Issue 1
8.5.74

DESIGNS DEPARTMENT MANUFACTURING INFORMATION

NO. 5.273(74)

Fixed Frequency Oscillator OS2/526

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G.G. JOHNSTONE
for Head of Designs Department

Written by: M.T. Ellen

BBC

DS/SPA4

JJS

D.D.M.I. No. 5.273(74)
Title Sheet

Issue 1
8.5.74

DESIGNS DEPARTMENT MANUFACTURING INFORMATION

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Fixed Frequency Oscillator OS2/526

C O N T E N T S

D R A W I N G S

Circuit	D 34510 A1
Parts List	D 34511 A4
Assembly and Wiring	D 34512 A1
Details	D 34513 A1
P.B. 1 Comp. Loc.	D 34516 A2
P.B. 1 Drilling	D 34517 A4
P.B. 2 Drilling	D 34519 A4

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DESIGNS DEPARTMENT MANUFACTURING INFORMATION NO. 5.273(74)

Fixed Frequency Oscillator OS2/526

1. Introduction

The OS2/526 is a reference frequency oscillator for use in UHF Test Equipment type EP14M/507. It generates the following frequencies with a high degree of stability: 0.5MHz (two outputs), 1MHz, 10MHz, 50MHz and 900MHz (two outputs). When the unit is used in the EP14M/507 the 0.5MHz and 900MHz outputs are used to drive the frequency synthesiser OS3/507 and the other outputs are used to produce markers on the various sweep functions.

All the output frequencies are derived from a 10MHz crystal oscillator inside a temperature controlled oven. Its output is divided by ten and two in order to obtain 1MHz and 0.5MHz, and it is multiplied by 5 x 3 x 2 x 3 in order to obtain 900MHz. The first multiplier stage is also connected to a 50MHz output buffer amplifier.

2. Mechanical

The unit consists of a double-sided printed circuit mounted in a CH1/68. The circuit carries a small tin box containing the 300 - 900MHz multiplier stage, and a crystal oscillator unit is fixed to one end of the CH1/68 and clamped onto the printed circuit. Internal and external RF connections are type SMB and supply connections are coloured feed-through terminals. All connections are on the end faces of the unit and a pre-set control for adjusting frequency is on the top of the unit.

Weight 1 lb. 7 oz.

Size 8" x 5" x 1¼"

3. Electrical

DC Input	+12V ± 0.2V at 150mA -12V ± 0.2V at 630mA when cold and 300mA when hot.
Output Frequencies	0.5MHz (two outputs) 1 MHz 10 MHz 50 MHz 900MHz (two outputs)
Output Levels	
0.5MHz, 1MHz, 10MHz	Standard TTL logic levels.
50MHz	+4dBm ± 2dB into 50Ω
900MHz	-5dBm to +2dBm into 50Ω
Fan Out (TTL only)	7
Frequency Stability Ageing Rate	Better than 1 part in 10^8 per day at time of despatch. Typically 5 parts in 10^9 after 30 days.

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Frequency Stability (Cont'd)

Change in Frequency with Temperature	Better than ± 1 part in 10^9 per °C. -10°C to + 60°C.
Change in Frequency with Voltage	Better than 3 parts in 10^8 for +5% change in Voltage. (-ve Rail).
Short Term	Noise level better than -60dB relative to centre frequency in a 1kHz bandwidth 20kHz from centre frequency and not worse than -50dB in a 10kHz bandwidth up to 2 MHz to centre frequency.
Frequency Adjustment Range	Greater than 2 parts in 10^{-5} x Fo
FM on Output	Less than 100Hz
RF Output of HCD 70 crystal oscillator unit	1.5V peak - peak nominal into 50Ω.
Warm-up Time	The nominal or previous setting will be attained within ± 5 parts in 10^8 in 5 minu tes at 20°C ambient.

Spurious Outputs

900MHz output	All spurious outputs better than -40dB with respect to 900MHz signal.
50MHz output	All spurious outputs better than -40dB with respect to 50MHz signal.
0.5MHz, 1MHz, 10MHz outputs	All spurious outputs except harmonics better than -40dB with respect to the fundamental.

Frequency Stability (Cont'd)

Change in Frequency with Temperature	Better than $\pm$ 1 part in 10^9 per ^{o}C. -10°C to + 60°C.
Change in Frequency with supply voltage	Better than 3 parts in 10^8 for $\pm$ 5% change in supply voltage.
Short term	Noise level better than -60dB relative to centre frequency in a 1kHz bandwidth, 20kHz from centre frequency.
Frequency Adjustment	Greater than 2 parts in 10^5.
RF output of HCD 70 crystal oscillator unit	1.5V peak - peak nominal into 50Ω
Warm-up Time	The nominal or previous setting will be attained within $\pm$ 5 parts in 10^8 in 5 minutes at 20°C. ambient.

Spurious Outputs

900MHz output	All spurious outputs better than -40dB with respect to 900MHz signal.
50MHz output	All spurious outputs better than -40dB with respect to 50MHz signal.
0.5MHz, 1MHz, 10MHz outputs	All spurious outputs except harmonics better than -40dB with respect to the fundamental.

Iss. 3
12.7.76

10MHz - 300MHz Multiplier Circuits

Tune the cores of inductors T1 to T7 fully clockwise and then anticlockwise two turns. Use a X100, 5KΩ high frequency probe connected to a spectrum analyser to set up the multiplier chain as follows:-

Adjust Capacitors	To resonate Stage	And obtain maximum output on	At a frequncy of	Typical Value
C6 & C9	TR1	TP1	50MHz	-30dBm
C19 & C21	TR3	TP2	150MHz	-33dBm
C25 & C27	TR4	TP3	150MHz	-13dBm
C31 & C33	TR5	R20	300MHz	+2dBm*

* Direct to power meter

If any of the tuned circuits will not resonate adjust the appropriate inductor core then repeat the above procedure. Seal all the inductor cores with PTFE tape.

Now connect SKB to a spectrum analyser directly and trim above capacitors to obtain maximum output at 300MHz.

50MHz Output

Adjust C14 to obtain maximum output at PLA and check that the output level meets the specification.

300MHz - 900MHz Multiplier Circuit

Connect SKB to PLB, connect a spectrum analyser to PLF (900MHz o/p) and a 50Ω termination to PLE. Set the spectrum analyser to 100MHz/div scan width and 800MHz centre frequency. Now adjust C37, C39 and C43 to obtain maximum output at 900MHz and adjust C41 for minimum output at 1200MHz. Reverse the connection to PLF and PLE and repeat the above.

NOTE - Capacitor adjustments to be made with 'special' rear cover fitted - repeat these adjustments at least 4 times.

Output Power Adjustment

Measure the output levels at PLE with a power meter (terminate the unused output), and if necessary adjust to bring the output power to +2dBm -5dBm (the specification of +2dBm -5dBm allows for temperature drift.) Check PLK levels are in range at +2dBm -5dBm.

Output Freqency Adjustment

Connect a frequency counter to PLF, terminate PLE and adjust R1 to obtain 900MHz ± 5Hz. (This adjustment should be made after the unit has been on for at least 10 minutes). Change supply by ± 0.5V and check that frequency change is less than 27Hz.

Noise Spectrum

Set spectrum analyser bandwidth to 1kHz and check that noise level is below -60dBm in the range 20 - 50kHz from carrier. Set spectrum analyser bandwidth to 10kHz and check that noise level is below -50dBm between 50kHz and 2MHz.

Temporarily heat unit using hairdryer and check level drifts by less than 1dB.

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14.11.75

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12.7.76

DESIGNS DEPARTMENT MANUFACTURING INFORMATION

NO. 5.273(74)

Fixed Frequency Oscillator OS2/526

PRODUCTION TEST SCEDULE

1. Drawings

Circuit	D34510A1
Assembly and Wiring	D34512A1
P.B. 1 Component Location	D34516A2

2. Test Equipment

	Example
Oscilloscope with 30MHz B/W	Telequipment D67
Spectrum Analyser, frequency range 1MHz to 1GHz	Hewlett Packard 141T, 8554L, 8552B.
Probe for Spectrum Analyser, X100 5KΩ	
Frequency Counter, maximum frequency 1GHz	Hewlett Packard 5245L, 5254A
Power Meter	Hewlett Packard 432A

3. Mechanical Inspection

Remove side covers of CH1/68. Loosen four screws round the lid of the multiplier box and lift lid off. Check that the unit has been satisfactorily made in accordance with the relevant drawings and in particular see that all the components have been wired with reasonably short leads, especially those inside the tin box. Check that none of the components foul the SMB connectors on the side of the tin box.

4. Alignment and Test

Connect positive and negative variable power supplies to the red and violet pins respective, the black pin is earth. Graduallly increase the power supply voltages and check that the currents drawn meet the specification. The crystal oven should reach its stable temperature after about 5 minutes and the current taken from the negative supply should drop as shown in the specification.

Divider Circuits

Check that the waveform on the collector of TR8 is suitable for driving TTL logic (logic 0 0.8V, and logic 1 2.4V) the check that the TTL divider circuits are giving the output frequencies shown on the diagram at normal TTL logic levels. The inverters in IC1 are used as buffers, with outputs on sockets G, H, J and K.

D34511A4

SHEET 1 OF 7 SHEETS

ISS.	CHANGE	
1	29-10-73	
2	*H.J.M. APPD 2.1.17.12.73	ITEM 16 REVISED. S.F.C. 7.8.74
3		

ITEM No.	No. OFF		DESCRIPTION	C'C'T REF.	BBC REF. OR DRG. No.
			DRAWING NUMBERS		
			CIRCUIT D34510A1		
			PARTS LIST D34511A4		
			ASSY & WIRING D34512A1		
			DETAILS D34513A1		
			P.B. WIRING (BD No 1) D34514A2		
			" " , COMP. SIDE (" " 1) D34515A2		
			" COMP. LOC. (" " 1) D34516A2		
			" DRILLING (" " 1) D34517A4		
			" WIRING (" " 2) D34518A4		
			" DRILLING (" " 2) D34519A4		
			FURTHER INFORMATION REQUIRED FOR MANUFACTURE		
			UNIT ASSEMBLY INFORMATION EA10484		
			" WIRING INFORMATION EA10139		
			" " " EA10140		
			" " " D32215A4		
			" " " D33243A4		
			LABEL D32193A4-CP		
			TERMINATION RESISTOR D35053A4-CP		
			INDUCTORS L/1663, L/1664		
			L/1665, L/12017		
			UNIT WIRING INFORMATION D23478A4		
1	1	*	CHASSIS, CH1/68, MODIFIED AS FOLLOWS :-		
			BODY, DRILLED TO		D34513A1 DET 1
			REAR LID		" " 2
2	1		BRACKET		D34513A1 DET 3
3	1		SPACER		" " 4
4	1		LABEL, D32193A4-CP, DET 1 ENGRAVED TO		" " 5
5	2		" " " 2 " "		" " 6
6	1		" " " 2 " "		" " 7
7	1		" " " 2 " "		" " 8
8	1		" " " 2 " "		" " 9
9	2		" " " 2 " "		" " 10
10	1		INDUCTOR	L8	" " 11
11	1		"	L9	" " 12
12	1		SCREENING BOX (EACH INCLUDING 10-8BA		" " 13
			BRASS HANK RIVET BUSHES. BBC REF. 1-31203-108)		
13	1		SCREENING BOX, LID.		D34513A1 DET 14
14	1		TRANSFORMER, PRIMARY	T10	" " 15
15	1		" SECONDARY	T10	" " 16
16	1	*	3dB COUPLER, GREEN.		D36411A4-CP
17					
18					
19					
20					

OS2/526
OSCILATOR, FIXED FREQUENCIES
PARTS LIST

BBC

DS/PLA4

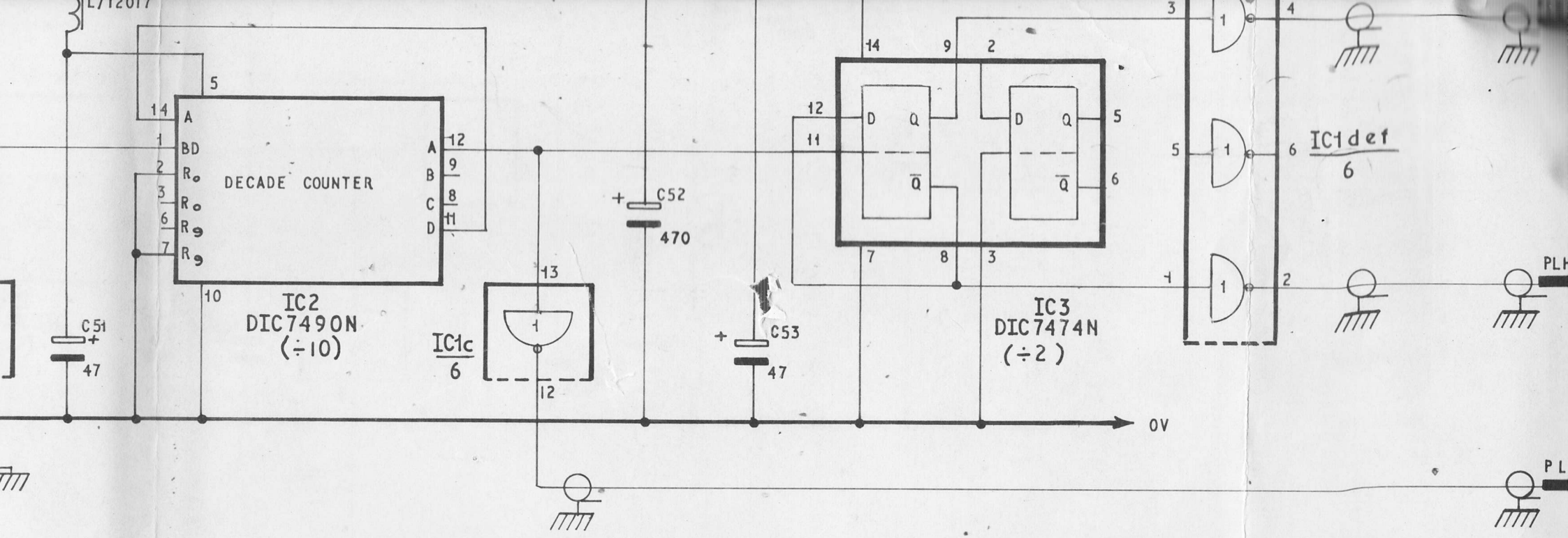
OS2/526
OSCILATOR, FIXED FREQUENCIES
PARTS LIST

DRN.	L.H.
TPD.	
CKD.	
APPD.	CRC

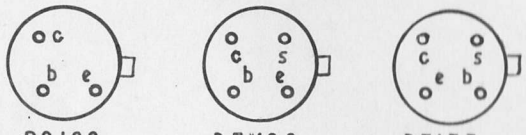
DESIGNS DEPARTMENT

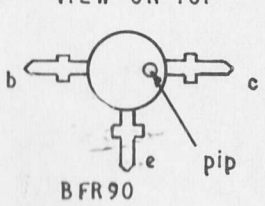
D34511A4

SHEET 1 OF 7 SHEETS

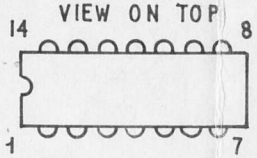


TRANSISTOR TERMINATIONS



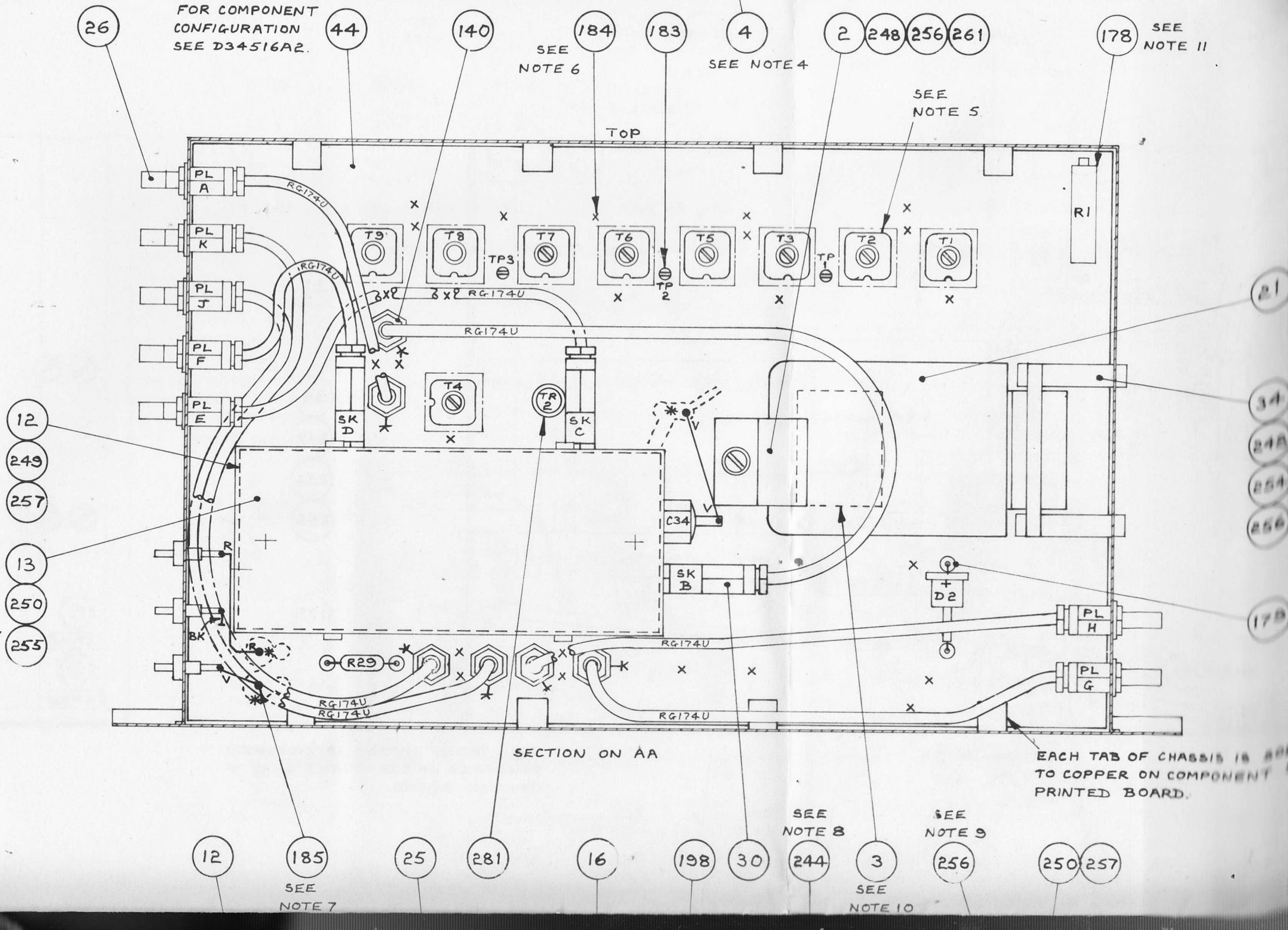


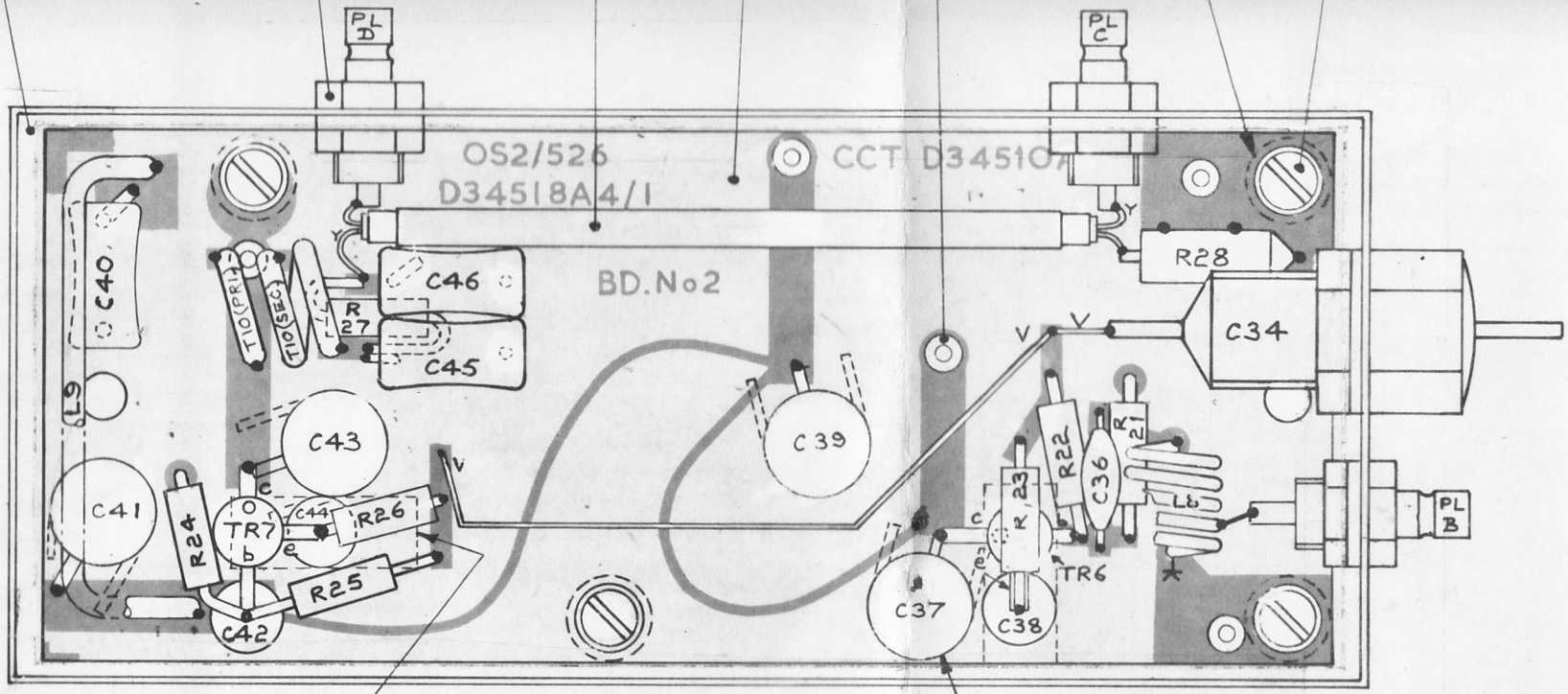
INTEGRATED CIRCUIT TERMINATIONS.



DIC7404N
DIC 7474 N
DIC 7490 N

REQUENCY OSCILLATOR) CIRCUIT


26
FOR COMPONENT CONFIGURATION SEE D34516A2.
44
140
184
SEE NOTE 6
183
4
SEE NOTE 4
2
248
256
261
178
SEE NOTE 11
SEE NOTE 5
TOP
PL A
PL K
PL J
PL F
PL E
RG174U
T9
T8
T7
T6
T5
T3
T2
T1
TP3
TP2
TP
R1
3 x 8 RG174U
RG174U
T4
TR 2
SK D
SK C
SK B
C34
V
R
BK
R29
D2
PL H
PL G
RG174U
RG174U
RG174U
RG174U
21
34
248
254
256
178
12
249
257
13
250
255
SECTION ON AA
EACH TAB OF CHASSIS IS SO
TO COPPER ON COMPONENT
PRINTED BOARD.
12
185
SEE NOTE 7
25
281
16
198
30
SEE NOTE 8
244
3
SEE NOTE 10
SEE NOTE 9
256
250
257



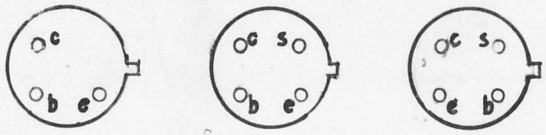
USE COPPER FOIL STRIPS, ·001" THICK (CUT TO SUIT) TO CONNECT CAPACITORS C38 & 44 WITH COPPER ON REVERSE SIDE OF BOARD No 2

FOR ASSEMBLY OF CAPACITORS C37, 39, 41 & 43 SEE SKETCH 'A'

ASSEMBLY OF SCREENING BOX (2 x FULL SIZE)

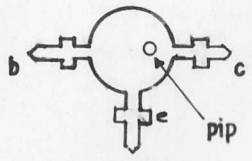
TRANSISTOR TERMINATIONS

VIEW ON LEADS



BC 108 BFY 90 BF 173

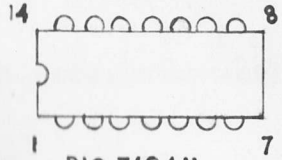
VIEW ON TOP



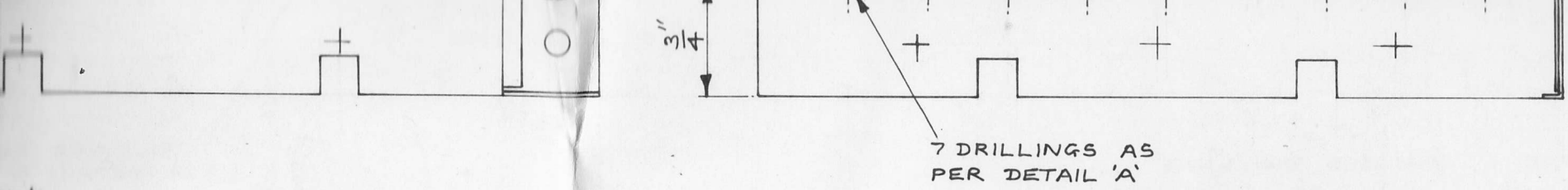
BFR 90

INTEGRATED CIRCUIT TERMINATIONS

VIEW ON TOP



DIC 7404 N
DIC 7474 N
DIC 7490 N



H1/68.

075" HIGH) CHARS,
TIVE CENTRE LINES,

MARKED THUS 'XXX'

XX

A4-CP DET 1

ENGRAVING TO BE IN No 10(·075" HIGH) CONDENSED CHARS, EQUISPACED ABOUT RESPECTIVE CENTRE LINES, & FILLED WHITE.

10MHz.

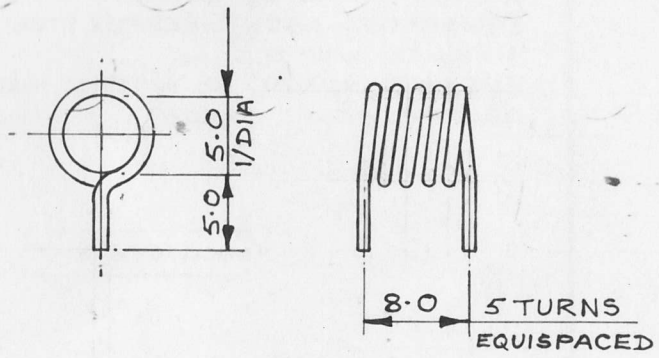
TYPICAL ENGRAVING

DET.	ENGRAVING
6	·5MHz
7	1MHz
8	10MHz
9	50MHz
10	·9GHz

DETAILS 6-10: LABELS

MATERIAL: LABEL, D3219 3A4-CP DET 2

FINISH CLEAN



DETAIL 11 INDUCTOR (L8)

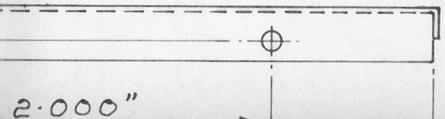
MATERIAL 0·9 DIA SILVER PLATED COPPER WIRE

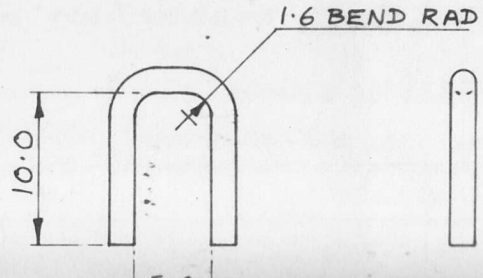
FINISH CLEAN.

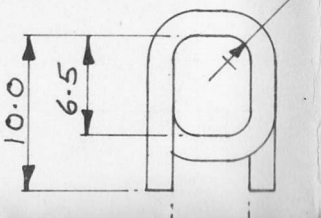
SCALE 2:1

TOLERANCES :- ±0·3 ALL DIMS

S No37DR.(·104"DIA)





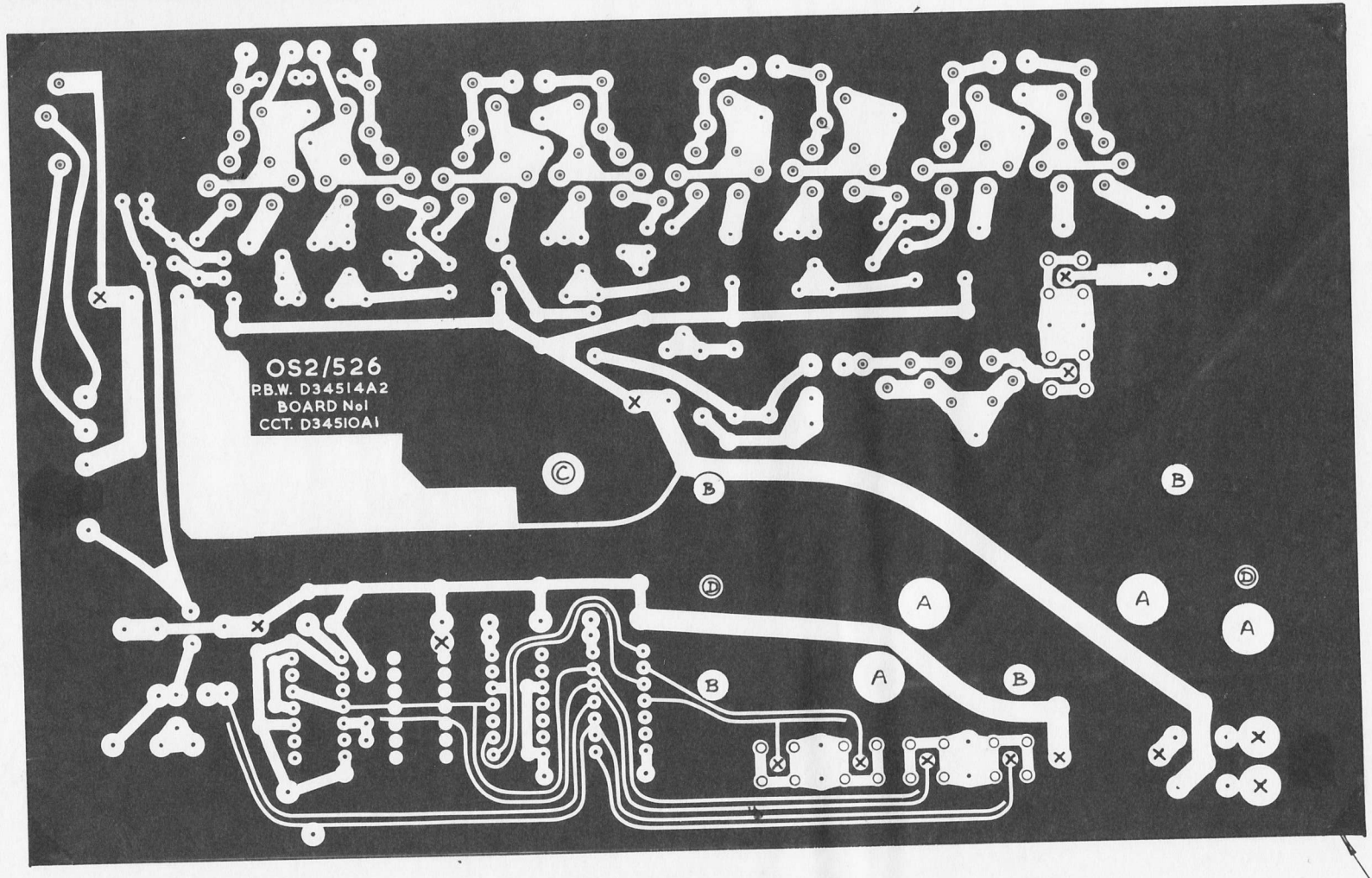


BBC

OS2/526 PRINTED BOARD DRILLING (BD. No1.)

D34517A4

CHANGE	ISS
29-10-73	1
No. OF HOLES ADDED H.J.M. 19-1-74	2
CORNERS OF P.B. FILLED IN. 1 HOLE ADDED. NOTE WAS 'CUT P.B. TO EDGE OF COPPER. V.W.W. J.D.M. 9.8.74	3



CUT BOARD TO OUTER EDGE OF COPPER

SCALE 1:1

HOLE REF	DRILL NO OR SIZE	DIAMETER DEC	DIAMETER MM
A	5/16"	·312	7·9
B	3/16"	·187	4·8
C	1/8"	·125	3·2
D	37	·104	2·65
O	52	·0635	1·6
⊙	55	·052	1·3
X	60	·040	1
UN-LETTERED	—	—	0·85

APPROX. 140 HOLES

MATERIAL : 1·5MM THICK BAKELITE XYLONITE LTD. SHEET TYPE H76FR/1/1 CLAD ON BOTH SIDES WITH COPPER 35 MICRONS THICK.

FINISH : TINNED.

MANUFACTURED TO D34514A2, D34515A2 & D34516A2

OS2/526
P.R.INTED BOARD DRILLING
(BOARD No 1)

DRN L.W.K.
T.C.D.
CKD
APPD Rec

DESIGNS DEPARTMENT

D34517A4

N1246 A4

052/526 PRINTED BOARD DRILLING (BD No2)

D34519A4

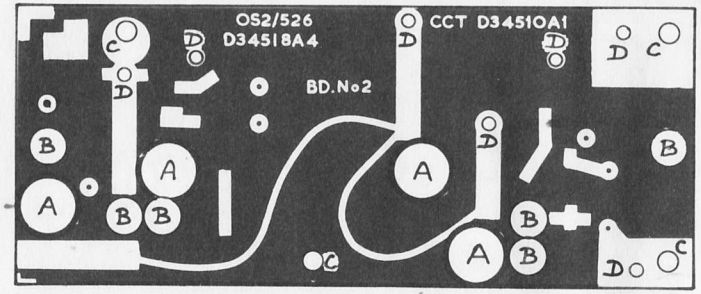
CHANGE	
29-10-73	1
Nº OF HOLES ADDED H.J.M. 21-1-74	2
MAT'L. WAS MG53/1 W.H.N. J.D.M. 9.8.74	3

052/526
PRINTED BOARD DRILLING
(BOARD No 2)

DRN R.H.S
TCD
CKD
APPD GRL

DESIGNS DEPARTMENT

D34519A4



HOLE REF	DRILL NO OR SIZE	DIAMETER DEC	DIAMETER MM
A	9/32"	·281"	7·2
B	13/64"	·203"	5·2
C	37	·104"	2·65
D	5/64"	·078	2·00
UN-LETTERED	60	·040	1·0

APPROX. 30 HOLES

CUT BOARD TO EDGE OF COPPER. SCALE 1:1

MATERIAL : 1·5MM THICK MICA & MICANITE LTD SHEET TYPE MG5/2/2 CLAD ON BOTH SIDES WITH COPPER 70 MICRONS THICK.

FINISH : TINNED.

MANUFACTURED TO D34518A4