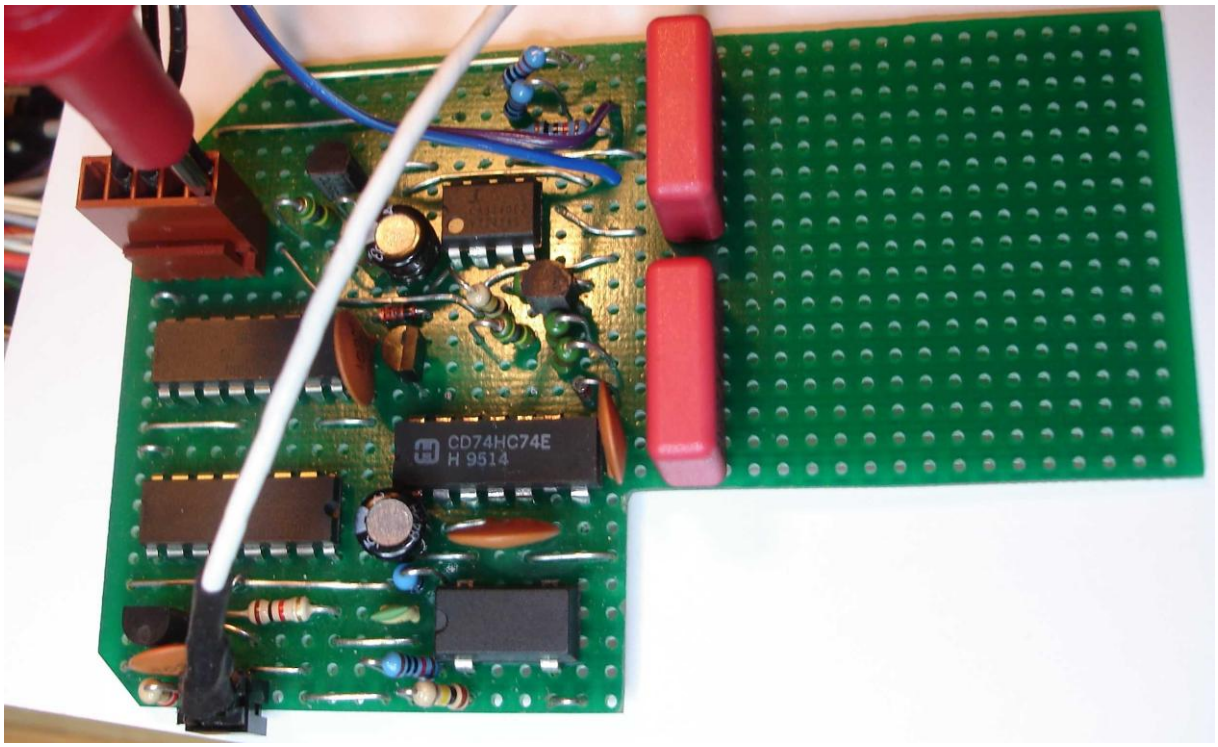
A Huf–Puf VFO stabilizer for the YAESU FT-707



The Yaesu FT707 is a good object to add a Huff Puff VFO stabilizer developed by the late Klaas Spaargaren PA0KSB.

The version of the Huff Puff that I built is the one modified by PA0FRI Frits Geerligs, another Dutch ham famous for his transceiver modifications and homebrew projects.

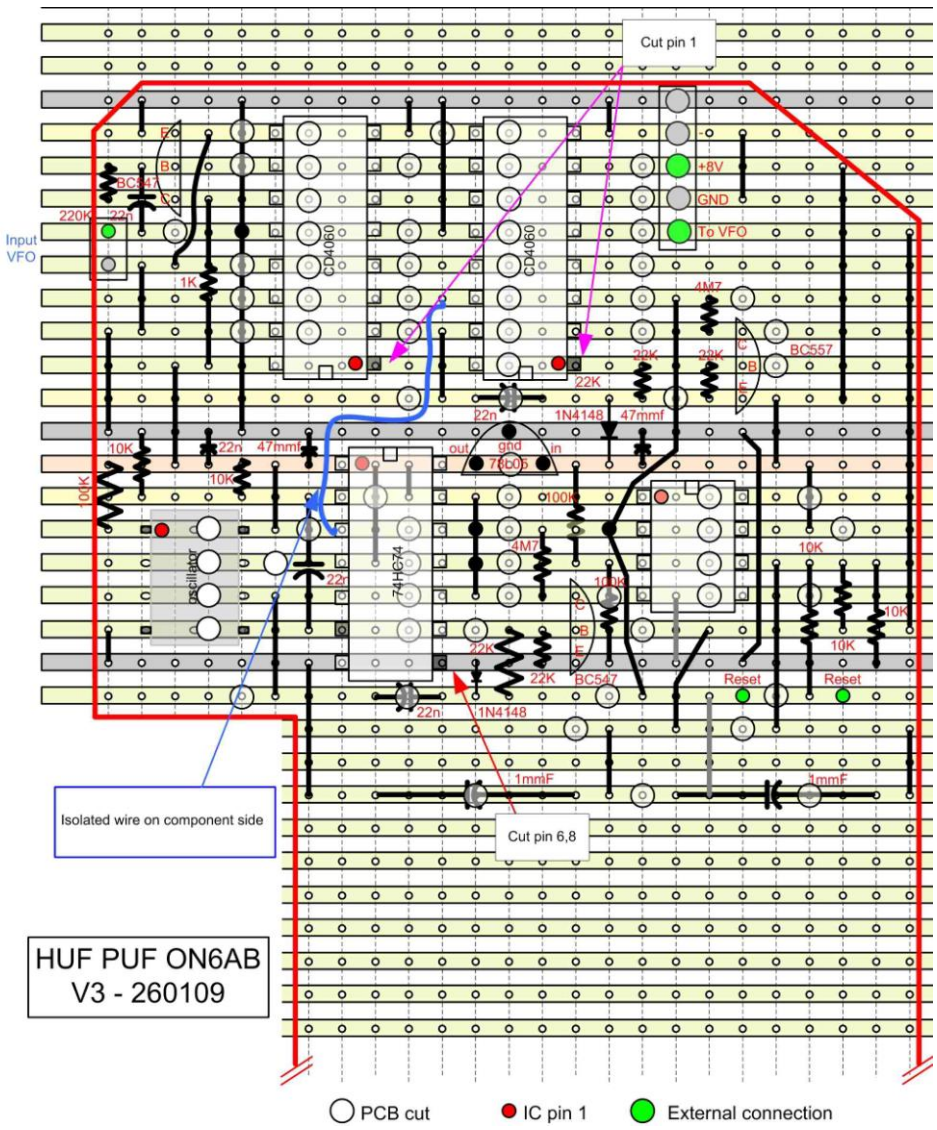
Lay-out issues:

There's not all that much room in the compact FT707. In fact, there is none.

Something has to go to make place for the stabilizer PCB. The obvious victim is the internal speaker. Indeed, the speaker is not all that good. On top of that it is faced to the bottom. The FT707 sounds much better with an external speaker, so out it went. This is the price I had to pay for a stable VFO.

The huf puf pcb was made on a regular stripboard pcb (with longitudinal tracks).

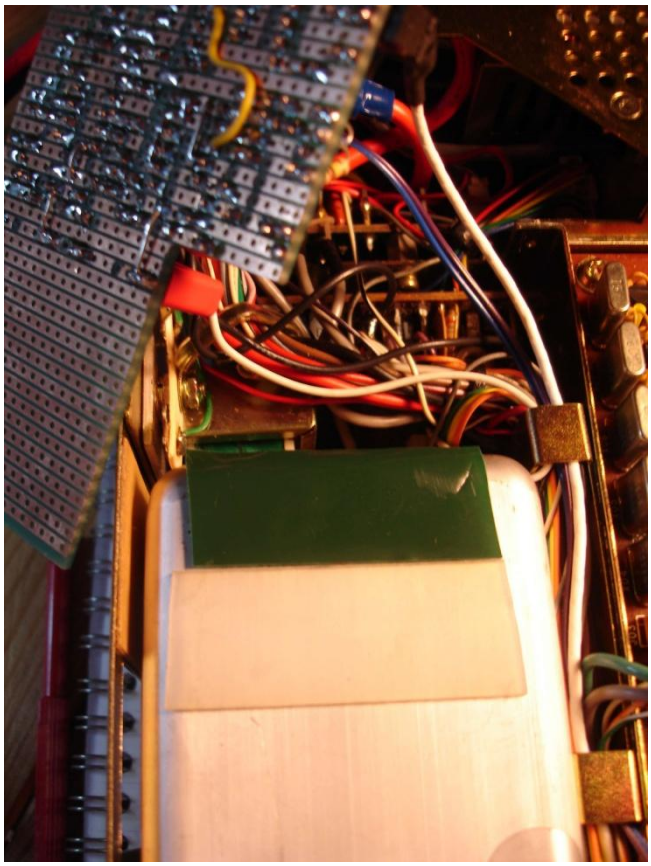
Board lay-out:

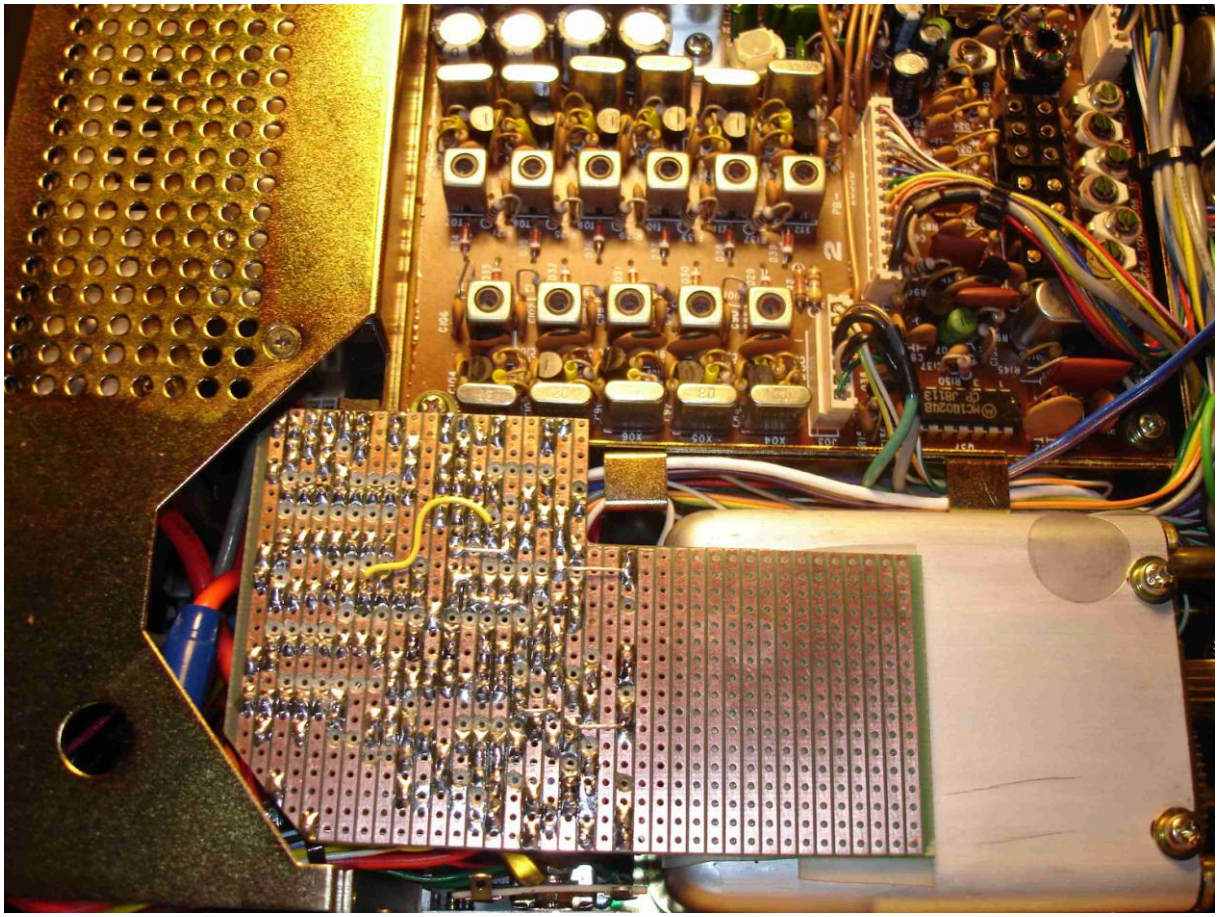


The white circles represent track cuts. Black lines are blank connection wires. Black dots on these lines are through-hole connections. Gray lines are also blank connection wires, but on the other side of the pcb. The yellow wire is isolation. Note the two green dots at the bottom for the reset switch. I don't claim the design to be optimal. Of course you can design your own pcb.

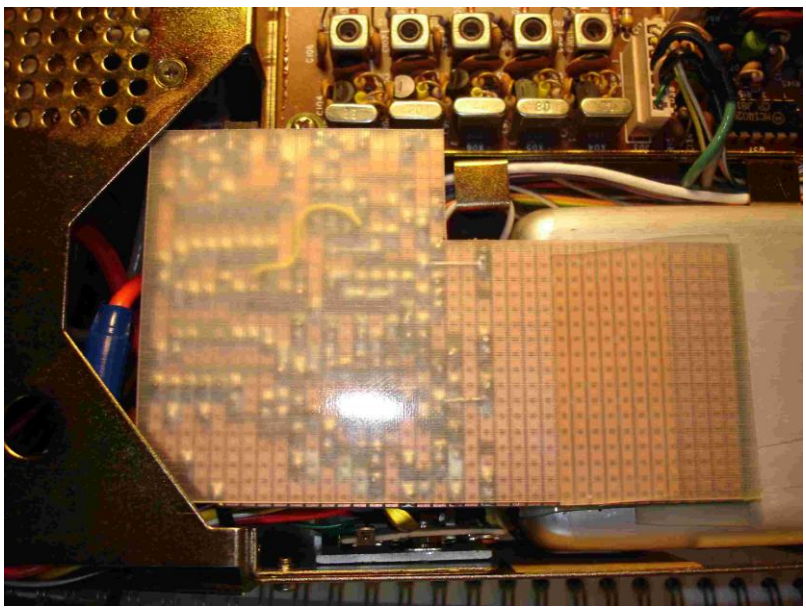
Note also that only the part containing components is shown, not the empty area intended for mounting purposes.

The PCB is mounted upside down on the location where the speaker used to sit. It is fixed with double sided tape on top of the VFO housing.





The stabilizer PCB does not touch the bottom cover at all, but to be safe, I mounted a protective transparent cover, also with a strip of double sided tape.



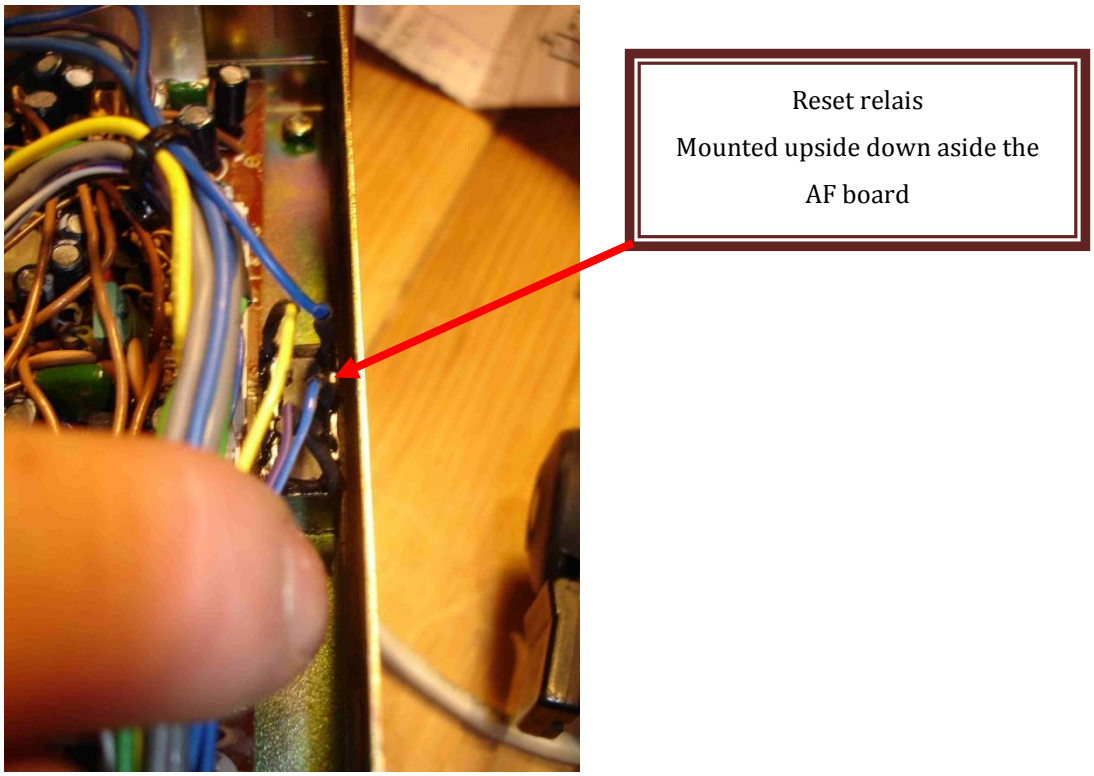
With the double sided tape, the stabilizer is VERY firmly fixed, in fact you will have to take care not to break the pcb if you want to remove it again!

The “reset button” :

I already used the “FIX” button for an “attenuator mod”. This really is a MUST on the low bands so I advise to keep it available for this purpose. Other push-buttons cannot be sacrificed.

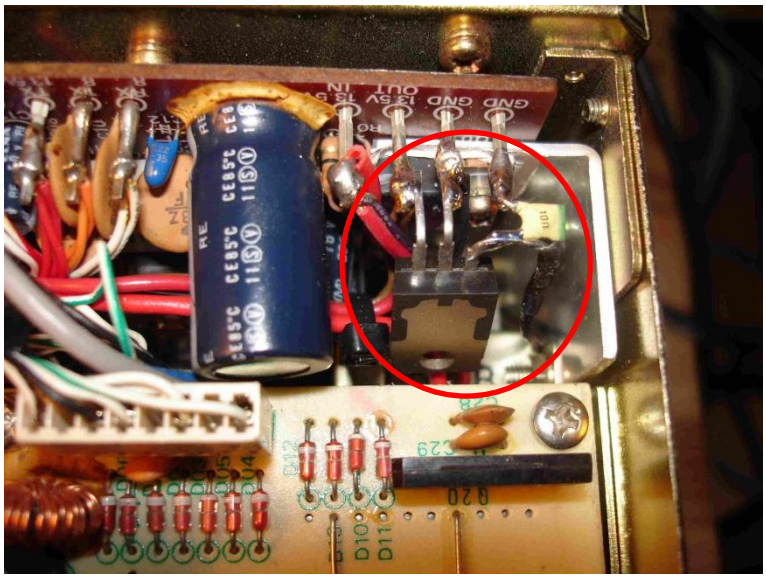
I really hate drilling holes in nice transceiver housings. So the issue was solved by using the “mode” switch. By turning it to the “AM” position and back, the VFO stabilizer is reset via an added 12V relay.

This implies it is not working in AM (as it is continuously reset) but then again, who needs a VFO stabilizer in AM mode?



Signals needed for the stabilizer and where to get them:

- **8V:** Don't use the stabilised 8V of the FT707. It is not stable enough. The stabilizer will jump now and then. Use an extra 7808 stabilizer IC. This can be mounted very neatly on the AVR PCB behind the counter PCB.



- **Ground:** just behind the VFO on the AVR pcb.
- **VFO signal:** NOT on the VFO connector as this is quite fragile. I got it from the underside of the connector on the RF PCB where the VFO signal is brought in and routed it down to the stabilizer.
- **VARICAP DIODE:** I initially used the varicap circuit already there for the clarifier (1S2236). I simply cut the gray wire going from the clarifier pot to the VFO connector and connected the stabilizer to it. This has several advantages:
    - We know this varicap circuit works, so we can eliminate that error-possibility if we should have problems with the stabilizer.
    - We don't have to go into the VFO in order to test the stabilizer.
    - If the circuit works ok with the clarifier Varicap and if you feel you can do without a clarifier, that's the end of the job. Otherwise you can install a new separate varicap for the stabilizer and use the original varicap for the clarifier again so you will have no clarifier alignment issues. This involves opening the VFO unit and some soldering inside. Not very difficult, but a job needing care and precision.

Adding a separate stabilizer varicap:

The varicap:

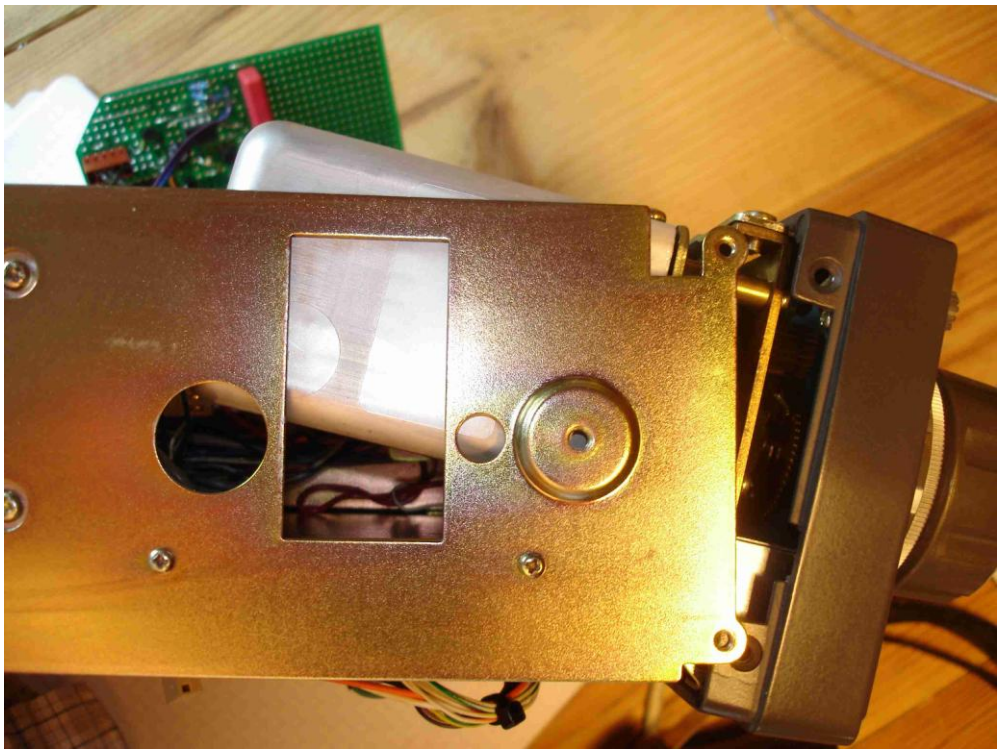
The proposed type in the schematic diagram by PA0FRI is a BB521. Because these were not obtainable at my location, I used a BB205 which has a range of 2pf – 17pf. Because of the lower capacitance values of a BB521, I still think this remains the preferred type.

Mounting the components:

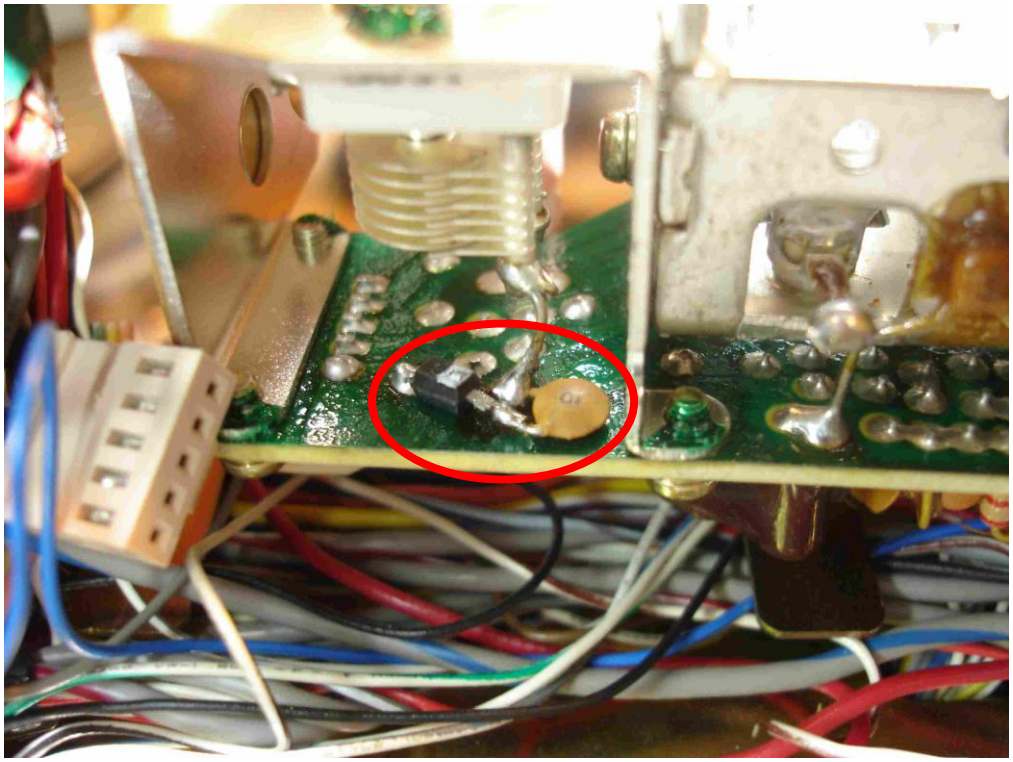
This involves opening the VFO unit. This can be done by :

- Removing the 4 screws fixing the front panel to the rest of the transceiver
- Removing the little strip where the loudspeaker connections are plugged on.
- Remove the connector to the VFO unit.
- Remove the counter pcb and it's base plate.

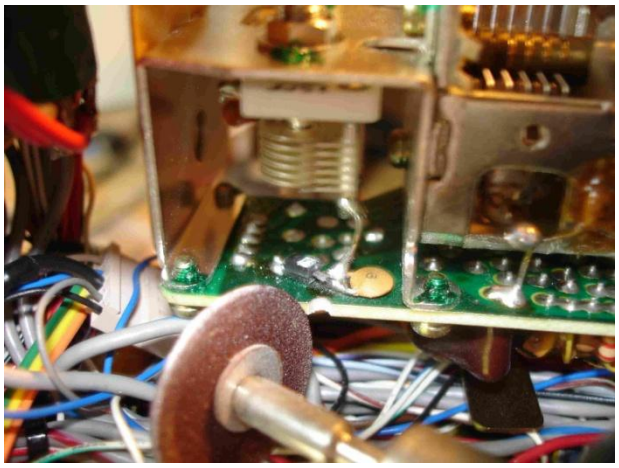
The front panel can now be tilted far enough so the VFO housing can be slid-off after removing the 4 screws holding it.

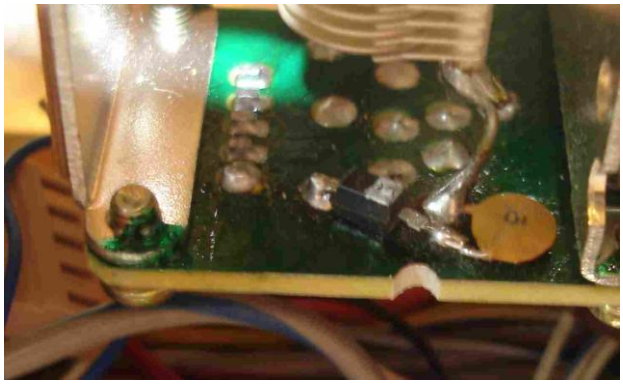


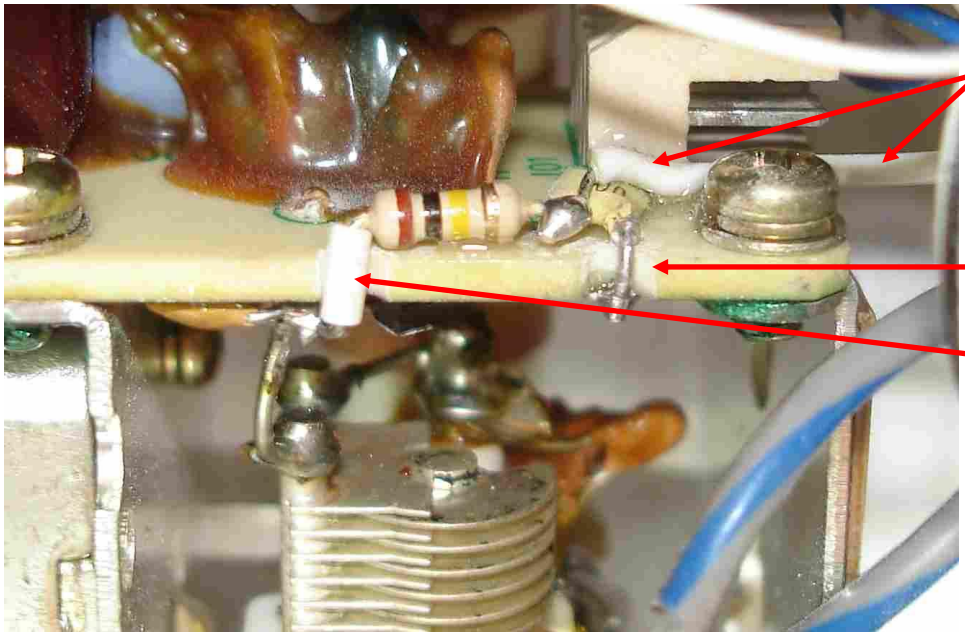
To avoid further dismantling and to disturb the VFO the least possible, the BB205 varicap and the 6pf capacitor were mounted on the foil side of the pcb and connected to the 15pf adjustable trimmer.



The rest of the circuit is mounted at the component side in order to avoid detuning as much as possible. To do so, two little slips are to be made in the side of the pcb to pass the component wires to the other side. With a Dremel tool, this is a quite straightforward job. All added components are glued to the pcb with epoxy glue to avoid any movement. Also the extra wire leaving the VFO assembly is glued to the pcb.







Re-alignment:

After finishing and reassembling the VFO again, the 15pf trimmer need readjustment because of the added varicap capacitance, otherwise the VFO range does not reach the lower part of the amateur bands. This can be done by partly removing the aluminum tape covering the adjustment hole at the side of the VFO.

Also, the main dial need readjustment, this can be done by loosening the screw of the appropriate cog-wheel.

A few critical point for the stabilizer:

- **The 7474 flip-flop IC.:**
  - This has to be a HC or HCT type. HC(T) types have a higher low-level input voltage. If you use other types, your oscillator signal might not go low enough to switch the flip-flop.

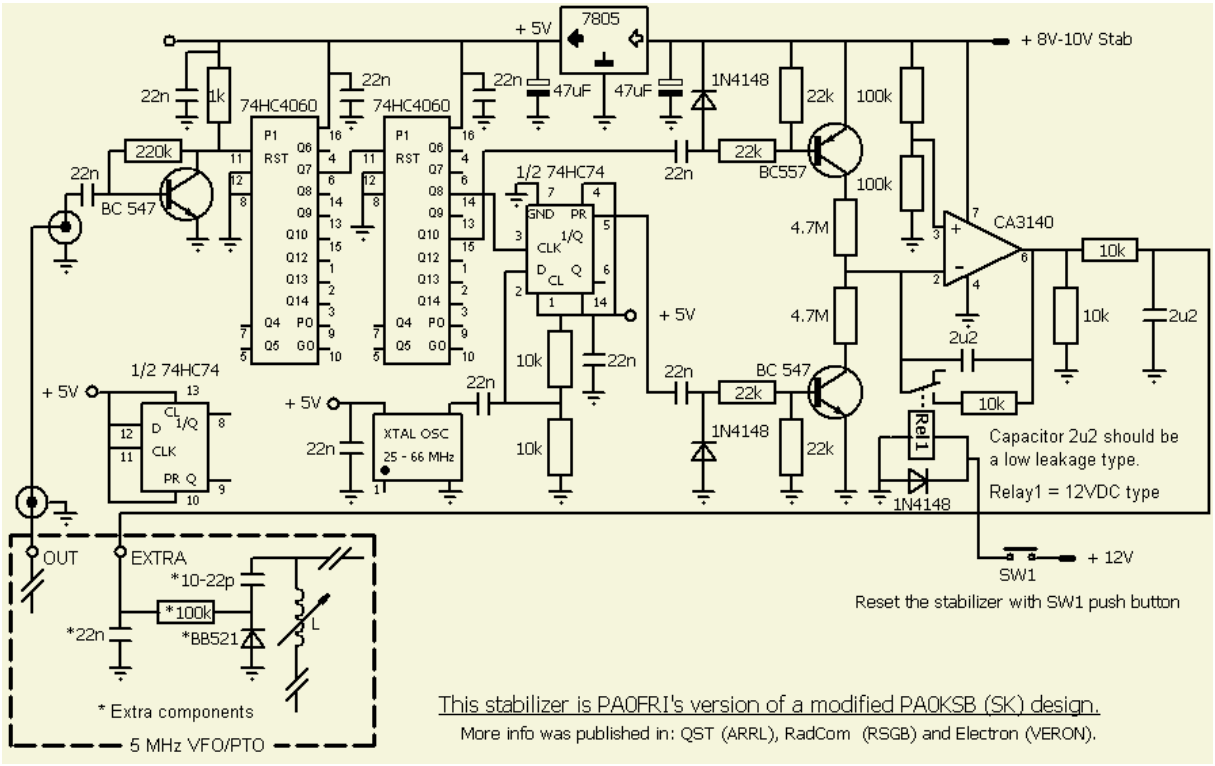
- **The diodes at the base of the BC557/BC547 transistors:**
  - There are some schematics going around on the internet where these are wronly polarized.

- **The 1 microfarad capacitors:**
  - These have to be low leakage. Preferred types are MKM or MKP.
  - 1mmF as in the original design by PA0KSB or 2,2mmF types as in the PA0FRI design both work. The stabilizer is a little bit “faster” when using 1mmF types.

- **The reference oscillator:**
  - As reference oscillator, I used a 48.000MHz chip which I desoldered from an old PC motherboard. The advantages over a regular Xtal oscillator with a coil are obvious:
  - far less RF radiation into the receiver
  - just a single component to mount
  - a tiny footprint
  - no adjustments
  - no fuzz.

Schematics:

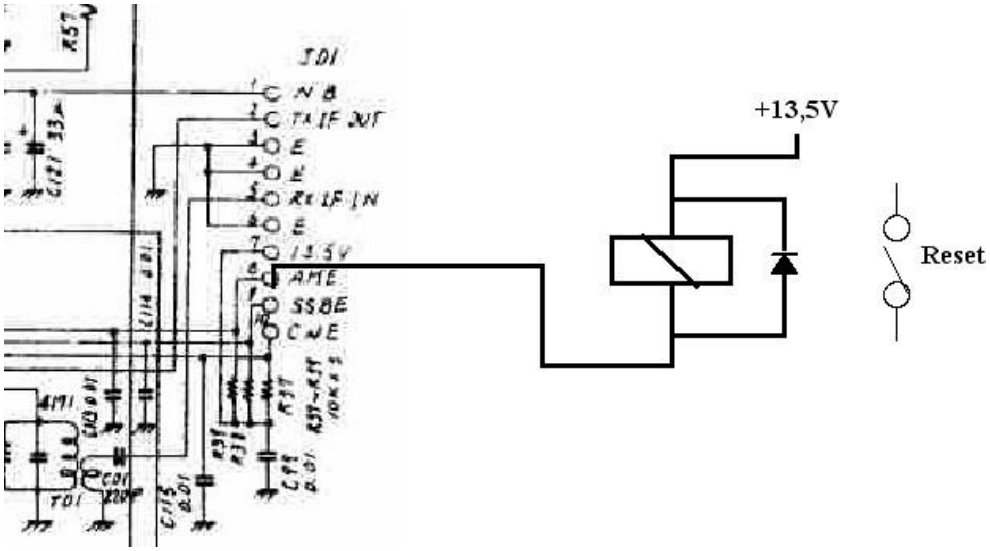
1- Huf Puf circuit diagram PA0FRI:



2- Reset button wiring:

A reset is generated by turning the mode switch into the “AM” position and back again.

Therefore, one end of the relay is connected to the 13,5v on the AVR board, the other end to J01 pin 8 marked “AME” on the IF board . This pin goes to ground when the AM position is selected.



Results:

Obtained results with the VFO stabilizer are amazing.

Before the modification is was simply impossible to do any digital mode with the FT707 because of drift problems. RTTY was barely possible. Drift was in the range of 10Hz/min, especially when the unit warms-up after multiple transmissions.

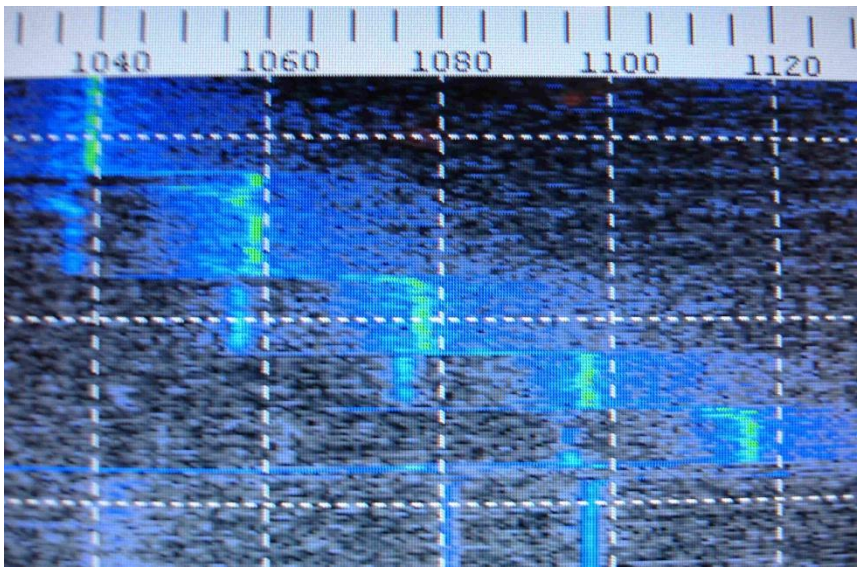
With the VFO stabilizer, the frequency is stable a few seconds after turn-on. It very occasionally jumps a few times (20Hz jumps) during warm-up. After 30 minutes or so it stays put for hours.

The stabilizer needs resetting on very few occasions.

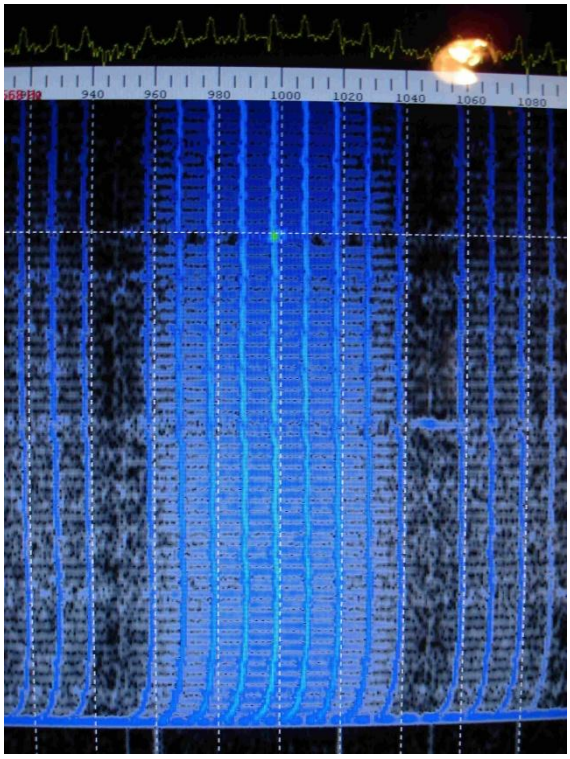
No problems operating PSK, MFSK, Olivia, JT65, or whatever other frequency-critical mode.

Frequency locking steps:

With the FT707 VFO, the 48MHz reference and the used divider settings these are +/- 19Hz.

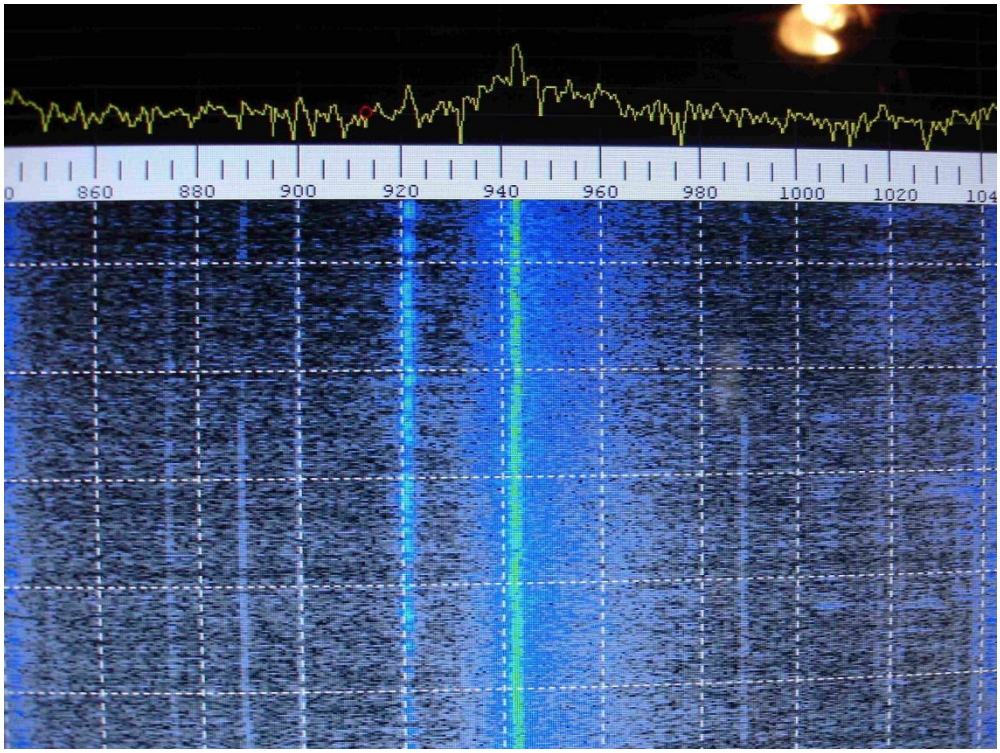


Frequency turn-on behavior:



The initial drift during turn-on of the transceiver (just a few seconds) is visible at the bottom.

Frequency stays put for hours and hours on end:



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