Issue 1
23.2.73

DESIGNS DEPARTMENT MANUFACTURING INFORMATION NO. 5.210(71)

Medium Power UHF Amplifier AM14/541

Introduction

This amplifier is a general purpose wideband amplifier for use in band IV and V. It was designed for the medium power stages of the EP7/513 and EP7/514 translators and active deflectors. Built in a CH1/57A, it can conveniently be mounted in CH1/12A or other systems. It supersedes the tunable medium power amplifier AM14/524.

Electrical Technique

The amplifier uses the Englebrecht configuration. The input signal is split by a 3dB coupler and drives two identical amplifier chains consisting of a BFW30 driving a BLX92 each. The outputs of these are combined in an identical 3dB coupler. Using this configuration, input and output return losses are only governed by the similarity of the two amplifier chains, not their independent return losses, and can be made over a wide bandwidth. The absolute mismatch at the amplifier inputs reflects power into the termination on the couplers fourth port, not out of the input socket. Failure of one half reduces both gain and power handling by 6dB.

Mechanical Construction

The amplifier consists of a single printed board carrying the four transistors and other components in two "mirror image" amplifiers. The 3dB couplers are a coaxial "Wireline" cable cut to length and connected to the edge of the printed board. The whole is mounted in a cast box type CH1/57A and the BLX92 stripline transistors are bolted through the casting for heat sinking. The connectors are Sealectro "Snap on" conhex, and the module can be mounted with a number of other CH1/57 type modules in the framework FW1/9.

General Specification

Gain and Frequency Response :	12dB ± 2dB 470-860MHz Between 470MHz and 760MHz, the slope should not be greater than 0.3dB over any 8MHz. Between 760MHz and 860MHz, the slope should not be greater than 0.6dB over any 8MHz.
Output level :	⩾ 16dBm (40mW) for 3 tune I.P. of -60dB 1dB compression > +20dBm (100mW)
Impedance and Return Losses :	Input 50 ohms, 20dB return loss Output 50 ohms, 14dB return loss
Recommended Load Return Loss :	14dB
Noise Figure :	Typical 11dB (not usually measured)
Connectors :	Sealectro "Snap-on" conhex
Power Supply :	-24V ± 2V @ 200mA ± 20mA

BBC
DS/SPA4

Issue 1
23.2.73

DESIGNS DEPARTMENT MANUFACTURING INFORMATION NO. 5.210(71)

Medium Power UHF Amplifier AM14/541

PRODUCTION TEST SCHEDULE

Measurements Required

Gain
Frequency Response
Return losses
Output power
} Including tuning procedure

Equipment		Example
Sweep generator, 0dB out, 400-900MHz		VS80, Polyskop etc.
Switched attenuators, 1dB steps + 10dB steps		
20dB coupler		Narda Microline 3020A
Detector and display of good sensitivity see sections 2(a) and 2(b).		Log amplifier, Texscan type LN40A X-Y display, Texscan type DU88 UHF amplifier AM14/540
	OR	Selektomat and Polyskop
Medium power three tone generating equipment, see section 2(c)		Power meter, Hewlett Packard type HP432A Spectrum analyser, Hewlett Packard type 141T, 8554L and 8552B. 3 off, UHF oscillator, General Radio type 1362 2 off, 3dB UHF couplers UHF amplifier AM14/541

A number of 50 ohms leads, adaptors, fixed coaxial attenuators e.g. 3, 6, and 10dB, variable attenuators (1dB step) and 10dB step) and terminations will be necessary.

Test Procedure

1. The amplifiers will be supplied in the first instance bolted down inside the chassis CH1/57B, but without connectors.

(a) Inspect the printed board carefully, noting that each leadless disc capacitor is not cracked, or has lost any of the silver surface area during soldering. See that dust caps have been removed from all trimmers. If necessary, remove board from chassis to inspect copper tape patches on earth-plane side. Remove the nuts on the transistor studs carefully, take care to retain and replace any washers placed between the transistors and the chassis and replace the nuts on re-assembly using a torque wrench (7.5 to 8.5Km cm). These transistors cost about £8 each.

(b) Inspect Sage "Wireline" 3dB couplers on input and output. Check that lengths of exposed inner conductors are as per Order of Assembly instructors D 29544 A4, and that yellow and clean leads are correctly connected.

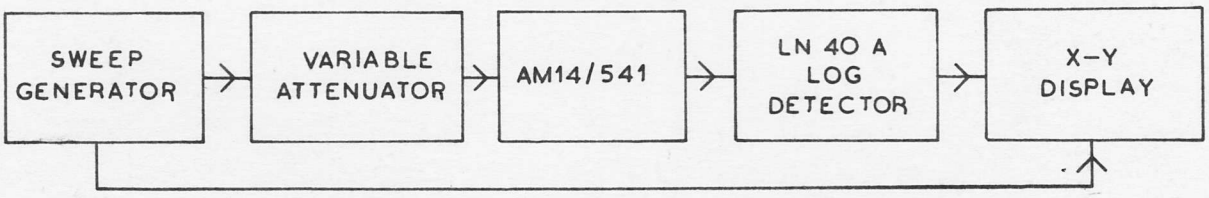
BBC
DS/SPA4

(c) Connect -24 volts to amplifier H.T., 0 volts to earth and measure H.T. current (300mA ± 20mA). If in doubt, measure voltage across emitter resistors. The two halves of the amplifier are "Mirror Images" facilitating comparison of one side against the other. Probable causes of any fault are broken leadless disc capacitors or transistors wrongly orientated.

(d) Return amplifiers for completion of assembly.

2. Ensure that terminations are attached to PLA and PLD and repeat each test with them changed to PLB and PLC.

(a) Tuning and frequency/gain response



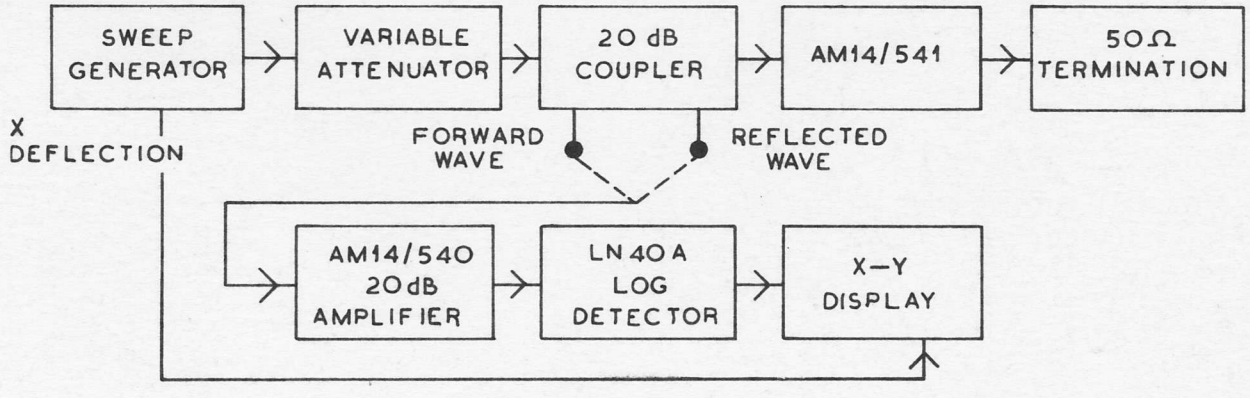
FREQUENCY RESPONSE MEASUREMENT

Fig. 2.1

With approximately 0dB out of the sweep generator fed straight into the LN40A, adjust the X-Y display to give a convenient trace height. Insert switched attenuators and amplifier as shown and adjust C11 and C17 to give a response flat to ± 2dB from 470 to 860MHz, with a rising "hump" at the high frequency end.

The gain should be 12dB ± 2dB everywhere in the range 470-860MHz. Inspect the whole range (470-860MHz) and expand any part of the trace with a rapid change of gain. The EP7/513 and EP7/514 translators and active deflectors must have an overall gain variation of less than ± 0.5dB relative to vision carrier over the range fv-0.75MHz to fv+6.75MHz. Therefore the AM14/541 amplifiers should have the smallest possible gain variation over any 8MHz channel. Between channels 21 and 57 (i.e. 470-760MHz) the gain variation should be less than 0.3dB per 8MHz, and between channels 58 and 68 (i.e. 760 to 860MHz) the gain variation should be less than 0.6dB per 8MHz. It is difficult to measure 0.3dB accurately, therefore, provided the slope is reasonably linear a larger gain variation may be measured over a proportionally larger frequency range.

(b) Return losses



RETURN LOSS MEASURMENT

Fig. 2.2

The lead from the coupler to the amplifier under test must be less than three inches long. With approximately -20dBm from the generator connect the detector amplifier input to the forward wave port on the 20dB coupler and set up a convenient trace on the X-Y display. Increase the generator output by 20dB and transfer the detector amplifier input to the reflected wave port. This should be below the forward wave trace over the ranges 470 to 860MHz. Adjust the attenuator to measure return loss to the nearest dB. Reverse the positions of the terminations and repeat. Choose the arrangement giving the best input return loss over the band and affix input and output labels to correspond.

Reverse the input and output of the amplifier to measure output return loss. Slight adjustment of one or other of the trimmers may well improve output return loss. Output return loss need be only 14dB. If the trimmers are adjusted, check the frequency response again. It may well be convenient to combine Figs. 2.1 and 2.2, by leaving the 20dB coupler permanently in front of the amplifier, and keeping the LN40A at the output instead of replacing it with the terminations.

(c) Power Handling

Set up the three tone generator as shown in the diagram (sheet 4). An alternative arrangement may be used provided it can produce a signal with a peak envelope power of 20mW and intermodulation products >70dB below PEP.

Connect the output of the amplifier to the spectrum analyser (via a 16dB pad), tune it to the required channel and adjust the controls to give a reference line level of 0dBm, 10dB/cm, 1MHz/cm. Adjust the frequencies of the generators to be the vision carrier (V) of the channel to which the amplifier is tuned, the sound carrier (V + 6MHz = S) and the colour carrier (V + 4.43MHz = C). Adjust the levels of the generators by the attenuators so that the spectrum analyser shows V at -8dB, S at -7dB and C at -17dB relative to the top line of the graticule.

Connect the output of the amplifier to a power meter via the shortest possible lead and an accurate 20dB attenuator then adjust the attenuator connected to the input of the amplifier so that the power meter reads -8.2dBm, that is 24.2dB below 40mW. By adding 4.2dB to the power meter reading the peak envelope power is obtained, (the power meter reads the mean power). Connect the output of the amplifier back to the spectrum analyser (via a 20dB pad) and adjust its sensitivity to show V at -8dB, S at -7dB and C at -17dB relative to the top line of the graticule. Now measure the level of the intermodulation product (IP) at V +1.57MHz, it should be better than -60dB relative to the top line of the graticule.

(d) Packing

Before despatching amplifier individually, i.e. not fixed into a chassis or framework, remove the two terminations and pack separately, or tape them onto the top of the amplifier to prevent damage.

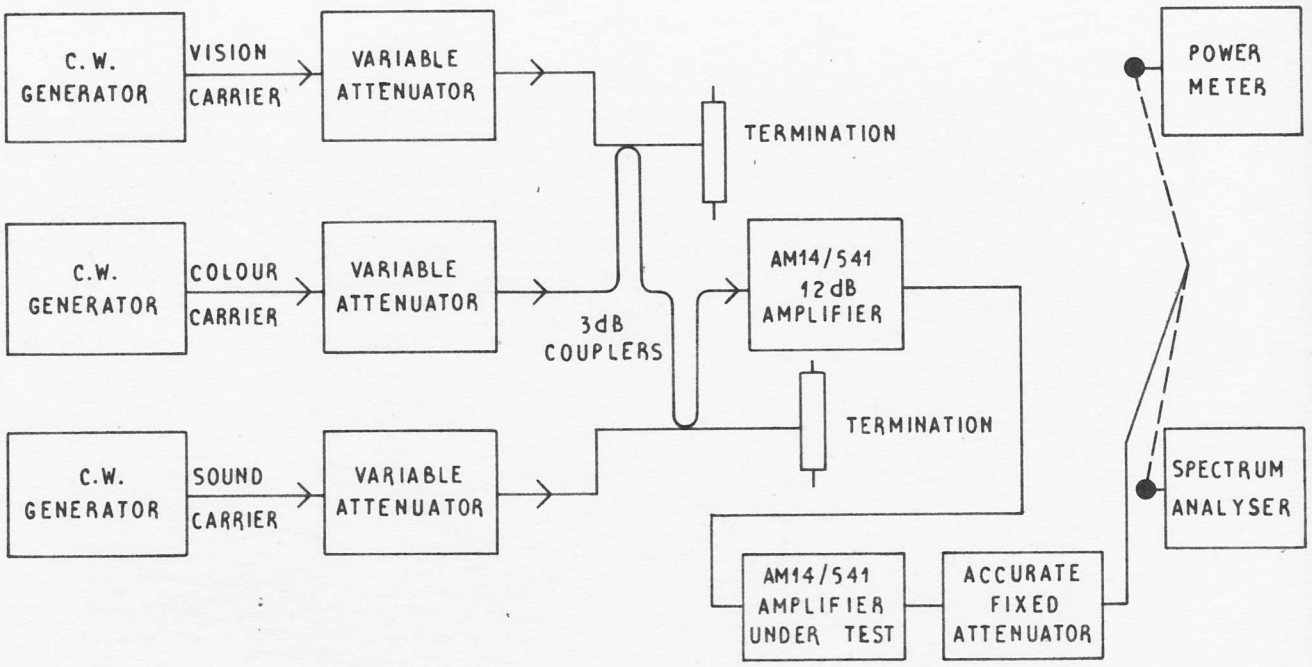


Fig. 2.3

OUTPUT POWER MEASUREMENT

D29542 A4.

sheet 1 of 3 sheets.

ISS.	CHANGE
1	24-11-71
2	ENG. LOAN STARS ADDED. ITEM1 - MOD. BY CONTRACTOR ITEM 7 SPEC. ADDED. ITEM 7 Rev? W.H.W. R.B.A. 28-4-72
3	ITEM 14 WAS ITEM 13. P.B ASSY. ADDED. C.J.A. 10/11/72
4	ITEMS 9-12 WERE TYPE 51-045-0000 CF 7828-AMA/541(5) 16-7-73 P.H.
5	ITEM 13 DELETED. ITEM 14. ENG. LOAN * ADDED P.B DRILLING WAS A4 SIZE. ITEM 16 WAS ITEM 85. D29544 A4 ADDED. W.H.W. H.J.M. 14-11-73

AM14/541 AMPLIFIER U.H.F. MEDIUM POWER. PARTS LIST

ITEM No.	No. OFF	SEE NOTE	DESCRIPTION	C'C'T REF.	BBC REF. OR DRG. No.
			DRAWING NUMBERS.		
			Circuit D29541A2		
			Parts List D29542A4		
			Assembly & Wiring D29543A2		
			Order of Assembly D29544A4		
			Detail 1 D29545A3		
			Detail 2 D29546A4		
			P.B. Wiring D29547A2		
			P.B. Drilling D29548A2		
			FURTHER INFORMATION REQUIRED FOR MANUFACTURE		
			Unit Assembly Information EA10434		
			ORDER OF ASSEMBLY. D29544A4.		
			SPEC. ED/AM14/541.		
1	1	*	Chassis CH1/57A comprising		SPEC: ED/CH1/57.
			Frame MODIFIED BY CONTRACTOR TO:-		D29545A3 Det.1
2					
3					
4	1	*	Resistive Terminations Sealectro Type 61-001-0501	SK.A	
5	1	*	" " " " "	SK.D	
6					
7	1	*	Unit Label		D29546 Det.2 & ESK. 2571A3.
9	1	*	Bulkhead Receptacle Sealectro Type 51-045-9009	PL.A.	1-24682-503
10	1	*	" " " " "	PL.B.	"
11	1	*	" " " " "	PL.C	"
12	1	*	" " " " "	PL.D	"
13	~~1~~	~~*~~	~~PRINTED BOARD ASSEMBLY COMPRISING ITEMS 14,17,18,21-24, 29-32, 34-44, 47-52, 55-59, 66-72, 74-77, 79 & 86-88~~		~~SPEC. ED/DC/2~~.
14	1	*	PRINTED BOARD		D29547A2, D29548A2
15	1		Solder Tag 6B.A. D/E		
16	2.		WASHER. AL. ALLOY 3/16" O.D. x .165" I.D. x 18 S.W.G.		
17	A/R		Copper Foil Strip 0.001" Thick x 3/8" wide.		
18	A/R		Copper Foil Strip 0.001" THick x 1/16" wide.		
19					
20					

BBC

DS/PLA4

AM14/541 - PARTS LIST

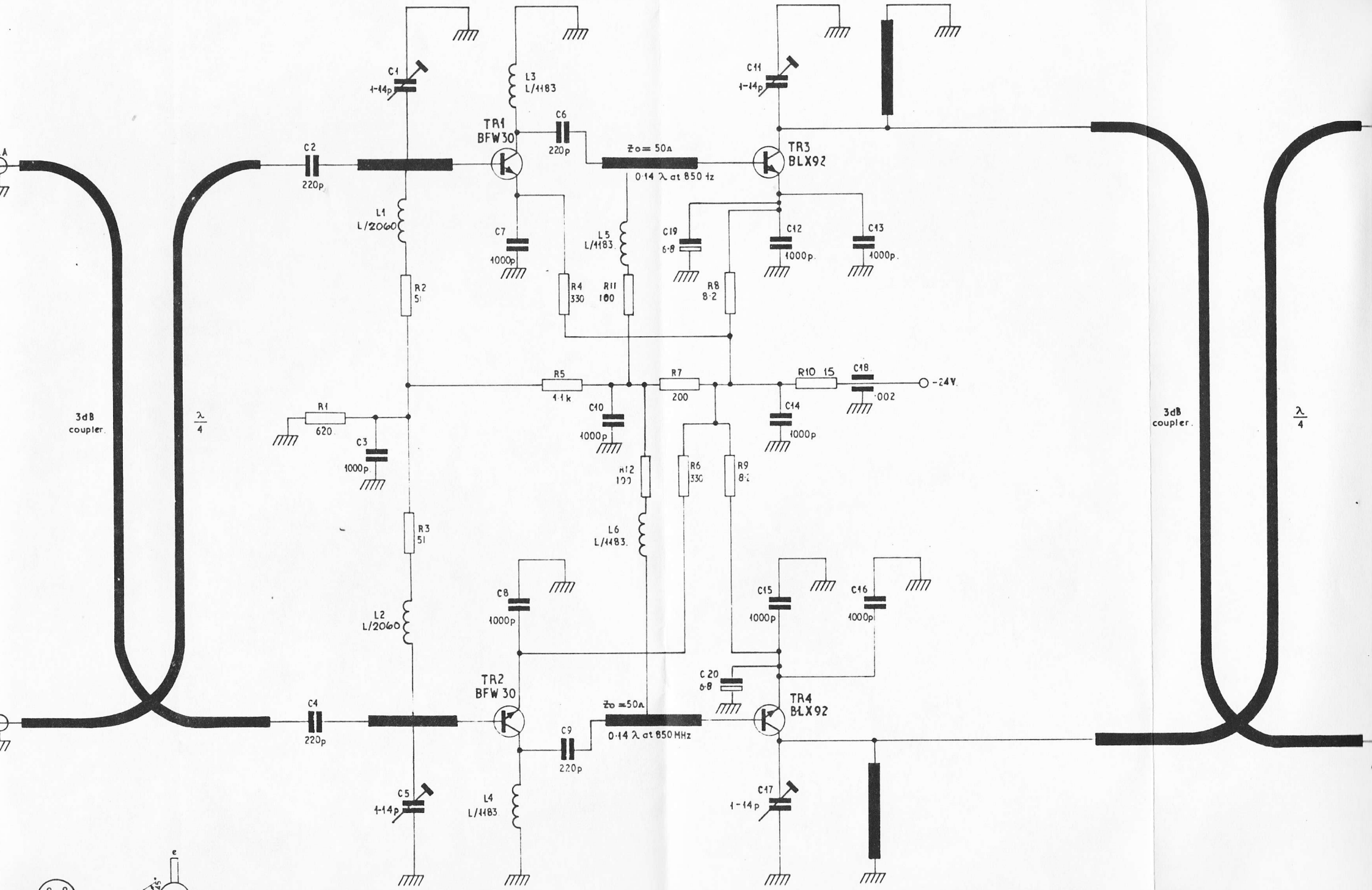
AMPLIFIER U.H.F. MEDIUM POWER.

DRN.	T.C.H.
TPD.	
CKD.	RC
APPD.	

DESIGNS DEPARTMENT

D29542A4

sheet 1 of 3 sheets.


3dB coupler.
λ/4
C1 1-14p
L3 L/1483
TR1 BFW30
C6 220p
C2 220p
Zo = 50Ω
0·14 λ at 850 Hz
TR3 BLX92
C11 1-14p
L1 L/2060
C7 1000p
L5 L/1483
C19 6·8
C12 1000p
C13 1000p
R2 51
R4 330
R11 100
R8 8·2
R5 1·1k
R7 200
R10 15
C18 ·002
-24V
R1 620
C3 1000p
C10 1000p
C14 1000p
R12 100
R6 330
R9 8·2
R3 51
L6 L/1483
L2 L/2060
C8 1000p
C15 1000p
C16 1000p
C20 6·8
TR2 BFW 30
TR4 BLX92
C4 220p
Zo = 50Ω
0·14 λ at 850 MHz
C9 220p
C5 1-14p
L4 L/1483
C17 1-14p
3dB coupler.
λ/4
e
c
b