Issue 1
23.6.82

Designs Department Manufacturing Information

No. 5.394(81)

UHF TV Transposer TM4M/503

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for Head of Designs Department

DDMI No. 5.394(81)
Title Sheet

VS

BBC

DS/SPA4

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UHF TV Transposer TM4M/503

PRODUCTION TEST SCHEDULE

C O N T E N T S

D R A W I N G S

Circuit	D 50032 A3
Parts List	D 50033 A4
Assembly	D 50034 A1
Details 1	D 50035 A2
Details 2 and 3	D 50036 A1
Legend	D 50037 A2

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PRODUCTION TEST SCHEDULE

1. DESCRIPTION

This is a broadband unit that may be set, by connecting it to a personality panel, to transpose between any UHF channels without tuning or adjustment. It comprises three easily detachable sub-modules mounted on a simple chassis and it has six flying leads that pass through its front panel for interconnection with other units.

The LEDs on the front panel indicate that the power is normal and that the vision carrier at IF is locked to the transposers oven-controlled crystal oscillator. A BNC socket and multiturn potentiometer on the front panel enable the oscillator to be monitored and controlled.

2. INFORMATION

2.1 Designed in RF Section(5), Designs Department

2.2 Designers: W. Murray, A.R. Lewis, R.J. Hart, M.T. Ellen

2.3 Engineer Responsible:- M.T. Ellen

2.4 Handbook - part of DD Handbook No. 5.156(81)

2.5 No technical instruction available 1.4.81

2.6 Pre-production batch of 8 tested at DD

3. MANUFACTURING PERFORMANCE SPECIFICATION

3.1 Input requirements

RF input	PLD, Input signal, -45 to -15dBm on channel determined by PA1M/579.
Control input	SKT must be connected to either a Personality Panel PA1M/579A or a Transposer Tester TE1/38.

3.2 Output requirements

RF output	PLG, +24 to +33dBm on channel determined by PA1M/579A.
Monitoring output	SKH, 5MHz output > 100mV p-p to drive a frequency counter.

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3.3 Filter connections

The input channel should be selected by a 4 element comb line filter (FL2/565) before application to to PLD. The output channel should be selected by connecting a 4 element comb line filter between PLE (mixer output) and PLF (power amplifier input).

3.4 Power supply — PLS, 28 volts, 2 ± 0.2amps

3.5 Performance

First Mixer Input Level	-45dBm to -15dBm
Second Mixer output Level	
Lower (wanted) Sideband	-29dBm to -19dBm
Local Oscillator	≤-20dBm
Upper (unwanted) sideband	-29dBm to -19dBm
Power Amplifier Input Level	-31dBm to -20dBm
Power Amplifier Output Level	+24dBm to +33dBm
3-tone Intermodulation Product at +33dBm	≤-52dB
Oven-Controlled Crystal Oscilaltor	
Monitor Frequency	5MHz
Frequency Tolerance	±3Hz
Adjustment Range	±10Hz
Output Power Control Range	+23dBm to +34dBm
Maximum Gain Control Range	37dB to 80dB
Slope Control Range (fs relative to fv)	±2.5dB
Channel and Offset Control	See OS3/509 Data and PA1M/579A

4. WARNINGS

4.1 UHF power transistors in the AM14/561 contain beryllium.

4.2 No voltages above 50 volts d.c. or 30 volts a.c. are connected to this unit.

4.3 The UHF output (PLG) must be terminated when power is applied see Handbook No. 5.156(81) for further information.

5. TEST APPARATUS REQUIRED

UHF Bandpass Filter FL2/558

UHF Distribution Amplifier AM4/535

Transposer Personality Panel PA1M/579A

Transposer Tester TE1/38

Power Supplier 28V, 7A, e.g. PS4/8

UHF Signal Generator, e.g. Hewlett-Packard Model 8640B

UHF 3 tone Generator

UHF Calibrated Noise Generator e.g. Rhode and Schwarz SKTU

UHF Sweep Generator, Log Amplifier and Display, e.g. Wiltron Model 640

UHF Frequency Counter (accurate to 1 in 10^8 at least)

UHF Spectrum Analyser, e.g. Hewlett-Packard Model 8558B

UHF Power Meter e.g. Hewlett-Packard Model 435A

UHF 20dB Coupler

Calibrated UHF 30dB, 10 watt, 50Ω pad

Calibrated UHF 3dB, 50Ω pad

DVM, e.g. Fluke Model 8020A

6. INSPECTION CHECKS

6.1 Check that the transposer has been assembled correctly in accordance with D 50034 A1.

6.2 Check that the transposer has been wired correctly in accordance with D 50032 A3, in particular check all the power supply connections, (black, red and violet wires).

7. TEST PROCEDURE see warning in Section 4.3

The sub-units OS3/509, AM21/506 and AM14/561 should have been tested before being assembled to form a TM4M/503, so the following tests are designed to check overall performance. A transposer that passes these tests could be fitted with a sub-unit that does not fully meet its specification, so it is important that the sub-units are tested in accordance with their individual Production Test Schedules.

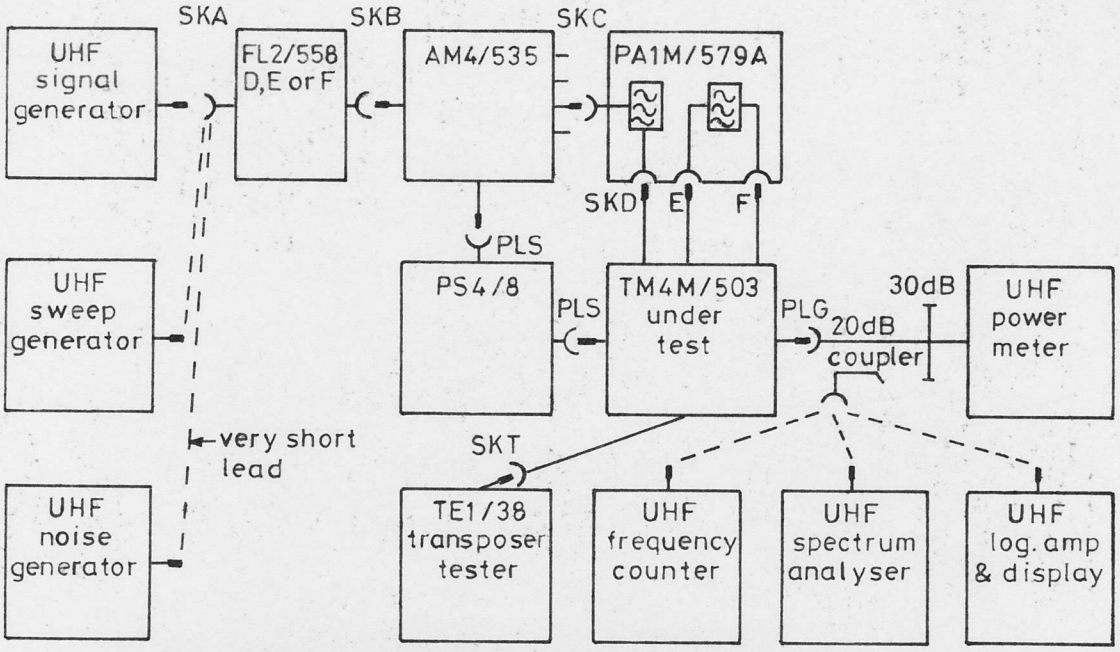


Figure 1. Test Arrangement

Connect the TM4M/403 as shown in Figure 1. The code switches in the TE1/38 must correspond with the channels selected by the filters in the PA1M/579A, but any convenient channel combination may be used. The loss between PLG and the power meter must be known to within an accuracy of ±0.2dB and allowed for in power measurements. All the coded units in the test arrangement must have passed their individual Production Test Schedules and they could be assembled in a TM4M/502 framework, but for better access to the TM4M/503 a horizontal bench mounting arrangement with the PA1M/579 under the TM4M/503 is recommended. The equipment must be left on for at least half an hour to warm up and stabilise before testing starts.

7.1 To Check the Sensitivity, AGC Range, Carrier Locking, Output Frequency, LEDs and Output Power

7.1.1 Set the controls on the TE1/38 to 'fixed slope', 'fixed power' and 'var. gain' with the gain control at maximum (fully clockwise). Set the signal generator to the input vision carrier frequency (±20kHz), with an output level of -63dBm and connect it to SKA. Connect a frequency counter to the output coupler shown in Fig. 1.

Check all the items listed in Section 7.1.2 then increase the level at SKA to -27dBm and repeat Section 7.1.2.

7.1.2.1 The output level should be +33 ±1dBm.

7.1.2.2 Both LEDs should light when the signal is applied.

7.1.2.3 The output frequency should be the nominal vision carrier frequency ±10Hz.

7.1.3.1 If there is no output at PLG check the +28 and +15 volt power supplies, then connect PLK and PLL in turn to a spectrum analyser and check that the local oscillator levels are between +10 and +13dBm. Also check that the frequencies are 40.75MHz above the required input and output channels.

If the local oscillator signals are correct, join PLK to SKK and PLL to SKL, then trace the input signal through the transposer to locate the fault. Refer to the block diagram DSK 22125 A1 for typical levels at various points.

7.1.3.2 If the output level is wrong check that R2 and R3 in the PA1M/579A are correctly wired, via the OS3/509 to C4 and C3 in the AM14/561.

7.1.3.3 If the 'power normal' LED does not light check that its polarity is correct and that it is wired via C5 R330 and D309 to IC302 in the AM14/561. A fault may also be associated with D310 and TR301 which ensure that the LED is extinguished when the control connector is removed.

7.1.3.4 If the 'carrier locked' LED does not light check that its polarity is correct and that it is wired to C6 on the OS3/509. If the wiring is correct remove PLJ and connect SKJ to a spectrum analyser using a high impedance probe (at least 5kΩ). Check that the voltage at SKJ is between 100 and 260mV (-47 to -39dBm at the output of a 5kΩ probe).

7.1.3.5 If the output frequency is wrong but the 'carrier locked' LED is lit, adjust the front panel 5MHz control potentiomter.

7.2 To Check for Spurious Outputs

7.2.1 Set the level at SKA to -53dBm, connect a spectrum analyser to the output coupler as shown in Fig. 1 and check for spurious outputs.

7.2.2 Spurious outputs should be at least 54dB below the output carrier level.

7.2.3 If ths figure is not met ensure that the braids of all the coaxial leads have been terminated correctly at both ends. Measure the frequency and relative level of the spurious output both with and without the signal applied to SKA and if no fault can be found, contact Designs Department for assistance.

7.3 To Check the Noise Figure

Set the level at SKA to -43dBm and adjust the gain control on the TE1/38 until the 'power normal' LED is on the threshold of turning off. Replace the signal generator with the calibrated noise generator connected to SKA using a lead with less than 0.2dB loss. Connect the spectrum analyser to the coupler (Fig. 1) and set the controls as follows:-

Video filter	10Hz (or minimum bandwidth)
Scale	2 or 1dB/div.
Scan	Manual, centre of screen
Input Attenuation	0dB (Take care not to damage the input mixer in the spectrum analyser)
Frequency	In output passband, but away from any spurious components that may be picked up from a local transmitter etc.

With the noise generator set to minimum set the spot on the screen to a convenient position. Then connect a precision 3dB pad between the coupler and the spectrum analyser and adjust the noise generator until the spot reaches its previous position on the screen. Read off the noise figure in dB directly from the noise generator.

7.3.2 The noise figure should be less than 8.5dB.

7.3.3 If this test is not passed, repeat it with the sensitivity set to -63dBm where the noise figure should be better than 5dB. If this test is not passed the fault is probably in the test arrangement, so check the FL2/558, AM4/535 (including its leads) and the input filter of the PA1M/579A. If the noise figure is satisfactory at -63dB, but not at -43dBm then the fault is probably in the leads, input mixer board or early stages of the AM21/506.

7.4 To Check the Frequency Response

7.4.1 With the sensitivity set to -43dBm as in Test 7.3, connect the sweep generator to SKA and connect the log amplifier/display to the coupler (in place of the spectrum analyser). Set the level at SKA to -50 ±2dB and adjust the sweep generator/log amplifier to display the frequency response of the passband, (e.g., 1dB/div. and 2MHz/div.). Disconnect PLJ/SKJ to avoid tracking. Measure the frequency response, then reconnect PLJ to SKJ.

7.4.2 The gain from fv -1.25MHz to fv +6.5MHz should vary by less than ±0.5dB.

7.4.3 If this test is not passed due to a slope across the passband check that R1 in the PA1M/579A is correctly wired via the OS3/509 to C2 in the AM21/506.

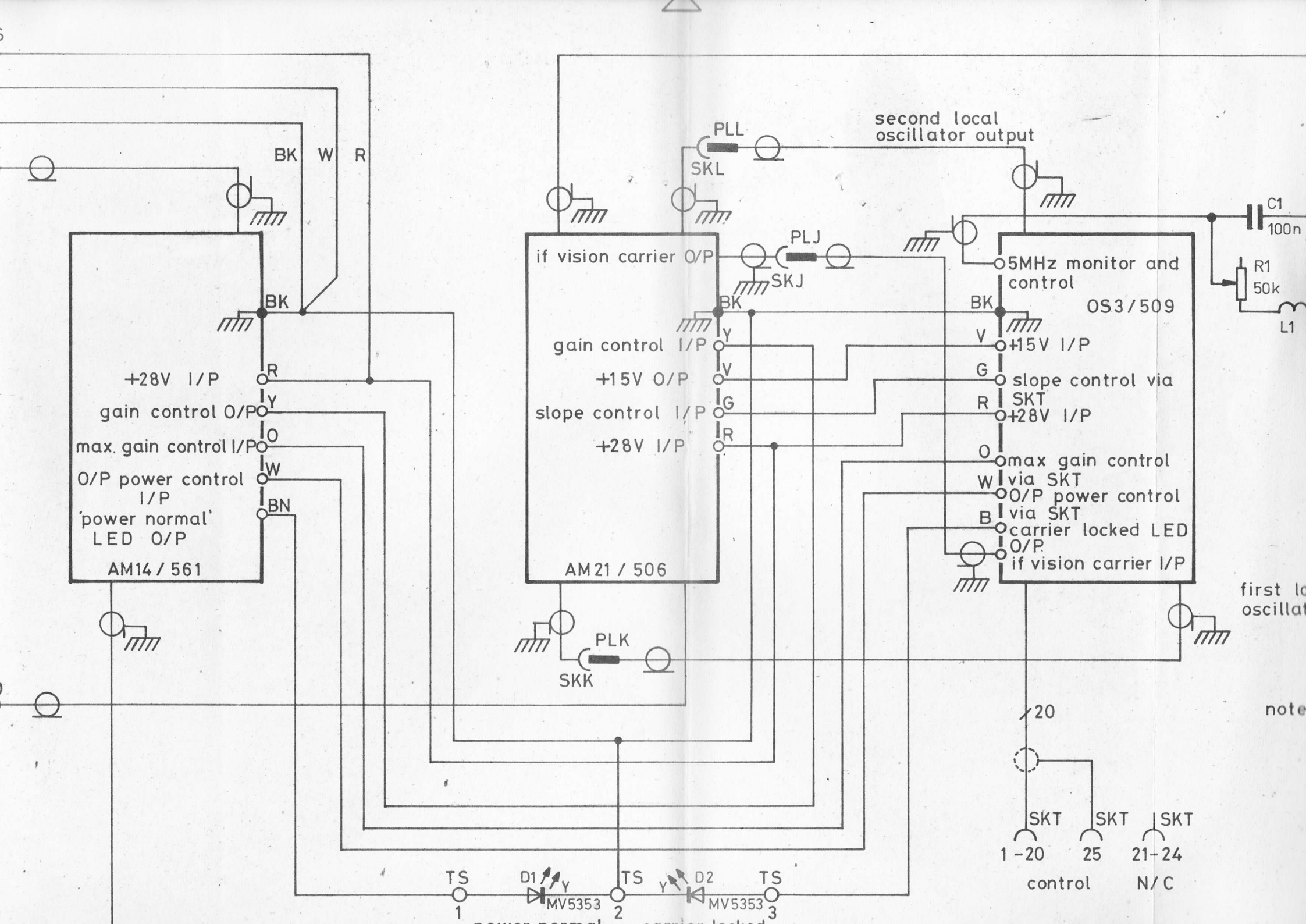
7.5 To Check Intermodulation Products (IP)

The Prdocution Test Schedule for the AM14/561 (Section 7.8) includes some notes on the generation and adjustment of the three UHF tones needed for this test. Notes describing how to make accurate measurements are also included and these should be read before doing this test.

7.5.1 Connect the three tone generator set to the appropriate input channel to SKA and connect the spectrum analyser to the coupler (Fig. 1). Adjust the relative levels of the three tones, then adjust the output level at PLG to be +33 ±0.2dB (PEP). Measure the IPs at fv ±1.57MHz.

7.5.2 The IPs should be better than -52dB with respect to peak envelope power.

7.5.3 If this test is not passed the fault is probably in the output mixer board or output stages of the AM21/506, assuming that the AM14/561 has passed its specification. To confirm this transfer the spectrum analyser to SKF (filter output) without altering the generator or transposer gain settings. The IP at this point should be better than -70dB.


BK
W
R
BK
+28V I/P
R
gain control O/P
Y
max. gain control I/P
O
O/P power control I/P
W
'power normal' LED O/P
BN
AM14 / 561
PLL
SKL
second local oscillator output
C1
100n
PLJ
if vision carrier O/P
SKJ
5MHz monitor and control
OS3/509
BK
BK
gain control I/P
Y
+15V O/P
V
slope control I/P
G
+28V I/P
R
V
+15V I/P
G
slope control via SKT
R
+28V I/P
O
max gain control via SKT
W
O/P power control via SKT
B
carrier locked LED O/P
if vision carrier I/P
R1
50k
L1
AM21 / 506
PLK
SKK
first lo
oscillat
note
20
SKT
SKT
SKT
1-20
25
21-24
control
N/C
TS
1
D1
Y
MV5353
TS
2
Y
D2
MV5353
TS
3

D50033A4

ISS.	CHANGE
1	18-6-81
1A	I.H 24/6/81
2	JAB 17.8.81
3	P.S.L. 26.10.81

TM4M/503 PARTS LIST

ITEM No.	No. OFF		DESCRIPTION	C'C'T REF.	B B C REF. OR DRG. No.
			DRAWING NUMBERS		
			CIRCUIT D50032A3		
			PARTS LIST D50033A4		
			ASSEMBLY D50034A1		
			DETAIL 1 D50035A2		
			DETAIL 2 D50036A1		
			LEGEND D50037A2		
			WIRING D50038A3		
			CABLEFORM E16243A2.		
			INFORMATION REQUIRED FOR MANUFACTURE		
			ASSEMBLY INFORMATION		EA10484
			WIRING INFORMATION		EA10137
			SPEC ED/TM4M/503		
1	1	Θ	AM14/561		
2	1	Θ	AM21/506		
3	1	Θ	OS3/509A		
4					
5					
6					
7	1		FRONT PANEL, LEGEND TO D50037A2		D50035A2 DET. 1
8	1		MOUNTING PLATE		D50036A1 DET. 2
9					
10					
11					
12					
13					

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TM4M/503
PARTS LIST

DRN.	L R.
TPD.	
CKD.	
APPD.	M.T.E

DESIGNS DEPARTMENT
D50033A4
SHT. 1 OF 3

SHT. TO BS4300/7-NS41/H4
R SEE SPEC ED 138)
SHEET SO THAT ROLLED
N OF ARROW.

T FACE IN DIRECTION OF
RFACE BLEMISHES USING
R EQUIVALENT & LIGHT

ADDED BRIGHTNERS) TO
K LINE ON NATURAL
037A2

HOLE	DESCRIPTION	NO. OFF
A	Ø 5·0	2
B	Ø 5·5 & C'SK M5 ON REAR	4
C	Ø 3·4 & C'SK M3	6
D	Ø 25·5	5
E	Ø 5·6	1
F	Ø 11·6	1
G	Ø 6·4	2
H	Ø 2·9 & C'SK M2	2
J	Ø 2·9 & C'SK M2·5	4

NOTES:

1. REMOVE SHARP EDGES AND CORNERS.
2. ANODISED FINISH TO BE REMOVED FROM C'SK.

PARTS LIST: D50033A4

TM4M/503 DETAIL 1

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

DRN.	LR.	DESIGNS DEPARTMENT
TCD.		D50035A2
CKD.	M.I.E	
APPD.		

S & H LTD L5996A