

Modification of IC910E

Instructions for use of the IFD demodulator

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Material required:

- SYMEK IFD-B-amplifier-mixer-demodulator board option 'IC970'
- 2x30cm thin coax cable, wire, shielded audio cable and hardware as needed.

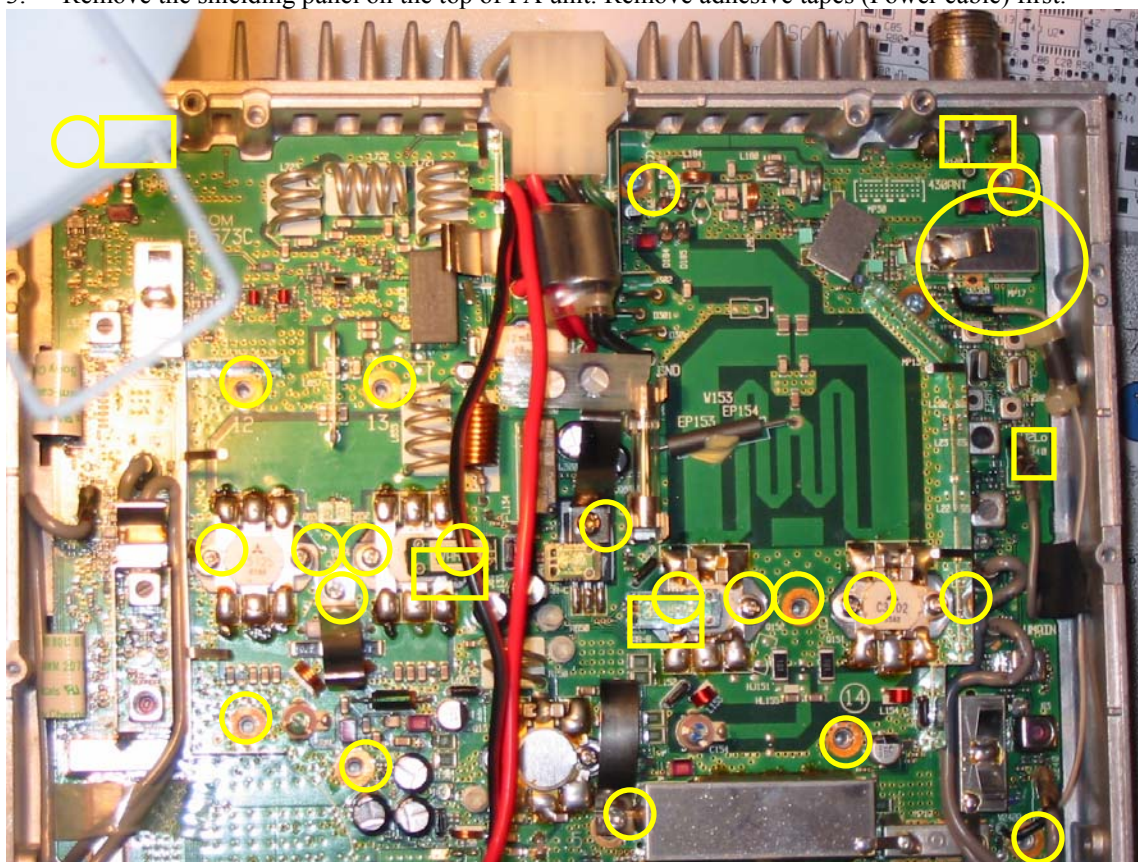
IC910 uses the same IF frequency as most other ICOM transceivers (IC820, IC821, IC970).

The modification of IC910 is not an easy task and requires some skill and knowledge.

Center frequency is shown correctly in SAT mode!

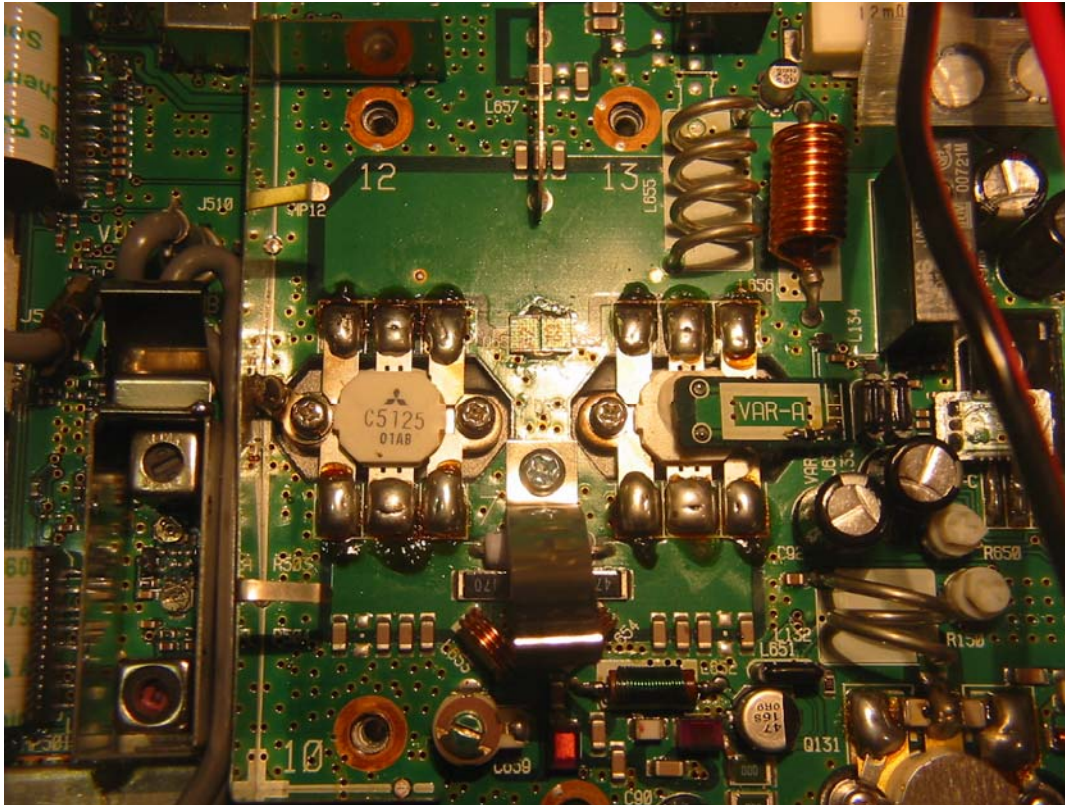
Preparation:

1. Measure the RF input voltage for S9 reading (2m and 7cm) for later comparison
2. Remove top and bottom cover. Take care not to damage the speaker cable. (disconnect it!)
3. Remove the shielding panel on the top of PA unit. Remove adhesive tapes (Power cable) first.

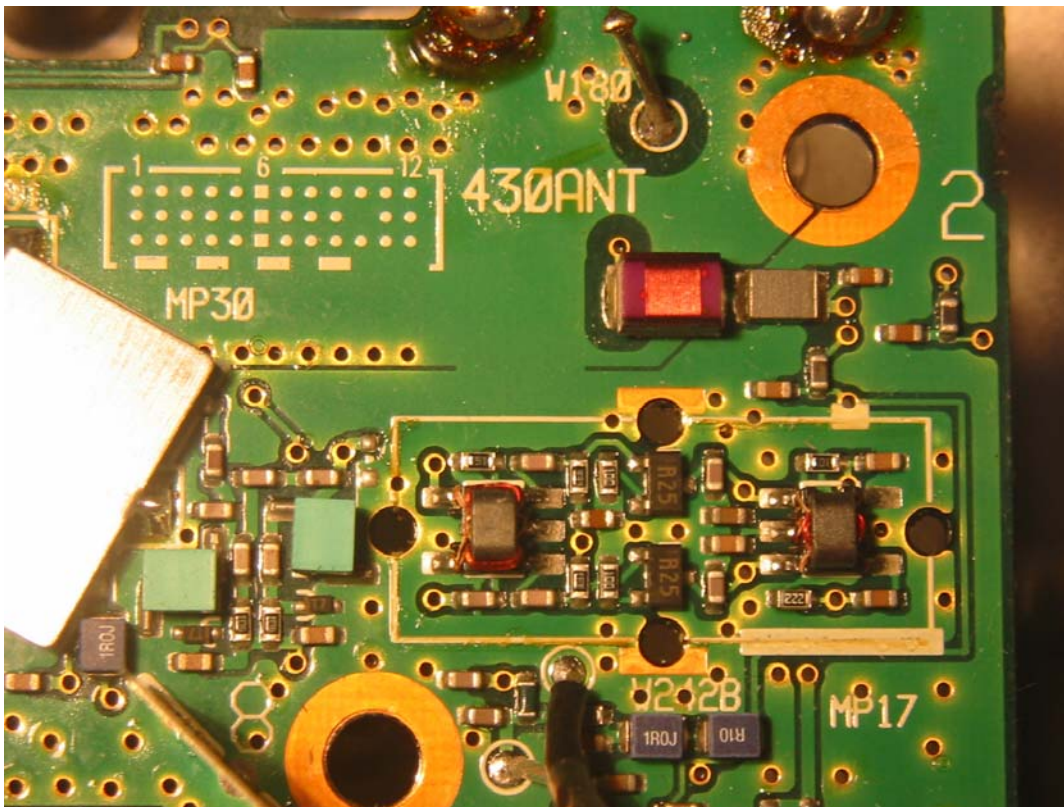


4. Remove all screws of PA unit (circles), uninstall the antenna connectors. (rectangles)
5. Disconnect the LO coax cable from J240 and the other coax cables on this side of PA unit

6. Unsolder the temperature sensor boards VAR-A and VAR-B to access the screws of the power transistors.

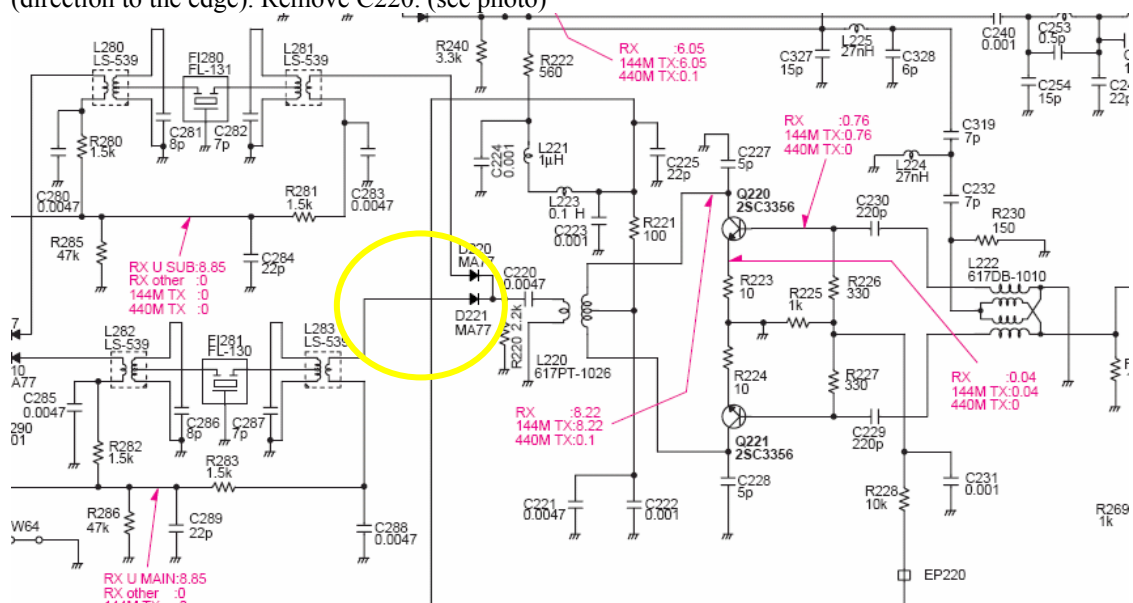


7. Unscrew all 5 power transistors and the self tapping board screws.
8. remove 1 screw from the small stamp-sized board in the middle (towards front side)
9. Pull the main power connector out of the slot in the rear panel
10. release all cables going to the main board from the brackets (behind the tuning knob)
11. Very carefully fold out the board to the left side. (cables of the 2m part remain as they are)
12. Unsolder the shielding box (3cm behind the UHF antenna jack) from the bottom side. This box contains the mixer with the balun transformers.



(Box removed)

13. Find C220 and R220. They are located in the corner of the box which is distant from the antenna jack (direction to the edge). Remove C220. (see photo)



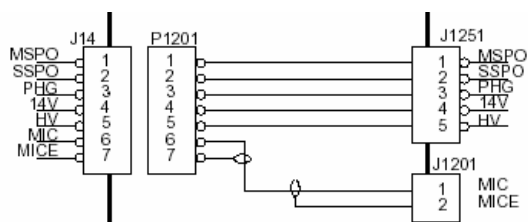
UHF 1st Mixer stage, showing C220 (to be removed)



15. Prepare a thin coax cable and solder the inner conductor to the output of the balun transformer (where you removed C220 before). Use the dark color or mark it as "Mixer cable UHF"
16. Cut the shielding box at this corner to allow the coax to leave the box. Bent the cut' part up. Re-install the shielding box and solder the outer conductor of the coax to the box. (Ground and strain relief). Mark this cable as 'mixer' cable going to the IF input of IFD.
17. Prepare a second coax cable and solder to cathode of D220/D221 (showing towards shield box), 1cm distance. Solder the outer connector to the shieldig box. Use the brighter cable or mark this cable as 'filter UHF', going to output of IFD.
18. Feed both coax cables through the opening near the fan to the opposite side.
19. Connect both ends of both cables with a 100 pF capacitor and repeat step 1. The S-meter should read S8 at 70cm (when the same voltage as required for S9 before is applied) (this step may be omitted)
20. Re-install the PA unit. If necessary, add some heat conducting grease. Reinstall the thermal sensors and **double check that all power-transistor screws are tight.**
21. Best place to install the IFD is on the panel over the PLL unit, where you find the brackets for DSP1 and DSP2 unit. However, you cannot use the DSP2 option later.



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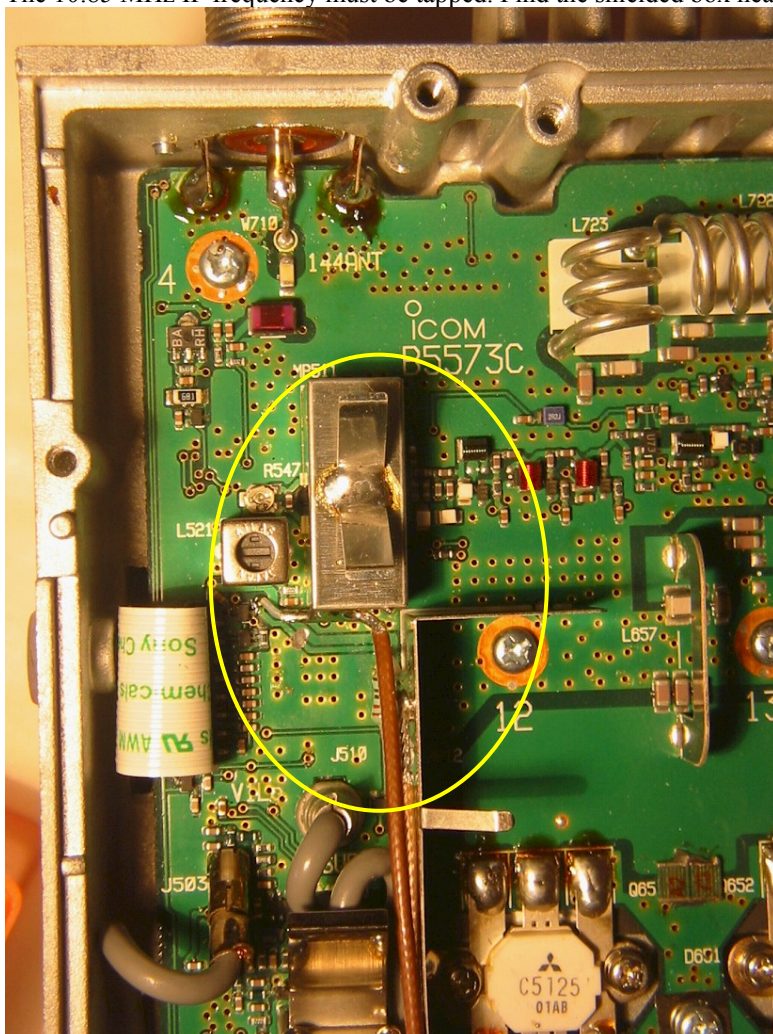


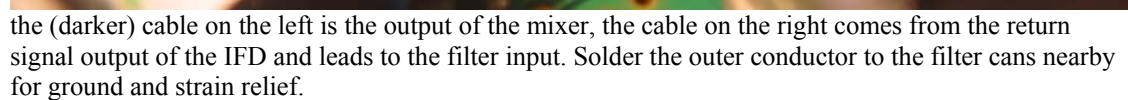
Power supply / location of J1251 (Pin 4 = +14V) 1=brown, 2=red, 3=orange, 4=yellow (+14V), 5=green

25. Make a connection from IFD data output to the packet-radio TNC (data input). Best is to drill a 6.5 mm hole in the rear panel near the grounding screw and install a Cynch connector there. (see below)
26. Repeat step 1. The S-meter should read now S9 or few dB more. (Typically +3 to +4 dB)
27. The transmitter is already prepared for 9600 baud transmission.

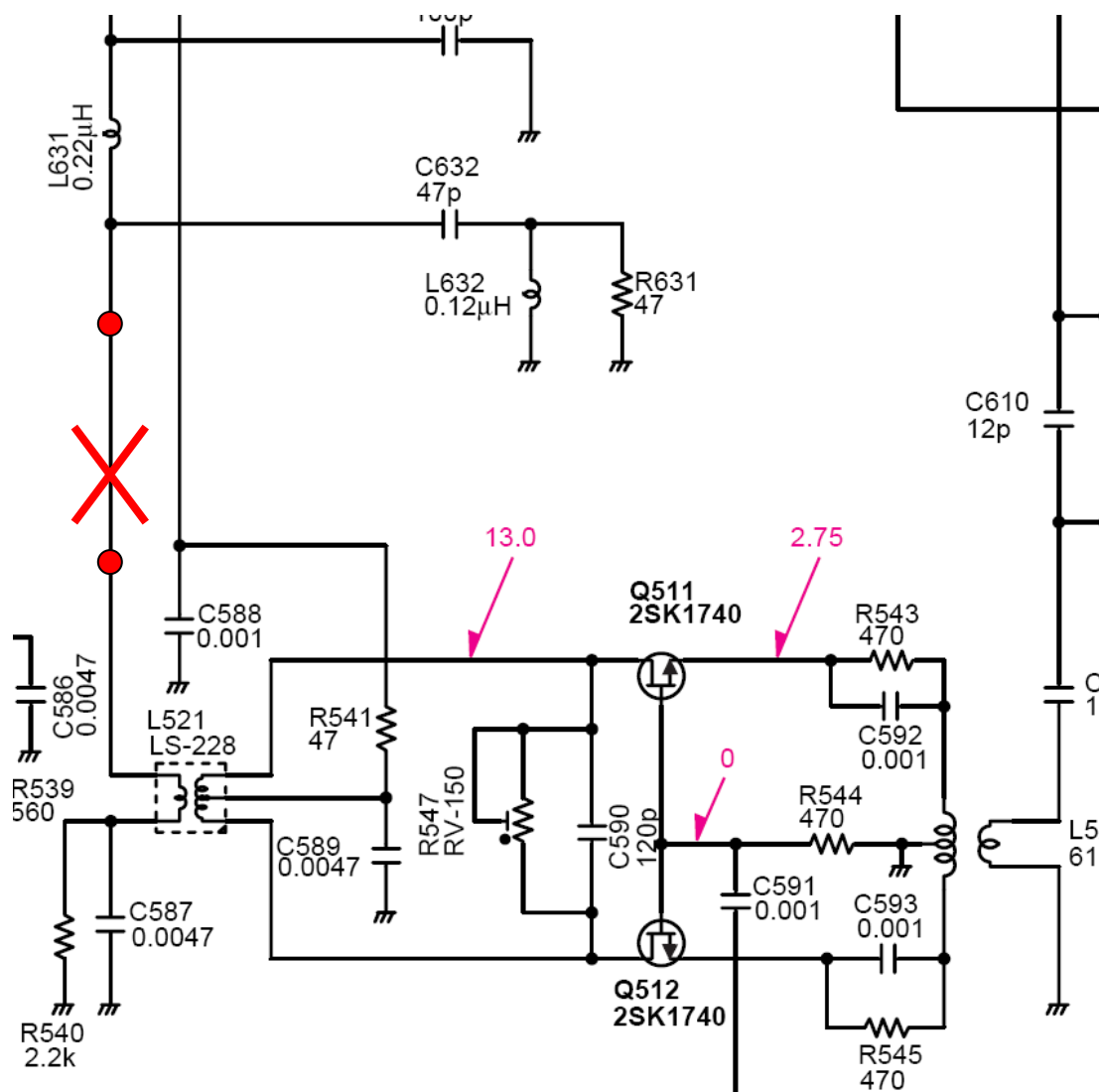
Adding an IFD Demodulator for the 2m (145 MHz) receiver of IC910

1. The modification described above is valid only for the 435 MHz UHF receiver. If the VHF receiver is to be used for reception of wide band signals, a second IFD module is required.
2. The 10.85 MHz IF frequency must be tapped. Find the shielded box near the VHF antenna connector



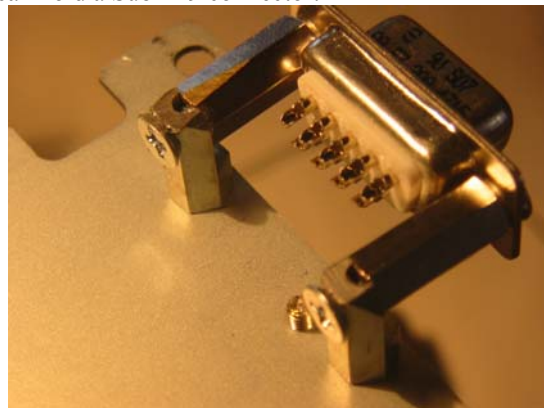


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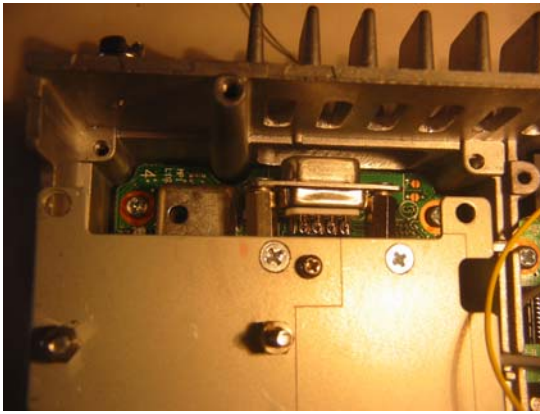


the "Mixer" cable is connected to the transformer L521 output (below the red cross), the cross marks the cut' trace. The "Filter" cable is connected to the joint of L631 / C632 above the red cross. To restore the DC level of the "filter" cable (as R540 did before the cut), a new resistor from the "Filter" cable (L631) to ground must be added.

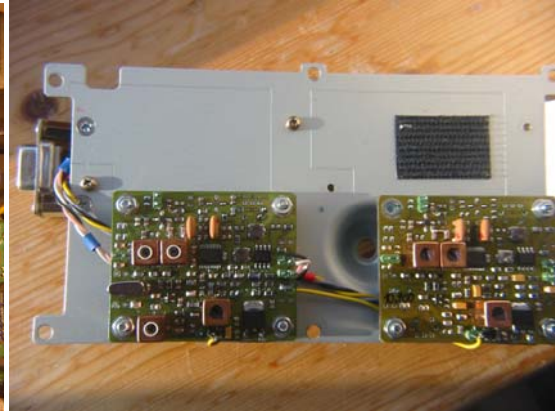
5. Connecting of the IFD signals to the packet-decoder (TNC) and RSSI instruments: There is a rectangular hole in the back panel of IC910 which can hold a Sub-D 9 connector.



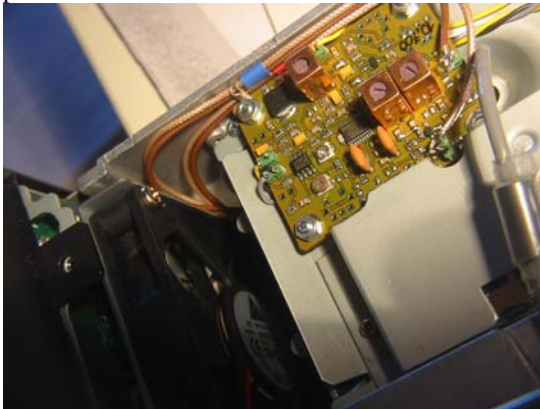
6. The connector is mounted on the bottom side of the support panel with standoffs as shown:
7. 7 wires are soldered to the SubD 9 connector: (suggested pinning):
pin 1 = GND; pin 2 = Data output 435 UHF; pin 3 = RSSI output 435 UHF, pin 4 = +5 V DC (fm IFD)
pin 5 = n.c.; pin 6 = GND; pin 7 = Data output 145 VHF; pin 8 = RSSI output 145 VHF, pin 9 = n.c.
8. If both IFDs and the DSP unit have to be installed, you have to modify the panel which contains the DSP unit to access the IF out pins of the IFD (see picture)



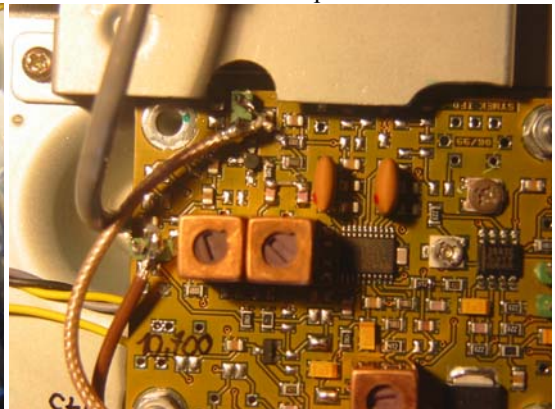
placement of the sub-D 9 connector



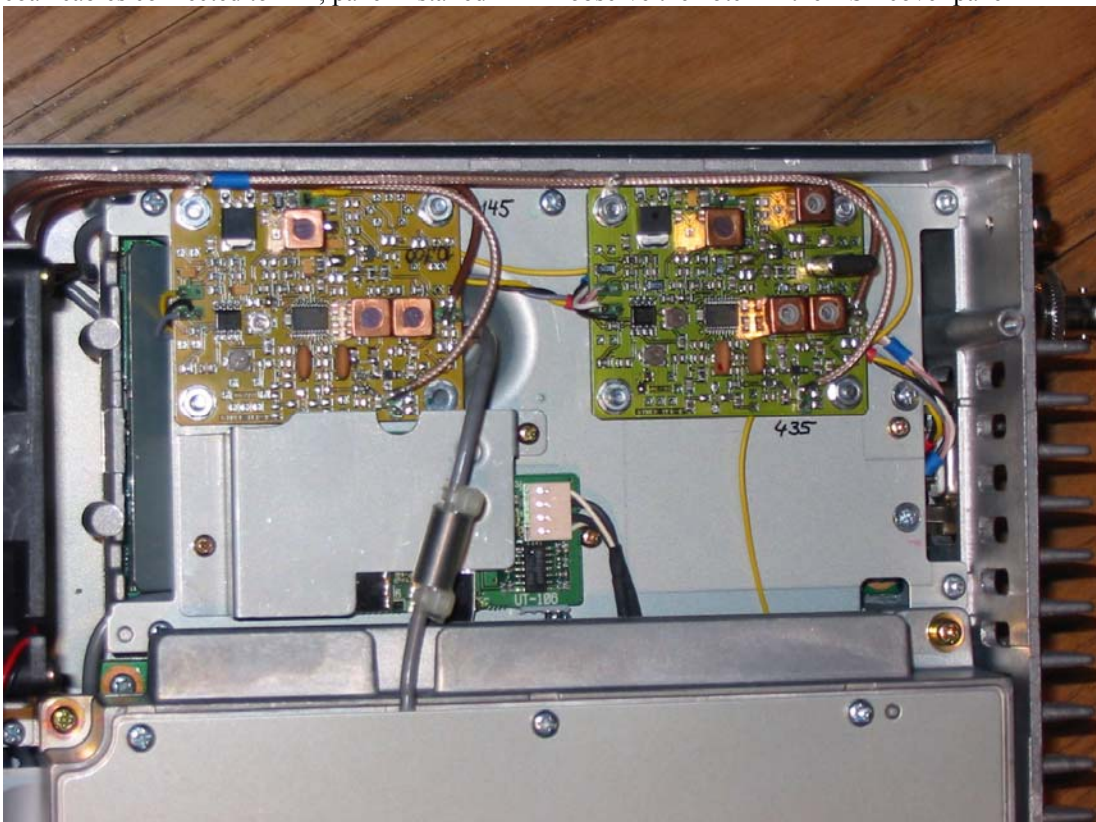
both IFDs mounted on the panel and wired



coax cables connected to IFD, panel installed



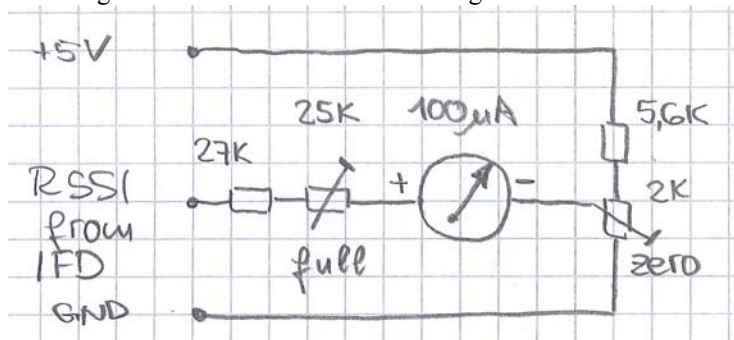
observe the notch in the DSP-cover panel



both IFD in the case

Adding RSSI meters

1. The IFD module provides an RSSI output. The voltage corresponds to the signal strength of the input signal. Typically, 0.5 volt corresponds to no signal and 4 volt RSSI means S9 +20 dB or more. The dynamic range of the RSSI output is 80 dB or more.
2. If a 100 uA meter is to be used, you can adjust gain and offset with two trimmers to get zero reading for no signal and full scale for maximum signal. See. draft.



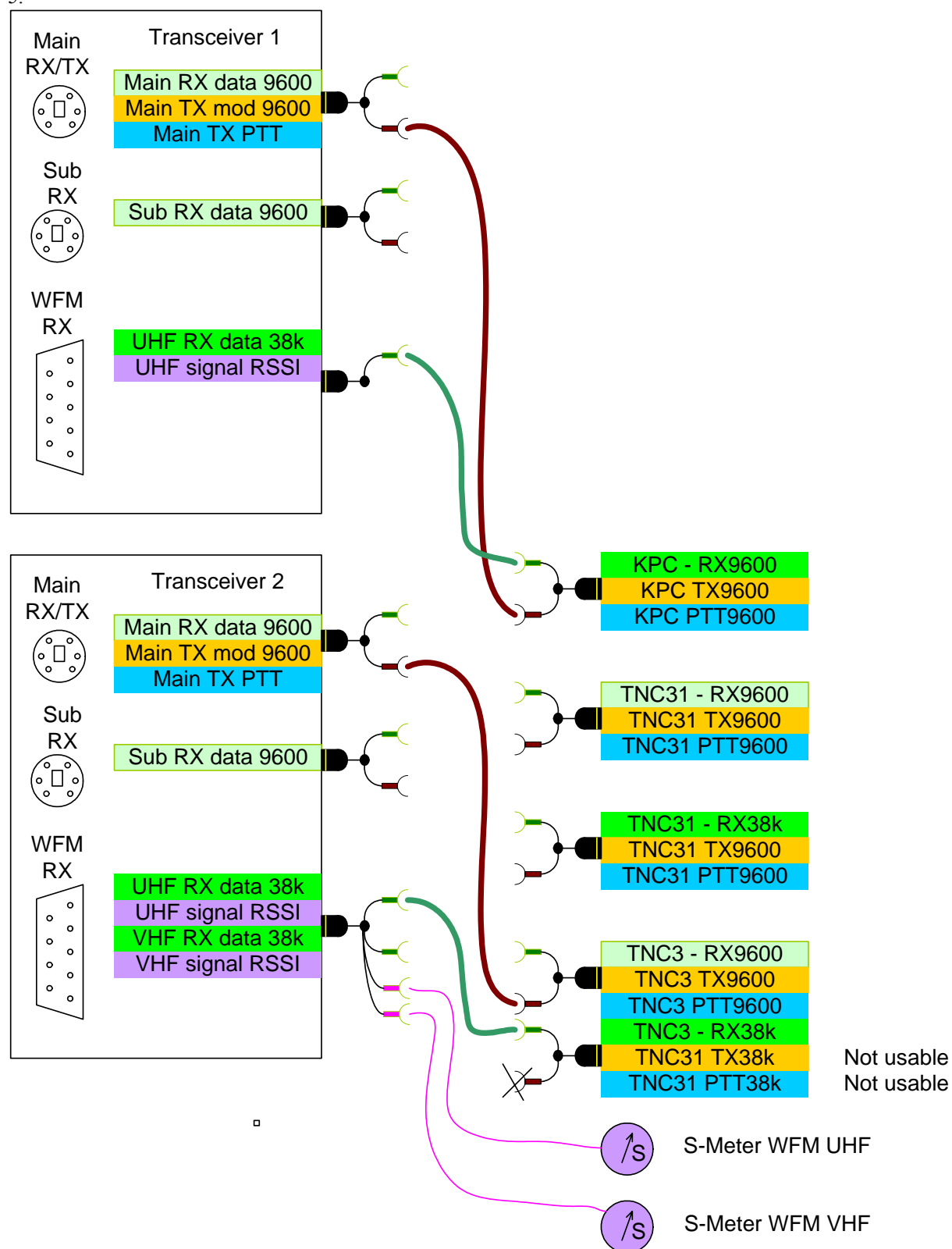
3. Best are simple analogue meters to display the signal strength as shown in the example



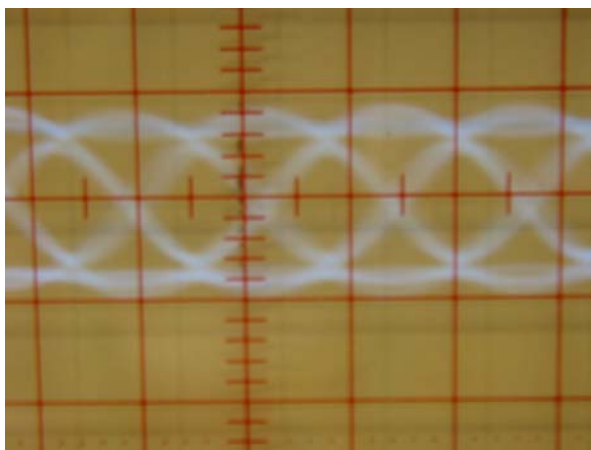
4. How to connect the transceivers to the TNCs:
 With a complex satellite ground station, you need some flexibility to configure the signals according to the used modes, frequencies and data speed.
 We have receiver output signals coming from the receivers on the one side and modulation / PTT outputs of the TNC going to the transmitters on the other side.
 Use 5 pin DIN connectors for the transmitters (shown as brown cables): Pin 1 is the modulation signal (9600 baud), Pin 2 is Ground and Pin 3 is PTT.
 Use simple cynch connectors between receiver (data) output and TNC input (green cables). So, you can do any combination of any receiver or transmitter to any TNC.

NOTE: the data output level(s) of the TNC(s) must be individually adjusted to give optimal modulation. If the modulation is too weak, the signal to noise ratio would be reduced. Over-modulation of the transmitter causes distortions in the receiver filter and makes the signal unreadable. To adjust the modulation (FM deviation), use a second FM receiver and simply check how the signal sounds in the speaker. As different receivers use different filters, you should fine-adjust the modulation index using a deviation-meter (rare and expensive) or test again with the remote receiver by comparing the error rate while carefully reducing or increasing the modulation.

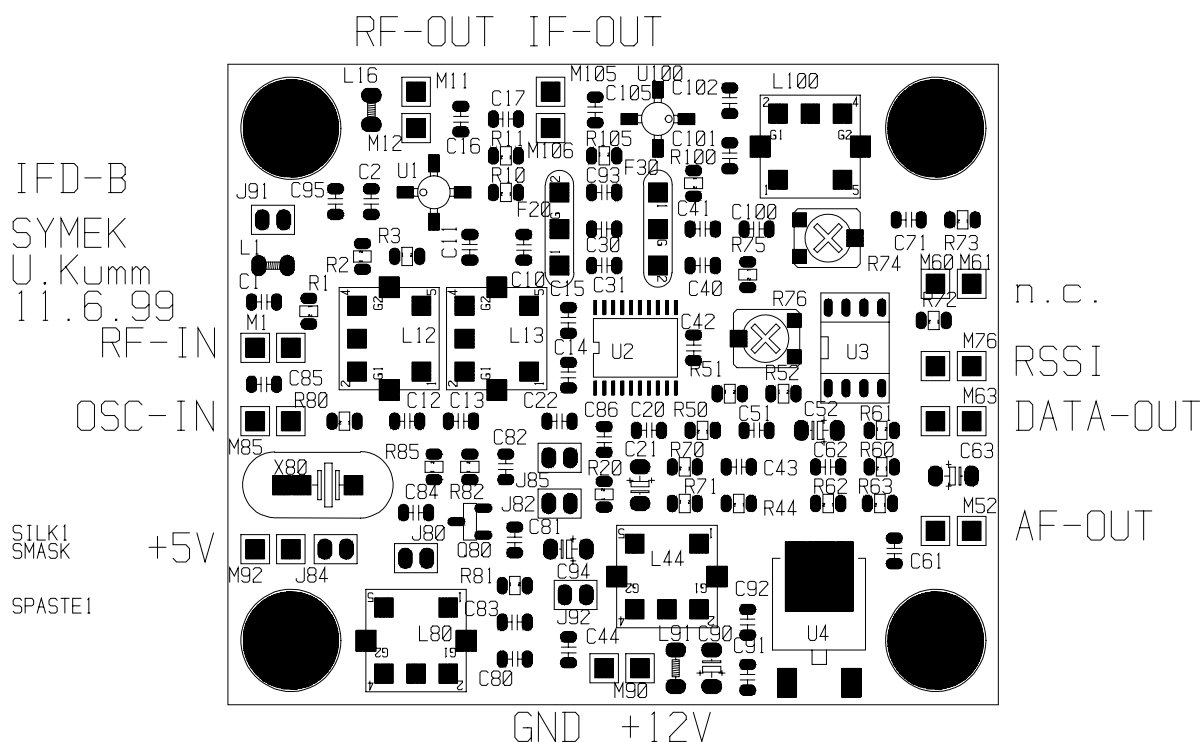
5.



- Connecting 2 transceivers with their different data outputs and transmitter inputs to different TNC controllers. (example shown)
- To connect a Kantronics KPC9612 port 2 (high speed), use a 15 pin SubD male connector and connect: Pin 1 as PTT (DIN5 Pin 3); Pin 2 as Receive Data (Cynch male); Pin 3 as transmit data (DIN5 pin 1) and Pin 11 as Ground (DIN5 pin 2 and cynch shield)



Eye diagram of a 76800 baud FSK signal, measured at the data output (new connector) of IFD



IF-Frequency: 71,350 MHz, Filter impedance: 50 Ohm. Correct reading for Sub-Band.

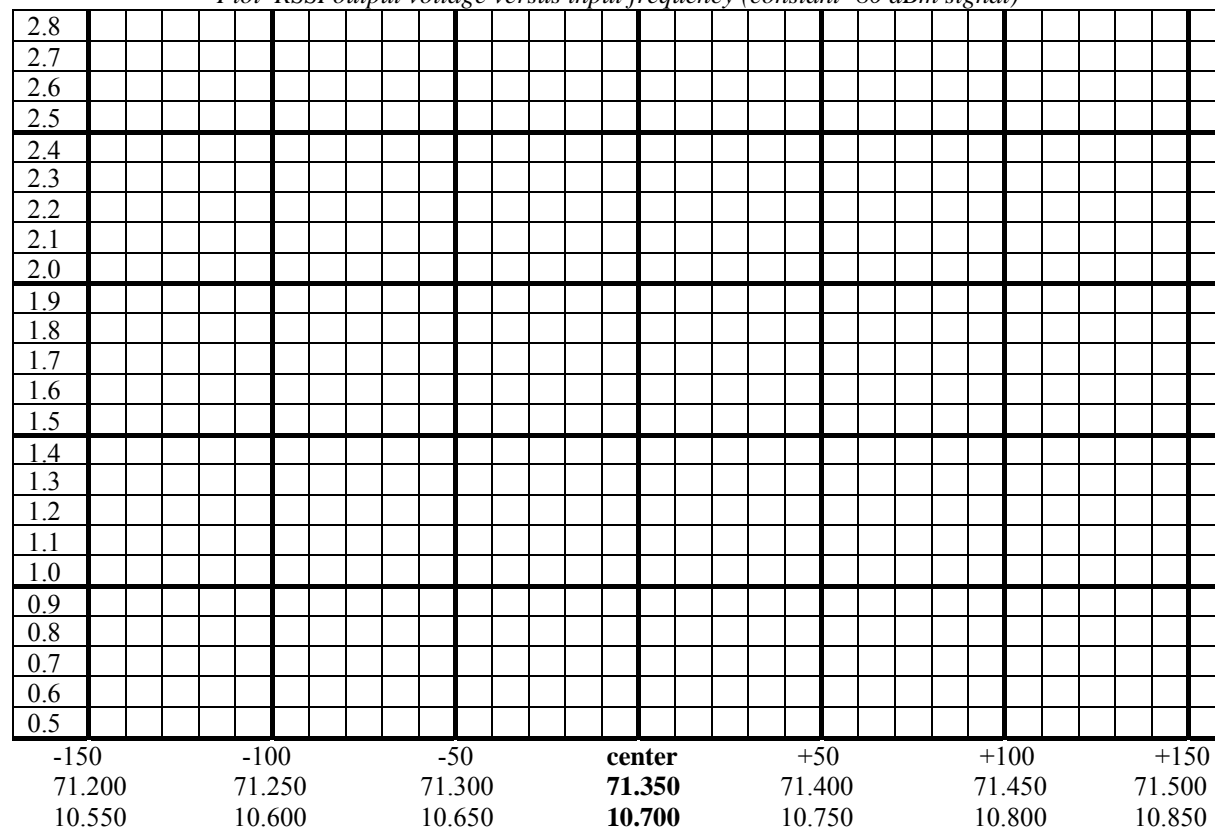
XTAL: 60,650 MHz, R80: 560Ω. IF-Filter: 76800: SFE 10.7 MHY (red dot, BW110kHz) or for 153600: SFE

10.7 MA (light blue, BW230kHz) Accessory parts added: 2 pcs thin coax cable (30 cm each)

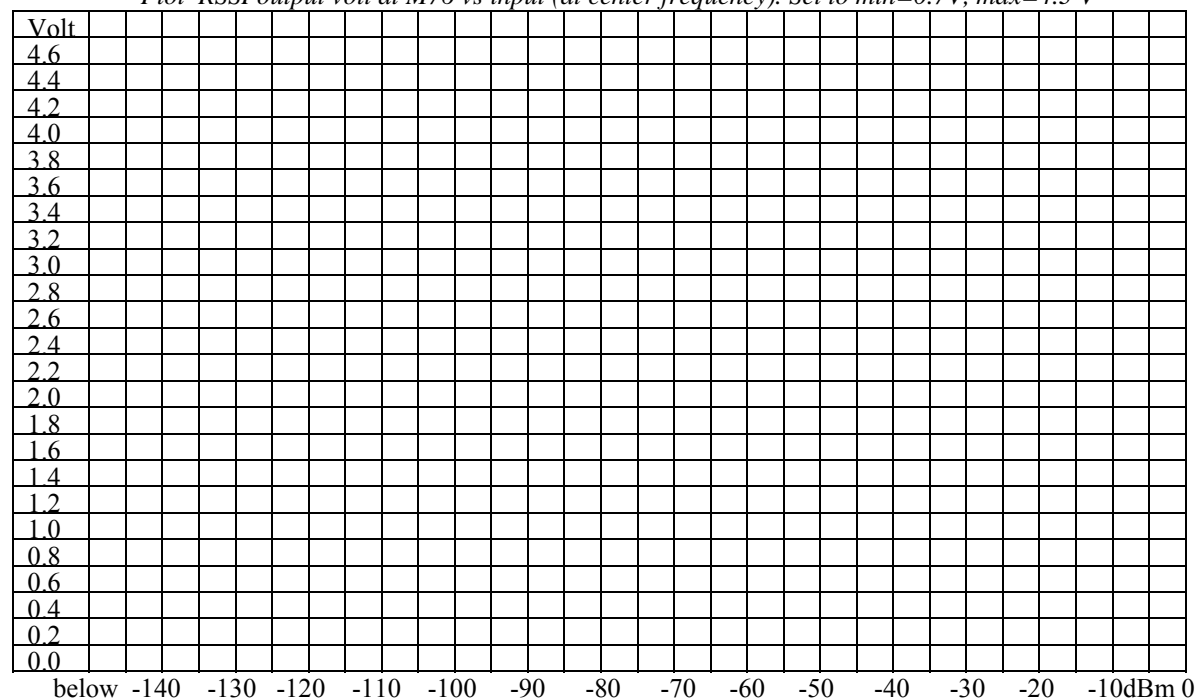
Supply voltage: 12 volt; supply current: _____ mA, total gain input to output: _____ dB

Plot discriminator output voltage (at R51 / R52) versus input frequency (-80 dBm signal)

Plot RSSI output voltage versus input frequency (constant -80 dBm signal)



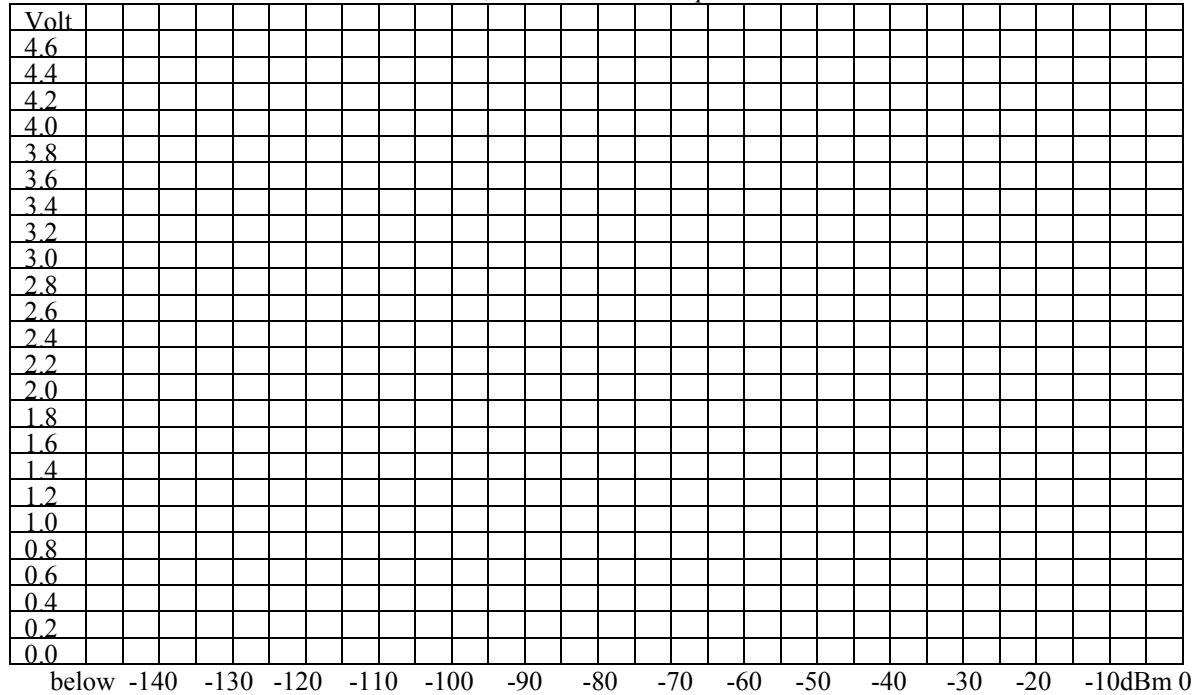
Plot RSSI output volt at M76 vs input (at center frequency). Set to min=0.7V, max=4.3 V



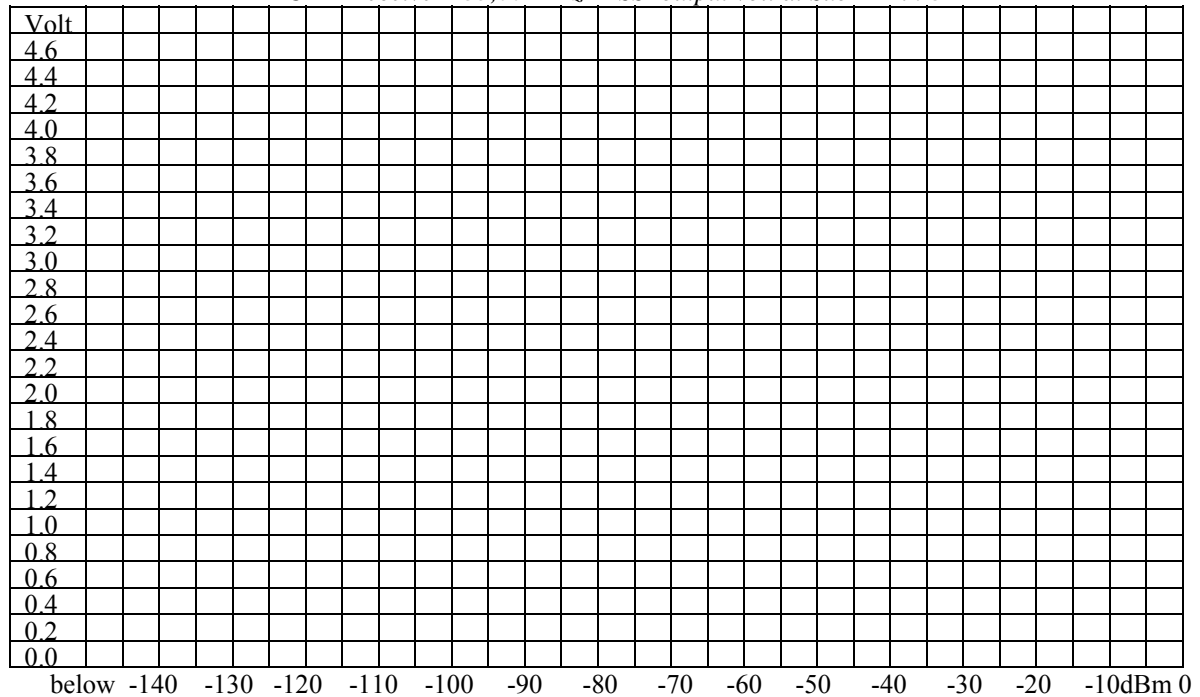
date: sign:

RSSI meter output diagram

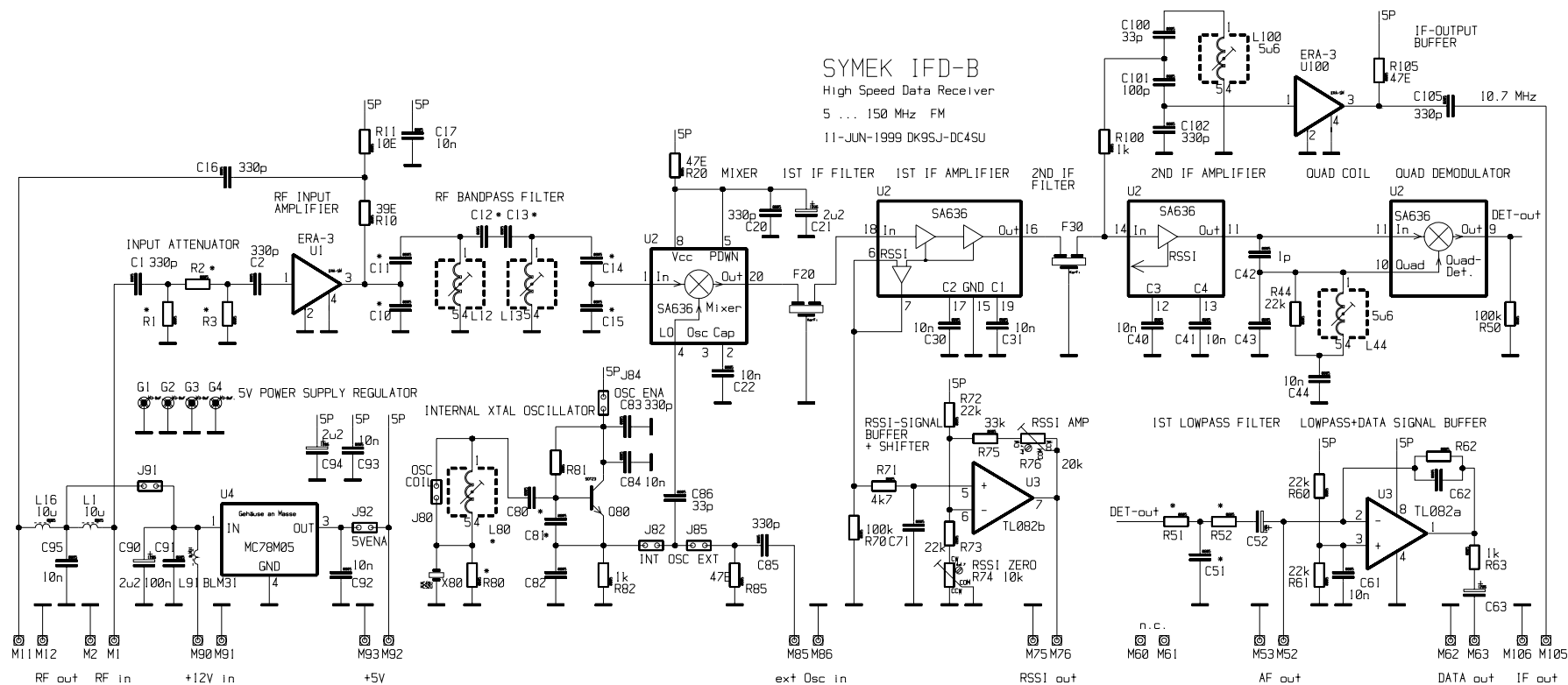
VHF-Receiver 145,00 MHz RSSI output volt at Sub-D Pin 3



UHF-Receiver 435,00 MHz RSSI output volt at Sub-D Pin 8



date: _____ sign: _____



Modifications IFD option IC970: Oscillator: quartz TQ730518 / 60,65 MHz for IF 71,350 Sub band IF, R80: 560Ohm, L80: 0,33 uH, C80: 27pF, C81: 33pF, C82: 33pF. Values for the band filter: C10: 82pF, C11: 15pF, L12: 0,33uH, C12: 2,7pF, (C13: 2,7pF), L13: 0,33uH, C14: 27pF, C15: 22pF. Between joint U1 Pin 3 / R10 and the joint C11 / C10 a 22 Ohm resistor was added to reduce influence of the filter input impedance on amplifier gain. R11 and R10 have been changed to 22 Ohms. A 22 Ohm resistor was connected in series to C16. Parallel to RF IN, a 68 pF capacitor was added to avoid oscillation.

Typical voltages (measured wit dc voltmeter):

U1 (ERA-3 Amplifier) Pin 1: 2.6 V	U2 (IF-IC) Pin 1: 1.1 V	U2 (IF-IC) Pin 18: 1.3 V	
U1 (ERA-3 Amplifier) Pin 3: 3.5 V	U2 (IF-IC) Pin 4: 4.2 V	U2 (IF-IC) Pin 16: 1.3 V	
Q 80 (Oscillator) Base 3.2 V	U2 (IF-IC) Pin 8: 4.6 V	U2 (IF-IC) Pin 14: 1.3 V	
Q 80 (Oscillator) Emitter 2.8 V	U2 (IF-IC) Pin 20: 2.6 V	U2 (IF-IC) Pin 11: 1.5 V	