Build Your Own Noise Source

If you are not familiar with noise sources, I recommend you check out "Noise Basics" at NoiseCom.com. If you are ready to build your own noise source, I will assume that you already know why you want to, or why you should! Another caveat: the title of this page is not "How to build a great noise source". If you want a great noise source, pony up some cash, on the cheap side you can expect to spend around a hundred bucks, even if you build it yourself!

Now on the other hand, a cheap and dirty noise source can be had for a few bucks, and can be very useful! The idea is simple: All electronic devices generate noise output, resistors, transistors, and diodes... but especially diodes, zener's that is... more specifically, reverse biased zener's! These things really pump out the noise! Most of the noise output is low frequency, less than a few MHz. But if you are willing to search through a batch of surplus zeners, you will eventually find one with significant output up to a few hundred MHz! A lot depends on the physical topography of the zener "chip". Small dimensions will emit greater high frequency noise, etc. (Zener's can be designed to emit noise intentionally, but I don't pretend to know how that's done!)

The Parts

Head to your local Radio Shack or whatever you have, and pick up the following:

- Nine-volt batteries, two of them.
- Battery connectors, two.
- A suitable chassis mount RF connector. BNC, 'N', whatever. This will be the noise output connector.
- A small physical size capacitor, value is not too critical for this application (low frequency cut off is set by this cap.), 0.01 mfd is fine.
- A small selection of low value resistors, maybe a 470-ohm and a couple of 1K ohms. Maybe a 2k pot for tuning too.
- A small RF choke, you can omit this, but it can help isolate the battery from the zener, and may help the output level.
- Here's the tricky part: Get a few zener's, a grab bag is best, but a few in any case. Try to find values between 5 to 15 volts.

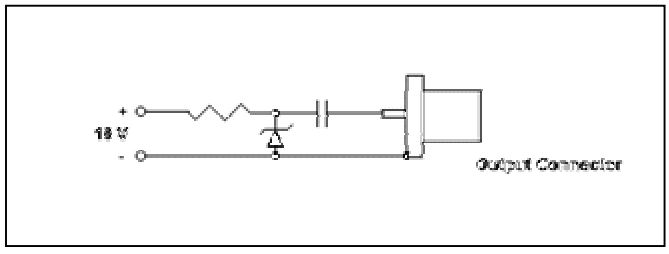
Don't get too smart here by building an AC to DC power supply here! This thing runs on batteries for a reason! They keep outside noise to a minimum.

Oh yeah, if you want to put it in a case, you can do that. Most of my projects are naked and homeless. If you're going to go that far, you may as well get an on/off switch too!

Construction and Tuning

This is very simple! Follow the schematic. Build directly on the connector, and keep the leads short to anything that is connected to the cap. Be certain of your connections and test them with an Ohmmeter, you don't want to send DC into your spectrum analyzer by mistake! And finally, don't solder in the zener just yet.

Connect the output of your noise source to your spectrum analyzer. Power up the spectrum analyzer and set for a wide sweep between around 1 MHz and maybe 500 MHz (optimism!). Set a wide resolution bandwidth, maybe 3 MHz. Since noise power is spread



across the whole band, you'll see more with a wide resolution bandwidth.

Now apply power to the noise source, and try different diodes and different bias levels. Careful of the bias level! Don't apply too much. You can use a 2K pot in series with a 470 Ohm resistor to help find the bias level, maybe even leave the pot in the circuit to adjust for the best output in some particular band? If you do that, you better use the RF choke! I usually end up with around 1K or 1.5K resistor for an 8-9 volt zener. Maybe someone out there knows the right formula for the right diode. That person isn't me. If that person is you, let me know! I'll be happy to amend the technique!

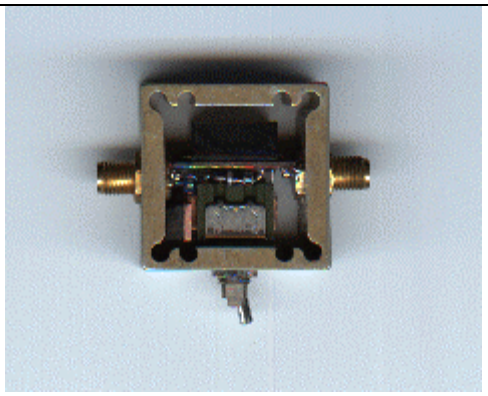
What you're looking for is a high, reasonably flat output across a wide band. The output will be quite low, just above the grass, but the right diode will give you a useful RF tool for lots of uses. Once you find the best of the lot, finish the solder job and trim all the long leads. Congratulations. You now have a noise source.

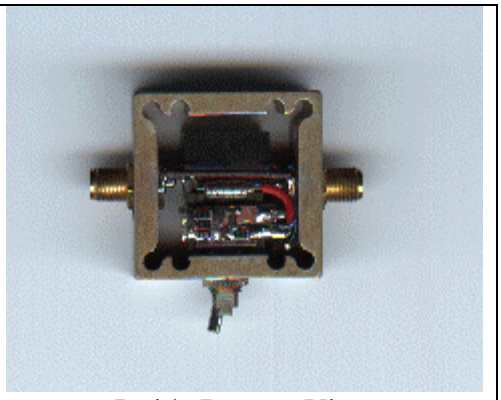
Go further

If you want a great noise source, order a real noise diode and use it the same way. Real noise diodes have much higher output than our homespun version. You could also use an amplifier on the output of the noise source to get higher levels. Companies like Minicircuits make wideband amplifiers that would work great. Another option is to get the noise diode with an integrated amplifier. Very pricey, but very good. Good luck!

Below are photos of my own noise source. I went the cool enclosure route on this one. The output is DC blocked and amplified, the power input is reverse voltage protected and regulated. I even have a small toriod on the power input to keep the noise where it belongs! This uses a pricey noise source diode and the output is high and flat within +/- 1 dB to nearly 3 GHz.

My Homebrew Noise Source


Inside Top View


Inside Bottom View