Designs Department Manufacturing Information

No. 5.401(81)

Dual UHF Frequency Synthesiser 0S3/509

.....
(G.G. Johnstone)
for Head of Designs Department

Written by: W.Murray

DDMI No. 5.401(81)
Title Sheet

VS

2nd Draft ? ?
marked up copy 13 Aug

# Designs Department Manufacturing Information

## No. 5.401(81)

## Dual UHF Frequency Synthesiser OS3/509

## PRODUCTION TEST SCHEDULE

C O N T E N T S



D R A W I N G S

| | |
|---|---|
| Circuit Boards 1 and 2 (Oscillators) | D 49990 A3 |
| Circuit Board 3 (Control) | D 49991 A1 |
| Parts List | D 49992 A4 |
| Assembly and Wiring | D 49993 A1 |
| Sub-Assembly | D 49994 A3 |
| Details 1 -9 | D 49995 A1 |
| Details 10 and 11 | D 49996 A3 |
| PB 1 and 2 Comp. Loc. | D 49998 A |
| PB 3 Comp. Loc. | D 50001 A2 |
| PB 1 and 2 Wiring Side Assembly. | D 50005 A2 |

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Dual UHF Frequency Synthesiser OS3/509

1. DESCRIPTION

This unit was designed as part of the television transposer TM4M/502. The two synthesised UHF oscillators contained in the OS3/509 are used to convert an incoming UHF television signal via an IF of 40.75MHz to an outgoing UHF signal. This Intermediate Frequency was chosen to give local oscillator frequencies of 512MHz to 896MHz which are an exact multiple of 8MHz. In the case of the input local oscillator this is not quite true as the frequency can be shifted slightly to cope with five-thirds line frequency offsets.

The OS3/509 consists of two identical voltage controlled UHF oscillators (Printed Boards 1 and 2) mounted in screened sections of extrusion on either side of the control circuitry (Printed Board 3). The unit derives +28V and +15V power from the PS4/8 and the AM21/506 respectively. The oscillators are tuned by programming earth links in the PA1M/579. This sets the appropriate ratios in the synthesiser dividers which control the oscillators.

2. INFORMATION

(a) Design Section - Radio Frequency (5)

(b) Designer W. Murray and O. Cullum

(c) Engineer Responsible W. Murray

(d) Handbook - Part of the UHF TV Transposer TM4M/502 Handbook No. 5.156(81)

(e) Technical Instruction - Not available 1st January 1981

(f) Pre-productin Batch - This Production Test Schedule has been tested on a pre-productin batch of 4 in Designs Department.

## 3. MANUFACTURING PERFORMANCE SPECIFICATION

### 3.1 Signals

#### 3.1.1 Outputs

(i) Two local oscillator outputs on free BNC plugs.

frequency range 512 to 896MHz in 8MHz steps

1st LO offset range ± 100kHz minimum

output impedance 50Ω

maximum return loss 15dB

output power +10dBm to +13dBm

(ii) 5MHz STAL overall reference on BNC panel socket.

output impedance 50Ω approx.

output power −10dBm approx.

(iii) Lock indication via filtercon

LED drive +10mA

#### 3.1.2 Inputs

IF vision carrier on free BNC plug.

Frequency 40.75MHz

level 100mV to 260mV R.M.S

impedance high

### 3.2 Power

two inputs via filtercons C5 and C4

+28V @ 60mA typical( 120mA max)

+15V @ 510 ± 40mA

### 3.3 Controls

via free 25 way D socket (from PA1M/509 or TE1/38)

3.3.1 16 synthesiser programming inputs (1.5mA current sink)

6 - 1st LO main divider

2 - 1st LO offset divider

1 - 1st LO band IV/V switch

6 - 2nd LO main divider

1 - 2nd LO band IV/V switch

3.3.2 3 control lines out to AM21/506 and AM14/561 (no internal connection - mechanical convenience only).

3.3.3 +15V power out for TE1/38 only.

5. TEST APPARATUS

~~Test Box~~ TE1/38

Synthesiser Test Socket to DSK A4 *

2 x Bench PSU (Capable of +28V @ 1A, with variable current limit)

Multimeter

Frequency Meter

RF Spectrum Analyser (up to 1GHz), e.g. HP8554L

UHF/VHF Signal Generator, E.g. HP ~~8660~~ 8640

Modulation Analyser - HP8901

Lowpass (or bandpass) Filter @ 40.75MHz

UHF/VHF Amplifier (gain >10dB O/P level >0dB), e.g. AM14/558

6dB Splitting Pad

Double-balanced Mixer; e.g. Lorch Electronics FC-2012

Audio Spectrum Analyser, e.g. HP3580A

6. INSPECTION

6.1 Once the three boards that comprise this unit are fixed in place in the three compartments of the extrusion the wiring side of the boards becomes inaccessible. For this reason inspection and preliminary performance checks are carried out prior to final assembly.

6.2 Voltage Controlled Oscillators (VCO) boards 1 and 2 of OS3/509

Note that boards 1 and 2 are identical electrically and in board layout.

Checkthat each has been assembled to drawings Assembly Information D 50005 A2. Comp. Loc. D 49998

6.2.1 Voltages above 50V d.c. or 30V a.c. are absent from this board.

6.2.2 Inspect the board CAREFULLY for soldering defects, as the faults these can induce can be difficult to locate.

6.2.3 Check the polarity of the Tantalum capacitors.

6.2.4 Check the insertion of all components in particular TR102, TR103, D101, D102, IC101 and IC102.

6.2.5 Also check that TR1 and TR2 do not stand further than 8mm above the board.

6.3 SYNTHESISER Board 3 of OS3/509

Check that it has been assembled to drawing Comp. Loc. D50001A2.

It is important that anti-static precautions are observed on this board.

6.3.2 Voltages above 50Vd.c. or 30Va.c. are absent from this board.

6.3.3 Inspect the board carefully for soldering defects as the faults these can induce can be difficult to locate, in particular, check for absense of short circuits on PLW and PLX R301, R328 and R348.

6.3.4 Check the polarity of C352 and all tantalum capacitors.

6.3.5 Check the insertion of ALL IC's in particular IC301, IC307, IC317, IC309, IC322.

6.3.6 Also check the insertion of MOD 1, (the crystal oscillator) and D 301 and D302.

6.4 Box and leads of OS3/509

6.4.1 Check wiring and assembly of extrusion as per D 49993 A1 except for absence of boards 1, 2, 3.

7. PRELIMINARY TESTS

Voltage controlled oscillators boards 1 and 2. The following tests apply to both boards.

7.1 To set damping constant

(a) With an ohmmeter connected between TP1 and ground set R105 to 2.5k ±100Ω.

(b) With an ohmmeter connected between TP2 and ground set R107 to 2.3k ± 100Ω.

7.2 To check current consumption

7.2.1 Connect a bench PSU to the +15V pin and ground.

7.2.2 Switch on and check that the current drawn is less than 100mA.

7.3 To check operation of regulator and band switching

Check the following voltages with respect to ground:-

7.3.1 Collector of TR103 for 10V ±0.25V

7.3.2 Base of TR103 for 4.8 ±0.2 volts

7.3.3 Pin 4 of IC101 for 12 ±0.5volts

7.3.4 Base of TR102 for less than 0.7 volts

With a crocodile clip short the band switching pin to ground. Check the following voltages with respect to ground.

7.3.5 Base of TR102 for 4.8 ±0.2 volts

7.3.6 Base of TR103 for less than 0.6 volts

7.4 To check oscillator output power and frequency range.

The following tests should be made with board not in extrusion and not near any conducting surface.

7.4.1 Switch off the +15 volts supply and remove shorting clip from band switching input.

7.4.2 Solder a suitable co-axial lead to the local oscillator otput. Connect this lead to the UHF spectrum analyser.

7.4.3 Connect the varactor control pin input to ground with a shorting clip and switch on the +15V supply. Check for output frequency between 470MHz and 500MHz and level of 10dBm and 14dBm

7.4.4 Switch off +15 V supply. Connect varactor control input to 20V ±0.1V and switch +15V supply on again. Check for output frequency between 690MHz and 740MHz and level of 10dBm and 14dBm.

7.4.5 Connect shorting clip to band switching input. Check for output frequency between 910MHz and 950MHz and level of 10dBm and 14dBm

7.4.6 Connect shorting clip to varactor control input.

Check for output frequency between 680MHz and 720MHz and level of 10dBm and 14dBm.

## 8. SYNTHESIZER BOARD 3 OF 0S3/509

The following tests are carried out on board 3 prior to fixing in extrusion.

### 8.1 To check current consumption

8.1.1 Taking care to connect the correct pin, connect flying leads to the +15V pin and ground. Connect up a bench power supply, switch on and check that the current taken is 350mA ± 20mA.

8.1.2 Connect flying leads to the +28V pin and ground from a second PSU and check that the current consumption does not exceed 120mA (may lie anywhere between30mAto 120mA dependent on ambient temperature.

### 8.2 To check voltage regulators

8.2 Check that the following voltages are present with respect to ground.

(i) IC301 PIN 1 5 ±0.2VOLTS

(ii) IC317 PIN 1 5 ±0.2 VOLTS

(iii) IC309 PIN 14 5 ±0.2 VOLTS

### 8.3 To check reference oscillators

8.3.1 With an oscilloscope check that the signal seen

(i) at TP312 is 5MHz (period 0.2μS) and greater than 6V p-p

(ii) at TP303 is 6MHz (period 0.167μS) and greater than 6V p-p

### 8.4 To check 1st Local Oscillator divider chains.

8.4.1 Connect UHF signal generator via temporary lead connected to copper track marked 'DI 1'. Set amplitude to -10dBm and frequency to 511MHz . Insert test socket (made to DSK ) into PLW and connect its flying lead to ground. (This sets IC303 to divide by 64).

8.4.2 Check that TP304 is at a voltage greater than 25V.

8.4.3 Change input frequency to 513MHz.

8.4.4 Check that TP304 is at a voltage less than0.6V.

If these tests fail check the output of each divider in reference and programmed chains and also the phase comparator.

### 8.5 To check 2nd Local Oscillator divider chains

8.5.1 Connect signal generator to 'DI 2' and set amplitude to -10dBm

and frequency to 511MHz insert test socket into PLX and connect flying lead to ground.

8.5.2 Check TP313 for 25V or greater.

8.5.3 Change frequency to 513MHz.

8.5.4 Check TP313 for .6V or less.

8.6 To check Carrier Locking divider chains

8.6.1 Connect signal generator to copper track marked 'CI 1', using leads less than 300mm. Set level to -12dBm and frequency to 40.5MHz.

8.6.2 Check TP309 for 25V or greater.

8.6.3 Set frequency to 41MHz.

8.6.4 Check TP309 for0.6V or less.

8.7 To check frequency pulling of 6MHz oscillator

8.7.1 Connect high impedance frequency counter to TP303.

8.7.2 Repeat frequency inputs of previous test.

8.7.3 Check frequency at TP303 to be 5.999MHz or less and 6.00MHz or more respectively.

9. SYSTEM TEST OF DUAL UHF OSCILLATOR OS3/509

9.1 Complete the assembly of the inspected boards and box as for D 49993 A1. Note that only the M3 screws shown should be fitted (the extra holes are maintenance spares). The M4 screws holding down boards 1 and 2 should be fitted after the M3 screws.
In addition the synthesiser board 3 should be temporarily held down by two M4 screws, nuts and washers to the extrusion.

9.2 To check current consumptions

9.2.1 Taking care not to reverse the +15 volt and + 28 volt rails, apply +15 volts to the unit from a bench PSU and check that the current consumption is 530mA $\pm$ 30mA.

9.2.2 Apply, from a second bench PSU +28 volts to the unit and check the current consumption is less than 120mA.

9.3 To check 5MHz reference oscillator ouput level

9.3.1 Connect BNC output from monitor box to modulation meter.

9.3.2 Measure frequency to be approximately 5MHz.

9.3.3 Measure power level to be 110 ± 30 ~~mW~~ μW

9.4 To set 5MHz reference oscillator to correct frequency

9.4.1 Wait till unit has been switched on for 30 minutes to allow oven to stabalise.

9.4.2 Connect BNC output from monitor box to frequency counter.

9.4.3 Adjust Potentiometer on monitor box till frequency is 5MHz ± 1Hz.

9.5.4 To check frequency setting of 2nd Local oscillator

9.5.1 Connect bench power supply, test box TE1/38 and OS3/509 as shown in diagram. Solder wires from power output of TE1/38 to the +28V and +15V input of the OS3/509 taking greater care not to reverse them. Plug the 'D' connector from the OS3/509 into the test box.

9.5.2 Connect the output of the 2nd Local oscillator via a 6dB splitting pad to the modulation analyzer (HP8901) and the spectrum analyzer (e.g. HP8554L).

9.5.3 Us e the push button switches on the TE1/38 to step through channels 21 to 38 inclusive on the output (2nd) Local Oscillator. While doing this observe the output on the spectrum analyzer for spurious oscillations and check the frequency using the modulation analyzer to be 512MHz rising to 648MHz in 8MHz steps. Check also that the output of the oscillator is greater than 9.5dBm (3.5dBm at input to either spectrum analyzer or

modulation meter) for all channels 21 - 38. If this is not achieved make the following extra checks.

(a) Is any output present? If not the fault is on board 2 or its wiring.

(b) Is the frequency below 500MHz? If so the most likely cause is a short on either the control voltage input to board 2 or on the divider output.

(c) Is the output unstable? If so increasing R207 to increase damping may stop spurious oscillation.

9.6 To check phase noise performance of 2nd Local Oscillator

9.6.1 Keep the bench power supply test box TE1/38 OS3/509 spectrum analyzer and modulation meter connected as in previous test.

9.6.2 Place the whole unit on a mat of foam rubber to isolate it from mechanical vibration.

9.6.3 Connect signal generator to PLA and apply an input of -6dBm at 40.5MHz. This is to prevent spurious oscillation of IC310 which occurs if no input is present and can cause some degradation in phase noise performance.

9.6.4 In the following tests the input channel selected on the TE1/38 should always be different from the output channel. Please note that selections less than channel 21 cause a default to channel 21 and selections over channel 69 cause a default to channel 69.

9.6.5 Select channel 21 for the output channel to set the 2nd local oscillator to 512MHz. Measure using the modulation analyzer the phase noise to be less than :-

(i) 0.020 radians average in a bandwidth 300Hz to 20kHz

(ii) 0.013 radians average in a bandwidth 300Hz to 3kHz.

If not adjust R207 on board 2.

9.6.7 Select channel 38 for the output channel to set the 2nd local oscillator to 64MHz.

9.6.8 Measure using the modulation analyser the phase noise to be less than:-

(i) 0.021 radians average in a bandwidth 300Hz to 20kHz

(ii) 0.017 radians average in a bandwidth 300Hz to 3kHz

If not adjust R207 and repeat tests 2.6.5 to 9.6.8.

If these phase noise figures cannot be achived listen to the modulation output of the modulation analyzer for any obvious tones. Otherwise consider changing D202 after doing tests 9.6.9 and 9.6.10.

9.6.9 Set the output to channel 39 which sets the 2nd local oscillator to 656MHz and measure the phase noise to be less than:-

0.023 radians overagle in a bandwidth 300Hz to 20kHz

0.017 radians average in a bandwidth 300Hz to 3kHz

If not adjust R205 on board 2.

9.6.10 Set the output to channel 69 which sets the 2nd local oscillator to 896MHz and measure the phase noise to be less than:-

0.030 radians average in a bandwidth 300Hz to 20kHz

0.027 radians average in a bandwidth 300kHz

If not adjust R205 on board 2 and repeat test 9.6.9.

If these phase noise figures cannot be achieved listen to the output of modulation analyzer for any obvious tones. Otherwise consider changing D201.

9.7. <u>To check the frequency setting of the 1st Local Oscillator</u>

9.7.1 Connect the output of the 1st Local Oscillator via a 6dB splitting pad to the modulation analyxer (HP8901) and the spectrum analyser (HP8554L)

9.7.2 Use the push button switches on the TE1/38 to step through channels 21 to 38 inclusive on the input (1st) Local Oscillator. While doing this observe the output on the spectrum analyser for spurious oscillations and check the frequency using themodulation analyser to be 512MHz rising to 64MHz in 8MHz steps. Note that since the 6MHz reference is not locked during this test the frequencies may be out by as much as 250kHz.

Check also that the output power level is greater than 9.5dBm.

9.7.3 The damping resistor for the band IV oscillator is R107.

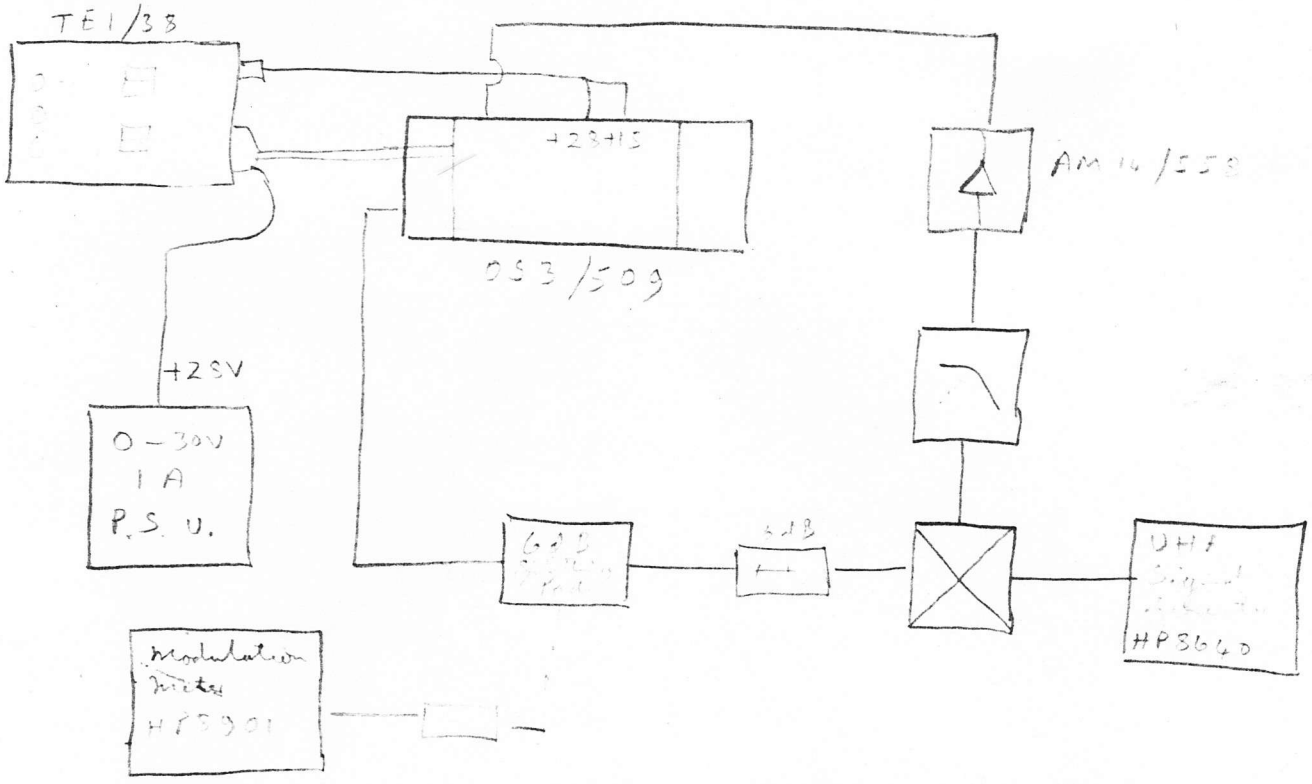
9.7.4 Use the push button switches on the TE1/38 to step through channels 39 to 69 inclusive on the input(1st) Local Oscillator. While doing this observe the output on the spectrum analyser for spurious oscillations and check the frequencies using the modulation analyser to be 656MHz rising to 896MHz in 8MHz steps note that the frequency error may be up to 200MHz. Check that the output of the oscillator is greater than 9.5dBm.

The damping resistor for the band V oscillator is R105.

9.8 <u>To check carrier locking circuit</u>

This circuit gives fine frequency control of the 1st Local Oscillator.

9.8.1 Connect the test items as shown in diagram:-




9.8.2 Set the signal generator frequency to 471.25MHz at an output level of +7dBm. Set the offset switch on the test box TE1/38 to '0' and the input channel to 21.

9.8.3 Usingthe modulation analyser check that the frequency is 512MHz within the limits of accuracy of the signal generator frequency and modulation meter. This is about ±1kHz.

9.8.4 Measure current from filtercon C6 to ground to be 10±2mA.

9.8.5 Set the offset switch on the test box TE1/38 to '+' and check that the frequency falls from '512MHz' by exactly 26040Hz. Set the offset switch on the test box TE1/38 to '-' and check that the frequency rises from the original '512MHz' by exactly 26040Hz.

9.8.7 Set the offset switch on the test box TE1/38 to '0'. Set the signal generator to 471.15MHz and check that the current measured at filtercon C6 is still 10mA.

9.8.8 Set the signal generator to 471.35MHz and check that the current measured at filtercon C6 is still 10mA.

9.9 To check phase noise performance of input (1st) Local Oscillator

9.9.1 Keep equipment connected as in previous test and in following tests ensure that the output channel is different from the input channel.

9.9.2 Set input channel to 21 and offset to '0'. Set signal generator to 471.25MHz and output level of +7dBm.

9.9.3 Measure the phase noise to be less than:-

(i) 0.020 radians average in an bandwidth 300Hz to 20kHz

(ii) 0.013 radians average in a bandwidth 3ooHz to 3kHz.=

If not adjust R107 on board 1.

9.9.4 Select channel 38 for the input channel and set the signal generator to 607.25MHz. Measure the phase noise to be less than:-

(i) 0.021 radians average in a bandwidth 3ooHz to 20kHz

(ii) 0.017 radians average in a bandwidth 300Hz to 3KHz

If not adjst R107 to board 1 and repeat previous test.

9.9.6 Set the input channel to 39 and the signal generator to 615.25MHz.

9.9.7 Measure the phase noise to be less than:-

(i) 0.023 radians average in a bandwidth 300Hz to 20kHz

(ii) 0.017 radians average in abandwidth 300Hz to 3kHz

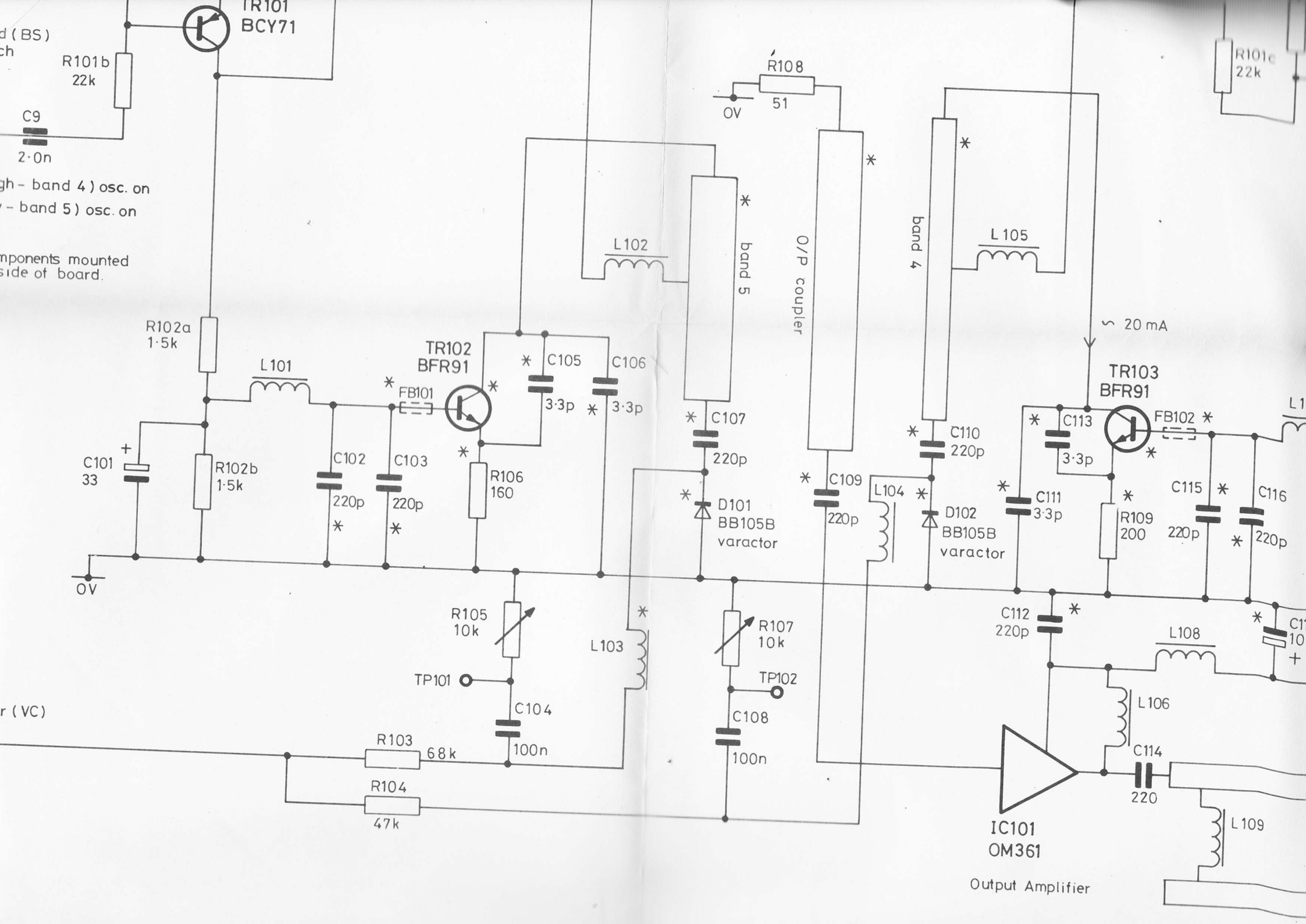
9.9.8 If not adjust R105. Set the input channel to 69 and the signal generator to 8.55.25MHz.

9.9.9 Measure the phase noise to be less than:-

(i) 0.030 radians avarage in a bandwidth 300kHz to 20kHz

(ii) 0.027 radians average in a bandwidth 300Hz to 3kHz.

If not adjust R105 and repeat previous test.


TR101
BCY71
R101b
22k
C9
2·0n
d (BS)
ch
gh – band 4) osc. on
– band 5) osc. on
mponents mounted
side of board.
R108
51
OV
R101c
22k
L102
band 5
O/P coupler
band 4
L105
~ 20 mA
R102a
1·5k
L101
TR102
BFR91
FB101
C105
3·3p
C106
3·3p
C107
220p
C101
33
R102b
1·5k
C102
220p
C103
220p
R106
160
D101
BB105B
varactor
C109
220p
L104
D102
BB105B
varactor
C110
220p
TR103
BFR91
C113
3·3p
FB102
C111
3·3p
R109
200
C115
220p
C116
220p
OV
R105
10k
L103
R107
10k
TP101
TP102
C104
100n
C108
100n
C112
220p
L108
L106
C114
220
R103
68k
R104
47k
IC101
OM361
Output Amplifier
L109

ISS. 2

CHANGE 22-1-82

# 053/509 PARTS LIST.

| ITEM No. | No. OFF | | DESCRIPTION | | C'C'T REF. | BBC REF. OR DRG. No. |
|---|---|---|---|---|---|---|
| | | | DRAWING NUMBERS | | | |
| | | | CIRCUIT (P.B 1 & 2) | D49990 A2 | | |
| | | | CIRCUIT (P.B 3) | D49991 A1 | | |
| | | | P. LIST | D49992 A4 | | |
| | | | ASSY & WIRING | D49993 A1 | | |
| | | | SUB-ASSY | D49994 A3 | | |
| | | | DETAILS 1-9 | D49995 A1 | | |
| | | | DETAILS 10 & 11 | D49996 A3 | | |
| | | | P. BOARD 1 & 2 MASTERS | D49997 A2 | | |
| | | | " " COMP LOC | D49998 A2 | | Not sent to contractor |
| | | | " " DRILLING | D49999 A3 | | |
| | | | P. BOARD 3 MASTERS | D50000 A1 | | |
| | | | " " COMP LOC | D50001 A2 | | |
| | | | " " DRILLING | D50002 A2 | | |
| | | | BOX ETCHING MASTERS | D50003 A1 | | |
| | | | LABEL LEGEND | D50004 A4 | | |
| | | | P.B 1&2 WIRING SIDE ASSY INFO. | D50005 A2 | | |
| | | | DETAIL 12 | D50006 A4 | | |
| | | | FURTHER INFORMATION REQUIRED FOR MANUFACTURE: | | | |
| | | | ASSY INFORMATION | EA 10484 | | |
| | | | WIRING " | EA 10137, EA 10140 | | |
| | | | SPACER | D50639 A4-CP | | |
| 1 | 1 | | LARGE EXTRUSION | | | D49995 A1 DET 1 |
| 2 | 2 | | SMALL EXTRUSION | | | " " 2 |
| 3 | 2 | | COVER (SMALL) | | | " " 3 |
| 4 | 1 | | COVER (LARGE) | | | " " 4 |
| 5 | 1 | | FRONT PLATE | | | " " 5 |
| 6 | 1 | | REAR PLATE | | | " " 6 |
| 7 | 1 | | DIVIDER PLATE (FRONT) | | | " " 7 |
| 8 | 1 | | " " (REAR) | | | " " 8 |
| 9 | 4 | | TIE ROD | | | " " 9 |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | 2 | | P. BOARD (SEE NOTE BELOW) | To | | D49997 A2, D49998 A2 |
| | | | | | | D49999 A3. D50005 A2 |
| | | | THE QUANTITY SPECIFIED (I.E 2) GIVES 2 | | | |
| | | | IDENTICAL BOARDS (P.B 1 & P.B 2) | | | |
| 13 | 1 | | P. BOARD No 3 | To | | D50000 A1, D50001 A2 |
| | | | | | | D50002 A2 |
| 14 | | | | | | |
| 15 | 1 | | LABEL (CODE & TITLE) | | | D50004 A4 |
| 16 | | | | | | |
| 17 | | | | | | |





BBC

DS/PLA4

053/509 PARTS LIST
DUAL, U.H.F FREQUENCY SYNTH.

| | |
|---|---|
| DRN. | K. TURNER |
| TPD. | |
| CKD. | |
| APPD. | |

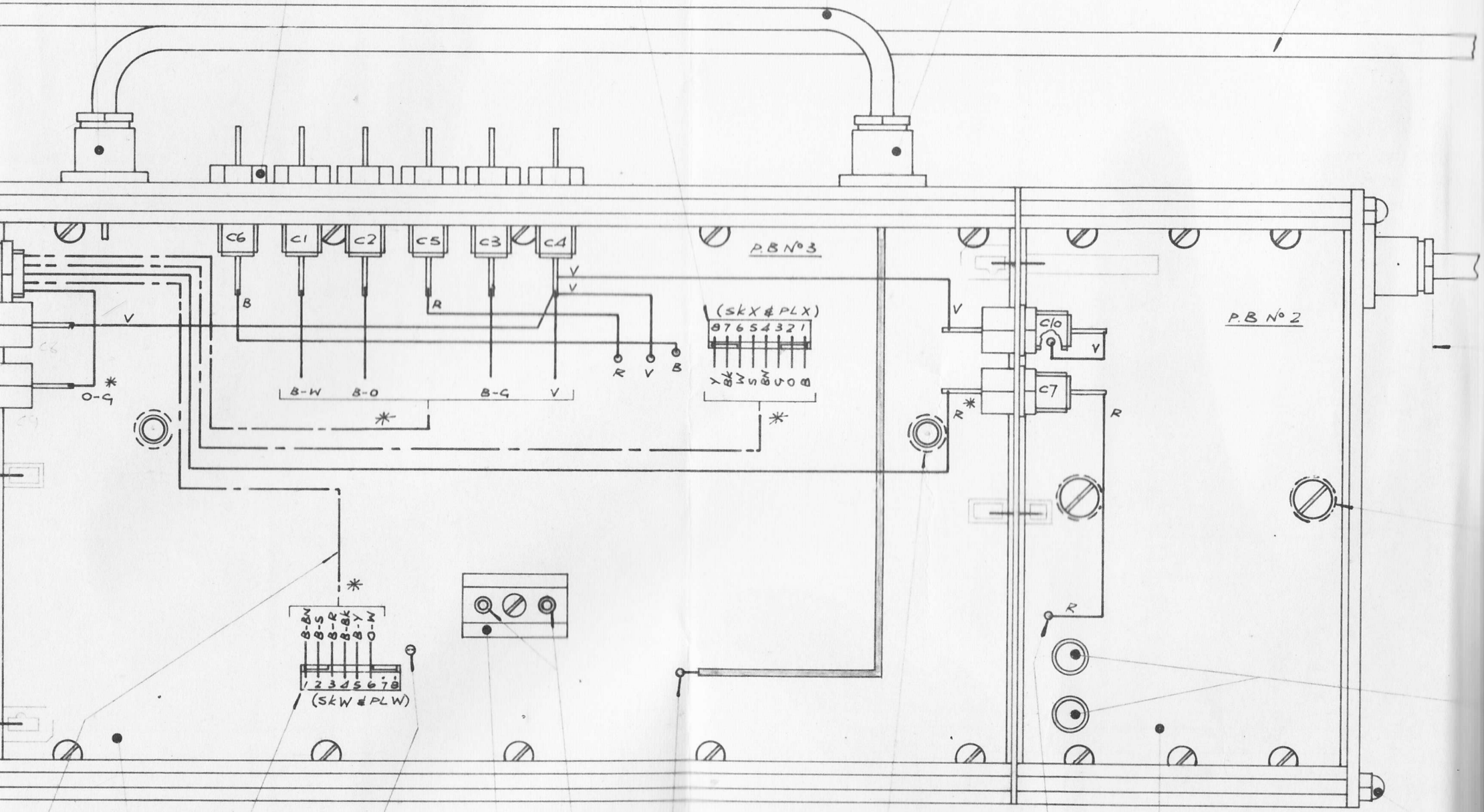
DESIGNS DEPARTMENT.

D 49992 A4

SHEET 1 OF 15 SHEETS

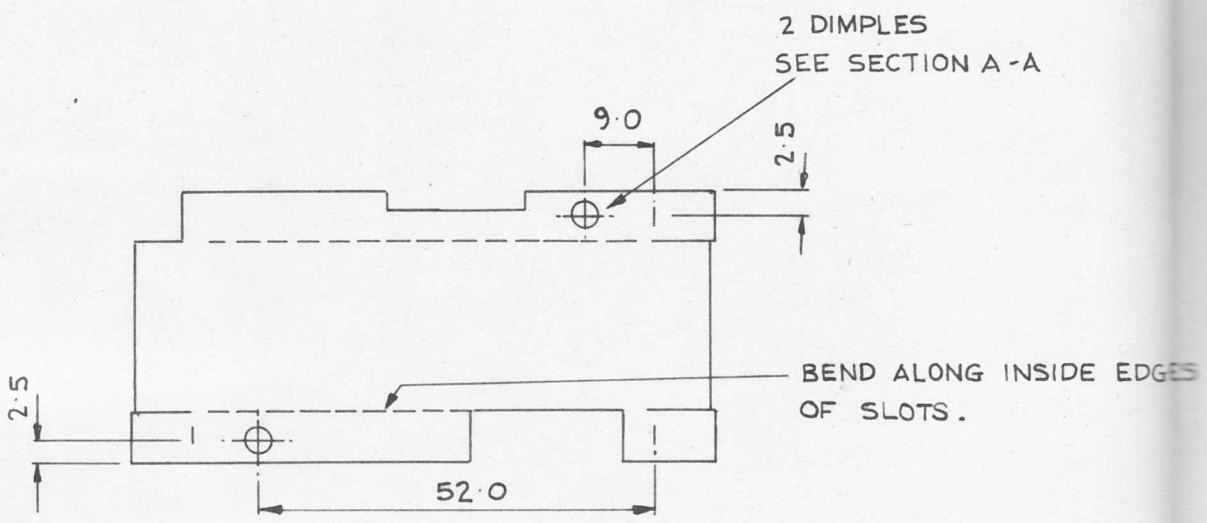
TERMINATION (ITEM 49) TO
BE 280 ± 10

LENGTH OF CABLE BE
PL A (ITEM 41) AND
TERMINATION (ITEM
BE 290 ± 10

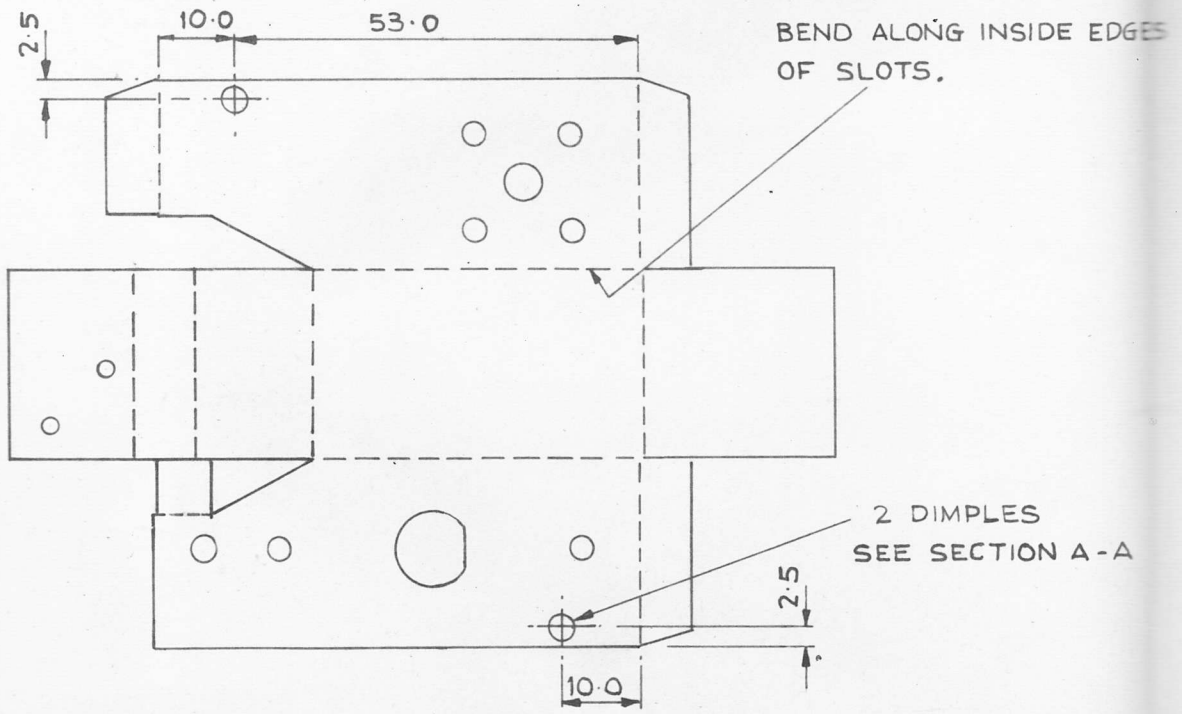



EE NOTE 5

D4999643




INSIDE SURFACE OF LID & BOX SHOWN




| | |
|---|---|
| DETAIL 10 | BOX |
| MATERIAL | ·5 THK COPPER ETCHED TO D50003A1 SHT. 1 & SHT. 2 |
| FINISH | ELECTRO TINNED |

SCALE:- 1:1

THIRD ANGLE PROJECTION

ORIGINAL FRAME SIZE
277mm x 400mm

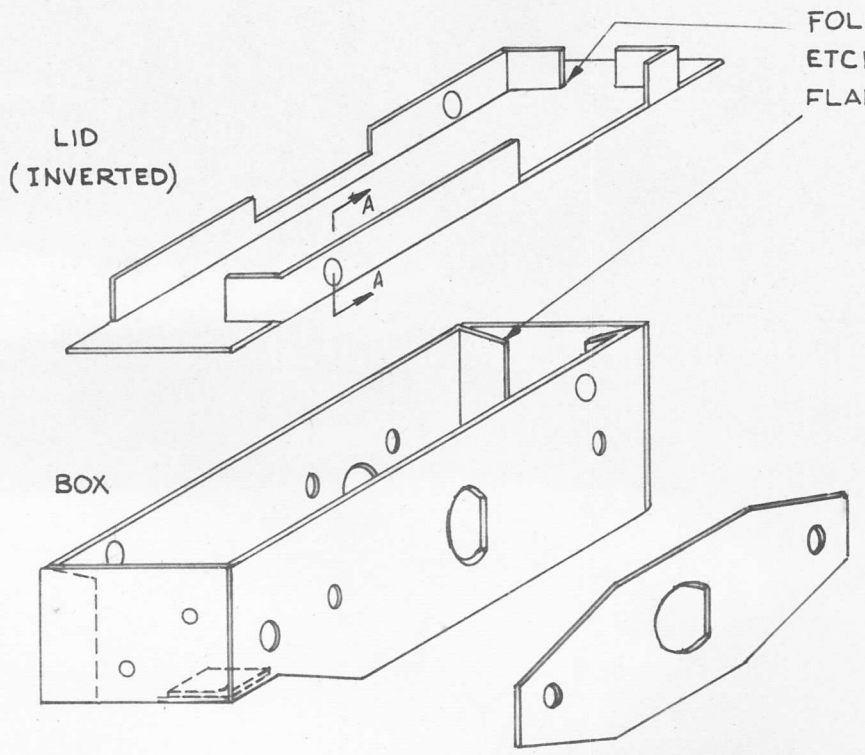
BBC

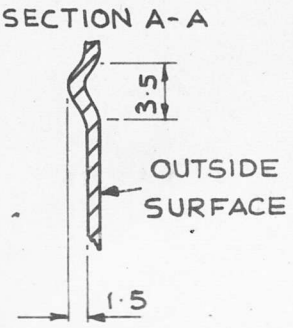


DS/A3/1

CHANGE ISS

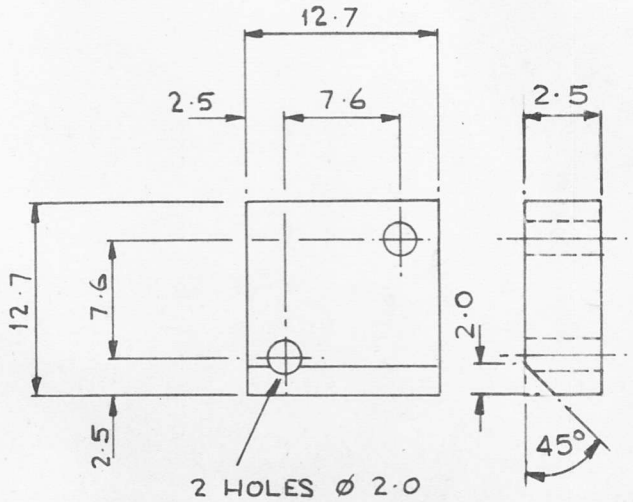
A 27-1-81
B 3-4-81
C 10-4-81




RE-ENFORCING PLATE TO BE LEFT FLAT

SCALE 2:1




DETAIL 11 BLOCK

MATERIAL TUFNOL SWAN BRAND SQ. BAR (OR SYNTHETIC RESIN BONDED ROD, PAPER BASED) (1/2" SQ) NATURAL.
ALTERNATIVE MATERIAL:- BAKELITE SHEET (3/16" THK) P5586BA, NATURAL.

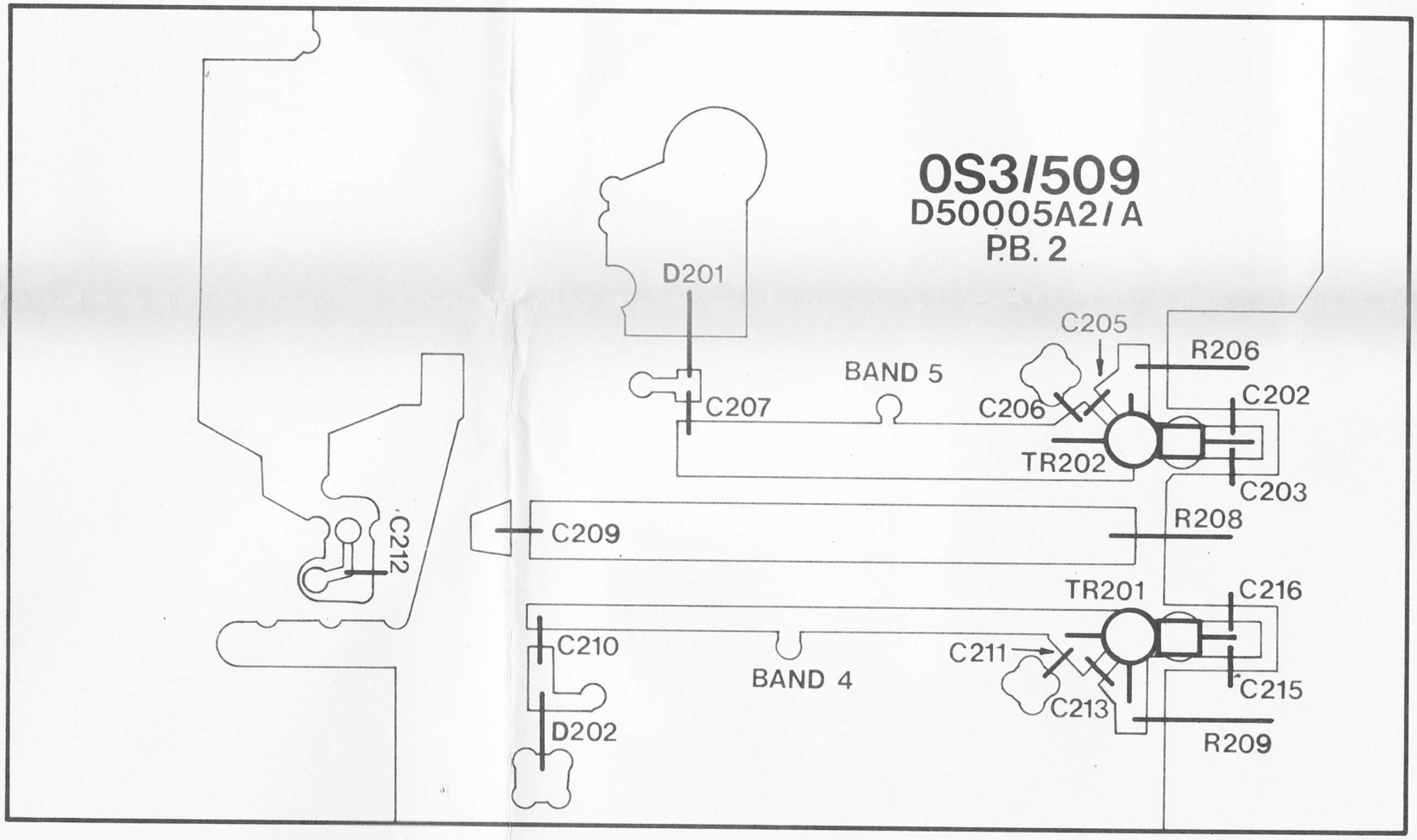
FINISH CLEAN

SCALE 2:1



OS3/509
DETAILS 10 & 11

| All dimensions in millimetres unless otherwise stated: Normal tolerances: | DRN. | C.R.W. | DESIGNS DEPARTMENT |
|---|---|---|---|
| no decimal place — ±1 mm unless | TCD. | | D4996A3 |
| one decimal place — ±0·3 mm otherwise | CKD. | | |
| two decimal places — ±0·1 mm stated | APPD. | | |

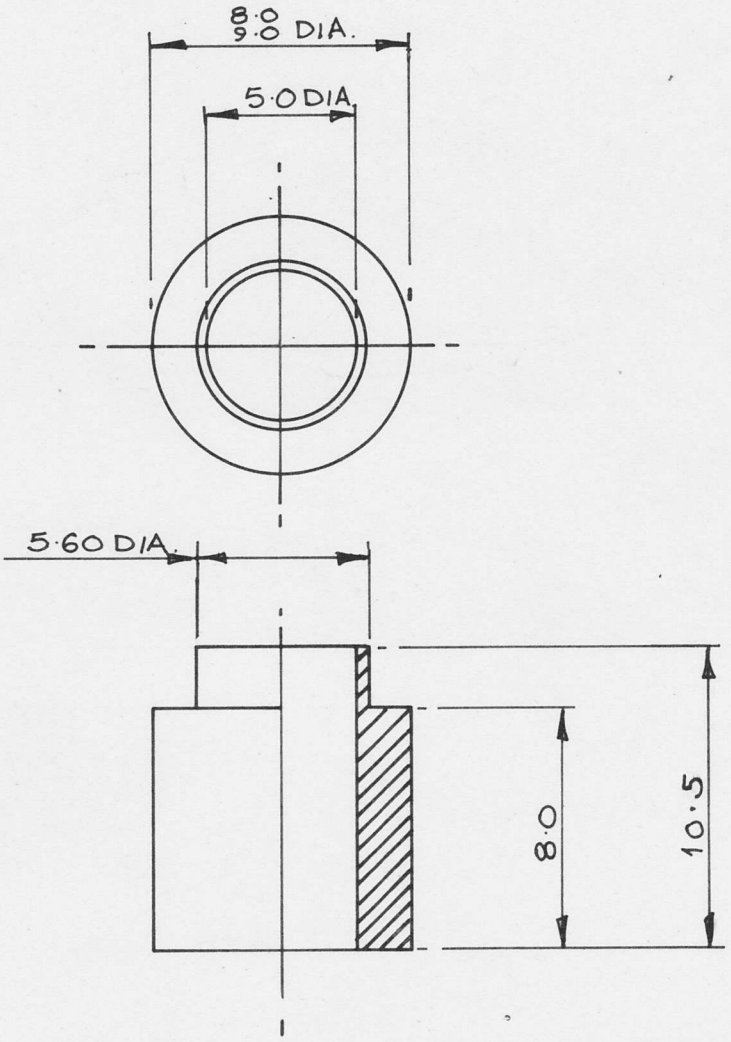

0S3/509
D50005A2/A
P.B. 2
D201
C205
R206
BAND 5
C207
C206
C202
TR202
C203
C212
C209
R208
TR201
C216
C210
C211
BAND 4
C215
C213
D202
R209

D50639A4-CP

ORIGINAL FRAME SIZE
190mm x 277mm

THIRD ANGLE PROJECTION

All dimensions in millimetres unless otherwise stated :
Normal tolerances :
no decimal place — ± 1 mm unless otherwise
one decimal place — ± 0·3 mm stated
two decimal places — ± 0·1 mm




PART SECTION ON ℄

MATERIAL: BRASS BS 249 (ANNEALED)

FINISH: ELECTRO-TINNED.



SCALE 4/1

BBC

DS/A4

| ISS | CHANGE |
|---|---|
| 1 | 22.7.80 |
| 2 | 15-1-81 WAs DSK 2196A4 |

# CAPTIVE SPACER

UNAPPROVED

| DRN. | RBA | DESIGNS DEPARTMENT |
|---|---|---|
| TCD. | | |
| CKD. | | D50639A4-CP |
| APPD | | |