

FT-980 General coverage 2-30 MHz in transmission

This modification is based on a document (dated January 1994) by Ray Pesek WB8NXR. This new and easy modification brings several improvements regarding transmitter harmonics rejection. From 2 to 30 MHz, it uses the right low pass filter at transmitter output instead of the 10 m filter for the whole band.

As Yeasu announced in 80's, transmission out of ham band was possible with a specific AUX BAND ROM; but this ROM never existed during the commercial life of this transceiver! As you can see on the RF unit, there is space for three out of band RF band pass filters. Those filters on the HAM section are switched at the input of the receiver or at the input of the power amplifier (PA).

The PA output low-pass filters (LPF unit) are the only ones to insure transmitter harmonics rejection. The WB8NXR modification activates the 12-10 m LPF for all frequencies from 2 to 30 MHz, but under 15 MHz rejection will not be sufficient even for the latest 60 m band ! The present easier modification adapts the right amateur band output LPF to the general coverage sub band.

Theory of modification:

(Refer to service manual found on <https://www.mods.dk/> or <http://www.radiomanual.info/index.html> , RF unit schematic on pages 193 to 194)

FT-980 uses two sets of RF band pass filters, one for ham band use for Rx and Tx, and one for general coverage (GEN) used for Rx only. During GEN mode, the ham band low pass filters at the output of the PA are deselected. Since the ham band filters pass the transmitter drive signal, the transmitter is effectively inhibited by diode D96 that holds Q01 off. At the bottom left on the RF unit schematic there is one filter for each ham band which results in high out of band rejection.

For general coverage operation there are only six filters used during receive only (shown on top left of the schematic). GEN band and corresponding filters are split into octaves : 0-0.999 MHz, 1-1.999 MHz, 2-3.999 MHz, 4-7.999 MHz, 8-15.999 MHz and 16 to 30 MHz. These sub-bands are obtained from FILT1 to FLT5 binary signals from the CPU at the J11/P58 connector. They are decoded by Q32 for each octave sub-band. Then Q28 and Q29 drive one of the six GEN filters. Note: signal FILT5 is used to differ between GEN mode (high level) and HAM mode (low level).

In HAM mode, the procedure is similar but the CPU encodes the right band on FILT1 to FILT4 (with FILT5 at low level). Only one output of the Q33 decoder activates the selected ham band. These signals activate both one of driver band-pass filter through Q30 and one of the PA output filters through Q31. On the RF unit there are three spare areas for HAM filters, one of these will be used by this modification to pass the Tx driver signal to the PA.

The modification consist in switching one of the PA output low pass filters for each GEN sub band to get the best harmonic rejection. In parallel, the driving signal will be routed to a common high pass filter mounted on the latest spare area of the HAM filters.

Depending on device serial numbers, details on PCB locations may differ.

Parts required:

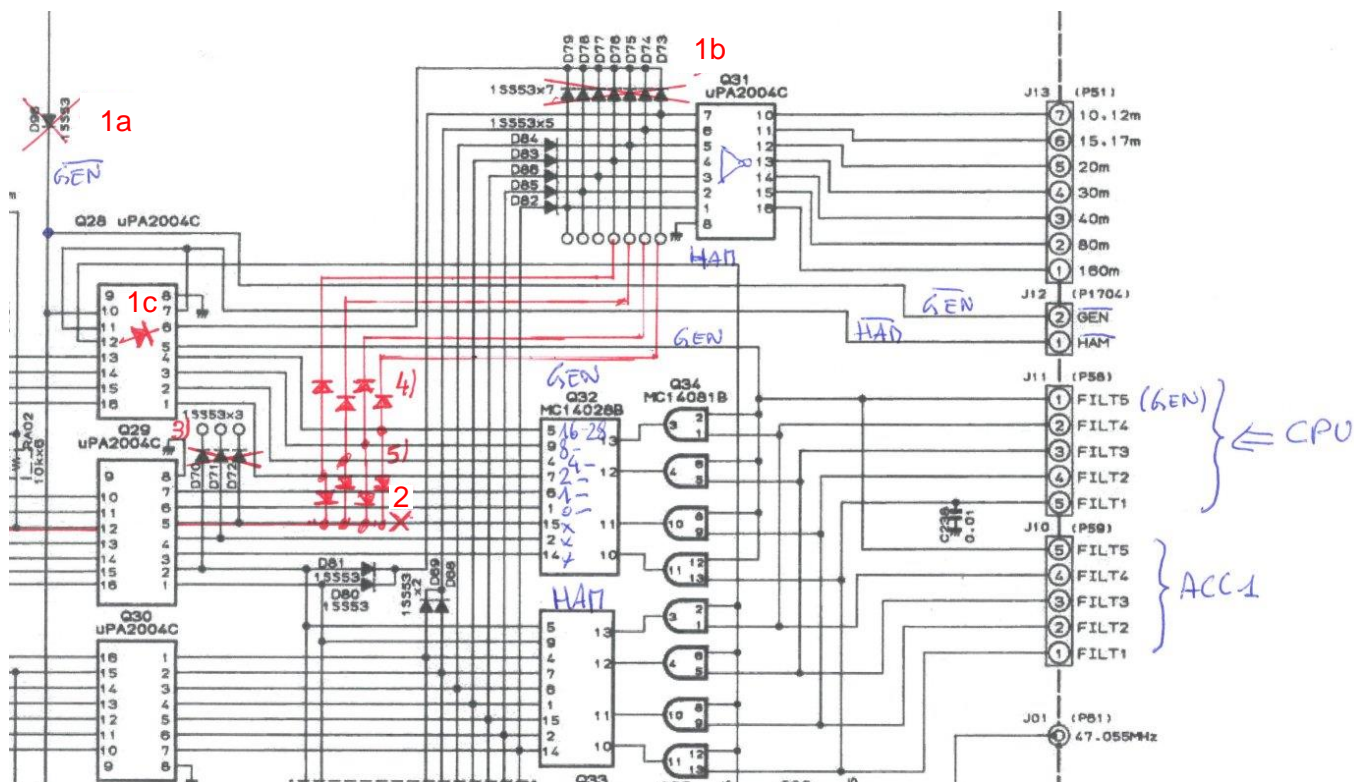
1x 100 Ω ¼ W resistor

2x 10 nF X7R ceramic capacitor, 1x 1,5 nF X7R ceramic capacitor

1x 22 μ F aluminum capacitor or better 1 μ F X7R ceramic capacitor

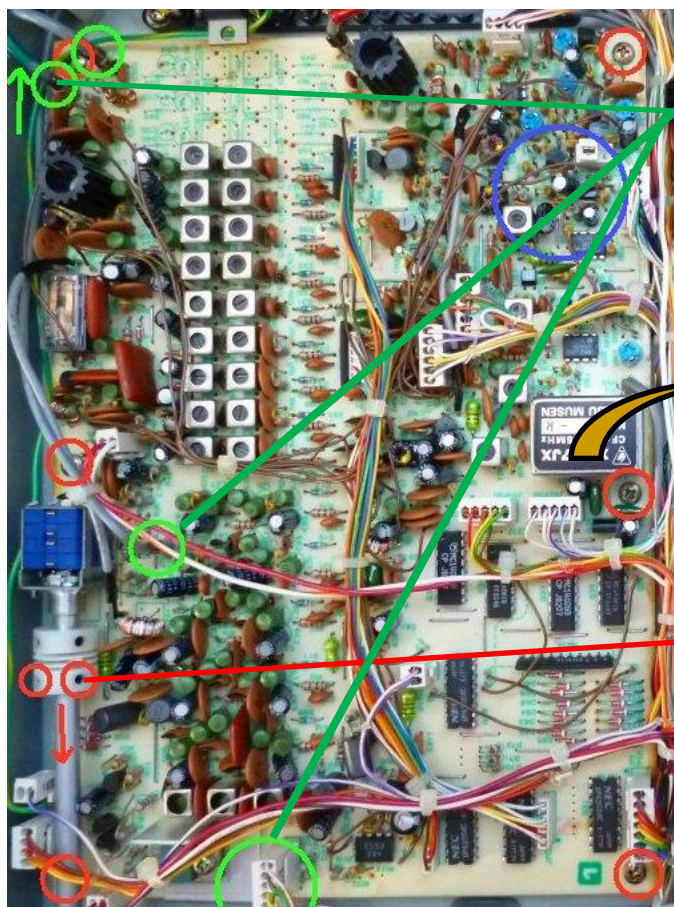
2x 4,7 μ H inductors as in ¼ W resistor format

4x new switching diodes 1N4148 and the removed 1SS53 diodes from the board are reused!



Modification step by step:

- Remove covers to access to the RF unit on bottom. **Unscrew the ATTEN shaft (1).**
- Unplug connectors circled in green on the picture; note well the position of the RF coax at top left corner: **the coax marked in green (2).**
- Remove the six screws on corners and middle. Flip the board to your right so as to have access to bottom.



(2) Coax green sleeve and connectors

Flip the board

(1) Release RF ATT Shaft

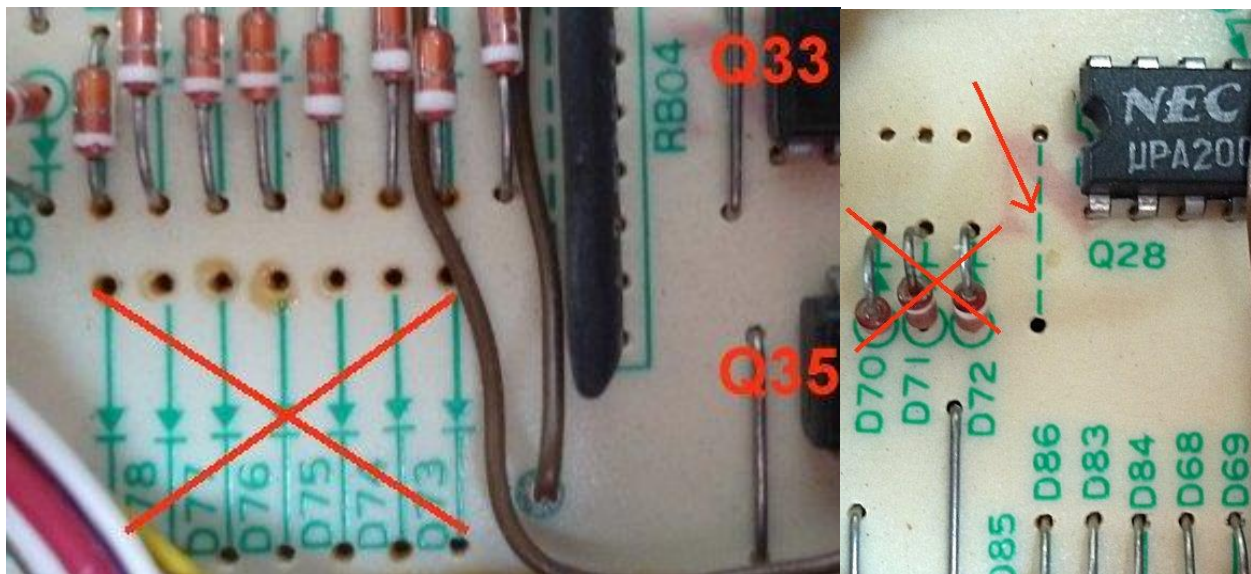
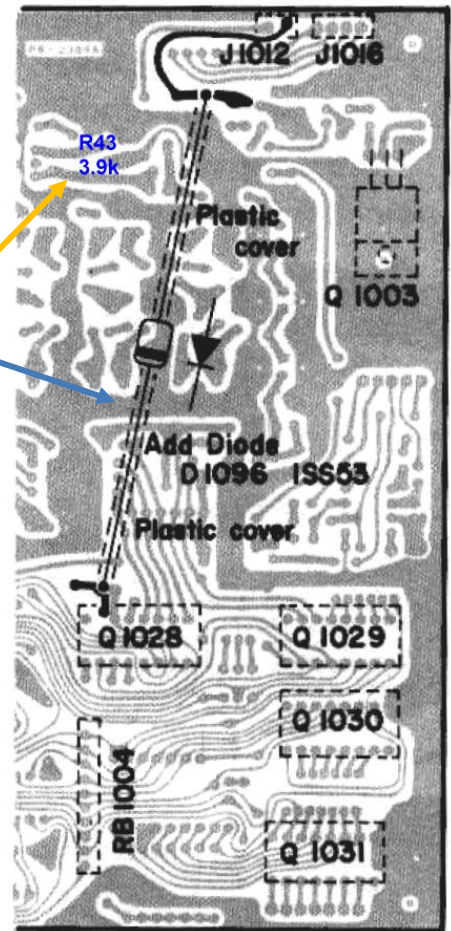
Remove diodes to release transmitter lock in GEN mode and change HAM/GEN signals:

Depending on your serial model, you will find a diode inside a long piece of green tubing. This diode is connected between common anode ends of D01 to D04 and Q28. These diodes are used to switch off the "PA 13.5 V" to the power amplifier when a transverter or GEN mode is selected.

- 1a) remove this D96 diode.

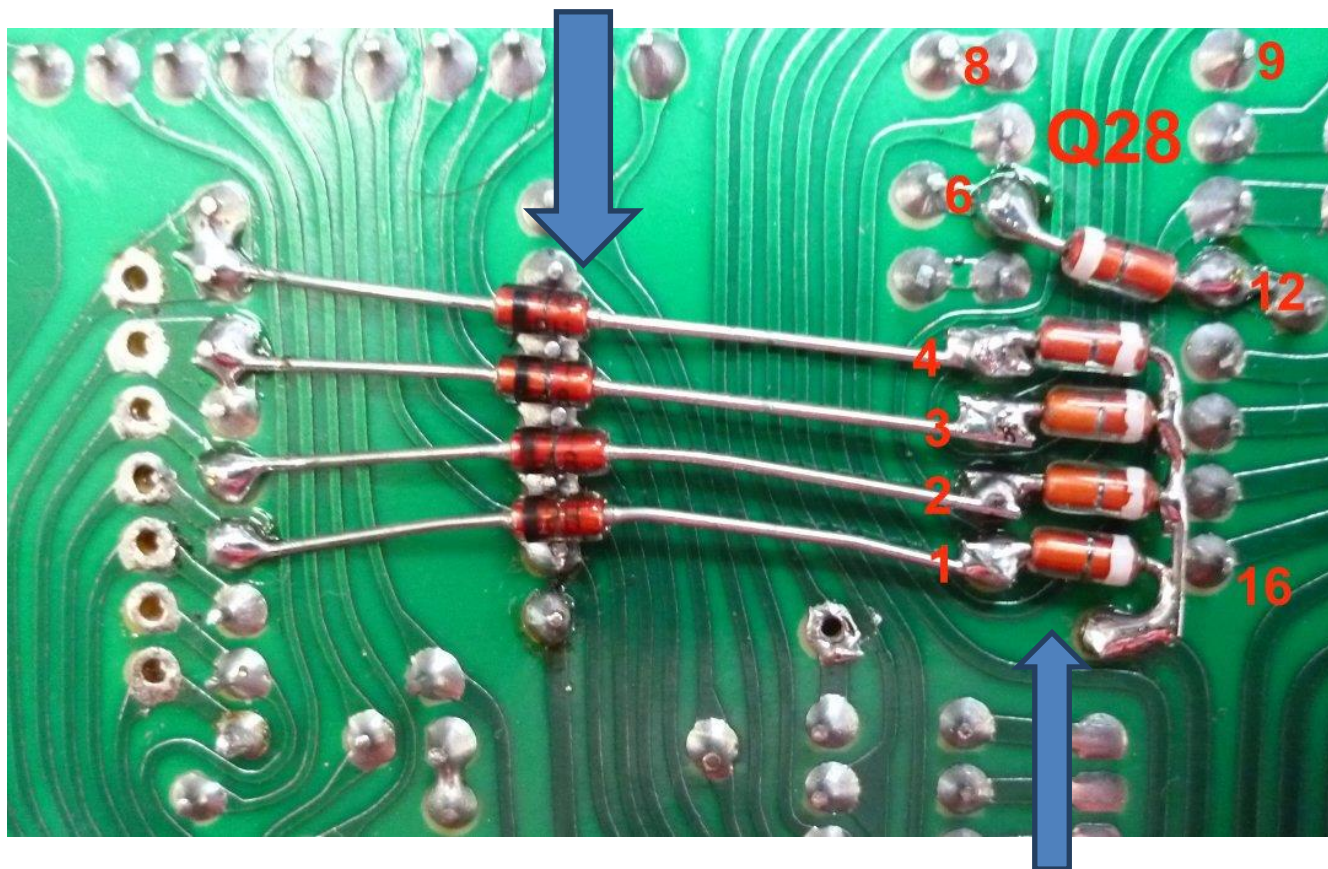
Tip :

- You can gain 10 dB in sensitivity from 0 to 1.999 MHz just by changing R43 from 3.9 k Ω to 1 k Ω . This resistor is located at the bottom of L67 (1mH ferrite coil) at the GEN filter bank input. In Europe most of AM transmitters definitively stopped broadcasting! If intermodulation occurs, you can use the manual ATTEN knob.
- 1b) Remove diodes D73 to D79. Keep the diodes for later use.
- 1c) Place a diode at the bottom of Q28, pin 12 anode, pin 6 cathode. This diode allows new logical signals for HAM and GEN. (see picture at PCB bottom)
- 2) Remove the jumper close to pin 1 of Q30. This will release Q30 pin 5 input from decoder output.
- 3) You can also remove the 3 diodes D70 to D72 as they are not necessary. Save the diodes for D44 and D45.



Set the corresponding output low pass filter for transmission in GEN mode:

- 4) From output of Q28 to Q31 inputs, place four new diodes as shown on picture below.



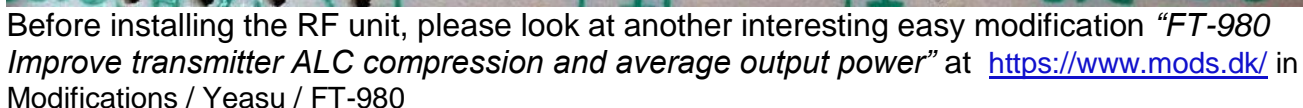
Set a new 2-30 MHz switching signal to activate the last spare location in the ham filter bank:

- 5) Under Q28, place four saved diodes as shown on the above picture. The common cathode is connected to the jumper's hole in front of Q28.

Now, new logical filter selection does not change anything to GEN/HAM mode until the new filter is in place!

Place the new high pass filter and its switching system:

- Place saved diodes at D44 and D45. (watch out for diode polarity !)
- Add R61 100 Ω ¼ W resistor
- Add C123 and C136 10 nF X7R ceramic capacitors
- Add C212 22 μ F aluminum capacitor or better replace it by 1 μ F SMD X7R ceramic.
I did it on my device.
- Add at the high side of T25 a 4.7 μ H inductor mounted vertically.
- Add C134 1.5 nF X7R ceramic or 1 nF // 470 pF if you don't have 1.5 nF.
- Add at the lower side of T26 winding a 4.7 μ H inductor mounted vertically.
- Make the right jumpers at bottom tracks to form a Pi high pass filter.



- Place the RF unit (careful with wire and connectors) and the six screws.
- Plug in the coax and mind the one with the green sleeve (or else you will get no output power at all !)
- Place the ATTEN shaft and position the knob index symmetrically between the 10 and 20 dB position.

On a dummy load.

- Note: The HAM VFO should still be used for any frequency that can be covered by it. This will insure maximum out-of-band receiver intermodulation rejection, best harmonic rejection of the transmitter and possibly a slightly better SWR (second and third harmonics may be reflected by antenna).