

# Service Instruction FT790RII

Compiled and illustrated by DL1RQ

## A. PLL Unit, Part I

### 1) Reference Oscillator

Connect the frequency counter to **pin 16** of **Q420** and adjust **TC402** for  $10,245 \text{ MHz} \pm 10\text{Hz}$ . Remove the counter.

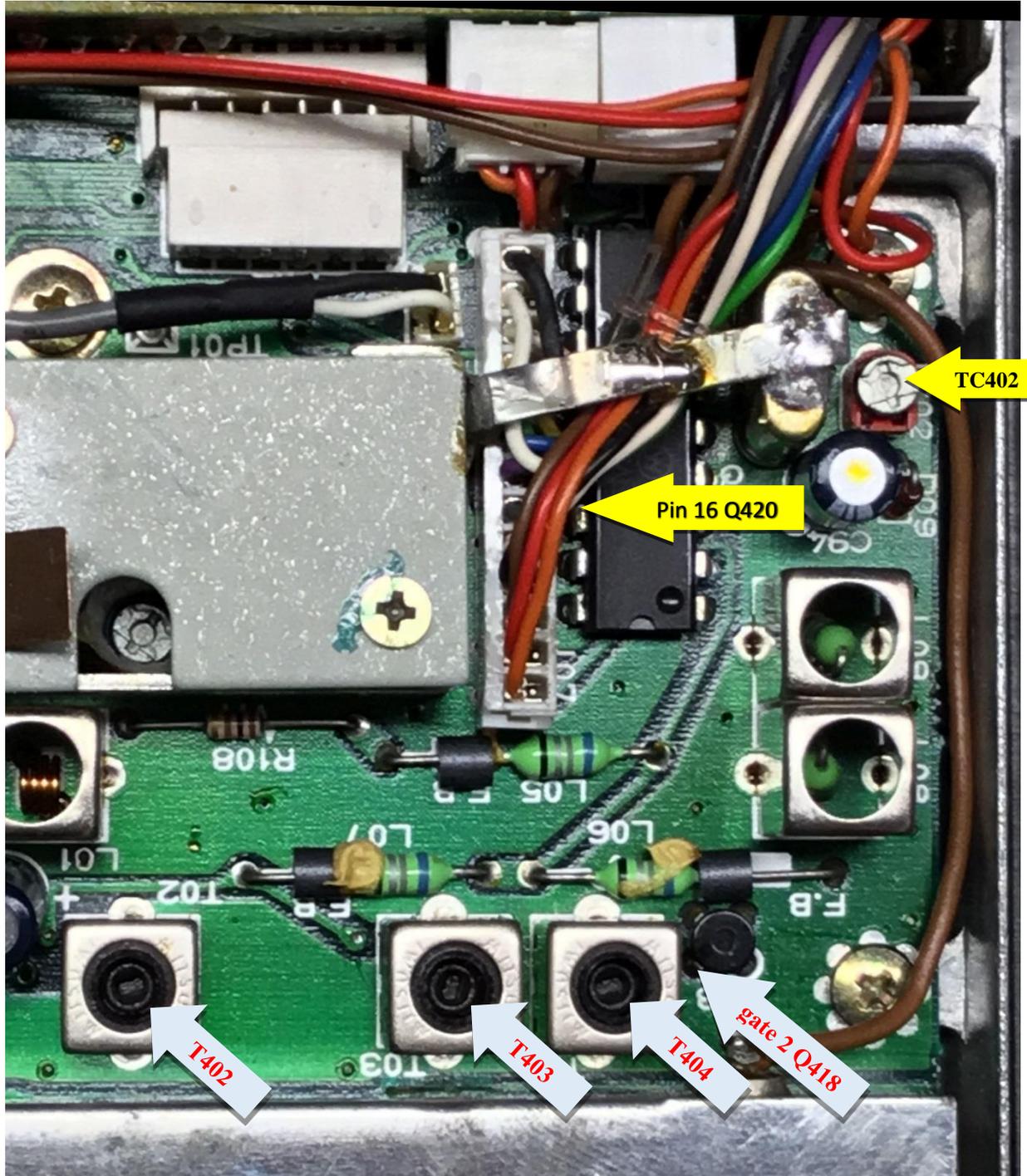


Fig. 1 (PLL/PA Board)

### 2) Loop Resonant Circuits

Connect the RF voltmeter (Oscilloscop, Spectrum-Analyzer) to the **gate 2 of Q418**. Adjust **T402**, **T403** and **T404** for maximum RF voltage. Remove the Voltmeter.

**NOTE:** All of the remaining steps in this section (A) require that **plug P3001** be removed from PJ401 (1<sup>st</sup> Local Out) and a 50 Ohm resistor (dummy load) be connected across PJ401. P3001 will be replaced in step A. 4) d).

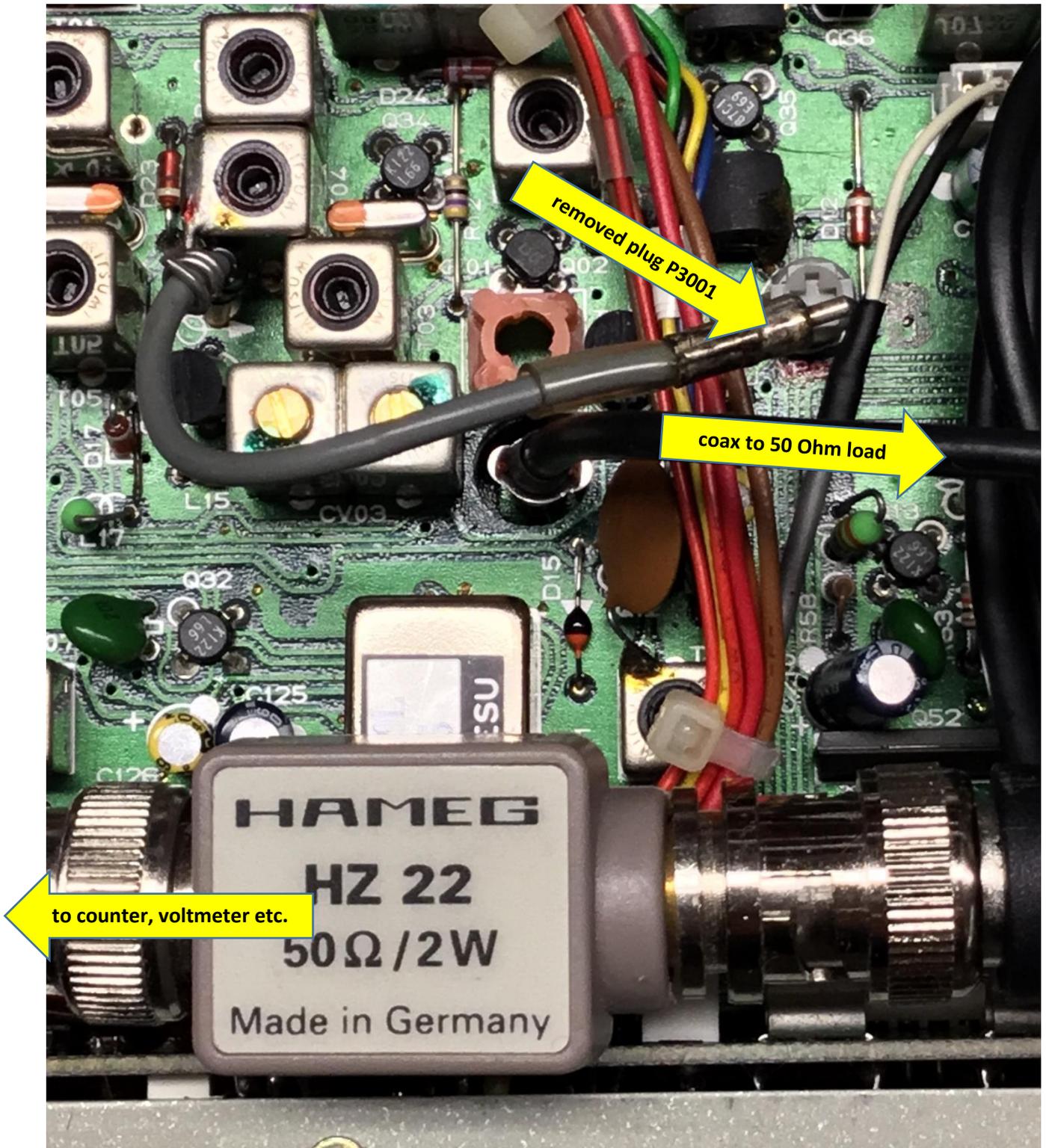


Fig. 2 (Main Board)

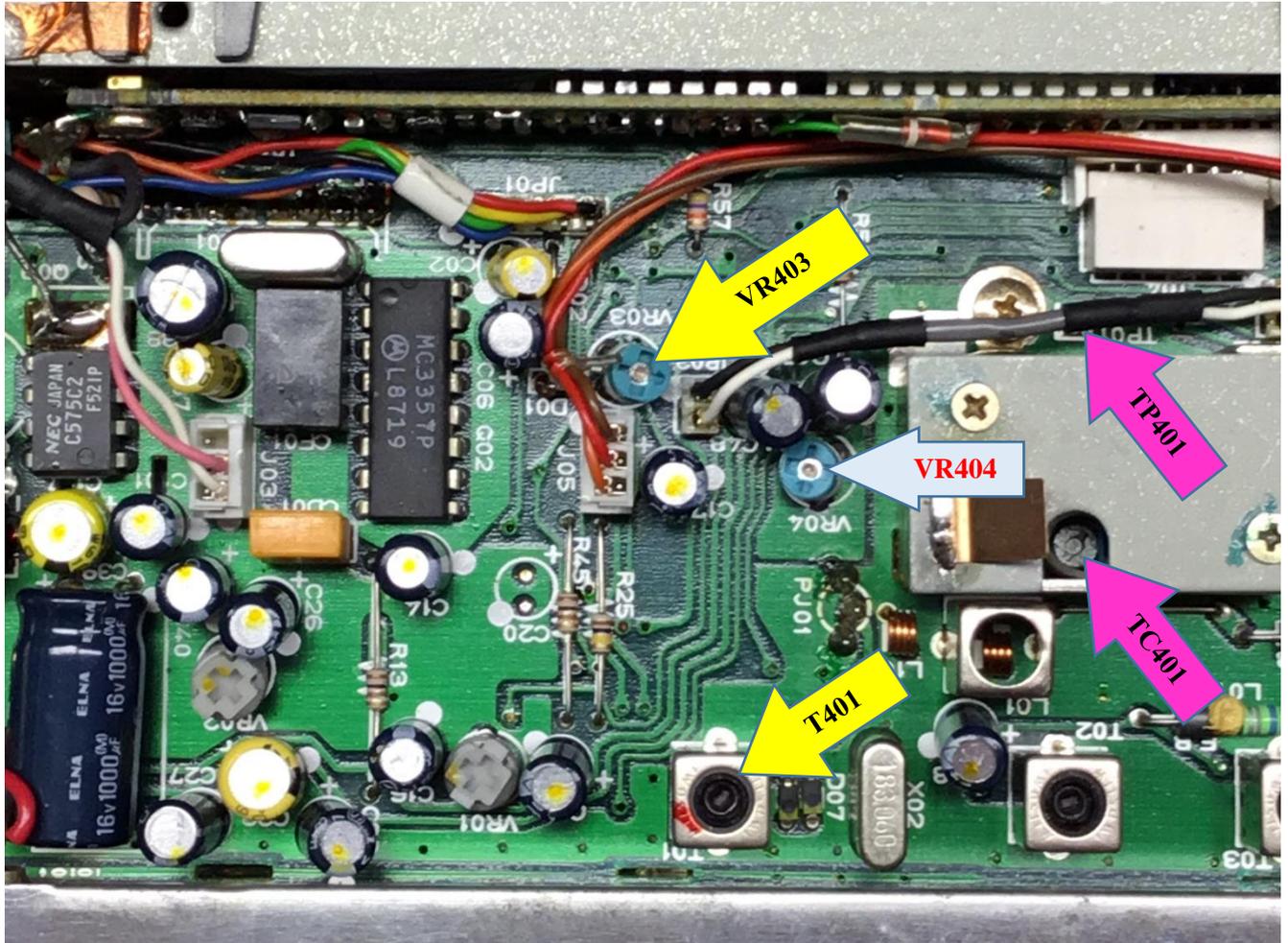


Fig. 3 (PLL/PA Board)

### 3) First Oscillator, D-to-A Converter

- a) Connect the frequency counter across PJ401 with the 50 Ohm resistor and adjust **VR403** for the same frequency in both transmit and receive ( $\pm 25\text{Hz}$ ).
- b) Adjust **T401** for counter indication 380,500 000 MHz within  $\pm 10\text{Hz}$ .
- c) Set the front panel controls to USB, 434,998 500 MHz.
- d) Slowly adjust the tuning knob until the display just steps down to 434,998 400 MHz.
- e) Adjust **VR404** for the frequency 380,498 400 MHz  $\pm 25\text{Hz}$  on the counter.
- f) Remove the frequency counter.

### 4) PLL VCV (Varactor Control Voltage)

- a) Select the FM mode and tune to the high band edge 440 MHz.
- b) Connect the DC voltmeter to **TP401** and adjust **TC401** for 2,8V.
- c) Tune the transceiver to the low band edge 430 MHz and confirm  $1,25 \pm 0,2 \text{ V}$ .
- d) Remove the voltmeter from TP401 and 50 Ohm dummy load from PJ401 and replace P3001 in PJ401.

## B. Main Unit, Receiver

**Note:** Remove plug **P4701** in the PA unit from **PJ3003** (RF Out) on the Main Unit for all of the steps in this section (B). (Ref. Fig. 4)

### 1) CW/FM Carrier Oscillator

- Touch the frequency counter probe to **gate 1 of Q3033** for the following adjustments.
- Set the mode to CW, short the KEY jack to transmit, and adjust **TC3004** for  $13,988\,500\text{ MHz} \pm 10\text{Hz}$ .
- Now select the FM mode, close the PTT line and adjust **T3013** for  $13,988\,380\text{ MHz} \pm 10\text{Hz}$ .
- Remove the counter.

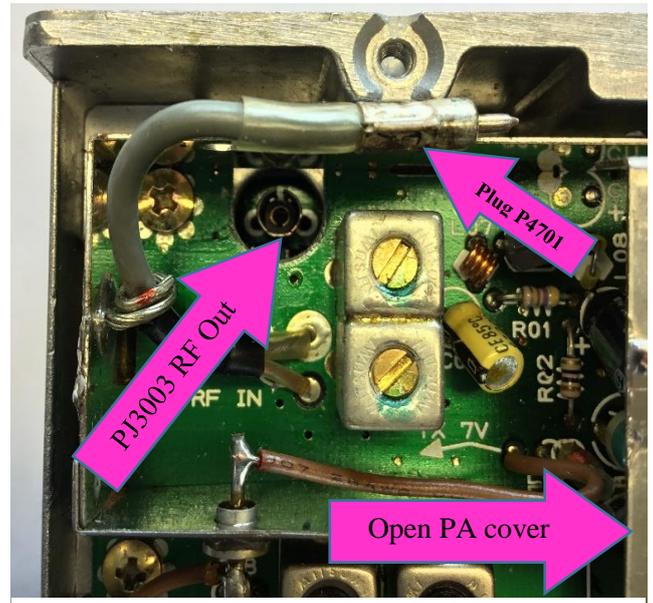


Fig. 4 (PLL/PA Board)

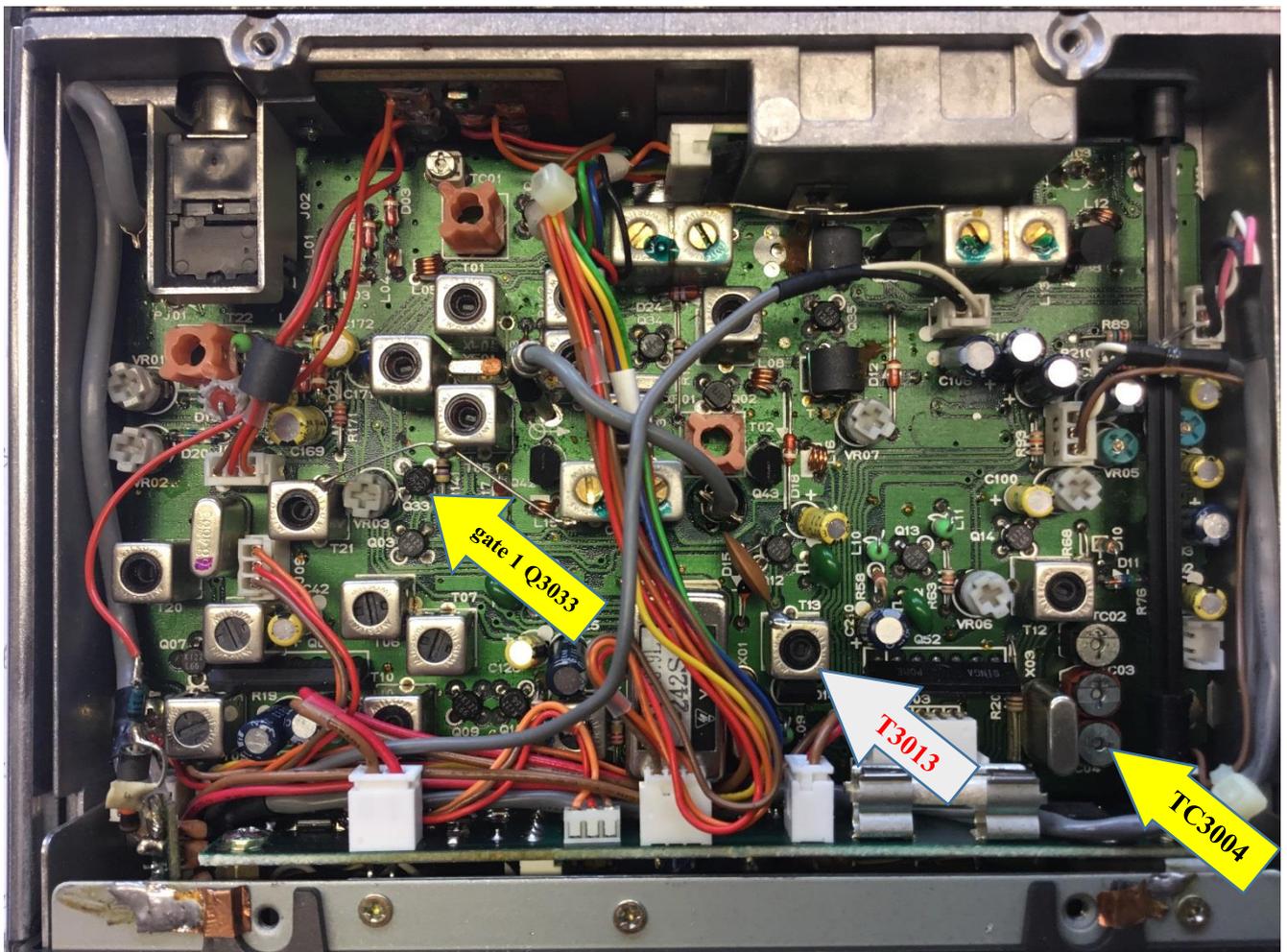


Fig. 5 (Main Board)

## 2) Second Oscillator

- a) Touch the RF voltmeter to **gate 2 of Q3003** for the following adjustment.
- b) Adjust **T3021** for maximum RF voltage. Remove the RF voltmeter.
- c) Touch the frequency counter probe to **gate 2 of Q3003** for the following adjustment.
- d) Adjust **T3020** for  $68,488\ 500\ \text{MHz} \pm 10\ \text{Hz}$  on the counter. Remove the counter.

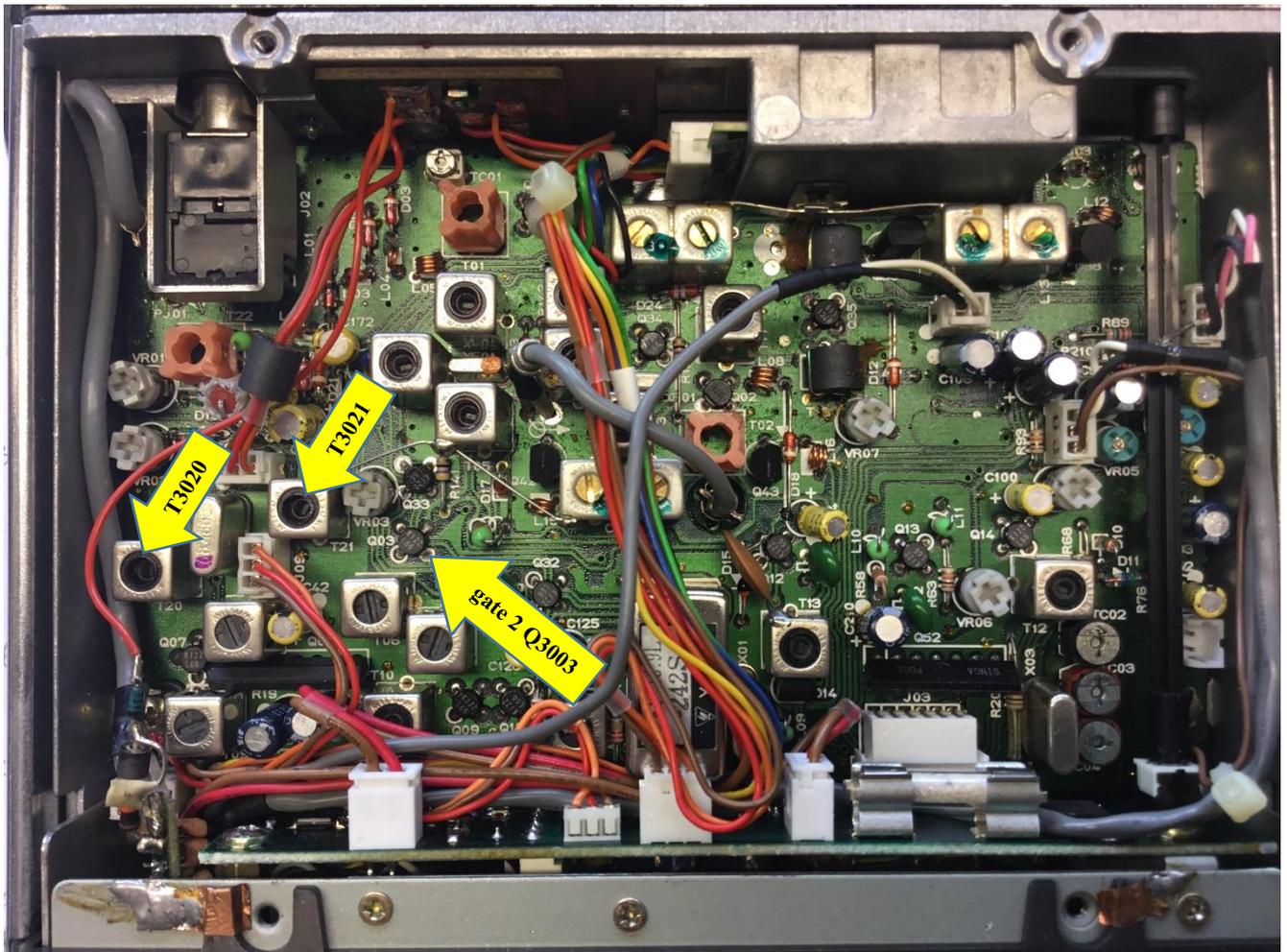


Fig.6 (Main Board)

### 3) RF and IF Transformers

- Connect the RF signal generator, tuned to 435 MHz, to the ANT jack.
- Set the transceiver to USB, and tune for peak on the signal. Then reduce the injection level just below the S-meter (AGC) threshold.
- Connect the AF voltmeter to the EXT SP jack and adjust **TC3001**, **CV3001** and **CV3003** for maximum AF (adjust the VOL control as necessary to keep meter readings near mid-range).
- Now set the injection level to -10dB $\mu$ V and adjust **T3003**, **T3004**, **T3005**, **T3006**, **T3007**, **T3010**, **T3011** and **T3012** for maximum AF. Then remove the voltmeter.

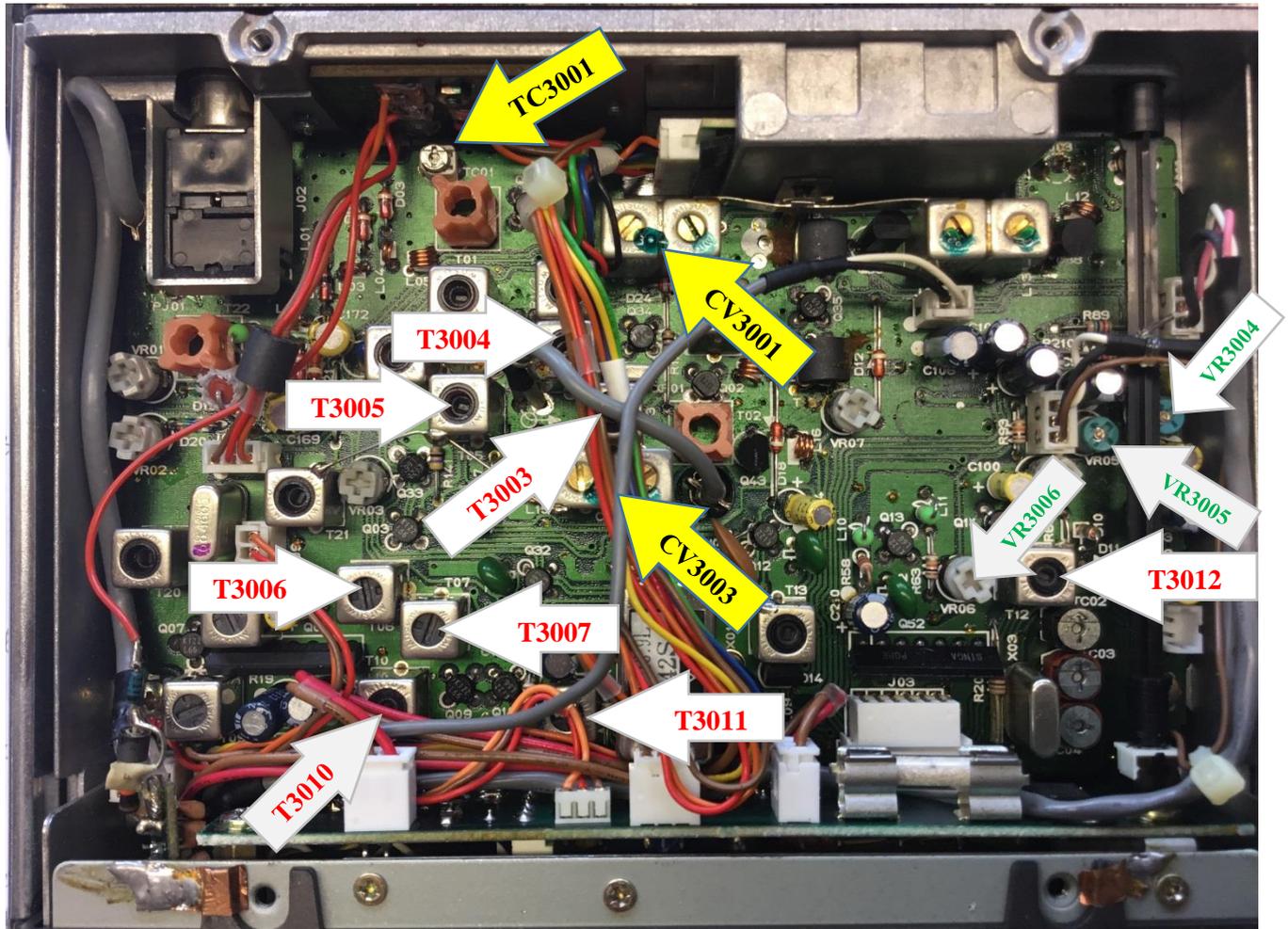


Fig. 7 (Main Board)

### 4) S-Meter Calibration

- In USB mode, with -10dB $\mu$ V injection, adjust **VR3004** for S-5 indication on the S-meter.
- Adjust **VR3006** just to the point, where the S-meter reading begins to rise above S-5.
- Increase injection to -4dB $\mu$ V and readjust **VR3004** for S-1 deflection.
- Increase injection to +16dB $\mu$ V and adjust **VR3005** for S-9 deflection.

## 5) Noise Blanker Transformers

- With +16dB $\mu$ V injection at the ANT jack, connect the DC voltmeter to the exposed end of **R3019** on the component side of the Main Unit.
- Turn on the noise blanker and adjust **T3008** and **T3009** for minimum voltage.
- Remove the voltmeter, and replace P4701 in PJ3003. (Ref. Fig. 4)

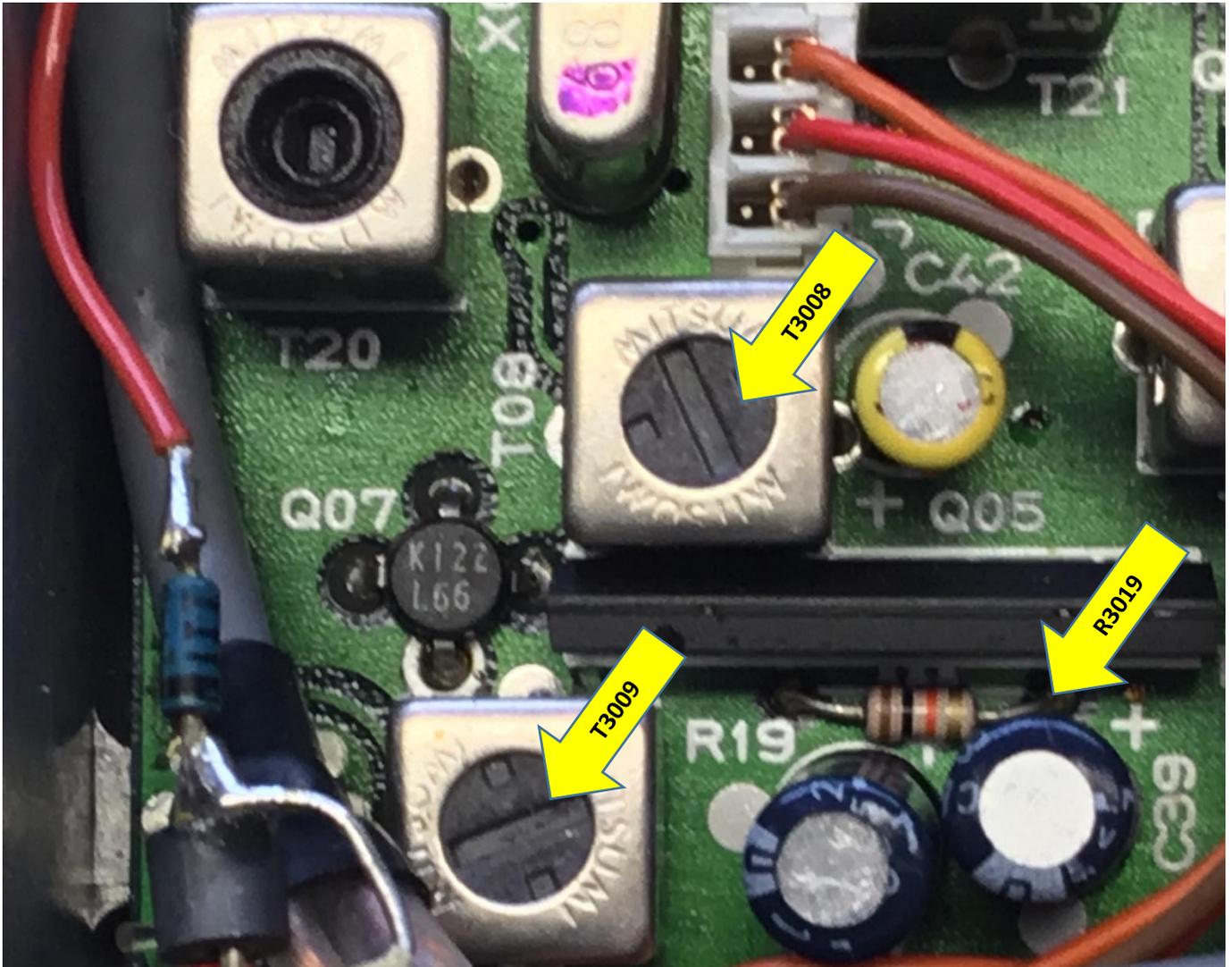


Fig. 8 (Main Board)

## C. PLL Unit, Part II

**The RF signal generator must be connected to the ANT jack for all steps.**

### 1) D-to-A Converter Linearity

- Tune the signal generator to 435 MHz and set for 0dB $\mu$ V injection.
- Set the front panel controls to USB, 25Hz steps, 434,9985 MHz.
- Slowly adjust the tuning knob back and forth around 434,9985 MHz and 434,9984 MHz while listening to the beat of the injected carrier.
- Adjust **VR404**, if necessary, for smooth transition between the 25 Hz tuning steps.

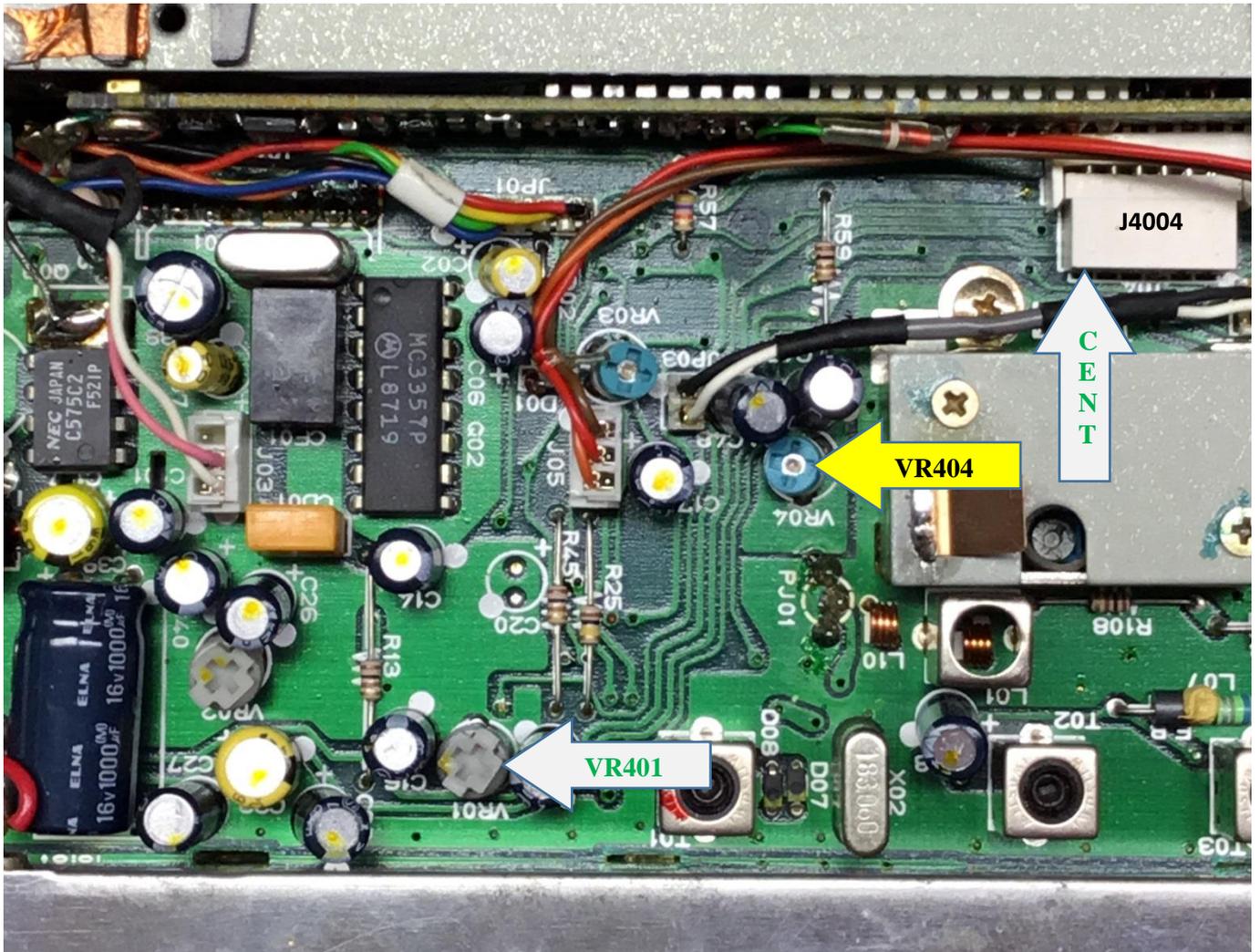


Fig. 9 (PLL/PA Board)

## 2) FM Discriminator Center Detection

- Select the FM mode and tune the transceiver to 435,000 MHz.
- Connect the DC voltmeter (10V range) to the **CENT** pin of J4004.
- Tune the signal generator to 435,001 500 MHz.
- Turn **VR401** fully clockwise and then counterclockwise just over the threshold where voltage on the meter drops to zero.
- Referring to Figure 9, raise the signal generator frequency gradually to confirm that the voltage rises to 5V within 1,5 to 4,0 kHz above the display frequency.
- Disconnect all test equipment.

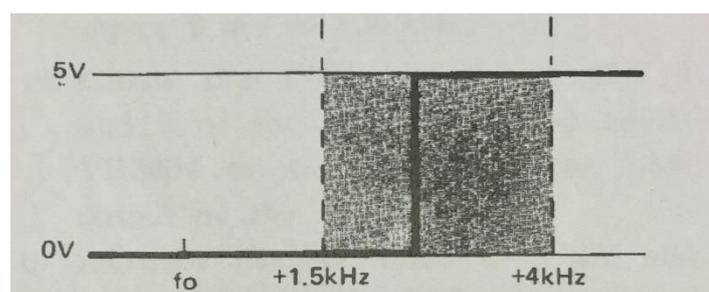


Fig. 10 Discriminator Center Detection

## D. Main Unit, Transmitter

**Note:** Remove plug P4701 from PJ3003 (RF Out) on the Main Unit for all of the steps in this section (D). (ref. Fig. 4)

### 1) Tx IF Transformers

- a) Set the transceiver to USB mode and tune to 435 MHz.
- b) Connect a 50 Ohm resistor across PJ3003 and connect the RF voltmeter (Power-Meter, Spectrum-Analyzer) across the resistor.
- c) Connect the AF generator to pin 8 (center pin) of the MIC jack and inject 1 mV@1,5 kHz.
- d) Close the PTT line (short pins 6 and 7 of the MIC jack) and adjust **T3014**, **T3015**, **T3016**, **T3017** and **CV3002** for maximum deflection on the RF voltmeter.

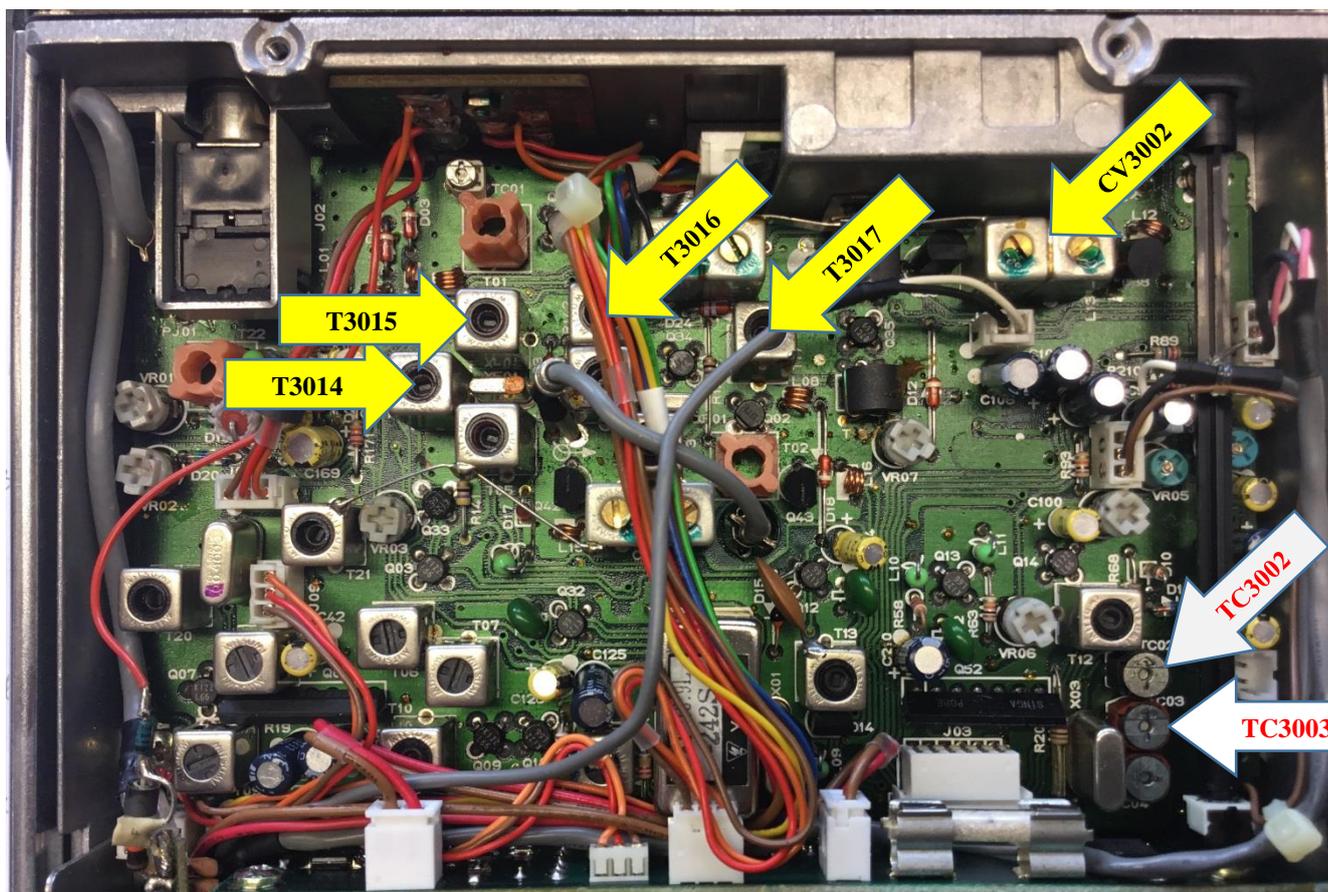


Fig. 11 (Main Board)

### 2) SSB Carrier Frequency

Perform these steps only after aligning the last step ( 1)Tx IF Transformers). Setup is the same.

- a) Retune the AF generator to 300 Hz and note the deflection on the voltmeter.
- b) Now retune the AF generator to 2700 Hz and compare the voltmeter deflection with that at 300 Hz. If the voltage is different, adjust **TC3003** while switching the AF generator between 300 Hz and 2700 Hz.
- c) Select the LSB mode and repeat a) and b), adjusting **TC3002** if necessary.
- d) Remove the test equipment, but do not replace P4701 in PJ3003 if you will be proceeding to the next section.

## E. PA Unit

**Note:** Plug P4701 must be disconnected from PJ3003 during this procedure. (Ref. Fig. 4)

- a) Connect the dummy load to the ANT jack.
- b) Temporarily remove the jumper between the terminal posts TP3 and TP4 and connect a milliammeter across these posts.
- c) Close the PTT line and adjust VR4702 for  $150 \text{ mA} \pm 10 \text{ mA}$  on the milliammeter.
- d) Remove the meter and replace the jumper between the posts TP3 and TP4.
- e) Temporarily remove the jumper between the terminal posts TP1 and TP2 and connect a milliammeter across these posts.
- f) Close the PTT line and adjust VR4701 for  $20 \text{ mA} \pm 2 \text{ mA}$  on the milliammeter.
- g) Remove the meter and replace the jumper between the posts TP1 and TP2.

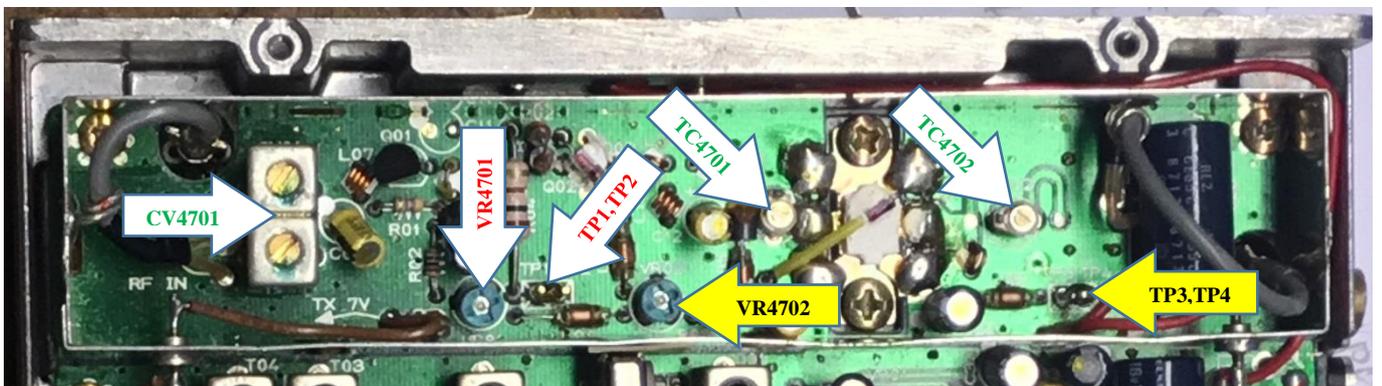


Fig. 12 (PA Board)

### 2) Interstage Matching Trimmers

- a) Connect plug P4701 (if removed earlier) to PJ3003. (Ref. Fig. 4)
- b) Connect the wattmeter and dummy load to the ANT jack.
- c) Select the FM mode and set the transceiver to 435 MHz.
- d) Close the PTT line and adjust filter CV4701 and trimmers TC4701 and TC4702 for maximum RF output.

## F. Miscellaneous Transmitter Adjustments

### 1) ALC and PO Meter Calibration

- a) With the wattmeter and dummy load connected to the ANT jack and the transceiver set to 435 MHz, select the USB mode.
- b) Connect the AF generator to pin 8 (center pin) of the MIC jack and inject  $2 \text{ mV} @ 1,5 \text{ kHz}$ .
- c) Close the PTT line (short pin 6 and 7 of the MIC jack) and adjust VR3008 on the Main Unit for 2,8 W output on the Wattmeter.
- d) Increase the AF level to 6 mV and adjust VR3002 for 2,8 W on the wattmeter.
- e) Adjust VR3001 so that the meter on the transceiver deflects to the center of the green zone.
- f) Select F-LOW power and adjust VR3003 to 0,3 W on the wattmeter. Select full power and repeat step d).

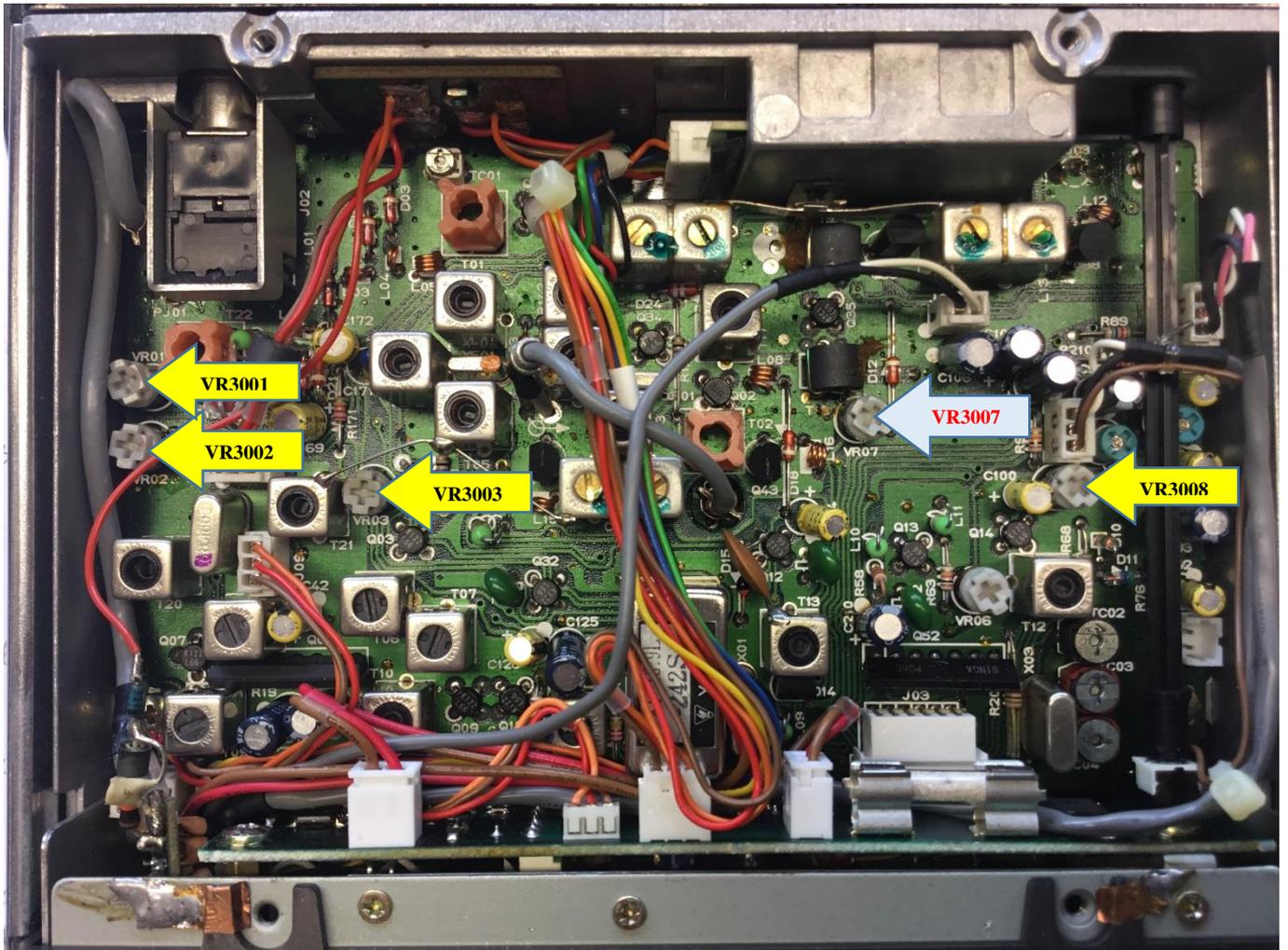


Fig. 13 (Main Board)

## 2) FM IDC (Deviation Control)

- Connect the linear detector / deviation meter with the dummy load to the ANT jack. Select the FM mode.
- Set the AF generator (step b) above) for 30 mV @ 1 kHz.
- Close the PTT line and adjust **VR3007** for  $\pm 4,5$  kHz ( $\pm 100$  Hz) deviation.
- Remove all test equipment.

## G. Frequency Fine Adjustments

- With the counter and dummy load connected to the ANT jack set the transceiver to 435,000 MHz and F-LOW power.
- Connect the AF generator to pin 8 (center pin) of the MIC jack and inject 2 mV @ 1,0 kHz.
- Set the mode to USB, close the PTT line (short pin 6 and 7 of the MIC jack) and adjust **T401** on the PLL/PA Unit for exactly 435,001 000 MHz  $\pm 50$  Hz. (Ref. Fig.3)
- Set the mode to LSB, close the PTT line (short pin 6 and 7 of the MIC jack) and confirm that the frequency is 434,999 000 MHz  $\pm 50$  Hz on the counter.
- Set the mode to FM, close the PTT line (short pin 6 and 7 of the MIC jack) and adjust **T3013** on the Main Unit for exactly 435,000 000 MHz  $\pm 100$  Hz. (Ref. Fig.5)