

## ICOM IC-201 Allmode Transceiver



### Alignment Procedure

Please note: This procedure is reengineered by myself and may be not in accordance with the original procedure from the manufacturer!

So I can't accept any claims from anybody in case of injuries, problems, damages and losses.

Usage of this procedure is at own risk!

Of course you may ask me or give hints for improvement.

I'm ready for any useful proposals.

Required Equipment:

Counter, 150MHz. High input impedance.

Scope, 50MHz (better 250MHz) with analog output for counter

Multimeter, best with analog scale

RF-Generator 145MHz, level adjustable down to 0,05uV

IF-Generator 10,7MHz, FM

Deviation meter or calibrated 2m FM-RX

SSB-RX for aligning carrier suppression

Dummy load and Power Meter, 145MHz >15W

Resistor 25 $\Omega$ /20W (2 x 50 $\Omega$ /10 $\Omega$  parallel)

Sweeper 10 ... 15MHz

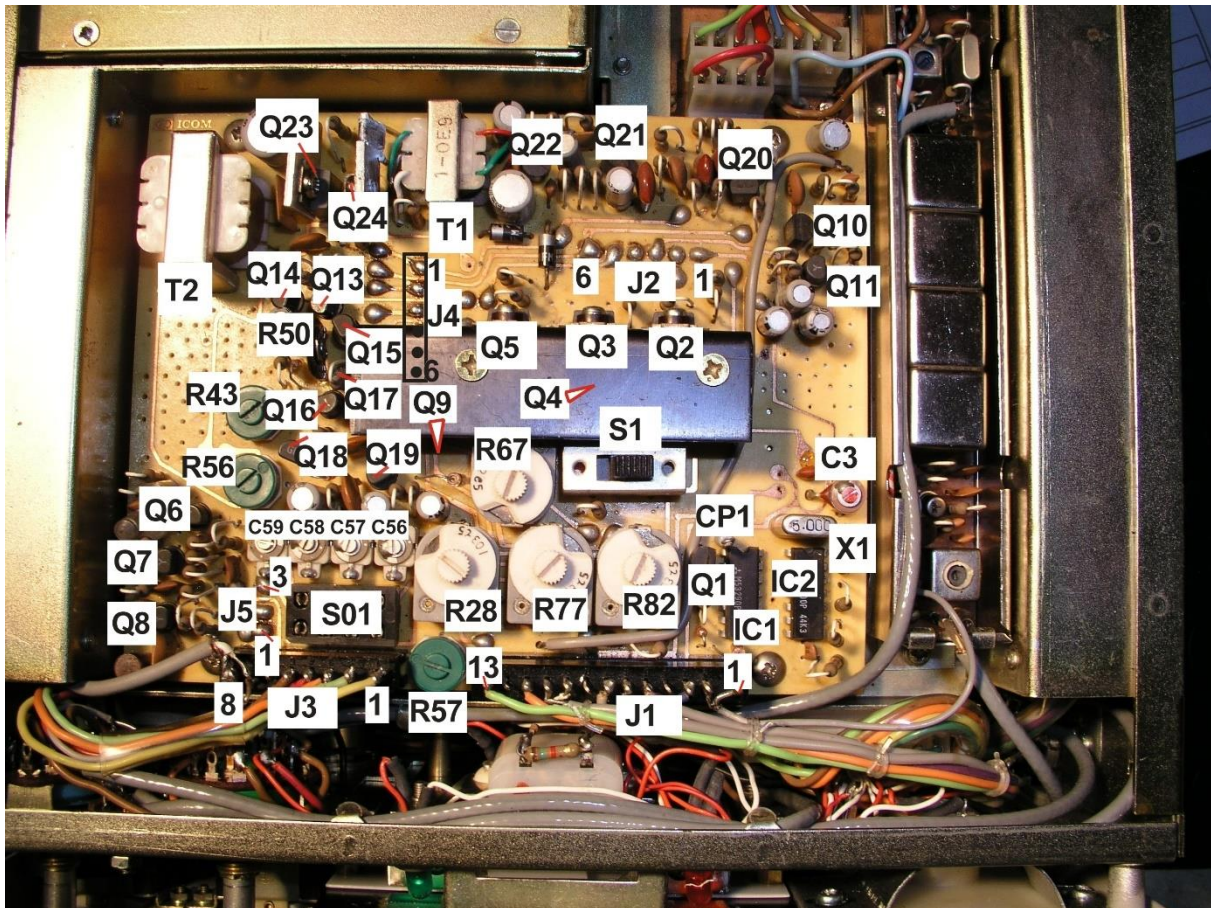
AF-Generator; adjustable for low output (mV-range)

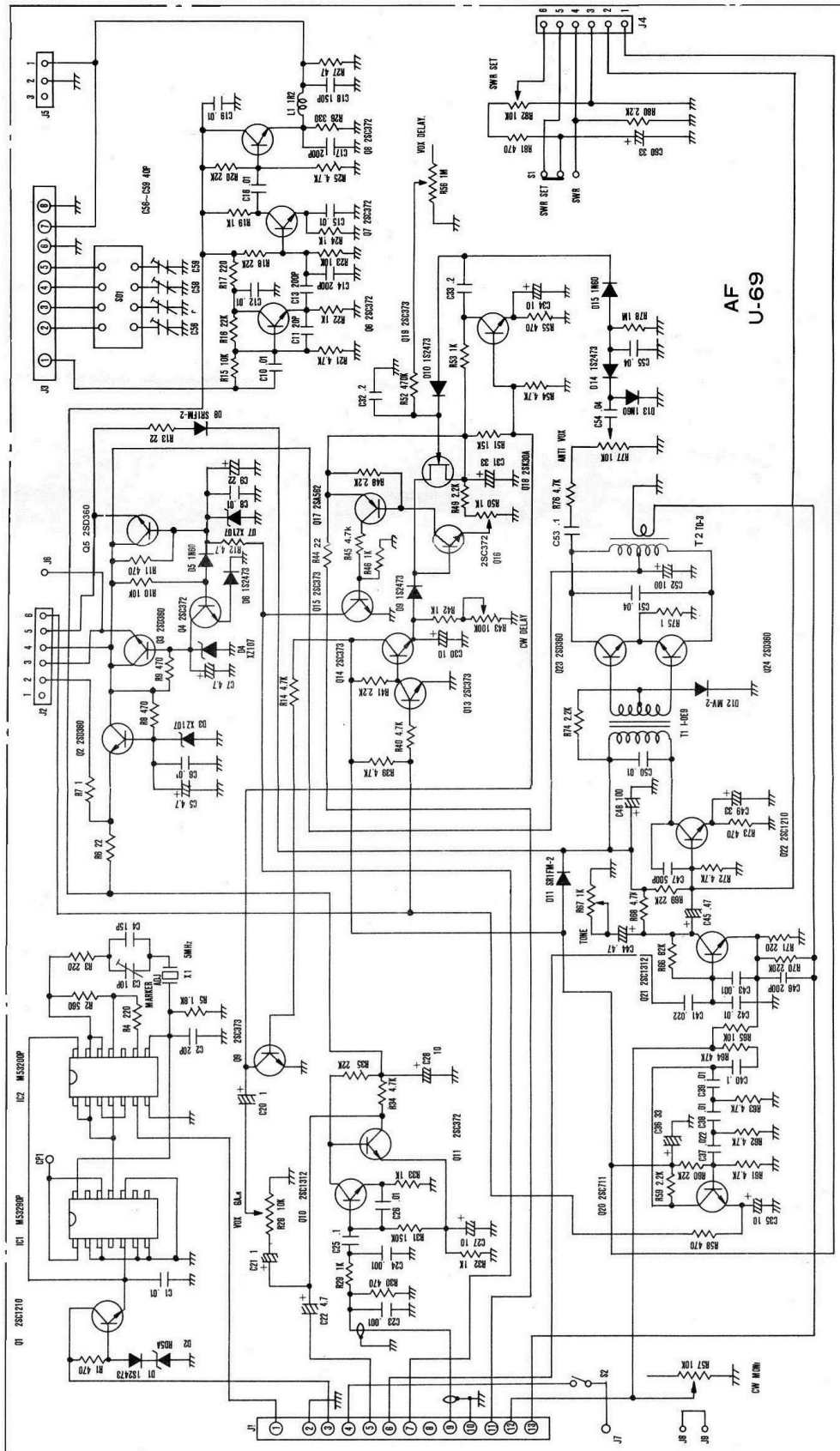
Microphone and CW-Key

Optional: Spectrum analyzer with attenuator or Scope >250MHz for optimum of PA linearity and best carrier suppression at SSB.

## AF

- 1) Mode „USB“
- 2) No microphone connected; „MIC GAIN“ control to CCW
- 3) „VOX“ On
- 4) Adjust R50 that VOX doesn't trip (search for the point where VOX trips without Modulation and set R50 shortly before this point.
- 5) Check that for all modes (FM, USB, LSB, CW) VOX doesn't trip without modulation
- 6) "CAL" switched on, connect counter to CP1. Best use analog scope with Y-output
- 7) Wait 1 minute
- 8) Adjust frequency to 2,500000 MHz

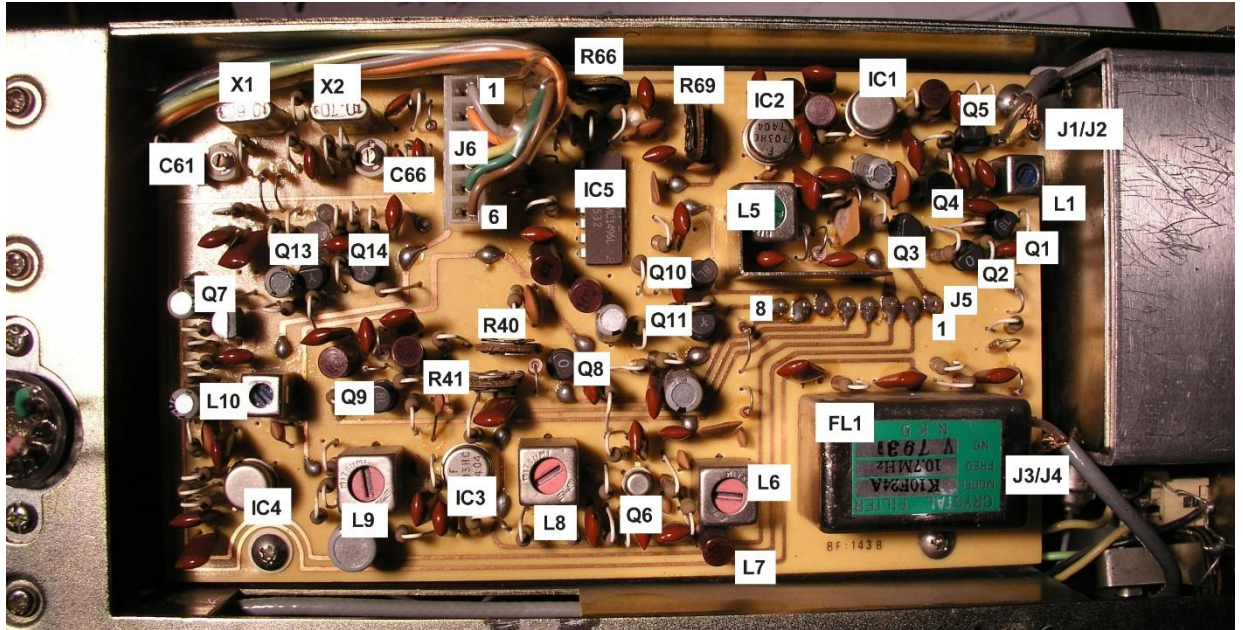




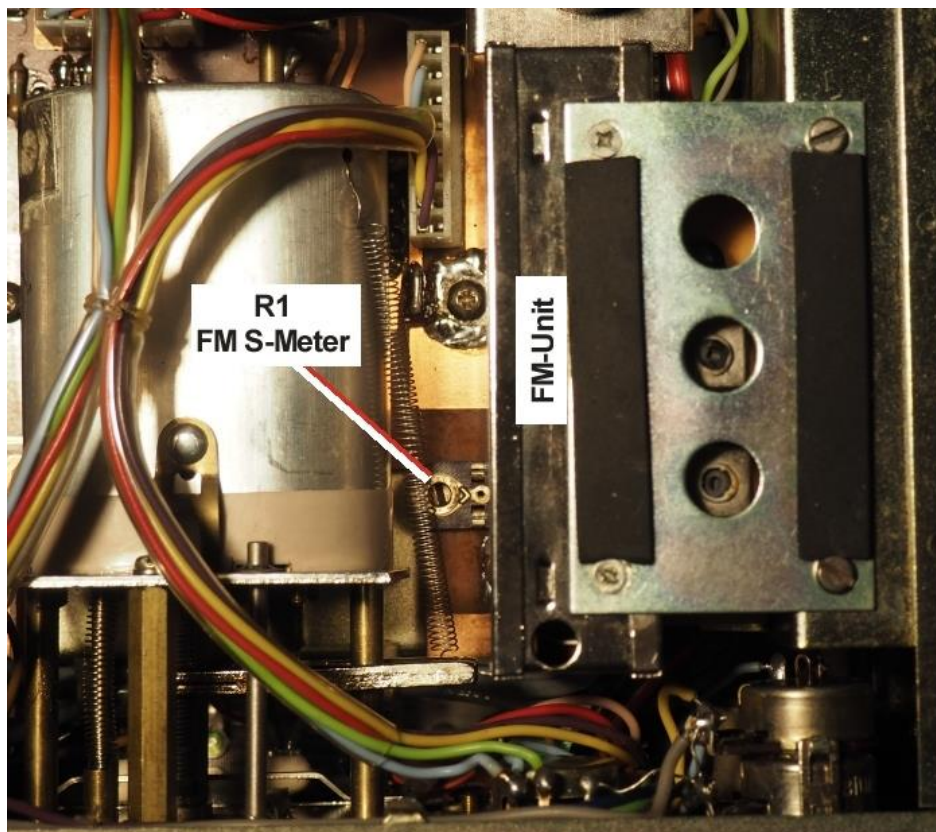
## GIF

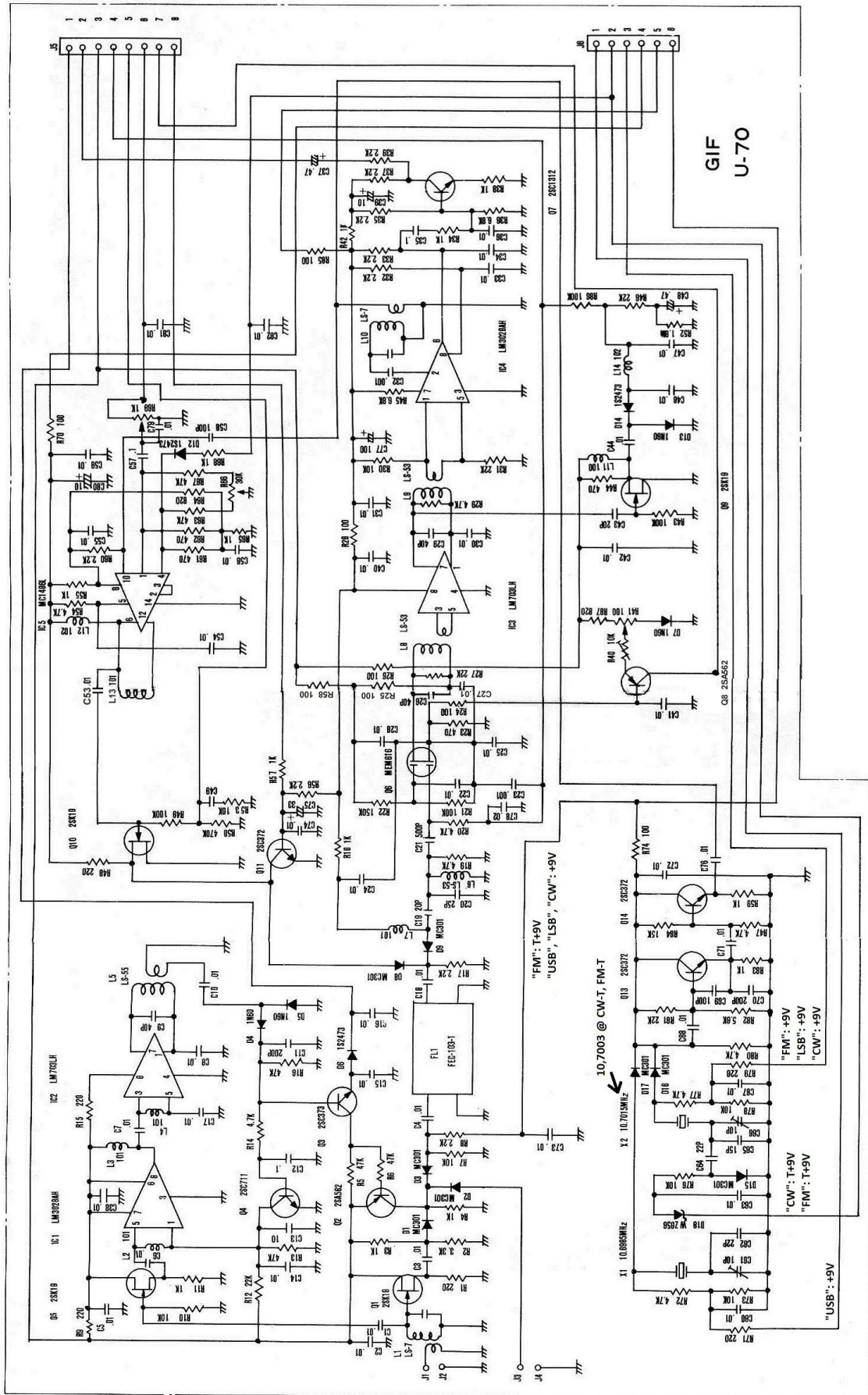
- 1) Receive "R"
- 2) Connect Counter (AC-coupled) with high input impedance to Emitter of Q14.  
Best use analog scope with Y-output!
- 3) Mode "USB" adjust C61 to 10,69850 MHz (X1)
- 4) Mode "LSB" adjust C66 to 10,70150 MHz (X2)
- 5) There may be some interaction so repeat 3 and 4 if necessary
- 6) Mode "CW" frequency should remain at 10,70150 MHz ("RX")
- 7) Connect dummy load; switch to Transmit "T"
- 8) Mode "CW" frequency should move to nearly 10,70000 MHz (not more than +/- 500Hz)
- 9) Mode "FM" frequency should move to nearly 10,70000 MHz (not more than +/- 500Hz)
- 10) Receive "R"
- 11) Note: At "FM" and receive "R" there is no output of BFO
- 12) Mode USB: Set R41 for just a little bit above S=0 (S-Meter just moves) on S-Meter
- 13) Tune in weak signal at 145,000MHz just enough to move S-Meter to S=5
- 14) Tune L1, L6, L8, L9, L10 for maximum
- 15) Tune in signal 5,0Mikrovolt 145,000MHz: Set R40 for S=9
- 16) Repeat steps 12 and 15 if necessary
- 17) Mode "FM"
- 18) Adjust R1 on Main board near FM-Unit to S=9
- 19) Mode "USB"
- 20) Connect power meter, scope or analyzer with attenuator; Transmit "T"
- 21) Mode "USB" with PA operating (jumper P11/J11); adjust R66 for best carrier suppression
- 22) Check carrier suppression with "LSB"
- 23) Receive "R"
- 24) Connect AF signal (2kHz, 10mVpp) to MIC-Input
- 25) Set "MIC GAIN" to 30% to 50% position \*)
- 26) Mode "USB"
- 27) Transmit "T"
- 28) Adjust output power with R69 to app.8 to 10W
- 29) Receive "R"

\*) This will be the later operation position with the external microphone.



Andrea Baldoni sent me a more precise alignment procedure for the GIF board.  
See attachment at the end of this document (mni tnx).





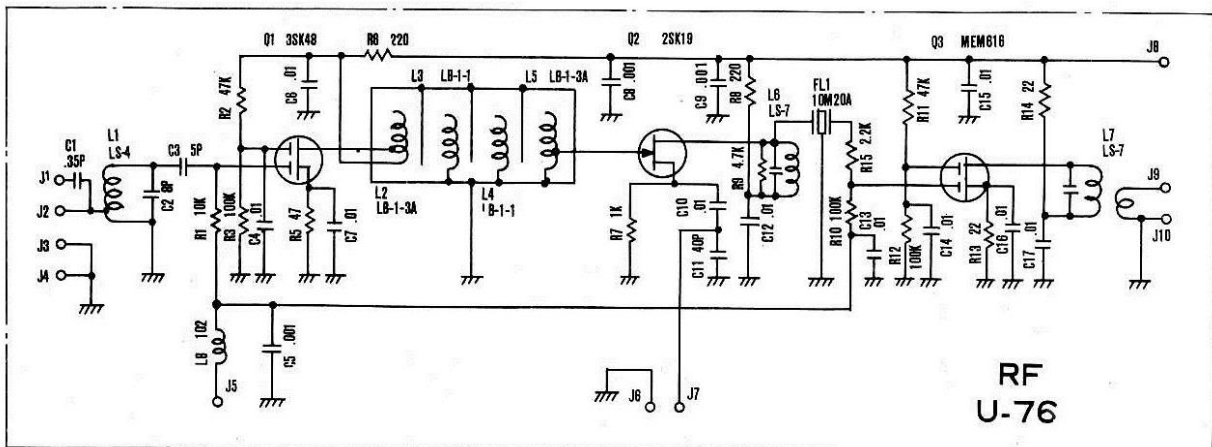
RF

- 1) Set "RF GAIN" to "H"
- 2) Weak signal at 145,000MHz just enough to move S-Meter to S=5
- 3) Tune L1, L6 and L7 for maximum AF or S-meter
- 4) Unmount RF-Module (one clamp at each end) and turn RF-module upside down
- 5) Tune L2 to L5 for maximum
- 6) Mount RF-Module
- 7) If a big increase of sensitivity has been achieved, then repeat adjustment of S-Meter (Look for GIF, step 14)



Note:

The resistor at the drain of Q1 (180hm) is a modification for damping oscillations in case of badly matched antennas!



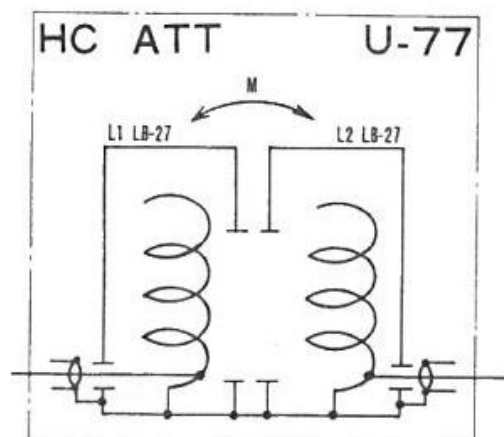
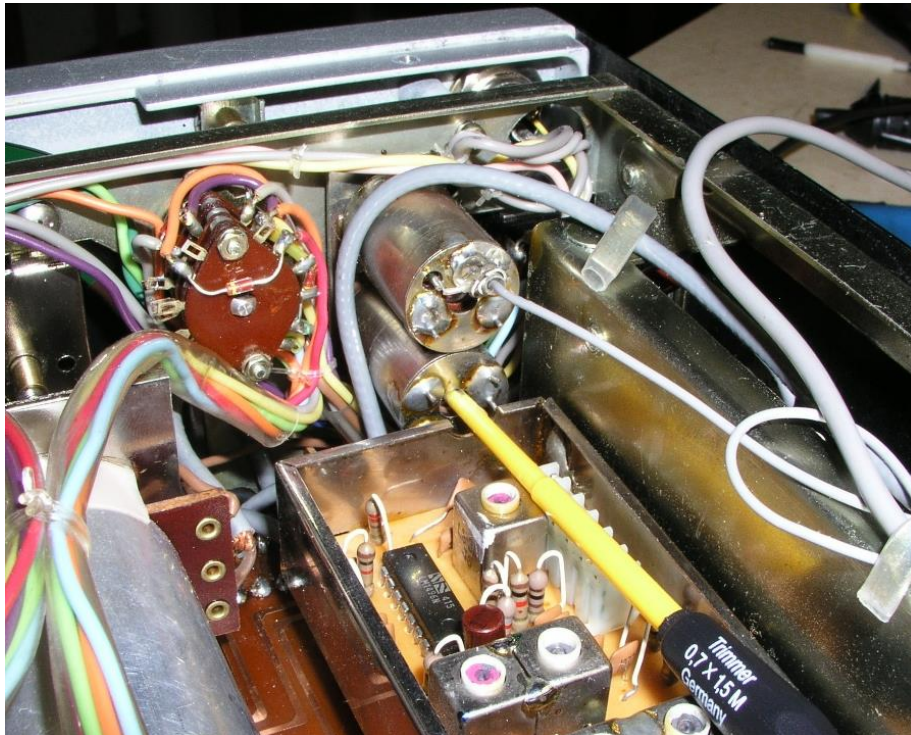


## Helical Filter

These filters (cores) are very sensitive, use appropriate tool only!

Adjust only if you feel that these filters are mismatched!

- 1) Weak signal at 145,000MHz, just enough to move S-Meter to S=1 or 2
- 2) Connect sensitive AF-Voltmeter or scope parallel to speaker
- 3) Adjust both helical filters to maximum AF
- 4) Repeat at 144,000 and 145,999MHz
- 5) If you observe differences tune for maximum at 144,500MHz

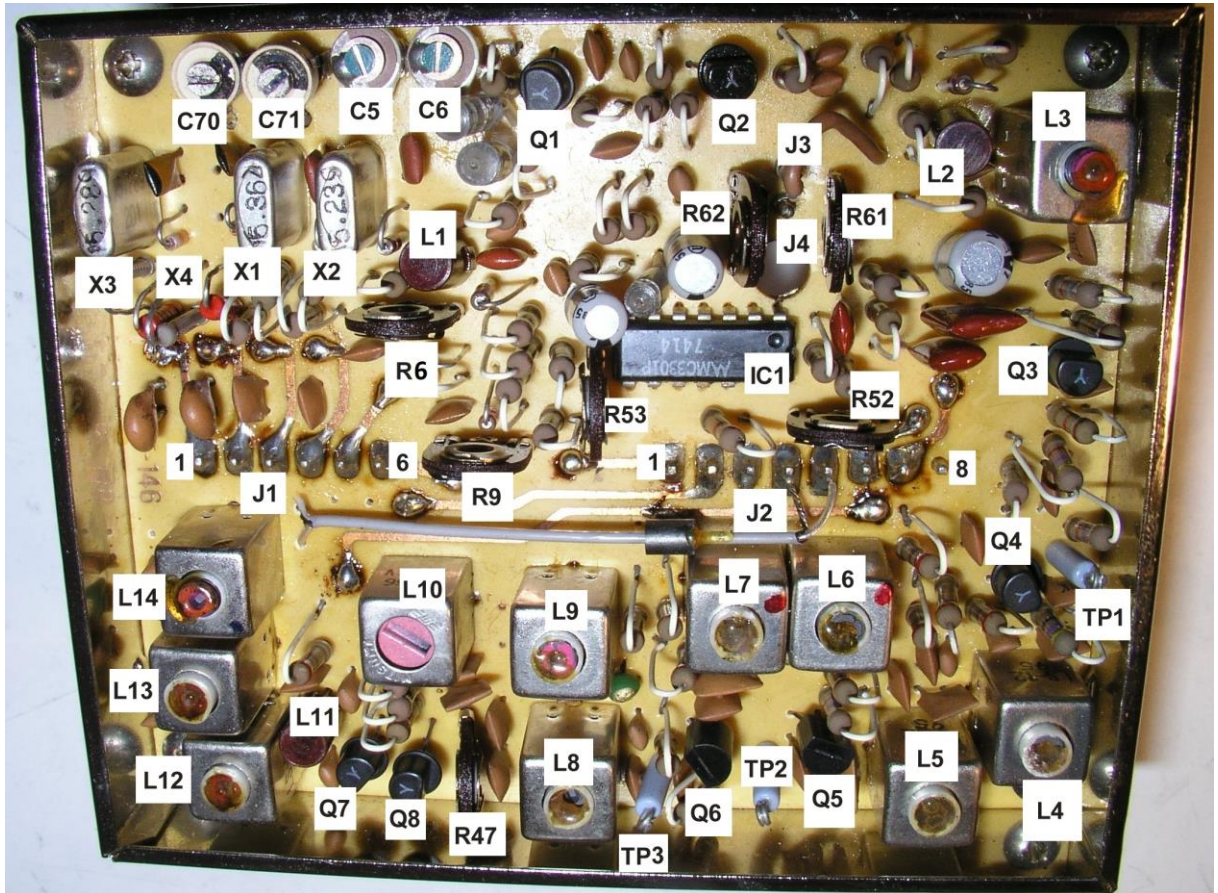


## Premix

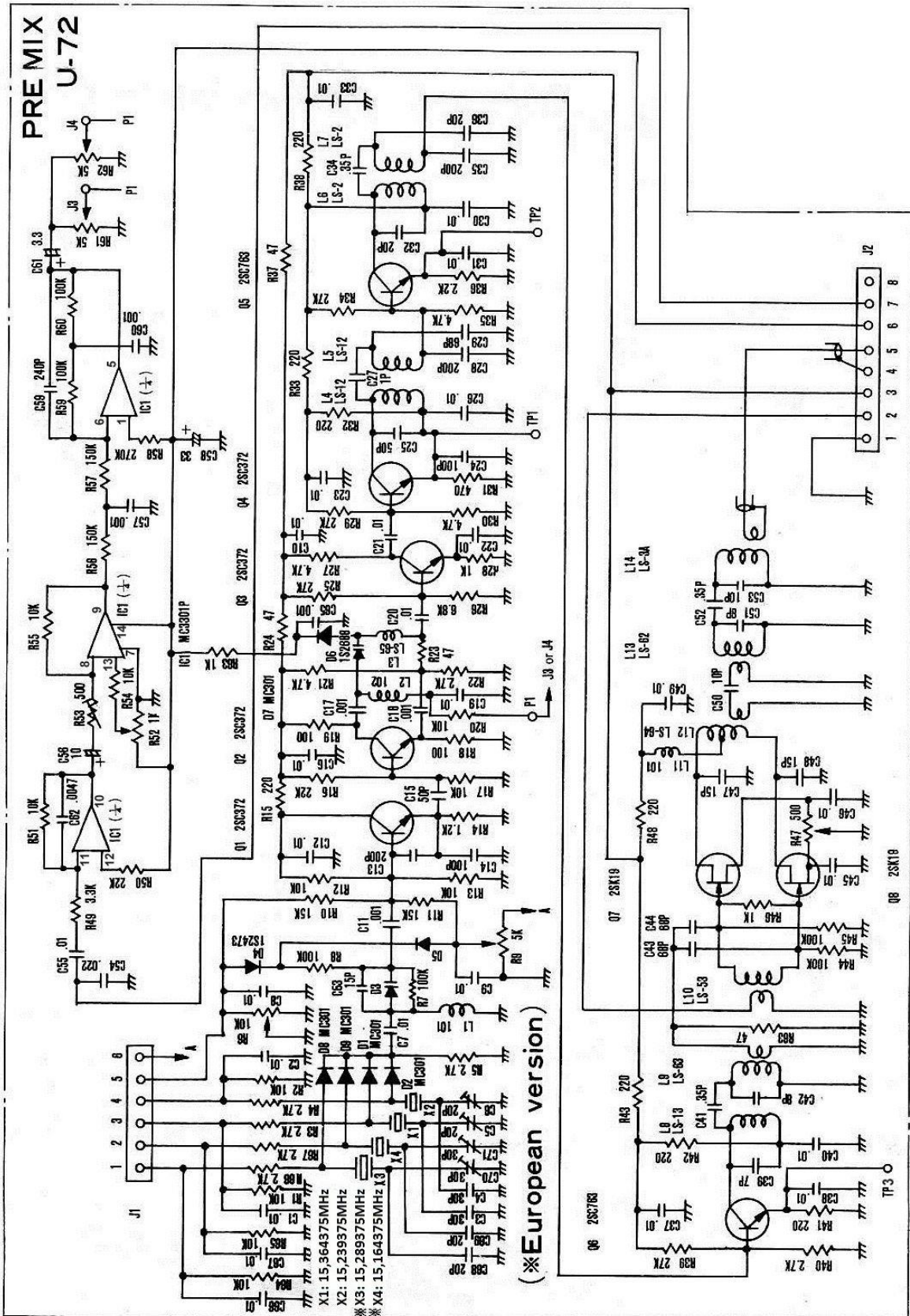
- 1) "CAL" (Calibrator) switched off
- 2) Receive "R", mode USB
- 3) Connect Counter (AC-coupled) to Collector of Q3. Best use analog scope with Y-output
- 4) Connect DC-Voltmeter or Scope with 10:1 probe to common cathodes of D4 and D5.
- 5) "RIT" centered: Trim R6 for app. 2,3VDC
- 6) Set "Coarse" to 144 MHz (simplex).
- 7) Measure frequency; should be app. 15,239 MHz.
- 8) Check: Tuning "RIT" should change frequency app. +/- 400 Hz – symmetrically to both sides
- 9) If not readjust R6 and check again – back to 7)
- 10) "RIT" centered again.
- 11) Measure frequency; should be app. 15,239 MHz.
- 12) Connect dummy load; switch to transmit "T".
- 13) Adjust R9 for exactly same frequency as 10)  
Note: Mode has to be "USB" not "FM"!  
In FM there is a small difference in RIT adjustment compared with USB/LSB/CW!
- 14) Switch to "R", "RIT" centered
- 15) "Coarse" 144 MHz: Adjust C6 to exactly 15,239375 MHz (X2)
- 16) "Coarse" 145 MHz: Adjust C5 to exactly 15,364375 MHz (X1)
- 17) "Coarse" 145 MHz DUPLEX: Switch to "T" and adjust C70 to exactly 15,289375 MHz (X3)
- 18) Check: 145 MHz in DUPLEX is on "RX" same as in 15 (15,364375 MHz)
- 19) Recheck 15, 16 and 17 in "R" and "T"
- 20) Connect AF signal (2kHz, 10mVpp) to MIC-Input
- 21) Set "MIC GAIN" to 30% to 50% position \*)
- 22) Connect Scope to Pin 9 of IC1 (MC3301P)
- 23) Mode "FM", Transmit "T"
- 24) Adjust R52 for symmetrical clipping at Pin 9 of IC1;  
adjust amplitude with R53 if necessary
- 25) DC-Level at Pin 9 of IC1 should be app. 4,5 to 5,0VDC without AF-Input
- 26) Check that AF at Pin 9 of IC1 is just clipped
- 27) Connect Jumper P1 to J3 and adjust FM-Deviation with R61 to 5.0kHz
- 28) Connect Jumper P1 to J4 and adjust FM-Deviation with R62 to 2.5KHz (for narrow band FM)
- 29) Switch back to receive "R"
- 30) Note: Maximum deviation with constant AF input amplitude will be at a modulation frequency of 2.4kHz due to phase modulation and frequency response of IC1 (R57/R59/R60/C59/C60)

\*) This will be the later operation position with the external microphone.

Up to now, I've no procedure for aligning L3 to L14.

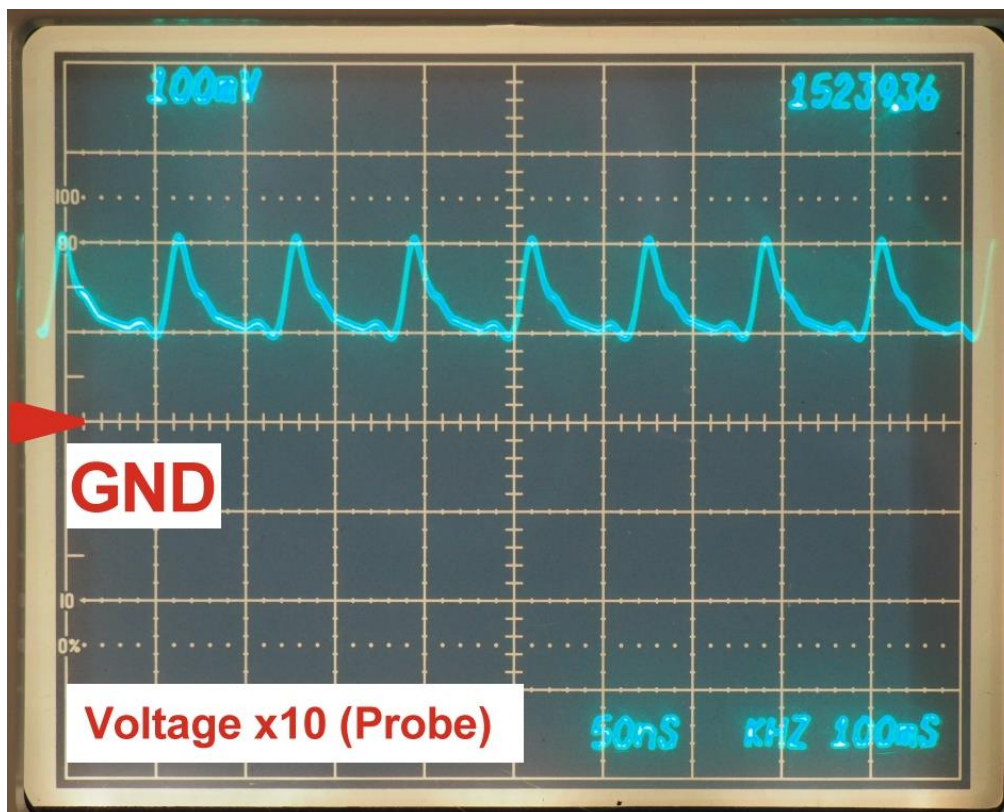


Andrea Baldoni sent me a more precise alignment procedure for the premerixer  
See attachment at the end of this document (mni tnx).



Here some measurements at TP1 to TP3:

At TP1, connected to first doubler, the scope shows:



Measured DC-levels:

TP1: 1,3VDC

TP2: 1,2VDC

TP3: 0,23VDC

It could be assumed, that the inductors L3 to L7 will be tuned for maximum DC-levels at the emitters of the corresponding frequency doublers Q4 to Q6:

L3 > Q4 (TP1)

L4/L5 > Q5 (TP2)

L6/L7 > Q6 (TP3)

L8...L14: Tune for maximum output of J2, Pin 5 (app. 134MHz).

Couldn't check this procedure – all coils are fixed with wax and I don't want to destroy them.

As long as you have no problems with the Premixer keep your fingers away from it!

## FM-IF

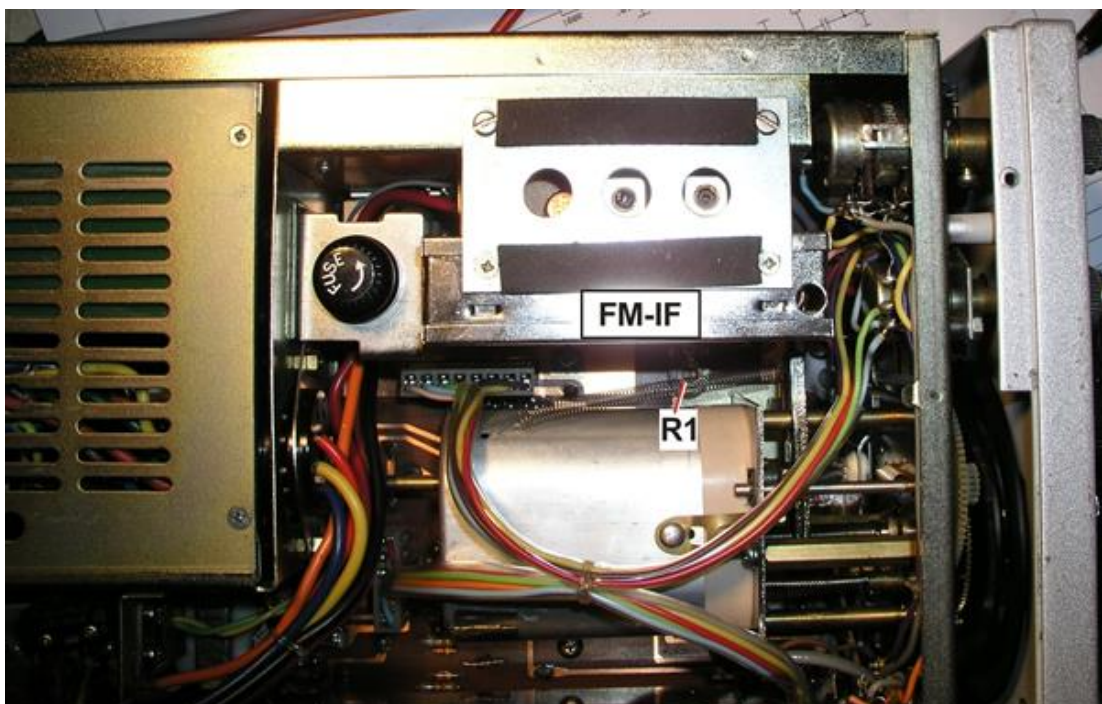
Alignment of FM-Unit can only be done outside the transceiver.

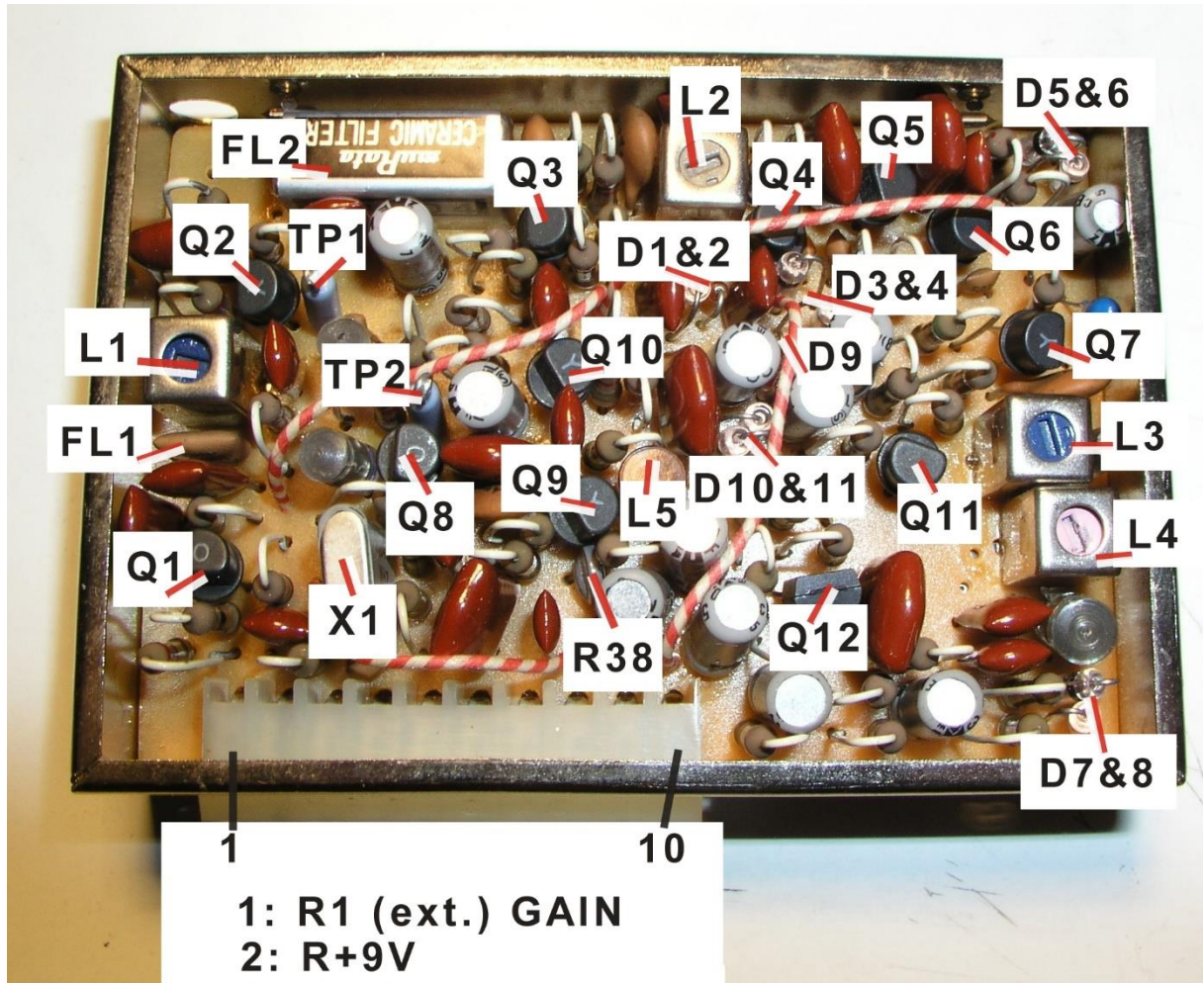
Use pins to connect supply (9V), ground, signals and meters acc. to the picture.

### IMPORTANT:

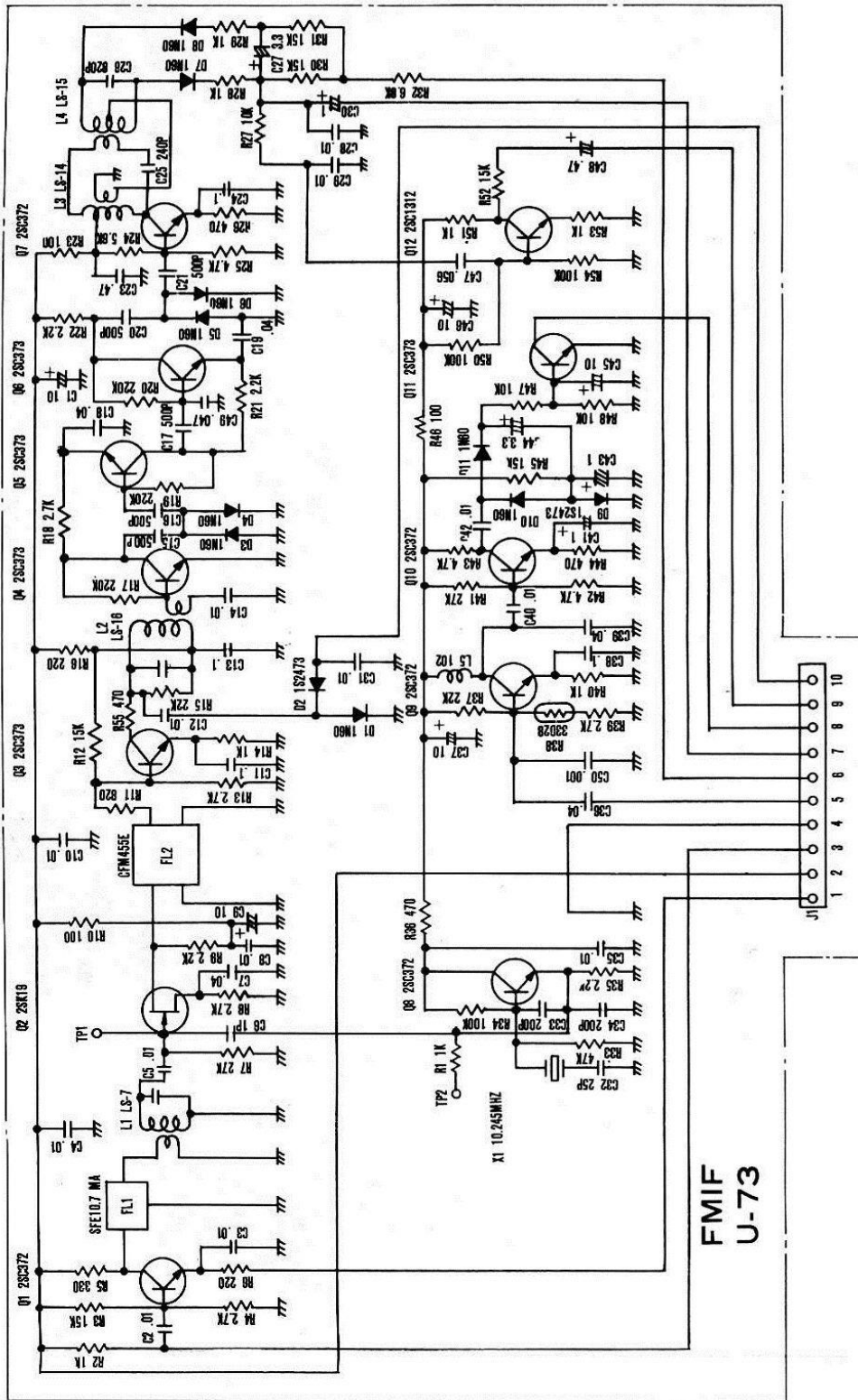
An external trimmer R1 (10kOhm) has also to be connected to ground, otherwise Q1 wouldn't operate.

- 1) Connect counter to TP2 (high impedance); frequency should be 10,245MHz +/-1kHz  
Use analog scope, probe 10:1, with Y-output to connect the counter if available
- 2) Connect IF-generator 10,700MHz, 1mV, unmodulated to pin 3 and 4(Gnd)
- 3) Connect DC-voltmeter to pin 10
- 4) Adjust L1 and L2 for max. negative AGC-voltage at pin 10; reduce amplitude of IF-generator as far as possible to find the point of best sensitivity; try variation of R1
- 5) FM-modulated IF-signal with sinus 1kHz and 5kHz deviation
- 6) Connect scope to pin 9, AF audio
- 7) Connect DC-voltmeter to pin 6, center meter
- 8) Adjust L3 and L4 for best demodulation (scope) and 0V at center meter
- 9) Reinstall FM-Unit into the transceiver
- 10) Mode "FM", "RX"
- 11) Tune in signal 50Mikrovolt 145,000MHz: Set R1 (mainboard nearby the FM-Unit) for S=9





DL7MAJ 03/2015

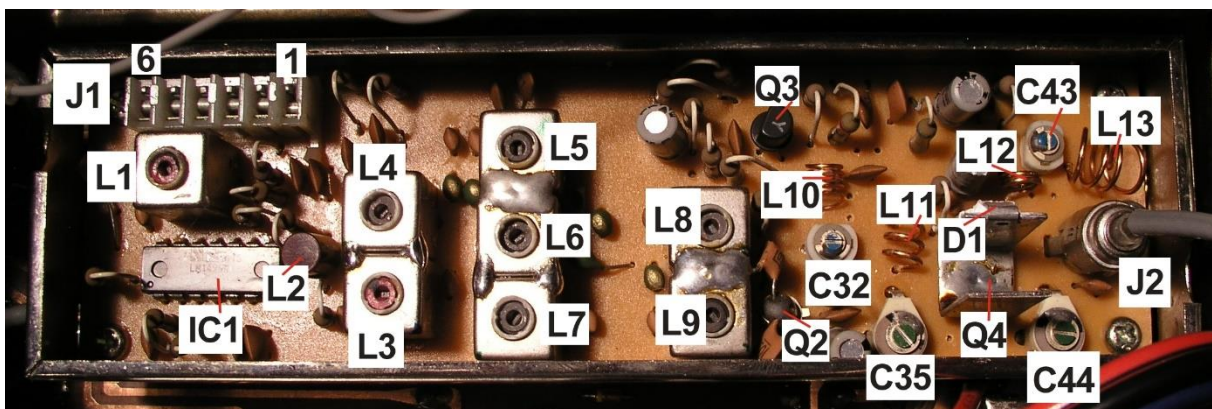


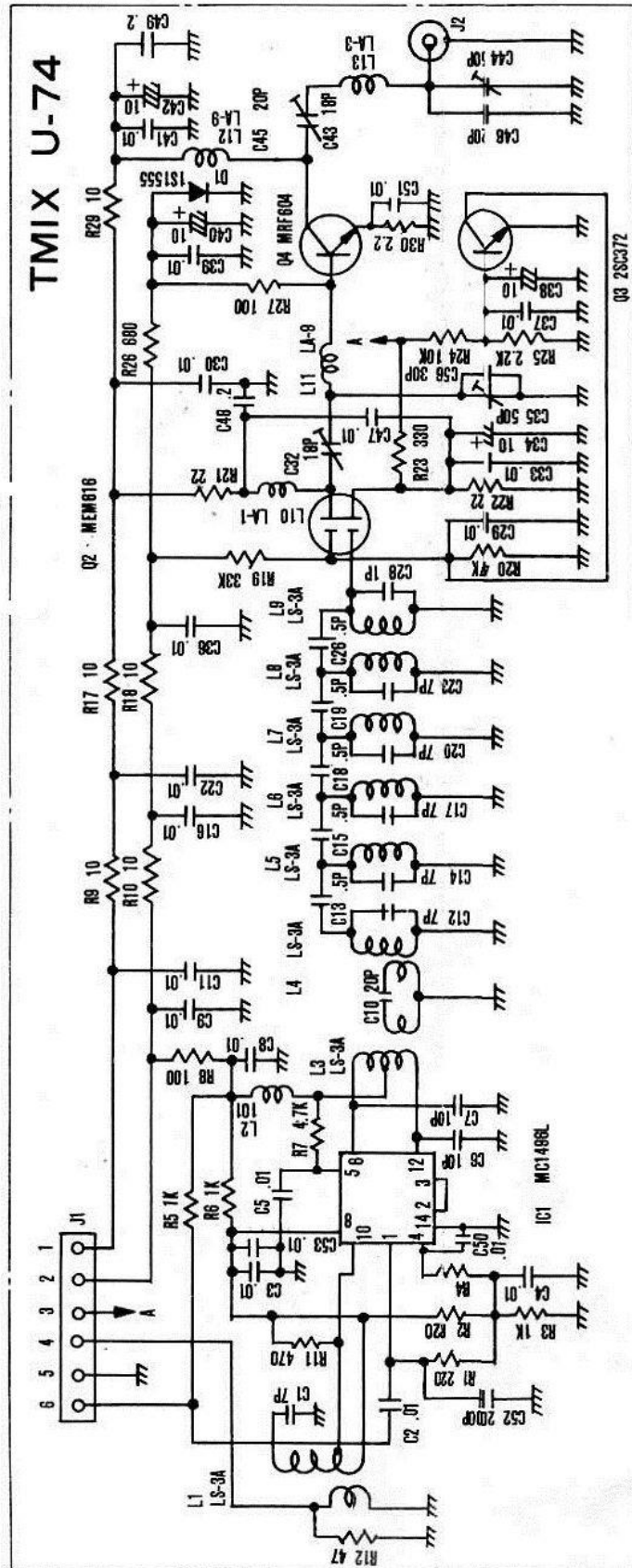


## T-MIX

- 1) Alignment requires an sweeper
- 2) Coarse "145MHz" \*)
- 3) Connect sweeper to the external VFO input: J2 pins 8 (Gnd) and 9
- 4) Set sweep to 10,000 to 13,000MHz, app. 0dBm (700mVpp) \*)
- 5) Mode "FM"
- 6) 50Ω Demodulator (10W) and viewer (scope) at Antenna output
- 7) Sweeper output to zero
- 8) "TX"
- 9) Set sweeper output to app. 1W at antenna output
- 10) Tune L1 to maximum
- 11) Tune L3 to L9 to maximum and flat response in the range of 10,385 to 12,385MHz \*)
- 12) Also tune L2 and L3 of the Buffer Amplifier for flat response (see Buffer Amplifier)
- 13) Reduce sweeper output when 1W at antenna output is exceeded
- 14) Tune C32, C35, C43 and C44 to maximum and flat response in the range of 10,385 to 12,385MHz
- 15) Go back to 10 until result is satisfying: Flat response (+/- 3dB in the range of 10,385 to 12,385MHz

\*) With "Coarse" 145MHz and sweeper from 10,385 to 13,385MHz the output is 144 to 146MHz

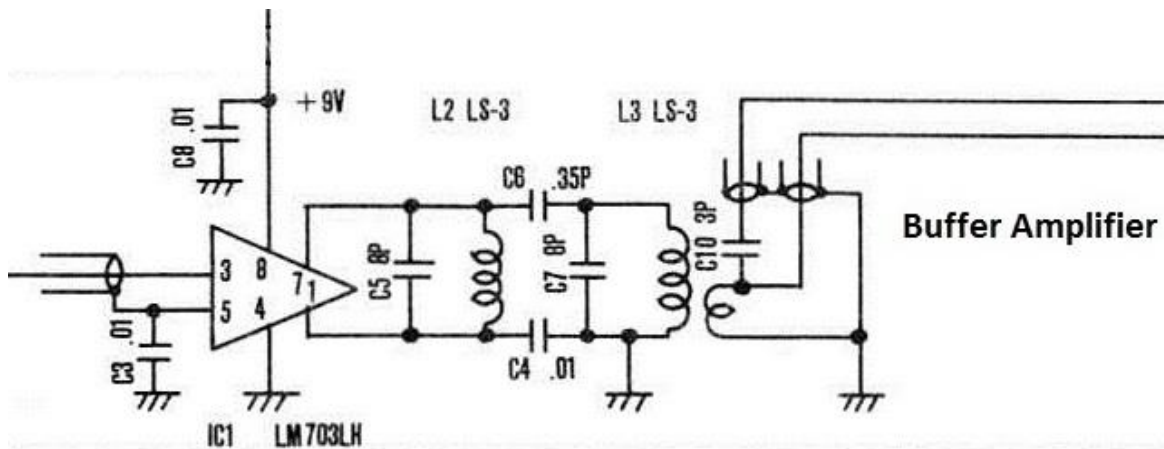
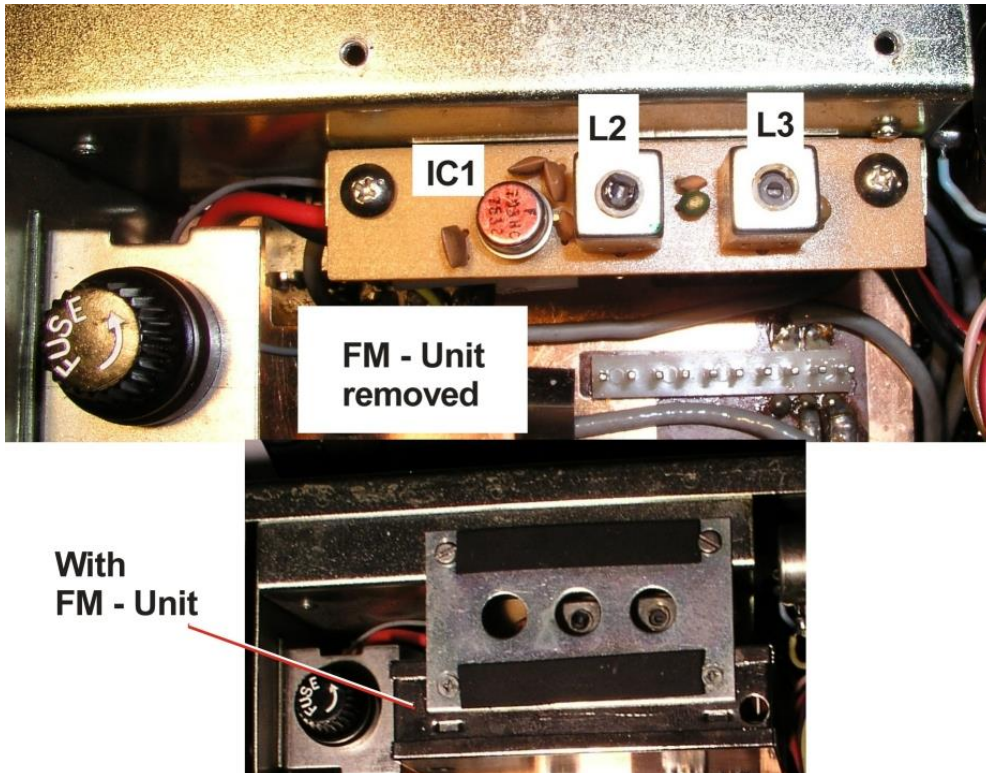




## Buffer Amplifier

This amplifier is located on the bottom of the chassis. It's not necessary to remove the FM-Unit, adjustment of L2 and L3 can be made with the FM-Unit in place through the two holes in the clamp.

Alignment: See T-MIX

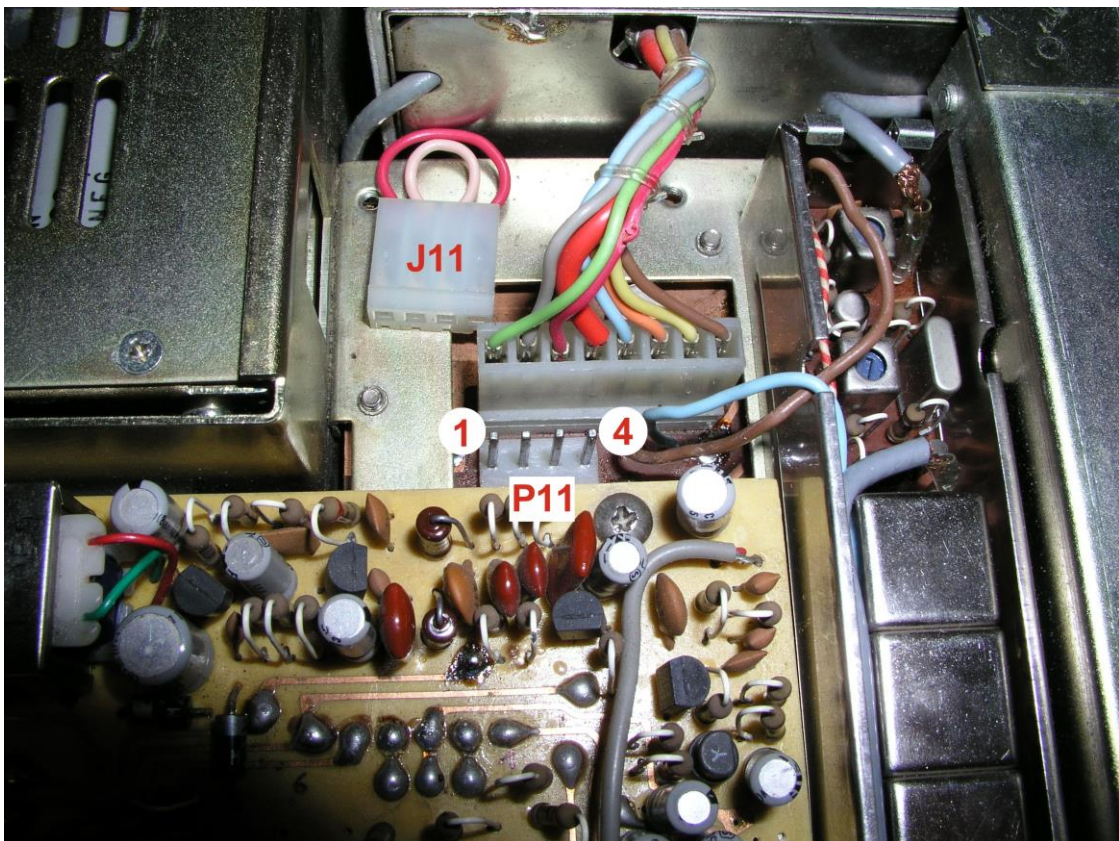
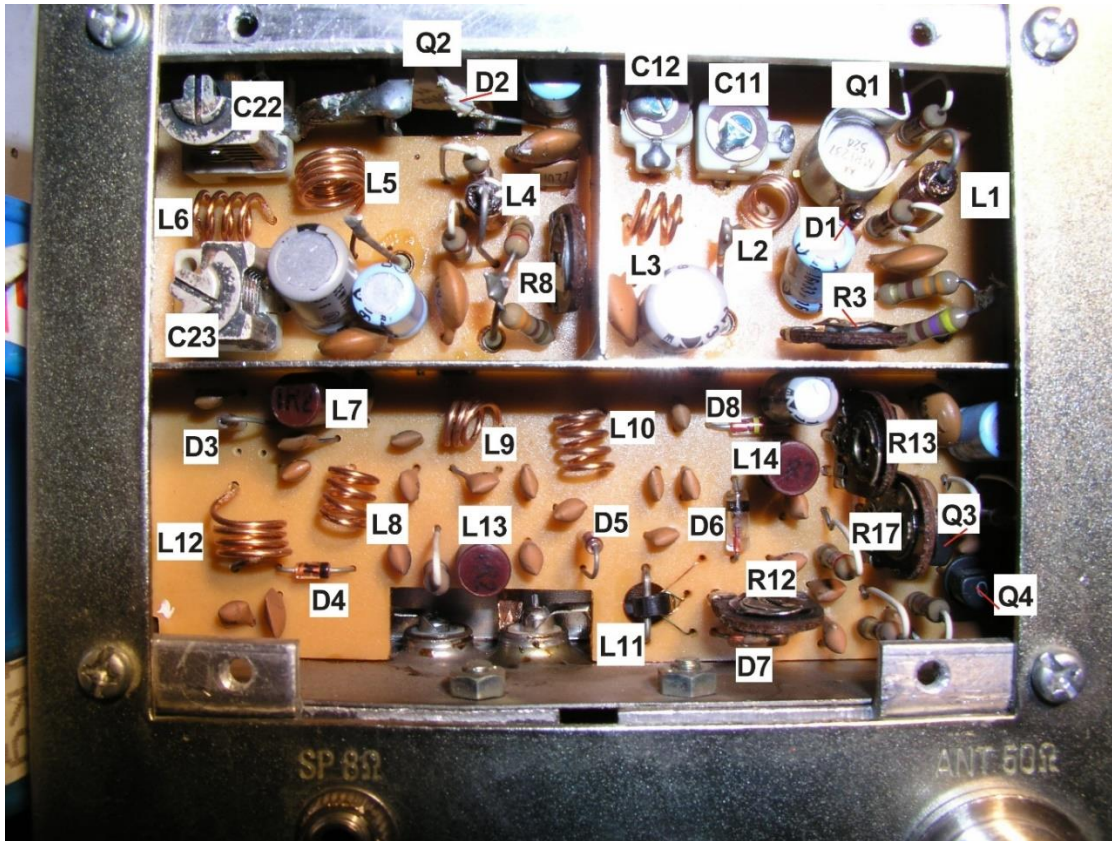


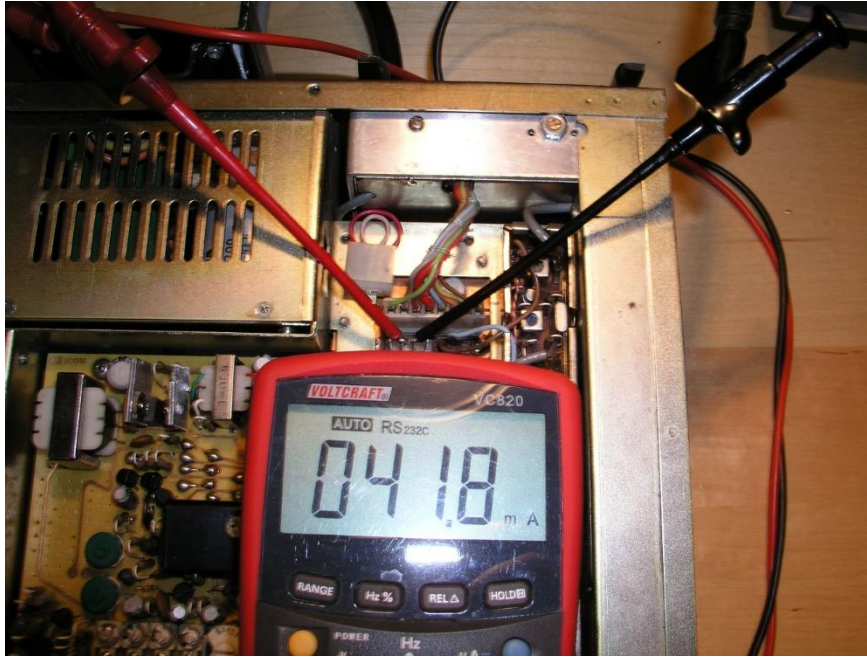
## Final/PA

- 1) "Coarse" to 145MHz, VFO to 000 (equals 145,000MHz)
- 2) Remove heatsink from rear of PA-unit (from now on observe it's temperature)
- 3) Connect Dummyload 50W and Powermeter to antenna output
- 4) Remove jumper P11 from J11
- 5) Switch to "CW", unkeyed! Adjustment of Bias of Q1 and Q2 without HF
- 6) Connect A-meter between pin 2 & 3 of J11 (measures current of Q1)
- 7) Switch to "TX"
- 8) Adjust R3 for app. 30 to 40mA
- 9) Switch to "RX"
- 10) Connect A-meter between pin 1 & 4 of J11 (measures current of Q2)
- 11) Switch to "TX"
- 12) Adjust R8 for app. 80 to 90mA
- 13) Switch to "RX"
- 14) Reinstall jumper P11 at J11
- 15) Mode "FM"
- 16) Switch to "TX"
- 17) Adjust C11, C12, C22, C23 for maximum output; should be 10W
- 18) Maybe TX-limiter R13 limits the output; then adjust R13 for 10W and go back to 15)
- 19) Adjust R12 for SWR=0
- 20) Connect resistor 25 $\Omega$ /20W to antenna output (2 x 50 $\Omega$ /10 $\Omega$  parallel)
- 21) Adjust R17 for reducing TX-output: SWR protection at SWR = 2
- 22) Repeat steps 18 to 21 if necessary
- 23) Switch to "RX"

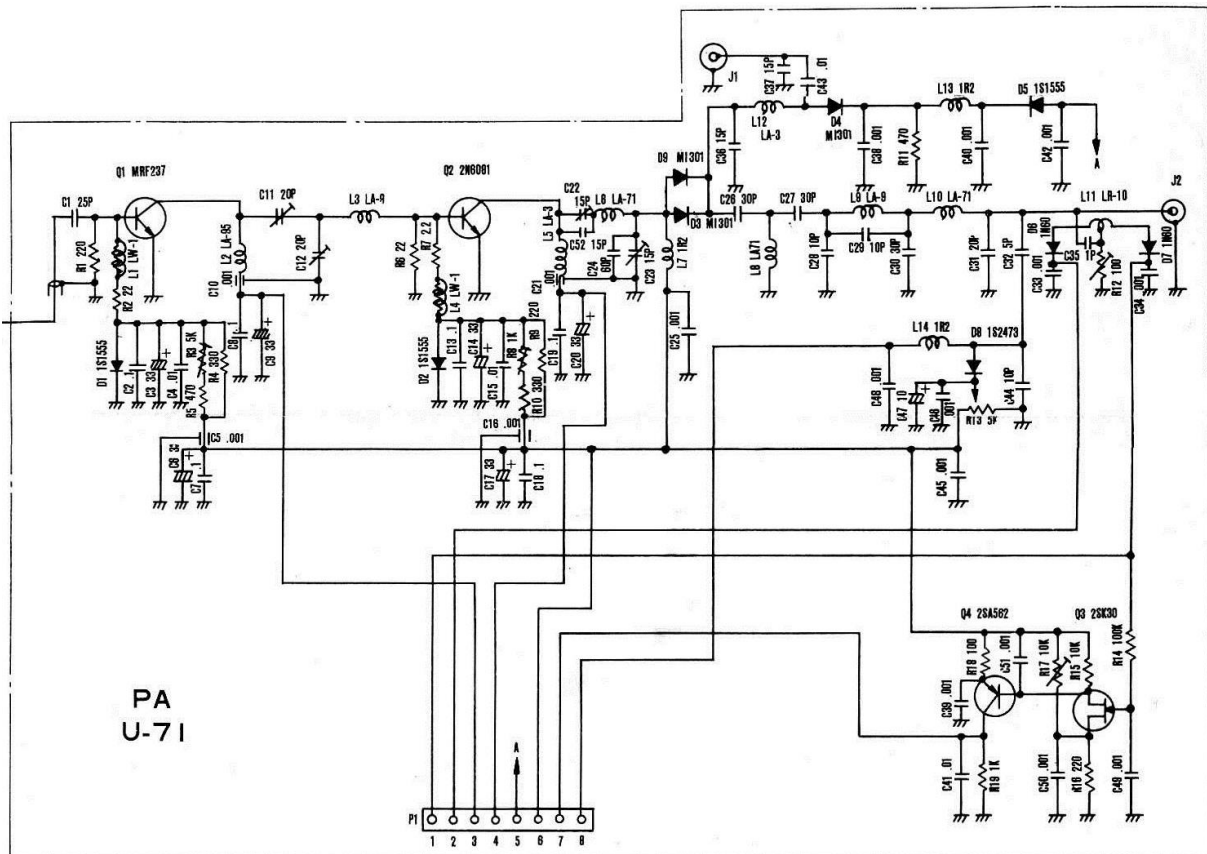
Reinstall the heatsink:

Clean it from old thermal compound and use new one.





Remove jumper P11 at J11, connect A-meter

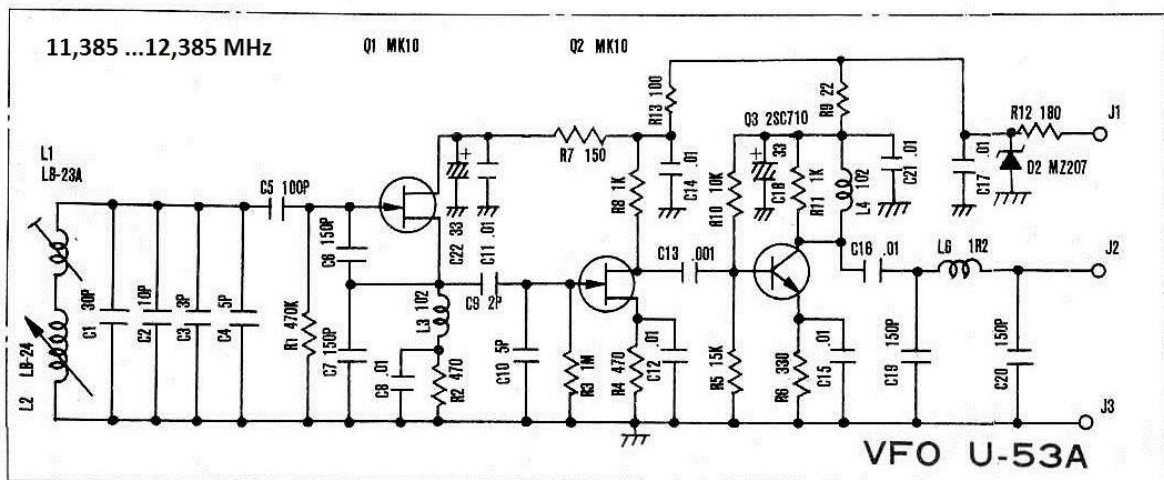
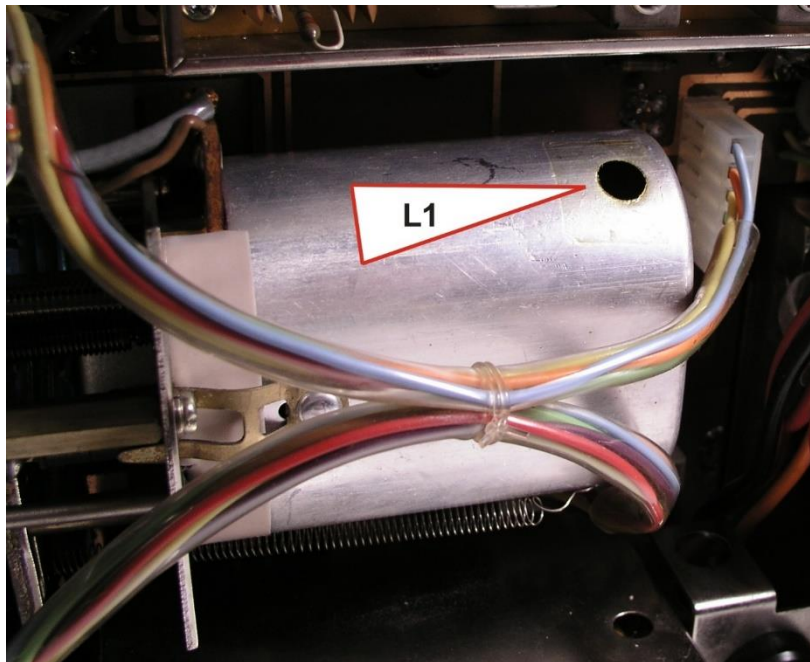


## VFO

- 1) Let the VFO warm up for app. 10 Minutes
- 2) Adjust tuning range of VFO with L1 to exactly 1000kHz (use internal calibrator as reference)
- 3) If you adjust L1, a realignment of the mechanical scale is necessary.
- 4) Repeat 2) and 3) if necessary

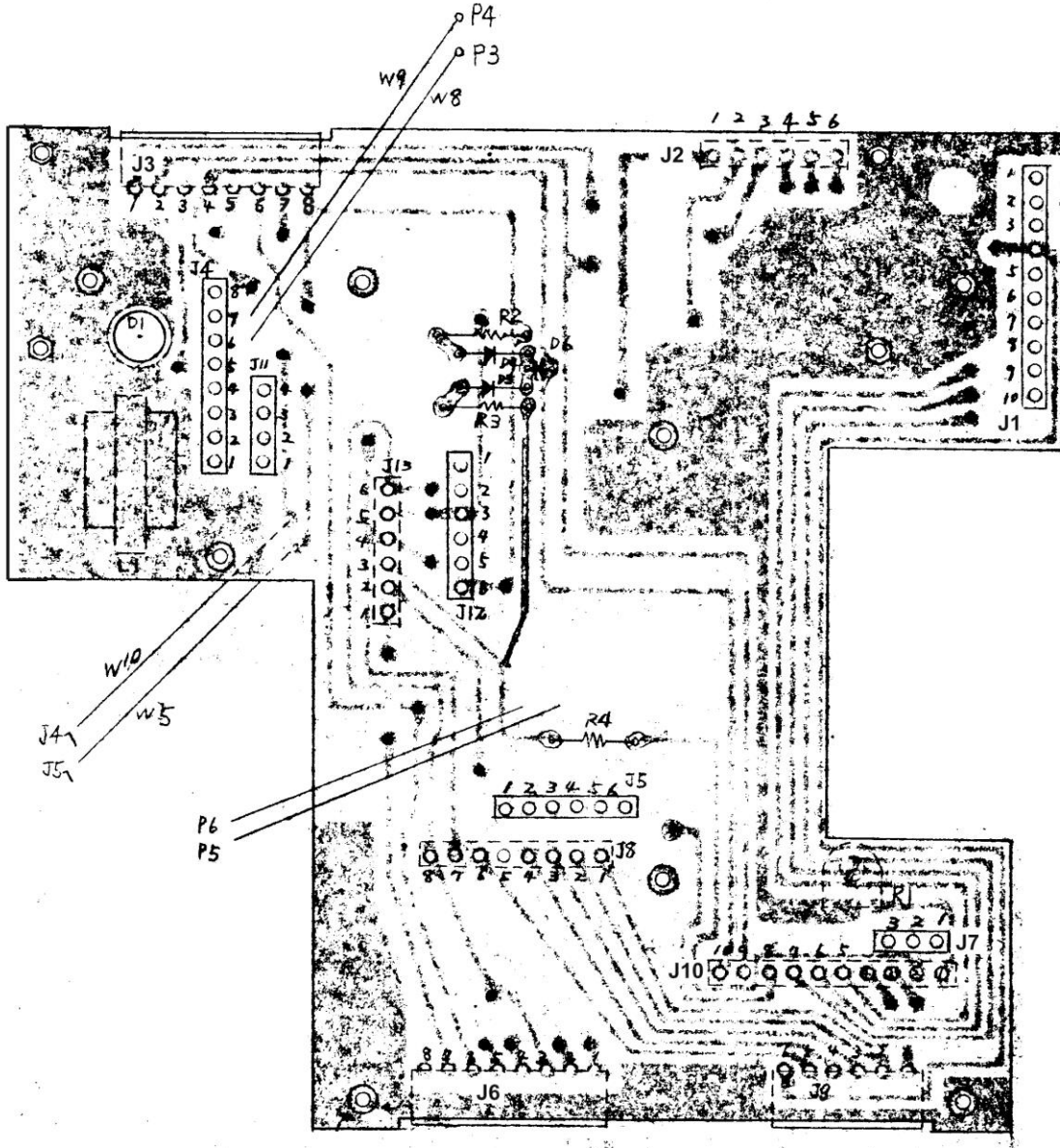
Be very careful! Use plastic trimmers only – otherwise destruction of L1 will result!

(And you are a fool for the rest of you life...)

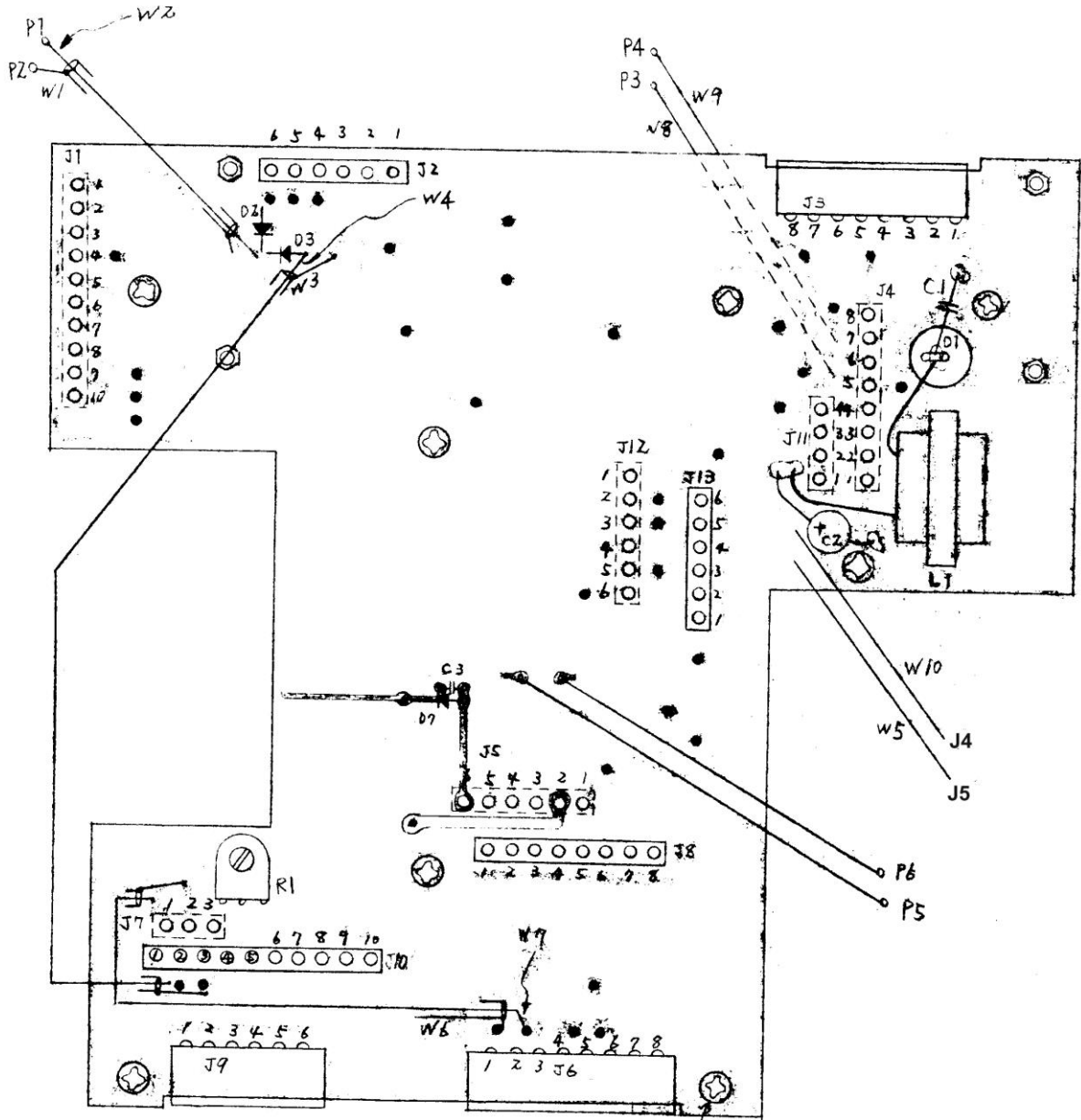


## Mainboard

Only one adjustment is on the mainboard: R1 for the S-meter of the FM-Unit; see **GIF** and **FM-IF**

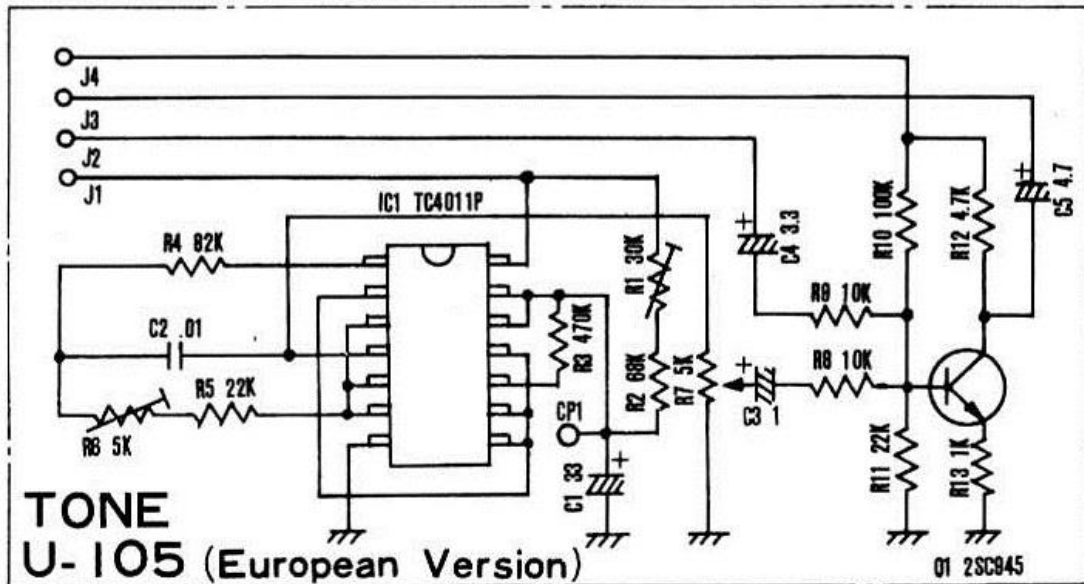






Mainboard

## Tone Unit



When the tone is activated (+9V at J1), C1 is not charged (pins 12 and 13 low) and via pin 11 (high), the RC-oscillator is activated via pin 2. IC1 is a quad NAND-gate. After a certain time, C1 is charged via R1 and R2 and blocks the tone generator via pin 11 (low), R3 is a positive feedback for this blocking.

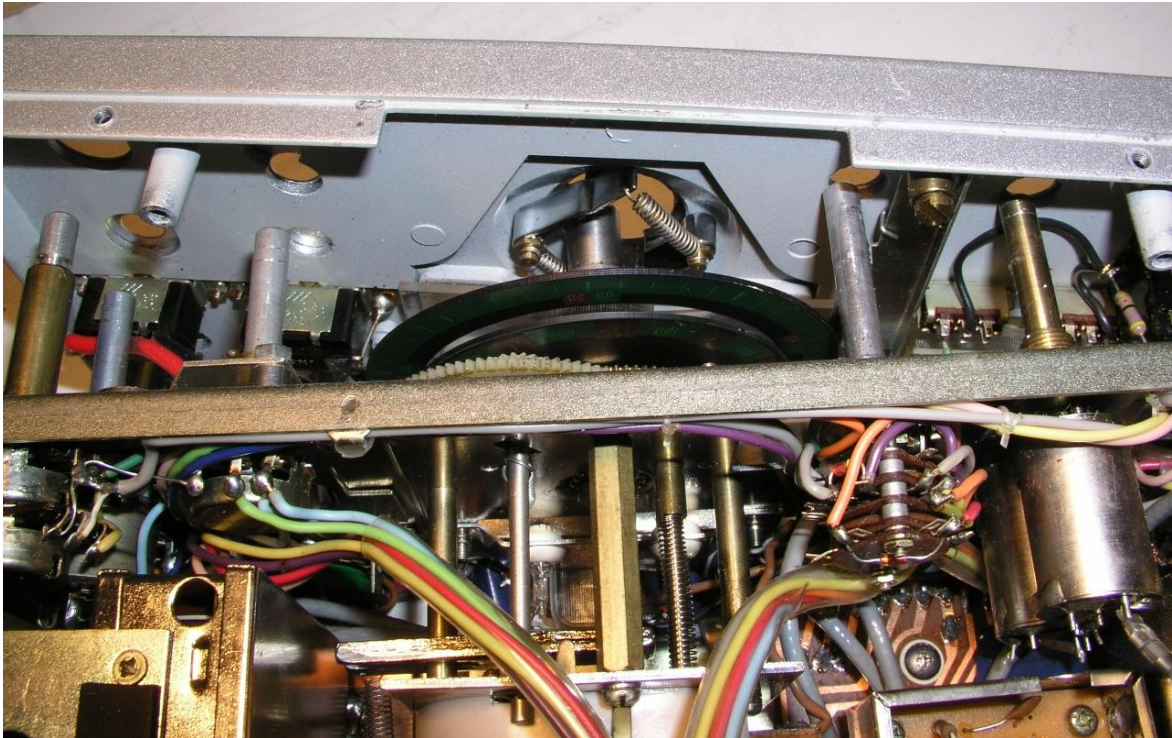
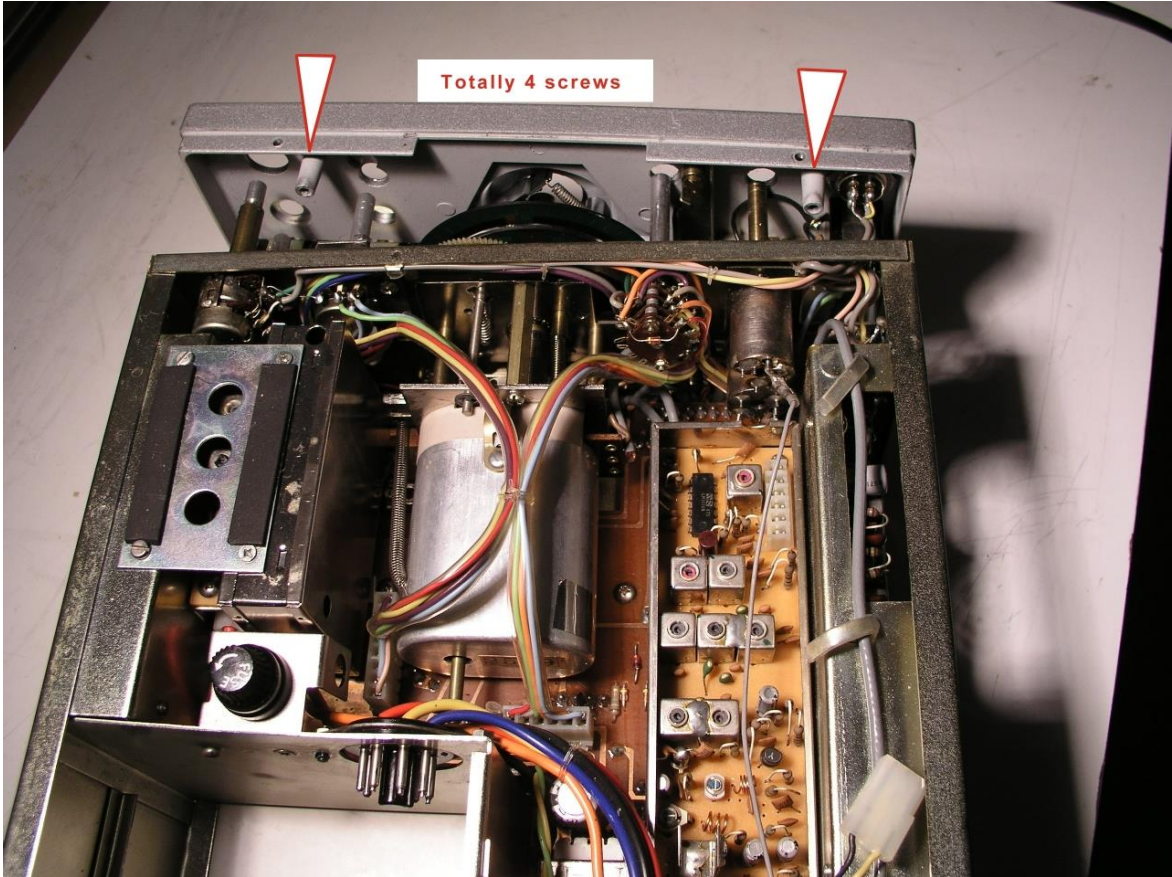
R1 sets the time (duration) for charging C1 and therefore the time, for which the tone is generated.

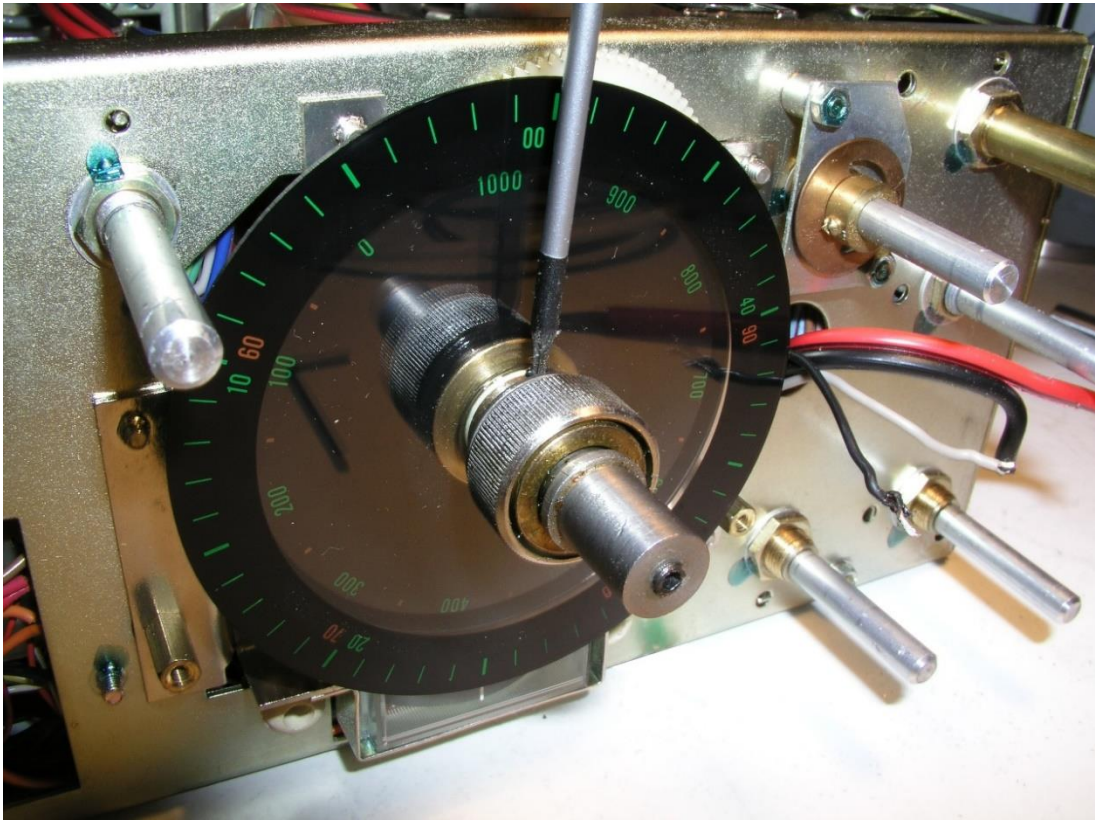
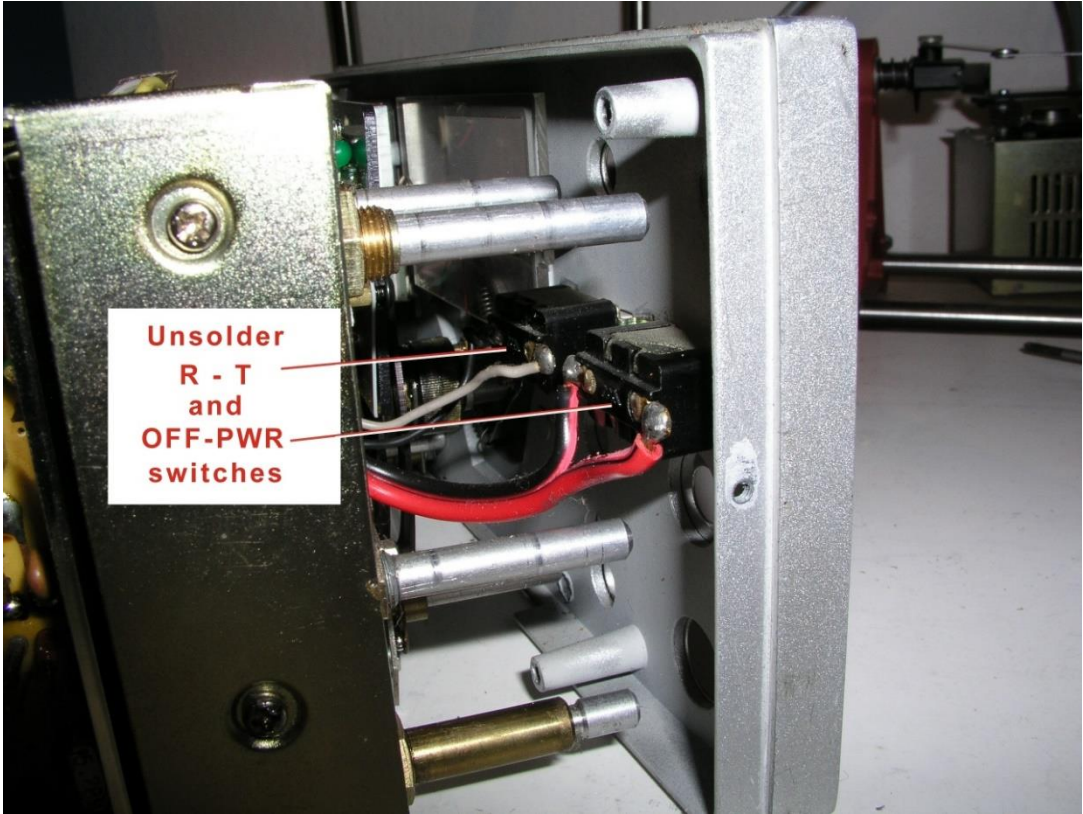
R5, R6 and C2 determines the tone frequency; R6 is adjusted to 1750Hz.

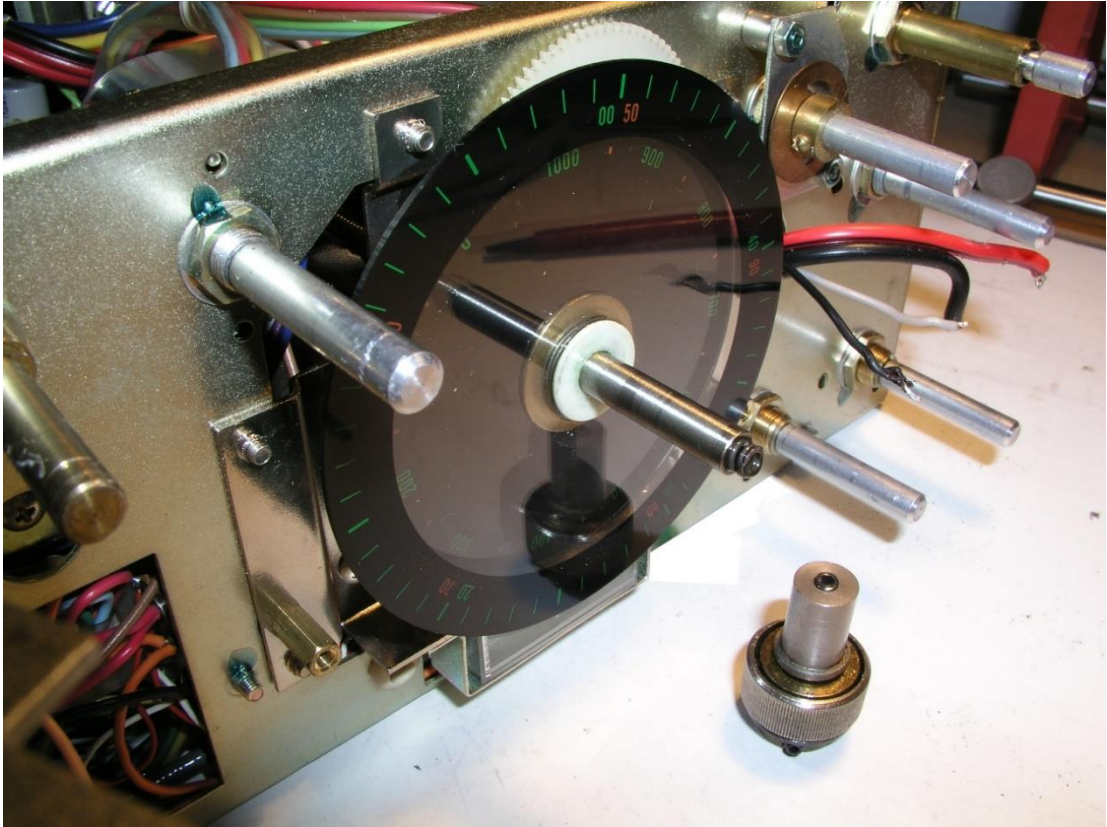
R7 sets the tone deviation. The deviation is also affected by R61 and R62 in the PREMIX-Unit. So first set R61/R62 in the PREMIXer and after that, align R7.

## (De-) Installation of the VFO, Sequence

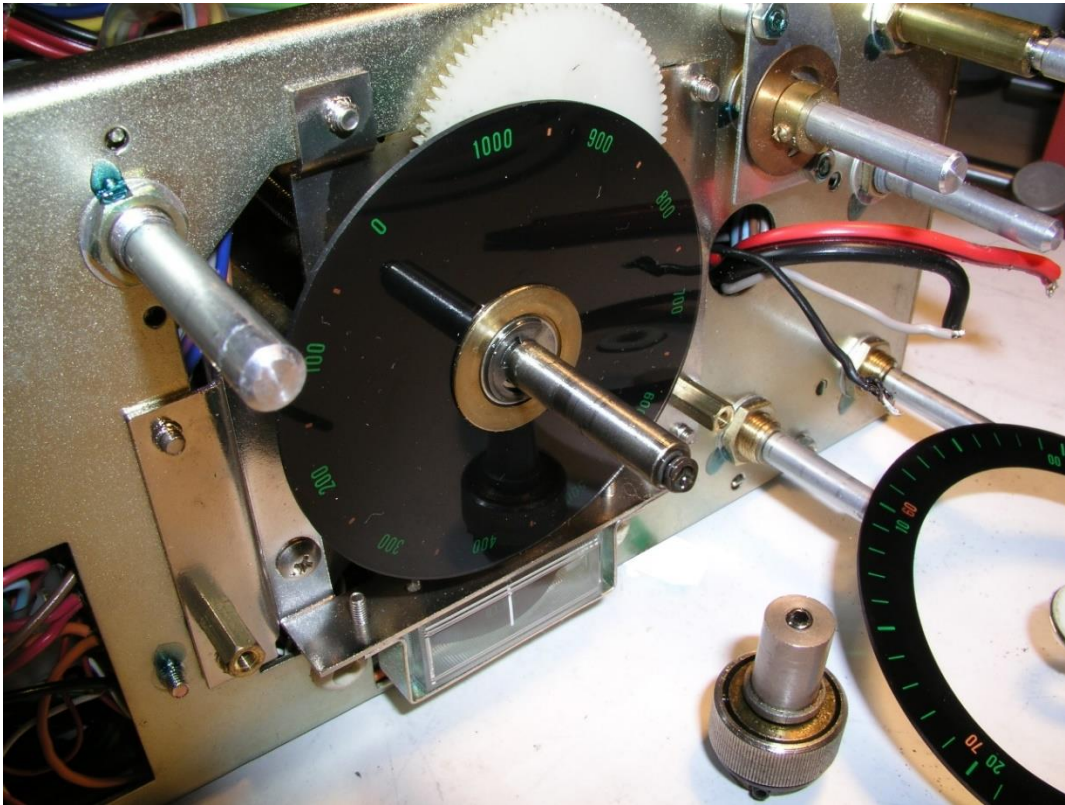
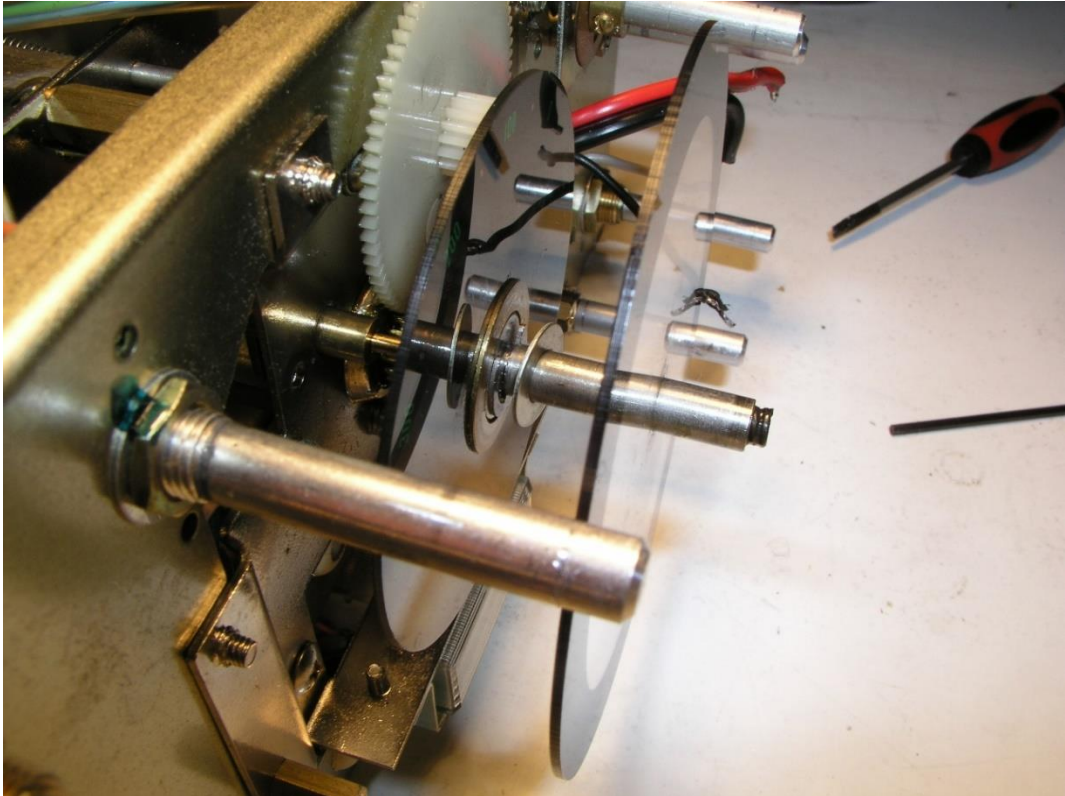


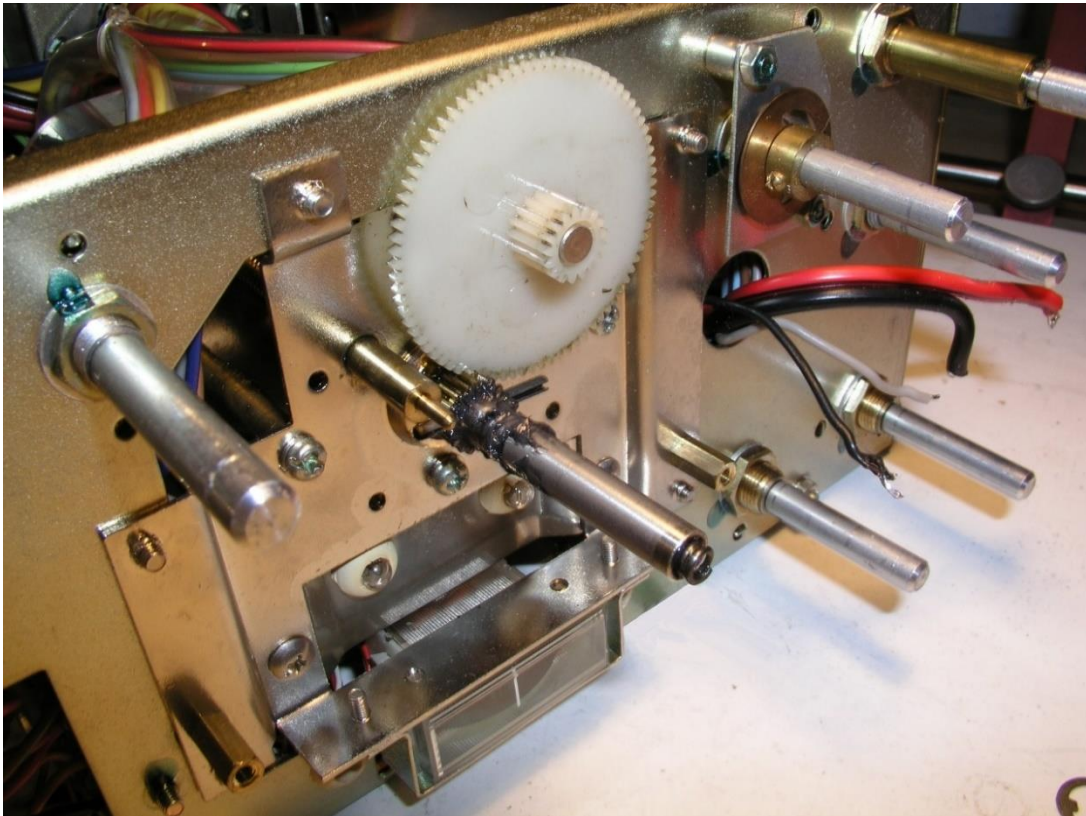
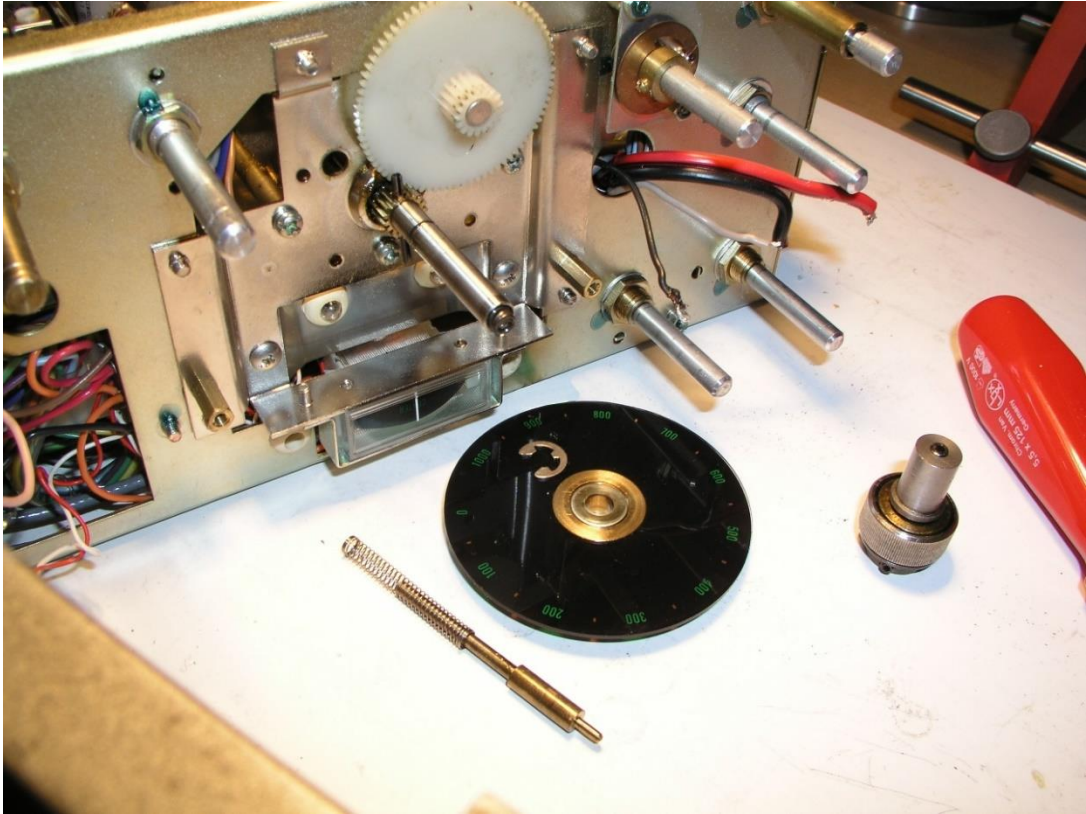




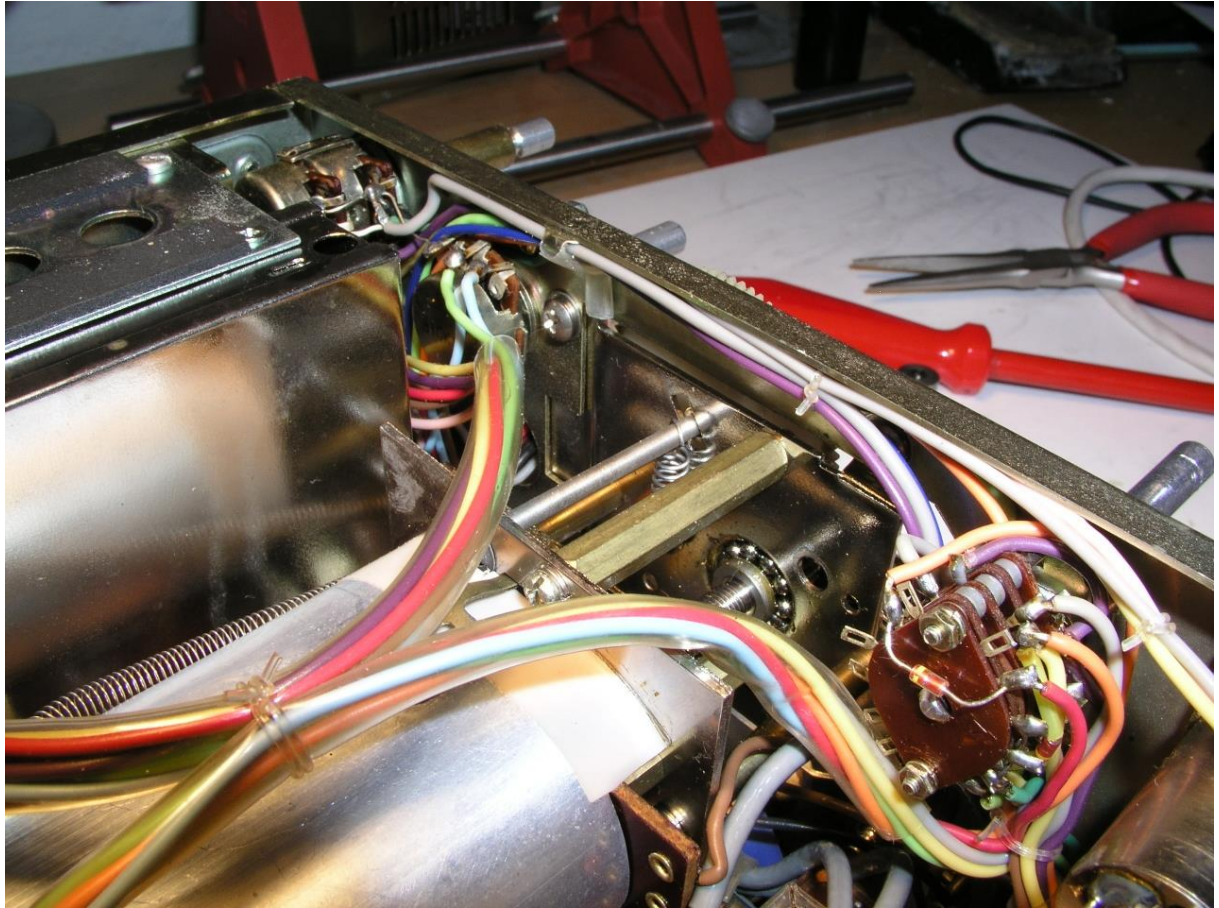


Don't loose it!!!



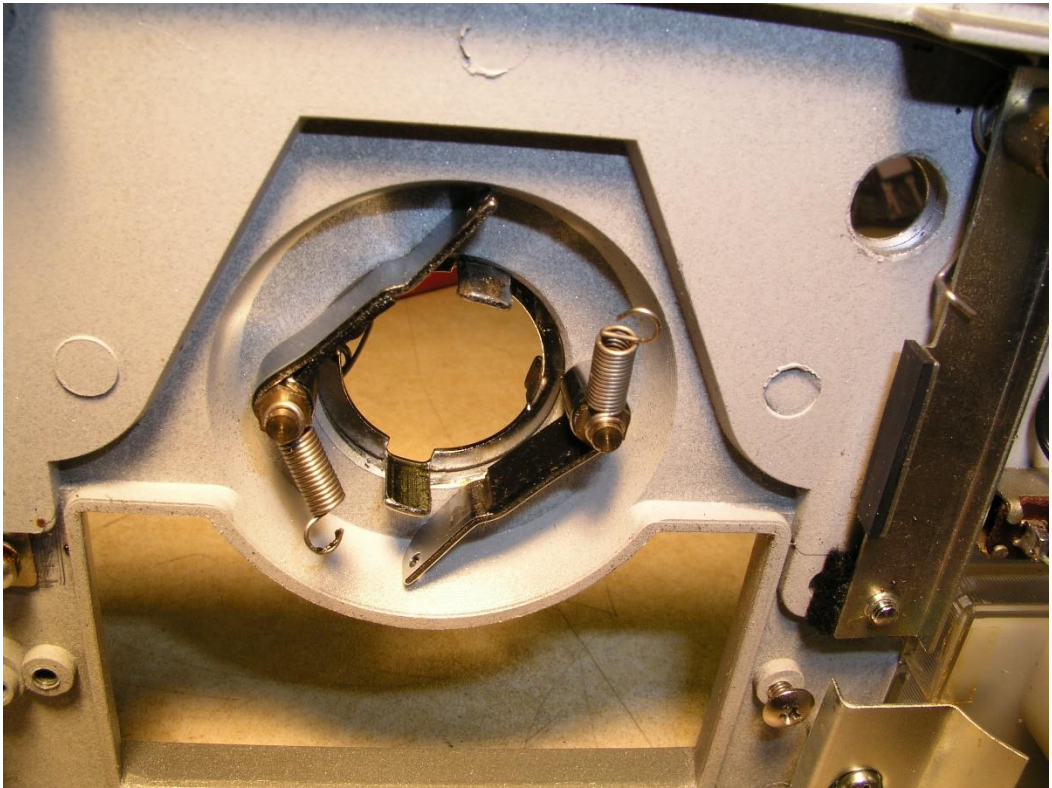
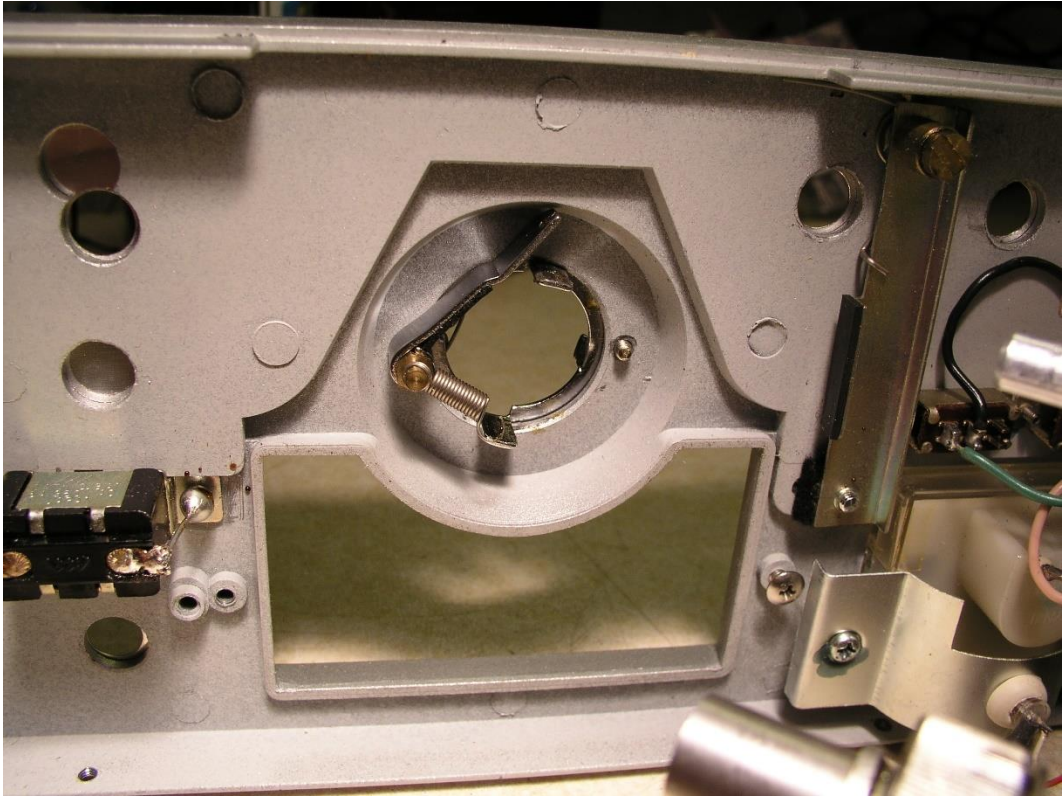


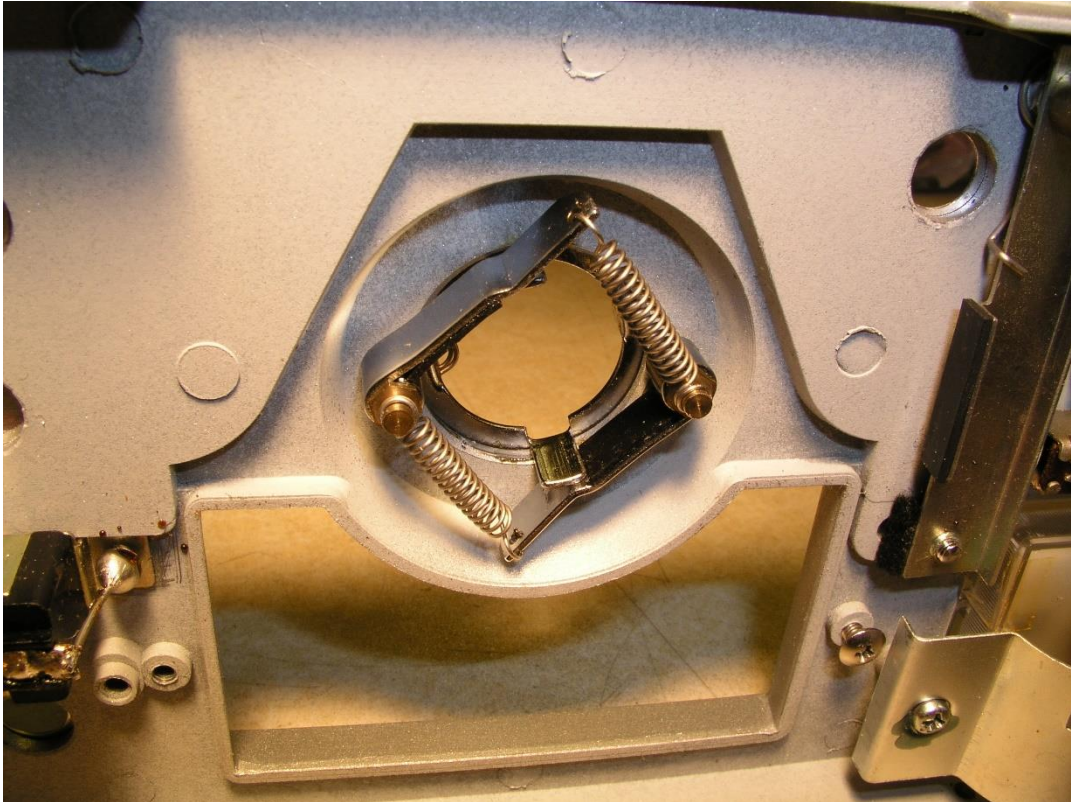


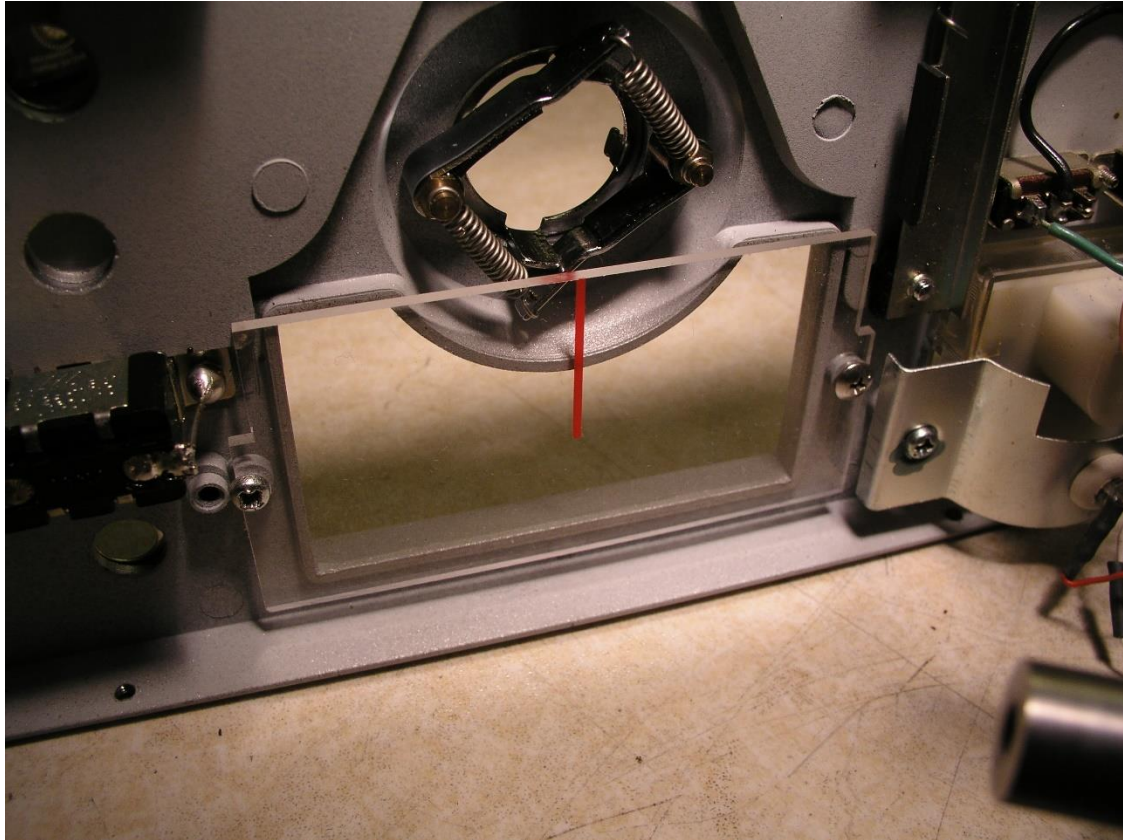


Following pictures show the VFO drive and its (dis-)assembly.









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Homepage: [www.dl7maj.de](http://www.dl7maj.de)

1<sup>st</sup> Attachment from Andrea Baldoni (mni tnx for his work):

I am speaking about the point 14 of the GIF board, where you say to tune L1, L6, L8, L9, L10 for maximum.

I did it, I gained some dB, but to the expense of an extreme nonlinear response of the passband, so extreme that a the Smeter will move many points when you tune a single frequency signal and sweep it between the 300 to the 2700Hz.

It has to be done in another way.

I connected a noise generator to the antenna. Signal level need to be very low, smeter should barely move. I used a power of -137dBm/Hz.

After that, you can proceed two ways.

The complex, is use a RF spectrum analyzer connected through a preamplifier (FET+BJT AC coupled follower) at pin 8 of IC4. Better to turn off the carrier oscillator (ground base of Q14). Center freq. 10.7MHz, span 10kHz.

The easy, that anyone with a PC could do, is with an audio SA. In this case, the line in of the PC should be connected to the pin 5 of the accessory socket. It's before tone and volume processing, so it's a good point to pickup "flat" audio.

I did both to check, but actually I aligned with audio SA because my RF SA is a FFT one and it's much slower. Also with audio I am sure not to load any circuit.

I tuned L1, L6, L8, L9 for max. flatness. L10 for peak signal.

Observations are that L1 work mainly at the mid-low part of the spectrum; L8 to the high... but there are correlations.

L10 could be aligned properly only measuring audio RMS voltage and even that way it's not easy - I suspect there should be a better way. I'll make some experiments.

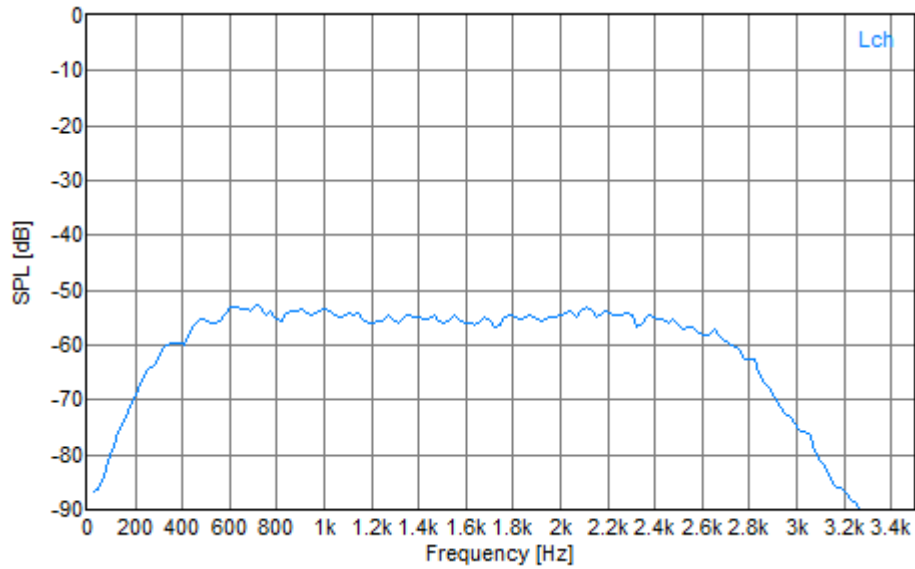
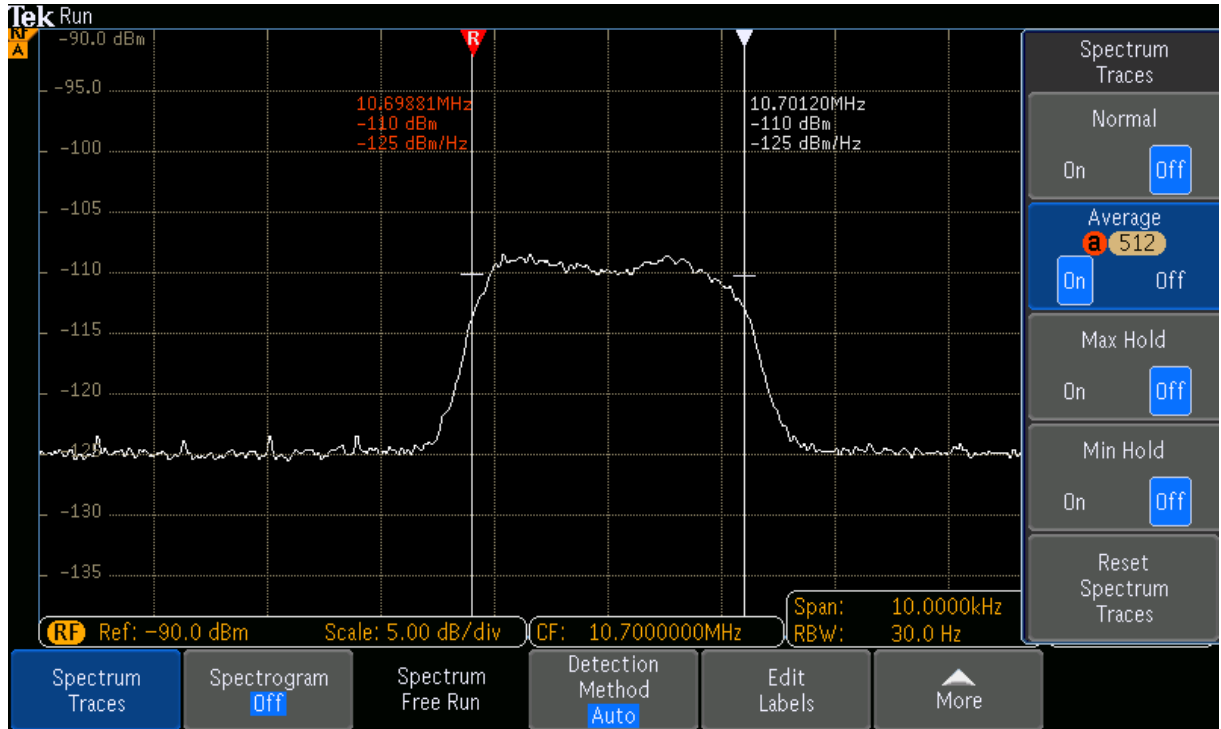
Of course everything could be done as well using a sweep generator instead of a noise one.

I have other two remarks. Premix module, steps 4 and 5. I think that with RIT centered, the voltage couldn't be 0.3V. I measured something like 2.3V. (Noted, DL7MAJ)

The other is, again GIF module, step 15. The standard for HF is 50uV, -73dBm for S9, the standard for VHF should be 5uV, -93dBm. (Noted, DL7MAJ)

I attach two pictures of the spectrum as measured after realigning, audio and RF.

Best regards,  
Andrea Baldoni



2<sup>nd</sup> Attachment from Andrea Baldoni (mni tnx for his work):

To the GIF-board (step14): My IC201 was already (pre)aligned, so maybe  
> i didn't observe the problem you described and i didn't need a sweeper  
> or similar. Starting with an completely unaligned unit, your way may be  
> the best.

If you have the time, please try to sweep it and compare with my results.  
(Didn't check it up to now, DL7MAJ)

> To the premix-module (step 4 and 5): The 0,3VDC are the starting  
> value for alignment > step 9. I didn't measure the actual value after  
> alignment.  
> Note: DC-measurement is difficult with an HF-level superimposed. Any  
> digital voltmeter may be wrong - only old analog meters or scopes will  
> show the correct value.

I checked again with a scope, with same results (maybe my fluke 177 has  
HF filters). I checked the schematic; the voltage here come from the RIT  
potentiometer, 0-9V (in my case actually, 0-9.9V, but it's correct: they  
are generated with a follower after a 10.7V zener), then there is the  
voltage drop of D4. I measure 0.1 left / 3.1 center / 9.4V right.

R6 trimmer contribution (it's actually R6, the R8 is a fixed 100k - yes it  
required much optical guessing) shouldn't be so strong to have 0.3V at center,  
unless your varicap is 10 times more sensitive than mine. My R6 is about at  
center now, with +-400Hz RIT range. (Noted, DL7MAJ)

Best regards,  
Andrea Baldoni