Designs Department Manufacturing Information

No. 5.399(81)

UHF Distribution Amplifier AM4/535

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for Head of Designs Department

DDMI No. 5.399(81)
Title Sheet

VS

BBC

DS/SPA4

Designs Department Manufacturing Information

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UHF Distribution Amplifier AM4/535

C O N T E.N T S

D R A W I N G S

Circuit	D 49954 A2
Parts List	D 49955 A4
Assembly and Wiring	D 49956 A1
Details	D 49957 A1
PCB Assembly Information	D 49959 A2
PCB Drilling	D 49960 A3

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UHF Distribution Amplifier AM4/535

1. DESCRIPTION

The AM4/535 UHF Distribution Amplifier was designed as part of the TM4M/502 UHF Transposer. It is a broadband UHF amplifier, followed by a four-way broadband splitter. The amplifier consists of a low noise discrete transistor stage followed by a thick film stage both using the Engelbrecht configuration. The splitter is formed by three 3dB wireline couplers.

The two power supply inputs are connected via diodes to the amplifier, so that if one power supplier fails the amplifier will remain powered.

2. INFORMATION

2.1 Designed in RF Section 5, Designs Department

2.2 Designed by S.P. Grimely

2.3 Engineer responsible W. Murray

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

2.5 No technical instruction available

2.6 Pre-production batch of 2 tested at DD

3. MANUFACTURING PERFORMANCE SPECIFICATION

3.1 Input requirements

RF input	PLB input signal up to -15dBm, 460 - 870MHz frequency range

3.2 Outputs

RF outputs	1 PLC, 2 PLC, 3 PLC, 4 PLC, UHF outputs up to +5dBm on single channel 460 - 870MHz frequency range

3.3 Power supply

C2, C3, 28V 200 ± 20mA max.

3.4 Performance

Gain from 460 - 870MHz	: 21±1.5dB
Input return loss	≥18dB

Output return loss	≥18dB
Isolation between outputs	≥18dB
3-tone Intermodulation at 5dBm output (one channel only)	≤-60dB
Noise figure	≤3.5dB

4. WARNING

There are normally no voltages in excess of 50V dc or 30V rms ac in this unit.

5. TEST EQUIPMENT REQUIRED

Power supply (28V 500mA)

Spectrum analyser and tracking generator 10 - 1200MHz

Precision Directional Coupler, 20dB, 50Ω, 400 - 900MHz

UHF 3-tone generator, 470 - 860MHz

4 off 50Ω BNC terminations

Calibrated UHF noise generator

3dB and 6dB pads

UHF amplifier 40dB gain e.g. AM14/558

6. INSPECTION CHECKS

6.1 Inspect the unit for any mechanical defects. Check that it has been manufactured correctly to D 49957 A1.

6.2 Inspect the unit for any wiring defects and check that it has been wired correctly to D 49956 A1.

6.3 Check the polarity of the following components:-

6.3.1 1TR1, 2TR1
6.3.2 10IC1, 11IC1
6.3.3 IC5, 2C5, 10C1, 11C1

7. TEST PROCEDURE

7.1 To check current consumption

7.1.1 Connect a source of 28V (500mA) to 2 PLS and then to 5 PLS.

7.1.2 Check that the current drawn from the supply is:- 200±20mA.

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7.2 Input return loss

7.2.1 Connect the equipment as follows. Connect 0dBm output of tracking generator via 30dB pad to 20dB coupler and thence to input of AM4/535 under test. Connect input of spectrum analyser to return port of coupler. Terminate four outputs of amplifier in 50Ω.

Set the tracking generator to give -30dBm into the 20dB coupler.
Check the return loss over the frequency range 460 - 870MHz.

7.2.2 The return loss should be ≥18dB.

7.2.3 Should the return loss be less than this, check that the the inner connection of the coaxial cable to the board is as short as possible and also that the wires of the wireline couplers are not shorted to ground. Adjust C1 by trimming 2mm lengths off the wire.

7.3 Output return loss

7.3.1 Connect the equipment as described in 7.2.1 but with the output of the 20dB coupler connected to an output lead of the distribution amplifier (its other four leads should be terminated in 50Ω). Check the output return loss over the range 460 - 860MHz and repeat for the other three outputs.

7.3.2 The return loss should be ≥18dB.

7.3.3 If this figure cannot be met, check that the output leads are the correct length as shown in D 49956 A1. Also ensure that the inner connection of the coaxial cable to the board is as short as possible and that the wires of the wireline coupler are not shorted to ground. Adjust C2, C3, C4, C5 by trimming wire.

7.4 Gain and frequency response

7.4.1 Connect the output of the tracking generator via a 30dB pad to the spectrum analyser and adjust to give a level of -30dBm. Then connect the tracking output of the generator via the 30dB pad to the input of the distribution amplifier. Connect one of the output leads to the spectrum analyser input and terminate the other three in 50Ω. Measure the output level over the frequency range 460 - 870MHz. Repeat for the other outputs.

7.4.2 The output level should be -9 ±1.5dBm (indicating an amplifier gain of 21 ±1.5dB).

7.5 Isolation

7.5.1 Connect the output of the tracking generator to output port 1 at the same level as in 7.4. Connect output 3 to the spectrum analyser and measure the output over the frequency range 460 - 870MHz. Repeat the test for the combination shown below:-
Output 2 driven, output from output 4
Output 1 driven, output from output 2

7.5.2 The output level should be ≤-48dBm (indicating an isolation of ≥18dB).

7.6 Intermodulation Products

7.6.1 Connect the equipment as follows. Connect the output of the three tone test generator via a continuously variable attenuator to the input of the AM4/535. The input level required is -15 ±5dBm. Monitor one of the outputs on a spectrum analyser. Terminate the other three outputs with 50Ω pads.

For more information on the alignment of the 3-tone generator see DDMI No. 5.393(81). on the AM14/561.

Set the vision frequency (fv) to 470MHz. Set the sound frequency (fs) to 6MHz above the vision frequency and the sub-carrier frequency (fc) to 4.4MHz above vision frequency. Increase the levels of the three tones simultaneously with the variable attenuator until the intermodulation product (IP) at fv + 1.57MHz reaches a level -60dB. Transfer the output of the distribution amplifier to the power meter and measure the RMS output power is 4.2dB below peak envelope power. Change the frequency of fc to:-
(i) 2.8MHz above fv and
(ii) 5.5MHz above fv and repeat the measurement in both cases. Repeat the above procedure with fv set to 850MHz.

7.6.2 The peak envelope power should be ≥+5dB.

7.7 Noise figure

7.7.1 Connect the input cable of the distribution amplifier directly to the output of the noise generator. Connect one output of distribution amplifier via 40dB amplifier cable, and 6dB pad to spectrum analyser. Terminate the other outputs in 50Ω.

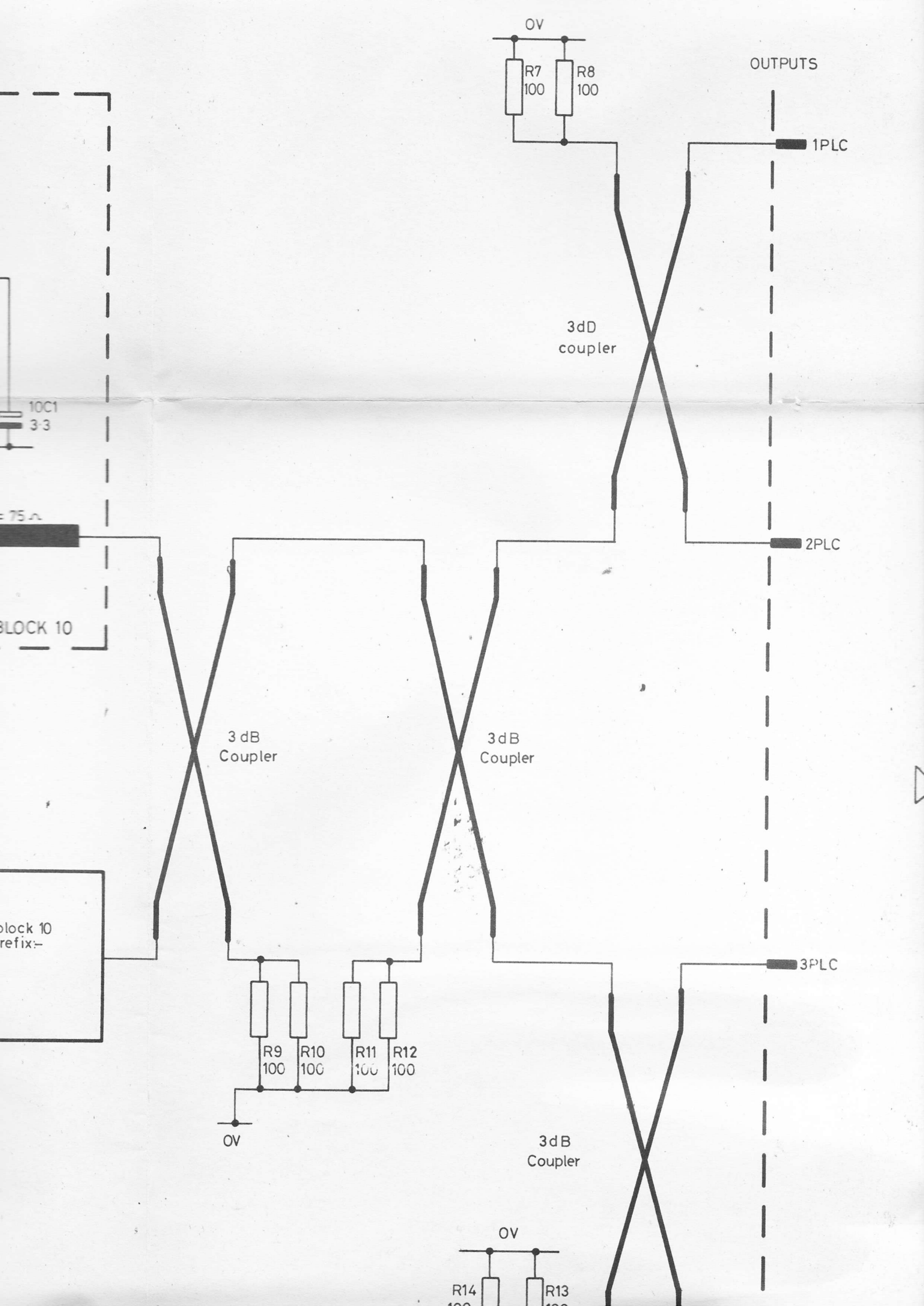
7.7.2 The analyser setting should be as follows:- video filter 10Hz, 2dB/div sensitivity, normal scan, 0dB input attenuation, centre frequency near 570MHz.

7.7.3 With the noise generator switched off set spot on the screen to a convenient position taking care to avoid

regions of strong RF pick-up.

7.7.4 Insert 3dB precision pad between 6dB pad and input to analyser and turn up noise generator till spot is at same position on screen. Read the noisee figure in dBs directly from noise generator. It should be less than 3.5dB.

7.7.5 Repeat for frequencies near 650MHz and 850MHz.


0V
R7
100
R8
100
OUTPUTS
1PLC
3dD
coupler
10C1
3·3
2PLC
BLOCK 10
3 dB
Coupler
3 dB
Coupler
3PLC
R9
100
R10
100
R11
100
R12
100
0V
3 dB
Coupler
0V
R14
R13

ISS.	1	1A*	2
CHANGE	23-6-81	I.H. 2/7/81	JAB 22.7.81

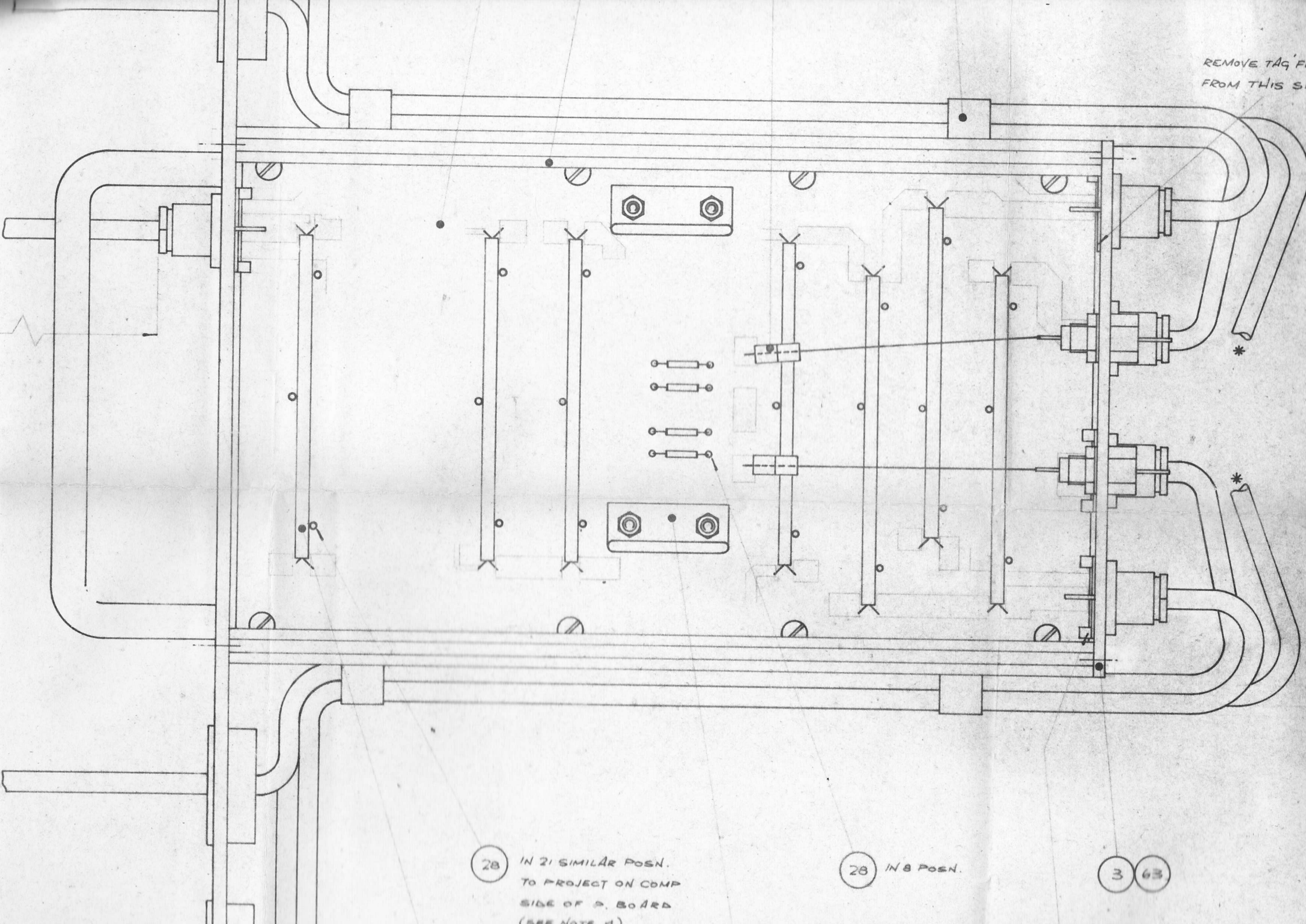
AM4/535 P. LIST
DISTRIBUTION AMPLIFIER

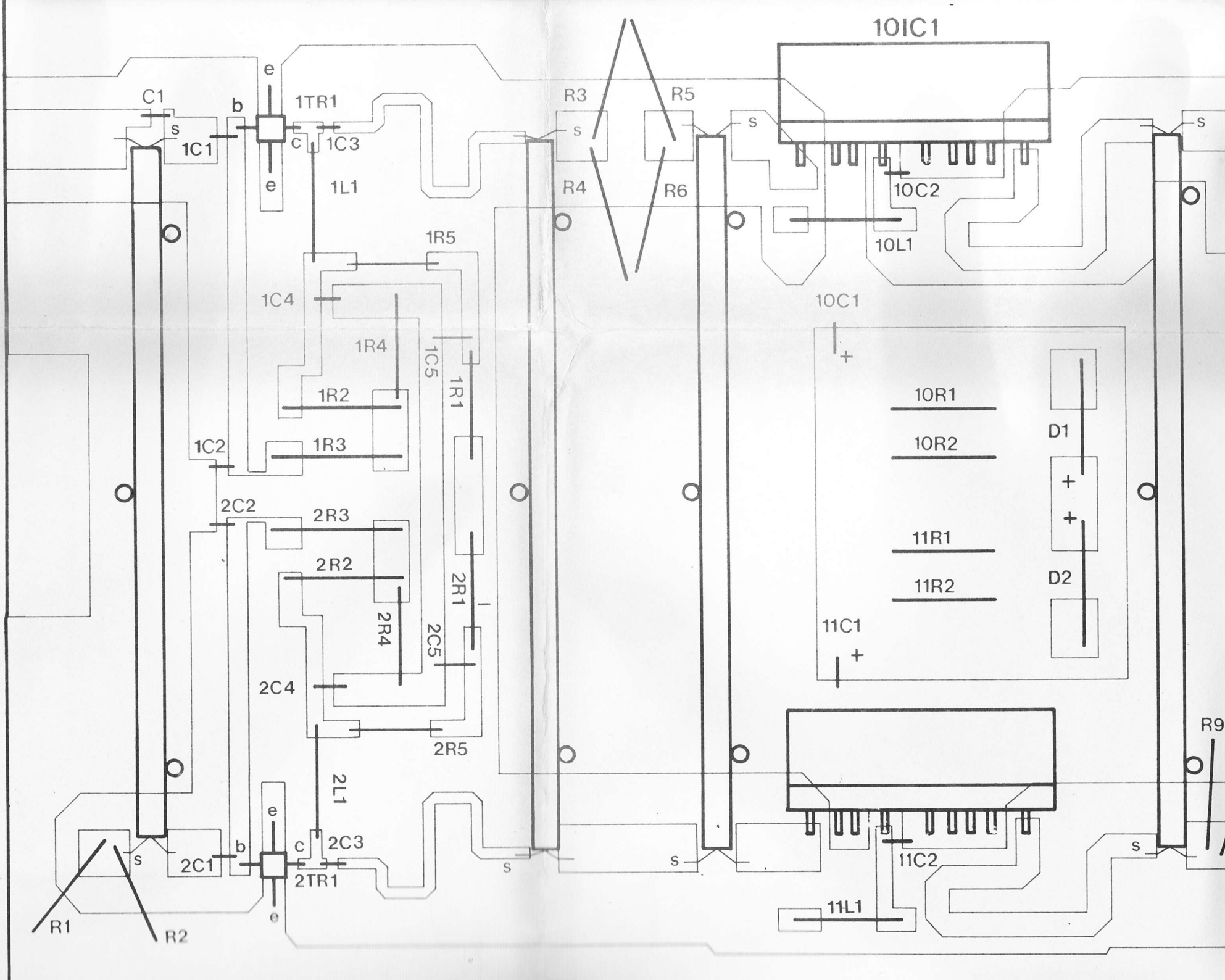
ITEM No.	No. OFF		DESCRIPTION	C'C'T REF.	BBC REF. OR DRG. No.
			DRAWING NUMBERS		
			CIRCUIT D49954 A2		
			P. LIST D49955 A4		
			ASSY & WIRING D49956 A1		
			DETAILS D49957 A1		
			P. BOARD MASTERS (3 SHEETS) D49958 A2		
			P. BOARD ASSY INFO. D49959 A2		
			P. BOARD DRILLING D49960 A3		
			FRONT PANEL LEGEND D49961 A2		
			FURTHER INFORMATION REQUIRED FOR MANUFACTURE:		
			UNIT ASSY INFORMATION EA10484		
			UNIT WIRING INFORMATION EA10137, EA10139, EA10140		
			COUPLER TUBE D49983 A4-CP		
			ETCHED BRACKET D49981 A2-CP		
			SPEC ED/AM4/535		
1	1		FRONT PANEL		D49957 A1 DET 1
2	1	<	EXTRUSION. (SEE NOTE ON SHEET 3)		" DET 2
3	1		REAR PLATE		" DET 3
4	1	>	COVER (SEE NOTE ON SHEET 3).		" DET 4
5					
6	1	*+	BOX EXTROSION (2 METRE LENGTH)		0423504.
7	1	*+	COVER EXTROSION (2 METRE LENGTH).		0423512.
8					
9					
10					0436996
11	1	*	PRINTED BOARD TO SPECIFICATION ED/PB/AM4/535/PTH.		D49958 A2 (3 SHEETS) D49959A, D49960 A3
12					
13					
14					
15	5	*	PLUG, FREE, R.F CO-AXIAL, TYPE BNC, 50Ω MATCHED	1PLC-4PLC, PLB	S 24705 - 0019173
16					
17	2	*	" " MINIATURE, 3 POLE, SWITCHCRAFT TYPE R3M 2PLS & 5PLS		0423311
18					
19					
20	5	*	CABLE, TERMINATION, FIXED		S 20165 - 0389340
21					
22					
23					
24	4	*	FERRITE BEAD, MULLARD TYPE FX1115	FB1-4	0210162
25					
26	4	*	CABLE CLAMP, TYPE X4		S 19095 - 0052538
27					
28	29	*	SOLDER PIN, SEALECTRO TYPE 229-1067 (BULLETT NOSE TYPE).		S 28677 - 0405743
29					

BBC
DS/PLA4

AM4/535 PARTS LIST
DISTRIBUTION AMPLIFIER

DRN.	K.TURNER	DESIGNS DEPARTMENT
TPD.		
CKD.		D49955A4
APPD.	M.T.E.	SHEET 1 OF 5 SHEETS


REMOVE TAG F
FROM THIS S
28
IN 21 SIMILAR POSN.
TO PROJECT ON COMP
SIDE OF P. BOARD
(SEE NOTE 4)
28
IN 8 POSN.
3
63


10IC1
C1
1TR1
1C1
1C3
1L1
R3
R5
R4
R6
10C2
10L1
10C1
1R5
1C4
1R4
1C5
1R1
1R2
1C2
1R3
10R1
10R2
D1
11R1
11R2
D2
11C1
2C2
2R3
2R2
2R4
2C5
2R1
2C4
2R5
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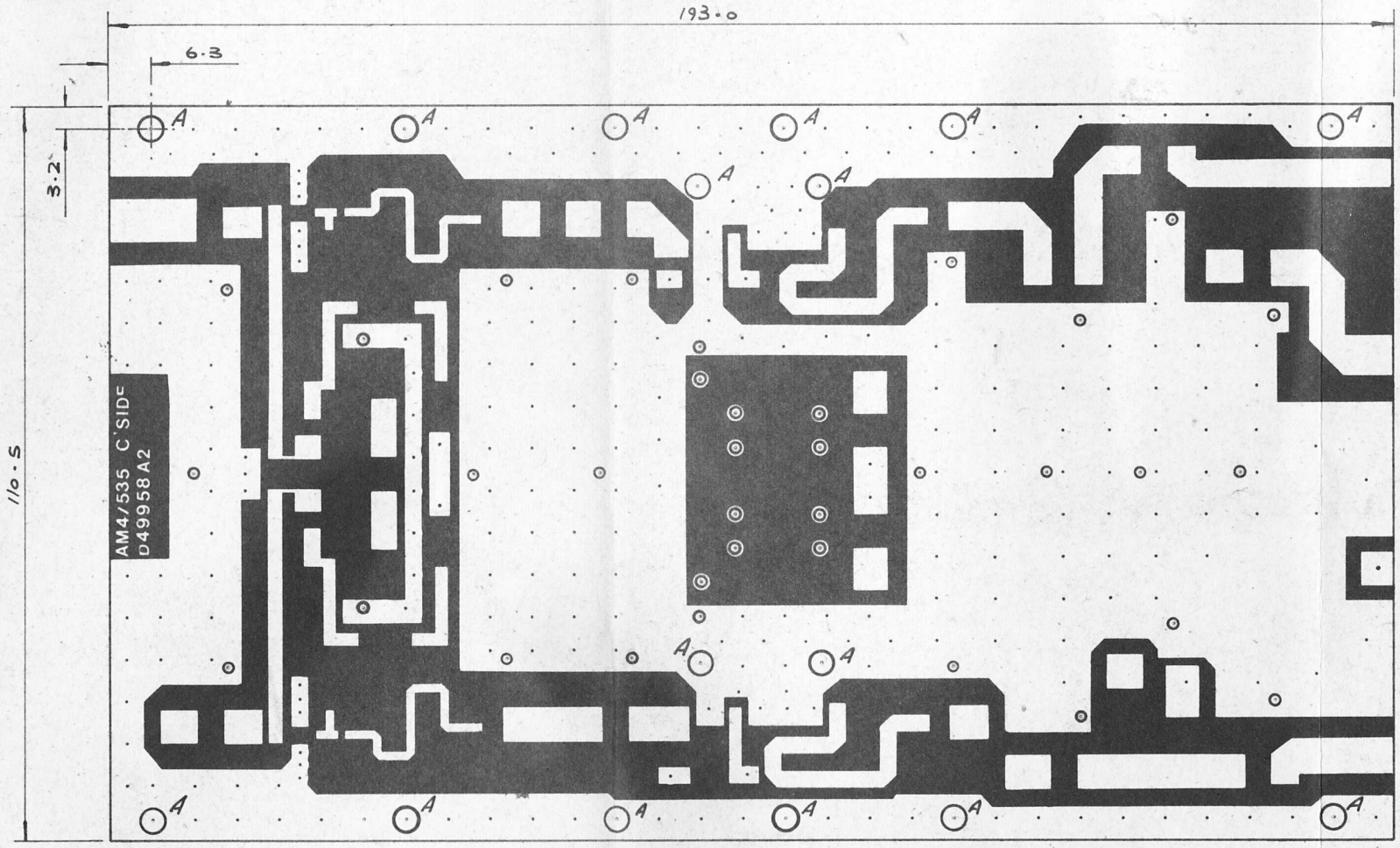
2C1
2TR1
2C3
11C2
11L1
R1
R2
R9



HOLE SIZE
OR 3.4 DIA

WARNING

P.T.F.E BASED MATERIAL — OBSERVE STANDARD SAFETY PRECAUTIONS.

APPROX. No. OF HOLES:- 312

MATERIAL 1.58 THK. TO MIL-P-13949E, k-6098 TYPE GT 35/35, 1.58 ± 0.08 (TEFLON / GLASS CLOTH LAMI CLAD ON BOTH SIDES WITH 35μm THK. COPPER.