# Yet Another QRP Transceiver (4 tubes, superhet, 2 bands. Incredible, WHAT ?????)

(By Jo, DL1JWA, in 05/2005)

Are you a tube freak? Do you like glowbug homebrewing?
No? Then you should not continue to read ...

After building some QRP transceivers with transistors, ICs like TCA 440, NE 612 and so on I said: Puh, it's boring ...

Springtime '2005 I thought about building a minimalistic QRP tube rig. It MUST glow in the dark !!!!

In magazine "Funkamateur 05/1976" there was published an article about a litte rig called the "UQ2FK Minitransceiver" (translated from in those days Soviet magazine "Radio") .
Originally it was a 80m/40m- SSB transceiver, working with only 4 tubes (it means really: 4 tube envelopes, in sum there are used 7 tubes, 4 pentodes and 3 triodes) , containing a really superhet/SSB exciter working with 2 diode ring mixers and a mechanical filter EMF500. CW was there the "fifth wheel", without TX shift and without sidetone generator. The propagated output should be around 1 Watt.

I was looking for tube replacements: the triode-pentode-combination 6F1P could easily replaced by ECF80 (look at Pollin Electronic in Pförring , for 1 EURO each), the 6J52P (S=55 ma/V, whow !!) by a another very-high-conductance pentode; I tried both the russian 6Ä6P and the E810F (see down the text).

But I'm a "CW man", some modifications should be done to get a suitable CW rig.
At first: I wasn't able to get a russian filter EMF500, and, anyway it has a too broad bandwidth. But I found some old crystals around 500 KHz via EBay, now the BFO/Carrier oscillator and a simple crystal CW filter were a realistic project. I read some articles about WWII-military, Hammarlund- and National-receivers and sections of the Frank C. Jones Radio Handbook to plan such a CW filter.
Second: The SSB exciter amplification tract now was unnecessary, the half tube (triode) section could be better used as a CW sidetone generator.
Third: The original publication contains some errors (RF LC circuit calculation, adjustment procedure ...)
Forth: A TX shift must be provided (by switching the carrier osc crystals).
The thoughts resulted in the actually concept: RX signal way: RF amplifier (pentode), mixer (Si-diode-quartett) +VFO (triode), IF amplifier (pentode), PD (Ge-diode-quartett)+BFO (triode), AF amplifier (pentode).
TX signal way: Carrier oscillator (triode), mixer (Si-diode-quartett)+VFO (triode), PA (pentode), AF sidetone (phase shifter) oscillator (triode).
RX/TX switching is made by 3 DPDT miniature relays.

My PCB design has more details and because of this greater dimensions than the original. I found while testing that the original antenna tuning indicator (glow lamp) wasn't usable, and I replaced it by a small russian anode current meter.
Some used E810F tubes I catched also via Ebay for some bucks.
For the 2 audio transformers I used very small AC power transformers.
IF LC circuits I made with old ferrite "shell" cores.
The band switch is made (similar like in the original TRX) by some mechanical (by special-prepared PCB material) coupled 3 single shifter-switches.

Passing some weekends of working a lot I will now "proudly" present the results:

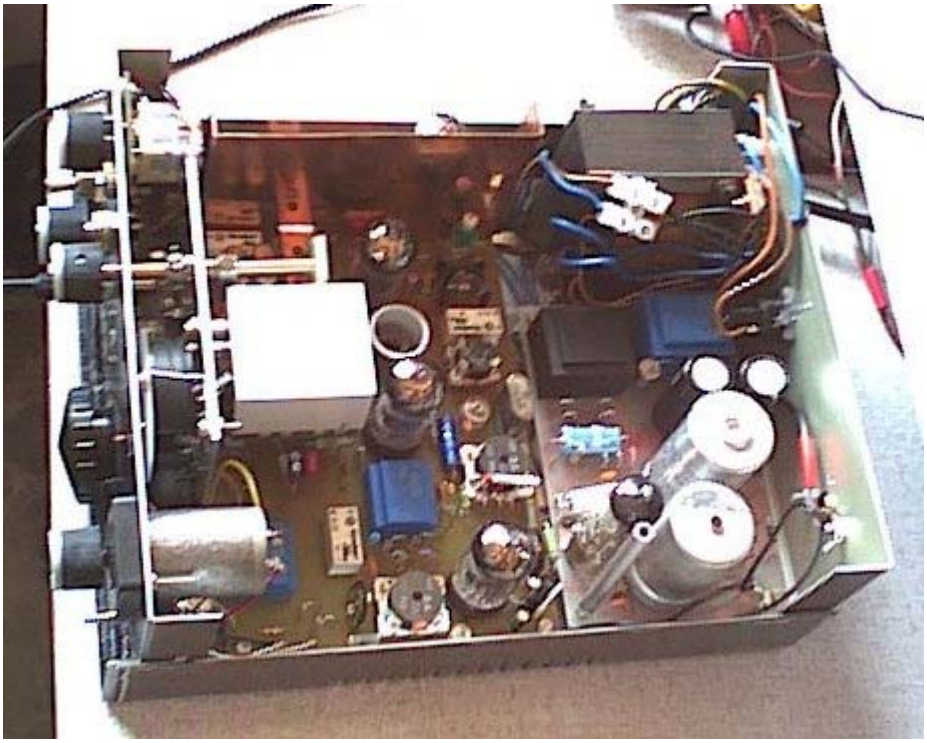
The receiver is working very stable, much better than some regenny. The sensitivity and selectivity is enough for 80/40. The only regulator is the grid voltage potentiometer (handles the RF and IF amp). But you cannot expect wonders with such a simple concept (image rejection on 40 is VERY VERY poor ...).
The crystal filter is adjustable and provides (nearly) single signal reception.
The TX tuning is very comfortable (beause of the transceiver concept); the keying works without remarkable chirps and clicks.
The transmitter reaches the ONE-WATT-OUTPUT only with the E810F (S=50 mA/V) and with high idle current ( 20 mA, total anode current around is 40 mA, that means low efficiency), the russian 6Ä6P (S=30 mA/V) seems to have another RF behavior and deliveres only ~ 200 mW. But notice: the voltage at the PA grid is only around 300 mV...
The adjustment (working point by grid voltage potentiometer) of sidetone generator is very critical, because the triode amplification is low and the feedback voltages are dropped down by the phase shifter network.

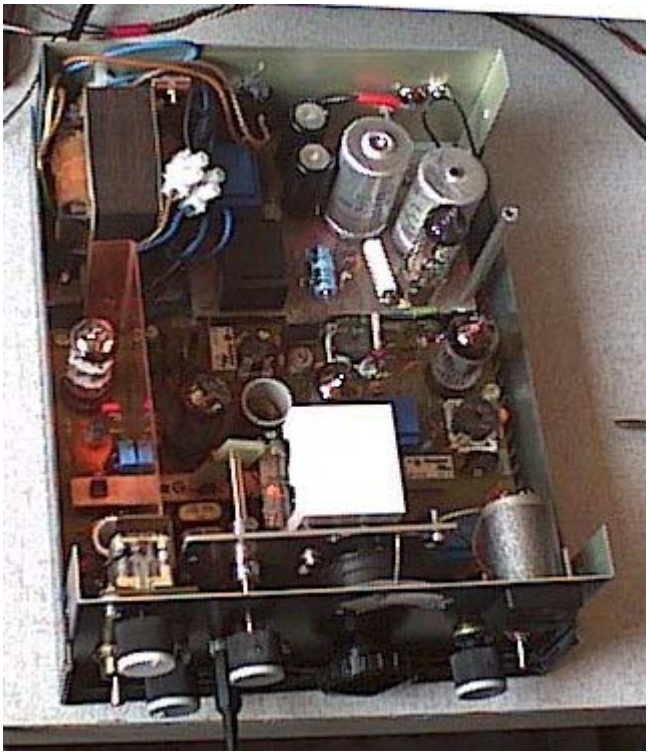
The power supply circuit is mounted on another PCB and delivers +300V, +250V, +150V and -24 V DC for tubes, 6,3V AC (for tube heating) and +6V DC (for relays) .
One additional gas-discharge stabilizer tube is used here for the 150 Volts (to feed oscillator anodes and pentode screen grids). The 4,7KOhm resistor in this part becomes VERY hot.

One amazing fact are the mechanical dimensions: This TRX can be contructed as a really small and neat tube device, my version has only 200x250x90 (mm) in a standard metal case (containing both PCBs and the AC transformer).

But the most exciting fact: The building was making a lot of fun, I was again learning much things more about tube based RF circuits.

Now some pictures of my work:





The schematics are hand-drawn:

schematic diagram of the TRX
schematic diagram of power supply

If you are interested and want some additional informations about this project please don't hesitate to contact me. I can provide originally/my version PCP plans, adjustment instructions, RF circuit calculation Excel sheets, voltage charts and and more.

PS: In 08/2006 I found a link to a very good publication about the original "UQ2FK-Minitransceiver":

http://rumine.donbass.com/~us3iat/radio/1975/angor/angor.htm