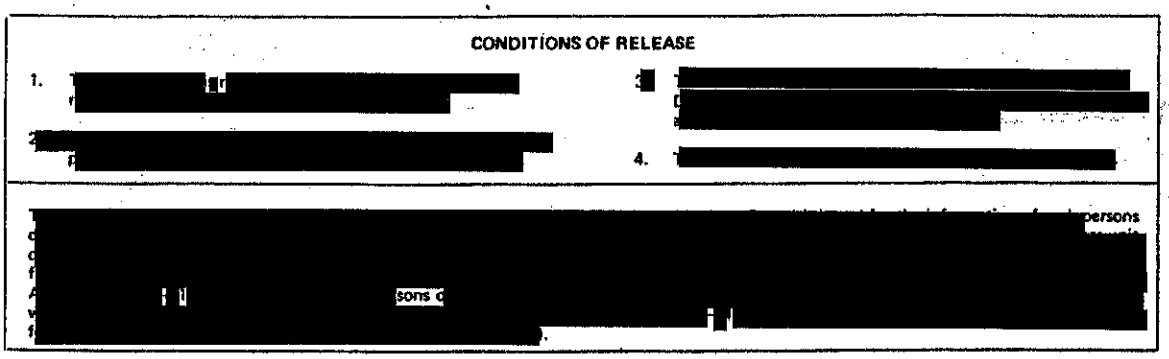


UK/PRC - 349

TECHNICAL HANDBOOK - TECHNICAL DESCRIPTION

Errata

Note...

This Page 0 is to be filed immediately in front of Page 1, Issue 2, dated Sep 78.

1 The following amendments must be made to the regulation.

2 Page 1001 Item 6 under 'Catalogue No.'

Delete: 5820-99-643-8736
Insert: 5330-99-643-8736

3 Page 1003 Item 29 under 'Catalogue No.'

Delete: 5330-99-649-2245
Insert: 5330-99-649-2445

4 Page 1005 Item 59 under 'Catalogue No.'

Delete: 5995-99-643-8723
Insert: 5820-99-643-8723

UK/PRC-349

TECHNICAL HANDBOOK - TECHNICAL DESCRIPTION

Note: These Pages 1-6 supersede Pages 1-6 Issue 1. Items marked ● have been amended.

CONTENTS

DETAILED DESCRIPTION

CIRCUIT DESCRIPTION

ACCESSORIES

ANCILLARIES

Note...

These Pages 3 and 4 supersede Pages 3 and 4, Issue 2, dated Sep 78. Page numbers of Figs 2008 to 2010 have changed.

TABLES

FIGURES

INTRODUCTION

WARNING

1. Assembly 4 in this equipment uses a component containing beryllium oxide. In certain circumstances, this can constitute a hazard to health. Before working on the equipment, consult Mgmt S 261 - Beryllium Toxic Hazard in Electronic Equipments - which gives general information, handling and disposal instructions.

GENERAL

2. The technical description of the RT-349 in this category is covered at three levels viz. brief description, detailed functional description and circuit description; however, the circuit description is for the synthesizer assembly only and is included in order to provide the required deeper understanding of this assembly when fault-finding (para 12).

3. The principle of operation of the RT-349 radio is similar to that of the RT-350 which forms part of the UK/PRC-350 radio station (Tels F 572).

ROLE AND PURPOSE

4. The UK/PRC-349 station is one of the Clansman range of radio equipments; it includes an RT-349 lightweight v.h.f./f.m. transmitter-receiver with a 12-volt primary battery, 0.5m whip antenna, sectional 1.0m whip antenna, audio gear and a carrying holster (para. 122).

5. The station is intended for use by infantry at section and platoon level. The mode of operation is narrow-band f.m., and the radio provides 400 channels (25kHz spacing) of voice communication in the frequency range 37 to 46.975MHz. Also incorporated is a battery-saving facility which functions in the 'receive' (listening out) state. Although it cannot be used as a rebroadcast station, it can initiate rebroadcast on the following stations; UK/PRC-351 and 352, and UK/VRC-353.

MAIN PARAMETERS

Operational parameters

6.	Frequency range:	37.000 - 46.975MHz.
	Channel spacing:	25kHz.
	Number of channels:	400.
	Mode of operation:	F3 (narrow-band simplex f.m.).
	Temperature Operational:	-20°C to +55°C plus temperature rise due to solar radiation.
	Storage:	-40°C to +55°C plus temperature rise due to solar radiation.
	Altitude:	May be used and stored at altitudes up to 3,048m (10,000 ft).

Humidity	
Operational:	95-100% with temperatures normally not exceeding 30°C.
Storage:	Suitable for long storage under humid tropical conditions without any special packing other than trade pack.
Air transportability:	May be carried unpressurized at altitudes up to 7,620 m (25,000 ft) and dropped by parachute using appropriate equipment.
Performance:	Using the battle antenna (0.5 m whip), typical range is 1 to 2 km dependent on siting and terrain. Using the sectional antenna (1.0 m whip), typical range is 1.5 to 3 km dependent on siting and terrain.

Physical parameters

7.	Weight	Height	Width	Depth
RT-349 (including battery)	1.4 kg (3.09 lb)	246 mm	91 mm	41 mm
Battery	0.35 kg (0.77 lb)	62 mm	91 mm	41 mm

Electrical parameters

8. Receiver (approximate values at room temperature with a nominal 12V supply using the antenna adaptor)

Sensitivity:	14dB (S+N)/N for 2μV e.m.f. input.
Limiting:	1.5dB change over 2μV e.m.f. to 100mV e.m.f. input.
Squelch sensitivity:	2dB quieting level - squelch open. 9dB quieting level - squelch closed.
A.F. power output	
Loud:	1mW into 300Ω for 1mV e.m.f. input.
Whisper:	Approximately 20dB below 'loud' level.
Low battery warning:	Operates at 9.6V.
Battery saving period and delay:	Starts 13 seconds after transmitting. Switches every 1.6 seconds.
Current consumption:	Receive - 65mA Battery saving - 6.5mA

9. Transmitter (approximate values at room temperature with a nominal 12V supply using the antenna adaptor).

Power output:	220mW into 50Ω.
Accuracy of radiated carrier:	±500Hz of selected frequency.
Squelch tone:	150Hz. ±1.9kHz deviation.
Modulation sensitivity	
Loud:	0.8mV p.d. input for ±3.5kHz deviation.
Whisper:	0.2mV p.d. input for ±3.5kHz deviation.
Modulation control:	±6.5kHz for 20mV p.d. input.
Sidetone:	0.3mW into 300Ω.
Current consumption:	140mA

Power supply parameters

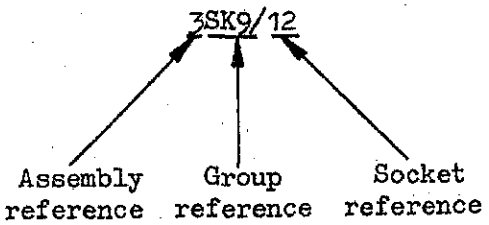
10. Primary battery

Type:	Manganese alkaline, 12V.
Life:	20 hours at 20°C and a transmit/receive/standby cycle of 1:1:9.
Voltage range:	9.5 to 16V.

SYMBOLS AND ABBREVIATIONS

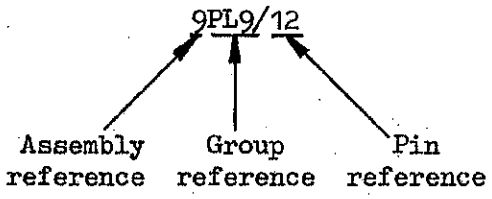
11. It should be noted that the 'assembly reference', in the following designations, will be encircled where it appears on illustrations (eg block diagrams, layouts) but not so in the text.

a. Designations of sockets or test points are derived as follows:



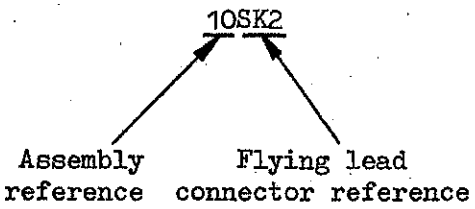
Thus, in this example, the socket referred to is on the motherboard, assembly 3; the group of sockets are those associated with assembly 9, and the socket number is 12.

b. Designations of pins are derived as follows:

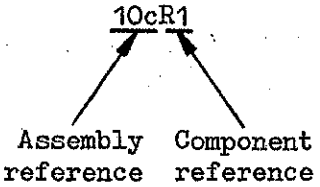


Thus, in this example, the pin referred to is on assembly 9, the group of pins are those associated with assembly 9, and the pin number is 12.

c. Synthesizer flying lead connectors are identified as follows:



d. Designations of components are derived as follows:



Thus, in this example, the component reference is R1, and it is to be found on sub assembly 10c.

e. The titles of all assemblies have an abbreviated form which is given in Table 2.

f. The following abbreviations (Table 1) are also used in this category; the addition of a bar over an abbreviation eg $\overline{N}$ indicates the inverse of that term.

Table 1 - Abbreviated expressions

Abbreviation	Expression
T_W	Transmitter working
L_K	Synthesizer locked
M	Mute audio
S	Signal received
N	Noise-on selected
L_B	Low battery
L	Loud
S_T	Sidetone

Table 1 (continued)

Abbreviation	Expression
V_T	Tuning voltage
F_C	Synthesizer comparison frequency
B_S	Battery saving
T	Transmit mode
W	Whisper

REPAIR POLICY

12. The repair policy is based on the agreed repair chart Tels F 606 which states the following:

a. Unit repairs: No repairs or servicing will take place within the sealed RT-349. The headset will be repaired by replacement of detailed faulty parts. The repair policy for the remaining accessories is by replacement of CES items under normal CES exchange procedures.

b. Field repairs: Repair of the RT-349 will be by adjustment and by replacement of faulty assemblies except for the box assembly and synthesizer where repair is by replacement of faulty sub-assemblies and mechanical parts.

c. Base repairs: As at field level. (It is not envisaged that there will be any Base overhaul to this equipment).

TESTING FACILITIES

Test rig, electronic (t.r.e.)

13. The test rig, electronic, consisting of a test-controller and peripheral test equipment, is used primarily for specification testing and alignment; however, when used in conjunction with the RT-349 field repair test kit (f.r.t.k., para 15), it can be used for fault-diagnosis. It is fully described in Tels M 380-389.

Automatic test equipment, radio, field repair (a.t.e.)

14. This equipment is designed for testing radio sets in the Clansman/ Larkspur range; it is fully described in Tels M 390-399. It is controlled by pre-punched 8-hole tapes which determine the programmed test procedures; provision is also made for operating under direct manual control. Measured test values are compared with specified limits, and the result provided in either of the following forms:

(a) GO or NO-GO indication in print-out form.

(b) Serviceability indicators displaying one of the following: HIGH, LOW, PASS, FAIL.

RT-349 field repair test kit (f.r.t.k.)

15. When carrying out alignment, fault diagnosis or repairs, the motherboard with all assemblies can be removed from the box assembly and fitted into a motherboard test jig, which, together with a number of accessories, forms the field repair test kit (f.r.t.k.). The accessories include the following items:

a. extractor tool for assemblies.

b. 50Ω, BNC antenna adaptor.

c. various power leads

d. trimming tools

e. items for synthesizer testing, repair and replacement.

CONSTRUCTION

GENERAL

(Fig 1)

16. The radio is housed in a hermetically sealed rectangular cast aluminium-alloy box, the base section of which is recessed to take a battery. On one face of the radio, a removeable lid - secured with ten screws - gives access to the interior of the radio. The mating face of the box is machined, and a sealing gasket is fitted. The interior consists of six screened assemblies which plug into a motherboard assembly, and one screened assembly which is screwed to the motherboard; all circuit functions are contained within these seven assemblies. The motherboard assembly is screwed to the box. A sachet type desiccator is placed within the box.

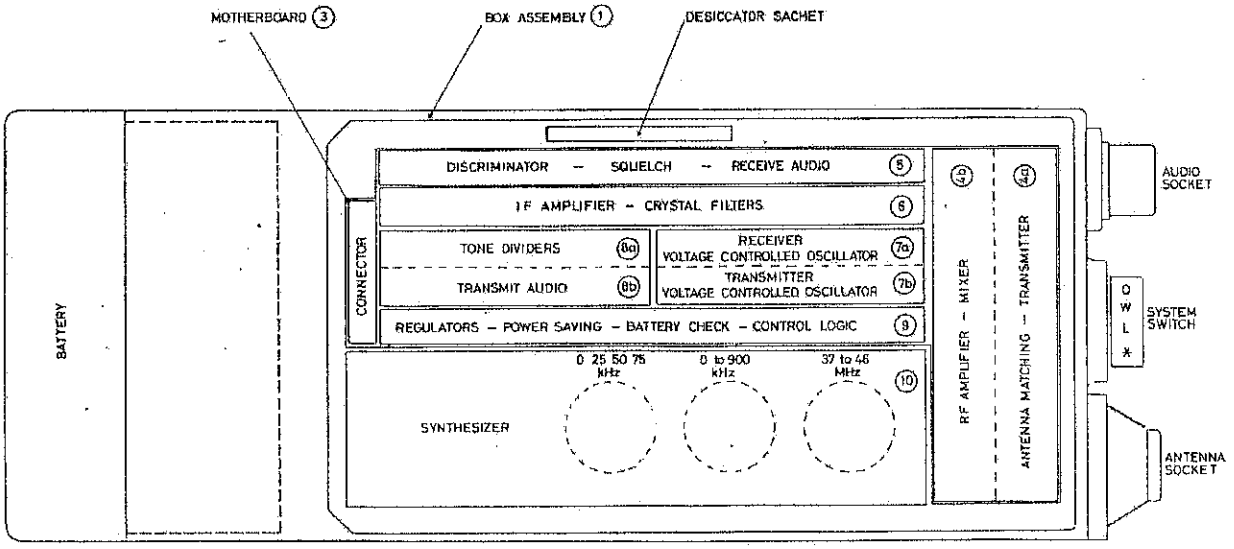


Fig 1 - Location of assemblies

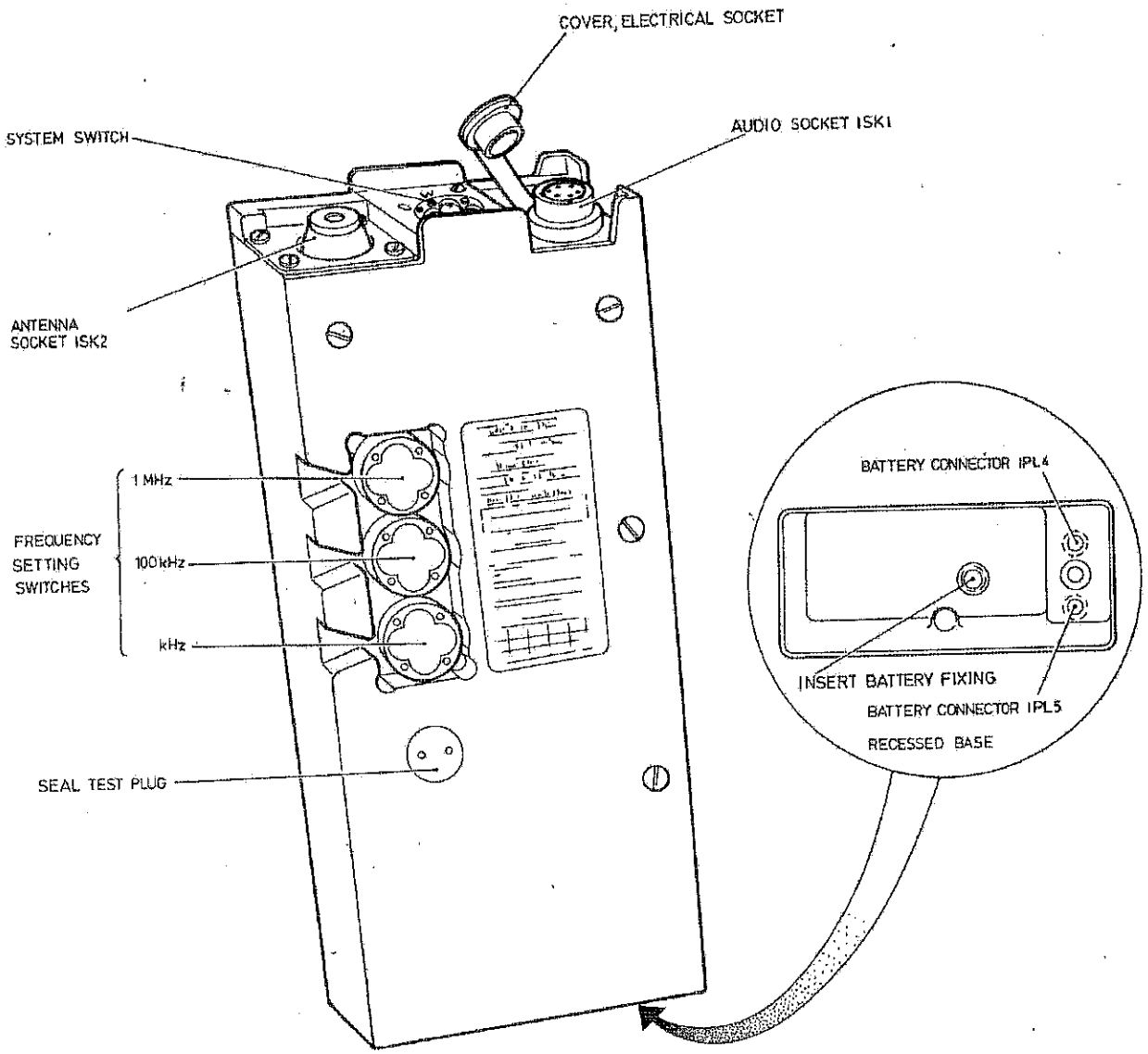


Fig 2 - Controls and connectors

BATTERY

(Fig 2)

17. The recessed base contains the battery connectors 1PL4 and 1PL5 and an off-centre tapped pillar. The battery pack fits into the recess, mating automatically with the connectors, and is secured by a single screw which engages in the tapped pillar.

MOTHERBOARD ASSEMBLY

(Fig 1)

18. The motherboard is a double-sided plated-through printed-circuit board fitted with six groups of sockets into which are plugged assemblies 4,5,6,7 8 and 9 (Table 2). Assembly 10 is screwed to the motherboard by five 2.5 mm pan-head screws, and connections are made by flying leads and clips which engage with the appropriate motherboard sockets.

19. Assemblies 5, 6 and 9 each consist of a single printed-circuit board fitted into a screening can; assemblies 4, 7 and 8 each consist of two printed-circuit boards within a screening can. The two boards in assembly 7 are physically and electrically connected to a third 'daughter' board. Assembly 10 consists of two printed-circuit boards mounted onto the rear of the frequency setting switch-assembly, the whole being contained in a screening can secured with three screws.

20. The complete motherboard assembly is secured in the box with four 3 mm pan-head screws and four 3 mm socket-head screws with Dowty sealing washers. The frequency setting switches mate with their respective knobs and spindles. Connection to the box assembly is via a cableform and polarised connector whic plugs into the motherboard.

CONTROLS

(Fig 2)

21. The front face of the box carries the three frequency setting switch knobs (secured to the box casting by circlips) and a sealing test plug. On the top face of the box are the antenna socket 1SK2, the system switch knob and the audio socket 1SK1 together with its printed-circuit panel assembly inside the box. The system switch carries the protection link which safeguards against reverse-polarity input supply connection. 'O' ring seals are fitted to the control shafts and around the connectors.

Table 2 - RT-349 assemblies

Assembly	Designation	Abbrev:	Principle circuits/items contained in assembly
1	Box assembly	-	Box casting, battery connectors, antenna socket, audio socket, system switch and wiring harness, frequency setting switch and system switch knobs.

Table 2 (cont'd)

Assembly	Designation	Abbrev:	Printed circuits/items contained in assembly
3	Motherboard	-	Motherboard only.
4	Transmitter, antenna matching and r.f. head	TXR AEM RFH	4a: Driver, control, p.a. and antenna matching. 4b: PIN diode switch, r.f. amplifier, filter and mixer.
5	Discriminator, receive audio amplifier and squelch	DIS RXA SQU	Discriminator, squelch, receiver audio amplifier, and loud/whisper facility.
6	I.F. amplifier	IFA	I.F. amplifiers, crystal filters and limiters.
7	Receiver and transmitter oscillators	RXO TXO	7a: Receiver oscillator 7b: Transmitter oscillator 7c: Tuning line filter
8	Frequency dividers and transmitter audio amplifier	DIV TXA	8a: Frequency dividers and 'call' facility 8b: Transmitter audio amplifier, and loud/whisper facility.
9	Regulator, d.c. switching and logic	REG DCS LOG	Regulators (9V), Tx/Rx switching, mute logic, battery saving and low-battery warning.
10	Synthesizer	SYN	10a: Receiver and transmitter crystal oscillators, mixer wideband amplifier, 1st prescaler, lock-timer and stabilizer. 10b: L.S.I. control unit, crystal reference oscillator, reference divider, rate multiplier and loop filter. 10c: frequency-setting switches.

BRIEF DESCRIPTION

GENERAL

(Fig 3)

22. The RT-349 comprises a single superheterodyne receiver and a transmitter. The local-oscillator frequency is controlled by a closed-loop synthesizer, tuning being effected by means of three frequency-setting switches; the synthesizer provides the tuning voltages for the varactor diode-controlled receiver and transmitter 'slave' oscillators. Fig 3 shows the basic configuration of the radio in block form.

RECEIVER

23. The received r.f. signal is applied, via the band-pass filter in the antenna matching stage and the Tx/Rx PIN diode switch, to the wideband r.f. amplifier. After amplification, the signal is mixed with the receiver oscillator signal to produce the 21.4MHz i.f. which is then applied to the i.f. amplifier assembly; this assembly also includes two crystal filters and limiters. The i.f. output is processed by a discriminator, and the resultant a.f. signal is passed to the receiver audio amplifier and to the squelch circuits; the gain of the audio amplifier is set by the loud/whisper control level derived from the system switch.

24. The squelch separates the 150Hz tone-modulation from the a.f. signal, and lifts an inhibit ('mute') condition from the final audio stage, allowing the amplified a.f. signal to be fed to the audio gear via the audio socket. If the synthesizer is not locked due to a fault condition, the receiver audio output is muted. With the system switch set to *(noise-on), the squelch is inoperative, permitting non-tone modulated signals to be received.

FREQUENCY CONTROL

25. The frequency control loop consists of the synthesizer and the receiver or transmitter voltage-controlled 'slave' oscillator (receive or transmit mode).

26. In the transmit mode, the tx slave oscillator tunes the basic radio frequency range. In the receive mode, an i.f. 'sidestep' of 21.4MHz is introduced. The r.f. output from the relevant slave oscillator is fed to a mixer, the other input of which is from one of two crystal-controlled oscillators. The mixer r.f. output is divided (by 8) in the prescaler and is then compared, via the variable dividers, with the divided 3.2MHz reference oscillator frequency in the l.s.i. control unit. Two d.c. voltages from the synthesizer (V_T 'coarse' and V_T 'fine') are used to control the varactor tuning diodes in the slave oscillators.

27. The comparison frequency (3.125kHz) is also taken as an output from the synthesizer and is used to produce the squelch tone by division in assembly 8. The synthesizer generates a 'lock' signal when the loop is locked.

TRANSMITTER

28. Microphone signals are applied to the transmit audio amplifier, the first stage of which is controlled by the loud/whisper control level from the system switch, and the second stage by an automatic gain control (a.g.c.). The output from the audio amplifier is added to the 150Hz squelch pilot tone. The audio amplifier output is also routed as sidetone to the receiver audio amplifier.

29. The audio signal with squelch tone is used to modulate the transmitter slave oscillator and the resultant r.f. signal is applied to the wideband power amplifier via a driver stage. The output from the p.a. stage is routed to the antenna socket via the antenna matching circuit.

CONTROL SWITCHING

30. The controls available to the operator are:

a. System switch.

b. Frequency setting switches.

31. Selection of receive or transmit mode is achieved by use of the pressel switch included in the audio gear.

32. All d.c. switching of supplies and logic switching within the radio is by transistor or diode switches.

SYSTEM SWITCHING

33. The system switch is a four-position switch providing the following functions:

a. O (Off):	Battery input disconnected except from reverse-polarity protection.
b. W (Whisper):	Battery input connected. Earphone output attenuated by approximately 20dB relative to the L position. Microphone sensitivity increased by approximately 10dB relative to the L position.
c. L (Loud):	Battery input connected. Earphone and microphone audio levels normal.
d. *(Noise-on):	Battery input connected. Earphone and microphone audio levels as loud. Squelch inoperative (receive audio not muted in absence of incoming signal) and battery-saving inoperative.

e. When switched to W or L, with the radio in the receive mode, the battery-saving circuit operates (para 37).

FREQUENCY SETTING SWITCHING

34. The three frequency setting switches provide digital information to the synthesizer and give selection of 400 channels in multiples of 25kHz in the frequency range 37.000 to 46.975MHz, as follows:

a. MHz switch:	sets 1MHz steps from 37 to 46MHz.
b. 100kHz switch:	sets 100kHz steps from 0 to 900kHz.
c. kHz switch:	sets 25kHz steps from 0 to 75kHz.

POWER SUPPLIES

35. Power is obtained from a 12V nominal primary battery. The various internal d.c. supplies (except for the transmitter, assembly 4a, which is powered direct from the battery) are obtained from two 9-volt regulators, the outputs from which are applied to the various assemblies.

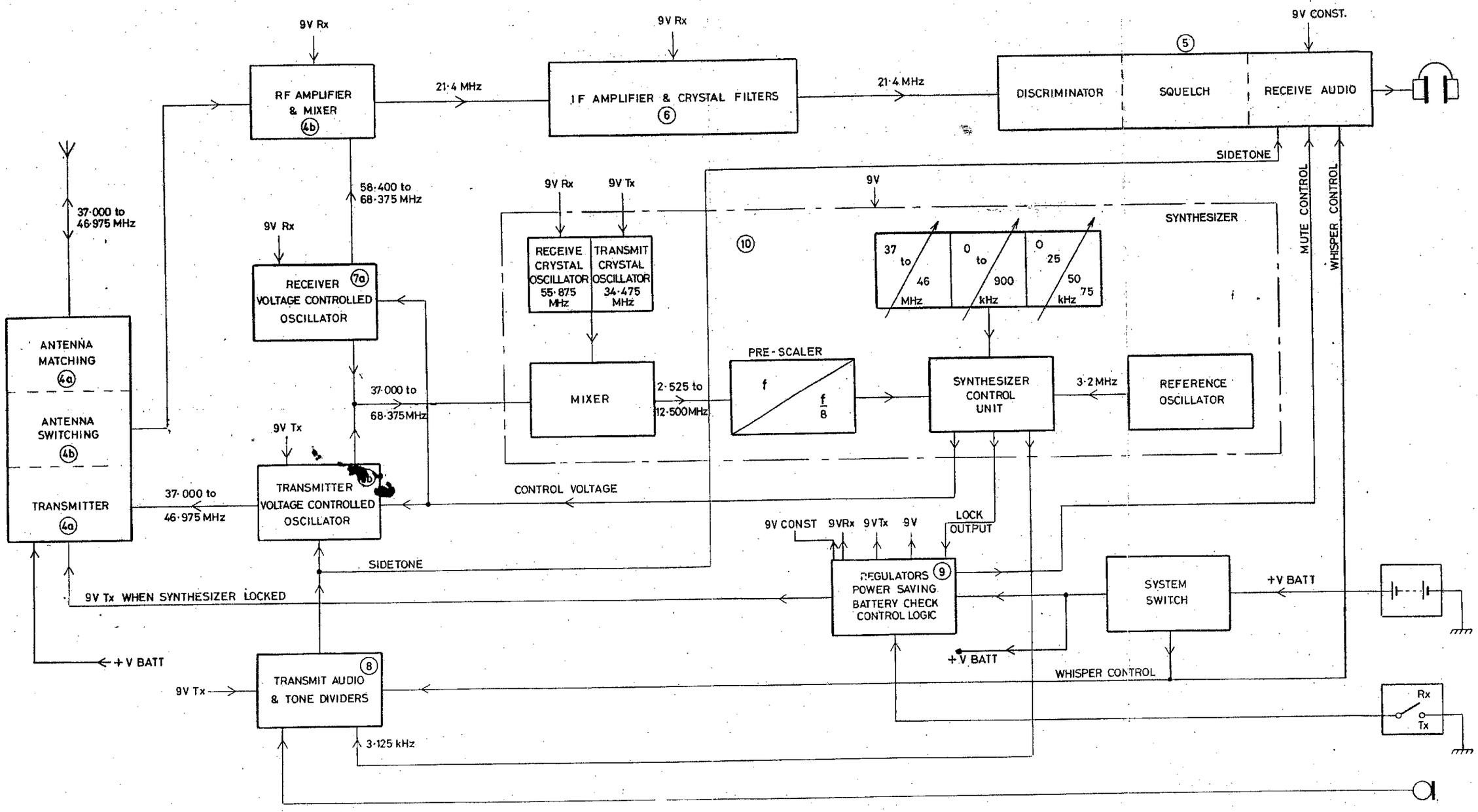


Fig 3 - RT-349, block diagram

Note: These Pages 17-18 supersede Pages 17-18 Issue 1. Items marked • have been amended.

36. The transmit and receive voltages are controlled by the Tx/Rx pressel switch so that basically only the transmit circuits are energized on transmit and only the receive circuits are energized on receive. The synthesizer and receiver audio stages are energized in both the transmit and receive modes.

37. With the system switch set to W or L, and the radio in the receive mode, continuous on/off switching by the battery-saving circuit during 'no-signal' conditions reduces the average receive current to approximately 50% of normal. The normal receive condition is assumed on receipt of an incoming signal and for 15 seconds after cessation of the signal, also for the same period after release of the transmit pressel switch. The battery-saving circuit is inoperative in the noise-on (*) mode.

38. Indication that the battery is reaching the end of its useful 'life' (9.5V nominal) is given in the W and L modes, only, by the low-battery-warning circuit which switches the squelch on and off in the receive mode, thereby muting and de-muting the receive audio stage. The pulsating noise produced ceases when receiving a wanted signal or when transmitting.

39. A reverse-polarity protection diode prevents damage to the radio if the input polarity is reversed (ie when incorrectly connected to an external power supply); the internal fuselink will need to be renewed in this eventuality.

40. Battery voltage is available at pin C of 1SK1 (audio socket) via the short-circuit protection resistor 10cR1 (100Ω).

DETAILED DESCRIPTION

GENERAL

41. The functional diagram (Fig 2001) gives the interconnections between the assemblies within the RT-349, and shows in block-symbol form how each assembly functions. The following assembly descriptions are supported by a series of block diagrams (Fig 4 to 12).

D.C. POWER SUPPLIES AND SWITCHING

General

42. The battery voltage enters at 1PL5 and is routed to the radio via the system switch (para 45). The voltages supplied to the various assemblies are:

a. +V BATT - battery voltage (para 48)

b. 9V CONST - regulated 9 volts (para 49 to 51)

c. 9V - battery saved, regulated 9 volts (para 49 to 51)

d. 9VRx - switched, battery saved, regulated 9 volts (paras 43 and 49 to 51).

e. 9VTx - switched, regulated 9 volts (paras 43 and 49 to 51)

43. The 9VRx or 9VTx supplies are controlled by the Tx/Rx switch in assembly 9 (para 53), depending on the state of the pressel line, and are used to energise the required assemblies in the receive or transmit mode.

44. Secondary logic signals are generated by certain assemblies under specific conditions; the logic levels are shown on Fig 2001, the symbol with a bar indicating the reverse condition (eg L = loud (+V BATT); $\overline{L}$ = whisper (OV)).

System switch

(Fig 4)

45. The battery input to the system switch is via the protective link 1LK1 which is connected to the normally reverse-biased diode 1aD1. If the input supply polarity is accidentally reversed, 1aD1 will be forward-biased and the resultant current will rupture the link.

46. When the system switch is set to any position other than OFF, the radio automatically assumes the receive mode and remains in this condition until the Tx/Rx (pressel) line is switched to transmit (OV).

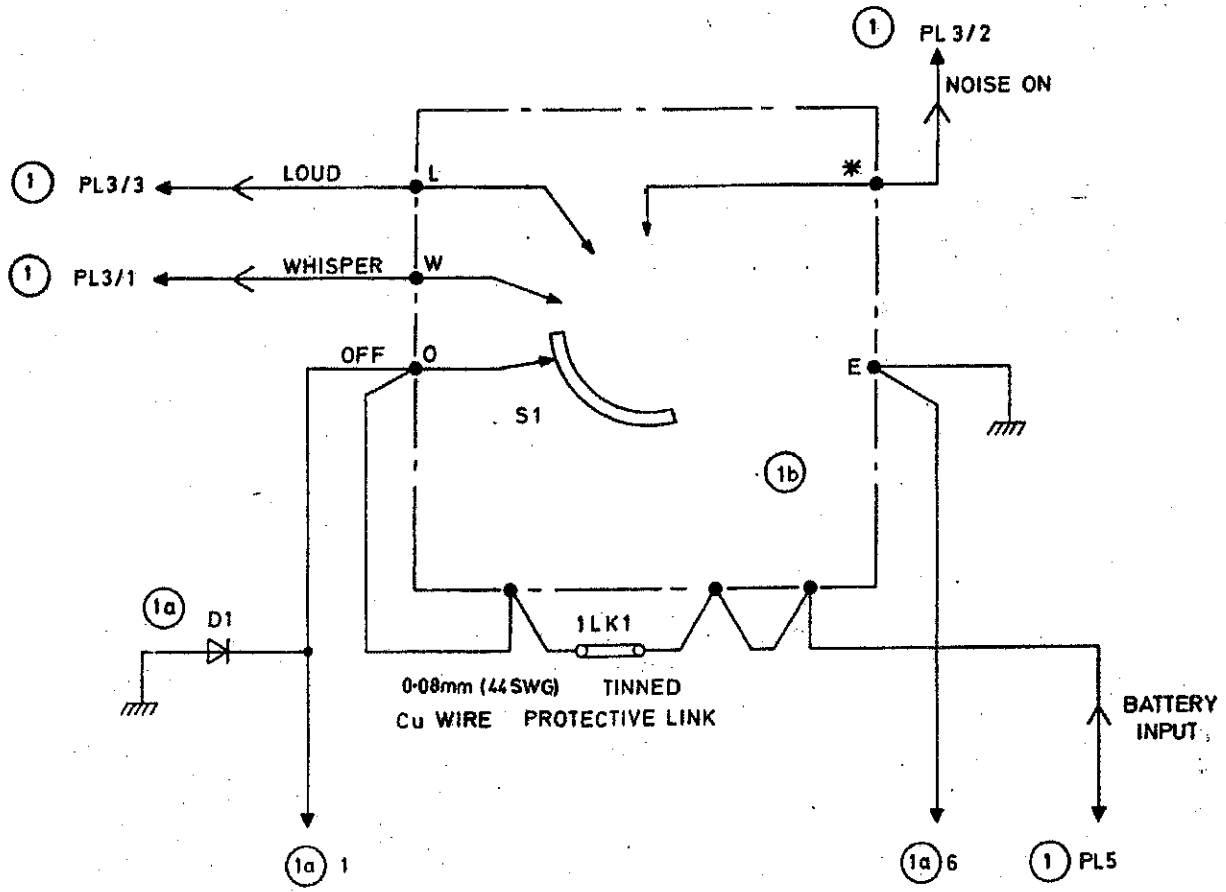


Fig 4 - System switch

47. With the system switch set to L (loud), a logic 1 L signal is routed to the loud/whisper electronic switches in the receive (assembly 5) and transmit (assembly 8b) audio amplifiers and, with the switch set to *(noise-on), a logic 1 N signal is routed to the logic circuits in assembly 9 (para 49).

48. When the system switch is set to W, L or *, the battery voltage (+V BATT) is supplied continuously to the regulator, d.c. switching and logic (assembly 9), the p.a. stage (assembly 4a), and to pin C of the audio socket (1SK1) via a 100Ω (10cR1) protection resistor situated on sub assembly 10c.

Regulator, d.c. switching and logic - assembly 9

(Fig 5)

49. Assembly 9 contains the circuits which provide the four stabilized supplies used by the other assemblies in the radio, together with the mute logic, the Tx/Rx (transmit/receive) switch and the low-battery-warning circuit. Two of the supplies (9V and 9VRx) are cycled on and off to conserve battery life in the loud and whisper modes during 'standby' (whilst no signal is being received or transmitted); this is referred to as 'battery-saving' in the following description.

50. The four supplies provided by the assembly are:

a. 9V CONST

b. 9V

c. 9VRx

d. 9VTx

51. The battery voltage (9.5 to 16V) is applied to the two 9V regulators; the 9V lines are adjusted by a pre-set control. One regulator provides the 9V CONST supply; the other regulator which can be switched by the battery-saving astable stage provides:

a. the 9V supply, and

b. via the Tx/Rx switch, the 9VRx and the 9VTx supplies.

52. The battery-saving astable stage switches on and off at 0.8 s nominal intervals and is inhibited during receive periods when the squelch is open (S - signal received level from assembly 5), during transmit by 9VTx and in the noise-on mode by the N level from the system switch. (Logic equation $Bs = \overline{T} + \overline{S} + \overline{N}$). In order to allow for pauses in conversation, a time delay is introduced to hold the astable stage off for a 13 s nominal period after both the S and 9VTx levels cease. Additionally, application of the OVTx level enables transmission to commence immediately the pressel is operated, thus obviating the 0.8 s delay which could occur during the 'off' state of the battery-saving cycle.

53. The Tx/Rx changeover switch is controlled by the pressel line. When the pressel line is open-circuit (receive), the switch provides the 9VRx output; with the pressel operated (OVTx), the 9VTx voltage is supplied as an output.

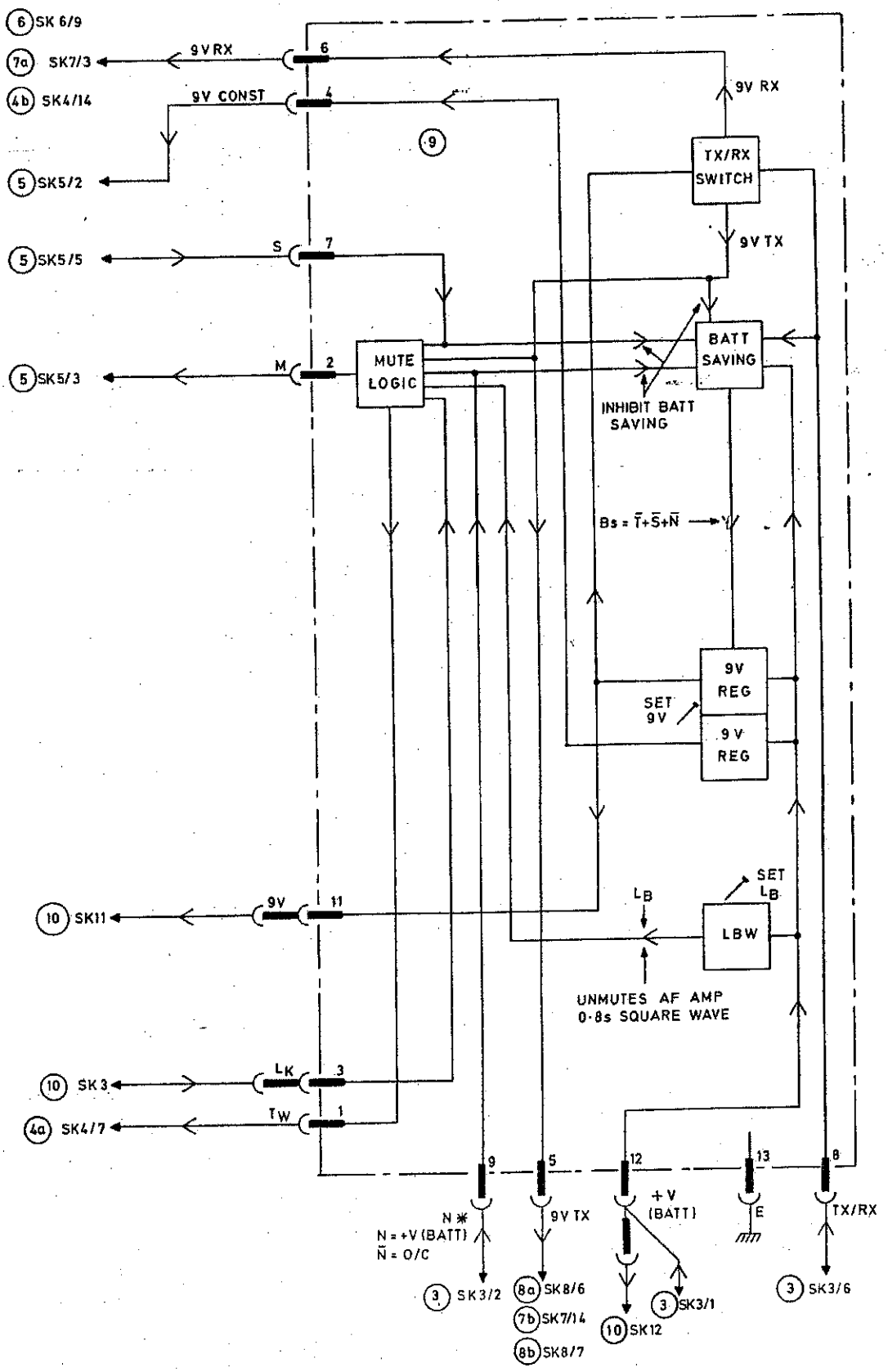


Fig 5 - Regulator, d.c. switching and logic

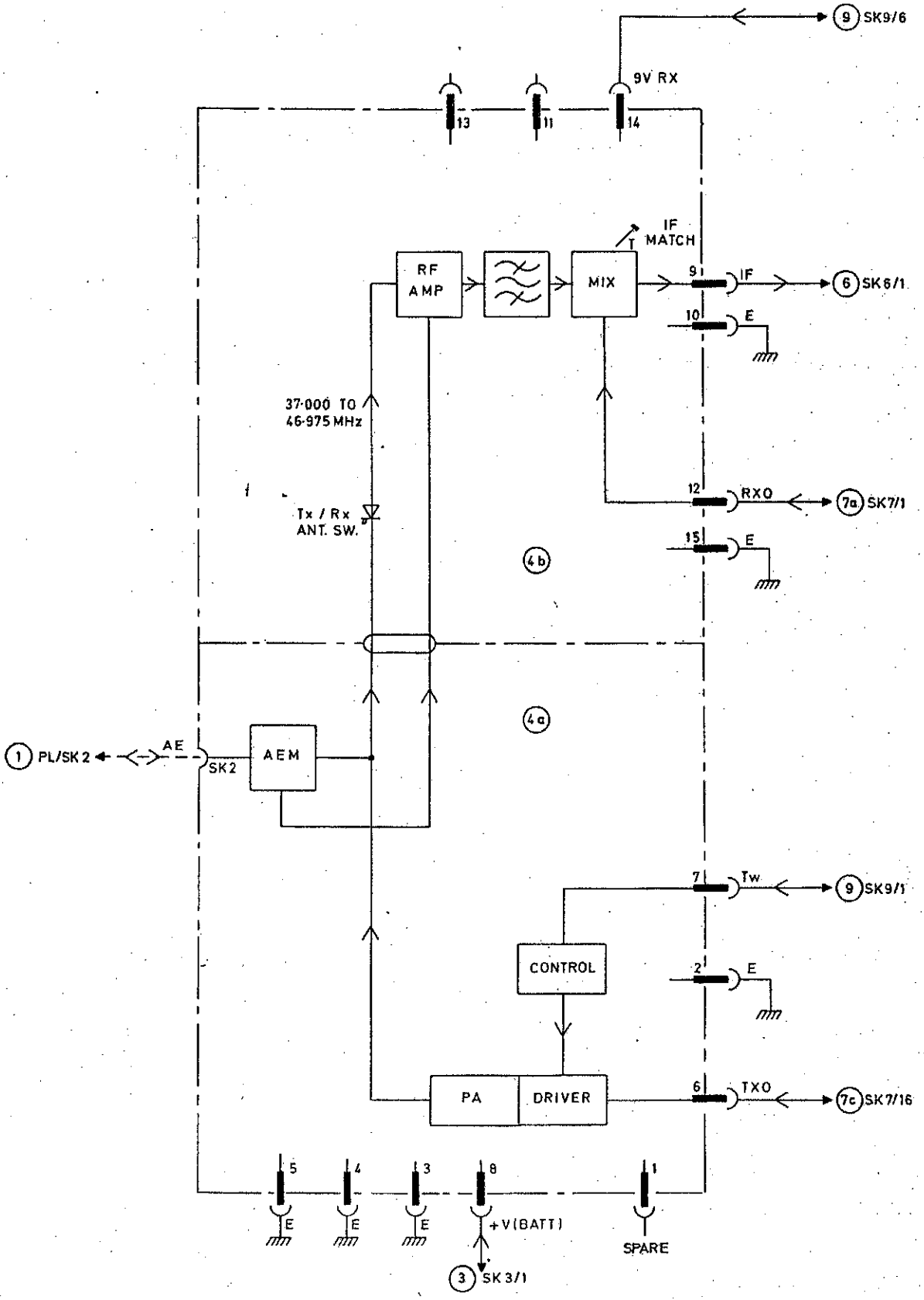


Fig 6 - R.F. head, transmitter and antenna matching

54. The low-battery-warning circuit consists of a voltage-operated switch. When the battery voltage falls to 9.5V (adjustable by a pre-set control), a 9V output is routed to the mute logic (para 56).

55. The logic controls the muting and unmuting of the receiver audio amplifier and also the switching on and off of the transmitter p.a. stage. The 9V unmute signal ($\overline{M}$) will be routed to the audio when the synthesizer is locked (L_k input = OV) and either the noise-on (N), received signal (S) or transmit (9VTx) inputs are present. The audio will be muted (M = OV output) if the synthesizer is unlocked ($\overline{L}_k$ = 0.6V) or if there is no received signal ($\overline{S}$ = OV) and noise-on ($\overline{N}$ = OV) is not selected. (Logic equation $\overline{M} = L_k.S + L_k.N + L_k.T + L_k.L_B$).

56. When the synthesizer is locked (L_k = OV) and the low-battery-warning signal is present (L_B = 9V) (para 54), the audio is unmuted at approximately 0.8s intervals (battery-saving cycle), provided that there is no received signal ($\overline{S}$ = OV).

57. The synthesizer lock input (L_k = OV) and 9VTx together generate the transmitter working (T_W = 9V) output to assembly 4a to switch on the transmitter p.a. stage. (Logic equation $Tw = L_k.T$).

RECEIVER ASSEMBLIES

R.F. head - assembly 4b

(Fig 6)

58. The r.f. head is powered by the 9VRx line (receive mode only). Incoming r.f. signals from the antenna matching circuit (para 96) are applied to the wideband r.f. amplifier via a PIN diode; this is forward-biased by a transistor switch controlled by the 9VRx supply during receive and is open-circuit during transmit, thus isolating the r.f. head during transmission periods.

59. The r.f. amplifier is coupled to the mixer by a band-pass filter (10MHz nominal).

60. The mixer is a single-balanced type and a pre-set control provides adjustment of balance for minimum spurious signal output. Input from the receiver oscillator (assembly 7a) is via a band-pass filter which maintains a constant drive level over the band. The mixer output transformer is tuned to the i.f. and its impedance is matched to the input impedance of the i.f. amplifier.

I.F. amplifier - assembly 6

(Fig 7)

61. The i.f. amplifier is powered by the 9VRx line (receive mode only). The assembly filters, amplifies and limits the frequency-modulated i.f. signal (21.4MHz) obtained from the r.f. head mixer.

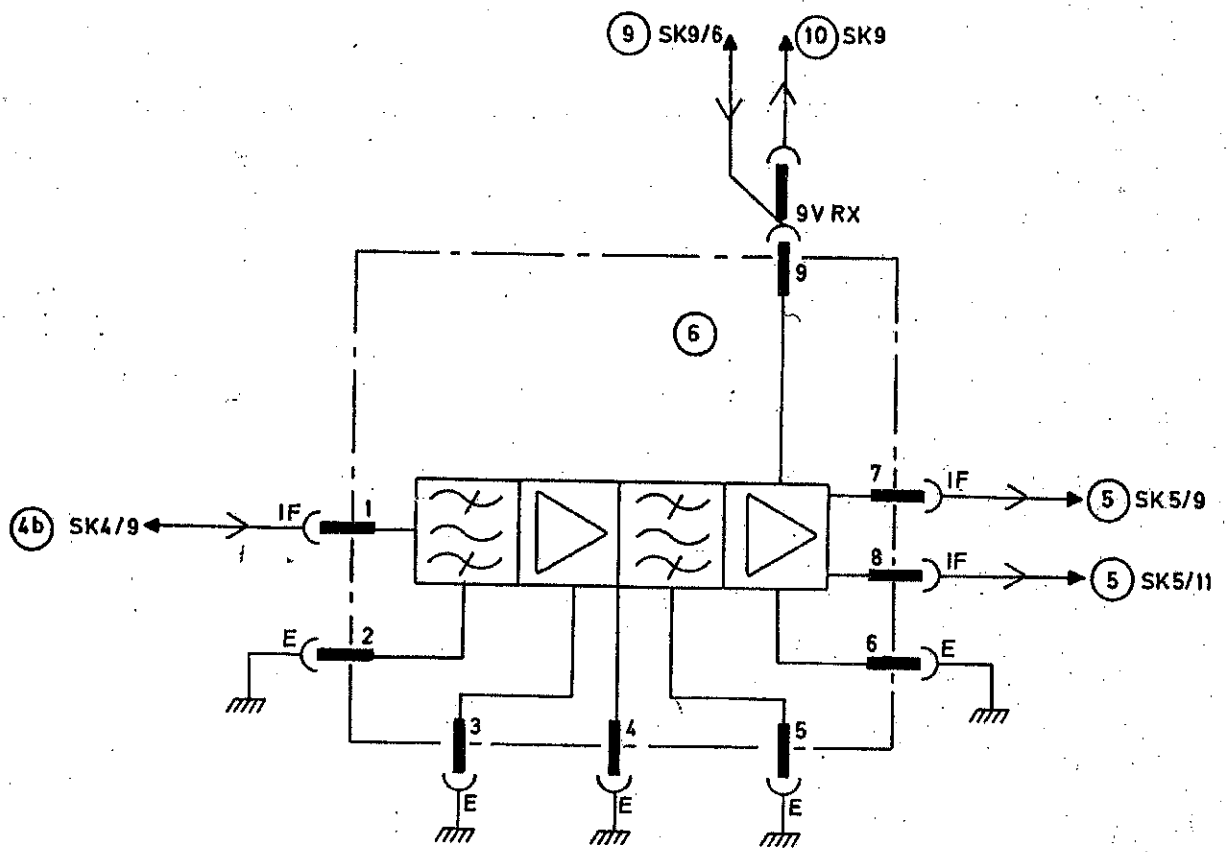


Fig 7 - I.F. amplifier

62. The input is applied to a band-pass filter (±10kHz) followed by two stages of amplification, then to a further band-pass filter (±15kHz) followed by two stages of amplification. The amplifiers are wideband, and each stage limits progressively as the input signal is increased. The assembly provides a balanced output at 21.4MHz for the discriminator in assembly 5.

Discriminator, receiver audio amplifier and squelch - assembly 5

(Fig 8)

63. The assembly is powered by the 9V CONST line (all modes of operation). The input is the balanced 21.4MHz i.f. signal from assembly 6.

64. The discriminator is a phase-locked f.m. detector with a lower threshold than a conventional discriminator; it consists of a phase detector, a voltage-controlled oscillator and a filter. The loop bandwidth is optimised for f.m. 3kHz speech with 5kHz peak deviation. The discriminator output is applied to the receiver audio amplifier and the squelch.

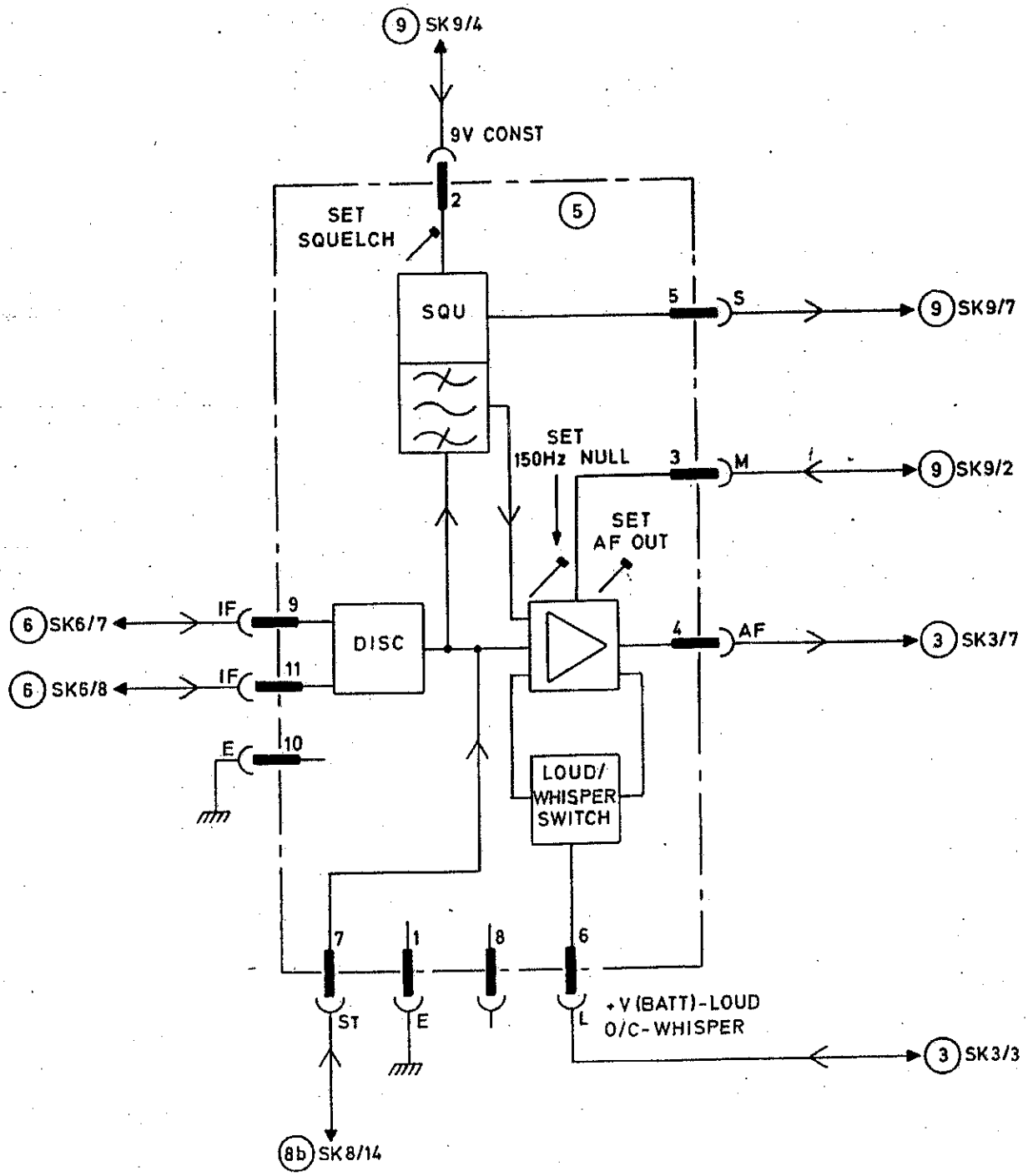


Fig 8 - Discriminator, receiver audio amplifier and squelch

65. The receiver audio amplifier accepts the a.f. output from the discriminator and the transmitter sidetone from the transmit audio amplifier assembly 8b. The loud/whisper function enables the gain of the amplifier to be reduced by approximately 20dB with respect to the loud mode, when the system switch is set to whisper. This control is given by the L (+V BATT) input in the loud mode and the OV (open-circuit) condition in the whisper mode. A mute function inhibits the amplifier whilst the mute signal (M = OV), from the logic in assembly 9, is present. A pre-set control allows the gain of the amplifier to be adjusted so that an audio output level of 1mW is obtained for a fully-modulated received signal.

66. The audio output is routed to the audio gear via pin 7 of SK3/PL3 and pins D and G of 1aSK1.

67. The squelch produces a logic 1 S (9V) output to assembly 9 when a signal of frequency 150Hz and amplitude greater than 3mV appears at the discriminator output. Under all other signal conditions, the squelch output is logic 0 ($\overline{S}$ = OV). The circuit consists of a band-pass filter, a level detector (comparator) and a Schmitt trigger. An appropriate received signal produces an output at the level detector which is then integrated and used to change the state of the Schmitt trigger, the output from which is inverted to be used as the squelch signal.

SYNTHESIZER LOOP

Frequency control

68. The synthesizer, together with the receiver and transmitter 'slave' voltage-controlled oscillators (v.c.o.), forms a closed frequency control loop. Frequency selection is by the frequency setting switches which 'program' the synthesizer. The synthesizer provides the tuning voltages (V_T COARSE and V_T FINE) for control of the varactor diodes in the v.c.o.'s. R.F. output from the v.c.o.'s is fed back to the synthesizer for comparison with a reference oscillator output to provide a frequency-lock condition.

69. Only one v.c.o. is operative for a given mode: in transmit, the Tx oscillator (assembly 7b) is operative and covers the basic frequency range 37.000MHz to 46.975MHz. In the receive mode, the Rx oscillator (assembly 7a) is operative and an i.f. sidestep of 21.4MHz is introduced so that the oscillator covers the range 58.4MHz to 68.375MHz.

70. When the synthesizer loop is locked, a 'lock' output signal (L_k) is routed to the logic in assembly 9

Synthesizer - assembly 10

(Fig 9)

71. The synthesizer is powered by a 9V continuous supply and by the 9VRx or 9VTx supplies (see para 73). An internal regulator provides a 6V stabilized line to certain of the internal circuits.

72. The assembly consists of transmitter and receiver crystal oscillators, a double balanced mixer and amplifier, a first prescaler, a voltage stabilizer, a l.s.i. (large-scale integration) control module, the frequency setting switches, a reference oscillator, a reference-frequency divider for the step-voltage generator, a rate multiplier, a loop filter and a lock output timer monostable.

73. The mixer accepts two inputs, the r.f. signal from the relevant v.c.o. (receive or transmit) and the signal from one of two crystal oscillators; in the receive mode, the 55.875MHz oscillator is energized by the 9VRx supply and in the transmit mode the 34.475MHz oscillator is energized by the 9VTx supply. The frequency range, after mixing, is 2.525MHz to 12.500MHz for both the Rx and Tx modes.

74. The mixer r.f. output is filtered, amplified and then divided by 4 in the first prescaler, the resultant frequency (0.63125 to 3.125MHz) being applied as an input to the l.s.i. module.

75. The l.s.i. module consists of a second prescaler, a programmable divider, a phase and frequency discriminator and a reference divider. The frequency from the first prescaler is divided by 2 in the second prescaler and the resultant frequency, 0.315625 to 1.5625MHz, is applied to the programmable divider. The division ratio is programmed by the frequency setting switches. The switches either short-circuit to earth (OV) or leave the lines to the programmable divider open-circuit, depending on the required code for a given frequency setting.

76. The 3.125kHz output from the programmable divider is applied to the phase and frequency discriminator, where it is compared with a stable frequency of 3.125kHz derived from the 3.2MHz reference oscillator and the reference divider. The output frequency from the programmable divider and the comparison frequency must be identical in order to obtain lock, the two differing only in phase.

77. By comparing the two signals, the phase discriminator produces phase pulses at its output which are integrated in the loop filter to give a direct voltage which varies according to the width of the phase pulse. This voltage (V_T FINE) controls, within a 1MHz band, the varactor diode of the associated v.c.o. The 3.125kHz phase pulse repetition frequency (equal to the comparison frequency) is also routed to the associated frequency dividers in assembly 8a.

78. The reference oscillator output frequency is also divided by 4 to give an 800kHz clock input to the rate multiplier which gates one or more clock pulses through to its output. The number of pulses passed is controlled by the MHz switch. The pulses are integrated in an RC filter to give a stepped d.c. voltage, V_T COARSE, varying in discrete steps with each 1MHz digit change. V_T COARSE therefore presets, in 1MHz steps, the frequency ranges covered by the v.c.o.

79. Whilst the synthesizer is locking, pulses are produced by the frequency discriminator which operates the lock timer (pulse-shaping monostable). The monostable output pulses are of 200ms nominal duration and are routed to the mute logic contained in assembly 9. When the synthesizer is in lock, the output from the monostable (L_k) is OV.

Receiver oscillator and tuning line filter - assembly 7a and 7c

(Fig 10)

80. The receiver oscillator (assembly 7a) is powered by the 9RVx supply (receive mode only).

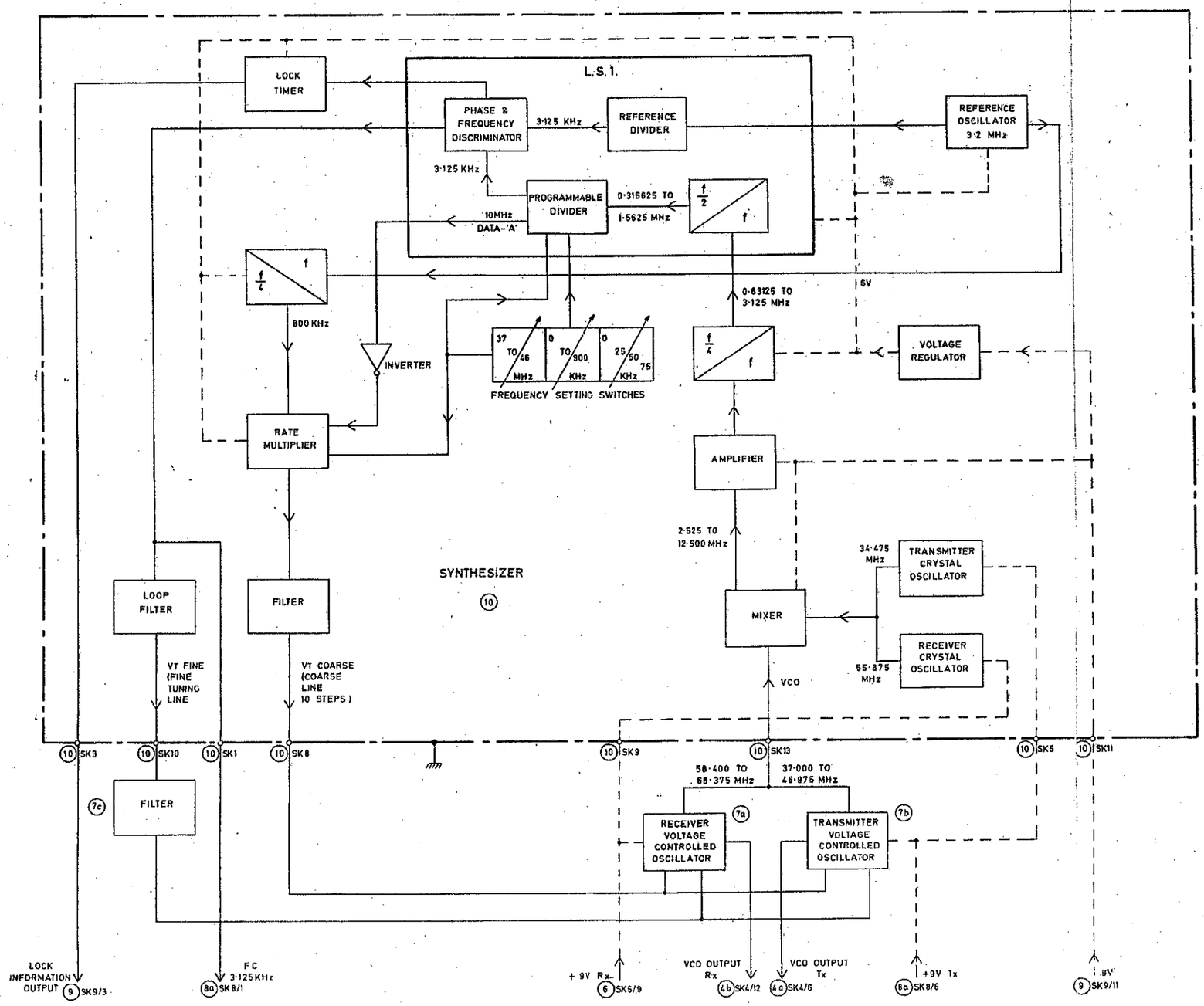


Fig 9 - Synthesizer: block diagram

[redacted]

81. The oscillator consists of a differential amplifier with a tuned circuit in the feedback path. The resonant frequency of the tuned circuit is determined by a varactor diode which is controlled by the step voltage, V_T COARSE, and the continuously-variable voltage over the range of 1MHz, V_T FINE, both supplied by the synthesizer; the voltage across the varactor diode is equal to the difference between the two voltages.

82. The frequency range (58.4 to 68.375MHz) is pre-set at the lower end of the band by a variable inductor and, at the high end, by a trimmer capacitor. The r.f. output is amplified and routed to the mixer in the r.f. head (assembly 4b). A buffered r.f. output is fed back to the synthesizer as part of the frequency control loop.

83. The tuning line filter is contained on 'daughter' board 7c which joins the receiver and transmitter oscillators (assembly 7a and 7b) and carries linking lines for the V_T COARSE and V_T FINE tuning voltages and the v.c.o. synthesizer feed from the two oscillators. The low-pass filter provides additional filtering on the V_T FINE line.

Transmitter oscillator - assembly 7b

(Fig 10)

84. The transmitter oscillator (assembly 7b) is powered by the 9VTx supply (transmit mode only).

85. The oscillator consists of a differential amplifier with a tuned circuit in the feedback path. The resonant frequency of the tuned circuit is determined by a varactor diode which is controlled by the step voltage, V_T COARSE, and the continuously-variable voltage over the range of 1MHz, V_T FINE, both supplied by the synthesizer. The voltage across the varactor diode is equal to the difference between the two voltages.

86. The frequency range (37.000 to 46.975MHz) is pre-set at the lower end of the band by a variable inductor and, at the higher end, by a trimmer capacitor. Modulation of the r.f. signal is obtained by applying the a.f. from the transmit audio amplifier (assembly 8b) to the tuning varactor diode. The modulated r.f. output is amplified and routed to the driver/power amplifier (assembly 4a). A buffered r.f. output is fed back to the synthesizer as part of the frequency control loop.

TRANSMITTER ASSEMBLIES

Transmit audio amplifier - assembly 8b)

(Fig 11)

87. The transmit audio amplifier provides a level-controlled modulating signal for the transmitter oscillator, assembly 7b, from the varying audio microphone input. The 150Hz squelch tone (from assembly 8a) is also added to the modulating signal output. The assembly is powered by the 9VTx line (transmit mode only).

88. The assembly consists of four stages: a switched-gain microphone pre-amplifier providing the loud/whisper facility, an a.g.c.-controlled amplifier, a limiter circuit and an output filter/adder.

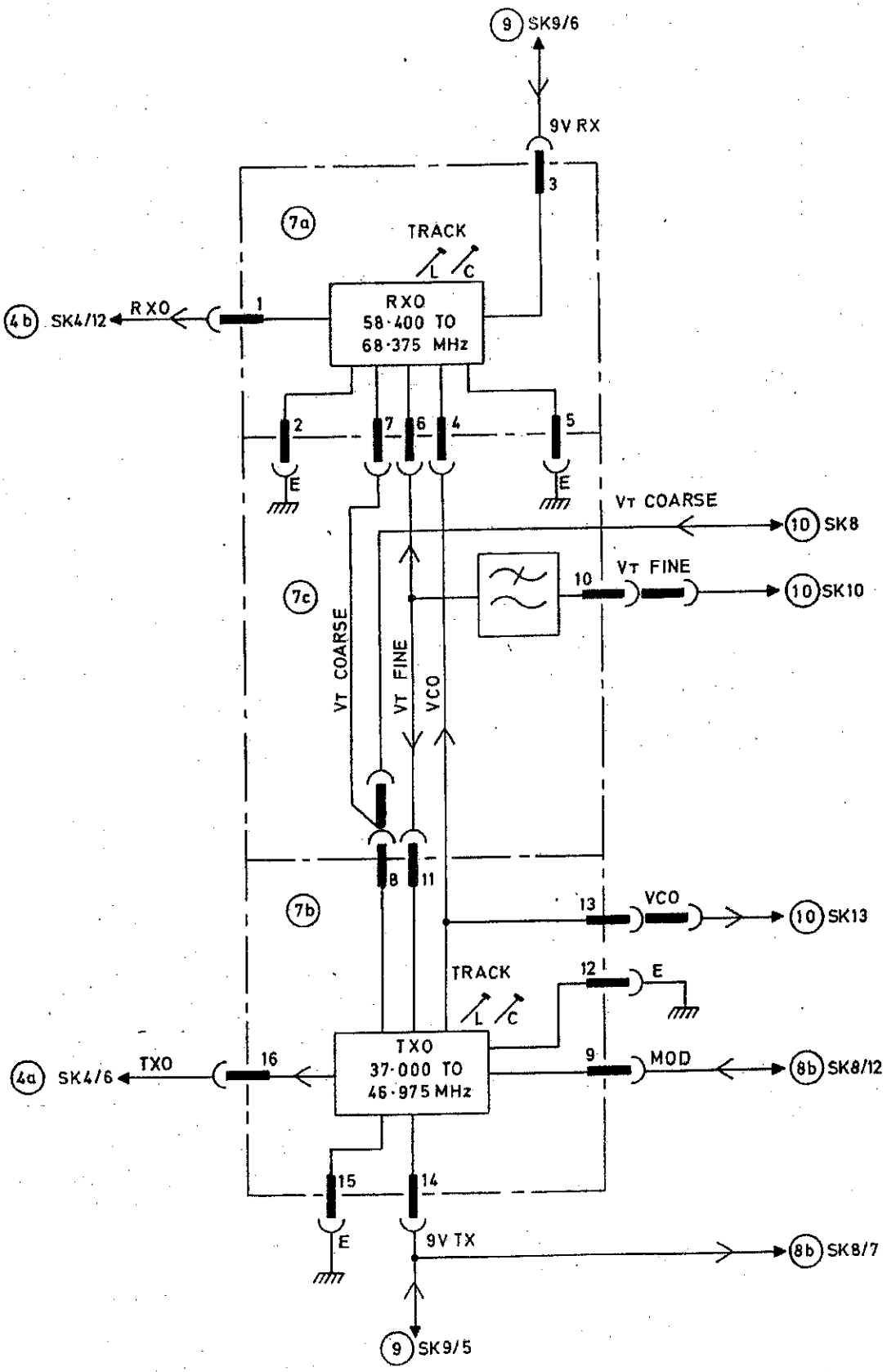


Fig 10 - Receiver oscillator, tuning line filter and transmitter oscillator

89. The microphone input is amplified by an additional 10dB approximately in the 'whisper' mode with respect to the 'loud' mode; control of the loud/whisper function is given by the L (+V BATT) input from the system switch in the loud position and the OV (open-circuit) condition when the system switch is in the whisper position. The pre-amplifier output is applied to the a.g.c. controlled amplifier to provide a constant-level output which is then fed via a limiter and an audio-shaping filter to the adder and to assembly 5 as sidetone. The audio is combined with the 150Hz squelch tone in the adder and applied to assembly 7b. Pre-set controls enable the modulation and 150Hz tone levels to be preset. The limiter prevents over modulation due to large transients.

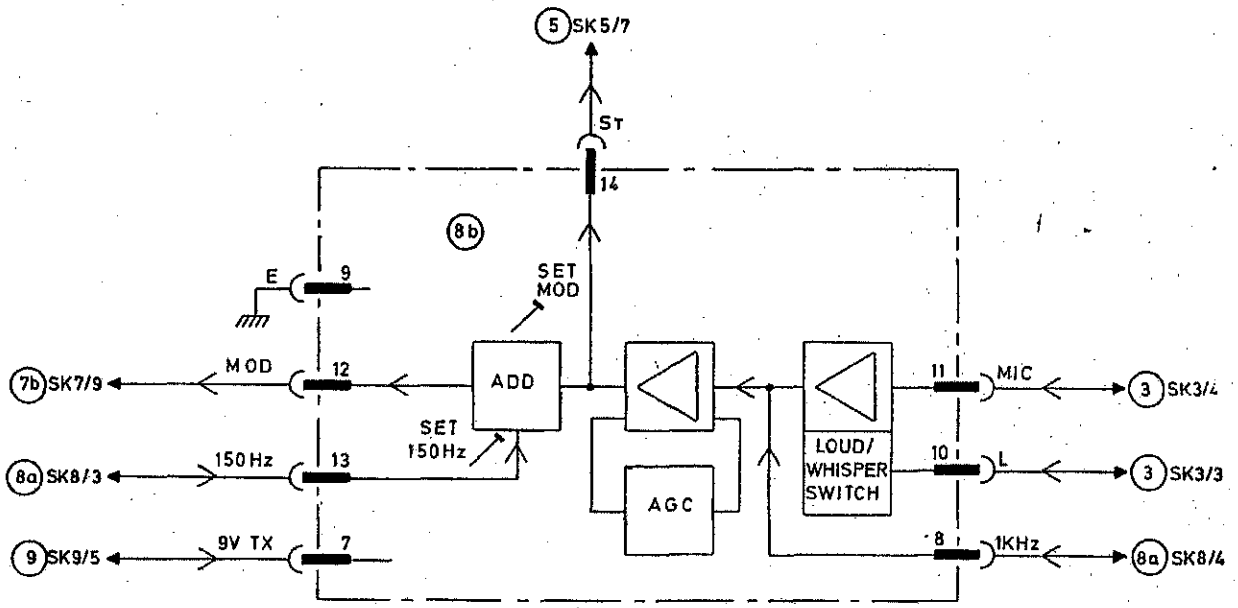


Fig 11 - Transmit audio amplifier

90. The 1kHz tone output from assembly 8a (para 92) is connected to the input of the a.g.c.-controlled amplifier to produce a constant-level output from the transmit audio, giving a transmitted 1kHz call tone when required.

Frequency dividers - assembly 8a

(Fig 12)

91. The frequency dividers provide the 150Hz squelch tone and the 1kHz call tone derived from the 3.125kHz output of the synthesizer (assembly 10). The unit is powered by the 9VTx supply (transmit mode only).

92. The 3.125kHz square-wave input (F_c) is divided by 3 to produce 1.042kHz; this output from the divider is applied to the call switch and also to a further divider.

Note: The 1kHz call facility is a requirement for the Commercial version of this radio. It cannot be initiated without a special pressel button on the audio gear, so the circuitry has not been removed.

93. The 1.042kHz output from the first divider is further divided by 7 to give the 148.85Hz (150Hz nominal) squelch tone which is routed via a low-pass filter to give a sinusoidal waveform that is added to the modulation signal in assembly 8b.

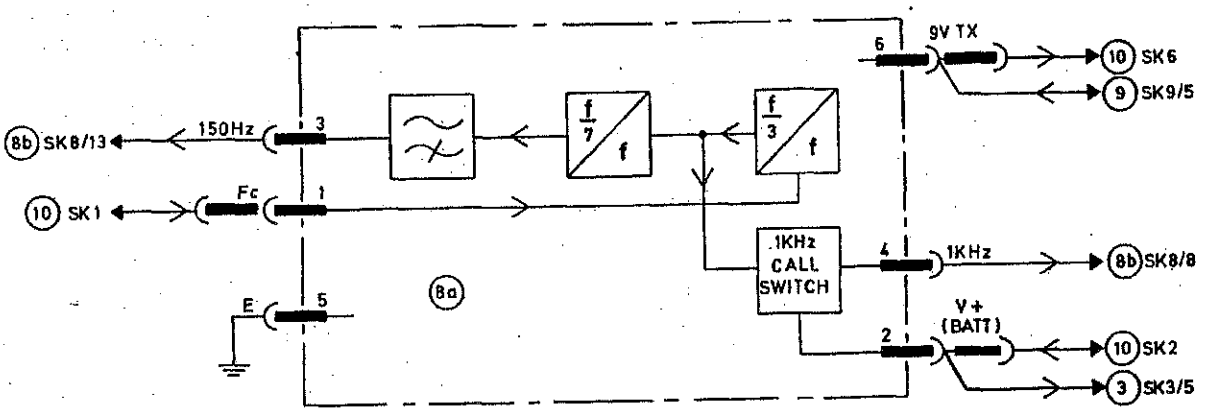


Fig 12 - Frequency dividers

Transmitter and antenna matching - assembly 4a

(Fig 6)

94. Assembly 4a consists of the driver and power amplifier stages and a control system which switches and controls the amplifiers when the pressel is operated and the synthesizer is locked. The assembly also contains the antenna matching circuits. Power is obtained from the +V BATT voltage which is present in all modes of operation.

95. The modulated r.f. signal from assembly 7b is amplified by the driver stage, which is a.g.c.-controlled. The a.g.c. is derived by sensing the output stage current. The stage is switched on by the T_W level from assembly 9 when in the transmit mode. The driver stage is coupled to the wideband power amplifier which is provided with selective feedback to stabilize gain over the band.

96. The power amplifier output to the antenna is via the antenna matching circuits; these consist of a band-pass filter and provide optimum power transfer to the antenna.

Note...

These Pages 33 and 34 supersede Pages 33 and 34 Issue 1 dated Jul 77. They have been revised throughout.

CIRCUIT DESCRIPTION

SYNTHESIZER - ASSEMBLY 10

(Fig 2007)

Power supplies

97. The assembly is powered by the continuous 9V line, the 9VRx line (receive mode only) and the 9VTx line (transmit mode only). The lines enter the assembly, are routed within and decoupled as follows (Table 3).

Table 3 - Synthesizer power supply

Supply	Connectors	Board 10b pins:		Board 10b: Decoupling	Board 10a pins: Enter	Board 10a: Decoupling
		Enter	Leave			
9V	10SK11	7	24	L3, C1	31	C26
9VRx	10SK9	8	26	L2	33	C2
9VTx	10SK6	9	25	L1	32	C12

98. The 9V battery save line is used to power the mixer, the amplifier and the 6-Volt stabilizer. The receiver crystal oscillator is powered by the 9V Rx line and the transmitter crystal oscillator by the 9VTx line. All other circuits within the assembly are powered by the regulated line from the 6V stabilizer.

99. The 6V stabilizer consists of 10aML4. Current limiting is provided by 10aR31 and internal decoupling by 10aC27 and 10aC28. The stabilized 6V line is developed across the divider chain 10aR32/10aR18/10aR34 the preset 10aR18 providing adjustment of the line voltage (set internal 6V).

Crystal oscillators

100. The two crystal oscillators 10aTR1 (Rx) and 10TR2 (Tx) provide the fixed frequencies of 55.875MHz in the receive mode and 34.475MHz in the transmit mode, only the relevant oscillator being energized for the given mode (para 98). The receiver oscillator frequency is higher than that of the transmitter oscillator by 21.4MHz (receiver i.f.).

101. Both oscillators use dual-gate MOS-FET transistors as the amplifying element. Feedback to the controlling gate (gate 1, pin 3) is taken from the source (pin 4) through the crystal. The amount of feedback is determined by the ratio of capacitance in the tuned circuit and the impedance of the feedback path.

102. Oscillation at the required frequency commences when the crystal is in its series resonance on the 3rd overtone, presenting a low resistance (approximately 30 ohms) to the tuned circuit. Adjustment during manufacture is provided by the preset inductors 10aL1 and 10aL6; fine adjustment within

the specified limits of +100Hz to -200Hz is accomplished by trimming 10aC1 (Rx) and 10aC13 (Tx). Both oscillators provide an r.f. signal of approximately 300mV to the mixer input through 10aC9 and 10aC10.

Double balanced mixer and filter

103. The double balanced mixer 10aML1 is supplied with two signals; the v.c.o. (assembly 7aRx, 7bTx) signal of approx 100mV entering on 10SK13 and applied to 10aML1 pin 1 via 10aC18, and the 300mV (approx) rf signal from one of the crystal oscillators (applied to 10aML1 pin 7). After mixing, two frequencies are present at the balanced output of 10bML1 pin 6 and pin 9. One is the sum and the other is the difference of the v.c.o. and crystal oscillator frequencies.

Amplifier and Filter

104. The sum and the difference frequencies are fed from the output of 10aML1 pins 6 and 9 to the push pull amplifier configuration of 10aTR3 and TR4. After this stage the sum frequency is lost in the low pass filter of 10aR7, L7, D1.

105. The difference frequency - between 2.525MHz and 12.5MHz - is then further amplified by 10aTR5 and squared off by 10aTR6 and TR7 for use as a clock pulse for 10aML2.

First Prescaler

106. The low-pass Schottky J-K unit 10aML2 is connected as a dual binary divider, dividing by four. The amplitude at the output (pin 9) is approximately 3V and the frequency band is 631.25kHz to 3.125MHz; this is the clock input for the l.s.i. module (para 109).

Lock pulse timer

107. The monostable 10aML3 receives the lock pulse output from the l.s.i. module on board 10b; this is zero when the loop is phase-locked. When switching from receive to transmit, the changeover from the Rx v.c.o. and crystal oscillators to the Tx v.c.o. and crystal oscillators causes the v.c.o. frequency to be incorrect and outside the correct channel after initial switch-on. The monostable produces a pulse of 200 ms nominal duration and 6.0V amplitude at its Q output. This pulse ($\overline{L_K}$) is routed to the logic in assembly 9 to inhibit transmission via 10SK3 with decoupling provided by 10aR35. The monostable time constant is set by 10aC25 and 10aR29.

L.S.I. module

108. The l.s.i. module, 10bML1, is a custom-built unit containing the second prescaler (dividing by two), the programmable dividers, the fixed divider and the phase and frequency discriminators.

109. Pulses from the output of the first prescaler (10aML2) are applied to the l.s.i. clock input (pin 18) and further divided by two; the total fixed division of the mixer frequency output is therefore eight times and the signal (frequency range 0.315625 to 1.5625MHz) is routed to the programmable dividers (pin 15).

Note...

These Pages 35 and 36 supersede Pages 35 and 36, Issue 2, dated Sep 78. They have been revised throughout.

110. The first divider changes the frequency in 25kHz increments and is programmed by the kHz frequency setting switch through line A, pin 10 and line B, pin 11. The second divider produces an output frequency in increments of 100kHz and is programmed by the 100kHz switch through line A, pin 12; line B, pin 20; line C, pin13 and line D, pin 19. The 100kHz decade divider is followed by the 1MHz programmable decade divider which is connected to the MHz switch; the division factor is changed in 1MHz increments between 37MHz and 46MHz. The data lines for the MHz decade divider are connected to the switch through line A, pin 14; line B, pin 17; line C, pin 15 and line D, pin 16. In the 46MHz position, the 10MHz decade is switched internally from 0 to 10MHz and the A line potential of the decade at pin 4 changes from 6V d.c. to 0V d.c. The output frequency from the last decade is 3.125kHz when the synthesizer is locked to the comparison frequency derived from the reference divider (para 112).

111. The frequency setting lines connected to the frequency setting switches are supplied internally, in the l.s.i., with 6V. The switches, depending on the required binary code, either short-circuit the data lines to earth or leave them open-circuit. The voltages on the data lines are as given in Table 4.

112. The reference divider gives fixed division (÷1024) of the 3.2MHz input from the reference oscillator (para 115) to provide the comparison frequency of 3.125kHz.

113. The two signals, one derived from the programmable divider and the other from the fixed reference divider, are applied internally to the input of the phase and frequency discriminators. The phase difference between the two input signals produces phase pulses at the output (pin 21); the pulse repetition frequency is 3.125kHz, the amplitude is 6V and the pulse-width is the phase error.

Table 4 - Frequency setting line voltage

kHz switch			100kHz switch					MHz switch				
F kHz	Voltage on line (V)		F 100kHz	Voltage on line (V)				F MHz	Voltage on line (V)			
	A	B		A	B	C	D		A	B	C	D
00	6	6	0	6	0	0	6	37	0	0	0	6
25	0	6	1	0	0	0	6	38	6	6	6	0
50	6	0	2	6	6	6	0	39	0	6	6	0
75	0	0	3	0	6	6	0	40	6	0	6	0
			4	6	0	6	0	41	0	0	6	0
			5	0	0	6	0	42	6	6	0	0
			6	6	6	0	0	43	0	6	0	0
			7	0	6	0	0	44	6	0	0	0
			8	6	0	0	0	45	0	0	0	0
			9	0	0	0	0	46	6	0	0	6

114. Changing the frequency setting switch by 1MHz, switching from receive to transmit mode or when the radio is switched on, will initially produce a large difference between the two comparison frequencies at the input to the phase discriminator; hence phase locking becomes impossible without the frequency discriminator which provides output pulses proportional to the frequency difference at l.s.i. pin 23. These pulses are routed to the loop filter; the frequency of the v.c.o. will change until the phase discriminator takes over and switches the frequency discriminator off.

Reference oscillator and inverters

115. The stable crystal reference oscillator (3.2MHz) provides a signal to the fixed divider of the l.s.i. (pin 24) and comprises part of 10bML2 (pins 10,11,12 and 13) together with the tuned circuit 10bXL1, L4, TR4; C25, C17, the latter providing oscillator frequency adjustment. The output to the l.s.i. is at pin 10; an inverted output at pin 8 is routed to the reference frequency divider 10bML3.

116. Inverter pins 1 and 2 buffer the 3.125kHz output from pin 21 of the l.s.i.; this is then routed to the frequency dividers (assembly 8a) via 10SK1 decoupling being given by 10bC14 and 10bR1. Inverter pins 3 and 4 invert the l.s.i. 10MHz 'A' line output which is then routed to the rate multiplier. Inverter pins 5 and 6 are used as a gate for the loop filter offset voltage.

Reference frequency divider

117. The inverted reference frequency (3.2MHz) from pin 8 of 10bML2 is applied to the two-stage binary divider 10bML3 (divide-by-four). The 800kHz output at Q2 (pin 9) is supplied as a clock input to the rate multiplier.

Rate multiplier

118. The function of the rate multiplier, 10bML4, is to produce one or more clock pulses at its output. The number of pulses (0 to 9) is selected by programming four setting lines in BCD code. The rate multiplier data lines (pins 14, 15, 2 and 3) are connected to lines A, B, C and D respectively of the MHz frequency setting switch. The SET line (pin 4) follows the potential (after inversion in 10bML2) of the 10MHz decade 'A' line (l.s.i., pin 4). The output used is $\overline{\text{OUT}}$ (pin 5) and the relationship between the data line input potentials and the output pulses is given in Table 5.

119. The output pulses are integrated (averaged) in the filter 10b R5/C19/R6/C20 to provide the d.c. step voltage V_T COARSE ouput at pin 5; this controls the frequency of the slave v.c.o. (assembly 7a or 7b) in increments of 1 MHz. The voltage V_T COARSE ranges from 3.65V (37MHz) to 6.04V (46MHz), the limits within the range depending on the setting of the 6V line (10aR18).

Loop Filter

120. The loop filter 10bR7/R8/R9/C21/C22/R10/R11/C23 averages the pulses produced by the phase discriminator in the l.s.i. to produce the d.c. control voltage V_T FINE. The value of this d.c. voltage depends on the width of the phase pulse; a change of approximately 120° produces 0.3V change in control

voltage and changes the frequency of the slave v.c.o. by 1MHz.

Table 5 - Relationship between rate multiplier inputs and output

Frequency setting switch: MHz	Potential on data lines: volts A pin 14	B pin 15	C pin 2	D pin 3	SET pin 4: volts	$\overline{OUT}$ - pin 5: No. of pulses (negative-going)
37	0	0	0	6	0	8
38	6	6	6	0	0	7
39	0	6	6	0	0	6
40	6	0	6	0	0	5
41	0	0	6	0	0	4
42	6	6	0	0	0	3
43	0	6	0	0	0	2
44	6	0	0	0	0	1
45	0	0	0	0	0	0
46	6	0	0	6	6	0

121. Pulses produced by the frequency discriminator, in the l.s.i., switch either the 2V discriminator supply or OV to 10bC21. Hence, the capacitor is charged or discharged thus changing the v.c.o. frequency in the required direction for the phase discriminator to phase-lock the synthesizer; following this, the frequency discriminator is switched off; V_T FINE is routed to the tuning line filter, assembly 7c, via 10SK10.

ACCESSORIES

122. The following accessories are issued with the RT-349:-

PRIMARY BATTERY

123. The primary battery consists of ten manganese-alkaline dry cells encapsulated inside a plastic case. The cells are wired in series to provide a nominal output of 12 volts. The battery is fastened to the radio by a single captive 'quick fit' plastic screw. The battery will supply the radio for approximately 20 hours on a 1:1:9 transmit/receive/standby duty cycle at 20°C. The battery is suitable for use over the temperature range -20°C to +55°C plus solar radiation with reduced life.

WHIP ANTENNA (0.5 metre)

124. The whip antenna is a 0.5 metre (22 in) plastic sleeved, copper plated, steel rod with integral loading coil. The base consists of a threaded stud which screws into the antenna socket of the radio. The antenna rod and loading coil are attached to the base by means of a resilient spring.

WHIP ANTENNA (1.0 metre)

125. The 1.0 m whip antenna consists of a folding four-section copper plated steel tube assembly with integral loading coil. The base consists of a threaded stud which screws into the antenna socket of the radio. The antenna rod and loading coil are attached to the base by means of a resilient spring.

HEADSET

126. The headset consists of a single earpiece transducer housed in a rubber earpad. It is fitted with a throat microphone which is held in place by an adjustable elastic strap and buckle. The earpiece assembly is attached to the head using webbing with a Velcro fastener. A pressel box and clothing clip is fitted in the down lead.

CARRYING HOLSTER

127. A lightweight terylene holster enables the radio to be carried on the chest or back by means of adjustable shoulder and body straps. A quick-release fastener is provided for rapid removal. The radio is retained in the holster by a strap secured with a Velcro tab. A cut-out on the side of the holster gives access to the frequency setting switches. The system switch, audio socket and antenna socket are accessible at the open top-end of the holster.

USER HANDBOOK

128. The User handbook has the Army Code No. 61646.

ANCILLARIES

CASSETTE DRY BATTERY

129. The cassette battery consists of a plastic case into which ten series connected 'pen cells' (size AA) are fitted; it has a similar shape, and is fastened to the radio in the same manner, as the primary battery (para 123). The nominal output is 12 volts, and the recommended cell is manganese-alkaline which produces the same performance as the primary battery (para 123). If Leclanche cells are used, a decrease in capacity and storage life is to be expected.

Note: The next page is Page 1001

Note: These Pages 1001-1006 supersede Pages 1001-1006 Issue 1. The Catalogue Nos have been amended.

Table 2001 - RT-349 component schedule

Item No (a)	Assy. code/ cct ref (b)	Component/assembly/ sub assembly (c)	Qty (d)	Catalogue No (e)	Refer to Fig (f)
1	1	Box assembly	1	5820-99-643-8400	
2		Cover and rubber assembly	1	5820-99-643-8724	
3		Screw, slotted pan-head M2.5 x 6 mm long to BS4183 (st. st. chem.black)	10	5305-99-136-3215	
4		washer, crinkle M2.5 to BS4463 (st. st. chem.black)	10	5310-99-136-2563	
5		Insert, heli-coil M2.5 x 1.5 D (st. st.)	10	*22631-123-20	
6		Gasket	1	~~5820~~ 5330-99-643-8736	
7		Audio socket, system switch and wiring harness	1	5820-99-643-8401	
8		Screw, socket head cap M3 x 8 mm long to BS4168 (st. st. chem. black)	2	5305-99-137-3550	
9		Seal, bonded 6BA AGS 1186-1	2	5330-99-943-3484	
10		Escutcheon plate	1	5340-99-643-8735	
11		Screw, slotted pan-head M2 x 5 mm long (st. st. chem. black) to BS4183	2	5305-99-139-0953	
12		Washer, crinkle M2 to BS4463 (st. st. chem. black)	2	5310-99-135-2531	

*B.C.C. Part Number

Table 2001 (cont'd)

Item No (a)	Assy. code/ cct ref (b)	Component/assembly sub assembly (c)	Qty (f)	Catalogue No (e)	Refer to Fig (f)
13		Antenna base	1	5985-99-646-0778	
14		Screw, slotted pan-head M3 x 6 mm long to BS4183 (st. st. chem.black)	4	5305-99-138-2673	
15		Washer, crinkle M3 to BS4463 (st. st. chem.black)	4	5310-99-138-2680	
16		Insert, heli-coil M3 x 1 D (st. st.)	4	*22631-104-20	
17		Seal, toroidal 0.926 inch int dia x 0.070 inch section	1	5330-99-630-6262	
18		Seal test plug	1	Z4/5365-99-626-4284	2
19		Seal, toroidal 0081 16 to BS4518 1R HD75	1	5330-99-642-1866	
20		Insert, heli-coil M6 x 1 D (st. st.)	1	*22631-107-20	
21		Insert, battery fixing	1	5340-99-646-0775	2
22		Loctite Studlock grade 270	as req'd	H1/8030-99-220-1635	
23		Modification record plate	1	9905-99-646-0776	
24		Identification plate	1	9905-99-646-0777	
25		Knob, frequency setting MHz	1	5355-99-643-8399	2

*B.C.C. Part Numbers

Table 2001 (cont'd)

Item No (a)	Assy code/ cct ref (b)	Component/assembly/ sub assembly (c)	Qty (d)	Catalogue No (e)	Refer to Fig (f)
• 26		Knob, frequency setting 100kHz	1	5355-99-643-8398	2
• 27		Knob, frequency setting kHz	1	5355-99-643-8397	2
• 28		Knob, system	1	5355-99-643-8396	2
• 29		Seal, toroidal 0.125 inch int dia 0.031 inch section	4	5330-99-649-~~2245~~ 2445	
30		Washer, flat	4	Z1/5365-99-622-4912	
• 31		Circlip ext. to BS3673 part 2 149PS	4	5365-99-638-2645	
32		Grease MX33 (for all knob shafts) to DTD900/4630A (AFS 1208)	as req'd	34B/9150-99-220-2492	
33		Cover, electrical socket	1	Z32/5935-99-626-4256	2
34		Grease XG271 (for all stationary seals)	as req'd	H1/9150-99-910-0510	
35		Desiccant sachet, 1 gramme	1	Z1/4440-99-013-9203	
• 36		Screw, socket head cap M3 x 8 mm long to BS4168 (st. st. chem.black)	4	5305-99-137-3550	
• 37		Screw, slotted pan-head M3 x 6 mm long to BS4183 (st. st. chem-black)	4	5305-99-138-2673	
• 38		Seal, bonded 6BA AGS1186	8	5330-99-943-3484	

Note: Items 36 to 38 are motherboard-to-box fixings.

Table 2001 (cont'd)

Item No (a)	Assy. code/ cct ref (b)	Component/assembly/ sub assembly (c)	Qty (d)	Catalogue No (c)	Refer to Fig (f)
39	3	Motherboard assembly	1	5820-99-643-8402	
40	4	R.F. head, transmitter and antenna matching assembly	1	5820-99-643-8403	2004
41	5	Discriminator, receiver audio and squelch assembly	1	5820-99-643-8404	2004
42	6	I.F. amplifier assembly	1	5820-99-643-8405	2004
43	7	Receive oscillator and transmit oscillator assembly	1	5820-99-643-8406	2004
44	8	Transmitter audio and divider assembly	1	5820-99-643-8407	2004
45	9	Regulator, d.c. switching and logic assembly	1	5820-99-643-8408	2004
46	10a	Synthesizer sub assembly (p.e.c.)	1	5820-99-643-8722	
47	10b	Synthesizer sub assembly (p.e.c.)	1	5820-99-643-8721	
48	10c	Synthesizer frequency setting switches and base sub assembly	1	5820-99-643-8409	
49		Connecting lead No 2	1	5995-99-643-8725	2005
50		Connecting lead No 3	1	5995-99-643-8726	2005
51		Connecting lead No 13	1	5995-99-643-8727	2005
52		Connecting lead No 12	1	5995-99-643-8728	2005

Table 2001 (cont'd)

Item No (a)	Assy. code/ cct ref (b)	Component/assembly/ sub assembly (c)	Qty (d)	Catalogue No (e)	Refer to Fig (f)
53		Connecting lead No 10	1	5995-99-643-8729	2005
54		Connecting lead No 8	1	5995-99-643-8730	2005
55		Connecting lead No 1	1	5995-99-643-8731	2005
56		Connecting lead No 11	1	5995-99-643-8732	2005
57		Connecting lead No 9	1	5995-99-643-8733	2005
58		Connecting lead No 6	1	5995-99-643-8734	2005
59		Can, screening assembly	1	~~5995~~ 5820-99-643-8723	
60		Screw, slotted CSK head M2 x 5 mm long to BS4183 (st. electro-tin plate to DTD924)	3	5305-99-139-0951	
61		Resistor, 100 ohms	1	Z30/5905-99-624-5907	2005
62		Spacer (screw special)	6	5340-99-646-0774	
63		Screw, slotted pan-head M2 x 4 mm long to BS4183 (st. electro-tin plate to DTD924)	3	5305-99-139-0950	
64		Washers, crinkle M2 to BS4463 (st. st.)	9	5310-99-135-2531	
65		Wire, Ø 0.56 (24 s.w.g.) to BS4109 (cu tinned)	as req'd	6145-99-910-2377	

Table 2001 (cont'd)

Item No (a)	Assy. code/ cct ref (b)	Component/assembly/ sub assembly (c)	Qty (d)	Catalogue No (e)	Refer to Fig (f)
66		Screw, slotted pan-head M2.5 x 4 mm long (st. electro-tin plate to DTD924)	5	5305-99-139-0952	
67		Washers, crinkle M2.5 to BS4463 (st. st.)	5	5310-99-137-0206	
68		Wire, ∅ 0.08 mm (44 s.w.g.) (cu tinned)	as req'd		

Note: Items 66 and 67 are synthesizer-to-motherboard fixings.

Table 2002 - Synthesizer sub assembly 10c frequency setting switch connections

MHz switch					100kHz switch					kHz switch		
Position	A	B	C	D	Position	A	B	C	D	Position	A	B
0	S/C	S/C	S/C	O/C	0	O/C	S/C	S/C	O/C	0	O/C	O/C
1	O/C	O/C	O/C	S/C	1	S/C	S/C	S/C	O/C	1	S/C	O/C
2	S/C	O/C	O/C	S/C	2	O/C	O/C	O/C	S/C	2	O/C	S/C
3	O/C	S/C	O/C	S/C	3	S/C	O/C	O/C	S/C	3	S/C	S/C
4	S/C	S/C	O/C	S/C	4	O/C	S/C	O/C	S/C			
5	O/C	O/C	S/C	S/C	5	S/C	S/C	O/C	S/C			
6	S/C	O/C	S/C	S/C	6	O/C	O/C	S/C	S/C			
7	O/C	S/C	S/C	S/C	7	S/C	O/C	S/C	S/C			
8	S/C	S/C	S/C	S/C	8	O/C	S/C	S/C	S/C			
9	O/C	S/C	S/C	O/C	9	S/C	S/C	S/C	S/C			

Notes: (1) Reference should be made to Fig 2010 for identification of switches and index marks.

(2) Switch position '0' is obtained when the index marks line-up (and corresponds to 37 on the MHz switch, 0 on the 100kHz switch and 0 on the kHz switch).

(3) Switch positions 1 to 9 are obtained by rotating the switch clockwise as viewed from the operating end.

(4) Using multimeter set CT 498A, check for a short-circuit (S/C) or open-circuit (O/C) between common 'X' line and switch line A, B, C or D as indicated in the table above.

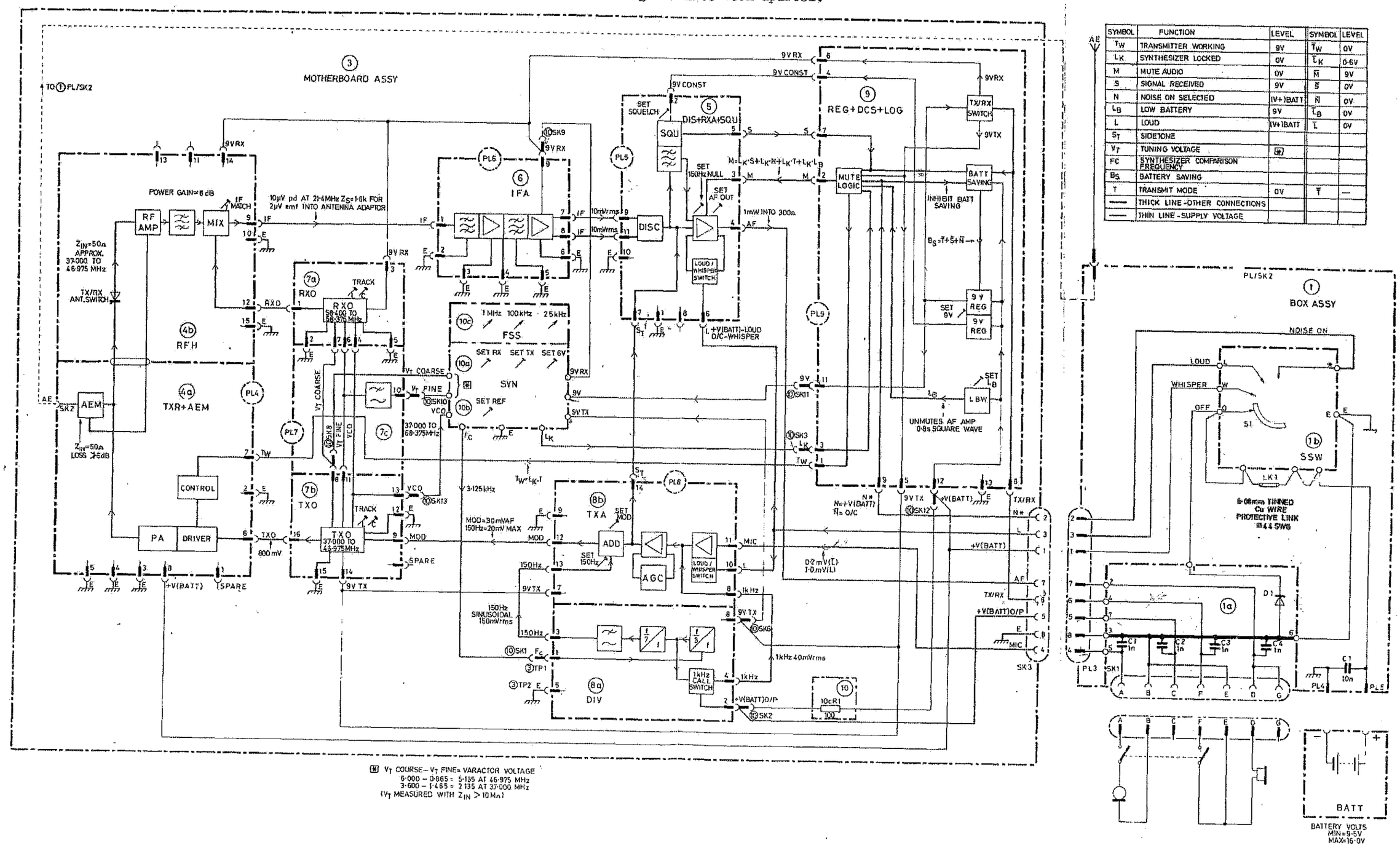
CAUTION: DO NOT attempt to verify switch connections with a sub assembly 10b fitted.

Table 2003 - Synthesizer step voltage/frequency data

Frequency setting	Step voltage/V_T coarse limits (d.c.)	
(MHz)	Minimum	Maximum
46.000-46.975	5.98	6.00
45.000-45.975	5.98	6.00
44.000-44.975	5.68	5.73
43.000-43.975	5.38	5.45
42.000-42.975	5.08	5.18
41.000-41.975	4.77	4.91
40.000-40.975	4.47	4.63
39.000-39.975	4.17	4.36
38.000-38.975	3.87	4.09
37.000-37.975	3.57	3.82

Note: These Pages 1009-1020 supersede Pages 1009-1020 Issue 1. All the figures have been updated.

SYMBOL	FUNCTION	LEVEL	SYMBOL	LEVEL
T_W	TRANSMITTER WORKING	9V	$\overline{T}_W$	0V
L_K	SYNTHESIZER LOCKED	0V	$\overline{L}_K$	0·6V
M	MUTE AUDIO	0V	$\overline{M}$	9V
S	SIGNAL RECEIVED	9V	$\overline{S}$	0V
N	NOISE ON SELECTED	(V+)BATT	$\overline{N}$	0V
L_B	LOW BATTERY	9V	$\overline{L}_B$	0V
L	LOUD	(V+)BATT	$\overline{L}$	0V
S_T	SIDETONE			
V_T	TUNING VOLTAGE	✱		
FC	SYNTHESIZER COMPARISON FREQUENCY			
B_S	BATTERY SAVING			
T	TRANSMIT MODE	0V	$\overline{T}$	—
———	THICK LINE - OTHER CONNECTIONS			
———	THIN LINE - SUPPLY VOLTAGE			



✱ V_T COURSE – V_T FINE = VARACTOR VOLTAGE
6·000 – 0·865 = 5·135 AT 46·975 MHz
3·600 – 1·465 = 2·135 AT 37·000 MHz
(V_T MEASURED WITH Z_{IN} > 10 MΩ)

Fig 2001 - RT-349 functional diagram