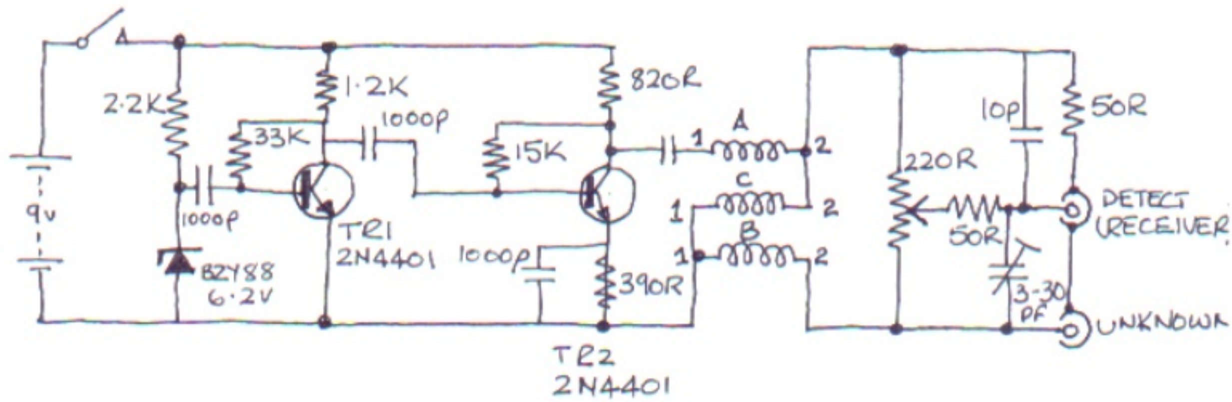
A Simple RF Noise Bridge

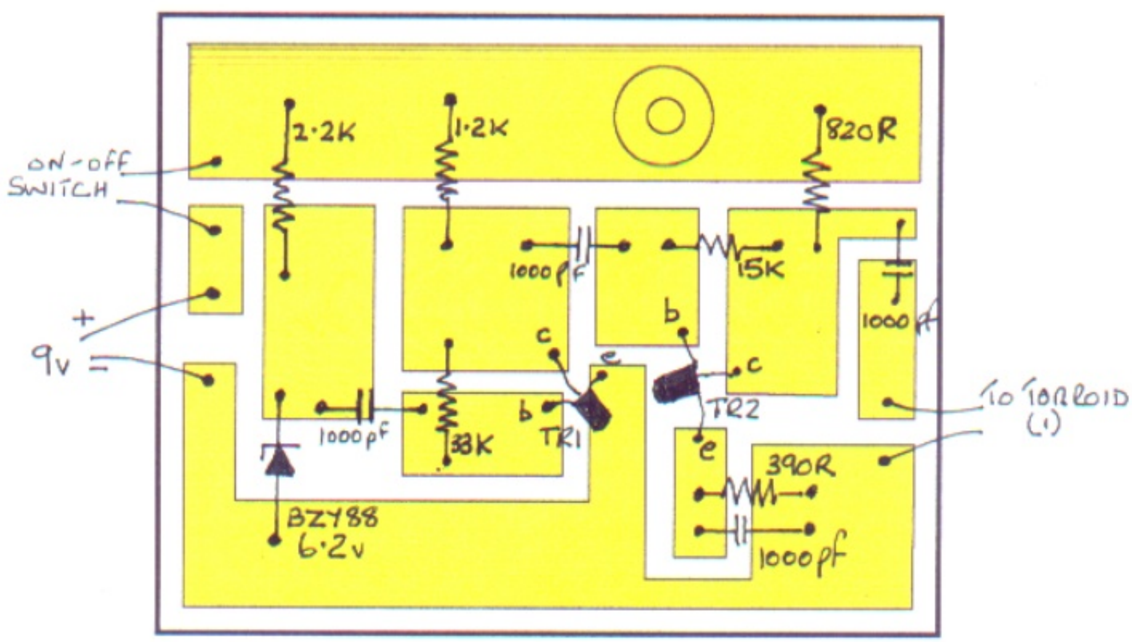


Acknowledgements

This excellent and extremely useful little piece of test equipment is probably not for the novice constructor, but well worth the effort if you are reasonably competent. It appears in the Seventh Edition of Amateur Radio Techniques by Pat Hawker, G3VA, published by the Radio Society of Great Britain, and I am most grateful to the RSGB for giving me permission to reproduce the project here, albeit in my own words and with my own diagrams. However, I have to say that this book is a must for any radio amateur who enjoys building things for the hobby and if that's you, I recommend that you go out now and buy a copy!

The circuit board

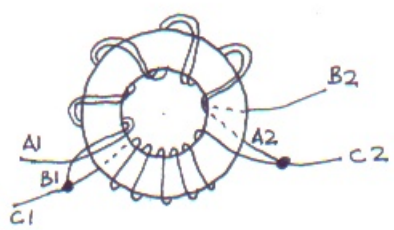
I used a spare piece of copper clad board for the project and rather than etch away the copper to form the printed circuit board, I ground it away with a small craft drill and burr. OK, OK, I can hear all the purists out there howling at me, but for a small PCB like this one there is nothing wrong with grinding the copper away in my view.



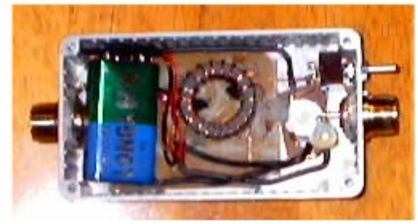
Circuit board 63mm x 45mm

The toroid, the bridge and the box

Putting the components on the board is quite straightforward and if there is a tricky part to this project it's winding the toroid. The toroid should be of the ferrox type and mine has a 28mm outside diameter with an 18mm inside diameter, but any torrid of this type of these sorts of dimensions will suffice. I use these guys for my toroids, they are pretty good:



http://www.jabdog.com/ (I think I used their T130-2). Anyway, to wind the toroid, first take two strands of 26 swg enamelled copper wire and twist them together at a rate of about one twists per centimetre, then wind nine turns of this twisted pair onto the toroid as shown, (for clarity's sake I haven't put nine turns on the diagram). Now take a single strand of the wire and wind another nine turns onto the torrid in the direction and in the manner shown in the diagram. Now connect the ends of the turns as shown, and be sure to use your multimeter to get this bit right. Now this is important: get a bit of sticky paper and label the A1/B1/C1/ end and the A2/B2/C2 ends of the wires because if you don't do this and come back to the torrid later you will never sort out which end is which - believe me - I know! After winding the toroid all that remains to complete the project is to connect the A1/B1/C1 side of the toroid to the circuit board as indicated above and connect the A2/B2/C2 side to the bridge circuit. All the resistors in the bridge circuit must be carbon and they should be connected with the shortest, thickest wire you can manage. Your box must be metal, of course, and because I had one on the shelf I managed to shoehorn mine into 110mm x 60mm x 25mm die cast box with an SO259 at each end and the on-off switch at one end also, see the pictures, but it might be better to use a bigger box than this if you're buying one specially for the project.



Calibration

Calibrate the noise bridge with a set of carbon resistors, I suggest you use values of 10, 20, 30, 50, 80, 100, 200 and 300 ohms. To calibrate the bridge connect your receiver to the RECEIVER/DETECTOR socket on the bridge and connect the calibration resistor across the UNKNOWN socket on the bridge. Switch the noise bridge on and you should hear the noise on your receiver. Turn the 220 ohm potentiometer until you find a null in the noise on your receiver's speaker and S meter. When you have done this adjust the trimmer capacitor in the bridge circuit for the best possible null in the noise, and then leave this trimmer capacitor alone. This procedure should bring the S meter reading down from about +20 to +40dB on either side of the null, to a reading of nothing at all at the null. So the null should be very obvious and it should be possible to locate the null very accurately with the 220 ohm potentiometer. Mark the scale on the bridge with the value of the calibration resistor and repeat the calibration process with all the other calibration resistor values. You should find the scale pretty linear, but may find a bit of scale 'spread' towards the high impedance end.

Uses

Right then, what do you do with it? The RF noise bridge has been variously described as the poor man's antenna analyser and the next step up from the SWR bridge, and both of these descriptions are probably right, but they do not do the unit justice. At its basic level you can check the impedance of your antenna at any given frequency simply by connecting you receiver to the DETECTOR socket on the bridge, connecting your antenna to the UNKNOWN socket on the unit, rotating the bridge's control to find the null and reading off the antenna's impedance on the scale. At a more adventurous level if you are tweaking up your trapped dipole the noise bridge is invaluable for getting your inter-trap lengths right. If you want to trim your mono-band antenna feeder to an exact number of half wavelengths just set the bridge to zero impedance, connect your receiver to the DETECTOR socket, your feeder to the UNKNOWN socket and short circuit the end of your feeder. Then cut your feeder back in short lengths to get the best null; this effectively places the bridge at the antenna and when the best null is achieved you have minimised your feeder losses. This little noise bridge was also the perfect tool for tuning the gamma match on my 40 metre loop antenna. So there we are. This is a very useful bit of test equipment which, with a bit of ingenuity, can be used for a whole host of antenna and other analysis functions; I will leave you to work out what you could find out about parallel and series tuned circuits with this noise bridge, for instance, and I hope you are encouraged to have a go at building one for yourself - good luck.