Wideband RF Noise Source

This module is designed to help with setting up many different homebrew radio and audio projects, it will produce a strong white noise type signal starting at low audio frequencies and up to the VHF spectrum.

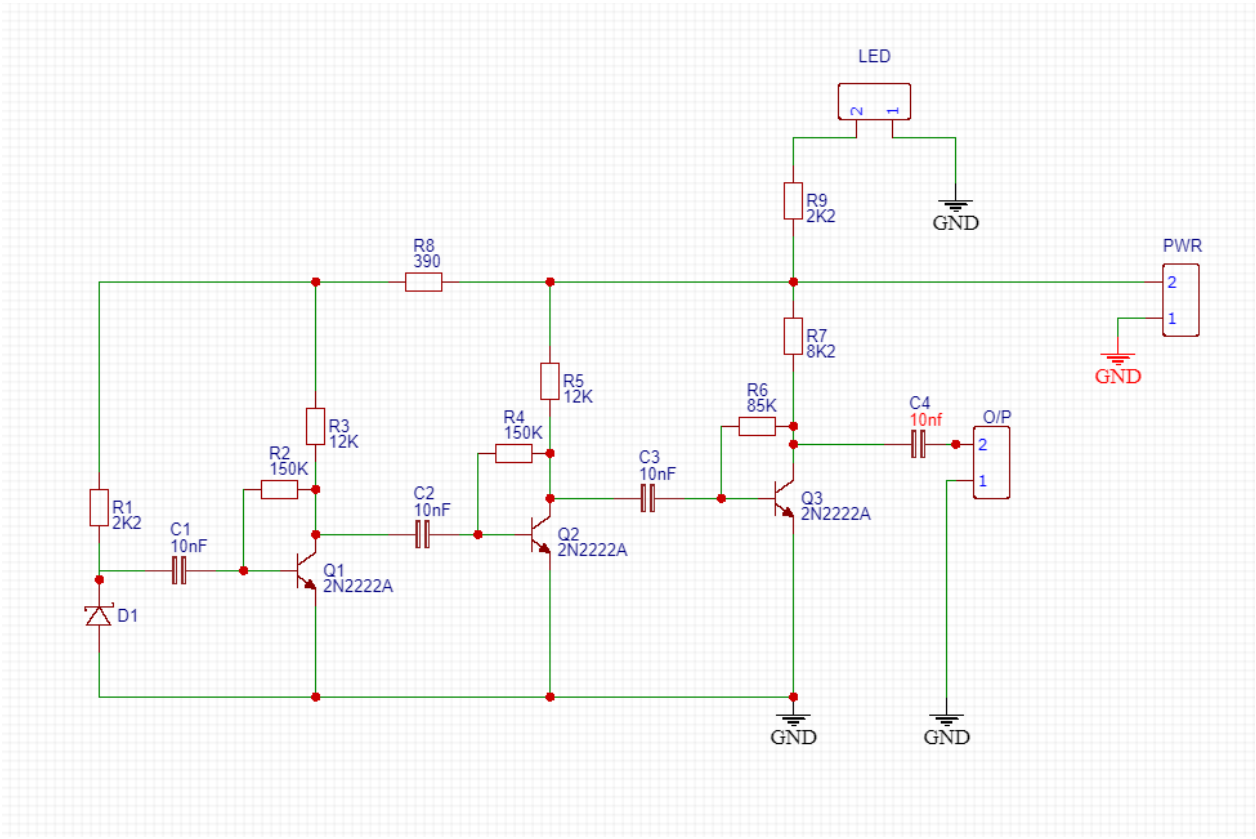
The noise source can be used in a number of ways.

It is useful for testing audio and RF filters in Ham radio circuits, They can really be helpful when aligning homebrew radios filters and checking losses in LPF's.

The traditional approach which is tried and tested is very simple. A RF noise source is amplified and fed into the front end of the radio being tested, spectrum analyser software on a PC is then used to look at the filter response (this software is free to download and use, see notes at the end of this document for download links).

OK how do we get a noise source to amplify? Well many years ago some design engineer must have been asked to make a regulated voltage source but to do it has cheap as possible. They used a Zener diode and resistor and to keep the cost down they didn't put a capacitor across the Zener, it saved a few pence BUT it was found that by using it this way a lot of noise was being produced. This noise was present right up to VHF frequencies, not what was wanted at that time but something that we can exploit in our circuit.

Let's have a look at our RF Noise generators circuit.

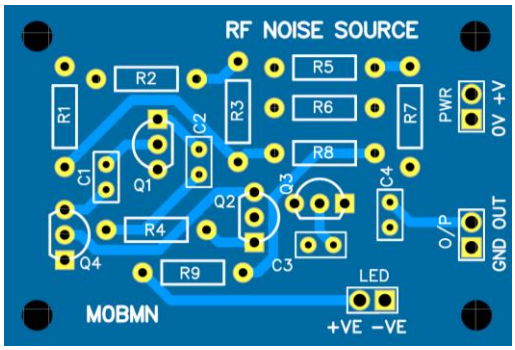


Here you can see the noise source is a small Zener diode, the exact value isn't critical anything from about 5 to 7 volts will do the trick. The noise from the diode is past via C1 to the first transistor, this and the following transistor act as amplifiers and the amplified signal is available just after C4.

The Board for this Noise source gives experimenters a chance to try a few different noises sources, one that I found to give higher levels of noise was to use a transistor in place of the Zener, only two pins are connected (Emitter and Base) the good old 2N2222 works well in this configuration. The board layout shows the outline for such a transistor should you wish to try it but I found that for this to work I needed a 12-18v Supply to the board, I wanted this to be more portable and to use a simple PP3 9v battery so I would recommend using the supplied Zener diode instead. The output is a few dB down but still works well and you will not have problems due to low voltage.

See the instructions as you build it that show how to fit each option.

Here is the PCB layout. The board is 52 x 35mm.



So lets build the Noise source.

If you are not confident in building your own equipment just take your time and follow the steps in order, mark off the parts as you fit them.

The Parts List. (Check you have all the parts before you start building) cross off each check box.

Noise Source PCB.		☐
R1, R9	2k2 Ohms	☐
R2, R4	150K Ohms	☐
R3, R5	12K Ohms	☐
R6	85K Ohms	☐
R7	8.2K Ohms	☐
R8	390 Ohms	☐
C1, C2, C3, C4	0.01uF	Ceramic Disk (Marked 103). ☐
Q1, Q2, Q3	2N2222A	(or 2N2222). ☐
ZD1	5-7.2V Zener Diode.	☐
LED	RED 5mm LED (mounted off Board).	☐

Lets start by fitting the resistors, start at R1 and work through to R9, use the screen printing on the PCB to located the placement of each resistor, the resistors can be fitted either way round. Make sure that the right resistor is fited in the correct location, If you have a meter that can measure resistance use it to check each one before you fit it.

Resistors Fitted and Checked ☐

Let's fit the Capacitors next

C1, C2, C3, C4 are all the same value (0.01uF or sometime called 10nF) the marking on them will say 103. These can be fitted either way round too. Fit each one and check all the soldering for dry joints.

Capacitors Fitted and solder joints checked ☐

Ok well done! You are half way through the build.

Next let's fit the transistors.

The transistors are used to amplify the noise signal, they are sensitive components and can be damaged with too much heat so we need to be careful when we solder these in place. Transistor MUST be fitted one way only, if you look at the transistor you will see that one side is flat. If you look at the PCB silkscreen you will see that the outline of the transistor shows a flat side. Orientate the transistor to match the outline on the board when you fit it. Push the transistor down a little so about 5mm of lead is above the board. Solder each leg in turn.

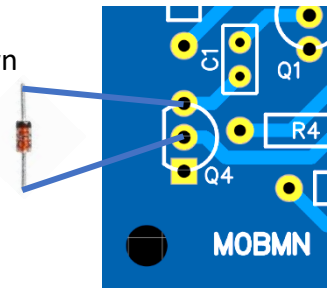
All transistors Fitted and Orientation checked ☐

Now we will fit the Zener Diode in the position Q4,

If you are following these instructions and you don't want to experiment with different devices for noise sources then fit the Zener Diode in the position at Q4 on the PCB, if you wish to experiment or intend to use a higher voltage (12-18v) to power the module you can fit another 2N2222 (Not Supplied) as indicated on the PCB.

Fit the Zener on the board between the two pins shown here, Make sure the Band on the diode is as shown.

You will have to mount the diode vertically.



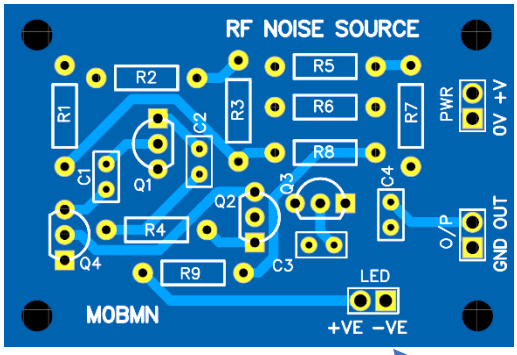
Diode Fitted and black band pointing up towards R1 ☐

Well done that's all the board mounted parts fitted, stand back and admire your handy work!

Time for a cuppa .

Next stage connecting up the board.

Let's look at the PCB again and this time think about how we will connect it up



The Power supply connects to the PWR terminals This can be 8 to 18 Volts DC.

The Output is from These O/P terminals, connect to a BNC or Phono socket is a good idea.

The 'Power On' Indicator led can be wired to here if you wish to use one. The resistor for it is already fitted (the Long lead on the LED is connected to +VE).

To use the RF noise source to check a receivers bandwidth and to see if the filter response is flat We will need some software to do this, there are many different packages that are free. A search for audio spectrum analyser software on the web will find a number of free ones, I would use one of these,

https://download.cnet.com/developer/wd6cnf (Look for SpectrumView on this page)

http://www.sillanumsoft.org/download.htm

https://www.phon.ucl.ac.uk/downloads/sfs/rtspect/rtspect260.exe

I would use the first one on this list but that's up to you.
Good luck and I hope you find the Noise source useful and it gives you good service.
The noise source is best fitted into a Case, a small plastic one will be fine and give the module protection from damage.

If you wish to make any comments good or bad please send them to :-
help@phoenixkitsonline.co.uk

73

Paul