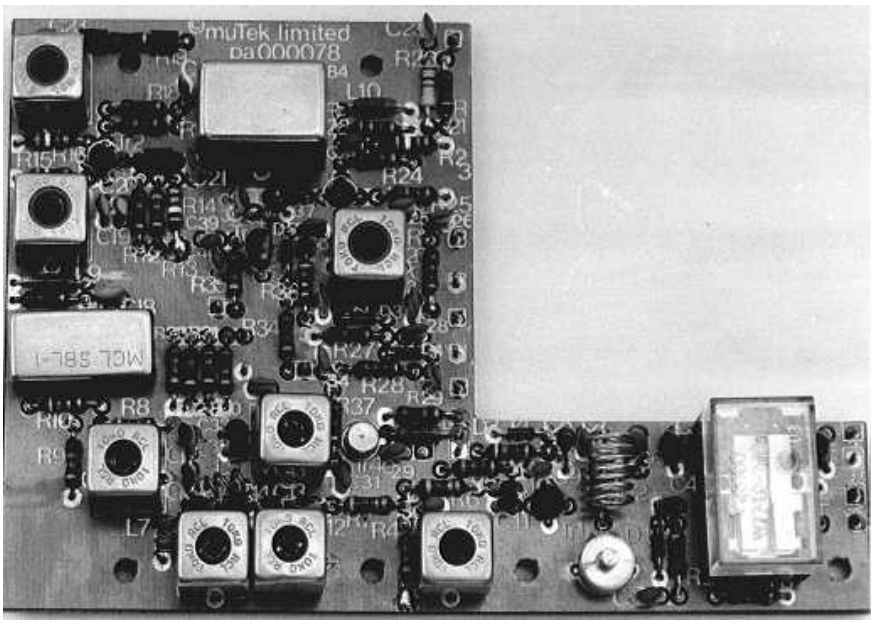
Edition 1

Replacement Front End for IC271A/E - Early Version RPCB271ub

a product produced by Mutek pre 1989



Manual compiled by Clive Smith, GM4FZH for general circulation

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Compilers Note

This manual has been put together and designated Edition 1. The information has been obtained from various sources, including past owners and the Internet; **I cannot vouch for the accuracy of this information.** It is not intended to produce an updated version of this manual, if additional information becomes available it maybe provided as an addendum.

The products produced by Mutek were of high quality and many are still in service. However, please remember that this product came on to the market some 20-30 years ago and must now be regarded as obsolete.

The units described herein have been supplied in different versions which may mean some changes to component values and types. I have no further information.

This manual has no copyright but I would be grateful that if it is used the source is acknowledged. Please let me know if you have further details that would help with this or any other Mutek product.

****** PLEASE NOTE: ******

The information contained herein is provided in good faith and I will not be responsible for any outcomes arising from the use of it. I have put it together for use by the amateur radio fraternity.

The list of other manuals can be found on my website www.gm4fzh.co.uk or the Mutek Facebook group as they become available. I have no association with the firm Mutek and this manual has been produced at my own expense and without any payment.

If anyone has further information I can make the amendments or I can supply the original document which was written using LibreOffice v6.0.7.3 under Ubuntu. It was then converted to a .pdf format.

Clive Smith, GM4FZH, Jan 2021

The filename of this document is ***earlyfrontendIC271.pdf***.

Specification

Noise Figure	2.2dB
Image rejection	85dB
Intermodulation free dynamic range	92dB*
Gain compression	125dB**

*level of one signal in equal two tone pair with respect to (wrt) noise floor required to generate 3rd order imp at 0dB s/n at 100kHz offset.

** level of interfering signal wrt noise floor required to produce 3dB gain compression of -76dBm signal at 100kHz offset.

History of the PCB

After some research, the history of this pcb appears to be as follows, EOE.

PCB Type	Notes	Approx. date of issue
pa00-078:i1-9'83 (early RPCB271ub)	**Very early pcbs. Standard components. L shaped board**	**Up to about Feb 1984**
pa00-078: Iss02.4/84 (early RPCB271ub)	**Early pcbs. Standard components. L shaped board.**	**After about April 1984**
*RPCB271ub Iss.1	NOT covered by this manual. CAD design. L shaped board.	1989
*RPCB271ub Iss.2b	NOT covered by this manual. Rectangular pcb, not L shaped as all earlier boards	1995

* Denotes not covered by this manual.

Kit List

The kit contained the following items:-

RPBC271ub board	1 off
Red coded coaxial cable	1 off
White coded coaxial cable	1 off
Black coded coaxial cable	1 off
White and green leads with free socket	1 off
Red and yellow leads with free socket	1 off
M3 x 6mm machine screws	6 off
Folded aluminium display screen shield	1 off
Cable ties	2 off

Tools Required

The following tools are required for installation:

Soldering iron, solder sucker	Side cutters
Flat blade screwdriver	Cross point screwdriver
Small pair of pliers	

Introduction

Thank you for buying Mutek's RPBC271ub transceiver optimised preamplifier for your Icom IC271 A/E series transceivers. It is a development of Mutek's outstandingly successful RPCB144ub and RPCB251ub front-end boards for the FT221/225 and IC211/251 transceivers and offers a combination of excellent sensitivity combined with superb dynamic performance. This ensures that external noise sources provide the ultimate limitation to receiver sensitivity in terrestrial communications, whilst minimizing the effects of strong signals.

There are usually two reasons for the less than adequate sensitivity of modern transceivers. Firstly, the receiver designer must balance strong signal handling against sensitivity. With the devices currently available and at the prices the manufacturer is prepared to pay, the balance usually comes out around 4 - 6dB noise figure and a 50 - 70dB dynamic range. The second point is that a typical economy is to use diode switching instead of an electromechanical relay. These diode switches are also usually run at low currents to save battery power and this inevitably leads to a greater insertion loss, often up to 4 dB. Hence it is not unusual for the noise figure to exceed 8dB.

At 144 MHz sky noise limits the maximum useable sensitivity of a receiver used for terrestrial communications to about 2dB noise figure (This corresponds to about 0.05uV for 10dB s+n/n ratio in ssb bandwidths). Lower noise figures can be obtained but will not let you hear any more. However, there is an advantage to using a low noise preamplifier to improve the sensitivity of a transceiver - it reduces the gain required to achieve the desired effect and hence does not degrade the dynamic range as much.

Circuit Description

Fig.1 shows the block diagram of the RPCB217ub. A power relay, broadband matched for high performance at vhf replaces Icom's lossy diode antenna changeover circuitry. This is followed by a very low noise silicon mosfet amplifier and high performance bandpass image filter. The mixer is a properly terminated class-1 diode ring mixer, which is pumped by a high current low-noise jfet power buffer amplifier which not only ensures adequate drive for the mixer, but also sufficient output via a resistive pad to drive Icom's transmit mixer.

A simple diplexer terminates the if port of the ring mixer: with the large difference between the local oscillator and if frequencies this is entirely adequate. The diplexer also matches the input of a mosfet amplifier operated at high drain current, using a combination of 'noiseless' and dissipative feedback for excellent linearity, which then drives the crystal filter.

The if crystal filter is a six-pole monolithic unit with adequate bandwidth for fm, whilst not being too wide when acting as an ssb roofing filter. Following the filter a conventional mosfet if amplifier drives the output diode switch which steers the transmit and receive if signals.

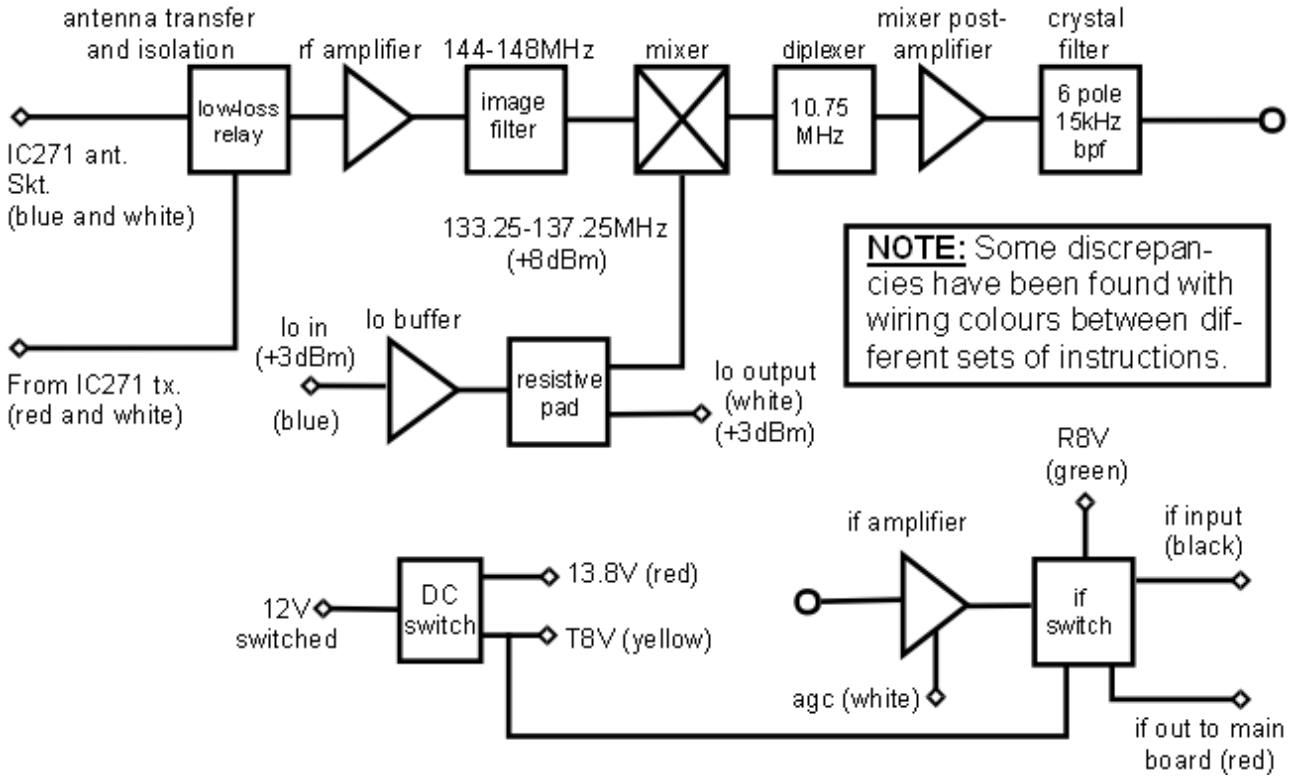


Figure 1: RPCB271ub Block Diagram

Installation Notes

The RPCB271ub is mounted in the space provided for Icom's optional preamplifier. Most connections to the transceiver are made using plugs and sockets forming part of the cable kit supplied.

Prior to attempting installation of the RPCB271ub it is very strongly recommended that you study very carefully the following instructions and familiarize yourself thoroughly with the relevant parts of the IC271 manual. If, after this, you are at all unsure of your abilities, we recommend that you employ the services of a competent technician to perform the installation; we cannot accept any responsibility for damage caused by incorrect or unskilled installation.

In the following installation instructions we refer to Icom's component designations thus: board/component designation e.g. RF YGR/D2. which refers to diode number D2 on board RF YGR. Coaxial cable marker colours in our cable kit are in parentheses thus (red/white) and dc supply and control line colours are in slashes thus /yellow/.

Have you read through all these instructions and the relevant parts in Icom's manual ?

BEWARE: there were wiring colour changes between early and later boards!!!!!!!

Detailed Installation

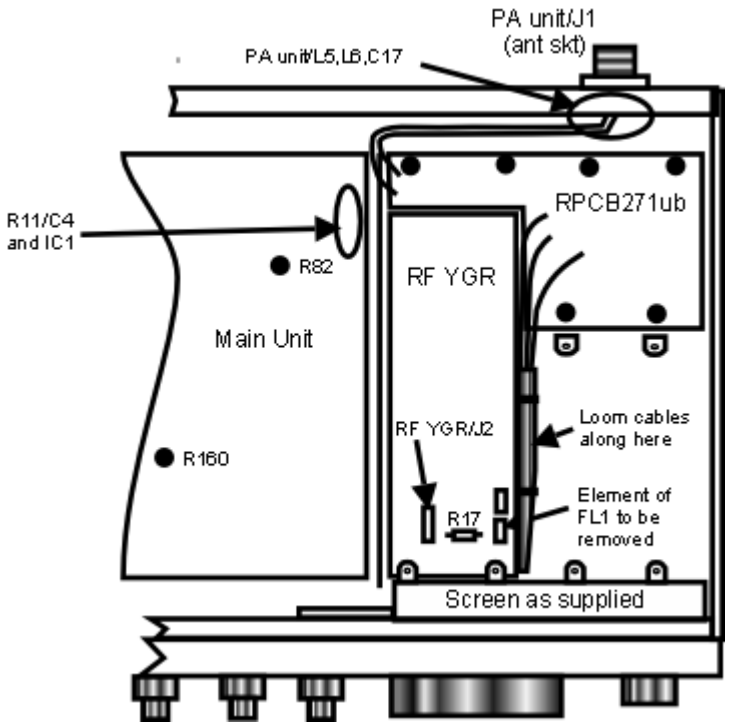


Fig.2: IC271 Layout

1) Disconnect the transceiver from external power sources, remove the antenna and any other external connections.
2) Remove the top cover of the IC271.
3) If fitted, carefully remove the plastic coated foil "screen" shielding from the display board.
4) Mount the aluminium screen supplied with the RPCB271ub over the display board. To do this it will be necessary to remove the M3 machine screws securing the RF YGR board and speech synthesiser (if fitted) and to slacken the countersunk machine screws holding the plastic front panel trim in position. The screen then slips between the trim and the pressed steel frame of the transceiver. Ensure that the screen is a tight fit against the pressed steel frame - if it is not a tight fit then distort the angle of the screen bend to make it so. The machine screws should then be replaced and tightened firmly, including those securing the RF YGR board. (Spare M3 machine screws are provided for transceivers not fitted with the optional speech synthesiser board).

Fig.3: FT271 PA unit, antenna connector J1

Showing components L5, L6 and C17 soldered together and about 3mm from centre pin of J1

5) See Fig.2 and Fig.3. Locate PA unit/J1, the antenna socket. Carefully remove the leads of PA Unit/L5, PA Unit/L6 and PA Unit/C17 from PA Unit/J1. Solder the free ends of these components together about 3mm away from the antenna socket centre pin.
6) Solder the cables supplied with the RPCB271ub to the solder pins on the RPCB271ub as shown on Fig.4.
7) Install carefully the RPCB271ub in the transceiver with the M3 machine screws and shake-proof washers provided. Ensure screws are firmly tightened down. **Take care not to break R19!**

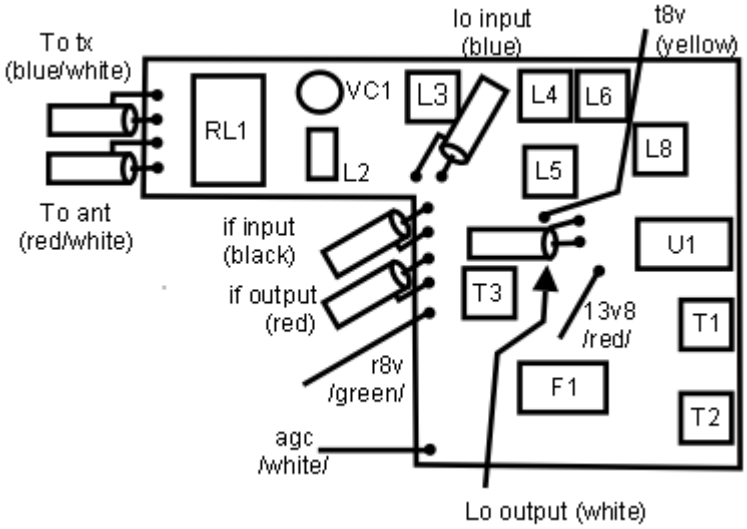
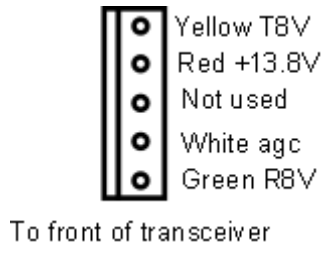


Fig.4: RPCB271ub Connections

NOTE: Some discrepancies have been found with wiring colours between different sets of instructions.

8) Solder the centre conductor of the (red/white) coaxial cable to the centre pin of PA Unit/J1 (the antenna socket). Solder the braid of this cable to the adjacent solder tag.
9) Solder the centre conductor of the (blue/white) coaxial cable to the junction of the three components described in step 5 - see also Fig.3. Solder the braid to the same tag as described in step 8.
10) Remove the free socket from RF YGR/J3 and connect it to the fixed plug on the small adapter board terminating the (blue) coaxial able.
11) Mate the free socket terminating the (white) coaxial cable with RF YGR/J3.
12) Remove the free socket from Main Unit/J10 and connect it to the other fixed plug on the small adapter board terminating the (black) coaxial cable.
13) Mate the free socket terminating the (red) coaxial cable with Main Unit/J10.
14) Mate the free socket terminating the /white/ and /green/ leads with the two pins of RF YGR/J2 nearest the front panel of the transceiver.
15) Mate the free socket terminating the /red/ and /yellow/ leads with the two pins of RF YGR/J2 furthest from the front panel of the transceiver. NOTE: the centre pin is NOT used.



16) Carefully remove RF YGR/D2 (the diode near RF YGR/J2). This may be done by simply cutting free with a small pair of cutters.
17) Check your wiring carefully, and then check it again!
18) With the cable ties supplied, neatly 'loom' the wires and cable you have just installed alongside board RF YGR - see Fig.2.
19) Connect a power source and an antenna (or preferably a dummy load) to the transceiver.
20) With the USB mode selected and mic gain and rf power controls set to minimum (fully anticlockwise), put the transceiver into the transmit mode. Observe the action of the antenna changeover relay on the RPCB271ub. In the transmit mode the relay should be in its non-energised state. If nothing happens check your wiring.
21) Connect your antenna and tune around the band. Signals should be heard (providing there is activity!). If all seems well then replace the top cover of the transceiver ensuring that the machine screws securing it are well tightened. Due to the amount of rf radiated from the transceiver display (particularly in earlier models), adequate tightening of the screws is necessary to ensure that the sensitivity of the transceiver is not degraded by this interference.

NOTE: No further details have been found for the circuit diagram and component listings of any later pcbs covered by this manual. It maybe that the components are the same but **BEWARE**.

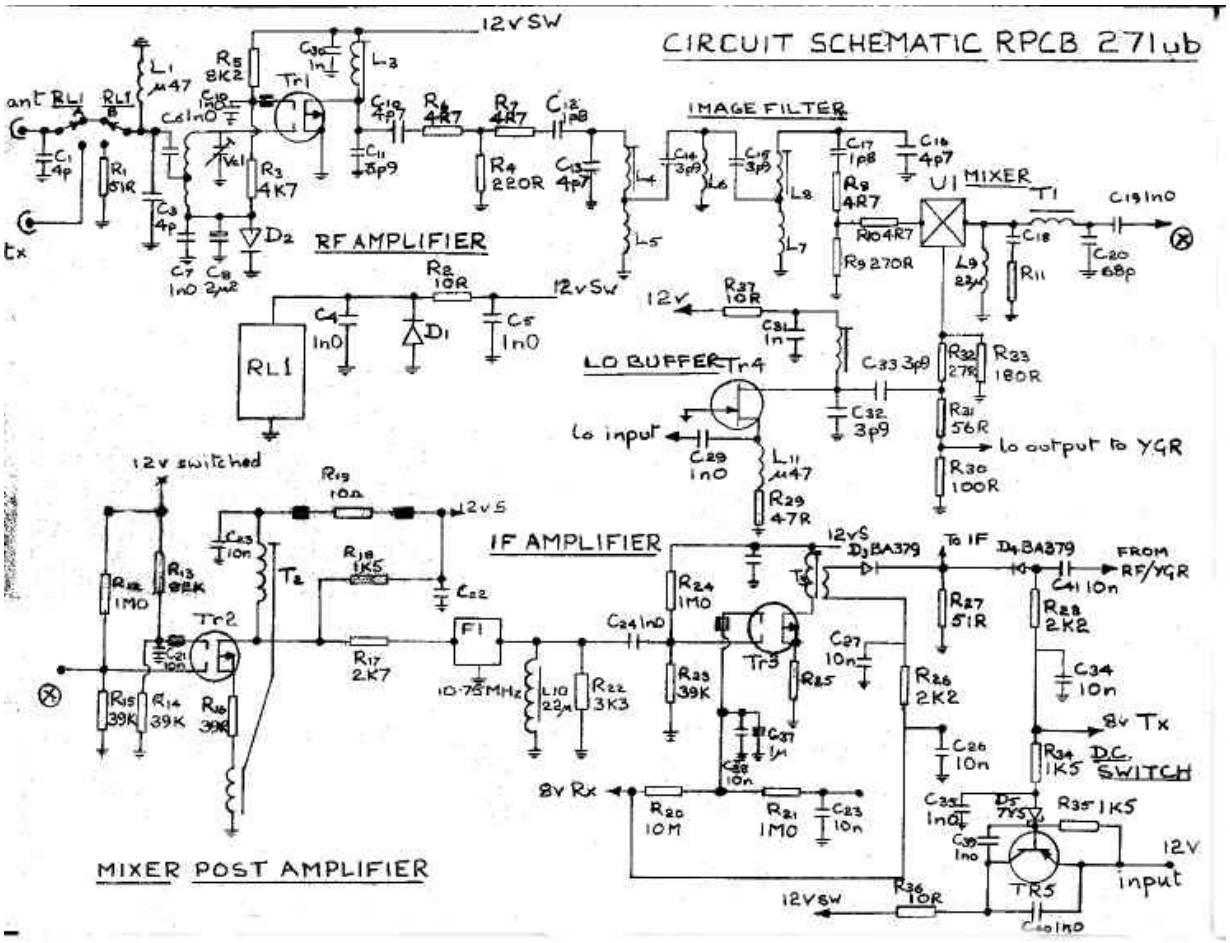


Fig. 5: Circuit Diagram