

K9YQQ AM Transmitter Project

The idea to build started 60 years ago but I never followed through. Now that I'm semi-retired, I have decided to build it.

Obtained from EBAY a sick Viking Ranger and fixed it up. Eliminated the first two audio stages and am feeding the phase inverter with a Berringer Ultra-Voice. This gives me a handle on response and level control. The guys tell me it sounds good.

I have decided to use Russian 6I7Bs in the transmitter. Two in the modulator and two in the modulated RF amp. The tubes are cheap (\$25 each) and the sockets are reasonable (\$50 each), plus I have some experience with them as I put two of them in a Dentron MLA2500 that I'm using in SSB. I do not know of anyone using these tubes in a class C plate modulated configuration. I'm putting on the "coonskin cap" so to speak. I drew up a schematic and started gathering parts.

Jack (K9ACT) provided me with a modulation transformer out of a BC-610. He said it "sings" but I am going to use a mod reactor to keep final plate current from saturating the secondary and I hope this cures the singing. Jack shipped the transformer to me and it got damaged in shipment. The two insulators on the secondary were smashed. The transformer still seems to be OK other than that. K7YOO Skip has told me that he has some insulators and he can "fix me up" so I'm waiting for that to materialize. Meanwhile, I put the broken insulators on the primary center tap terminals where they will only see DC and not any high AC voltages.

Jim (KJ9T) got me acquainted with Bruce (W9OTN) in Valparaiso, IN. Bruce is quite the builder and has accumulated a lot of stuff over the years. I went to visit Bruce and drove home about 400 pounds heavier. I obtained a 175HY mod reactor (71 lbs.), a plate transformer (old pole pig) 2400 VAC @ 3KVA, two 14 HY chokes, four 7uf @3KV filter caps, a B&W 850A pi-net coil assembly, a 375pf Jennings vac var cap, a 4000pf Jennings ceramic var cap, an MB-150 coil assembly for the input, a plate contactor, a DOW-KEY antenna relay, three nice old style 1" pilot lamp assemblies, a couple of insulated shaft couplings, two nice turns counters for the var caps, some feed through insulators and a chassis. What a haul.....

Bruce also gave me a modulation transformer from a KW-1 that has some shorted turns. I will look into getting it rewound and use it in place of the BC-610 transformer later on.

I ordered two 12.6 VAC @ 4 Amp fil XFMRs. I already have an RFC for the plate circuit, an R-145.

I ordered four 6I7B tubes and four tube sockets. I also ordered four meters, RF plate current, MOD plate current, HV and RF grid current.

I built a cabinet out of wood and two closet doors to house everything including the Viking Ranger and the Ultra-Voice. It stands just less than 6' with heavy duty casters.

I still need a bleeder resistor, a chassis for the RF deck, rack panels, two bias supplies, control relays, switches, connectors and misc. other parts.

10/15/2013

The tubes arrived and so did the meters. I had to send one meter back as it wouldn't "zero" properly. I drew up board for the HV PS diode stack. Used as a template and drilled out a 7" x 7" piece of plexiglass for the diodes. Ordered (50) 6A10 diodes and (100) .001uF 2KV caps from EBAY. I'm going to work on the chassis layouts for the modulator and the RF deck. My son Patrick will come over today and help me get the new cabinet I built down the stairs and into the basement. He will also help me carry some of the big iron down the stairs.

Patrick came and the cabinet and all the iron are in the basement. I'm doing front and side views of all the major hardware.

10/16/2013

I finished layouts for RF Deck and Mod Deck. I ordered chassis for RF deck (15 x 17 x 4) and rack panels for RF deck (10-1/4") and Mod deck (8-3/4"). I'm going to use the 12 x 17 x 3 chassis I got from Bruce for the mod deck. The four inch depth on the RF deck chassis allows me to put the MB-150 under the chassis and saves me from creating a shielded compartment on top of the chassis for the grid circuit. 6I7B sockets arrived today. I went to MAI Prime to look for parts and found two 28 vac transformers I can use for bias supplies and some Teflon circular insulators I can stack and use as an air chimney for the tubes. I contacted Bruce KA9EDE because he has two 4uf @ 3KV caps I can put in series to make a 2uf @ 6KV cap for the mod xfmr return to ground. No deal

has been made yet.

10/17/2013

I fabricated stand-offs for the sockets so as to be able to allow pressurization of the chassis. I mounted the two GI7B sockets on the Mod chassis along with the fil. Xfmr. Took PIX. Bruce (KA8EDE) shipped the two caps today. The replacement 0-1A ma meter came today and so did the high current diodes. Ordered more stuff from Mouser, relays, HV wire, relay sockets, 2.5mh choke, SO-239 chassis mount connectors.

10/18/2013

Built the HV bridge rectifier assembly. Waiting for the HV wire to show up, then I'll RTV all the solder connections to prevent arcing from the cut ends. Took PIX.

10/19/2013

Received the two caps from Bruce KA8EDE. Designed OL protection circuit. Calculated needed inductance on Pi-Net for Q between 10 and 15. I will need to add 5uh coil in place of 10 meter coil for proper operation on 40 and 80. I will not use 10, 15 or 20. 18 turns of #10 wire, 1-1/2" diameter and 3" long.

10/20/2013

Drew up the OL circuit and added to schematic drawing. Ordered OL relays, sockets and shunt resistors. Mod and PA will trip at 450 ma, the PS will trip at 1 amp.

10/21/2013

Received the RF deck chassis and both rack panels late today.

10/22/2013

Plotted full size templates and rubber cemented them to rack panels. Drilled and punched holes for all major components. Took PIX.

10/23/2013

Mounted major components. Made a design change. Now that I have replaced the 10 meter coil with a home brew coil, I can bend it down allowing me to mount the B&W assembly in a vertical position. I also swapped the plate tune and plate load caps for better placement of the HV RFC and bypass caps.

10/24/2013

Mounted RF choke & HV parts, fil xfmr and AC input.

10/25/2013

Fired up the HV power supply. The voltage is high without a load other than the 100k bleeder. It appears that the input choke won't start working until at least 100 ma is drawn from the supply. This will happen when the RF and MOD decks are put into service. The 100k bleeder is enough to drain the caps after shut off.

10/26/2013

Added 110 VAC distribution to the rack and installed main fused shut-off in front.

10/27/2013

Built bias supply for MOD deck and tested. Range with 5K pot is -20VDC to -36VDC. This should be enough range to adjust the two 6I7Bs for approx 80 ma zero-signal plate current. I will put a fixed resistance in for the RF deck bias supply to get approximately -35VDC to the grids in the event of drive failure. This will almost cut the tubes off but it will be well below the operating point of 4 times cut-off when drive is applied across the 2K variable resistance in series with the fixed bias. Little parts are starting to trickle in such as shaft couplings, panel bearings, terminal strips, fuse holders, ceramic insulators, etc.

10/29/2013

Completed bias circuit on RF deck, applied some drive from the Ranger just to see what kind of grid current I could get. I measured 100 ma of grid current with 2 tubes. It looks promising.

Progress from this point is not logged as day by day.

Using the 6I7Bs presented a challenge in that there is no published data for using these tubes under plate modulated class C conditions. I had to interpolate existing tube curves and make some educated guesses based on these interpolated figures.

The time came to try out the RF deck. My first attempt ended with a problem. The R-145 plate choke smoked. I soon found out that the RFC in the MB-150 had a resonant point very close to a resonant point in the R-145. (KABOOM!) I bought an RFC-3 choke from RF Parts and this cured that problem. I also had to experiment with the value of

the capacitor that balances the MB-150 grid tank. The tube specs say that each tube has 12.5 pf grid to cathode capacitance. I used two 10 pf @ 6kv caps in parallel and put two more in series to make 5 pf. I put this in parallel with the 20 pf and everything balanced out as it should. I started out with just the 20 pf and it would not neutralize.

I soon realized that the Ranger was not going to be able to provide the drive I needed to saturate the tubes for proper class C plate modulated conditions. I was pretty upset. Jim (KJ9T) suggested I experiment with something more powerful so I tried to drive the RF deck with my TS-520. The TS-520 provided enough drive to saturate the tubes and I was able to find the correct value for the grid leak resistance. I can load the RF deck to well over 500 ma which brings the plate impedance below the 5k limit for the stock B&W 850A so I restored the assembly to it's original 10 meter coil instead of the additional inductance. The tubes don't do well at the lower power I had anticipated.

Without the Ranger, I needed something to drive the modulator grids. I have an old Crown D-75 broadcast monitor amplifier and decided to use it along with the Ultra-Voice mic preamp. The Crown D-75 only has line level inputs. I am only using ½ of the Crown D-75. The other half is terminated and turned down to minimum. The only thing left was to find a way to get the Crown D-75 to feed the grids of the 6L7Bs. I found that Hammond makes a line of "70v line to voice-coil" transformers. The 117F32 was perfect. It has an 8 ohm secondary and a tapped primary for 2, 4, 8, 16 and 32 watts. The 8 watt tap is exactly the center tap of the entire winding. I fed the Crown D-75 into the 8 ohm winding, I fed the mod bias into the 8 watt tap and fed the grids with the entire winding (common and 2 watts).

I fired everything up and got 100% modulation with about 550 ma of RF PA plate current and about 350 ma of modulator plate current with a 1K tone. The Crown D-75 is running at about 30 watts so it is well within it's limits. If you listen closely, you can hear the modulation transformer talk back to you but it is very faint. I guess keeping the final plate current from flowing through the secondary made the difference.

The high voltage is at 2160 and is rock stable. There is less than 50 volts fluctuation from no modulation to full modulation. Thanks again Bruce.....

I put it on the air on 12/27/2013 and with the help of Jim (KJ9T), Bruce (W9OTN), and a few others, I was able to fine tune the Ultra-Voice to get the audio sounding like it should. I will debut the rig on the AM Forum later today (12/30/2013) and I look forward to many years of enjoyment using this transmitter.

I wish to thank Bruce(W9OTN) and Jim (KJ9T) for all their help, encouragement and resources to get this project from a thought to a finished transmitter. You guys are the best.

Jim Borgioli (BORG)

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