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B.R.4146

Handbook for

SYNTHESIZER, ELECTRICAL FREQUENCY 5820-99-519-7000

(REVISED 1972)

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By Command of the Defence Council

J. T. Dunnett

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MINISTRY OF DEFENCE
DIRECTOR GENERAL WEAPONS (NAVAL)

(N/W62565/70)

ANY SUGGESTIONS FOR AMENDMENTS OR ADDITIONS TO THIS BOOK SHOULD BE SUBMITTED TO THE DIRECTOR GENERAL, WEAPONS (NAVAL) THROUGH THE USUAL CHANNELS FOR ONWARD TRANSMISSION TO DWRDS.

BR 4146
Original

AMENDMENT RECORD LEAF

When an amendment to this handbook is incorporated the brief details required below are to be filled in.

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9	P1650/84	17/5/88	P. Hutchin
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Continued Overleaf

FOREWORD

This book uses Part 5 only of the NWS 1 seven-part documentation format. Associated system or equipment information is given in:-

(a) BR 4144 - Handbook for Transmit Receive Equipment Type 641.

(b) BR 4218 - Handbook for Receiver Outfit CJM.

(c) BR 4219 - Handbook for Transmitter Drive Outfit TDC.

COMPLETE LIST OF HANDBOOKS

FOR TYPE 641 AND ASSOCIATED EQUIPMENT

BR 4144(2)	WIRELESS TRANSMITTER/RECEIVER TYPE 641 - USER HANDBOOK
BR 4144(3 & 4)	TYPE 641 TRANSMIT-RECEIVE EQUIPMENT
BR 4144(6)	TRANSMIT-RECEIVE OUTFIT TYPE 641 - ACCEPTANCE TRIALS
BR 4145(5)(1)	MODULATOR TUNING UNIT 5820-99-519-6983
BR 4145(5)(2)	MODULATOR TUNING UNIT 5820-99-519-6983
BR 4146	SYNTHESIZER, ELECTRICAL FREQUENCY 5820-99-519-7000
BR 4147(5)(1)	RECEIVER, RADIO FREQUENCY 5820-99-519-7019
BR 4147(5)(2)	RECEIVER, RADIO FREQUENCY 5820-99-519-7019
BR 4148(5)(1)	100 WATT SELF-TUNING AMPLIFIER AND ANTENNA MATCHING UNIT
BR 4148(5)(2)	100 WATT SELF-TUNING AMPLIFIER AND ANTENNA MATCHING UNIT
BR 4218	RECEIVER OUTFIT CJM
BR 4219	TRANSMITTER DRIVE OUTFIT TDC

SYNTHESIZER, ELECTRICAL FREQUENCY

5820-99-519-7000

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PART 5A

TECHNICAL DESCRIPTION

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CHAPTER 1

GENERAL DESCRIPTION

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CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1. The basic function of a frequency synthesizer is to generate a range of output frequencies from an external frequency standard.

2. The 5820-99-519-7000 Synthesizer, Electrical Frequency serves this purpose in Type 641 Transmit Receive Equipment, Transmitter Drive Outfit TDC and Receiver Outfit CJM but its role varies, depending on whether it is being used in a transmitter drive or in a receiver. It also provides automatic range switching and tuning control for the associated equipment.

3. The synthesizer is referenced to a stable and accurate input frequency of 1 MHz which is usually supplied by either Frequency Standard Outfit FSA or FSB.

4. Any desired frequency in the range 100 kHz to 27.9999 MHz can be selected in steps of 100 Hz by means of five front panel decade selectors four of which also control the servo reference voltage required for automatic tuning. Automatic frequency range switching is controlled by the MHz decade switch.

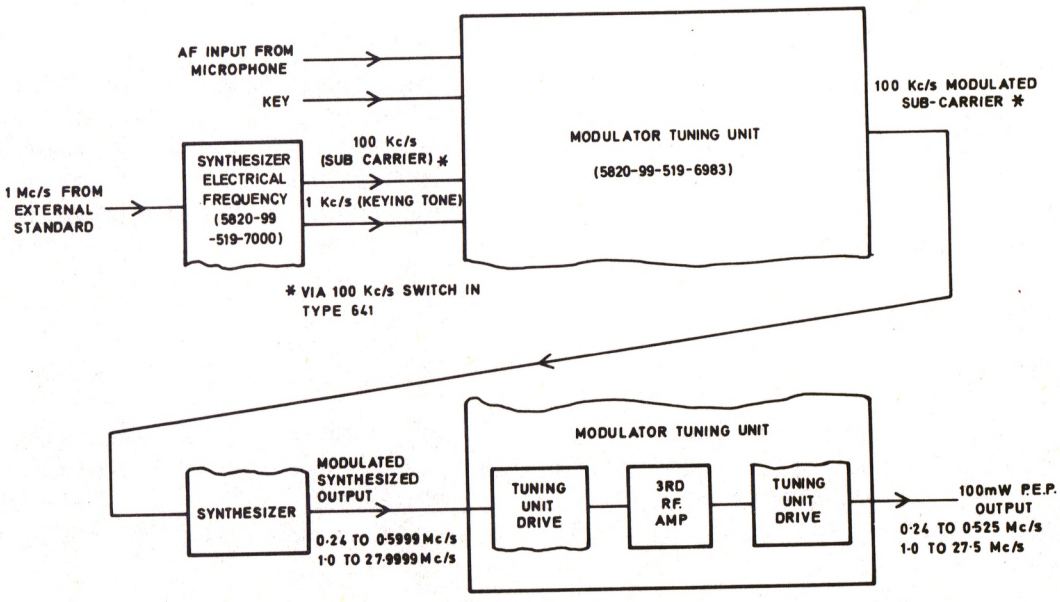


FIG. 1.1 DRIVE EQUIPMENT SYNTHESIZER CONNECTIONS SIMPLIFIED BLOCK DIAGRAM

5. In its transmitter drive application the synthesizer accepts a modulated sub-carrier of 100 kHz and translates it to the desired output frequency. Outputs of 100 kHz and 1 kHz are provided for the sub-carrier and tone modulation frequencies respectively. See Figure 1.1.

6. In the receiver application the 100 kHz input is unmodulated and three output frequencies from the synthesizer are processed to produce the local oscillator frequency. The normal synthesizer output is not used. The 100 kHz output is used for demodulation and mixing in the receiver. Also, it is attenuated and used to provide the 100 kHz input to the synthesizer. See Figure 1.2.

7. The synthesizer is switched to the transmit or receive condition by external Send/Receive switching circuits.

PHYSICAL DESCRIPTION — Figures 1.5 and 1.6

8. The Synthesizer, Electrical Frequency consists of:-

(a) A Frame and Power Supply. Unit 1.

(b) 5820-99-519-7003 Frequency Divider. Unit 7.

(c) 5820-99-519-7002 Oscillator, Audio Frequency. Unit 6.

(d) 5820-99-580-8258 Frequency Multiplier (1 kHz). Unit 5.

(e) 5820-99-580-8261 Frequency Multiplier (10 kHz). Unit 4.

(f) 5820-99-580-8260 Frequency Multiplier (100 kHz). Unit 3.

(g) 5820-99-519-7001 Frequency Multiplier (MHz). Unit 2.

9. The six sub-units (b) to (g) are mounted in the Frame and interconnected by means of plug-in cable assemblies to facilitate their removal. The Frame also contains part of a servo reference potentiometer, fitted behind the front panel, and a relay associated with it. The Frame fits into the parent cabinet on telescopic mounts.

10. The five frequency controls are carried on the front panel of the Frame; each control has an illuminated translucent numbered dial to indicate the selected frequency. Each control is ganged to its associated switches in the appropriate sub-unit (d) to (g). The kHz control shafts carry interlock switch wafers and the 100, 10 and 1 kHz control shafts also carry switch wafers controlling the servo reference potentiometer.

PRINCIPLES OF OPERATION

Frequency Conversion — Figures 1.3 and 1.4

11. The 1 MHz frequency standard is fed to a series of regenerative divider circuits in the Frequency Divider. These effect successive division by two and five to provide frequencies of 100, 10 and 1 kHz. The basic 1 MHz reference and these sub-multiples are fed to their respective decade multiplying units via tuned buffer amplifiers.

12. The 100 Hz element of the synthesizer output is provided by the Oscillator, Audio Frequency which produces an output of 2.0 to 2.9 kHz in steps of 0.1 kHz, selected by the 0.1 kHz decade switch. Frequencies from 2.1 to 2.9 kHz are derived from a free-running oscillator within the sub-unit, so the 0.1 kHz elements of the synthesizer output are not as stable and accurate as the other integral frequencies. The 2.0 kHz frequency, however, is produced by multiplying the 1 kHz sub-multiple of the 1 MHz reference by 2.

13. The four frequency multipliers operate in the same way but at different frequencies, using a method of triple mixing. Their operation is illustrated in Figure 1.4. Let:-

f1 = the reference frequency ie the sub-harmonic of the 1 MHz standard

f2 = a local oscillator frequency

f3 = a partially synthesized frequency from the preceding multiplier

h = a number between 25 and 32 which is the selected harmonic of the reference.

Then the output of:-

(a) 1st Mixer = f2 - h.f1

(b) 2nd Mixer = f3 + f2 - h.f1

(c) 3rd Mixer = f2 - (f3 + f2 - h.f1)
= f2 - f3 - f2 + h.f1
= h.f1 - f3.

Therefore the output of a frequency multiplier is independent of the local oscillator frequency and equals the difference between a selected harmonic of the reference and the output of the preceding multiplier.

14. The local oscillator frequencies (f2) in each sub-unit are given in Table 1.1.

TABLE 1.1 Local Oscillator Frequencies

Control Set to	Oscillator A.F.	Multiplier			
		kHz	10 kHz	100 kHz	MHz
	O/P Freq. kHz	Osc. Freq. kHz	Osc. Freq. kHz	Osc. Freq. kHz	Osc. Freq. MHz
0	2.0	69.5	605	6950	40.5
1	2.1	68.5	615	6850	41.5
2	2.2	67.5	625	6750	42.5
3	2.3	66.5	635	6650	43.5
4	2.4	65.5	645	6550	44.5
5	2.5	64.5	655	6450	45.5
6	2.6	63.5	665	6350	46.5
7	2.7	62.5	675	6250	47.5
8	2.8	61.5	685	6150	48.5
9	2.9	60.5	695	6050	49.5
10	-	-	-	-	50.5
and sequentially to:-					
27					67.5

15. The 10 kHz multiplier has an additional mixer stage to allow the synthesizer to accept a 100 kHz input. This input is a modulated sub-carrier when the synthesizer is used in a transmitter drive, so that the incoming modulation is

impressed on the output. The additional mixer stage is counteracted by offsetting the pass-bands of the first and second filters by 100 kHz. Because of this, an unmodulated 100 kHz input is necessary when the synthesizer is used in a receiver. The source of the 100 kHz input is the 100 kHz output from the Frequency Divider at PLBG.

16. The MHz multiplier contains send/receive change over arrangements. When the synthesizer is used in a transmitter drive -30 V is applied to a diode switching circuit (the 2-3 Mc/s switch) so that the 2-3 MHz input from the 100 kHz multiplier is fed to the second mixer of the MHz multiplier. This produces a modulated output from PLBC at the frequency shown on the decade dials.

17. In the receiver application the -30 V is removed and the 2-3 MHz switch diverts the input to provide an output of 2-3 MHz at PLBP. This output, together with the local oscillator output of 40.5 to 67.5 MHz at PLBR and the 37.5 MHz output at PLBQ, is fed to a Frequency Off-set Unit in the receiver.

18. The equations given in Paragraph 13 show how a particular frequency is obtained. If the controls are set to 18764.2 kHz, for example, the frequencies in each sub-unit will be as shown in Table 1.2 and Figure 1.4. Note that the reference frequency (f1) and the output frequency of the first mixer (f2 - h.f1) are constant in each unit.

TABLE 1.2 — Sub-unit Frequencies

	Oscillator A.F.	Multiplier			
		1 kHz	10 kHz	100 kHz	MHz
Controls to	.2	4	6	7	18
f1		1 kHz	10 kHz	100 kHz	1 MHz
f2		65.5 kHz	665 kHz	6250 kHz	58.5 MHz
f3	2.2 kHz	2.2 kHz	25.8 kHz	264.2 kHz	2.2358 MHz
f2 - h.f1		37.5 kHz	475 kHz	3750 kHz	37.5 MHz

19. Using the equations in Paragraph 13, we obtain:-

(a) In the Oscillator, Audio Frequency

Output 2.2 kHz fed to the Multiplier (1 kHz).

(b) In the Multiplier (1 kHz)

1st Mixer output = 37.5 kHz

2nd Mixer output = 37.5 + 2.2 = 39.7 kHz

3rd Mixer output = 65.5 - 39.7 = 25.8 kHz fed to the Multiplier (10 kHz).

(c) In the Multiplier (10 kHz)

1st Mixer output = 475 kHz

2nd Mixer output = 475 + 25.8 = 500.8 kHz

3rd Mixer output = 500.8 - 100 = 400.8 kHz (extra mixer because of 100 kHz input)

4th Mixer output = 665 - 400.8 = 264.2 kHz fed to the Multiplier (100 kHz).

(d) In the Multiplier (100 kHz)

1st Mixer output = 3750 kHz

2nd Mixer output = 3750 + 264.2 = 4014.2 kHz

3rd Mixer output = 6250 - 4014.2 = 2.2358 MHz fed to the Multiplier (MHz).

(e) In the Multiplier (MHz)

(i) On Send

1st Mixer output = 37.5 MHz

2nd Mixer output = 37.5 + 2.2358 = 39.7358 MHz

3rd Mixer output = 58.5 - 39.7358 = 18.7642 MHz which is required output frequency for use in a transmitter drive. The effect of a 1 kHz modulating tone on this output is shown in Figure 1.4.

(ii) On Receive

Local Oscillator output of 58.5 MHz

1st Mixer output of 37.5 MHz

Multiplier (100 kHz) output of 2.2358 MHz.

These are the required outputs, to be processed in a receiver.

Automatic Tuning — Figure 1.5

20. For automatic tuning purposes the tuning circuits in associated equipment are disposed into six frequency ranges as shown in Table 1.3.

21. A range switch, wafer 2SWA7 on the MHz decade control shaft, controls an open circuit seeking system using Ledex rotary solenoids. By this means the circuits for the appropriate frequency range are automatically selected in the other units by setting the MHz control on the Synthesizer.

TABLE 1.3 — Frequency Ranges for Automatic Tuning

MHz Dial at	Range Selected	Frequency Range
0	1	240 to 525 kHz
1	2	1 to 1.999 MHz
2,3	3	2 to 3.999 MHz
4 to 7	4	4 to 7.999 MHz
8 to 15	5	8 to 15.999 MHz
16 to 27	6	16 to 27.999 MHz

22. The tuning circuits thus selected are then servo tuned to the required frequency. The positions of the MHz and the 100, 10 and 1 kHz decade controls determine the output of a precision potential divider network. Within each range this direct voltage, from about 0.75 V to 28 V and proportional to frequency, is the reference voltage for the tuning servos.

23. The potential divider network is in two parts. One potentiometer is in the Frequency Multiplier (MHz) and the other is fitted behind the front panel and connected across the output of the first via 2SKCD.B, C and relay contracts 1RLA1, 2.

24. Within each range the output voltage level of the first potentiometer is controlled by 2SWA8, 9 and 10 on the MHz control shaft and thus represents the reading on the MHz dial; the potential difference between 2SKCD.B and 2SKCD.C represents 1 MHz.

25. The final output level, that of the second potentiometer, is determined by switch wafers on the 100, 10 and 1 kHz control shafts and represents the desired frequency. This output is returned to the Frequency Multiplier (MHz) via 2PLCD.A and is available at 2PLCB.A.

26. On Range 1 the MHz dial is at 0 and, via 2SWA7 and 2SKCD.D, relay 1RLA is energised to change the resistor network associated with the 100 kHz decade control. This ensures that the potentiometer output voltage accurately represents frequencies from 240 to 525 kHz.

(See Chapters 2 and 8).

TUNE INTERLOCK Figure 1.5

27. A tune-interlock facility is provided by four switch wafers and one microswitch. The wafers SWA1, SWB1, SWC1, SWD1 are fitted behind the front panel on the shafts of the kHz frequency controls. The microswitch 2SWB is fitted in the Frequency Multiplier (MHz) and operated by a detent mechanism on the MHz frequency switch 2SWA.

28. The wafers and the microswitch are wired in series so that whenever the selected output frequency of the synthesizer is changed the receiver tuning servo supply and/or the transmitter tune interlock circuits are affected, preparing the equipment for tuning to the new frequency.

A.C. MAINS SUPPLY

29. The synthesizer can be used with 50 to 60 Hz supply voltages from 200 to 260 V or 100 to 130 V, depending on the connections of the mains transformer 1TR2. A reversible tally should be set to indicate the correct input voltage.

D.C. POWER SUPPLIES

30. Stabilised positive and negative d.c. supplies are obtained from the internal Power Supply (see Chapter 2).

TRANSISTORS

31. Germanium transistors are used except in the final output stage where a silicon mesa transistor is employed. Most stages are in common emitter form with conventional base bias from a potentiometer between the negative supply and chassis. Where common base circuits are used the bias is from the positive supply.

TEST POINTS

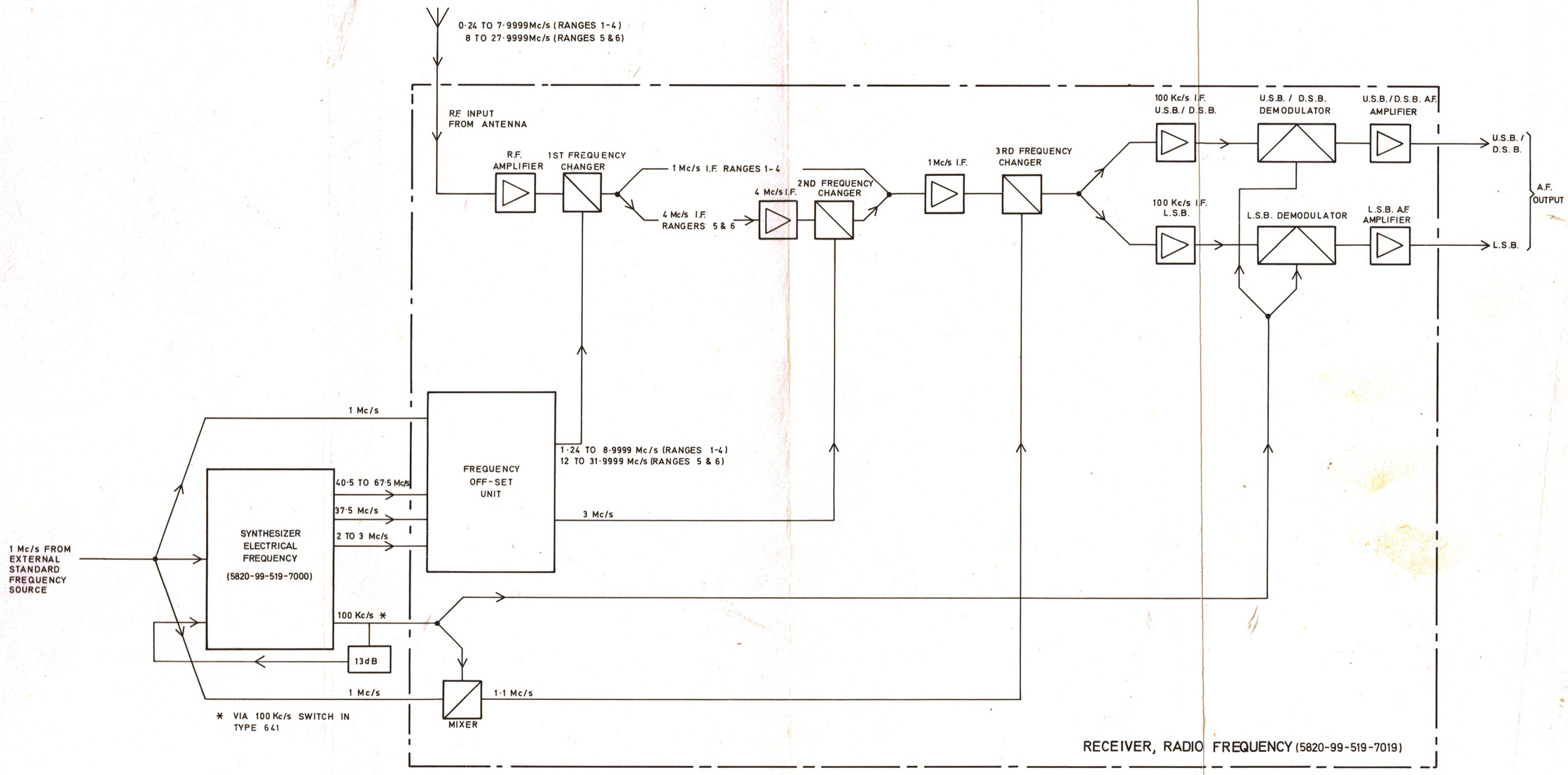
32. Test Points are provided on each unit, colour coded as follows:-

(a) Blue = r.f. outputs

(b) White = d.c. level

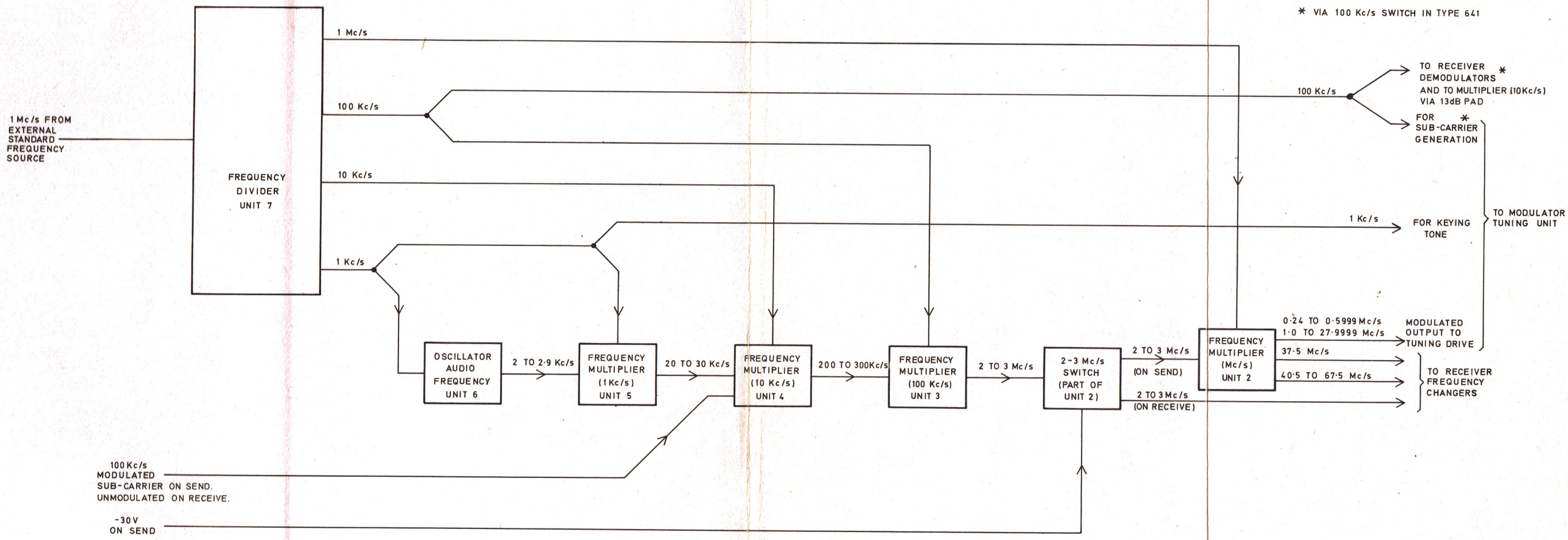
(c) Purple = negative supply

(d) Red = positive supply



RECEIVING EQUIPMENT (FREQUENCY CHANGING & DEMODULATION)
SYNTHESIZER CONNECTIONS — SIMPLIFIED BLOCK DIAGRAM

FIG. 1·2



SYNTHESIZER, ELECTRICAL FREQUENCY
5820-99-519-7000 SIMPLIFIED BLOCK DIAGRAM

FIG.1·3

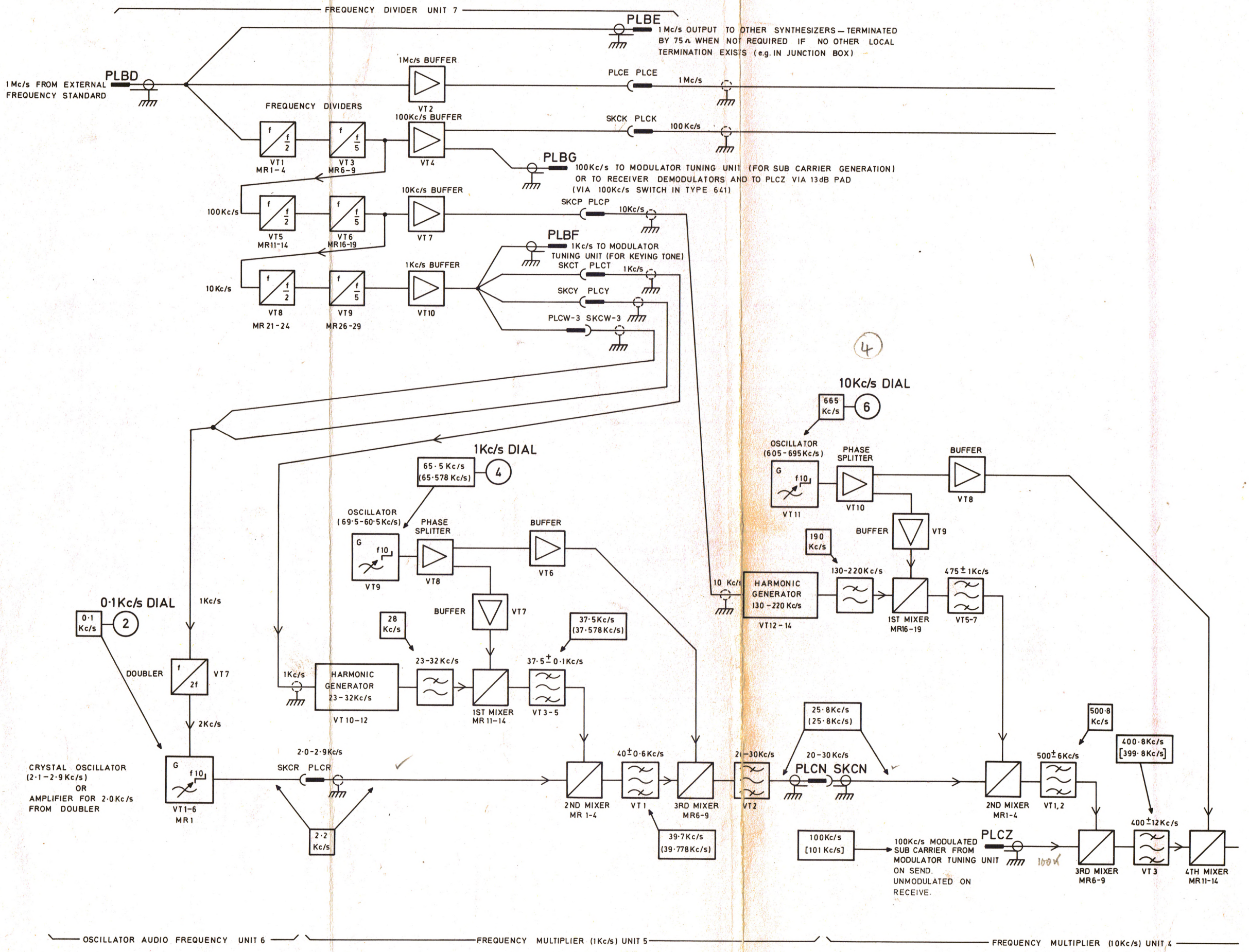

FREQUENCY DIVIDER UNIT 7
PLBE
1 Mc/s OUTPUT TO OTHER SYNTHESIZERS — TERMINATED BY 75Ω WHEN NOT REQUIRED IF NO OTHER LOCAL TERMINATION EXISTS (e.g. IN JUNCTION BOX)
PLBD
1 Mc/s FROM EXTERNAL FREQUENCY STANDARD
1Mc/s BUFFER
VT2
PLCE PLCE
1 Mc/s
FREQUENCY DIVIDERS
100Kc/s BUFFER
SKCK PLCK
100 Kc/s
VT1 MR1-4
VT3 MR6-9
VT4
PLBG
100Kc/s TO MODULATOR TUNING UNIT (FOR SUB CARRIER GENERATION) OR TO RECEIVER DEMODULATORS AND TO PLCZ VIA 13dB PAD (VIA 100Kc/s SWITCH IN TYPE 641)
10Kc/s BUFFER
SKCP PLCP
10Kc/s
VT5 MR11-14
VT6 MR16-19
VT7
PLBF
1Kc/s TO MODULATOR TUNING UNIT (FOR KEYING TONE)
1Kc/s BUFFER
SKCT PLCT
1Kc/s
SKCY PLCY
PLCW-3 SKCW-3
VT8 MR21-24
VT9 MR26-29
VT10
4
10Kc/s DIAL
665 Kc/s
6
OSCILLATOR (605-695Kc/s)
PHASE SPLITTER
BUFFER
VT11
VT10
VT8
BUFFER VT9
190 Kc/s
130-220Kc/s
475 ± 1Kc/s
HARMONIC GENERATOR 130-220 Kc/s
VT12-14
1ST MIXER MR16-19
VT5-7
1Kc/s DIAL
65·5 Kc/s (65·578 Kc/s)
4
OSCILLATOR (69·5-60·5Kc/s)
PHASE SPLITTER
BUFFER
VT9
VT8
VT6
0·1Kc/s DIAL
0·1 Kc/s
2
1Kc/s
BUFFER VT7
28 Kc/s
37·5Kc/s (37·578Kc/s)
DOUBLER
VT7
1Kc/s
HARMONIC GENERATOR 23-32Kc/s
VT10-12
23-32Kc/s
37·5 ± 0·1Kc/s
1ST MIXER MR11-14
VT3-5
2Kc/s
25·8Kc/s (25·8Kc/s)
500·8 Kc/s
400·8Kc/s [399·8Kc/s]
CRYSTAL OSCILLATOR (2·1-2·9Kc/s) OR AMPLIFIER FOR 2·0Kc/s FROM DOUBLER
VT1-6 MR1
2·0-2·9Kc/s
SKCR PLCR
2·2 Kc/s
2ND MIXER MR 1-4
40 ± 0·6Kc/s
VT1
3RD MIXER MR6-9
VT2
20-30Kc/s
PLCN SKCN
2ND MIXER MR1-4
500 ± 6Kc/s
VT1, 2
400 ± 12Kc/s
39·7Kc/s (39·778Kc/s)
100Kc/s [101 Kc/s]
100Kc/s MODULATED SUB CARRIER FROM MODULATOR TUNING UNIT ON SEND. UNMODULATED ON RECEIVE.
PLCZ
3RD MIXER MR6-9
VT3
4TH MIXER MR11-14
OSCILLATOR AUDIO FREQUENCY UNIT 6
FREQUENCY MULTIPLIER (1Kc/s) UNIT 5
FREQUENCY MULTIPLIER (10Kc/s) UNIT 4

FIG.1·4A

| | | |

PART OF RECEIVER RADIO FREQUENCY (5820-99-519-7019)

FREQUENCY SYNTHESIZER (5820-99-519-7000)

PART OF RECEIVER RADIO FREQUENCY (5820-99-519-7019)

RECEIVER OUTFIT CJM
CABINET ASSEMBLY E1 CIRCUIT DIAGRAM

FIG.1.4

NOTES:
1. SKTAL IS FITTED IN OUTFIT CJM PLUG PLAL IS TERMINATED AS SHOWN ONLY WHEN NO AERIAL OUTPUT IS REQUIRED.
2. SOCKET SKTBE IS TERMINATED AS SHOWN IF THERE IS NO OTHER TERMINATION ON THE 1Mc/s LINE. E.G. A JUNCTION BOX. SKTBH IS NOT USED AND PLC IS DISCONNECTED IN OUTFIT CJM.
3. SKTBC IS TERMINATED AS SHOWN BECAUSE THIS OUTPUT IS NOT REQUIRED.
4. CIRCUIT SYMBOLS FOR CERTAIN CAPACITORS ARE OMITTED FOR CLARITY. POSITIONS ARE SHOWN THUS C1 AND ARE CONNECTED TO EARTH AS C25 ALL CAPACITORS ARE 0·1.

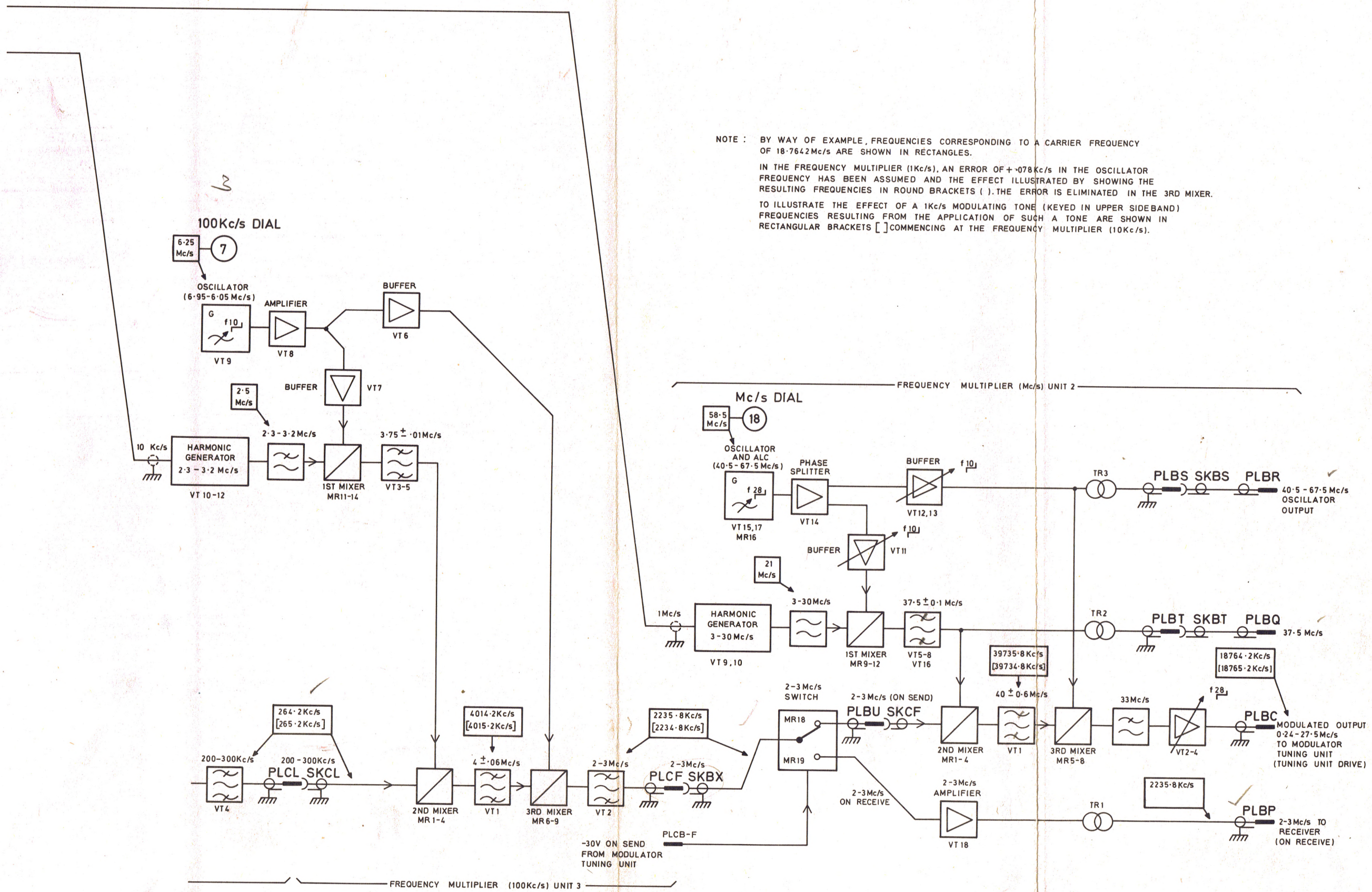
MOD RECORD
1 2 3 4 5 6
7 8 9 10 11 12

B.R. 4146(5) A
Original

NOTE : BY WAY OF EXAMPLE, FREQUENCIES CORRESPONDING TO A CARRIER FREQUENCY OF 18·7642 Mc/s ARE SHOWN IN RECTANGLES.

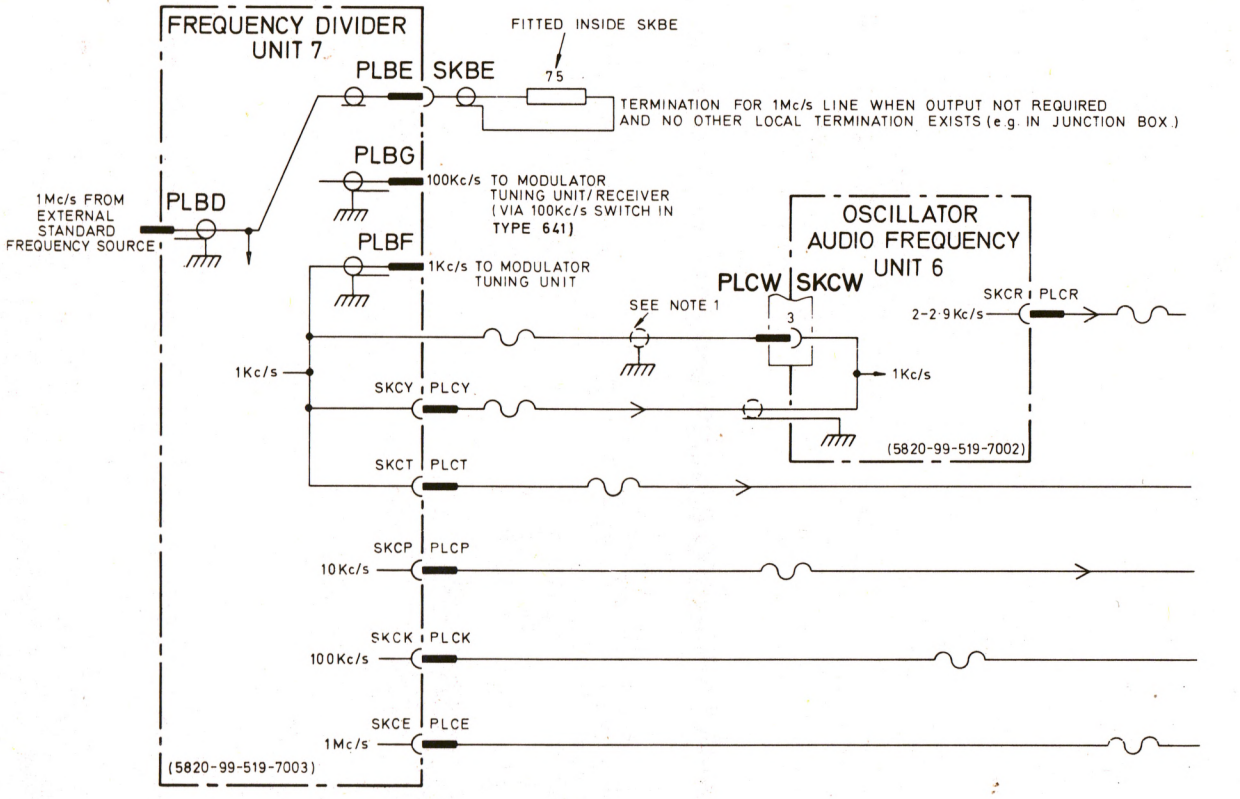
IN THE FREQUENCY MULTIPLIER (1Kc/s), AN ERROR OF + ·078 Kc/s IN THE OSCILLATOR FREQUENCY HAS BEEN ASSUMED AND THE EFFECT ILLUSTRATED BY SHOWING THE RESULTING FREQUENCIES IN ROUND BRACKETS ( ). THE ERROR IS ELIMINATED IN THE 3RD MIXER.

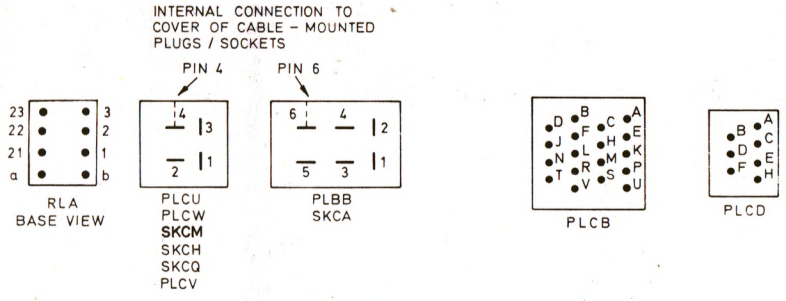
TO ILLUSTRATE THE EFFECT OF A 1Kc/s MODULATING TONE (KEYED IN UPPER SIDEBAND) FREQUENCIES RESULTING FROM THE APPLICATION OF SUCH A TONE ARE SHOWN IN RECTANGULAR BRACKETS [ ] COMMENCING AT THE FREQUENCY MULTIPLIER (10Kc/s).



SYNTHESIZER, ELECTRICAL FREQUENCY
5820-99-519-7000 BLOCK DIAGRAM

FIG. 1·4B



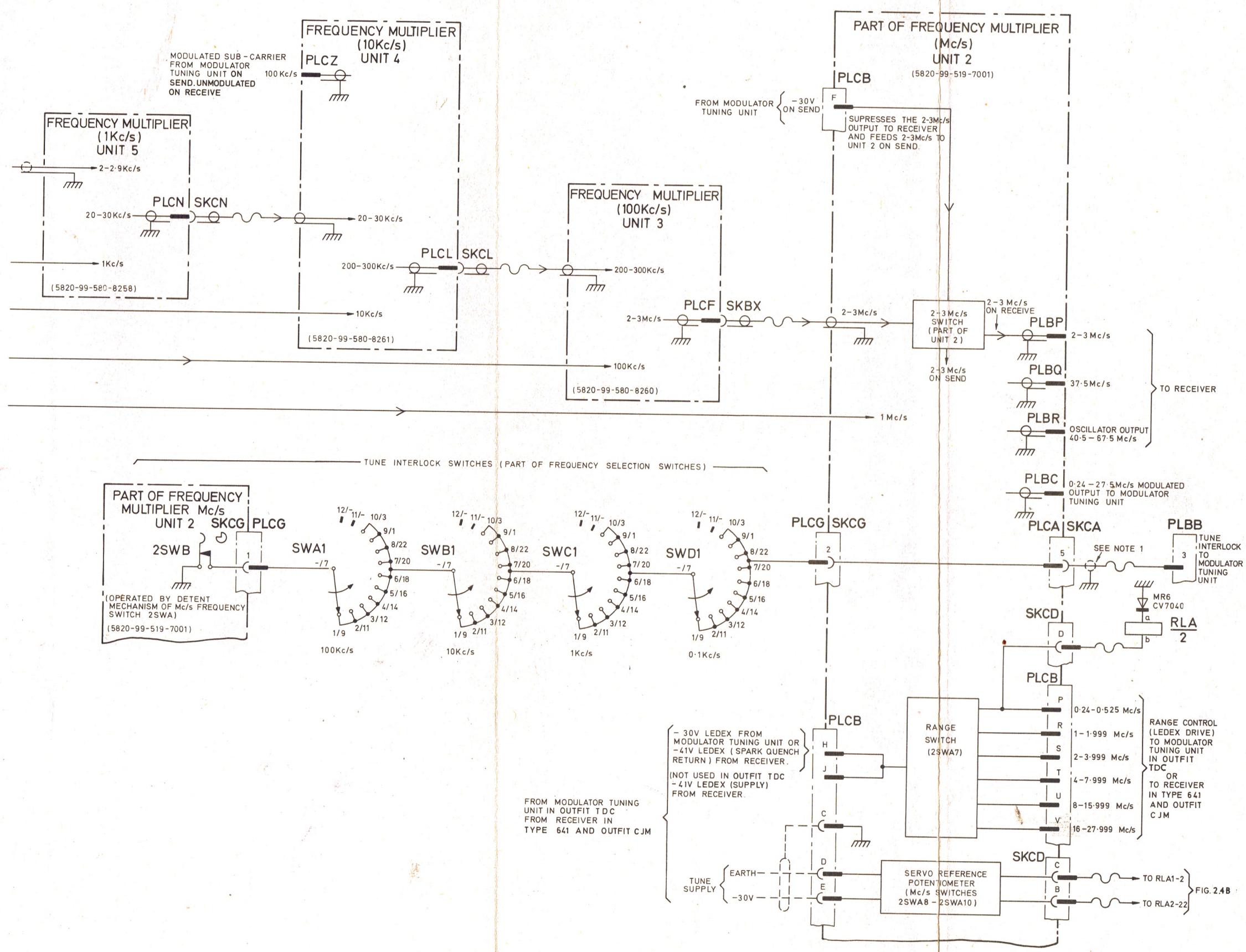


PIN CONNECTIONS ON PLUGS / SOCKETS
(VIEWED FROM PIN SIDE OF PLUGS
AND WIRING SIDE OF SOCKETS.)

NOTE 1. SEE FIG 2·3B FOR DETAILS OF
SCREEN EARTHING ON PLCW & SKCA

FIG.1·5A

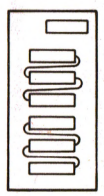
B.R. 4146 (5) A
Original



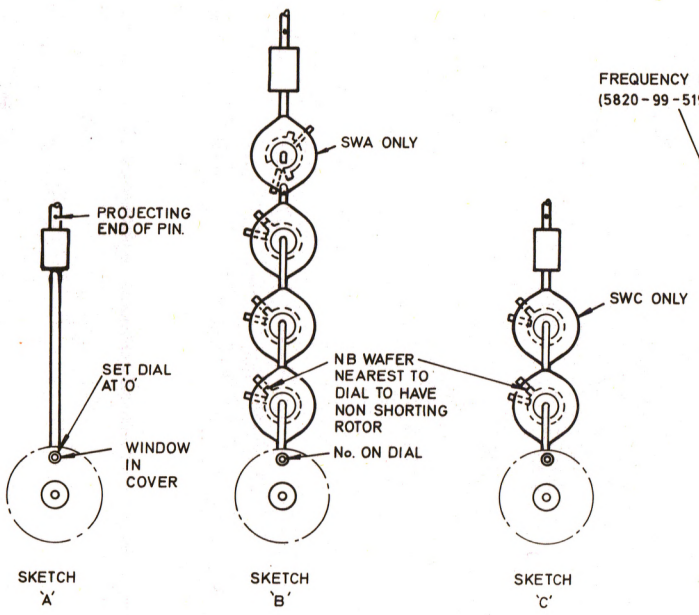
MOD RECORD					
X	2	3	4	5	6
7	8	9	10	11	12

SYNTHESIZER ELECTRICAL FREQUENCY 5820-99-519-7000
CIRCUIT DIAGRAM

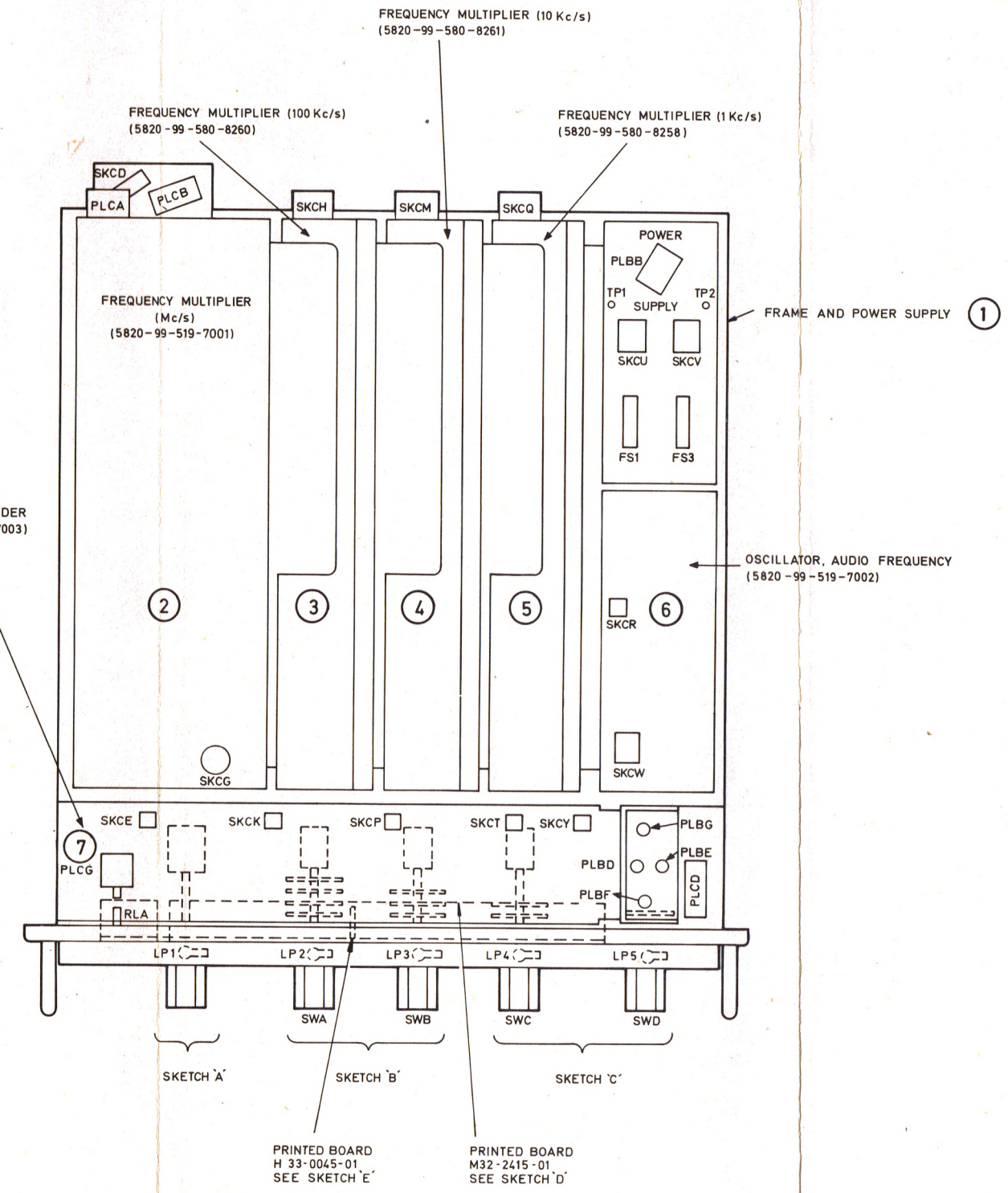
FIG.1·5B

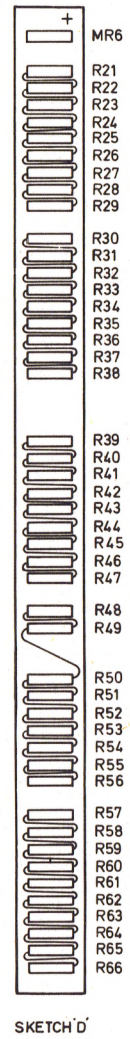


SKETCH 'E'



DIAGRAMMATIC SKETCHES SHOWING RELATIVE SETTING POSITIONS OF DIALS AND SWITCHES





SKETCH 'D'

MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

SYNTHESIZER, ELECTRICAL FREQUENCY 5820-99-519-7000

LAYOUT - TOP VIEW

FIG.1·6

CHAPTER 2

FRAME AND POWER SUPPLY

UNIT 1

Introduction

1. The frame is the mounting for units 2 to 7 which are described, in reverse order, in Chapters 3 to 8. It also carries the power supply chassis and part of the servo reference potentiometer for automatic tuning with its associated relay 1RLA.

2. The front panel of the frame contains the five decade selectors which are ganged to and operate the switches shown in Table 2.1.

TABLE 2.1 — Front Panel Controls

Control	Unit	Switches	Function
MHz	2	SWA1-6	Frequency Selection
	2	SWA7	Frequency Range Control
	2	SWA8-10	Servo Potentiometer Control
	2	SWB	Tune Interlock (Microswitch)
100 kHz	3	SWA1, 2	Frequency Selection
	1	SWA1	Tune Interlock
	1	SWA2-4(b)	Servo Potentiometer Control
10 kHz	4	SWA1, 2	Frequency Selection
	1	SWB1	Tune Interlock
	1	SWB2, 3	Servo Potentiometer Control
1 kHz	5	SWA1, 2	Frequency Selection
	1	SWC1	Tune Interlock
	1	SWC2	Servo Potentiometer Control
0.1 kHz	6	SWA1-5	Frequency Selection
	1	SWD1	Tune Interlock

Power Supply

Figures 2.1, 2.2 and 2.3

3. The power supply provides:-

(a) 6.3 V a.c. via fuse FS3 for dial illuminating lamps. The supply to 1SKCU is not used.

(b) +ve and -ve 8.2 V d.c. stabilised for the transistor supplies.

(c) +ve and -ve 27 V d.c. unstabilised for the silicon mesa n.p.n. transistor VT4 in the Frequency Multiplier (MHz).

4. An a.c. mains supply in the range 100 to 260 V, 50 to 60 Hz can be used, according to the connections of the mains transformer TR2. The primary windings of TR2 are connected in series for 230 V and in parallel for 115 V. A reversible label should indicate the correct supply.

5. There are two secondary windings on TR2. One provides the 6.3 V a.c. output and the other supplies 45 V a.c., via FS1, to the full-wave rectifier MR1 which provides d.c. for the 27 V and 8.2 V supplies. The 8.2 V d.c. supplies are stabilised by zener diodes MR2, MR3, MR4, MR5.

Servo Reference Potentiometer Figure 2.4

6. In Type 641, Outfit TDC and Outfit CJM the tuning circuits for the appropriate frequency range are automatically selected and tuned by setting the synthesizer decade controls. Selection is by a Ledex system controlled by 2SWA7 in the Frequency Multiplier (MHz). The selected circuits are then servo tuned to the desired frequency. (See Chapters 1 and 8).

7. The servo reference voltage for automatic tuning is the output of a potential divider network, one section of which is in the Frequency Multiplier (MHz) and the other behind the front panel. The latter is permanently connected across the output terminals of the former and always presents a resistance of 10 kilohms to them. Within each frequency range, except range 1, the potential at 2PLCD.B represents the MHz dial reading and the p.d. between 2 PLCD.B and 2PLCD.C represents 1 MHz.

8. The direct voltage across 10 000 ohms, then, represents 1000 kHz. Consequently the potentials across steps of 1000, 100 and 10 ohms, represent steps of 100, 10, and 1 kHz respectively. These potentials are tapped by 1SWA2 and 3, 1SWB2 and 3 and 1SWC2 the positions of which are determined by the 100, 10 and 1 kHz dial readings. The resulting potential at 2PLCD.A is then at a level representing the frequency set on the synthesizer.

9. When the MHz dial is at 0, range 1 is selected, a constant direct voltage supply appears at 2PLCD.B, C and 1RLA operates to connect this supply to 1SWA4(a) and 1SWA4(b) via 1RLA1 and 1RLA2. (See Chapter 8).

10. In this event, only frequency settings between 240 and 525 kHz have any effect on the tuning servos. Also the servo reference voltage produced over this range has a non-linear relationship to frequency.

11. Resistors R67 to R73, associated with 1SWA4(a) and 1SWB4(b), are suitably graded and connected to SWB2 and SWB3 so that the potential at 2PLCD.A accurately represents the frequency set on the 100, 10 and 1 kHz controls.

12. The setting of the 0.1 kHz frequency control has no effect on automatic tuning circuits.

Tune Interlock

13. Switch wafers SWA1, SWB1, SWC1, SWD1 are fitted behind the front panel and wired in series with microswitch 2SWB in the Frequency Multiplier (MHz). Movement of any decade control results in momentary interruption of the transmitter tune lock circuit and/or the receiver servo supply switch circuit.

CHAPTER 2

FRAME AND POWER SUPPLY

UNIT 1

CONTENTS LIST

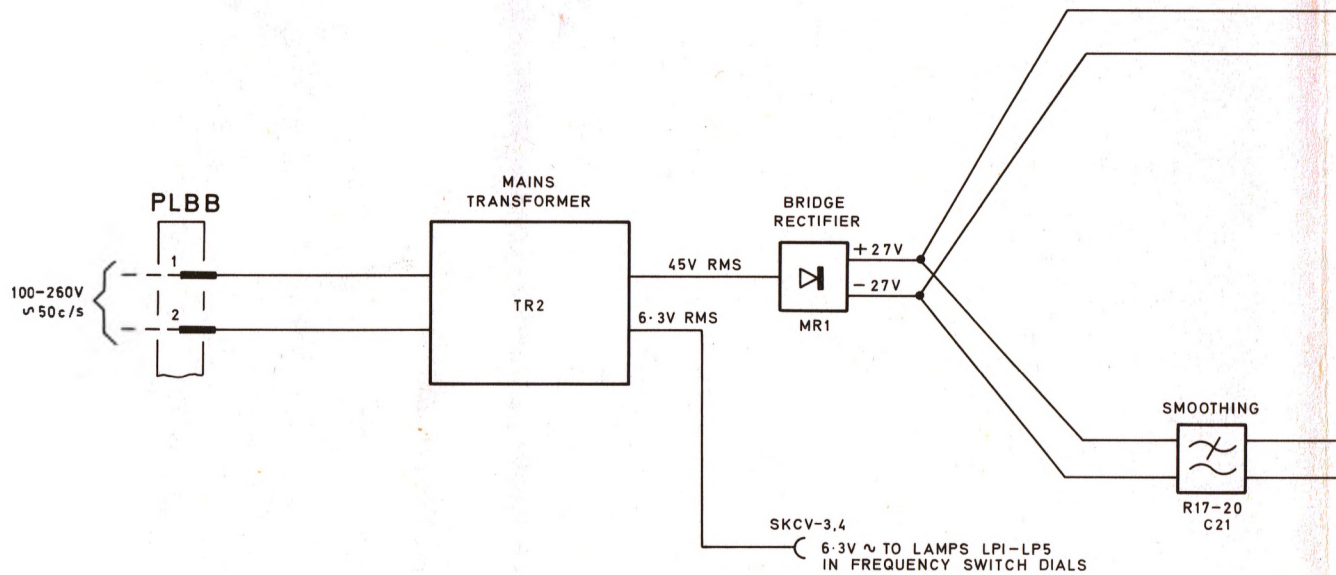
	Paragraphs
Introduction	1,2
Power Supply	3-5
Servo Reference Potentiometer	6-12
Tune Interlock	13

TABLES

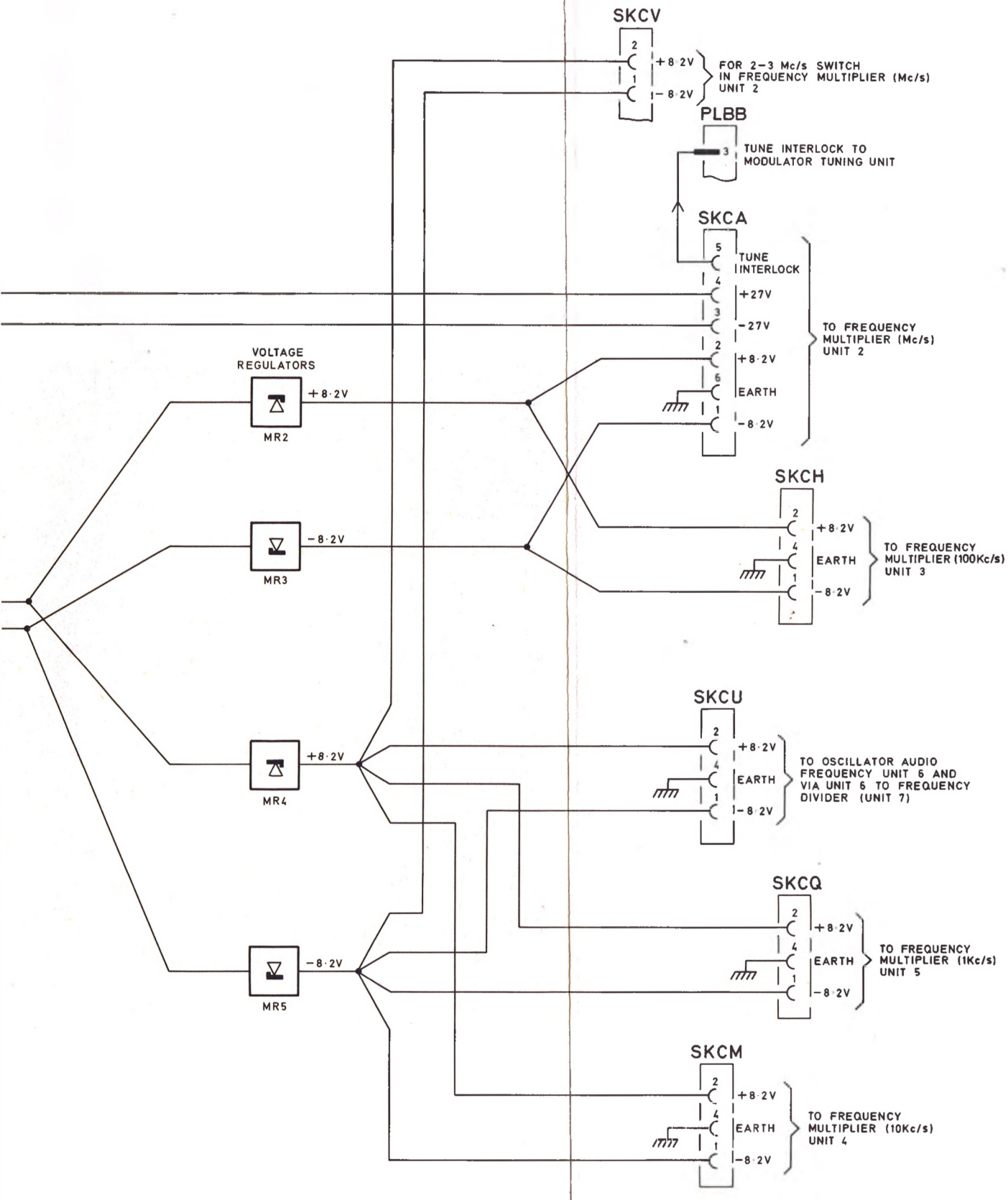
	Table No
Front Panel Controls	2.1

ILLUSTRATIONS

	Figure No
Power Supply. Block Diagram	2.1
Power Supply. Component Layout	2.2
Power Supply. Circuit Diagram	2.3A,B
Servo Reference Potentiometer. Circuit Diagram	2.4A,B


PLBB
1
2
100–260V
∿50c/s
MAINS
TRANSFORMER
TR2
45V RMS
6·3V RMS
BRIDGE
RECTIFIER
+27V
–27V
MR1
SMOOTHING
R17–20
C21
SKCV-3,4
6·3V ∿ TO LAMPS LP1–LP5
IN FREQUENCY SWITCH DIALS

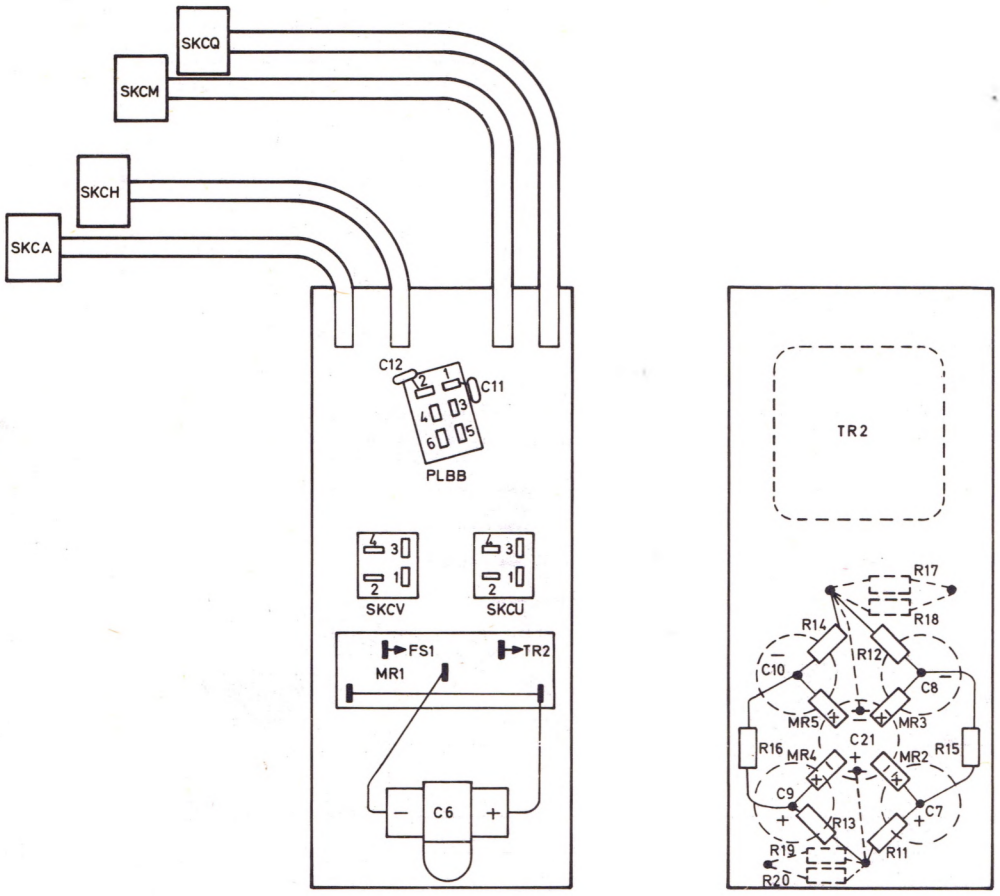
B.R.4146(5)A
Original



SYNTHESIZER, ELECTRICAL FREQUENCY 5820-99-519-7000

POWER SUPPLY BLOCK DIAGRAM

FIG. 2·1



UNDERSIDE OF UPPER CHASSIS

UNDERSIDE OF LOWER CHASSIS

POWER SUPPLY

MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

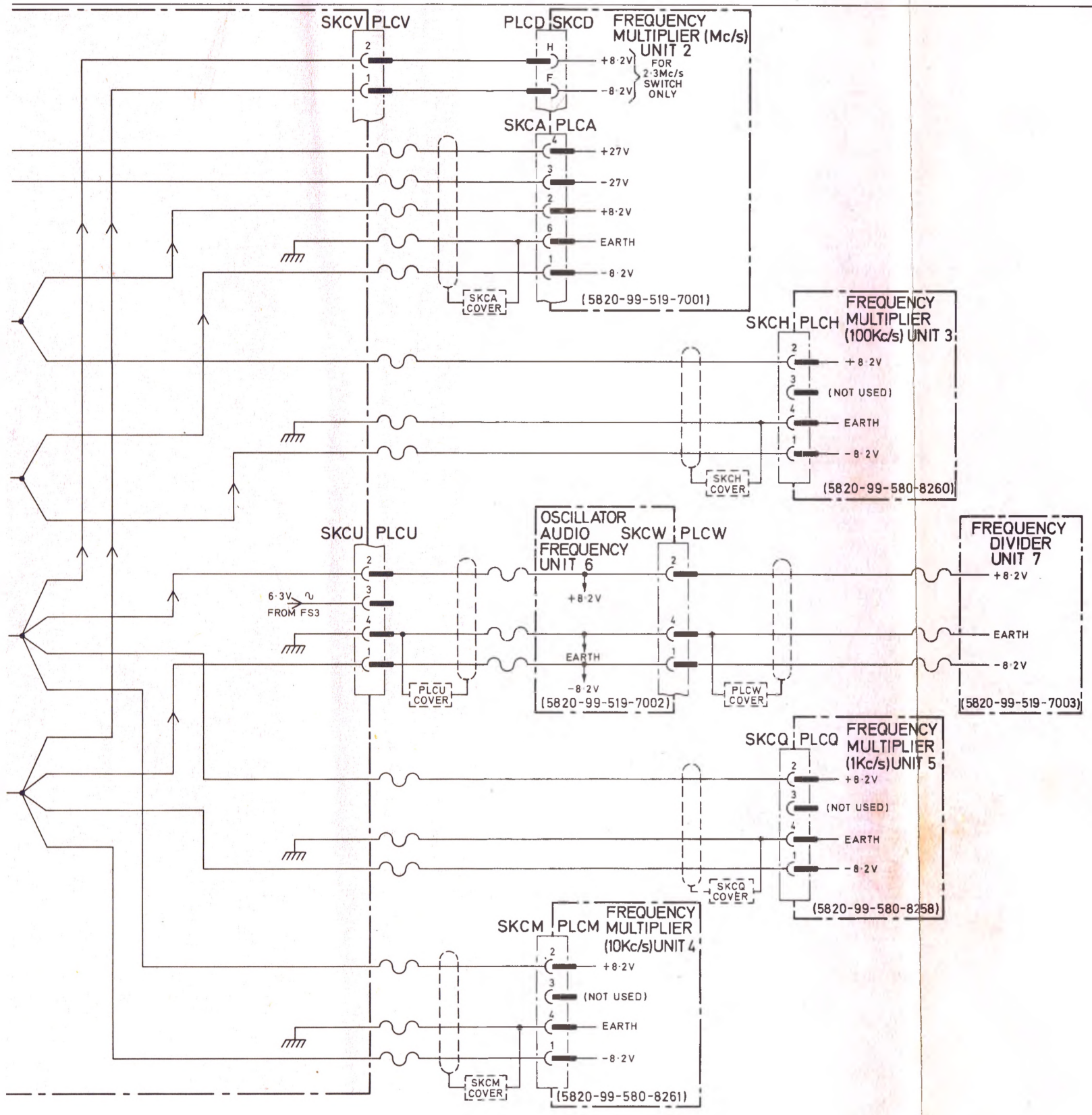
SYNTHESIZER, ELECTRICAL FREQUENCY 5820-99-519-7000

POWER SUPPLY COMPONENT LAYOUT

FIG. 2·2

B.R. 4146 (5) A
Amdt. 5, 5. 79

| | | |



MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

SYNTHESISER ELECTRICAL FRQUENCY 5820-99-519-7000

POWER SUPPLY CIRCUIT DIAGRAM

FIG. 2·3B

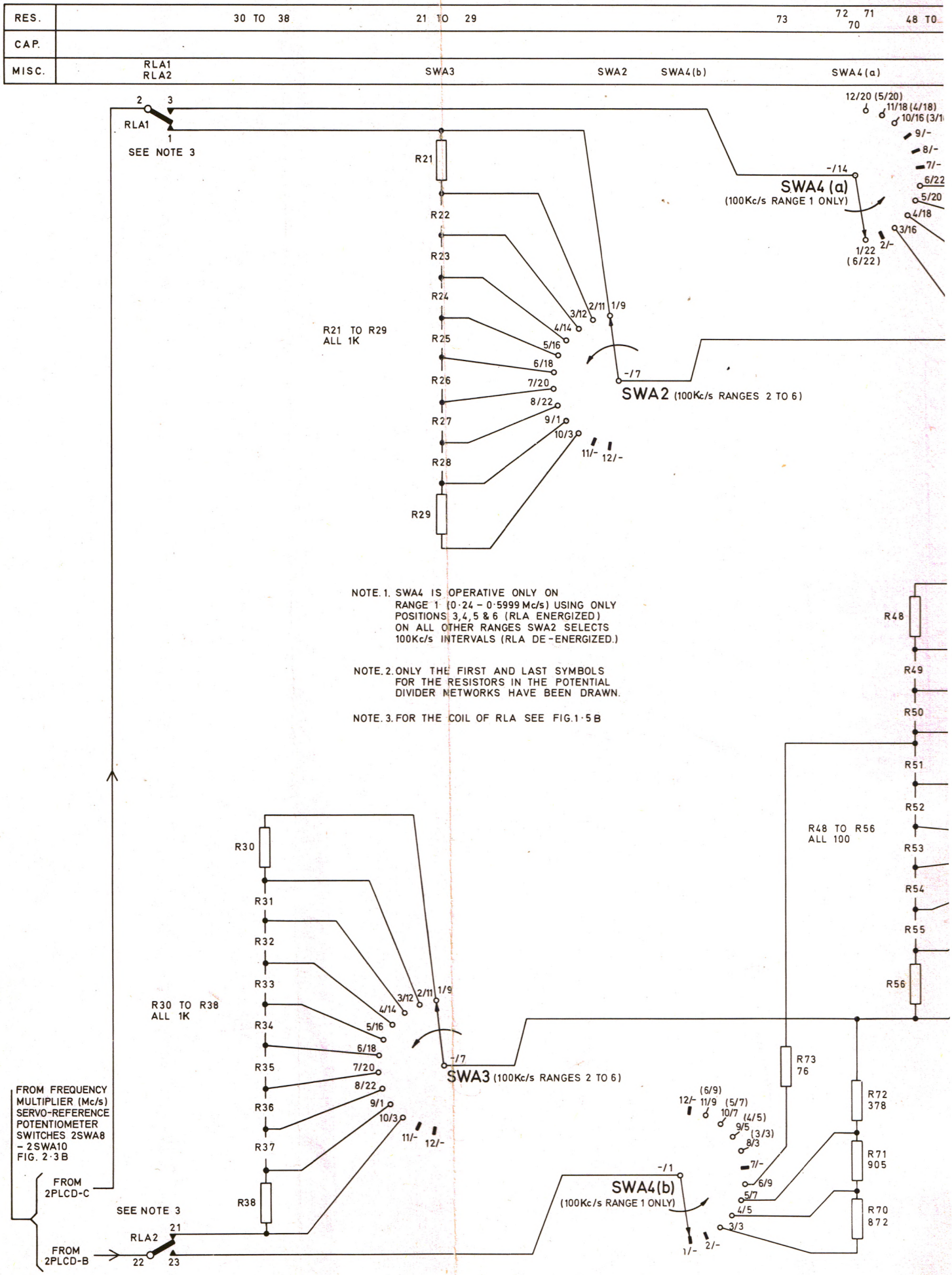
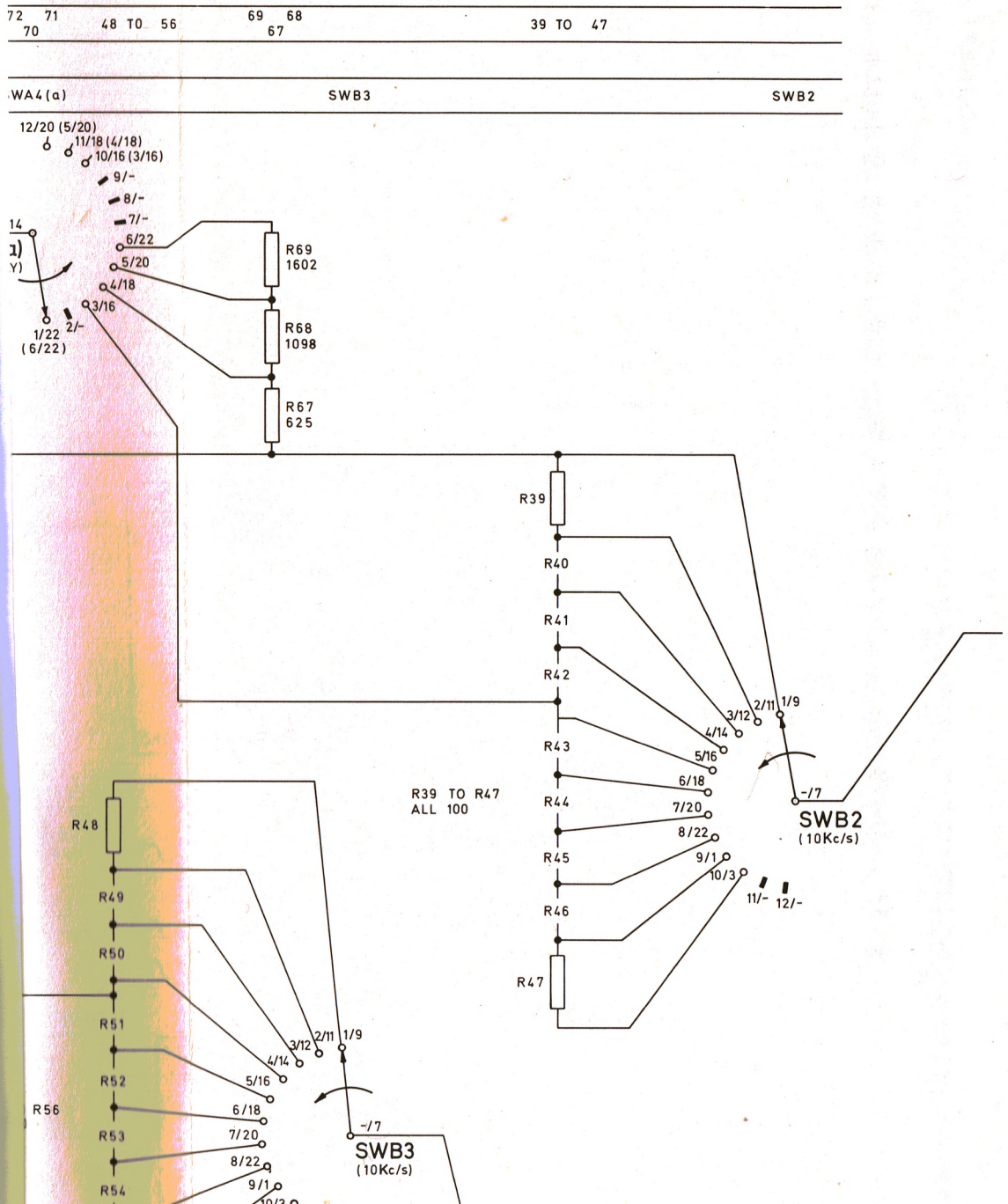
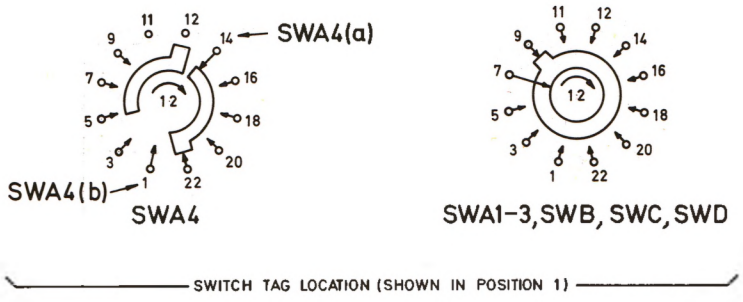
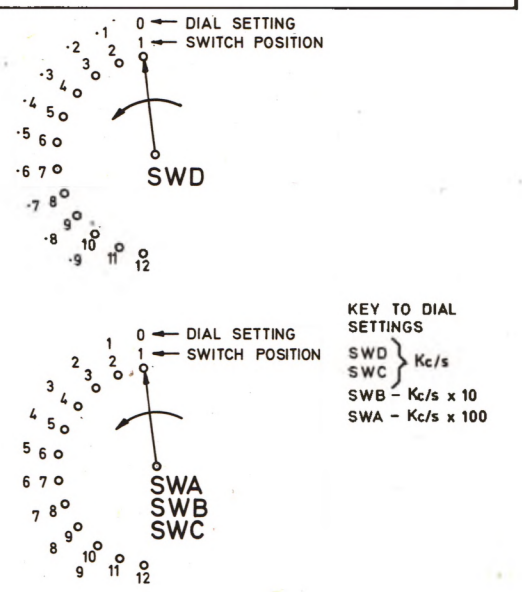

RES.
30 TO 38
21 TO 29
73
72
71
70
48 TO
CAP.
MISC.
RLA1
RLA2
SWA3
SWA2
SWA4(b)
SWA4(a)
2
3
RLA1
1
SEE NOTE 3
R21
R22
R23
R24
R25
R26
R27
R28
R29
R21 TO R29
ALL 1K
3/12
2/11
1/9
4/14
5/16
6/18
7/20
8/22
9/1
10/3
11/-
12/-
-/7
SWA2 (100Kc/s RANGES 2 TO 6)
12/20 (5/20)
11/18 (4/18)
10/16 (3/1
9/-
8/-
7/-
6/22
5/20
4/18
3/16
2/-
-/14
SWA4 (a)
(100Kc/s RANGE 1 ONLY)
1/22
(6/22)
NOTE. 1. SWA4 IS OPERATIVE ONLY ON RANGE 1 (0·24 – 0·5999 Mc/s) USING ONLY POSITIONS 3,4,5 & 6 (RLA ENERGIZED) ON ALL OTHER RANGES SWA2 SELECTS 100Kc/s INTERVALS (RLA DE-ENERGIZED.)
NOTE. 2. ONLY THE FIRST AND LAST SYMBOLS FOR THE RESISTORS IN THE POTENTIAL DIVIDER NETWORKS HAVE BEEN DRAWN.
NOTE. 3. FOR THE COIL OF RLA SEE FIG.1·5B
R48
R49
R50
R51
R52
R53
R54
R55
R56
R48 TO R56
ALL 100
R30
R31
R32
R33
R34
R35
R36
R37
R38
R30 TO R38
ALL 1K
3/12
2/11
1/9
4/14
5/16
6/18
7/20
8/22
9/1
10/3
11/-
12/-
-/7
SWA3 (100Kc/s RANGES 2 TO 6)
FROM FREQUENCY MULTIPLIER (Mc/s) SERVO-REFERENCE POTENTIOMETER SWITCHES 2SWA8 – 2SWA10 FIG. 2·3B
FROM 2PLCD-C
FROM 2PLCD-B
SEE NOTE 3
RLA2
21
22
23
R73
76
R72
378
R71
905
R70
872
12/-
(6/9)
11/9
(5/7)
10/7
(4/5)
9/5
(3/3)
8/3
7/-
6/9
5/7
4/5
3/3
1/-
2/-
-/1
SWA4(b)
(100Kc/s RANGE 1 ONLY)

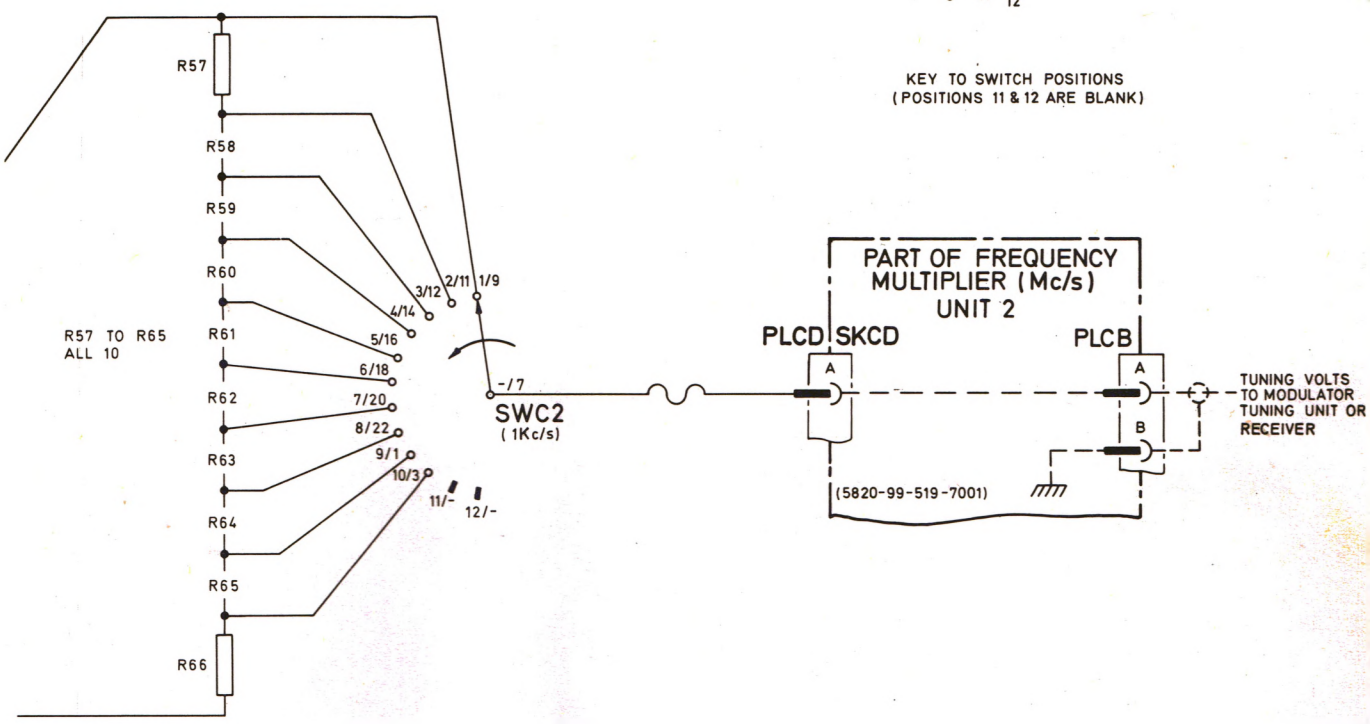
FIG. 2·4A


72 71 70
48 TO 56
69 68 67
39 TO 47
WA4(a)
SWB3
SWB2
12/20 (5/20)
11/18 (4/18)
10/16 (3/16)
9/-
8/-
7/-
6/22
5/20
4/18
3/16
1/22 (6/22)
2/-
R69 1602
R68 1098
R67 625
R39
R40
R41
R42
R43
R44
R45
R46
R47
R39 TO R47 ALL 100
3/12
2/11
1/9
4/14
5/16
6/18
7/20
8/22
9/1
10/3
11/-
12/-
-/7
SWB2 (10Kc/s)
R48
R49
R50
R51
R52
R53
R54
R56
SWB3 (10Kc/s)

57 TO 66
SWC2







MOD RECORD

1	2	3	4	5	6
7	8	9	10	11	12

SYNTHESIZER ELECTRICAL FREQUENCY 5820-99-519-7000
SUB-ASSEMBLY 1 (SERVO REFERENCE POTENTIOMETER) CIRCUIT DIAGRAM

FIG. 2-4B

CHAPTER 3

FREQUENCY DIVIDER 5820-99-519-7003

UNIT 7

CONTENTS LIST

	Paragraphs
Introduction	1,2
Physical Description	3
Electrical Description	4-11

ILLUSTRATIONS

	Figure No
Frequency Divider. Block Diagram	3.1
Frequency Divider. Component Layout	3.2
1 MHz and 100 kHz Outputs. Circuit Diagram	3.3A,B
10 kHz and 1kHz Outputs. Circuit Diagram	3.4A,B

CHAPTER 3

FREQUENCY DIVIDER 5820-99-519-7003

UNIT 7

Introduction

1. The Frequency Divider provides reference frequencies of 1 MHz, 100 kHz, 10 kHz and 1 kHz for the decade multiplier units. These references are derived from a 1 MHz standard frequency which is fed to the Frequency Divider from an external source (eg Outfit FSA or FSB).

2. The following outputs are also provided:-

(a) 100 kHz for use in the Modulator Tuning Unit and/or Receiver.

(b) 1 kHz for the Oscillator Audio Frequency.

(c) 1 kHz for Tone Keying.

(d) 1 MHz for use as a "loop" to other synthesizers.

Physical Description

3. The unit, which is an enclosed rectangular frame containing printed wiring boards, is behind and adjacent to the front panel. It is secured to the main frame by four screws on the left-hand side and two nuts and bolts on the right-hand side. Plug-in cables are long enough for the unit to be removed and reconnected for test purposes.

Electrical Description

Figures 3.1, 3.3 and 3.4

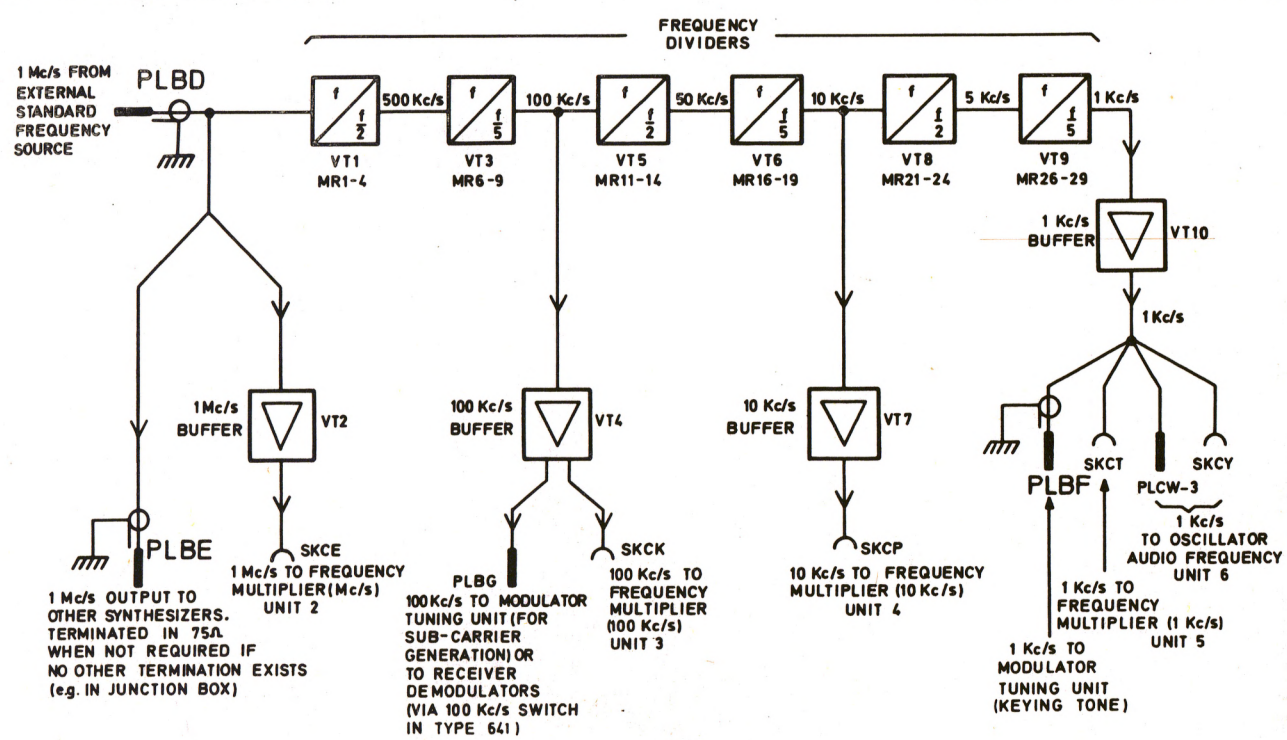


FIG. 3.1 FREQUENCY DIVIDER 5820-99-519-7003
BLOCK DIAGRAM

4. Sub-multiples of the 1 MHz standard frequency are obtained by a series of re-generative modulator dividers which effect successive division by two and five. Except for the 1 MHz output at PLBE, the outputs are provided via individually tuned buffer amplifiers.

5. The six dividers work in the same way so only one, the 1 MHz to 500 kHz divider, is described. This comprises the shunt modulator MR1-4, the amplifier VT1 and the turned circuit L3 and C4.

6. VT1 collector circuit L3-C4 is tuned to the required output frequency of 500 kHz. This frequency is fed back from the secondary of L3 to the balanced modulator MR1-4 which produces harmonics of the 500 kHz. These harmonics are mixed with the incoming 1 MHz to produce a number of sum and difference frequencies at the input to VT1. The tuned collector circuit of VT1 ensures that only the difference frequency resulting in 500 kHz is effective. Base bias is determined by R3, R4 and R5 which is decoupled by C8. The 500 kHz output is coupled to the next divider ($\div$ 5) by C13.

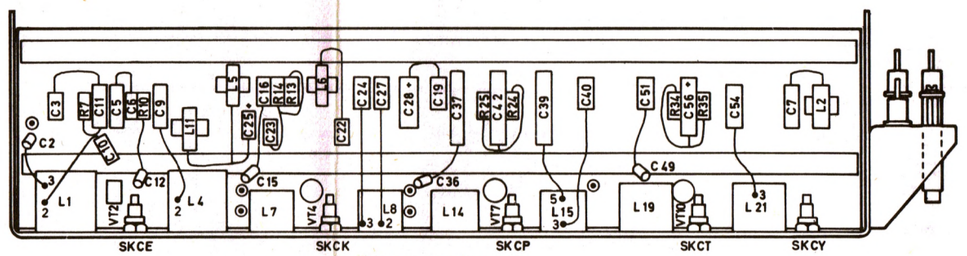
7. Note that the balance of the modulator diodes must be accurate enough to prevent feedback from the collector of VT1 to its base, which might cause the divider to behave as an oscillator.

8. Although each divider is self-sustaining by re-generative action, the balanced action of the modulator ensures that no spurious output is produced by loss of input.

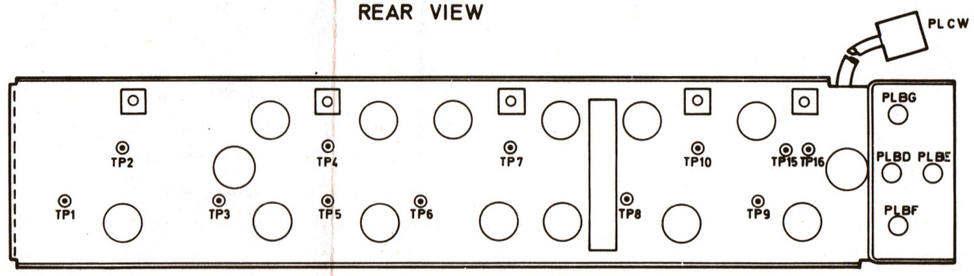
9. Each of the buffer amplifiers has a tuned circuit in the base and collector circuits. Emitter bias is used, with negative feedback being provided by R13, R24, R34 in the 100 kHz, 10 kHz and 1 kHz buffers respectively.

10. The two outputs from the 100 kHz buffer amplifier are one of high impedance from C24 at SKCK to the Multiplier (100 kHz) and another of low impedance (75 ohms) from C27 at PLBG to the Modulator Tuning Unit and/or Receiver.

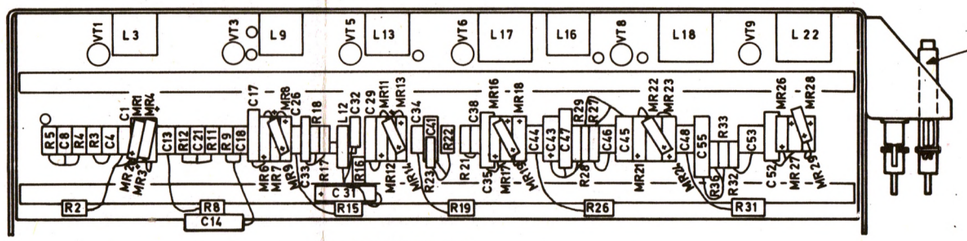
11. Positive and negative 8.2 V d.c. supplies are provided via PLCW1, 2 from the Power Supply on the synthesizer frame. In respect of signal frequencies the negative d.c. supplies of individual circuits are isolated from each other by LC filters. The unit negative d.c. supply is isolated from other units by filter L2, C7.



REAR VIEW



TOP VIEW



FRONT VIEW

SOCKET SKBE CONTAINING R1 PLUGGED INTO PLBE (USED WHEN NO OTHER TERMINATION OF 1Mc/s INPUT EXISTS

MOD RECORD
1 2 3 4 5 6
7 8 9 10 11 12

FREQUENCY DIVIDER 5820-99-519-7003
SUB-ASSEMBLY 7 COMPONENT LAYOUT

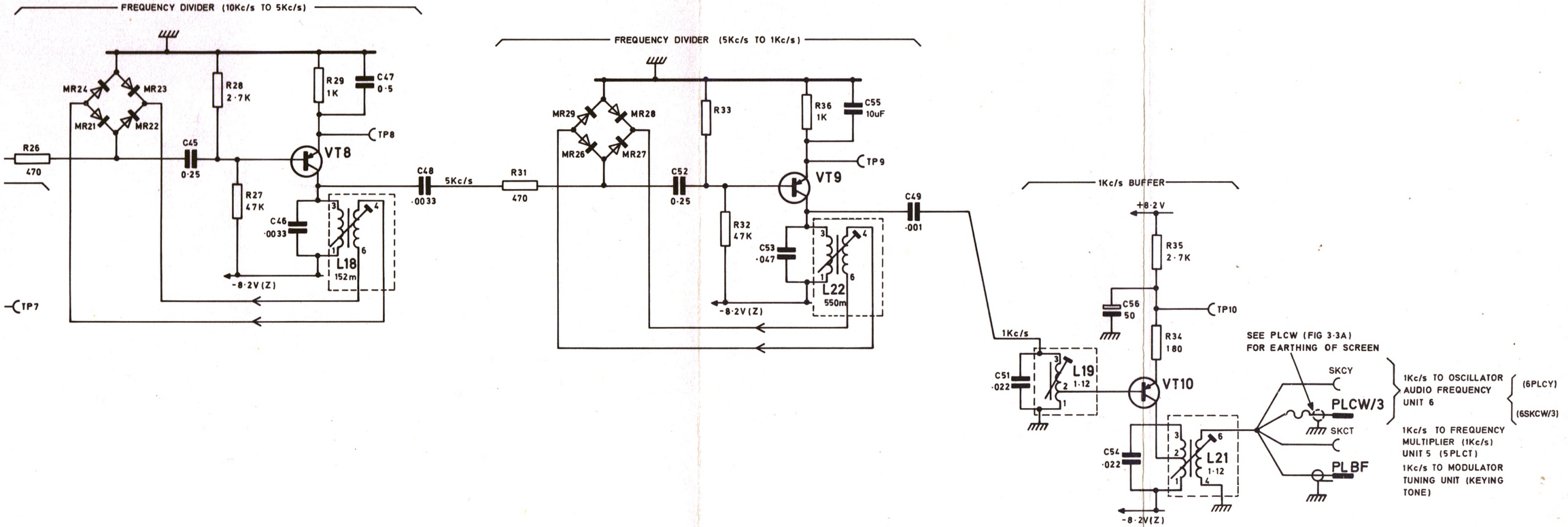
FIG. 3·2

| | | |

| | | |

| | | |

26	28	27	29	31	33	32	36	35 34
45	46	47	48	52	53	55	49	51	56	54
MR24 MR23 MR21 MR22	VT8 L18	MR29 MR28 MR26 MR27	VT9 L22	L19	VT10	L21



MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY DIVIDER 5820-99-519-7003

SUB-ASSEMBLY 7 (10Kc/s & 1Kc/s OUTPUTS) CIRCUIT DIAGRAM

FIG. 3·4B

CHAPTER 4

OSCILLATOR, AUDIO FREQUENCY

5820--99-519-7002

UNIT 6

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	Paragraphs
Introduction	1-3
Physical Description	4
Electrical Description	5-9

ILLUSTRATIONS

	Figure No
Oscillator Audio Frequency. Block Diagram	4.1
Oscillator Audio Frequency. Component Layout	4.2
Crystal Switching. Circuit Diagram	4.3
Oscillator Audio Frequency. Circuit Diagram	4.4A,B

CHAPTER 4

OSCILLATOR, AUDIO FREQUENCY

5820-99-519-7002

UNIT 6

Introduction

1. The Oscillator, Audio Frequency provides outputs from 2.0 kHz in 0.1 kHz steps to 2.9 kHz. The required output is selected by SWA which is operated by the 0.1 kHz decade control on the front panel of the synthesizer.

2. The 2.1 to 2.9 kHz outputs are derived from an internal free-running oscillator, the crystal for which is selected by SWA at dial settings from 0.1 to 0.9 kHz.

3. The 2.0 kHz output, selected by SWA at dial setting 0 kHz, is obtained by doubling the 1 kHz reference frequency supplied by the Frequency Divider.

Physical Description

4. The unit is an enclosed rectangular frame, containing printed wiring boards, on the right-hand side of the synthesizer frame between the Frequency Divider and the Power Supply. It is secured by four screws. Plug-in cables are long enough for the unit to be removed and re-connected for test purposes.

Electrical Description

Figures 4.1, 4.3 and 4.4

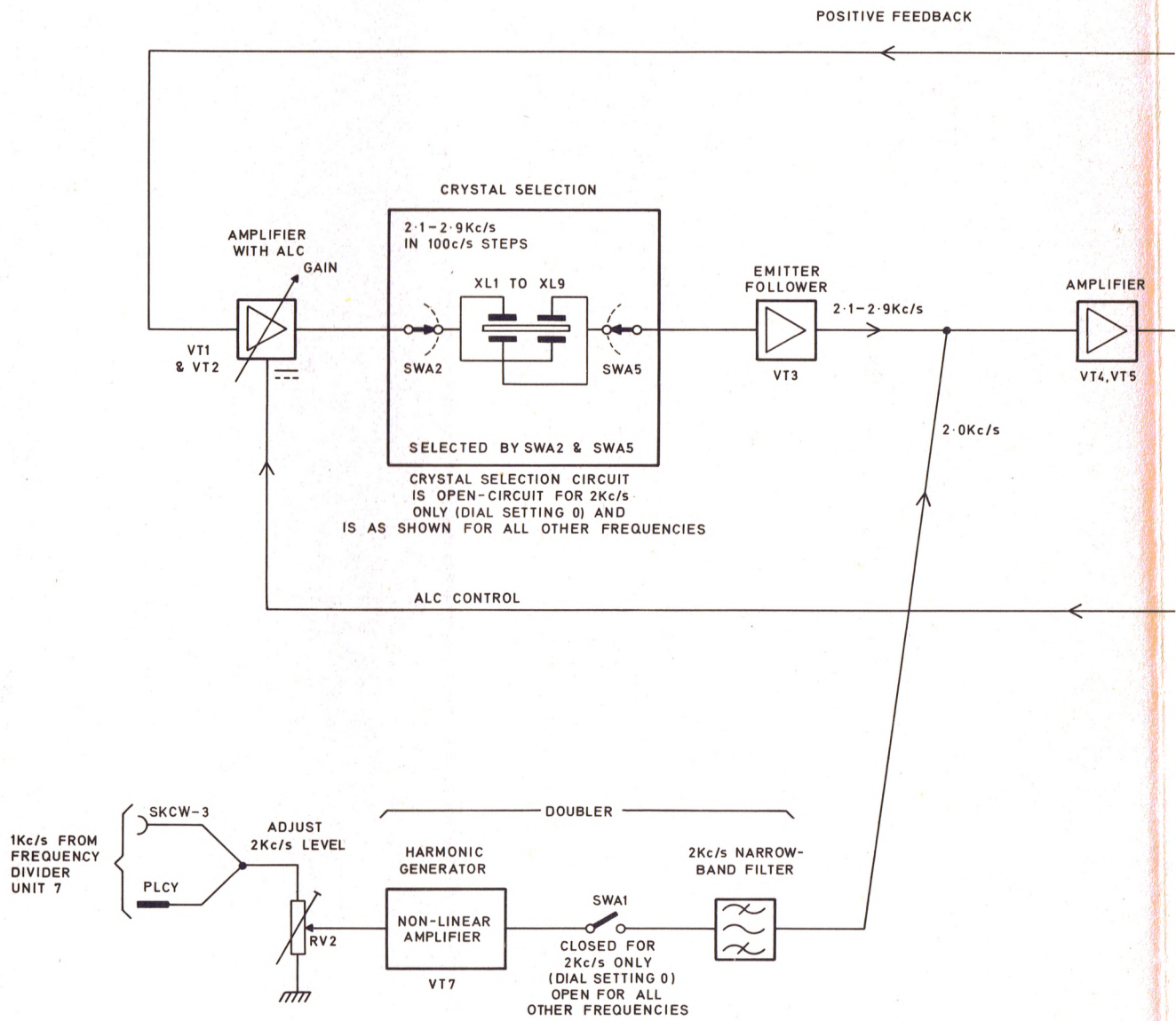
5. The Oscillator, A.F. circuit employs flexure mode crystals connected between the collector of VT1 and the base of emitter follower VT3. The crystal in use depends upon the position of the 0.1 kc/s decade switch. Any one of nine crystals can be selected by switch wafers SWA2 and SWA5, while switch wafers SWA3 and SWA4 earth the crystals not in use.

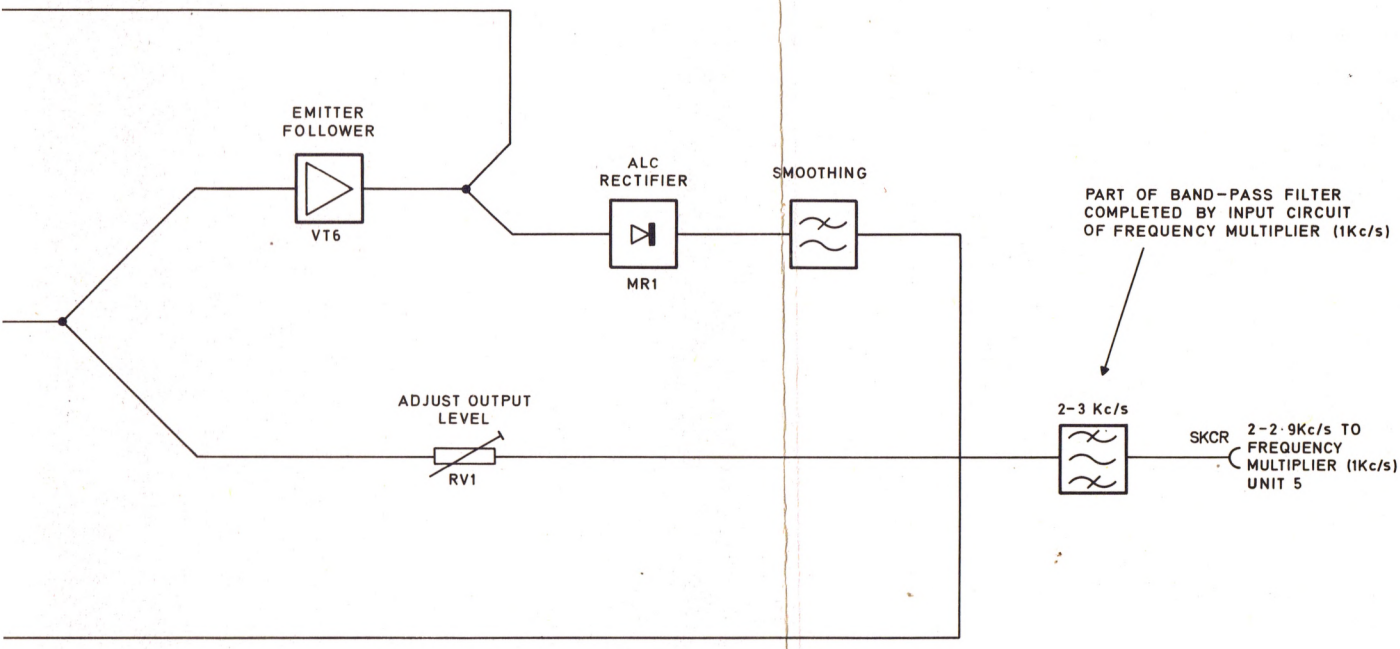
6. The crystal output is taken from contact 4 of SWA5 and fed to the base of emitter follower VT3. The output from VT3 emitter is coupled via C8 to VT4 base. VT4 and VT5 amplify the signal to the required output level. L2 and C22 in VT5 collector circuit form half a bandpass circuit with a passband of 2.0 to 3.0 kHz. The other half of the circuit is formed by the input circuit of the Frequency Multiplier (1 kHz). The output level is adjusted by RV1.

7. Emitter follower VT6 provides feedback via R7 and C1 to the emitter of VT1, a feedback amplifier. VT1 provides an output to maintain oscillation of the crystal in circuit (XL1 to XL9). The output at VT1 collector depends on the a.g.c. voltage fed to the variable shunt VT2. This a.g.c. voltage is taken from VT6 emitter, rectified by MR1, smoothed by L1 and C18, and fed to VT2 base.

8. VT7 is operated as a frequency doubler stage to provide an output of 2.0 kHz. This output is derived from the 1 kHz input from the Frequency Divider and is switched into circuit by switch wafer SWA1 when the decade switch is set to .0 kHz. The input level is adjustable by means of RV2. The thermistor TH1 in parallel with R40 is fitted to improve response at high temperatures.

9. The pair of tuned circuits formed by L3, C27, L4 and C31 are tuned to 2.0 kHz to provide sufficient rejection of 1 kHz and are loosely coupled by C29. The 2.0 kHz output is taken from a tapping on L4 and fed via R43 and C32 to VT4 base and then via the common output circuit to the Frequency Multiplier (1 kHz).


POSITIVE FEEDBACK
CRYSTAL SELECTION
2·1–2·9Kc/s
IN 100c/s STEPS
AMPLIFIER
WITH ALC
GAIN
XL1 TO XL9
EMITTER
FOLLOWER
2·1–2·9Kc/s
AMPLIFIER
VT1
& VT2
SWA2
SWA5
VT3
VT4,VT5
2·0Kc/s
SELECTED BY SWA2 & SWA5
CRYSTAL SELECTION CIRCUIT
IS OPEN-CIRCUIT FOR 2Kc/s
ONLY (DIAL SETTING 0) AND
IS AS SHOWN FOR ALL OTHER FREQUENCIES
ALC CONTROL
1Kc/s FROM
FREQUENCY
DIVIDER
UNIT 7
SKCW-3
PLCY
ADJUST
2Kc/s LEVEL
DOUBLER
HARMONIC
GENERATOR
2Kc/s NARROW-
BAND FILTER
SWA1
RV2
NON-LINEAR
AMPLIFIER
VT7
CLOSED FOR
2Kc/s ONLY
(DIAL SETTING 0)
OPEN FOR ALL
OTHER FREQUENCIES

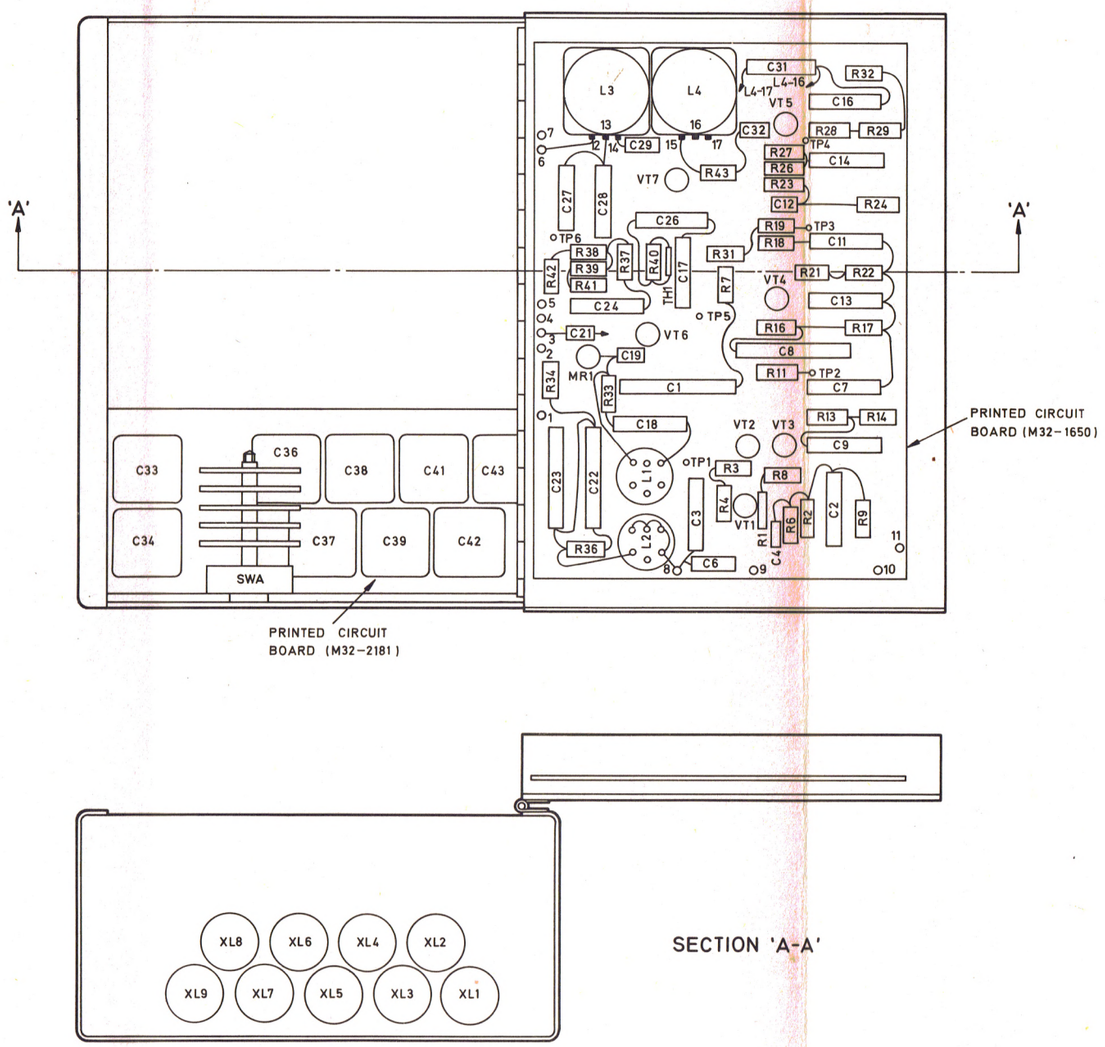


OSCILLATOR, AUDIO FREQUENCY 5820-99-519-7002

SUB-ASSEMBLY 6

BLOCK DIAGRAM

FIG. 4·1



SECTION 'A-A'

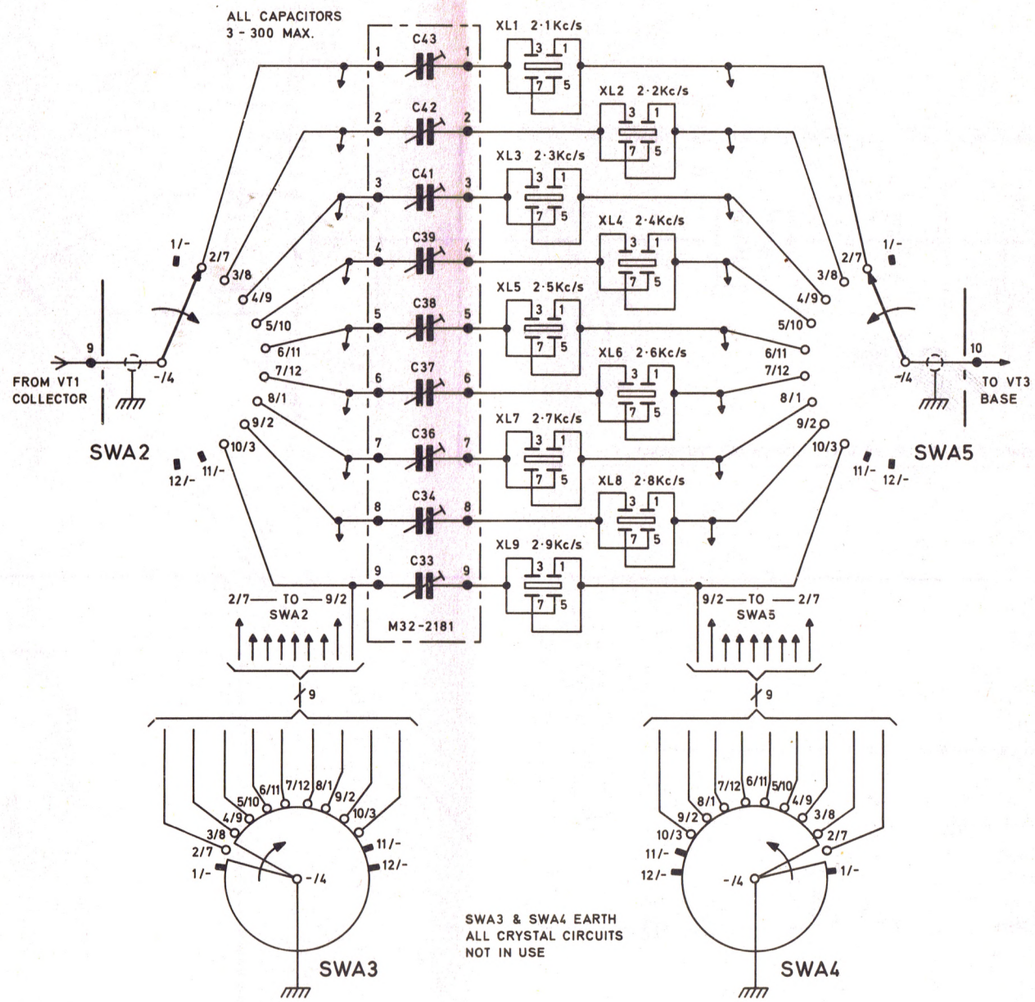
MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

OSCILLATOR, AUDIO FREQUENCY 5820-99-519-7002
SUB-ASSEMBLY 6 COMPONENT LAYOUT

FIG. 4·2

RES.	
CAP.	43 TO 41 39 TO 36 34 33
MISC.	SWA2 SWA3 XL1 XL3 XL5 XL7 XL9 XL2 XL4 XL6 XL8 SWA4 SWA5

COMPLETE CRYSTAL SELECTION SWITCHING CIRCUIT



NOTE. SEE FIG.4·4 A FOR COMPLETE OSCILLATOR CIRCUIT

MOD RECORD

1	2	3	4	5	6
7	8	9	10	11	12

OSCILLATOR AUDIO FREQUENCY 5820-99-519-7002

SUB-ASSEMBLY 6 (CRYSTAL SWITCHING) CIRCUIT DIAGRAM

FIG. 4·3

| | | |

| | | |

CHAPTER 5

FREQUENCY MULTIPLIER (1 KHZ)

5820-99-580-8258

UNIT 5

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CHAPTER 5

FREQUENCY MULTIPLIER (1 KHZ)

5820-99-580-8258

UNIT 5

INTRODUCTION

1. The Frequency Multiplier (1 kHz) receives a reference frequency of 1 kHz from the Frequency Divider (Chapter 3) and an input at 2.0 to 2.9 kHz from the Oscillator A.F., (Chapter 4). By the synthesis process, the basic principle of which is described in Chapter 1, the multiplier produces an output in the range 20 to 30 kHz which is supplied to the Frequency Multiplier (10 kHz) (Chapter 6).

PHYSICAL DESCRIPTION

2. The unit is an open rectangular frame, containing printed wiring boards, behind the Frequency Divider. To reduce the effect of radiation the internal oscillator, including its output phase splitter and buffer amplifiers, is surrounded by a screening cover.

3. All connections to the unit are made to fixed plugs; the free sockets of the Frequency Synthesizer are connected to cables of sufficient length to permit connection to the unit removed from the frame for test purposes.

ELECTRICAL DESCRIPTION

Figures 5.1, 5.4 and 5.5

Oscillator

4. The internal oscillator is VT9 connected in a common base Hartley type circuit operating over the frequency range 69.5 to 60.5 kHz in ten steps of 1 kHz. The collector tuned circuit of VT9 comprises L38, C88 and the additional fixed and trimmer capacitors C90 to C109. These capacitors are switched into circuit by switch wafer SWA2 which is controlled by the 1 kHz decade switch. The collector and the emitter of VT9 are tapped down on the tuned circuit to reduce the loading. In the two blank positions of SWA2 the tuned circuit is shorted to prevent spurious oscillations.

5. Switch wafer SWA2 and its associated fixed and trimmer capacitors are mounted on a printed wiring board in order to eliminate changes in frequency due to wire and component movement.

Phase Splitter and Buffer Amplifiers

6. The output of the oscillator circuit is taken from VT9 emitter via blocking capacitor C84 to VT8 base. VT8 is used as a phase splitter to feed two output amplifiers.

7. From VT8 collector an output is fed via C76 to the emitter of VT6 which is a common-base band-pass amplifier tuned to 60-70 kHz. The tuned circuit comprises L32, C68 damped by R42, coupled by C67 to tuned circuit L31, C66. The output is taken from a tap on L31 and supplies an input to the 3rd Mixer stage.

8. From VT8 emitter an output is taken via C77 to the emitter of VT7, a common-base band-pass amplifier tuned to 60-70 kHz. The tuned output circuit comprises L34, C73 damped by R44, coupled by C72 to tuned circuit L33, C71. The output is taken from a tap on L33 and supplies an input to the 1st Mixer stage.

Harmonic Generator

9. The 1 kHz input at PLCT from the Frequency Divider is fed via C112 to the base of VT10, the first stage of the Harmonic Generator. VT10 is a limiting amplifier with a resistive load R63 in the collector circuit and its distorted waveform output is coupled via C115 to VT11 emitter. The limiter diode MR15 provides further distortion of the waveform which thus contains a wide range of harmonics of the 1 kHz input.

10. The collector circuit of VT11 is tuned to 27 kHz by L41, C117 damped by R68. The tuned circuit has a low Q and responds to harmonics in the range 23 to 32 kHz. These harmonics are applied via C118 to the base of VT12 which is a common emitter amplifier having a low Q tuned circuit L42, C121 damped by R73 in its collector circuit.

11. The output of VT12 is coupled via C122 to the low-pass filter C124, L43, C125, L44, L45, C126, L46 and L48 which rejects harmonics above 32 kHz.

First Mixer and 37.5 kHz Filter

12. The 1st Mixer stage comprises germanium diodes MR11-14 connected as a double-balanced bridge-ring modulator. The high level input obtained from L33 is applied between the centre taps of L48 and L29; the centre tap of L29 being at earth potential. The low level input from the secondary of L48 is applied via the potentiometers RV5 and RV6 which provide adjustment of modulator balance.

13. The low level input contains all harmonics of the 1 kHz signal between 23 and 32 kHz. Therefore the output of the 1st Mixer stage will contain the selected oscillator output frequency ± all these harmonics. The required output of the Mixer is 37.5 kHz ± 100 Hz. This frequency is selected by the 37.5 kHz filter which has a band-pass of ± 100 Hz and provides an attenuation of at least 70 dB for all other frequencies.

14. The 37.5 kHz filter comprises six tuned circuits, four of which are arranged in pairs of under-coupled band-pass circuits separated by amplifying stages VT5, VT4 and VT3. These circuits contain inductors L29, L28, L25, L23, L22 and L21 with their associated capacitors. The circuits have a Q of approximately 150. The amplifiers provide a gain of 40 dB at an output level of 1 V. This output is taken from the secondary of L21 and is the high level input to the 2nd Mixer stage.

Second Mixer and 40 kHz Filter

15. The 2nd Mixer stage comprises MR1-4 connected as a double-balanced bridge-ring modulator. The high level input from the 37.5 kHz filter is connected between the centre-tap of L1 and the centre-tap of L2 which is at earth potential. The low level input of 2-2.9 kHz is from the Oscillator A.F. via PLCR and the tuned circuit L1, C1. The potentiometers RV1 and RV2 provide adjustment for balancing the modulator to minimize the unwanted output of 37.5 kHz.

16. The required output of the 2nd Mixer stage, 39.4 to 40.6 kHz, is selected by the 40 kHz ± 600 Hz filter comprising two sets of three tuned over-coupled band-pass circuits. These tuned circuits contain L2, L3, L4 and L6, L7, L8 with their associated capacitors and damping resistors. The two band-pass circuits are coupled by the common emitter amplifier VT1. Negative feedback is provided by R4 to improve the linearity and gain of the stage. The output of the filter is applied to the 3rd Mixer stage via the secondary of L8.

Third Mixer and Output Filter

17. The 3rd Mixer stage comprises MR6-9 connected as a double-balanced bridge-ring modulator. The high level input is provided from the 69.5 to 60.5 kHz oscillator via buffer amplifier VT6 and fed from the centre-tap on L31 to the junction of C20, C25 and earth. C20 and C25 are connected across the primary winding of L11. The low level input, from the secondary winding of L8, is the output of the 40 kHz ± 600 Hz filter. RV3 and RV4 enable balancing of the modulator circuit to reduce the unwanted output of third order inter-modulation frequencies.

18. The required output, the difference frequency in the range 20 to 30 kHz, is selected by the 20-30 kHz filter comprising L11, L13, L14, L15 and their associated capacitors. The output is applied to the base of the common-emitter amplifier VT2.

19. RV7 and R21 provide negative feedback, RV7 acting as a preset gain control. The collector circuit of VT2 is tuned to 20-30 kHz by L17, C29 which forms one half of a pair of coupled band-pass circuits, the other half of which is formed by the input circuit of the 2nd Mixer stage in the Frequency Multiplier (10 kHz). The coupling between the two parts of this tuned circuit is provided by C31 via PLCN.

D.C. Supplies

20. A direct voltage of 16.4 V from the synthesizer Power Supply is connected to the unit as -8.2 V at PLCQ1 and +8.2 V at PLCQ2 with respect to earth at PLCQ4. The supplies include filters to isolate the various stages in respect of signal frequencies. They are connected as follows:-

(a) Oscillator, Phase Splitter and Buffer Amplifiers

-8.2 V via L49, C78.
+8.2 V via L50, C79.

(b) Harmonic Generator

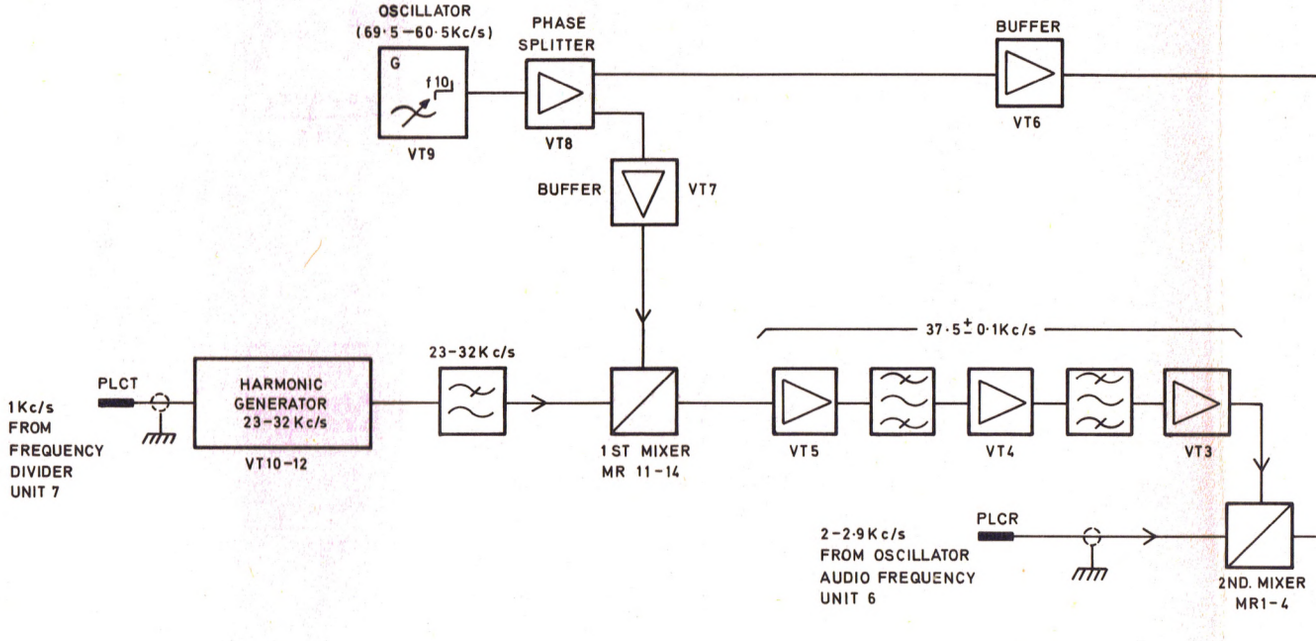
-8.2 V via L40, C113.

(c) 37.5 kHz Filter

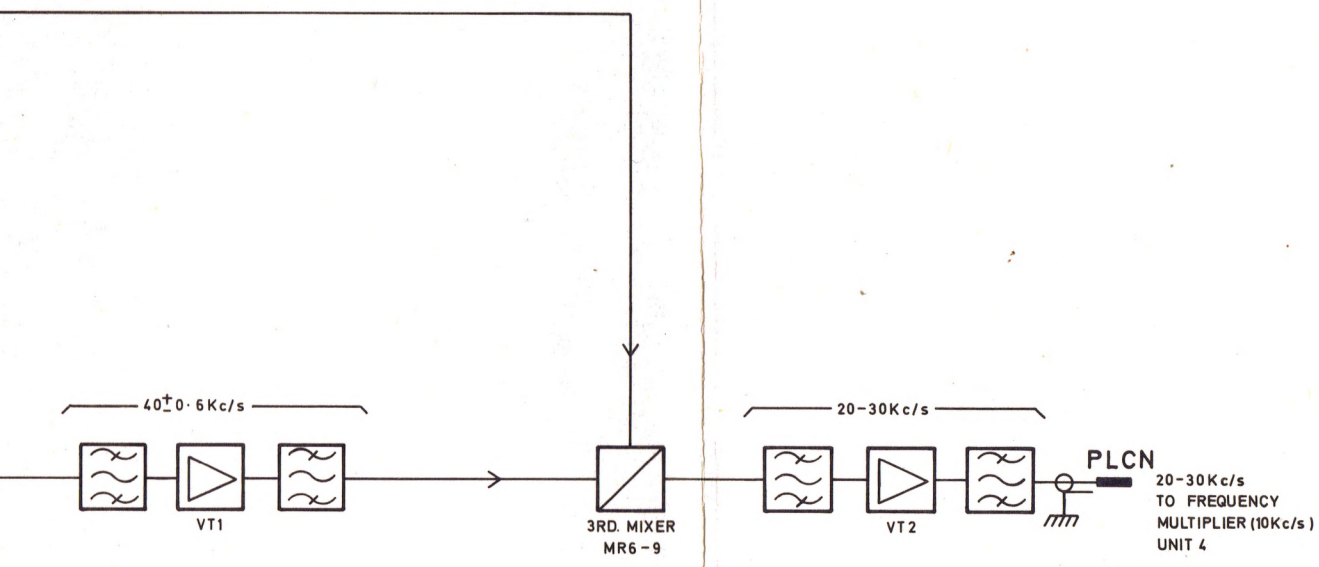
-8.2 V via L20, C35.
+8.2 V.

(d) 20 kHz Filter

-8.2 V.


OSCILLATOR
(69·5—60·5Kc/s)
G
f10
VT9
PHASE
SPLITTER
VT8
BUFFER
VT6
BUFFER
VT7
37·5±0·1Kc/s
23—32Kc/s
PLCT
1Kc/s
FROM
FREQUENCY
DIVIDER
UNIT 7
HARMONIC
GENERATOR
23—32Kc/s
VT10—12
1ST MIXER
MR 11—14
VT5
VT4
VT3
PLCR
2—2·9Kc/s
FROM OSCILLATOR
AUDIO FREQUENCY
UNIT 6
2ND. MIXER
MR1—4

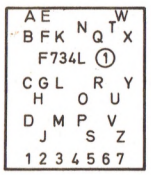
BR 4146 (5) A
Original



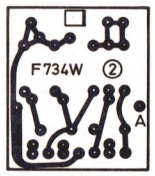
FREQUENCY MULTIPLIER (1 Kc/s) **5820-99-580-8258**

SUB – ASSEMBLY 5 BLOCK DIAGRAM

FIG. 5·1



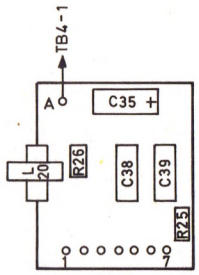
COMPONENT SIDE



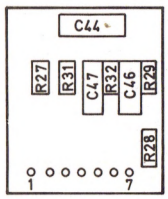
TRACK SIDE

TRACK LAYOUT - TERMINAL BOARDS TB1-TB5

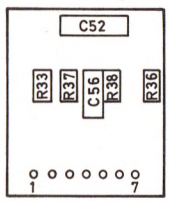
TB1 - TB5 COMPONENTS		
REF.	T.B. No.	CONNEXIONS
R1	1	B - C
R2	1	K - L
R3	1	Q - R
R4	1	U - Z
R7	1	X - Y
R8	1	F - G
R13	2	B - C
R16	2	K - L
R17	2	Q - R
R19	2	H - J
R21	2	U - Z
R22	2	X - Y
R25	3	U - Z
R26	3	F - G
R27	4	B - C
R28	4	U - Z
R29	4	X - Y
R31	4	K - L
R32	4	Q - R
R33	5	B - C
R36	5	X - Y
R37	5	K - L
R38	5	Q - R
C9	1	E - W
C12	1	T - V
C13	1	N - M
C24	2	E - W
C27	2	T - V
C28	2	N - M
C35	3	E - W
C38	3	N - M
C39	3	T - V
C44	4	A - W
C46	4	T - V
C47	4	N - P
C52	5	A - W
C56	5	N - P
L20	3	B - D



TB3

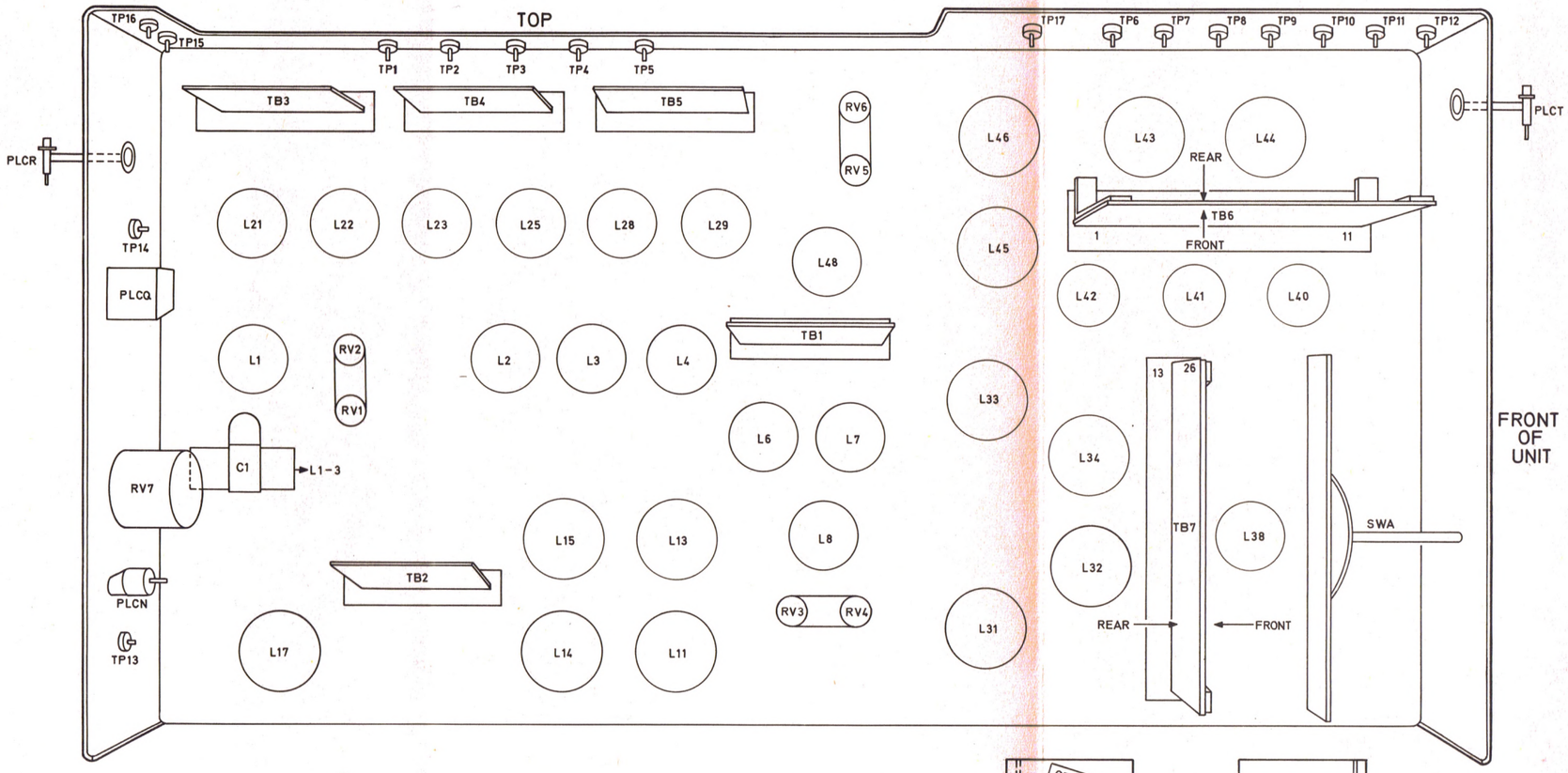


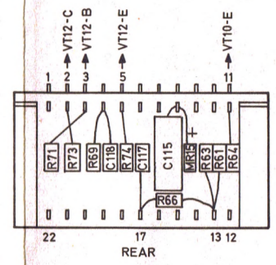
TB4



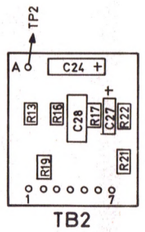
TB5

FIG. 5 · 2A

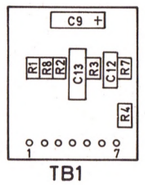




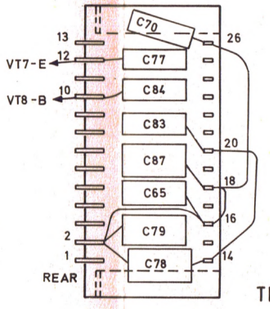
SWITCH ASSEMBLY

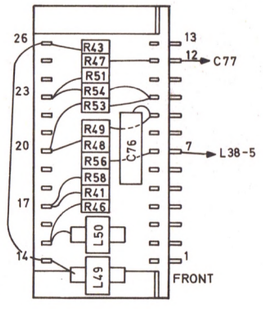


TB2



TB1





TB7

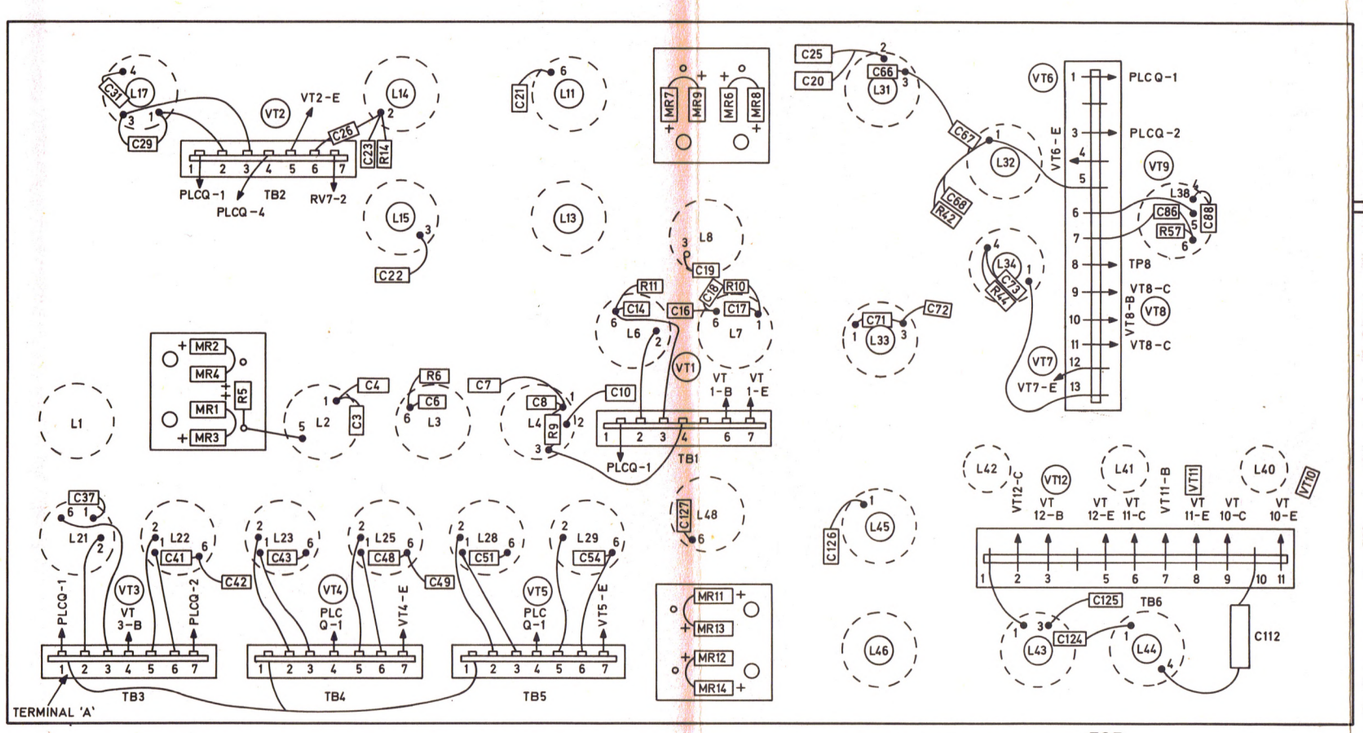
MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (1 Kc/s) 5820-99-580-8258

SUB - ASSEMBLY 5

COMPONENT LAYOUT

FIG.5·2B



MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (1Kc/s) 5820-99-580-8258

SUB-ASSEMBLY 5 COMPONENT LAYOUT

FIG. 5·3

| | | |

| | | |

| | | |

CHAPTER 6

FREQUENCY MULTIPLIER (10 KHZ)

5820-99-580-8261

UNIT 4

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ILLUSTRATIONS

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Frequency Multiplier (10 kHz). Block Diagram	6.1
Frequency Multiplier (10 kHz). Component Layout	6.2A,B
Frequency Multiplier (10 kHz). Component Layout	6.3
Oscillator and Harmonic Generator. Circuit Diagram	6.4A,B
First, Second, Third and Fourth Mixers. Circuit Diagram	6.5A,B

CHAPTER 6

FREQUENCY MULTIPLIER (10 KHZ)

5820-99-580-8261

UNIT 4

INTRODUCTION

1. The Frequency Multiplier (10 kHz) receives a reference frequency of 10 kHz from the Frequency Divider (Chapter 3) and an input at 20 to 30 kHz from the Frequency Multiplier (1 kHz) (Chapter 5). By the synthesis process, the basic principle of which is described in Chapter 1, the multiplier produces an output in the range 200 to 300 kHz, which is supplied to the Frequency Multiplier (100 kHz) (Chapter 7).

2. A third input permits the acceptance of modulation upon a 100 kHz sub-carrier the presence of which results in the modulation appearing on the output. This facility is for use when the synthesizer is in a transmitter drive. In receiver applications the 100 kHz input is unmodulated.

PHYSICAL DESCRIPTION

3. The unit is an open rectangular frame, containing printed wiring boards, behind the Frequency Divider. To reduce the effect of radiation the internal oscillator, including its output phase splitter and buffer amplifiers, is surrounded by a screening cover.

4. All connections to the unit are made to fixed plugs; the free sockets of the Frequency Synthesizer are connected to cables of sufficient length to permit connection to the unit removed from the frame for test purposes.

ELECTRICAL DESCRIPTION

Figures 6.1, 6.4 and 6.5

Oscillator, Phase Splitter and Buffer Amplifiers

5. The internal oscillator is a Colpitts type circuit, including VT11, in which C77 and C78 form a capacitive potential divider across the tuning inductor L38. The fixed and trimmer capacitors selected by switch wafer SWA2, which is controlled by the 10 kHz decade switch, are C84 to C107. The collector of VT11 is tapped down on L38 to reduce the loading. Feedback to the emitter is obtained from the junction of C77 and C78, emitter bias being provided by R63, R64 which is returned to the +8.2 V supply.

6. The output from VT11 emitter is taken via C85 to the base of the phase splitter VT10 which feeds the two tuned buffer amplifiers VT8 and VT9 which in turn provide the high level inputs to the 4th Mixer stage and the 1st Mixer stage respectively.

Harmonic Generator

7. The harmonic generator comprises stages VT12, VT13, and VT14 with the limiting diode MR15. The output signal consists of harmonics of the 10 kHz reference in the range 130 to 220 kHz. The output of the low-pass filter from L45 is the low level input to the 1st Mixer stage.

First Mixer and 475 kHz Filter

8. The 1st Mixer stage comprises MR16-19 connected as a double-balanced bridge-ring modulator. The output required is 475 kHz ± 1 kHz which is selected by the filter amplifier circuit VT7, VT6 and VT5. A total of six tuned circuits are employed, the interstage tuned circuits having fixed coupling by C56 and C48. VT7 and VT6 operate as common emitter amplifiers with base and collector tapped down on their associated tuned circuits to reduce the loading. VT5 is a common base amplifier whose input is taken from the junction of C47, C46 across L24 from VT6. The collector of VT5 is tapped down on L23 and the output which is the 2nd Mixer stage high level input, is taken from a second tap of L23 via C43 to the centre-tap on L1.

Second Mixer and 500 kHz Filter

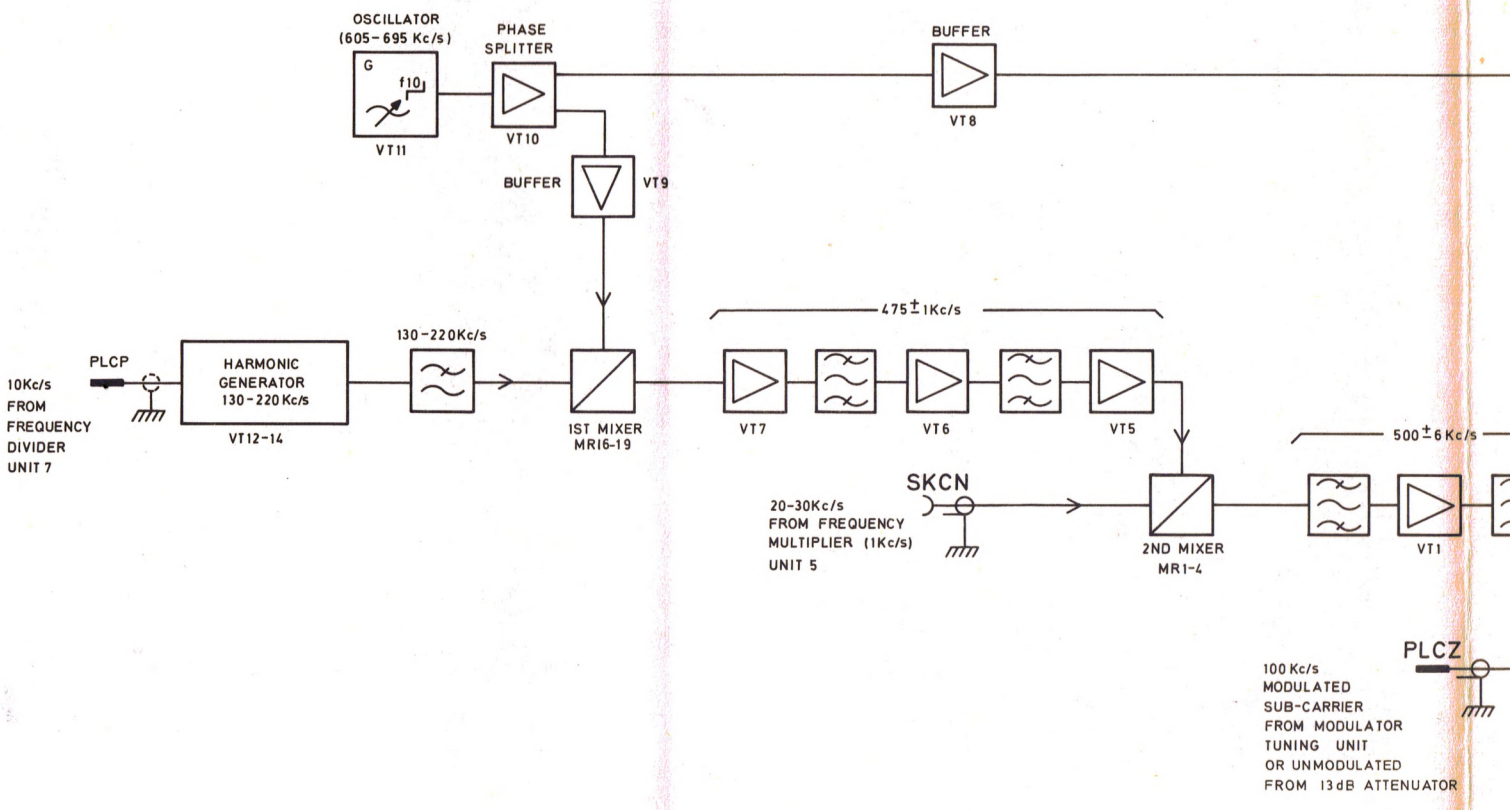
9. The low level input to the 2nd Mixer is the output of the Frequency Multiplier (1 kHz) connected at SKCN. The high level input is fed from the 475 kHz filter. The required mixer output of 500 kHz ± 6 kHz is selected by the active filter network which includes VT1 and VT2. The filter has two sets of three tuned circuits with fixed coupling capacitors C3, C6; C13 and C16. The two parts of the filter are coupled via the common emitter amplifier VT1. The common collector amplifier VT2 provides the high level input to the 3rd Mixer.

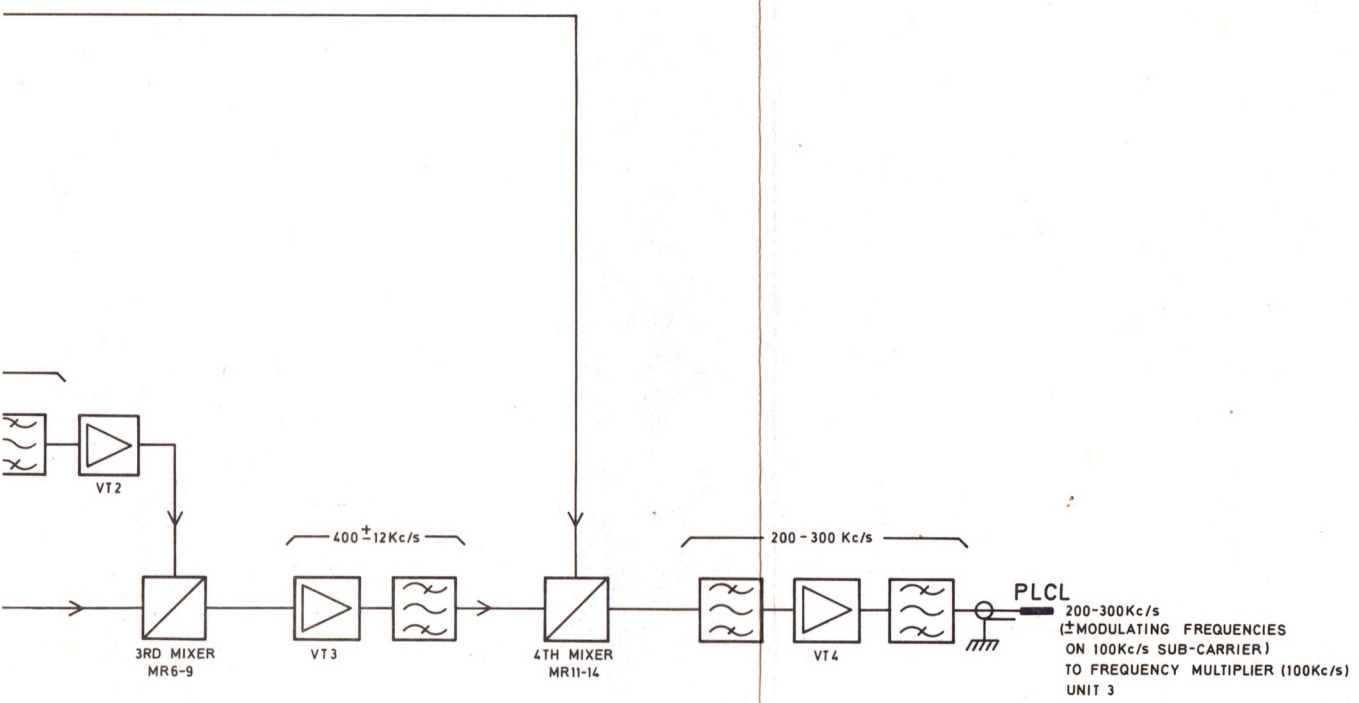
Third and Fourth Mixers and Associated Filters

10. The low level input to the 3rd Mixer is 100 kHz, which may be modulated, via PLCZ. The band-pass filter which follows the mixer is tuned to 400 kHz ± 12 kHz and consists of three tuned circuits L12, L13 and L14 and a common emitter amplifier VT3. The tuned circuits containing L13 and L14 are over-coupled to give a double-humped response which together with the sharp response of the single tuned circuit L12 gives the required bandwidth. The final mixing, in MR11-14, is that of the oscillator frequency with the output of the 400 kHz filter which through the active band-pass filter L17, L18, L19 and VT4 gives the required output in the range 194 to 306 kHz. The tuned circuit L21 and C36 in VT4 collector forms part of a band-pass circuit completed at the input of the Frequency Multiplier (100 kHz) to which connection is made from PLCL.

D.C. Supplies

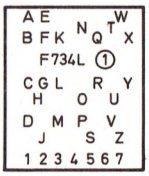
11. Positive and negative 8.2 V d.c. supplies are provided, via PLCM1 and 2, from the synthesizer Power Supply and connected through filters to the various stages.


OSCILLATOR
(605-695 Kc/s)
G
f10
VT11
PHASE
SPLITTER
VT10
BUFFER
VT8
BUFFER
VT9
475±1Kc/s
130-220Kc/s
PLCP
10Kc/s
FROM
FREQUENCY
DIVIDER
UNIT 7
HARMONIC
GENERATOR
130-220Kc/s
VT12-14
1ST MIXER
MR16-19
VT7
VT6
VT5
500±6Kc/s
SKCN
20-30Kc/s
FROM FREQUENCY
MULTIPLIER (1Kc/s)
UNIT 5
2ND MIXER
MR1-4
VT1
PLCZ
100 Kc/s
MODULATED
SUB-CARRIER
FROM MODULATOR
TUNING UNIT
OR UNMODULATED
FROM 13dB ATTENUATOR

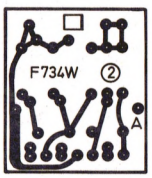


FREQUENCY MULTIPLIER (10Kc/s) 5820-99-580-8261
SUB-ASSEMBLY 4
BLOCK DIAGRAM

FIG. 6·1



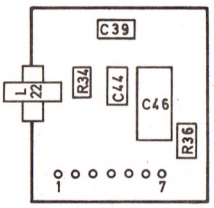
COMPONENT SIDE



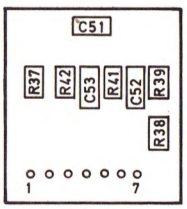
TRACK SIDE

TRACK LAYOUT - TERMINAL BOARDS TB1 & TB3 - TB7

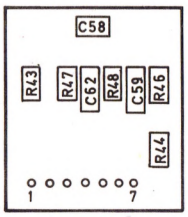
TERMINAL BOARD COMPONENTS		
REF	T.B. No	CONNEXIONS
R4	1	L-M
R6	1	Q-R
R7	1	X-Y
R8	1	F-G
R14	3	B-C
R17	3	K-L
R18	3	Q-R
R21	3	U-Z
R22	3	X-Y
R24	4	B-C
R25	3	O-S
R27	4	Q-O
R28	4	K-L
R29	4	F-G
R31	4	H-J
R32	4	Z-U
R33	4	X-Y
R34	5	F-G
R36	5	U-Z
R37	6	B-C
R38	6	Z-U
R39	6	X-Y
R41	6	Q-R
R42	6	K-L
R43	7	B-C
R44	7	U-Z
R46	7	X-Y
R47	7	K-L
R48	7	Q-R
C7	1	E-W
C8	1	O-S
C9	1	T-V
C11	1	H-N
C25	3	T-V
C30	3	E-W
C32	4	E-W
C33	4	R-S
C34	4	T-V
C37	4	M-N
C39	5	E-W
C44	5	M-N
C46	5	V-X
C51	6	E-W
C52	6	T-V
C53	6	P-N
C58	7	E-W
C59	7	T-V
C62	7	N-P
L4	1	A-C
L22	5	A-D



TB5

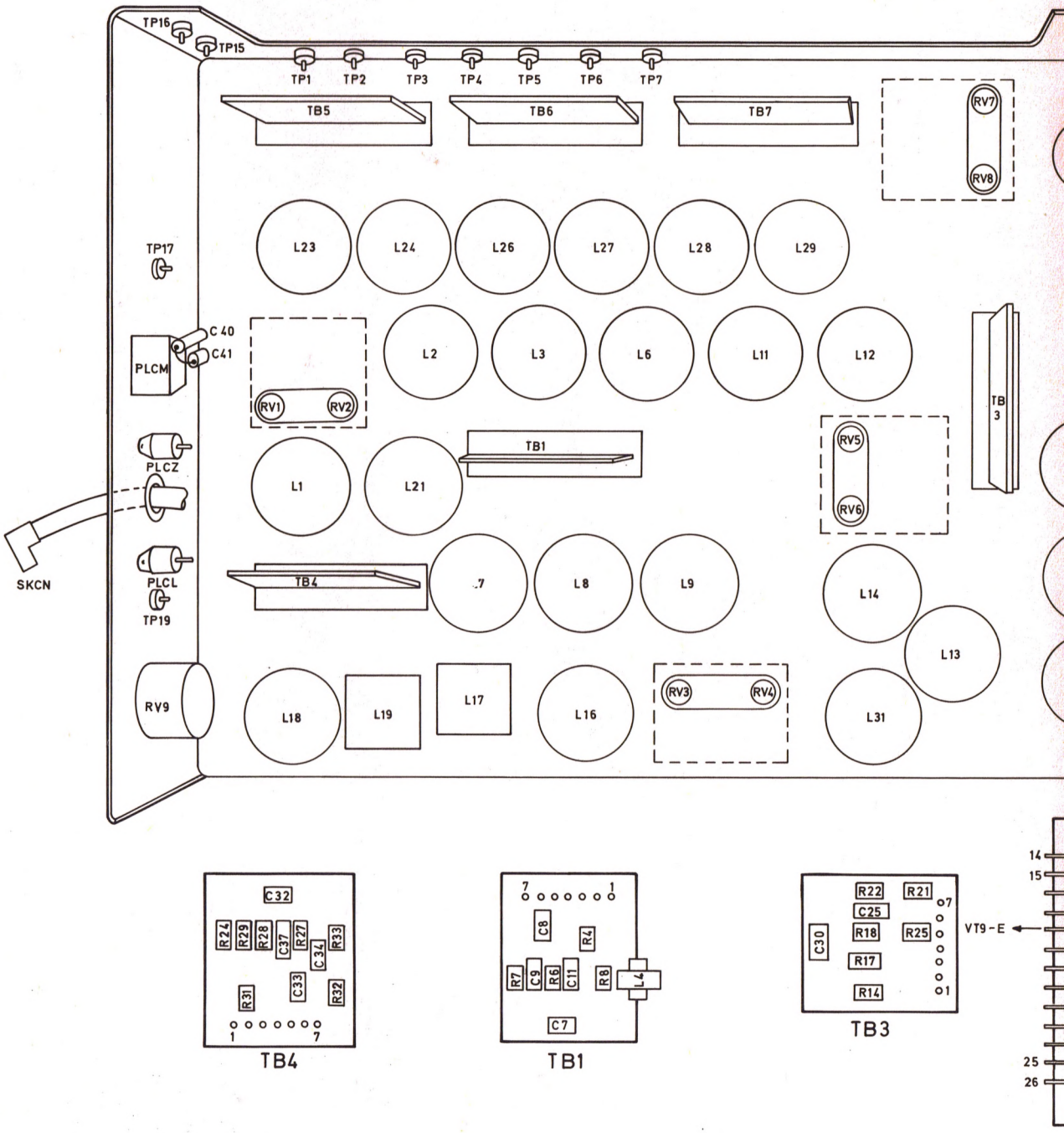


TB6



TB7

FIG. 6·2A


TP16
TP15
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TB5
TB6
TB7
RV7
RV8
TP17
L23
L24
L26
L27
L28
L29
C 40
C41
PLCM
L2
L3
L6
L11
L12
TB 3
RV1
RV2
PLCZ
TB1
RV5
RV6
L1
L21
SKCN
PLCL
TP19
TB4
L7
L8
L9
L14
L13
RV9
L18
L19
L17
L16
RV3
RV4
L31

C32
R24
R29
R28
C37
R27
R33
C34
C33
R31
R32
1
7

TB4

7
1
C8
R4
R7
C9
R6
C11
R8
L4
C7

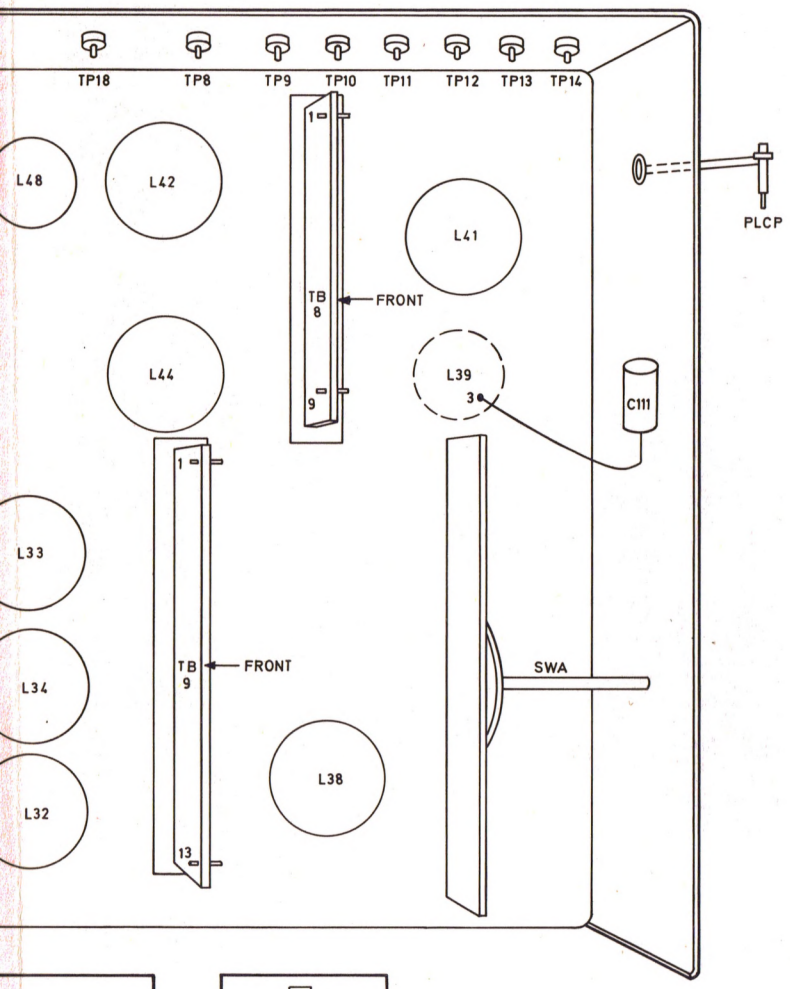
TB1

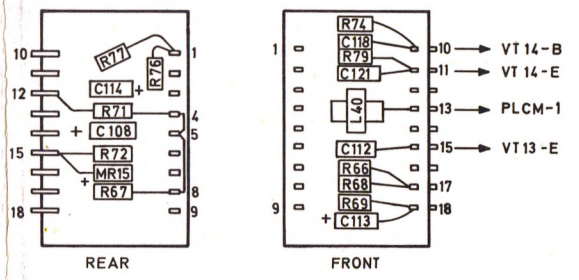
R22
R21
C25
R18
R25
C30
R17
R14
7
1

TB3

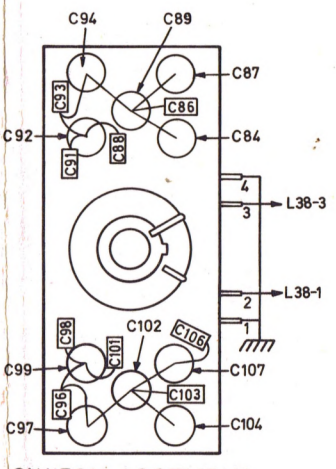
14
15
VT9-E
25
26

B.R. 4146(5)A
Original.

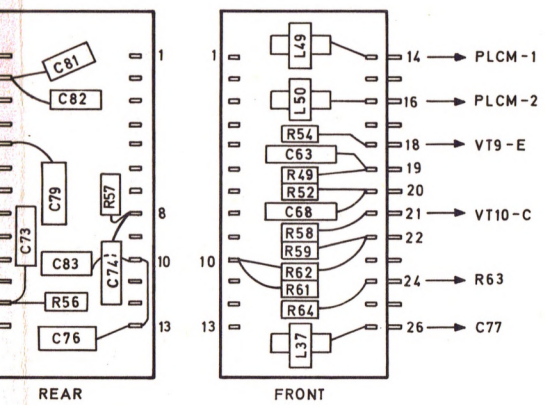




TB8



SWITCH ASSEMBLY



TB9

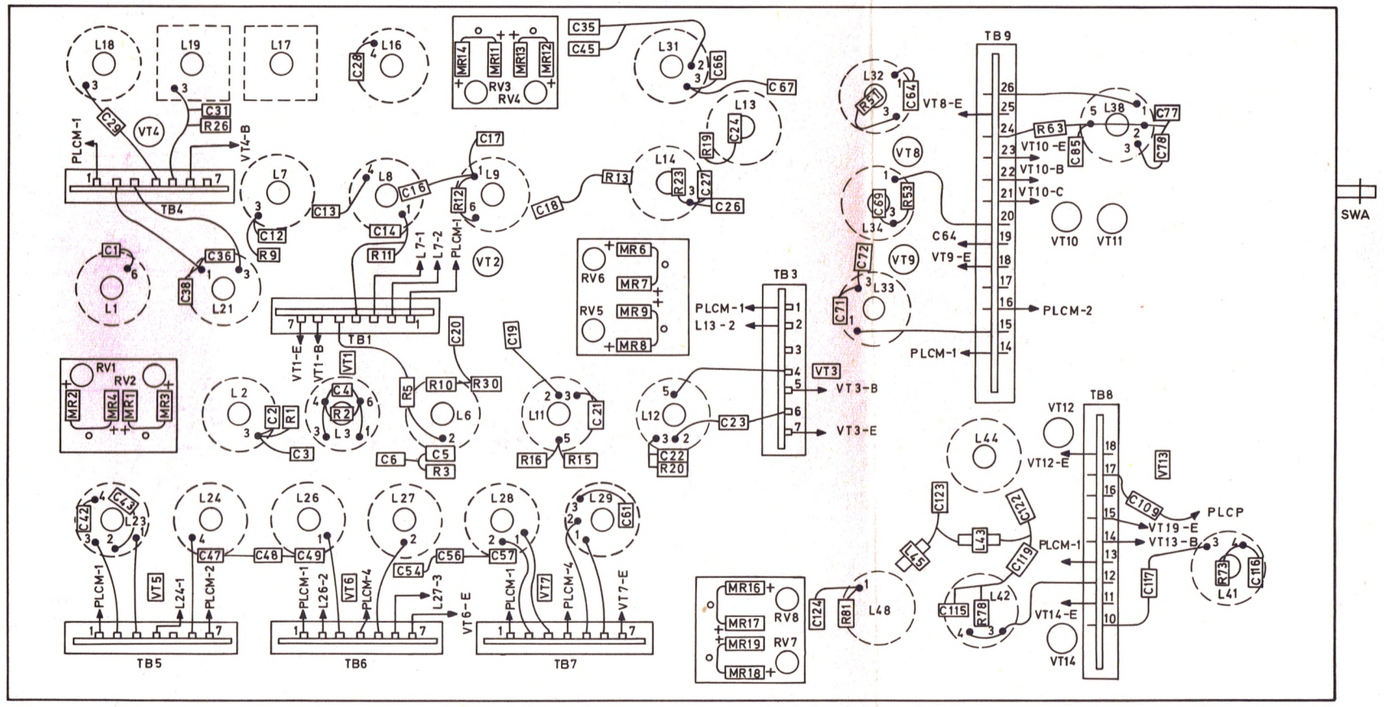
MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (10Kc/s) 5820-99-580-8261

SUB-ASSEMBLY 4

COMPONENT LAYOUT

FIG. 6·2 B



MOD RECORD

1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (10Kc/s) **5820-99-519-8261**

SUB-ASSEMBLY 4

COMPONENT LAYOUT

FIG. 6·3

RES	
CAP	40 41 81 82 7 39 108 76
MISC	L49 L50 L4 L22 L40 L37

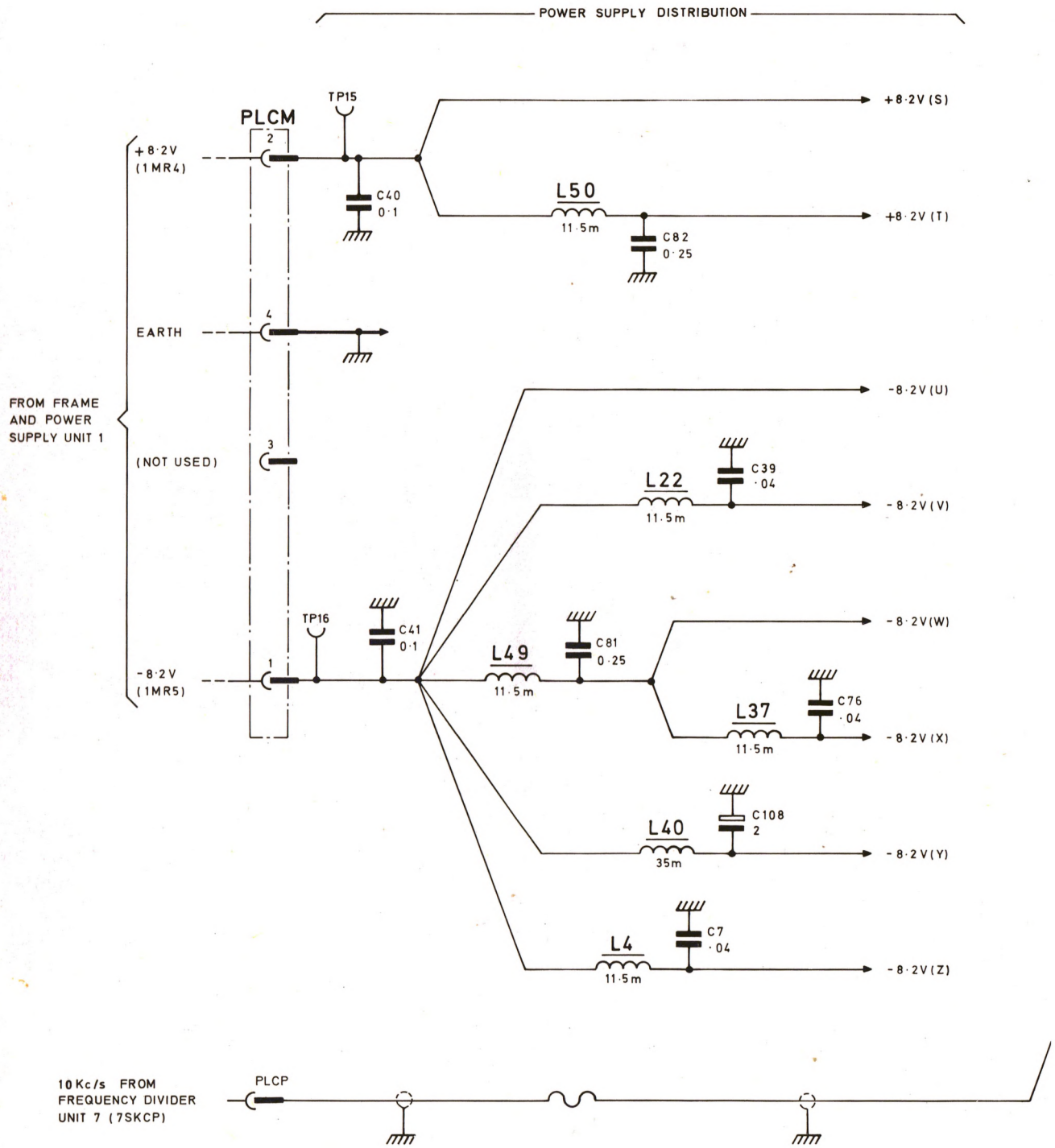
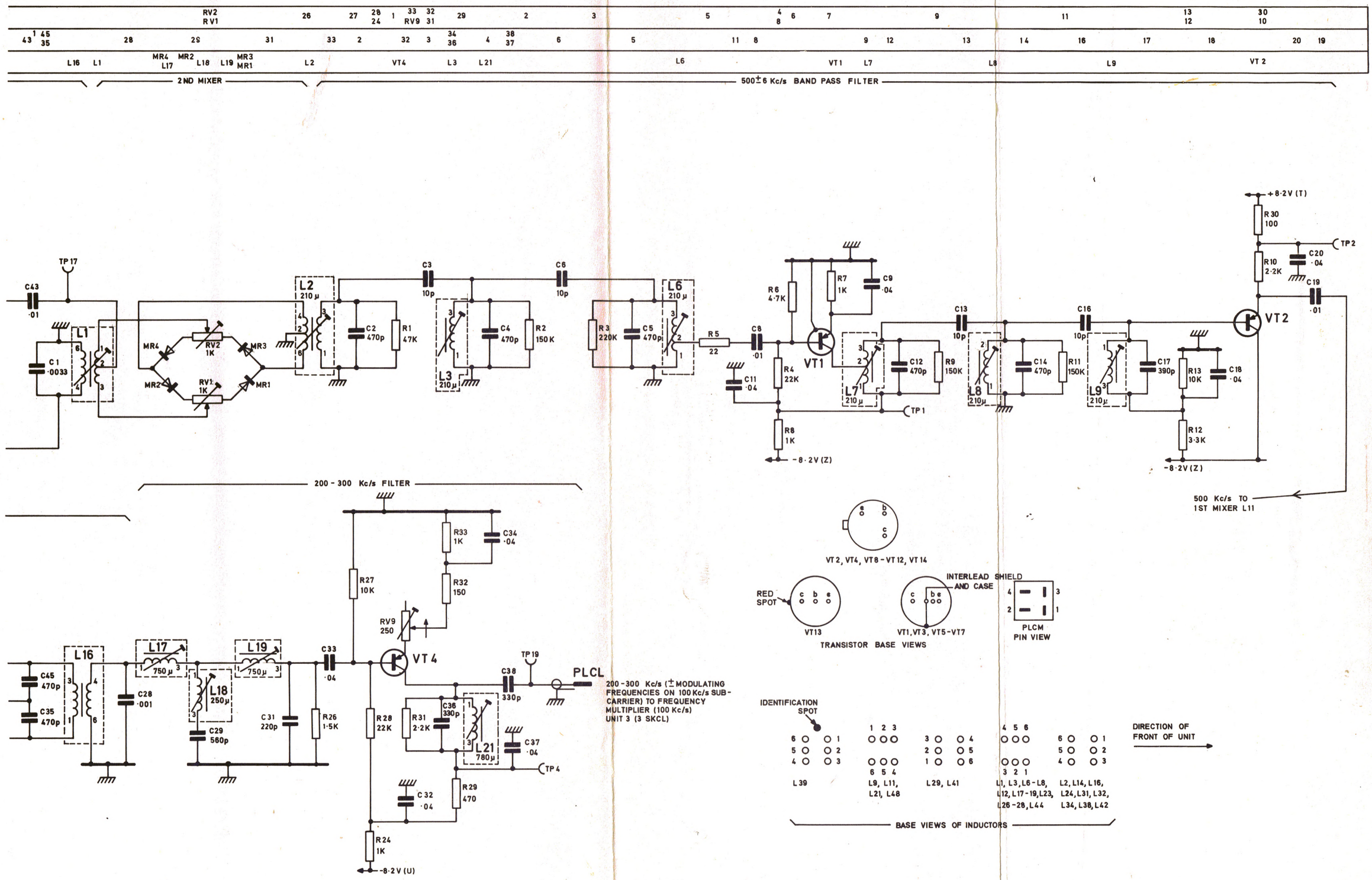


FIG. 6·4A

| | | |

| | | |



MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (10Kc/s) 5820-99-580-8261

SUB-ASSEMBLY 4 (1st, 2nd, 3rd & 4th MIXERS) CIRCUIT DIAGRAM

FIG.6·5B

CHAPTER 7

FREQUENCY MULTIPLIER (100 KHZ)

5820-99-580-8260

UNIT 3

CONTENTS LIST

	Paragraphs
Description	1,2

ILLUSTRATIONS

	Figure No
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Frequency Multiplier (100 kHz). Component Layout	7.2A,B
Frequency Multiplier (100 kHz). Component Layout	7.3
Oscillator and Harmonic Generator. Circuit Diagram	7.4A,B
First, Second and Third Mixer. Circuit Diagram	7.5A,B

CHAPTER 7

FREQUENCY MULTIPLIER (100 KHZ)

5820-99-580-8260

UNIT 3

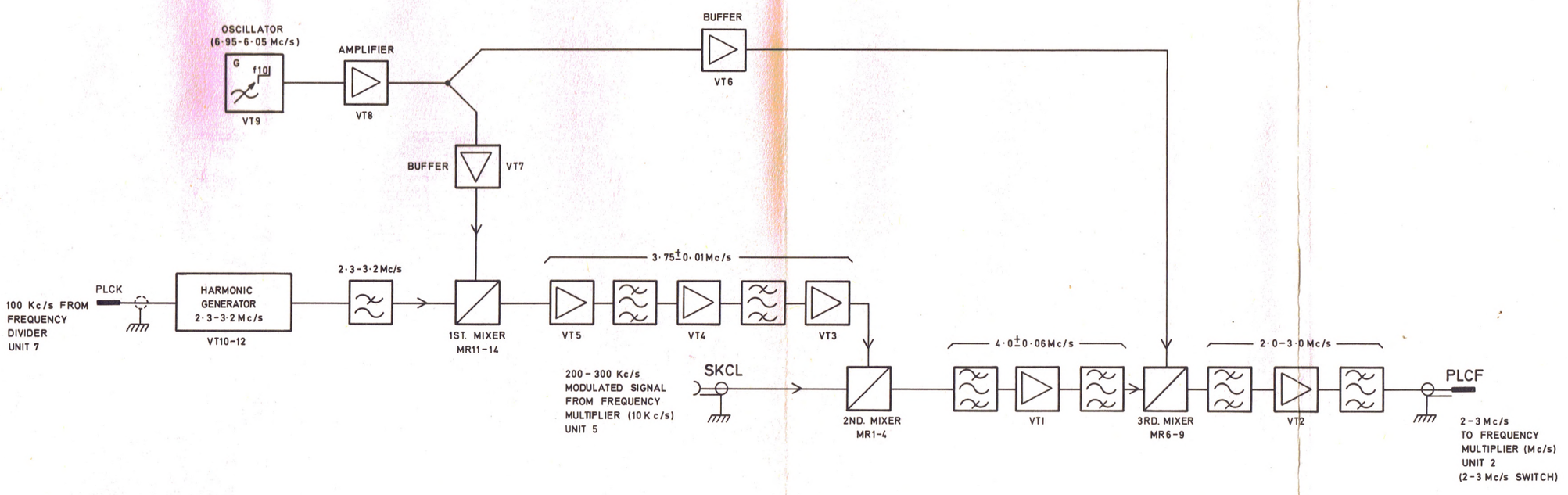
Description

Figures 7.1, 7.4 and 7.5

1. The Frequency Multiplier (100 kHz) is similar to the Frequency Multiplier (1 kHz) described in Chapter 5 but it operates at frequencies 100 times higher. It is fitted behind the Frequency Divider. Neutralisation is necessary for transistor stages VT1, VT4, VT5 and VT8 and is provided by C12, C48, C63 and C92 respectively.

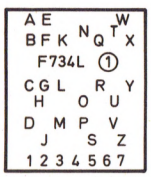
2. This multiplier gives an output at PLCF in the range 2 to 3 MHz, depending on the setting of its internal oscillator and the input frequency at SKCL. This input, from the Frequency Multiplier (10 kHz), will be modulated or unmodulated depending on whether the synthesizer is used in a transmitter drive or in receiver. A reference frequency of 100 kHz is supplied from the Frequency Divider at PLCK.

B.R. 4146 (5) A
Original

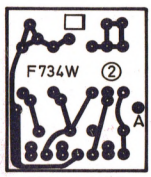


FREQUENCY MULTIPLIER (100Kc/s) **5820-99-580-8260**
SUB-ASSEMBLY 3 BLOCK DIAGRAM

FIG. 7:1



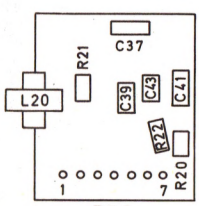
COMPONENT SIDE



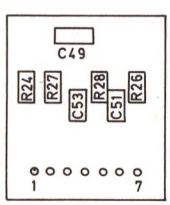
TRACK SIDE

TRACK LAYOUT - TERMINAL BOARDS TB1 - TB5

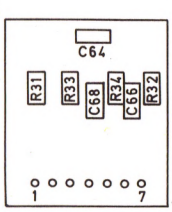
TB1–TB5 COMPONENTS		
REF.	T.B. No.	CONNEXIONS
R1	1	K–L
R2	1	Q–R
R3	1	U–Z
R4	1	X–Y
R6	1	F–G
R12	2	K–L
R13	2	Q–R
R14	2	F–G
R16	2	H–J
R17	2	U–Z
R18	2	X–Y
R20	3	U–Z
R21	3	F–G
R22	3	V–R
R24	4	C–B
R26	4	X–Y
R27	4	K–L
R28	4	Q–R
R31	5	C–B
R32	5	X–Y
R33	5	K–L
R34	5	Q–R
C9	1	E–W
C11	1	O–S
C14	1	V–T
C16	1	M–N
C29	2	E–W
C31	2	O–S
C32	2	V–T
C34	2	M–N
C37	3	E–W
C39	3	M–N
C41	3	X–Y
C43	3	O–Q
C49	4	E–W
C51	4	V–T
C53	4	N–P
C64	5	E–W
C66	5	V–T
C68	5	N–P
L5	1	A–C
L16	2	A–C
L20	3	B–D



TB3

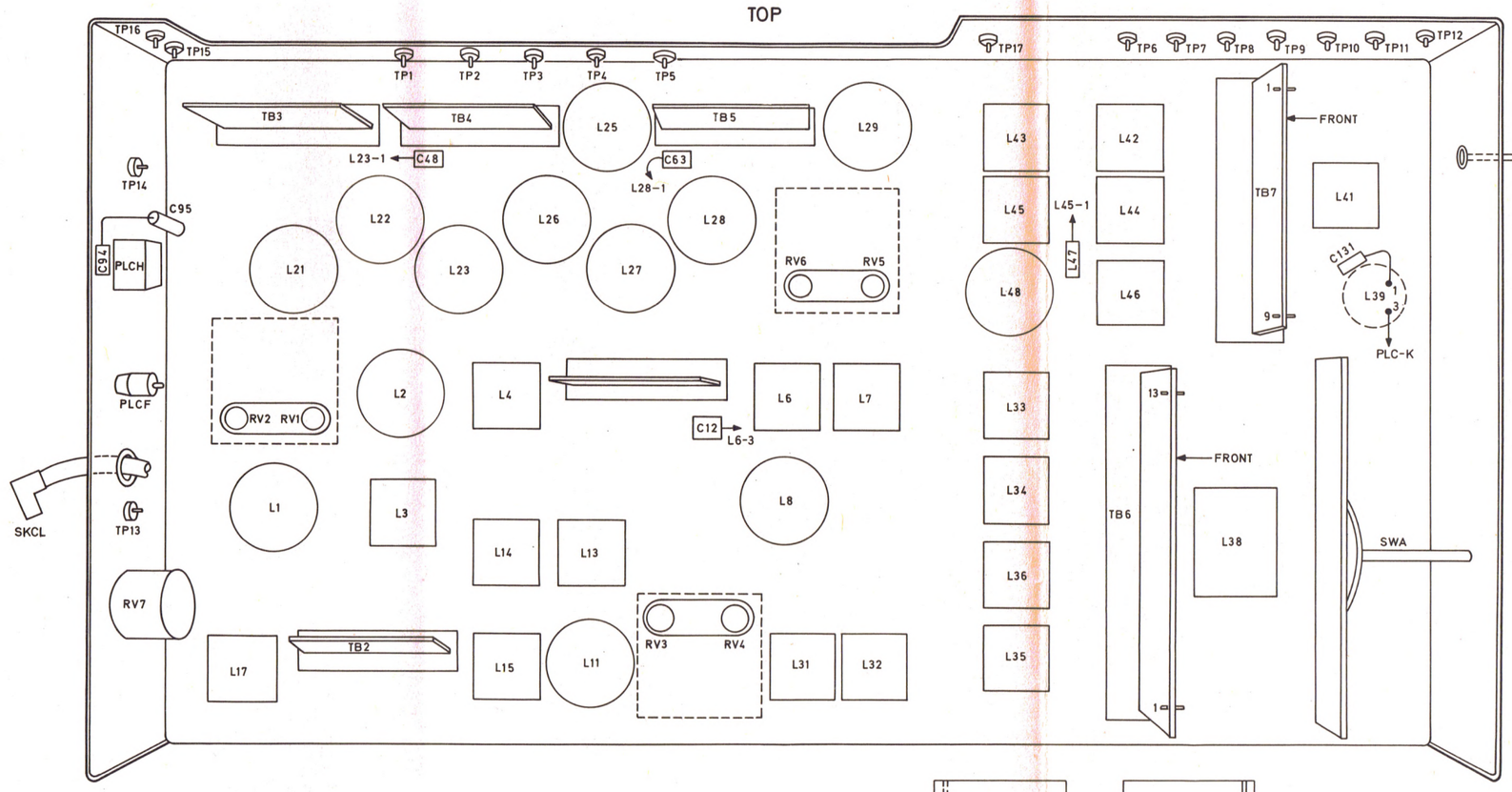


TB4



TB5

FIG. 7·2A



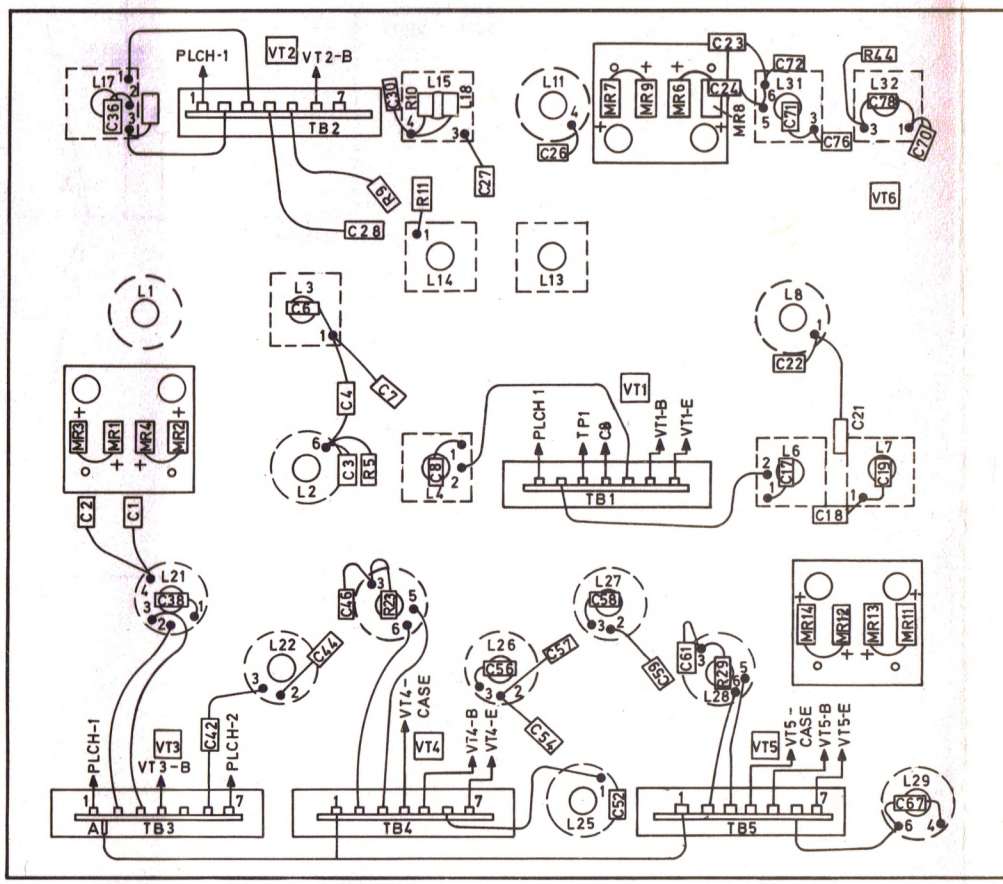
MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (100Kc/s) 5820-99-580-8260

SUB-ASSEMBLY 3

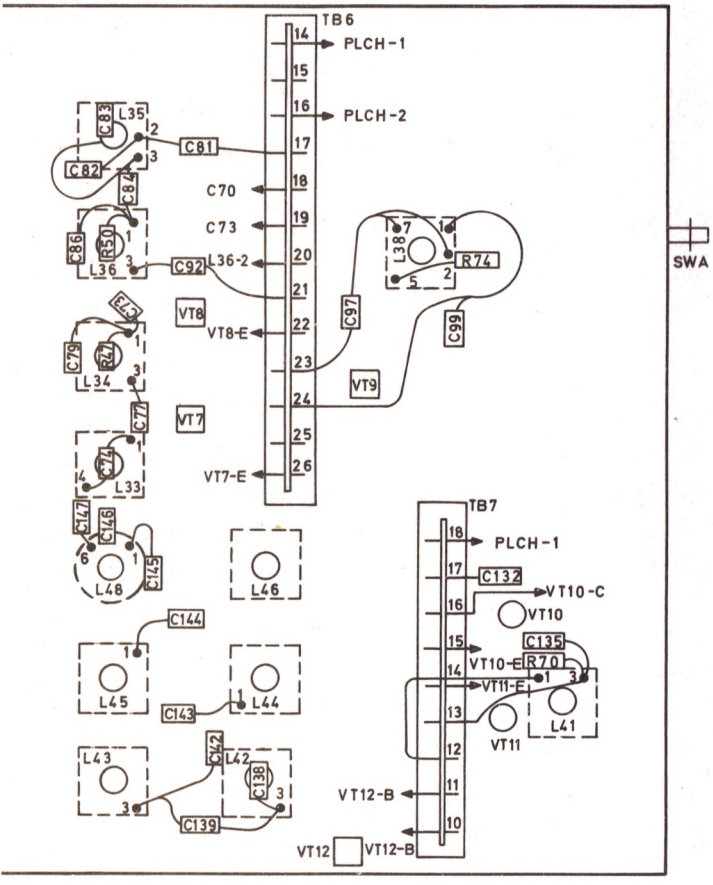
COMPONENT LAYOUT

FIG.7·2B



UNDERSIDE VIEW

B.R. 4146 (5) A
Amdt.3,12.77



MOD RECORD

1	2	3	4	5	6
7	8	9	10	11	12

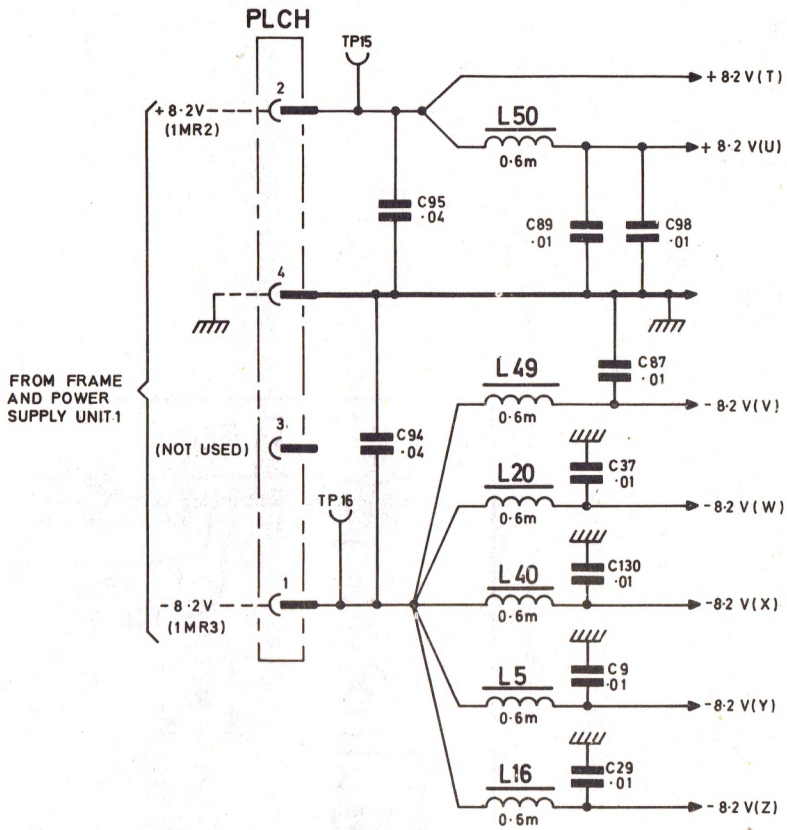
FREQUENCY MULTIPLIER (100 Kc/s) 5820-99-580-8260

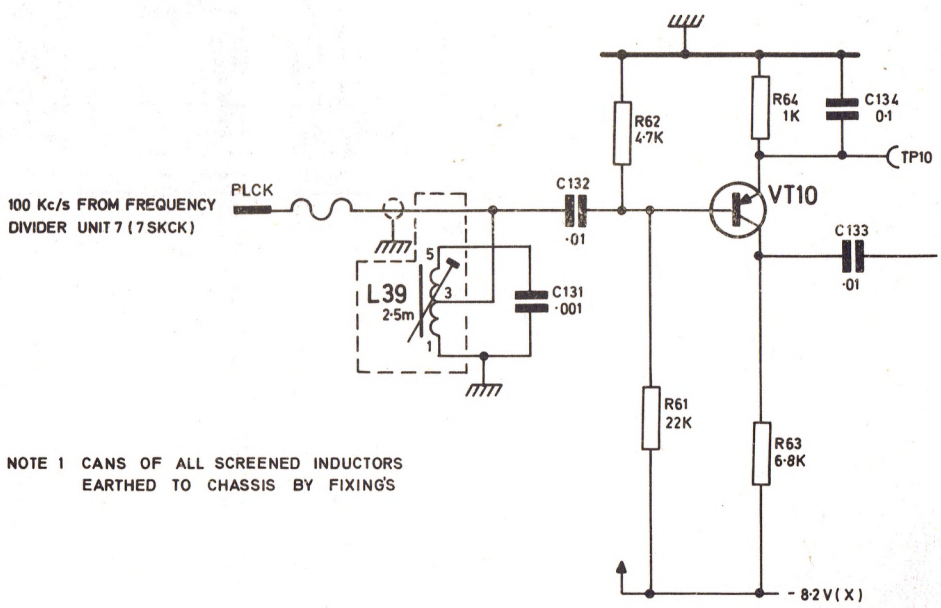
SUB-ASSEMBLY 3

COMPONENT LAYOUT

FIG. 7·3

RES	62 64 61 63
CAP	94 95 131 89 98 87 37 134 130 9 29 132 133
MISC	L39 L50 L49 L20 L40 L5 L16 VT10





NOTE 1 CANS OF ALL SCREENED INDUCTORS EARTHED TO CHASSIS BY FIXING'S

FIG.7·4A

| | | |

| | | |

| | | |

CHAPTER 8

FREQUENCY MULTIPLIER (MHZ)

5820-99-519-7001

UNIT 2

CONTENTS LIST

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Introduction	1-5
Physical Description	6
ELECTRICAL DESCRIPTION	7-42
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Phase Splitter and Buffer Amplifiers	9-12
Harmonic Generator	13,14
First Mixer and 37.5 MHz Filter	15-18
Second Mixer and 40 MHz Filter	19-21
Third Mixer and Low-pass Filter	22,23
Output Stage	24
Transmit Receive Switching	25-28
Auto-tuning Facilities	29-41
Tune Interlock	42

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ILLUSTRATIONS

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Oscillator and Harmonic Generator. Circuit Diagram	8.4A,B
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Servo and Range Control. Circuit Diagram	8.7A,B

CHAPTER 8

FREQUENCY MULTIPLIER (MHz)

5820-99-519-7001

UNIT 2

Introduction

1. A reference frequency of 1 MHz from the Frequency Divider and a 2-3 MHz input from the Frequency Multiplier (100 kHz) are processed in the Frequency Multiplier (MHz) to produce a modulated output in the range 0.24 - 27.5 MHz. This is the synthesizer output for use in a transmitter drive.

2. The Frequency Multiplier (MHz) also provides outputs of 37.5 MHz, 40.5 - 67.5 MHz and 2-3 MHz which are the synthesizer outputs for use in a receiver. A send/receive circuit in the multiplier switches the 2-3 MHz input through an amplifier circuit to provide the 2-3 MHz output.

3. Frequency conversion is achieved in the same way as in the other multipliers but the harmonic generator filter and the output filter are step-tuned to obtain the necessary response over the wide frequency range.

4. In addition to the r.f. circuits the Frequency Multiplier (MHz) contains the MHz section of the servo reference potentiometer (for automatic tuning) plus switching arrangements for the frequency range control and tune interlock circuits.

5. The switches in the unit, shown in Table 8.1, are ganged to and operated by the MHz decade selector on the front panel.

TABLE 8.1 Switches in Frequency Multiplier (MHz)

Switch	Associated with:-	Function
2SWA1	40.5-67.5 MHz Oscillator	Frequency Selection
2SWA2B 2SWA2F	Harmonic Generator	
2SWA3	Buffer to First Mixer	
2SWA4	Buffer to Third Mixer	
2SWA5	0.24-27.5 MHz Tuned Amplifier (Driver)	
2SWA6	0.24-27.5 MHz Tuned Amplifier (Output)	
2SWA7	Ledex system	Frequency Range Control
2SWA8 2SWA9 2SWA10	MHz section of reference potentiometer	Automatic Tuning
2SWB	1SWA1, 1SWB1, 1SWC1, 1SWD1	Tune Interlock

Physical Description

6. Unit 2, on the left of the synthesizer frame behind the Frequency Divider, is an open rectangular frame containing printed wiring boards and a switch assembly. Plug-in cables are long enough for the unit to be removed and re-connected for test purposes.

ELECTRICAL DESCRIPTION — Figures 8.1, 8.4 to 8.7

Oscillator — Figure 8.4

7. The oscillator is a Colpitts type tunable over the frequency range 40.5 to 67.5 MHz in 28 steps of 1 MHz. The required output is obtained by selecting one of the inductors L120-147, in parallel with C212, C213 and C216. The appropriate inductor is selected by switch wafer SWA1 which is controlled by the MHz switch. The junction of C212 and C216 is returned to the emitter of VT15 to provide capacitative feedback. The oscillator output is also taken from this point.

8. The +8.2 V supply applied to the oscillator is maintained at a nominal 5.6 V by zener diode MR13. The amplitude of the oscillator output is stabilised over the frequency range by an a.l.c. circuit in which MR16 is the a.l.c. detector through which the negative potential on the base of VT17 is controlled by the output amplitude. Increase of amplitude increases the base-emitter voltage and the conduction of VT17 which in turn reduces the conduction of VT15 to reduce the oscillation amplitude.

Phase Splitter and Buffer Amplifiers — Figure 8.4, 8.6

9. The oscillator output is fed via R74, C208 and R75 to the base of the phase splitter VT14. VT14 provides a balanced drive to the buffer amplifiers VT11 and VT12, 13. The emitter of VT14 is biased from the +8.2 V supply by R71 and R69. The emitter load is R69, and the collector load is R68.

10. The base of the buffer amplifier VT11 is fed via C202 and R57 from VT14 emitter. VT11 is a conventional r.f. amplifier. The collector is tuned in 10 steps, spaced over the oscillator frequency range, by SWA3 which connects a suitable capacitor in parallel with L82. The output of this stage is taken from a tap on L82 and applied via C161 and C165 as the high level input of the 1st Mixer stage to L79 centre tap.

11. The second buffer amplifier comprises VT12 and VT13 in parallel, fed from VT14 collector via C204 and R70. The circuit is similar to that of VT11 but parallel stages are used because of the higher output level required. The output is taken from a tap on L83 and fed as the high level input to the 3rd Mixer stage via C166.

12. The oscillator buffer output is also taken via R181, C222 and TR3 to PLBR to provide a synthesizer output in the range 40.5-67.5 MHz for use in a receiver. (Figure 8.6).

Harmonic Generator — Figure 8.4

13. The 1 MHz input from the Frequency Divider is applied via PLCE, C89 and R52 to the base of VT9, the harmonic generator. The tuned circuit L71 and C91 forms part of the band-pass coupling between the Frequency Divider and the harmonic generator. The output of VT9 is fed via L72 to the common emitter, tuned amplifier VT10. The emitter is biased from the +8.2 V supply via R56 decoupled by C94. The collector circuit is tuned in 28 steps of 1 MHz from 3 to 30 MHz. On the first four steps the tuned circuit comprises L73, C96 in parallel with one of the capacitors C125 to C128 selected by SWA2F. On the other steps the tuned circuit is formed by L73,

C96 with one of the capacitors C101 to C124 selected by SWA2B and one of the inductors L150 to L173 selected by SWA2F.

14. The output of VT10 is fed via the secondary of L73 to the low-pass filter network which cuts off frequencies above 33 MHz. The resultant output is coupled via the wideband transformer L79 as the low level input to the 1st Mixer.

First Mixer and 37.5 MHz Filter — Figure 8.5

15. The 1st Mixer comprises MR9-12 connected as a double-balanced bridge-ring modulator. The preset carrier leak potentiometers RV5 and RV6 provide adjustment of the modulator balance. The high level input is the oscillator output from VT11 applied via C161 and C165. The output of the 1st Mixer is applied to an active filter network which selects an output of 37.5 MHz ± 100 kHz.

16. The 37.5 MHz filter is a narrow-band filter having a pass-band of ± 100 kHz. This filter is a series of similar cascaded stages comprising 10 under-coupled tuned circuits and the common emitter r.f. amplifiers VT8, VT7, VT6, VT5.

17. The output of the 1st Mixer which appears across the secondary of L67 is fed from the junction of the tuning capacitors C86 and C87 to VT8 base. Emitter bias for VT8 is obtained from the +8.2 V supply via R46 and R44 decoupled by C84. Negative feedback is provided by the un-bypassed R44. The collector circuit comprises three tuned circuits with top capacity coupling, each inductor being tapped to reduce the loading on VT8.

18. The circuits of VT7, VT6 and VT5 are similar to that of VT8. The tuned collector circuit of VT5 is tapped from L56 to provide, via C221 and TR2, a synthesizer output of 37.5 MHz at PLBQ for use in a receiver. The output of VT5 from L56 is also capacitively coupled to the base of the untuned limiter stage VT16. Excessive reverse voltage between the base and emitter of VT16 is prevented by MR14. VT16 by its limiting action maintains a constant output level to the 2nd Mixer.

Second Mixer and 40 MHz Filter — Figure 8.5

19. The 2nd Mixer comprises MR1-4 connected in the same manner as the 1st Mixer. The high level input is the output from the 37.5 MHz filter and the low level input is the 2 to 3 MHz output of the Frequency Multiplier (100 kHz). Potentiometers RV1 and RV2 balance the modulator to minimise the 37.5 MHz component in the output.

20. A 40 MHz tuned amplifier with a pass-band of ± 600 kHz selects the required output of the 2nd Mixer. This tuned amplifier comprises a common emitter amplifier VT1, preceded and followed by three tuned circuits, capacitively coupled. L3, C7 and L4, C11, C12 form an over-coupled pair but L2, C4 is under-coupled. The collector circuit is similar, L6, C13 and L7, C17 being the over-coupled pair. This arrangement gives the required band-pass characteristics.

21. The output of this stage appears across L8 which has two balanced primary windings connected in parallel but with opposite phase. The purpose of this is to balance out the capacitive coupling to the secondary of L8 which provides the low level input to the 3rd Mixer.

Third Mixer and Low-pass Filter — Figure 8.6

22. The 3rd Mixer comprises MR5-8 connected in the same manner as the 1st Mixer. The high level input is the output of the buffer amplifier VT12, VT13 at the oscillator frequency. The output is the difference between the two inputs and lies in the range 0.24 to 27.5 MHz. The potentiometers RV3 and RV4 balance the modulator to reduce the level of unwanted mixer products in the output.

23. The 3rd Mixer is followed by a low-pass filter having a cut off above 33 MHz. The signal is then amplified by VT2 and VT3. VT2 is a common emitter r.f. amplifier in which R11 provides negative feedback and C33 partial decoupling for the higher output frequency range. VT3 collector circuit is tuned by C39, C55 in parallel with one of the inductors L16 to L44 selected by SWA5.

Output Stage — Figures 8.6, 8.4

24. The output of VT3 is coupled via L31 to the output amplifier VT4. This is a silicon mesa n.p.n. transistor which obtains its d.c. supplies from the filtered +27 V and -27 V outputs of the Power Supply on the synthesizer frame. Smoothing for these supplies is provided by R24, C44; R23, C43 and C46. R25 is a permanent load resistor. The emitter is biased from the -27 V supply via a network in which thermistors R28, R29 give gain-temperature compensation. VT4 collector circuit is tuned in 1 MHz steps over the output frequency range by C48, C65 in parallel with one of the inductors L91 to L117 selected by SWA6. MR17 in VT4 collector circuit is a protection diode which ensures that the maximum possible voltage on the collector of VT4 is +27 V. The output of VT4 is fed to PLBC at an impedance of 75 ohms via L51 the secondary of which is matched to this impedance by C49, R134.

Transmit Receive Switching — Figure 8.5

25. A diode switching circuit is provided in the 2-3 MHz input circuit to enable the 2-3 MHz output of the Frequency Multiplier (100 kHz) to be diverted from the Frequency Multiplier (MHz) to an associated receiver.

26. The diode switching circuit is mounted on a printed wiring board on the rear plate of the unit and operates as follows. -30 V is applied externally to cut off VT18. A d.c. path from +8.2 V is then provided via R120, L174, MR18 to earth via R135, R132. MR18 therefore provides a signal path for the 2-3 MHz output from the Frequency Multiplier (100 kHz) to PLBU and the voltage drop across R120 provides reverse bias for MR19 thus blocking that signal path. This is the transmit condition and provides normal output from the Frequency Synthesizer.

27. When the -30 V is removed VT18 is caused to conduct and the voltage at VT18 collector drops to nearly -8.2 V. A d.c. path now exists from the +8.2 V supply via R120, L174, MR19 and TR1 to the -8.2 V supply. Thus MR19 now provides a signal path for the 2-3 MHz signal to TR1 whose secondary winding feeds the 75 ohms output.

28. The d.c. potential at the junction of MR18 and MR19 now falls to nearly -8.2 V and therefore MR18 is reverse biased and blocks the signal path for the 2-3 MHz signal to the Frequency Multiplier (MHz). This is the receive condition with no output from the Frequency Multiplier (MHz) at PLBC but with the 2-3 MHz output from the Frequency Multiplier (100 kHz) provided at PLBP for use in the receiver.

Auto-tuning Facilities — Figure 8.7

29. The tuning circuits in Type 641, Outfit TDC and Outfit CJM are grouped into six frequency ranges and remotely controlled from the synthesizer. When a frequency is set on the synthesizer decade controls the tuning circuits for the appropriate frequency range are automatically selected by the position of the MHz control. This is achieved by a Ledex system controlled by range switch SWA7. The selected circuits are then servo tuned to the frequency set on the synthesizer. The servo reference voltage is produced by a potential divider network. (See Chapter 1).

30. The Ledex d.c. supply at PLCB.H,J is -41 V from the receiver tuning unit in Type 641 and Outfit CJM but -30 V from the modulator tuning unit in Outfit TDC. The -30 V (Tune Supply) to the potential divider at PLCB,E is from the receiver in Type 641 and Outfit CJM, from the modulator tuning unit in Outfit TDC.

31. The potential divider is in two parts; the kilohertz section which is part of Unit 1 and the megahertz section which is in Unit 2. The kilohertz potentiometer is described in Chapter 2. It is permanently connected across the output of the megahertz potentiometer at SKCD.C, B.

32. The d.c. voltage levels at SKCD.C and B are controlled by switching resistor chains to the required value. Within each frequency range, except range 1, the potential at SKCD.B represents the MHz dial reading and the potential difference between SKCD.C and B represents 1 MHz. Note that the kilohertz potentiometer forms a 10 k load across SKCD.C, B.

33. The voltage range available from the megahertz potentiometer to cover each frequency range is from about -0.75 V to -27.75 V.

34. On ranges 3, 4 and 5 these potentials are provided at junctions R114, R105 and R104, R91 respectively. They are produced from the 0 V to -30 V supply at PLCB.D,E by the fall in potential across R114 (22 ohms) and R104 (66 ohms) in series with a resistance chain totalling 800 ohms. The composition of this chain is determined by the setting of the MHz dial and thus by the position of SWA8, 9 and 10.

35. Range 3 (2,3 MHz). R117 (416 ohms) is in parallel with the 10 k load of the kilohertz potentiometer so that the resistance between SKCD.C and B is 400 ohms. On dial setting 2 MHz this 400 ohms in series with R88, R89, R90, R91 (total 400 ohms) forms the 800 ohm chain. The p.d. between SKCD.C, B covers the less negative half of the voltage range and the potential at SKCD.B represents 2 MHz. On dial setting 3 MHz the 800 ohm chain comprises R105, R106, R107, R108 (total 400 ohms) in series with 400 ohms between SKCD.C, B. The p.d. between SKCD.C, B now covers the more negative half of the voltage range and the potential at SKCD.B represents 3 MHz.

36. Range 4 (4 to 7 MHz). R118 (204 ohms) is in parallel with the 10 k load so that the resistance between SKCD.C, B is now 200 ohms and the voltage range is covered in four steps. On dial setting 4 MHz the 800 ohm chain comprises 200 ohms between SKCD.C, B in series with R86 to R91 (total 600 ohms). The p.d. between SKCD.C, B covers the first quarter of the voltage range and the potential at SKCD.B represents 4 MHz. On dial setting 5 MHz the 800 ohm chain comprises R105, R106 (total 200 ohms), 200 ohms between SKCD.C, B and R88 to R91 (total 400 ohms). The p.d. between SKCD.C, B covers the second quarter of the voltage range and the potential at SKCD.B is at half the voltage range representing 5 MHz. On dial settings 6 MHz and 7 MHz similar stepping action takes place so that the output represents the setting.

37. Range 5 (8 to 15 MHz). R119 (101 ohms) is in parallel with the 10 k load so that the resistance between SKCD.C, B is now 100 ohms and the voltage range is covered in eight steps. The stepping action for each dial setting is similar to that for ranges 3 and 4.

38. Range 2 (1 MHz). There is no resistor in parallel with the 10 k load. In order to cover this frequency range by the same voltage range as on ranges 3, 4 and 5 additional resistors are connected in series with the load. The values of resistance required are given by increasing 22 ohms (R114) and 66 ohms (R104) in the ratio 10 000 to 800 ie multiplying them by 12.5. Thus the required values are 275 ohms and 825 ohms respectively but the preferred value resistors actually used are R114, R105, R106, R130 totalling 278 ohms and R129, R85 to R91, R104 totalling 822 ohms. On this range the full range of voltage appears across SKCD.C, B to represent 1 MHz.

39. Range 6 (16 to 27 MHz). This range uses the resistance chain R113, R112, R92 to R103 which is connected across PLCB.D, E. According to the 2:1 relationship between the other ranges this range should cover 16 to 32 MHz in 16 steps. Consequently the range of voltage available to cover MHz dial settings from 16 to 27 is related to

that for the other ranges and is limited to the correct value by R113 (44 ohms) and R103 (625 ohms). The potentiometer formed by R112, R92 to R102 is tapped by SWA9, 10 to provide an output voltage at SKCD.C, B in 12 steps representing the dial readings. The resistor values are graded to suit the frequency law of the tuned circuits which depart from the linear law of those in ranges 2 to 5. The effect of the 10 k load of the kilohertz potentiometer is negligible.

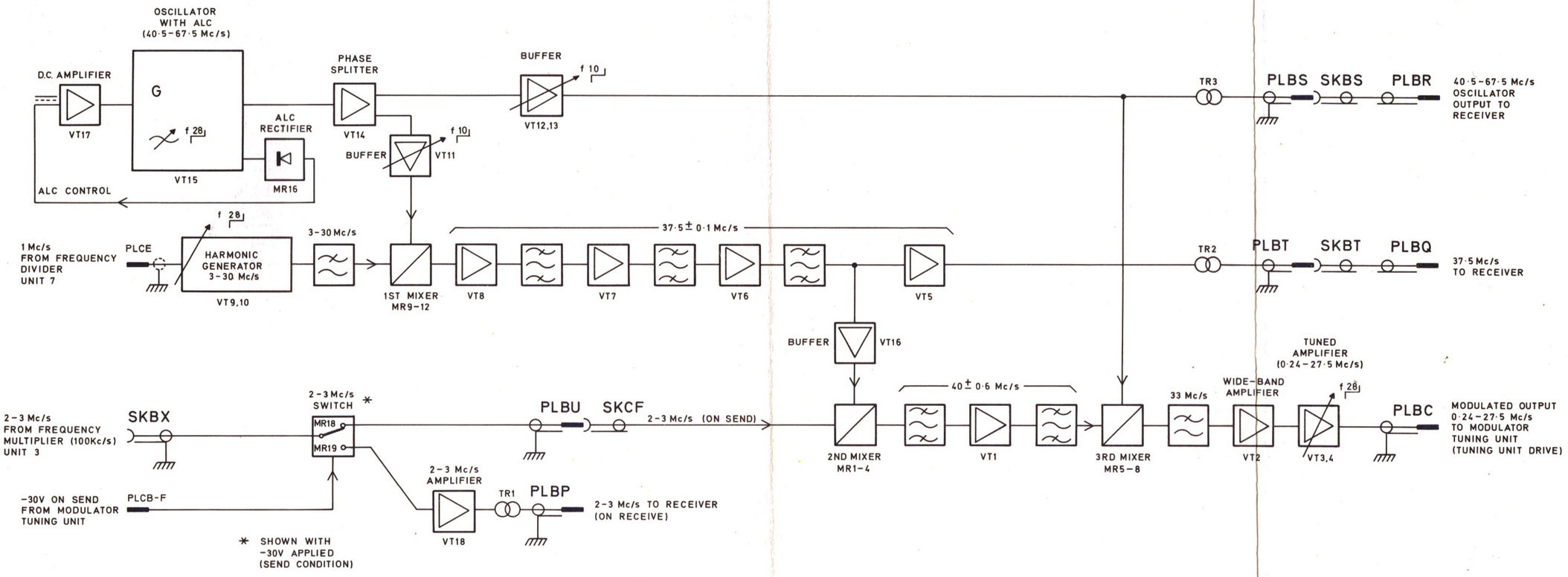
40. Range 1 (MHz dial at 0). The Ledex supply (-30 V or -41 V) energises 1RLA via SWA7 and 2SKCD.D, changing over 1RLA1, 2 to connect the 240 kHz to 525 kHz network in the kilohertz potentiometer. (See Chapter 2). At the same time the 0 to -30 V supply at PLCB.D, E is connected through R114 (22 ohms) and R104 (66 ohms) by SWA9, 10 to provide the correct voltage at SKCD.C, B for this arrangement.

41. The final output level of the complete potential divider network represents the frequency set on the synthesizer. This output is returned to Unit 2 at SKCD.A and connected via R133 (1.8 k) to PLCB.A. R133 prevents damage to the precision wirewound resistors by possible external faults.

Tune Interlock

42. Microswitch SWB is in series with four tune interlock switch wafers behind the front panel of the synthesizer and operated by the kHz decade controls. SWB is operated by detent mechanism on SWA when the MHz control is used resulting in momentary interruption of the interlock circuit.

B.R.4146(5)A
Original

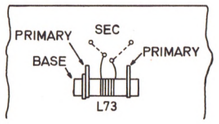


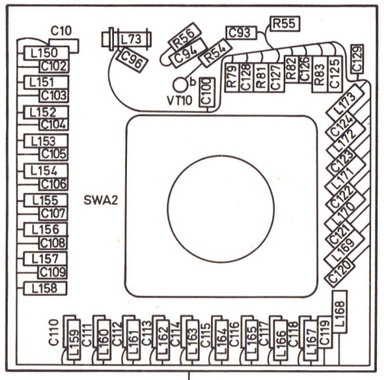
FREQUENCY MULTIPLIER (Mc/s) 5820-99-519-7001

SUB-ASSEMBLY 2

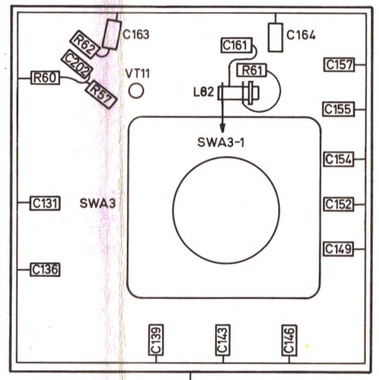
BLOCK DIAGRAM

FIG. 8·1

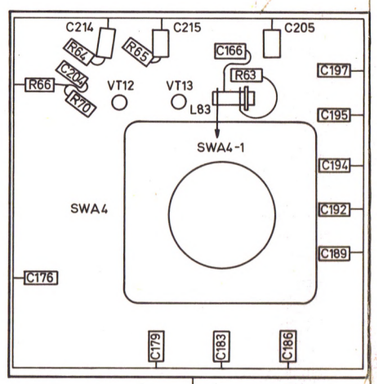




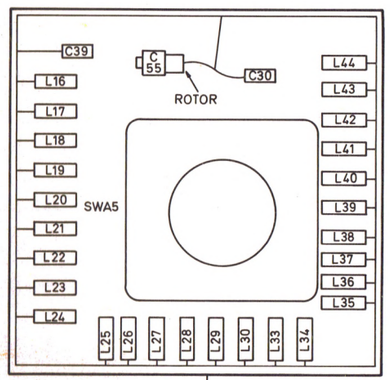
HARMONIC GENERATOR



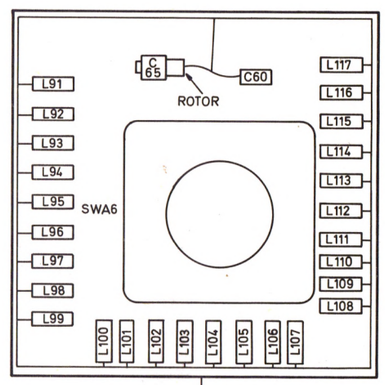
BUFFER TO 1ST. MIXER



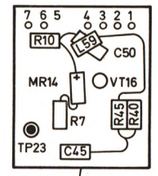
BUFFER TO 3RD. MIXER

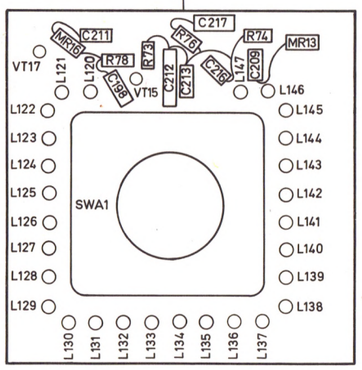


TUNED DRIVER

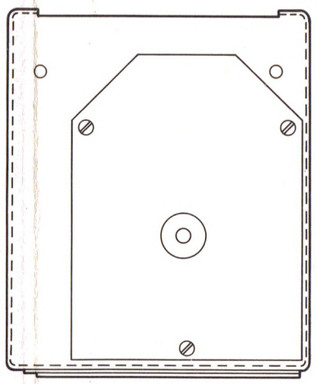


TUNED OUTPUT





OSCILLATOR



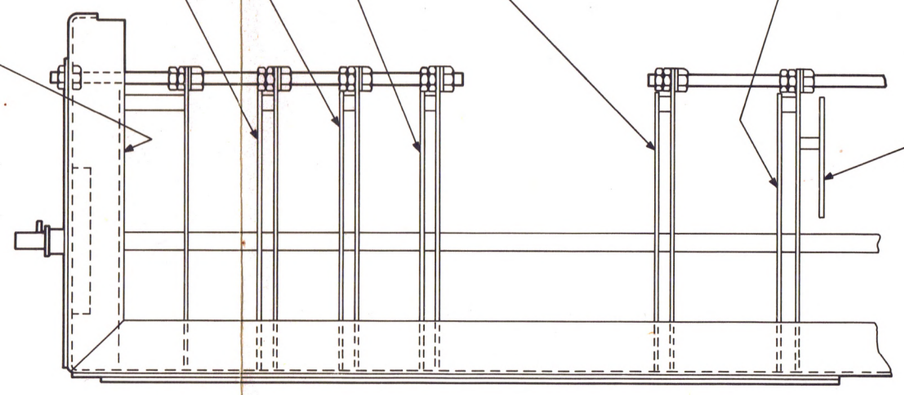
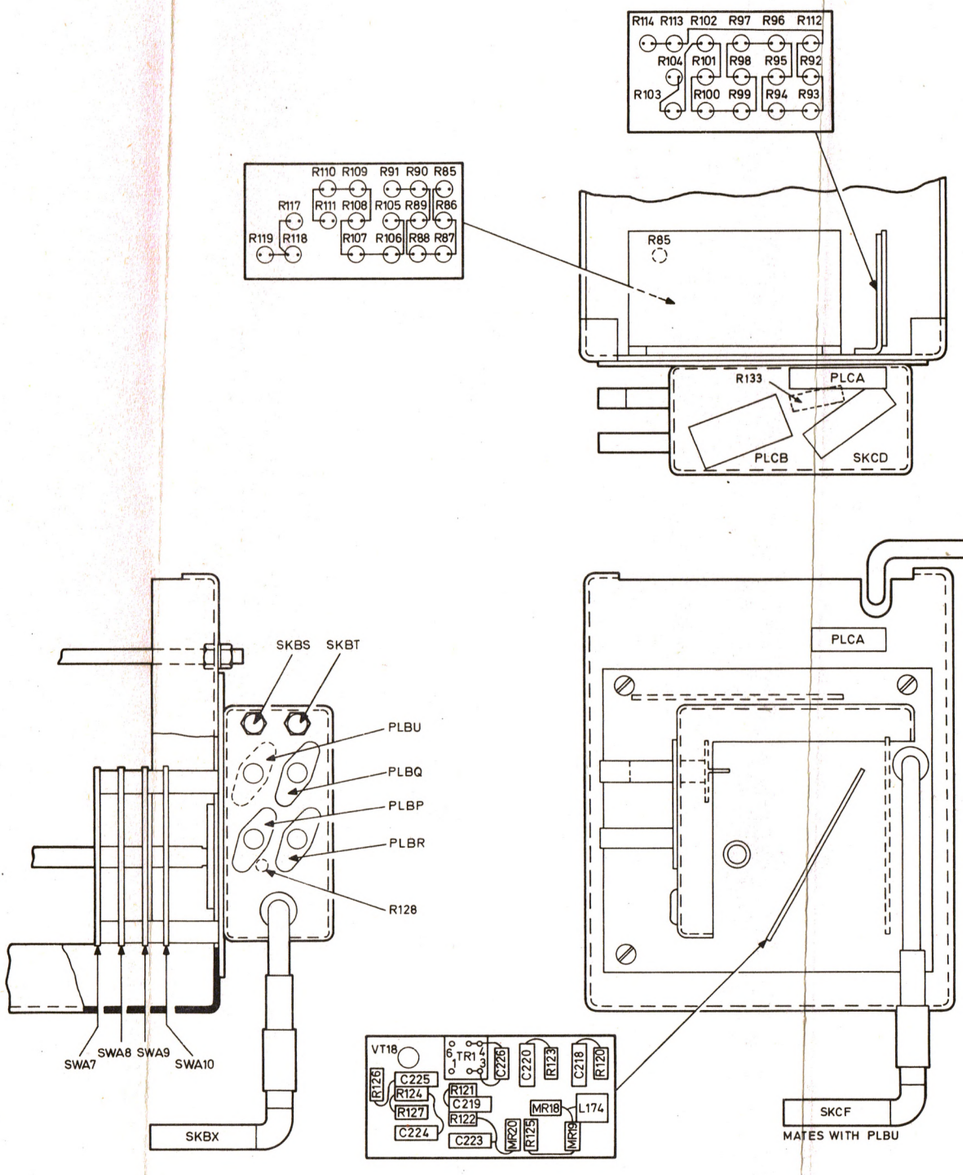


FIG.8·2A

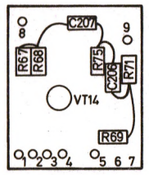


MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

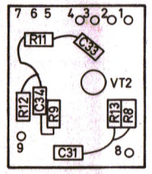
FREQUENCY MULTIPLIER (Mc/s) **5820-99-519-7001**

SUB-ASSEMBLY 2 (SWITCH ASSEMBLY & END VIEWS) COMPONENT LAYOUT

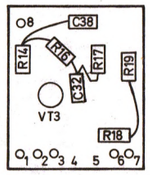
FIG.8·2B



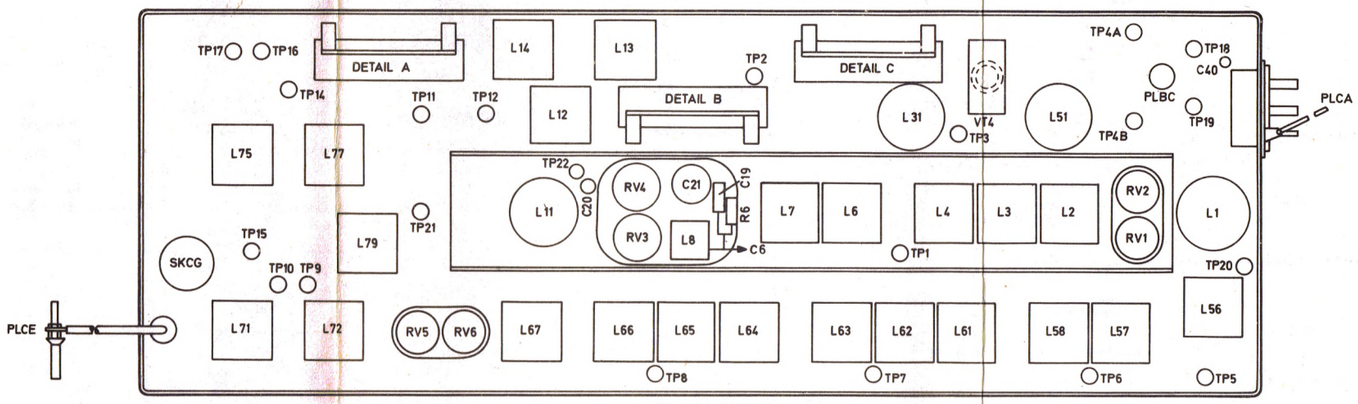
DETAIL A



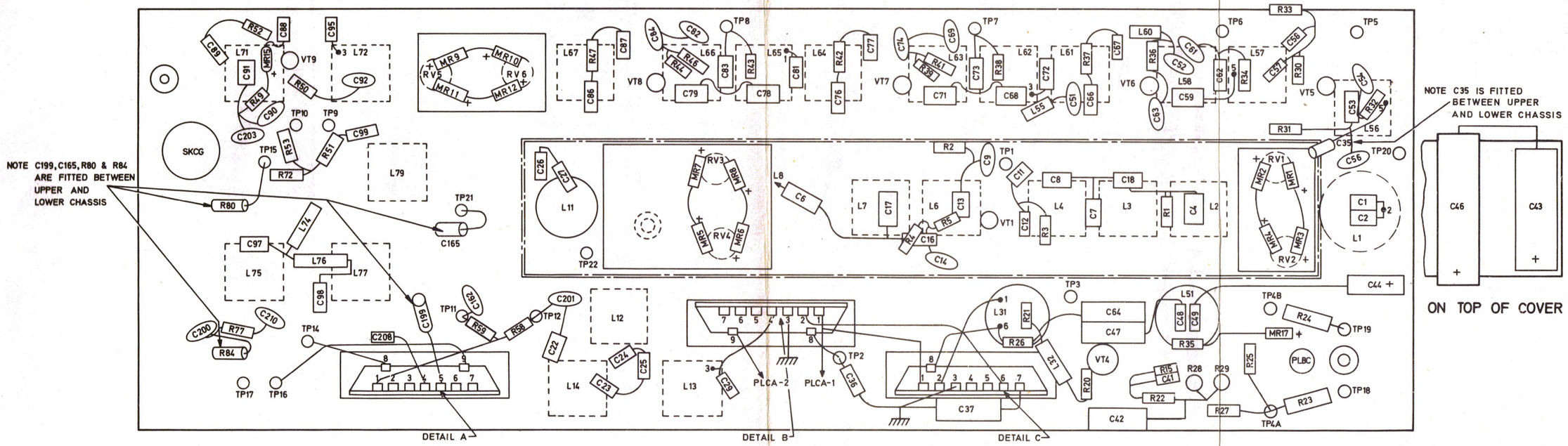
DETAIL B



DETAIL C



PLAN VIEW



UNDERSIDE VIEW

MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (Mc/s) 5820-99-519-7001

SUB-ASSEMBLY 2 (GENERAL VIEWS) COMPONENT LAYOUT

FIG. 8·3

| | | |

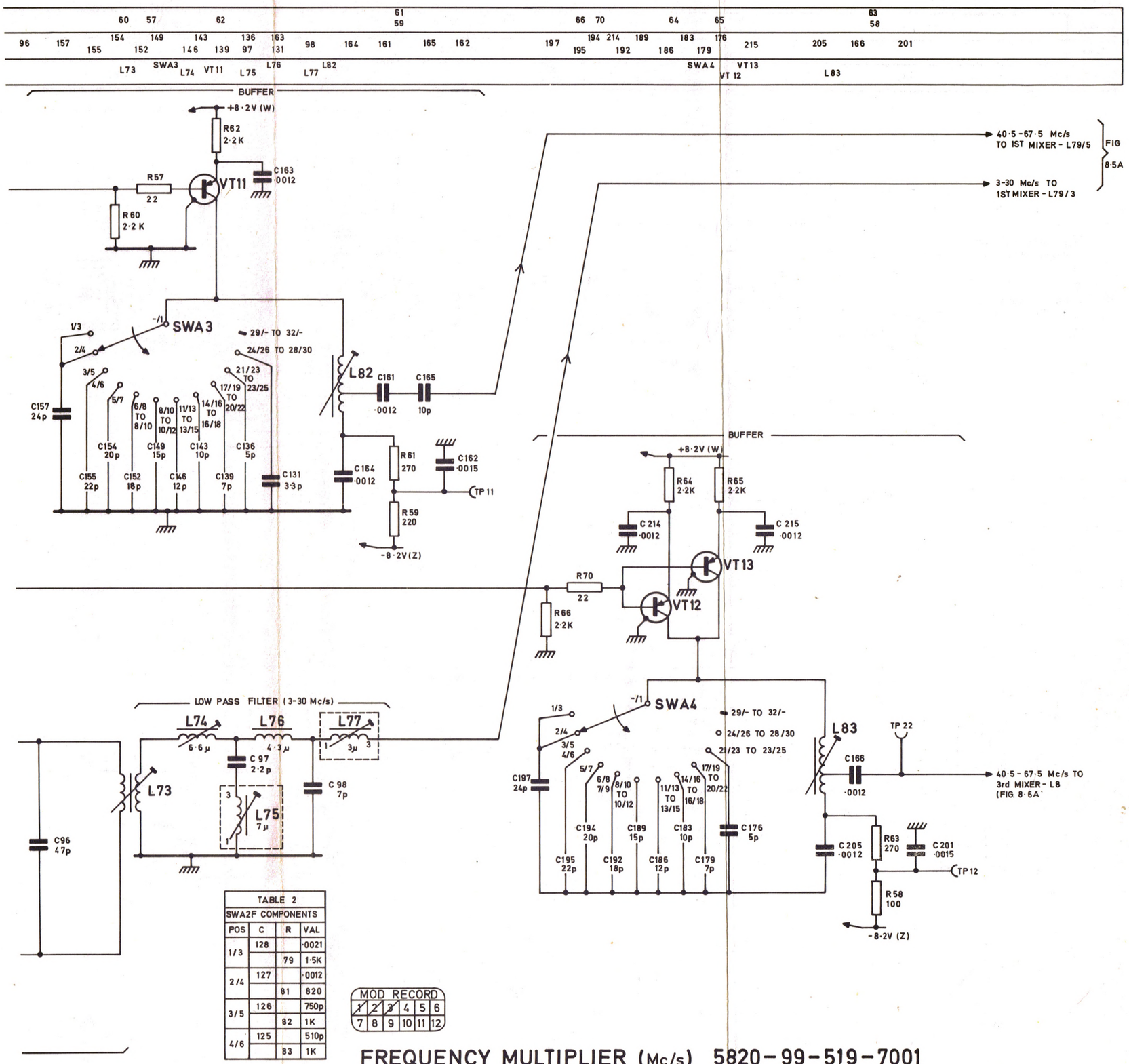


TABLE 2			
SWA2F COMPONENTS			
POS	C	R	VAL
1/3	128		·0021
		79	1·5K
2/4	127		·0012
		81	820
3/5	126		750p
		82	1K
4/6	125		510p
		83	1K

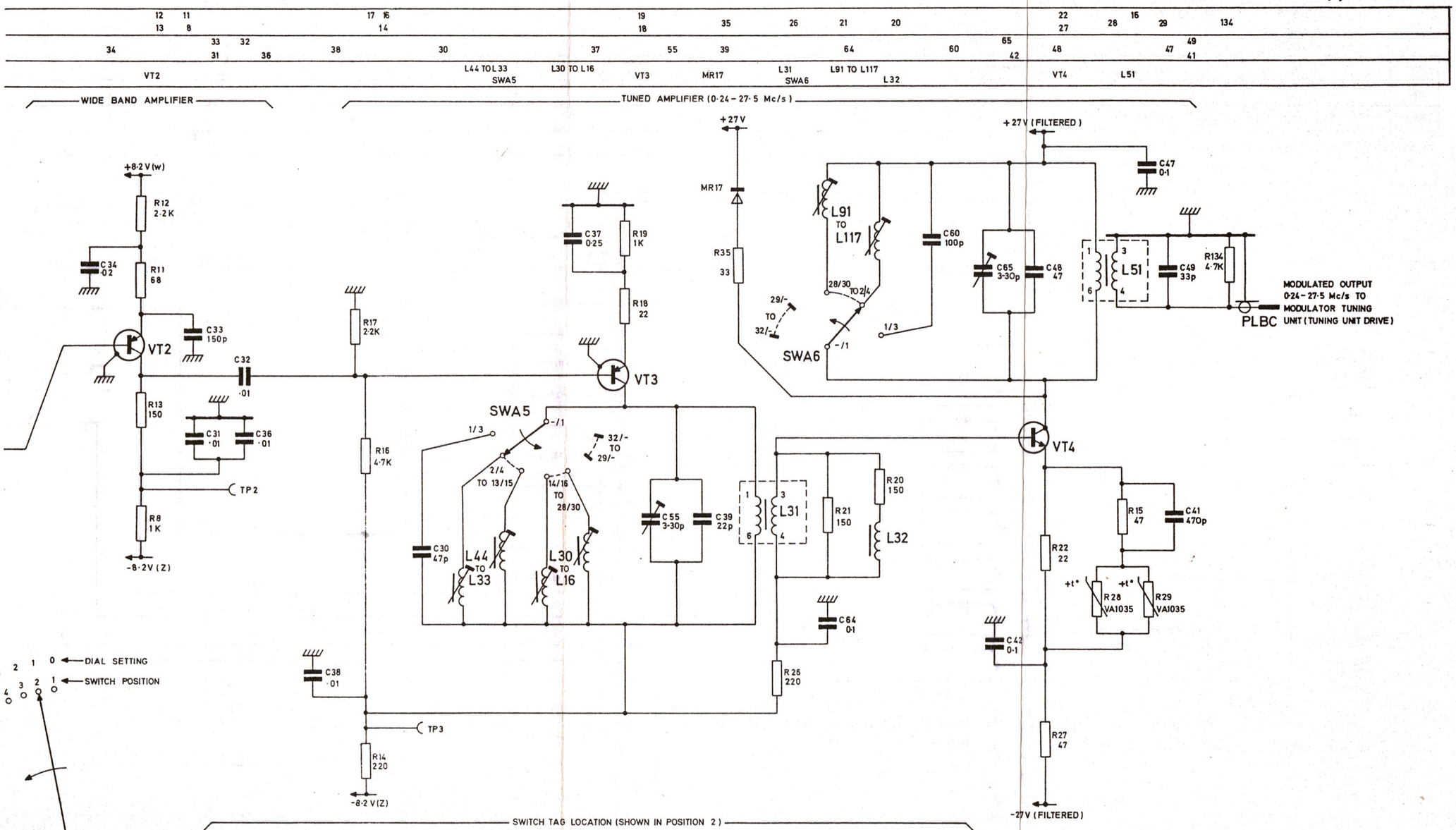
MOD RECORD					
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7	8	9	10	11	12

FREQUENCY MULTIPLIER (Mc/s) 5820-99-519-7001

SUB-ASSEMBLY 2 (OSCILLATOR & HARMONIC GENERATOR) CIRCUIT DIAGRAM

FIG. 8·4B

| | | |



NOTE 1. CANS OF ALL SCREENED INDUCTORS EARTHED TO CHASSIS BY FIXINGS.
2. ON FAILURE REPLACE C20 BY 0·8-6·0p

MOD RECORD					
1	2	3	4	5	6
7	8	9	10	11	12

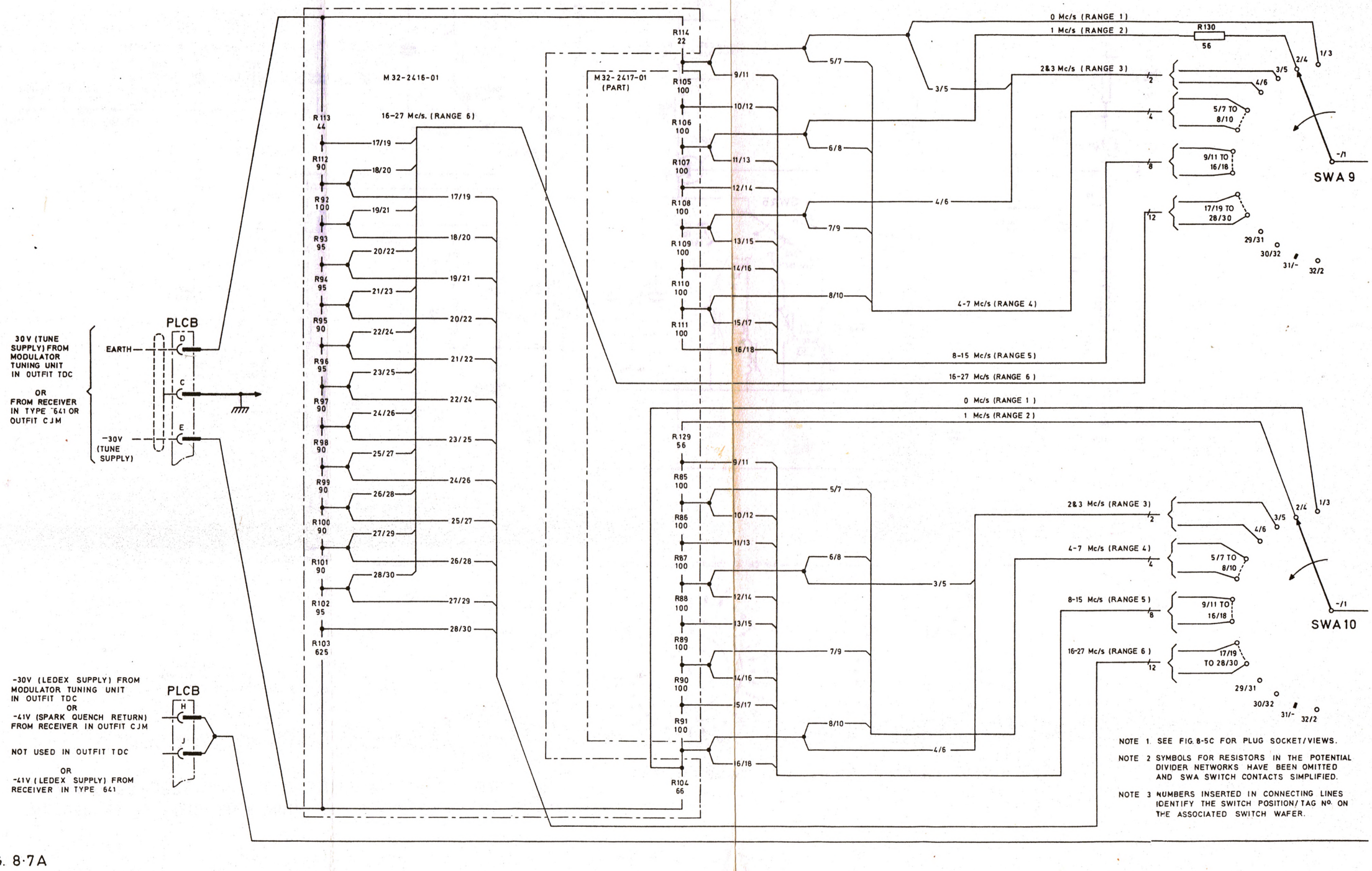
FREQUENCY MULTIPLIER (Mc/s) 5820-99-519-7001

SUB-ASSEMBLY 2 (3rd MIXER & OUTPUT) CIRCUIT DIAGRAM

FIG. 8·6B

RES	113 112 — 92 — 103	114 — 111	129 104	85-91	130
CAP					
MISC					SWA9 SWA10

SERVO REFERENCE POTENTIOMETER (Mc/s SWITCHES)



NOTE 1. SEE FIG. 8-5C FOR PLUG SOCKET/VIEWS.

NOTE 2 SYMBOLS FOR RESISTORS IN THE POTENTIAL DIVIDER NETWORKS HAVE BEEN OMITTED AND SWA SWITCH CONTACTS SIMPLIFIED.

NOTE 3 NUMBERS INSERTED IN CONNECTING LINES IDENTIFY THE SWITCH POSITION/TAG No. ON THE ASSOCIATED SWITCH WAFER.

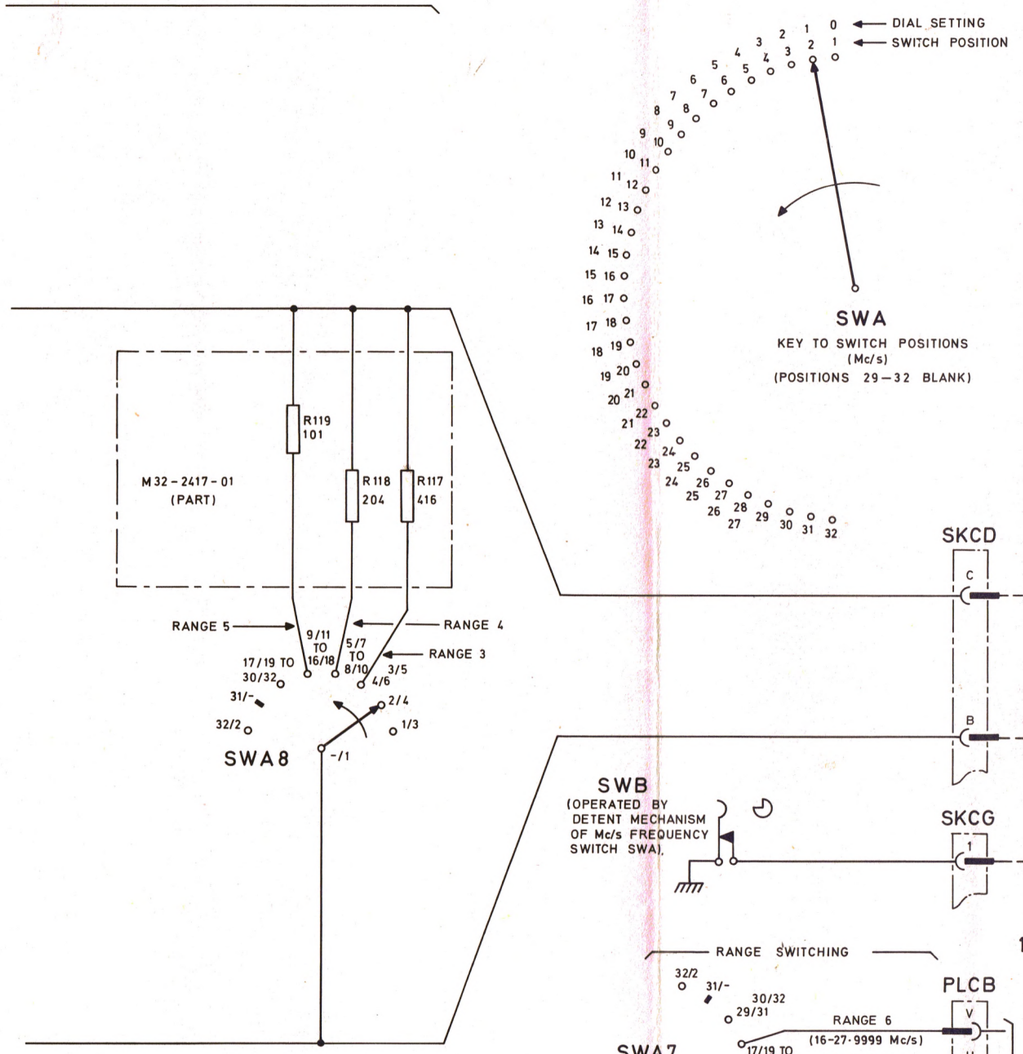
FIG. 8·7A

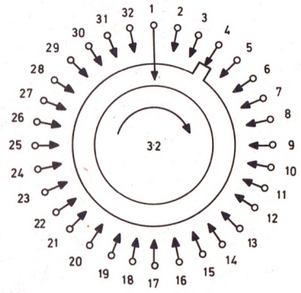
BR4146(5)A
Original

119 118 117 133

40

SWA8 SWA7 SWB





SWA 7 - SWA 10

SWITCH TAG LOCATION
(SHOWN IN POSITION 2)

NOTE 4 GROUPING OF CONDUCTORS INTO SINGLE-LINE REPRESENTATION IS SHOWN THUS:-

8 — 9/11 TO 16/18 (PART OF SWA9)

(THE SINGLE LINE REPRESENTS THE CONNECTIONS TO THE 8 TAGS NUMBERED 11-18)
CONDUCTORS EMERGE FROM THE SINGLE LINE ONE AT A TIME AS SHOWN BELOW:-

15/17
16/18
8

MOD RECORD

1	2	3	4	5	6
7	8	9	10	11	12

FREQUENCY MULTIPLIER (Mc/s) 5820-99-519-7001

SUB-ASSEMBLY 2 (SERVO & RANGE CONTROL) CIRCUIT DIAGRAM

FIG. 8·7B

CHAPTER 9

MODIFICATIONS

CONTENTS LIST

	Paragraphs
Introduction	1
Synthesizer	2
Oscillator Audio Frequency	3
Frequency Multiplier (10 kHz)	4
Frequency Multiplier (100 kHz)	5
Frequency Multiplier (MHz)	6

CHAPTER 9

MODIFICATIONS

Introduction

1. This Chapter lists the modifications that have been made to the Frequency Synthesizer to March 1971.

Synthesizer

2. Modification No. 1: Bellows type coupling replaced by one of different design.

Modification No. 2: Two diodes CV7332 connected between pins 1 and 3, 14 and 22 of SWA4. The positive terminals of the diodes to pins 1 and 22. Incorporated to prevent damage, in Outfits TDC or CJM, to gear teeth or tuning shaft by driving against the end stop while the synthesizer dials are being set outside the normal frequency range.

Oscillator Audio Frequency

3. Modification No. 1: R18 and R40 changed to 3.9 k and 150 ohms respectively and a thermistor added in parallel with R40. Incorporated to improve response at high temperatures.

Modification No. 2: When necessary, replace CV4073 with 1N914 or ZS10A or ZS10B.

Frequency Multiplier (10 kHz)

4. Modification No. 1: R44 changed from 100 to 27 ohms. Incorporated to increase the gain of F3 circuit.

Frequency Multiplier (100 kHz)

5. Modification No. 1: R17 changed from 47 to 39 ohms. Incorporated to increase the gain of F2 circuit.

Frequency Multiplier (MHz)

6. Modification No. 1: C226 changed from 820 pF to 100 pF. Incorporated to increase the 2 to 3 MHz output.

Modification No. 2: R133 (1.8 k) inserted between SKCD.A and PLCB.A. Incorporated to prevent overheating of precision wirewound resistors due to possible external faults.

Modification No. 3: When necessary replace C20, PC20301-1 with PC20303-2.

APPENDIX 1

THE BALANCED MODULATOR

CONTENTS LIST

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THE BALANCED MODULATOR	1-14

ILLUSTRATIONS

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Balanced Modulator with Carrier Balancing	2b
Balanced Modulator Waveforms	3
Double-Balanced Bridge-Ring Modulator (Drawn In Bridge Configuration)	4a
Double-Balanced Bridge-Ring Modulator (Drawn In Lattice Configuration)	4b
Double-Balanced Modulator Waveforms	5
Single-Balanced Modulator	6a
Double-Balanced Modulator	6b

APPENDIX 1

THE BALANCED MODULATOR

1. In a balanced modulator the carrier is suppressed and the output contains only the upper and lower sidebands which give rise to a beat note output waveform as shown in Figure 1.

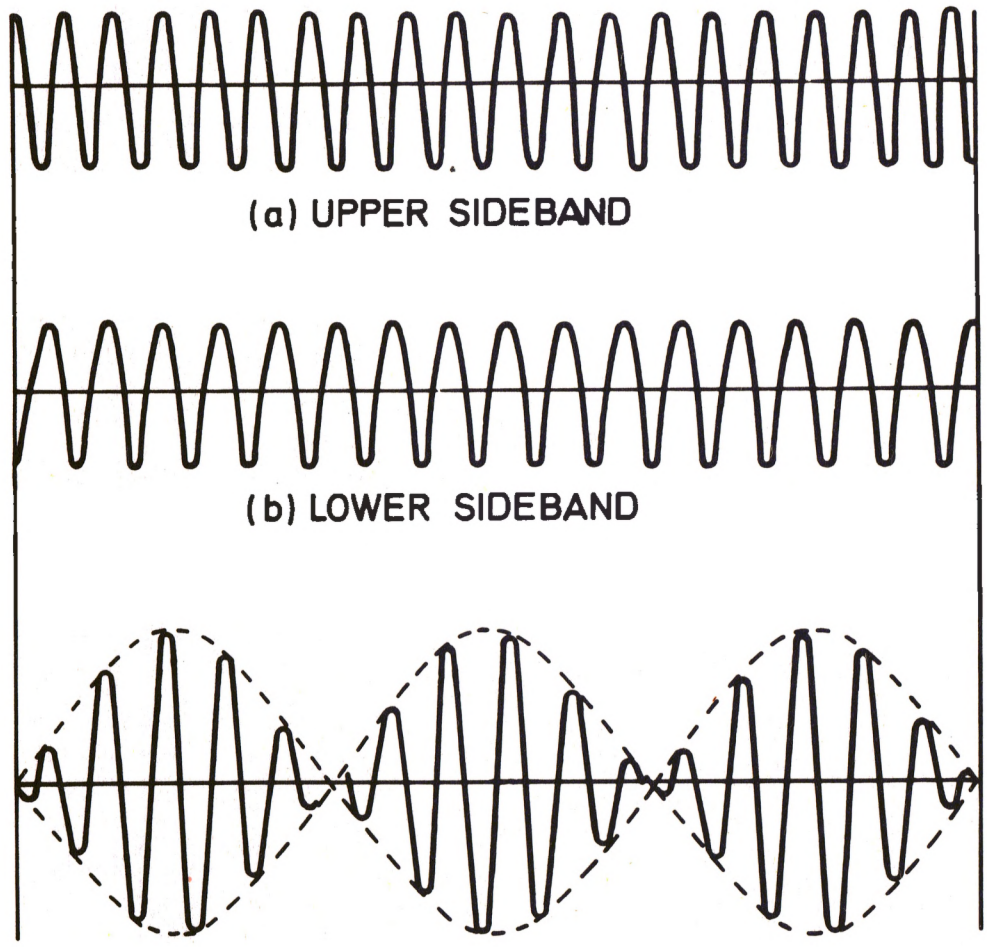


FIG. 1 SIDEBAND WAVEFORMS

2. A typical circuit is shown in Figure 2a. The carrier is applied between the centre taps of T1, T2 and provided the diodes are exactly matched no carrier frequency oscillation will reach the output of T2. It is usual to incorporate a carrier-leak potentiometer, as shown in Figure 2b, to allow balancing of the carrier currents in the two halves of the primary of T2 to obtain minimum carrier output.

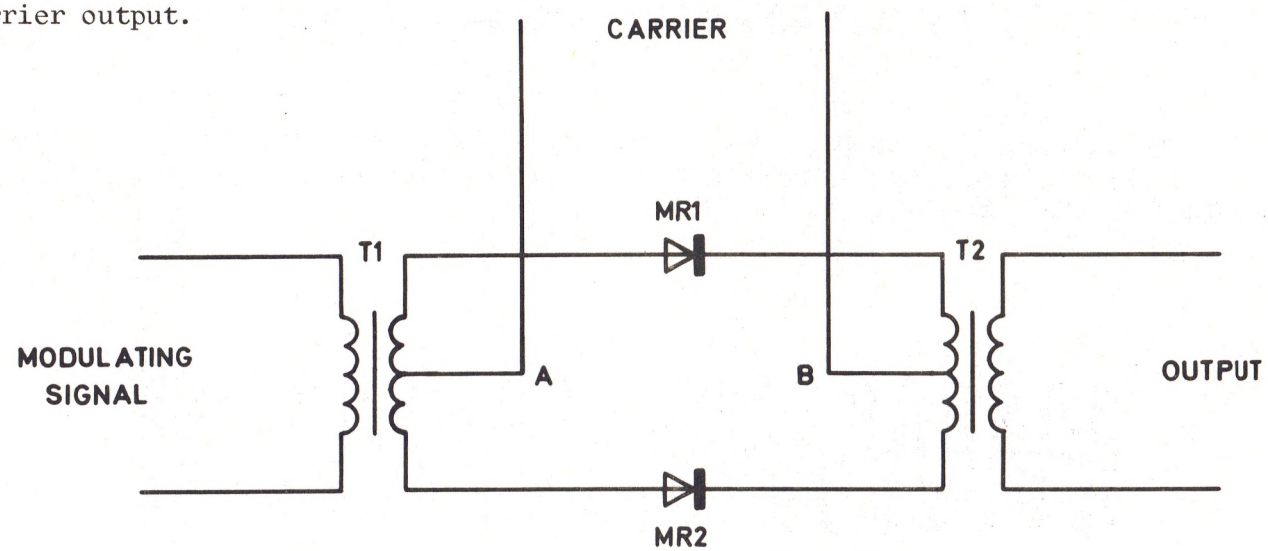


FIG. 2a BALANCED MODULATOR

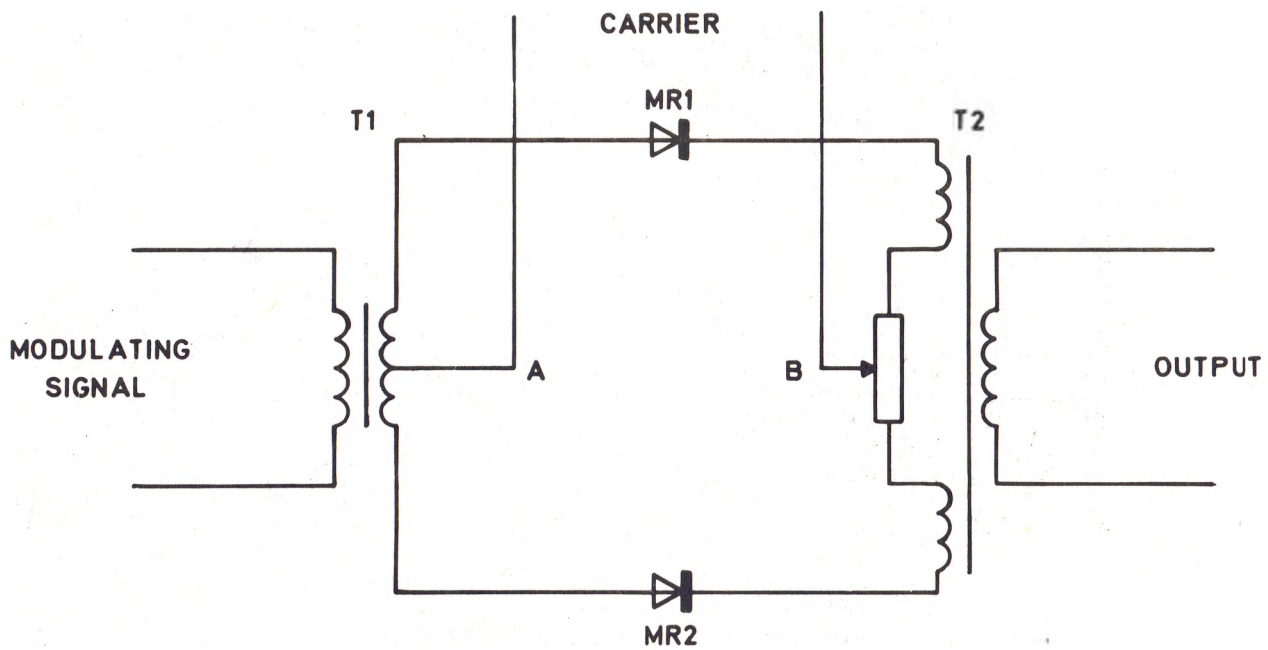


FIG. 2b BALANCED MODULATOR WITH CARRIER BALANCING

3. The impedance of the diodes varies according to the bias applied, being quite small when the diode is forward-biased and very large when it is back-biased. The carrier input is arranged to be of considerably greater amplitude than the modulating signal and therefore controls the bias. On half-cycles of carrier when A is at a higher potential than B, the diodes are forward-biased and a low impedance path is set up between T1 and T2. During the other half-cycles, when B is at a higher potential than A, the diodes are back-biased and the impedance between T1 and T2 is high, thus blocking the signal path.

4. The input and output waveforms are shown in Figure 3, and the output waveform appears to show no resemblance to the anticipated waveform of Figure 1c. This is due to the presence of a large number of frequencies, including a modulating signal component, in addition to the upper and lower sidebands. The output waveform follows the modulating signal input during the positive half-cycles of the carrier, but is zero during the negative half-cycles; which is exactly the waveform produced when the signal input waveform of Figure 3a is multiplied by the square waveform of Figure 3d.

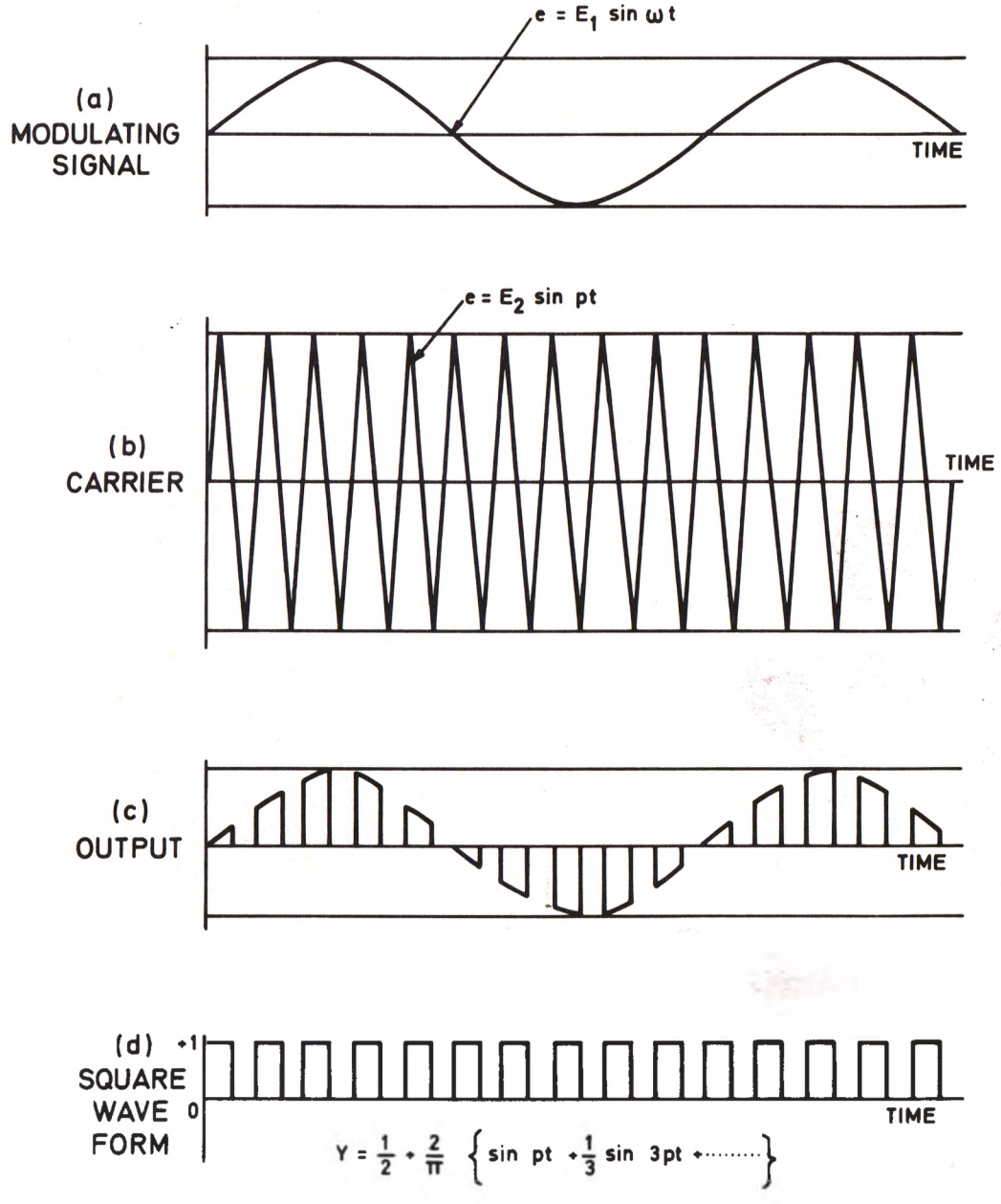


FIG. 3 BALANCED MODULATOR WAVEFORMS

5. In the double-balanced bridge-ring modulator the carrier is suppressed in a similar manner to that employed in the circuit of Figure 2, but the modulating signal is also suppressed by arranging the four diodes in bridge form and applying the modulating signal across one diagonal, as shown in Figure 4a. The same circuit re-drawn in lattice form is given in Figure 4b and either form may be encountered on circuit diagrams of equipment. This circuit gives an output comprising the upper and lower sidebands free of both modulation and carrier frequencies.

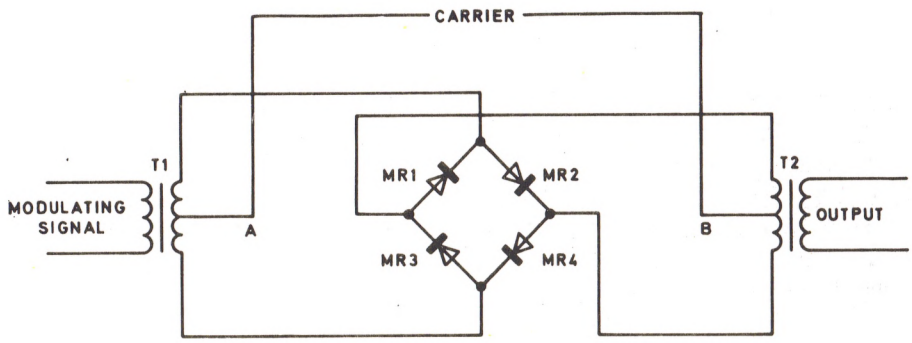


FIG. 4a DOUBLE-BALANCED BRIDGE-RING MODULATOR (DRAWN IN BRIDGE CONFIGURATION)

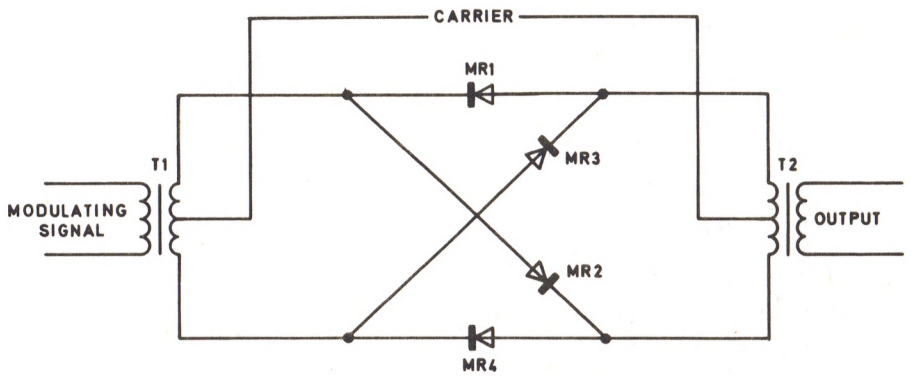


FIG. 4b DOUBLE-BALANCED BRIDGE-RING MODULATOR (DRAWN IN LATTICE CONFIGURATION)

6. As before, the carrier amplitude must be large compared with the modulation. When A is at a higher potential than B, MR2, MR3 being forward-biased will offer a low impedance path, whilst MR1, MR4 being back-biased offer a high impedance. On the other half-cycle of carrier this state of affairs is reversed, MR2, MR3 being back-biased and MR1, MR4 being forward-biased. The signal path between T1 and T2 is therefore reversed after each half-cycle of carrier and, since the carrier frequency is greater than the modulating signal, this reversal occurs several times during each cycle of the modulation.

7. The input and output waveforms are given in Figure 5, from which it will be seen that the output waveform is equivalent to the input multiplied by the square waveform and is similar to that obtained for the single balanced circuit. However, the modulation frequency is no longer present and the sidebands have twice the amplitude, indicating that an improvement in the output is obtained from the use of the double-balanced circuit.

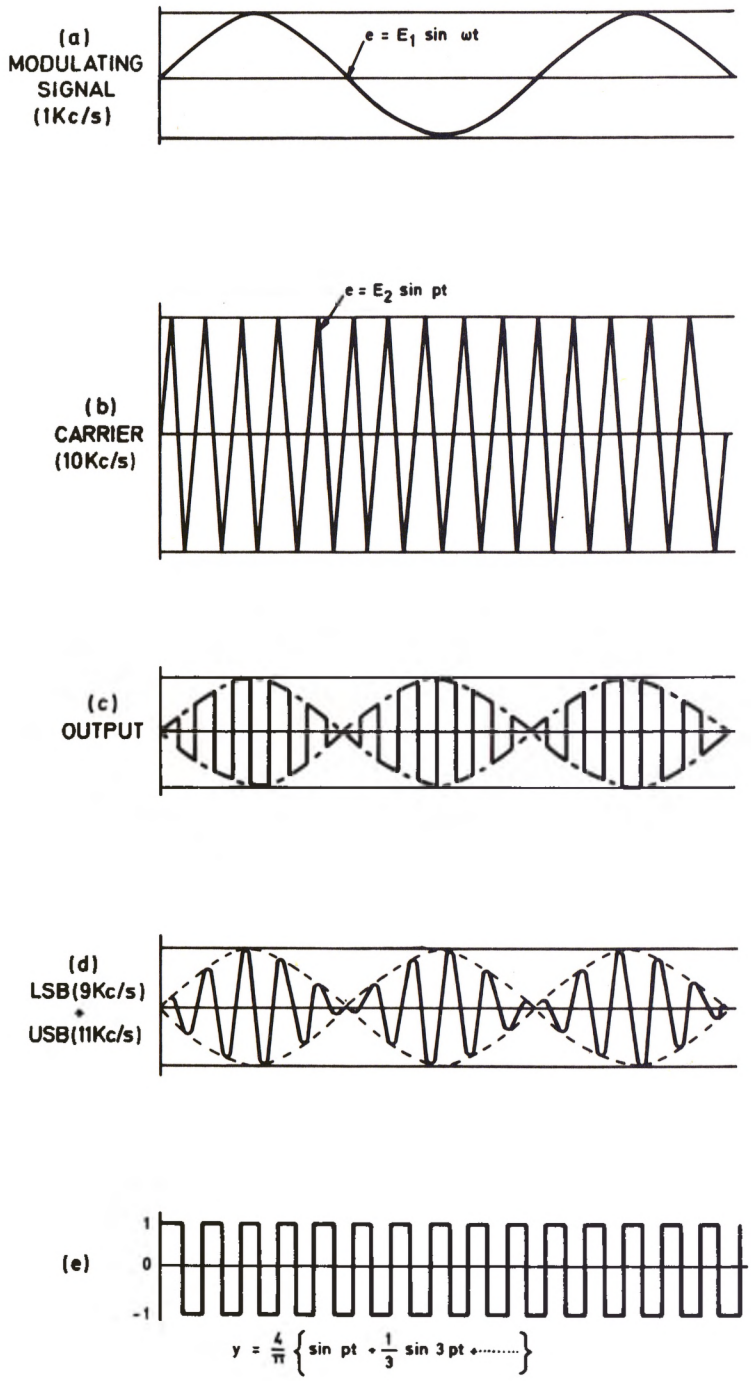


FIG. 5 DOUBLE-BALANCED MODULATOR WAVEFORMS

8. This circuit also balances out the odd order intermodulation products:- $2f_1 \pm f_o$; $3f_1 \pm 2F_o$; etc.

9. There are a number of modulators designed to operate in the 'switched Mode', the circuit variations usually giving the unit some particular advantage over the standard circuit. One of these circuits, in its single and double balanced form, is shown in Figure 6.

10. Consider Figure 6a. The carrier is at a higher level than the modulating signal and switches the four diodes on or off on alternate half-cycles of the carrier. The signal path between the source and load is thus made or broken on alternate half-cycles of the carrier and the output waveform is as shown in Figure 3c.

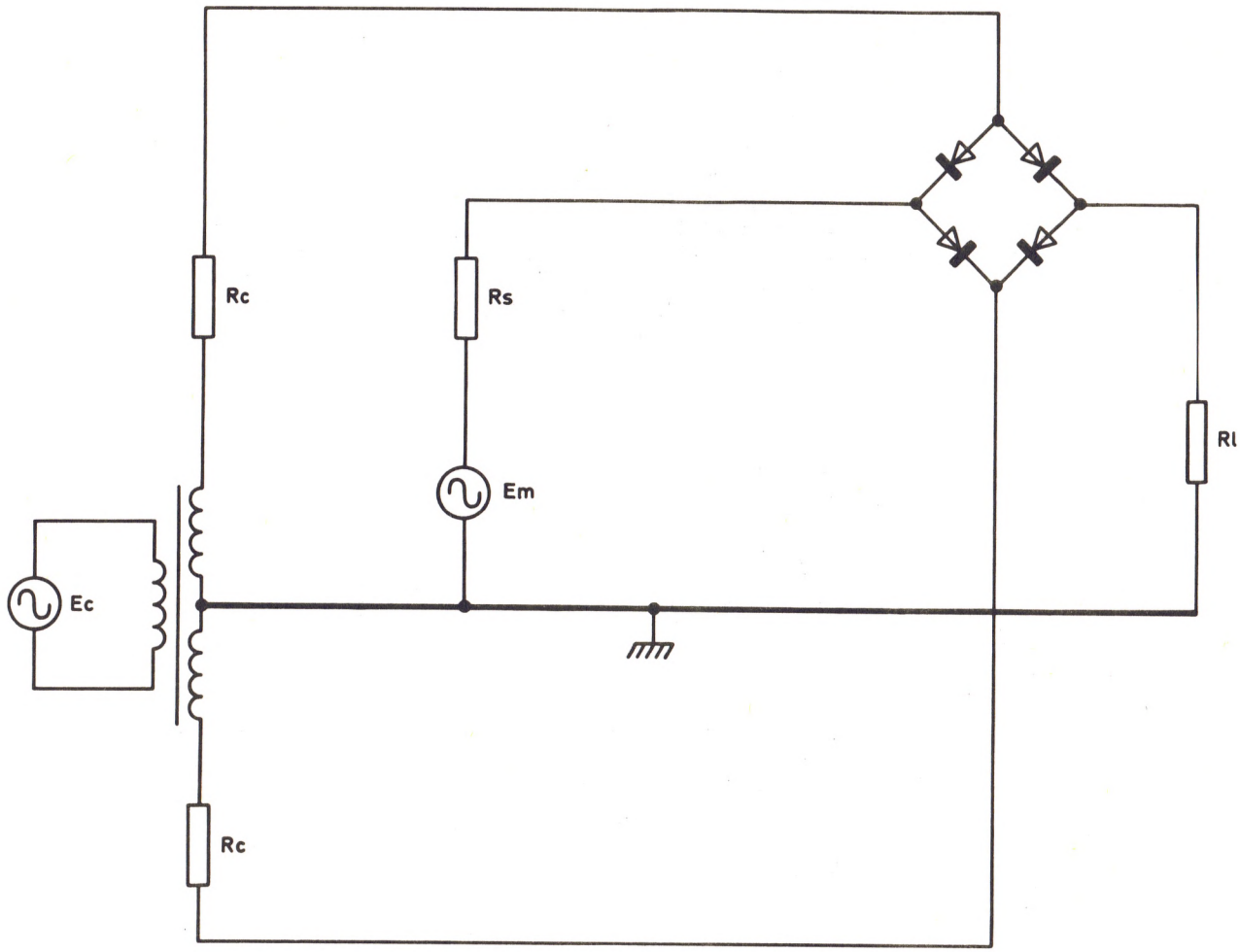


FIG. 6a SINGLE-BALANCED MODULATOR

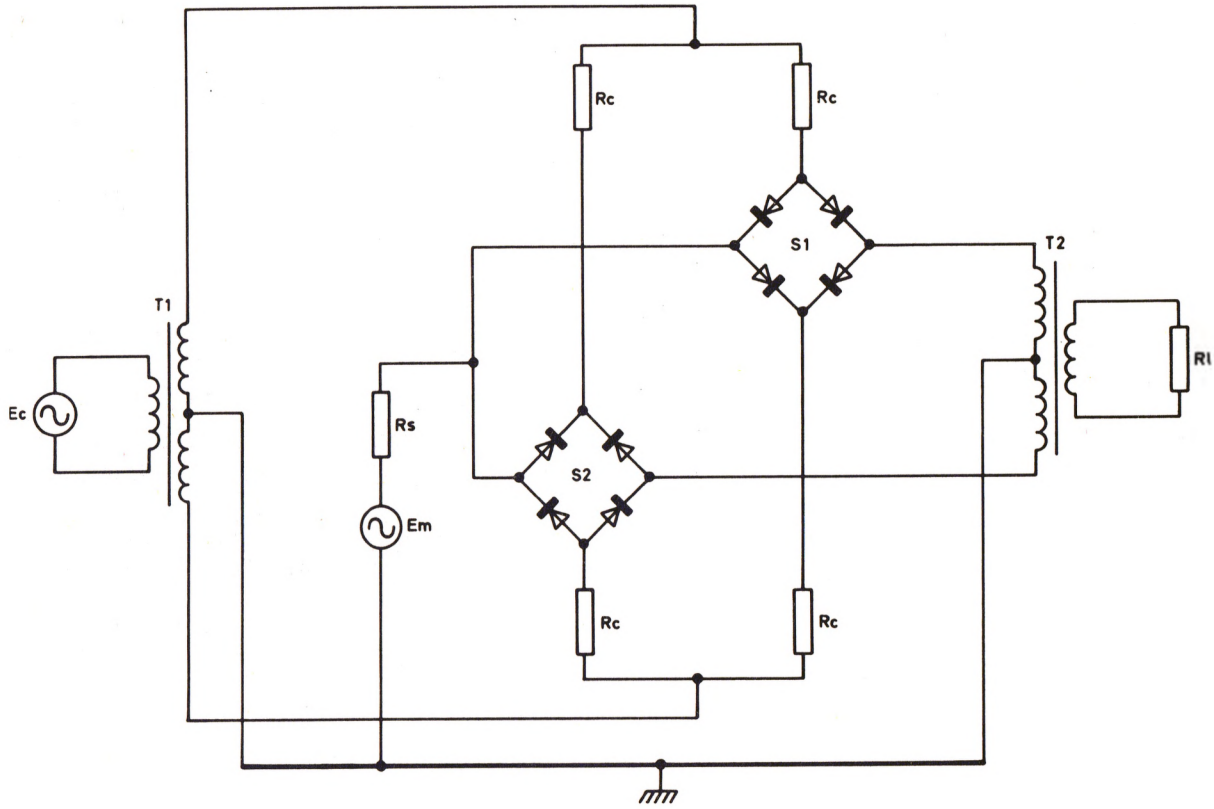


FIG. 6b DOUBLE-BALANCED MODULATOR

11. The double balanced version shown in Figure 6b has two paths for the modulating signal, one via the four diodes labelled S1, and one via those labelled S2. The diode connections are so arranged that S2 is open when S1 is closed, and vice versa. The modulating signal path is thus continuously made to T2 but in the reverse sense on alternate half-cycles of the carrier. This results in the desired output waveform of Figure 5c.

12. One limitation of the double balanced circuit of Figure 4 is the low level of modulating signal that can be handled. This is due to the fact that the carrier voltage holding one pair of diodes back-biased is the voltage developed across the other pair of diodes when forward-biased. Because of the 'limiting nature' of the forward characteristic of the diode this voltage is limited, and the modulating signal level must be much less than this to avoid interference with the carrier switching action.

13. This disadvantage is over come in the circuit of Figure 6b. The voltage developed across either 'diode switch' is independent of the state of the other switch and almost any desired level of modulating signal can be handled if the carrier level is adjusted to suit. Because of this the circuit is often termed a 'high level modulator'.

14. Circuit 6a also has the following advantages:-

(a) Only one balanced transformer is required, designed to cater only for the carrier frequency.

(b) The carrier balance is due almost entirely to the balance of the carrier transformer and the balancing resistors RC; the diodes have little effect.

(c) The source and load can be unbalanced so that, with signal and output transformers not required, a wide frequency response can readily be achieved.

APPENDIX 2

REGENERATIVE MODULATOR DIVIDER

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APPENDIX 2

REGENERATIVE MODULATOR DIVIDER

1. The regenerative modulator divider consists of a shunt modulator comprising four diodes connected in bridge form across the input of a tuned amplifier. The tuned circuit in the amplifier output provides feedback to the modulator.

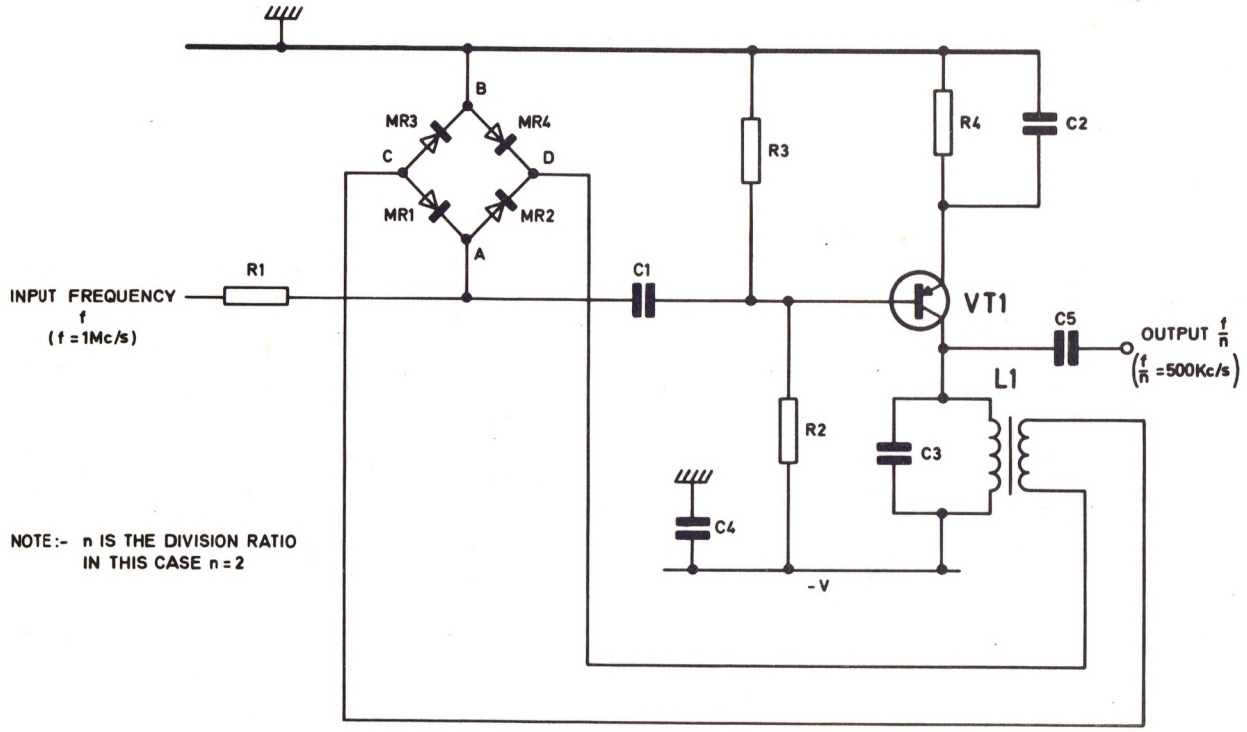


FIG. 1 TYPICAL REGENERATIVE MODULATOR DIVIDER

2. With reference to Figure 1, VT1 collector circuit is tuned by C3, L1 to the required output frequency. Assuming an input frequency of 1 MHz and a required output frequency of 500 kHz, the modulator divider is a divide-by-two stage.

3. Feedback to the shunt modulator MR1 to MR4 is via the secondary of L1. This feedback is applied to terminals C and D of the modulator as a switching signal.

4. The 1 MHz input applied via R1 to the modulator mixes with the 500 kHz feedback via the secondary of L1. A difference frequency of 500 kHz is therefore obtained and fed to VT1 base via C1. The amplified 500 kHz signal appears across the tuned circuit C3, L1 and an output is taken from this circuit via C5.

5. Terminals A and B of the modulator are connected to the input. During one half-cycle of the switching signal the diodes MR1-4 are forward-biased and present a low impedance across the input, whilst during the next half-cycle they are back-biased and their shunting effect is small.

6. No special precautions are necessary to reduce carrier leak. The balance of the diodes must be accurate enough to prevent feedback from the collector to the base. Otherwise, if the phase conditions are correct, the divider will balance as an oscillator.

7. To produce a division ratio of 5:1 it is only necessary to retune the collector circuit. If the input frequency is f, for a ratio of 5:1 the collector circuit is tuned to f/5.

8. When the divider is switched on a signal at the frequency f/5 is fed back to the modulator. Owing to its non-linear characteristics, the modulator generates harmonics of f/5. The fourth harmonic 4f/5, modulates the input frequency f to produce output frequencies of f + 4f/5 and f - 4f/5. The collector circuit is tuned to f - 4f/5 and with the correct phasing the divider will maintain an output at this frequency.

9. With a division ratio of 5:1 the divider can be called a divide-by-five stage. With an input frequency of 1 MHz the circuit behaves as follows:-

Input frequency:	1 MHz
Collector tuned circuit:	200 kHz
Frequencies generated in modulator (ie 4th harmonic):	800 kHz
Output frequencies produced by VT1:	1 MHz +800 kHz and 1 MHz -800 kHz

Collector tuned circuit is tuned to 200 kHz, therefore the frequency of 1 Mhz -800 kHz is selected and fed via C5 as the output.

10. Other division ratios may be obtained in a similar manner. If f is the input frequency and n is the division ratio, the output frequency will be f - (n - 1) f/n = f/n. At low division ratios the circuit is unaffected by detuning of the input or output circuits by up to 5%. The lower the division ratio, the higher the circuit stability.

PART 5B

SWITCHING ON OFF AND SETTING UP

PART 5B

SWITCHING ON/OFF AND SETTING UP

CONTENTS

CHAPTER 1 SWITCHING ON/OFF AND SETTING UP

CHAPTER 1

SWITCHING ON/OFF AND SETTING UP

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ILLUSTRATIONS

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Mains Transformer Connections	1.1

CHAPTER 1

SWITCHING ON/OFF AND SETTING UP

Introduction

1. The Synthesizer is used in Type 641 and Outfits TDC, CJM and is therefore set up in the cabinet appropriate to its particular function. In the following paragraphs it is assumed that the cabinet supplies and connections are correct and that the associated Modulator-Tuning Unit or Receiver is serviceable.

2. It is important that records are kept so that changes in performance can be observed and appropriate action taken.

Mains Transformer Connections

Figure 1.1

3. Check that the mains transformer connections (see Table 1.1) are correct for the mains supply voltage which is normally 230 V in Type 641 and Outfits TDC, CJM. The SUPPLIES indicator plate should be set to show the state of the tappings.

TABLE 1.1 MAINS TRANSFORMER CONNECTIONS

Supply Voltage	Link a to b	Connect supply to a	b
100	100 to 100 0 to 0	0	100
105	100 to 100 5 to 5	5	100
110	110 to 110 0 to 0	0	110
115	110 to 110 5 to 5	5	110
120	120 to 120 0 to 0	0	120
125	120 to 120 5 to 5	5	120
130	130 to 130 0 to 0	0	130
200	0 to 100	100	0
205	5 to 100	100	0
210	5 to 100	100	5
215	5 to 110	100	0
220	0 to 110	110	0
225	5 to 110	110	0
230	5 to 110	110	5
235	5 to 120	110	0
240	0 to 120	120	0
245	5 to 120	120	0
250	5 to 120	120	5
255	5 to 130	120	0
260	0 to 130	130	0

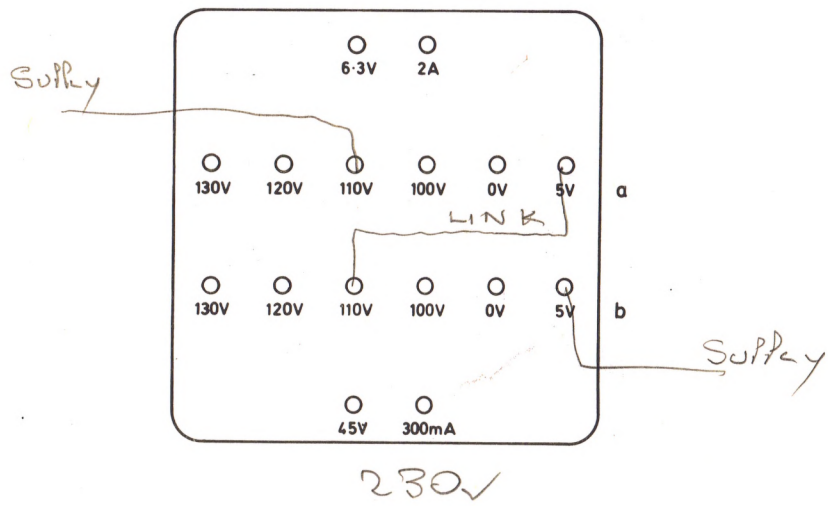


FIG. 1.1 MAINS TRANSFORMER CONNECTIONS

Switching On/Off

4. The Synthesizer mains supply is via the Receiver SUPPLY switch in Type 641 and Outfit CJM, and via the Modulator-Tuning Unit SUPPLY switch in Outfit TDC. Illuminated dials indicate that power is on.

R.F. Levels

5. Ensure that the Synthesizer is operating correctly by checking various signal levels. Table 1.2 in Part 5C gives typical voltages which should be obtained at the points listed, taking into account the observations in the following paragraphs. A Multimeter CT471 should be used for the measurements, with an unterminated probe unless otherwise specified.

6. The outputs of units 6 to 2 should be measured for each position of the associated decade control.

7. The outputs from units 4, 3 and 2 depend on the level of the 100 kHz input to unit 4, and in a transmitter drive the TUNE switch must be pressed to obtain them. The voltages given in Table 1.2 are for an input level of 100 mV.

8. When the synthesizer is being used in a transmitter drive the 100 kHz input to 4 PLCZ is the 100 kHz output from the Modulator Tuning Unit and should be approximately 100 mV. To check this input set the METERING switch on the Modulator-Tuning Unit to position 14 (100 kHz output) and press the TUNE switch. The meter should read 480 to 500.

9. When the synthesizer is being used in a receiver the 100 kHz input to 4 PLCZ is from the synthesizer 100 kHz output via a 13 dB attenuator and will generally be higher than 100 mV. Measure the input level with a Multimeter CT471 connected across SKTCZ via a 75 ohm probe. If the level is higher than 100 mV then the output voltages should be proportionately higher than those given in Table 1.2 eg if the input level is 110 mV then the outputs should be 10% higher.

10. For correct operation of the associated Modulator-Tuning Unit and/or Receiver R.F. it is important that the synthesizer output level at 2 PLBC is correctly set. It should be between the limits stated for all combinations of dial settings. The dial settings for minimum and maximum output voltage are recorded on the Test Record Sheet supplied with the Synthesizer. If these settings are not known it will be necessary to determine them by successive manipulation of all the decade controls.

Proceed as follows:-

(1) Disconnect SKTBC from the back of the MHz Frequency Multiplier, Unit 2. Connect PLB to a Multimeter CT471 via a 75-ohm probe, thus monitoring the synthesizer output level.

(2) Measure and record the output level at 240 kHz, 525 kHz.

(3) Operate the MHz decade control, measuring the output level at each position of the control between 1 and 27 MHz. Select the position of the control at which the output level is minimum.

(4) Operate the 100 kHz decade control, measuring the output level at each position of the control. Select the position at which the output level is minimum.

(5) Operate the 10 kHz decade control, measuring the output level at each position of the control. Select the position at which the output level is minimum.

(6) Operate the 1 kHz decade control, measuring the output level at each position of the control. Select the position at which the output level is minimum.

NOTE: This setting of the decade controls represents the frequency of minimum output level, unless the output at 240 kHz or 525 kHz is less.

(7) Adjust 3RV7 for 0.4V indication on Multimeter CT471 at the frequency of minimum output level.

(8) Repeat the procedures described in (3) to (6), but setting the decade controls for maximum output level.

NOTE: This setting of the decade controls represents the frequency of maximum output level, unless the output at 240 or 525 kHz is greater.

(9) Check that the indication on Multimeter CT471 is not greater than 0.8V at the frequency of maximum output level.

11. To set the output level at 2 PLBC in Type 641 and Outfit TDC proceed as follows:-

(1) Disconnect SKTBC. (During the following steps the tuning sequence will not complete because there will be no input to the Tuning Unit Drive).

(2) Check the input to 4 PLCZ as in paragraph 8.

(3) Connect a Multimeter CT471, via a 75 ohm probe, across 2 PLBC.

(4) Set the synthesizer to the frequency of minimum output and press the TUNE switch. The multimeter should read between 0.4V and 0.44V. If outside these limits reset 3RV7 at the rear of unit 3.

(5) Set the synthesizer to the frequency of maximum output and press the TUNE switch. The multimeter should read less than 0.8 V.

(6) Remove the test equipment and replace SKTBC.

12. To set the output level at 2 PLBC in Outfit CJM proceed as follows:-

(1) Measure the input to 4 PLCZ, as in paragraph 9, and calculate the minimum output voltage acceptable at 2 PLBC. This will exceed 0.4 V in the same proportion as the measured input exceeds 0.1 V.

(2) Disconnect SKTCB and connect a temporary link between PLCB(F) and 2TP4A to operate the 2-3 MHz switch.

(3) Connect a Multimeter CT471, via a 75 ohm probe, across 2 PLBC.

(4) Set the synthesizer to the frequency of minimum output. The multimeter reading should be within 1% of the voltage calculated in step (1). If necessary, reset 3RV7 at the rear of unit 3.

(5) Manipulate the decade controls to check that at all frequencies the output does not exceed the voltage calculated in step (1) by more than 6%.

(6) Remove the temporary link and replace SKTCB.

(7) Remove the test equipment and fit a 75 ohm termination to PLBC.

Metering Checks

13. Correct operation of the Synthesizer can be checked by using the metering arrangements on the associated Modulator-Tuning Unit or Receiver R.F. as shown in Tables 1.2 and 1.3.

TABLE 1.2 SYNTHESIZER CHECKS WITH MODULATOR-TUNING UNIT

METERING switch position to:-		Other controls	Meter reading should be:-
3	1 MHz INPUT		50-150
6	A.F. INPUT 1 kHz		200-500
12	100 kHz INPUT		150-450
15	SYN. O/P	TRANSMIT U.S.B. switches to LOC and CW Press TUNE switch or:- Press TEST KEY	20-80 during tune sequence 20-80

TABLE 1.3 SYNTHESIZER CHECKS WITH RECEIVER R.F.

METERING switch position to:-		Meter reading should be:-
7	37.5 MHz FROM SYN	greater than 2
8	VAR. OSC. FROM SYN	greater than 2
9	2-3 MHz FROM SYN	greater than 8

BR 4146 Pt.5C
Original

PART 5C

MAINTENANCE

P A R T 5 C

M A I N T E N A N C E

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CHAPTER 1 MAINTENANCE

CHAPTER 1

MAINTENANCE

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CHAPTER 1

MAINTENANCE

Introduction

1. It is assumed that fuses FS1 (500 mA) and FS3 (2A) are correct and all units are in position with plugs and sockets secure in their right location. To gain access release four captive screws and withdraw the synthesizer on its telescopic mounts. Spring catch plates will hold it in the fully extended position. The catch plates must be released by thumb pressure. Test points are accessible on the units without the need for dismantling the synthesizer. Plug-in cables are long enough for units to be removed and reconnected. A unit, thus removed for maintenance, can be rested on top of the synthesizer. Table 1.1 gives the test equipment required.

TABLE 1.1 — TEST EQUIPMENT

NSN	CT No.	Description	For units
6625-99-943-1524		Multimeter, model 8SX	All
6625-99-972-7357	452	Signal generator (10 kHz to 72 MHz) 2 reqd.	2,3,4,5,7
6625-99-943-4059	433	Signal generator (15 Hz to 50 kHz)	5,6,7
		Oscilloscope CD513-2 (Solartron) or 1035 (Cossor)	1 and 7
6625-99-972-0247	471	Multimeter, electronic	2,3,4,5,6,7
6625-99-971-8519	488	Counter, electrical frequency (d.c. to 100 MHz)	2,3,4,5,6,7
6625-99-580-6737 6625-99-947-5358		Spectrum Analyser and Converter, frequency, electrical	2,3,4,5,6,7
6625-99-951-5188		Analyser, Spectrum (Airmec 248) or Receiver 770R (Eddystone)	2
		Receiver with I.F. indicator (Adapted CR300)	3,4,5
5905-99-972-9733	421	Attenuator R.F. (0 to 100 dB)	2,3,4,5
		Tuned Harmonic Generator as Figure 1.4	7
6625-AP 105934		Generator, Sweep and Indicator (Polyskop)	1
		Hybrid unit as Figure 1.9	2
		Output Terminating Transformer as Figure 1.3	6
		Power Supply Unit +8.2 V, -8.2 V, +27 V, -27 V, ± 5%	All

FAULT LOCATION

2. The information given in paragraphs 3 to 10 can be used as a guide to the location of faults to a particular unit.

Output Signals

3. Output levels can be checked by using the metering arrangements on the associated Modulator-Tuning Unit or Receiver R.F. The output frequency can be measured on a Counter, electrical frequency CT488.

R.F. Levels

4. Table 1.2 gives typical voltages which should be obtained at the points listed. Measurements should be taken with a Multimeter, electronic CT471 with an unterminated probe unless stated otherwise. The Multimeter CT471 should be used on the most suitable r.f. range for frequencies higher than 20 kHz, on the a.c. range for frequencies lower than 20 kHz.

TABLE 1.2 R.F. LEVELS

Unit	Points and Colour Code	Signal to be measured	Voltages V
Frequency Divider Unit 7	7PLBD	1 MHz input	1.0
	7PLBG	100 kHz output	0.5 to 1.0
	7SKCE, Red	1 MHz output	greater than 0.4
	7SKCK, Red	100 kHz output	greater than 0.6
	7SKCP, Red	10 kHz output	greater than 0.5
	7SKCT, Red	1 kHz output	greater than 0.7
Oscillator A.F. Unit 6	6SKCR, Blue	2-3 kHz output	0.15 to 0.6 (0.25 typical, set by 6RV1 and 6RV2)
Frequency Multiplier (1 kHz) Unit 5	5TP13, Blue	20-30 kHz output in 1 kHz steps	0.1 to 0.3 (0.2 typical, set by 5RV7)
	5TP17, Blue	60.5-69.5 kHz oscillator output	greater than 0.8
	5TP14, Blue	37.5 kHz filter output	greater than 0.4
Frequency Multiplier (10 kHz) Unit 4	4TP19, Blue	194-306 kHz output in 10 kHz steps	0.15 to 0.5 (0.18 typical, set by 4RV9)
	4TP18, Blue	605-695 kHz oscillator output	greater than 1.0
	4TP17, Blue	475 kHz filter output	greater than 0.7

Unit	Points and Colour Code	Signal to be measured	Voltages V
Frequency Multiplier (100 kHz) Unit 3	3TP13, Blue	2-3 MHz output in 100 kHz steps	0.05 to 0.12 (set by 3RV7)
	3TP17, Blue	6.05-6.95 MHz oscillator output	greater than 0.6
	3TP14, Blue	3.75 MHz filter output	greater than 0.5
Frequency Multiplier (MHz) Unit 2	2PLBC	0.24-27.5 MHz output (Terminated in 75 ohms in Outfit CJM)	0.4 to 0.8 into 75 ohms (set by 3RV7)
	2PLBP	2-3 MHz output (Not available in Outfit TDC)	greater than 0.1 into 75 ohms
	2TP20, Blue	37.5 MHz filter output	greater than 0.2
	2PLBQ	37.5 MHz output	greater than 0.02 into 75 ohms
	2RV1 wiper	37.5 MHz filter output	0.6
	2TP21, Blue	40.5-67.5 MHz oscillator output	greater than 0.08
	2TP22, Blue	40.5-67.5 MHz oscillator output	greater than 0.4
	2PLBR	40.5-67.5 MHz output	greater than 0.025 into 75 ohms

5. For test purposes, an input of 100 kHz to the Frequency Multiplier (10 kHz) can be obtained from the Frequency Divider by connecting the 100 kHz output from 7PLBG via a 13 dB pad to 4PLCZ as shown in Figure 1.1.

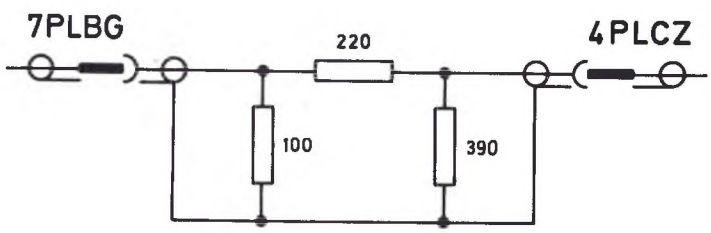


FIG. 1.1 13 dB PAD

6. The output levels from units 4, 3 and 2 depend on the level of the 100 kHz input to 4PLCZ. The values given in Table 1.2 are for 100 mV input.

7. Check the r.f. output levels of units 2 to 6 in each position of the appropriate decade switches. If any output level is low, slight re-adjustment of the output level controls is permissible if the oscillator and filter levels are correct.

8. A low filter output level at 2TP20, 3TP14, 4TP17 or 5TP14 in one or more positions of the decade switches may be due to oscillator frequency drift. Compare the levels in all switch positions and, if necessary, adjust the appropriate oscillator output frequency as detailed in the relevant paragraphs of this chapter. Before carrying out any oscillator adjustment a check should be made on the appropriate reference frequency. If necessary peak the tuning as detailed in paragraph 23.

Power Supplies

9. Mains supply is indicated by the dial lamps which are supplied at 6.3 V a.c. from 1T2 via 1FS3 in the Frame and the Power Supply.

10. The positive and negative supplies can be measured at the test points listed in Table 1.3 with a Multimeter 8SX. The readings should be within 10% of the nominal voltage.

TABLE 1.3 POWER SUPPLY TEST POINTS

-8.2 V (Violet)	+8.2 V (Red)	-27 V (Violet)	+27 V (Red)
1TP1	1TP2	2TP18	1TP19
2TP17	2TP16		
3TP16	3TP15		
4TP16	4TP15		
5TP16	5TP15		
6TP6	6TP7		
7TP16	7TP15		

UNIT MAINTENANCE

Alignment

11. The Synthesizer can be expected to remain in alignment over an extremely long period so other causes of low output should be eliminated before re-alignment is considered. Ensure that all necessary test equipment is available before commencing alignment. During alignment only a very small adjustment of trimmers should be necessary unless circuits have been disturbed.

12. Special trimming tools for adjusting the inductor cores, trimmer capacitors and preset potentiometers are as follows:

(a) 5120-99-580-1647 Tool, Frequency Tuning. This is a non-magnetic screwdriver for vinknor inductors.

(b) 5120-99-971-9674 Alignment Tool. This is a screwdriver for miniature potentiometers.

(c) 5120-99-971-9672 Alignment Tool. This is a hexagonal trimming tool for inductors.

(d) 5120-99-971-9675 Alignment Tool. This is a screwdriver plus a hexagonal trimming tool, for variable capacitors and inductors on ceramic formers.

(e) 5120-99-971-9673 Alignment Tool. This is a screwdriver for potentiometer core assemblies.

(f) 5820-99-971-9677 Locking Tool, for variable capacitors

13. A Frequency Counter is necessary for the accurate setting up of the oscillator and filter circuits, otherwise the following limitations apply:

(a) All circuits in unit 7 can be tuned with sufficient accuracy provided a stable 1 MHz source is available.

(b) The tuning of the oscillator circuits of unit 6 cannot be carried out.

(c) In units 2 to 5 the oscillators may be retuned by first tuning to approximately the correct frequency, using a receiver loosely coupled to one of the oscillator output test points, and finally tuning for maximum output from the narrow band filter eg the 37.5 kHz filter in unit 5 can be monitored at test point 5 TP14. The initial tuning of the receiver has to be sufficiently accurate to ensure that the frequency is not one complete step out ie 1 kHz out in unit 5, 10 kHz out in unit 4.

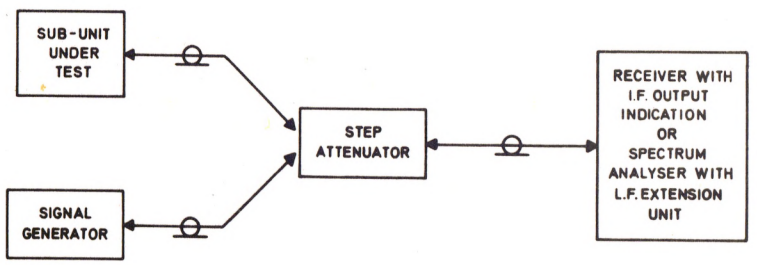
(d) Single elements of the narrow band filters may be retuned for maximum output at the appropriate test point eg 5TP14.

(e) A Signal Generator with crystal calibrator which can be set to the required accuracy may be used for frequency setting, but the centre frequency of the 37.5 kHz filter must be set to an accuracy of better than $\pm$ 0.1 kHz.

Intermodulation Products and Spurious Outputs

14. Most alignment can be carried out without using a receiver or Spectrum Analyzer which are used mainly for checking out-of-band attenuation of filters and for balancing out spurious components. If they are not available the relevant tests may be omitted and no adjustments made. In some instances this will result in certain spurious outputs being outside the specification limits but will not affect the level or frequency stability of the wanted output.

15. When using a receiver or Spectrum Analyzer to measure intermodulation products, spurious outputs or out-of-band attenuation of filters, the suggested method of connecting test equipment is shown in Figure 1.2.



NOTE: ALL CONNECTIONS SHOULD BE MADE WITH 75 OHM COAXIAL CABLE

FIG. 1.2 TEST EQUIPMENT INTERCONNECTIONS

16. The following methods of using test equipment are suggested:-

(a) The Signal Generator may be used as a marker to locate a spurious signal and should be used to obtain a reference level on the Spectrum Analyzer or receiver for attenuation measurements.

(b) Filters in the L.F. Extension unit should be used wherever possible and tuned to the spurious frequency being measured.

(c) When a resistor is required (usually 2.2 kilohms) between the unit under test and the Receiver, it should be connected as close as possible to the appropriate point on the unit.

(d) Any Receiver may be used provided it covers the required frequency range and is either fitted with a carrier level meter or modified to enable a Valve Voltmeter to be connected to the i.f. output.

(e) The attenuator measurements should be made by noting the change in the setting of the Step Attenuator required to obtain a constant reference level on the receiver or Analyzer. This method is more accurate than relying on the attenuation scale of the Analyzer.

FREQUENCY DIVIDER UNIT 7

Voltage Measurements

17. The d.c. voltages at the test points given in Table 1.4 should be obtained with a Multimeter 8SX set to the 10 V d.c. range. The readings should be within the limits given.

TABLE 1.4 UNIT 7 VOLTAGE LEVELS AT TEST POINTS

Test Point	Test Point Colour	Circuit	Typical Reading V	
			No Input	Normal Input
TP1	White	VT1 emitter	-0.3	-0.6 to 1.1
TP2	White	VT2 emitter	+0.35	+0.2 to 0.4
TP3	White	VT3 emitter	-0.3	-0.9 to 1.5
TP4	White	VT4 emitter	+0.35	+0.2 to 0.4
TP5	White	VT5 emitter	-0.3	-0.45 to 0.75
TP6	White	VT6 emitter	-0.3	-0.4 to 0.7
TP7	White	VT7 emitter	+0.3	+0.2 to 0.4
TP8	White	VT8 emitter	-0.3	-0.2 to 0.4
TP9	White	VT9 emitter	-0.3	-0.4 to 0.7
TP10	White	VT10 emitter	+0.7	+0.5 to 0.9
TP15	Red	+ve Supply	+7.8 to 9	
TP16	Violet	-ve Supply	-7.8 to 9	

18. On a correctly aligned unit with an input of 1 V at 1 MHz applied at PLBD, and with a 75 ohm resistor connected across PLBG, use a Multimeter CT471 to measure the signal voltages at the plugs and sockets listed in Table 1.5.

TABLE 1.5 UNIT 7 OUTPUT VOLTAGES

Check Point	Circuit	Typical Reading V
SKCE	1 MHz Output	greater than 0.4
SKCK	100 kHz Output	greater than 0.6
SKCP	10 kHz Output	greater than 0.5
SKCT	1 kHz Output	greater than 0.7
SKCY	1 kHz Output (Spare)	greater than 0.7
PLBG	100 kHz Output	0.5 to 1
PLBF	1 kHz Output	greater than 0.7

19. If any of the voltage outputs given in Tables 1.4 and 1.5 are low, the inductors in the respective buffer amplifiers may be retuned for maximum output. The divider circuits, however, must not be adjusted in this manner and reference should be made to the full alignment procedure.

20. The signal voltage readings given in Table 1.6 were obtained under the same conditions as those given in Paragraph 18. The check points listed are accessible only when the unit is removed from the frame and connected up for test purposes, with the side covers removed.

TABLE 1.6 UNIT 7 TRANSISTOR VOLTAGES

Check Point Collector of	Typical Reading (V r.m.s.)
VT1	4.4
VT2	5.7
VT3	4.6
VT4	6.0
VT5	4.5
VT6	4.75
VT7	5.2
VT8	4.95
VT9	4.65
VT10	4.8
VT11	0.68
VT12	1.02
VT13	0.76
VT14	2.95

Resistance Measurements

21. The resistance of the input plug pin connections, measured with a Multimeter 8SX (positive lead to frame) are given in Table 1.7.

CAUTION Do not measure the resistance across any transistor electrode with the Multimeter 8SX on the ohms times 100 range. The voltage applied may damage the transistor.

TABLE 1.7 UNIT 7 INPUT PLUG RESISTANCES

PLCW1	270 ohms
PLCW2	1 kilohm
PLCW3	8 ohms
PLCW4	0 ohms

ALIGNMENT

22. The unit should be removed and re-connected for test purposes, as necessary.

Frequency Dividers

23. Proceed as follows:

(1) Apply a signal of 2 V r.m.s. at 5 kHz via a 1 uF capacitor to VT8 collector, and apply the same signal to the X plates of the Oscilloscope.

(2) Connect the Y amplifier of the Oscilloscope via a 100 pF capacitor to VT9 collector.

(3) Observe the distorted Lissajous figure which should be visible on the Oscilloscope. Adjust L22 to obtain a division ratio of 5:1, ie so that the Lissajous figure has five loops.

(4) Vary the frequency of the Signal Generator by ± 250 Hz (± 5% of 5 kHz) and ensure that the circuit remains in lock.

(5) Remove the 5 kHz input and check that no output is obtained from the frequency divider stage.

(6) Repeat steps (1) to (5) on the other divider stages in turn with inputs, connections and conditions as detailed in Table 1.8.

(7) Check that the division ratio of each stage remains correct for a frequency variation of the 1 MHz input of ± 30 kHz (± 3% of 1 MHz) and over an input level of 500 mV to 1.5 V. The number of loops in the Lissajous figure depends on the division ratio.

TABLE 1.8 UNIT 7 FREQUENCY DIVIDERS SETTING-UP

Input kHz	Level V r.m.s.	X Plate connected to:	Y Plate connected to:	Adjust	Division Ratio	Typical Lock Range kHz
5	2	VT8 collector	VT9 collector	L22	5	4.7 to 5.2
10	2	VT6 collector	VT8 collector	L18	2	8 to 13
50	2	VT5 collector	VT6 collector	L17	5	45 to 55
100	2	VT3 collector	VT5 collector	L13	2	86 to 119
500	2	VT1 collector	VT3 collector	L9	5	465 to 530
1 MHz	1	PLBD	VT1 collector	L3	2	900 to 1100

(8) Ensure that when the 1 MHz input is removed there is no output from any frequency divider stage.

Buffer Amplifiers

24. Proceed as follows:-

(1) Connect an input of 0.5 V r.m.s. at 1 MHz ± 1 kHz to PLBD.

(2) Connect the Multimeter CT471 to output socket SKCE terminated in 220 ohms.

(3) Adjust L1 and L4 in the input and output circuits of buffer amplifier VT2, for maximum output at 1 MHz. This output should be at least 0.4 V.

(4) Connect the Multimeter CT471 to output socket SKCK terminated in 560 ohms.

(5) Terminate output plug PLBG in 75 ohms.

(6) Adjust L7 and L8 in the input and output circuits of buffer amplifier VT4 for maximum output at 100 kHz. The output level should be at least 0.7 V. With the Multimeter CT471 connected to PLBG the output level should be between 0.5 and 1.0 V.

(7) Connect the Multimeter CT471 to output socket SKCP terminated in 220 ohms.

(8) Adjust L14 and L15 in the input and output circuits of buffer amplifier VT7 for maximum output at 10 kHz. The level should be at least 0.7 V.

(9) Connect the Multimeter CT471 to output socket SKCT terminated in 4.7 ohms.

(10) Adjust L19 and L21 in the input and output circuits of buffer amplifier VT10 for maximum output at 1 kHz. The level should be at least 0.8 V. The same output level should also be obtained at output socket SKCY, output plug PLCW3 and PLBF.

25. On completion of the alignment procedures check the r.f. output levels as detailed in paragraph 18 and Table 1.5.

SPURIOUS OUTPUTS

26. Proceed as follows:

(1) Connect output sockets SKCE, SKCK, SKCP and SKCT in turn to the Spectrum Analyzer, via a 220 ohms resistor to prevent damping of the tuned circuits,

(2) Check that there are no spurious outputs worse than -70 dB relative to the wanted frequency in a bandwidth of $\pm$ 20% of the wanted frequency.

27. Disconnect all test equipment and replace all covers and screws.

OSCILLATOR, A.F. UNIT 6

Voltage Measurements

28. To measure the voltages given in the following paragraphs the unit must be removed and re-connected so that its side cover can be removed.

29. The d.c. voltages given in Table 1.9 should be measured with a Multimeter 8SX, set to the 10 V d.c. range. The positive lead of the Multimeter 8SX should be connected to the frame and the oscillator should be switched off ie the 0.1 kHz decade switch should be in the .0 kHz position. Test points TP1 to TP5 are on the printed wiring board.

TABLE 1.9 — UNIT 6 D.C. VOLTAGE MEASUREMENTS

Test Point	Circuit	Typical Reading V
TP1	VT1 collector	-7.6
TP2	VT3 collector	-7.15
TP3	VT4 collector	-7.8
TP4	VT5 collector	-6.9
TP5	VT6 collector	-7.35
TP6	VT7 collector (unit giving 2 kHz output)	-8.0
Printed Board Terminal		
5	-ve Supply	-8.2
11	+ve Supply	+8.2

30. Measure the a.g.c. voltage with the Multimeter 8SX connected between the negative end of C18 and the frame and the oscillator switched to the 2.5 kHz position. The a.g.c. voltage should be -1.75 V.

31. The a.c. voltages given in Table 1.10 should be measured with the Multimeter CT471 set to the appropriate range.

TABLE 1.10 — UNIT 6 A.C. VOLTAGE MEASUREMENTS

Test Position	Circuit	Typical Reading
Printed Board Terminal 10	VT3 base	30 mV
Junction of C8 and R16	VT4 base	30 mV
Junction of R24 and C12	VT5 base	120 mV
Junction of R27 and C21	VT6 base	1.6 V
Junction of C1 and C4	VT1 emitter	20 mV

Resistance Measurements

32. With the 0.1 kHz decade switch in the .0 kHz position, RV1 and RV2 turned fully clockwise and the mains supply disconnected the resistance values given in Table 1.11 should be obtained using the Multimeter 8SX with its negative lead connected to chassis.

CAUTION On the ohms times 100 range transistors can be damaged by the Multimeter battery.

TABLE 1.11 UNIT 6 PLUG AND SOCKET RESISTANCES

PLCU1	4 kilohms ± 10%
PLCU2	6 kilohms ± 10%
PLCU4	0 ohms
SKCW4	0 ohms
SKCR	Infinity

ALIGNMENT

Output Circuit

33. Proceed as follows:

(1) From the Power Supply Unit connect the +8.2 V and -8.2 V to the unit under test.

(2) Switch the 0.1 kHz decade switch to its blank position.

(3) Short circuit socket SKCR.

(4) Connect the Signal Generator CT433 via a 1 uF capacitor to terminal 3 on the printed wiring board and adjust it to give an output of 1 V at 2.25 kHz.

(5) Connect the Multimeter CT471 to the junction of C22 and C23.

(6) Adjust L2 for maximum indication on the multimeter and check that adjustment of RV1 will control the output.

(7) Disconnect the signal generator.

Doubler and 2 kHz Filter

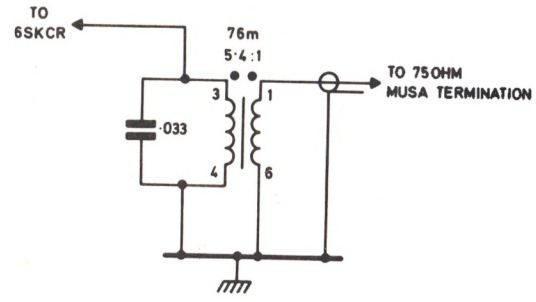
34. Proceed as follows:

(1) Connect a terminating transformer to the output socket SKCR as in Figure 1.3.

(2) Switch the 0.1 kHz decade switch to the .0 kHz position and connect the Multimeter CT471 to Terminal 3 on the printed wiring board.

(3) Inject a signal level of 1 V at 1 kHz ± 1 Hz between socket SKCW Pins 3 and 4.

(4) Adjust L3 and L4 for maximum indication on the Multimeter.



PRIMARY TO BE WOUND AS 76m WINDING OF
L1 (FREQUENCY MULTIPLIER 1Kc/s) M32-2361-01
SECONDARY, 108 TURNS 42SWG GRADE F
POLYURETHANE COVERED WIRE
START PIN 1 AND FINISH PIN 6

FIG. 1.3 OUTPUT TERMINATING TRANSFORMER

Output Level

35. Proceed as follows:

(1) Disconnect the Multimeter CT471 from terminal 3 on the printed wiring board and connect it to the output socket SKCR with the terminating transformer still connected.

(2) Set the decade switch to the 0.5 kHz position and check that RV1 controls the output. The approximate range of the output should be 0.15 to 0.3 V. Adjust RV1 to give a reading of 0.25 V on the multimeter.

(3) Set the decade switch to the .0 kHz position and check that RV2 controls the output. The approximate range of the output should be 0 to 0.5 V. Adjust RV2 for a reading of 0.25 V on the multimeter.

Oscillator

36. Proceed as follows:

(1) Connect the Frequency Counter CT488 to the output socket SKCR and set the decade switch to its .0 kHz position.

(2) Check that the output frequency is 2 kHz.

(3) If the frequency counter can count to 0.01 Hz omit this step. If not, connect a Tuned Harmonic Generator as Figure 1.4 between SKCR and the frequency counter.

(4) Set the decade switch to the positions shown in Table 1.12 and adjust the appropriate trimming capacitors to set the oscillators on frequency.

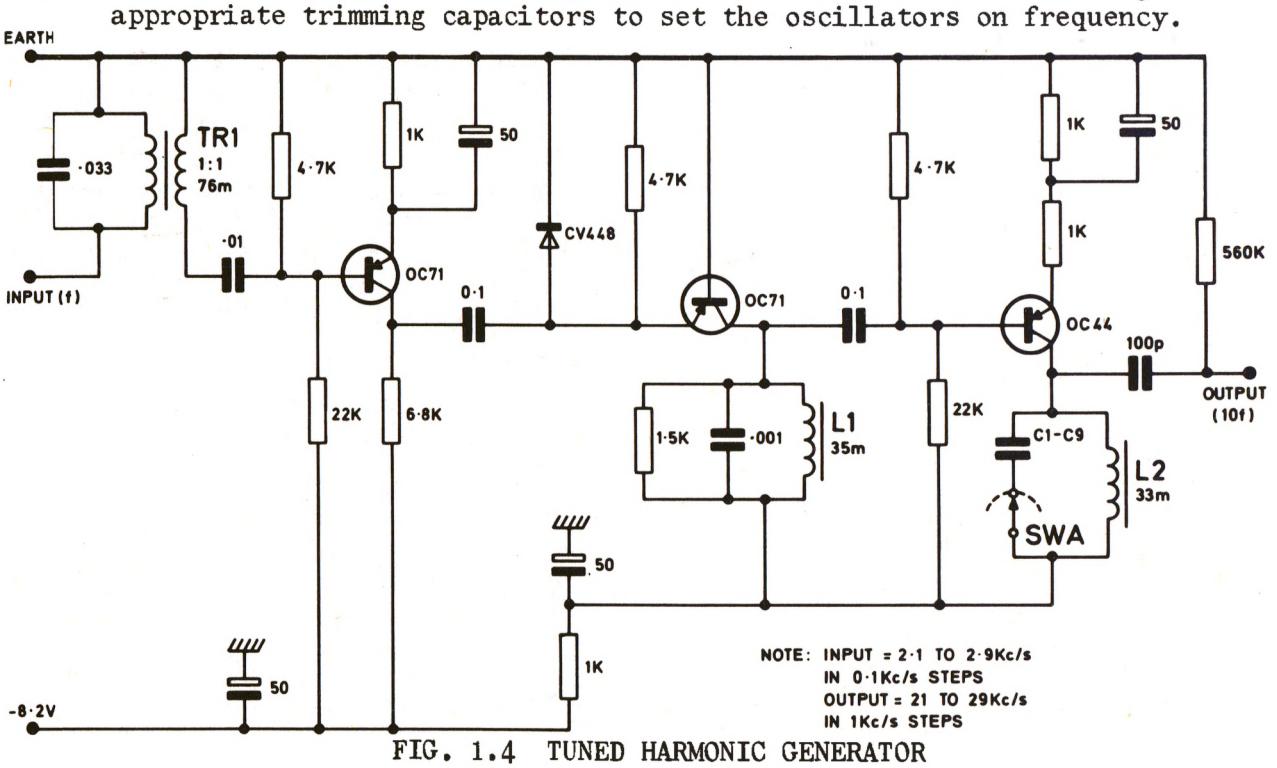


FIG. 1.4 TUNED HARMONIC GENERATOR

TABLE 1.12 UNIT 6 OSCILLATOR SETTING-UP

Decade Switch Position kHz	Tuned Harmonic Generator Capacitor	Oscillator Capacitor	Output Frequency ± 0.01 Hz
0.1	C1	C43	2100.06
0.2	C2	C42	2200.07
0.3	C3	C41	2300.07
0.4	C4	C39	2400.07
0.5	C5	C38	2500.07
0.6	C6	C37	2600.08
0.7	C7	C36	2700.08
0.8	C8	C34	2800.08
0.9	C9	C33	2900.09

(5) Disconnect the harmonic generator, reconnect the output terminating transformer and check that the output level at output socket SKCR in each position of the decade switch is 0.25 V ± 0.03 V.

SPURIOUS OUTPUTS

37. Proceed as follows:

(1) Connect the Signal Generator CT433 at a level of 1 V at a frequency of 1 kHz to pins 3 and 4 of input socket SKCW.

(2) Connect the 75 ohms output of the terminating transformer to the L.F. Extension Unit on the Spectrum Analyzer.

(3) Set the decade switch to each operating position in turn and check that the second harmonic is lower than -40 dB relative to the wanted output frequency.

(4) With the decade switch in the .0 kHz position check that the spurious outputs at 1 kHz and 3 kHz are greater than 65 dB down relative to the wanted output.

38. Disconnect all test equipment and replace all covers and screws.

FREQUENCY MULTIPLIER (1 kHz) UNIT 5

Voltage Measurements

39. The d.c. voltages given in Table 1.13 should be obtainable, under normal operating conditions, using a Multimeter 85X for the measurements. An input of 700mV at 10kHz, available from the Frequency Divider (Unit 7) should be applied to PLCP.

TABLE 1.13 UNIT 5 D.C. VOLTAGE MEASUREMENTS

Test Point +ve	Test Point -ve	Circuit	Typical Reading V
TP1	TP16	VT1 collector	1.0 to 1.4
TP2	TP16	VT2 collector	1.4 to 2.0
TP3	TP16	VT3 collector	2.5 to 4.1
TP4	TP16	VT4 collector	1.6 to 2.6
TP5	TP16	VT5 collector	1.5 to 2.5
TP6	TP16	VT6 collector	2.5 to 4.2
TP7	TP16	VT7 collector	2.5 to 4.2
TP8	TP16	VT8 collector	1.5 to 2.5
TP9	TP16	VT9 collector	2.0 to 2.2
Frame	TP10	VT10 emitter	0.8 to 1.4
TP11	TP16	VT11 collector	1.1 to 1.7
Frame	TP12	VT12 emitter	0.8 to 1.3
TP15	Frame	+ve Supply	+7.8 to +9.0
Frame	TP16	-ve Supply	-7.8 to -9.0

40. The a.c. voltages given in Table 1.14 were obtained on a correctly aligned unit. Inputs of 700 mV at 1 kHz and 250 mV at 2.5 kHz should be applied to PLCT and PLCR respectively. Load resistors of 82 ohms and 2.2 kilohms should be connected across the input plug PLCR and the output plug PLCN respectively. The voltages should be obtainable on a Multimeter CT471 with the 1 kHz decade switch in any position except the blank ones.

TABLE 1.14 UNIT 5 A.C. VOLTAGE MEASUREMENTS

Test Point	Voltage
TP13	140 to 280 mV
TP14	greater than 0.4 V
TP17	greater than 0.8 V
L11 pin 2	greater than 1.0 V

NOTE If the voltage at TP14 is low, the 37.5 kHz filter amplifier may be peaked for maximum output provided that the oscillator frequencies are correct (see paragraph 43). All other filters are band-pass filters and should be adjusted in accordance with the full alignment procedure (see paragraphs 44 to 47).

Resistance measurements

41. The resistance of the input plug PLCQ pin connections measured with the Multimeter 8SX with its positive lead to frame, should be as shown in Table 1.15.

CAUTION On the Ohms times 100 range transistors can be damaged by the multimeter battery.

TABLE 1.15 UNIT 5 INPUT PLUG RESISTANCES

PLCQ1	380 ohms
PLCQ2	1.7 kilohms
PLCQ4	0 ohms

ALIGNMENT

Oscillator Buffer Amplifiers

42. Proceed as follows:

(1) Set the decade switch to one of its blank positions.

(2) Connect the Signal Generator CT452 to the base of VT8 via a 0.1 μF capacitor, at a level of 50 mV and a frequency of 64.2 kHz.

(3) Temporarily link terminals 1 and 3 of L31.

(4) Connect the Multimeter CT471 to VT6 collector.

(5) Tune L32 for maximum reading on the multimeter. The reading should be in the range 3.5 to 4.5 V.

(6) Remove the link from L31 and tune L31 for minimum reading on the multimeter. The reading should be approximately 1 V.

(7) Connect the Multimeter CT471 to terminal 2 of L31 and check the response between 60 and 70 kHz. The output level should be greater than 500 mV and should not vary by more than 3 dB over the stated frequency range.

(8) Reset the Signal Generator CT452 to 64.2 kHz.

(9) Temporarily link terminals 1 and 3 of L33.

(10) Connect the Multimeter CT471 to VT7 collector.

(11) Tune L34 for maximum reading on the multimeter. The reading should be in the range 3.5 to 4.5 V.

(12) Remove the link from L33 and tune L33 for minimum reading on the multimeter. The reading should be approximately 2 V.

(13) Connect the Multimeter CT471 to terminal 2 of L33 and check the response between 60 and 70 kHz. The output level should be greater than 500 mV and should not vary by more than 3 dB over the stated frequency range.

(14) Disconnect the Signal Generator.

(15) Connect the Multimeter CT471 to the base of VT8. Check that a reading of between 600 and 700 mV is obtained in each operative position of the 1 kHz decade switch. Check that there is no output from the two blank positions.

(16) Disconnect the multimeter.

Oscillator

43. Proceed as follows:

(1) Connect the Frequency Counter CT488 to TP17.

(2) Set the decade switch to position 9.

(3) Adjust L38, with C91 set to its mid-position, to give a frequency output of 60.5 kHz.

(4) Set the output frequency for each position of the decade switch by adjustment of the appropriate trimming capacitor as given in Table 1.16.

TABLE 1.16 UNIT 5 OSCILLATOR SETTING-UP

Decade Switch Position	Output Frequency kHz ± 10 Hz	Trimmer Capacitor
0	*69.5	C109
1	68.5	C107
2	67.5	C105
3	66.5	C103
4	65.5	C101
5	64.5	C99
6	63.5	C97
7	62.5	C95
8	61.5	C93
9	60.5	C91

* NOTE - See Paragraph 48 (15)

(5) Disconnect the Frequency Counter.

(6) Verify that the level of each output frequency at TP17 and terminal 2 of L11 is greater than 800 mV. A Multimeter CT471 should be used for the measurements.

(7) Check that in each position of the decade switch the frequency repeats within ± 10 Hz of nominal when the switch is returned to a position from either direction.

(8) Check that no change occurs in frequency with moderate tapping or shaking of the sub-unit.

37.5 kHz Filter

44. Proceed as follows:

(1) Set the decade switch to one of its two blank positions.

(2) Connect the Multimeter CT471 to TP14.

(3) Connect the Signal Generator CT452 to the emitter of VT3 via a 0.1 uF capacitor. Set the Signal Generator to give an output of 37.5 kHz at a level of 50 mV.

(4) Tune L21 for maximum reading on the multimeter. The reading should be approximately 2V.

(5) Connect the Signal Generator to the base of VT4 via a 0.1 μF capacitor. ( )

(6) Tune L22 and L23 for maximum reading on the multimeter. The reading should be in the range 1.5 to 2 V.

(7) Connect the Signal Generator to VT5 base via a 0.1 μF capacitor, and set the output level of the Signal Generator to 10 mV.

(8) Tune L25 and L28 for maximum reading on the multimeter. The reading should be in the range 0.5 to 1.0 V.

(9) Connect the Signal Generator at an output level of 2 mV to terminal 3 of L29 via a 4.7 kilohm resistor.

(10) Tune L29 for maximum reading on the multimeter and finally peak up the tuned circuits L21, L22, L23, L25 and L28 to give an output of approximately 0.5 V.

(11) Disconnect the Signal Generator.

(12) Check that the response of the 37.5 kHz Filter is within 3 dB for ± 100 Hz and greater than -70 dB for ± 900 Hz with a constant input level of 2 mV. To check the response disconnect the Valve Voltmeter and connect TP14 to the adapted receiver via the 100 dB Step Attenuator CT421. The receiver is used to obtain sufficient sensitivity and the attenuator enables the relative attenuation to be measured by simply adjusting the attenuator for a constant output level from the receiver. ( )

Harmonic Generator

45. Proceed as follows:

(1) Temporarily connect TP17 to the frame.

(2) Connect the Multimeter CT471 to terminal 1 of L48.

(3) Connect the Signal Generator CT433 to the base of VT12, and adjust the Signal Generator to give an output of 500 mV at 37.5 kHz.

(4) Tune L44 to obtain minimum reading on the multimeter. ( )

(5) Adjust the Signal Generator to give an output of 500 mV at 41 kHz.

(6) Tune L46 to obtain minimum reading on the multimeter.

(7) Adjust the Signal Generator to give an output of 500 mV at 30 kHz.

(8) Tune L42 to obtain maximum reading on the multimeter.

(9) Check that the response between 23 and 32 kHz is level within 3 dB. Check that the response at 37.5 kHz is at least 25 dB below peak level. The output level should be in the range 120 to 150 mV. Check that this level is also present at terminal 6 of L48.

NOTE Inductors L43 and L45 are preset and if they are disturbed they should be disconnected from the circuit and accurately reset on an Inductance Bridge to 6 mH and 3.86 mH respectively.

(10) Remove the short circuit from TP17 and disconnect the multimeter and the Signal Generator. ( )

(11) Adjust RV5 and RV6 to their mid-positions.

(12) Connect the 1 kHz output from the Frequency Divider (unit 7) to the input plug PLCT.

(13) Connect the Multimeter CT471 to TP14.

(14) Check that an output in the range 0.5 to 1.0 V is obtained for each operative position of the 1 kHz decade switch. If necessary, adjust L41 and L42 to ensure a reasonably level output for each position of the decade switch. If no output is obtained on any position of the decade switch, check the oscillator output at TP17.

(15) Disconnect the multimeter.

(16) Connect the Spectrum Analyzer to TP14 via a 2.2 kilohm resistor, and monitor the output at 37.5 kHz.

(17) Set the decade switch to position 9 and set the oscillator frequency 60 Hz low by adjusting L38 in the collector circuit VT9. One unwanted sideband may be seen 120 Hz higher than the carrier frequency (twice Oscillator Frequency error). Adjust RV5 and RV6 in the 1st Mixer stage to reduce this sideband to a minimum. The unwanted sideband should be at least -60 dB relative to the carrier.

(18) Reset the Oscillator to 60.5 kHz $\pm$ 10 Hz as detailed in paragraph 38.

(19) Check that all other sidebands are below -70 dB relative to the carrier. In particular, check those at 38.5 kHz and 36.5 kHz. Repeat this check for all operative positions of the decade switch.

(20) Disconnect all test equipment and the 1 kHz input from the Frequency Divider.

20-30 kHz Filter

46. Proceed as follows:

(1) Set the decade switch to a blank position.

(2) Temporarily connect terminal 2 of L31 and the output plug PLCN to the frame.

(3) Connect the Signal Generator CT433 to terminal 3 of L11 via a 2.2 kilohms resistor and set it to 22.5 kHz at a level of 200 mV.

(4) Connect the Multimeter CT471 to VT2 collector.

(5) Adjust L17 for maximum reading on the multimeter. The reading should be in the range 0.4 to 1.5 V and is adjustable by RV7.

(6) Remove the short circuit from PLCN and disconnect the multimeter.

(7) Connect the receiver to PLCN.

(8) Set the Signal Generator to give an output of 42 kHz at a level of 200 mV and tune the receiver to this frequency.

(9) Adjust L15 for minimum output on the I.F. Indicator.

(10) Disconnect the receiver from PLCN.

(11) Terminate PLCN with a 2.2 kilohms resistor.

(12) Connect the Multimeter CT471 to TP13.

(13) Remove the short circuit from terminal 2 of L31 and connect it to terminal 1 of L8.

(14) Reset the Signal Generator to give an output of 22.5 kHz at a level of 200 mV.

(15) Set the decade switch to its 0 kHz position.

(16) Adjust RV7 for a nominal reading of 250 mV on the multimeter.

(17) Check that the output between 20 and 30 kHz is level within 1 dB. If necessary, adjust L13 and L14 to achieve this level.

(18) Check that the response at 42 kHz is at least -35 dB relative to that in the passband for the filter.

(19) Remove the short circuit from terminal 1 on L8. Disconnect the multimeter and the Signal Generator.

40 kHz Filter

47. Proceed as follows:

(1) Set the decade switch to position 5.

(2) Connect the 1 kHz output of the Frequency Divider (unit 7) to input plug PLCT.

(3) Using the Multimeter CT471, check that there is a signal level of approximately 1 V at TP14 and terminal 2 of L31.

(4) Connect the A.F. Signal Generator CT433 to terminal 4 of L2 via a 2.2 kohm resistor and set it to 40 kHz $\pm$ 10 Hz at a level of 50 mV.

(5) Connect the Multimeter CT471 to terminal 2 of L6 and tune L2, L3 and L4 for maximum reading.

(6) Connect the Multimeter CT471 to terminal 4 of L8 and tune L6, L7 and L8 for maximum reading.

(7) Connect 4.7 kilohm resistors across L3 and L7.

(8) Tune L2, L4, L6 and L8 for maximum reading on the multimeter. It will be necessary to increase the input level from the Signal Generator to obtain a reading. This level must be reduced before the resistors are removed from L3 and L7 for the next step.

(9) Connect the 4.7 kilohm resistors across L4 and L6.

(10) Tune L3 and L7 for maximum output. Again it will be necessary to increase the Signal Generator output to obtain a reading on the multimeter and this input must be reduced before the resistors are removed.

(11) The voltage at terminal 4 of L8 should be approximately 100 mV. Ensure that the same level is obtained at terminal 5 of L8.

(12) Disconnect the Signal Generator and the multimeter.

(13) Connect the Multimeter CT471 in parallel with a 0.033 μF capacitor across the input plug PLCR.

(14) Connect the Signal Generator CT433 in parallel with an 82 ohm resistor to PLCR. The output from the Signal Generator should be 2.5 kHz at a level of 250 mV.

(15) Tune L1 to give a symmetrical response over the frequency range 2 to 2.9 kHz.

(16) Connect the Multimeter CT471 to TP13.

(17) Set the decade switch to position 5 and connect the 1 kHz output of the Frequency Divider (unit 7) to input plug PLCT. Ensure that the output from the Signal Generator is still 2.5 kHz at a level of 250 mV.

(18) Adjust RV7 to give a reading of 200 mV on the multimeter.

(19) Check the frequency response of the filter by varying the input frequency from 1.9 to 3.0 kHz. The variation in output should be less than 1 dB. Some adjustment of L2, L3, L4, L6, L7 and L8 may be necessary to obtain the required response.

(20) Disconnect the Signal Generator and the multimeter.

(21) Connect the receiver to terminal 4 of L8 via a 2.2 kilohm resistor.

(22) Connect the Signal Generator CT433 to terminal 4 of L2 via a 2.2 kilohms resistor, and set it to 40 kHz at a level of 50 mV. Note the level on the receiver I.F. Indicator at 40 kHz.

(23) By tuning the Signal Generator in turn to 37.6, 35.6 and 41.4 kHz check that the out of band response is as follows:

(a) 37.6 kHz, more than 45 dB down on the level obtained at 40 kHz.

(b) 35.6 kHz, more than 70 dB down on the 40 kHz level.

(c) 41.4 kHz, more than 20 dB down on the 40 kHz level.

(24) Disconnect the test equipment, ensure that all covers and screws are replaced.

OVERALL TEST

48. Proceed as follows:

(1) Connect the 1 kHz output from the Frequency Divider (unit 7) to the input plug PLCT.

(2) Connect an input of 2.5 kHz from the Signal Generator CT433 at a level of 250 mV, in parallel with an 82 ohms resistor, to input plug PLCR.

(3) Connect the Multimeter CT471 to TP17.

(4) Check that an output of at least 1 V is obtained in all operative positions of the 1 kHz decade switch.

(5) Repeat step (4) with the multimeter connected to TP14. A low output at TP14 in any position of the decade switch is an indication of incorrect oscillator frequency.

(6) Disconnect all test equipment.

(7) Connect the Frequency Counter CT488 to TP17 and recheck the oscillator frequencies as detailed in paragraph 43. If any frequency has changed by more than 10 Hz since the oscillator was set up, the circuit should be investigated. Check that the frequency repeats itself when the decade switch is moved to the position from either direction.

(8) Connect the Multimeter CT471 to TP13.

(9) Terminate output plug PLCN with a 2.2 kilohm resistor.

(10) Check the output level in each position of the decade switch, with an input frequency to PLCR from the Frequency Divider varying from 2.0 to 3.0 kHz. The response should remain level within 2 dB.

(11) Check that RV7 controls the output from about 150 to 400 mV and set it to about 200 mV.

(12) Connect the Spectrum Analyzer to the output plug PLCN via a 2.2 kilohm resistor.

(13) Set the decade switch to position 9.

(14) Apply an input to PLCR of 2.5 kHz from the Frequency Divider. Three outputs should appear on the Spectrum Analyzer, the wanted output at 20.5 kHz and two spurious outputs at 19.5 and 23 kHz. Adjust RV1 and RV2 in the 2nd Mixer stage to reduce the 23 kHz output to a minimum, and adjust R3 and RV4 in the 3rd Mixer stage to reduce the 19.5 kHz output to a minimum. Check that the level of each spurious output is at least -70 dB relative to the wanted output.

(15) Oscillator frequencies are set up in manufacture at an ambient temperature of approximately 20°C to be accurate to within ±10 Hz and these figures should be achieved when setting the oscillators on redeployment of the installation. In normal operation the circuits should not be adjusted unless they are found to be more than ±70 Hz from the nominal frequency. The synthesizer will operate within its design limits up to ±100 Hz from the nominal oscillator frequency.

FREQUENCY MULTIPLIER (10 kHz) UNIT 4

Voltage Measurements

49. The d.c. voltages given in Table 1.17 should be obtainable, under normal operating conditions, using a Multimeter 85X for the measurements. An input of 700mV at 11kHz, available from the Frequency Divider (Init 7) should be applied to PLCT.

TABLE 1.17 UNIT 4 D.C. VOLTAGE MEASUREMENTS

Test Point +ve	Test Point -ve	Circuit	Typical Reading V
TP1	TP16	VT1 collector	1.3 to 2.1
TP15	TP2	VT2 emitter	0.4 to 0.8
TP3	TP16	VT3 collector	1.6 to 2.6
TP4	TP16	VT4 collector	1.8 to 3.0
TP5	TP16	VT5 collector	2.2 to 3.8
TP6	TP16	VT6 collector	1.3 to 2.1
TP7	TP16	VT7 collector	1.0 to 1.8
TP8	TP16	VT8 collector	2.6 to 4.4
TP9	TP16	VT9 collector	2.6 to 4.4
TP10	TP16	VT10 collector	1.2 to 2.0
TP15	TP11	VT11 emitter	3.1 to 5.3
Frame	TP12	VT12 emitter	0.9 to 1.5
TP13	TP16	VT13 collector	1.4 to 2.4
Frame	TP14	VT14 emitter	0.5 to 1.0
TP15	Frame	+ve Supply	+7.8 to +9.0
Frame	TP16	-ve Supply	-7.8 to -9.0

50. The a.c. and r.f. voltages given in Table 1.18 were obtained on a correctly aligned unit. Inputs of 700 mV at 10 kHz, 300 mV at 25 kHz and 100 mV at 100 kHz should be applied to PLCP, SKCN and PLCZ respectively. A 2.2 kilohm resistor should be connected across PLCL. The voltages should be obtainable on a Multimeter CT471 with the 10 kHz decade Switch in any position except the blank ones.

TABLE 1.18 UNIT 4 A.C. AND R.F. VOLTAGE MEASUREMENTS

Test Point	Voltage
TP17	greater than 700 mV
TP18	greater than 1.0 V
TP19	250 to 300 mV
L31 terminal 2	greater than 1 V

NOTE If the voltage at TP17 is low, the 475 kHz filter amplifier may be peaked for maximum output provided that the oscillator frequencies are correct (see paragraph 53). All other filters are band-pass filters and should be adjusted in accordance with the full alignment procedure.

Resistance Measurements

51. The resistance of the input plug PLCM pin connections, measured with the Multimeter 8SX with its positive lead to frame should be as shown in Table 1.19.

CAUTION On the Ohms times 100 range transistors can be damaged by the multimeter battery.

TABLE 1.19 UNIT 4 INPUT PLUG RESISTANCES

PLCM1	340 ohms
PLCM2	900 ohms
PLCM4	0 ohms

ALIGNMENT

Oscillator Buffer Amplifiers

52. Proceed as follows:-

(1) Adjust all four mixer stage potentiometers to their mid-positions.

(2) Set the 10 kHz decade switch to one of its two blank positions.

(3) Connect the Signal Generator CT452 to the base of VT10 via a 0.1 uF capacitor.

(4) Adjust the Signal Generator output for 642 kHz at a level of 150 mV.

(5) Temporarily connect terminals 1 and 3 of L31 together.

(6) Connect the Multimeter CT471 to the collector of VT8.

(7) Adjust L32 for maximum reading on the multimeter. The reading should be in the range 3 V to 4 V.

(8) Remove the short circuit from L31 and adjust L31 for minimum output on the multimeter. The reading should be approximately 1 V.

(9) Connect the Multimeter CT471 to terminal 2 of L16. Check the response between 600 and 700 kHz. The output level as indicated on the multimeter should be greater than 1 V and should not vary by more than 3 dB over the frequency range.

(10) Reset the Signal Generator to 642 kHz.

(11) Temporarily link terminals 1 and 3 of L33.

(12) Connect the Multimeter CT471 to the collector of VT9.

(13) Adjust L34 for maximum reading on the multimeter. The reading should be in the range 3 V to 4 V.

(14) Remove the short circuit from L33 and adjust L33 for minimum output on the multimeter. The reading should be approximately 2 V.

(15) Connect the Multimeter CT471 to TP18. Check the response between 600 and 700 kHz. The output level should be greater than 1 V and should not vary by more than 3 dB over the frequency range.

(16) Disconnect the Signal Generator.

Oscillator

53. Proceed as follows:

(1) Connect the Multimeter CT471 to the base of VT10.

(2) Check that a reading of approximately 500 mV is obtained in each operative position of the decade switch. Check that there is no output in the two blank positions.

(3) Disconnect the multimeter.

(4) Connect the Frequency Counter CT488 to TP18.

(5) Set the decade switch to its 0 position.

(6) Adjust L38, with trimmer C107 in its mid-position, to give an output frequency of 65 kHz.

(7) Set the output frequency for each position of the decade switch by adjusting the appropriate trimming capacitor as shown in Table 1.20.

TABLE 1.20 UNIT 4 OSCILLATOR SETTING-UP

Decade Switch Position	Output Frequency kHz ± 100 Hz	Trimmer
0	* 605	C107
1	615	C104
2	625	C102
3	635	C99
4	645	C97
5	655	C94
6	665	C92
7	675	C89
8	685	C87
9	695	C84

* NOTE - See Paragraph 59 (16)

(8) **Disconnect the Frequency Counter.**

(9) Check that the level of each frequency output at TP18 is greater than 1 V, using a Multimeter CT471.

(10) Check that in each position of the decade switch the frequency repeats itself within ± 100 Hz of nominal when the switch is returned to a position from either direction.

(11) Check that no change occurs in frequency with moderate tapping or shaking of the unit.

475 kHz Filter

54. Proceed as follows:

(1) Set the decade switch to one of its two blank positions.

(2) Connect the Multimeter CT471 to TP17.

(3) Connect the Signal Generator CT452 to the emitter of VT5 via a 0.1 µF capacitor.

(4) Set the Signal Generator to give an output of 475 kHz ± 100 Hz at a level of 15 mV. Check the output of the Signal Generator with the Frequency Counter.

(5) Tune L23 for maximum reading on the multimeter. The reading should be in the range 1 V to 2 V.

(6) Connect the Signal Generator CT452 to the base of VT6 via a 0.1 µF capacitor.

(7) Adjust the output to give 475 kHz at a level of 50 mV.

(8) Tune L24 and L26 for maximum reading on the Multimeter CT471. The reading should be in the range 1 V to 2 V.

(9) Connect the Signal Generator to VT7 base via the 0.1 μF capacitor.

(10) Tune L27 and L28 for maximum reading on the multimeter. The reading should be in the range 1 V to 2 V.

(11) Connect the Signal Generator to terminal 4 of L29 via a 4.7 kilohms resistor.

(12) Adjust the output level of the Signal Generator to 10 mV.

(13) Tune L29 for maximum reading on the multimeter.

(14) Recheck that L23, L24, L26, and L28 are tuned for maximum output.

(15) Check that the response is within 3 dB ± 1 kHz of the input frequency and greater than -70 dB for ± 9 kHz with a constant output level of 10 mV. To do this disconnect the Multimeter CT471 from TP17 and measure the output on the Receiver (Adapted CR300) which should be connected to TP17 via a 1 kilohm resistor and the Step Attenuator CT421. The relative attenuation can be measured by adjusting the attenuator for a constant output from the Receiver.

Harmonic Generator

55. Proceed as follows:

(1) Temporarily connect TP18 to the frame.

(2) Connect the Signal Generator CT452 to the base of VT14 via a 0.1 μF capacitor.

(3) Connect the Receiver to terminal 6 of L48.

(4) Temporarily remove R81.

(5) Set the Signal Generator to an output level of 50 mV.

(6) Tune L44 for minimum output at 400 kHz.

(7) Tune L42 for maximum output at 200 kHz.

(8) Check that the response is level between 130 and 220 kHz to within 8 dB.

(9) Check that the response at 470 kHz is at least 40 dB below the peak level measured in Step (8). The output level should be in the range 150 to 200 mV.

(10) Check that this same output level is obtained at terminal 1 of L48.

(11) Remove the short circuit from TP18 and disconnect the multimeter.

(12) Replace R81.

(13) Connect the 10 kHz output from the Frequency Divider (unit 7) and the Multimeter CT471 to input plug PLCP.

(14) Tune L39 for maximum reading on the multimeter. The reading should be greater than 600 mV.

(15) Connect the Multimeter CT471 to TP17.

(16) Check that an output of approximately 700 mV is obtained on each operative position of the decade switch. If necessary, adjust L41 and L42 to level the output over the range. If an output is not obtainable on any position of the decade switch, check the oscillator output as in paragraph 53.

(17) Connect the Spectrum Analyzer to TP17. Two unwanted sidebands will be seen on each side of the carrier within 200 kHz. Adjust RV7 and RV8 to reduce these sidebands to a level of -70 dB relative to the carrier.

(18) Check that all other sidebands are at least -70 dB relative to the carrier, particularly those at 465, 470, 480 and 485 kHz.

500 kHz Filter

56. Proceed as follows:

(1) Set the decade switch to its 0 position.

(2) Check that the reading on the Multimeter CT471 is approximately 1 V at TP17.

(3) Connect the Signal Generator CT452 to terminal 4 of L2 via a 2.2 kilohms resistor and adjust its output to 500 kHz ± 100 Hz at a level of 5 mV.

(4) Connect the Multimeter CT471 to terminal 2 of L7.

(5) Tune L2, L3 and L6 for maximum reading on the multimeter.

(6) Connect the Multimeter CT471 to terminal 2 of L11.

(7) Tune L7, L8 and L9 for maximum reading on the multimeter.

(8) Connect a 4.7 kilohm resistor across both L3 and L8.

(9) Tune L2, L6, L7 and L9 for maximum output. It will be necessary to increase the input level from the Signal Generator to obtain a reading on the multimeter. Reduce the Signal Generator output before the next step.

(10) Disconnect the 4.7 kilohm resistors from L3 and L8 and connect them across L6 and L7.

(11) Tune L3 and L8 for maximum output. It will be necessary to increase the input level from the Signal Generator to obtain a reading on the multimeter.

(12) Reduce the Signal Generator output level and then remove the resistors.

(13) Connect the Signal Generator CT452 to input socket SKCN at 25 kHz and a level of 200 mV.

(14) Connect the Multimeter CT471 in parallel with a 0.0033 uF capacitor to input socket SKCN.

(15) Adjust L1 for a balanced response between 20 and 30 kHz.

(16) Remove the multimeter and the capacitor.

(17) Connect the Multimeter CT471 to terminal 2 of L11.

(18) Check the filter response by varying the input frequency between 19 and 31 kHz at a constant level of 200 mV. The output level should be approximately 1 V and the total variation of output should not exceed 3 dB in the passband. Record the peak response of the passband.

(19) Set the Signal Generator to 39 kHz at a level of 200 mV. The output must fall not less than 22 dB on the peak reading recorded in Step (18).

(20) Disconnect the Signal Generator.

(21) Set the decade switch to one of its two blank positions.

(22) Connect the Signal Generator CT452, set to 500 kHz, to terminal 6 of L2 via a 2.2 kilohm resistor.

(23) Adjust the Signal Generator level control to give a reading of 1 V on the multimeter.

(24) Disconnect the multimeter.

(25) Connect the Receiver to terminal 2 of L11 via a 2.2 kilohms resistor. At a frequency of 476 kHz the rejection should be greater than 45 dB. At a frequency of 456 kHz the rejection should be greater than 70 dB.

(26) Disconnect all test equipment.

200-300 kHz Filter

57. Proceed as follows:

(1) Temporarily connect terminal 2 of L16 and output plug PLCL to the frame.

(2) Connect the Signal Generator CT452 to terminal 3 of L16.

(3) Adjust the Signal Generator to give an output of 225 kHz at a level of 50 mV.

(4) Connect the Multimeter CT471 to the collector of VT4.

(5) Tune L21 for maximum reading on the multimeter. The reading should be in the range 0.3 V to 1.5 V and should be adjustable by RV9.

(6) Remove the short circuit from output plug PLCL and disconnect the multimeter.

(7) Connect the Receiver (Adapted CR300) to output plug PLCL.

(8) Tune the Receiver and Signal Generator to 420 kHz.

(9) Adjust L18 for minimum output.

(10) Connect a 2.2 kilohm resistor across output plug PLCL.

(11) Connect the Multimeter CT471 to TP19.

(12) Transfer the short circuit from terminal 2 of L16 to terminal 3 of L14.

(13) Adjust the Signal Generator to give an output of 250 kHz at a level of 50 mV.

(14) Set the decade switch to position 9.

(15) Adjust RV9 for a nominal output of 200 mV.

(16) Check that the output level between 200 and 300 kHz is within 1 dB. If necessary, adjust L17 and L19.

(17) Check that the response at 420 kHz is at least -40 dB relative to that in the passband.

(18) Disconnect the short circuit from L14.

(19) Disconnect the Signal Generator.

400 kHz Filter

58. Proceed as follows:

(1) Connect the Signal Generator CT452 to input plug PLCZ and adjust it to give an output of 100 kHz at a level of 150 mV.

(2) Connect the Multimeter CT471 to terminal 3 of L11.

(3) Connect terminal 2 of L11 to the frame.

(4) Tune L11 for maximum output.

(5) Check the response over the range 94 to 106 kHz and readjust L11 to obtain the best response.

(6) Disconnect all test equipment and the short circuit on terminal 2 of L11.

(7) Set the decade switch to position 5.

(8) Connect the Multimeter CT471 to terminal 2 of L11.

(9) Connect the Signal Generator CT452 to the base of VT2 via a 0.1 μF capacitor.

(10) Adjust the Signal Generator level at 500 kHz ± 1 kHz to give a reading on the multimeter of 1 V.

(11) Disconnect the multimeter.

(12) Connect a second Signal Generator CT452 to input plug PLCZ and adjust it to give an output of 100 kHz ± 100 Hz at a level of 100 mV.

(13) Connect the Multimeter CT471 to TP19. The 2.2 kilohm resistor should still be connected across output plug PLCL.

(14) Adjust RV9 for maximum reading on the multimeter.

(15) Tune L12, L13 and L14 for maximum reading on the multimeter.

(16) Connect a 1 kilohm resistor across L13.

(17) Tune L14 for maximum reading on the multimeter.

(18) Remove the 1 kilohm resistor from L13 and connect it across L14.

(19) Tune L13 for maximum output.

(20) Disconnect the 1 kilohm resistor from L14.

(21) Tune L12 for maximum reading on the multimeter.

(22) Adjust RV9 for a nominal output of 200 mV.

(23) Check the frequency response of the filter by varying the frequency of the Signal Generator connected to VT2 base between 488 and 512 kHz ± 100 Hz. The output should be level with 1 dB. Small adjustment of L12, L13 and L14 may be necessary to obtain the required response.

(24) Disconnect the Signal Generator.

(25) Connect the Signal Generator CT452 to input socket SKCN via a 2.2 kilohm resistor and adjust it to give an output of 25 kHz at a level of 200 mV.

(26) Connect the Receiver to terminal 2 of L11 via a 2.2 kilohm resistor.

(27) Tune to the spurious output at 475 kHz and adjust RV1 and RV2 for minimum output. The level should be at least -70 dB relative to the wanted output at 500 kHz.

(28) Transfer the Receiver to terminal 4 of L14. Tune to the spurious output at 500 kHz and adjust RV5 and RV6 for minimum output. The level should be at least -70 dB relative to the wanted output at 400 kHz.

(29) Remove all test equipment and refit all covers and screws.

OVERALL TEST

59. Proceed as follows:

(1) Connect the 10 kHz output from the Frequency Divider (unit 7) to the input plug PLCP.

(2) Connect the Signal Generator CT452 to input socket SKCN and adjust it to give an output of 25 kHz at a level of 200 mV.

(3) Connect a second Signal Generator CT452 to input plug PLCZ and adjust it to give an output of 100 kHz at a level of 100 mV.

(4) Connect the Multimeter CT471 to TP18.

(5) Check that at least 1 V output is obtained in all operative positions of the decade switch.

(6) Repeat step (5) with the multimeter connected to TP17. The output should be at least 700 mV. A low output at TP17 in any position of the decade switch may be due to incorrect oscillator frequency in that position

(7) Connect the Frequency Counter CT488 to TP18 and check the oscillator frequencies as in paragraph 53. If any frequency has changed by more than 100 Hz since setting-up, the reason should be investigated.

(8) Check that the frequency repeats itself when the decade switch is moved to a position from either side.

(9) Connect the Multimeter CT471 to TP19.

(10) Connect a 2.2 kilohm resistor across the output plug PLCL.

(11) Adjust RV9 to give a nominal output of 200 mV.

(12) Check the output level in each position of the decade switch with varying input frequencies at SKCN between 20 and 30 kHz, also with varying input frequencies at PLCZ between 94 and 106 kHz. The output level should remain constant to within 2 dB.

(13) Check that RV9 has a range control from 150 to 600 mV and set it to give a nominal output of 200 mV.

(14) Connect the Spectrum Analyzer to output plug PLCL via a 2.2 kilohm resistor.

(15) Set the decade switch to its 0 position, and connect the test equipment as described in steps (2),(3) and (4). Under these conditions there will be a wanted output at 205 kHz and a spurious output at 195 kHz. Adjust RV3 and RV4 to reduce the spurious output to at least -70 dB relative to the wanted output.

(16) Oscillator frequencies are set up in manufacture at an ambient temperature of approximately 20°C to be accurate to within ±100 Hz and these figures should be achieved when setting the oscillators on redeployment of the installation. In normal operation the circuits should not be adjusted unless they are found to be more than ±700 Hz from the nominal frequency. The synthesizer will operate within its design limits up to ±1 kHz from the nominal oscillator frequency.

PARAGRAPH 60 next leaf.

FREQUENCY MULTIPLIER (100 kHz) UNIT 3

Voltage Measurements

60. The d.c. voltages given in Table 1.21 should be obtainable, under normal operating conditions, using a multimeter 85X for the measurements. An input of 700mV at 100kHz, available from the Frequency Divider (Unit 7), should be applied to PLCK.

TABLE 1.21 UNIT 3 D.C. VOLTAGE MEASUREMENTS

Test Point +ve	Test Point -ve	Circuit	Typical Reading V
TP1	TP16	VT1 collector	1.7 to 2.9
TP2	TP16	VT2 collector	1.0 to 1.8
TP3	TP16	VT3 collector	0.7 to 1.2
TP4	TP16	VT4 collector	2.0 to 3.3
TP5	TP16	VT5 collector	2.1 to 3.0
TP6	TP16	VT6 collector	0.6 to 1.2
TP7	TP16	VT7 collector	0.6 to 1.2
TP8	TP16	VT8 collector	1.1 to 1.7
TP9	TP16	VT9 collector	1.4 to 2.4
Frame	TP10	VT10 emitter	0.9 to 1.5
TP11	TP16	VT11 collector	4.6 to 7.6
Frame	TP12	VT12 emitter	0.7 to 1.5
TP15	Frame	+ve Supply	+7.8 to +9.0
Frame	TP16	-ve Supply	-7.8 to -9.0

61. The r.f. voltages given in Table 1.22 were obtained on a correctly aligned unit. Inputs of 700 mV at 100 kHz and 200 mV at 250 kHz should be applied to PLCK and SKCL respectively. Load resistors of 82 ohms and 220 ohms should be connected across SKCL and PLCF respectively. The voltages should be obtainable on a Multimeter CT471 with the 100 kHz decade switch in any position except the blank ones.

TABLE 1.22 UNIT 3 R.F. VOLTAGE MEASUREMENTS

Test Point	Voltage
TP14	greater than 500 mV
TP17	greater than 600 mV
TP13	47 to 85 mV

NOTE If the voltage at TP13 is low, the 3.75 MHz filter amplifier may be peaked for maximum output provided that the oscillator frequencies are correct (see paragraph 64). All other filters are band-pass filters and should be adjusted in accordance with the full alignment procedure.

Resistance Measurements

62. The resistance of the input plug PLCH pin connections, measured with the Multimeter CT471 with its positive lead to frame should be as shown in Table 1.23.

CAUTION On the Ohms times 100 range transistors can be damaged by the multimeter battery.

TABLE 1.23 UNIT 3 INPUT PLUG RESISTANCES

PLCH1	300 ohms
PLCH2	1.1 kilohms
PLCH4	0 ohms

ALIGNMENT

Oscillator Buffer Amplifiers

63. Proceed as follows:-

(1) Adjust all Mixer stage potentiometers to their mid-positions.

(2) Set the decade switch to one of its two blank positions.

(3) Connect an 82 ohm resistor across L36.

(4) Connect the Signal Generator CT452 to terminal 3 of L35 via a 0.1 uF capacitor.

(5) Adjust the Signal Generator output to 6.42 MHz at a level of 1.0 V.

(6) Temporarily link terminals 1 and 3 of L31.

(7) Connect the Multimeter CT471 to the collector of VT6.

(8) Tune L32 for maximum reading on the multimeter. The reading should be in the range 4 V to 5 V.

(9) Remove the link from L31 and tune L31 for minimum reading on the multimeter. The reading should be approximately 1.5 V.

(10) Connect the Multimeter CT471 to the junction of C23, C24.

(11) Check the response between 5.9 and 7 MHz. The output level should be greater than 600 mV and should not vary by more than 3 dB over the stated frequency range.

(12) Reset the Signal Generator to 6.42 MHz.

(13) Temporarily link terminals 1 and 3 of L33.

(14) Connect the Multimeter to the CT471 collector of VT7.

(15) Tune L34 for maximum reading on the multimeter. The reading should be in the range 2 to 3 V.

(16) Remove the link from L33 and tune L33 for minimum reading on the multimeter. The reading should be approximately 1.5 V.

(17) Connect the Multimeter CT471 to TP17.

(18) Check the response between 5.9 and 7 MHz. The output level should be greater than 600 mV and should not vary by more than 3 dB over the stated frequency range.

(19) Disconnect the Signal Generator.

(20) Connect the Signal Generator CT452 to the base of VT8 via a 0.1 uF capacitor.

(21) Adjust the Signal Generator to give an output of 6.42 MHz at a level of 100 mV.

(22) Connect the Multimeter CT471 to TP17.

(23) Tune L35 for maximum output.

(24) Remove the 82 ohm resistor from L36 and connect it across terminals 1 and 2 or L35.

(25) Tune L36 for maximum reading on the multimeter.

(26) Remove the 82 ohm resistor and disconnect the Signal Generator.

Oscillator

64. Proceed as follows:

(1) Connect the Multimeter CT471 to VT8 base.

(2) Check that a reading of at least 100 mV is obtained in each operative position of the decade switch.

(3) Disconnect the multimeter.

(4) Connect the Frequency Counter CT488 to TP17.

(5) Set the decade switch to position 9.

(6) With trimmer C104 in its mid-position adjust L38 for a frequency of 6.05 MHz as indicated on the Frequency Counter.

(7) Set the decade switch to each position in turn and adjust the appropriate trimmer to set the output frequency as shown in Table 1.24.

TABLE 1.24 UNIT 3 OSCILLATOR SETTING-UP

Decade Switch Position	Output Frequency MHz ± 1 kHz	Trimmer
0	*6.95	C126
1	6.85	C124
2	6.75	C122
3	6.65	C119
4	6.55	C117
5	6.45	C114
6	6.35	C112
7	6.25	C109
8	6.15	C107
9	6.05	C.04

* NOTE - See Paragraph 69 (18)

(8) **Disconnect the Frequency Counter.**

(9) Check that the level of each frequency output at TP17 is greater than 600 mV, using a Multimeter CT471.

(10) Check that in each position of the decade switch the frequency repeats itself within ± 1 kHz of nominal when the switch is returned to a position from either direction.

(11) Check also that no change occurs in frequency with moderate tapping or shaking of the unit.

(12) Disconnect all test equipment.

3.75 MHz Filter

65. Proceed as follows:

(1) Set the decade switch to one of its two blank positions.

(2) Connect the Multimeter CT471 to TP14.

(3) Connect the Signal Generator CT452 to VT3 emitter via a 0.1 uF capacitor. Care must be taken not to short VT3 emitter to the adjacent 8.2 V tag.

(4) Adjust the Signal Generator to give an output of 3.75 MHz ± 1 kHz at a level of 50 mV.

(5) Tune L21 for maximum reading on the multimeter. The reading should be in the range 1 V to 2 V.

(6) Connect the Signal Generator CT452 to the base of VT4 via a 0.1 uF capacitor. Check that the output level of the Signal Generator is still 50 mV.

(7) Tune L22 and L23 for maximum reading on the multimeter. The reading should be in the range 1 V to 2 V.

(8) Connect the Signal Generator CT452 to VT4 collector via the 0.1 uF capacitor.

(9) Adjust the Signal Generator to give an output of 3.75 MHz at a level of 1 V.

(10) Connect the Multimeter CT471 to terminal 3 of L25.

(11) Slightly adjust the Signal Generator to obtain a maximum reading on the multimeter.

(12) Adjust the neutralizing capacitor C48 to obtain a minimum reading on the multimeter.

(13) Connect the Multimeter CT471 to TP14.

(14) Retune L22 and L23 for a maximum output.

(15) Connect the Signal Generator CT452 to the base of VT5 via the 0.1 uF capacitor.

(16) Adjust the Signal Generator to give an output of 3.75 MHz at a level of 10 mV.

(17) Tune L25, L26, L27 and L28 for maximum reading on the multimeter. The reading should be in the range 1 V to 2 V.

(18) Connect the Signal Generator CT452 to the collector of VT5 via the 0.1 uF capacitor.

(19) Adjust the output of the Signal Generator to give 3.75 MHz ± 1 kHz at a level of 1 V.

(20) Connect the Multimeter CT471 to terminal 4 of L29.

(21) Slightly adjust the Signal Generator frequency for maximum reading on the multimeter.

(22) Adjust the neutralizing capacitor L63 for a minimum reading on the multimeter.

(23) Connect the Multimeter CT471 to TP14.

(24) Retune L25, L26, L27 and L28 for maximum reading on the multimeter.

(25) Connect the Signal Generator CT452 to terminal 3 of L29 via a 4.7 kilohm resistor.

(26) Adjust the Signal Generator to give an output of 2.75 MHz ± 1 kHz at a level of 150 mV (measured at the Signal Generator end of the 4.7 kilohm resistor).

(27) Tune L29 for maximum reading on the multimeter.

(28) Check that L21, L22, L23, L25, L26, L27 and L28 are tuned for maximum output. The reading should be in the range 1 V to 2 V.

(29) Check that the response of the filter is within 3 dB for ± 10 kHz and greater than -70 dB for ± 90 kHz with a constant input level of 150 mV. To do this connect a Receiver to TP14 via the Step Attenuator CT421. The relative attenuation can be measured by adjusting the Attenuator for a constant output level from the Receiver. Slight retuning may be necessary to obtain the required response.

(30) Disconnect all test equipment.

Harmonic Generator

66. Proceed as follows:

(1) Temporarily link TP17 to the frame.

(2) Connect the Signal Generator CT452 to the base of VT12 via a 0.1 μF capacitor.

(3) Connect the Receiver to terminal 4 of L48.

(4) Adjust the Signal Generator to give an output of 50 mV at the frequencies specified in steps (5), (6) and (7).

(5) Tune L44 for minimum output at 3.75 MHz.

(6) Tune L46 for minimum output at 4.1 MHz.

(7) Tune L42 for minimum output at 3.0 MHz.

(8) Connect the Multimeter CT471 to terminal 4 of L48.

(9) Check that the response between 2.3 and 3.2 MHz is approximately 75 to 500 mV.

(10) Check that the same output is obtained at terminal 6 of L48.

(11) Check that the response at 3.75 MHz is at least -40 dB below the level at 3 MHz.

NOTE Inductors L43 and L45 are preset and if they are disturbed they should be disconnected from the circuit and accurately reset on an Inductance bridge to 60 μH and 39 μH respectively.

(12) Remove the link from TP17.

(13) Disconnect all test equipment.

(14) Connect the 100 kHz output from the Frequency Divider (unit 7) to input plug PLCK.

(15) Connect the Multimeter CT471 to PLCK.

(16) Tune L39 for maximum reading on the multimeter. The reading should be greater than 600 mV.

(17) Connect the Multimeter CT471 to TP14.

(18) Check that an output of about 1.5 V is obtained at TP14 for each operative position of the decade switch. If necessary adjust L41 and L42 to level the output over the range. If no output is obtained on any position check the oscillator frequency and output level at TP17.

(19) Set the decade switch to position 9, and adjust the oscillator for an error of 500 to 1000 Hz.

(20) Connect the Spectrum Analyzer to TP14 via a 2.2 kilohm resistor and monitor the 3.75 MHz output. Two unwanted sidebands may be seen on each side of the carrier within 2 kHz (twice the oscillator error). If these are higher than -70 dB relative to the carrier they should be reduced by adjusting RV5, RV6, L41 and L42. If L41 or L42 are adjusted it will be necessary to repeat step (18).

(20) Check that all other sidebands are lower than -70 dB relative to the carrier. In particular check those at 3.65, 3.7, 3.8 and 3.85 MHz.

(21) Disconnect all test equipment.

2-3 MHz Filter

67. Proceed as follows:

(1) Set the decade switch to one of its two blank positions.

(2) Temporarily connect the junction of C23, C24 to the frame.

(3) Connect the Signal Generator CT452 to terminal 3 of L11 via a 2.2 kilohm resistor.

(4) Adjust the Signal Generator to give an output of 2.25 MHz at a level of 120 mV.

(5) Temporarily connect the output plug PLCF to the frame.

(6) Connect the Multimeter CT471 to the collector of VT2.

(7) Tune L17 for maximum reading on the multimeter.

(8) Check that RV7 gives adjustment of output from 300 to 800 mV.

(9) Remove the short circuit from PLCF.

(10) Disconnect the multimeter.

(11) Connect the Receiver to PLCF.

(12) Tune the Receiver and the Signal Generator to 4.2 MHz.

(13) Adjust L15 for minimum output at this frequency.

(14) Connect a 2.2 kilohm resistor across PLCF.

(15) Connect the Multimeter CT471 to TP13.

(16) Transfer the link from the junction of C23, C24 to terminal 1 of L8.

(17) Adjust the output level of the Signal Generator to 120 mV.

(18) Set the decade switch to its 0 position.

(19) Adjust RV7 to give a nominal reading of 150 mV on the multimeter.

(20) Check that the output between 2 and 3 MHz is level within 1 dB. If necessary, adjust L13 and L14 to achieve this.

(21) Remove the shorting link from terminal 1 of L8.

(22) Disconnect the Signal Generator.

4 MHz Filter

68. Proceed as follows:

(1) Set the decade switch to position 5.

(2) Check with the Multimeter CT471 that there is approximately 1 V at TP14 and at the junction of C23, C24.

(3) Connect the Signal Generator CT452 to terminal 4 of L2 via a 2.2 kilohm resistor.

(4) Adjust the Signal Generator to give an output of 4.0 MHz ± 1 kHz at a level of 50 mV.

(5) Connect the Multimeter CT471 to the collector of VT1.

(6) Tune L2, L3 and L4 for maximum reading on the multimeter.

(7) Connect the Multimeter CT471 to terminal 4 of L8.

(8) Tune L6, L7 and L8 for maximum output.

(9) Connect the Multimeter CT471 to VT1 collector.

(10) Adjust the Signal Generator to give an output of approximately 4.0 MHz ± 20 kHz. (This allows for the multimeter detuning L6.)

(11) Detune L7 and L8 by removing the cores.

(12) Tune L6 for maximum output.

(13) Reset the Signal Generator Frequency to 4.0 MHz ± 1 kHz.

(14) Tune L7 for minimum and L8 for maximum reading on the multimeter.

NOTE The Multimeter CT471 must not be moved during the alignment detailed in steps (9) to (14) and an inductor must not be tuned unless all following inductors are detuned.

(15) Connect the Multimeter CT471 to terminal 4 of L2.

(16) Connect the Signal Generator CT452 via a 2.2 kilohm resistor to terminal 4 of L2.

(17) Adjust the Signal Generator output level to 100 mV.

(18) Detune L3 and L4 by removing the cores.

(19) Tune L2 for maximum output.

(20) Tune L3 for minimum and L4 for maximum reading on the multimeter.

(21) Connect the Signal Generator CT452 to VT1 collector.

(22) Adjust the Signal Generator output to 4 MHz at a level of 1 V.

(23) Connect the Multimeter CT471 to terminal 1 of L4.

(24) Adjust the Signal Generator frequency for maximum reading on the multimeter.

(25) Adjust the neutralizing capacitor C12 for a minimum reading.

(26) Repeat Steps (1) to (25).

(27) Connect the Signal Generator CT452 to terminal 4 of L2 via a 2.2 kilohm resistor.

(28) Adjust the Signal Generator output level to 50 mV.

(29) Connect the Multimeter CT471 to terminal 4 of L8. The level at this point should be in the range 150 to 200 mV. Check that the same output level is obtained at terminal 6 of L8.

(30) Connect the Signal Generator CT452 to input socket SKCL via a 2.2 kilohm resistor.

(31) Adjust the Signal Generator to give an output of 250 kHz at a level of 200 mV.

(32) Connect the Multimeter CT471 across the input socket SKCL in parallel with a 330 pF capacitor.

(33) Tune L1 to give a symmetrical response over the range 200 to 300 kHz.

(34) Connect the Multimeter CT471 to TP13. With the conditions as detailed in Steps (1) and (2) and with the Signal Generator set to give an output of 250 kHz at a level of 200 mV, RV7 should control the output in the range 25 to 200 mV.

(35) Adjust RV7 for a nominal output of 150 mV.

(36) Check the frequency response of the filter by varying the input frequency from 184 to 316 kHz. The variation in output should be less than 1 dB. Slight adjustment of L2, L3, L4, L6, L7 and L8 may be necessary to obtain the required response.

NOTE It is sometimes necessary to refit the covers before readjusting the inductors since the covers may slightly detune the filter.

(37) Disconnect all test equipment, ensure that all covers and screws are replaced.

OVERALL TEST

69. Proceed as follows:

(1) Connect the 100 kHz output from the Frequency Divider (unit 7) to the input plug PLCK.

(2) Connect the Signal Generator CT452 at input socket SKCL and set it to 250 kHz at a level of 200 mV.

(3) Connect the Multimeter CT471 to TP17.

(4) Check that a reading of at least 600 mV is obtained on the multimeter in all operative positions of the decade switch.

(5) Connect the Frequency Counter CT488 to TP17 and check the oscillator frequencies as detailed in paragraph 64. The frequencies may have changed due to fitting the covers. Check that each frequency repeats itself when the decade switch is moved to a position from either direction. Check that the trimmer capacitors and the core of L38 are not loose.

(6) Check with the Multimeter CT471 that a reading of approximately 600 mV is obtained at TP14.

(7) Connect the Multimeter CT471 to TP13.

(8) Connect a 2.2 kilohm resistor across output plug PLCF.

(9) Check the output level as indicated on the multimeter for each position of the decade switch with the input frequency to SKCL varying from 194 to 306 kHz. The response should remain level to within 2 dB.

(10) Check that RV7 controls the output in the range 25 to 180 mV.

(11) Adjust RV7 to give a nominal output of 120 mV.

(12) Connect the Receiver to TP13. Apply an input of 300 kHz at a level of 200 mV to input socket SKCL. Set the decade switch to position 9. This will give a wanted output at 2.0 MHz and a spurious output at 2.3 MHz. Adjust RV1 and RV2 to minimize the spurious output. The level should be at least -70 dB relative to the wanted output.

(13) Repeat Step 12 with an input of 200 kHz to SKCL at a level of 200 mV and with the decade switch set to its 0 position. This will give an output at 3.0 MHz and a spurious output at 3.2 MHz. It may be necessary to slightly readjust RV1 and RV2 to obtain the required rejection.

(14) Adjust the input frequency at SKCL to 300 kHz. Set the decade switch to position 9. This will give a wanted output at 2.0 MHz and a spurious output at 2.05 MHz. Adjust R3 and RV4 to minimize the spurious output. The level should be at least -70 dB relative to the wanted output.

(15) Adjust the input frequency at SKCL to 200 kHz. This will give a wanted output of 2.1 MHz and a spurious output of 2.5 MHz. Check that the level of the spurious output is at least -70 dB relative to the wanted output.

(16) Set the decade switch to position 6. Note the level of the wanted output at 2.4 MHz. Reset the frequency at SKCL to 400 kHz. Set the decade switch to position 4. Check that the level of the spurious output at 2.4 MHz is at least -25 dB relative to the wanted output at 2.4 MHz.

(17) Disconnect all test equipment.

(18) Oscillator frequencies are set up in manufacture at an ambient temperature of approximately 20°C to be accurate to within ±1 kHz and these figures should be achieved when setting the oscillators on redeployment of the installation. In normal operation the circuits should not be adjusted unless they are found to be more than ±7 kHz from the nominal frequency. The synthesizer will operate within its design limits up to ±10 kHz from the nomainal oscillator frequency.

PARAGRAPH 70 next leaf.

FREQUENCY MULTIPLIER (MHz) UNIT 2

Voltage Measurements

70. The d.c. voltages given in Table 1.25 should be taken with the MHz decade switch in its 0 position with all inputs except power supplies disconnected. Using the Multimeter CT471 set to the 10 V d.c. range, the readings should be within the limits given.

TABLE 1.25 UNIT 2 D.C. VOLTAGE MEASUREMENTS

Test Point +ve	Test Point -ve	Circuit	Typical Reading V
TP1	TP17	VT1 collector	1.4 to 2.2
TP2	TP17	VT2 collector	2.6 to 4.3
TP3	TP17	VT3 collector	0.3 to 0.8
TP4A	TP18	VT4 emitter	12.0 to 17.0
TP19	TP4B	VT4 collector	9.0 to 13.0
TP5	TP17	VT5 collector	0.3 to 0.7
TP6	TP17	VT6 collector	0.4 to 0.8
TP7	TP17	VT7 collector	0.25 to 0.5
TP8	TP17	VT8 collector	0.3 to 0.5
TP9	TP17	VT9 collector	4.0 to 7.0
TP10	TP17	VT10 collector	0.9 to 1.5
TP11	TP17	VT11 collector	0.6 to 1.0
TP12	TP17	VT12 collector	0.55 to 0.95
TP14	TP17	VT14 collector	0.3 to 0.6
TP15	TP17	VT15 collector	2.0 to 4.5
TP16	Frame	8.2 V +ve Supply	+7.8 to +9.0
Frame	TP17	8.2 V -ve Supply	-7.8 to -9.0
Frame	TP18	27 V -ve Supply	-24 to -30
TP19	Frame	27 V +ve Supply	+24 to +30
TP23	TP17	VT16 collector	0.35 to 0.45

71. The r.f. voltages given in Table 1.26 were obtained on a correctly aligned unit. Inputs of 500 mV at 1 MHz and 125 mV at 2.5 MHz should be applied to PLCE and SKCF respectively. A load resistor of 75 ohms should be connected across PLBC. The voltages should be obtainable on a Multimeter CT471 with the MHz decade switch in any position except the blank ones.

TABLE 1.26 UNIT 2 R.F. VOLTAGE MEASUREMENTS

Test Point	Voltage
TP20	200 to 500 mV
TP21	greater than 80 mV
TP22	greater than 400 mV
PLBC	400 to 800 mV
RV1 Wiper	600 mV

NOTE If the voltage at TP20 is low the 37.5 MHz filter amplifier may be peaked for maximum output provided that the oscillator frequencies are correct (see paragraph 74). All other filters are band-pass filters and should be adjusted in accordance with the full alignment procedure.

Resistance Measurements

72. The resistance of the input plug PLCA pin connections, measured with the Multimeter CT471 with its positive lead to frame should be as shown in Table 1.27.

CAUTION On the Ohms times 100 range transistors can be damaged by the multimeter battery.

TABLE 1.27 UNIT 2 INPUT PLUG RESISTANCES

PLCA1	2 to 5 kilohms
PLCA2	2 to 3.5 kilohms
PLCA3	Approximately 8 kilohms
PLCA4	Approximately 8 kilohms
PLCA5	Infinity
PLCA6	0 ohm

ALIGNMENT

37.5 MHz Filter

73. Proceed as follows:

(1) Adjust RV1, RV2, RV5 and RV6 to their mid-positions.

(2) Set the decade switch to a blank position.

(3) Connect the Multimeter CT471 to TP20.

(4) Connect the Signal Generator CT452 terminated with a 47 ohm resistor to the base of VT5 via a 0.1 uF capacitor.

(5) Adjust the Signal Generator to give an output of 37.5 MHz ± 10 kHz at a level of 50 mV.

(6) Tune L56 and L57 for maximum reading on the multimeter. The reading should be in the range 400 to 500 mV.

(7) Connect the Signal Generator CT452 to the points listed in Table 1.28 via a 0.1 uF capacitor. Adjust the Signal Generator to give an output of 37.5 MHz ± 10 kHz at the levels specified. Tune the inductors listed for maximum reading on the multimeter. The reading should be in the range 400 to 500 mV.

TABLE 1.28 UNIT 2 37.5 MHz FILTER TUNING

Test Point	Input Level (mV)	Inductors to be tuned
VT6 base	10	L56,57,58,61
VT7 base	10	L56,57,58,61,62,63,64
VT8 base	2	L56,57,58,61,62,63,64,65,66,67

(8) Connect the Signal Generator CT452 via a 330 ohms resistor to terminal 4 on L67.

(9) Adjust the Signal Generator output level to 2 mV.

(10) Check that all the inductors in Table 1.28 are peaked for maximum output.

(11) Increase the input level from the Signal Generator and check that the output TP20 tends to limit between 500 and 700 mV.

(12) Reset the input level to 200 mV and check that the passband of the filter is ±100 kHz within 3 dB. The output level should be approximately 350 mV. Check that the level drops outside the passband.

Oscillator

74 (1) Check with the Multimeter CT471 that the voltage at the junction of C208 and R75 at VT14 base for each operative position of the decade switch is between 100 and 120 mV.

(2) Check that there is 60 to 100 mV at the base of VT11.

(3) Check that there is 10 to 60 mV at the bases of VT12 and VT13 for all positions of the decade switch.

(4) Connect the Frequency Counter CT488 to TP21 or TP22 and adjust the oscillator frequency in each operative position of the decade switch by tuning the appropriate inductor as shown in Table 1.29.

NOTE: Oscillator frequencies are set up in manufacture at an ambient temperature of approx. 20°C to be accurate to within ±10 kHz. These figures should be achieved when setting the oscillators on redeployment of the installation. In normal operation the circuits should not be adjusted unless they are found to be more than ±70 kHz from the nominal frequency. The synthesizer will operate within its design limits up to ±100 kHz from the nominal oscillator frequency.

TABLE 1.29 UNIT 2 OSCILLATOR SETTING-UP

Decade Switch Position	Oscillator Frequency MHz	Inductor	Decade Switch Position	Oscillator Frequency MHz	Inductor
0	40.5	L120	15	55.5	L135
1	41.5	L121	16	56.5	L136
2	42.5	L122	17	57.5	L137
3	43.5	L123	18	58.5	L138
4	44.5	L124	19	59.5	L139
5	45.5	L125	20	60.5	L140
6	46.5	L126	21	61.5	L141
7	47.5	L127	22	62.5	L142
8	48.5	L128	23	63.5	L143
9	49.5	L129	24	64.5	L144
10	50.5	L130	25	65.5	L145
11	51.5	L131	26	66.5	L147
12	52.5	L132	27	67.5	L147
13	53.5	L133			
14	54.5	L134			

(5) Disconnect the Frequency Counter and connect the Multimeter CT471 to TP21.

(6) Set the decade switch to all operative positions in turn. In the position which gives the lowest reading on the multimeter, adjust L82 to peak this reading which should be greater than 100 mV. Typical readings are in the range 150 to 500 mV.

(7) Connect the Multimeter CT471 to TP22 and repeat Step (6) by adjusting L83 so that the lowest reading exceeds 400 mV. Typical readings are in the range 600 mV to 1.3 V.

(8) Disconnect all test equipment.

Harmonic Generator

75. Proceed as follows:

(1) Disconnect the junction of L73 and L74 and then connect the Polyskop R.F. Output via a 1 kilohm resistor to L74. Connect the Polyskop Diode Probe to L79 terminal 3. Adjust the Polyskop trace to display a frequency spectrum of 0 to 30 MHz.

(2) Set the decade switch to position 14 and tune L75 and L77 for a minimum at 30 MHz. A typical response curve is shown in Figure 1.5.

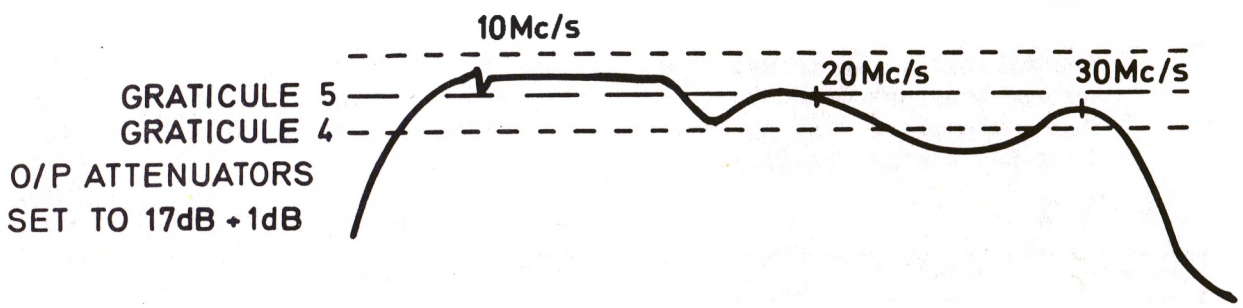


FIG. 1.5 HARMONIC GENERATOR RESPONSE (UNIT 2)

(3) Disconnect the Polyskop.

(4) Reconnect the junction of L73 and L74.

(5) Connect the Frequency Standard output of 1 MHz ± 1 Hz at a level of 0.5 V, and the Multimeter CT471 between input plug PLCE and frame.

(6) Tune L71 for maximum multimeter reading.

(7) Check that d.c. voltage between TP17 and TP9 is approximately 5.5 V.

(8) Connect the Multimeter CT471 to TP20 and with the decade switch set to its 0 position, tune L73 for maximum indication on the multimeter.

(9) Set the decade switch to position 27 and adjust L150 for maximum reading on the multimeter.

(10) Repeat Steps (8) and (9) for all operative positions of the decade switch, adjusting the appropriate inductor for maximum indication on the multimeter.

(11) Turn the decade switch through all its operative positions and adjust L72 to give the best flat response over the range.

(12) In all operative positions of the decade switch and with the 1 MHz input not less than 0.5 V check that:

(a) The frequency measured at TP20 remains at 37.5 MHz ± 10 kHz, and that for repetitive rotations of the decade switch the frequency remains within ± 20 kHz.

(b) The voltage at TP21 is greater than 100 mV.

(c) The voltage at TP22 is greater than 400 mV.

(d) The voltage at TP20 is greater than 200 mV.

(e) The voltage at the wipers of RV1 and RV2 is greater than 400 mV.

(13) Disconnect all test equipment.

Output Circuits

76. Proceed as follows:

(1) Connect the Polyskop R.F. output via a 330 ohm resistor to L11 terminal 4, and the Polyskop Diode Probe to the base of VT3.

NOTE To reduce pick-up the Polyskop input and output leads should be kept well apart and not run parallel to each other.

(2) Adjust the Polyskop to display the 60 MHz marker, set it to the 50 to 150 MHz range, turn the output attenuators to zero and the 'Y' gain amplifiers control to its maximum position.

(3) Set the decade switch to position 6.

(4) Adjust L13 for minimum output at 60 MHz.

(5) Adjust L12 for minimum at 28.5 MHz and L14 for a sharp fall off at 28.5 MHz.

(6) Connect the Polyskop Diode Probe to VT2 base and readjust L12 and L14 for the best overall response as shown in Figure 1.6.

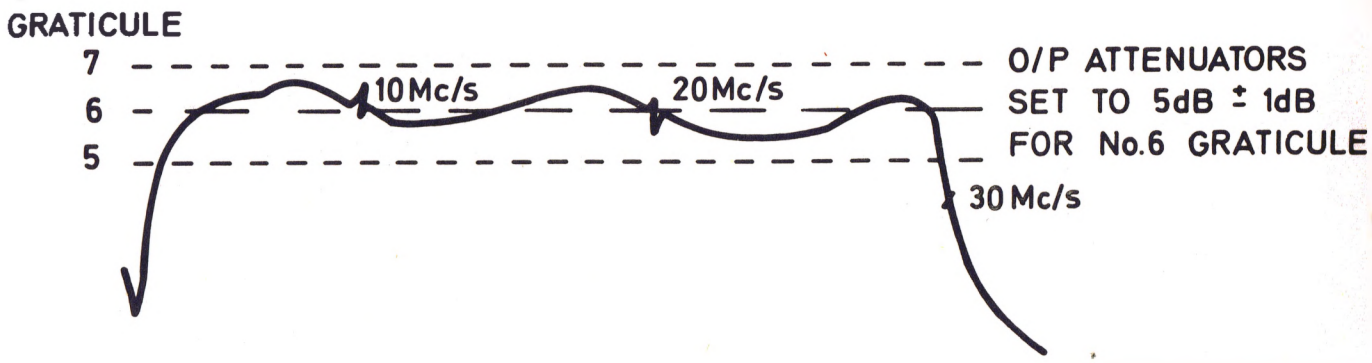


FIG. 1.6 OVERALL RESPONSE OF FREQUENCY MULTIPLIER (MHZ)

(7) Terminate output plug PLBC in 75 ohms and connect the Polyskop Diode Probe across this load.

(8) Set trimmers C55 and C65 to their mid-positions.

(9) Set the decade switch to position 27 and, using the Polyskop internal markers, adjust L16 and L91 for minimum output at 27.5 MHz as shown in Figure 1.7.



ICY

FIG. 1.7 OUTPUT AT 27.5 MHZ OF FREQUENCY MULTIPLIER (MHZ)

(10) Repeat Step (9) for all decade switch positions as indicated in Table 1.30.

TABLE 1.30 UNIT 2 OUTPUT RESPONSE

Decade Switch Position	Mid-band Frequency MHz	Output Passband Frequency MHz	Inductors to be adjusted
27	27.5	27 to 28	L16, L91
26	26.5	26 to 27	L17, L92
25	25.5	25 to 26	L18, L93
24	24.5	24 to 25	L19, L94
23	23.5	23 to 24	L20, L95
22	22.5	22 to 23	L21, L96
21	21.5	21 to 22	L22, L97
20	20.5	20 to 21	L23, L98
19	19.5	19 to 20	L24, L99
18	18.5	18 to 19	L25, L100
17	17.5	17 to 18	L26, L101
16	16.5	16 to 17	L27, L102
15	15.5	15 to 16	L28, L103
14	14.5	14 to 15	L29, L104
13	13.5	13 to 14	L30, L105
12	12.5	12 to 13	L33, L106
11	11.5	11 to 12	L34, L107
10	10.5	10 to 11	L35, L108
9	9.5	9 to 10	L36, L109
8	8.5	8 to 9	L37, L110
7	7.5	7 to 8	L38, L111
6	6.5	6 to 7	L39, L112
5	5.5	5 to 6	L40, L113
4	4.5	4 to 5	L41, L114
3	3.5	3 to 4	L42, L115
2	2.5	2 to 3	L43, L116
1	1.5	1 to 2	L44, L117
0		0 to 1	

NOTE The passband for each decade switch position should be flat to within 1 dB over a 1 MHz bandwidth. The variation of the maximum peaks over all positions should be less than 6 dB.

(11) Remove the Polyskop.

(12) Connect a Signal Generator CT452 terminated in 47 ohms to terminal 6 of L11 in series with a 330 ohm resistor.

(13) Adjust the output of the Signal Generator to a frequency of 5.5, 10.5, 15.5, 20.5 and 25.5 MHz in turn at a constant level of 50 mV.

NOTE It will be necessary to switch the decade switch to a blank position to set the output of the Signal Generator to 50 mV, measured at the end of the 330 ohm resistor nearest to the Signal Generator.

(14) Check that the voltage measured across the 75 ohm load at output plug PLBC, with the decade switch at the correct output frequency position, is within the range 0.4 to 0.8 V.

(15) Disconnect all test equipment.

40 MHz Filter

77. Proceed as follows:

(1) Set the decade switch to any operative position and connect the Signal Generator CT452 to input socket SKCF via a 180 ohm resistor.

(2) Adjust RV1, RV2, RV3 and RV4 to their mid-positions.

(3) Adjust C16 and C21 to their mid-positions.

(4) Detune L2, L3, L4, L6 and L7.

(5) Connect the Polyskop R.F. output via a 330 ohm resistor to terminal 4 of L2 and the Polyskop Diode Probe to the frame.

(6) With the Polyskop set to display the 40 MHz marker, tune L2 for maximum at this point. Tune L3 for minimum and L4 for maximum.

(7) Connect the diode probe to VT1 collector and adjust L6 for maximum at 40 MHz.

(8) Adjust L7 for minimum and C21 for maximum as shown in Figure 1.8.

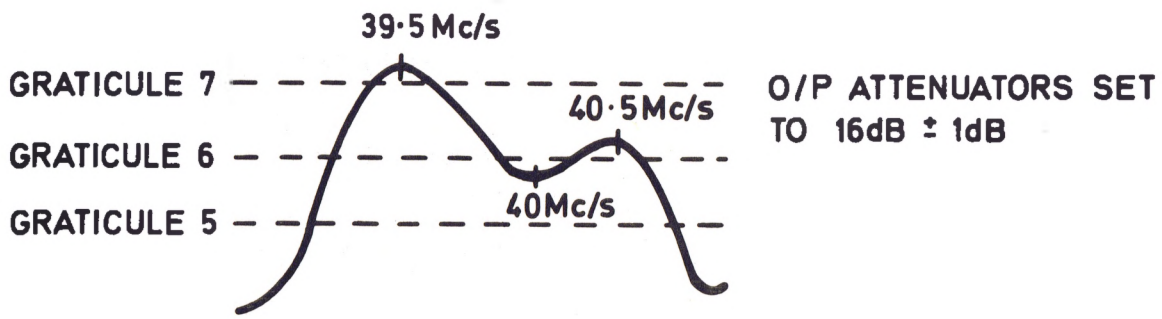


FIG. 1.8 40 MHZ FILTER RESPONSE (UNIT 2)

2-3 MHz Switch

78. Proceed as follows:

(1) Set the Synthesizer to 3.0000 MHz.

(2)

(a) Connect the Spectrum Analyser to output plug PLBC via the Step Attenuator CT421.

(b) Set the Step Attenuator to 40 dB.

(c) Apply -30 V to PLCB(F).

(d) Note the output level on the Spectrum Analyser.

(e) Remove the -30 V from PLCB(F) and check that the output level drops by at least 45 dB.

(f) Remove the test equipment.

(3)

(a) Connect the Multimeter CT471 to TP13 on the Frequency Multiplier (100 kHz) and note the reading.

(b) Terminate PLBP in 75 ohms and connect the Multimeter CT471 across the 75 ohm termination.

(c) Check that the multimeter reading is at least three times greater than that measured at TP13 in Step (2)(a).

(d) Remove the test equipment.

(4)

(a) Terminate PLBC in 75 ohms.

(b) Connect the Spectrum Analyser across PLBP and note the output level.

(c) Connect -30 V to PLCB(F) and check that the output level drops by at least 60 dB.

(d) Remove test equipment.

(5) Set the Synthesizer to 3.9999 MHz and repeat steps (2), (3) and (4).

OVERALL TEST

79. Proceed as follows:

(1) Check the oscillator frequencies as detailed in paragraph 74 Steps (4) and (5) and reset as necessary.

(2) Check that there is at least 100 mV at TP21 and 400 mV at TP22 for all operative positions of the decade switch.

(3) Check that the voltage at input plug PLCE is more than 500 mV.

(4) Check that the voltage at the wiper of RV1 is more than 400 mV.

(5) Connect the 1 MHz output from the Frequency Divider (unit 7) to the input plug PLCE and check that the level is greater than 300 mV.

(6) Connect an input of 2.5 MHz to input socket SKCF. Adjust the Signal Generator output level to 125 mV.

(7) Connect the Multimeter CT471 across the 75 ohm load at output plug PLBC. Check that there is 1 V ± 1 dB for all positions of the decade switch.

(8) Vary the input frequency at SKCF between 2 and 3 MHz. Check that there is an output of 1 V ± 3 dB for all operative positions of the decade switch.

SPURIOUS FREQUENCY TESTS

80. The main spurious components are f3 and fHG break-through which are always coincident; also 2f1 - f osc and f osc - 2 f out, where f1 and f3 are the actual frequencies passing through the 40 MHz and 37.5 MHz filters respectively. Proceed as follows:

(1) "2f1 - f osc" and "f osc - 2f out".

(a) Set the decade switch to position 20. Adjust the Signal Generator input frequency at input socket SKCF to 2.833 MHz at a level sufficient to give an output across the 75 ohm load at output plug PLBC of 860 mV.

(b) Connect the Spectrum Analyzer in place of the 75 ohm load at PLCB via the Step Attenuator CT421. Set the Attenuator to 60 dB. Obtain the wanted output trace at 20.166 MHz, adjusting the displayed signal to a convenient graticule.

(c) Reduce the attenuation by 60 dB. The spurious output will be seen within a few kHz of the wanted output. Adjust RV3, RV4 and C20 to minimize the spurious output, which should be lower than 70 dB with respect to the wanted output.

(2) f3 and fHG

(a) Set the decade switch to position 6. Adjust the Signal Generator input frequency at SKCF to 3 MHz and obtain the wanted output trace at 6 MHz. Set the Attenuator to 60 dB and the displayed signal to a convenient graticule.

(b) Reduce the attenuation by 60 dB. Set the decade switch to positions 5, 4 and 3 in turn and adjust RV1 and RV2 to minimize the spurious output, which should be lower than 70 dB with respect to the wanted output.

(c) Repeat Step (2)(b) for decade switch positions 27, 23 and 15; reduce the spurious output, if necessary, by adjusting the corresponding inductor on the Harmonic Generator Board to give increased inductance. This ensures that the voltage at TP20 does not fall below 300 mV, eg f out = 20.0 MHz f spurious = 23.0 MHz. Detune L157 by turning the core in a clockwise direction.

INTERMODULATION PRODUCTS

81. Proceed as follows:

(1) Connect the two Signal Generators CT452 via a hybrid unit (Figure 1.9) to input socket SKCF, at a frequency of 2.0 MHz. Switch off the carrier of one Signal Generator. Set the decade switch to its 0 position. Adjust the other Signal Generator output level to give a reading of 860 mV across the 75 ohm load at PLBC.

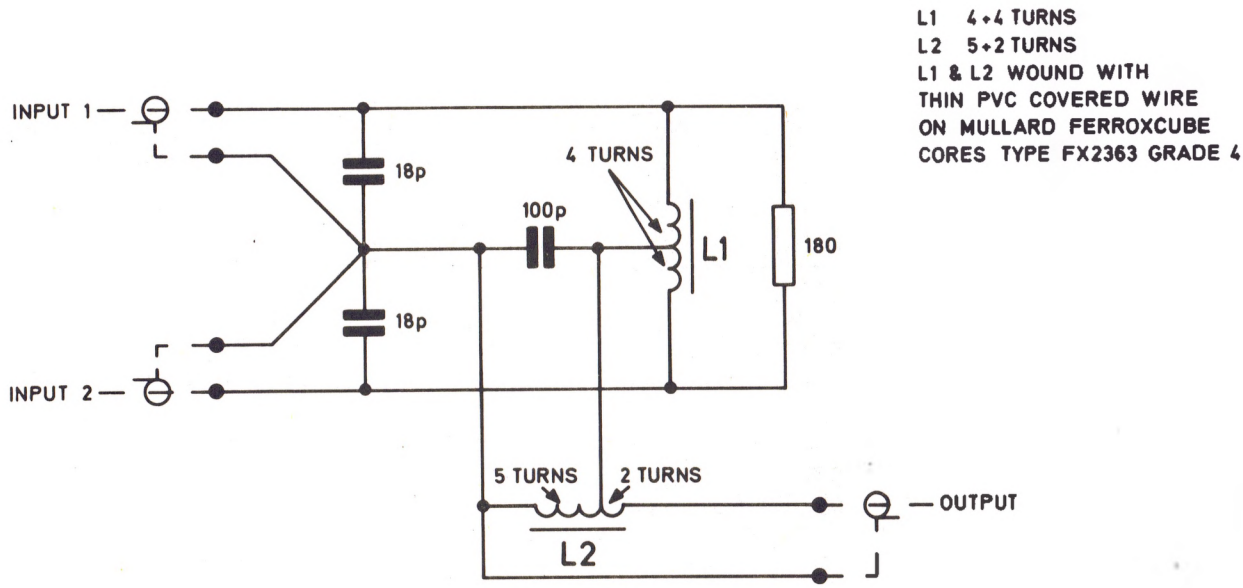


FIG. 1.9 HYBRID UNIT

(2) Connect the Spectrum Analyzer in place of the 75 ohm load via the Step Attenuator CT421 set to 56 dB. Obtain the wanted output at 0.9999 MHz and a adjust the displayed signal to a convenient graticule.

(3) Set the attenuator to 50 dB and switch on the carrier of the second Signal Generator. Adjust both displayed signals to the original graticules by means of the Signal Generator output level controls.

(4) Reduce the attenuation by a further 40 dB with respect to the original two tone levels. Repeat the above tests for frequencies of 27.5 and 26.9999 MHz.

NOTE It is advisable to keep 20 dB in the Spectrum Analyzer main R.F. Attenuator. Make all measurements on the 10 second timebase position.

(5) Disconnect all test equipment, ensure that all covers and screws are replaced.

FRAME AND POWER SUPPLY UNIT 1

Voltage Measurements

82. Use the Multimeter 8SX to measure the voltages at the points given in Table 1.31. Use the Oscilloscope to measure the ripple levels on full load. For the full load tests, connect load resistors as follows:

1 kilohm, 1 W between SKCA-3 and SKCA-6
1 kilohm, 1 W between SKCA-4 and SKCA-6
120 ohm, $\frac{1}{2}$ W between SKCH-1 and SKCH-4
160 ohm, 1 W between SKCH-2 and SKCH-4
100 ohm, 1 W between SKCU-1 and SKCU-4
160 ohm, 1 W between SKCU-2 and SKCU-4
6 ohm, 6 W between SKCU-3 and SKCU-4

TABLE 1.31 UNIT 1 VOLTAGE MEASUREMENTS

Circuit Test Point	No Load Voltage ± 10% V	Full Load Voltage V	Ripple Peak to Peak mV
Across C6	53	51 ± 5%	
Frame to TP1	-8.6	-7.8 to -9.0	Less than 1
Frame to TP2	+8.6	+7.8 to +9.0	Less than 1
SKCH-4 to SKCH-1	-8.6		
SKCH-4 to SKCH-2	+8.6		
SKCQ-4 to SKCQ-1	-8.6		
SKCQ-4 to SKCQ-2	+8.6		
SKCU-4 to SKCU-1	-8.6	-7.8 to -9.0	Less than 1
SKCU-4 to SKCU-2	+8.6	+7.8 to +9.0	Less than 1
SKCV-4 to SKCV-1	-8.6		
SKCV-4 to SKCV-2	+8.6		
SKCM-4 to SKCM-1	-8.6		
SKCM-4 to SKCM-2	+8.6		
SKCU-4 to SKCU-3	6.5 a.c.	6.3 a.c.	
SKCV-4 to SKCV-3	6.5 a.c.		
SKCA-6 to SKCA-1	-8.6		
SKCA-6 to SKCA-2	+8.6		
SKCA-6 to SKCA-3	-27	-24 to -30	
SKCA-6 to SKCA-4	+27	+24 to +30	

Potential Divider Network

83. The accuracy of the reference voltage employed for automatic tuning depends on the correct operation of the potential divider resistor network. In the event of a failure in this circuit repairs must be carried out with extreme care.

84. If automatic tuning is not functioning correctly due to a fault in the Frequency Synthesizer, check switches SWA, SWB, SWC for correct detent action. See that no switch contacts are bent, burnt or otherwise defective. No attempt should be made to repair damaged contacts or wafers. No form of abrasive cleaning should be employed.

85. Continuity checks may be made on the resistor network to ensure that no component is faulty. It is emphasized that individual resistances can measured accurately with a Multimeter 8SX because of their close toler

86. A suitable comparator test jig is shown in Figure 1.10. To use it proceed as follows:

(1) Connect 2PLCB to SKCB.

(2) Connect the Signal Generator CT452 (600 ohm output) to the TUNE SUPPLY terminals.

(3) Connect the Multimeter CT471 to the VALVE VOLTMETER terminals.

(4) Connect the 30 V power supply.

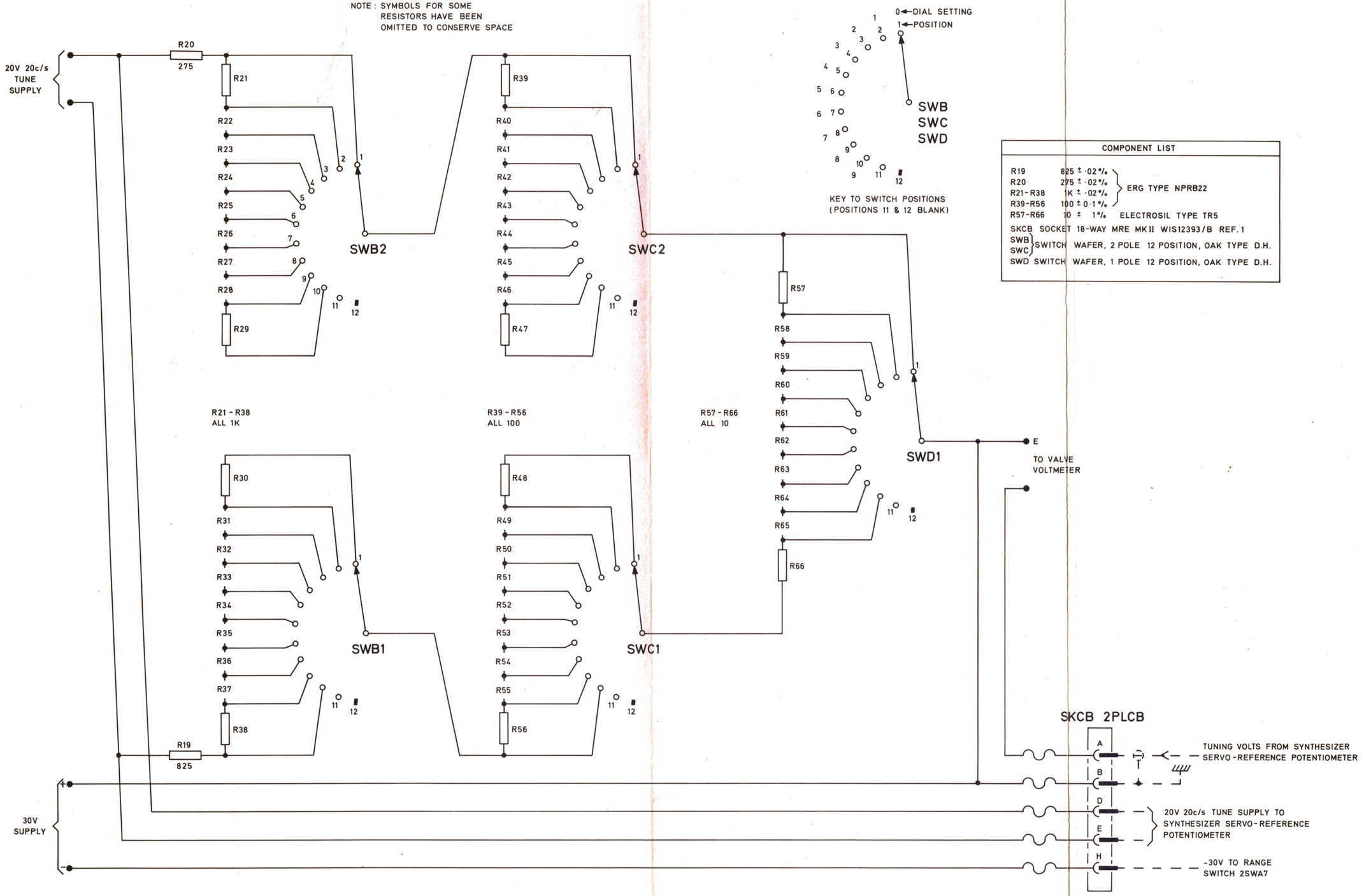
(5) Set the Signal Generator to give an output of 20 V at 20 Hz.

(6) Set the Synthesizer and the test jig to the settings shown in Table 1.32 and verify that the reading on the multimeter does not exceed the corresponding error voltage.

TABLE 1.32 AUTOMATIC TUNING COMPARATOR. MAXIMUM PERMITTED ERROR VOLTAGES

SYNTHESIZER DIAL SETTING	TEST JIG DIAL SETTING	MAX.ERROR mV	SYNTHESIZER DIAL SETTING	TEST JIG DIAL SETTING	MAX.ERROR mV
0.2450	002	30	1.800	800	40
0.3000	219	70			
0.4000	575	90	1.900	900	40
0.5000	918	80	2.0000	000	10
0.5220	995	50			
1.0000	000	15	3.0000	500	10
1.0010	001	15	4.0000	000	10
1.0020	002	15	5.0000	250	10
1.0030	003	15	6.0000	500	10
1.0040	004	15	7.0000	750	10
1.0050	005	15	8.0000	000	10
1.0060	006	15	9.0000	125	10
1.0070	007	15	10.0000	250	10
1.0080	008	15	11.0000	375	10
1.0090	009	15	12.0000	500	10
1.0100	010	10	13.0000	625	10
1.0200	020	20	14.0000	750	10
1.0300	030	20	15.0000	875	10
1.0400	040	30	16.0000	000	10
1.0500	050	30	17.0000	056	10
1.0600	060	30	18.0000	119	20
1.0700	070	40	19.0000	178	20
1.0800	080	50	20.0000	237	20
1.0900	090	50	21.0000	293	20
1.100	100	20	22.0000	353	20
1.200	200	30	23.0000	409	20
1.300	300	40	24.0000	465	20
1.400	400	50	25.0000	521	20
1.500	500	50	26.0000	577	20
1.600	600	50	27.0000	634	20
1.700	700	40	27.9999	693	20

B.R.4146 (5) C
Original



COMPONENT LIST		
R19	825 ± ·02%	ERG TYPE NPRB22
R20	275 ± ·02%	
R21-R38	1K ± ·02%	
R39-R56	100 ± 0·1%	
R57-R66	10 ± 1%	ELECTROSIL TYPE TR5
SKCB	SOCKET 18-WAY MRE MKII WIS12393/B REF.1	
SWB, SWC	SWITCH WAFER, 2 POLE 12 POSITION, OAK TYPE D.H.	
SWD	SWITCH WAFER, 1 POLE 12 POSITION, OAK TYPE D.H.	

AUTOMATIC-TUNING COMPARATOR TEST JIG

FIG. 1·10

PART 5D

REPAIR

FREQUENCY MULTIPLIER (MHz) - 5820-99-519-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± - %	Rating
SWA9	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWA10	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
TP1	5935-99-913-6813	Test Point			
TP2	913-6813	Test Point			
TP3	913-6813	Test Point			
TP4	913-6813	Test Point			
TP5	913-6813	Test Point			
TP6	913-6813	Test Point			
TP7	913-6813	Test Point			
TP8	913-6813	Test Point			
TP9	913-6813	Test Point			
TP10	913-6813	Test Point			
TP11	913-6813	Test Point			
TP12	913-6813	Test Point			
TP14	913-6813	Test Point			
TP15	913-6813	Test Point			
		TRANSISTORS			
VT1	5960-99-037-3135	CV7335			
VT2	037-3135	CV7335			
VT3	037-3135	CV7335			
VT4	197-3459	CV8333			
VT5	037-3135	CV7335			
VT6	037-3135	CV7335			
VT7	037-3135	CV7335			
VT8	037-3135	CV7335			
VT9	037-3135	CV7335			
VT10	037-3135	CV7335			
VT11	037-3135	CV7335			
VT12	037-3135	CV7335			
VT13	037-3135	CV7335			
VT14	037-3135	CV7335			
VT15		ZT2475			
VT16	037-3135	CV7335 * See Note 1			
VT17		BCY32			
VT18		Fairchild A1504			
TR1	Marconi M32-2672-01	Transformer			
TR2	Marconi M32-3882-01	Transformer			
TR3	Marconi M32-3882-01	Transformer			

* Note 1: Post Mod. Strike 4 units are fitted with 5961-99-038-0440 Transistor (BCY72) at circuit reference VT16 (Mod. Leaflet No. 30).

P A R T 5 D

R E P A I R

CONTENTS LIST

CHAPTER 1 DISMANTLING AND REASSEMBLY

CHAPTER 2 COIL DATA

FREQUENCY MULTIPLIER (MHz) - 5820-99-591-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS (Cont'd)	Ohms		Watts
	5905-99-				
R82	022-2004		1k	10	¼
R83	022-2004		1k	10	¼
R84	022-1109		100	10	¼
R85	523-8730	Wirewound Precision	100	0.1	
R86	523-8730	Wirewound Precision	100	0.1	
R87	523-8730	Wirewound Precision	100	0.1	
R88	523-8730	Wirewound Precision	100	0.1	
R89	523-8730	Wirewound Precision	100	0.1	
R90	523-8730	Wirewound Precision	100	0.1	
R91	523-8730	Wirewound Precision	100	0.1	
R92	523-8730	Wirewound Precision	100	0.1	
R93	523-8729	Wirewound Precision	95	0.1	
R94	523-8729	Wirewound Precision	95	0.1	
R95	523-8728	Wirewound Precision	90	0.1	
R96	523-8729	Wirewound Precision	95	0.1	
R97	523-8728	Wirewound Precision	90	0.1	
R98	523-8728	Wirewound Precision	90	0.1	
R99	523-8728	Wirewound Precision	90	0.1	
R100	523-8728	Wirewound Precision	90	0.1	
R101	523-8728	Wirewound Precision	90	0.1	
R102	523-8729	Wirewound Precision	95	0.1	
R103	523-8727	Wirewound Precision	625	0.1	
R104	523-8726	Wirewound Precision	66	0.1	
R105	523-8730	Wirewound Precision	100	0.1	
R106	523-8730	Wirewound Precision	100	0.1	
R107	523-8730	Wirewound Precision	100	0.1	
R108	523-8730	Wirewound Precision	100	0.1	
R109	523-8730	Wirewound Precision	100	0.1	
R110	523-8730	Wirewound Precision	100	0.1	
R111	523-8730	Wirewound Precision	100	0.1	
R112	523-8728	Wirewound Precision	90	0.1	
R113	523-8722	Wirewound Precision	44	0.1	
R114	523-8721	Wirewound Precision	22	0.1	
R115	013-5904	Wirewound Precision	18k	1	⅛
R117	523-8725	Wirewound Precision	416	0.1	
R118	523-8724	Wirewound Precision	204	0.1	
R119	523-8723	Wirewound Precision	101	0.1	
R120	013-5882	Metal Oxide	2.2k	1	⅛
R121	013-5898	Metal Oxide	10k	1	⅛
R122	013-5898	Metal Oxide	10k	1	⅛

CHAPTER 1

DISMANTLING AND REASSEMBLY

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Frequency Multipliers and Oscillator A.F.	4
2-3 MHz Switch-board	5
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Dial Lamps	8

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Frequency Multiplier (MHz) Inter-connections	1.3
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Frequency Multiplier (10 kHz) Plug and Sockets	1.5
Frequency Multiplier (1 kHz) Plug and Sockets	1.6
Oscillator A.F. Plug and Socket	1.7
Frequency Divider Plugs	1.8

FREQUENCY MULTIPLIER (MHz) - 5820-99-519-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS	Ohms		Watts
	5905-99-				
R1	022-2058		2.7k	10	¼
R2	022-1151		470	10	¼
R3	022-2004		1k	10	¼
R4	022-2088		2.2k	10	¼
R5	022-1016		18	10	¼
R6	022-2016		1.2k	10	¼
R7	022-2046		2.2k	10	¼
R8	022-2004		1k	10	¼
R9	022-1130		150	10	¼
R10	022-2046		2.2k	10	¼
R11	012-8556		68	10	¼
R12	022-2046		2.2k	10	¼
R13	022-1130		150	10	¼
R14	022-1151		220	10	¼
R15	022-1067		47	10	¼
R16	022-2088		4.7k	10	¼
R17	022-2046		2.2k	10	¼
R18	022-1025		22	10	¼
R19	022-2004		1k	10	¼
R20	022-1130		150	10	¼
R21	022-1130		150	10	¼
R22	022-1025		22	10	¼
R23	011-3247	Wirewound	470	5	1½
R24	011-3243	Wirewound	330	5	1½
R25	022-2130		10k	10	¼
R26	022-1151		220	10	¼
R27	022-1067		47	10	¼
R28	580-1965	Thermistor	92.5-134		
R29	580-1965	Thermistor	92.5-134		
R30	022-1046		33	10	¼
R31	022-1151		220	10	¼
R32	022-2079		3.9k	10	¼
R33	022-2004		1k	10	¼
R34	022-1184		390	10	¼
R35	022-1046		33	10	¼
R36	022-2088		4.7k	10	¼
R37	022-2004		1k	10	¼
R38	022-1151		220	10	¼
R39	022-1001		10	10	¼
R40	022-1109		100	10	¼

CHAPTER 1

DISMANTLING AND REASSEMBLY

DISMANTLING

1. To open the drawer release four captive screws and pull it out until the automatic catches engage. To close the drawer release the catches by thumb pressure.

2. To remove the complete Synthesizer from the cabinet proceed as follows:-

(1) Switch OFF the mains supply from the associated Receiver or Modulator-Tuning Unit.

(2) Disconnect SKBB from the Power Supply at the rear right-hand side of the Synthesizer.

(3) Disconnect the plugs and sockets listed in Table 1.1 and pass them through the cut-out position at the rear of the chassis.

Table 1.1 Synthesizer Plugs and Sockets

Identity	Location
SKBD) SKBE) SKBF) SKBG)	Right front of chassis
SKCZ) SKBP) SKBQ) SKBR) PLCB)	Rear of Frequency Multiplier (MHz)
SKBC	Top rear of Multiplier (MHz)

(4) Remove the three screws securing each runner plate to the side of the chassis.

NOTE The Frequency Synthesizer weighs 60 lb and two people are needed to lift it out.

(5) Remove the chassis from the runner plates by placing one hand through the open front of the cabinet and under the rear of the chassis, and the other hand under the front of the chassis.

(6) Lift the chassis approximately 2 inches and swing it forward and clear of the runner plates.

(7) To replace reverse the procedure.

FREQUENCY MULTIPLIER (MHz) - 5820-99-591-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		INDUCTORS (Cont'd)			
	5950-99-				
L124	924-4972	Inductor A.F.			
L125	924-4973	Inductor A.F.			
L126	924-4973	Inductor A.F.			
L127	924-4974	Inductor A.F.			
L128	924-4974	Inductor A.F.			
L129	924-4975	Inductor A.F.			
L130	924-4976	Inductor A.F.			
L131	924-4976	Inductor A.F.			
L132	924-4976	Inductor A.F.			
L133	924-4976	Inductor A.F.			
L134	924-4977	Inductor A.F.			
L135	924-4977	Inductor A.F.			
L136	924-4978	Inductor A.F.			
L137	924-4983	Inductor A.F.			
L138	924-4979	Inductor A.F.			
L139	924-4979	Inductor A.F.			
L140	924-4979	Inductor A.F.			
L141	924-4979	Inductor A.F.			
L142	924-4979	Inductor A.F.			
L143	924-4979	Inductor A.F.			
L144	924-4979	Inductor A.F.			
L145	924-4980	Inductor A.F.			
L146	924-4980	Inductor A.F.			
L147	924-4982	Inductor A.F.			
L150	Marconi W.99114 Sh.1 Ed.AA				
L151	Marconi W.99114 Sh.1 Ed.AA				
L152	Marconi W.99114 Sh.1 Ed.AA				
L153	Marconi W.99114 Sh.1 Ed.AA				
L154	Marconi W.99114 Sh.1 Ed.AA				
L155	Marconi W.99114 Sh.1 Ed.AA				
L156	Marconi W.99114 Sh.1 Ed.AA				
L157	Marconi W.99114 Sh.1 Ed.AA				
L158	Marconi W.99114 Sh.1 Ed.AA				
L159	Marconi W.99114 Sh.1 Ed.AC				
L160	Marconi W.99114 Sh.1 Ed.AC				
L161	Marconi W.99114 Sh.1 Ed.AC				
L162	Marconi W.99114 Sh.1 Ed.AC				
L163	Marconi W.99114 Sh.1 Ed.AC				
L164	Marconi W.99114 Sh.1 Ed.AA				
L165	Marconi W.99114 Sh.1 Ed.AA				

Table 1.4 Frequency Multiplier (100 kHz) Plugs and Sockets

Identity	Location	Remarks
PLCK	Top of Frequency Divider	
SKCH) SKBX)	Rear of Frequency Multiplier (100 kHz)	Fits on to PLCF
SKCL	Rear of Frequency Multiplier (10 kHz)	

Table 1.5 Frequency Multiplier (10 kHz) Plug and Sockets

Identity	Location
SKCM) SKCL)	Rear of Frequency Multiplier (10 kHz)
PLCP	Top of Frequency Divider

Table 1.6 Frequency Multiplier (1 kHz) Plug and Sockets

Identity	Location
SKCQ) SKCN)	Rear of Frequency Multiplier (1 kHz)
PLCT	Top of Frequency Divider

Table 1.7 Oscillator A.F. Plug and Socket

Identity	Location
SKCR) PLCW)	Top of Oscillator A.F.

(4) Remove the four screws and crinkle washers securing the unit then lift and slide it out, releasing the shaft and coupling at the same time.

(5) To replace reverse the procedure. For new type coupling set switch shafts as described and replace the centre section before fixing the units in the frame.

2-3 MHz Switch-board

5. The 2-3 MHz Switch-board is mounted on the rear of the Frequency Multiplier (MHz) Unit 2. To remove it proceed as follows:-

(1) Remove Unit 2 as in Paragraph 4.

FREQUENCY MULTIPLIER (MHz) - 5820-99-591-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		INDUCTORS (Cont'd)	uH		
L20	Marconi W.99114 Sh.1 Ed.P		1.15		
L21	Marconi W.99114 Sh.1 Ed.O		1.25		
L22	Marconi W.99114 Sh.1 Ed.N		1.37		
L23	Marconi W.99114 Sh.1 Ed.M		1.51		
L24	Marconi W.99114 Sh.1 Ed.L		1.67		
L25	Marconi W.99114 Sh.1 Ed.K		1.85		
L26	Marconi W.99114 Sh.1 Ed.J		2.07		
L27	Marconi W.99114 Sh.1 Ed.H		2.32		
L28	Marconi W.99114 Sh.1 Ed.G		2.63		
L29	Marconi W.99114 Sh.1 Ed.F		3.0		
L30	Marconi W.99114 Sh.1 Ed.E		3.45		
L31	Marconi M32-2365-01				
L32	5950-99-580-7161		1.3		
L33	Marconi W.99114 Sh.1 Ed.D		4.05		
L34	Marconi W.99114 Sh.1 Ed.C		4.8		
L35	Marconi W.99114 Sh.1 Ed.B		5.75		
L36	Marconi W.99114 Sh.1 Ed.A		7.0		
L37	Marconi W.99115 Sh.1 Ed.H		8.75		
L38	Marconi W.99115 Sh.1 Ed.G		11.2		
L39	Marconi W.99115 Sh.1 Ed.F		15		
L40	Marconi W.99115 Sh.1 Ed.E		21		
L41	Marconi W.99115 Sh.1 Ed.D		31		
L42	Marconi W.99115 Sh.1 Ed.C		51		
L43	Marconi W.99115 Sh.1 Ed.B		101		
L44	Marconi W.99115 Sh.1 Ed.A		282		
L51	5950-99-519-3880				
L55	5950-99-580-7161		1.3		
L56	5950-99-580-7173		0.18		
L57	5950-99-580-7173		0.18		
L58	5950-99-580-7173		0.18		
L59	Marconi W.73984-C Sh.24		0.6		
L60	5950-99-580-7161		1.3		
L61	5950-99-580-7171		0.18		
L62	5950-99-580-7171		0.18		
L63	5950-99-580-7171		0.18		
L64	5950-99-580-7171		0.18		
L65	5950-99-580-7171		0.18		
L66	5950-99-580-7171		0.18		
L67	5950-99-580-7171		0.18		
L71	5950-99-580-7175		200		

(5) Unsolder the connections and links from the selected wafer.

(6) To reassemble reverse the procedure.

Dial Lamps

8. To renew a dial lamp remove the Frequency Divider as in Paragraph 6 and then unscrew the lamp from the holder on the back of the front panel.

FREQUENCY MULTIPLIER (MHz) - 5820-99-519-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS (Cont'd)	/uF		Volts
	5910-99-				
C121	580-0306	Polystyrene	0.0011	2	125
C122	944-6750	Polystyrene	0.0012	2	125
C123	580-0301	Polystyrene	0.0016	2	125
C124	999-5927	Polystyrene	0.0022	2	125
C125	519-3896	Polystyrene	510p	2	125
C126	580-0278	Polystyrene	750p	2	125
C127	944-6750	Polystyrene	0.0012	2	125
C128	954-7670	Polystyrene	0.0021	2	125
C129	580-7201	Polystyrene	18p	1	125
C131	011-8342	Ceramic	3.3p	½pF	750
C136	519-8912	Polystyrene	5p	1pF	125
C139	580-7475	Polystyrene	7p	1pF	125
C143	945-1531	Polystyrene	10p	1pF	125
C146	580-7474	Polystyrene	12p	1pF	125
C149	580-0284	Polystyrene	15p	1pF	125
C152	580-7201	Polystyrene	18p	1pF	125
C154	580-0285	Polystyrene	20p	2pF	125
C155	945-1534	Polystyrene	22p	2pF	125
C157	519-3889	Polystyrene	24p	2pF	125
C161	944-6750	Polystyrene	0.0012	2	125
C162	940-8022	Ceramic	0.0015	+80 -20	500
C163	944-6750	Polystyrene	0.0012	2	125
C164	944-6750	Polystyrene	0.0012	2	125
C165	945-1531	Polystyrene	10p	1pF	125
C166	944-6750	Polystyrene	0.0012	2	125
C176	519-8912	Polystyrene	5p	1pF	125
C179	580-7475	Polystyrene	7	1pF	125
C183	945-1531	Polystyrene	10p	1pF	125
C186	580-7474	Polystyrene	12p	1pF	125
C189	580-0284	Polystyrene	15p	1pF	125
C192	580-7201	Polystyrene	18p	1pF	125
C194	580-0285	Polystyrene	20p	2pF	125
C195	945-1534	Polystyrene	22p	2pF	125
C197	519-3889	Polystyrene	24p	2pF	125
C198	011-8269	Ceramic	1.5p	½pF	750
C199	901-8873	Polystyrene	22p	5pF	350
C200	580-7489	Ceramic	0.0047	+80 -20	500
C201	940-8022	Ceramic	0.0015	+80 -20	500
C202	944-6750	Polystyrene	0.0012	2	125
C203	580-7489	Ceramic	0.0047	+80 -20	500

CHAPTER 2

COIL DATA

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FREQUENCY MULTIPLIER (MHz) - 5820-99-591-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS (Cont'd)	/uF		Volts
	5910-99-				
C41	945-6625	Polystyrene	470p	2	125
C42	999-4135	Metal Film	0.1	20	250
C43	580-7492	Electrolytic	500	+100 -20	25
C44	580-7494	Electrolytic	100	+100 -20	25
C45	940-8022	Ceramic	0.0015	+80 -20	500
C46	012-4909	Electrolytic	100	+100 -20	50
C47	999-4135	Metal Film	0.1	20	250
C48	945-1537	Polystyrene	47p	2pF	125
C49	945-1535	Polystyrene	33p	2pF	125
C50	940-8022	Ceramic	0.0015	+80 -20	500
C51	940-8022	Ceramic	0.0015	+80 -20	500
C52	940-8022	Ceramic	0.0015	+80 -20	500
C53	946-2785	Polystyrene	82p	2pF	125
C54	011-7006	Variable	3-30p		
C56	940-8022	Ceramic	0.0015	+80 -20	500
C57	946-2785	Polystyrene	82p	2pF	125
C58	945-6655	Polystyrene	470p	2	125
C59	011-8340	Ceramic	2.2p	½pF	750
C60	913-6616	Polystyrene	100p	2pF	125
C61	940-8022	Ceramic	0.0015	+80 -20	500
C62	946-2785	Polystyrene	82p	2pF	125
C63	940-8022	Ceramic	0.0015	+100 -20	500
C64	999-4135	Metal Film	0.1	20	250
C65	011-7006	Variable	3-30p		
C66	946-2785	Polystyrene	82p	2pF	125
C67	945-6655	Polystyrene	470p	2	125
C68	011-8340	Ceramic	2.2p	½pF	750
C69	940-8022	Ceramic	0.0015	+80 -20	500
C71	011-8340	Ceramic	2.2p	½pF	750
C72	946-2785	Polystyrene	82p	2pF	125
C73	946-2785	Polystyrene	82p	2pF	125
C74	940-8022	Ceramic	0.0015	+100 -20	500
C76	946-2785	Polystyrene	82p	2pF	125
C77	945-6655	Polystyrene	470p	2	125
C78	011-8342	Ceramic	3.3p	½pF	750

CHAPTER 2

COIL DATA

INTRODUCTION

1. Winding information on the coils used in the Synthesizer is given in Tables 2.1 to 2.6, the following code being used in the column indicating the Type or SWG of wire:-

A	=	Bunched conductor 30/48
B	=	Litz 9/46
C	=	Bunched conductor 7/46
D	=	Litz 81/48
E	=	Bunched conductor 5/46
F	=	Bunched conductor 3/46

2. It is emphasised that most coils are impregnated with a sealing material which cannot be removed and attempts to open them up may result in irreparable damage.

Table 2.1 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L11, L12	1 winding		3.5 mH ± 5%	42	1760	W56565-C-4 Iss. 3 5950-99-580-7143
L13	Winding					W96071-1
	(a) Pin 1 Red Pin 3 Blue	>190	5.75 +0.55 −0.15) uH	38	$158\frac{3}{4}$	Iss. 7 5950-99-580-7176
	(b) Pin 4 Green Pin 6 Yellow		580 uH ± 10%	38	$49\frac{3}{4}$	
L14, L15	Winding					W96074-1
	Pin 1 Red Pin 5 Blue	>100	Pins 1-5 25+2-1 mH	38	$332\frac{1}{4}$	Iss. 5 5950-99-580-7168
	Tap Pin 2 Green		Pins 2-5 23 mH ± 5%		$14\frac{3}{4}$	
	Tap Pin 3 Orange		Pins 3-5 17.2 mH ± 5%		$56\frac{1}{2}$	
L16	Winding Pin 1 Red Pin 3 Blue	>14	150 mH ± 5%	42	$667\frac{1}{2}$	W96072-1 Iss. 3 5950-99-580-7137
L17	Winding					W96078-1
	(a) Pin 6 Yellow Pin 4 Green		7.6 mH ± 10%	42	$155\frac{3}{4}$	Iss. 4 5950-99-580-7141
	(b) Pin 1 Red Pin 3 Blue	>75	66 ± 3 mH	42	$472\frac{3}{4}$	
L18	Winding					W96080-1
	(a) Pin 1 Red Pin 3 Blue	>70	155 +1 −5) mH	42	$567\frac{3}{4}$	Iss. 5 5950-99-580-7139
	(b) Pin 4 Orange Pin 5 Yellow		18 mH ± 10%	42	$191\frac{3}{4}$	

FREQUENCY MULTIPLIER (100 kHz) - 5820-99-580-8260

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5905-99-	RESISTORS (Cont'd)	Ohms		Watts
R20	022-2004		1k	10	¼
R21	022-1151		220	10	¼
R22	022-2004		1k	10	¼
R23	022-2214		47k	10	¼
R24	022-2004		1k	10	¼
R26	022-2004		1k	10	¼
R27	022-2088		4.7k	10	¼
R28	022-2046		2.2k	10	¼
R29	022-2214		47k	10	¼
R31	022-2004		1k	10	¼
R32	022-2004		1k	10	¼
R33	022-2088		4.7k	10	¼
R34	022-2046		2.2k	10	¼
R44	022-2046		2.2k	10	¼
R45	022-1151		220	10	¼
R46	022-1151		220	10	¼
R47	022-2004		1k	10	¼
R48	022-2046		2.2k	10	¼
R49	022-2046		2.2k	10	¼
R50	022-2109		6.8k	10	¼
R51	022-2004		1k	10	¼
R52	022-2004		1k	10	¼
R53	022-2130		10k	10	¼
R54	022-2046		2.2k	10	¼
R55	022-2004		1k	10	¼
R56	022-2088		4.7k	10	¼
R61	022-2172		22k	10	¼
R62	022-2088		4.7k	10	¼
R63	022-2109		6.8k	10	¼
R64	022-2004		1k	10	¼
R65	022-1088		68	10	¼
R66	022-2130		10k	10	¼
R67	022-2088		4.7k	10	¼
R68	022-2121		8.2k	10	¼
R70	022-2004		1k	10	¼
R71	022-2088		4.7k	10	¼
R72	022-2172		22k	10	¼
R73	022-2004		1k	10	¼
R74	022-1001		10	10	¼

Table 2.2

Oscillator A.F. Coil Data

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L1	Winding Pin 4 Red Pin 6 Blue		>1 H	40	665	M32-2299-01 Iss. 2
L2	Winding Pin 1 Red Pin 3 Blue		735+1 -1.5 mH	38	455	M32-2300-01 Iss. 4
L3, L4	Winding Pin 2 Green Tap Pin 1 Blue Pin 3 Red	50	640 ± 20 mH	38	1112 Tap 142	M32-2301-01 Iss. 2

FREQUENCY MULTIPLIER (100 kHz) - 5820-99-580-8260

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5950-99-				
L1	580-6952	Transformer R.F.	780uH		
L2	580-6962	Transformer R.F.	14uH		
L3	580-6942	Inductor R.F.	14uH		
L4	580-6949	Transformer R.F.	14uH		
L5	580-7164	Inductor R.F.	600uH		
L6	580-6953	Transformer R.F.	14uH		
L7	580-6942	Inductor R.F.	14uH		
L8	580-6962	Transformer R.F.	14uH		
L11	580-6961	Transformer R.F.	130uH		
L13	580-6946	Inductor R.F.	30uH		
L14	580-6946	Inductor R.F.	30uH		
L15	580-6954	Inductor R.F.	9.5uH		
L16	580-7164	Inductor R.F.	600uH		
L17	580-6948	Inductor R.F.	35uH		
L18	580-7163	Inductor R.F.	3uH		
L20	580-7164	Inductor R.F.	600uH		
L21	580-6960	Transformer R.F.	16uH		
L22	580-6963	Transformer R.F.	16uH		
L23	580-6963	Transformer R.F.	16uH		
L25	580-6963	Transformer R.F.	16uH		
L26	580-6958	Transformer R.F.	16uH		
L27	580-6958	Transformer R.F.	16uH		
L28	580-6953	Transformer R.F.	16uH		
L29	580-6959	Transformer R.F.	14.5uH		
L31	580-6947	Inductor R.F.	2.5uH		
L32	580-6947	Inductor R.F.	2.5uH		
L33	580-6947	Inductor R.F.	2.5uH		
L34	580-6947	Inductor R.F.	2.5uH		
L35	580-6951	Transformer R.F.	8.2uH		
L36	580-6933	Inductor R.F.	10.8uH		
L38	580-7179	Inductor R.F.	6.5uH		
L39	580-6844	Transformer R.F.	2.5mH		
L40	580-7164	Inductor R.F.	600uH		
L41	580-6943	Inductor R.F.	22uH		
L42	580-6943	Inductor R.F.	22uH		
L43	580-6944	Inductor R.F.	60uH		
L44	580-6941	Inductor R.F.	70uH		
L45	580-7140	Inductor R.F.	39uH		
L46	580-6946	Inductor R.F.	30uH		
L47	580-7166	Inductor R.F.	70uH		

Table 2.3 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L11	Winding (a) Pin 4 Yellow Pin 6 Red (b) Pin 1 Green Tap Pin 2 Orange Pin 3 Pink		(a) 2450/uH Pins 1-3 21 500/uH Pins 1-2 6950/uH Pins 2-3 6950/uH	46 44	600 600 Tap 300	W94367-1 Iss. 5 5950-99-580-7293
L13, L14, L17	Winding Pin 3 Yellow Pin 1 Red	>40	7100 +200 -300/uH	38	327	W94370-1 Iss. 6 5950-99-580-7153
L15	Winding Pin 1 Red Pin 3 Yellow	>70	2300 +200 -100/uH	36	187	W94365-1 Iss. 5 5950-99-580-6822
L20, L49, L50	1 winding		3.5 mH ± 5%	42	1760	W56565-C-4 Iss. 3 5950-99-580-7143
L21, L38	Winding (a) Pin 6 Red Tap Pin 2 Pink Pin 1 Blue (b) Pin 4 Green (Earth) Pin 5 Yellow	>200	Pins 1-6 3.7 ± 0.15 mH Pins 2-1 2.56 mH ± 1% Pins 4-5 50/uH ± 10% Pins 5-6 4.4 mH	36 40	129 Tap 22 11	M32-2351-01 Iss. 4
L22	Winding Pin 1 Red Tap Pin 2 Pink Pin 6 Blue Pin 3 (Earth)	>200	Pins 1-6 3.7 ± 0.15 mH Pins 2-6 3.6 mH ± 1%	34	129 Tap 2	M32-2352-01 Iss. 3

FREQUENCY MULTIPLIER (100 kHz) - 5920-99-580-8260

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS (Cont'd)	µF		Volts
	5910-99-				
C52	972-7831	Polystyrene	100p	2pF	125
C53	012-0113	Paper Metallised	0.01	20	250
C54	011-8272	Ceramic	3.3p	½pF	750
C56	972-7831	Polystyrene	100p	2pF	125
C57	011-8269	Ceramic	1.5p	½pF	750
C58	972-7831	Polystyrene	100p	2pF	125
C59	011-8272	Ceramic	3.3p	½pF	750
C61	972-7831	Polystyrene	100p	2pF	125
C63	016-0040	Variable	1.5-10p		250
C64	012-0113	Paper Metallised	0.01	20	250
C66	012-0113	Paper Metallised	0.01	20	250
C67	945-1545	Polystyrene	120p	2pF	125
C68	012-0113	Paper Metallised	0.01	20	250
C70	012-0113	Paper Metallised	0.01	20	250
C71	972-7836	Polystyrene	680p	2	125
C72	915-0862	Polystyrene	330p	2	125
C73	012-0113	Paper Metallised	0.01	20	250
C74	945-8379	Polystyrene	180p	2	125
C76	945-1535	Polystyrene	33p	2pF	125
C77	945-1535	Polystyrene	33p	2pF	125
C78	972-7832	Polystyrene	220p	2	125
C79	972-7832	Polystyrene	220p	2	125
C81	012-0113	Paper Metallised	0.01	20	250
C82	012-0113	Paper Metallised	0.01	20	250
C83	972-7830	Polystyrene	68p	2pF	125
C84	580-7201	Polystyrene	18p	2pF	125
C86	972-7830	Polystyrene	68p	2pF	125
C87	012-0113	Paper Metallised	0.01	20	250
C89	012-0113	Paper Metallised	0.01	20	250
C91	012-0113	Paper Metallised	0.01	20	250
C92	011-8274	Ceramic	4.7p	½pF	750
C93	012-0113	Paper Metallised	0.01	20	250
C94	012-0116	Paper Metallised	0.04	20	250
C95	012-0116	Paper Metallised	0.04	20	250
C96	911-6683	Ceramic	0.001	+80 -20	500
C97	012-0113	Paper Metallised	0.01	20	250
C98	012-0113	Paper Metallised	0.01	20	250
C99	012-0113	Paper Metallised			
C101	972-7767	Ceramic	22p	½pF	750
C102	013-2287	Ceramic	47p	1	750

Table 2.3 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L43	Winding Pin 1 Brown Pin 3 Pink	>45	6000 $^{+500}_{-1200}$/uH	42	900	W94371-B-1 Iss. 3 5950-99-580-7152
L44	Winding Pin 3 Yellow Pin 1 Red	>70	6900 $^{+200}_{-500}$/uH	38	321	W94369-1 Iss. 4 5950-99-580-6819
L45	Winding Pin 1 Brown Pin 3 Pink	>500	3900 $^{+600}_{-800}$/uH	42	750	W941372-B-1 Iss. 5 5950-99-580-7165
L46	Winding Pin 1 Red Pin 3 Yellow	>65	3000 $\pm$ 200/uH	36	214	W94366-1 Iss. 4 5950-99-580-6821
L48	Winding (a) Pin 1 Red Tap Pin 2 Pink Pin 6 Blue (b) Pin 4 Green Pin 3 Yellow	>150	Pins 1-6 57 $\pm$ 2.5 mH Pins 3-4 59 mH $\pm$ 1% Pins 1-3 230 mH appx. Pins 2-6 15 mH appx. Pins 1-2 15 mH appx.	42 46	506 Tap 253 506	M32-2362-01 Iss. 4

Table 2.4 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L11	Winding (a) Pin 1 Green Tap Pin 2 Yellow Pin 3 Red (b) Pin 4 Green Pin 6 Red	>50	Pins 1-3 250 $^{+25}_{-10}$/uH Pins 2-3 81/uH) Pins 4-6 140/uH) ± 5%	36 36	72 Tap 36 50	W95305-1 Iss. 5 5950-99-580-6838
L12	Winding (a) Pin 1 Green Tap Pin 2 Blue Pin 3 Red (b) Pin 4 Green Tap Pin 5 Yellow Pin 6 Red	>130	Pins 1-3 150 $^{+5}_{-10}$/uH Pins 1-2 20.4/uH) Pins 4-6 18.2/uH) Pins 4-5 4.7/uH) ± 5% Pins 5-6 4.7/uH)	A 34	52 Tap 18 16 Tap 8	W95305-1 Iss. 5 5950-99-580-6838
L13	Winding Pin 1 Green Tap Pin 2 Blue Pin 3 Red	>180	Pins 1-3 150 $^{+5}_{-10}$/uH Pins 1-2 44/uH ± 5%	A	55	W95307-1 Iss. 4 5950-99-580-6842
L14	Winding (a) Pin 1 Green Pin 3 Red (b) Pin 4 Green Tap Pin 5 Blue Pin 6 Red	>130	(a) 150 $^{+5}_{-10}$/uH Pins 4-5 & 5-6 3.5/uH ± 10%	A 34	52 14 Tap 7	W95308-1 Iss. 6 5950-99-580-6843

FREQUENCY MULTIPLIER (10 kHz) - 5820-99-580-8261

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5905-99-	RESISTORS	Ohms		Watts
R56	022-2046		2.2 k	10	¼
R57	022-1151		220	10	¼
R58	022-1226		820	10	¼
R59	022-2088		4.7 k	10	¼
R61	022-2004		1 k	10	¼
R62	022-2088		4.7 k	10	¼
R63	022-2088		4.7 k	10	¼
R64	022-2067		3.3 k	10	¼
R66	022-2172		22 k	10	¼
R67	022-2109		6.8 k	10	¼
R68	022-2088		4.7 k	10	¼
R69	022-2004		1 k	10	¼
R71	022-2004		1 k	10	¼
R72	022-2088		4.7 k	10	¼
R73	022-2088		4.7 k	10	¼
R74	022-2214		47 k	10	¼
R76	022-2088		4.7 k	10	¼
R77	022-2172		22 k	10	¼
R78	022-2004		1 k	10	¼
R79	022-2004		1 k	10	¼
R81	022-1214		680	10	¼
RV1	011-8259	Resistor Variable	1 k	20	¼
RV2	011-8259	Resistor Variable	1 k	20	¼
RV3	011-8259	Resistor Variable	1 k	20	¼
RV4	011-8259	Resistor Variable	1 k	20	¼
RV5	011-8259	Resistor Variable	1 k	20	¼
RV6	011-8259	Resistor Variable	1 k	20	¼
RV7	011-8259	Resistor Variable	1 k	20	¼
RV8	011-8259	Resistor Variable	1 k	20	¼
RV9	911-4960	Resistor Variable Wirewound	250	10	½
SKCN	5935-99-580-6609	Socket			
SWA	5930-99-580-6076	Switch Rotary Wafer			
	5935-99-				
TP1	913-6813	Test Point			
TP2	913-6813	Test Point			
TP3	913-6813	Test Point			
TP4	913-6813	Test Point			
TP5	913-6813	Test Point			
TP6	913-6813	Test Point			
TP7	913-6813	Test Point			
TP8	913-6813	Test Point			
TP9	913-6813	Test Point			
TP10	913-6813	Test Point			

Table 2.4 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L26, L28	Winding Pin 1 Green Tap Pin 2 Yellow Pin 3 Red	>220	Pins 1-3 240 $^{+15}_{-10}$ Pins 1-2 8.2 ± 10%	A	$70\frac{1}{2}$ Tap $11\frac{1}{4}$	W95311-1 Iss. 4 5950-99-580-6825
L27	Winding Pin 3 Green Tap Pin 2 Yellow Pin 1 Red	>200	Pins 1-3 240 $^{+15}_{-10}$ Pins 2-3 1.4 ± 10%	A	$70\frac{1}{2}$ Tap $4\frac{1}{4}$	W95312-1 Iss. 5 5950-99-580-6826
L28	Winding (a) Pin 1 Green Tap Pin 2 Yellow Pin 3 Red (b) Pin 6 Green Tap Pin 5 Blue Pin 4 Red	>150	Pins 1-3 236 $^{+14}_{-11}$ Pins 1-2 3.3 ± 5% Pins 4-6 2.8) ± 10% Pins 4-5 0.75) ± 10%	B 36	66 Tap 7 6 Tap 3	W95301-1 Iss. 5 5950-99-580-6840
L31, L32, L33, L34	Winding Pin 3 Pink Pin 1 Brown Tap Pin 2 Pink	100	60 $^{+10}_{-15}$	A	90 Tap 45	W98272-B-1 Iss. 5 5950-99-580-6937
L38	Winding Pin 3 Red Tap Pin 4 Yellow Pin 1 Green	>210	Pins 1-3 218 $^{+12}_{-18}$ Pins 3-4 172 +4%	A	66 Tap $7\frac{1}{2}$	W92273-1 Iss. 4 5950-99-580-6936
L39	Winding Pin 1 Red Tap Pin 5 Green Pin 3 Blue	>80	Pins 1-3 25 ± 1.5 23 mH ± 5%	38	$332\frac{1}{2}$ Tap $13\frac{3}{4}$	W96069-1 Iss. 6 5950-99-580-6839

FREQUENCY MULTIPLIER (10kHz) - 5820-99-580-8261

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5950-99-	INDUCTANCES			
L32	580-6937	Inductor R.F.	62 uH		
L33	580-6937	Inductor R.F.	62 uH		
L34	580-6937	Inductor R.F.	62 uH		
L37	971-8857	Inductor R.F.	11.5 mH		
L38	580-6936	Inductor R.F.	218 uH		
L39	580-6839	Transformer A.F.	25 mH		
L40	580-7143	Inductor A.F.	35 mH		
L41	580-6935	Inductor R.F.	182 uH		
L42	580-6935	Inductor R.F.	132 uH		
L43	580-7145	Inductor R.F.	1.15 mH		
L44	580-7156	Inductor R.F.	145 uH		
L45	580-7156	Inductor R.F.	145 uH		
L48	580-6828	Transformer R.F.	3.0 mH		
L49	971-8857	Inductor R.F.	11.5 mH		
L50	971-8857	Inductor R.F.	11.5 mH		
		RECTIFIERS			
MR1	5960-99-000-0478	CV478			
MR2	5960-99-000-0478	CV478			
MR3	5960-99-000-0478	CV478			
MR4	5960-99-000-0478	CV478			
MR6	5960-99-037-2373	CV7130			
MR7	5960-99-037-2373	CV7130			
MR8	5960-99-037-2373	CV7130			
MR9	5960-99-037-2373	CV7130			
MR11	5960-99-000-0478	CV478			
MR12	5960-99-000-0478	CV478			
MR13	5960-99-000-0478	CV478			
MR14	5960-99-000-0478	CV478			
MR15	5960-99-037-2373	CV7130			
MR16	5960-99-037-2373	CV7130			
MR17	5960-99-037-2373	CV7130			
MR18	5960-99-037-2373	CV7130			
MR19	5960-99-037-2373	CV7130			
PLCL	5935-99-054-0201	Plug			
PLCM	5935-99-580-2867	Plug			
PLCP	5935-99-932-5838	Plug			
PLCZ	5935-99-054-0201	Plug			
	5905-99-	RESISTORS	Ohms		Watts
R1	022-2214		47 k	10	¼
R2	022-3058		150 k	10	¼
R3	022-3079		220 k	10	¼
R4	022-2172		22 k	10	¼
R5	022-1025		22	10	¼

Table 2.5

Frequency Multiplier (100 kHz) Coil Data

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L1	Winding (a) Pin 3 Red Pin 1 Blue	>60	Pins 1-3 780 $^{+20}_{-90}$	40	112	W92301-1 Iss. 5
	(b) Pin 4 Yellow Tap Pin 5 Orange Pin 6 Green		Pins 4-6 348) Pins 4-5 116) ± 5% Pins 5-6 116)	36	82 Tap 41	
L2, L8	Winding (a) Pin 4 Yellow Tap Pin 5 Orange Pin 6 Green		Pins 1-3 14 $^{+1}_{-0.5}$ Pins 4-6 3.8) Pins 4-5 1.0) ± 5% Pins 5-6 1.0)	D	8 Tap 4	W92284-1 Iss. 7 5950-99-580-6962
	(b) Pin 1 Blue Pin 3 Red	>150			17	
L3, L7	Winding (a) Pin 3 Pink Pin 1 Brown	>75	14 ± 2.5	A	38	W92290-B-1 Iss. 4 5950-99-580-6942
L4	Winding (a) Pin 1 Brown Tap Pin 2 Pink Pin 3 Pink	>75	14 $^{+4}_{-3}$ Tap 10 ± 5%	A	38 Tap 32	W92303-B-1 Iss. 4 5950-99-580-6949
L5, L16 L20, L40 L49, L50	1 winding		600 ± 5%	42	185	W92238-C-1 Iss. 3 5950-99-580-7164

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5910-99-	CAPACITORS	/uF		Volts
C48	011-8270	Ceramic	2.2 pF	5	750
C49	945-6655	Polystyrene	470 pF	2	125
C51	012-0116	Paper Metallised	0.04	20	250
C52	012-0116	Paper Metallised	0.04	20	250
C53	012-0116	Paper Metallised	0.04	20	250
C54	945-6655	Polystyrene	470 pF	2	125
C56	011-8270	Ceramic	2.2 pF	5	750
C57	945-6655	Polystyrene	470 pF	2	125
C58	012-0116	Paper Metallised	0.04	20	250
C59	012-0116	Paper Metallised	0.04	20	250
C61	945-6655	Polystyrene	470 pF	2	125
C62	012-0116	Paper Metallised	0.04	20	250
C63	012-0116	Paper Metallised	0.04	20	250
C64	580-0298	Polystyrene	0.001	2	125
C66	580-0298	Polystyrene	0.001	2	125
C67	580-0308	Polystyrene	150 pF	2	125
C68	012-0116	Paper Metallised	0.04	20	250
C69	580-0298	Polystyrene	0.001	2	125
C71	580-0298	Polystyrene	0.001	2	125
C72	580-0308	Polystyrene	150 pF	2	125
C73	012-0114	Paper Metallised	0.02	20	250
C74	012-0116	Paper Metallised	0.04	20	150
C76	012-0116	Paper Metallised	0.04	20	150
C77	972-7843	Polystyrene	0.0047	2	125
C78	972-7832	Polystyrene	220 pF	2	125
C79	012-0114	Paper Metallised	0.02	20	250
C81	913-6398	Metal Film	0.25	20	250
C82	913-6398	Metal Film	0.25	20	250
C83	012-0116	Paper Metallised	0.04	20	250
C84	016-7006	Variable	3-30 pF		
C85	012-0114	Paper Metallised	0.02	20	250
C86	580-7475	Polystyrene	7 pF	1 pF	125
C87	016-7006	Variable	3-30 pF		
C88	580-0284	Polystyrene	15 pF	2 pF	125
C89	016-7006	Variable	3-30 pF		
C91	945-1534	Polystyrene	22	2 pF	125
C92	016-7006	Variable	3-30 pF		
C93	945-1535	Polystyrene	33 pF	2 pF	125
C94	016-7006	Variable	3-30 pF		
C96	580-0288	Polystyrene	39 pF	2 pF	125
C97	016-7006	Variable	3-30 pF		
C98	945-1537	Polystyrene	47 pF	2 pF	125
C99	016-7006	Variable	3-30 pF		
C101	580-0291	Polystyrene	56 pF	2 pF	125
C102	016-7006	Variable	3-30 pF		

Table 2.5 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L21	Winding (a) Pin 4 Yellow Pin 6 Green (b) Pin 1 Blue Tap Pin 2 Orange Pin 3 Red	>140	Pins 1-3 16 ± 1 Pins 4-6 4.9) Pins 1-2 5.75) ± 5% Pins 2-3 5.75)	D	9 18 Tap 9	W92286-1 Iss. 6 5950-99-580-6960
L22, L23, L25, L28	Winding Pin 3 Red Tap Pin 2 Yellow Tap Pin 6 Orange Tap Pin 5 Green Pin 1 Blue	>180	16 ± 1	D	18 Tap 9 Tap 12½ Tap 16½	W92283-1 Iss. 6 5950-99-580-6963
L26, L27	Winding Pin 1 Blue Tap Pin 2 Yellow Pin 3 Red	>180	Pins 1-3 16 ± 1 Pins 1-2 4.6) Pins 2-3 4.6) ± 5%	D	18 Tap 9	W92288-1 Iss. 5 5950-99-580-6958
L29	Winding (a) Pin 1 Blue Tap Pin 2 Orange Pin 3 Red (b) Pin 4 Yellow Tap Pin 5 Pink Pin 6 Green	Pins 4-6 >160	Pins 4-6 14.5 +0.5 -1 Pins 1-3 32 ± 20%		17 Tap 16	W92287-1 Iss. 8 5950-99-580-6959
L31, L32, L33, L34	Winding Pin 1 Brown Pin 3 Pink	>60	2.5 +1.5 -0.4	30	18	W92306-B-1 Iss. 4 5950-99-580-6947

Table 2.5 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L45	Winding Pin 1 Brown Pin 3 Pink	>80	39 $^{+16}_{-5}$	A	67	W93934-B-1 Iss. 5 5950-99-580-7140
L47	1 winding		70 ± 10%	42	80	W94374-C-1 Iss. 6 5950-99-580-7166
L48	Winding (a) Pin 1 Blue Pin 3 Red (b) Pin 4 Yellow Tap Pin 5 Orange Pin 6 Green		Pins 1-3 300 ± 10% Pins 4-6 250 ± 10% Pins 4-5 84 ± 5% Pins 5-6 84 ± 5%	40 34	74 74 Tap 37	W92282-1 Iss. 5 5950-99-580-6964

FREQUENCY MULTIPLIER (1 kHz) 5820-99-580-8258

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS (Cont'd)	Ohms		Watts
R69	5905-99-022-2214		47k	10	¼
R71	022-2088		4.7k	10	¼
R72	022-2172		22k	10	¼
R73	022-2025		1.5k	10	¼
R74	022-2004		1k	10	¼
RV1	011-8259	Resistor Variable	1k	20	¼
RV2	011-8259	Resistor Variable	1k	20	¼
RV3	011-8259	Resistor Variable	1k	20	¼
RV4	011-8259	Resistor Variable	1k	20	¼
RV5	011-8259	Resistor Variable	1k	20	¼
RV6	011-8259	Resistor Variable	1k	20	¼
RV7	011-4960	Resistor Variable. Wirewound	250	10	½
SWA	5930-99-580-6076	Switch, Rotary Wafer			
TP1	5935-99-913-6813	Test Point			
TP2	913-6813	Test Point			
TP3	913-6813	Test Point			
TP4	913-6813	Test Point			
TP5	913-6813	Test Point			
TP6	913-6813	Test Point			
TP7	913-6813	Test Point			
TP8	913-6813	Test Point			
TP9	913-6813	Test Point			
TP10	913-6813	Test Point			
TP11	913-6813	Test Point			
TP12	913-6813	Test Point			
TP13	901-3061	Test Point			
TP14	901-3061	Test Point			
TP15	914-7189	Test Point			
TP16	901-3062	Test Point			
TP17	901-3061	Test Point			
		TRANSISTORS			
VT1	5960-99-037-2978 *	CV7354			
VT2	5960-99-037-2978 *	CV7354			
VT3	5960-99-037-2978 *	CV7354			
VT4	5960-99-037-2978 *	CV7354			
VT5	5960-99-037-2978 *	CV7354			

* Alternative 5960-99-037-2003

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L12, L13	Winding Pin 3 Pink Pin 1 Brown	80	>0.8 <1.2	24	$11\frac{3}{4}$	W96800-B-1 Iss. 2 5950-99-580-7158
L14	Winding Pin 1 Pin 3	80	<1.7 >1.1	26	$13\frac{3}{4}$	W96803-B-1 Iss. 3 5950-99-580-7159
L16, L100	1 winding	>65	>0.45 <0.85	26	10	W99114-1-S Iss. 6
L17, L18, L101	1 winding	>65	>0.5 <0.97	28	10	W99114-1-R Iss. 6
L19	1 winding	>65	>0.55 <1.1	28	11	W99114-1-Q Iss. 6
L20, L102	1 winding	>65	>0.6 <1.2	30	11	W99114-1-P Iss. 6
L21, L103	1 winding	>65	>0.65 <1.3	30	12	W99114-1-O Iss. 6
L22, L104	1 winding	>65	>0.7 <1.4	32	12	W99114-1-N Iss. 6
L23, L105	1 winding	>65	>0.8 <1.6	32	13	W99114-1-M Iss. 6

FREQUENCY MULTIPLIER (1 kHz) 5820-99-580-8258

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5950-99-				
L41	580-6820	Inductor R.F.	35mH		
L42	580-6820	Inductor R.F.	35mH		
L43	580-7152	Inductor R.F.	6mH		
L44	580-6819	Inductor R.F.	7mH		
L45	580-7165	Inductor R.F.	3.86mH		
L46	580-6821	Inductor R.F.	3.2mH		
L48	580-6830	Transformer R.F.	57mH		
L49	580-7143	Inductor A.F.	35mH		
L50	580-7143	Inductor A.F.	35mH		
		RECTIFIERS			
	5960-99-				
MR1	037-2373	CV7130			
MR2	037-2373	CV7130			
MR3	037-2373	CV7130			
MR4	037-2373	CV7130			
MR6	037-2373	CV7130			
MR7	037-2373	CV7130			
MR8	037-2373	CV7130			
MR9	037-2373	CV7130			
MR11	037-2373	CV7130			
MR12	037-2373	CV7130			
MR13	037-2373	CV7130			
MR14	037-2373	CV7130			
MR15	037-2373	CV7130			
PLCN	5935-99-054-0201	Plug			
PLCQ	5935-99-580-2867	Plug			
PLCR	5935-99-932-5838	Plug			
PLCT	5935-99-932-5838	Plug			
		RESISTORS	Ohms		Watts
	5905-99-				
R1	022-2004		1k	10	¼
R2	022-2172		22k	10	¼
R3	022-2088		4.7k	10	¼
R4	022-1130		150	10	¼
R5	022-2109		6.8k	10	¼
R6	022-3016		68k	10	¼
R7	022-2004		1k	10	¼
R8	022-2004		1k	10	¼
R9	022-3049		120k	10	¼
R10	022-3058		150k	10	¼

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L33	1 winding	>65	>2.1 <4.1	36	22	W99114-1-D Iss. 6
L34, L110	1 winding	>65	>2.4 <4.8	38	22	W99114-1-C Iss. 6
L35, L111	1 winding	>65	>3 <6	38	26	W99114-1-B Iss. 6
L36	1 winding	>65	>3.5 <7	38	28	W99114-1-A Iss. 6
L37	1 winding	>70	>4 <9	C	32	W99115-1-H Iss. 5
L38	1 winding	>75	>6 <12	C	37	W99115-1-G Iss. 5
L39 L114	1 winding	>75	>7 <15	C	43	W99115-1-F Iss. 5
L40	1 winding	>75	>10 <21	C	52	W99115-1-E Iss. 5
L41	1 winding	>75	>15 <32	E	62	W99115-1-D Iss. 5
L42, L116	1 winding	>70	>27 <55	E	84	W99115-1-C Iss. 5

FREQUENCY MULTIPLIER (1 kHz) 5820-99-580-8258

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS (Cont'd)	µF		Volts
	5910-99-				
C54	972-7843	Polystyrene	0.0047	2	125
C56	913-6398	Metal Film	0.25	20	250
C65	999-4135	Metal Film	0.1	20	250
C66	972-7843	Polystyrene	0.0047	20	125
C67	580-7192	Polystyrene	820p	2	125
C68	972-7843	Polystyrene	0.0047	2	125
C70	999-4135	Metal Film	0.1	20	250
C71	972-7843	Polystyrene	0.0047	2	125
C72	580-7192	Polystyrene	820p	2	125
C73	972-7843	Polystyrene	0.0047	2	125
C76	012-0113	Metallised	0.01	20	250
C77	999-4135	Metal Film	0.1	20	250
C78	913-6398	Metal Film	0.25	20	250
C79	913-6398	Metal Film	0.25	20	250
C83	999-4135	Metal Film	0.1	20	250
C84	999-4135	Metal Film	0.1	20	250
C86	999-4135	Metal Film	0.1	20	250
C87	913-6398	Metal Film	0.25	20	250
C88	580-7192	Polystyrene	820p	2	125
C90	580-7203	Polystyrene	280p	2	125
C91	016-7006	Variable	3-30p		
C92	580-7212	Polystyrene	230p	2	125
C93	016-7006	Variable	3-30p		
C94	813-6317	Polystyrene	200p	2	125
C95	016-7006	Variable	3-30p		
C96	580-7206	Polystyrene	170p	2	125
C97	016-7006	Variable	3-30p		
C98	945-1546	Polystyrene	140p	2	125
C99	016-7006	Variable	3-30p		
C100	580-7205		110p	2	125
C101	016-7006	Variable	3-30p		
C102	946-2785	Polystyrene	82p	2pF	125
C103	016-7006	Variable	3-30p		
C104	580-7194	Polystyrene	54p	2pF	125
C105	016-7006	Variable	3-30p		
C106	580-7199	Polystyrene	27p	2pF	125
C107	016-7006	Variable	3-30p		
C109	016-7006	Variable	3-30p		
C112	999-4135	Metal Film	0.1	20	250
C113	012-4906	Electrolytic	50	+100 -20	25

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L74	1 winding		6.6/uH ± 10%	38	18	W56565-C-26 Iss. 3 5950-99-580-7167
L75	1 winding Pin 1 Brown Pin 3 Pink		$7\ ^{+1}_{-2}$/uH	36	$28\frac{1}{4}$	W96828-B-1 Iss. 2 5950-99-580-7147
L76	1 winding		4.3 ± 10%	38	14	W56565-C-28 Iss. 2 5950-99-580-7154
L77	1 winding (a) Pin 1 Brown Pin 3 Pink	80	$3\ ^{+0.7}_{-0.5}$/uH	36	18	W96832-B-1 Iss. 3 5950-99-580-7148
L79	Winding (a) Pin 1 Blue Pin 3 Red (b) Pin 4 Green Tap Pin 5 Orange Pin 6 Yellow		13/uH ± 20% 13/uH ± 20%	36 36	8 8 Tap 4	W94344-1 Iss. 7 5950-99-580-7162
L82	1 winding with tap	>80	>0.25 <0.5	24	8 Tap 2	W99125-1-A Iss. 7
L83	1 winding with tap	>80	>0.15 <0.25	24	5 Tap 2	W99125-1-B Iss. 7

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L113	1 winding	>70	>6 <11	C	36	W99115-1-L Iss. 5
L115	1 winding	>75	>13 <30	E	60	W99115-1-K Iss. 5
L117	1 winding	>70	>100 <200	F	160	W99115-1-J Iss. 5
L120, L121	1 winding	>100	>0.21 < 0.29	24	$8\frac{1}{2}$	M32-3925-01 Iss. 4
L122	1 winding	>100	>0.2 < 0.28	24	8	M32-3925-02 Iss. 4
L123, L124	1 winding	>100	>0.18 < 0.24	24	$7\frac{1}{2}$	M32-3295-03 Iss. 4
L125, L126	1 winding	>100	>0.16 <0.215	24	7	M32-3925-04 Iss. 4
L127, L128	1 winding	>100	>0.145 <0.19	24	$6\frac{1}{2}$	M32-3925-05 Iss. 4
L129	1 winding	>100	>0.13 <0.17	24	6	M32-3925-06 Iss. 4
L130, L131 L132, L133	1 winding	>100	>0.12 <0.15	24	$5\frac{1}{2}$	M32-3925-07 Iss. 4
L134, L135	1 winding	>100	>0.11 <0.13	24	5	M32-3925-08 Iss. 4

OSCILLATOR AUDIO FREQUENCY – 5820–99–519–7002

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or other Ref. No.	Description	Value	Tol. %	Rating
L1	5950–99–924–6360	Inductor A.F.			
L2	5950–99–924–6359	Inductor A.F.			
L3	5950–99–849–9760	Transformer A.F.			
L4	5950–99–849–9760	Transformer A.F.			
MR1	5960–99–000–4073 OR	CV4073			
	5961–00–842–9864	IN 914			
PLCU	5935–99–580–1497	Plug			
		RESISTORS	Ohms		Watts
	5905–99–		12k	10	¼
R1	022–2142		2.2k	10	¼
R2	022–2046		820	10	¼
R3	022–1226		3.3k	10	¼
R4	022–2067		1.2k	10	¼
R6	022–2016				
R7	013–5892	Metal Oxide	5.6k	1	1/8
R8	022–3028		82k	10	¼
R9	022–3007		56k	10	¼
R11	022–2058		2.7k	10	¼
R12	022–3247		4.7M	10	¼
R13	022–2004		1k	10	¼
R14	022–2184		27k	10	¼
R16	013–5908	Metal Oxide	27k	1	1/8
R17	013–5894	Metal Oxide	6.8k	1	1/8
R18	142–0570	Metal Oxide	3.9k	2	½
R19	013–5874	Metal Oxide	1k	1	1/8
R21	013–5848	Metal Oxide	82	1	1/8
R22	013–5880	Metal Oxide	1.8k	1	1/8
R23	013–5912	Metal Oxide	39k	1	1/8
R24	013–5892	Metal Oxide	5.6k	1	1/8
R26	013–5874	Metal Oxide	1k	1	1/8
R27	013–5890	Metal Oxide	4.7k	1	1/8
R28	013–5856	Metal Oxide	180	2	½
R29	013–5874	Metal Oxide	1k	1	1/8
R31	022–1172		330	10	¼
R32	022–2046		2.2k	10	¼
R33	022–2214		47k	10	¼
R34	022–2088		4.7k	10	¼
R36	022–2046		2.2k	10	¼
R37	022–2100		5.6k	10	¼

PART 5E

COMPONENTS LISTS

FREQUENCY DIVIDER 5820-99-519-7003

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5935-99-				
SKCE	911-4160	Socket			
SKCK	911-4160	Socket			
SKCP	911-4160	Socket			
SKCT	911-4160	Socket			
SKCY	911-4160	Socket			
TP1	913-6813	Test Point			
TP2	913-6813	Test Point			
TP3	913-6813	Test Point			
TP4	913-6813	Test Point			
TP5	913-6813	Test Point			
TP6	913-6813	Test Point			
TP7	913-6813	Test Point			
TP8	913-6813	Test Point			
TP9	913-6813	Test Point			
TP10	913-6813	Test Point			
TP15	914-7189	Test Point			
TP16	901-3062	Test Point			
		TRANSISTORS			
	5960-99-				
VT1	037-2978	CV7354			
VT2	037-2207	CV8354			
VT3	037-2978	CV7354			
VT4	037-2978	CV7354			
VT5	037-2003	CV7003			
VT6	037-2003	CV7003			
VT7	037-2003	CV7003			
VT8	037-2003	CV7003			
VT9	037-2003	CV7003			
VT10	037-2003	CV7003			

FRAME AND POWER SUPPLY

COMPONENTS LIST

NOTE Before ordering parts, refer to relevant E List and BR 1923 - Substitution Guide.

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS	uF		Volts
C6	5910-99-972-4240	Electrolytic	200	+100 -20	100
C7	5910-99-638-5202	Electrolytic	4700	+50-10	25
C8	5910-99-638-5202	Electrolytic	4700	+50-10	25
C9	5910-99-638-5202	Electrolytic	4700	+50-10	25
C10	5910-99-638-5202	Electrolytic	4700	+50-10	25
C11	5910-99-580-7490	Ceramic	0.01	+80-20	500
C12	5910-99-580-7490	Ceramic	0.01	+80-20	500
C21	5910-99-192-6165	Electrolytic	1250	+50-10	40
FS1	5920-99-059-0108	Fuse Anti-Surge 500 mA			
	5920-99-059-0102	Fuseholder			
FS3	5920-99-059-0110	Fuse Anti-Surge 2A			
	5920-99-972-0102	Fuseholder			
LP1	6240-99-995-1148	Lamp			
	6250-99-580-9023	Lampholder			
LP2	6240-99-995-1148	Lamp			
	6250-99-580-9023	Lampholder			
LP3	6240-99-995-1148	Lamp			
	6250-99-580-9023	Lampholder			
LP4	6240-99-995-1148	Lamp			
	6250-99-580-9023	Lampholder			
LP5	6240-99-995-1148	Lamp			
	6250-99-580-9023	Lampholder			
MR1	6130-99-011-9379	Rectifier Assembly			
MR2		STC Z2A Zener Diode			
MR3		STC Z2A Zener Diode			
MR4		STC Z2A Zener Diode			
MR5		STC Z2A Zener Diode			
MR6	5960-99-037-2016	CV7040			
PLBB	5935-99-914-9846	Plug			
PLCD	Marconi WIS.12400-B-1 Ref 2	Plug			
PLCG	5935-99-972-8184	Plug			

* AMMEND 2. MR7, MR8. 5960-99-037-2903, CV 7332

FREQUENCY DIVIDER 5820-99-519-7003

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± - %	Rating
		CAPACITORS	uF		Volts
C51	5910-99-580-7472	Polystyrene	0.022	2	125
C52	5910-99-913-6398	Metal Film	0.25	20	250
C53	Marconi 1-PC.19566-35	Polystyrene	0.047	2	125
C54	5910-99-580-7472	Polystyrene	0.022	2	125
C55	5910-99-946-2716	Electrolytic	10	+100 -20	50
C56	5910-99-525-8222	Electrolytic	50	+100 -20	12
		INDUCTORS			
L1	5950-99-580-7336	Inductor R.F.	257uH		
L2	580-7160	Inductor R.F.	1.6mH		
L3	580-7287	Inductor R.F.	200uH		
L4	580-7336	Inductor R.F.	257uH		
L5	580-7160	Inductor R.F.	1.6mH		
L6	580-8310	Inductor R.F.	3.9mH		
L7	580-6844	Inductor R.F.	2.5mH		
L8	580-6844	Inductor R.F.	2.5mH		
L9	580-7288	Inductor R.F.	2.5mH		
L11	580-7143	Inductor A.F.	35mH		
L12	580-7143	Inductor A.F.	35mH		
L13	580-7176	Transformer R.F.	5.75mH		
L14	580-7168	Inductor Assembly A.F.	25mH		
L15	580-7168	Inductor Assembly A.F.	25mH		
L16	580-7137	Inductor R.F.	150mH		
L17	580-7141	Inductor A.F.	66mH		
L18	580-7139	Inductor A.F.	152mH		
L19	580-7138	Inductor A.F.	1.12H		
L21	580-7136	Inductor A.F.	1.12H		
L22	580-7140	Inductor A.F.	550mH		
		RECTIFIERS			
MR1	5960-99-037-2373	CV7130			
MR2	037-2373	CV7130			
MR3	037-2373	CV7130			
MR4	037-2373	CV7130			
MR6	037-2373	CV7130			
MR7	037-2373	CV7130			
MR8	037-2373	CV7130			
MR9	037-2373	CV7130			
MR11	037-2373	CV7130			
MR12	037-2373	CV7130			
MR13	037-2373	CV7130			
MR14	037-2373	CV7130			
MR16	037-2373	CV7130			
MR17	037-2373	CV7130			
MR18	037-2373	CV7130			

FRAME AND POWER SUPPLY

COMPONENTS LIST (Contd.)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS (Contd.)	Ohms		Watts
R51	5905-99-106-6465	Metal Oxide	100	3	½
R52	5905-99-106-6465	Metal Oxide	100	3	½
R53	5905-99-106-6465	Metal Oxide	100	3	½
R54	5905-99-106-6465	Metal Oxide	100	3	½
R55	5905-99-106-6465	Metal Oxide	100	3	½
R56	5905-99-106-6465	Metal Oxide	100	3	½
R57	5905-99-954-4456	Metal Oxide	10	7	¼
R58	5905-99-954-4456	Metal Oxide	10	7	¼
R59	5905-99-954-4456	Metal Oxide	10	7	¼
R60	5905-99-954-4456	Metal Oxide	10	7	¼
R61	5905-99-954-4456	Metal Oxide	10	7	¼
R62	5905-99-954-4456	Metal Oxide	10	7	¼
R63	5905-99-954-4456	Metal Oxide	10	7	¼
R64	5905-99-954-4456	Metal Oxide	10	7	¼
R65	5905-99-954-4456	Metal Oxide	10	7	¼
R66	5905-99-954-4456	Metal Oxide	10	7	¼
R67	Select on test	Metal Film	1k	5	⅛
R68	Select on test	Metal Film	1k	5	⅛
R69	Select on test	Metal Film	1k	5	⅛
R70	Select on test	Metal Film	1k	5	⅛
R71	Select on test	Metal Film	1k	5	⅛
R72	Select on test	Metal Film	400	5	⅛
RLA	5945-99-011-9882	Relay 300 V	2.5k	10	
SKCA	5935-99-580-1504	Socket			
SKCH	5935-99-580-1503	Socket			
SKCM	5935-99-580-1503	Socket			
SKCQ	5935-99-580-1503	Socket			
SKCU	5935-99-948-3842	Socket			
SKCV	5935-99-948-3842	Socket			
SWA	5930-99-192-6175	Switch Rotary			
SWB	Marconi WIS.11944-B Sh.8	Switch Rotary			
SWC	Marconi WIS.11944-B Sh.7	Switch Rotary			
SWD	Marconi WIS.11944-B Sh.6	Switch Rotary			
TP1	5935-99-914-3062	Test Point			
TP2	5935-99-914-7189	Test Point			
TR2	5950-99-580-6827	Transformer			
	5820-99-525-6299 (after Mod.1)	Coupling OD/PC25509/1			

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FREQUENCY DIVIDER 5820-99-519-7003

COMPONENTS LIST

NOTE Before ordering parts, refer to relevant E List and BR 1923 - Substitution Guide.

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS	uF		Volts
C1	5910-99-012-0114	Paper Metallised	0.02	20	250
C3	972-7831	Paper Metallised	100pF	2	125
C4	913-6605	Paper Metallised	270pF	2	125
C5	999-4135	Metal Film	0.1	20	250
C6	945-1545	Polystyrene	120pF	2	125
C7	999-4135	Metal Film	0.1	20	250
C8	012-0108	Paper Metallised	0.002	20	250
C9	012-0114	Paper Metallised	0.02	20	250
C11	012-0113	Paper Metallised	0.01	20	250
C12	915-0862	Polystyrene	330pF	2	125
C13	972-7832	Polystyrene	220pF	2	125
C14	913-6398	Metal Film	0.25	20	250
C15	945-1531	Polystyrene	10pF	1pF	125
C16	580-0298	Polystyrene	0.001	2	125
C17	012-0114	Paper Metallised	0.02	20	250
C18	972-7836	Polystyrene	680pF	2	125
C19	999-4135	Metal Film	0.1	20	250
C21	012-0113	Paper Metallised	0.01	20	250
C22	580-0298	Polystyrene	0.001	2	125
C23	999-4135	Metal Film	0.1	20	250
C24	012-0108	Paper Metallised	0.002	20	250
C25	038-5986	Electrolytic	10	+100 -10	25
C26	913-6605	Polystyrene	270pF	2	125
C27	999-4135	Metal Film	0.1	20	250
C28	525-8222	Electrolytic	50	+100 -20	12
C29	999-4135	Metal Film	0.1	20	250
C31	038-5986	Electrolytic	10	+100 -10	25
C32	940-9490	Polystyrene	0.0015	2	125
C33	012-0113	Paper Metallised	0.01	20	250
C34	945-6655	Polystyrene	470pF	2	125
C35	913-6398	Metal Film	0.25	20	250
C36	972-7831	Polystyrene	100pF	5	125
C37	011-3568	Mica Metallised	0.01	5	350
C38	580-7476	Polystyrene	0.0033	2	125
C39	011-3568	Mica Metallised	0.01	5	350
C40	999-4135	Metal Film	0.1	20	250
C41	999-4135	Metal Film	0.1	20	250
C42	945-0777	Metal Film	0.5	20	250
C43	525-8222	Electrolytic	50	+100 -20	12
C44	945-6655	Polystyrene	470pF	2	125
C45	913-6398	Metal Film	0.25	20	250
C46	580-7476	Polystyrene	0.0033	2	125
C47	945-0777	Metal Film	0.5	20	250
C48	580-7476	Polystyrene	0.0033	2	125
C49	580-0298	Polystyrene	0.001	2	125

FRAME AND POWER SUPPLY

COMPONENTS LIST (Contd.)

Cot. Ref.	NSN or other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS	Ohms		Watts
R11	5905-99-011-3229	Wirewound	82	5	1½
R12	5905-99-011-3229	Wirewound	82	5	1½
R13	5905-99-011-3227	Wirewound	68	5	1½
R14	5905-99-011-3227	Wirewound	68	5	1½
R15	5905-99-011-2151	Wirewound	15k	10	¼
R16	5905-99-011-2151	Wirewound	15k	10	¼
R17	5905-99-011-3231	Wirewound	100	5	1½
R18	5905-99-011-3231	Wirewound	100	5	1½
R19	5905-99-011-3231	Wirewound	100	5	1½
R20	5905-99-011-3231	Wirewound	100	5	1½
R21	5905-99-955-6437	Metal Oxide	1k	1	½
R22	5905-99-955-6437	Metal Oxide	1k	1	½
R23	5905-99-955-6437	Metal Oxide	1k	1	½
R24	5905-99-955-6437	Metal Oxide	1k	1	½
R25	5905-99-955-6437	Metal Oxide	1k	1	½
R26	5905-99-955-6437	Metal Oxide	1k	1	½
R27	5905-99-955-6437	Metal Oxide	1k	1	½
R28	5905-99-955-6437	Metal Oxide	1k	1	½
R29	5905-99-955-6437	Metal Oxide	1k	1	½
R30	5905-99-955-6437	Metal Oxide	1k	1	½
R31	5905-99-955-6437	Metal Oxide	1k	1	½
R32	5905-99-955-6437	Metal Oxide	1k	1	½
R33	5905-99-955-6437	Metal Oxide	1k	1	½
R34	5905-99-955-6437	Metal Oxide	1k	1	½
R35	5905-99-955-6437	Metal Oxide	1k	1	½
R36	5905-99-955-6437	Metal Oxide	1k	1	½
R37	5905-99-955-6437	Metal Oxide	1k	1	½
R38	5905-99-955-6437	Metal Oxide	1k	1	½
R39	5905-99-106-6465	Metal Oxide	100	3	½
R40	5905-99-106-6465	Metal Oxide	100	3	½
R41	5905-99-106-6465	Metal Oxide	100	3	½
R42	5905-99-106-6465	Metal Oxide	100	3	½
R43	5905-99-106-6465	Metal Oxide	100	3	½
R44	5905-99-106-6465	Metal Oxide	100	3	½
R45	5905-99-106-6465	Metal Oxide	100	3	½
R46	5905-99-106-6465	Metal Oxide	100	3	½
R47	5905-99-106-6465	Metal Oxide	100	3	½
R48	5905-99-106-6465	Metal Oxide	100	3	½
R49	5905-99-106-6465	Metal Oxide	100	3	½
R50	5905-99-106-6465	Metal Oxide	100	3	½

FREQUENCY DIVIDER 5820-99-519-7003

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RECTIFIERS			
	5960-99-				
MR19	037-2373	CV7130			
MR21	037-2373	CV7130			
MR22	037-2373	CV7130			
MR23	037-2373	CV7130			
MR24	037-2373	CV7130			
MR26	037-2373	CV7130			
MR27	037-2373	CV7130			
MR28	037-2373	CV7130			
MR29	037-2373	CV7130			
PLBE	5935-99-054-0201	Plug			
PLBF	5935-99-054-0201	Plug			
PLBG	5935-99-054-0201	Plug			
PLBT	5935-99-054-0201	Plug			
PLCW	5935-99-580-1497	Plug			
		RESISTORS	Ohms		Watts
	5905-99-				
R2	022-1193		470	10	¼
R3	022-2214		47k	10	¼
R4	022-2058		2.7k	10	¼
R5	022-2004		1k	10	¼
R7	022-2058		2.7k	10	¼
R8	022-1193		470	10	¼
R9	022-2214		47k	10	¼
R11	022-2058		2.7k	10	¼
R12	022-2004		1k	10	¼
R13	022-1067		47	10	¼
R14	022-2058		2.7k	10	¼
R15	022-1193		470	10	¼
R16	022-2214		47k	10	¼
R17	022-2058		2.7k	10	¼
R18	022-2004		1k	10	¼
R19	022-1193		470	10	¼
R21	022-2214		47k	10	¼
R22	022-2058		2.7k	10	¼
R23	022-2004		1k	10	¼
R24	022-1067		47	10	¼
R25	022-2058		2.7k	10	¼
R26	022-1193		470	10	¼
R27	022-2214		47k	10	¼
R28	022-2058		2.7k	10	¼
R29	022-2004		1k	10	¼
R31	022-1193		470	10	¼
R32	022-2214		47k	10	¼
R33	022-2058		2.7k	10	¼
R34	022-1142		180	10	¼
R35	022-2004		1k	10	¼

OSCILLATOR AUDIO FREQUENCY - 5820-99-519-7002

COMPONENTS LIST

NOTE Before ordering parts, refer to relevant E List and BR 1923 - Substitution Guide.

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. + - %	Rating	
		CAPACITOR	uF		Volts	
C1	5910-99-945-0777	Metallised	0.5	20	250	
C2	525-8222	Electrolytic	50	+100 -20	12	I
C3	525-8222	Electrolytic	50	+100 -20	12	I
C4	972-1816	Plastic Film	0.1	20	250	
C6	012-0113	Paper	0.01	20	250	
C7	525-8222	Electrolytic	50	+100 -20	12	I
C8	945-0777	Metallised	0.5	20	250	
C9	525-8222	Electrolytic	50	+100 -20	12	I
C11	525-8222	Electrolytic	50	+100 -20	12	I
C12	013-0496	Solid Tantalum	2.2	20	20	
C13	525-8222	Electrolytic	50	+100 -20	12	I
C14	525-8222	Electrolytic	50	+100 -20	12	I
C16	525-8222	Electrolytic	50	+100 -20	12	I
C17	525-8222	Electrolytic	50	+100 -20	12	I
C18	014-5281	Electrolytic	12	+100 -20	50	
C19	972-1816	Plastic Film	0.1	20	250	
C21	972-1816	Plastic Film	0.1	20	250	
C22	580-7498	Polystyrene	0.033	2	125	
C23	580-7498	Polystyrene	0.033	2	125	
C24	525-8222	Electrolytic	50	+100 -20	12	I
C26	525-8222	Electrolytic	50	+100 -20	12	I
C27	580-8791	Polystyrene	0.0095	1	125	
C28	525-8222	Electrolytic	50	+100 -20	12	I
C29	108-2300	Polystyrene	68 p	2	350	
C31	580-8791	Polystyrene	0.0095	1	125	
C32	972-1816	Plastic Film	0.1	20	250	
		CAPACITORS VARIABLE				
C33	942-6342	Capacitor Variable	300 p	2	350	
C34	942-6342	Capacitor Variable	300 p	2	350	
C36	942-6342	Capacitor Variable	300 p	2	350	
C37	942-6342	Capacitor Variable	300 p	2	350	
C39	942-6342	Capacitor Variable	300 p	2	350	
C41	942-6342	Capacitor Variable	300 p	2	350	
C42	942-6342	Capacitor Variable	300 p	2	350	
C43	942-6342	Capacitor Variable	300 p	2	350	

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L136	1 winding	>100	>0.095 <0.12/uH	24	$4\frac{1}{2}$	M32-3925-09 Iss. 4
L137, L138 L139, L140 L141, L142 L143, L144	1 winding	>100	>0.08 <0.095/uH	24	4	M32-3925-10 Iss. 4
L145, L147	1 winding	>100	>0.075 <0.085/uH	24	$3\frac{1}{2}$	M32-3925-11 Iss. 4
L146	1 winding	>100	>0.055 <0.065/uH	24	3	M32-3925-12 Iss. 4
L159, L160 L161, L162 L163	1 winding	>65	>0.07 <0.12/uH	24	3	W99114-1-AC Iss. 6
TR1	Winding (a) Pin 4 Blue Pin 3 Green (b) Pin 1 Red Pin 6 Pink		<530 >250/uH Pins 1-3 Links 4-6 890/uH (b) >46 <109/uH	36 36	17 5	M32-2672-01 Iss. 2
TR2, TR3	Winding (a) (b)		>25 <55/uH Ratio (a) to (b) is 12:1 ± 20%	32 32	$3\frac{1}{2}$ 1	M32-3882-01 Iss. 3

OSCILLATOR AUDIO FREQUENCY - 5820-99-519-7002

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS (Cont'd)	Ohms		Watts
	5905-99-				
R38	022-2172		22k	10	¼
R39	022-2046		2.2k	10	¼
R40	022-1130	Composition, Grade 2, Insulated	150	10	¼
R41	022-2046		2.2k	10	¼
R42	022-2004		1k	10	¼
R43	022-2163		18k	10	¼
RV1	011-9465	Resistor Variable	10k	20	¼
RV2	011-9465	Resistor Variable	10k	20	¼
	Marconi PH.71104-1	Nut Spindle Gripping for RV1, RV2			
SKCR	Marconi WIS.6562-C Ref 6	Socket			10A
SKCW	5935-99-948-3842	Socket			5A
SWA	Marconi WIS.10264-C Sh.46	Switch Rotary 12 Position			
TH1	5905-99-580-8554	Res. Thermistor	500	±20	1
		TRANSISTORS			
VT1	5960-99-037-2978	CV7354			
VT2	5961-99-118-0469	BFX29 (see Note 1)			
VT3	5960-99-037-2978	CV7354			
VT4	5961-99-037-3499	CV7439			
VT5	5961-99-037-3499	CV7439			
VT6	5961-99-037-2005	CV7005			
VT7	5961-99-037-2005	CV7005			
		CRYSTALS			
	5955-99-				
XL1	924-6356	2.1 kHz to Crystal Specification XLD 23/C			
XL2	924-6355	2.2 kHz to Crystal Specification XLD 23/C			
XL3	924-6354	2.3 kHz to Crystal Specification XLD 23/C			
XL4	924-6353	2.4 kHz to Crystal Specification XLD 23/C			
XL5	924-6352	2.5 kHz to Crystal Specification XLD 23/C			
XL6	924-6351	2.6 kHz to Crystal Specification XLD 23/C			
XL7	924-6350	2.7 kHz to Crystal Specification XLD 23/C			
XL8	924-6349	2.8 kHz to Crystal Specification XLD 24/C			
XL9	924-6348	2.9 kHz to Crystal Specification XLD 24/C			

NOTE 1: Units with Mod.Strike 3 have a 5961-99-118-0469 Transistor (BFX29) fitted as VT2

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L91, L150 L151, L152 L153, L154 L155, L156 L157, L158 L165, L166 L167, L168 L169, L170 L171, L172 L173	1 winding	>65	>0.17 <0.25	24	5	W99114-1-AA Iss. 6
L92, L93	1 winding	>65	>0.2 <0.35	24	5 Tap 2	W99114-1-Z Iss. 6
L94, L95 L96	1 winding	>65	>0.25 <0.45	24	7	W99114-1-Y Iss. 6
L97	1 winding	>65	>0.3 <0.6	24	8	W99114-1-X Iss. 6
L98	1 winding	>65	>0.35 <0.68	24	9	W99114-1-U Iss. 6
L99	1 winding	>65	>0.4 <0.75	26	9	W99114-1-T Iss. 6
L108	1 winding	>65	>1.4 <2.9	34	18	W99114-1-W Iss. 6
L112	1 winding	>65	>4 <8.5	40	30	W99114-1-V Iss. 6

FREQUENCY MULTIPLIER (1 kHz) 5820-99-580-8258

COMPONENTS LIST

NOTE Before ordering parts, refer to relevant E List and BR 1923 - Substitution Guide.

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS	uF		Volts
C1	5910-99-580-7481	Polystyrene	0.033	5	125
C3	972-7843	Polystyrene	0.0047	2	125
C4	580-0308	Polystyrene	150p	2	125
C6	972-7843	Polystyrene	0.0047	2	125
C7	580-0308	Polystyrene	150p	2	125
C8	972-7843	Polystyrene	0.0047	2	125
C9	933-1742	Electrolytic	8	+100 -20	50
C10	999-4135	Metal Film	0.1	20	250
C12	999-4135	Metal Film	0.1	20	250
C13	999-4135	Metal Film	0.1	20	250
C14	972-7843	Polystyrene	0.0047	2	125
C16	580-0288	Polystyrene	160p	2	125
C17	972-7843	Polystyrene	0.0047	2	125
C18	580-0308	Polystyrene	150p	2	125
C19	972-7843	Polystyrene	0.0047	2	125
C20	999-5927	Polystyrene	0.0022	2	125
C21	580-0299	Polystyrene	0.01	2	125
C22	972-7844	Polystyrene	0.0056	2	125
C23	972-7843	Polystyrene	0.0047	2	125
C24	933-1742	Electrolytic	8	+100 -20	50
C25	999-5927	Polystyrene	0.0022	5	125
C26	999-4135	Metal Film	0.1	20	250
C27	525-8222	Electrolytic	50	+100 -20	12
C28	913-6398	Metal Film	0.25	20	250
C29	972-7842	Polystyrene	0.0033	5	125
C31	972-7842	Polystyrene	0.0033	5	125
C35	933-1742	Electrolytic	8	+100 -20	50
C37	972-7843	Polystyrene	0.0047	2	125
C38	913-6398	Metal Film	0.25	20	250
C39	913-6398	Metal Film	0.25	20	250
C41	972-7843	Polystyrene	0.0047	2	125
C42	580-7199	Polystyrene	27p	2	125
C43	972-7843	Polystyrene	0.0047	2	125
C44	913-6398	Metal Film	0.25	20	250
C46	913-6398	Metal Film	0.25	20	250
C47	913-6398	Metal Film	0.25	20	250
C48	972-7843	Polystyrene	0.0047	2	125
C49	580-7199	Polystyrene	27p	2	125
C51	972-7843	Polystyrene	0.0047	2	125
C52	913-6398	Metal Film	0.25	20	250

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L43	1 winding	>70	>60 <110/uH	F	120	W99115-1-B Iss. 5
L44	1 winding	>60	>150 <280/uH	F	190	W99115-1-A Iss. 5
L51	Winding (a) Pin 1 Pin 6 (b) Pin 3 Pin 4 Pin 2 (Earth)		Pins 1-6 900/uH ± 20% Pins 3-4 130/uH ± 20% Pins 1-4 1.8 mH appx.	36 26	18 7	M32-2364-01 Iss. 3
L59	1 winding		0.6/uH	24	8	W73984-C-24 Iss. 1
L71	1 winding Pin 1 start Tap Pin 2 Pin 3 finish	100	200 $^{+20}_{-30}$/uH	A	170 Tap 7	W96785-B-1 Iss. 5 5950-99-580-7175
L72	Winding (a) Pin 1 Pin 3 (b) Pin 4 Pin 6	70	6.5 ± 1.5 mH	36	$30\frac{1}{4}$ $8\frac{3}{4}$	W96808-B-1 Iss. 4 5950-99-580-7169
L73	Winding (a) (b)	>55	<1.8) >0.9/uH) 0.34/uH	34 34	14 5	W10193-B-1 Iss. 5

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FREQUENCY MULTIPLIER (1 kHz) 5820-99-580-8258

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± - %	Rating
		CAPACITORS (Cont'd)	uF		Volts
C114	5910-99-525-8222	Electrolytic	50	+100 -20	12
C115	913-6398	Metal Film	0.25	20	250
C116	525-8222	Electrolytic	50	+100 -20	12
C117	946-2790	Polystyrene	680p	2	125
C118	972-7089	Polystyrene	330p	10	125
C119	580-0298	Polystyrene	1000p	2	125
C121	913-6616	Polystyrene	100p	2	125
C122	999-4135	Metal Film	0.1	20	250
C124	972-7843	Polystyrene	0.0047	2	125
C125	580-0366	Polystyrene	0.0027	20	125
C126	972-7843	Polystyrene	0.0047	2	125
C127	972-7843	Polystyrene	0.0047	2	125
L1	5950-99-580-6832	Transformer A.F.			
L2	580-6845	Transformer A.F.			
L3	580-6814	Inductor R.F.			
L4	580-6813	Inductor R.F.			
L6	580-6833	Transformer R.F.			
L7	580-6814	Inductor R.F.			
L8	580-6845	Transformer R.F.			
L11	580-7293	Inductor			
L13	580-7153	Inductor R.F.			
L14	580-7153	Inductor R.F.			
L15	580-6822	Inductor R.F.			
L17	580-7153	Inductor R.F.			
L20	580-7143	Inductor A.F.			
L21	580-6932	Inductor R.F.			
L22	580-6831	Transformer R.F.			
L23	580-6815	Inductor R.F.			
L25	580-6816	Inductor R.F.			
L28	580-6815	Inductor R.F.			
L29	580-6846	Transformer R.F.			
L31	580-7174	Transformer R.F.			
L32	580-7174	Transformer R.F.	1.1mH		
L33	580-7174	Transformer R.F.	1.1mH		
L34	580-7174	Transformer R.F.	1.1mH		
L38	580-6834	Transformer R.F.	6.1mH		
L40	580-7142	Inductor A.F.	240mH		

Table 2.6 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L24	1 winding	>65	>0.9 <1.8	32	14	W99114-1-L Iss. 6
L25, L106	1 winding	>65	>1.0 <2.0	32	15	W99114-1-K Iss. 6
L26	1 winding	>65	>1.1 <2.2	32	16	W99114-1-J Iss. 6
L27, L107	1 winding	>65	>1.2 <2.4	32	17	W99114-1-H Iss. 6
L28	1 winding	>65	>1.3 <2.7	34	17	W99114-1-G Iss. 6
L29	1 winding	>65	>1.6 <3.2	34	19	W99114-1-F Iss. 6
L30, L109	1 winding	>65	>1.8 <3.6	36	20	W99114-1-E Iss. 6
L31	Winding (a) Pin 1 Red Pin 6 Blue (b) Pin 3 Green Pin 4 Yellow Pin 2 (Earth)		Pins 1-6 2250 ± 20% Pins 3-4 170 ± 20% Pins 1-4 4 mH appx.	38 26	29 8	M32-2365-01 Iss. 3
L32, L55, L60	1 winding		1.3 ± 10%	26	13	W73984-C-15 Iss. 2 5950-99-580-7161

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FREQUENCY MULTIPLIER (1 kHz) 5820-99-580-8258

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS (Cont'd)	Ohms		Watts
	5905-99-				
R11	022-3037		100k	10	¼
R13	022-2004		1k	10	¼
R14	022-2025		1.5k	10	¼
R16	022-2172		22k	10	¼
R17	022-2130		10k	10	¼
R19	022-2046		2.2k	10	¼
R21	022-1130		82	10	¼
R22	022-2004		1k	10	¼
R25	022-2046		2.2k	10	¼
R26	022-1214		680	10	¼
R27	022-2004		1k	10	¼
R28	022-1088		68	10	¼
R29	022-2004		1k	10	¼
R31	022-2172		22k	10	¼
R32	022-2088		4.7k	10	¼
R33	022-2004		1k	10	¼
R36	022-2004		1k	10	¼
R37	022-2172		22k	10	¼
R38	022-2088		4.7k	10	¼
R41	022-1214		680	10	¼
R42	022-2088		4.7k	10	¼
R43	022-1214		680	10	¼
R44	022-2088		4.7k	10	¼
R46	022-2046		2.2k	10	¼
R47	022-2046		2.2k	10	¼
R48	022-1151		220	10	¼
R49	022-1226		820	10	¼
R51	022-2004		1k	10	¼
R53	022-2088		4.7k	10	¼
R54	022-2088		4.7k	10	¼
R56	022-2121		8.2k	10	¼
R57	022-1172		330	10	¼
R58	022-2004		1k	10	¼
R61	022-2172		22k	10	¼
R62	022-2088		4.7k	10	¼
R63	022-2109		6.8k	10	¼
R64	022-2004		1k	10	¼
R66	022-2004		1k	10	¼
R67	022-2088		4.7k	10	¼
R68	022-2130		10k	10	¼

Table 2.6

Frequency Multiplier (MHz) Coil Data

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L1	Winding (a) Pin 3 Red Pin 1 Blue (b) Pin 4 Yellow Tap Pin 5 Orange Pin 6 Green	>45	<10.5 /uH >9.5 /uH 33 /uH ± 5%	 28 28	 13 26 Tap 13	W93938-1 Iss. 5 5950-99-580-6950
L2, L67	Winding (a) Pin 3 Pin 1 (b) Pin 4 Tap Pin 6	70	<0.2 >0.16 /uH 0.09 /uH	 24 24	 $4\frac{3}{4}$ $2\frac{3}{4}$ Tap $1\frac{3}{8}$	W96786-B-1 Iss. 5 5950-99-580-7171
L3, L4, L6, L7, L56, L57, L58, L61, L62, L63, L64, L66	Winding Pin 3 Tap Pin 5 Pin 1	80	<0.2 >0.15 /uH	 22	 $4\frac{3}{4}$ Tap $2\frac{3}{8}$	W96789-B-1 Iss. 5 5950-99-580-7173
L8	Winding (a) Pins 1-2 (b) Pins 3-5 Tap 4 (c) Pins 1-2		Pins 1-2 0.2 /uH ± 10% Pins 3-5 0.33 /uH ± 10%	 26 26 26	 4 4 4	W99085-B-1A Iss. 6 5950-99-971-8856
L11	Winding (a) Pin 6 Red Pin 1 (b) Pin 2 Pink (c) Pin 3 Green Pin 4		Pins 1-6 2400 /uH ± 20% Pins 4-6 4.5 mH Pins 3-4 390 /uH ± 20%	 40 28	 30 1 12	M32-2366-01 Iss. 3

FREQUENCY MULTIPLIER (1 kHz) 5820-99-580-8258

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		TRANSISTORS (Cont'd)			
	5960-99-				
VT6	037-2978	CV7354			
VT7	037-2978	CV7354			
VT8	037-2978	CV7354			
VT9	037-2978	CV7354			
VT10	037-2478	CV5457			
VT11	037-2478	CV5457			
VT12	037-2978	CV7354			

Table 2.5 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L35	Winding (a) Pin 1 Brown Tap Pin 2 Pink Pin 3 Pink	>60	$8.2\ ^{+2.8}_{-1.5}$/uH Pins 1-2 0.35/uH ± 10%	36	36 Tap 4	W92307-B-1 Iss. 5 5950-99-580-6951
L38	Winding (a) Pin 3) Tap Pin 5) Pink Pin 2) Pin 1) Across Pins 1 & 5 C101 & C102 in //	50	6.5 ± 1.5/uH	34	25 Tap 17 Tap 24	W93941-B-1 Iss. 3 5999-99-580-7179
L39	Winding (a) Pin 1 Red Pin 5 Blue Tap Pin 2 Green Tap Pin 3 Orange Tap Pin 4 Yellow	>170	Pins 1-5 2.5 mH Pins 2-5 2.35 mH) Pins 3-5 2.25 mH) ± 5% Pins 4-5 1.65 mH)	38	$132\frac{1}{2}$ Tap 3 Tap 6 $24\frac{1}{2}$	W96073-1 Iss. 6 5950-99-580-6844
L41, L42	Winding Pin 1 Brown Pin 3 Pink	>70	$22\ ^{+11}_{-6}$/uH			W92310-B-1 Iss. 5 5950-99-580-6943
L43	Winding Pin 1 Brown Pin 3 Pink	>85	$60\ ^{+25}_{-5}$/uH	A	85	W92292-B-1 Iss. 4 5950-99-580-6944
L44	Winding Pin 1 Brown Pin 3 Pink	>85	$70\ ^{+30}_{-8}$/uH	A	91	W92293-B-1 Iss. 4 5950-99-580-6941

COMPONENTS LIST

NOTE Before ordering parts, refer to relevant E List and BR 1923 - Substitution Guide.

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5910-99-	CAPACITORS	/uF		Volts
C1	972-7842	Polystyrene	0.0033	5	125
C2	945-6655	Polystyrene	470 pF	2	125
C3	945-1531	Polystyrene	10 pF	1	125
C4	945-6655	Polystyrene	470 pF	2	125
C5	945-6655	Polystyrene	470 pF	2	125
C6	945-1531	Polystyrene	10 pF	1	125
C7	012-0116	Paper Metallised	0.04	20	250
C8	012-0113	Paper Metallised	0.01	20	250
C9	012-0116	Paper Metallised	0.04	20	250
C11	012-0116	Paper Metallised	0.04	20	250
C12	945-6655	Polystyrene	470 pF	2	125
C13	945-1531	Polystyrene	10 pF	1	125
C14	945-6655	Polystyrene	470 pF	2	125
C16	945-1531	Polystyrene	10 pF	1	125
C17	913-6618	Polystyrene	390 pF	2	125
C18	012-0116	Paper Metallised	0.04	20	250
C19	012-0113	Paper Metallised	0.01	20	250
C20	012-0116	Paper Metallised	0.04	20	250
C21	580-0299	Polystyrene	0.01	2	125
C22	580-0306	Polystyrene	0.0011	2	125
C23	012-0113	Paper Metallised	0.01	20	250
C24	580-0298	Polystyrene	0.001	2	125
C25	012-0116	Paper Metallised	0.04	20	250
C26	972-7830	Polystyrene	68 pF	2 pF	125
C27	580-0298	Polystyrene	0.001	2	125
C28	580-0298	Polystyrene	0.001	2	125
C29	946-9073	Polystyrene	560 pF	2	125
C30	012-0116	Paper Metallised	0.04	20	150
C31	972-7832	Polystyrene	220 pF	2	125
C32	012-0116	Paper Metallised	0.04	20	150
C33	012-0116	Paper Metallised	0.04	20	150
C34	012-0116	Paper Metallised	0.04	20	150
C35	945-6655	Polystyrene	470 pF	2	125
C36	915-0862	Polystyrene	330 pF	2	125
C37	012-0116	Paper Metallised	0.04	20	250
C38	915-0862	Polystyrene	330 pF	2	125
C39	012-0116	Paper Metallised	0.04	20	250
C40	999-4135	Metal Film	0.1	20	250
C41	999-4135	Metal Film	0.1	20	250
C42	945-6655	Polystyrene	470 pF	2	125
C43	012-0113	Paper Metallised	0.01	20	250
C44	012-0116	Paper Metallised	0.04	20	250
C45	945-6655	Polystyrene	470 pF	2	125
C46	913-6398	Metal Film	0.25	20	250
C47	945-6655	Polystyrene	470 pF	2	125

Table 2.5 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE (/uH)	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L6	Winding Pin 1 Brown Tap Pin 2 Pink Tap Pin 5 Pink Pin 3 Pink	>75	Pins 1-3 $14^{+4.5}_{-2.5}$ Pins 1-2 3.9) ± 5% Pins 1-5 10.2)	A	38 Tap 19 Tap $32\frac{1}{2}$	W92289-B-1 Iss. 4 5950-99-580-6953
L11	Winding (a) Pin 4 Yellow Pin 6 Green (b) Pin 1 Blue Tap Pin 2 Orange Pin 3 Red		Pins 4-6 130) Pins 1-3 222) Pins 1-2 75) ± 10% Pins 2-3 75)	38 36	48 70 Tap 35	W92285-1 Iss. 6 5950-99-580-6961
L13, L14, L46	Winding Pin 1 Brown Pin 3 Pink	>70	30^{+15}_{-2}	A	60	W92291-B-1 Iss. 5 5950-99-580-6946
L15	Winding Pin 1 Brown Pin 3 Pink	>65	9.5^{+4}_{-2}	36	36	W92304-B-1 Iss. 4 5950-99-580-6954
L17	Winding Pin 1 Brown Tap Pin 2 Pink Pin 3 Pink	>80	35^{+11}_{-2}	A	66 Tap 33	W92305-B-1 Iss. 5 5950-99-580-6948
L18	1 winding		3 ± 5%	36	17	W73984-C-20 Iss. 1 5950-99-580-7163

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5910-99-	CAPACITORS	/uF		Volts
C103	972-7830	Polystyrene	68 pF	2 pF	125
C104	016-7006	Variable	3-30 pF		
C106	946-2785	Polystyrene	82 pF	2 pF	125
C107	016-7006	Variable	3-30 pF		
C108	971-8787	Electrolytic	2	+100 -20	12
C109	999-4135	Metal Film	0.1	20	250
C111	580-0299	Polystyrene	0.01	2	125
C112	999-4135	Metal Film	0.1	20	250
C113	999-4135	Metal Film	0.1	20	250
C114	971-8787	Electrolytic	2	+100 -20	12
C115	972-7843	Polystyrene	0.0047	2	125
C116	972-7843	Polystyrene	0.0047	2	125
C117	580-0298	Polystyrene	0.001	2	125
C118	945-6655	Polystyrene	470 pF	2	125
C119	012-0114	Paper Metallised	0.02 pF	20	250
C121	999-4135	Metal Film	0.1	20	250
C122	580-7478	Polystyrene	620 pF	2	125
C123	915-0447	Polystyrene	0.0012	2	125
C124	580-7478	Polystyrene	620 pF	2	125
	5950-99-				
L1	580-6931	Inductor Assembly R.F.	7.8 uH		
L2	580-6837	Transformer R.F.	207 uH		
L3	580-6836	Transformer R.F.	207 uH		
L4	971-8857	Inductor R.F.			
L6	580-6836	Transformer R.F.	207 uH		
L7	580-6835	Transformer R.F.	207 uH		
L8	580-6835	Transformer R.F.	207 uH		
L9	580-6835	Transformer R.F.	207 uH		
L11	580-6838	Transformer R.F.	250 uH		
L12	580-6841	Transformer R.F.	150 uH		
L13	580-6842	Transformer R.F.	150 uH		
L14	580-6843	Transformer R.F.	150 uH		
L16	580-7170	Inductor Assembly R.F.	2.0 mH		
L17	580-7146	Inductor R.F.	750 uH		
L18	580-6940	Inductor R.F.	255 uH		
L19	580-7146	Inductor R.F.	750 UH		
L21	971-6938	Inductor R.F.	780 uH		
L22	971-8857	Inductor R.F.	780 uH		
L23	580-6823	Transformer R.F.	236 uH		
L24	580-6824	Transformer R.F.	236 uH		
L26	580-6825	Transformer R.F.	236 uH		
L27	580-6826	Transformer R.F.	236 uH		
L28	580-6825	Transformer R.F.	236 uH		
L29	580-6840	Transformer R.F.	236 uH		
L31	580-6937	Inductor R.F.	62 uH		

Table 2.4 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L40	1 winding		3.5 mH ± 5%	42	1760	W56565-C-4 Iss. 3 5950-99-580-7143
L41, L42	Winding Pin 3 Pink Pin 1 Brown	>80	182 $^{+28}_{-37}$/uH	A	160	W92275-B-1 Iss. 4 5950-99-580-6935
L43	1 winding		1.15 mH ± 5%	42	255	W56565-C-23 Iss. 1
L44	Winding Pin 1 Brown Pin 3 Pink	>85	145 ± 25/uH	A	140	W96819-B-1 Iss. 3 5950-99-580-7156
L45	1 winding		470/uH ± 5%	42	165	W56565-C-24 Iss. 2 5950-99-580-7145
L48	Winding (a) Pin 3 Red Pin 4 Blue (Earth) (b) Pin 1 Green Tap Pin 5 Pink Pin 6 Yellow	 >70 >70	Pins 3-4 & 1-6 3000/uH ± 10%	 38 38	 156 156 Tap 78	M32-2363-01 Iss. 4

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5905-99-	RESISTORS	Ohms		Watts
R6	022-2088		4.7 k	10	¼
R7	022-2004		1 k	10	¼
R8	022-2004		1 k	10	¼
R9	022-3058		150 k	10	¼
R10	022-2046		2.2 k	10	¼
R11	022-3058		150 k	10	¼
R12	022-2067		3.3 k	10	¼
R13	022-2130		10 k	10	¼
R14	022-2004		1 k	10	¼
R15	022-1130		150	10	¼
R16	022-1100		82	10	¼
R17	022-2130		10 k	10	¼
R18	022-2088		4.7 k	10	¼
R19	022-2121		5.6 k	10	¼
R20	022-2184		27 k	10	¼
R21	022-1109		100	10	¼
R22	022-2004		1 k	10	¼
R23	022-2214		47 k	10	¼
R24	022-2004		1 k	10	¼
R25	022-2004		1 k	10	¼
R26	022-2025		1.5 k	10	¼
R27	022-2130		10 k	10	¼
R28	022-2172		22 k	10	¼
R29	022-1193		470	10	¼
R30	022-1109		100	10	¼
R31	022-2046		2.2 k	10	¼
R32	022-1130		150	10	¼
R33	022-2004		1 k	10	¼
R34	022-1214		680	10	¼
R35	022-2046		2.2 k	10	¼
R37	022-2004		1 k	10	¼
R38	022-1067		47	10	¼
R39	022-2004		1 k	10	¼
R41	022-2088		4.7 k	10	¼
R42	022-2172		22 k	10	¼
R43	022-2004		1 k	10	¼
R44	022-1037		27	10	¼
R46	022-2004		1 k	10	¼
R47	022-2172		22 k	10	¼
R48	022-2088		4.7 k	10	¼
R49	022-1214		680	10	¼
R51	022-2046		2.2 k	10	¼
R52	022-1214		680	10	¼
R53	022-2046		2.2 k	10	¼
R54	022-2046		2.2 k	10	¼

Table 2.4 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L16	Winding (a) Pin 4 Red Pin 6 Green (b) Pin 3 Yellow Pin 2 Green Pin 1 Red	(b) & (c) >85	Pins 1-3 1650/uH) Pins 2-3 575/uH) Pins 2-1 575/uH) Pins 4-6 2000/uH)	40 38 38	200 100 100	W92261-1 Iss. 6 5950-99-580-7170
L17, L19	Winding Pin 3 Pink Pin 1 Brown	>65	750 ± 120/uH	C	330	W92262-B-1 Iss. 4 5950-99-580-7146
L18	Winding Pin 3 Pink Pin 1 Brown	>90	255 ± 35/uH	A	190	W92266-8-1 Iss. 5 5950-99-580-6940
L21	Winding Pin 3 Pink	>50	780 $^{+100}_{-130}$/uH	C	337	W92267-B-1 Iss. 5 5950-99-580-6923
L23	Winding Pin 1 Green Tap Pin 2 Blue Tap Pin 3 Yellow Pin 4 Red	>200	Pins 1-4 240 $^{+15}_{-10}$/uF Pins 1-2 3.6/uH) Pins 1-3 13/uH) ± 10%	A	70½ Tap 7¼	W95309-1 Iss. 4 5950-99-580-6823
L24	Winding Pin 1 Red Tap Pin 2 Yellow Pin 3 Green	>200	Pins 1-3 240 $^{+15}_{-10}$/uH Pins 1-2 232/uH ± 10%	A	70½ Tap 1¼	W95310-1 Iss. 4 5950-99-580-6824

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FREQUENCY MULTIPLIER (10 kHz) - 5820-99-580-8261

COMPONENTS LIST (Contd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± - %	Rating
	5935-99-				
TP11	913-6813	Test Point			
TP12	913-6813	Test Point			
TP13	913-6813	Test Point			
TP14	913-6813	Test Point			
TP15	914-7189	Test Point			
TP16	901-3062	Test Point			
TP17	901-3061	Test Point			
TP18	901-3061	Test Point			
TP19	901-3061	Test Point			
	5960-99-	TRANSISTORS			
VT1	037-2207	CV8354			
VT2	037-2978	CV7354			
VT3	037-2207	CV8354			
VT4	037-2978	CV7354			
VT5	037-2207	CV8354			
VT6	037-2207	CV8354			
VT7	037-2207	CV8354			
VT8	037-2978	CV7354			
VT9	037-2978	CV7354			
VT10	037-2978	CV7354			
VT11	037-2978	CV7354			
VT12	037-2978	CV7354			
VT13	037-2478	CV5457			
VT14	037-2978	CV7354			

Table 2.4

Frequency Multiplier (10 kHz) Coil Data

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L1	Winding (a) Pin 3 Yellow Tap Pin 2 Blue Pin 1 White (b) Pin 4 Yellow Pin 5 Red (c) Pin 5 Red Pin 6 Green	 (b) & (c) >40	Pins 4-6 7800 $^{+200}_{-800}$/uH Pins 4-5 2500/uH) Pins 5-6 2400/uH) Pins 3-2 1100/uH) ± 5% Pins 2-1 1200/uH) Pins 1-3 4500/uH)	42 40 40	238 Tap 123 167 167	W92257-1 Iss. 6 5950-99-580-6931
L2	Winding (a) Pin 1 Green Pin 3 Red (b) Pin 4 Green Tap Pin 2 Yellow Pin 6 Red	>140	Pins 1-3 207 $^{+23}_{-12}$/uH Pins 4-6 15/uH) Pins 4-2 4/uH) ± 10%	B 36	63 15 Tap $7\frac{1}{2}$	W95302-1 Iss. 5 5950-99-580-6837
L3, L6	Winding (a) Pin 1 Green Pin 2 Yellow Pin 3 Red	>230	Pins 1-3 207 $^{+18}_{-7}$/uH Pins 1-2 4.4/uH ± 5%	A	66 Tap 8	W95303-1 Iss. 5 5950-99-580-6836
L4, L22 L37, L49 L50	Winding Pin 4 Red Pin 6 Yellow		>67.0) <68.2)/uH	38	435	W103996-C-1 Iss. 2
L7, L8 L9	Winding Pin 1 Green Tap Pin 2 Yellow Pin 3 Red	>220	Pins 1-3 207 $^{+18}_{-12}$/uH Pins 1-2 1.5/uH ± 10%	A	65 Tap 16	W95304-1 Iss. 6 5950-99-580-6835

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FREQUENCY MULTIPLIER (100kHZ) – 5820–99–580–8260

COMPONENTS LIST

NOTE Before ordering parts, refer to relevant E list and BR 1923 – Substitution Guide.

Cct. Ref.	NSN or other Ref. No.	Description	Value	Tol. %	Rating
		CAPACITORS	/uF		Volts
	5910–99–				
C1	580–0354	Polystyrene	0.0012	5	125
C2	580–0354	Polystyrene	0.0012	5	125
C3	972–7831	Polystyrene	100p	2pF	125
C4	011–8272	Ceramic	3.3p	½pF	750
C6	972–7831	Polystyrene	100p	2	125
C7	012–8274	Ceramic	4.7p	½pF	750
C8	972–7831	Polystyrene	100p	2pF	125
C9	012–0113	Paper Metallised	0.01	20	250
C11	012–0113	Paper Metallised	0.01	20	250
C12	972–8322	Variable	1.5–10p		250
C14	012–0113	Paper Metallised	0.01	20	250
C16	012–0113	Paper Metallised	0.01	20	250
C17	972–7831	Polystyrene	100p	2pF	125
C18	011–8272	Ceramic	3.3p	½pF	750
C19	972–7831	Polystyrene	100p	2pF	125
C21	011–8272	Ceramic	3.3p	½pF	750
C22	972–7831	Polystyrene	100p	2pF	125
C23	972–7831	Polystyrene	100p	2pF	125
C24	972–7831	Polystyrene	100p	2pF	125
C26	972–7832	Polystyrene	220p	2	125
C27	580–0308	Polystyrene	150p	2	125
C28	972–7831	Polystyrene	100p	2pF	125
C29	012–0113	Paper Metallised	0.01	20	250
C30	580–0298	Paper Metallised	0.001	2	125
C31	012–0113	Paper Metallised	0.01	20	250
C32	012–0113	Paper Metallised	0.01	20	250
C33	972–7830	Polystyrene	68pF	2pF	125
C34	012–0113	Paper Metallised	0.01	20	250
C36	913–6605	Polystyrene	270p	2pF	125
C37	012–0113	Paper Metallised	0.01	20	250
C38	580–7197	Polystyrene	91p	2pF	125
C39	012–0113	Paper Metallised	0.01	20	250
C41	012–0113	Paper Metallised	0.01	20	250
C42	972–7831	Polystyrene	100p	2pF	125
C43	972–7842	Polystyrene	0.0033	5	125
C44	011–8272	Ceramic	3.3p	½pF	750
C46	972–7831	Polystyrene	100p	2pF	125
C48	972–8322	Variable	1.5–10p		250
C49	012–0113	Paper Metallised	0.01	20	250
C51	012–0113	Paper Metallised	0.01	20	250

Table 2.3 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L23, L28	Winding Pin 1 Red Tap Pin 2 Pink Pin 6 Blue	>200	Pins 1-6 3.7 ± 0.15 mH Pins 2-6 2.36 mH ± 1%	34	129	M32-2353-01 Iss. 4
L25	Winding Pin 1 Red Tap Pin 2 Pink Pin 6 Blue	>200	Pins 1-6 3.7 ± 0.15 mH Pins 2-6 3.21 mH ± 1%	34	129 Tap 9	M32-2354-01 Iss. 3
L29	Winding (a) Pin 6 Red Tap Pin 2 Pink Pin 1 Blue (b) Pin 4 Green Tap Pin 5 Black (Earth) Pin 3 Yellow	>200	Pins 1-6 3.7 ± 0.15 mH Pins 1-2 2.55 mH ± 1% Pins 4-3 90/uH ± 15% Pins 3-6 4.7 mH appx. Pins 3.5 45/uH appx. Pins 4-5 45/uH appx.	36 40	129 Tap 22 16 Tap 8	M32-2355-01 Iss. 6
L31, L32	Winding Pin 3 Yellow Pin 1 Red Tap Pin 2 Blue	>85	Pins 1-3 1000 ± 50/uH Pins 1-2 143/uH ± 5%	34	122 Tap 41	W94368-1 Iss. 5 5950-99-580-7174
L40	Winding Pin 1 Red Pin 3 Blue		240 mH	42	860¼	W96068-1 Iss. 2 5950-99-580-7142
L41, L42	Winding Pin 1 Red Pin 3 Blue	>130	35 000 ± 3000/uH	38	380½	W96067-1 Iss. 3 5950-99-580-6820

FREQUENCY MULTIPLIER (100 kHz) - 5820-99-580-8260

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS (Cont'd)	/uF		Volts
	5910-99-				
C103	945-1548	Polystyrene	310p	2	125
C104	016-7006	Variable	3-30p		
C106	913-6605	Polystyrene	270p	2	125
C107	016-7006	Variable	3-30p		
C108	580-7193	Polystyrene	240p	2	125
C109	016-7006	Variable	3-30p		
C111	945-1547	Polystyrene	210p	2	125
C112	016-7006	Variable	3-30p		
C113	945-8379	Polystyrene	180p	2	125
C114	016-7006	Variable	3-30p		
C116	945-1546	Polystyrene	140p	2	125
C117	016-7006	Variable	3-30p		
C118	580-7205	Polystyrene	110p	2	125
C119	016-7006	Variable	3-30p		
C121	946-2785	Polystyrene	82p	2pF	125
C122	016-7006	Variable	3-30p		
C123	945-1537	Polystyrene	47p	2pF	125
C124	016-7006	Variable	3-30p		
C125	580-7201	Polystyrene	18p	2pF	125
C126	016-7006	Variable	3-30p		
C130	012-0113	Paper Metallised	0.01	20	250
C131	580-0298	Polystyrene	0.001	2	125
C132	012-0113	Paper Metallised	0.01	20	250
C133	012-0113	Paper Metallised	0.01	20	250
C134	999-4135	Metal Film	0.1	20	250
C135	580-0308	Polystyrene	150p	2	350
C136	012-0113	Paper Metallised	0.01	20	250
C137	972-7831	Polystyrene	100p	2pF	125
C138	945-1545	Polystyrene	120p	2	125
C139	012-0113	Paper Metallised	0.01	20	250
C141	012-0113	Paper Metallised	0.01	20	250
C142	580-0288	Polystyrene	39p	2pF	125
C143	945-1534	Polystyrene	22p	2pF	125
C144	580-7485	Polystyrene	47p	2pF	125
C145	913-6616	Polystyrene	100p	2pF	350
C146	580-0308	Polystyrene	150p	2pF	125
C147	580-0308	Polystyrene	150p	2pF	125

Table 2.3

Frequency Multiplier (1 kHz) Coil Data

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L1	Winding (a) Pin 4 Red (Earth) Pin 3 Blue (b) Pin 1 Green Tap Pin 5 Pink Pin 6 Yellow	>20	Pins 3-4 76 ± 3.5 mH Pins 1-6 41 mH ± 5% Pins 4-6 222 mH appx. Pins 1-5 11 mH appx. Pins 6-5 11 mH appx.	42 46	585 420 Tap 210	M32-2361-01 Iss. 4
L2, L8	Winding (a) Pin 1 Red Pin 2 Blue (b) Pin 4 Green Tap Pin 3 Pink (Earth) Pin 5 Yellow	>200	Pins 1-2 3.15 ± 0.15 mH Pins 4-5 465 uH ± 5% Pins 1-5 5.95 uH appx.	36 40	119 44 Tap 22	M32-2356-01 Iss. 4
L3, L7	Winding Pin 1 Red (Earth) Pin 6 Blue	>200	3.05 ± 0.15 mH	34	117	M32-2357-01 Iss. 3
L4	Winding Pin 6 Red (Earth) Tap Pin 2 Pink Pin 1 Blue	>200	Pins 1-6 3.15 ± 0.15 mH Pins 1-2 2.55 mH ± 5%	34	119 Tap 12	M32-2358-01 Iss. 3
L6	Winding Pin 6 Red Tap Pin 2 Pink Pin 1 Blue	>200	Pins 1-6 3.15 ± 0.15 mH Pins 1-2 1.41 ± 1% mH	34	119 Tap 40	M32-2359-01 Iss. 3

FREQUENCY MULTIPLIER (100 kHz) - 5820-99-580-8260

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
L48	5950-99-580-6964	Transformer R.F.	300uH		
L49	5950-99-580-7164	Inductor R.F.	600uH		
L50	5950-99-580-7164	Inductor R.F.	600uH		
		RECTIFIERS			
	5960-99-				
MR1	037-3527	CV8332			
MR2	037-3527	CV8332			
MR3	037-3527	CV8332			
MR4	037-3527	CV8332			
MR6	037-3527	CV8332			
MR7	037-3527	CV8332			
MR8	037-3527	CV8332			
MR9	037-3527	CV8332			
MR11	000-0478	CV478			
MR12	000-0478	CV478			
MR13	000-0478	CV478			
MR14	000-0478	CV478			
MR15	037-2373	CV7130			
PLCF	054-0201	Plug			
PLCH	5935-99-580-2867	Plug			
PLCK	5935-99-932-5838	Plug			
		RESISTORS	Ohms		Watts
	5905-99-				
R1	022-2130		10k	10	¼
R2	022-2088		4.7k	10	¼
R3	022-1067		47	10	¼
R4	022-2004		1k	10	¼
R5	022-2172		22k	10	¼
R6	022-2004		1k	10	¼
R9	022-1067		47	10	¼
R10	022-2025		1.5k	10	¼
R11	022-1193		470	10	¼
R12	022-2130		10k	10	¼
R13	022-2109		6.8k	10	¼
R14	022-1193		470	10	¼
R16	022-2004		1k	10	¼
R17	022-1058		39	10	¼
R18	022-2004		1k	10	¼

Table 2.1 Continued

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L19	Winding Pin 1 Red Pin 3 Blue Tap Pin 2 Green	>25	1.12 ± 0.05 H Tap 1.02 H ± 10%	44	$1540\frac{1}{2}$ Tap $65\frac{3}{4}$	W96081-1 Iss. 4 5950-99-580-7138
L21	Winding (a) Pin 4 Orange Pin 6 Yellow		2.3 mH ± 10%	44	$69\frac{3}{4}$	W96082-1 Iss. 4 5950-99-580-7136
	(b) Pin 1 Red Pin 3 Blue Tap Pin 2 Green	>25	1.12 ± 0.05 H Tap 740 mH ± 10%	44	$1539\frac{3}{4}$ Tap $259\frac{3}{4}$	
L22	Winding (a) Pin 4 Green Pin 6 Yellow		61 mH ± 10%	44	$359\frac{3}{4}$	W96079-1 Iss. 4 5950-99-580-7140
	(b) Pin 1 Red Pin 3 Blue	>14	550 ± 25/uH	44	$1079\frac{3}{4}$	

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FREQUENCY MULTIPLIER (100 kHz) - 5820-99-580-8260

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± - %	Rating
		RESISTORS (Cont'd)	Ohms		Watts
RV1	5905-99-011-8259	Resistor Variable	1k	20	¼
RV2	011-8259	Resistor Variable	1k	20	¼
RV3	011-8259	Resistor Variable	1k	20	¼
RV4	011-8259	Resistor Variable	1k	20	¼
RV5	011-8259	Resistor Variable	1k	20	¼
RV6	011-8259	Resistor Variable	1k	20	¼
RV7	011-4960	Resistor Variable Wirewound	250	10	
SKCL	5935-99-580-6609	Socket Coaxial Free			
SWA	5930-99-580-6076	Switch Rotary Wafer			
TP1	5935-99-913-6113	Test Point			
TP2	913-6113	Test Point			
TP3	913-6113	Test Point			
TP4	913-6113	Test Point			
TP5	913-6113	Test Point			
TP6	913-6113	Test Point			
TP7	913-6113	Test Point			
TP8	913-6813	Test Point			
TP9	913-6113	Test Point			
TP10	913-6113	Test Point			
TP11	913-6113	Test Point			
TP12	913-6113	Test Point			
TP13	901-3061	Test Point			
TP14	901-3061	Test Point			
TP15	914-7189	Test Point			
TP16	901-3062	Test Point			
TP17	901-3061	Test Point			
		TRANSISTORS			
VT1	5960-99-037-2207	CV8354			
VT2	037-2207	CV8354			
VT3	037-2207	CV8354			
VT4	037-2207	CV8354			
VT5	037-2207	CV8354			
VT6	037-2207	CV8354			
VT7	037-2207	CV8354			
VT8	037-2207	CV8354			
VT9	037-2207	CV8354			
VT10	037-2978	CV7354			
VT11	037-2978	CV7354			
VT12	037-2207	CV8354			

Table 2.1

Frequency Divider Coil Data

CCT. REF.	COLOUR CODE	Q	INDUCTANCE	TYPE OR SWG OF WIRE	NO. OF TURNS	MARCONI NO. & NSN
L1, L4	1 winding, Pins 1 and 4 Taps at Pins 5, 2, 3	>110	<290 >210/uH Pins 4-5 >247 <251/uH Pins 4-3 >231 <248/uH Pins 4-2 >178 <179/uH	A	$170\frac{1}{2}$ Tap $2\frac{1}{2}$ Tap 7 Tap 28	W93936-B-1 Iss. 2 5910-99-580-7336
L2, L5	1 winding		1.6 mH ± 10%	42	305	W92239-C-1 Iss. 3 5910-99-580-7160
L3	Winding (a) Pin 4 Green Pin 6 Yellow (b) Pin 1 Red Pin 3 Blue	>35	20.5/uH ± 10% 209-12+8/uH	28 28	$11\frac{3}{4}$ $36\frac{3}{4}$	W96075-1 Iss. 6 5910-99-580-7287
L6	1 winding		3.5 mH ± 5%	42	1760	W92237-C-1 Iss. 2 5910-99-580-8310
L7, L8	Winding Pin 1 Red Pin 5 Blue Tap Pin 2 Green Tap Pin 3 Orange Tap Pin 4 Yellow	>170	Pins 1-5 2.5 mH Pins 2-5 2.35 mH Pins 3-5 2.25 mH Pins 4-5 1.65 mH ± 5%	38	$132\frac{1}{2}$ Taps 3 6 $24\frac{1}{2}$	W96073-1 Iss. 6 5910-99-580-6844
L9	Winding (a) Pin 4 Green Pin 6 Yellow (b) Pin 1 Red Pin 3 Blue	>150	282/uH ± 10% 2500/uH ± 5.5%	38 38	$43\frac{3}{4}$ $131\frac{3}{4}$	W96070-1 Iss. 4 5910-99-580-7288

FREQUENCY MULTIPLIER (MHz) - 5820-99-519-7001

COMPONENTS LIST

NOTE Before ordering parts, refer to relevant E List and BR 1923 - Substitution Guide.

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS	/uF		Volts
	5910-99-				
C1	952-0544	Polystyrene	120p	2	350
C2	952-0544	Polystyrene	120p	2	350
C4	945-1541	Polystyrene	68p	2	125
C6	011-8342	Ceramic	3.3p	½pF	750
C7	945-1541	Polystyrene	68p	2pF	125
C8	011-8342	Ceramic	3.3p	½pF	750
C9	940-8022	Ceramic	0.0015	+80 -20	500
C11	946-2785	Polystyrene	82p	2pF	125
C12	915-0862	Polystyrene	330p	2	125
C13	945-1541	Polystyrene	68p	2	125
C14	940-8022	Ceramic	0.0015	+80 -20	500
C16	798-7977	Variable	7-4p		
C17	945-1541	Polystyrene	68p	2pF	125
C18	011-8342	Ceramic	3.3p	½pF	750
C19	946-2785	Polystyrene	82p	2pF	125
C20	580-8445	Variable	1-8p		350
C21	016-7006	Variable	3-30p		
C22	580-7195	Polystyrene	59p	2pF	125
C23	945-1537	Polystyrene	47p	2pF	125
C24	580-0285	Polystyrene	20p	2pF	125
C25	580-7196	Polystyrene	43p	2pF	125
C26	945-1531	Polystyrene	10p	1pF	125
C27	945-1531	Polystyrene	10p	1pF	125
C29	945-1534	Polystyrene	22p	2pF	125
C30	945-1537	Polystyrene	47p	2	125
C31	012-0113	Paper Metallised	0.01	20	250
C32	012-0113	Paper Metallised	0.01	20	250
C33	580-0165	Polystyrene	150p	2	350
C34	012-0114	Paper Metallised	0.02	20	250
C35	012-0165	Polystyrene	150p	2	350
C36	012-0113	Paper Metallised	0.01	20	250
C37	913-6398	Metal Film	0.25	20	250
C38	012-0113	Paper Metallised	0.01	20	250
C39	945-1534	Polystyrene	22p	2pF	125
C40	012-0113	Paper Metal	0.01	20	250

FREQUENCY MULTIPLIER (MHz) - 5820-99-519-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
	5910-99-	CAPACITORS (Cont'd)	µF		Volts
C79	011-8342	Ceramic	3.3p	½pF	750
C81	946-2785	Polystyrene	82p	2pF	125
C82	940-8022	Ceramic	0.0015	+80 -20	500
C83	946-2785	Polystyrene	82p	2pF	125
C84	940-8022	Ceramic	0.0015	+80 -20	500
C86	946-2785	Polystyrene	82p	2pF	125
C87	945-6655	Polystyrene	470p	2	125
C88	972-7831	Polystyrene	100p	2	125
C89	012-0113	Peper Metallised	0.01	20	250
C90	580-7489	Ceramic	0.0047	+80 -20	500
C91	945-1545	Polystyrene	120p	2	125
C92	940-8022	Ceramic	0.0015	+80 -20	500
C93	012-0113	Paper Metal	0.01	20	250
C94	944-6750	Polystyrene	0.0012	2	125
C95	580-7474	Polystyrene	12p	1pF	125
C96	945-1537	Polystyrene	47p	2pF	125
C97	011-8340	Ceramic	2.2p	½pF	750
C98	580-7475	Polystyrene	7p	1pF	125
C99	012-0113	Paper Metal	0.01	20	250
C100	945-6655	Polystyrene	470p	2	125
C101	945-1541	Polystyrene	68p	2pF	125
C102	519-3892	Polystyrene	76p	2pF	125
C103	946-2785	Polystyrene	82p	2pF	125
C104	580-7197	Polystyrene	91p	2pF	125
C105	913-6616	Polystyrene	100p	2pF	125
C106	945-1546	Polystyrene	140p	2	125
C107	945-1546	Polystyrene	140p	2	125
C108	580-7207	Polystyrene	160p	2	125
C109	613-6617	Polystyrene	200p	2	125
C110	580-0310	Polystyrene	300p	2	125
C111	915-0862	Polystyrene	330p	2	125
C112	580-0303	Polystyrene	360p	2	125
C113	580-0178	Polystyrene	450p	2	125
C114	519-3896	Polystyrene	510p	2	125
C115	913-6618	Polystyrene	390p	2	125
C116	519-3894	Polystyrene	430p	2	125
C117	519-3896	Polystyrene	510p	2	125
C118	580-7478	Polystyrene	620p	2	125
C119	580-0278	Polystyrene	750p	2	125
C120	580-7189	Polystyrene	910p	2	125

FREQUENCY MULTIPLIER (MHz) - 5820-99-591-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		CAPACITORS (Cont'd)	µF		Volts
	5910-99-				
C204	944-6750	Polystyrene	0.0012	2	125
C205	944-6750	Polystyrene	0.0012	2	125
C206	940-8022	Ceramic	0.0015	+80 -20	500
C207	940-8022	Ceramic	0.0015	+80 -20	500
C208	946-2790	Polystyrene	680p	2	125
C209	915-0892	Polystyrene	220p	2	125
C210	580-7489	Ceramic	0.0047	+80 -20	500
C211	915-0862	Polystyrene	330p	2	125
C212	924-6343	Ceramic Temperature Coefficient 080	27p	2½	750
C213	519-9961	Ceramic Temperature Coefficient -220	27p	2½	750
C214	944-6750	Polystyrene	0.0012	2	125
C215	944-6750	Polystyrene	0.0012	2	125
C216	580-0308	Polystyrene	150p	2	125
C217	944-6750	Polystyrene	0.0012	2	125
C218	972-0761	Polyester	0.01	20	250
C219	972-0761	Polyester	0.01	20	250
C220	972-0761	Polyester	0.01	20	250
C221	972-7686	Ceramic	4.7p	½pF	250
C222	972-7686	Ceramic	4.7p	½pF	250
C223	972-0761	Polyester	0.01	20	250
C224	972-0761	Polyester	0.01	20	250
C225	972-0761	Polyester	0.01	20	250
C226	110-4919	Polystyrene tubular	100p	2	125
		INDUCTORS	µH		
	5950-99-				
L1	580-6950		10		
L2	580-7171		0.18		
L3	580-7173		0.18		
L4	580-7173		0.18		
L6	580-7173		0.18		
L7	580-7173		0.18		
L8	971-8856		0.33		
L11	Marconi M32-2366-01		1.07		
L12	5950-99-580-7158		1.07		
L13	5950-99-580-7158		1.07		
L14	5950-99-580-7159		0.48		
L16	Marconi W.99114 Sh.1 Ed.S		0.84		
L17	Marconi W.99114 Sh.1 Ed.R		0.9		
L18	Marconi W.99114 Sh.1 Ed.R		0.97		
L19	Marconi W.99114 Sh.1 Ed.Q		1.05		

(2) Remove three securing screws in the corners of the box cover which houses the Switch-board and take off the cover.

(3) Unsolder leads and remove two securing screws to release the Switch-board.

(4) To replace reverse the procedure.

NOTE There is no need to remove Unit 2 to gain access to Switch-board components. Take off the cover as in Step (2) after opening the Synthesizer drawer as in Paragraph 1.

Frequency Divider

6. To remove the Frequency Divider proceed as follows:-

(1) Disconnect the plugs listed in Table 1.8.

Table 1.8 Frequency Divider Plugs

Identity	Location
PLCE) PLCK) PLCB) PLCT) PLCY)	Top of Frequency Divider
PLCW	Top of Oscillator A.F.

(2) Disconnect the earth link between the unit and the Frequency Multiplier (MHz).

(3) Remove the four screws and crinkle washers which secure the Frequency Divider at the left-hand side of the frame.

(4) Remove the two screws and crinkle washers which secure the unit to the bracket attached to the right-hand side of the frame.

(5) Grasp the two knobs on the top of the unit and lift it out.

(6) To replace reverse the procedure.

Switch Wafers

7. To remove a switch wafer first remove the associated Frequency Multiplier as in Paragraph 4. There is no need to dismantle the front panel. Then proceed as follows:-

(1) Using an Allen key, slacken the grub screws and remove the flexible coupling from the switch shaft.

(2) Remove the two nuts and crinkle washers at the ends of the switch rods.

(3) Cut the pvc lacing adjacent to the switch.

(4) Lift the strap, and remove enough spacers and wafers from the switch rods to gain access to the selected wafer.

FREQUENCY MULTIPLIER (MHz) - 5820-99-591-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		INDUCTORS (Cont'd)	uH		
L72	5950-99-580-7169		6.5		
L73	Marconi W.101093-B Sh.1		1.6		
L74	5950-99-580-7167		6.6		
L75	5950-99-580-7147		7		
L76	5950-99-580-7145		4.3		
L77	5950-99-580-7148		3		
L79	5950-99-580-7162		12.5		
L82	Marconi W.99125 Sh.1 Ed.A		0.25-0.5		
L83	Marconi W.99125 Sh.1 Ed.B		0.25-0.5		
L91	Marconi W.99114 Sh.1 Ed.AA		0.42		
L92	Marconi W.99114 Sh.1 Ed.Z		0.45		
L93	Marconi W.99114 Sh.1 Ed.Z		0.48		
L94	Marconi W.99114 Sh.1 Ed.Y		0.52		
L95	Marconi W.99114 Sh.1 Ed.Y		0.57		
L96	Marconi W.99114 Sh.1 Ed.Y		0.62		
L97	Marconi W.99114 Sh.1 Ed.X		0.68		
L98	Marconi W.99114 Sh.1 Ed.U		0.75		
L99	Marconi W.99114 Sh.1 Ed.T		0.83		
L100	Marconi W.99114 Sh.1 Ed.S		0.92		
L101	Marconi W.99114 Sh.1 Ed.R		1.03		
L102	Marconi W.99114 Sh.1 Ed.P		1.16		
L103	Marconi W.99114 Sh.1 Ed.O		1.31		
L104	Marconi W.99114 Sh.1 Ed.N		1.50		
L105	Marconi W.99114 Sh.1 Ed.M		1.72		
L106	Marconi W.99114 Sh.1 Ed.K		2.02		
L107	Marconi W.99114 Sh.1 Ed.H		2.40		
L108	Marconi W.99114 Sh.1 Ed.W		2.87		
L109	Marconi W.99114 Sh.1 Ed.E		3.50		
L110	Marconi W.99114 Sh.1 Ed.C		4.37		
L111	Marconi W.99114 Sh.1 Ed.B		5.6		
L112	Marconi W.99114 Sh.1 Ed.Y		7.5		
L113	Marconi W.99115 Sh.1 Ed.L		10		
L114	Marconi W.99115 Sh.1 Ed.F		15		
L115	Marconi W.99115 Sh.1 Ed.K		25		
L116	Marconi W.99115 Sh.1 Ed.C		50		
L117	Marconi W.99115 Sh.1 Ed.J		141		
L120	5950-99-924-4970	Inductor A.F.			
L121	5950-99-924-4970	Inductor A.F.			
L122	5950-99-924-4971	Inductor A.F.			
L123	5950-99-924-4972	Inductor A.F.			

Power Supply

3. To remove the Power Supply, access is required underneath the drawer so if necessary remove it from the cabinet. Then proceed as follows:-

(1) Disconnect the plugs and sockets listed in Table 1.2.

Table 1.2 Power Supply Plugs and Sockets

Identity	Location
PLCU PLCV	Top of Power Supply
SKCA	Rear of Frequency Multiplier (MHz)
SKCH	Rear of Frequency Multiplier (100 kHz)
SKCZ	Rear of Frequency Multiplier (10 kHz)
SKCQ	Rear of Frequency Multiplier (1 kHz)

(2) Remove the four screws and crinkle washers securing the Power Supply and lift it out.

(3) To replace reverse the procedure.

Frequency Multipliers and Oscillator A.F.

4. To remove the units, access is required underneath the drawer so if necessary remove it from the cabinet. Then proceed as follows:-

(1) Using an Allen key, slacken the grub screws securing the flexible coupling to the unit which is to be removed. On units fitted with the new type of coupling it is not necessary to release either end before removing a unit. The centre section of the coupling will drop out when the two ends are parted.

(2) Note the position of the switch and the switch shaft so that the two parts can be correctly mated on reassembly. (See Part 5A, Figure 1.6).

(3) Remove the connections listed in the appropriate one of Tables 1.3 to 1.7.

Table 1.3 Frequency Multiplier (MHz) Inter-connections

Identity	Location	Remarks
SKCG	Top of Frequency Multiplier (MHz)	-
SKCA) SKCD) SKCF)	Rear of Frequency Multiplier (MHz)	- Fits on to PLBU
SKBX	Rear of Frequency Multiplier (100 kHz)	Fits on to PLCF
PLBS) PLBT)	Rear of Frequency Multiplier (MHz)	From TP21 -
SKCE) EARTH)	Top of Frequency Divider	- -

FREQUENCY MULTIPLIER (MHz) - 5820-99-519-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		INDUCTORS (Cont'd)			
L166	Marconi W.99114 Sh.1 Ed.AA				
L167	Marconi W.99114 Sh.1 Ed.AA				
L168	Marconi W.99114 Sh.1 Ed.AA				
L169	Marconi W.99114 Sh.1 Ed.AA				
L170	Marconi W.99114 Sh.1 Ed.AA				
L171	Marconi W.99114 Sh.1 Ed.AA				
L172	Marconi W.99114 Sh.1 Ed.AA				
L173	Marconi W.99114 Sh.1 Ed.AA				
L174	Marconi WIS 12012-B Sh.1 Ref. 4		220 uH		
		DIODES			
	5960-99-				
MR1	037-3527	CV8332			
MR2	037-3527	CV8332			
MR3	037-3527	CV8332			
MR4	037-3527	CV8332			
MR5	037-3527	CV8332			
MR6	037-3527	CV8332			
MR7	037-3527	CV8332			
MR8	037-3527	CV8332			
MR9	037-3527	CV8332			
MR10	037-3527	CV8332			
MR11	037-3527	CV8332			
MR12	037-3527	CV8332			
MR13	037-2201	CV7101			
MR14	037-3527	CV8332			
MR15	037-3527	CV8332			
MR16	037-3527	CV8332			
MR17	037-2373	CV7130			
MR18	037-2302	CV7127			
MR19	037-2302	CV7127			
MR20	037-2016	CV7040			
	5935-99-				
PLBC	054-0201	Plug			
PLCA	914-9846	Plug			
PLCE	932-5838	Plug			
PLBP	054-0201	Plug			
PLBQ	054-0201	Plug			
PLBR	054-0201	Plug			
PLBS	5820-99-552-1177	Plug and lead assembly			
PLBT	5820-99-552-7198	Plug and lead assembly			
PLBU	5835-99-054-0201	Plug			
PLCB	Marconi WIS.12394-B Sh.1 Ref 1	Plug			

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COMPONENTS LIST (Cont'd)

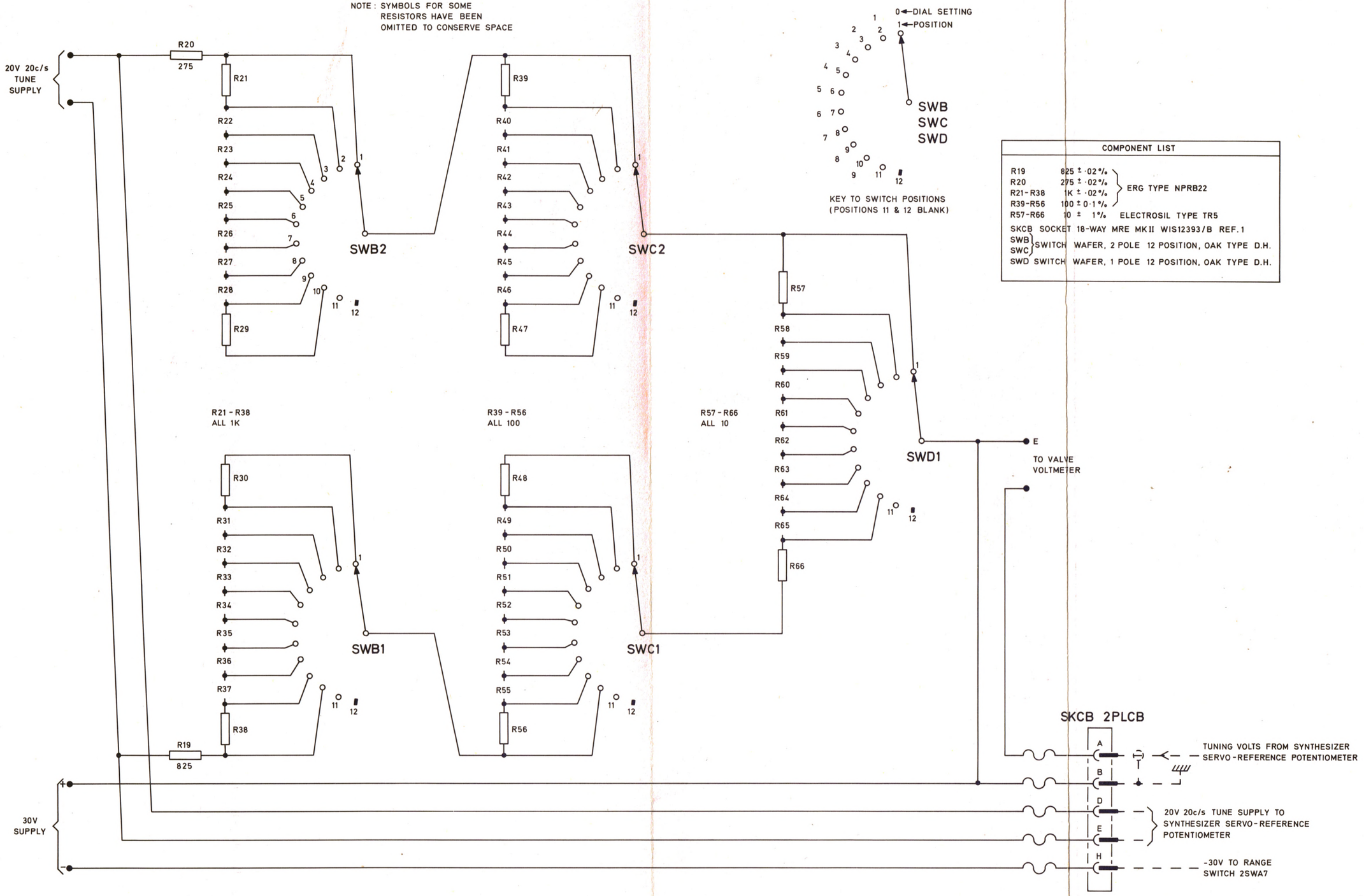
Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS (Cont'd)	Ohms		Watts
	5905-99-				
R41	022-2088		4.7k	10	¼
R42	022-2004		1k	10	¼
R43	022-1151		220	10	¼
R44	022-1001		10	10	¼
R45	022-1205		560	10	¼
R46	022-2088		4.7k	10	¼
R47	022-2004		1k	10	¼
R49	022-2004		1k	10	¼
R50	022-3079		220k	10	¼
R51	022-2046		2.2k	10	¼
R52	022-2004		1k	10	¼
R53	022-2004		1k	10	¼
R54	022-1130		150	10	¼
R55	022-2058		2.7k	10	¼
R56	022-2109		6.8k	10	¼
R57	022-1025		22	10	¼
R58	022-1109		100	10	¼
R59	022-1151		200	10	¼
R60	022-2046		2.2k	10	¼
R61	022-1163		270	10	¼
R62	022-2046		2.2k	10	¼
R63	022-1163		270	10	¼
R64	022-2046		2.2k	10	¼
R65	022-2046		2.2k	10	¼
R66	022-2046		2.2k	10	¼
R67	022-1151		220	10	¼
R68	022-2046		2.2k	10	¼
R69	022-2046		2.2k	10	¼
R70	022-1025		22	10	¼
R71	022-2046		2.2k	10	¼
R72	022-2109		6.8k	10	¼
R73	022-1109		100	10	¼
R74	022-1142		180	10	¼
R75	022-2046		2.2k	10	¼
R76	022-2004		1k	10	¼
R77	022-2004		1k	10	¼
R78	022-2130		10k	10	¼
R79	022-2025		1.5k	10	¼
R80	022-1109		100	10	¼
R81	022-1226		820	10	¼

FREQUENCY MULTIPLIER (MHz) - 5820-99-519-7001

COMPONENTS LIST (Cont'd)

Cct. Ref.	NSN or Other Ref. No.	Description	Value	Tol. ± %	Rating
		RESISTORS (Cont'd)	Ohms		Watts
R123	5905-99-013-6277		47k	1	0.062
R124	013-5890	Metal Oxide	4.7k	1	1/8
R125	013-5862	Metal Oxide	330	1	1/8
R126	013-5842	Metal Oxide	47	5	1/2
R127	013-5862	Metal Oxide	330	1	1/8
R128	022-2001		1k	5	1/4
R129	013-5844	Metal Oxide	56	1	1/8
R130	013-5844	Metal Oxide	56	1	1/8
R133	954-5007	Metal Oxide	1.8k	2	1/2
RV1	580-7134	Variable	300	20	1/4
RV2	580-7134	Variable	300	20	1/4
RV3	580-7134	Variable	300	20	1/4
RV4	580-7134	Variable	300	20	1/4
RV5	580-7134	Variable	300	20	1/4
RV6	580-7134	Variable	300	20	1/4
SKCF	5945-99-523-9905	Socket			
SKCG	5935-99-972-8229	Socket			
SKBS	5935-99-523-9905	Socket			
SKBT	5935-99-523-9905	Socket			
SKBX	5945-99-523-9905	Socket			
SWA1	Marconi W.98444-B Sh.1 Ref.1	Single Pole 31-way			
SWA2	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWA2A	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWA3	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWA4	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWA5	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWA6	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWB	5930-99-051-0080	Micro switch			
SWA	5930-99-051-9004	Switch Actuator			
SWA7	Marconi W.101115-C Sh.1 Ref.1	Switch Single Pole 31-way			
SWA8	Marconi W.10115-C Sh.1 Ref.1	Switch Single Pole 31-way			

B.R.4146 (5) C
Original



COMPONENT LIST		
R19	825 ± ·02%	ERG TYPE NPRB22
R20	275 ± ·02%	
R21-R38	1K ± ·02%	
R39-R56	100 ± 0·1%	
R57-R66	10 ± 1%	ELECTROSIL TYPE TR5
SKCB	SOCKET 18-WAY MRE MKII WIS12393/B REF.1	
SWB, SWC	SWITCH WAFER, 2 POLE 12 POSITION, OAK TYPE D.H.	
SWD	SWITCH WAFER, 1 POLE 12 POSITION, OAK TYPE D.H.	

AUTOMATIC-TUNING COMPARATOR TEST JIG

FIG. 1·10