RESTORATION OF THE NATIONAL 1-10A RADIO.

(H. Holden, Jan. 2020).

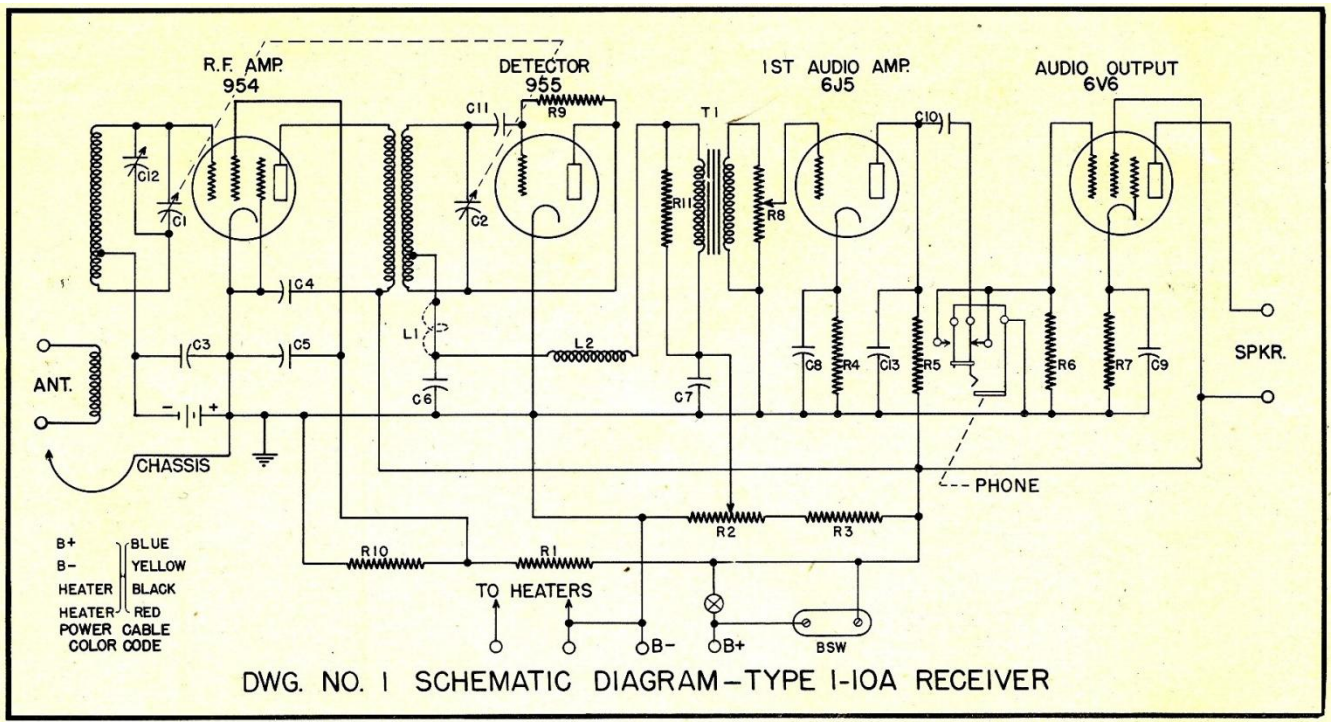
Background:

I acquired a 1-10 in fairly good condition, complete with a full coil set. However no 5886 power supply. I designed and built a substitute power supply. This is the subject of another article on the www.worldphaco.com website.

Photo of National's 1-10A radio, sans the two Acorn Valves and coil pair:

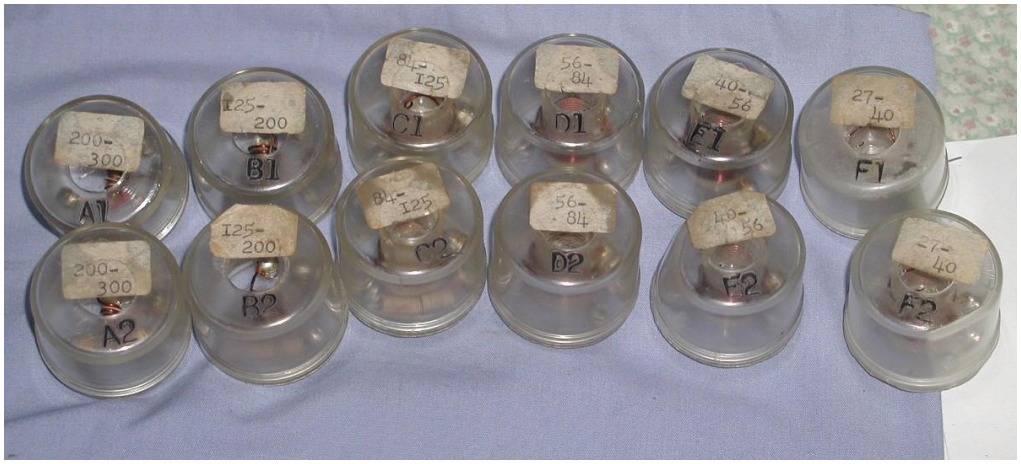
I had almost forgotten how beautiful the Acorn tubes were, until one arrived in the mail in its original RCA box dated 1944:

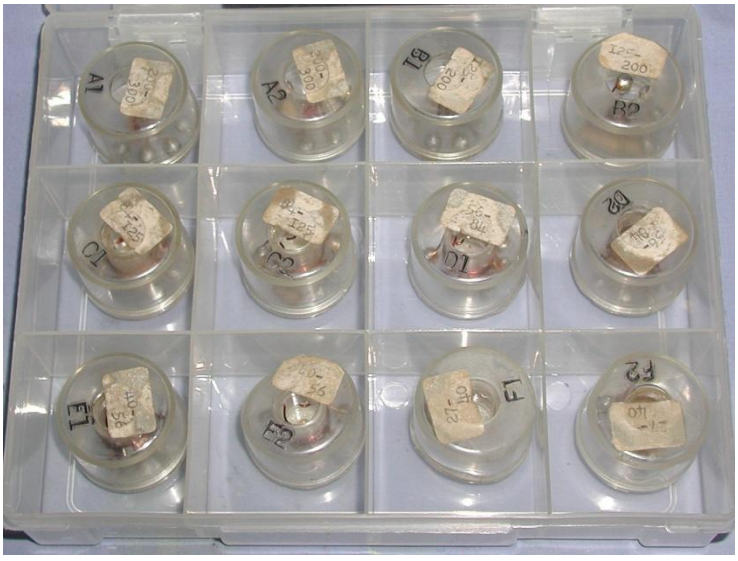
The 1-10A's Schematic:



Firstly I cleaned and polished the coil set and found a suitable container for them. There was a moderate amount of black oxidation of the silver plated pins.

Some had a distorted housing, however it won't affect their function.





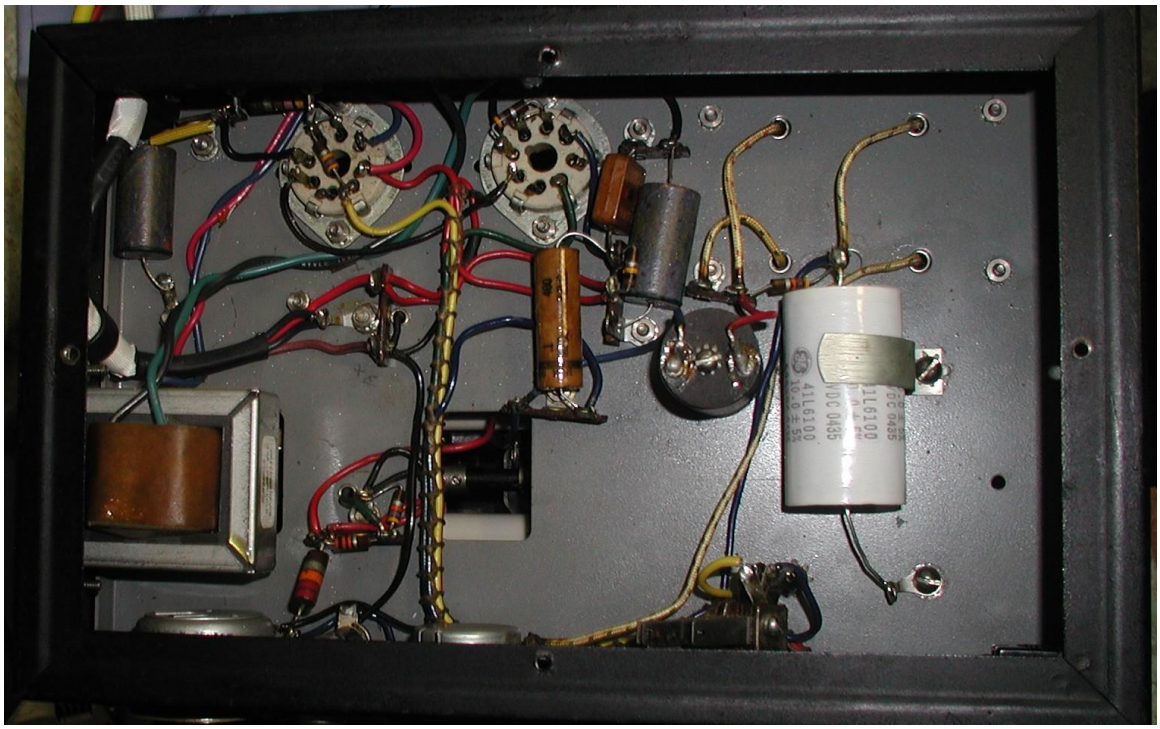
The Restoration:

This was fairly easy as some radios go, as the unit was in basically good order.

Firstly any small amount of cabinet surface rust area were identified and treated with Fertan organic rust converter. This converts the rust into a dark-blue black harmless tannate. These areas where then painted over with a small amount of satin black paint to hide & protect them. This gave the radio a new look.

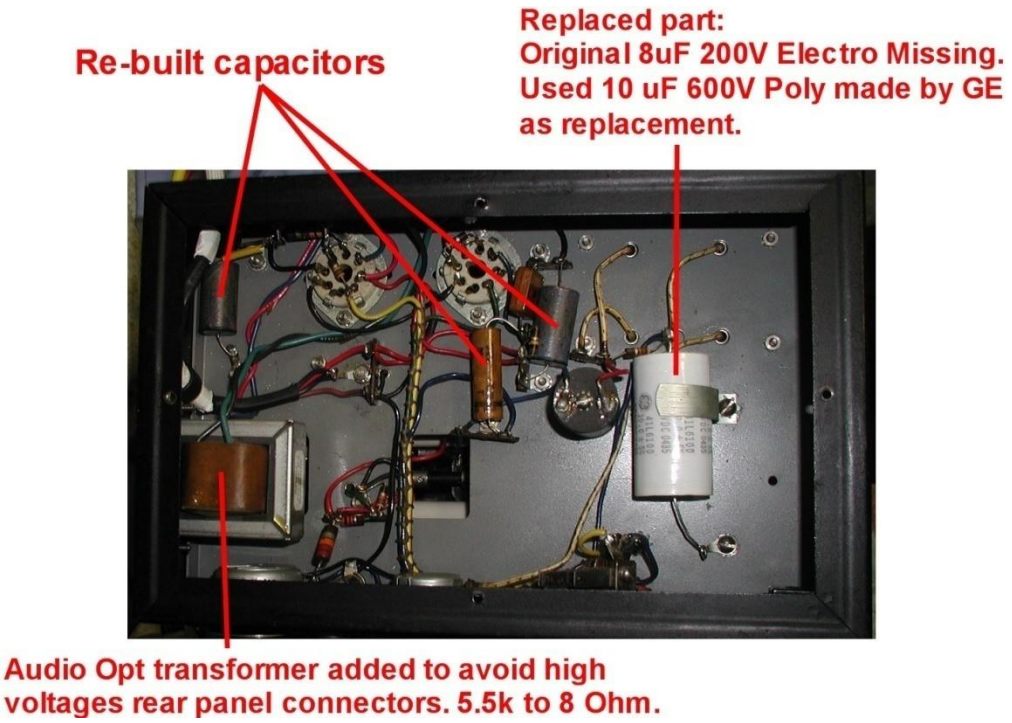
All of the mechanical parts were cleaned & lubricated. The grease in the zero backlash gearbox had totally dried out and hardened, so it was replaced. The main tuning knob internal gear assembly also required gleaning and lubricating.

The first thing I noticed about the electrical side of things was that National made a little blunder by having the radio's 180V HT on exposed connectors on its rear panel. This is because they designed the 1-10A radio to power an extension speaker that contained the audio output transformer. So the 180V HT and the plate connections were exposed on the radio's rear panel. I cannot see that being done today. So this unacceptable situation is better remedied by putting the audio output transformer inside the radio and disconnecting the high voltage connections from the connectors on the radios rear panel, along with another HT connection. The transformer I added can be seen on the lower left. Photo with the metal base removed:

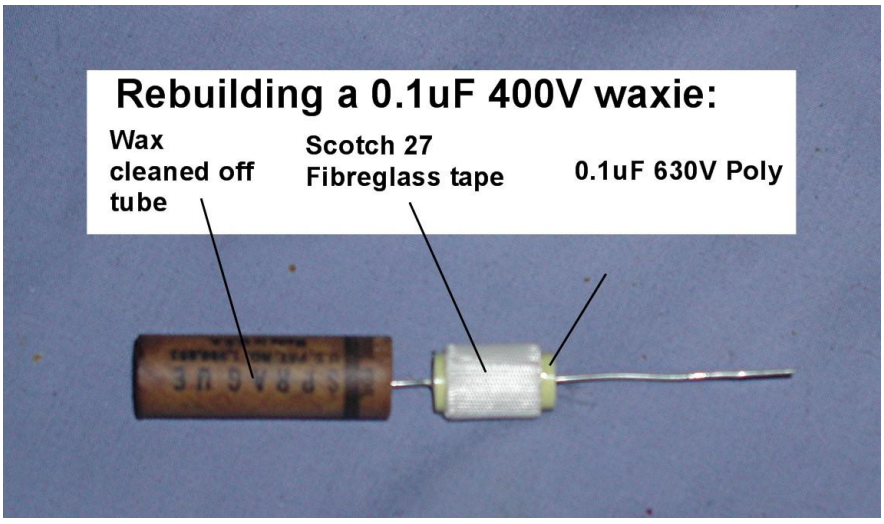


It is important when you fit the audio output transformer to connect one side of the voice coil winding to ground, or otherwise it is still possible to receive a shock from the speaker connections if there are issues with the output transformer's insulation.

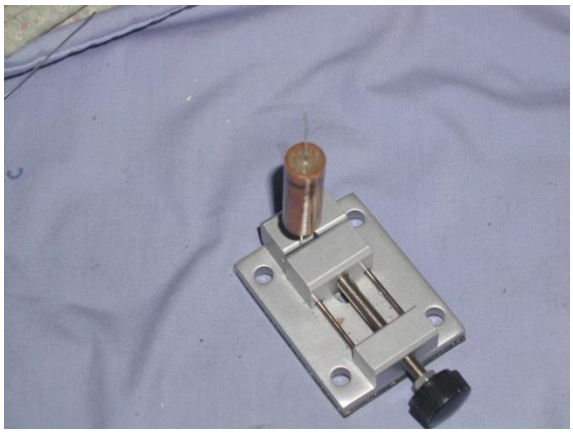
Also, the capacitors were rebuilt or replaced. I avoided an electrolytic in the HT section, but stuck with electrolytics for the cathode bypass capacitors for the 6J5 and 6V6:



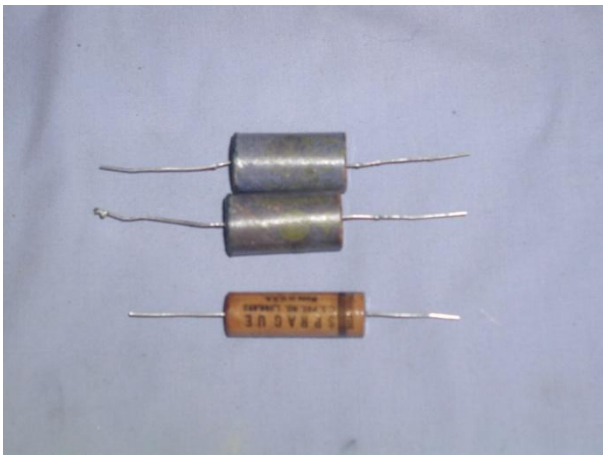
The one and only waxie had its internals replaced with a 630V rated poly capacitor:



For the most part, doing large batches of waxies for TV restorations, I re-seal the ends by pouring them on alternate days with Polyester Resin. In this case for a one off I used 24 Hr Araldite. Also, I varnish the waxie with marine grade spar varnish (after the wax is removed, the varnish is miscible with the residual wax). This way they look good and the surface is non tacky and they don't stick to dust.

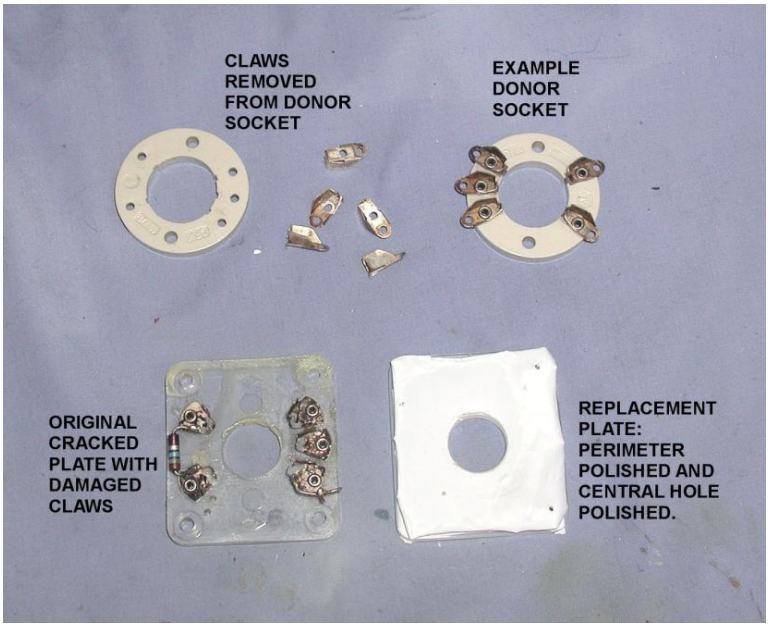


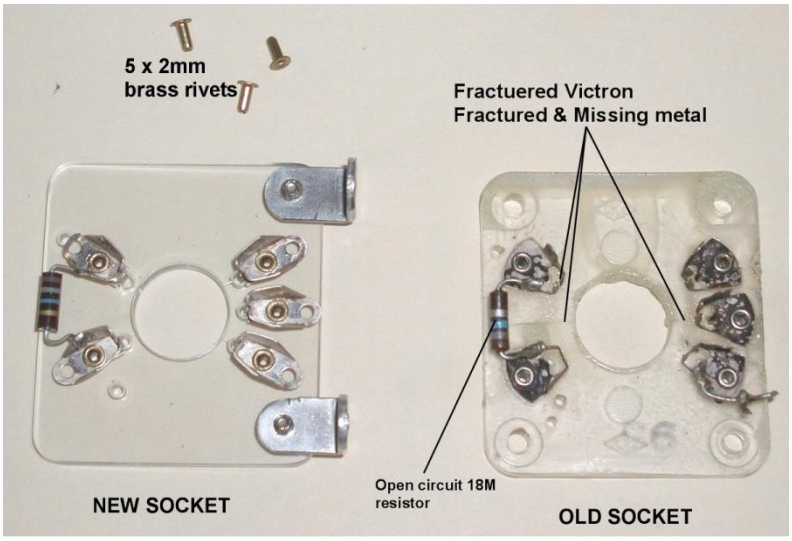
Two of the cathode bypass capacitors in the set were also re-built:



All the resistors and moulded mica capacitors were checked, none were found to be defective so they were left initially. None were found later to be defective on extended testing of the radio either. Though the micas should remain as suspect, still the originals are working and look good so I have no plans to replace them yet.

One of the main issues in the radio was that one of the Acorn tube sockets was damaged, with the metal fractured away from the contact areas and the original "Victron" plastic plate cracked in half. So I acquired a donor socket for the claws and I made a new plate out of acrylic:

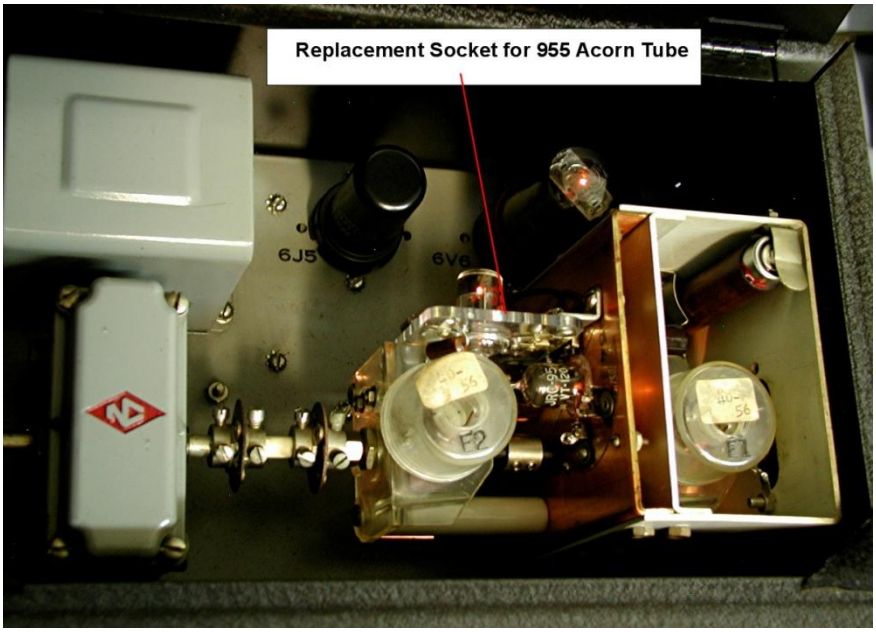




It was unexpected that the 18 Meg Ohm 955 tube's grid resistor was open circuit too. I replaced with a vintage 5% carbon composition resistor. It is important that this resistor does not have any inductive or reactive properties.

National warned in their manual that it was important that each of the coils were fully plugged in. At the 250 to 300MHz end of the range, even the smallest amount of extra length in the conductors leading to the plug in coil could have a big effect and upset the calibration.

The photo below shows the socket installed in the working radio:



Performance of the 1-10A radio:

Firstly I tested the radio and all the coil sets on a feed from a signal generator. The regeneration control is very smooth, also unexpectedly stable over time, once its set there is no significant drift to more or less regeneration over some hours.

Then with the C coil set, I attempted to tune local FM radio stations. It does work with slope detection and the FM carrier gets demodulated on either side of the tuned frequency, however is not as clear and undistorted as an AM “Station” and the exact position of the regeneration control becomes more critical.

The photo below shows the setup with the home made power supply and an extension speaker:

Then the next test was to transmit a low power AM signal to the radio to simulate a radio station. For this application I have a modified Tek SG503 sine wave generator.

(Very briefly this particular Tek unit has been modified to amplitude modulate the output level. Normally its output amplitude is controlled by an internal feedback loop to level it. This loop is disconnected. A processor circuit board, a professionally made pcb, fits on existing mounting holes in the unit. This board volume levels the output from an iPod using NE571 compander IC's, before it modulates the oscillator, by controlling the oscillator transistor's emitter current. This gives fairly linear amplitude modulation. It transforms this Tek unit to a 250kHz to 250 MHz variable frequency low power short range radio transmitter. For lower frequencies (MW band) I used resonant loops, for the higher frequencies whip antennas. It has become a very useful workshop tool as I also have sine wave recordings on the iPod and can control the modulation level too. The grey box on the top contains a 300 to 50 Ohm matching transformer because my all my home made resonant loops have a 50 Ohm input impedance. So this generator can be used to test many AM radios, MW,SW,VHF types over a wide frequency range. The VFO in this Tek unit particularly impressed me and it has a handy digital frequency counter. This unit, unlike my other SG503's, had a damaged area on the front panel, so I placed the 3mm panel socket and peak clipping LED there. I would have been reluctant to have modified it / made holes in it otherwise)

Fitting the F coil set to the 1-10 A I transmitted to it on 30.1MHz as an extended listening test. Once the regeneration control was set, it was perfectly stable. The audio output quality is excellent (especially with the broad range speaker attached, a vintage bookcase type) and the audio does not sound as bandwidth limited as it is on a standard Superhet radio. So it is a very pleasant listening experience.

Other information that might be useful:

I did some testing on the audio inter-stage transformer.

It is a 1:4 ratio type. The primary DC resistance is around 1600 Ohms and the secondary 8.2k Ohms. Its -3dB frequency response is 50Hz to around 6.5Khz.

The DC resistance of L2 (the 250 mH Quench frequency choke) is 800 Ohms.

I was surprised by the relatively low quench frequency. Depending on the coil set used and the regeneration control setting, it can be as low as 5kHz, which is very audible, or as high as 40kHz. I had suspected it might be in the 100kHz region for a Super-regenerative that covered 27MHz to 300MHz. So the fact it can extend into the audio spectrum surprised me. However, this does not appear to cause any issue aside from a loud 5kHz screech if the regeneration control is advanced too far.

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