Modification of TS2000 for wideband FM Data reception
Instructions for use of the IFD demodulator

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Uplink (TX): any frequency (144-146 MHz, 430-440 MHz etc.), FSK-modulation 4800 up to 19200 kBaud,
Downlink (RX): 430-440 MHz, 38400/76800 Baud FSK (153 kBaud with wider filters (optional)).

IF-Frequency: Main Band: 41.895 MHz, XTAL-frequency is 52,585 MHz. (Difference = 10.7 MHz)
(IF-Frequency: Sub Band: 58,525 MHz, XTAL-frequency is 47,825 MHz. (Difference = 10.7 MHz)))

Accessories: 2x 35cm PTFE thin coax cables, Resistors (0805 SMD): 680 Ohm and 56 (68) Ohm.

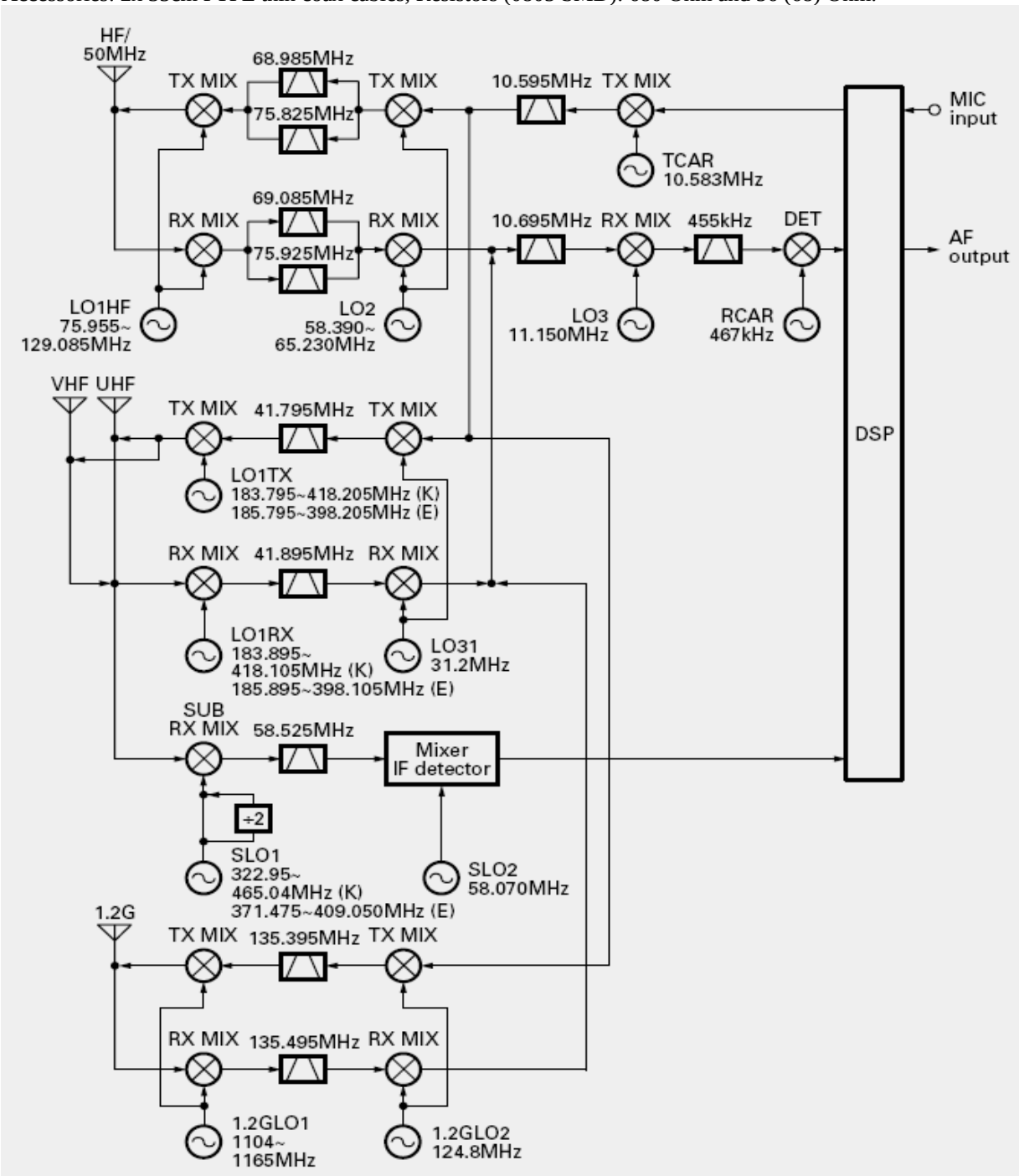


Fig. 1 Frequency configuration

430MHz LO1

When the UHF band is operating in the main band, the UHF REF VCO (Q431) generates 378.105 to 418.105MHz (K), 388.105 to 398.105MHz (E) in receive mode and 378.205 and 418.205MHz (K), 388.205 to 398.205MHz (E). (See Table 3, Frequency Configuration.)

The output signal (8.328 to 8.475MHz (K), 8.344 to 8.469MHz (E)) from the DDS (IC407) passes through a ceramic filter (CF400), is input to pin 8 of the PLL IC (IC412) for UHF and divided into 1/16 in IC412 to produce comparison frequency fø of 520 to 530 kHz.

The output signal from the VCO (Q431) goes to pin 6 of IC412 and its frequency is divided into 1/N in IC412, compared with comparison frequency fø by a phase comparator, and is locked.

The DDS (IC407) sweeps output frequency (8.328 to 8.475MHz (K), 8.344 to 8.469MHz (E)) in 10Hz steps by equation $f_{DDS\ STEP}$ (Hz) = 10*R/N and in 1Hz steps by equation $f_{DDS\ STEP}$ (Hz) = 1*R/N, the LO1 covers the frequencies of 378.105 to 418.105MHz (K), 388.105 to 398.105MHz (E) in receive mode and 378.205 to 418.205MHz (K), 388.205 to 398.205MHz (E) in transmit mode in 10Hz or 1Hz steps.

The PLL output signal is changed by the switching circuit of Q471 (receive) and Q472 (transmit) so that the output amplifier and low-pass filter correspond to UHF band transmission and reception.

In receive mode, the signal is amplified by the broadband amplifier (IC415), and passes through a low-pass filter. The impedance is converted by an attenuator and the signal is output to the RF unit (X57-606) as the local oscillator signal RXLO1.

In transmit mode, the signal is amplified by the broadband amplifier (IC416), and passes through a low-pass filter. The impedance is converted by an attenuator and the signal is output to the RF unit (X57-606) as the local oscillator signal TXLO1.

When the UHF is not operating, Q434 is turned OFF with a signal from the serial-parallel IC (IC404) and UHF VCO (Q431) stops operation.

Display frequency f_{RX} (MHz)		LO1 OUT (MHz)	IC412ÅF LMX2306TMX		DDS output (MHz) IC407 : AD9835BRU
Start	Stop		R	N	
420.000000 (K)	425.999999 (K)	LO1	16	726	f_{DDS}
425.000000 (K) 430.000000 (E)	431.499999 (K)	$= f_{RX} - IF$		736	$= \frac{f_{RX} - IF}{N} * R$
431.500000 (K,E)	435.499999 (K,E)			747	
435.500000 (K,E)	439.499999 (K,E)			754	
439.500000 (K,E)	443.499999 (K) 440.000000 (E)			762	
443.500000 (K)	447.999999 (K)			770	
448.000000 (K)	449.999999 (K)			778	

IF = RX : 41.895
TX : 41.795

Table 3 Main UHF band frequency configuration

SUB LO1

When the sub band receiver is operating, the sub VCO (Q406, Q407) generates 322.95 to 465.040MHz. (See Table 4, frequency configuration.)

The 15.6MHz reference signal fstd is input to pin 8 of the PLL IC (IC402) for the sub VCO, divided into 1/R in IC402 to produce comparison frequency fø of 5 and 6.25kHz. The division ratio data comes from the control unit.

The output signal from the VCO (Q406, Q407) goes to pin 6 of IC402, its frequency is divided into 1/N in IC402, compared with comparison frequency fø by a phase comparator, and locked.

The output signal from the VCO (Q406, Q407) passes through a buffer amplifier (Q413, Q414), is amplified by the broad-band amplifier (IC405), and passes through a low-pass filter. The impedance is converted by an attenuator and the signal is output as SLO1.

When the sub band receiver is not operating, Q411 and Q411 are turned OFF with the BSW1 and BSW2 signals and sub VCO (Q406, Q407) stops operation.

Display frequency fRX (MHz)		SLO1 OUT (MHz)	IC404 : BU4094BCFV			IC402 : LMX2316TMX			
						Step : 5,10,15,20,30 (kHz)		Step : 6.25,12.5,25,50,100 (kHz)	
			13pin : Q6	12pin : Q7	11pin : Q8	R	N	R	N
Start	Stop		(BSW2)	(BSW1)	(B LU SW)		Formula		Formula
118.00000 (K)	118.94500 (K)	SLO1	L	H	L	3120	$N = \frac{2 \times (f_{RX} + 58.525)}{0.005}$	2496	$N = \frac{2 \times (f_{RX} + 58.525)}{0.00625}$
118.95000 (K)	134.99500 (K)	= (fRX + 58.525) *2	H	L					
135.00000 (K)	154.49500 (K)		L	H	H				
144.00000 (E)	146.00000 (E)								
154.50000 (K)	173.99500 (K)		H	L					
220.00000 (K)	235.99500 (K)	SLO1	L	H	L		$N = \frac{2 \times (f_{RX} - 58.525)}{0.005}$		$N = \frac{2 \times (f_{RX} - 58.525)}{0.00625}$
236.00000 (K)	252.49500 (K)	= (fRX – 58.525) *2	H	L					
252.50000 (K)	271.54500 (K)		L	H	H				
271.55000 (K)	289.99375 (K)		H	L					
290.00000 (K)	296.42000 (K)	SLO1	L	H	L		$N = \frac{f_{RX} + 58.525}{0.005}$		$N = \frac{f_{RX} + 58.525}{0.00625}$
296.42500 (K)	328.99500 (K)	= fRX + 58.525	H	L					
329.00000 (K)	367.52000 (K)		L	H	H				
367.52500 (K)	399.99500 (K)		H	L					
400.00000 (K)	413.47000 (K)	SLO1	L	H	L		$N = \frac{f_{RX} - 58.525}{0.005}$		$N = \frac{f_{RX} - 58.525}{0.00625}$
413.47500 (K)	445.99500 (K)	= fRX – 58.525	H	L					
430.00000 (E)	440.00000 (E)								
446.00000 (K)	484.57000 (K)		L	H	H				
484.57500 (K)	511.99500 (K)		H	L					

Table 4 Sub band frequency configuration

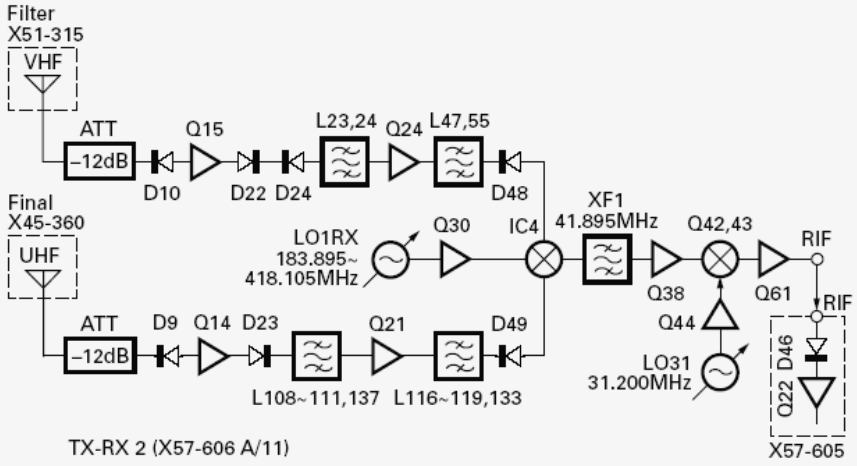


Fig. 5 Main band receiver section

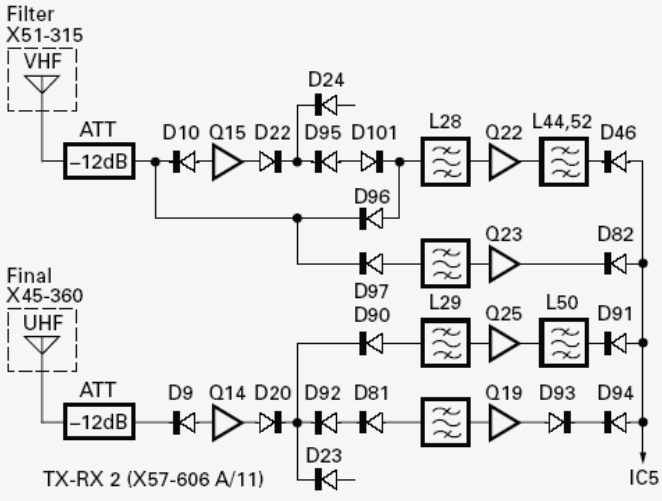
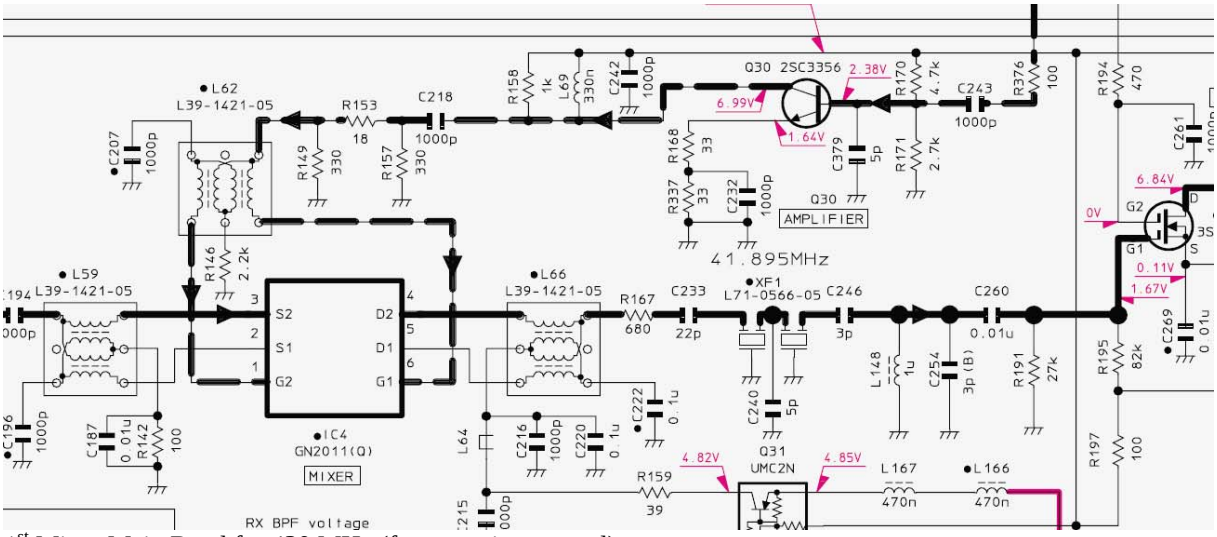


Fig. 6 Sub band receiver section

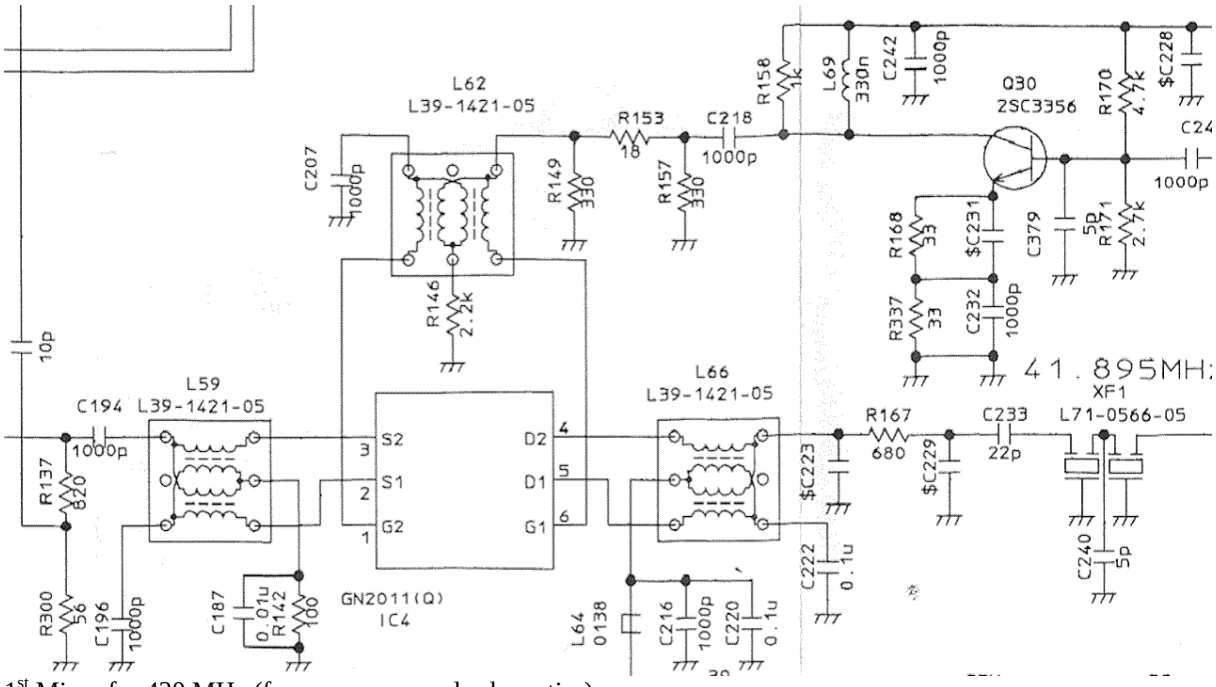
Ref No.	XF1	XF2	XF3	CF1	CF2
Parts No.	L71-0566-05	L71-0565-05	L71-0582-05	L72-0984-05	L72-0986-05
Nominal center frequency	41.895MHz	58.525MHz	41.795MHz	455kHz	455kHz
Pass bandwidth	3dB : ±7.5kHz	3dB : ±7.5kHz	3dB : ±15kHz	6dB : ±7.5kHz or more 50dB : ±15kHz or less	6dB : ±4.5kHz or more 50dB : ±10kHz or less
Ripple	1.0dB or less	1.0dB or less	1.0dB or less	2.0dB or less	2.0dB or less
Insertion loss	3.0dB or less	3.5dB or less	1.5dB or less	6.0dB or less	6.0dB or less
Guaranteed attenuation	Fo+(500~1000)kHz Fo–(200~1000)kHz 70dB or more	Fo±1MHz 80dB or more	Fo–(500~1000)kHz 50dB or more	Fo±100kHz 35dB or more	Fo±100kHz 35dB or more
Cener	–	–	–	455kHz±1.0kHz	455kHz±1.0kHz
Terminating impedance	960Ω//1.0pF CC=7.0pF	350Ω//4.0pF CC=15.5pF	960Ω//1.0pF	1.5kΩ	2.0kΩ
Spurious	Fo±1.0MHz 40dB or more	Fo±1.0MHz 40dB or more	–	–	–

CF2 : Only E destination

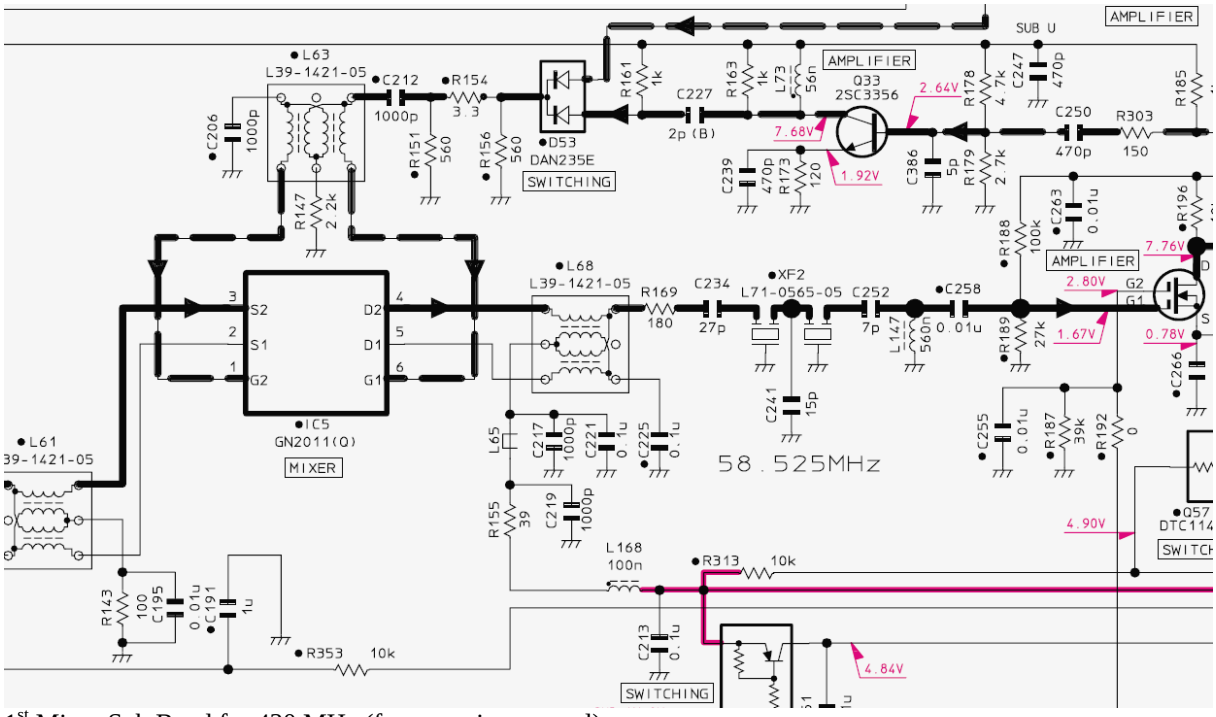
Table 15 Filters rating (TX-RX 2 unit : X57-606)



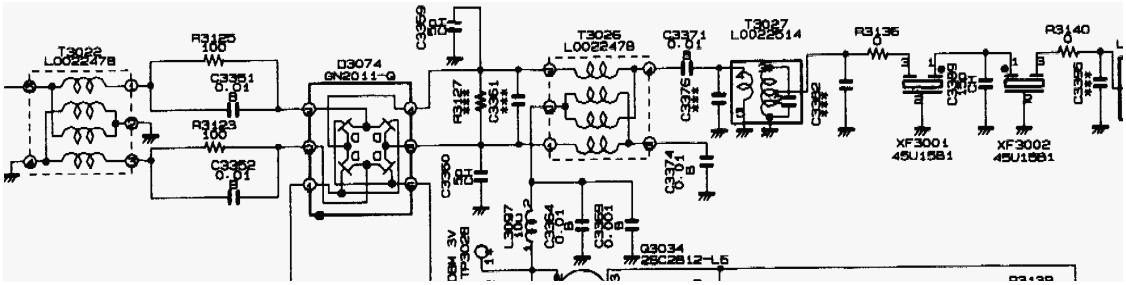
1st Mixer Main Band for 430 MHz (from service manual)



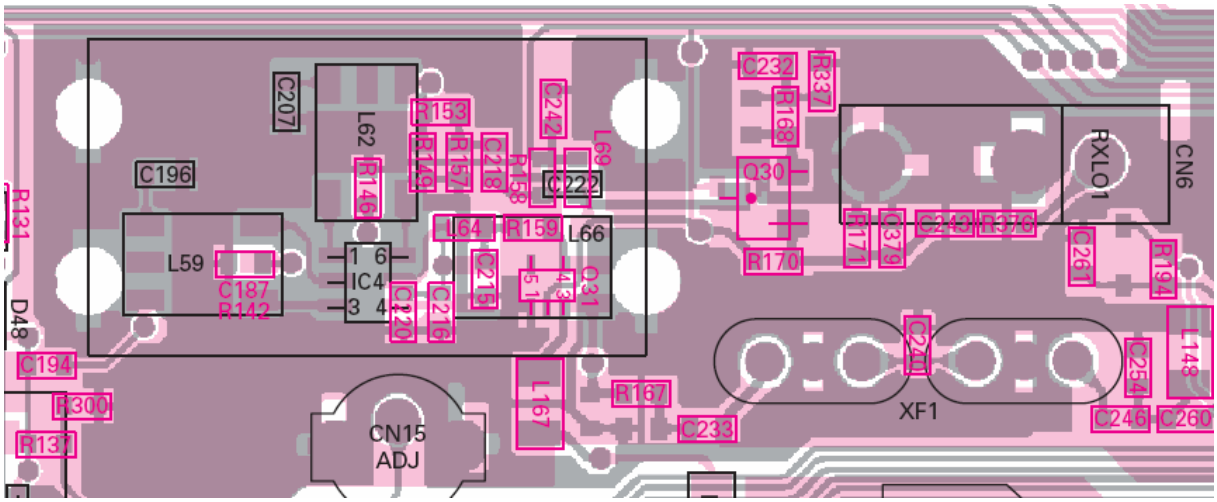
1st Mixer for 430 MHz (from users manual schematics)



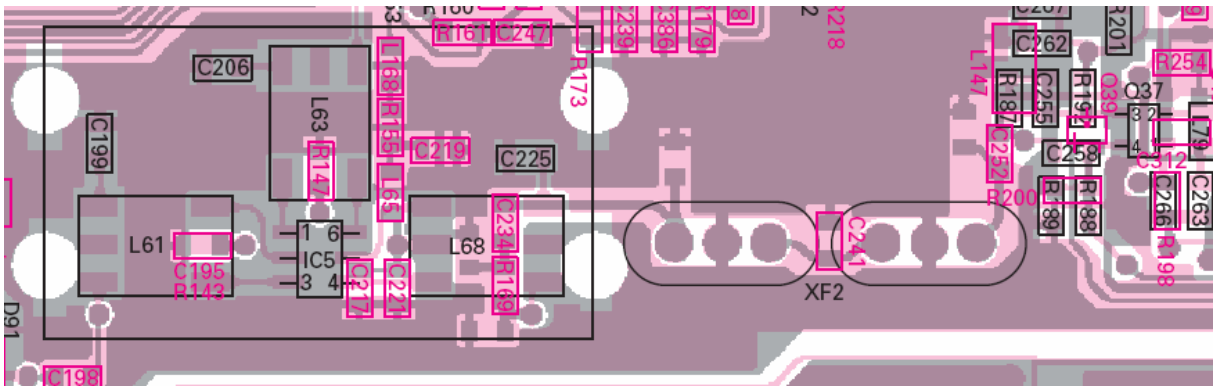
1st Mixer Sub Band for 430 MHz (from service manual)



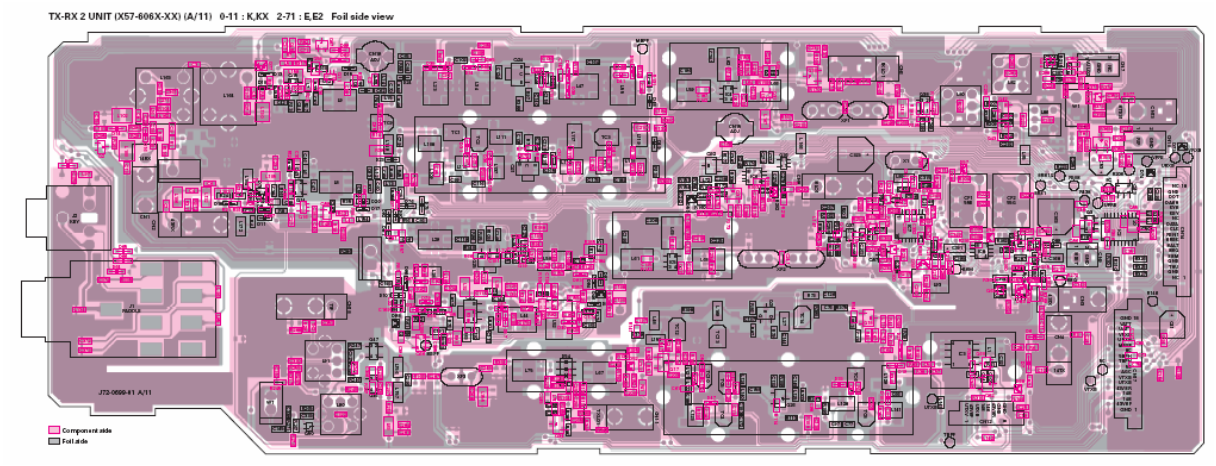
(very similar: the mixer of FT847)

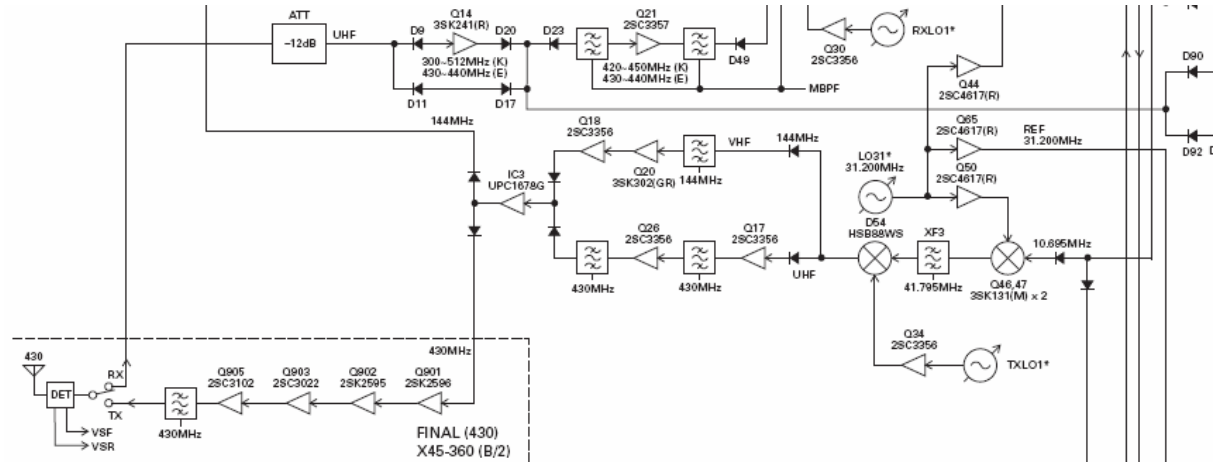


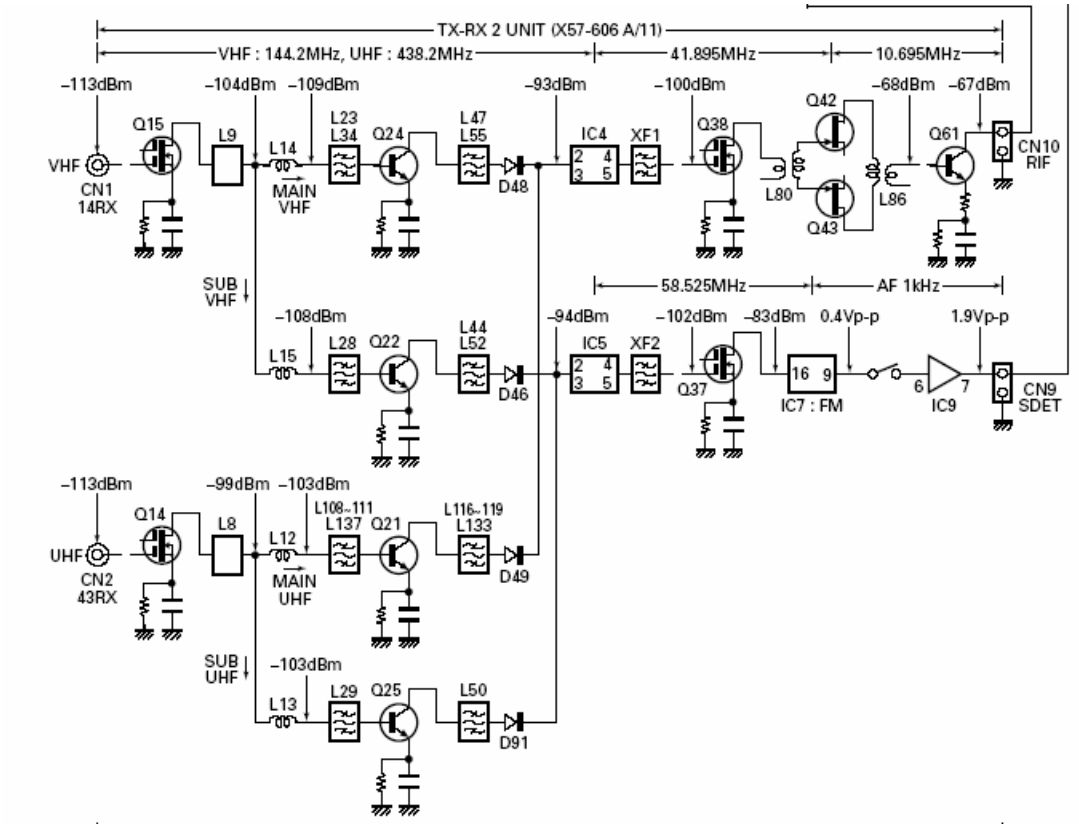
Find the pad between L167 and R167



Sub Band Mixer (not used here)

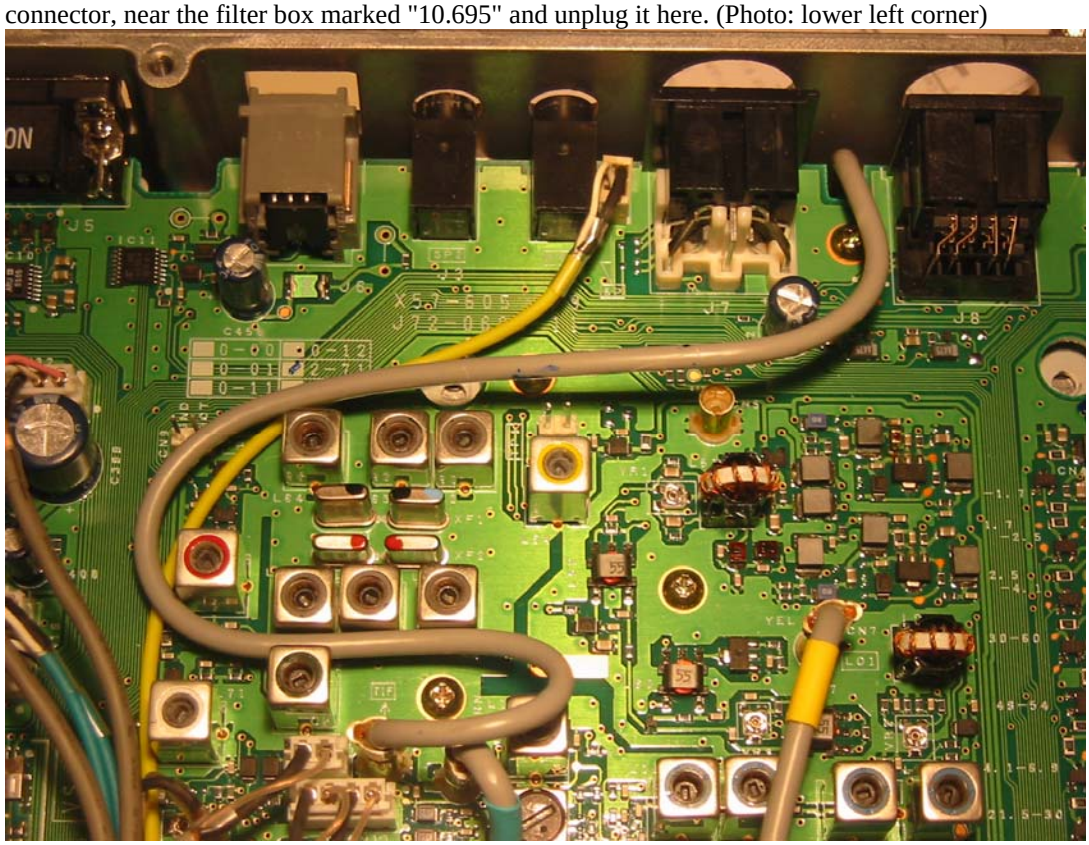






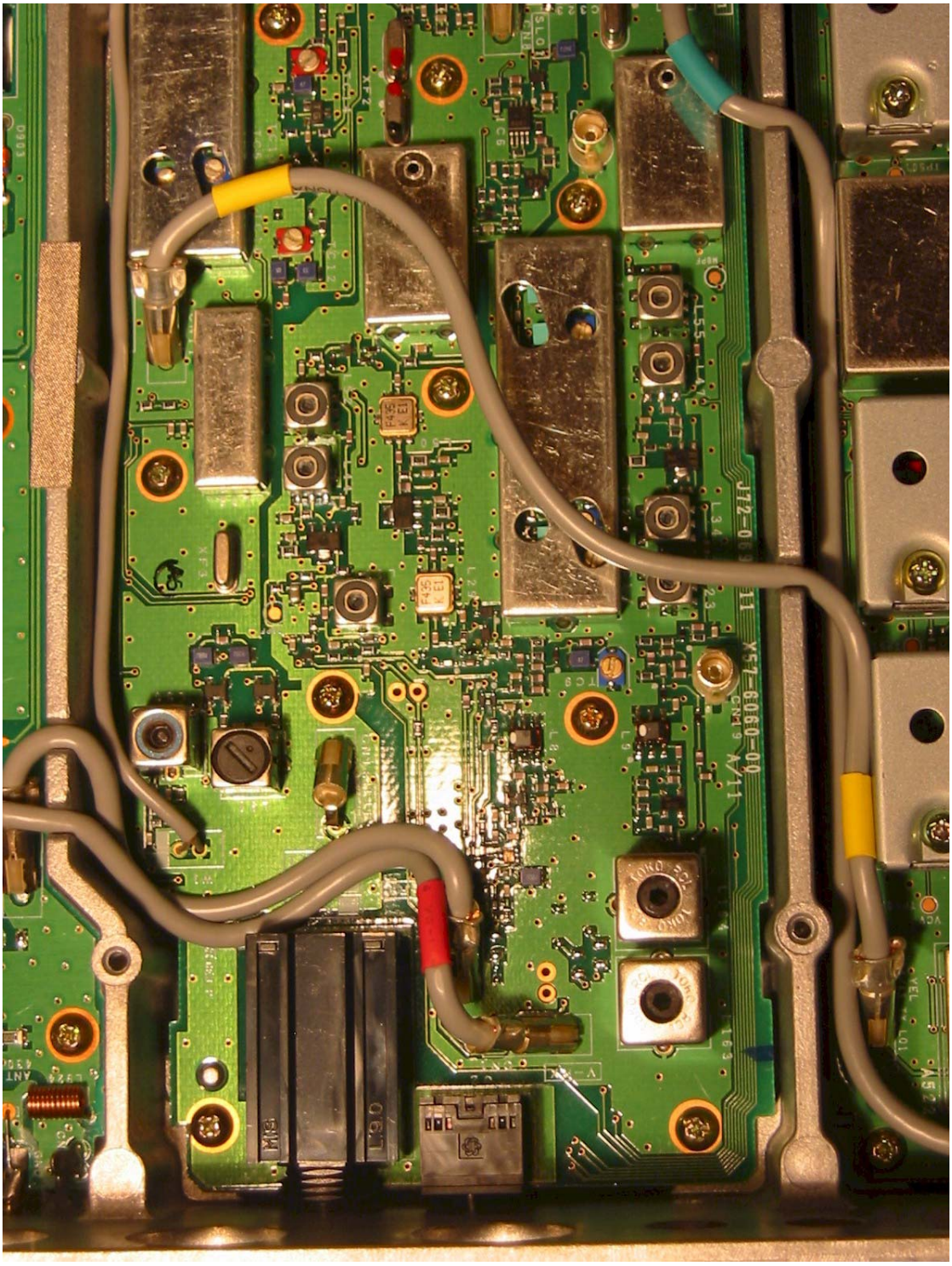
Installation procedure

1. Open the transceiver case, lower cover. It is not necessary to open the top cover!
2. remove 10 screws to access the inner part of the case. The large board which appears after opening the lower case is mounted on a support panel which must be removed.
   There are 3 screws on the left and 3 on the right edge of the case plus 4 screws within the board area to unscrew and take away with tweezers. Store the screws in a safe place to find them again later ☺.
3. Find the coax cable which goes from the center of the large printed circuit board (at the white connector, near the filter box marked "10.695" and unplug it here. (Photo: lower left corner)

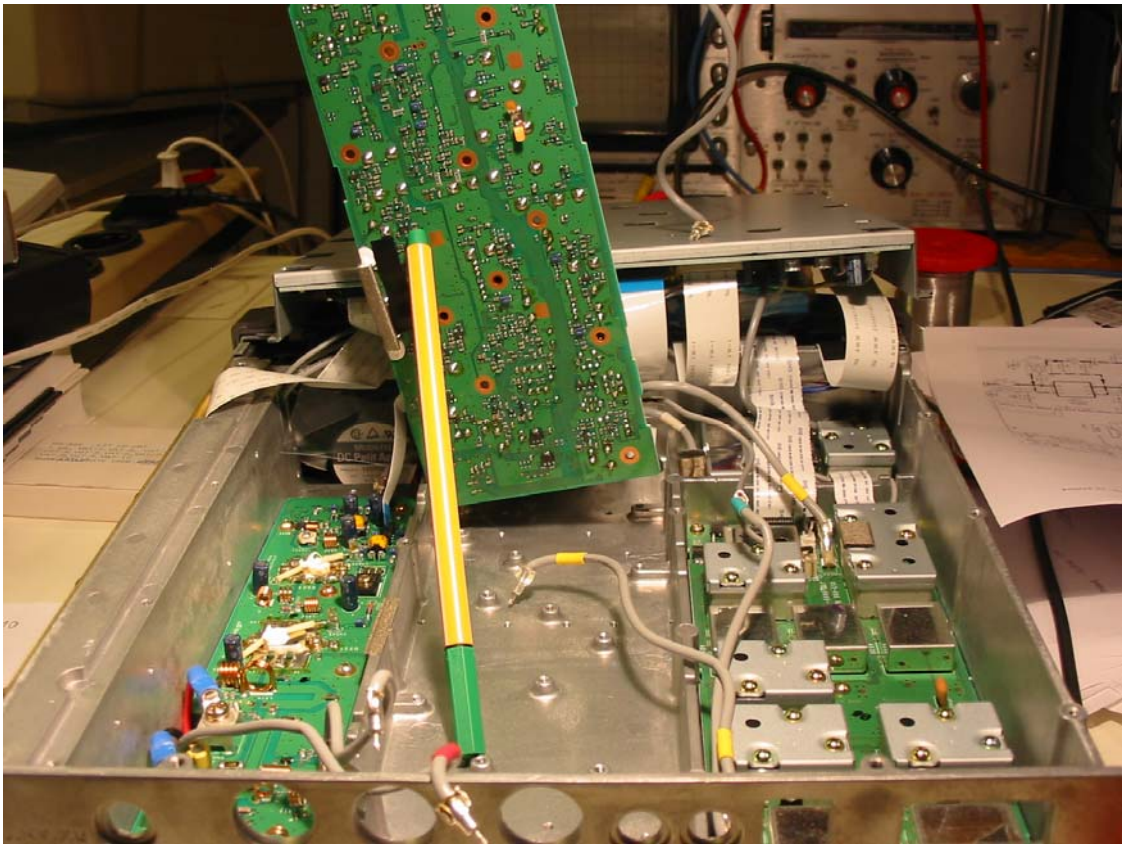


4. Now, gently try to lift the board with the support panel. Does it move? OK!
5. Gently push the panel with the large board away from the rear panel until the 9 pin SubD connector unlocks and the board can be totally folded back. Use some pad or cardboard to prevent scratches on the lower part of the plastic front panel assembly when the large board lies top down on the plastic front.
6. Place the transceiver top down, rear panel towards you on your table. (See photo). The coax cable you see on the photo will should be disconnected before.

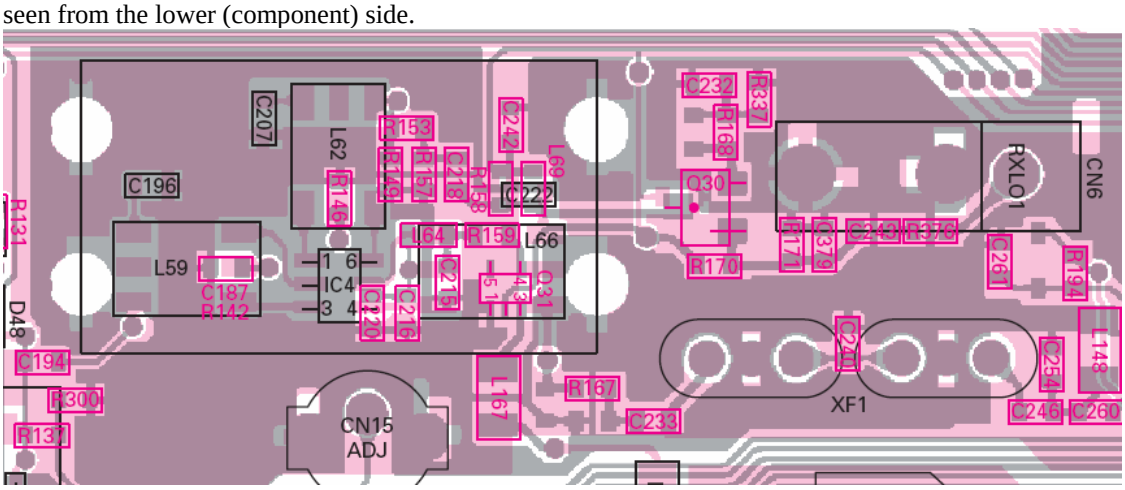
7. Now you find three long boards in three compartments inside the transceiver. The middle one with the connectors "KEY" and "PADDLE" contains the 1st IF mixer for 435 MHz where the IFD must be connected to. Unfortunately, the traces between mixer and filers cannot be accessed from top. So there is no other way: you have to remove the board totally from its support frame.
8. Unscrew all 13 golden screws from the board. Be **very careful** not to slip with the screwdriver. These self-tapping screws are quite tight and need some force to loosen. If the screwdriver slips off, you might damage the tiny smd components nearby which will cause a big problem.
9. Unplug four coax cables: U-RX (no marking), V-RX (red marking) , TXLO1 (yellow ring) and RXLO1 (green ring). A cable from the right board (with the 11 shield boxes on it) with a yellow ring is pinched between two filters: Loosen this cable first (do not unplug it).



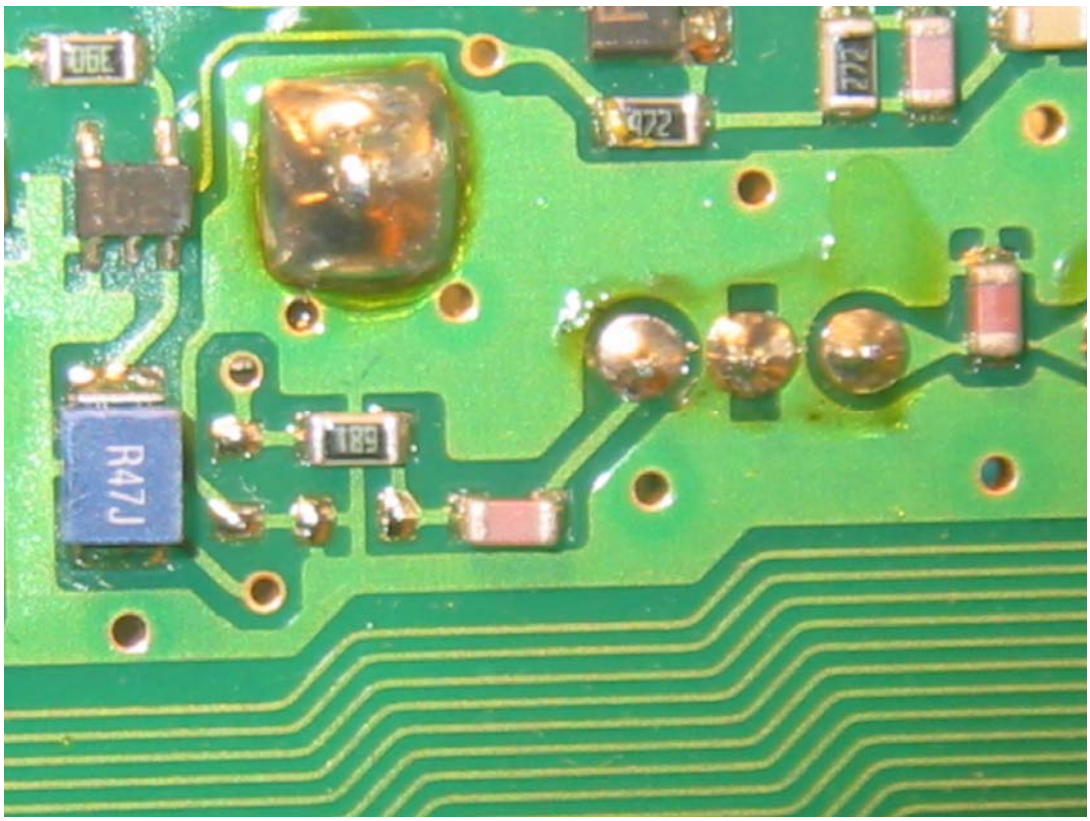
10. Gently lift the board at the end which is located to the front panel to loosen it.
11. Shift the board back so that the KEY and PADDLE connectors come free. It may clamp a bit but if all 13 screws are removed, the board should move. There is a kind of index bolt at the corner of the PADDLE connector and you have to lift the board here 3mm before moveing it horizontally.



12. You can access the component side now. The component layout is shown below. It shows the board seen from the lower (component) side.

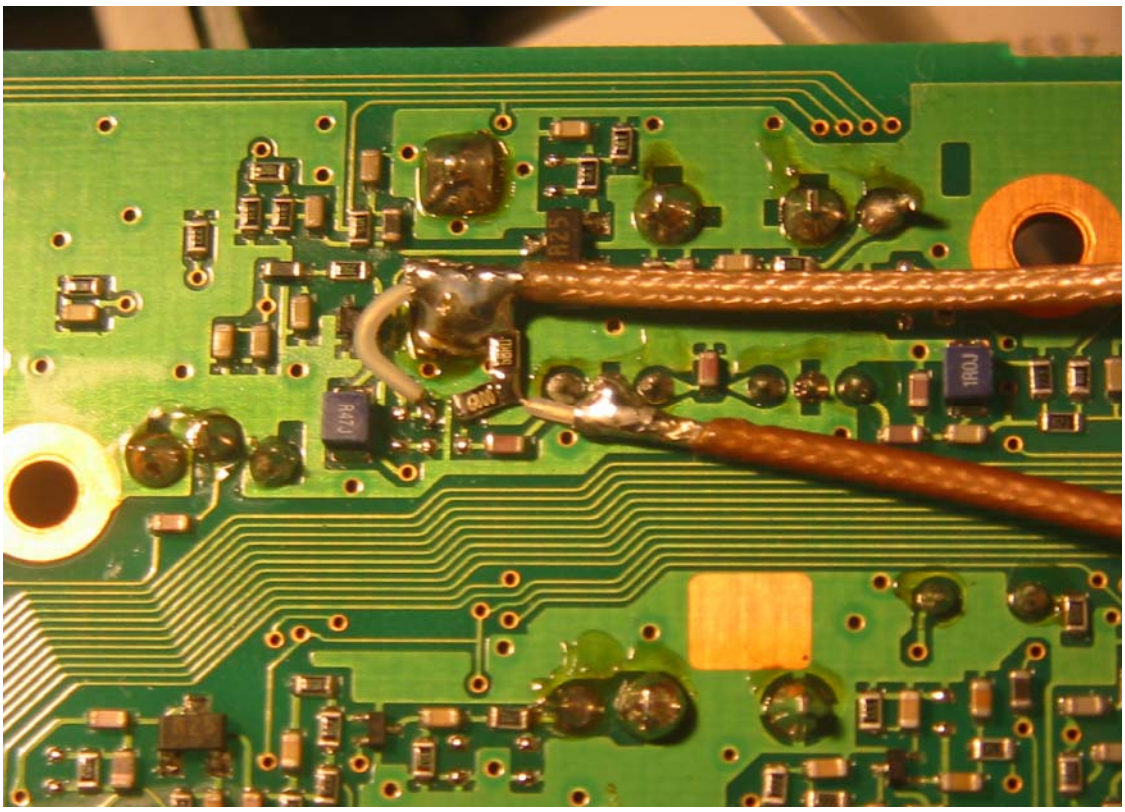


13. Find the resistor R167 and unsolder it. Marking: "681". This is difficult because the board is vertical and somehow floating in the air. Use a hot air pencil if possible.

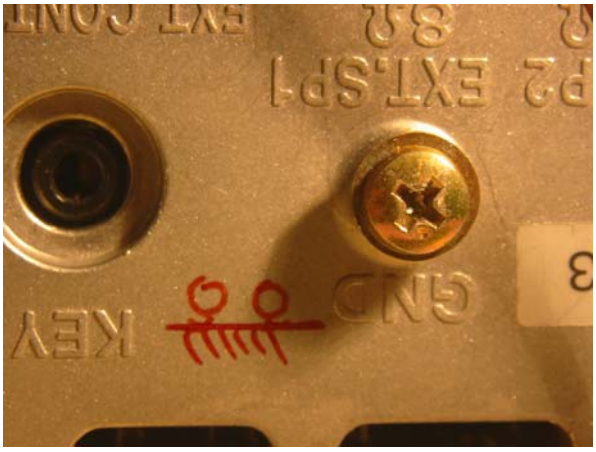


Find the resistor with marking "681" and remove it.

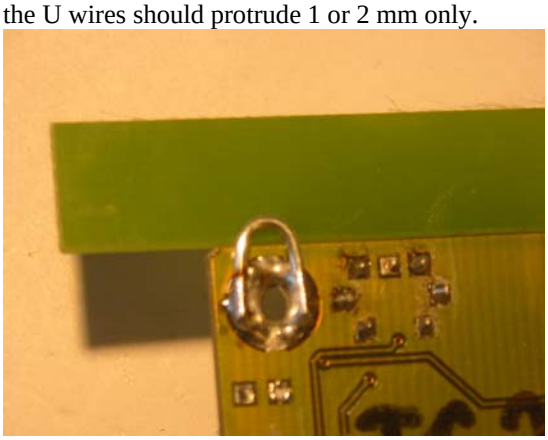
14. Prepare two coax cables: Remove 1.5 cm of the brown outer insulation. Totally solder the outer conductor with much of solder and move the excess solder to a drop at the very end of the cable. The PTFE cannot melt. Put the cable end on the table and gently press a sharp knife to the solder filled outer conductor, 5mm away from the point where the outer brown insulation ends. Turn the cable fully round while pressing the knife to get a notch in the outer conductor. Now try to bent the cable back and forth, left and right at the point where you have nicked it. The outer conductor will break and can be pulled off easyly. Now use the knife again to cut the inner dielectric. Be carefull not to cut the inner conductor. With a wire cutter, pinch the inner insulation carefully and find the cut. Then pinch the wire cutter without cutting the wire and pull the coax to remove the inner conductor insulation. Solder the inner wire and cut the free end to 1.5 mm length.
15. It is a good idea to mark the both coax cables with color stipes to distinguish later between the "mixer" and the "filter" cable. Best is to use cables with different color insulation (light and dark brown). We always use the brighter color for "mixer" and the darker color or marking-stripe for "filter"
16. For soldering of the tiny smd components, you need a soldering iron with a fine pointed tip. To solder the outer conductor of the cables to the ground, you should use a medium size soldering iron with a thick tip and higher temperature if possible.
17. The (light) "mixer" cable is soldered to the "upper" smd pad of the (removed) R167 (on the photo above the left pad). There are two pads (R167 and the unused C223 pad) which go to a thru-hole with an L-shaped trace (2 x 2 mm long traces). The size of the solder pads is 1 x 0.5 mm only, so have a steady hand. The inner conductor should be bent to form an "U" shape. The wire should go in direction to the rear panel connectors and, after the U-bent, go back so that the coax points 'down' to go to the front panel direction. So, the outer connector passes the solder pad of the shield box and must be soldered to ground here for strain relief. (See photo below)
18. Now solder a 680 Ohm resistor (marking "681" or "6800") to the other end of the removed R167 (right side on the photo above). You find a L-shaped trace (also 2x2 mm size) going from R167 and the (not installed) C229 to the 22pF coupling capacitor C233. The resistor may lay on the green solder resist and points in an angle of 45 degree right-down. (right up on the photo)
19. Solder a 56 Ohm (68 Ohm is also possible, marking "68R0") to the unconnected end of the new 680 Ohm resistor so that its other end is close to the ground connection of the screening box (where you soldered the outer connector of the "mixer" cable before). The 68 Ohm resistor is oriented horizontally, (vertical on the photo), right end is somewhat below the ground pin.
20. Now solder the (dark or striped) "filter" cable inner conductor to the joint of the 680 and the 56 (68) Ohm resistors. Solder the outer conductor to ground. We used the middle ground pin of the first XF1 filter can for ground, i.e. the wire goes straight down as you can see in the photos.



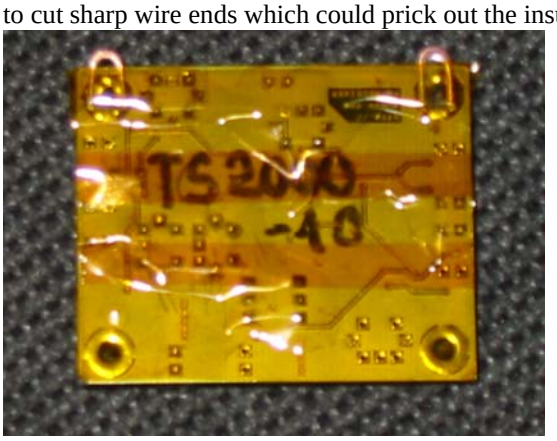
21. Done! Now you can reinstall the board. Observe that the coax wires do not collide with the spacers in the diecast frame. They must not be visible throught the screw holes in the board. Feed the cables in direction to the fan and pull them gently straight so that they do not pass one of the mounting holes. The PADDLE connector must be pushed down before the board can be pushed in place. You remember not to slip with the screwdriver because this would be disastrous!
22. There are two ways to install the IFD board in the TS2000: We recommend to install it internally but it can be installed externally as well. For external installation, you have to drill 2 holes (3mm) in the rear panel. The holes should align the bottom of the middle compartment. Use a pair of pincers to transfer the level of the compartment's bottom inside to the outside of the rear panel (the legs of the pincers have equal length ☺) . Mark the end of the pincer's outer leg. When drilling, make sure the board cannot be touched by the drill. To avoid that the splinters fall into the expensive transveiver, you should permanently use a vacuum cleaner to remove all crumbs, like the dentist does.
    Feed the coax cables through the new holes and make sure they do not collide with the mounting holes. The cables should not cross under the board (maybe there is no sufficient space for both cables to pass). The IFD can be installed now in a separate box outside the transceiver later. If you want the transceiver to work without IFD, you have to connect the both ends of the cables comeing out through the new drilled holes.

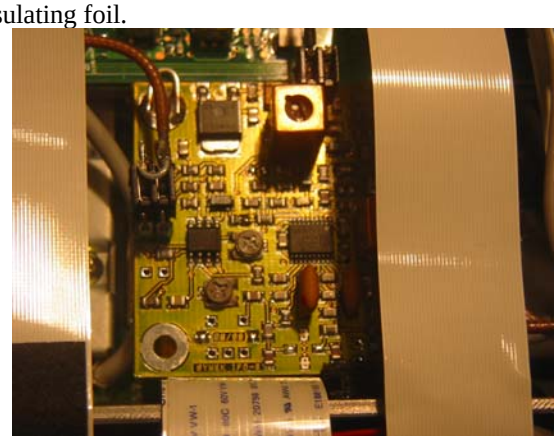


23. Reinstall 4 coax cables and 13 golden screws to the 435 MHz board. Count the 13 screws. Some of them will need some force to make them tight.
24. Reinstall the large board with its support panel (3+4+3 golden screws)
25. (internal installation only): Solder two pairs of U-shaped copper wires to the mounting holes as shown in the photo. The wire diameter should be 0.5 mm on the solder side (may be thicker on the component side), the "U" is made by bending the wire round a 3mm tool, length approx. 7 mm. The round part of the U wires should protrude 1 or 2 mm only.

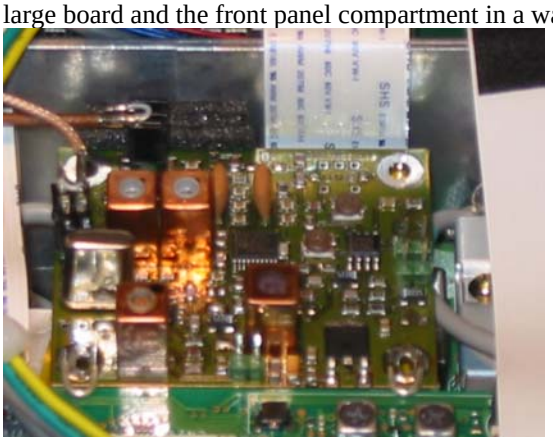


26. To prevent short circuits, totally insulate the bottom of the IFD board with 1 or 2 layers of adhesive tape (we use Kapton tape). Before that, put the IFD on a piece of sandpaper and shift it gently back and forth to cut sharp wire ends which could prick out the insulating foil.



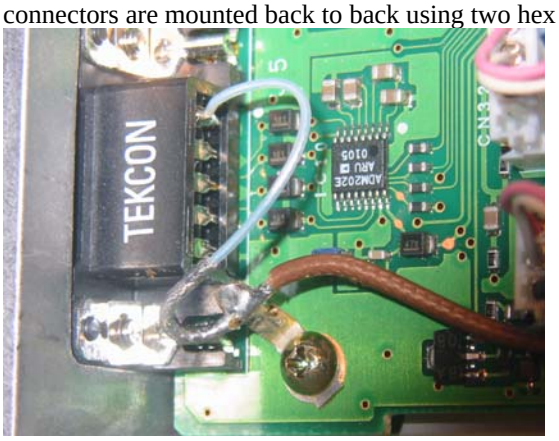


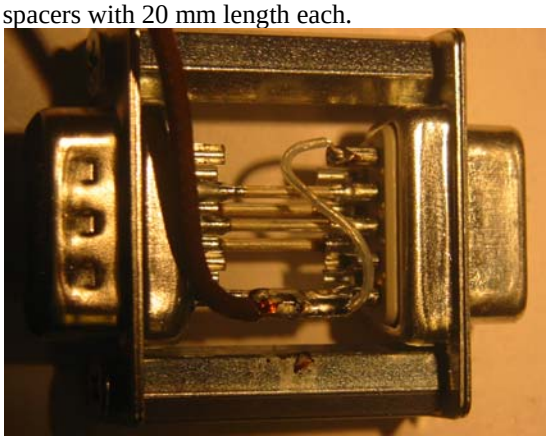
27. Remove the ribbon cable from the CN25 connector on the large board on the bottom side of the transceiver. You find it behind the "M>VFO" button on the front panel. Arrange the cables between the large board and the front panel compartment in a way that there is space for the IFD.



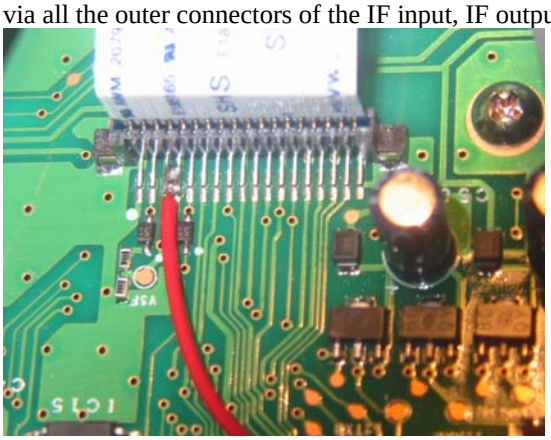
28. Stick a piece of self-adhesive foam tape (2x1 cm, 6mm thick) to the cast wall under the (still removed) ribbon cable, level with the large board. Then push the IFD against the foam tape and latch the U wires. When you release the board, it will be pressed against the large board, the protruding U wires will fix the IFD level with the large board. The left U-wire is placed between the two ribbon-cable connectors, the rigth U is placed between the two square filters with the black screw on top.
29. Now connect the two coax cables to input and output of the IFD: The signal coming from the mixer, goes to IFD terminal "RF in" (M1), the "RF out" (M11) goes to the IF filter via the "filter" coax cable. Note: the inner terminal is Ground, the terminal near the edge of the IFD is the signal.

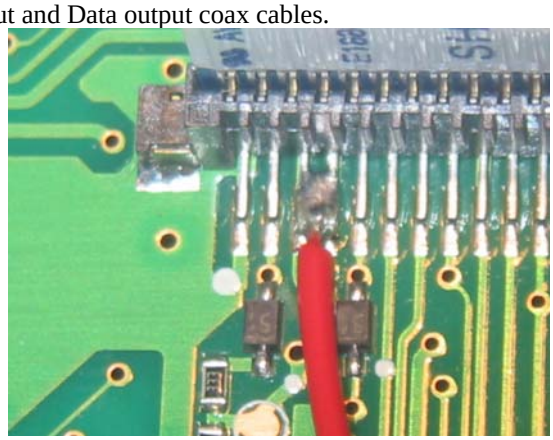
30. The Data Output of IFD (Terminal M63) must go to the external modem (TNC). You may drill some holes in the back panel but we found, that the pins 1, 6, 4 and 9 of the 9 pin Sub D connector (COM) are not connected and can be used for the additional signal. Pin 5 is Ground. If COM is not used in your application, just make a cable with a 9 pin female SubD connector. IFD Data is pin 1 and Ground is pin 5. If a computer must be connected, you should build a simple adaptor with a pair of SubD 9 connectors (1 male, 1 female), Connect pins 2, 3, 5, 7 and 8 by short straight wires (10 mm) and solder a shielded cable (going to the TNC) to pin 1 (signal) and pin 5 (ground). The adaptor will be more stable if the connectors are mounted back to back using two hex spacers with 20 mm length each.

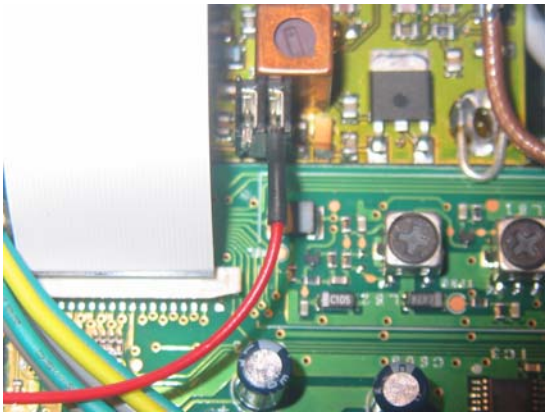




31. Now we need a power supply for the IFD. Any constant voltage of 10 and more volts would be OK. As there are no points on the large board, which are easy to access and easy to find, we used the 14VS line, which has a constant voltage equal to the 12 (13.8) Volt input. The ribbon cable on CN26 (second cable from left) pins 3 and 4 are used for this voltage. You can solder a wire to the pins 3 and 4 which goes to terminal M90 (12 Volt) of the IFD. A ground wire is not necessary because the ground potential comes via all the outer connectors of the IF input, IF output and Data output coax cables.







32. Now the task is finished. Reinstall the ribbon cable and double check if all cables etc. are as they were before you started. There should be only the black screws for the outer cover left.
33. Apply power to the transceiver now. There should be absolutely no change in behaviour compared to the first tests. It may be that the S-meter shows + or – 3 db more or less signal: This is not critical.
34. Apply an oscilloscope to the new data output (pin 1 of the SubD): with no RF signal, there must be noise visible.
35. Test the sensitivity of the transceiver if possible. It must not have changed!

36. Apply a FM modulated RF signal (435.xx MHz) and check the data output. With a deviation up to 50 kHz there should be a proper demodulated signal visible. Note: When increasing the deviation of the test signal, there will be additional noise on the loudspeaker when the deviation exceeds the normal FM bandwidth (20 kHz) of the original receiver. But the new IFD can demodulate signals beyond the narrow band FM bandwidth. That's the reason we made it.
37.

GaAs MMICs **Panasonic**

GN2011

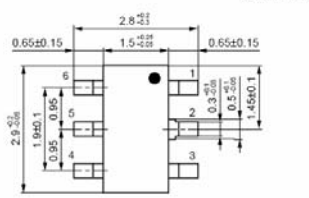
GaAs N-Channel MES IC

For VHF/UHF wide-band mixer

■ Features

- High conversion gain
- Operates in low local oscillation input

Unit : mm



1 : Gate 2
2 : Source 1
3 : Source 2
4 : Drain 2
5 : Drain 1
6 : Gate 1

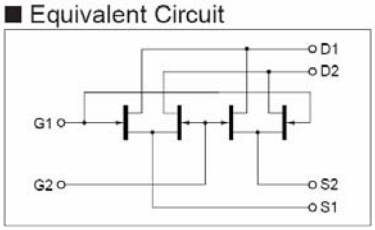
Mini Type Package (6-pin)

■ Part Number Symbol : 4W

■ Absolute Maximum Ratings (Ta = 25 ± 2°C)

Parameter	Symbol	Rating	Unit
Drain-Source voltage	V_{DS}	5	V
Gate-Source voltage	V_{GS}	– 4	V
Drain-Source current	I_{DS}	60	mA
Gate current	I_G	1	mA
Allowable power dissipation	P_D	200	mW
Channel temperature	T_{ch}	150	°C
Storage temperature	T_{stg}	– 55 to +150	°C

■ Equivalent Circuit



■ Electrical Characteristics (Ta = 25°C)

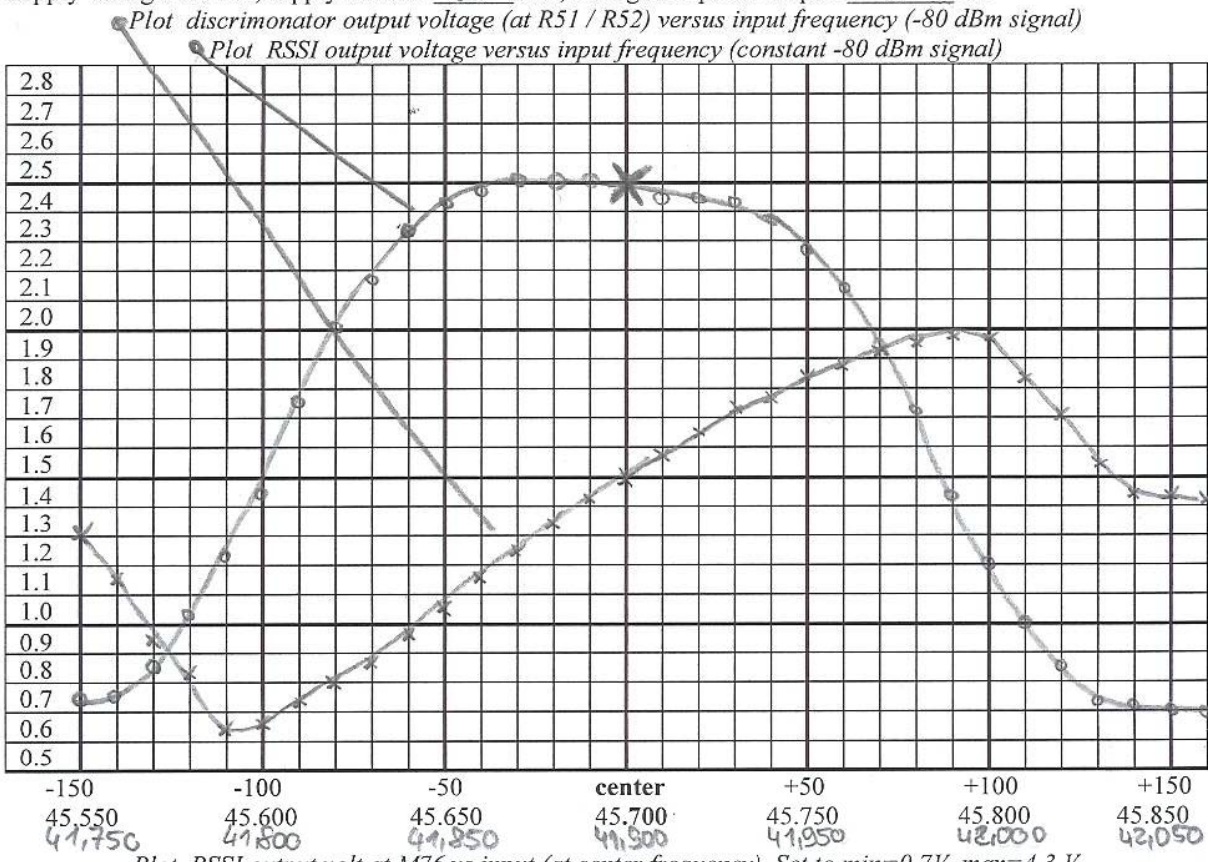
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Drain cut-off current	I_{D1SX}	V_{D1}= 5V, V_{G1}=V_{G2}= – 4V, V_{S1}= V_{S2}= 0			100	μA
	I_{D2SX}	V_{D2}= 5V, V_{G1}=V_{G2}= – 4V, V_{S1}= V_{S2}= 0			100	μA
Gate cut-off current	I_{G1S1S}	V_{G1}= – 4V, V_{S1}= V_{D1}= 0			– 50	μA
	I_{G1S2S}	V_{G1}= – 4V, V_{S2}= V_{D2}= 0			– 50	μA
	I_{G2S1S}	V_{G2}= – 4V, V_{S1}= V_{D2}= 0			– 50	μA
	I_{G2S2S}	V_{G2}= – 4V, V_{S2}= V_{D1}= 0			– 50	μA
Drain current	I_{D1S1S}*	V_{D1}= 3V, V_{G2}= – 4V, V_{G1}= V_{S1}= 0	4	30	80	mA
	I_{D1S2S}	V_{D2}= 3V, V_{G2}= – 4V, V_{G2}= V_{S2}= 0	4	30	80	mA
	I_{D2S1S}	V_{D2}= 3V, V_{G1}= – 4V, V_{G2}= V_{S1}= 0	4	30	80	mA
	I_{D2S2S}	V_{D1}= 3V, V_{G1}= – 4V, V_{G2}= V_{S2}= 0	4	30	80	mA

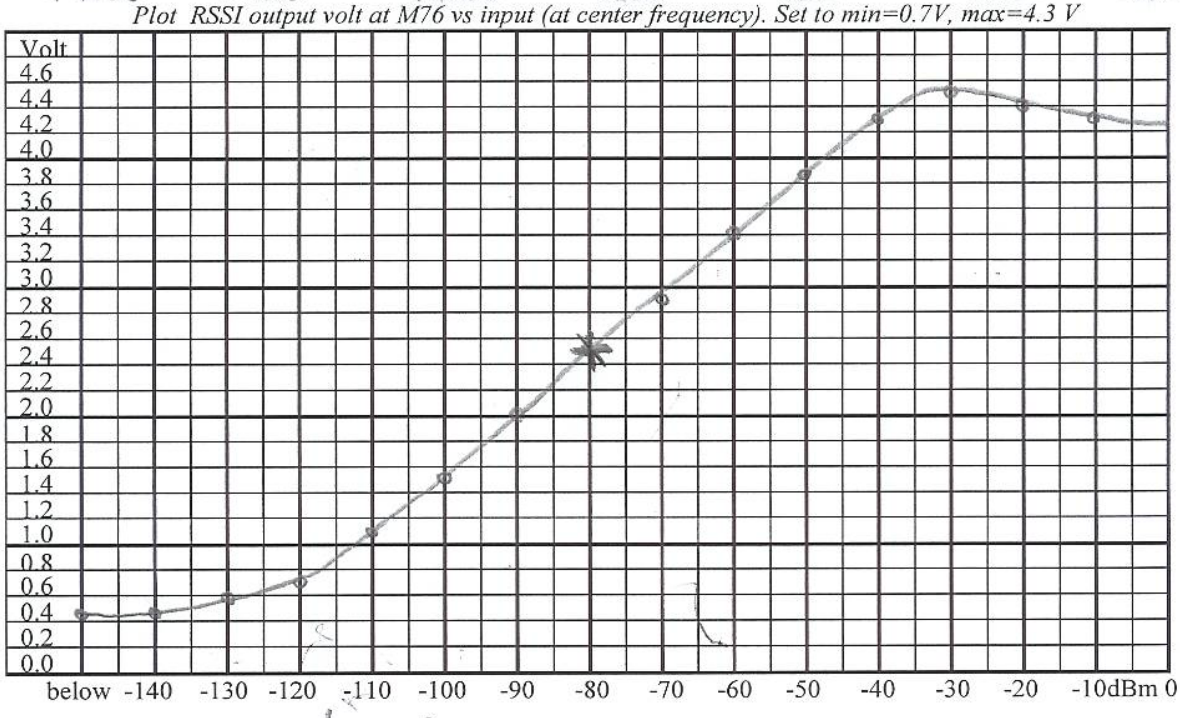
* I_{D1S1S} rank classification

Rank	P	O	R

Data sheet of the 1st mixer IC

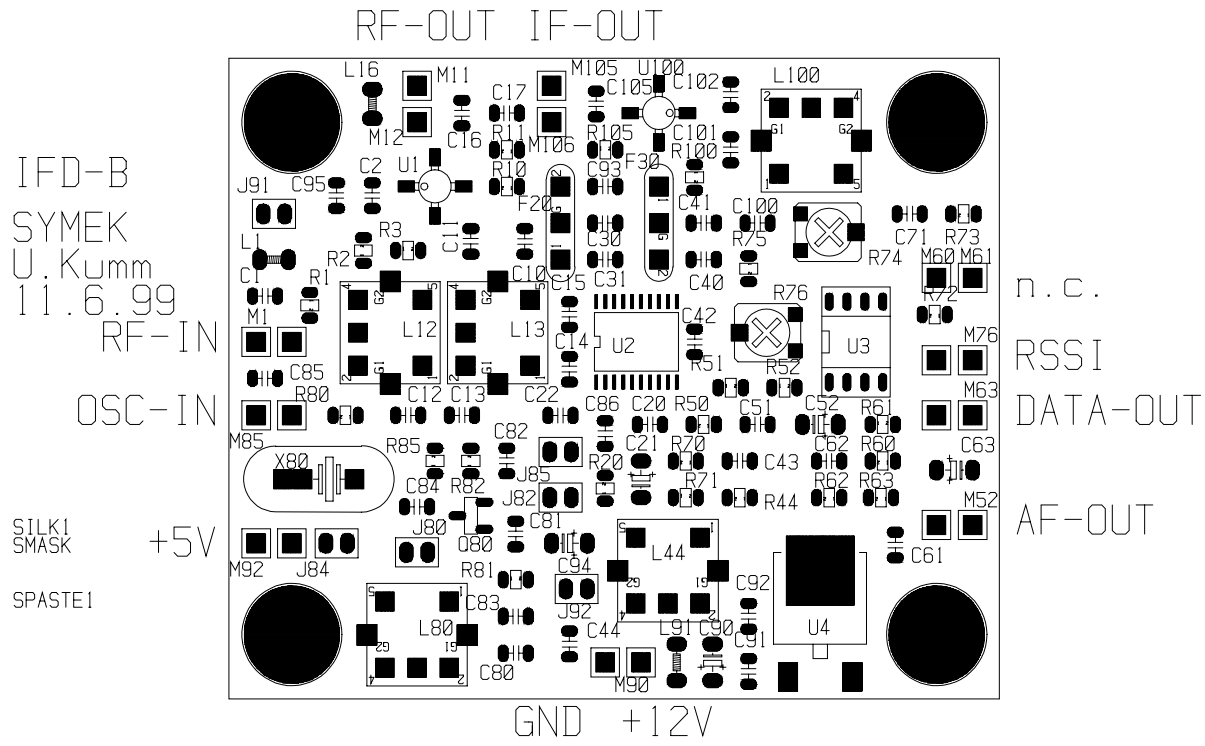
Supply voltage: 12 volt; supply current: 50 mA, total gain input to output: 3 dB





typical frequency and amplitude response of IFD:
upper: DET out (DC coupled) and RSSI vs input frequency,
lower: RSSI output vs input signal strength.

Transmitting 9600 Baud with TS2000
Sorry but we could not find information on that in the users manual. Operating the PTT via the ACC connectors however is possible.



6**. Questions and Answers:**

Q: why is the IF signal fed through the IFD? Wouldn't it be easier to connect the IFD in parallel to the mixer output?
A: directly after the mixer, the signal passes a quartz filter. As with every filter, the input impedance varies significantly with frequency: within the passband, the filter is matched, outside the passband, the filter reflects the signal. The amplitude spectrum at the filter input shows a sharp notch at the passband. Attaching a parallel demodulator here would cause severe distortions due to the varying load. So, the signal after the mixer has to be buffered. The amplified signal is attenuated again to get the same (or a few dB more) signal level as without amplifier.

Q: is a AFC output available?
A: There is an unconnected pair of pins on the printed circuit board (M60/M61). These pins can be connected to the joint of R52/C52 (DET out) via a 100 kΩ resistor to pin M60. The voltage measured at this pin will depend on the center frequency of the received FM signal.

Q: how do I decode a fast packet-radio signal of 38kBaud or more?
A: The TNC2 with the Z80 processor cannot decode signals beyond 19200 Baud. The newer TNC3 or TNC31 series is capable of receive and transmit baudrates up to 1 Mbit/s. There are modems with all common baudrates (9600, 19200, 38400, 76800, 153600 and above). Special modems with different RX and TX speed (e.g. TX 9600 / RX 38400 for UO-12) are also available. When using WISP software with a TNC3 packet controller, you may use the modem 2 for receiving and modem 1 for transmitting. As WISP uses kiss-mode, both modems are received simultaneously, the data will be transmitted via the default port 1.

For best symmetry, apply a wideband modulated FSK signal to the IF input and adjust L44 to maximum af signal (1 Vpp) at data out.

L12 and L13 can be readjusted for maximum signal (measure RSSI signal) with a weak (-90 dBm) input signal.

With the input open, there should be approx. 2 V peak-peak noise at the data output.

IFD Option TS2000 test plot

IF-Frequency: 41.895 MHz, Filter impedance: 50 Ohm. Acessory parts: 2 pcs thin coax cable (30 cm each), SMD Resistor 680 Ohm and 68 Ohm

XTAL: 52.595 MHz. Band filter L12, L13: 850nH, C10: 82p, C11: 22p, C12=C13: 2.7p; C14: 39p, C15: 33p.

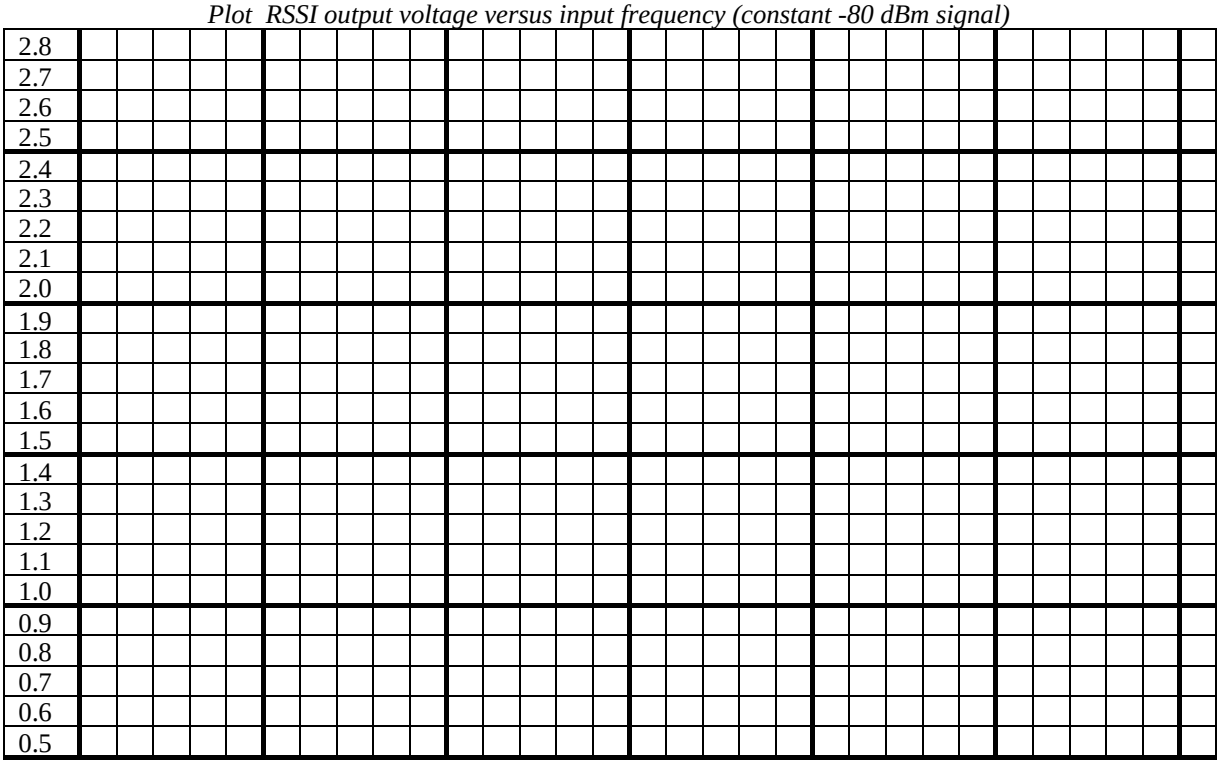
XO: L80: 400nH, C80: 68p, C81: 68p, C82: 56p, C86: 33p, R80: none R1=R3=150E, R2=39E.

IF-Filter: 76800: SFE 10.7 MHY (red dot, BW110kHz) or for 153600: SFE 10.7 MA (light blue, BW230kHz)

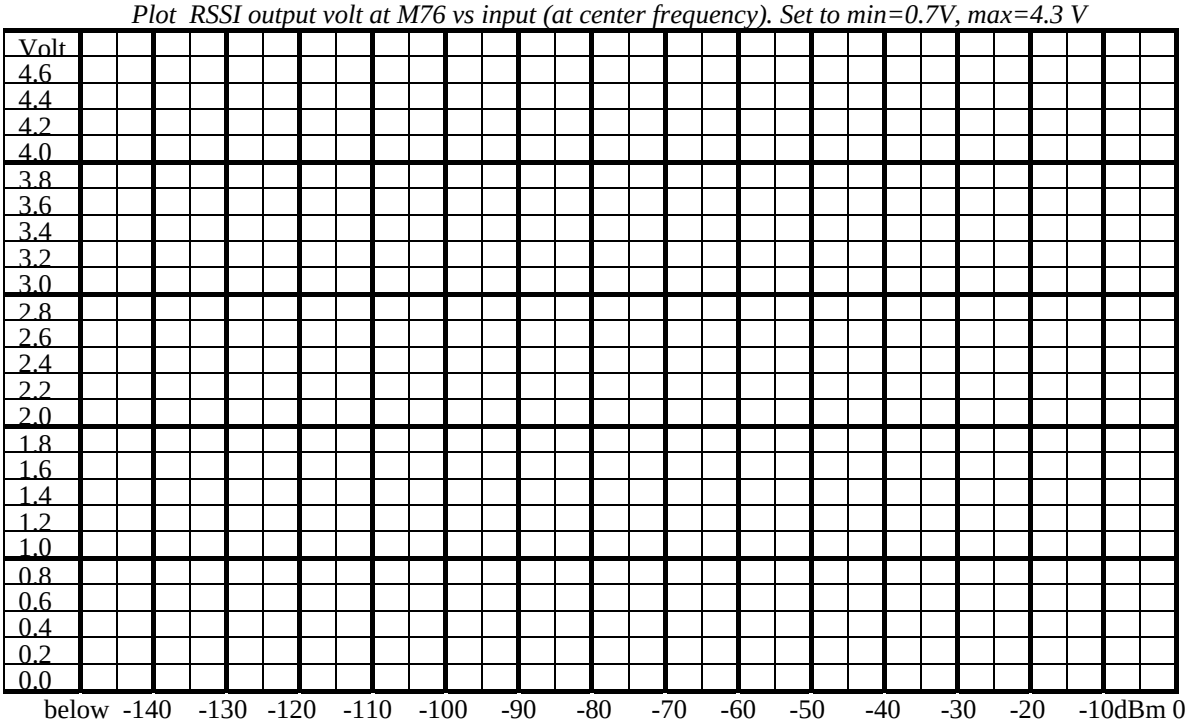
supply voltage: 12 volt; supply current: _____ mA, total gain input to output: _____ dB

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

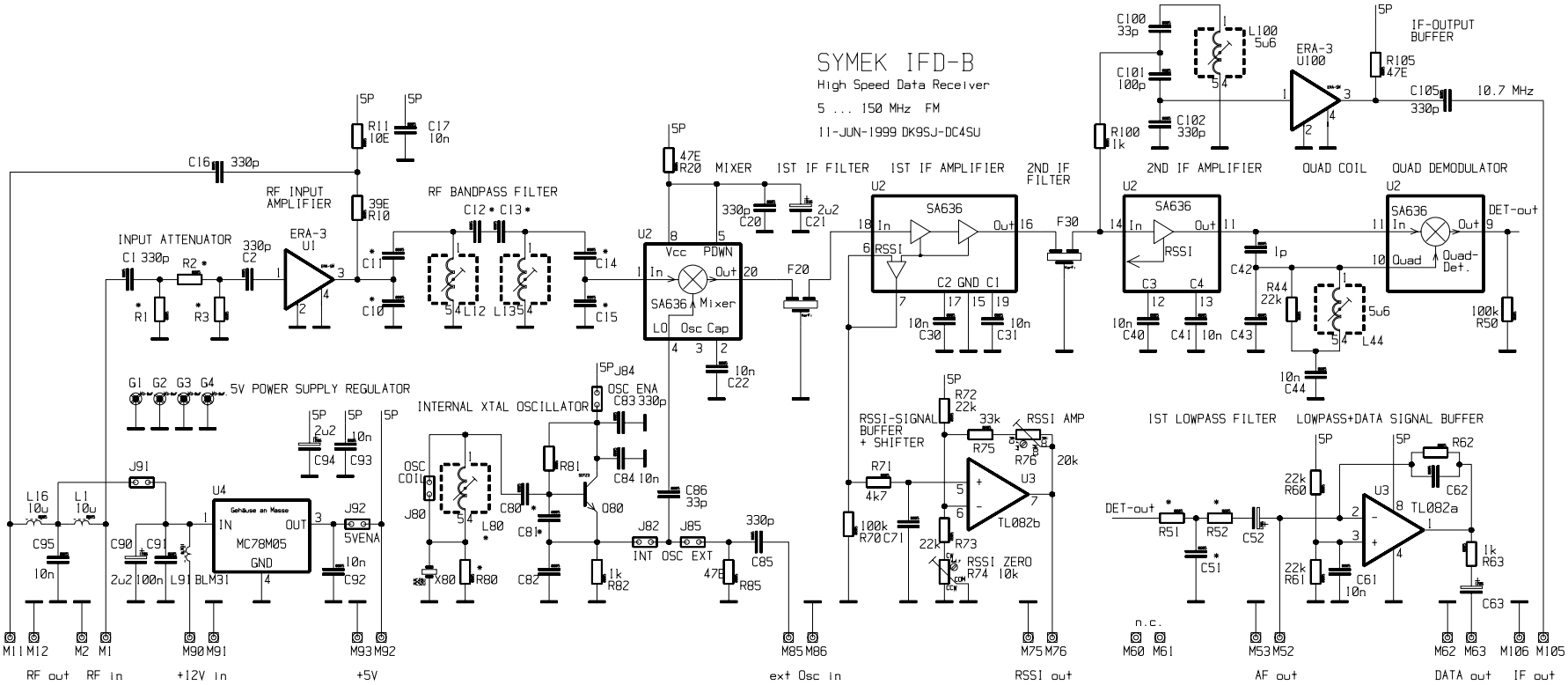
Plot RSSI output voltage versus input frequency (constant -80 dBm signal)



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



date: _____ sign: _____



Modifications IFD option TS2000: Oscillator: quartz TQ730518 / 52,595 MHz for IF 41,895 MHz (main band, standard), R80: 680E, L80: 0,4 uH, C80: 68pF, C81: 68pF, C82: 56pF. Values for the band filter: C10: 82pF, C11: 22pF, L12: 0,85uH, C12: 2.7pF, C13: 2,7pF, L13: 0,85uH, C14: 39pF, C15: 33pF.
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.

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	