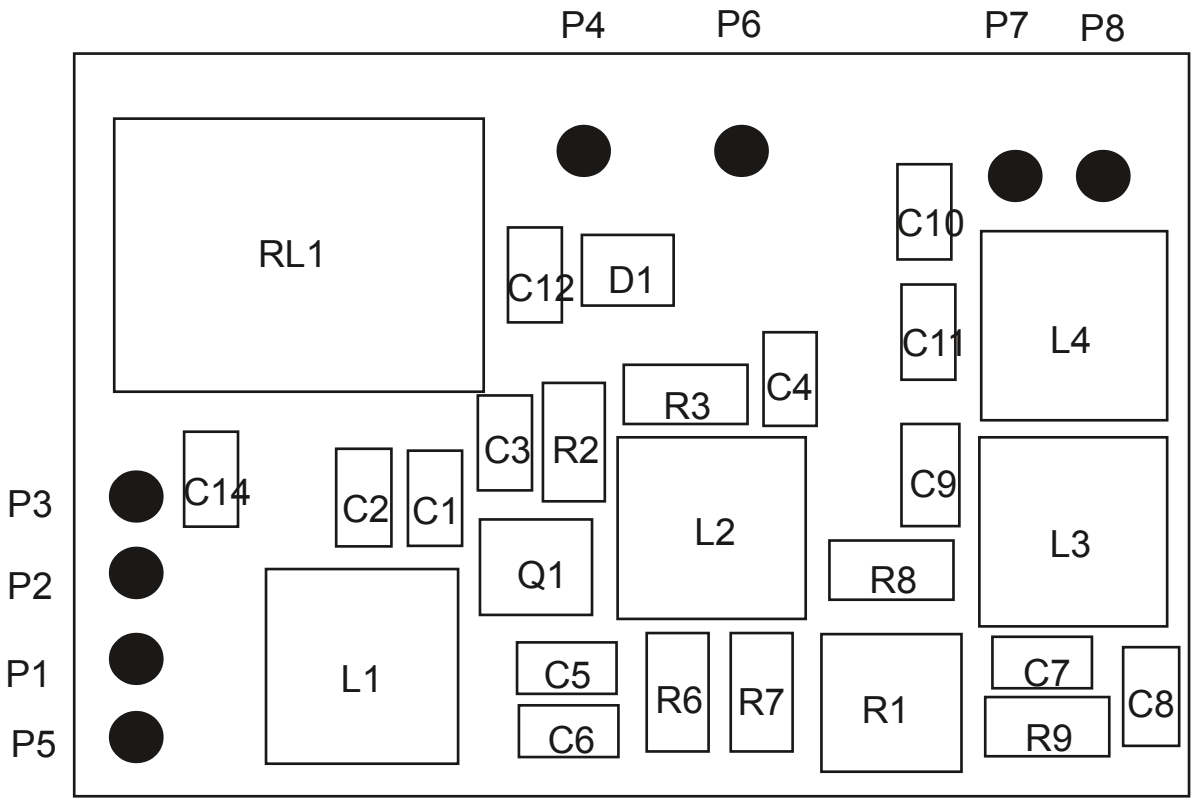
Replacement Front End for FT290 Mk2
SLNA290s2

a product produced by Mutek (circa 1995)



(no photograph available)

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 SLNA290s2, is for the FT290 Mk 2 radio. This appears to be the end of the line for the FT 290 preamplifiers. History of PCBs below.

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 (as they become available) where there are also details of how to contact me. I have no association with the firm Mutek and this manual has been produced at my own expense and without any payment.

Clive Smith, GM4FZH, Summer 2020

The filename of this document is ***preamp slna290s2.pdf***.

Note

The SLNA290s board is for primarily fitting to the Yaesu FT290. It comes in two forms:-

1) The SLNA290s1 comes with the fitting kit for the FT290Mk 1 and has a 6V relay fitted.

2) The SLNA290s2 comes with the fitting kit for the FT290 Mk 2 and has a 12V relay fitted. See separate manual.

If fitting to other transceivers it is suggested that the SLNA290s2 is used because of the more normal 12V relay.

Specification

Noise Figure	1 dB typical
Transducer Gain	0 - 14 dB
Ip3 input	-3 dBm
-3dB bandwidth	6 MHz
Relay Handling Power	30W
Relay voltage	12 V dc
Preamp voltage	12 V dc

Kit List

Your kit should contain the following items:-

SLNA290s2 board	1 off (includes mounting plate)
double sided sticky pad	1 off
cable ties	2 off
red coax	1 x 100mm
blue coax	1 x 100mm
white coax	1 x 180mm
red wire	1 x 150mm
orange wire	1 x 150mm

If any of the parts are not present please contact your dealer/ distributor or ourselves directly.

History of the PCB

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

PCB Type	**Notes**	**Approx. date of issue**
*144MHz preamplifier	Very early pcbs. Standard components, hand layout.	1979-1983
*SLNA145sb *PA00065	Through hole components. Produced as a preamplifier for the FT290 Mk1.	Circa 1983 onwards
*SLNA145ub	Through hole components. Produced as a build yourself kit - no changeover relay included.	1991
*SLNA145s	Stand-alone preamplifier but part could be cut to form a pcb similar to SLNA290s1. Uses SMD	1995
*SLNA290s1	Uses SMD and produced as a preamplifier for the FT290 Mk1.	1995
SLNA290s2	**Uses SMD. Produced as a 1995 preamplifier for the FT290 Mk2**	**1995**

* Denotes not covered by this manual.

Introduction

Thank you for buying Mutek's SLNA290s2 transceiver optimised preamplifier for your FT290R Mk2. The SLNA290s2 has developed from the SLNA145sb, this latter unit used standard leaded components and a BF981 or BF988. Although it has been designed specifically for this transceiver, it may also find applications in other transceivers for which a complete front end modification is not available. The installation notes below refer to the FT290s2; we regret that we cannot provide information for installing the unit in other transceivers.

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.

Overall system noise figure depends not only on the noise figure of the preamplifier but also on its gain and the second stage noise figure. By adjusting the gain of the preamplifier, it is possible to set the system noise figure to any value greater than the intrinsic noise figure of the preamplifier-transceiver system. Why adjust the gain? It is an unfortunate fact that the more gain ahead of the receiver, the more susceptible it becomes to overload by strong signals. By putting the minimum amount of low noise gain ahead of the receiver so as to set the sensitivity to a level where external noise is the limiting factor, an optimum (for the system) level is reached. A very low noise amplifier such as the SLNA290s1 will minimise the amount of gain required and hence minimise the degradation of the dynamics.

Circuit Description

A low loss Relay provides the antenna changeover function. This is followed by a BF998 in a noise matched amplifier configuration. This provides the lowest noise figure with the optimum dynamic range. Following the output matching, a variable attenuator provides the gain control facility, without compromising the dynamic performance or the noise figure of the amplifier, as would be the case if the usual practice of varying the gate 2 bias was adopted. Following the attenuator, a bandpass filter provides substantial rejection of out of band signals, preventing these from reaching the original receiver and causing intermodulation. The amplifier has been designed, constructed and tested to very high standards. A plated through hole fibreglass-epoxy pcb is used, and bushed mountings are provided for attachment.

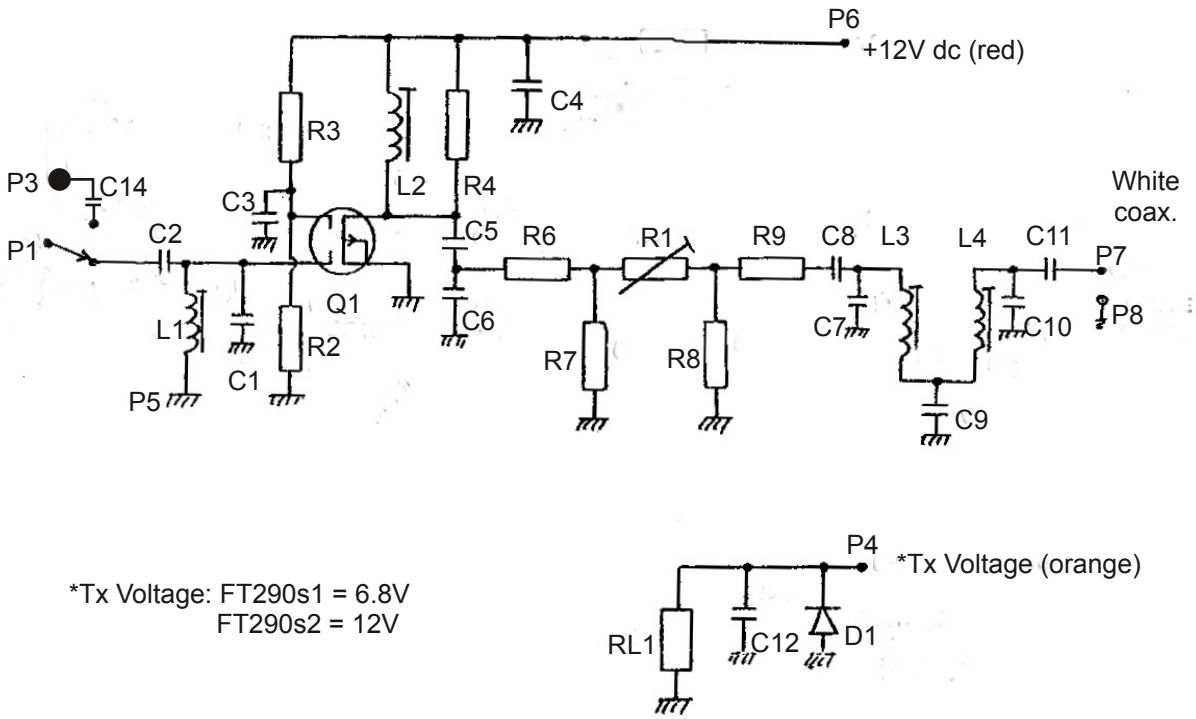

Figure 1: Circuit Diagram

Ref	Value	Ref	Value	Ref	Value
R1	470R pot	C2	4p7	C13	Not used
R2	39k	C3	1n0	C14	1n
R3	82k	C4	1n0		
R4	Not used	C5	6p8	L1	Type 1054
R5	Not used	C6	22p	L2	Type 1054
R6	15R	C7	1p8	L3	Type 1056
R7	68R	C8	1p8	L4	Type 1056
R8	68R	C9	120p		
R9	15R	C10	1p8	RL1	12 V relay
		C11	1p8	D1	BAS16/1N4148
C1	1p8	C12	10n	TR1	BF998

Table 1: Component Listing

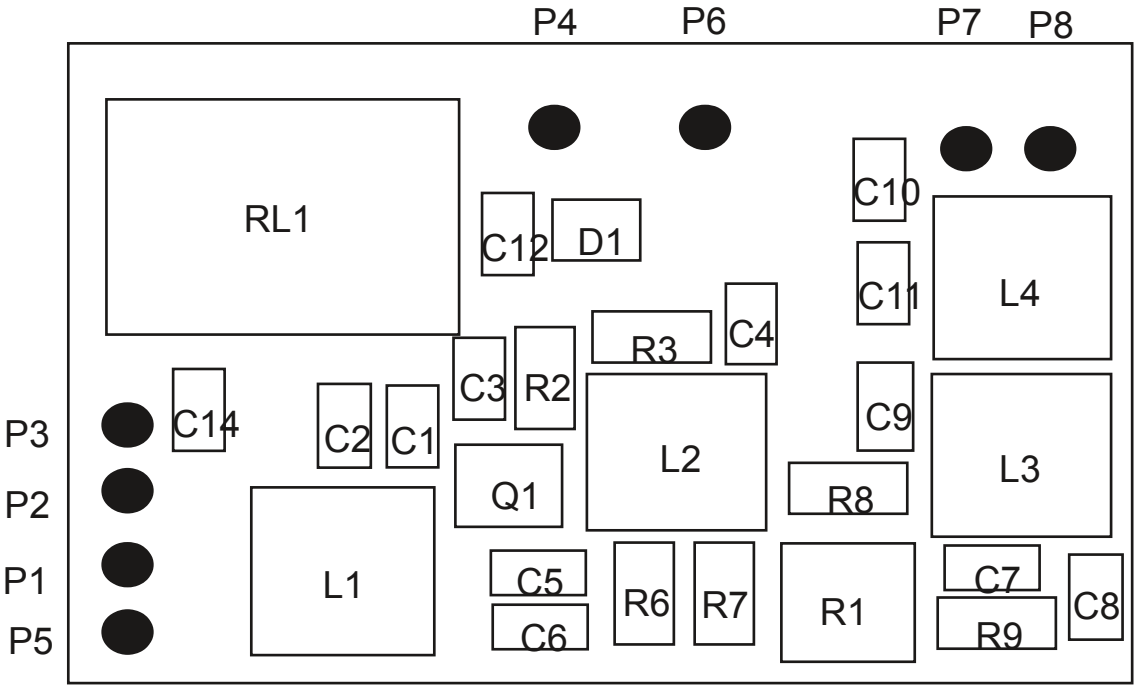

Figure 2: Component Layout

Installation Notes

Before attempting installation of the SLNA290s2 it is very strongly recommended that the FT290 manual and circuit diagrams are studied thoroughly. If you are at all uncertain of your abilities we recommend that you find a competent technician to perform the installation; we cannot accept responsibility for any damage however caused. If any difficulties are encountered then please get in touch with us - we want to ensure that you are happy.

The preamplifier mounts on the underside of the top lid of the transceiver, using the mounting pad provided.

Detailed Installation

1. Remove the battery pack (FBA-8) or linear amplifier (FL2025) from the rear of the transceiver.

2. Remove the top and Bottom covers, disconnecting the speaker plug from J05. Remove the side trim from each side of the transceiver.

3. Remove the tone squelch unit (if fitted), including the sticky mounting pad.

4. See Fig. 3. Remove the coaxial connectors PJ02 (Antenna) and PJ01 (l.o.) from the top unit and the coaxial connectors PJ03 (Tx drive) and PJ01 (Tx output) from the bottom unit.

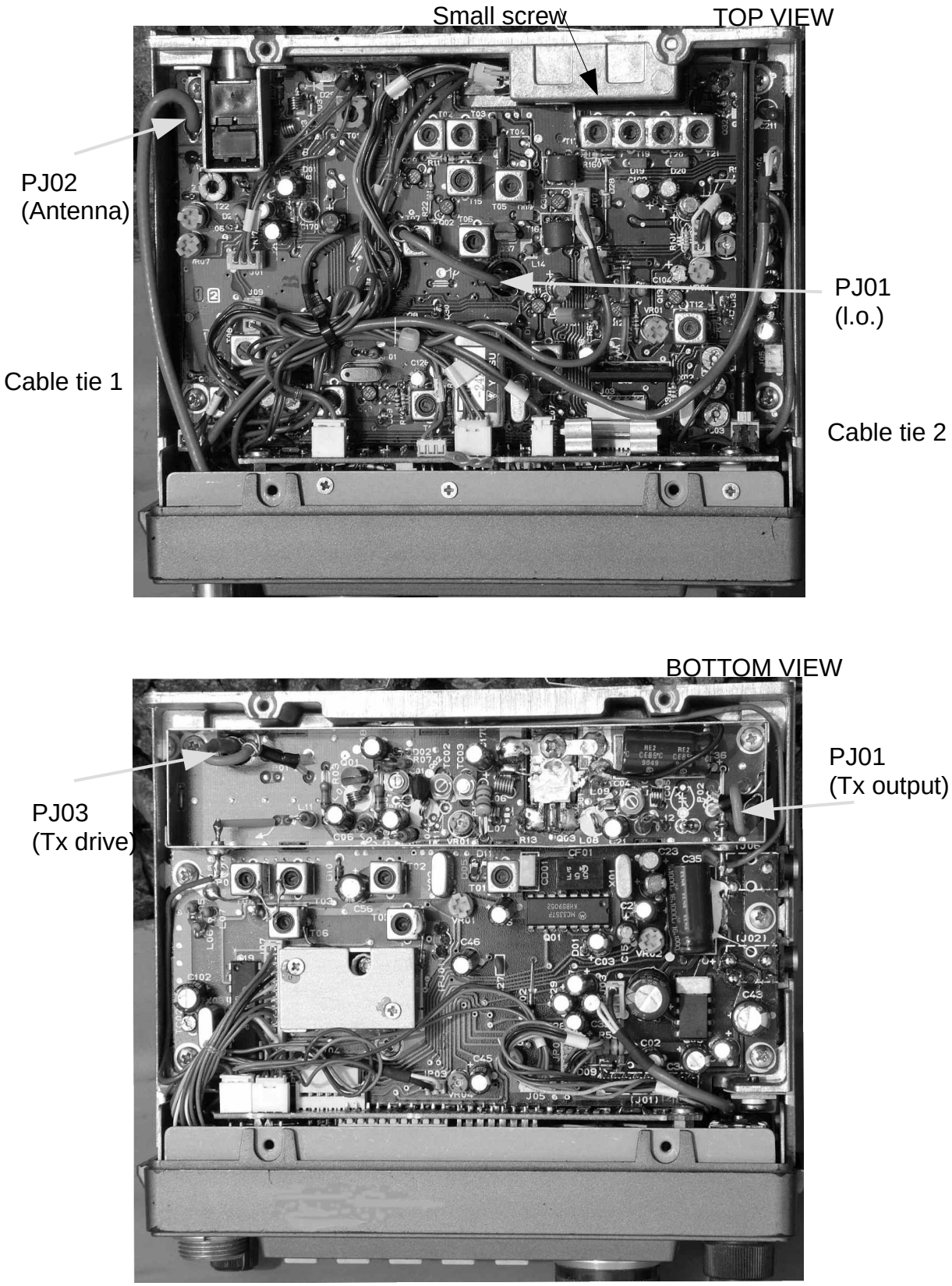

Figure 3: Inside of FT290 Mk 2

5. Cut the two cable ties as shown in Fig. 3, take care not to damage the cables.

6. Ease the front panel and control unit away from the main chassis. Take care during this operation. Carefully remove the operating rod from the font panel lamp switch.

7. Remove plugs from connectors J01, J04, J06 and J09 on the main unit board. Remove the four fixing screws from the corners of the board AND the small screw located in the back of the tone squelch position. Remove the two screws from the rear antenna jack screen and remove the screen. Carefully remove the main unit pcb, remember to disengage the connector J08 at its front edge.

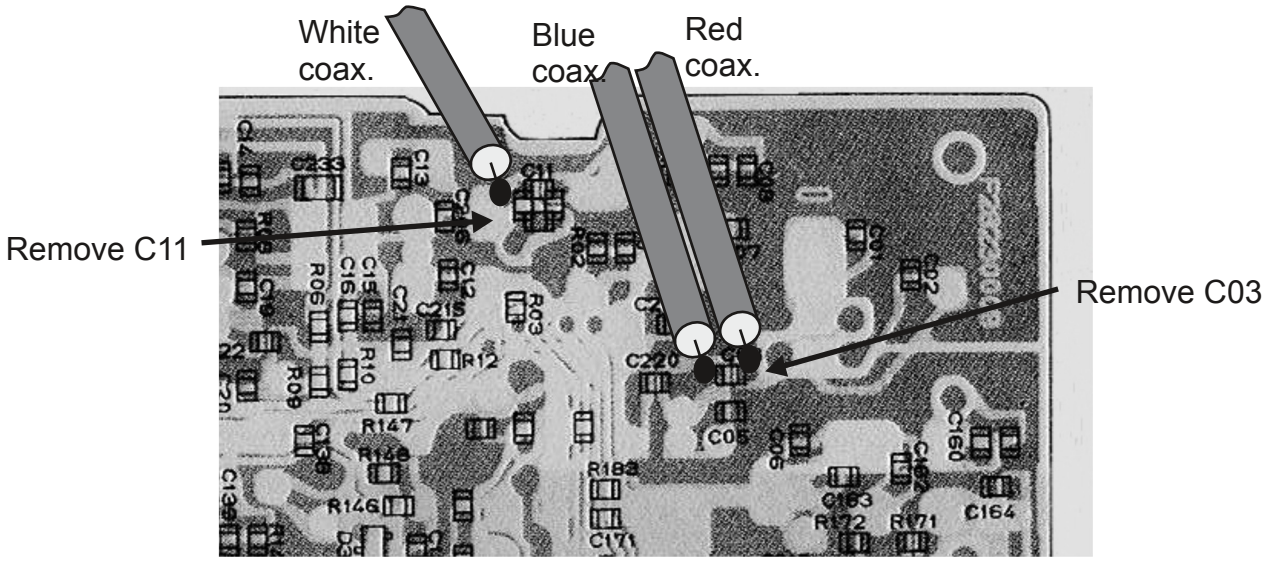

Figure 4: Component Removal and coax connections

8. Remove the surface mount capacitors C03 and C11 from the under side of the PCB. Solder the coaxial cables from the kit as shown in Fig. 4. Keep the ends of the cables as short as possible and lead the cables towards the small cut out at the rear of the main board. NOTE: ensure that whiskers of braid do not cause short circuits. Solder the braid to any convenient location on the ground plane. The white cable connects to T01 end of C11 location: the blue cable to L01 end of C03 location and the red cable to J02 end of C03 location.

9. Replace the main unit board in the chassis, locating J08 in its mating half and taking care not to trap any lose cables beneath the board. Locate the three coax cables in the small cut-out as shown. Replace the five screws in the main board and the screen on the rear antenna connector.

10. Reconnect all of the connectors removed in step 7. Carefully align and replace the front panel / control unit. Check the alignment of the inter board connectors on both sides before pushing the unit home. Remember to replace the lamp operating rod.

11. Replace the two cable ties (step 5) with the new ones provided.

12. Solder the red wire to the top of the DC protection diode. This is located adjacent to the main fuse on the control PCBs.

13. Solder the orange wire to the RLY TXB pad on the 'terminal unit A' mounted on the rear of the chassis, adjacent to the rear antenna connector.

14. Replace the tone squelch unit (if required) and the lid of the compartment.

15. Solder the wires and coax cables to the SLNA290s2 as shown in Fig.5.

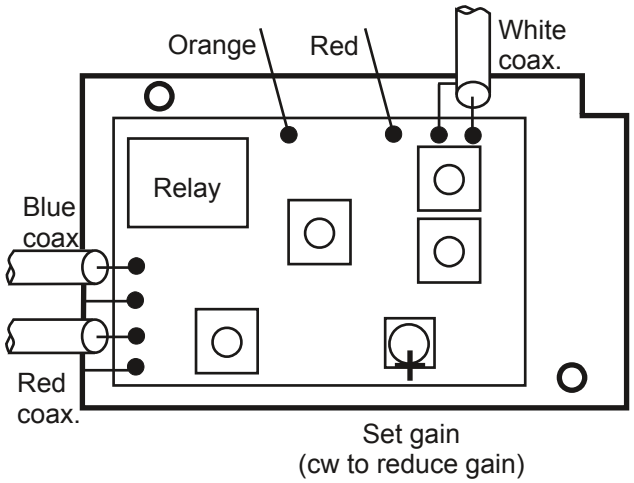

Figure 5: Connections to FT290s2 pcb

16. Replace the side trim on the transceiver. Connect a power supply and external speaker - or reconnect the internal speaker. Connect an antenna to the transceiver. Turn on and find a weak signal using FM mode. Now adjust the attenuator on the preamplifier board clockwise until the slightest degradation in signal to noise ratio is noticed, then rotate the adjuster counter clockwise slightly to obtain the correct operating point. This procedure will ensure the maximum dynamic range for the system is achieved. Disconnect the antenna and power supply.

17. Replace top and bottom covers. The preamplifier should be mounted on the inside of the top cover using the adhesive pad supplied.

18. Replace any rear accessory removed in step 1. Installation is now complete.

Tools Required

Soldering Iron (small)	Solder (thin multicore)	Solder sucker (might be useful)
Side cutters	Small pair of pliers (long nose)	