Zenith Console Radio Restoration

1939 Model 7S363

Preface

My wife and I have a 1939 Zenith console radio, model 7s363, which had been sitting in a hallway corner, unused, gathering dust for 48 years or thereabouts. I say unused, but it provided amusement for a one-year old boy who liked to beat on it with an egg beater and, years later, two brothers enjoyed revving the flywheel-weighted tuning dial up to speed to listen to the whirring sound inside. More importantly for the countless mice always found in an old farm house, the chassis provided secure housing over the years. So many mice had occupied the metal chassis that the entire volume was solid-packed with a fluffy, cotton-like material filling the entire volume except for access tunnels. The cloth-insulated wiring provided enjoyable chewing satisfaction as evidenced by bare wires and dangling insulation fragments.

I had never restored a radio, and I didn't think the chances of this radio ever working again were very good but a little research showed that reproduction knobs and buttons were available to replace the badly damaged and missing originals. I decided I had nothing to lose by trying so I proceeded with disassembly. My biggest regret now is that I didn't photograph the original condition or the disassembly but I think you'll get a good idea of what the radio looked like at the time by looking at the following restoration photos. There is a video version of this document on YouTube with additional video clips of the radio being tested and operated at https://youtu.be/BgMSkJ4j6oQ. If the link fails, search for title “1939 Zenith 7S363 Console Radio Restoration”. Fortunately, I thought to start photographing the process immediately after disassembly.

Re-laminating the Chassis Base

The plywood chassis base appeared solid near its mountings but had severely delaminated at the unsupported back portion. By severely delaminated, I mean that there was a gap exceeding an inch between plies. I doubted that clamping could restore the plies without warping but decided to give it a try. Because the gaps were so large, I was able to just pour undiluted Gorilla wood glue directly into the gaps. I crossed my fingers and clamped with a 1x4 on each side. As I tightened the clamps, I wiped excess glue off as it was squeezed out of the closing gaps.

After allowing the wood glue several days to dry, I removed the clamps to find the plywood base was very straight and solid, and as good as new. Well, as good as new except for the dirty appearance. Thus encouraged, I looked for something else simple to restore.

Replacing Dial Glass Rubber

The next thing that caught my eye was the dial glass which was loose in the frame because the rubber edge trim had crumbled with age. I couldn't find any reproduction sources but I found an SBR rubber, U-channel, push-on trim at McMaster Carr, item number 8510K14 (3/32" wide by 21/64" high inside). The rubber is soft and flexible, and all I had to do was trim the excessive height. I found an easy way to trim the excess was by mounting the trim on the edge of an aluminum yardstick, then laying this yardstick on my table saw and pushing the back edge of the rubber up against the guide. Then I found another yardstick of approximately 0.1" thickness and set this edgewise on the rubber trim and used a razor tool to cut the excess as shown in the photo. The resulting cut was very straight and the trim looked factory made.

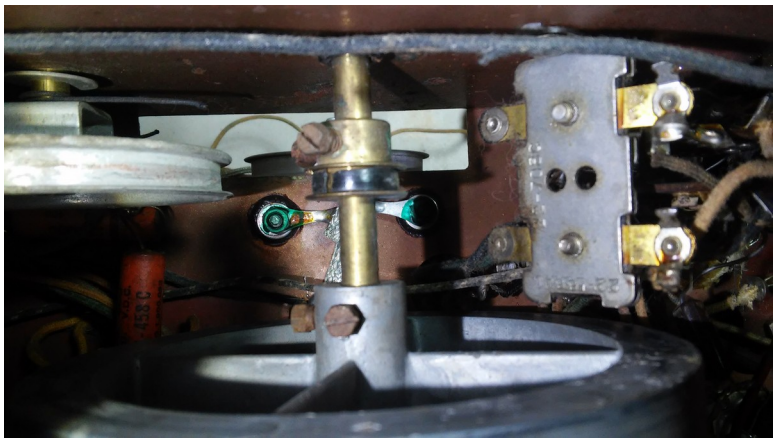
Rather than risk making a mess by gluing the trim onto the glass, I applied a band of aluminum tape around the trim so that it couldn't expand outward. This held the trim securely in place.

The aluminum tape wouldn't show when assembled, and the rubber trim looked perfect to my eye.

Dial Shaft Issues

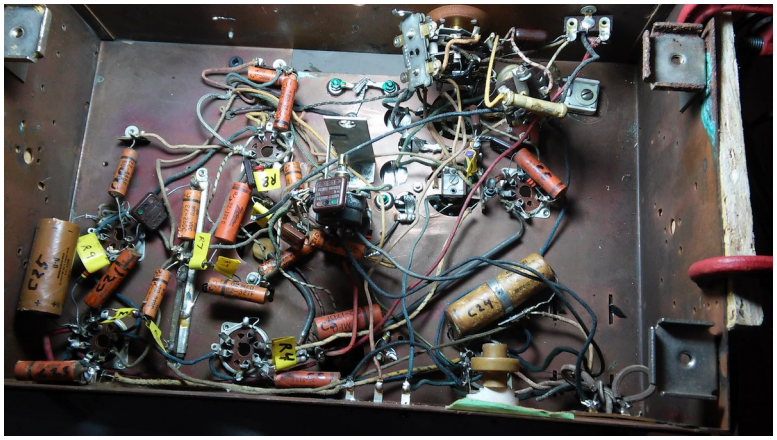
I turned my attention to the dial shaft and first noticed that the back-end nylon bearing had popped out of its mounting hole, and it didn't want to stay in place if I pushed it in.

Further dial shaft investigation revealed the the front-end bearing liked to pop out of the chassis wall, and a nylon band on the pulley had snapped. I couldn't find replacement parts online so I decided to ponder on this in the back of my mind while I moved on to another task.

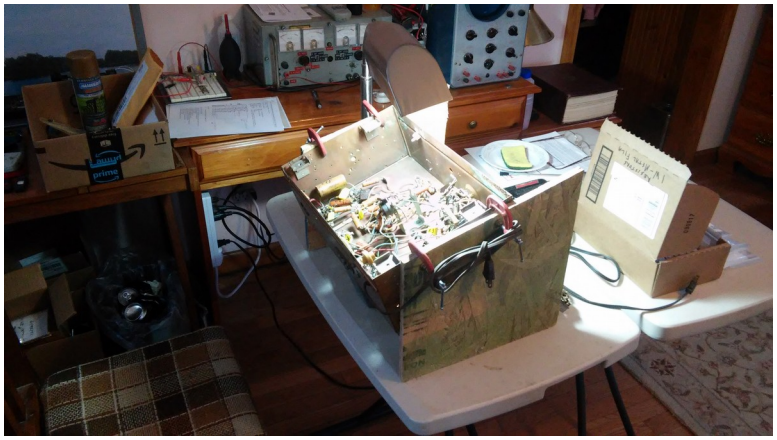


Resistors, Capacitors and Wiring

I decided it would be a good time to test and/or replace resistors and capacitors. Well, it turns out that they don't wire the radio in anything even resembling the nicely organized schematic, and nothing is labeled. The resistors are color coded and not too hard to identify but I am sure they purposely mounted all the capacitors with the value facing the chassis so the value was impossible to see. Well after hours of matching parts to the schematic, I eventually got them all labeled for testing and/or replacement. You might notice on the top, right of the photo, I unmounted the band switch and pulled it back a bit for easier access.

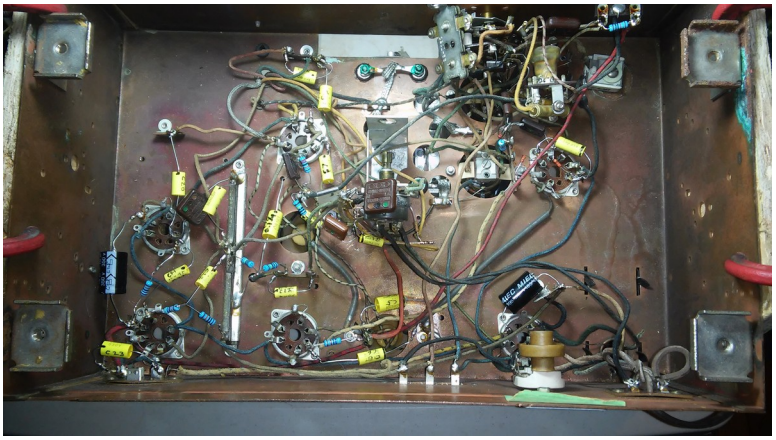


I found it much easier to work on the chassis underside if I clamped the chassis to scrap USB boards as shown. This kept the top side of the chassis safely above the table top, and also kept the chassis secure when working on it.



There is a 1 megohm resistor (R15) connecting pin 2 (triode plate) to pin 4 (target) of the 6U5 indicator tube (Magic Eye). This resistor is inconveniently mounted in the base of the socket as shown in the photo. This resistor measured over 5 megohm and needed to be replaced. Gaining access required removing a Bakelite disk holding the circular contacts in place. I found it impossible to pry the disk out but I cut a short length of wood, about 2", off of an extra long matchstick. The wood was soft and just fit through the wire hole. I slid it in past the resistor until it contacted the disk. With the socket placed face down on a table top, a gentle tap on the stick with a small hammer popped it out without damage. Note also that the B+ wire to pin 4 had crumbled rubber insulation and also needed to be replaced.

This photo shows the socket with the new resistor (1 megohm metal film, 1 watt) and a new B+ wire. After pressing the Bakelite disk back into place, this repair was complete.



Generally, with a vintage radio, all of the paper film capacitors are suspect and should be replaced even if they test good. The same is true of electrolytics. The mica capacitors generally last forever.

Whether resistors should be replaced is debatable, however, almost all that I tested were more than 30% over their stated values. I then decided to replace all resistors with modern metal film resistors. The old carbon resistors generally suffer from molecular migration which always leads to resistance increases over time. I saw no point in keeping any original resistors. The photo shows the chassis after replacement of all paper film capacitors, all electrolytic capacitors, and all resistors.

I found a neat technique for replacing and soldering components on a YouTube video by user joernone (https://www.youtube.com/watch?v=OI9P01eYbjA). I think the author called it a quig or quiggle connection. Take the new resistor or capacitor and form a pigtail coil on each lead by wrapping the lead around a miniature screwdriver shaft of approximately 1/32" diameter. Make 3 or 4 turns on each end. Then snip out the old component, leaving at least 1 quarter inch of stub in the chassis, or even more if the new leads are too short. You can then slip the pigtails over the stubs and you'll generally find this holds the new component in place so well it frees both hands for soldering, and the soldered connection is very robust. Best of all, if you need to remove the component later, you can just heat the solder and pull the component leads off. Good examples in the photo are C12 near the bottom, left of center, and C7 near the top, also left of center. Another good benefit of this soldering technique is the reduced stress on sockets and other fragile components. Damage due to heat and tugging or pulling is eliminated.

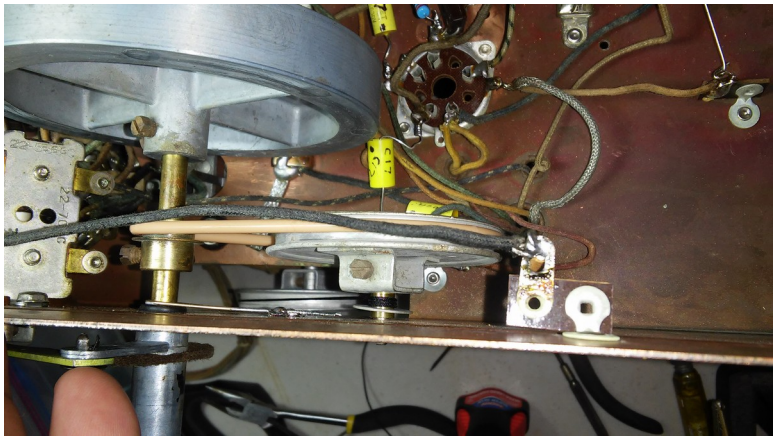
I should mention the candohm resistor which tested good and was not replaced. It is the long coiled-wire resistor encased in metal with two taps in addition to the end connections. The resistor is very visible and riveted to the chassis toward the left side of the photo. The quig soldering technique eliminated risk of damaging this unobtainable resistor---break it and you'll have to make your own.

This photo shows the rewired chassis and the removed components. You might notice that the original paper film capacitors had a black band on one end. I didn't know what this was, and it made no sense since these are not polarized capacitors. A little research and I found out that the black band indicates which lead is connected to the outer foil. These capacitors are formed by rolling two foils together with an insulating material sandwiched between. Well, one of the foils ends up on the outside. Does it matter? Well, yes, sometimes. Stray electromagnetic radiation in the chassis strikes the outer foil first. This can cause undesirable effects such as noise, oscillation, etc. The capacitors were therefore installed with the outer foil connected at ground, or at the end with the

lowest impedance path to ground. This had the effect of damping the stray signals and minimizing their effects.

Well, newer poly film capacitors don't have the above-described band. Supposedly, they have an additional wrap or cylinder of shielding foil that blocks some of the radiation. Still, however, it is good practice to determine which lead is connected to the outer foil. I simply held the plastic portion between a thumb and finger, and then alternately connected each end to a sensitive amplified speaker. I could hear the hum from room radiation being injected into the capacitor. The lead that produced the loudest hum was connected to the outer foil, and I placed a black dot on the corresponding end of the plastic. I then installed the new capacitors in the same orientation as the originals. The black dots are visible in the photo.

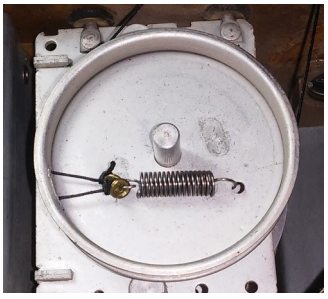
Dial Shaft and Dial Cord Repairs



I turned my attention now to the tuning dial belt and cord. The Zenith has a 2-stage dial mechanism. The knob turns a flywheel-weighted shaft having a small diameter pulley. A belt from this pulley (the manila-colored round belt) turns a large diameter pulley. A dial cord (the black string) wrapped several times around the shaft of this larger pulley drives the large pulley of the tuning capacitor. You may notice that I simply discarded the broken nylon band on the small pulley.

I found good text instructions for stringing the cord by a forum user going by the name John k9uwa (keeping in mind that the instructions are for a right-side-up chassis while the photo is from the bottom):

"You need to start at the top tuning capacitor spring. Looking at the front side of the chassis, out the slot in the top pulley and down to your right... clockwise.. down to the small shaft sized area on the lower pulley... there you should have a little washer that is against the front edge of the chassis so your dial cord passes behind it... between the small washer and the larger frame part.. make two laps [actually 2 and a half] around this shaft... stay in clockwise direction... and then back up the left hand side of the top pulley.... into the slot and tie to spring... pull at this point to stretch the spring before you tie a couple knots in this last end... trim the ends... and put a drop of super glue on the knots... that will keep them from untying."

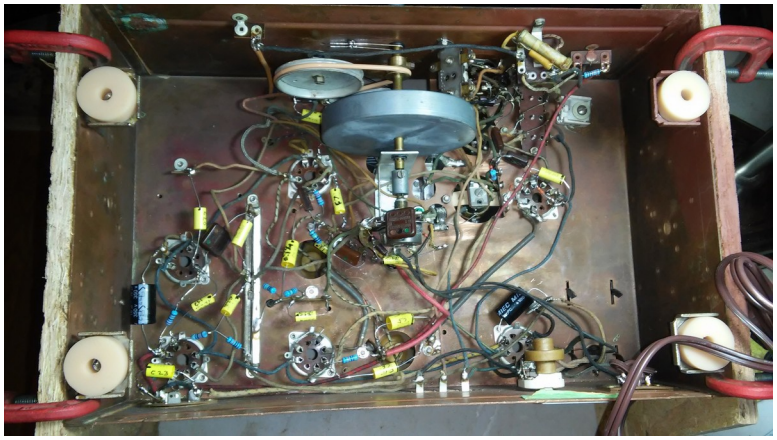


I retained the brass eyelets from the original cord.

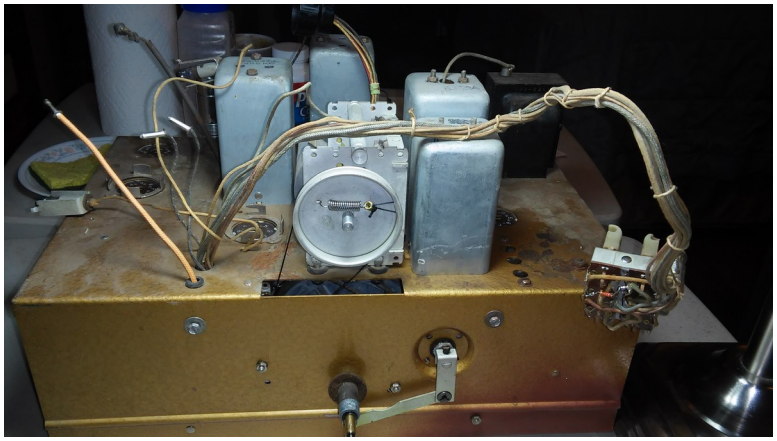
The dial belt shown above is an electronically welded polyurethane belt sourced from Adams Manufacturing Company (www.AdamsRadio.com), belt number 115.

The dial cord is 0.8 mm braided nylon dial cord string, available from many sources.

Returning to the subject of the loose nylon bearings that I decided to ponder on, if you look at the top-center of the photo, you will see a long, u-shaped wire soldered to the front wall of the chassis. The wire wraps around the shaft without touching it. The wire is a springy 0.030" mig welding wire. It exerts a small spring force on the nylon bearing which keeps it from popping out of the chassis wall. This solves the above-described problem with the bearings. Not visible in the photo is a similar wire soldered to the bearing support just below the flywheel.



A top, front view of the tuning capacitor pulley.



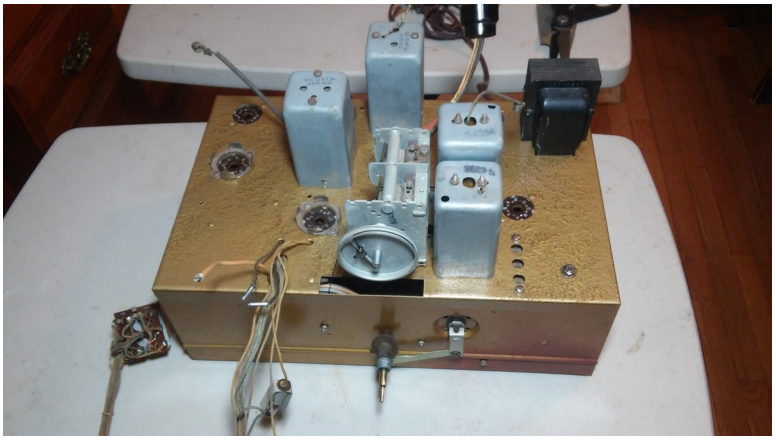
Painting the Chassis

This photo shows the chassis masked for painting. The mouse urine created some deep rust pockets even on the top of the chassis. I wire brushed and sanded but didn't worry too much about a little rust and roughness. The paint I was using was Masterchem Industries 41170 Hammerite Spray Paint, 12 oz, Gold. On the spray can, it is described as hammered finish, paint and primer and paint right over rust.

This is after a single coat of the Hammerite spray paint. The single coat provided very good coverage.

After removing the masking, this rear view shows how well the paint covered and removed all traces of roughness. If you look at the masking line just above the antenna terminals, you can see that it is a reasonably good match to the original, not perfect but good enough for me.

A front view of the chassis after painting.



Speaker Board Repairs

It was now a good time to work on the speaker board and cloth. The original wave design cloth peeled off rather easily. Obviously not reusable.

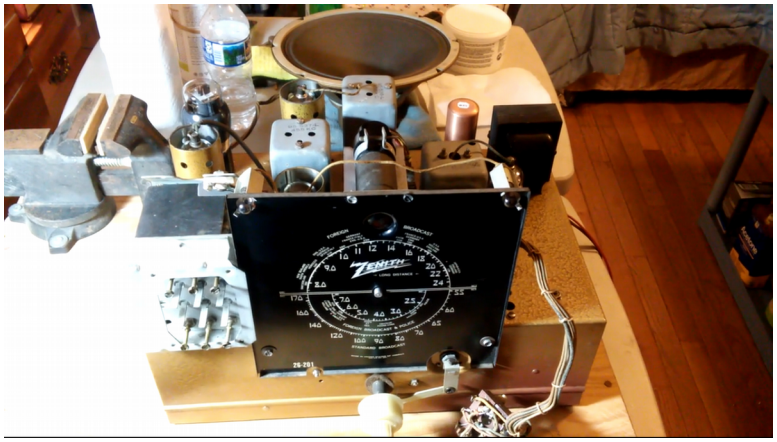
The board required minimal re-laminating on the side edges. This time, however, I laid waxed paper over the edges before clamping to make for clean removal of the clamp lumber.

A rear view of the repaired speaker board.

A front view of the repaired speaker board.

Some Initial Testing

I used a vintage Conar tube tester to test the tubes, and I replaced one weak tube with an NOS tube. The 6X5G rectifier tube tested as having a heater to cathode short. These tubes were infamous for killing power supply transformers because of this tendency to short. Fortunately, this transformer is A-OK, but I opted to replace the tube with a copper top, solid state replacement as can be seen in the photo. The WX5 Copper Cap from Weber Vintage Sound Technology is designed to work as a direct replacement for the 6X5 tube (https://www.tedweber.com/wx5). I hadn't yet replaced the tube shields.



I performed my first test of the radio on the AM broadcast band. For an antenna, I strung a length of cheap phone cord, about 80 ft, out a back door of the house. I don't know what frequency the radio was tuned to because I hadn't yet installed or calibrated the dial pointer, however, I was surprised to find the station was in Philadelphia; I live in Chardon, Ohio near Cleveland. I couldn't find this broadcast on my other AM radios. The sound was good considering the broadcast was AM and the speaker was sitting on a table.

I used the same setup as for the AM test for testing the medium wave band, 2.28-7.8 MHz (SHORT WAVE 2 on the selector switch) and short wave, 7.6-24.5 MHz (SHORT WAVE 1 on the selector switch). As before, I am not sure of the station frequency. I got a good signal, and on one station the announcer mentioned the weather “here in China.”

I dimmed the lights to get a video of the original 6U5 magic eye tube working but the tube is too dim to see clearly even with the dimmed lights. The original 6U5 tube was working, but the phosphors had lost their glow. Time to start searching for a replacement for this hard to find tube. More on this later.

Radio Alignment

I forget whether I aligned the radio before or after the initial tests but I performed the alignment pretty much as outlined in the Zenith literature. The only exception was that I used a vintage Conar analog transistorized volt-ohmmeter to monitor the AGC voltage. High impedance, analog voltmeters are great for this purpose. It's easy to follow the big needle and locate the exact point where the voltage peaks. I don't think they used this method back in the day because few service technicians, if any, had access to high input impedance voltmeters. The 12 megohm input impedance of the Conar TVOM didn't have any negative effect on the circuit being measured. As it turned out, the alignment was pretty much spot-on to begin with.

The following image outlines the basic alignment procedure.

ALIGNMENT PROCEDURE

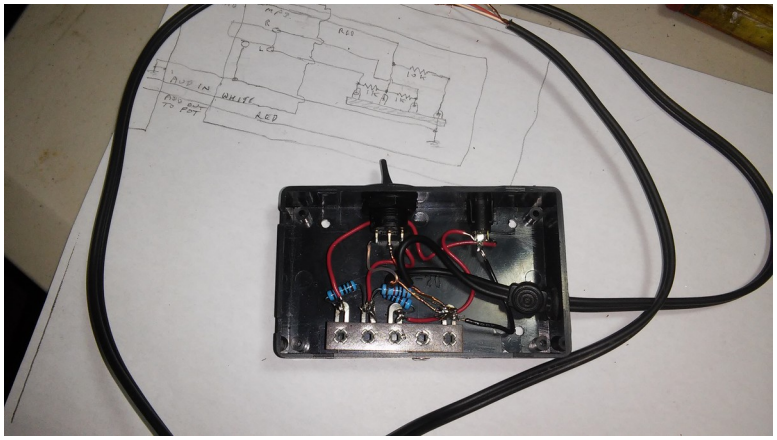
Operation	Connect Test Oscillator to	Dummy Antenna	Set Test Osc. to	Band	Set Dial At	Adjust Trimmers	Purpose
1	1st Det. Grid	1/2 Mfd.	455	Br'dc't	600	ABCD	I. F. Alignment
2	Rec. Ant. Post	200 Mmfd.	455	"	600	E	See Note
3	" " "	200 Mmfd.	1500	"	1500	F	Set Osc. to Scale
4	" " "	200 Mmfd.	1500	"	1500	G	Al'gment of Ant
5	" " "	200 Mmfd.	600	"	600	J	Rock gang & adj. for max. output.
6	" " "	200 Mmfd.		"		FG	Repeat 3 & 4
7	" " "	400 Ohms	18000	S.W.	18000	K	Set Osc. to Scale
8	" " "	400 Ohms	18000	S.W.	18000	L	Rock Gang & adj. for max. output.
9	" " "	400 Ohms	6000	Police	6000	N	Rock Gang & adj. for max. output.

NOTE: If receiver is used in location subject to code interference adjust wave trap (E) for minimum interference with antenna connected and receiver operating in broadcast band.

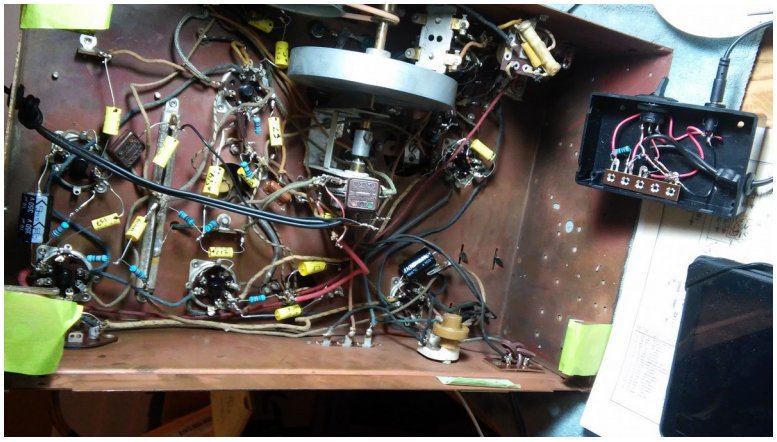
This image shows the assortment of test equipment I used consisting of mostly vintage Conar kits from National Radio Institute (NRI).

A Simple Modification for MP3 Player Input

I found a neat mod for the Zenith on a YouTube video (https://www.youtube.com/watch?v=j8YeJ0T3DpI) that would allow for playing an MP3 player, smart phone or any other source with a headphone output on the radio. Someday, AM will be obsolete but the radio can still be played by this means. More detailed information showing schematic modifications for this and for a 6E5 tube to replace the 6U5 are provided further down.



This shows the MP3 input mod wired into the radio, and some testing showed it to be working well. This modification is described in detail further down.



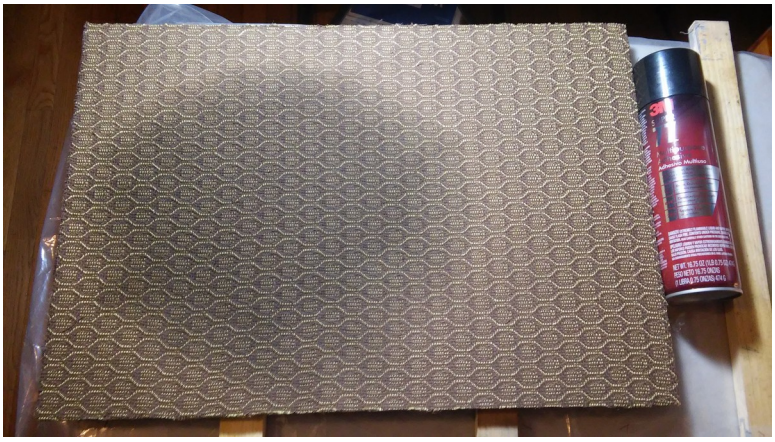
Replacing Broken Control Buttons

Several push/pull buttons were missing or broken. The broken tone control buttons were a problem because they were glued or molded onto phenolic stems, tough but breakable. I found it easy to gingerly grind off the top of the buttons with a coarse sanding drum on my Dremel tool, stopping on first sighting of the phenolic board. The bottom half of the button then practically fell off on its own power.

I glued the replacement buttons on with clear epoxy, but care has to be taken here! The replacement buttons were good quality but didn't quite fit onto the phenolic when I test fit them. They had to be enlarged slightly with appropriate drill bits until they fit smoothly. I sourced replacement buttons and knobs from Renovated Radios LLC (renovatedradios.com).

Speaker Cloth Replacement

Now that the speaker board glue had dried fully, I turned my attention to the speaker cloth. I couldn't find an exact wave design replacement so I decided to use another Zenith design of the 1930's that I liked better. It is Zenith Gold, rayon and cotton. The seller said that it is difficult to capture accurately with the camera and I found that to be very true. It is much better looking than any photo I have seen, including my own.



In this photo, I have just attached it to the board with a heavy coat of 3M Super 77 contact adhesive. This stuff grabs immediately and permanently! I made practice runs without adhesive. I didn't dare to just lay the cloth on because the adhesive was so unforgiving. So, I rolled the cloth onto a length of 1-1/4" or 1-1/2" PVC pipe and then practiced unrolling it onto the board until I felt confident. Happily, I got it nearly perfect on my first attempt. If I remember correctly, I trimmed with scissors after installing.

The dark area on the cloth is dark because I had just lightly misted both sides of the cloth over the speaker opening. The resulting shrinkage almost immediately removed all sag and tightened the cloth over the opening.

This is the finished board, and the real colors are much more vibrant than the photo shows.

Stripping and Repairing the Cabinet

This is a view of the bottom, right (as viewed from the front), rear of the cabinet. The left rear was in similar shape. The veneer was pretty decent everywhere else on the cabinet. It looks like these lower back corners took the brunt of hits by wayward feet, vacuum cleaners and whatnot. At this point, I was re-gluing the peeling veneer while I pondered how I would fix this.

This left side view shows the veneer to be in decent shape except for a few chinks here and there. ==>

Another left side view showing most damage to be toward the bottom rear.

The front of the cabinet was in good shape except for a few chips and the veneer on the two narrow center posts was starting to peel.

I spent a lot of time watching Youtube videos about stripping and had a hard time choosing between chemical strippers and simply using lacquer thinner to dissolve and remove the old nitrocellulose lacquer. I opted for the latter since it was the method least likely to damage the wood veneer. If you don't already know, nitrocellulose lacquer doesn't cure as such; it simply dries and can be dissolved again by applying lacquer thinner. The photo shows a gallon of lacquer thinner, a bag of 0000 steel wool, some rags, and a container. That's all thats needed.

Keeping a suitable amount of relatively clean thinner in the container, the procedure goes like this:

1. Submerse a steel wool pad into the thinner;
2. rub an area of about 1 square foot with the wet pad until the pad starts sticking in the gooey lacquer;
3. repeat steps 1 and 2 until the pad no longer starts sticking because most of the lacquer has been removed;
4. wipe the area clean with a thinner-soaked rag; and
5. repeat steps 1-4 until the entire cabinet is clean.

The end result of the above stripping procedure looked remarkably good except for nooks and crannies which the steel wool pads couldn't reach. The solution for that is simple. Use a small, somewhat stiff-bristled brush. Packs of disposable solder brushes are very inexpensive and work well. Solder brushes usually have long horse-hair bristles. To make the brush as stiff as necessary, simply trim the length back with scissors. Keep the brush wet with lacquer thinner and brush out the nooks and crannies. Keep a rag in one hand to wipe away dissolved lacquer.

I decided that replacing veneer was beyond my capabilities so I started filling missing chunks with a stainable wood filler. As it turned out, large areas like this were simply not going to look good. A better solution was to make some kick/scuff plates as described a little later.

Small areas like this were barely noticeable after staining and refinishing.

The veneer on the vertical bars in front of the speaker was delaminating in several areas. The Gorilla wood glue was much too thick to work with here but thinning solved the problem. We give our alpacas monthly shots and, therefore, I had a number of syringes with needles on hand. I thinned the wood glue to an appropriate consistency and trimmed the needle back to a shorter length to eliminate flex. The syringe worked very well for injecting the thinned glue into the narrow gaps.

Clamping the vertical bars with 1x2 wood and waxed paper.

I mentioned earlier that wood filler wasn't going to look good over large areas. It seemed to me that Zenith would have been well-advised to install scuff plates on the bottom, rear of the sides because vacuum cleaners and what-not seemed likely to damage these areas. For me, it also seemed like a good solution for covering the missing veneer and protecting against future damage. I think my home-made scuff plates look good.

Some sections of the cabinet such as the top corners, side ledges, and the base were apparently finished with a dark, brown-toned lacquer. After stripping, I decided I liked the natural wood color better except for the base which didn't have a nice color after stripping. Rather than using a toner, I stained the base with Varathane dark walnut stain.

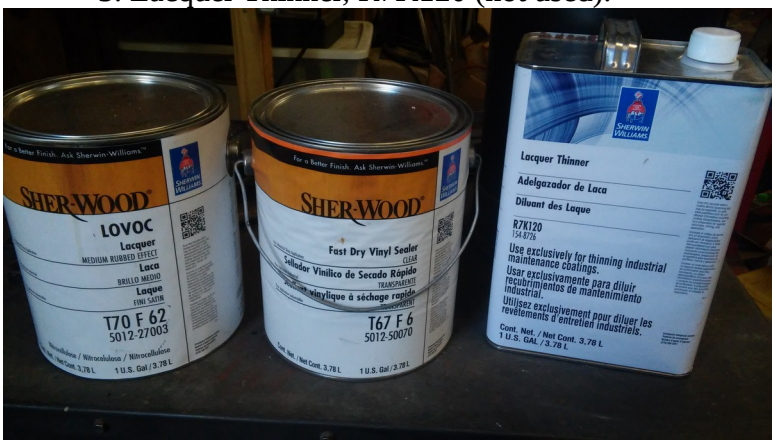
For your information, if you like the original Zenith brown tone as described above, Behlen makes an Encore Brown, Guitar Toner Aerosol which is highly regarded by the DIY guitar community. It looks to be a good color match and can be made as light or dark as necessary by applying thin coats. It's also nitrocellulose based and should be compatible with other nitrocellulose lacquers. I didn't buy any but this is what I would have tried if I wanted the original trim color.

I sourced decals from radiodaze.com, item number DCL-ZR4. I sprayed a coat of vinyl sealer before applying the decals. After careful application, I decided to apply protection over them before spraying the final lacquer coats. I had tested some of the letters I wasn't using and found that a heavy coat of lacquer spray can cause them to bubble or peel. I had a can of Testors Dull Cote that I bought in the early 1980's. Yes, really that old. I sprayed several very light coats until I felt the decals had adequate protection. The Dull Cote was literally invisible.

I sprayed 2 finish coats of lacquer and the photo shows the final result.

Shown below are the Sherwin Williams products I used; the lacquer is nitrocellulose as described earlier. I found that they are a favorite of many DIY guitar people, and best of all, the prices at a Sherwin Williams store were much less than the prices for inferior products at the big box stores. I have a big compressor and some inexpensive spray guns I picked up at Costco, and I sprayed full strength so I didn't really need the thinner. The products are:

1. SHER-WOOD, Fast Dry Vinyl Sealer, clear, T67 F 6 (first coat);
2. SHER-WOOD, LOVOC lacquer, medium rubbed effect, T70 F 62 (second and third coats); and
3. Lacquer Thinner, R7K120 (not used).



Testing the NOS 6E5 Tube

It was now time to test out a couple of NOS (new old stock) 6E5 tubes I bought to replace the weak 6U5 tube. I opted for the 6E5 because they seemed much brighter than even an NOS 6U5, and I got them for a much lower price. The reason I opted for this tube was the brightness evidenced in this 6E5 tube video: https://www.youtube.com/watch?v=kgm6Kwi24KA.

In order to use the 6E5 in place of the 6U5, a modification was required. This photo shows an adapter I mounted in the back of the cabinet for playing either the radio or an external source such as an MP3 player. It also shows the side of the chassis where I mounted a switch for the magic eye tube, for either an original 6U5 or the replacement 6E5. More on this later.

This is the installed magic eye tube switch which allows for either the original 6U5 or the newer 6E5.

This is a test of the nice-and-bright 6E5 tube with no input signal (fully open).

This is a test of the 6E5 tube with a strong input signal (fully closed).

Installing the Chassis and Finishing the Radio

The chassis is finally installed in the cabinet with the tube shields in place.

A backside view of the installed chassis and speaker.

These are two views of the finished radio---looking pretty good in my opinion.

Additional testing was performed on the radio at this point. The AM broadcast band and both shortwave bands were found to be working flawlessly, and the magic eye tuning tube was performing brightly and accurately. I mentioned earlier that I had aligned the radio circuits using a vintage Conar digital signal generator, and the tuning pointer proved to be always right on the mark.

The most exciting result, however, was the quality of the sound when playing an external input source. I used a Sony Walkman portable for playing FM stations and found that the power amplifier of the Zenith produced astounding audio on the original 10 inch speaker. If you watch the video mentioned at the beginning of this document, I think you will agree.

Because our house has coal and wood stoves for heat, 2 dogs, and 3 cats, it is a rather dusty environment. Therefore, I made a dust cover for the back side of the radio to keep the innards clean when not in use. It simply lifts off when I play the radio. I cut some air holes but I doubt the radio would stay cool enough with the cover in place.

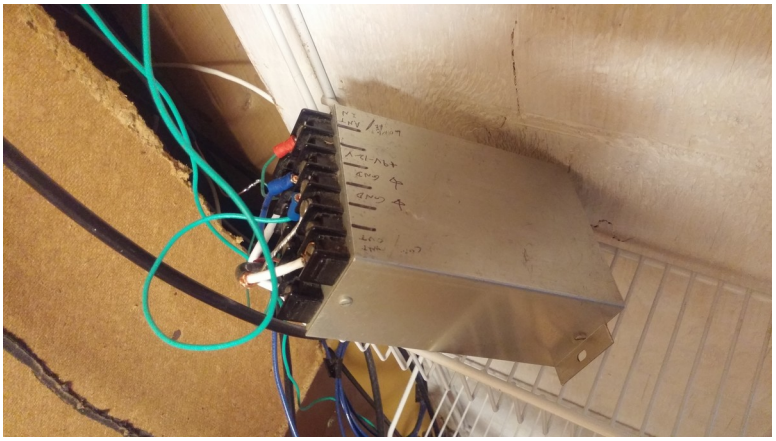
A view with the dust cover lifted off. Note the wire guide at the base to make reinstalling the dust cover easy.

Antenna and Antenna Preamplifier

A view of the antenna connections. I have a shorter-than-recommended long wire antenna in the attic. Because of our noisy electrical environment, I had to bring the signal down through a 100 foot 75 ohm coax cable. And then, because the cable was apparently a lousy impedance match to the long wire antenna, I didn't get a usable signal at the radio. So, I experimented with antenna amplifier circuits I found online that worked with AM broadcast. Unfortunately, these all failed due to saturation caused by stronger electrical interference. I then resorted to designing and making my own noise-tolerant antenna amplifier which works well. More on that later.

This is power for my antenna amplifier. The transformer is an old-fashioned transformer type ac-dc adapter wired into a 9V regulator circuit in the plastic box. Newer switching-type adapters don't work here because they inject too much noise into the amplifier. That's the nature of switching-type power supplies.

My home-made antenna amplifier sitting in a second-floor closet.



Miscellany, Removed Parts

All of the capacitors, resistors, and some of the other hardware removed from the radio.

Knobs, push-pull buttons, chassis cushions and other miscellaneous stuff removed from the radio.

The old 6U5 tube, an empty 6E5 tube box, and a box with a spare 6E5 tube.

A few spare tubes.

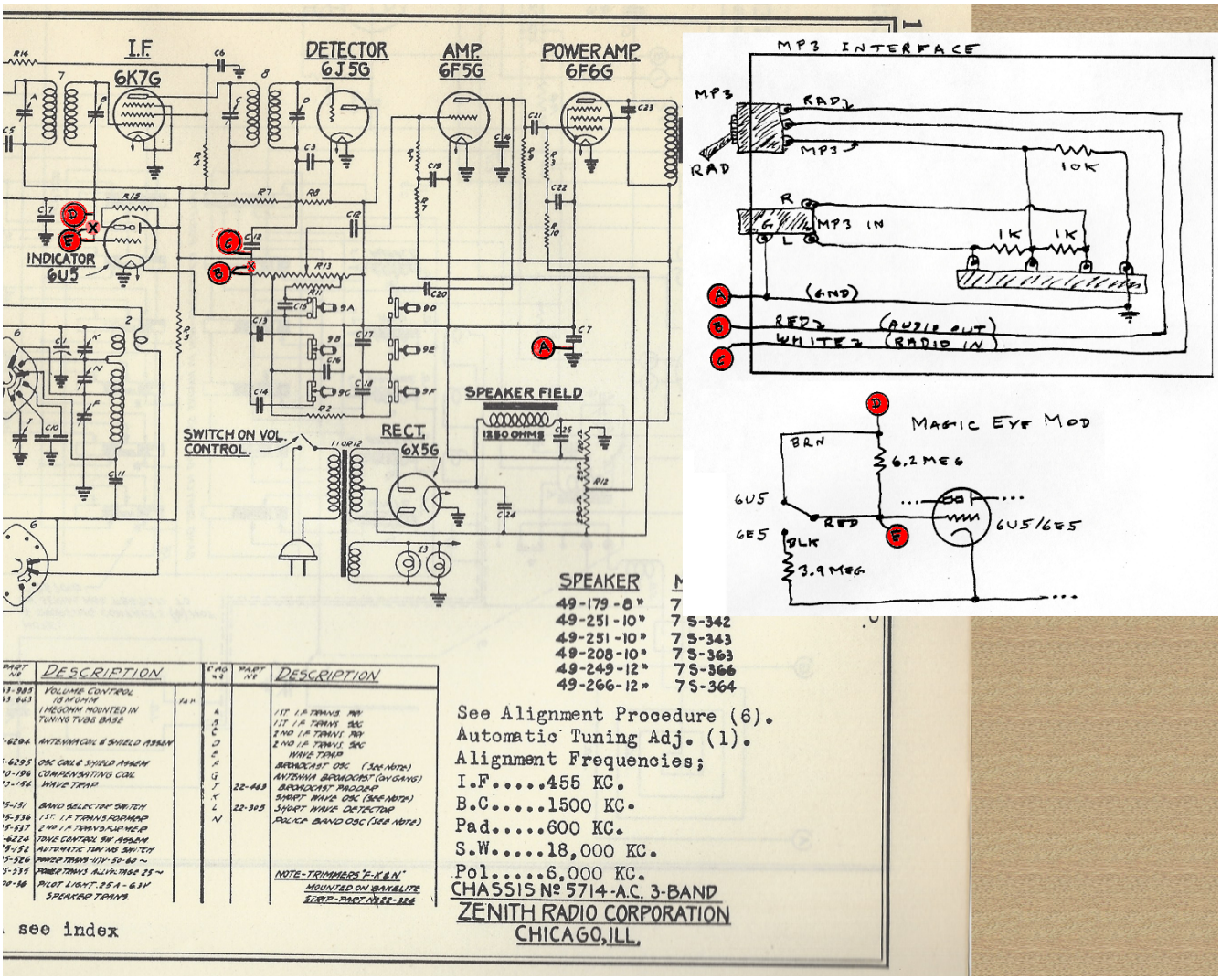
Details on Modifications for MP3 Input and 6E5 Magic Eye Tube

In the image below, you will find a section of the Zenith 7S363 schematic showing my modifications for an MP3 player input and switchable modifications for using a 6E5 magic eye tube as an alternate to the original 6U5 tube.

First, for the MP3 input, the audio signal wire to the volume potentiometer is broken between points C and B, and the two wires are routed to the input source switch box. In radio mode, the source switch simply reconnects points C and B. In MP3 mode (or for any device with similar audio output), the input stereo channels are combined passively into a mono signal which is routed to point B. It should be noted that there is a bit of a sneak path for radio audio into the other end of the volume

control from the 6J5G detector circuit. Therefore, to play an MP3 source cleanly, the radio should first be tuned to a silent zone. One of the shortwave bands usually provides suitably quiet zones. And finally, as noted earlier, this modification is not of my own making. It is exactly as described in YouTube video at https://www.youtube.com/watch?v=j8YeJ0T3DpI.

Finally, for using an alternate 6E5 magic eye tube, the AGC control voltage at point D which normally connects directly to the grid of the magic eye tube at point E, is instead routed through a voltage divider circuit consisting of a 6.2 megohm resistor between points D and E, and a 3.9 megohm resistor between point E and the cathode of the tube. The alternate 6E5 tube is almost identical to the 6U5 tube except that it is more sensitive to grid voltage changes.

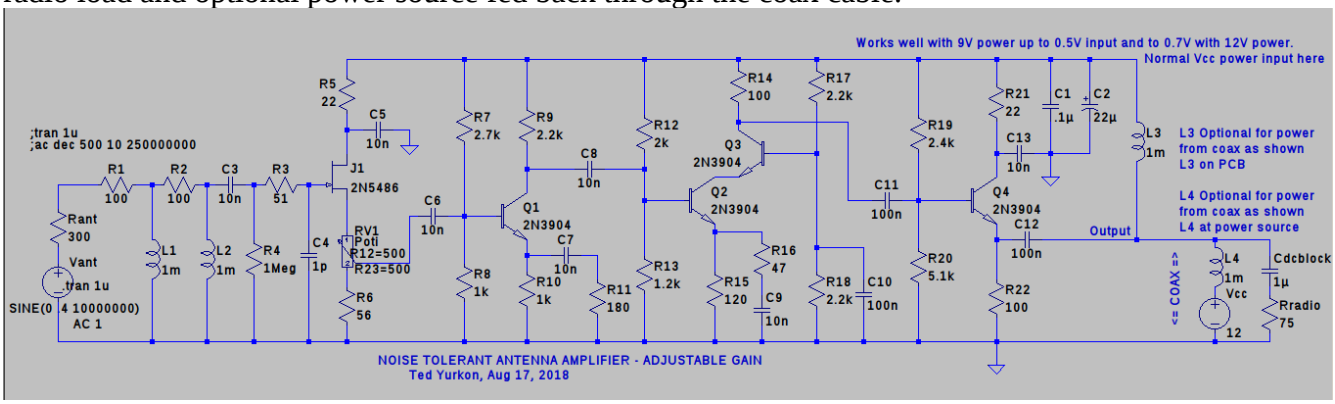


My Antenna Amplifier Schematics and PCB

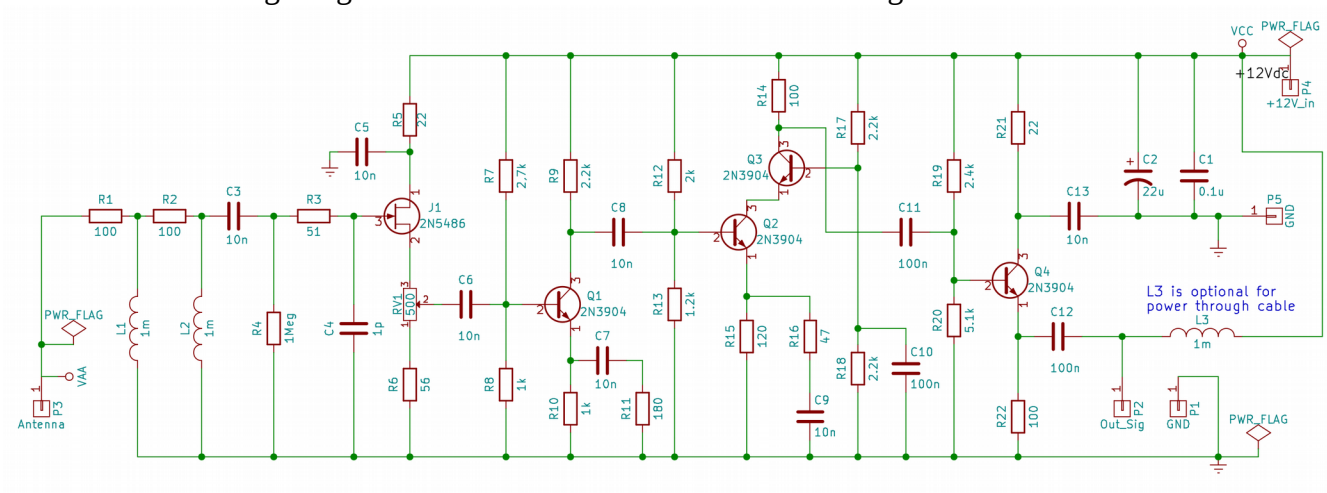
My antenna amplifier was briefly described above but schematic diagrams and PCB board images are provided here. My goal was to provide an amplifier of manually variable gain so that it could be adjusted to local environmental requirements. Additionally, I wanted it to attenuate signals below 500 kHz and above 30 MHz, essentially the tuning range of the Zenith radio. Because the most significant noise in our home was low frequency, I designed the amplifier with a second order high pass filter to strongly attenuate low frequency noise below 500 kHz. I further decided to use inductor coils in the high pass filter, thinking that shunting low frequencies on the long-wire antenna to ground would forcefully damp low frequency oscillations on the antenna. I added a first order, capacitive, low pass filter to attenuate noise above 30 MHz. The circuit features a high impedance input for a long-wire antenna and a low impedance output for a 75 (or 50) ohm coax cable.

I used the freely available LTspice circuit simulator to perform test simulations the circuit design. This excellent simulator was downloaded from https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html. I used KiCad to design the printed circuit board (PCB). Many Linux distributions include this software in their repositories. Alternately, and for other operating systems, it can be downloaded from http://kicad-pcb.org/. Most components are of a generic nature and can be sourced from many places. The gain control RV1 is a Bourns 3296 Trimming Potentiometer or equivalent.

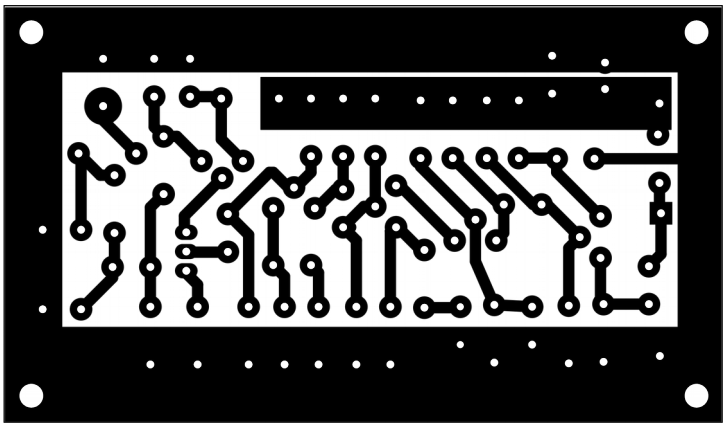
The following image shows the LTspice schematic I used for test simulations. Note that Vant and Rant on the left side of the schematic are not part of the amplifier. These were added to simulate an antenna input signal. Similarly, everything to the right of the COAX notation is added to simulate a radio load and optional power source fed back through the coax cable.



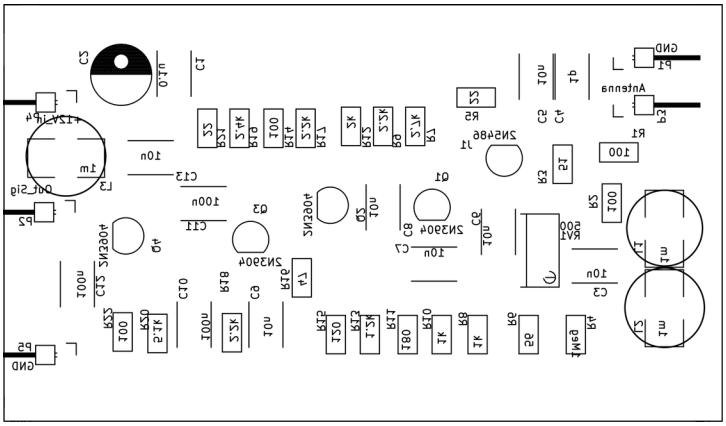
The following image shows the KiCad schematic used to design the PCB.



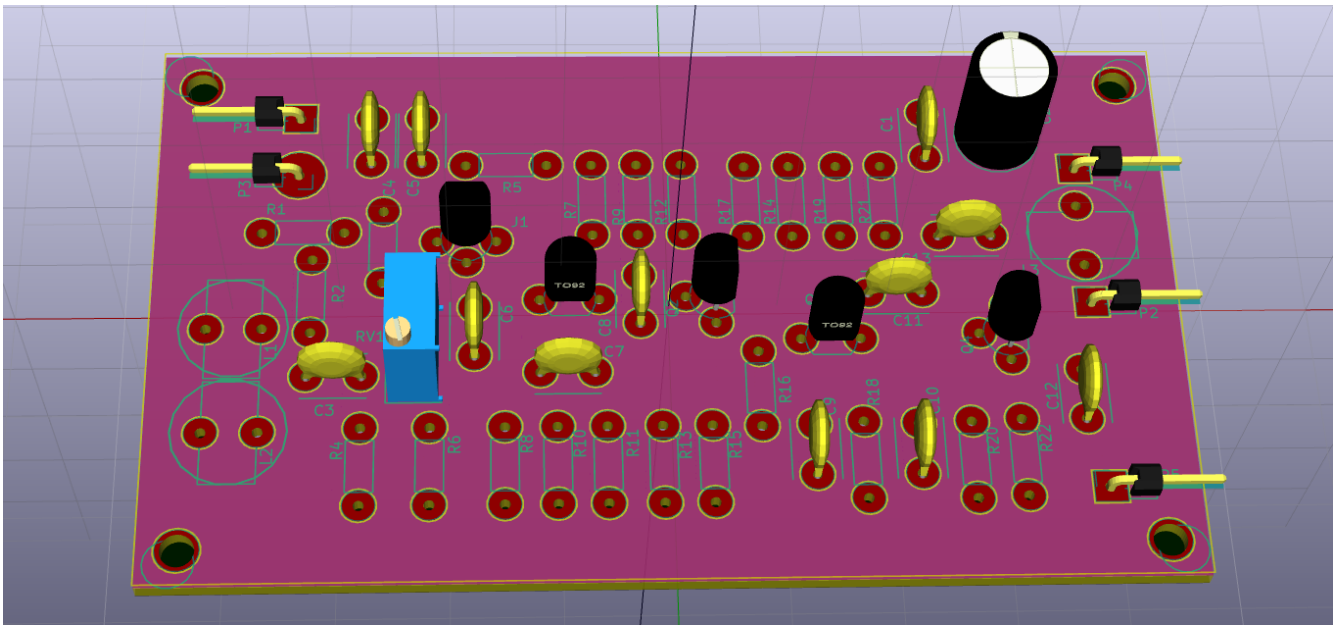
The following is an image of the PCB copper side. The dimensions of the PCB are 95 mm by 55 mm.

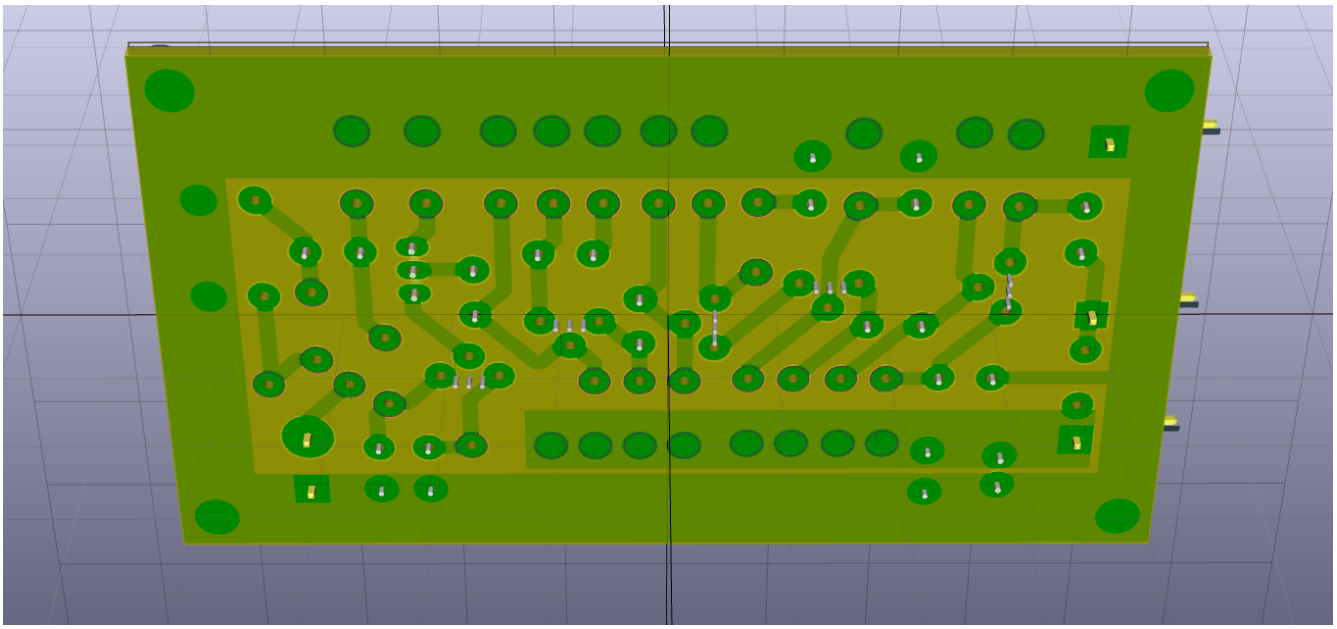


The following is an image of the PCB silk-screen side of the board.



The following images are enlarged top and bottom Kicad 3D views of the PCB.





The End - but Hopefully the Beginning of Years of Enjoyment