Issue 1
30.1.73

DESIGNS DEPARTMENT MANUFACTURING INFORMATION NO. 5.211(71)

UHF Drive Amplifier AM14/539 and AM14/542

1. Introduction

The AM14/542 was designed for the output stages of the EP7/513 and EP7/514 translators and active deflectors. The module is tunable to any channel in bands IV and V and supersedes all versions of the AM14/516 series. It operates comfortably at a level of ½ watt peak-sync-power plus sound.

The AM14/539 comprises the module mounted on a CH1/12A. Early units of this code used the AM14/516 module.

2. Electrical Technique

The amplifier uses the Englebrecht configuration. The input signal is split by a 3dB coupler and drives two identical amplifier circuits comprising an input matching circuit, stripline power transistor BLX92 and output tuned circuit. The two outputs are combined in an identical 3dB coupler. Using this configuration, input and output return losses are only governed by the similarity of the two amplifiers, not their independent return losses. The absolute mismatch at the amplifier inputs reflects power into the termination on the coupler's fourth port, not out of the input socket.

The gain of the module is the gain of the individual transistor stages which work in class A, common emitter mode. Failure of either half reduces both gain and power handling by 6dB.

3. Mechanical Construction

The amplifier consists of a single printed board carrying the two transistors and other components in two "mirror image" amplifiers. The 3dB couplers are 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 transistors are bolted through the casting for heat dissipation. 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.

The module can also be mounted conveniently elsewhere, e.g. on a CH1/12A in which case the unit bears the code AM14/539.

4. General Specification

The figures apply to the channel to which the amplifier has been aligned.

Gain		7dB to 9dB Band IV 6dB to 8dB Band V
Bandwidth		Greater than 12MHz at .1dB Greater than 30MHz at 1dB.
Impedance		50 ohms
Return losses:	Input	> 20dB
	Output	> 14dB

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Recommended Load Return loss	20dB
Output power	For 3 tone i.p. of 60dB: -½ watt P.E.P. 1dB compression: 2 watts
Normal operating output level	½ watt peak-sync-power plus sound carrier
Power Requirement: AM14/542	-20V ± 1V base supply and 300mA constant current emitter supply.
AM14/539	24 volts +1 volt -0 volts at 350mA
Connectors	AM14/542 Sealectro "Snap-on" conhex AM14/539 type 'N' Female

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UHF Drive Amplifiers AM14/539 and AM14/542

PRODUCTION TEST SCHEDULE

Measurements Required

Gain
Frequency Response } with tuning procedure
Return losses
Power handling

Equipment	Example
Sweep Generator, 0dBm out, 400-900MHz	Texscan VS60 VS80 Polyskop II
Switched attenuators 1dB and 10dB steps (unless incorporated in generator)	
Coupler, 20dB	Hewlett Packard 7775D Narda Microline
Detector and Display of good sensitivity	Log amplifier, Texscan type LN40A. X-Y display, Texscan type DU88. UHF amplifier AM14/540 or Selektomat and Polyskop.
High 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 amps. type AM14/541 and AM14/542.
Double Bench power supply 0 to 20 volts 500mA	

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

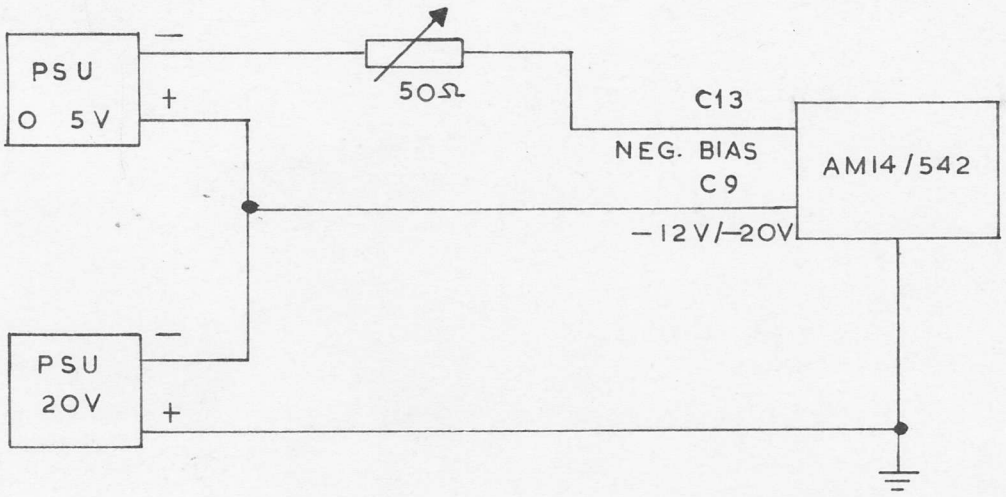
Test Procedure

1. The amplifiers will be supplied in the first instance bolted down inside the chassis CH1/57A, 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 the board from the chassis to inspect the copper tape patches on the 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 reassembly using a torque wrench (oz/inches). These transistors cost about £8 each.

   (b) Inspect the Sage "Wireline" 3dB couplers on the input and output. Check that lengths of exposed inner conductors are as per Order of Assembly instructions D 2934 A4 and that yellow and clean leads are correctly connected.

(c) Connect power supply as shown:



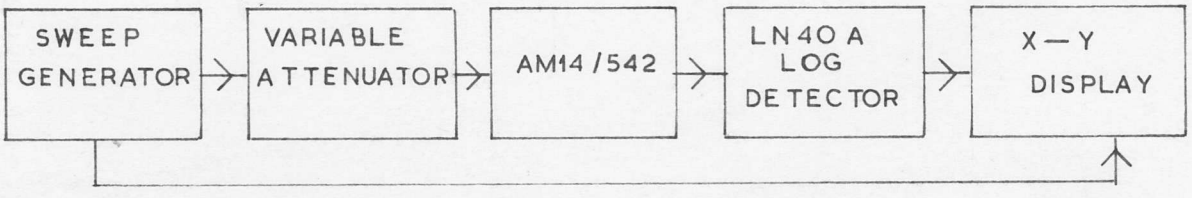
POWER SUPPLY CONNECTIONS

Adjust the upper power supply, or rheostat, till the current is 300mA. See that the base supply (-20 volts) takes the same current to within 5%. Measure the voltage drop across the emitter resistors R4 and R5, these should be within 5% of each other. Probable causes of any fault are broken leadless disc capacitors or wrongly orientated transistors.

(d) Return the amplifiers for completion of assembly.

2. Ensure that terminations are attached to PLA and PLD. These tests must be carried out on the channel at which each individual amplifier will be used, if the channel is not known the tests should be carried out on channels 21 and 66.

(a) Tuning and Gain/Frequency Responses.



FREQUENCY RESPONCE MEASUREMENT

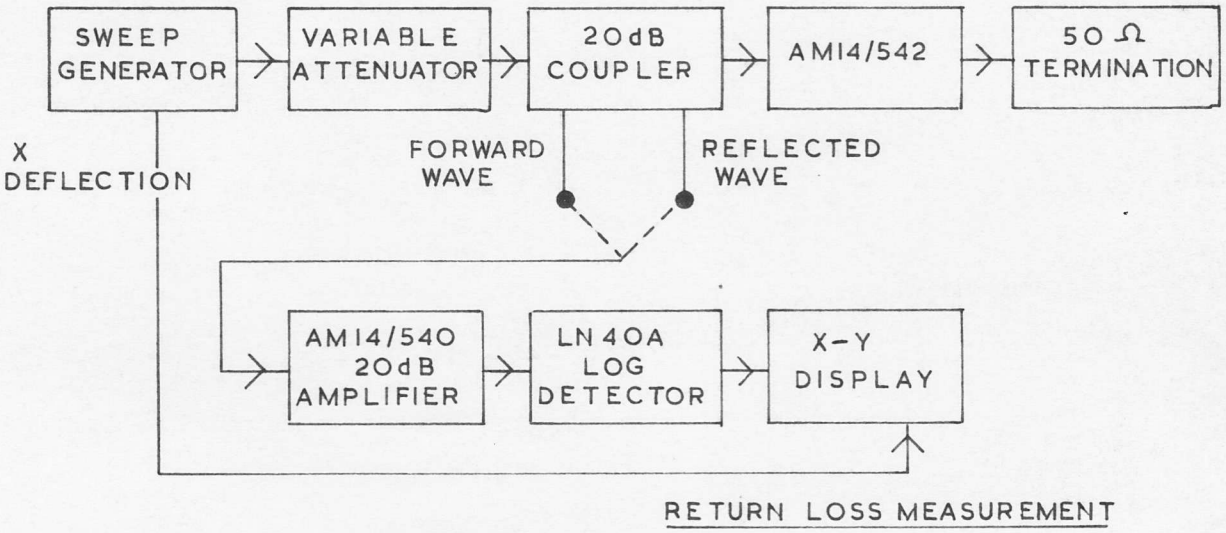
Fig. 2.1

With approximately OdBm output from the sweep generator into the LN40A, set up a convenient trace on the X-Y display. Insert the amplifier and attenuators and tune the amplifier to the required channel.

The generator must be centred on the channel, and it is convenient to start with a sweep greater than ± 100MHz narrowing this to ± 20MHz later.

Adjust all the trimmers for maximum output at the channel centre frequency (vision carrier +2.75MHz) as shown on the X-Y display. Then measure the gain of the amplifier by noting the attenuation which has to be removed in order to maintain the same maximum overall gain when the amplifier is replaced by a through connection. Replace the amplifier in the test set up and reduce the attenuation by 1dB in order to measure the 1dB bandwidth. Ensure that gain and bandwidth are within the specification.

(b) Return loss



RETURN LOSS MEASUREMENT

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's input to the forward wave port on the input coupler and set up a convenient trace on the X-Y display. Increase the generator output by 20dB and transfer the detector amplifier's input to the reflected wave port on the coupler. The return wave should be below the forward wave trace over the channel. Adjust the attenuator to measure return loss to the nearest dB. Slight adjustment of one of the input trimmers willusually bring the return loss well into specification. Otherwise change the positions of the terminations from PLA & PLD or PLB and PLC and measure return loss on the other input port. Failure on this test is usually due to a badly fitted wireline coupler. When satisfactory, affix input and output labels to the appropriate, chosen sockets. It is necessary to check the gain/response test if the input is changed over, or any serious adjustment or repair is made.

Reverse the amplifier and measure the output return loss. This must be 14dB over the channel. Again, a slight adjustment of an output trimmer will correct small errors.

(c) Power Handling

(c) Power Handling

Set up the three tone generator as shown in the diagram below. An alternative arrangement may be used provided it can produce a signal with a peak envelope power of 150mW and intermodulation products > 70dB below PEP.

Connect the output of the amplifier to the spectrum analyser (via a 26dB 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.

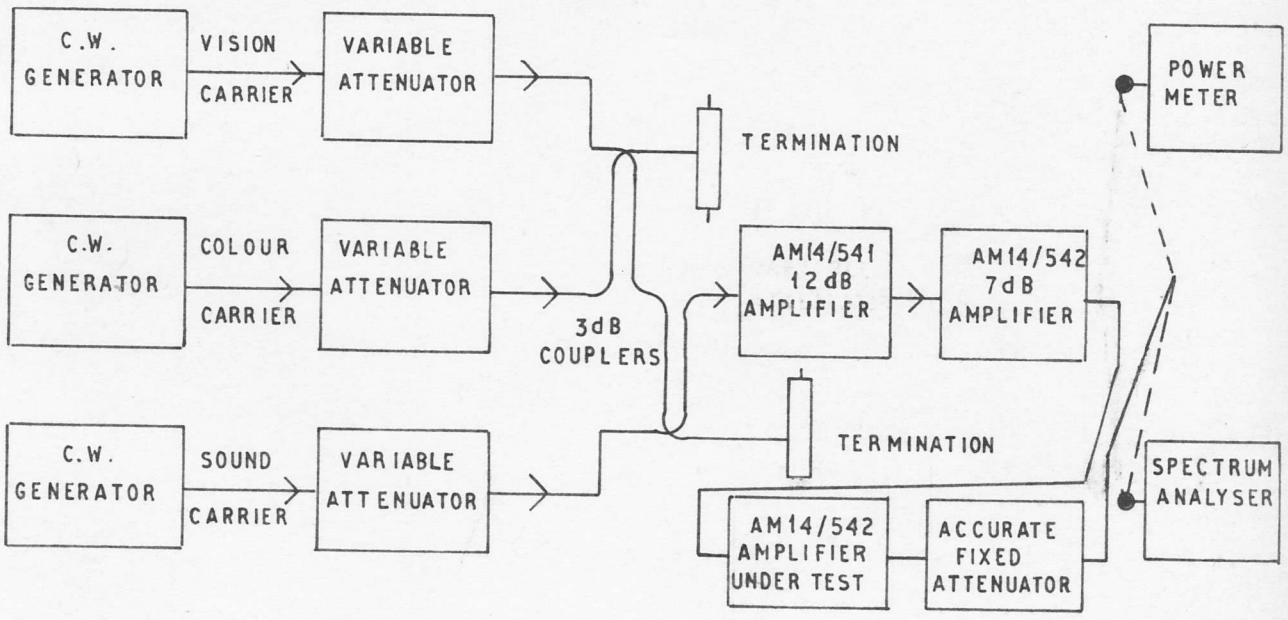
Connect the output of the amplifier to a power meter via the shortest possible lead and an accurate 30dB attenuator then adjust the attenuator connected to the input of the amplifier so that the power meter reads -7.2dBm, that is 34.2dB below 500mW. By adding 4.2dB to the power meter reading the peak envelope power is obtained (the power meter reads the mean power). Connect the output of the amplifier back to the spectrum analyser (via a suitable 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) Labelling

Fix a label to the side of the cast box showing the channel number to which the amplifier has been tuned.

(e) Packing

Before despatching amplifiers 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.



OUTPUT POWER MEASUREMENT

D29415 A4.

sheet 1 of 3 sheets.

ISS.	CHANGE	
1	17. 11. 71	
2	ITEM 1 REVISED. ITEMS 16-21 WERE AIRTRONIC TYPE. J.H. R.B.A 20—4—72	ITEMS 4.5.7-10 C.S.N° ADDED. ITEM 11 ADDED. ITEMS 12,16-21 + WAS ✱. ITEMS 16-21 GUEST N° AT3901 DELETED. GNG 7-11-72
3	ITEMS 7-10 WERE T-72 1-24682-500. ITEM 11 DELETED. EMB. LOAN ✱ ADDED TO ITEMS 12,16-21 W.L.N. CF 7829 (4) H.J.M. 20-11-73	
4		

AM14/542 -AMPLIFIER U.H.F. DRIVE PARTS LIST

ITEM No.	No. OFF	SEE NOTES	DESCRIPTION	C'C'T REF.	BBC REF. OR DRG. No.
			DRAWING NUMBERS.		
			Circuit D29414A3		
			Parts List D29415A4		
			Assembly & WIRING D29416A2		
			Order of Assembly D29434A4		
			Details 1&2 D29417A3		
			P.B. Wiring D29418A2		
			P.B. Drilling D29419A4		
			Detail 3 D29420A4		
			FURTHER INFORMATION REQUIRED FOR MANUFACTURE		
			Unit assembly information EA10484		
			UNIT WIRING INFORMATION EA10140		
			SPEC. ED/AM14/542		
1	1	✱	Chassis CH1/57A modified BY CONTRACTOR AS FOLLOWS:- Frame DRILLED TO:-		SPEC. ED/CH1/57 D29417A3, Det.1
2	1	✱	LABEL, SELF ADHESIVE, BLICK REF 8 GREEN		
3					
4	1	✱	Resistive Terminations	SK.A	1-27422-515
5	1	✱	" "	SK.D	" "
6	1	✱	Unit Label		D29420A4, Det.3 & ESK 2571 A3
7	1	✱	Bulkhead receptacle	PL.A	1-24682-503
8	1	✱	" "	PL.B	" "
9	1	✱	" "	PL.C	" "
10	1	✱	" "	PL.D	" "
~~11~~	~~1~~	~~✱~~	~~P.B. ASSEMBLY COMPRISING ITEMS 12,16-21,1,2,3,8,30,31,33,38,44-48,51,52 -55-58,60,61,78-~~		~~SPEC ED/DO/3~~
12	1	✱	PRINTED BOARD		D29418A2, D29419A4
13	1		6 B.A. Solder Tag. D/E		
14					
15	A/R		Copper Foil Strip, 0.001" Thick		
			VARIABLE CAPACITORS.		
16	1	✱	1-14pF	C3	1-21213-007
17	1	✱	1-14pF	C4	" "
18	1	✱	1-14pF	C10	" "
19	1	✱	1-14pF	C11	" "
20	1	✱	1-14pF	C15	" "
21	1	✱	1-14pF	C16	" "
22					

BBC

DS/PLA4

AM14/542
AMPLIFIER U.H.F. DRIVE
PARTS LIST

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

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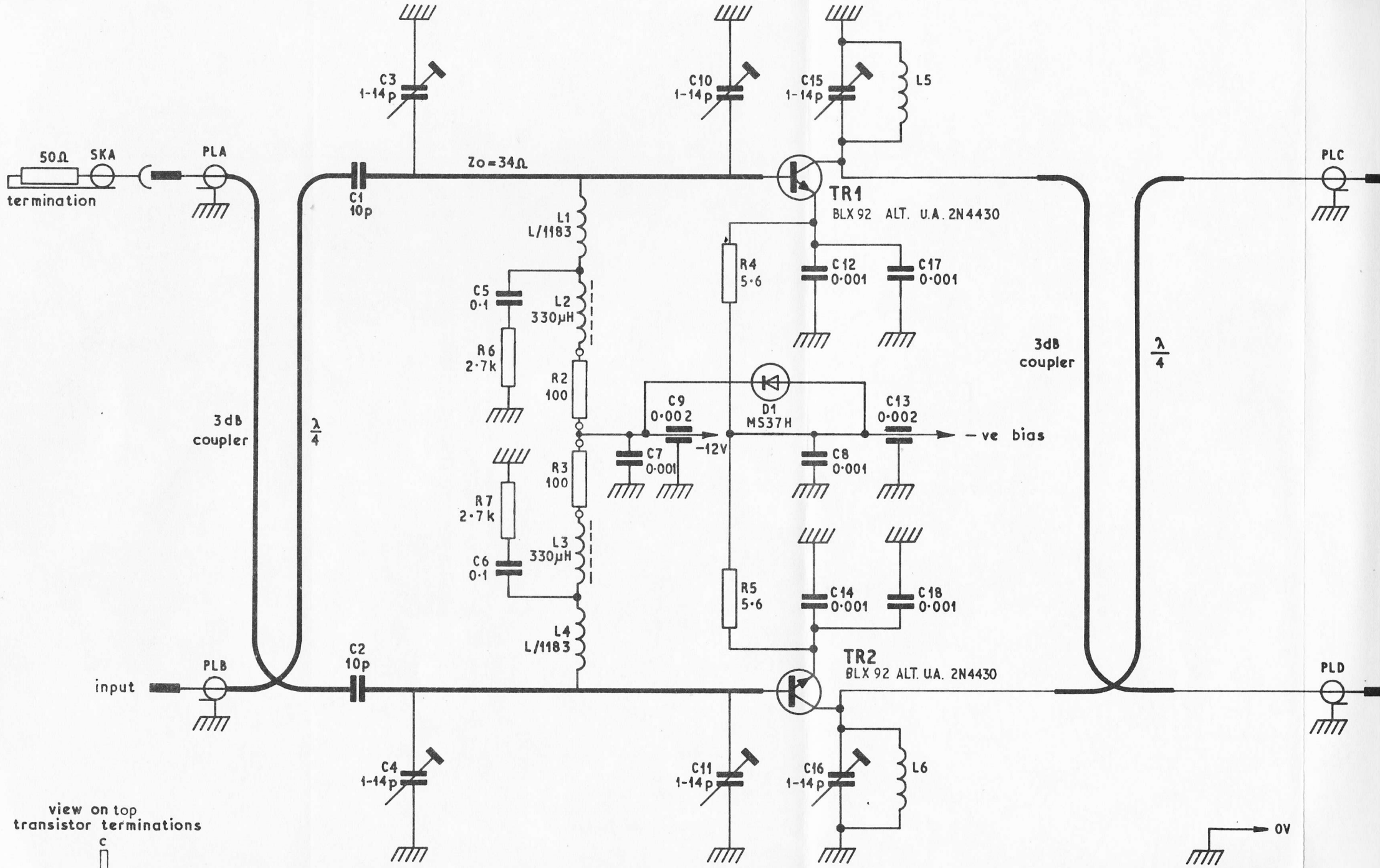
sheet 1 of 3 sheets.


50Ω
SKA
termination
PLA
PLB
input
PLC
PLD
C1 10p
C2 10p
C3 1-14p
C4 1-14p
C10 1-14p
C11 1-14p
C15 1-14p
C16 1-14p
L5
L6
Zo=34Ω
TR1
BLX 92 ALT. U.A. 2N4430
TR2
BLX 92 ALT. U.A. 2N4430
L1 L/1183
L2 330µH
L3 330µH
L4 L/1183
C5 0·1
C6 0·1
R6 2·7k
R7 2·7k
R2 100
R3 100
R4 5·6
R5 5·6
C12 0·001
C17 0·001
C14 0·001
C18 0·001
C7 0·001
C8 0·001
C9 0·002
C13 0·002
D1 MS37H
-12V
-ve bias
3dB coupler
3dB coupler
λ/4
λ/4
0V
view on top
transistor terminations
c
e
e