QRV on 160 meters with TS-130V

The Kenwood shortwave transceivers have TS 120 and TS-130 1970-1980 found good value for money because of their many friends. It came in the following variants:

Type	Amateur radio band		Pout [W]
TS-120S	80, 40, 20, 15, 10 m		100
TS-120V	80, 40, 20, 15, 10 m		10
TS-130S	80, 40, 20, 15, 10 m	30, 17, 12 m	100
TS-130V	80, 40, 20, 15, 10 m	30, 17, 12 m	10

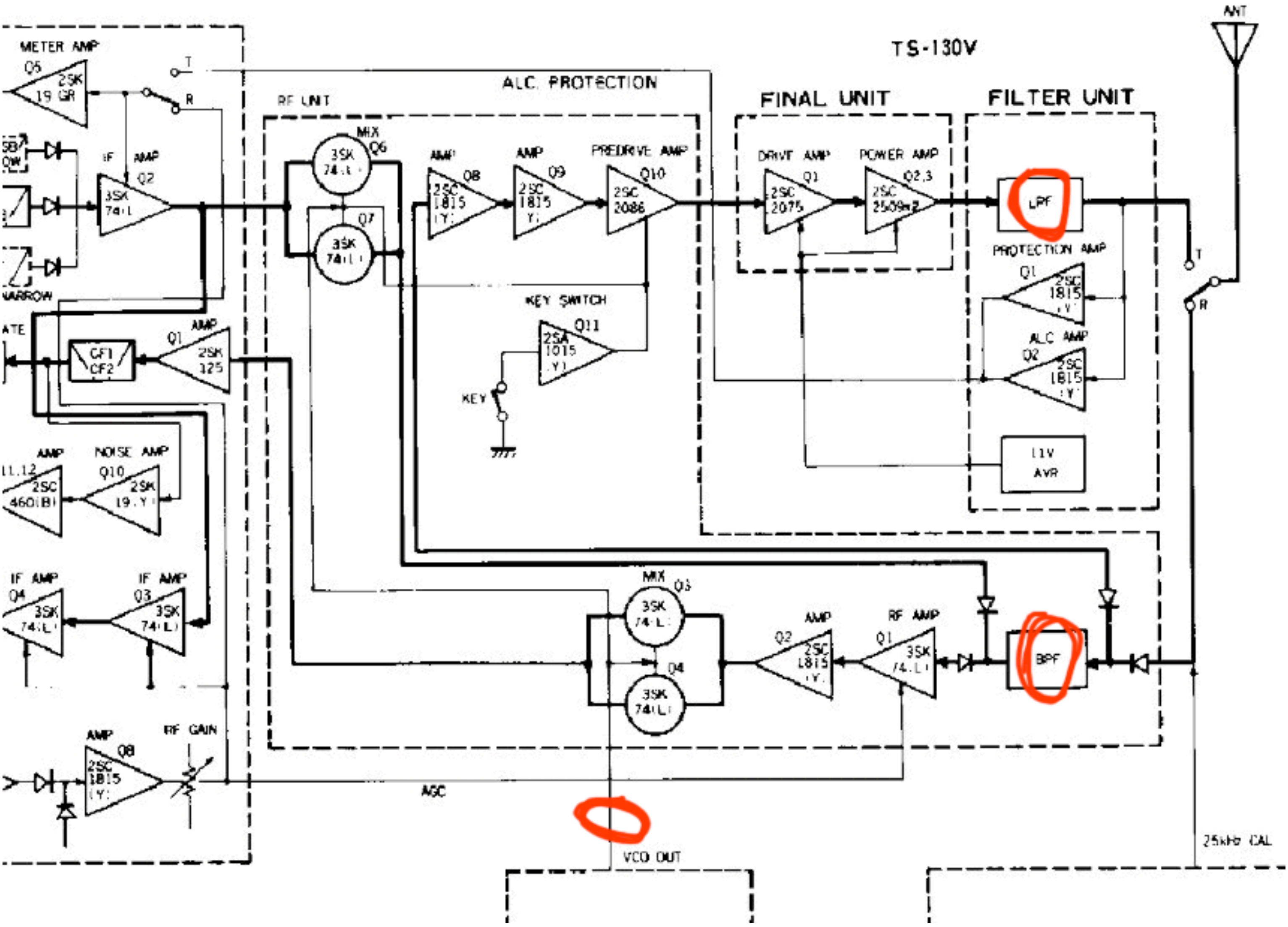
Figure 1: Line with Kenwood VFO-120, SP-120, TS-130V, TL-120 and AT-120

Especially the V variants were / popular, compact devices are for mobile use, the second home and vacation trips. It is a pity that this series is missing in all the transceivers 160 m band. Thus, as one QTH operating on vacation, where there is often plenty of space for antennas is not possible. **Or is it?**

The concept

After studying the frequency of treatment based on the TS-130V block diagram was clear, at least theoretically, to be carried at which points in the circuit has an engagement. The aim was to modify only so much as is absolutely necessary.

Fig.2: block diagram of the TS-130V

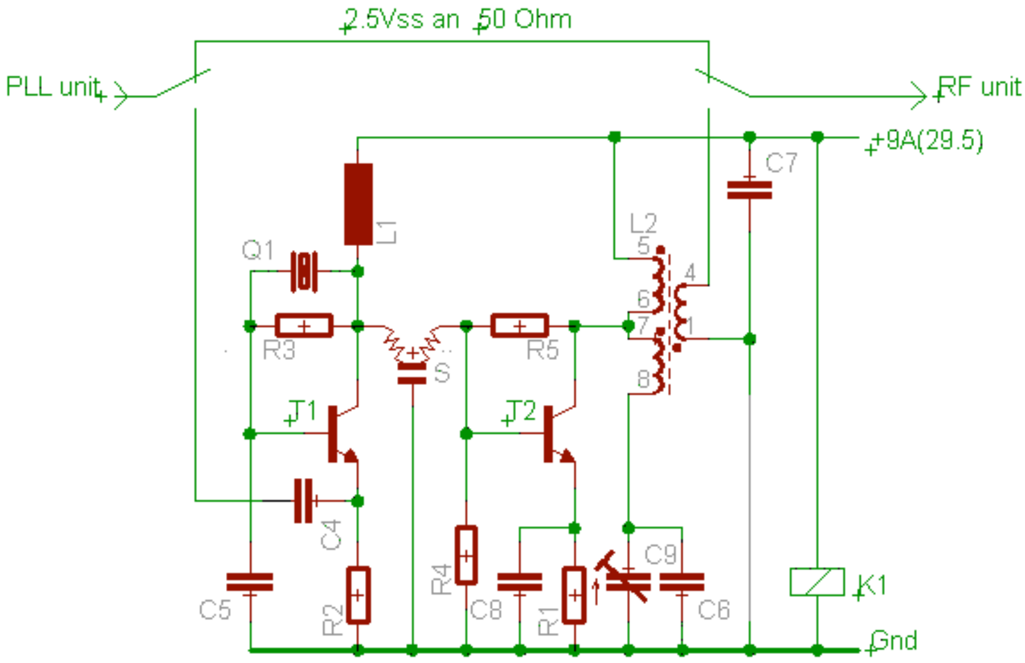


An original idea to activate the relay with the help of several additional area was too complicated and was quickly discarded. Instead, I decided that I never used to sacrifice 500 kHz fourth segment of the 10m band and convert to operate on 160m.
Said segment is 29.5 to 30 Mhz. At an intermediate frequency IF of 8832 MHz has to be mixed with the input signal generated VCO-Out signal from the PLL unit, a frequency F vco 38.33 to 38.83 MHz.
For receive and transmit up to 160m (1815-1890 MHz), however, a VCO frequency 10645-10720 MHz required. It is thus necessary in the switch position, the VCO OUT signal 29.5 down-mix with a 28 MHz signal to FXO 10.xx MHz. The display shows the initial frequency, only one has a 1 instead of the 29th . think Corresponds to a display of 29832.5 1832.5 kHz.

VCO converter

The +9 V switching voltage from the band selector switch (connector J46 / 1) supplies the circuit and the relay K1. The switching voltage is only 29.5 MHz in the switch position, otherwise not. 29.5 MHz in the position, the circuit operates as a frequency converter (converter). In all other positions, the circuit is not functional. The tension-free relay enough then the light coming from the PLL unit VCO OUT signal remains unchanged by the RF unit.

The circuit consists of a mixer, 14 MHz crystal oscillator / doubler, 10.7 MHz ceramic filter and a selective amplifier. The difference between 2x and fxo Fvco yields the desired desktop, new frequency F vco * 10 645 -10 720 for the reception of the 160 m band. The fine tuning of the frequency to exactly 14 MHz Xo done with R3 (100 ohms ..... 220), and C5. Depending on the resistance value changed in parallel with Q1 lying Miller capacitance Cbc of T1

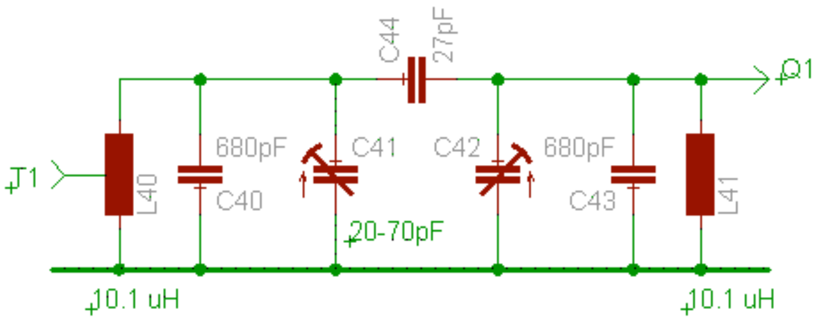


Component	Value
R1	220 Ohm
R2	560 Ohms
R3	100th .. 220 kOhm
R4	22 kOhm
R5	27 kOhm
C4	1 nF
C5	22nd ... 47 pF
C6	56 pF
C7	0.1 uF
C8	2.2 nF
C9	20th .. 90 pF trimmer
Q1	14 MHz quartz
K1	12V miniature relay, 2 CO
T1	2N3904
T2	2N5179 (high Ft)
L1	Choke, 1 mH
L2	Toroidal T44-2, 3 x 12 turns, trifilar
S	Ceramic filter SFE10.7, red, Murata, B = 250 kHz

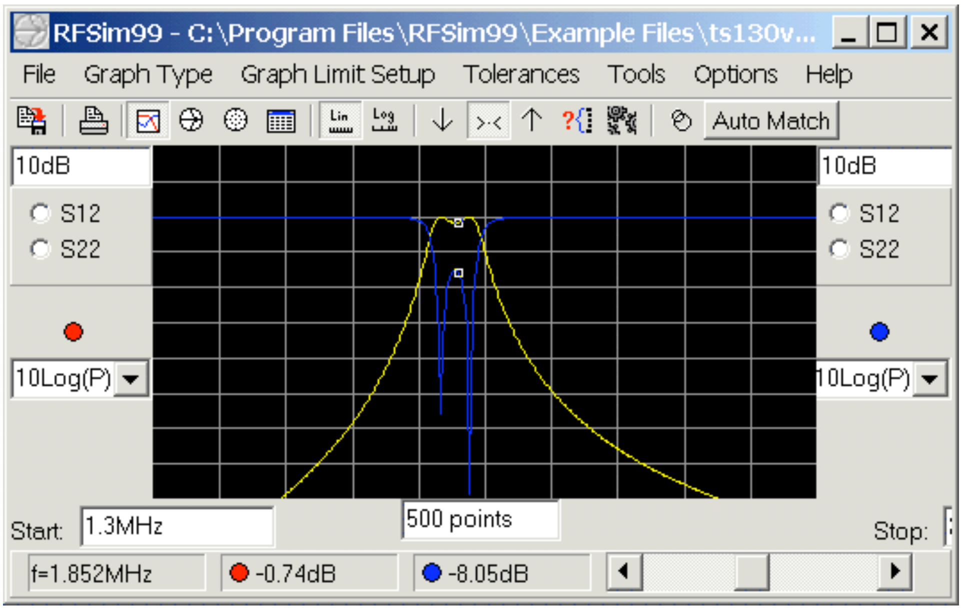
Before the construction of the circuit has been tested by me if the 10.xx MHz signal also reaches up to send and receive mixer. If on the way to the FET's Q6 / 7 and Q 3 / 4 Eventually filters, transformers, etc. Components should lie with high-pass response and a cutoff frequency of about 10 MHz, the effort would be wasted. Fortunately the latter was not the case. After the installation of the mixer but nothing had been heard - logically - because the existing 10 m bandpass signals BPF allows only 28 to 30 MHz.

BPF band-pass for 160 m

The contacts range from 29.5 to happiness lie above the band selector switch, making them easily accessible. On both levels, the switch horizontal trace about 15 mm was separated left side of the contact. Between the plains and on the amount prepaid contacts we now added a small 40 x 40 mm board. It bears the 160m bandpass (1.8 - 1.9 MHz,-3dB) and the converter circuit. L40/41 are quadrofilar wound T44-2 toroids. You ever get 4x 11 = 44 turns. L9 brägt has a tap, an 50%. The Q1 and T1 data refer to the wiring diagram of the RF Unit.



The input impedance of the BPF 160 m is 5 ohms and the output impedance of 20 ohms. The values were determined as best as possible against diagram of the RF Unit and confirmed by measurements. The simulation with these values gives the following attenuation curve. The -3 dB bandwidth is approximately 100 kHz at 1.8 and 1.9 MHz). The circuit was adjusted after installation using a signal generator and oscilloscope.



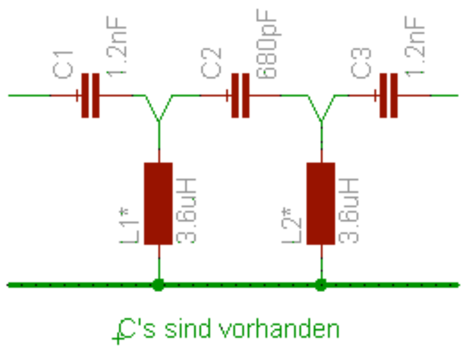
After this modification, the signal from the signal generator could be heard already, but somehow the receiver at 160m compared to 80m deaf. As one culprit lying between the ANT pin (J43 / 1) and the high pass filter HPF bandpasses was localized. He is prevented by strong inter-modulation broadcast signals. The path is also a notch filter and IF-IF trap circuit. The block diagram omits these filters.
A simulation with RF-SIM and the data component of the input filter showed that its cut-off frequency is about 3.5 MHz. At 1.85 MHz is the curve of an attenuation of 25 dB, which agrees with observation. So also here modify.

HPF high pass for> 1.8 MHz

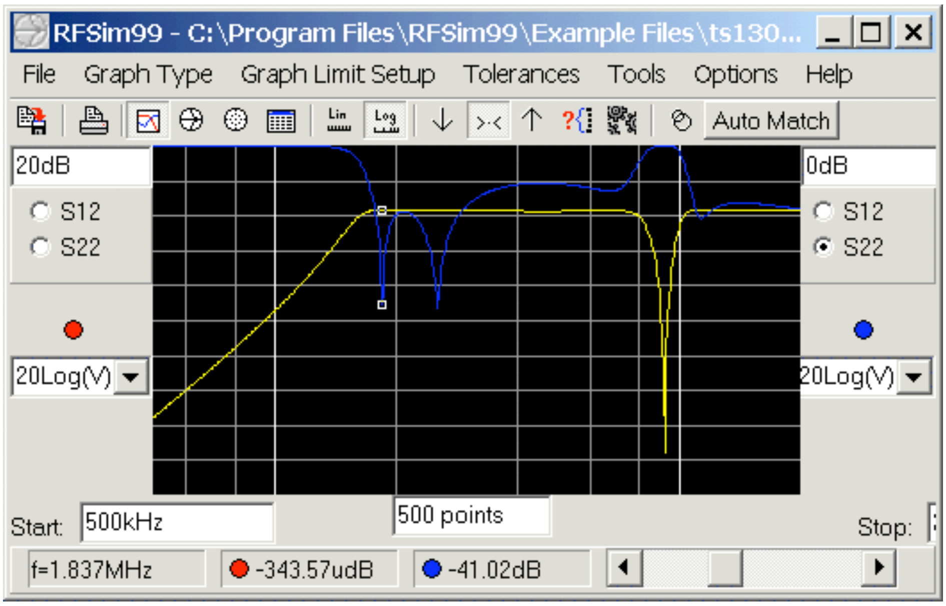
The high pass filter is located at the back of the RF unit, just below the band clutch switch. Since there also is tight, the "brutal" method was chosen.

- L1 and L2 (1.5 uH Festinduktivität, green) from above pinch off
- C1, C2 and C3 leave, even if the values fit for the new filter does not completely
- to the legs of C2 from above carefully solder the two new inductors L1 and L2 * *
- * L1 and L2 are small * T37-2 toroids to 3.6 uH (2 x 15 = 30 turns, bifilar)
- as a mass point, the L3-filter housing is used on the RF Unit

As I said, the values of C1 to C3 does not fit 100 percent, but give the new inductors together with a useful input filter (high pass) with a corner frequency of 1.75 MHz.

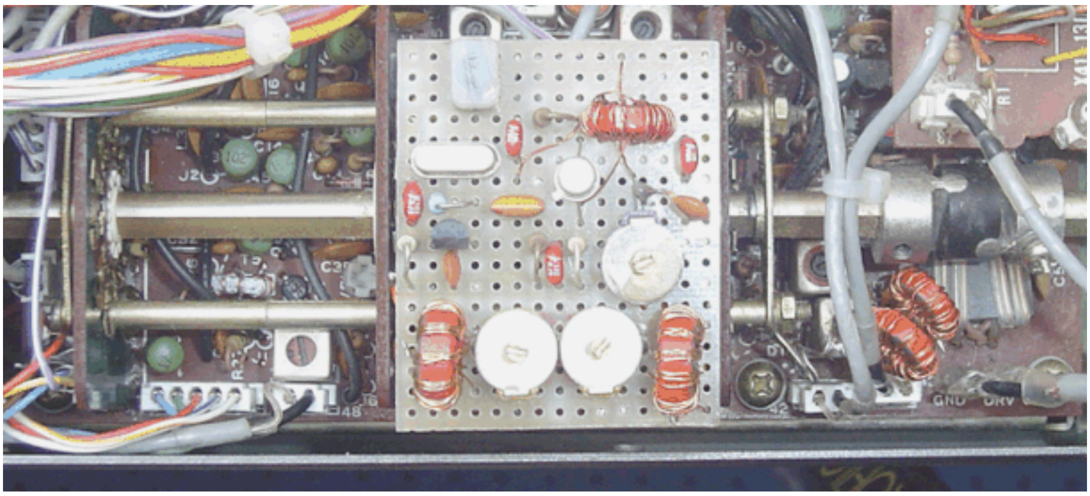


After this third modification of the TS-130V for 160 receiving standard was prepared. The first "sound" was a kräfiges QRN by a thunderstorm at a late hour and then bake YR2TOP to 1810 MHz.



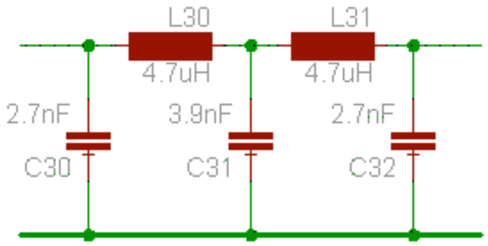
Below is a photo of the strip-board and the two cantilevered fixed ring cores of the input filter (under the clutch). The relay K1 and the fixed capacitors of the BPF was not forgotten, due to lack of space, these components are mounted on the solder side of the board.

Fig.3: PCB with converter and bandpass

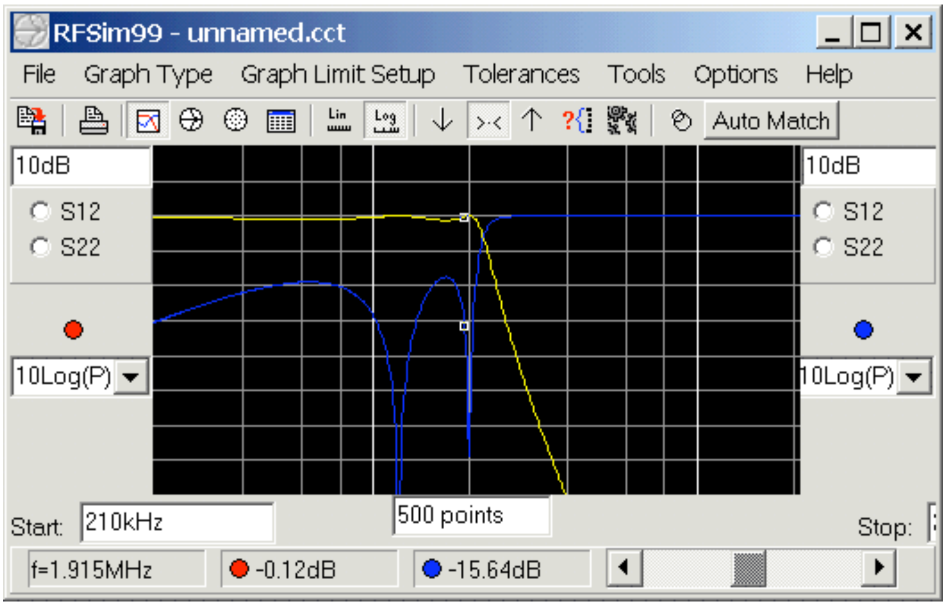


LPF low-pass for 160 m

This means that 80 m hams and radio listeners are not happy with harmonics, the transmission side was still providing a low pass. It reduces the push-pull output for typical strong third harmonic by more than 40 dB.



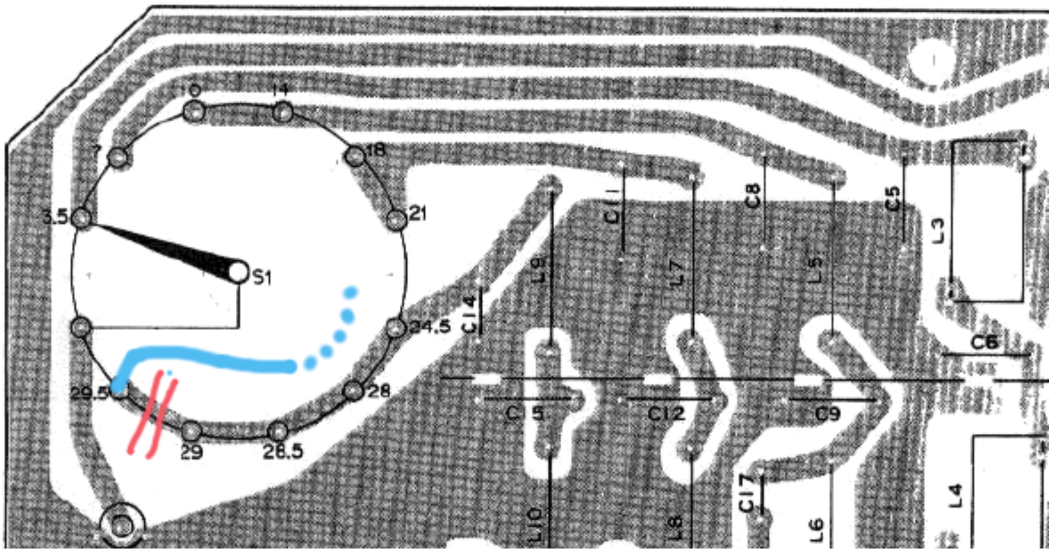
The impedance of the LPF (Chebyshev) is 50 ohms on both sides. The simulation with these values gives the following attenuation curve. The corner frequency was not set to 2.2 and to 1.9 MHz, there remains a QRP transceiver is a single watt.



Here too, the associated contacts of the selector switches are optional. The switch planes are located at the rear of the transceiver. This part which modification of the TS-130V is the most difficult to execute.

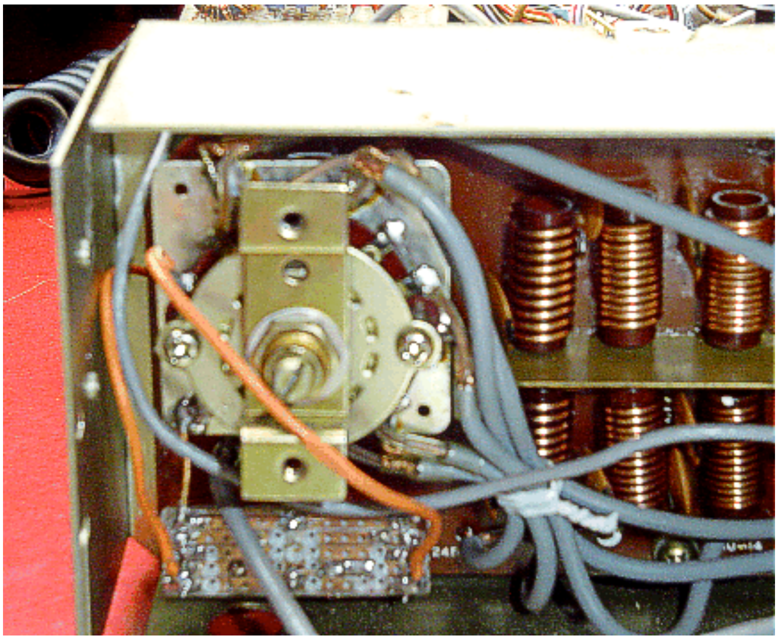
First, the band selector to the position of 29.5 MHz and resolve to bring the clutch axis. The screws of the rear door off completely and fold the cover down. Now the four screws on the board to solve the deep passes. All this is necessary because the board itself forms a switching level at which we have approached. This level is no execution of the previously described steps are not accessible. The contact is located 29.5 indemnified from the component side as seen in the 8 clock position! First, the conductive path between the 29.5 and 29 Contact in the software and then solder a 5 cm long cable (blue line in the drawing) to 29.5 contact.

Fig.4: Layout of the filter unit (X51-1250-00)



Up the front plane of the filter unit is easily accessible. Again, the connection (this time a wire) between 29.5 and 29 Contact unravel. Contact us now at 29.5 also solder a 5 cm long cable. The small circuit board with the 160 m harmonic filter fits well into the open area below the band selector switch. A short, thick ground connection also serves as the attachment.

Figure 5: PCB with the low-pass



It should be noted that the results of preliminary tests on the final tests were confirmed. The Kenwood developers with the transformers at the RF PA stage and NOT inductance unit