Natural Radio

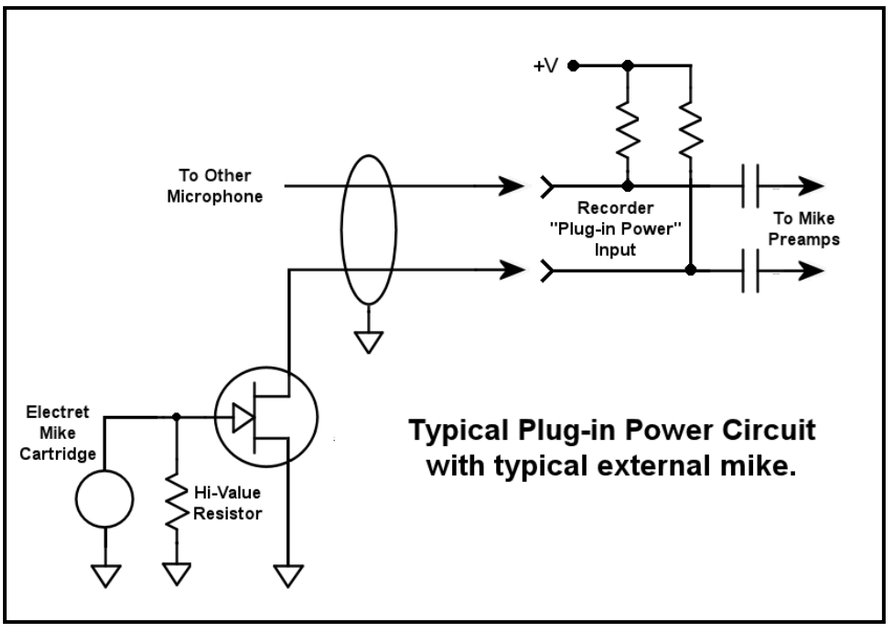
News, Comments and Letters About Natural Radio

December 2011

Thanksgiving is upon us and this is the week that I usually finish my yard cleanup for the fall. The loss of summer, though always a bit sad, means more time in the workshop and the projects have already begun. I've been thinking about building a more compact portable listening and recording setup. The battery in my M-Audio Microtrack recorder suddenly gave up the ghost and since it's an internal battery, replacement is probably going to be a bit of a pain, especially since the recorder has been discontinued.

A while back I purchased a Zoom H2 portable recorder for studio use – these now have a street price of about $125. I wondered if I might not be able to use it to power a receiver even though it doesn't have phantom power. I like this unit for a number for a number of reasons including its compactness and four built in microphones, but one of the biggest being that it is powered by 2 AA batteries. I can power it with alkalines or rechargeables and don't have to worry about the hassle and cost of replacing an internal battery that may fail when I need it the most. I am trying to avoid purchasing anything with non-replaceable batteries.

Instead of phantom power, this unit has what's called "plug-in power", which is delivered through the 1/8 inch stereo microphone input. The standards for "plug-in power" are fairly loose, but as you'll see in the diagram below, power from the batteries is applied through two resistors to the tip and ring connections on the mike jack. The tip and ring are also feed the inputs of the mike preamp through two capacitors.



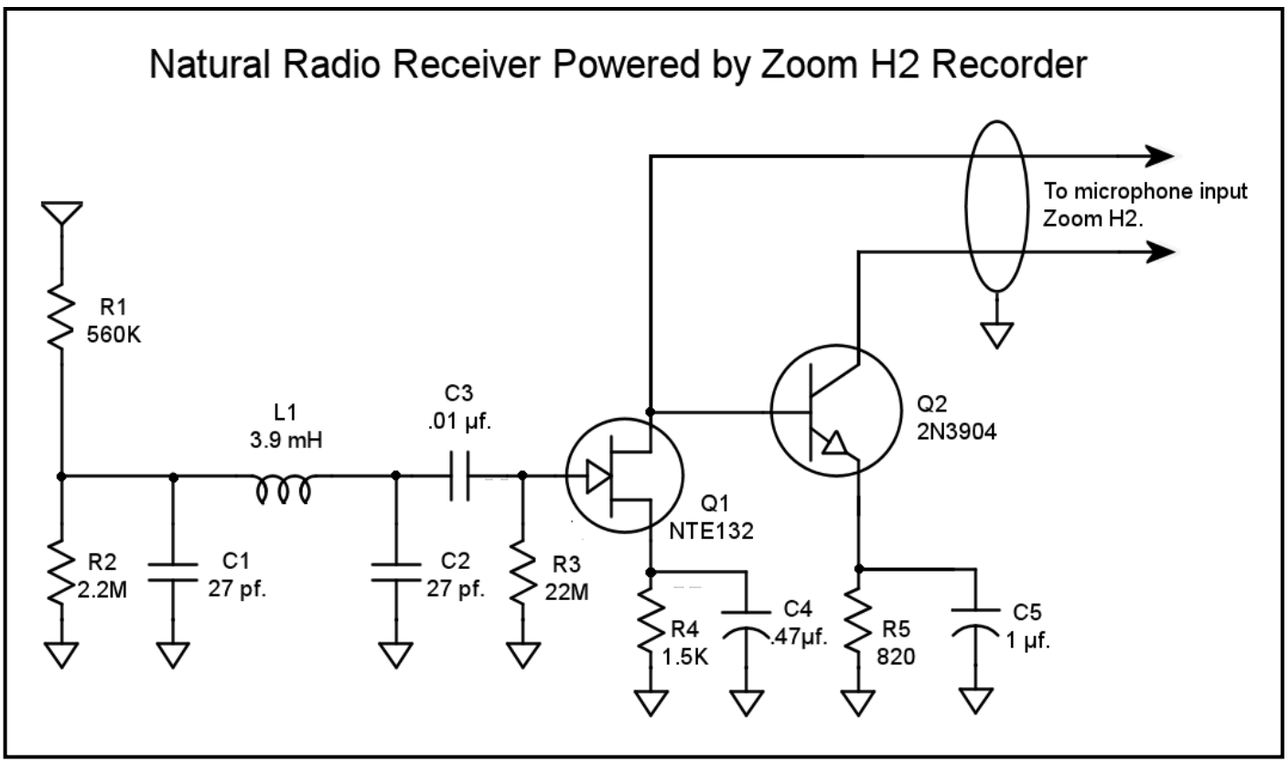
For a typical plug in mike, one of the input leads is connected to the drain of a JFET. The source is grounded and the electret's mike and a high value resistor are connected between the gate and ground. The resistor in the recorder acts as a drain resistor for the JFET and we have a preamp in the microphone powered by the recorder.

I was hoping to use a circuit similar to this as the front end of a simple Natural Radio receiver, substituting the antenna and input network for the mike cartridge. This would plug into my Zoom H2 which would handle most of the amplification, power, headphones and recording.

To test the concept, I built up a circuit loosely patterned after the BBB-4 with just a single JFET and mounted it in a small cast aluminum box and plugged it into the H2. It picked up hum quite well so I went to my listening location the next morning and did a quick test.

I was able to hear some sferics but they were weaker than what I could hear on my WR-3, and that was with the mike gain on the H2 wide open. Conclusion: another stage for amplification was necessary.

I was encouraged that the concept of powering the receiver from plug-in power worked and went back to the drawing board to see if I could modify the circuit to have another stage of amplification. Since the Zoom H2 is a stereo recorder, I figured that I could use each of the two powered channels to power one stage of amplification. See the schematic below.



Since it appeared that the project would be viable, I refined the design a bit and added a low-pass filter to get rid of broadcast and other RF interference. With the demise of OMEGA and LORAN, the filtering is probably less necessary than it was in the past, and the filter might be able to be omitted depending on your location. Of course, if you are near one of the powerhouse Navy stations, more filtering might be necessary.

The rest of the circuit is somewhat basic. The values of R4 and R5 were optimized experimentally since I didn't know the values of the two resistors inside the H2 recorder. If you are working with a different recorder, the values may need to be tweaked. The bypass capacitors on the source of the JFET and the emitter of the final stage are chosen to reduce the low-frequency gain and help eliminate some of the power line hum. The roll-off has a -3db point at about 250 Hz. Increasing the value of the capacitors will lower this frequency, lowering their values will increase the frequency where the lows roll off.

Now of course, this minimalist type of design is not going to produce a "research grade" Natural Radio receiver, but for most of us, the limiting factor is not going to be the noise floor of the receiver, but atmospheric and power line noise. I am concerned that the low

voltage available to power the unit might limit dynamic range with strong signals. That will have to wait for further field testing.

The initial tests of the breadboard unit have been encouraging. The unit seemed to have about the same sensitivity as the WR-3, which was determined in a non-scientific test while I was standing at the end of my driveway at about midnight. I heard some nice tweeks, which is about all I can ever hear in my rather poor home location.

I built a final version and mounted it in the aluminum case, so the next step will be to go out to my listening site and hopefully check it out with some chorus or whistlers. I'll be A/B testing it against the WR-3.

I'm currently tending toward attaching the H2 to the receiver box with Velcro which would make separation of the units fairly easy, which is important since I use the H2 for many other applications. The receiver is small enough that holding the receiver together with the H2 in one hand is comfortable. I would expect that several feet of cable between the receiver and recorder would work, and this would allow mounting the receiver outside of the car with a magnetic mount or hooked over the window with the recorder and myself inside the car away from cold winter winds.

One other thing that I need to investigate is Broadcast Wave Files. The H2 records this type of file which contains a time stamp on the file since the H2 has an internal clock. I haven't been able to find any details on this file header yet, but it might eliminate the need to record WWV on the second channel, which would be impossible with this circuit as both channels are needed to derive power for the two stages of amplification. It also appears that none of my editing software will read the time data from the Broadcast Wave file.

I'll publish a final schematic and parts list after testing, assuming the performance proves adequate. I'd also be interested in hearing your comments on the unit, especially if you attempt a similar design.

Finally, as we again enter the holiday season I wish you peace and prosperity, time to relax, reflect and regenerate, and happy celebrations with family and friends.