SERVICE MANUAL
for
PRC 420 HF TRANSCEIVER

Volume 1

1st and 2nd Line Servicing

Publication No. 630/HA/38180

THE PLESSEY COMPANY plc

PLESSEY MILITARY COMMUNICATIONS

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THE PLESSEY COMPANY plc
PLESSEY MILITARY COMMUNICATIONS
Ilford, Essex IG1 4AQ, England.
Telephone: 01-478 3040 Telex: 897971

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AMENDMENT RECORD SHEET

To record the incorporation of an amendment list in this publication, sign against the appropriate A.L. No. and insert the date of incorporation.

A.L. No.	AMENDED BY	DATE	A.L. No.	AMENDED BY	DATE

WARNING

THIS EQUIPMENT CONTAINS, IN CERTAIN PARTS, BERYLLIA (BERYLLIUM OXIDE) MATERIAL WHICH, UNDER CETAIN CIRCUMSTANCES AND IF NOT PROPERLY HANDLED, CAN BE A SERIOUS HEALTH HAZARD.

IN THE FORM IN WHICH IT IS USED IN THIS EQUIPMENT, THE MATERIAL IS VERY HARD, INERT AND PHYSIOLOGICALLY HARMLESS. HOWEVER, IF IT IS CHIPPED OR CRACKED, OR THE SURFACE DAMAGED IN ANY WAY, PARTICLES OF BERYLLIA MAY BECOME FREE AND THIS IS A POTENTIAL SOURCE OF DANGER EVEN IN MICROGRAM QUANTITIES. BERYLLIA DUST IS TOXIC IF INHALED OR ABSORBED VIA THE MOUTH OR AN OPEN WOUND. IF BERYLLIA MATERIAL IN ANY FORM IS INVOLVED IN A FIRE, THERE IS AN IMMEDIATE AND ACUTE HAZARD, AS TOXIC FUMES MAY BE RELEASED.

ABSORPTION OF BERYLLIA MATERIAL THROUGH THE SKIN, PARTICULARLY THROUGH CUTS AND ABRASIONS, CAN CUASE ULCERATION AND DERMATITIS AND INHALATION OF BERYLLIA DUST OR FUMES CAN CAUSE ACUTE AND CHRONIC RESPIRATORY DISEASES.

Most countries issue national regulations concerning the handling of beryllia components and the disposal of waste beryllia material. These should be studied and adhered to. The following notes concerning handling are provided as a guide.

Handling is safe provided that components are undamaged and carry no surface powder. Handling rules are:

1. Cover all cuts, grazes or skin abrasions, however small, with sticking plaster or similar covering.

2. Use non-porous rubber or plastic gloves.

3. Never machine or work by hand.

4. Never handle whilst smoking, eating or drinking.

5. Wipe contaminated areas clean with a damp cloth. Do not brush or dry dust. Dispose of the cloth as beryllia waste, according to National or local instructions.

Note: Use of a mechanical filter respirator is recommended

A seperate warning relative to the above is given at the appropriate place in this handbook.

SERVICE MANUAL

FOR

PRC420 HF TRANSCEIVER

HEALTH HAZARD

AVOID TOUCHING THE WHIP ANTENNA SOCKET WHEN OPERATING THE RADIO. RF VOLTAGES UP TO 2kV MAY BE PRESENT ON THE HIGH VOLTAGE TERMINAL.

SERVICE MANUAL

FOR

PRC420 HF TRANSCEIVER

PREFACE

1. The lines of servicing to which this manual refers are assumed to provide facilities for repair as follows:

   First line — Generally complete replacement of a faulty equipment. Replacement of minor items such as batteries, fuses, etc.

   Second line — Reinstatement of a faulty equipment by replacement of a faulty module with a serviceable spare. Limited replacement of piece parts.

   Third line — Repair of equipment or modules returned from second line by replacement of sub-modules or piece parts.

2. Part 1 of the manual can be used independently of the other parts and meets the requirements of a technician at first line.

3. Part 2 of the manual provides additional information such that with Part 1, the requirements of a technician at second line are met.

4. Part 3 of the manual provides information such that together with Parts 1 and 2 the requirements of a technician at third line are met.

SERVICE MANUAL

FOR

PRC420 HF TRANSCEIVER

CONTENTS

NOTE: Parts 1 and 2 of this manual are located in Volume 1, Part 3 in Volume 2 and Part 4 in Volume 3.

SERVICE MANUAL

FOR

PRC420 HF TRANSCEIVER

VOLUME 1

CONTENTS

TECHNICAL SUMMARY

GENERAL

Frequency Range	1.5 MHz to 29.9999 MHz.
Frequency Control	From built-in frequency synthesiser and reference oscillator.
Frequency Indication	The frequency indicated on the LED display is: The suppressed carrier frequency on SSB and CW. Carrier frequency AM. 1 kHz below radiated frequency on CW.
Operating Frequency	By switch or hand held channel selector from any one of 9 channel frequencies (8 preset) held in a memory unaffected by removal of power supply.
Frequency Setting	Any frequency setting held in memory is changed in increments of 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz or 10 MHz by push button with LED read out.
Frequency Stability	+ 1 ppm -25°C to +45°C. ∓ 1.5 ppm -40°C to -25°C and +45°C to +55°C.
Operating Modes	USB voice. LSB voice. AM voice. CW. FSK (with adaptor).
Power Supplies	24V rechargeable battery pack or 24V nominal supply.
Battery Life	Using SSB speech on a 1:9 Tx/Rx ratio: 2 Ah battery up to 7.3 hours. 4 Ah battery up to 14.6 hours.
Auto ATU Tuning Time	1 second (maximum).
Remote Voice/Pressel	Available from two terminals on PRC420, with call facility and intercomm.
Built-in Test Facilities	Audio indication of: Low battery volts. Poor antenna match (high VSWR). Phase lock fault. ATU tuning.

Dimensions (PRC420 without battery)	Height: 84 mm. Width : 275 mm. Depth : 250 mm.
Weight (PRC420 without battery)	5.6 kg approx.
Operational Temperature	-40°C to +55°C.
Environmental Characteristics	Meets the specified requirements of DEF STAN 07-55.

TRANSMITTER

Output Power SSB & CW	High power: 20W nominal pep. Low power : 5W nominal pep.
AM (Unmodulated)	High power: 5W minimum.
Modulation Sensitivity	0.2 mV - 20 mV for specified pep on SSB. 0.8 mV - 20 mV for more than 70% Modulation on AM.
Spurious Emissions	Harmonics : -40 dB max. Non-harmonic : -40 dB max.

RECEIVER

Sensitivity	1 uV (SSB & CW) or 7 uV (AM 30% mod.) for better than 12 dB (S+N) : N ratio.
Audio Output	At least 10 mW into 75 ohm with volume control at maximum.
Audio Bandwidth	6 dB bandwidth typically 300 Hz to 2700 Hz.
1st IF	38 MHz.
Blocking	Less than 3 dB desensitisation for an unwanted signal input of 90 dB above 1 uV at a frequency of 5% removed from the wanted signal.
Adjacent Channel	+60 dB.

PART 1

FIRST LINE SERVICING

OF

PRC420 HF TRANSCEIVER

CONTENTS

ILLUSTRATIONS

INTRODUCTION

General

1. The HF Radio Type PRC420 comprises a lightweight transmitter/receiver operating in the 1.5 to 30 MHz range, providing 285,000 channels spaced at 100 Hz intervals. The PRC420 provides AM, USB, LSB voice and CW modes of operation and can be used in the manpack, ground station or vehicle roles.

2. Items of ancillary equipment may be used in various combinations, with the Transceiver PRC420 (abb: radio). A brief description of some of the items available is given in the following paragraphs. These items are considered directly relevant to the operation of the radio and although many more items of ancillary equipment are available, they are described only in their respective Plessey manuals.

Power supplies

3. The radio operates from either a 2 Ah or 4 Ah, 24V Nickel Cadmium secondary battery affixed to the side of the radio in the manpack role, or from a 28V negative earth vehicle supply in the vehicle role. In addition the radio can be operated from the 3.3 Ah or 1 Ah 24V Clansman batteries which clip-on to the radio when used with an adaptor plate. The Clansman Hand Operated Generator can also be supplied which provides the following facilities:

(1) Clip-on to the 1 Ah battery and float charge it whilst the battery is supplying the radio.

(2) Battery charging.

4. The 2 Ah radio battery (PV1302) or 4 Ah battery (PV1304) can be charged by either a PV2329 d.c. charging unit or a PV2328B a.c. charging unit. The d.c. charging unit can charge a 4 Ah, 3.3 Ah, 2 Ah or 1 Ah battery in 2.5 hours, 2.5 hours, 1.25 hours and 0.75 hours respectively. The a.c. charging unit can charge up to six of each of two types of batteries or twelve batteries of a common type from fully discharged to fully charged in 12 to 15 hours.

Antennas

5. The following antenna configurations can be provided:

(1) Whip Antenna, for manpack configuration. A 2.4m antenna element comprising seven sections fitted with an angle adaptor push fits directly into the antenna socket of the radio. The assembly will give ground wave SSB communications for distances up to 35 km over undulating terrain, in the frequency range 2.0 to 30 MHz only.

(2) Centre-fed dipole for ground station. Two wire antenna elements, when unwound from their carrying reels, connect to terminals on a junction block. The whole assembly forms a centre-fed dipole which is connected to the radio by a 20m coaxial cable provided. The assembly will give sky wave SSB or CW communications up to 800 km.

(3) End-fed long-wire for ground station. One of the two wire antenna elements provides an end-fed long-wire which is directly connected to the radio.

Audio equipment

6. The following audio equipment can be provided:

(1) A headset assembly which connects to the radio, by a cable incorporating a pressel switch, either directly or via a Control Radio System, Remote Combining Unit, used in the remote configuration.

(2) A handset assembly which connects to the radio by a cable incorporating a pressel switch.

(3) A morse key assembly which connects either directly to the radio or via a Control, Radio Set Combining Unit.

(4) A remote control handset which is connected by a two-wire field cable directly to the radio.

Other items

7 Other items which can be supplied with the radio are:

(1) Carrying frame. This is used to mount the radio. Straps attached to the frame enable the radio to be carried on a man's back.

(2) Rack, electrical equipment. This rack enables the manpack to be mounted in a vehicle.

(3) Carrying satchel. This provides space for the radio with its battery plus a spare battery, the antenna and audio equipment.

(4) Handheld channel selector PV2319.

FUNCTIONAL DESCRIPTION

RADIO

Front panel controls and transceiver connectors (see Fig.1)

8. The following switches and controls are provided on the front panel of the radio.

(1) Mode switch. Four settings thus:

LSB	- for single sideband (lower) voice operation.
USB	- for single sideband (upper) voice operation.
AM	- for voice amplitude modulated carrier wave.
CW	- for wideband (USB) 'keyed' carrier wave.

(2) Power switch. Three settings thus:

OFF	- radio power is switched off.
LP	- selects low power RF output (5W).
HP	- selects high power RF output (20W).

(3) Channel select switch:

Position 1	'Synth' - enables selection of frequency using 'UP' and 'DOWN' count buttons.
Position 2-9	Preset channels 1-8. 'UP' and 'DOWN' count buttons inoperative. To reset preset channels 'Program Key' must be inserted into the front panel audio socket SKB.
Position 10	'Ext' - enables selection of channels by Remote Channel Selector PV2319.

(4) Digit select switch:

Position 1 - 'Normal Display' - illuminates display and enables 'UP' and 'DOWN' count buttons.

Position 2-7 100 Hz to 10 MHz digit select. The final window in the display shows the mode selected by the mode switch or pre-programmed channel i.e. L = LSB
U = USB
A = AM
C = CW

Position 8 - 'Dim Display' illuminates display at a reduced intensity for low light use.

(5) Antenna switch:

Selects the whip antenna socket on the side of the radio or the 50 ohm socket on the front panel of the radio.

(6) Remote switch. Four settings thus:

LOCAL - Normal operation of radio.

REMOTE This position allows operation of the radio using remote facilities up to 3 km from, and in addition to, the local operator.

I/C Allows local and remote operators to intercommunicate, transmitter is inhibited in this position.

CALL - Alerts remote operator with a 1 kHz tone.

(7) Volume control:

Controls audio output level.

(8) 'UP' and 'DOWN' frequency count buttons:

Allows the change of selected digits automatically when depressed, providing the Channel Select Switch is set to 'Synth' or the Program Key is fitted. Display extinguishes 8 seconds after the frequency is set and frequency change becomes inoperative. Channel Select Switch must be set to 'Normal Display' or 'Dim Display' to reactivate buttons. When the Program Key is fitted the display extinguishes 20 seconds after a frequency change.

NOTE: Circuits within the radio prevent the selection of frequencies below 1.5 MHz and above 29.9999 MHz.

(9) 50 ohm socket:

Used for the connection of a dipole antenna, external ATU or 100W amplifier. If selected, internal ATU inhibited.

(10) AUDIO and SECURE sockets:

Used for the connection of headsets and handsets. The AUDIO socket is also used to connect the Program Key. The pin connections are as follows:

Pin	Secure	Audio
A	MIC.A	MIC.A
B	MIC.B	MIC.B
C	+24V output	WRITE I/P
D	HEADPHONE	HEADPHONE
E	EARTH	EARTH
F	PRESSEL	PRESSEL
G	HEADPHONE	HEADPHONE

(11) ATU, ANCILLARIES and POWER sockets (Rear panel):

The ATU socket can be used to connect an external Antenna Tuning Unit or a 100W Power Amplifier. The pin connections are as follows:

Pin	A	READY
	B	FAULT
	C	24V UNREG OUT
	D	ATU present I/P
	E	EARTH
	F	Tx/Rx IND. O/P
	G	RESET O/P

The ANCILLARIES socket can be used for connection to a vehicle harness system or to a hand held channel selector. The pin connections are as follows:

Pin	A	MIC.A
	B	MIC.B
	C	+24V
	D	AF O/P
	E	EARTH
	F	PRESSEL
	G	BCD CH MSB
	H	BCD CH
	J	BCD CH
	K	BCD CH LSB

The POWER socket is used when connecting a vehicle or external power supply. The pin connections are as follows:

Pin	A	SYSTEM ON/OFF
	B	RELAY DRIVE O/P
	C	VEHICLE SUPPLY I/P
	D	PA PRESENT
	E	EARTH
	F	EARTH
	G	VEHICLE SUPPLY I/P

Reception (see Fig.2)

9. In the receive mode of operation the incoming signal from the antenna is fed to the ATU (Module 12). This module matches the antenna to the 50 ohm input to the band pass filters (Module 10) at the operating frequency.

10. The signal is then fed into one of the 8 pre-selected band pass filters in Module 10 and from there to the 1st Rx mixer.

11. The first local oscillator frequency, which is the selected frequency (fi) added to 38 MHz (fi + 38 MHz) from the synthesiser (Module 9) is mixed in the 1st Rx mixer with the received signal output from the band pass filter. The resultant frequency is a single sideband signal at 38 MHz which is fed to the 38 MHz filter.

12. The 38 MHz output from this filter is fed via an amplifier to the 2nd Rx mixer which produces 1.4 MHz USB frequency. This is achieved by mixing the 39.4 MHz from the synthesiser with the 38 MHz input from the filter to produce 1.4 MHz USB. In the case of LSB the 38 MHz is mixed with 36.6 MHz from the synthesiser, thus producing 1.4 MHz USB. In each case 1.4 MHz becomes the 2nd IF.

13. The 1.4 MHz 2nd IF output from the 2nd Rx mixer is fed via the USB filter to an IF amplifier. The amplified output is then fed to a demodulator where the audio component of the signal is extracted and routed to the headphones via an AF power amplifier. Automatic gain control (AGC) is provided by the AGC generators for the IF amplifiers in Module 7.

Transmission (see Fig.2)

14. In the transmit mode either 36.6 MHz or 39.4 MHz, depending on whether LSB or USB is selected, is fed from the synthesiser to the 1st Tx mixer. Also taken from the synthesiser is 1.4 MHz and the quadrature phase of this frequency. These are fed to the SSB/AM generator in Module 3, together with the AF output and its quadrature phase.

15. The 1.4 MHz output from this generator is fed to the RF clipper and then to the 1.4 MHz SSB filter in Module 7. The filter output of 1.4 MHz is then fed to the 1st Tx mixer where it is mixed with either the 36.6 MHz or the 39.4 MHz from the synthesiser. The resulting output of 38 MHz is fed to the 2nd Tx mixer where it is mixed with fi + 38 MHz from the synthesiser. The resulting output of between 1.5 MHz and 29.9999 MHz is fed via a low pass filter and amplifiers in Module 11 to the pre-selected band pass filter in Module 10. The resulting output is fed via the ATU to the antenna. In the case of AM, the clipper and SSB filter are bypassed, the signal routeing otherwise being the same.

Control (see Fig.2)

16. Control of internal circuitry of the radio is provided by the synthesiser module (Module 9) in conjunction with the microprocessor (Module 5).

17. Signals from the front panel controls of the radio are fed into the microprocessor. The memory within the microprocessor provides storage of synthesiser frequency in 8 preset channels.

18. In the Synth mode, when the display position is selected, the display indicates the frequency and the modulation mode selected. In the preset channel mode both stored frequency and modulation mode are displayed.

19. After a change of frequency of 10 kHz or more, when the pressel is next depressed, the ATU is commanded by the microprocessor to retune antenna matching at the new frequency.

20. The microprocessor also produces a signal which provides selection of one of the 8 preset band pass filters.

21. The selected frequency, set by the front panel controls, is also fed to the synthesiser to ensure the correct synthesiser output for that particular frequency.

22. The synthesiser module (Module 9) produces the 250 Hz and 1 kHz warning tones which are fed via Unit 3 to either the AF sockets or the remote control module (Module 4) to alert the operator that the radio is not functioning correctly.

23. The remote module (Module 4) provides:

(1) Call facility, to alert the local operator from a remote position.

(2) An input to VOGAD (voice operated gain adjusting device), on I/C and remote transmit.

(3) Audio output on Rx and local Tx for the remote operator, via the remote amplifier in Module 3.

Power supply (see Fig.2)

24. Power is provided for the radio by the Power Supply Unit (Module 2). The module produces regulated 6.2V, 6.2V Tx, 10V, 10V Tx and 24V outputs from either the battery or vehicle supply. In the Clip-in role when the vehicle supply is connected the battery is automatically disconnected. Incorporated in Module 2 is a spike and surge suppression circuit, which provides protection for the circuits within the radio when powered by a vehicle supply.

SERVICING AT FIRST LINE

Policy

25. Repair at first line is restricted to complete replacement of a faulty radio or of an ancillary equipment. Faulty items should be sent to the second line repair facility. Confidence and functional checks of the radio can be carried out at first line to ascertain that the radio is operating correctly. For these checks reference should be made to Chapter Four of the PRC420 System User Manual. In addition to these checks the functioning of the DIM DISPLAY position of the digit select switch should be checked.

CAUTION: THE SEALING OF AN ITEM OF EQUIPMENT AGAINST THE ENVIRONMENT WILL BE PREJUDICED BY ANY ATTEMPT AT FIRST LINE SERVICING LEVEL TO OPEN THE ITEM FOR INSPECTION OR ANY OTHER PURPOSE.

Memory battery

26. Immediately a PRC420 radio is received for repair the following procedure should be carried out:

(1) Locate and identify the memory battery compartment on the radio back panel

(2) Using a suitable size Allen key, remove the three screws securing the battery compartment cover. Remove the cover.

(3) Remove the battery. If the battery condition is suspect (e.g. memory will not hold) the battery should be discarded and replace by a new item. In any case, clean the battery thoroughly with a soft clean cloth and apply a smear of petroleum jelly to the whole of the battery.

NOTE: The battery should be replaced, irrespective of condition, at a period not exceeding one year.

(4) Using a soft clean cloth, remove all traces of petroleum jelly from the battery compartment and the battery compartment cover.

(5) Inspect the battery compartment, and the cover, for signs of corrosion. If corrosion is evident, remove by washing with a weak solution of acetic acid. Dry thoroughly with a soft clean cloth.

(6) Apply a smear of petroleum jelly to the battery compartment and the battery compartment cover.

(7) Insert the battery, ensuring that the correct polarity is observed (+ve end first) replace the cover and the securing screws.

(8) Proceed with the required inspection and testing as stipulated in the manual.

27. On satisfactory completion of the required tests the battery should be removed and placed in a plastic bag, together with an Allen key (of the size required for use on the battery compartment cover securing screws) and attached to the radio unit. However, if it is known that the radio is to be used within one month, the instructions to remove the battery may be disregarded.

NOTE: Presence of electrolyte on the battery is not necessarily detrimental to battery performance. Venting of the electrolyte is a design feature of the battery, preventing a dangerous build up of gas pressure which could result from use exceeding the battery design parameters.

Maintenance

28. Refer to the Chapter Three of the PRC420 System User Manual for maintenance instructions.

29. There should be no attempt to repair mechanical damage to any item.

Tools

30. A 250 mm screwdriver with 6 mm blade may be required at first line for attachment of frame, tray, or Clansman battery interface plate.

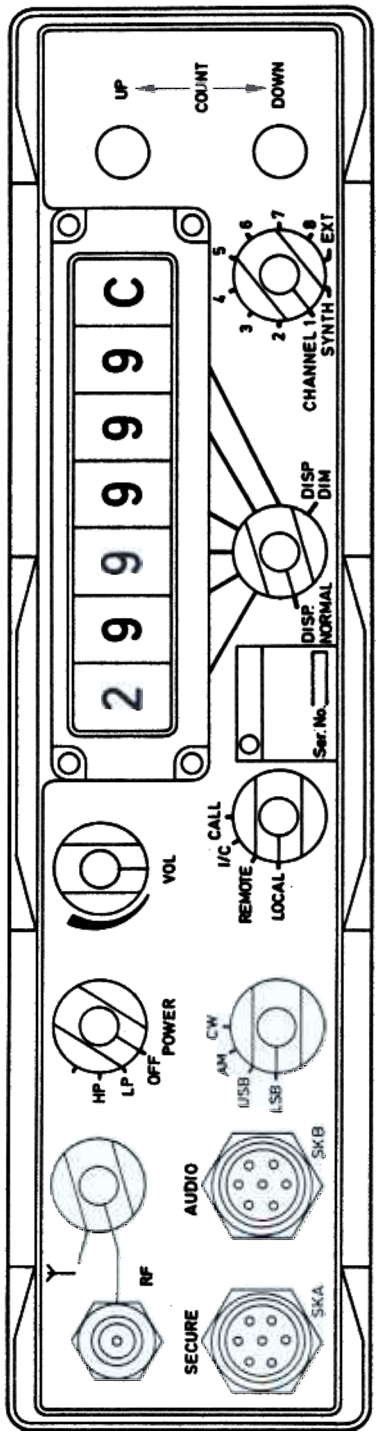


Fig. PRC 10-Front panel layout

PART 2

SERVICE MANUAL

FOR

PRC420 HF TRANSCEIVER

PART 2

SECOND LINE SERVICING

CONTENTS

SECOND LINE SERVICING

OF

PRC420 HF TRANSCEIVER

SECTION 1

INTRODUCTION

CONTENTS

ILLUSTRATIONS

Policy

1. Repair at second line is restricted to the reinstatement of faulty equipment by replacement of faulty modules and by replacement of faulty components which are not discrete parts of any module.

2. Any unit, or sub-assembly which cannot be repaired at second line and any faulty module, should be packed in the container in which the replacement item was received, and forwarded to the third line repair facility.

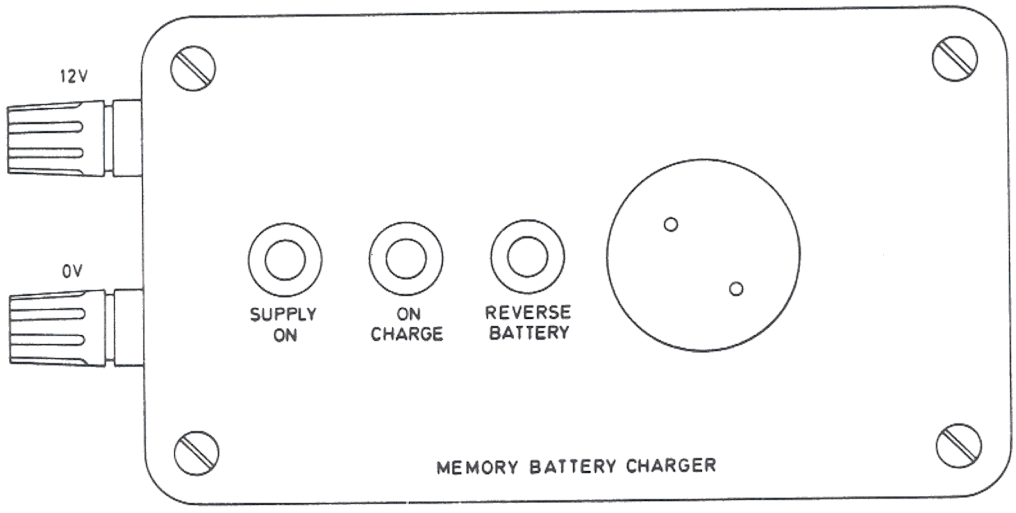
General

3. On receipt for repair, an item must be examined for obvious physical damage, subjected to a leak test (sealed units only), opened, and any obvious repairs and replacements carried out. The item should then be subjected to the relevant electrical tests and any necessary repair to effect satisfactory completion of the tests should be carried out.

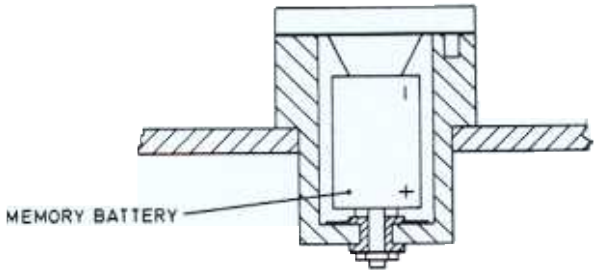
NOTE: In many instances, a repair to effect satisfactory completion of one test can have an effect on tests already satisfactorily completed. Accordingly, after all repairs have been carried out, a unit should be subjected to all the relevant tests.

4. Servicing information for the radio is provided in Sections 3 and 4 of this part of the manual. The sections provide relevant technical descriptions, tests and repair information.

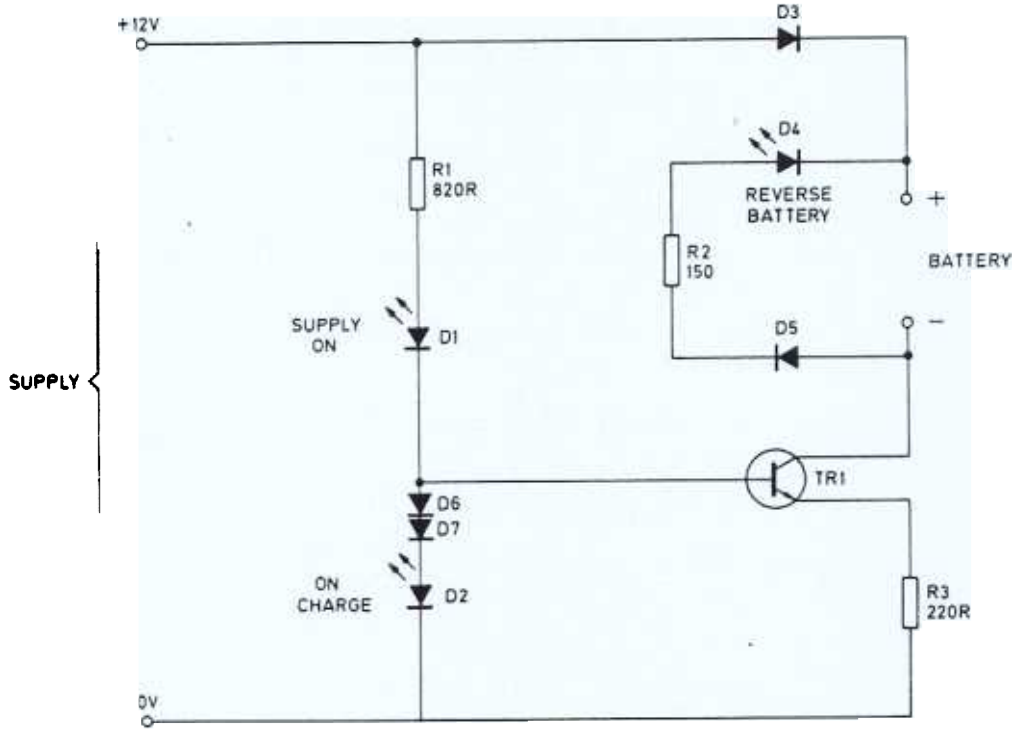
CAUTIONS: 1. DC VOLTAGES IN EXCESS OF 3V MUST NOT BE APPLIED TO ANY CIRCUIT UNLESS OTHERWISE STIPULATED. BUZZER CIRCUITS MUST NOT BE USED FOR CONTINUITY OR ANY OTHER TEST UNDER ANY CIRCUMSTANCES.



FRONT PANEL VIEW



DETAIL OF BATTERY CONNECTOR



CIRCUIT DIAGRAM

Fig 1 Memory battery charger

SECOND LINE SERVICING

OF

PRC420 HF TRANSCEIVER

SECTION 2

TECHNICAL DESCRIPTION

CONTENTS

MODULE	FUNCTION
1	Case assembly including controls and connectors
2	Power supply unit (PSU)
3	Audio stages/AM and SSB generators (AF/SSB)
4	Remote control
5	Microprocessor
6	Filter board (rear)
7	Transmit and receiver IF stages (IF)
8	Display modules
9	Synthesiser
10	Bandpass filters
11	Power amplifier
12	Antenna tuning unit
13	Filter board (front)

NOTE: The functional description which follows is divided into three parts covering transmission, reception, and control of the radio.

TRANSMIT/RECEIVE (Tx/Rx) SWITCHING

5. The receiver elements are bypassed, and the transmitter elements switched on only while the pressel (or key) is depressed. On CW modes only, a delay circuit in the synthesiser (Module 9) prevents the radio returning to the receive condition when the key is released for the transmission of spaces.

6. Switching is by relay contacts which transfer circuit and power supply connections from the receiver to the transmitter (and vice versa). The relay coils are operated by circuits associated with the pressel (or key).

TRANSMISSION refer to Fig.2

NOTE: Circuits which are unique to the transmitter will function only when the pressel is depressed.

Audio signal path

7. Speech from a microphone is applied to the radio at either of front panel sockets A or B and is routed to the VOGAD circuit in Module 3. This provides a speech signal for the main signal path and a similar signal for the sidetone path, as well as the ancillaries socket or remote terminals.

8. A 1 kHz CW square wave generated within the synthesiser is routed via the AF/SSB module to the main signal path and the sidetone path.

9. The output from the VOGAD (voice operated gain adjusting device) circuits is at a constant level, irrespective of the amplitude of the input signal.

10. The main signal is amplified and fed to two AF phase change circuits which produce two audio outputs which are in quadrature phase. These outputs are modulated by the 1.4 MHz in phase and quadrature inputs produced by the synthesiser. The two modulated outputs are combined in a summing circuit which cancels the unwanted lower sideband signal and leaves only the 1.4 MHz upper sideband signal.

21. The receiver mute circuit is used for inter-communication (I/C) and reduces the AF signal level in this mode for more comfortable listening by both local and remote operators.

22. AF from the mute circuit is taken to the audio amplifier. CW sidetone and warning tone signals are fed in at this stage from the synthesiser (Module 9).

POWER SUPPLIES

23. Power for the radio is derived from either the battery or vehicle supply, by the power supply unit (Module 2).

24. Incorporated in Module 2 is a spike and surge suppression circuit which protects the power supply from any sudden current surges or spikes when the radio is powered by the +28V vehicle supply. Relay contacts provide the switching between vehicle and battery supply, bypassing the spike and surge suppression circuit when the battery is used to power the radio.

25. The power supply contains circuits which produce 6.2V and 6.2V Tx, 10V and 10V Tx and 24V switched for the radio circuits. The distribution of these supplies is shown in Figs.4 and 5.

CONTROL

26. Overall control of the radio is effected by a microprocessor and its associated software in response to instructions generated by the MODE, CHANNEL, DISPLAY, and COUNT switches on the front panel.

Microprocessor (Module 5)

27. A simplified block diagram of the microprocessor is given in Fig.6. The module consists of a single pcb circuit which utilizes a CMOS microprocessor with 128 x 8-bits of RAM, and 2048 x 8-bits of ROM, to (a) monitor the inputs from the front panel controls of the radio through three CMOS input ports, and (b) control the ATU, Bandpass Filter, Synthesiser and Display Modules of the radio through its three CMOS output ports.

28. Other control lines allow feedback to the microprocessor from the ATU and Synthesiser modules, and peripheral circuitry is provided to give RAM protection during supply failure; clock control; and trickle charging of the memory back-up cell.

Channel selection

29. The setting of the channel select switch (S6) on the front panel generates a four-bit BCD code to an input port on the microprocessor board (Module 5). Table 1 gives the conditions on the four input pins of Module 5 for each setting of the switch. When the switch is set to EXT, selection of operating channel is by the remote hand held channel selector via input pins PL1/17 (MSB), PL1/18, PL1/7, and PL1/19 (LSB). The input code is the same as given in Table 1.

Table 3 - Display switch inputs to Module 5

DISPLAY Switch (S5) Position	Function	Module 5 Plug/Pin
NORMAL DISPLAY	--	PL1/11
10 MHz	Digit 5	PL1/1
1 MHz	Digit 4	PL6/16
100 kHz	Digit 3	PL6/17
10 kHz	Digit 2	PL6/18
1 kHz	Digit 1	PL1/4
100 Hz	Digit 0	PL1/15
DIM DISPLAY	--	PL1/6

34. Operation of a count button causes an increment or a decrement of the frequency selected in 10 MHz, 1 MHz, 100 kHz, 10 kHz, 1 kHz or 100 Hz steps, as determined by the position of the DISPLAY switch.

Change of frequency

35. To change the frequency of any of the eight preset channels the programme key is inserted in the AUDIO socket B (SK3) on the front panel. This puts a logic 0 (0V) condition on pin C of SK3 which is routed out of the Filter Board (Module 13) on PL1/13 to PL1/5 on the Microprocessor Board.

36. The new frequency can then be written into the memory location for the relative channel, digit by digit, as already described in paras.31-34.

RF control (antenna output)

37. When the RF switch (S1) on the front panel is set at the antenna symbol the internal ATU is retuned each time the transmission frequency is changed and the pressel is operated. This matches either a manpack whip antenna or vehicle antenna connected to the side panel antenna socket to 50 ohms.

38. When the 50 ohm rf socket output is selected at the RF switch, a TUNE INHIBIT signal is initiated from the switch. This is a logic 1 (10V) condition to the Microprocessor Board (Module 5) PL1/16 which inhibits the retuning sequence of the internal ATU. In this position of the switch, tuning of the radio rf output to the antenna is effected by an externally connected ATU.

SYNTHESISER (MODULE 9)

39. A basic functional block diagram of the Synthesiser is given in Fig.7

Reference frequencies

40. These are derived from the 5.6 MHz output of a temperature controlled crystal oscillator (TCXO) as follows:

(1) The 5.6 MHz is applied to the input of a quadrature divider to produce 1.4 MHz and 1.4 MHz +90° for the modulator on the AF/SSB Board (Module 3).

Data input

48. Frequency information from the microprocessor is fed into the internal registers of the loop variable dividers in a serial/parallel format. A program clock is used to synchronise the entry of the data during the loading sequence.

Fast loop

49. The divide by 10/11 stage serves to extend the range of variable division to allow unit steps instead of minimum steps of ten in the divider ratios. This is achieved by varying its ratio between divide by 10 and divide by 11 in a regular manner during each output cycle of the divider chain, the control for the divide by 10/11 being derived from the variable dividers as logic levels. The change from divide by 10 to divide by 11 once in an output cycle for one count of elevent, implies that one more input count is required to achieve the same output cycle length. Thus the division ratio is increased by a unit step, and by causing the change to occur a number of times, the appropriate units figure may be selected,

50. In the fast loop, control down to tens of kHz is achieved by operating once for an offset of 10 kHz. ie. offset = n x 10 kHz.

where n is a single control operation

The output of the prescaler is passed to a variable divider the action of which is to divide the output of the divide by 10/11 stage down to the reference frequency of approximately 10 kHz. The variable divider output is fed to a phase detector which compares it with the reference frequency generated by the slow loop.

51. The output of the phase detector is filtered before being used to control a VCO.

Slow loop

52. The slow loop is similar in operation to the fast loop, starting with the divide by 10/11 stage which in this case controls the 100 Hz and 1 kHz steps. The variable divider covers a greater range and its output, along with the internal reference frequency fixed at 10 kHz, is applied to the phase detector. The 10 kHz reference is derived by applying the 2.8 MHz signal to the fixed divider section of the reference divider/phase detector circuit. The phase detector output is fed via a filter to control the voltage controlled crystal oscillator (VCXO) which provides an output of approximately 6 MHz.

NOTE: The effective division ratio is a fractional one, becoming a whole number over 10 output cycles.

53. The VCXO output is divided by 2 and fed to the phase detector/reference divider of the fast loop where it is further divided by 300. The slow loop is completed by the VCO of the fast loop, the output of which is fed back to both the divide by 10/11 stages.

NOTE: A 1 kHz tone is activated:

(a) as a sidetone when the key (pressel) is operated in CW mode,

(b) when a CALL signal is initiated by the local or remote operator (Logic 1 on PL1/22 of Module 9).

and (c) during an ATU tuning sequence.

ATU tuning (high power override) (Fig.8)

57. When the operating frequency of the radio is altered by more than 10 kHz the ATU (internal or external) is automatically instructed to retune the radio rf output to the antenna impedance at the new frequency.

58. A change of frequency of 10 kHz or more is detected in the fast loop of the main synthesiser which then generates a 10 millisecond RESET pulse (logic 1). This pulse leaves the Synthesiser Board on PL1/17 and is connected to PL6/12 on the Microprocessor Board (Module 5). A second reset output, designated RESET (EXT), puts a logic 0 on PL1/15 of the synthesiser which is connected to Filter (rear) Module 6, PL1/2 and hence via the rear connector pin G to reset an externally connected ATU. The ATU READY output of the microprocessor on PL6/5, which is connected to PL10/3 of the synthesiser changes state to logic 0.

59. Retuning does not commence until the next time the pressel is operated when a tune commence signal (0V) is put on output PL1/10 of the synthesiser to the Microprocessor (Module 5) PL6/3. The M/P initiates a tune sequence programme to the ATU. When the ATU has successfully tuned an ATU READY signal is sent to the synthesiser. This appears as a logic 1 (10V) condition on PL10/3 from the M/P (Module 5, PL6/5) when an internal ATU is in use, or alternatively, on PL10/11 from PL1/16 on the Filter Board (rear) when an external ATU is in use.

60. The Tx = 1 line is held high during tune and enables output of the 1 kHz CW tone at PL1/11. The poor VSWR tone is disabled during tuning.

61. The High Power (HP) or Low Power (LP) signal, selected when the power switch (S2) is set on the front panel of the radio, is routed into the Synthesiser Board logic at input PL1/7 and gated through output pin PL1/18 to the PA (Module 11) input PL1/4. An override condition is generated in the logic to put a LP (logic 0) condition on output pin PL1/18 during tuning, or when an external PA is present.

Receiver muted (Fig.9)

62. When the REMOTE switch (S4) on the front panel of the radio is set at I/C (Intercomm) or at CALL the receiver gain is reduced by about 10 dB allowing remote and local operators to intercommunicate without undue interference from the radio.

63. The Synthesiser Board (Module 9) input PL1/8 goes to logic 1 (10V) when S4 is set to I/C, and input PL1/22 goes to logic 1 when S4 is operated to the CALL position. When a remote operator calls a logic 1 state is routed from the Remote Control Board (Module 4) output PL1/4 to the Synthesiser Board input PL1/9. When either of these synthesiser inputs goes to logic 1 the Rx

drain. Only the local operator can transmit in this position. The remote operator can listen to Rx audio warning tones, and local operator sidetone from the radio which are fed to him via RLA (in the Rx position) and the transformer.

'C

70. In this position the +10V is again removed from PL1/3. The AF path is fed in at PL1/7 and PL1/9 and routed through to the remote operators headset via the transformer.

Call

71. The call tone can be initiated by either operator irrespective of the mode selected, and without interfering with the radio.

72. When the remote operator presses the call button the remote lines are short circuited. This causes a dc line current to be drawn from ML1 which initiates the CALL circuit and mutes the PRESSEL circuit. If the mode switch is set to LOCAL then the +10V is removed from PL1/3 and ML1 is therefore switched off. In this instance a call detect circuit is used to switch the interface into the call condition.

TEST PROCEDURES

73. For functional tests and fault finding guide, refer to Section 3 of this part of the manual.

ASSEMBLY/DISASSEMBLY

74. For assembly/disassembly instructions reference should be made to Section 4 of this part of the manual.

REPAIR

General

75. As the removal of one or both covers of the radio exposes the case interior to the environment, the repair of faulty units should be carried out in the driest possible conditions.

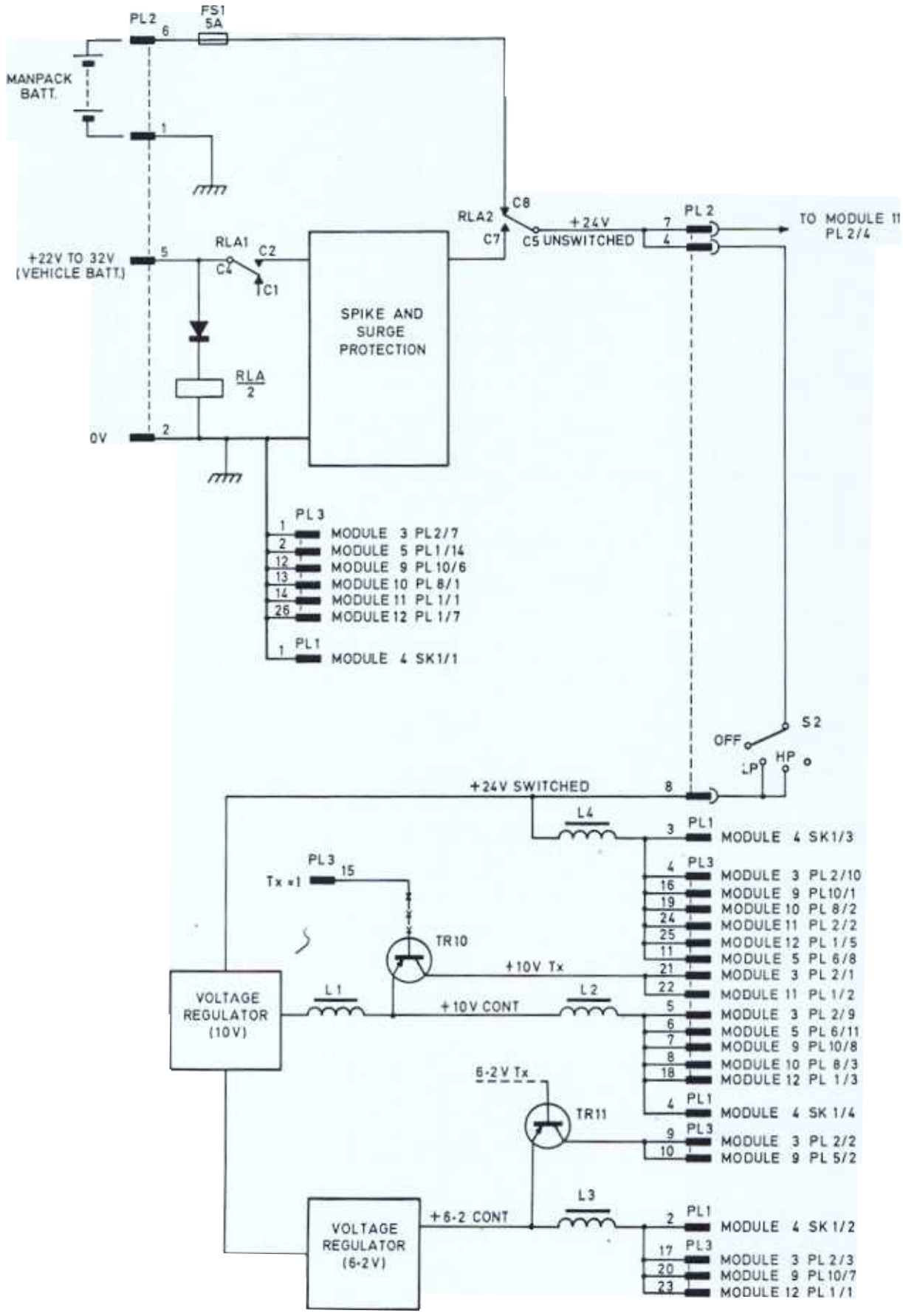
76. After clearing the fault and effecting any necessary repairs the following procedure is recommended before replacing the covers:

(1) Where suitable facilities are available, place the open unit in a dehumidifier for an hour at 50°C, with dry air passing through the oven

(2) Inspect the sealing 'O' ring and replace it if damaged. Lightly smear with grease GP XG271 (Plessey Part No.992/4/01070) and relocate in the grooves in the top and bottom surfaces of the case.

(3) Check the colour of the indicator in the desiccator. The crystals are blue when 'dry', changing to pink as moisture is absorbed. Replace the desiccator container if required.

Module	Description	Plessey Part No.
1	Case assembly and case mounted components as follows:	
	Case, transmitter/receiver	630/1/41732
	Cap - protective cover for antenna socket	630/1/38917
	Cover assembly (case covers)	630/1/42779
	Plug mounting assembly for desiccant container	418/9/37029
	Desiccant container dehumidifier	418/9/37030
	Ring sealing toroidal (cover seal)	999/9/32797
	Ring sealing toroidal (desiccant plug)	915/4/04071/017
	Ring sealing toroidal (antenna socket)	915/4/04071/018
	Knob assembly	630/1/39029
	Knob assembly (RF and Display switches)	630/1/39032
	Memory battery	999/9/32836
2	Power Supply Board	419/1/51162
3	AF/SSB Board	419/1/51165
4	Remote Board	419/1/51168
5	Microprocessor Board	419/1/51171
6	Filter Board (Rear)	419/1/66405
7	IF Board	419/1/51177
8	Display Module	630/1/39070
9	Synthesiser Module	630/1/38185
10	Bandpass Filter Module	630/1/38186
11	Power Amplifier Board	419/1/51228
12	ATU Board 1	419/1/51231
	ATU Board 2	419/1/69106
13	Filter Board (Front)	419/1/66402


PL2
6
FS1
5A
MANPACK
BATT.
1
+22V TO 32V
(VEHICLE BATT.)
5
RLA1
C2
C4
TC1
RLA
2
0V
2
SPIKE AND
SURGE
PROTECTION
RLA2
C8
C7
+24V
C5 UNSWITCHED
7
4
PL 2
TO MODULE 11
PL 2/4
PL 3
1 MODULE 3 PL2/7
2 MODULE 5 PL1/14
12 MODULE 9 PL10/6
13 MODULE 10 PL 8/1
14 MODULE 11 PL 1/1
25 MODULE 12 PL 1/7
PL1
1 MODULE 4 SK1/1
S2
OFF
LP
HP
+24V SWITCHED
8
L4
3 PL1 MODULE 4 SK1/3
PL3
Tx x1
15
TR10
+10V Tx
L1
L2
+10V CONT
VOLTAGE
REGULATOR
(10V)
4 PL3 MODULE 3 PL2/10
16 MODULE 9 PL10/1
19 MODULE 10 PL 8/2
24 MODULE 11 PL 2/2
25 MODULE 12 PL 1/5
11 MODULE 5 PL 6/8
21 MODULE 3 PL 2/1
22 MODULE 11 PL 1/2
5 MODULE 3 PL 2/9
6 MODULE 5 PL 6/11
7 MODULE 9 PL10/8
8 MODULE 10 PL 8/3
18 MODULE 12 PL 1/3
6·2V Tx
TR11
4 PL1 MODULE 4 SK 1/4
9 PL3 MODULE 3 PL 2/2
10 MODULE 9 PL 5/2
L3
+6·2 CONT
VOLTAGE
REGULATOR
(6·2V)
2 PL1 MODULE 4 SK 1/2
17 PL3 MODULE 3 PL 2/3
20 MODULE 9 PL10/7
23 MODULE 12 PL 1/1

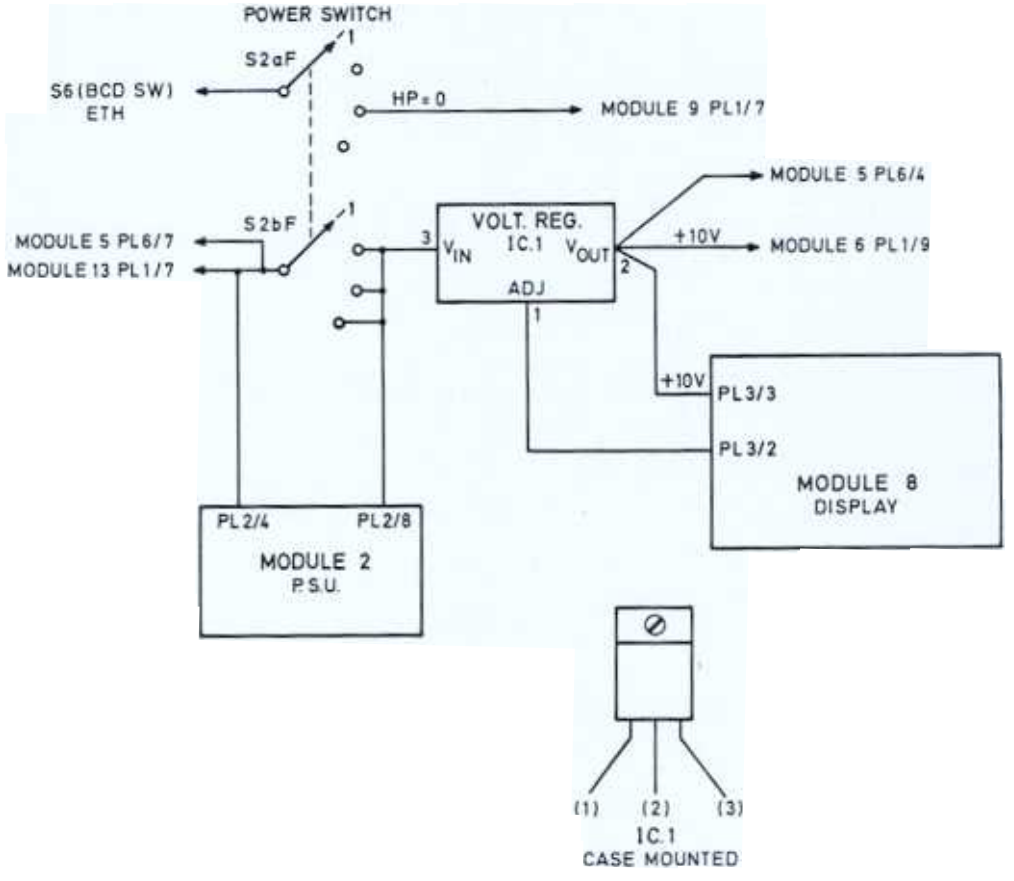


Fig 5 Power distribution – power switch & module 8

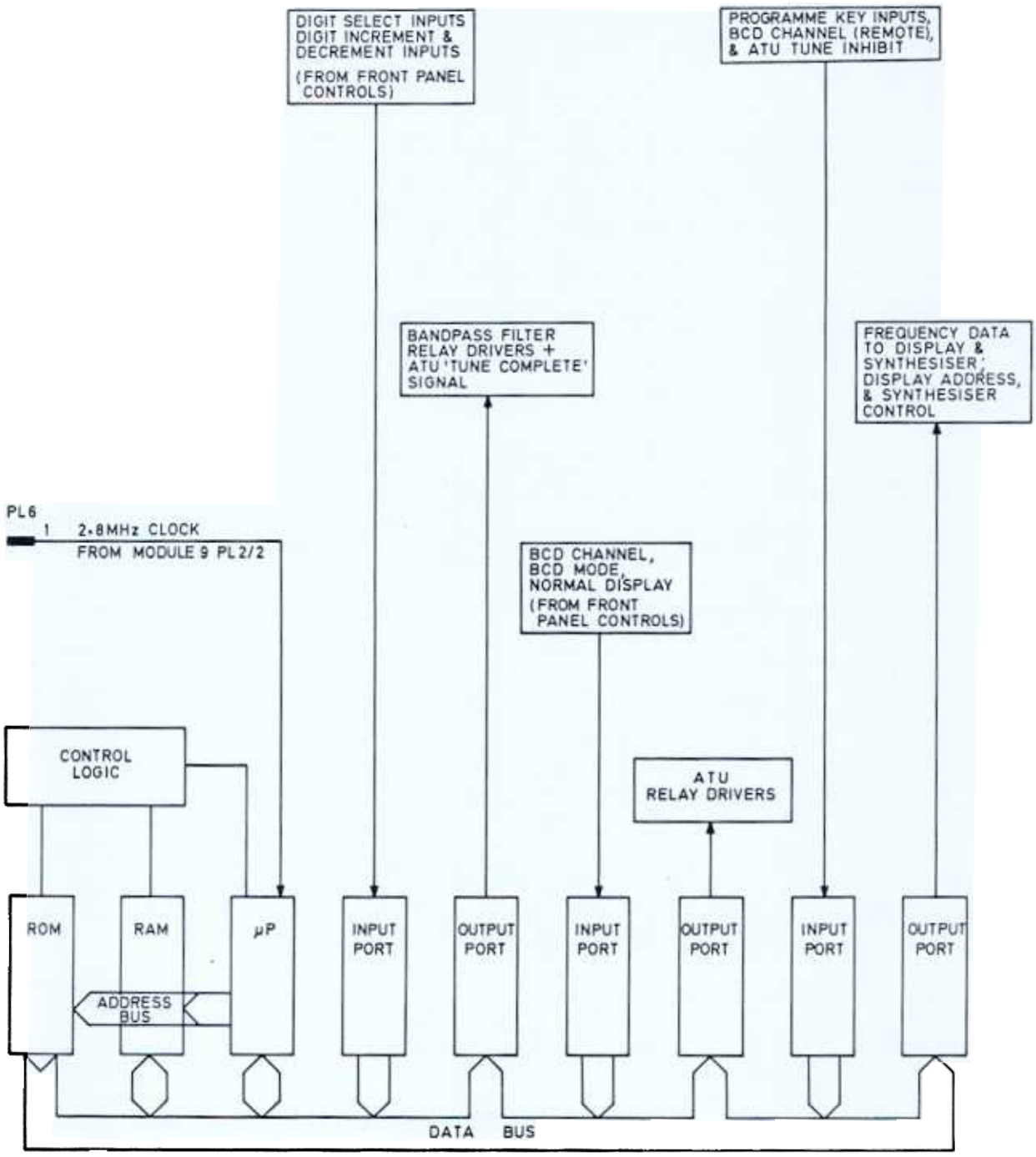


Fig 6 Microprocessor (module 5) - simplified block diagram

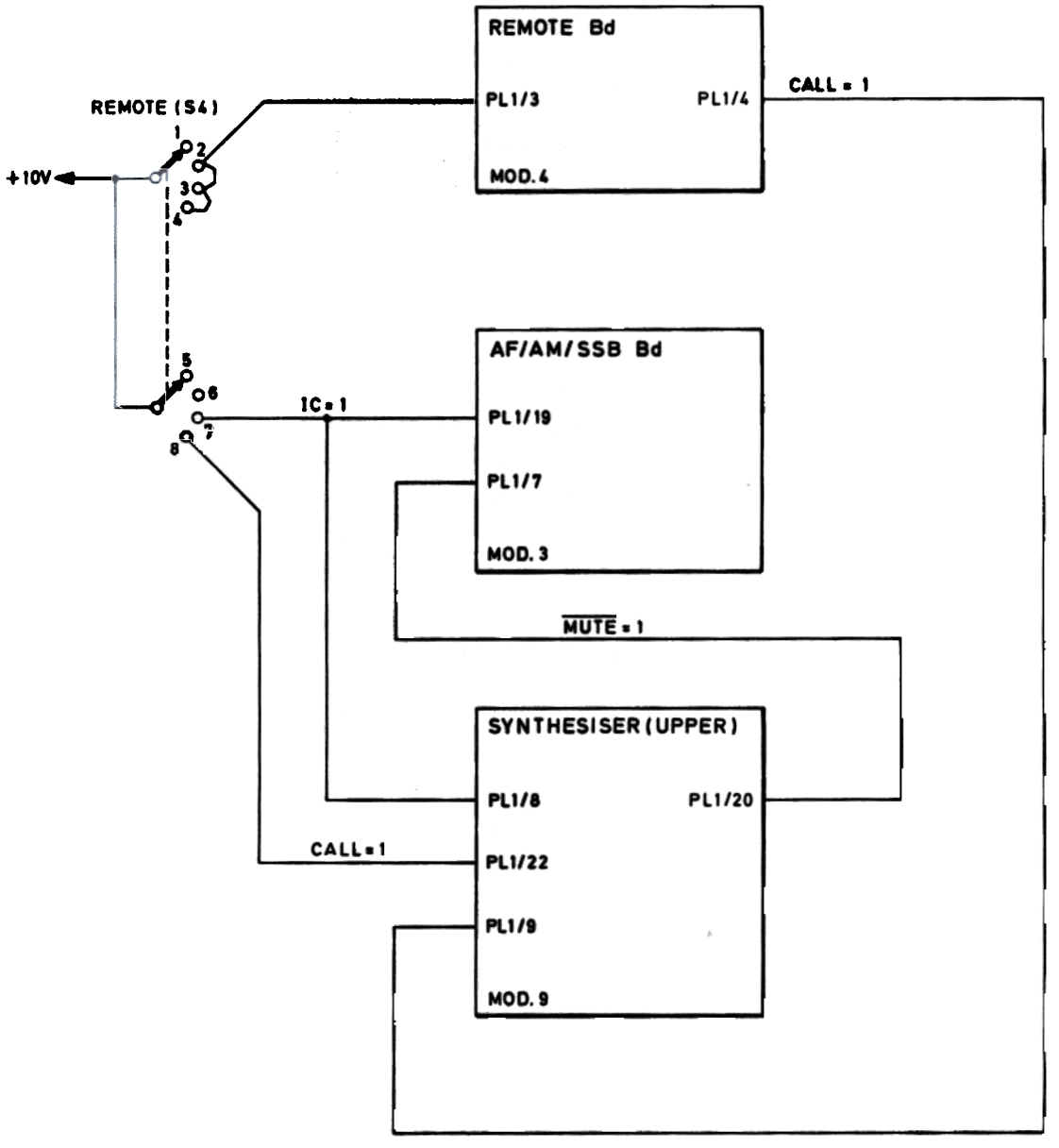


Fig. 9 Receiver muted - functional diagram

SECOND LINE SERVICING

OF

PRC420 HF TRANSCEIVER

SECTION 3

ELECTRICAL TESTING

CONTENTS

TABLES

ILLUSTRATIONS

INTRODUCTION

1. The procedures given in this section detail the steps necessary to electrically test the radio at the second line repair facility.

2. All tolerances quoted include an allowance for test equipment inaccuracies.

3. This section also includes a guide to fault finding.

TEST EQUIPMENT

4. The following items of test equipment are required:

Item	Description
RFG	Radio frequency signal generator. Output 0.6 uV to 1V. Source impedance 50 ohmm. Frequency 1.5 MHz to 100 MHz. Setting accuracy ± 10 Hz. Modulation 30% and 85% AM at 1 kHz.
	Audio frequency generator. Output 0.4 mV to 40 mV rms. Output impedance 600 ohms balanced. Range 100 Hz to 10 kHz ± 10%.
Wattmeter	RF power meter. Power range 0 to 100W ± 5%. Range 1.5 MHz to 30 MHz. Load resistor 50 ohms.
DC Ammeter	Current ranges 0 to 0.3 mA, 100 mA to 170 mA, 1A to 4A. Accuracy ± 2%.
	Digital voltmeter. Voltage range 10V. Impedance greater than 1M ohm.
	True rms millivoltmeter. Voltage range 4V ± 5%. Frequency ranges 1 kHz and 2 kHz. Impedance greater than 20k ohm.
DCVM	DC voltmeter. Voltage range 30V ± 2%. Impedance greater than 20k ohm.
SCOPE	Oscilloscope. Frequency range dc to 10 kHz. Sensitivity 0.1V/cm. Input impedance 1M ohm.
	A dc power supply unit with output voltage continuously variable between 18.0 and 32.5V all at ± 0.1V. Peak-to-peak ripple less than 100 mV. Output current limit 4.0A. Output impedance 50M ohm.
AAB	Audio adaptor box to facilitate connection to the audio circuits of the radio and enable pressel simulation without handset or morse key. Plessey part No.608/1/42354/001.
IAB	Interface adaptor box to facilitate connection to the interface circuits of the radio via the rear panel sockets AUTO ATU and POWER. Plessey part No.608/1/42355/001.
Antenna load	Antenna simulator. Plessey part No.612/1/39064
20 dB Attenuator	50 ohms impedance.

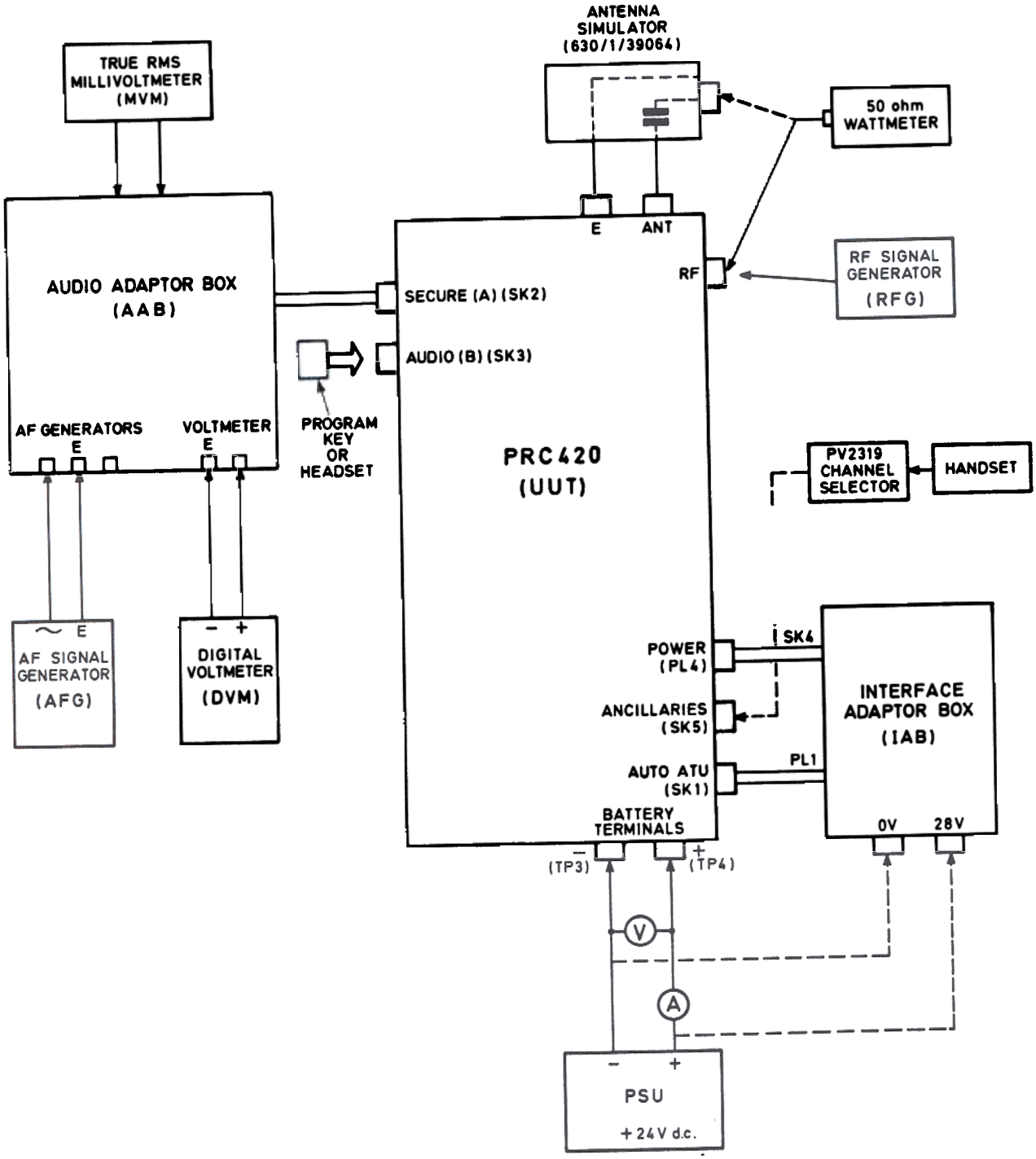


Fig 1 Schematic of connections for performance tests

Accessories

5. The following items are required to carry out functional testing of radio:

		Qty
Battery, secondary 2 Ah (PV1302) or 4 Ah (PV1304)		1
Antenna, whip 2.4m	Plessey part No.640/4/15030	1
Antenna adaptor	Plessey part No.640/1/14557	1
Key, telegraph	Plessey part No.640/1/14527	2
Headset	Plessey part No.612/9/41568 or 612/9/43071	2
Hand-held channel selector	Plessey part No.630/1/42795	1
Handset, remote control	Plessey part No.999/9/32539	1

PERFORMANCE TESTS

Introduction

6. The tests which follow will check that the major performance parameters of the radio are correct and that the controls are all functioning satisfactorily. A radio must pass all the tests before it can be classed as serviceable.

Preliminary

7. A schematic drawing showing the radio connected to the test equipment is given in Fig.1. Prepare the radio for test as follows:

Connect:

(1) The PSU output to the battery terminals on the side panel of the UUT with the ammeter connected in series with one leg of the supply to measure input current.

(2) The AAB connector to the SECURE(A) socket on UUT.

(3) The AFG output terminals, the voltmeter (DCVM), and millivoltmeter (MVM) to the relevant terminals of the AAB.

(4) The antenna simulator to the whip antenna socket on the side panel of the UUT.

(5) The plug and socket connectors of the IAB to the AUTO ATU and POWER connectors respectively of the UUT.

(6) The wattmeter (50 ohm load) to the 50 ohm RF socket on the front panel of the UUT.

(7) The headset to the AUDIO B socket of the UUT.

8. Controls and switches should be set as follows unless instructed otherwise in the test procedures:

Item	Control etc	Setting
UUT	REMOTE switch	LOCAL
	Pressel	Rx
	ANTENNA switch	RF
AAB	MVM AF switch	AF OUT
	AF LOAD switch	75 ohms
	Tx/Rx (Pressel)	Rx
IAB	PA, ATU, FAULT	OFF
	READY	ON

9. Switch on the PSU and set the supply voltage to 24V. This will be the test voltage unless otherwise stated in the test procedure.

NOTES: (1) Do not leave the Tx/Rx switch in the AAB set to Tx for any longer than is necessary to take the required readings/observations.

(2) To set a channel of the UUT for a required frequency, fit the program key to the UUT AUDIO B socket, momentarily set DISPLAY switch to NORMAL DISPLAY, then select each digit of the display in turn, at each setting operating the UP or DOWN buttons as necessary to obtain the required digit value. On completion remove the program key. The program key is not required to change the frequency of the SYNTH channel.

Display unit

10. Before proceeding with the tests carry out a functional check of the frequency display by setting to SYNTH and entering 28.8888 MHz AM.

Input current (drawn from supply)

11. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to LP
Mode	to AM
Remote	to LOCAL
Channel select	to SYNTH
Frequency	to 2.4 MHz (refer to para.9, Note 2)

(2) Set the AAB AF switch to AF IN.

(3) Switch on the AFG.

(4) Operate the pressel switch on AAB to Tx and set the output frequency of AFG to 1 kHz and adjust its output level to read 6 mV on MVM.

(5) Set the AAB AF switch to AF OUT. The reading on MVM should be between 297 mV and 423 mV. Restore AAB pressel key to Rx.

(6) Set the UUT mode switch to CW, operate AAB pressel to Tx and check the ammeter reading is not more than 1.95A. The rf power meter should read between 3.5W min. and 6.5W max. Restore pressel key to Rx.

(7) Set the UUT power to HP, operate pressel to Tx and check the ammeter reading is not more than 3.9A. The rf power meter should read between 15.5W min. and 26.5W max.

(8) Restore the AAB pressel to Rx. Switch UUT mode to CW. Check the ammeter reading is less than 166 mA.

Channel presetting and transmitter output power

12. This procedure checks the frequency setting circuits and that the RF power output on LP and HP is within specified limits.

13. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to LP
Mode	to CW
Remote	to LOCAL
Channel select	to 1

(2) Set the UUT channel select switch to each of the positions listed below. For each position adjust the frequency of the selected channel until the required frequency reading is obtained (refer to para.9 Note 2). Check the output power displayed on the wattmeter is between 3.5W min. and 6.5W max.

UUT Channel	Frequency (MHz)
1	1.80
2	2.60
3	3.80
4	5.50
5	8.00
6	11.50
7	16.80
8	24.60

(3) Switch the UUT power switch to off and wait for 5 seconds before proceeding.

Switch the UUT power switch to HP.

(5) Set the channel select switch on the UUT to channel 1 and operate the pressel key on AAB to Tx. Check the frequency display is as set in (2) and the power output is within the limits 15.5W min. and 26.5W max. The input current should not be greater than 3.9A. Restore the pressel key or AAB to Rx.

(6) Repeat (5) with the UUT channel select switch set for channels 2 to 8 in turn.

Operation of integral antenna tuning unit (ATU)

14. Disconnect the wattmeter from the 50 ohm RF output on the UUT and connect it to the antenna simulator which is plugged into the whip antenna socket on the side of the UUT.

15. Proceed as follows:

Set the UUT switches thus:

POWER	to HP
Mode	to USB
Remote	to LOCAL
Channel select	to 2
Antenna	to

(2) Flick the AAB pressel key to Tx to initiate an antenna tuning sequence and check that a 1 kHz tone is audible in the headset for the duration of the tuning sequence. The tone should be heard for no longer than 1 second.

Set the mode switch on the UUT to CW

(4) Operate the AAB pressel key to Tx and listen for a 1 kHz tone in the headset.

NOTE: A 250 Hz tone indicates the ATU has not tuned.

(5) Check the reading on the wattmeter is greater than 1.35W and indicates a steady rf output power.

NOTE: Intermittant breaks in the rf output power level indicates voltage breakdown in the ATU circuitry.

(6) Disconnect the wattmeter from the antenna simulator and check that a 250 Hz tone is heard in the headset.

(7) Restore the AAB pressel key to Rx and reconnect the power meter to the antenna simulator.

(8) Repeat procedures (1) to (7) for channels 3 to 8 and check the wattmeter reading is greater than the output power figures listed below for each channel.

UUT Channel	Frequency (MHz)	Output Power (Watts)
2	2.6000	1.1
3	3.8000	8.2
4	5.5000	8.2
5	8.0000	8.2
6	11.5000	7.5
7	16.8000	7.5
8	24.6000	8.2
SYNTH	29.9999	6.8

(9) Set the channel select switch on the UUT to SYNTH and set the frequency of the UUT to 29.9999 MHz (refer to para.9 Note 2).

(10) Repeat procedures (1 to (7) and check the wattmeter reading is greater than 10.3W.

External ATU interface (AUTO ATU)

16. Disconnect the PSU from the UUT battery terminals and connect it to the supply terminals on the IAB. Switch on the PSU and adjust its output voltage to 28V.

17. Connect the wattmeter to the 50 ohm RF socket on the front panel of the UUT.

18. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to LP
Mode	to CW
Remote	to LOCAL
Channel select	to SYNTH
Antenna	to RF

(2) Set the IAB switches thus:

PA	OFF
ATU	OFF
Ready	ON
Fault	OFF

(3) Using the DVM with its negative measuring terminal connected to the EARTH terminal of the IAB check that the dc voltage on the following IAB terminals is within the limits specified. The AAB pressel key should be operated to Tx where indicated.

IAB Terminal	Pressel	Voltage limits
Tx/Rx	Rx	Not less than 24V
Tx/Rx	Tx	0.6V to 2.9V
ON/OFF	Rx	9.5V to 10.5V
RELAY	Rx	Not less than 24V
RELAY	Tx	0.6V to 2.9V

(4) Adjust the SCOPE to observe a negative going pulse of approximately 28V amplitude and connect the scope probe to the RESET terminal on IAB.

(5) Momentarily operate the display switch on the UUT to NORMAL DISPLAY and then set it to the 100 kHz digit, and by operating the COUNT DOWN button reduce the frequency of the UUT by 100 kHz. As the frequency is changed a negative pulse with a duration greater than 10 millisecond should be observed on the scope trace.

(6) At the IAB set the ATU switch ON, and the READY switch OFF.

(7) Listen in the headset and operate the AAB pressel to Tx and restore to Rx. A 1 kHz tone should be heard and the wattmeter should indicate between 3.5 and 6.5W.

(8) Set the READY switch on the IAB to ON. The 1 kHz tone should cease and the wattmeter reading should return to zero.

(9) Set the READY switch on the IAB to OFF and repeat (7).

(10) Set the FAULT switch on the IAB to ON. The 1 kHz tone should cease and the wattmeter reading should return to zero.

(11) Set the UUT power switch to HP. When the pressel is operated to Tx a 250 Hz tone should be heard in the headset and the wattmeter should indicate between 15.5 and 26.5W.

(12) At the IAB restore the FAULT and ATU switches to OFF, and set the READY and PA switches to ON.

(13) Operate the AAB pressel to Tx and check the wattmeter indicates between 3.5W min. and 6.5W max.

Hand-held channel selector interface

19. Disconnect the PSU from the IAB and connect the PSU output to the battery terminals of the UUT. Set the PSU output at 24V.

20. Connect a hand-held channel selector (PV2319) known to be in good working order to the ANCILLARIES socket on the rear panel of the UUT. Plug a headset into the channel selector and set the selector to the SYNTH position.

21. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to HP
Mode	to CW
Remote	to LOCAL
Channel select	to EXT
Frequency	to 1.5 MHz (refer to para.9 Note 2)
Antenna	to RF

(2) Connect RFG to the 50 ohm RF socket on the UUT and set the RFG frequency to 1.5010 MHz $\pm$ 10 Hz (unmodulated) at 1 uV.

(3) Check that a 1 kHz tone can be heard in the headset connected to the hand-held channel selector.

(4) Disconnect RFG from the UUT and connect the wattmeter to the 50 ohm RF socket.

(5) Operate the pressel key on the handset connected to the HHCS and check:

1 kHz tone is audible in headset.

Wattmeter indicates between 15.5W and 26.5W

Restore pressel key to Rx.

(6) Using the hand-held channel selector to select channels 1 to 8 in turn, initiate a NORMAL DISPLAY on the UUT and check that the frequency displayed is in agreement with the frequency listed for that channel in para.13(2).

(7) Disconnect the hand-held channel selector and the wattmeter from the UUT.

Receiver: signal-to-noise ratio

22. Connect the RFG to the 50 ohm RF socket on the UUT

23. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to LP
Mode	to USB
Remote	to LOCAL
Antenna	to RF

(2) On the UUT set the channel frequencies as listed below (refer to para.9 Note 2).

UUT Channel	Frequency (MHz)	RFG Frequency (MHz)
1	1.5000	1.5010
2	3.2000	3.2010
3	4.6000	4.6010
4	6.6000	6.6010
5	9.6000	9.6010
6	13.9000	13.9010
7	20.2000	20.2010
8	2.0000	-

(3) Select channel 1 on UUT and set the output of the RFG for 1.5010 MHz $\pm$ 10 Hz at 1 uV pd.

(4) Adjust the volume control on the UUT to give an AF output level reading of 300 mV on the MVM.

(5) Switch off the RFG and check MVM reading is below 42 mV.

(6) Select channels 2 to 7 in turn, and setting the RFG frequency for each channel in accordance with the list in (2), repeat (4) and (5).

Receiver: sensitivity

24. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to LP
Mode	to USB
Remote	to LOCAL
Antenna	to RF

(2) Select channel 8 (2.0000 MHz) on the UUT, and set the volume control to maximum.

(3) Set the RFG frequency to 2.0010 MHz ± 10 Hz (unmodulated) at a level of 1 uV. Check the AF output reading on the MVM is greater than 1090 mV rms.

(4) Change the mode switch on the UUT to LSB and the RFG frequency to 1.9990 MHz ± 10 Hz (unmodulated) at 1 uV. Check the AF output reading on the MVM is greater than 1090 mV rms.

(5) Change the mode switch on the UUT to AM and the RFG frequency to 2.000 MHz ± 10 Hz modulated to 85% with a 1 kHz signal at a level of 14 uV. Check the AF output reading on the MVM is greater than 1090 mV rms.

Remote control

25. Connect the wattmeter to the 50 ohm socket.

26. Connect a remote control handset to the + and - line terminals on the rear panel of the UUT using a piece of line cable greater than 5 metres in length.

NOTE: If a 1 kHz tone is heard in the remote control handset the polarity of the connection is incorrect and the line terminations to the UUT should be reversed.

27. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to HP
Mode	to CW
Remote	to LOCAL
Antenna	to RF

(2) At the remote handset operate the pressel to Tx and check that the wattmeter remains at a zero reading (ie UUT does not go to Tx). Restore the remote pressel to Rx.

(3) At the remote handset, press the call button. Check a 1 kHz call tone is heard in the headset at the UUT.

(4) Set the UUT remote switch to REMOTE.

(5) At the remote handset operate the pressel to Tx. Check that the power meter indicates an rf output between 15.5 and 26.5W, and that a 1 kHz sidetone can be heard in the remote handset. Restore the pressel to Rx.

(6) At the UUT, operate the remote switch to I/C and check for good two-way speech communication between the local handset and the remote handset. Check that when either the local or remote pressel is operated to speak the UUT does not go to the Tx condition. (ie Zero reading on wattmeter should be continuous).

(7) At the UUT operate the remote switch to CALL and check that a 1 kHz call tone can be heard in the remote control handset.

Low volts warning (battery discharged)

28. Proceed as follows:

(1) Set the UUT switches thus:

POWER	to LP
Mode	to Any
Remote	to LOCAL
Channel select	to Any
Antenna	to

(2) Reduce the PSU output voltage to 17.5V and check for the presence of the interrupted 250 Hz warning tone (supply volts low) in the headphones. The warning tone should cease when the PSU output voltage is increased to 21V.

OPERATIONAL TEST

29. In this test the radio under test (UUT) is operated in conjunction with a PRC420 (or other compatible HF radio) which is known to be in good working order. The distance between the two radios during the test should be about 5 to 10 metres. Connect ancillaries and test equipment to the radio as follows:

At the UUT connect:

(a) a headset with pressel (or handset) to socket B (AUDIO)

(b) a telegraph key to socket A (SECURE).

(c) a whip antenna to the antenna socket.

(d) a fully charged battery to the battery terminals.

At the serviceable test radio (RADIO B) connect:

(a) a headset with pressel (or handset) to one of the audio sockets.

(b) a fully charged battery to the battery terminals.

(c) the antenna simulator to the whip antenna socket and earth terminal.

(d) the rf wattmeter to the antenna simulator.

30. Set the controls on the radios as follows:

	UUT	RADIO B
POWER	HP	LP
Mode	AM	AM
Remote	LOCAL	LOCAL
Channel select	ANY	ANY
Antenna Frequency*	27.0000 MHz	27.0000 MHz

*The test frequency should be as specified or the closest frequency which complies with local regulations controlling allocation of test frequencies in the band 25 to 30 MHz.

31. Proceed as follows:

(1) Operate the telegraph key at the UUT and check for any evidence of instability which will be indicated by the presence of hum or whistle in the headphones at the UUT or RADIO B.

(2) At each radio in turn, operate the pressel to transmit and establish two-way speech communication between the UUT and RADIO B adjusting the volume controls for a comfortable audio level. Check the transmitted speech is clearly intelligible and of good quality.

(3) Set the mode switch at both radios to LSB and repeat (2).

(4) Set the mode switch at both radios to USB and repeat (2).

FAULT FINDING

32. If a performance test produces an unsatisfactory result it is recommended that testing be continued until the full test programme is completed; later tests may provide additional information which may help to diagnose the cause of a fault.

33. Both covers should be removed from the radio under test before proceeding with fault location, and a visual inspection should be made for any obvious damage such as loose or broken connectors, wires etc.

34. In the absence of any visual damage reconnect the test equipment to the UUT as described in para.7 before attempting to locate the fault. Table 1 provides a Fault Finding Guide which may be of some assistance in the location of a faulty module. In it the fault symptoms are listed against the relevant test paragraph, with a recommended action to take to identify a faulty module. By substituting a known serviceable module the diagnosis can be confirmed.

35. Before changing a suspect module the dc power supplies to same should be checked. Refer to Part 2, Section 1, Fig.4, which gives the distribution and connection points for the various supplies.

36. In the action column of Table 1 it is assumed that all inter-module connectors are properly mated. The number preceding a socket or plug identification denotes the module number eg 9/PL1/12 denotes Module 9, Plug 1, pin 12. In some cases this designation is followed by an abbreviated description of the main function of the module. eg (PA) - Power Amplifier Module.

37. Defective modules should be packed in a suitable protective container and returned to 3rd line for servicing. In the case of modules comprised of more than one printed circuit board, the complete assembly should be returned for servicing as a unit.

Table 1 - Fault finding guide

Test para.	Test/Symptom	Action
	Current consumption	
10	One or more segments of display not illuminated.	Change Module 8 (Display).
11(5)	No reading on MVM (No AF output).	Check for 0V (Pressel at Tx) on 9/PL1/12 (Synth.). If NO - change Module 13 (Filter front). If YES - change Module 9 (Synth.).
11(6),(7)	Input current high.	(1) Check display is off. (2) Disconnect 11/PL2 (PA) and repeat test. If current now less than about 500 milliamps change Module 11. (3) Change Module 2 (PSU). (4) Disconnect remaining modules individually to diagnose which module should be changed. (Refer to Table 2 for typical module currents).
11(6)	RF power output out of limits.	See action for power output symptoms against test para.13(5).
	Channel presetting and rf output power	
13(2)	No display.	(1) Operate DISPLAY on UUT to NORMAL position. If no display check power supply to display module (+10V on 8/PL3/3; 0V on 8/PL1/7). (2) Check for DISPLAY ENABLE +10V on 8/PL1/8. If YES - change Module 8 (Display); then Module 5 (M/P).

continued ...

Table 1 continued ...

Test para.	Test/Symptom	Action
13(2)	One or more digits missing on display.	Change Module 8 (Display); then Module 5 (M/P).
13(2)	Count UP/DOWN not functioning.	Check for +10V on 5/PL6/9 (UP) or 5/PL6/15 (DOWN) when relevant button pressed. If OK change Module 5 (M/P).
13(5)	Preset channels not displayed (memory failure).	(1) Check memory battery fitted. (2) Check for +3.6V on 5/PL6/10. If OK change module 5 (M/P).
	Channel selection faulty.	Refer to Table 1 in Part 2, Section 2 of this volume and check BCD channel select code conditions on 5/PL1/pins 3, 8, 20 and 9. If codes correct for each channel selected, change module 5 (M/P).
	Digit selection faulty.	(1) Check for +10V on Module 5 (M/P) PL1/15, PL1/4, PL6/18, PL6/17, PL6/16, PL1/1 for digit selections 100 Hz, 1 kHz, 10 kHz, 1 MHz and 10 MHz respectively. (2) Check for +10V on 5/PL1/11 (Normal display) and 5/PL1/6 (DIM display). If (1) and (2) correct, change module 5 (M/P).
13(5)	LP rf power output out of limits on all channels.	Check rf input to Module 11 (PA) on 11/PL1/6 is 420 to 562 mV rms. If OK change Module 11; then Module 10.
	HP rf power output low (All channels).	Check for +10V (HP = 1) at 11/PL1/4. If OK change Module 10 (PA).
	Power output low on channel 1 to 4 only or channels 5 to 8 only.	Change Module 10 (BPF).
	Integral ATU	
15(4)	No tone heard.	Check for 1 kHz tone on 9/PL1/11 (Synthesiser) and 3/PL1/14 (AM/SSB). If NO, change Module 9.

continued

Table 1 continued ...

Test para.	Test/Symptom	Action
15(6)	No 250 Hz tone.	(1) Check for +10V (logic 1) on 11/PL2/5. If NO: (a) Change Module 12 (ATU). (b) Change Module 11 (PA. (2) Change Module 9 (Synthesiser).
	RF power output out of limits (para.15 only).	(1) Change Module 12 (ATU). (2) Change Module 5 (M/P).
	RF power output out of limits (paras.13 and 15).	Check rf input to PA on 11/PL1/16 is 420 to 562 mV rms. If YES, change Module 11 (PA); if NO, change Module 7 (IF).
18(3)	External ATU interface (AUTO ATU)	
	No low condition (0.6V to 2.9V) on IAB Tx/Rx terminal when pressel at Tx.	Check 6/PL1/4 for low. If NO - check 9/PL1/3 (Synth.); if NO again, change Module 9 (Synth.).
	ON/OFF - no 10V supply.	Check for 10V on 6/PL1/9 (Filter - rear). If YES, change Module 6.
	No low (0.6V - 2.9V) on RELAY terminal when pressel at Tx.	Check for low on 6/PL1/11 (Filter - rear). IF YES, change Module 6 (Filter - rear); if NO - change Module 9 (Synth.).
18(5)	No negative pulse.	Repeat the test checking 6/PL1/2 for the pulse; if YES, change Module 6 (Filter - rear). If NO - check 9/PL1/15 (Synth.); if NO - change Module 9 (Synth.).
18(7)	No 1 kHz tone, and no rf power output.	Check for +24V on 6/PL1/7; if YES, change Module 9 (Synth.).
18(10)	Continuous 1 kHz tone; wattmeter shows rf output present.	Change Module 6 (Filter - rear).
18(11)	No 250 Hz tone.	Change Module 9 (Synth.).
18(13)	Wattmeter indicates 15.5W -26.5W (HP).	(1) Check for +10V on 6/PL1/10 (Filter - rear). If NO - change Module 6. (2) Change Module 9 (Synth.).

continued

Table 1 continued

Test para.	Test/Symptom	Action
	Hand held channel selector	
21(3)	No 1 kHz tone.	Check for 1 kHz on 6/PL1/5 (Filter - rear); if YES, change Module 6.
21(6)	Channel selection not operating correctly.	(1) Check for correct BCD code for each channel on 6/PL1/pins 19, 22, 3 and 21. (Refer to Part 2, Section 2, Table 1). If code(s) incorrect change Module 6 (Filter - rear). (2) Change Module 5 (M/P).
	Receiver signal-to-noise ratio	
23	Noise level too high (greater than 42 mV). (a) channels 1-4 or channels 4-8 only. (b) ALL channels.	Change Module 10 (BPF). Repeat test para.23(1) to (4) and then disconnect MVM from the AAB and use it to measure the af signal level at 3/SK1 (AM/SSB) which should be about 50 mV. Make a note of this voltage. Switch off the REG and check the MVM reading drops by at least 18 dB's; if it does, change Module 3 (AM/SSB). If drop is less than 18 dB's, change Module 7 (IF); then Modules 10, 11 and 12 individually.
	Receiver sensitivity	
24	AF output low. (a) All modes. (b) SSB only or AM only.	Check af level (50 mV approx.) at 3/SK1 (AM/SSB). If YES, change Module 3 (AM/SSB). If NO, change Module 7 (IF). Change Module 7 (IF).
	Remote control	
27(2)	Reading on wattmeter (ie UUT switched to Tx).	(1) Check 4/PL1/3 (Remote control) for 10V. If YES, check Remote switch (S4) for contact be-

continued ...

Table 1 continued ...

Test para.	Test/Symptom	Action
		tween Remote terminal and +10V supply to switch. (2) Change Module 4 (Remote control).
27(3)	No CALL tone.	Check for 10V on 4/PL1/4 (Remote control). If NO, change Module 4. If YES, change Module 9 (Synth.).
27(5)	No rf output.	(1) Check for low (0V) on 4/PL1/5 (Remote control). If NO, change Module 4. (2) If (1) YES, check for 0V on 6/PL1/6 (Filter - rear) - if YES, change Module 6.
27(6)	No intercomm.	Change Module 4 (Remote control).
	UUT goes to Tx.	See action for para.27(2) above.
27(7)	Remote operator gets no call tone.	Check for 10V (logic 1) on 9/PL1/22 (Synth.) when remote switch is operated to the CALL position. If NO, check CALL terminal on remote switch; if YES, change Module 9 (Synth.).
	Low volts warning	
28(2)	No 250 Hz warning tone heard when supply less than 18V.	Change Module 9 (Synth.).

Table 2 - Current drawn per module

Module	Supply Voltage	Current Consumption (milliamps) Tx	Rx	Tx/Rx
2 PSU (see NOTE)	28V	less than 299	less than 171	
3 AF/AM/SSB	10V	43 max.	31 max.	
	6V	28 max.	1.0 max.	
4 Remote Control	24V			less than 30
	10V			3-5
	6V			less than 30
5 Microprocessor	24V			14 max.
	10V			64 max.
6 Filter Board	-	-	-	-
7 IF	10V	30 max.	12 max.	
	6V	200 max.	50 max.	
	24V	30 max.		
8 Display	24V		7 max.	less than
	(10V REG)		1.0 max.	330
9 Synthesiser	24V		9	
(upper + lower)	10V		74	
	6V	4	77	
(lower)	10V		41	
	6V	4	42	
10 BPF	24V	(Relay Switching)		200
	10V			44 max.
11 PA	24V*			3500 max.
*measured at 24V supply input to radio	10V	45		
12 ATU	24V			30 (Relay Switching)
	10V			1
	6V			0.5
13 Filter	-	-	-	-

NOTE: The total output currents taken from each supply from the PSU (Module 2) are:

10V = 229 mA maximum
6V = 383 mA maximum

SECOND LINE SERVICING

OF

PRC420 HF TRANSCEIVER

SECTION 4

DISMANTLING AND RE-ASSEMBLY

CONTENTS

ILLUSTRATIONS

HEALTH HAZARD

POWER TRANSISTORS TR6 AND TR7, AND THE INSULATED WASHERS UNDER THE TULIP HEATSINKS FOR TRANSISTORS TR4, TR5, TR17, TR19 & TR21, ON THE POWER AMPLIFIER BOARD (MODULE 11), CONTAIN BERYLLIA WHICH CAN CONSTITUTE A SERIOUS HEALTH HAZARD IF HANDLED IMPROPERLY. UNDER NO CIRCUMSTANCES SHOULD THESE ITEMS BE EXPOSED TO FIRE, BROKEN, OR ABRADED. REFER TO THE HEALTH HAZARD WARNING AT THE BEGINNING OF THIS VOLUME.

General

1. Before starting to dismantle the equipment the following points should be noted:

(1) Power supplies should be disconnected.

(2) Connectors should not be pulled out by their wires but disconnected using a connector parting tool.

(3) Care should be taken not to unduly stress wires to feedthru capacitors.

(4) When replacing printed circuit boards all the securing screws should be loosely engaged with the threaded holes, and then tightened.

(5) Before replacing covers on a repaired radio the sealing rings should be smeared with grease XG271 (Plessey Part No.992/4/01070), or Aeroshell 6.

(6) Before unsoldering wires from connectors and controls mounted on the case pull back the identity sleeves to avoid damage by heat.

(7) When replacing control switches or connectors on the front, side, or rear panels of the case, the sealing washers should be lightly smeared with grease XG271 or Aeroshell 6.

(8) For left/right/back/front orientation in the descriptions which follow the front panel of the radio is considered to be right-way up, facing the reader in the normal operating position.

2. To check the sealing of the unit on completion of repairs see procedure in Part 2, Section 2, Paragraph 79.

Covers

3. To remove the top or bottom cover of the radio, undo the 18 socket head captive securing screws using a 3 mm allen key.

4. When replacing the covers the sealing rings should be lightly smeared with grease XG271 or Aeroshell 6, and located in the groove on the mating surface of the case. Check that no wires have been trapped between the cover and case before securing.

Module location

5. Refer to the General Assembly drawing in Part 2, Section 2, Figure 1 for location of individual modules in the radio. The disposition of the modules in the two compartments of the radio is as follows:

UPPER compartment: Modules 5, 8, 10, 11 and 12.
LOWER compartment: Modules 2, 3, 4, 6, 7, 9 and 13.

See Figs.1, 2 and 3 for identification of plugs and sockets on the modules.

MODULE 5 - Microprocessor

6. The microprocessor module comprises one printed circuit board. To remove the board proceed as follows:

(1) Remove the nine screws securing the board.

(2) Disengage SK/PL3 on Module 10 (BPF board - upper). The other end of this connector cable on Module 5 (PL4) cannot be removed.

(3) Disconnect board connectors PL1, PL2, PL3 and PL6.

(4) Using a small screwdriver as a lever, ease up the top left hand corner of the board (next to Module 12/ATU board 2) to disengage SK5 from the mating pins of PL5 on Module 12 (ATU board 1). Some gentle levering under the left-hand edge of the board will help to seperate the connectors. Remove the board from the radio.

7. To replace the board reverse the procedure of para.6.

MODULE 9 - Synthesiser

8. The synthesiser module comprises two printed circuit boards; the lower board is identified as Board 1, the upper as Board 2. Sockets SK8 and SK9 on the upper board (2) are directly engaged with plugs PL6 and PL7 respectively, on the lower board (1); care should be taken not to distort, or unduly stress these connectors, when removing the module from the radio. To remove the module proceed as follows:

(1) Unplug connectors PL1, PL10 and ribbon connector PL4 from the upper board, and connectors PL2, PL3 and PL5 from the lower board (front edge)

(2) Remove the seven screws securing the upper board to the centre plate of the radio. Note the position of the earth lead terminal and the terminals supporting the co-ax lead.

(3) Remove the two screws securing the lower board, these are located at the front edge of the lower board next to PL2 and PL3.

(4) Lift out the complete module without unduly stressing the inter-board connectors.

9. To replace the module reverse the sequence of operations in para.8 taking care to replace the earth lead terminal under one of the screws securing the upper board, and the two solder tags used to support the co-ax lead.

MODULE 11 - Power amplifier (PA)

10. The power amplifier module comprises one printed circuit board. To remove the board proceed as follows:

(1 Remove Module 5 as described in para.6.

(2) Remove the three remaining screws securing the screen plate and take out the screen.

Remove Module 9 as described in para.8.

(4) Remove the five white nylon screws which can be seen on the centre plate with the removal of Module 9: these pass through the centre plate and retain the tulip clip heatsinks of five transistors on the PA board

(5) Turn the radio right way up again and remove the remaining two board retaining screws, and the four screws which clamp the two power transistors on the PA board.

Unplug the four board connectors and lift out Module 11.

11. To replace the PA board follow the dismantling sequence of para.10 in reverse, after reading the following notes.

NOTES: 1. It will be found easier to locate the holes in the centre plate for the power transistor securing screws if two of the board securing screws are replaced first, and partially tightened, to align the board with the case.

2. Before replacing Module 11, a light smear of silicon heatsink compound should be applied to (a) the underside of the two power transistors (TR6 & TR7) and (b) the bases of the five tulip clip heatsinks.

MODULE 12 - Antenna tuning unit (ATU)

12. The ATU module comprises two printed circuit boards, Boards 1 and 2. Board 2 plugs directly into a connector on Board 1. To remove the module proceed as follows:

Remove Module 5 as described in para.6.

(2) Remove the three remaining screws securing the screen plate and lift off the screen.

(3) Remove the two screws securing Board 2 to Board 1, and disengage the Board 2 socket (SK10) from the plug (PL7) on Board 1. Remove Board 2.

(4) Disconnect the wire from the rear of the antenna socket by unsoldering at PL9 on Board 1.

(5) To facilitate removal of Board 1 unplug connector PL1 on Module 11 (PA board).

Unplug connectors PL1, PL8, and co-ax PL2.

Disconnect the flying co-ax lead from Module 12 at SK1 on Module 10.

(8) Remove the three screws securing Board 1 to the centre plate and lift out.

13. To replace the module follow the dismantling sequence of para.12 in reverse order.

MODULE 10 - Band-pass filters

14. The Band-pass filter module comprises two printed circuit boards which are removed as a single unit. Remove the module as follows:

(1) Disconnect the flying co-ax lead at Module 11/PL3.

Disconnect co-ax connector SK1 and the ribbon connector PL3.

(3) Disconnect the two lower board connectors PL7 and PL8 - these are located at the rear of the radio adjacent to the back edge of the upper board.

Remove the six screws securing the upper board to the centre plate

(5) The complete module can now be removed using the lifting strap provided on the upper board.

15. To replace the module follow the dismantling sequence of para.14 in reverse order.

MODULE 4 - Remote control

16. The remote control module comprises one printed circuit board. Socket SK1 on the board engages with plug PL1 on the PSU Module 2. To remove Module 4 proceed as follows:

(1) Unplug connector PL1 and, to facilitate removal of the remote board disconnect PL10 on the synthesiser upper board of Module 9.

Remove the six screws securing the board to the supporting pillars

(3) Ease the board upwards endeavouring to maintain its parallel alignment with the centre plate until connector SK1/PL1 is disengaged, and then remove the board from the radio.

17. To replace the module reverse the sequence of operations in para.16 taking due care when engaging the socket (SK1) on the remote board with the plug pins (PL1) on the PSU board.

MODULE 2 - Power supply unit

18. The power supply module comprises one printed circuit board which is located under the remote control board (Module 4). To remove Module 2 proceed as follows:

Remove Module 4 as described in para.16

(2) Remove the two screws clamping the power transistors (TR5 and TR6) to the centre plate.

Unplug the two connectors PL2 and PL3.

Unscrew the six hexagonal pillars to release the PSU, and lift out.

19. To replace the module reverse the sequence of operations in para.18. Apply a light smear of silicon heatsink compound to the underside of power transistors TR5 and TR6, and ensure the insulating washers are in place, before securing the transistors to the centre plate.

MODULE 3 - AF/AM/SSB

20. The AM/SSB module comprises one printed circuit board. This board carries three sockets which engage directly with three sets of pins on Module 7 (IF board) which is located directly beneath it. To remove Module 3 proceed as follows:

Unplug connector PL2.

Remove the seven securing screws.

(3) Ease up the board to disengage the three sockets from the pins on Module 7 taking care not to place too much stress on the pins.

Unplug connector PL1 and lift out the AM/SSB module.

21. To replace the module reverse the sequence of operations in para.20. Take due care when mating the three sockets on Module 3 with the pins on Module 7.

MODULE 7 - IF

22. The IF module comprises one printed circuit board. To remove the module proceed as follows:

(1) Remove Module 3 as described in para.20.

Remove the screening plate which covers Module 7.

Unplug connectors PL1 and PL2 on the IF board.

(4) Remove the five screws securing the board to the centre plate and lift out the board.

23. To replace the module reverse the sequence of operations in para.22.

MODULE 8 - Display

24. The display module comprises two printed circuit boards, one housing the decoding and display driver circuits, and the other the LED display digits which are visible behind a protective screen on the front panel of the radio. The LED display board plugs directly into a socket on the driver board. The combined boards are removed from the radio as a single unit as follows:

Remove Module 10 as described in para.14.

Remove Modules 5 and 9 as described in paras.6 and 8.

Remove Module 11 as described in para.10.

(4) Remove the five screws securing the screen round Module 10 and remove the screen.

Unplug connector PL3.

(6) Remove the two screws securing the module to the centre plate, withdraw the module to clear the front panel of the radio and lift out.

25. To replace the module reverse the sequence of operations in para.24.

MODULE 6 - Filter board - rear

26. This module is located inside the radio immediately behind, and connected to, the three connectors designated AUTO ATU, ANCILLARIES, and POWER which are fitted on the back panel of the radio and form part of the module. Remove the module as follows:

Remove Module 4 as described in para.16

(2) Remove Module 2 as described in para.18

Unplug PL1 on the filter board.

Remove the two screws securing the board to the centre plate.

(5) Undo the nuts securing the rear connectors POWER, ANCILLARIES and AUTO ATU, and ease the filter board towards the front of the radio to withdraw the three connectors inside the rear panel. Take care not to break the wiring between the connectors and the filter board.

27. Replace the Filter board - rear reversing the sequence of operations given in para.26.

MODULE 13 - Filter board - front

28. The filter board module comprises a printed circuit board, and the two connectors mounted on the front panel of the radio designated SECURE and AUDIO respectively. The three parts are removed from the radio as a single unit. Proceed as follows:

Remove Module 3 as described in para.20.

(2) Remove Module 7 as described in para.22.

(3) Unsolder the seven wires connected to PL1.

(4) Remove the two screws securing the board to the centre plate.

(5) Undo the nuts securing the SECURE and AUDIO connectors to the front panel and ease the filter board to the back of the radio to withdraw the two connectors inside the front panel. Take care not to break the wiring between the connectors and the filter board.

29. To replace the filter module reverse the sequence of operations in para.28.

ANTENNA socket

30. To remove the whip antenna socket proceed as follows:

Remove the top cover on the radio.

(2) Remove the four socket head cap screws securing the socket to the left-hand side panel of the radio.

Remove Module 5 as described in para.6.

(4) Remove the three remaining screws securing the screen plate and lift off the screen.

(5) On Module 12 remove the two screws securing the small Board 2 to Board 1; disengage the socket SK10 on Board 2 from plug PL7 on Board 1 and remove Board 2.

(6) Remove the nut retaining the lead attached to the rear of the socket and remove the socket.

31. To replace the antenna socket repeat the sequence in para.30 in reverse order.

Switches and connectors

32. To remove the Volume control, Power switch, Antenna switch, or 50 ohm socket proceed as follows:

(1) With the radio standing right way up remove the eighteen socket head captive screws securing the top cover and lift off the cover.

Remove Modules 5 and 12 as described in paras.6 and 12 respectively.

(3) Push back the identity sleeves on the wired connection to the switch or socket to prevent damage by heat and unsolder the connections.

(4) Prise out the small plastic blanking plug on the face of control knobs and undo the knob retaining screw using an M2 allen key.

(5) Undo the retaining nut securing the component to the front panel, remove the crinkle washer and withdraw the shaft inside the radio to clear the front panel.

33. To remove the Remote switch, Display switch, or Channel Select switch proceed as follows:

(1) With the radio turned upside down remove the eighteen socket head captive screws securing the bottom cover, and lift off the cover.

Remove Module 9 as described in para.8.

Follow the procedure described in para.32(3) to (5).

34. To remove the Mode switch proceed as follows:

Same as for para.33(1).

Remove Modules 3 and 7 as described in paras.20 and 22 respectively.

Same as for para.33(3)

35. To remove front panel connectors designated SECURE and AUDIO, refer to the procedure for removing Module 13 in para.28.

36. To remove rear panel connectors designated AUTO ATU, ANCILLARIES, and POWER, refer to the procedure for removing Module 6 in para.26.

Remote terminals + and - (rear panel)

37. To remove the line terminals proceed as follows:

Remove Module 10 as described in para.14.

Unscrew the nut at the rear of the terminal (2BA spanner).

Remove solder tag.

Unscrew securing nut and remove the terminal.

38. To replace the line terminals reverse the procedure in para.37. The sealing washer should be lightly smeared with Grease XG271 or Aeroshell 6 and correctly seated in the recess provided.

Count UP pushbutton (PBS1)

39. To remove the count UP pushbutton proceed as follows:

(1) Remove Modules 5, 9 and 11 as described in paras.6, 8 and 10 respectively.

(2) Remove the five screws securing the screen round Module 10 and remove the screen.

Remove Module 10 as described in para.14.

Pull off the pushbutton knob.

(5) Roll back the identity sleeves from the pushbutton terminals and unsolder the wired connections.

(6) Undo the nut securing the pushbutton to the front panel and withdraw the switch into the radio to lift out.

40. To replace the count UP pushbutton reverse the procedure in para.39

Count DOWN pushbutton (PBS2)

41. To remove the count DOWN pushbutton proceed as follows:

Remove Module 9 as described in para.8.

(2) Follow the procedure of paragraph 39(4) to (6).

42. To replace the count DOWN pushbutton reverse the procedure in para.4.

Voltage regulator (IC1)

43. To remove the voltage regulator proceed as follows:

Remove Module 9 as described in para.8.

Remove the channel select switch (S6) as described in para.33.

(3) Roll back the identity sleeves and unsolder the wiring on the regulator terminals.

(4) Undo the screw securing the regulator to the centre plate and lift out

44. To replace the voltage regulator reverse the procedure in para.43 but before securing the component to the centre plate a light smear of silicon heatsink compound should be applied to the mating surfaces.

Desiccator

45. To remove the desiccant container unscrew the plug on the rear panel using a Pin Spanner (special desiccator) 630/1/38803.

46. When replacing the plug the sealing ring should be lightly smeared with Grease XG271 or Aeroshell 6.

Memory battery

46. To remove the memory battery undo the three screws securing the circular cover on the rear panel.

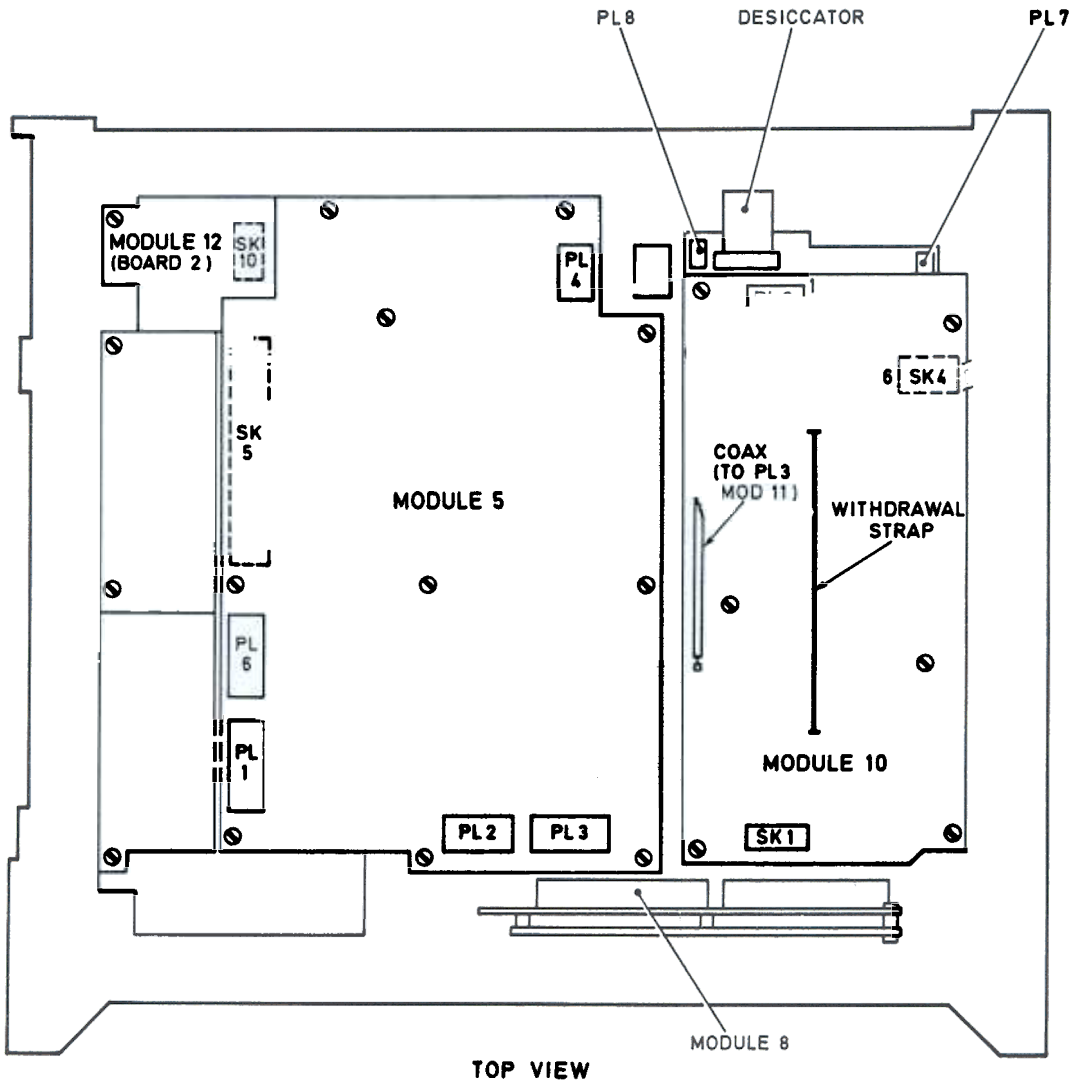
NOTE: The memory battery can be changed without jeopardising the sealing of the radio.

The battery can now be removed.

47. Before fitting a replacement battery, refer to para.26, in Part 1 of this manual.

Location of plugs and sockets

48. The locations of the various plugs and sockets which have to be disconnected when removing modules from the radio are given in Figs.1, 2 and 3.



TOP VIEW

NOTES: 1 SOCKET SK5 ON MODULE 5
MATES WITH PL6 ON MODULE 12

2 SOCKET SK10 ON MODULE 12 (BOARD 2)
MATES WITH PL7 ON MODULE 12 (BOARD 1)

Fig 1 PL/SK Locations—radio top view

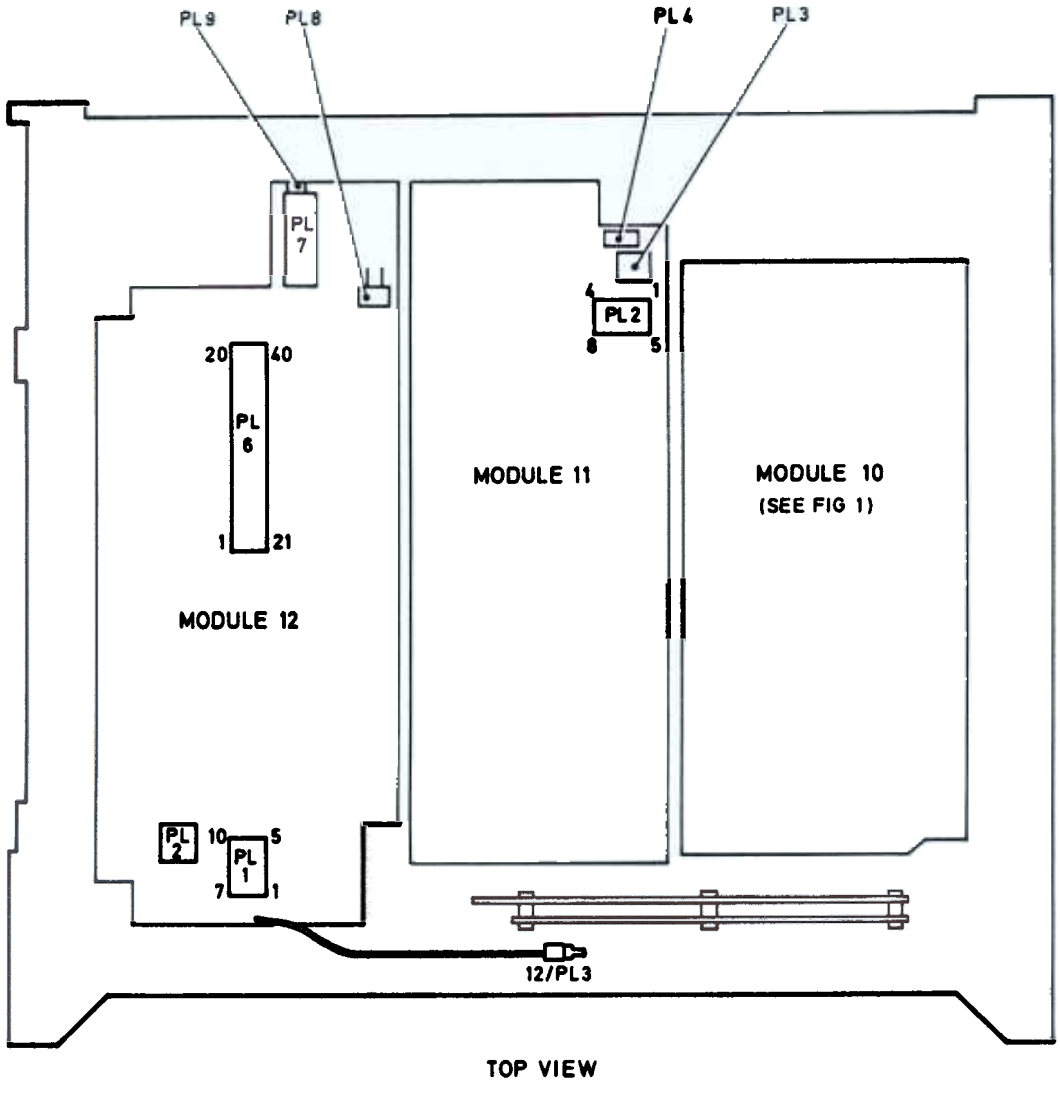
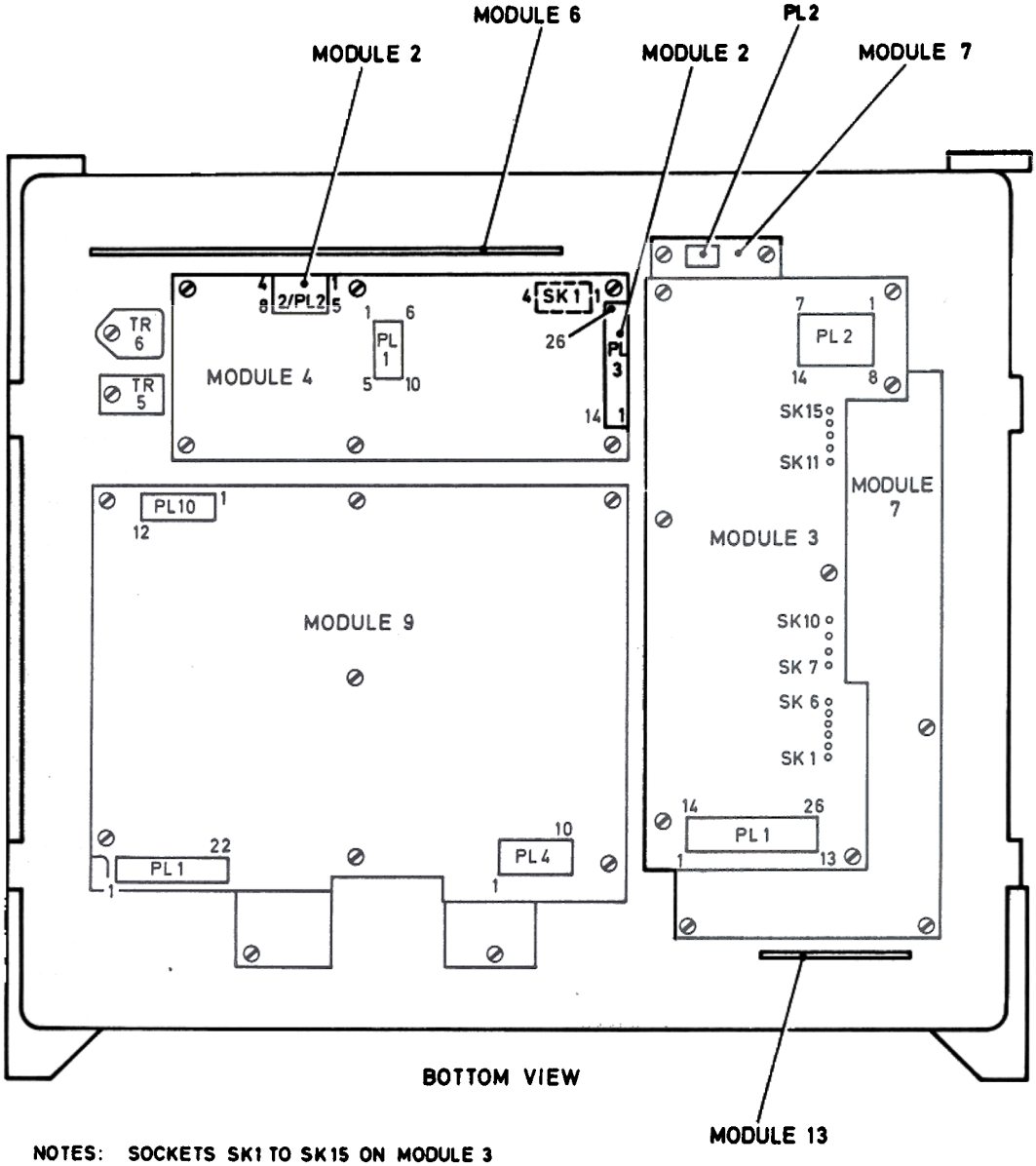


Fig 2 PL/SK locations – radio top view (module 5 removed)



NOTES: SOCKETS SK1 TO SK15 ON MODULE 3
MATE WITH PINS 1 TO 15 ON MODULE 7

Fig 3 PL/SK locations - radio bottom view

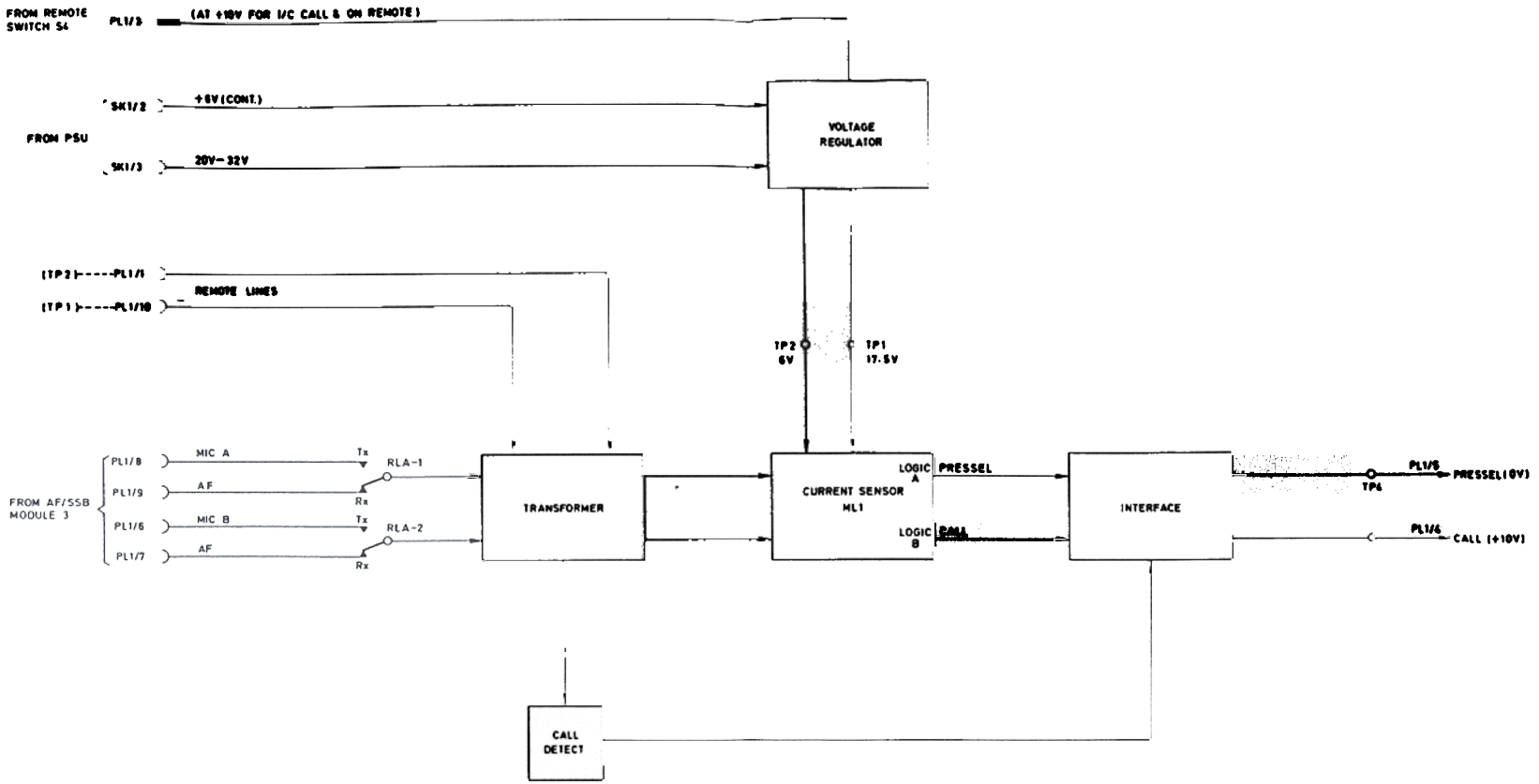


Fig 1

Remote control (module 4)–functional block diagram

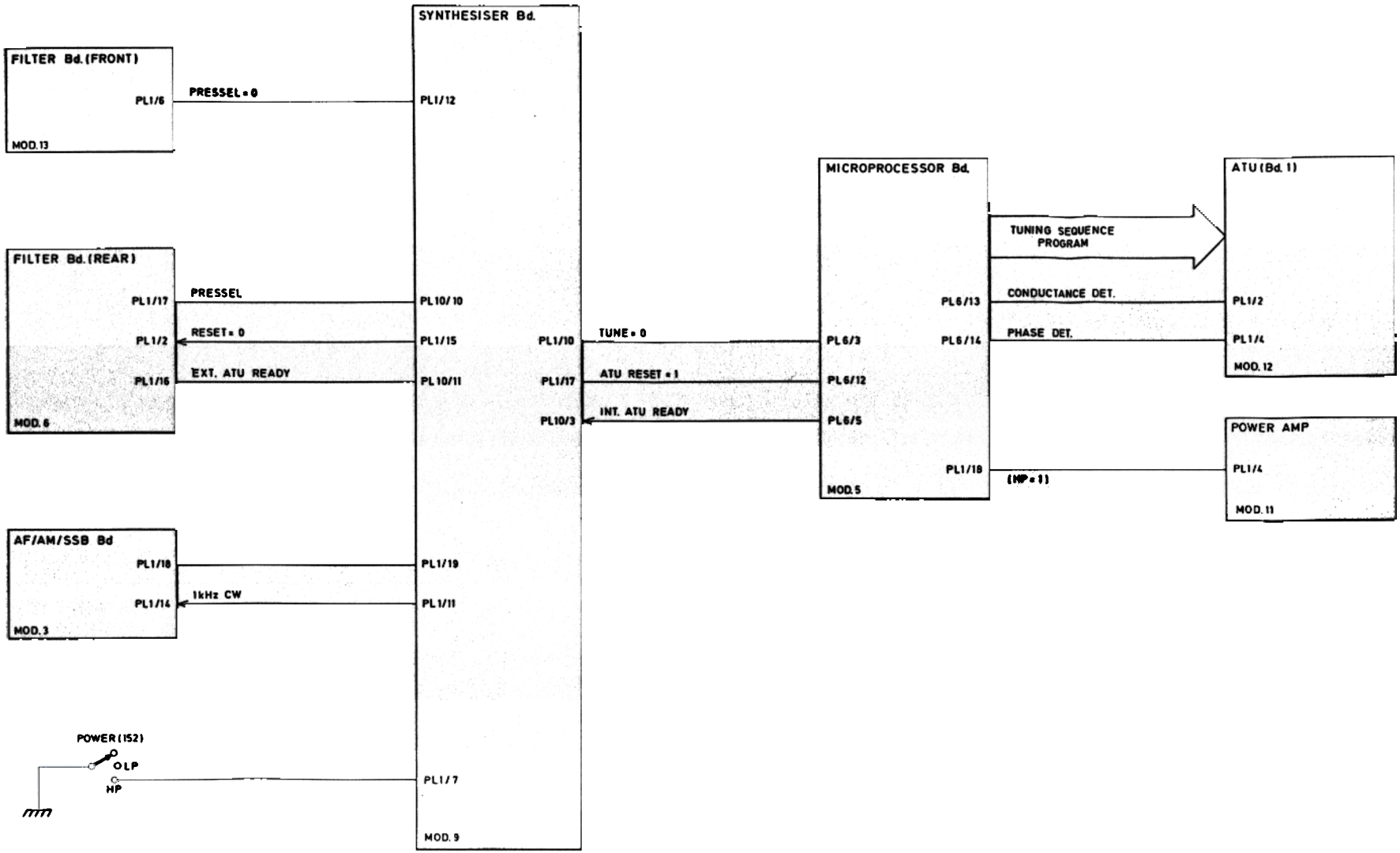


Fig. 8

ATU tuning (high power override) - functional diagram

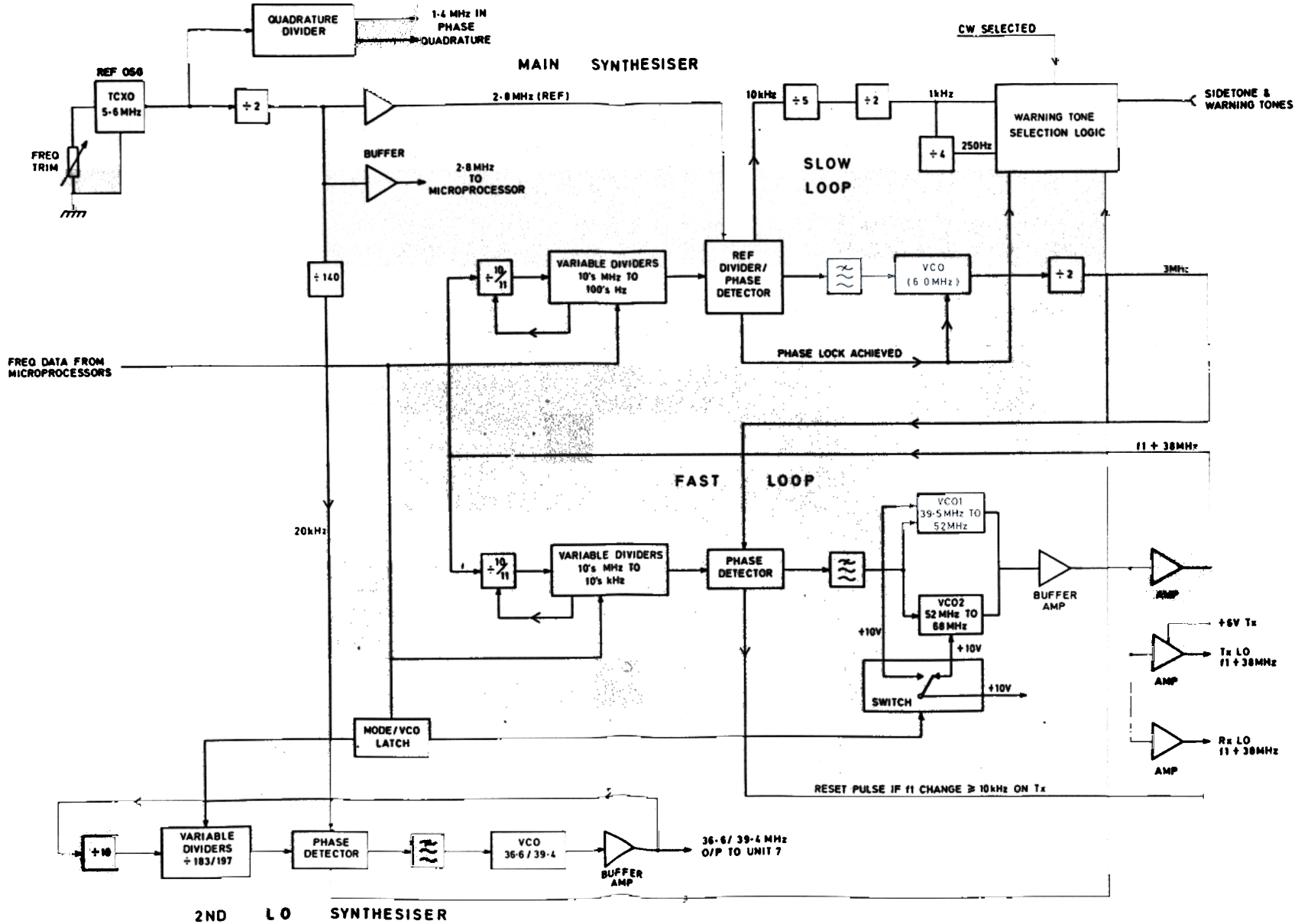


Fig.7 Synthesiser : functional block diagram

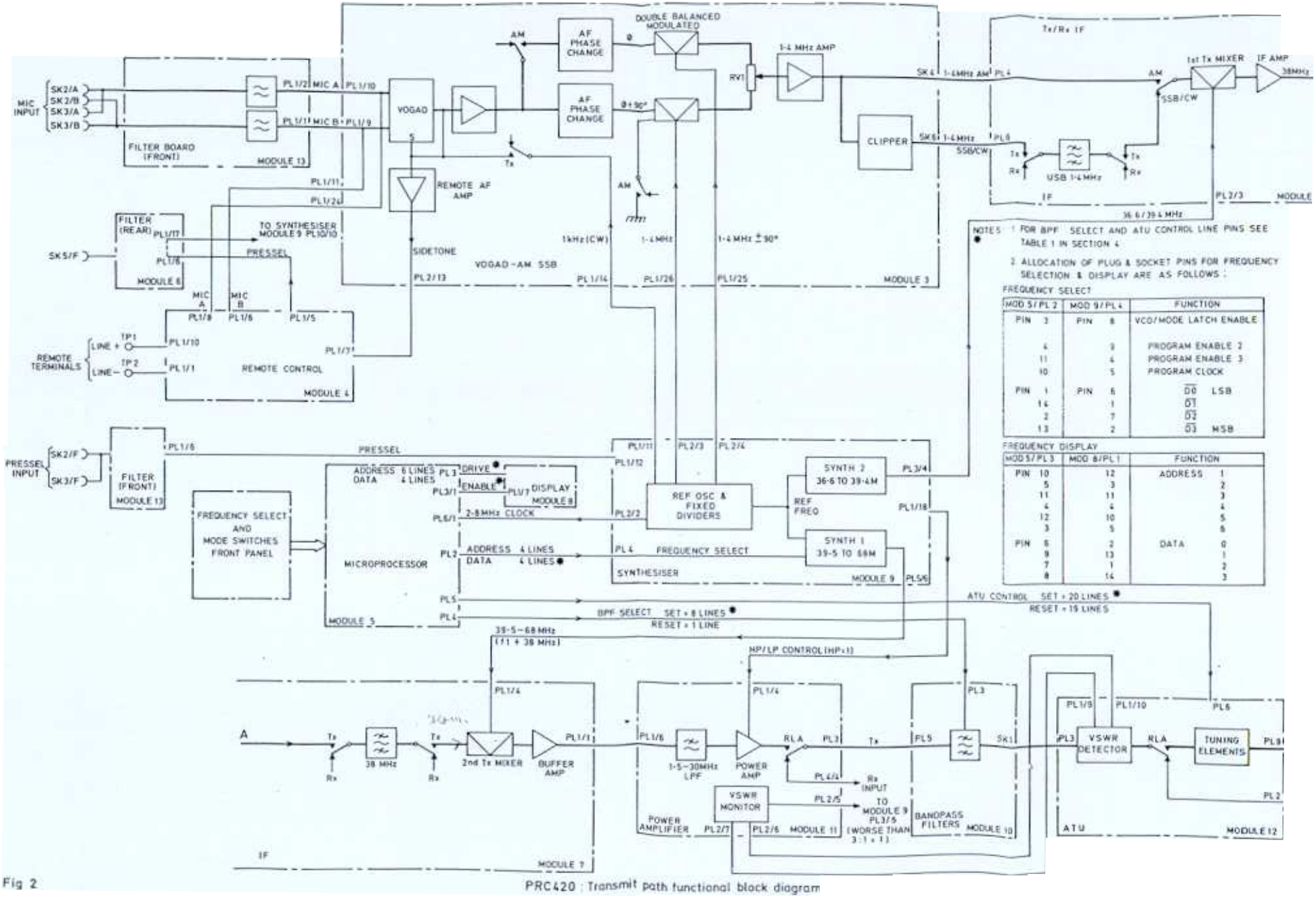


Fig 2 PRC420 : Transmit path functional block diagram

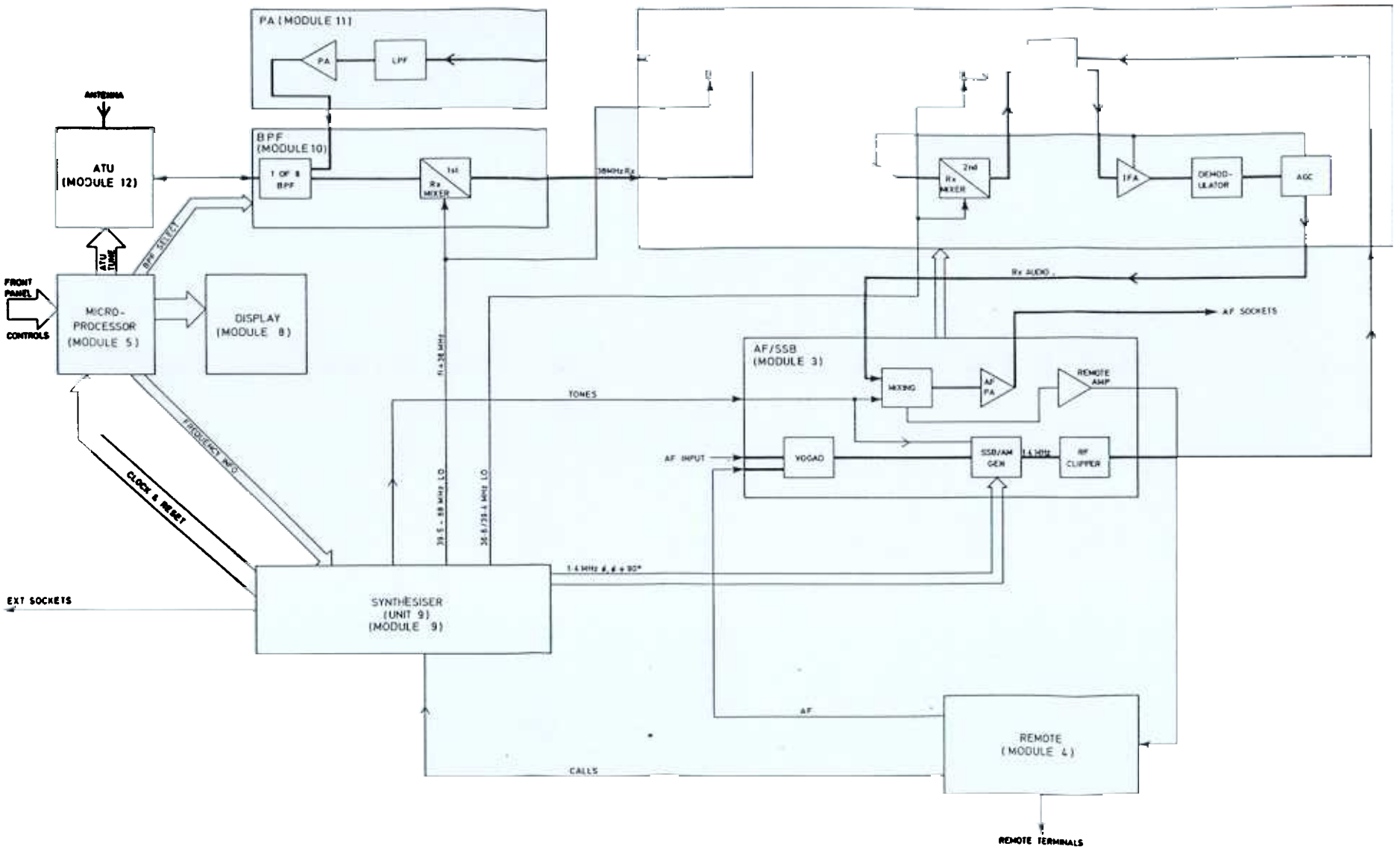


Fig 2 PRC 420 HF transceiver - simplified functional block diagram

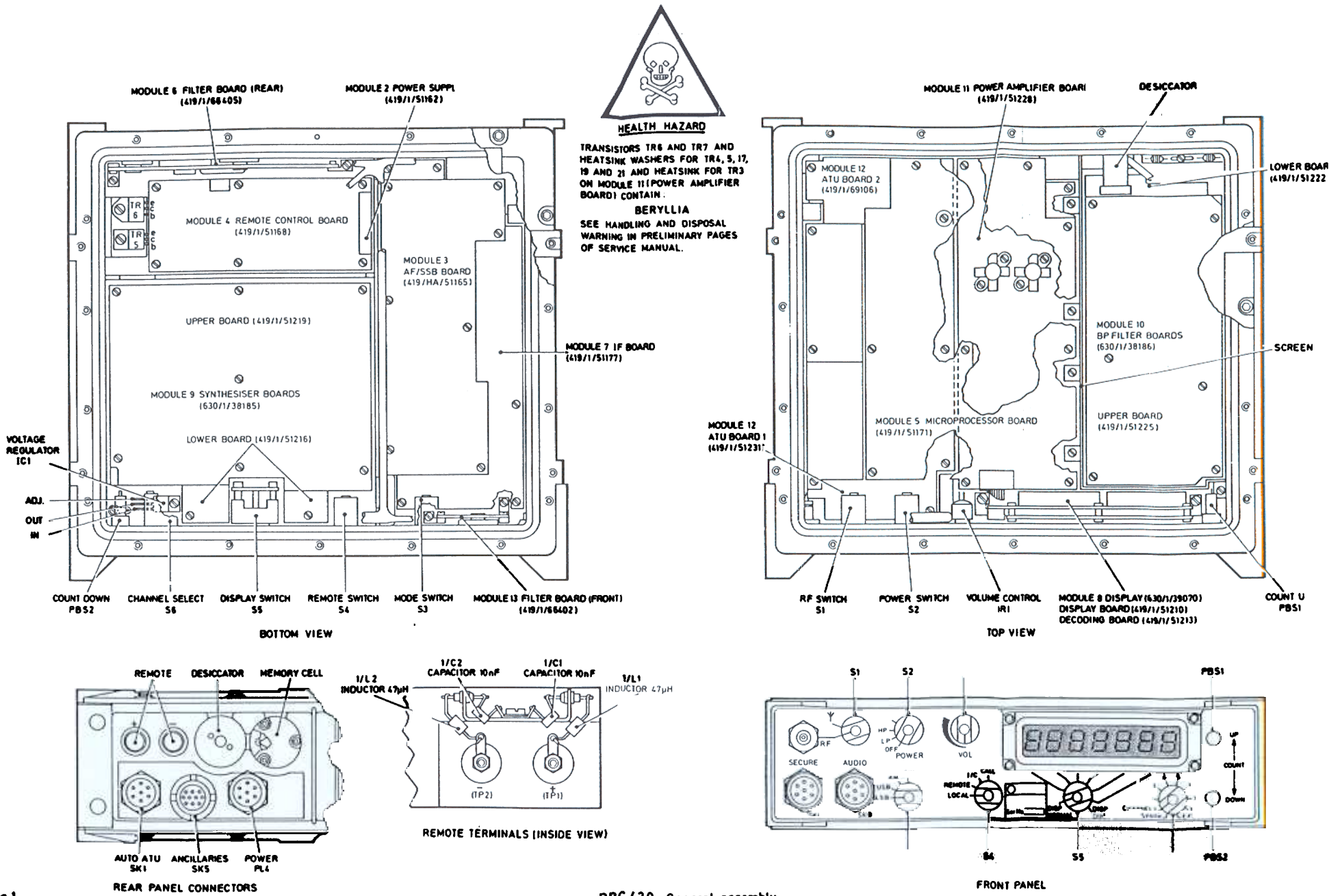


Fig.1 PRC 420 General assembly