revisions by various experimenters had ways of adding compensation for the stray capacitances and inductances within the circuit. It was found there was no need to do anything in the HF range for the unit made up for trial (Photo 2.)

Calibration – The resistance marks can be made by using an ohmmeter to measure the resistance of the potentiometer and mark accordingly. A good 50 ohm dummy load will confirm the main 50 ohm mark after the variable capacitor is nulled. It was difficult to calibrate the capacitance dial except for the "0 pF" mark. An inductive reactance (X_L) is present if the null is at a higher capacity from the 0 pF mark. It is the other way for capacitance (X_C). Try measuring a wire wound resistor or potentiometer of 30 to 100 ohm at different frequencies – they have an inductive reactance!

Operation – The noise bridge is more sensitive to reactance at the higher frequencies. In general, this noise bridge is perhaps more useful to determine if, say, an antenna has just an inductive or capacitive reactance. It may be noted that a straight forward dipole will likely display capacitive reactance when too short and inductive reactance when too long.

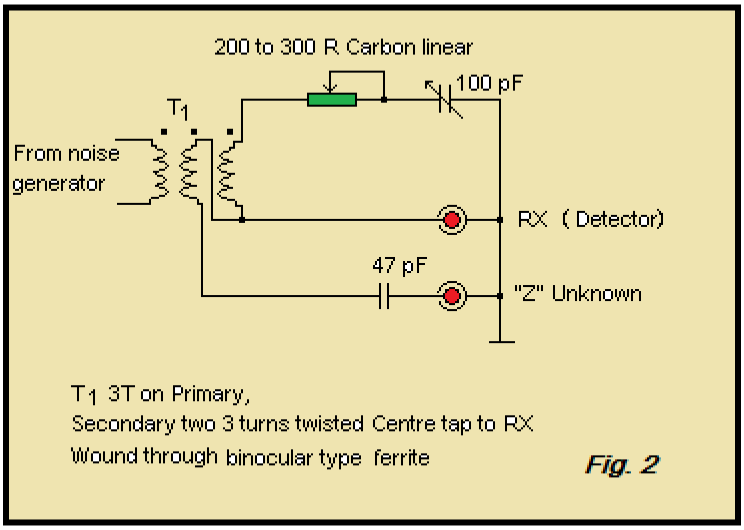
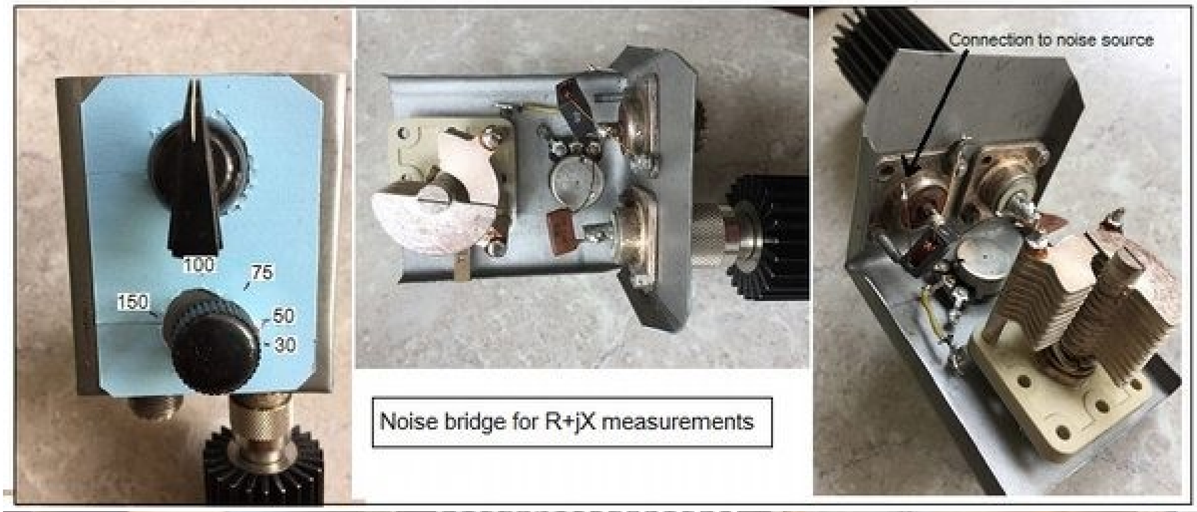


Fig. 2

Photo 2. Noise Bridge for series equivalent impedances.



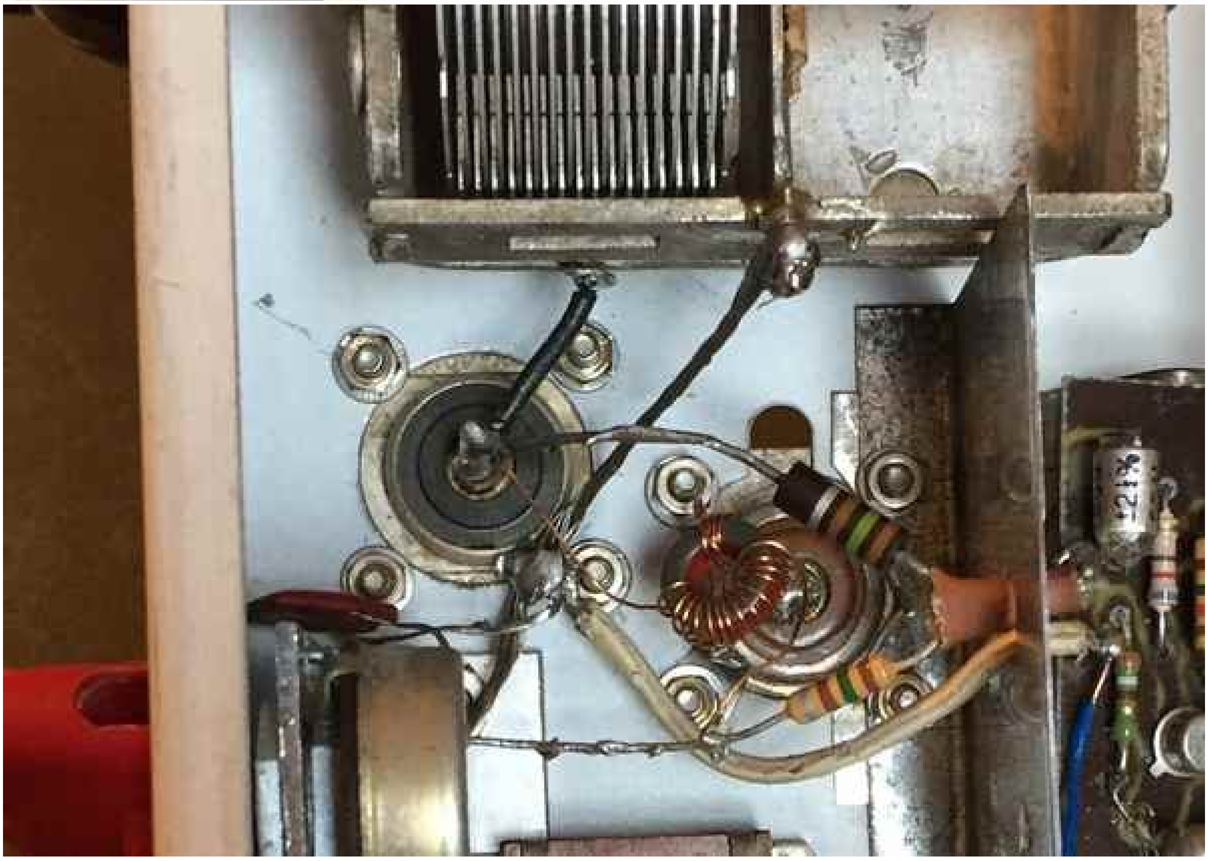


Photo 3. Some detail of the bridge connections of Fig. 1.

A good idea is to have both types of noise-bridge for experimental purposes!
(It was said that the parallel equivalent unit built with smaller components and having compensation applied would then work well to over 200 MHz.)

Finally something to consider as you start your next project:

"Your theory is crazy, but it's not crazy enough to be true"

73's Rob VK3MQ
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