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1. BRIEF SPECIFICATION

1.1 Application

The A.W.A. Carphone Equipment type J59429 forms the complete mobile transmitting and receiving installation for a radio telephone system employing frequency modulation.

Simplex operation, with a "press-to-talk" control switch on the microphone, is used throughout.

The equipment operates on two fixed frequencies in the 70 - 85 Mc/s band, selection of the frequency being made by a simple two-way switch on the vehicular control unit.

1.2 Composition

The complete installation consists of a transmitter, receiver, power unit, aerial, vehicular control unit and accessories. The equipment may be arranged to operate from either 6 or 12 volt batteries.

The complete equipment schedule is as follows:-

(a) Transmitter/Receiver Assembly type J59430
(b) Power Supply type 2H30322
(c) Control Unit type 23P51048
(d) Aerial type 23Y52259
(e) Loudspeaker type 29652
(f) Four Connectors type 16R5585
(g) Battery Connector type B54905
(h) Speaker Connector type B55679
(i) Valves, Crystals and Vibrators
(j) Instruction Book No. 59429R

1.3 Mechanical Arrangement

The transmitter and receiver are assembled on a common chassis and front panel to form an assembly which fits into a single case. The vibrator power unit is in a separate case, both cases being designed for horizontal mounting. The control unit carries the telephone handset, and is normally mounted on or above the dashboard of the vehicle.

2. INSTALLATION AND OPERATION

2.1 Location and Mounting of Units

The location of the equipment will naturally depend on the type of vehicle and any special requirements; however, the normal arrangement is to place the transmitter/receiver and the power unit in the luggage boot. The control unit is always mounted on the dash panel.

2.2 Mounting the Aerial

The aerial is normally mounted in the centre of the roof of the vehicle to avoid directional characteristics which could reduce the range of communication in certain directions.

The Series Y52259 aerial is a thin whip cut to approximately one-quarter wavelength of the operating frequency. The mounting details are as follows:-

(i) Mark out and cut the centre hole of 2½" diameter
(ii) Mark and drill all mounting holes as shown on Drg. 51835D3.
(iii) Feed in the clamp ring by passing the slot in it over the edge of the centre hole, and attach by means of the countersunk screws.
(iv) Mount the aerial by means of the screws passing into the tapped ring, again as shown in Drg. 51835D3.

2.3 Check of Battery Connections

IMPORTANT

Before switching on, check that the wiring to the heater circuit of the transmitter and receiver valves and the connections to the vibrator in the power unit are correct for the voltage of the vehicle battery.

For details of connections, refer to the circuit diagram of the power unit, (Drg. 30322C2) and the transmitter/receiver assembly, (Drg. 59430A1).

2.4 Cables

The following cables have to be made up during installation to suit the physical layout of the units.

(a) Cable from Power Unit to Control Unit

After the correct length is determined a type 16R5585 plug must be fitted to each end of the 12-core cable supplied. The method of attaching the plug is shown in Drg. 51835D5. If it is necessary to pass the cable through a bulkhead, make a hole large enough to take a rubber grommet which will just pass over the cable, and finish feeding through before attaching the second 12-pin plug. It is customary to run the cable through along the underside of the vehicle floorboards, securing it at short intervals and taking care that it is well clear of exhaust pipe, muffler and any moving parts such as the tail shaft, controls etc.

(b) Cable from Power Unit to Transmitter/Receiver

This cable is made up in the same way as described in (a) above. It should be kept as short as possible to minimise voltage drop in the heater circuits.

(c) Cable from Battery to Power Unit

Two leads of 770/.0076 rubber covered cable are required and should be kept as short as possible, by proper placement of the equipment, to minimise voltage drop. These leads are normally run in the same way as the control unit cable in (a).

The power unit end of this cable has to be fitted with Battery Plug type B54905, according to the details in Drg. 54905D1.

(d) Aerial Cable

This should be kept as short as possible to avoid losses. Its exact length is not important. Coaxial cable type RG58AU (50-ohms) is supplied, together with coaxial connector type 31067. This connector should be attached to the cable according to the details in Drg. 54900D4.

2.5 Final Tuning of Transmitter and Receiver During Installation

The transmitter and receiver are joined together as a complete assembly and are normally supplied pre-tuned to the carrier frequency specified. However, tuning of the transmitter output circuit and the receiver crystal oscillator circuits must be completed during installation.

For the transmitter, carry out steps (9) to (14) of the complete tuning procedure given in section 4.

For the receiver, it is normally only necessary to receive a strong carrier at the desired frequency from the base station transmitter and tune the FREQ. ADJ. controls (C34 and C36 respectively for Zone A and Zone B) for zero indication on a centre-zero meter plugged into the DISCR. jack CF4.

When tuning up, the transmitter and receiver may be operated from the normal source of L.T. and H.T., but must be withdrawn from the case so that access to both sides of the chassis is possible.

All controls, metering jacks, etc., may be identified from the stencilling on the chassis.

ON ALL OCCASIONS when altering or checking the tuning, allow the transmitter and receiver to run for at least 20 minutes with only the heater supply switched on until both attain a stable operating temperature.

2.6 Operating Instructions

Normally the equipment must remain switched ON as long as it is desired to receive calls from the central station.

Switching ON is accomplished by turning the MUTING/OFF-ON switch control (on the Vehicular Control Unit) from the maximum anti-clockwise position in a clockwise direction until the REC. pilot lights.

When the receiver has warmed up, turn the control in a clockwise direction until the noise output from the speaker just disappears.

(a) Making a Call

(i) Lift the handset from its cradle and wait 10 seconds for the transmitter to warm up.

(ii) Depress the press-to-talk button on the microphone. The TRANS. pilot on the dashboard control unit will light.

(iii) Speak into the microphone at normal conversational level.

(iv) Release the press-to-talk button as soon as finished speaking or the reply will not be heard.

(v) When the message is completed, return the handset to its cradle.

(b) Answering a Call

With the equipment on "standby" (i.e., with the handset on its cradle) an incoming call will first be heard on the speaker. To reply to the call, follow the procedure set out in para.(a) above. The incoming call can be made completely private by setting the SPKR-H/SET switch on the control unit to H/SET.

3. TECHNICAL DESCRIPTION

3.1 Transmitter/Receiver type J59430 (Drg. 594304A1)

3.1.1 Transmitter

Summary of Performance

Frequency Range:	70 to 85 Mc/s.
Frequency Control:	Crystal control using A.W.A. plug-in type D crystals operating at ambient temperature. Frequency tolerance ±0.003%. Temperature coefficient better than one part per million per degree centigrade. Adjusted for 30 μμF. input circuit.
Frequency Multiplication:	36 times crystal frequency with adjustment for variation of crystal frequency by approximately ±200 c/s.
Audio Frequency Characteristics:	(a) Response Flat from 500 to 1,000 c/s, rising 10 db over the modulating frequency range from 1,000 to 3,000 c/s. (b) Harmonic Distortion Less than 5% when modulated by a 1,000 c/s tone to a frequency deviation of 15 kc/s which corresponds to 100% modulation for this type of transmitter.
Power Output:	The nominal output of the transmitter is 10 - 14W.

Power Input:	6V.	12V.
Standby (filaments only)	4.0 A.	2.0 A.
Transmit	17 A.	8.5 A.

Valve Complement

Valve	Type	Function
V15	6AU6	Oscillator
V16	6C4	Modulator
V17	6AU6	1st Doubler
V18	6AQ5	1st Tripler
V19	6AQ5	2nd Tripler
V20	6AQ5	2nd Doubler
V21	2E26	Power Amplifier
V22	12AU7	Audio Amp. and Rectifier
V23	6BA6	Constant Output Amplifier

Description of Circuits

A modified Pierce circuit is employed for crystal oscillator V15. Two separate crystals are used for the two bands, but these are close enough in frequency to use the same tuned circuits without deterioration of performance. Relay RLA, energised by the ZONE switch on the control unit, provides the crystal changeover circuit.

The output of V15 is frequency-modulated by modulator V16, which is fed from the audio section consisting of audio amplifier and rectifier V22 and constant output amplifier V23.

The modulated carrier is then frequency-multiplied by 1st doubler V17, 1st tripler V18, 2nd tripler V19 and 2nd doubler V20. The final power amplifier, V21, is coupled to the aerial via a pi network and the aerial changeover relay contact 1C. The total frequency multiplication is 36 times the crystal frequency.

Jacks CF5 to CF11 are provided for metering during tuning and servicing of the transmitter.

Relay RLC is the press-to-talk relay switching H.T. voltage to the transmitter or receiver as determined by operation of the press-to-talk switch on the handset microphone.

The deviation control R108 is set at the factory AND ITS SETTING SHOULD NOT NORMALLY BE ALTERED. However, the indication of maladjustment of this control and the procedure for correcting it are given in the maintenance section.

The line level to the audio input should not be more than 1 mW. in 60 ohms.

The valve heaters are connected in two groups of equal loading and these are connected in parallel for 6V. operation and in series for 12V.

3.1.2 Receiver

Summary of Performance

Frequency Range:	70 to 90 Mc/s
Frequency Control:	Crystal control using A.W.A. plug-in type D crystals operating at ambient temperature. Frequency tolerance ±0.005%; temperature coefficient less than one part per million per degree centigrade. Adjusted for 30 μμF. input circuit.
Crystal Frequency: (in Mc/s)	$\frac{\text{Signal Frequency (in Mc/s)} - 2\text{ Mc/s}}{7}$
Audio Frequency-Characteristics:	(a) Response Approximately flat between 500 and 1,000 c/s, the response dropping by 10 db. at 3,000 c/s. (b) Harmonic Distortion Less than 12% for 1W. output or less than 5% for 0.5W. output from a signal modulated by a 1,000 c/s tone to a frequency deviation of 10 kc/s.
Signal-to-Noise Ratio:	With a 1 μV. signal fully modulated [illegible] 1,000 c/s tone, the ratio between the audio output and the output received without modulation is at least 38 db.
Quieting Figure:	Not less than 25 db for 1 μV. input. The audio output is substantially constant for signal input levels from approximately 0.5 μV. to 0.1V.
Power Output:	The power output of the receiver is 1 watt into 3 ohms.

Aerial Circuit Impedance: Designed to feed from a 50-ohm or 70-ohm coaxial cable.

Intermediate Frequency: The first intermediate frequency (difference frequency output of the first mixer) is determined by the frequency to which the receiver is tuned. For the 70 to 90 Mc/s receiver, it varies from 12 to 14.5 Mc/s approximately. The second intermediate frequency (difference frequency output of second mixer) is held constant at 2 Mc/s.

Selectivity of 2nd I.F. Channel: At ±20 kc/s, output at 1st LIM. grid is within 3 db of centre-frequency output. At ±60 kc/s, output at 1st LIM. grid is down more than 70 db.

Spurious Responses: The worst spurious response, including images, is 70 db down.

Muting: An input of approximately 0.5 µV. will unmute the receiver when the muting control is set to "just muting". With the muting control fully clockwise, the minimum signal to unmute the receiver is not more than 2.5 µV.

Power Input: (filaments + H.T.)

6V.	12V.
7.5 A	4.0 A

Valve Complement

Valve	Type	Function
V1	6AK5	R.F. Amplifier
V2	6AU6	1st Mixer
V3A) V3B)	6J6	Tripler-doubler (for local oscillator)
V4	6AU6	Local oscillator and amplifier
V5	6AU6	2nd Mixer
V6) V7) V8)	6AU6	1st, 2nd and 3rd I.F. amplifiers
V9) V10)	6AU6	1st and 2nd Limiters
V11	6AL5	Detector

Valve	Type	Function
V12	6AV6	Noise Amplifier and Rectifier
V13	6AV6	A.F. Amplifier and Muting
V14	6AQ5	Output Amplifier

Description of Circuits

The receiver is a double-conversion superheterodyne covering the frequency range 70 to 90 Mc/s. It operates on two fixed frequencies within this range, controlled by a crystal oscillator with two plug-in type crystals which are selected by a switch which also controls the selection of the transmitter crystal frequency.

Valve V1 is an R.F. amplifier at the signal frequency feeding the 1st mixer V2, which is supplied with local oscillator voltage from V4 at six times the crystal frequency via the frequency multiplying stages V3B and V3A. The 2nd mixer is supplied at crystal frequency. In each case the frequency of the local oscillator voltage is below the signal frequency with which it is being mixed.

Narrow-band characteristics are obtained by the use of back-to-back and single transformers with overcoupling, in the 2 Mc/s I.F. amplifier chain V6 to V8.

Two stages of limiting are provided, followed by a conventional phase discriminator (V11). The A.F. output is fed to voltage amplifier V13 (which also acts as a muting valve as explained below), and thence to the power amplifier V14.

To prevent excessive noise appearing at the output in the absence of a signal, a muting circuit is included. With no signal input, noise voltages present across the H.T. dropping resistor of the second limiter are applied to the grid of V12, where they are amplified by the triode section and rectified by the diodes. The resultant D.C. is applied in negative polarity to the grid of the A.F. voltage amplifier V13, to hold it at cut-off. With a signal input to the receiver the noise disappears, the bias at V13 grid is removed and the valve functions normally. The sensitivity of the noise amplifier, and hence the degree of muting, is controlled by a potentiometer in its cathode circuit. This is the MUTING control on the dashboard control unit.

A relay $\frac{RLC}{2}$, is provided to changeover the aerial and the H.T. from receiver to transmitter when the press-to-talk button on the microphone is depressed.

3.2 Power Supply Unit type 2H30322 (Drg. 30322C2)

Dual interrupter type vibrator supplies using selenium rectifiers are incorporated in this unit, to provide H.T. for the transmitter/receiver, bias for the transmitter and microphone supply voltages.

The power unit may be operated from a 6V. or 12V. vehicle battery by wiring the H.T. input circuits according to the details shown in Drg. 30322C2.

The filament supply for the valves is taken from the battery via relays RL1 (for the receiver) and RL2 (for the transmitter), energised by switches on the control unit. These relays also switch the battery voltage to the appropriate vibrator power supply.

The receiver H.T. from rectifier W2 (+150V.) is connected via normally closed contacts on the press-to-talk relay RL3 to the H.T. input to the receiver. When the P.T.T. relay (RL3) is operated, RL3 contacts changeover, the +300V. supply from V3 and W2 in series is fed to the H.T. line which is changed over to the transmitter by contact RLC2 in the transmitter/receiver unit. Relay RL3 also makes available the microphone supply, tapped off from a voltage divider across the +150V. supply.

The bias supply from W1 is permanently connected to the transmitter.

Note: When the power unit is operated from a 12V. battery, energising voltage for each vibrator driving coil is taken from a tapping on the primary winding of the appropriate vibrator transformer.

Vibrator Complement

2 x type V6606 for either 6V. or 12V. operation.

3.3 Vehicular Control Unit type 23P51048 (Drg. 51048D15)

This unit provides full operating control of the installation. These controls and the functions they perform are listed below:-

(i) ON-OFF/MUTING Control

When turned from its extreme anti-clockwise position, switch S1 is closed. The receiver control relay operates and the REC. pilot lamp lights. As soon as the valves warm up, the receiver will function, as indicated by noise in the speaker. The MUTING should then be advanced until the noise just disappears.

(ii) ZONE Switch

This switch controls the frequency changing relays in the transmitter/receiver unit.

(iii) SPEAKER/HANDSET Control

This is a four-position switch, giving three different volume levels for the speaker, and a fourth position in which the speaker is cut off entirely when the handset is lifted and the receiver output heard only in the telephone earpiece.

(iv) Telephone Handset

This is a standard telephone handset with the addition of a "press-to-talk" button. The cradle switch contacts are used to energise the transmitter control relay when the handset is lifted, and to change over the receiver output from speaker to handset when the SPEAKER/HANDSET switch is set to HANDSET.

When the "press-to-talk" button is depressed the P.T.T. relays in the transmitter/receiver and power supply units are operated and the TRANS. pilot lamp on the control unit lights.

4. MAINTENANCE

4.1 General

Proper maintenance is one of the most important aspects of any radio-telephone service. In the following section, every assistance is given to facilitate testing. Stage gain figures, valve operating conditions, methods of alignment and a tabulated list of fault conditions and their probable causes are provided. These are extremely useful, but cannot at any time take the place of a thorough fundamental knowledge of the equipment and a logical step by step procedure to localise and trace equipment faults.

The availability of the correct test instruments is a necessity, is complete and adequate service is to be provided.

4.2 Handling Miniature Valves

Care should be exercised when handling or removing miniature valves. The pins are sealed directly in the glass base, there is no locating plug and the valve is aligned in its socket by means of the large spacing between the first and seventh pins.

DO NOT ATTEMPT to force a valve into its socket, as this may result in bent pins or breakage of the glass envelope.

Similarly, when removing the valve, pull it straight out and do not rock it from side to side. There is a combined tool available for straightening bent pins and easing tight sockets.

4.3 Relays

4.3.1 Miniature Relays

The press-to-talk and aerial changeover relays in the transmitter and receiver are miniature types, accurately adjusted during manufacture. They should not be interfered with under normal circumstances, but the contacts may be cleaned when necessary by drawing between them a strip of firm paper. When moving the contacts by hand in order to clean them, exert pressure on the armature only. Do not handle or strain the contact springs in any way.

If either of these relays does not function properly, first check the operating voltage. If this is correct, measure the resistance of the coil; this should be approximately 60 ohms.

The following adjustment procedure is for use only if there is definite evidence that the relay is out of adjustment, and a technician having the necessary experience in the adjustment of relays, and furnished with the necessary tools is available.

(i) Insert an 0.006" feeler gauge between the pole piece and armature. Adjust the lower fixed contacts on both sides until contacts just make when the armature is depressed.

(ii) Remove the feeler gauge and check that there is over-travel on the moving springs.

(iii) Remove the armature. Insert a test gauge and adjust the upper fixed contacts to obtain a spacing of 0.080".

(iv) Reassemble the relay and check that the moving contacts make on the upper fixed contacts simultaneously, as closely as can be judged by the eye. The 0.080" spacing can be varied slightly to achieve this.

(v) Adjust the tension on the spring until the relay just pulls in between 4.4 and 4.6V. Whilst performing this adjustment, see that the copper braid is quite free and is not restraining the armature movement.

(vi) Check the moving springs for overtravel against the upper contacts as evidenced by bending of the contact arms.

(vii) Check the contact pressure. This should be greater than 14 grams measured in line with the centre of the contact.

The relays in the power unit should be cleaned when necessary, as described above. Where contacts carrying heavy current become deeply pitted, the entire spring set should be replaced.

Under no circumstances should files or coarse abrasives be used.

4.3.2 <u>Relay type B52866</u>

A relay of this type is used in the RL1 and RL2 positions in the D.C. power supply. It consists of a 3,000 type relay yoke, coil and armature, fitted with special heavy-duty contacts. The adjustment figures for this relay are as follows:-

Residual air gap:	0.002" to 0.004"
Armature travel:	0.041" to 0.045"
Lever spring tension:	10 to 20 grams
Buffer spring tension:	110 to 130 grams (with relay operated)

4.4 Batteries

The batteries should be charged regularly according to the amount of service, since low battery voltage will cause a reduction in transmitter and receiver efficiency.

The specific gravity of the electrolyte should be 1280 when the battery is fully charged, and should never be allowed to fall below 1225.

The battery clamps and terminals should be cleaned periodically and all corrosion removed, before coating them with a film of vaseline.

4.5 Transmitter

The following sub-sections detail the complete testing procedure for the transmitter, together with a current and voltage analysis.

In checking the various metering points, always use a meter having the correct range, or damage to the meter, or incorrect reading could result. Complete servicing cannot be accomplished unless the range of instruments mentioned is available.

4.6 Complete Tuning Procedure for Transmitters

Apparatus Required

One D.C. meter having ranges of 0-1 mA., 0-10 mA., and 0-250 mA.

NOTE: NO CONTROL OTHER THAN THOSE ASSOCIATED WITH THE VARIOUS PIN-JACKS CF5 TO CF11 MUST BE ALTERED DURING TUNING. THIS APPLIES PARTICULARLY TO L4B. THIS COIL IS ADJUSTED DURING FACTORY TESTING AND SHOULD NOT BE DISTURBED UNLESS A FAULT EXISTS IN THIS PART OF THE CIRCUIT.

Tuning Procedure

Set the P.A. loading capacitors C161 and C162 to maximum. Remove the screen resistor (R142) from the P.A. valve V21.

Align the transmitter in the following sequence:-

STEP	METER RANGE	METERING POINT	ADJUST THE FOLLOWING	METER READING
1	0-1 mA.	1st TRIPLER GRID	Top & Bottom slugs of T13	Max.
2	0-1 mA.	2nd TRIPLER GRID	Top & Bottom slugs of T14	Max.
3	0-1 mA.	2nd DOUBLER GRID	Top & Bottom slugs of T15	Max.

Adjust top and bottom slugs alternately until T15 is correctly peaked.

STEP	METER RANGE	METERING POINT	ADJUST THE FOLLOWING	METER READING
4	0-50 mA.	2nd DOUBLER ANODE	C147 (T16A)	Min.
5	0-10 mA.	P.A. GRID	C148 (T16B)	Max.
6	0-10 mA.	With the meter still in the P.A. GRID jack, adjust C147 and C148 until the meter reads maximum.		
7	0-10 mA.	P.A. GRID	C152 (neutralising)	Adjust C152 for minimum current change while tuning C159 back and forth over resonance.
8		Replace the screen resistor on V21.		
9	0-250 mA.	P.A. ANODE	C159	Min.
10	0-10 mA.	P.A. GRID	Re-tune C148 and adjust the coupling between T16A and T16B until the meter reads between 3 & 4 mA. Re-adjust C147 and C148 and repeat coupling adjustment if necessary until the correct grid current is obtained.	
11	0-250 mA.	P.A. ANODE	C161 & C162	Reduce the capacitance gradually until the P.A. anode current increases to 75 mA. (It may be found that one of these capacitors must be fully out of mesh at the frequency used).
12	0-250 mA.	P.A. ANODE	C159	Adjust C159 for minimum anode current.
13		Repeat steps 11 and 12 alternately until the P.A. anode circuit is perfectly tuned at 75 mA. loading.		
14		Check to see the grid current is still in the range mentioned.		

4.7 Adjustment of Set Deviation Control

This control should not be touched unless there is definite evidence that the factory setting has been disturbed. An altered or incorrect setting will cause low receiver output, or excessive output coupled with distortion, depending on which way the control has been moved. The correct control of deviation in any narrow band F.M. system is quite important if proper operation of the system is to be maintained.

Replacement of the 6BA6 constant output amplifier valve or any component associated with it should always be followed by a check of control characteristics as outlined in sub-section 4.8 below, and the final setting of the SET DEV. control is given below.

Apparatus Required

(a) F.M. Monitor, A.W.A. type FA51931, or equivalent.

(b) Beat Frequency Oscillator, A.W.A. type R7077 or A56030

(c) 600 to 60-ohm matching pad. An L pad, consisting of a 560 ohms series resistor and a 68 ohms shunt resistor is satisfactory.

(d) Noise and Distortion Meter, A.W.A. type A51932.

Procedure

(i) With the transmitter operating normally, but with no modulation, couple a small portion of the R.F. output to the F.M. monitor. Set the F.M. monitor for flat response.

(ii) Connect the B.F.O. or A.F. oscillator to the microphone input terminals via the 600-60 ohm pad, and set the B.F.O. output to 2.75V. at 1,000 c/s at the 600-ohm side of the pad.

(iii) Connect the noise and distortion meter to the audio output terminals of the F.M. monitor.

(iv) Adjust the transmitter deviation control R108 for approximately 15 kc/s deviation.

(v) Tune the modulator inductance L4B for minimum distortion. Note that this tuning changes the modulation sensitivity; it is therefore necessary to adjust the deviation control simultaneously to keep the deviation constant at 15 kc/s.

(vi) Finally, set the deviation control for 8 kc/s deviation.

4.8 Checking the Constant Output Amplifier Characteristics

The constant output amplifier incorporated in the transmitter speech circuit is designed to give sufficient control of modulation depth to accommodate the variations in the levels of different speaking voices. When correctly adjusted, the amplifier characteristics are such that the input level, as measured at the input of the 600 - 60-ohm pad, may vary from the mean level of 2.75V. by ±2.25V., resulting in a deviation change of not more than ±20%.

To achieve this degree of control with a single valve, somewhat stringent control is required on the variable-mu characteristic of the valve used in the circuit, so that it may be necessary to make a selection before a valve is obtained which will give satisfactory performance. However, type 6BA6 valves which do not function satisfactorily in this circuit may be quite suitable for conventional A.G.C. operation in other equipment.

If a 6BA6 valve is replaced, the constant output characteristics of the new one should be checked before again placing the transmitter in service.

The same set-up as that used in sub-section 4.7 is employed; the procedure is as follows:-

(i) Set the deviation control (R108) to give 15 kc/s deviation with the mean level of 2.75V. at 1,000 c/s applied to the input of the 600 - 60-ohm pad.

(ii) Reduce the input level to the lowest value accommodated, i.e., 0.5V., wait for the constant amplifier to recover, and then the final reading of deviation should be within ±1.5 db. (or 15% of 15 kc/s). Increase the input level to the highest value accommodated, i.e., 5.0V., and the final reading of deviation should again be within ±1.5 db of 15 kc/s. If necessary, try a number of valves until this result is obtained.

(iii) When the constant output amplifier is operating satisfactorily, reset the modulation depth for 8 kc/s deviation.

4.9 Voltage and Current Analysis

NOTE: All voltages and currents quoted are typical only and are intended as a guide to correct operation. They may vary from unit to unit due to commercial tolerances in valves and components.

(a) Voltages

The voltages were measured with respect to earth, with a voltmeter of 1,000 ohms-per-volt, using the 500V. range for anode and screen measurements and the 10V. range for cathode measurements.

Valve	Anode	Pin	Screen	Pin	Cathode	Pin
V15	240	5	155	6	--	
V16	240	1+5	--		17.5	7
V17	240	5	135	6	7.5	7
V18	240	5	115	6	--	
V19	240	5	125	6	--	
V20	240	5	120	6	--	
V21	240	cap	190	3	--	
V22	195	1	--		7	3
V23	100	5	--		--	

(b) Currents

Metering Jack	Meter Range	Average Current
CF5 1st TRIPLER GRID	1.0 mA.	300 µA.
CF6 2nd TRIPLER GRID	1.0 mA.	0.65 mA.
CF7 2nd DOUBLER GRID	10 mA.	1.5 mA.
CF8 2nd DOUBLER ANODE	100 mA.	15 mA.
CF9 P.A. GRID	10 mA.	3.5 mA.
CF10 P.A. ANODE	100 mA.	75 mA.

4.10 Receiver

In many respects the receiver is more complicated than the transmitter, and requires careful and accurate alignment and adjustment, if the system is to be maintained at full working efficiency.

Again it must be stressed that the maintenance technician should have a thorough working knowledge of the function and operation of the various circuits, and must be equipped with the proper test instruments and meters.

4.11 Complete Tuning Procedure for Receivers

Apparatus Required

(a) Centre-zero microammeter, 25-0-25 µA., D.C.

(b) Milliammeter, 0-1 mA. D.C.

(c) Microammeter, 0-100 µA., of 2,000 ohms resistance (comprising 1,000 ohms D.C. resistance of meter and 1,000 ohms external resistance).

(d) Signal Generator, A.W.A. type 2R7231, or equivalent, covering a frequency range on either side of 2 Mc/s with some means of accurately setting the frequency to 2.00 Mc/s.

(e) V.H.F. Signal Generator such as A.W.A. type 5R7490 (45-100 Mc/s).

(f) A 5,000-ohm alignment probe, consisting of a 5,000-ohm resistor attached to a pair of probes having as little capacitance as possible.

(g) F.M. Sweep Generator, such as A.W.A. type 1FA51920(2.0 Mc/s). Note that due to overcoupling in the 2 Mc/s I.F. transformers, these must be subjected to a "damp alignment" procedure employing the 5,000 ohm alignment probe (as indicated in steps 1-12 of this section).

The receiver audio output, owing to the action of the limiter stages, is independent of the carrier strength and cannot therefore be used as an indication of correct tuning. Hence the various circuits are first tuned for maximum input to the first limiter as indicated by maximum grid current in this valve. This current can be read by plugging an 0-1 mA. or 0-100 μA. meter into the 1st LIMITER jack CF2.

The complete tuning procedure is as follows:-

NOTE: In steps 1 to 13 inclusive, adjust the signal generator output level to maintain approximately 60 µA. at CF2 as read on the 0–100 µA. meter.

STEP	METER USED	SIGNAL INPUT TO	SIGNAL FREQ.	ALIGNMENT PROBE ACROSS	METER POINT	ADJUST THE FOLLOWING	METER READING REQUIRED
NOTE:	Remove the receiver crystals for steps 1 to 16.						
1	100 µA.	V8 grid	2 Mc/s	T9/2–T9/3	CF2	Bottom slug T9	Max.
2	100 µA.	V8 grid	2 Mc/s	T9/1–T9/4	CF2	Top slug T9	Max.
3	Remove probe from T9/1–T9/4, swing the signal generator ±20 kc/s, and check for equality of output at CF2. If the outputs vary by more than 5%, a slight re-adjustment of the bottom slug of T9 (less than 1/8 turn is usually sufficient) will equalise the outputs.						
4	100 µA.	V7 grid	2 Mc/s	T8/2–T8/3	CF2	Bottom slug T8	Max.
5	100 µA.	V7 grid	2 Mc/s	T8/1–T8/4	CF2	Top slug T8	Max.
	DO NOT alter the alignment of T9. Small adjustments to bottom slug of T8 may be necessary if balance at ±20 kc/s is not within 5%.						
6	100 µA.	V6 grid	2 Mc/s	T7/2–T7/3	CF2	Bottom slug T7	Max.
7	100 µA.	V6 grid	2 Mc/s	T7/1–T7/4	CF2	Top slug T7	Max.
	DO NOT alter alignment of T8. Make slight re-adjustments to bottom slug of T7 if necessary for balance at ±20 kc/s.						
8	100 µA.	T5/2	2 Mc/s	T6/1–T6/4	CF2	Top slug T6	Max.
9	100 µA.	T5/2	2 Mc/s	T6/2–T6/3	CF2	Bottom slug T6	Max.
	Remove probe from T6/2–T6/3 and check that balance at ±20 kc/s is within 5%. DO NOT alter alignment of T7.						

STEP	METER USED	SIGNAL INPUT TO	SIGNAL FREQ.	ALIGNMENT PROBE ACROSS	METER POINT	ADJUST THE FOLLOWING	METER READING REQUIRED
10	100 µA.	V5 grid	2 Mc/s	T5/2–T5/3	CF2	Bottom slug T5	Max.
11	100 µA.	V5 grid	2 Mc/s	T5/1–T5/4	CF2	Top slug T5	Max.
12	Remove probe.						
13	Check overall alignment at ±20 kc/s about Mc/s. Stage sensitivities should be approximately as shown in sub-section 4.13 below. Note: The presence of a pronounced dip in he centre of the pass-band may be ignored if overall balance is sufficient. The maximum ariation throughout the pass-band should be not more than 2 db. relative to the response t 2 Mc/s, corresponding to a variation of 20% in input for constant output.						
14	0–1 mA.	V5 grid	2 Mc/s		CF3	Top slug L3	Max. meter reading (approx. 150 µA.)
15	25–0–25 (at least 10 mV., to ensure that limiters are saturated).	V5 grid	2 Mc/s		CF4	Top slug T10	Resonance as indicated by balance or zero meter reading.
16	25–0–25	V5 grid (10 mV.)	2 Mc/s		CF4	Bottom slug T10	Peak T10 primary with signal generator 10 kc/s off-tune, as indicated by max. meter reading.
	(Meter current at ±15 kc/s should not be less than 15 µA.)						Adjust primary so that outputs at ±15 kc/s are equal.

STEP	METER USED	SIGNAL INPUT TO	SIGNAL FREQ.	ALIGNMENT PROBE ACROSS	METER POINT	ADJUST THE FOLLOWING	METER READING REQUIRED
17	0-1 mA.	Plug in either one of the receiver crystals			CF1	Top slug T4 for oscillation.	Max. output
18	0-1 mA.				CF1	Bottom slug T4	Screw slug in until current in CF1 just commences to dip.
19	0-1 mA.				CF1	Top slug L2	For max. output approx. 400 - 600 μA.
20	100 μA.	V2 grid	Xtal 2 Mc/		CF2	Top and bottom slugs T3	Maximum meter reading. Input adjusted to give 60 μA. Re-adjust bottom slug T4 for maximum reading.
21	Note: A certain amount of pulling may exist between the secondaries of T4 and T3 making it necessary to adjust these circuits several times.						
22	100 μA.	CF12 (1 μV. approx.)	Carrier frequency		CF2	C1, C4, C6, C9 and C11	Meter reading approx.60-100 μA.

Notes: Pulling occurs between C4 and C11, making it necessary to peak these circuits several times. Quieting at 1 μV. input is not less than 25 db, i.e., the noise level across a 3-ohm load resistor for 1 μV. input should be not less than 25 db below the output noise level obtained with no signal.

23 Adjusting MUTING Control

With the signal generator connected, but with the carrier turned off, turn the MUTING control on the control unit clockwise to the MUTING ON position until the noise output from the receiver cuts out completely.

STEP 23 CONT'D

Apply a modulated signal of 1 µV. at carrier frequency and check that the receiver unmutes. Check that the receiver mutes when the signal is removed.

4.12 Voltage and Current Analysis

NOTE: All voltages and currents quoted are typical only and are intended as a guide to correct operation. Actual figures may vary from those given due to tolerances in valves and components.

(a) Voltages

All voltages measured with respect to earth with a 1,000 ohms-per-volt meter, using the 500V. range for anode and screen measurements and the 10V. range for cathode measurements.

		Valve	Anode	Screen	Cathode
1uV	120 uA.	V1	75	75	—
13 mc/s XTAL	FSD (340 uA)	V2	45	45	—
		V3 A) B)	70) 70)	Measured at earthy end of anode circuit	
		V4	100	100	—
2uV	44uA	V5	45	45	1.8
20uV	60uA	V6	87	87	1.6
200 uV	20 uA	V7	135	135	2.7
FLD DET.	50 uA.	V8	135	135	2.7
		V9	30	30	—
		Measured with V8 removed from its socket.			
		[illegible]	45	45	—
		Measured with V8 removed from its socket.			
		V12	90	—	—
		Measured with V12 cathode earthed.			
		V13	90	—	1
		V14	145	145	5

(b) Currents

Metering Jack	Meter Range	Average Current
CF1 TRIPLER	1.0 mA.	800 µA.
CF2 1st LIMITER	1.0 mA.	200 µA. (for 1 µV. R.F. input)
CF3 2nd LIMITER	1.0 mA.	150 µA.
CF4 DISCRIMINATOR	1.0 mA.	zero

4.13 Sensitivity Figures for Receiver

(a) Overall Sensitivity of Complete Receiver

1 watt output (measured across a 3-ohm load resistor) for 1 µV. input signal, modulation frequency 1,000 c/s, deviation of carrier frequency 15 kc/s.

(b) Discriminator Sensitivity

At least ±15 µA. at CF4 for ±15 kc/s deviation of 2 Mc/s test signal.

(c) Stage Sensitivities

Signal Frequency	Applied to	Input for 60 µA. at CF2
2 Mc/s	V8 grid	0.8V.
2 Mc/s	V7 grid	26 mV.
2 Mc/s	V6 grid	900 µV.
2 Mc/s	V5 grid	150 µV.
High I.F., i.e., crystal frequency + 2 Mc/s	V2 grid	10 - 20 µV.

The above sensitivity figures were measured with the A.W.A. Signal Generator series R7231. This unit has a low-resistance output attenuator, and consequently gives quite reliable figures. If signal generators with higher impedance outputs are used, considerable variation in the above sensitivity figures could result. In such cases, a new set of figures could be obtained with the other signal generator, on a receiver known to be quite normal, and these figures used as a reference list in place of those given above.

5. FAULT FINDING

5.1 General

It is to be expected that by far the largest number of faults occurring during any given period of service operation will occur during the initial period immediately after installation. Partly dry solder joints or mechanically defective components are most likely to become apparent during this period, particularly when the equipment is installed in a vehicle and subjected to a vigorous "shake down".

The outstanding defect to be expected during this period is complete loss of function due to broken wires or components. A careful inspection of the installation may be sufficient to reveal these mechanical faults; likewise a valve which does not light owing to a fractured filament would be readily apparent.

As regards the receiver, it is emphasised that if the necessary test instruments are available, it is highly preferable to carry out systematic sequence of stage sensitivity tests at an early stage of the checking, in order to locate most readily that part of the receiver which is defective. This could normally be done after a mechanical inspection and a brief reference to the fault finding chart.

When a defective stage has been located, replacement of the valve, or a check as to the correct insertion of the valve in its socket, might clear the trouble. This part of the circuit might also be checked in detail for accordance of components and wiring with the circuit diagram.

Replacement of all valves in turn with the object of locating a defective stage is NOT a practice to be recommended.

Alteration of the settings of the tuning studs of the coils and transformers is to be avoided as far as possible. The high I.F., low I.F. and discriminator transformers have been accurately aligned and sealed at the factory. These components are very stable and should not require re-adjustment unless it is necessary to replace a damaged transformer or some frequency-determining component. After replacement, alignment of the stage concerned will usually be sufficient. Measurements of stage sensitivities and currents, and comparison of these figures with typical values should precede any check on the tuning of components.

5.2 Tuning Studs

It is possible that the sealing of a transformer tuning stud may become damaged during installation and allow accidental mistuning of that stage. In such a case only a slight adjustment should be necessary. All stud settings should finally appear to be approximately the same and near the middle of the range of travel.

The range of travel of some tuning studs is such that the same inductance value may be obtained for both a normal setting and an extreme inwards setting, the two possible positions of the tuning slug being approximately equi-distant from the centre of the coil. In view of this possibility, it is good practice, when tuning double-tuned transformers which are far out of adjustment, to commence by withdrawing both slugs to the extreme outwards position, and to return by screwing in both studs alternately about 1½ turns at a time so that the final settings will be near the middle of the range of travel in each case.

5.3 Tuning of Modulator Coil

That portion of the low inherent distortion of the transmitter/receiver system which is due to the modulator circuit alone, is normally less than 3%. Tuning of inductor L4B, by means of the top tuning stud, for minimum distortion, is not a critical adjustment, and so it is most unlikely that an abnormally high percentage of distortion, if in the modulator circuit, would be due to slight mistuning of L4B. It would more likely be due to a faulty or disconnected component in this part of the circuit. However, alteration of the factory setting of the tuning stud of L4B should be avoided as far as possible.

5.4 Receiver Fault Finding Procedure

When a receiver fails completely, or performance falls off, a systematic check will increase the change of locating the trouble quickly. The following procedure is suggested. WHEN THE LISTED INDICATION IS NOT PRESENT, OR WHEN SUGGESTED MEASURES DO NOT CORRECT THE TROUBLE, PROCEED TO THE NEXT STEP.

In this table, a number of possible faults have been grouped loosely into three categories, viz. Distortion, Noise and Low Sensitivity.

1. Distortion

Fault Indication	Possible Cause	Remedy
Distorted reception (not evident in other receivers)	Chassis volume control too high.	Adjust volume control.
	Receiver off tune.	Plug 25-0-25 µA. meter into DISCRIM. socket, and if necessary, adjust top and bottom studs of T10 for zero and balance according to sub-section 4.11, steps 15 and 16.
		Check settings of fre-

		quency adjusting controls C34 and C36 according to sub-section 2.5.
	Defect in audio amplifier or output stage	Check cathode bias of V13 and V14.

2. <u>Noise</u>

<u>Fault Indication</u>	<u>Possible Cause</u>	<u>Remedy</u>
Reception noisy but transmission normal.	Discriminator off tune.	Plug 25-0-25 μA. meter into DISCRIM. socket and if necessary, adjust top and bottom studs of T10 as above.
	Loss of receiver sensitivity	Measure quieting as in 4.11, step 22. Quieting appreciably less than 25 db indicates loss of sensitivity in R.F., high I.F. or low I.F. stages. Conduct a stage-by-stage sensitivity check through these stages and compare with 4.13. Remove X1 or X2 from socket during check on low I.F. sensitivity.
		Replace defective valve or other component, and then retune any associated transformer.
		Check tuning of defective stage.
	Defective or overloaded component in audio amplifier or output stage	Check components in circuit around V13 and V14.
		Replace V13 or V14.
Noisy reception and noisy transmission.	Defect in power supply filtering.	Check power supply components.
Noisy reception and transmission together with low receiver sensitivity and low transmitter output.	Defect in aerial system.	Check aerial and feeder cable for shorts, or open or intermittent connections.
	Low supply voltages	Check battery voltage.
		Check power supply.

Fault Indication	Possible Cause	Remedy
Audio noise not muted when control turned clockwise.	Failure in circuits of V12 or V13.	Check voltages on valves V12 and V13 and check the associated circuits. Replace V12 or V13.

3. **Low Sensitivity**

Fault Indication	Possible Cause	Remedy
Meters do not read in any of sockets CF1 to CF4.	Power supply failure.	Check that receiver L.T. and H.T. are present. If not, check fuses. If fuse blown, CHECK FOR SHORTS and replace fuse. Feel vibrator to check that it is operating. If not, replace. Check for broken connections between power supply and receiver.
All meter readings low.	Low battery volts.	Check battery and H.T. voltages.
	Defective power supply.	Check power supply components.
Meter does not read, or reads very low in CF1.	Failure of [illegible], X2, V4, V3B or associated circuits.	Replace V4. Rotate top stud of T4 for maximum current at CF1. Replace V3. Rotate stud of L2 for maximum current at CF1. If the stud setting of T4 or L2 is extreme, check for broken leads to C37 or C17. Check for dirty or shorting plates of C34 or C36. If either capacitor is replaced or the setting altered,

Fault Indication	Possible Cause	Remedy
		retune according to sub-section 2.5.
		Replace X1 or X2. If this corrects the trouble, retune T4 (top stud) and reset trimmer C34 or C36.
Meter does not read, or reads very low in CF2.	Failure in R.F., high I.F. or low I.F. stages.	Note whether heaters of V1, V2, V5, V6, V7 and V8 are alight. If not, replace defective valve.
		Check voltage on these valves. Look for a discrepancy such as could be caused by open or shorted connection or component. If a replacement is made, retune the associated transformer.
		Conduct sensitivity tests as above. Replace valve of defective stage. Retune transformers associated with replaced valve. If transformer is erratic, investigate and if necessary, replace transformer.
	[illegible]ent high or low frequency injection voltage.	Rotate bottom stud of T4 for maximum current at CF2.
		Adjust C4, C6 for maximum current at CF2.
		Thoroughly check all components associated with T1 and T4.
		Replace V3, retune L2 and top stud of T4 for maximum current at CF1 and retune C6, C4 for maximum current at CF2.
		If rotor of C4 is noticeably more in mesh than C6, inspect for a broken lead to C3.

Fault Indication	Possible Cause	Remedy
Meter reads very low or does not read in CF3 (but normal at CF2)	Failure of 1st or 2nd limiter stage	Check voltages and circuitry of these stages. Replace V9 or V10. Retune T9 and L3.
25-0-25 μA. meter in CF4 reads less than ±15 μA. when signal generator frequency shifted ±15 kc/s from 2 Mc/s	Failure of 2nd limiter, discriminator or detector sections	Note whether heaters of V10, V11 are alight. If not, replace the defective valve. Retune T10 (top and botton studs) according to 4.11, steps 15, 16. Replace V10 and retune L3. Replace V11 and retune T10. Check wiring and components associated with V10, V11. After correcting fault, retune T10.
25-0-25 μA. meter reads other than zero when 2 Mc/s test signal applied at 2nd mixer grid	Discriminator off tune	Check discriminator tuning according to 4.11, steps 15, 16.
No audio noise when muting control turned to anti-clockwise position. (apparent sensitivity at CF2 normal).	Failure in discriminator or audio sections	Make sure that volume controls on chassis and control unit are properly adjusted. 25-0-25 μA. meter in CF4 should swing at least +15 μA. as top turning stud of T10 is rotated when the 2.0 Mc/s signal is applied. If not, make checks as above. Check for opened connection in circuitry between V11, V13. Check that heaters of V13, V14 are alight. If not, replace valve. Check voltages on these valves. Replace V13, or V14.

5.5 Transmitter Fault Finding Procedure

Most troubles can be found by a systematic process of elimination. The faulty stage can usually be found by checking currents at the metering sockets against the typical values given in subsection 4.9.

The table below gives suggestions for locating trouble in the three main sections of the transmitter, power output, drive and modulator.

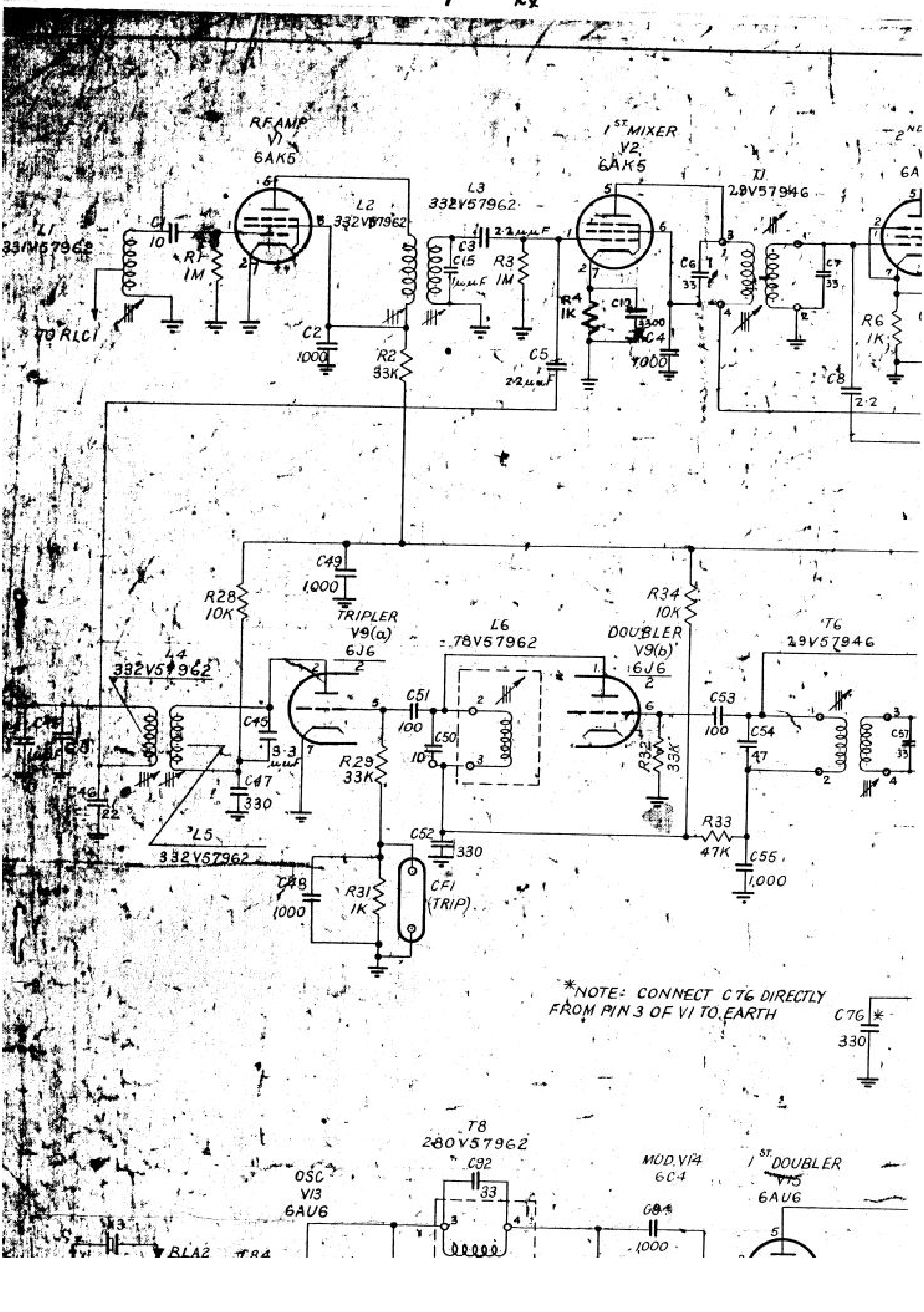
1. Power Output

Fault Indication	Possible Cause	Remedy
No power output with P.T.T. button operated	Power supply failure	Check transmitter H.T. If not present, check power supply, vibrators, fuses, etc.
	Relay failure	If H.T. present at power supply, check changeover relays and cables.
Low power output	Low battery supply	Check battery voltage.
	Vibrator failure	Check H.T. voltage. If H.T. low, check vibrators.
	Valve failure	Check all metering points. If not normal, check tuning. If re-tuning is ineffective check components associated with the first stage where the drive is abnormal. If the drive to the P.A. is normal and it is still not possible to fully load the output, check the electrode voltages of the P.A. valve (V21). If normal, change V21.

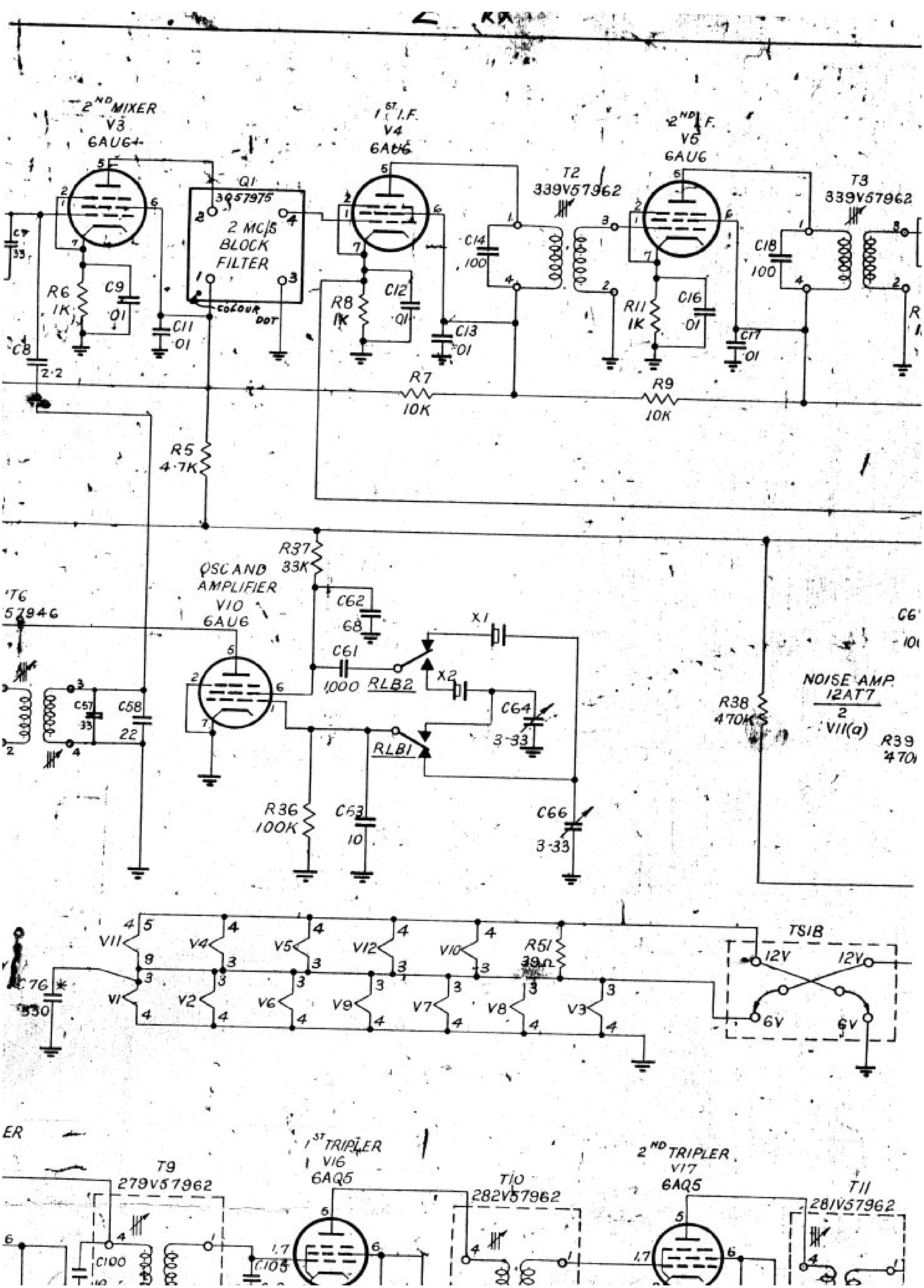
2. Drive

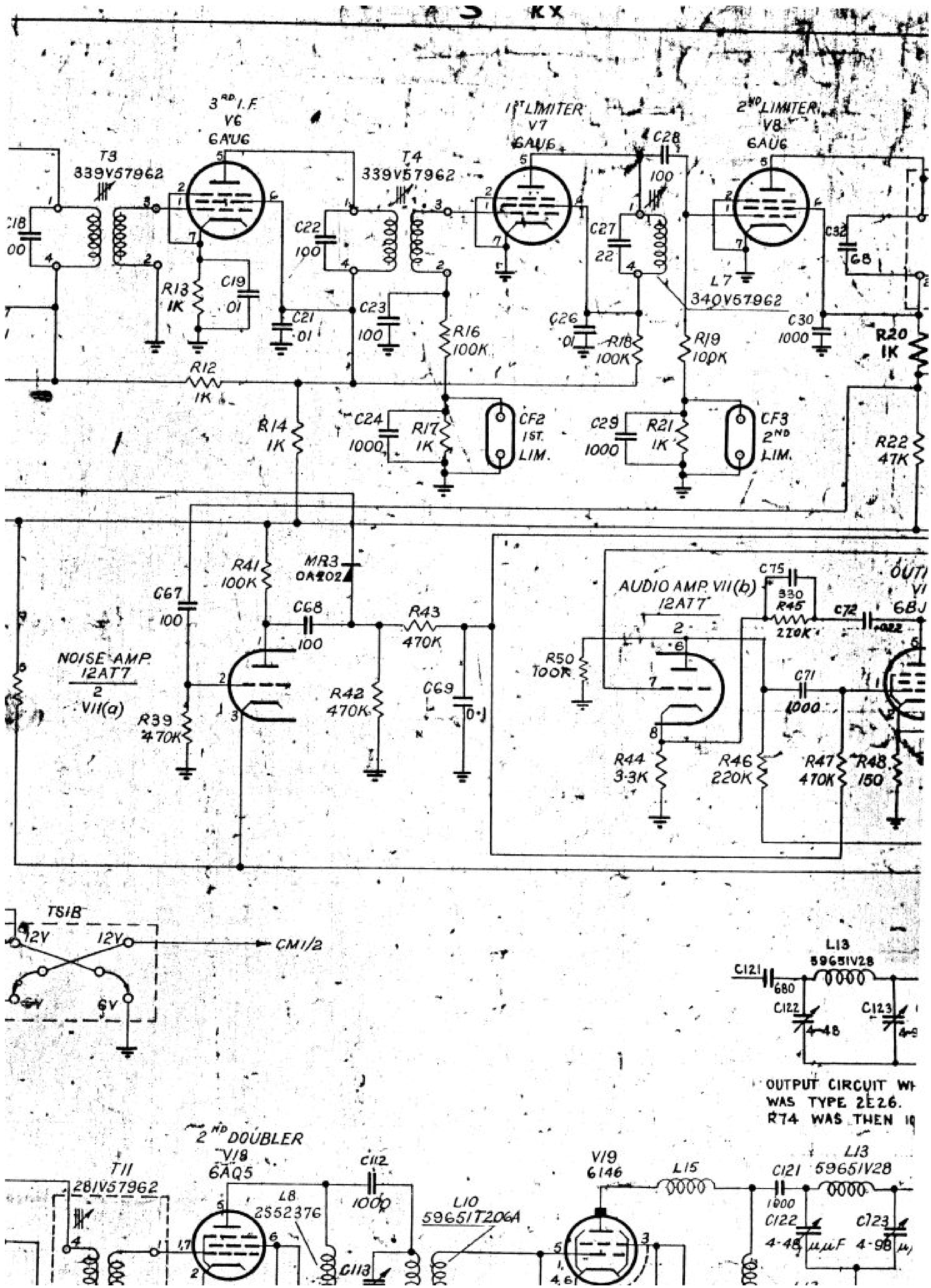
Fault Indication	Possible Cause	Remedy
No meter readings in any metering socket, H.T. being correct	Failure of crystal oscillator valve or circuit component. Failure of crystal Crystal frequency trimmer short-circuited.	Check that crystal oscillator is functioning by observing that screen voltage of crystal oscillator changes when crystal is removed. If not, check crystal trimmer and components around crystal oscillator circuit. If everything appears normal, check the crystal changeover relay and finally the crystal itself or oscillator valve.
Obvious over-modulation	SET.DEV. control setting disturbed	Check sealing of SET. DEV. control. If normal, check deviation as in sub-section 4.7.
	Constant output amplifier ineffective due to valve or component failure.	If deviation excessive, check amplifier characteristics as in 4.8. If abnormal check electrode voltages and replace valves if necessary.
Excessive distortion	Defective component in modulation circuit.	Check deviation as in 4.7. Check distortion with tone input as in 4.7.
	Defective microphone insert.	Replace if necessary.
No modulation.	Defective component in modulator circuit.	Check deviation as in 4.7. Check voltages and components around V22 and V23.
	No microphone supply voltage.	Check microphone supply voltage at H.T. changeover relay in power supply. With P.T.T. button operated, this voltage should vary between 1 and 5 volts as the microphone is shaken around. Check microphone output at the microphone transformer (T12) in the transmitter.

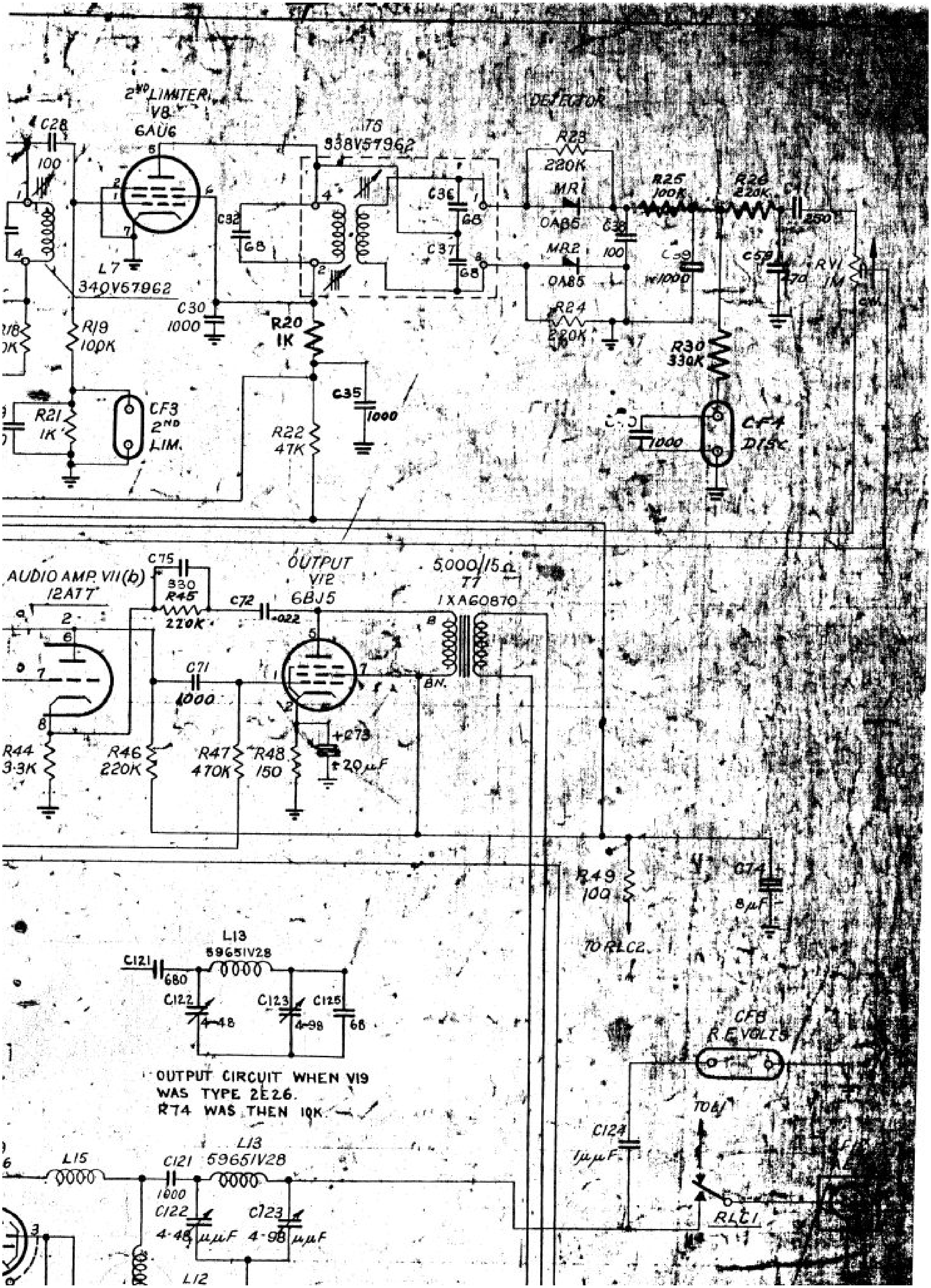
I Rx

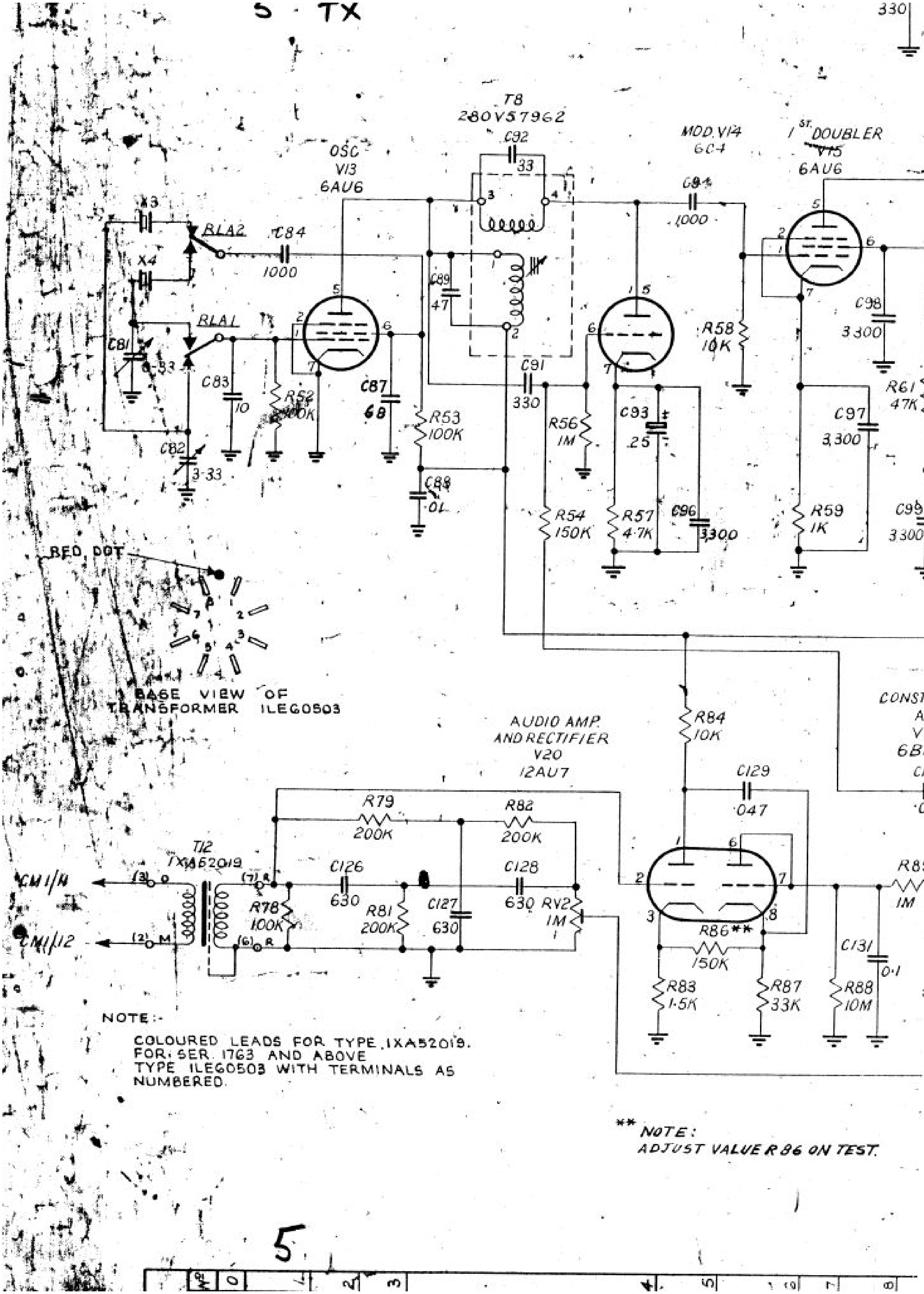


RF AMP
V1
6AK5
L1
331V57962
C1
10
R1
1M
TO RLC1
L2
332V57962
C2
1000
R2
33K
L3
332V57962
C3
2·2 μμF
C15
1 μμF
R3
1M
1ST MIXER
V2
6AK5
R4
1K
C10
3300
C4
1000
C5
2·2 μμF
T1
29V57946
C6
33
C7
33
R6
1K
C8
2·2
C49
1000
R28
10K
TRIPLER
V9(a)
6J6
L4
332V57962
C45
3·3 μμF
C47
330
C46
22
L5
332V57962
R29
33K
C51
100
C50
10
L6
78V57962
DOUBLER
V9(b)
6J6
R32
33K
R34
10K
C52
330
C48
1000
R31
1K
CF1
(TRIP)
C53
100
C54
47
T6
29V57946
C57
33
R33
47K
C55
1000
*NOTE: CONNECT C76 DIRECTLY FROM PIN 3 OF V1 TO EARTH
C76 *
330
T8
280V57962
C92
33
OSC
V13
6AU6
MOD. V14
6C4
C84
1000
1ST DOUBLER
V15
6AU6
BLA2


2ND MIXER
V3
6AU6
Q1
3057975
2 MC/S
BLOCK
FILTER
COLOUR DOT
1ST I.F.
V4
6AU6
T2
339V57962
2ND I.F.
V5
6AU6
T3
339V57962
C7
33
R6
1K
C9
·01
C11
·01
C8
2·2
R8
1K
C12
·01
C13
·01
C14
100
R11
1K
C16
·01
C17
·01
C18
100
R7
10K
R9
10K
R5
4·7K
R37
33K
OSC AND
AMPLIFIER
V10
6AU6
T6
57946
C62
68
C61
1,000
X1
X2
RLB2
RLB1
C64
3-33
C66
3-33
C57
33
C58
22
R36
100K
C63
10
R38
470K
NOISE AMP.
12AT7
2
V11(a)
R39
470
C6
10
V11
V4
V5
V12
V10
R51
39Ω
TS1B
12V
12V
6V
6V
C76
330
V1
V2
V6
V9
V7
V8
V3
ER
1ST TRIPLER
V16
6AQ5
2ND TRIPLER
V17
6AQ5
T9
279V57962
T10
282V57962
T11
281V57962
C100
C105


RX
3RD I.F.
V6
6AU6
T3
339V57962
C18
100
R13
1K
C19
.01
C21
.01
R12
1K
C22
100
T4
339V57962
C23
100
R16
100K
R14
1K
C24
1000
R17
1K
CF2
1ST.
LIM.
1ST LIMITER
V7
6AU6
C28
100
C27
22
C26
.01
R18
100K
R19
100K
L7
340V57962
C29
1000
R21
1K
CF3
2ND
LIM.
2ND LIMITER
V8
6AU6
C32
68
C30
1000
R20
1K
R22
47K
MR3
OA202
R41
100K
C67
100
C68
100
R43
470K
NOISE AMP.
12AT7
2
V11(a)
R39
470K
R42
470K
C69
0.1
AUDIO AMP. V11(b)
12AT7
C75
330
R45
220K
C72
.022
6BJ
R50
100R
C71
1000
R44
3.3K
R46
220K
R47
470K
R48
150
TS1B
12V
12V
6V
6V
CM1/2
C121
680
L13
59651V28
C122
4-48
C123
OUTPUT CIRCUIT WH
WAS TYPE 2E26.
R74 WAS THEN 10
2ND DOUBLER
V18
6AQ5
T11
281V57962
C112
1000
L8
2S52376
C113
L10
59651T206A
V19
6146
L15
C121
1000
L13
59651V28
C122
4-48 μμF
C123
4-98


2ND LIMITER
V8
6AU6
C28
100
L7
340V67962
R19
10K
C30
1000
R21
1K
CF3
2ND
LIM.
T6
338V57962
C32
68
C36
68
C37
68
R20
1K
C35
1000
R22
47K
DETECTOR
R23
220K
MR1
OA85
MR2
OA85
R24
220K
R25
100K
R26
220K
C38
100
C39
1000
C58
470
250
RV1
1M
R30
330K
1000
CF4
DISC
AUDIO AMP. V11 (b)
12AT7
R44
3.3K
C75
330
R45
220K
C72
.022
C71
1000
R46
220K
R47
470K
R48
150
OUTPUT
V12
6BJ5
+273
20μF
5000/15Ω
T7
1XA60870
BN.
R49
100
C74
8μF
TO RLC2
L13
59651V28
C121
680
C122
4-48
C123
4-98
C125
68
OUTPUT CIRCUIT WHEN V19
WAS TYPE 2E26.
R74 WAS THEN 10K.
L15
C121
1000
L13
59651V28
C122
4-48 μμF
C123
4-98 μμF
L12
CF8
R.F. VOLTS
C124
1μμF
RLC1

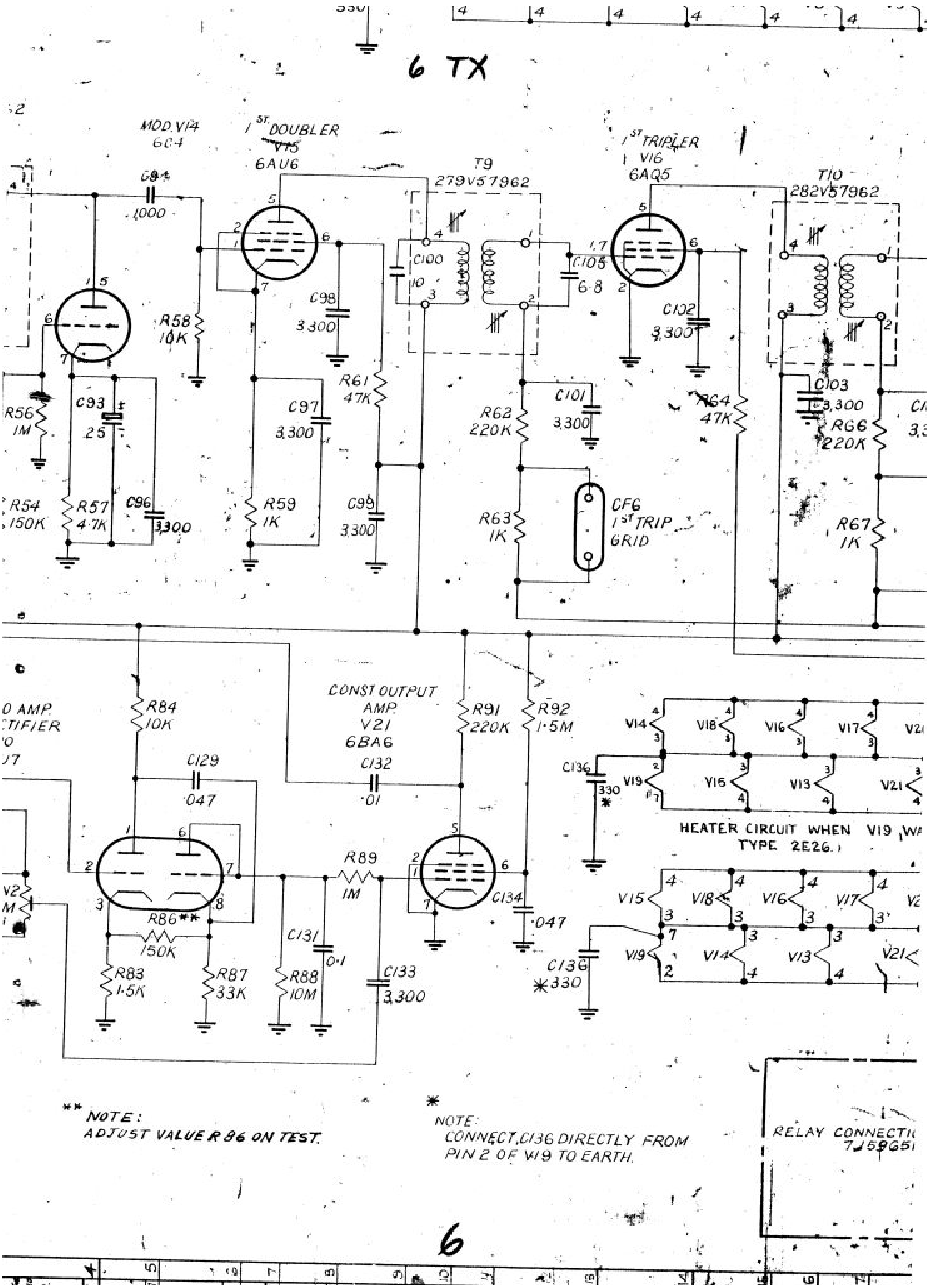


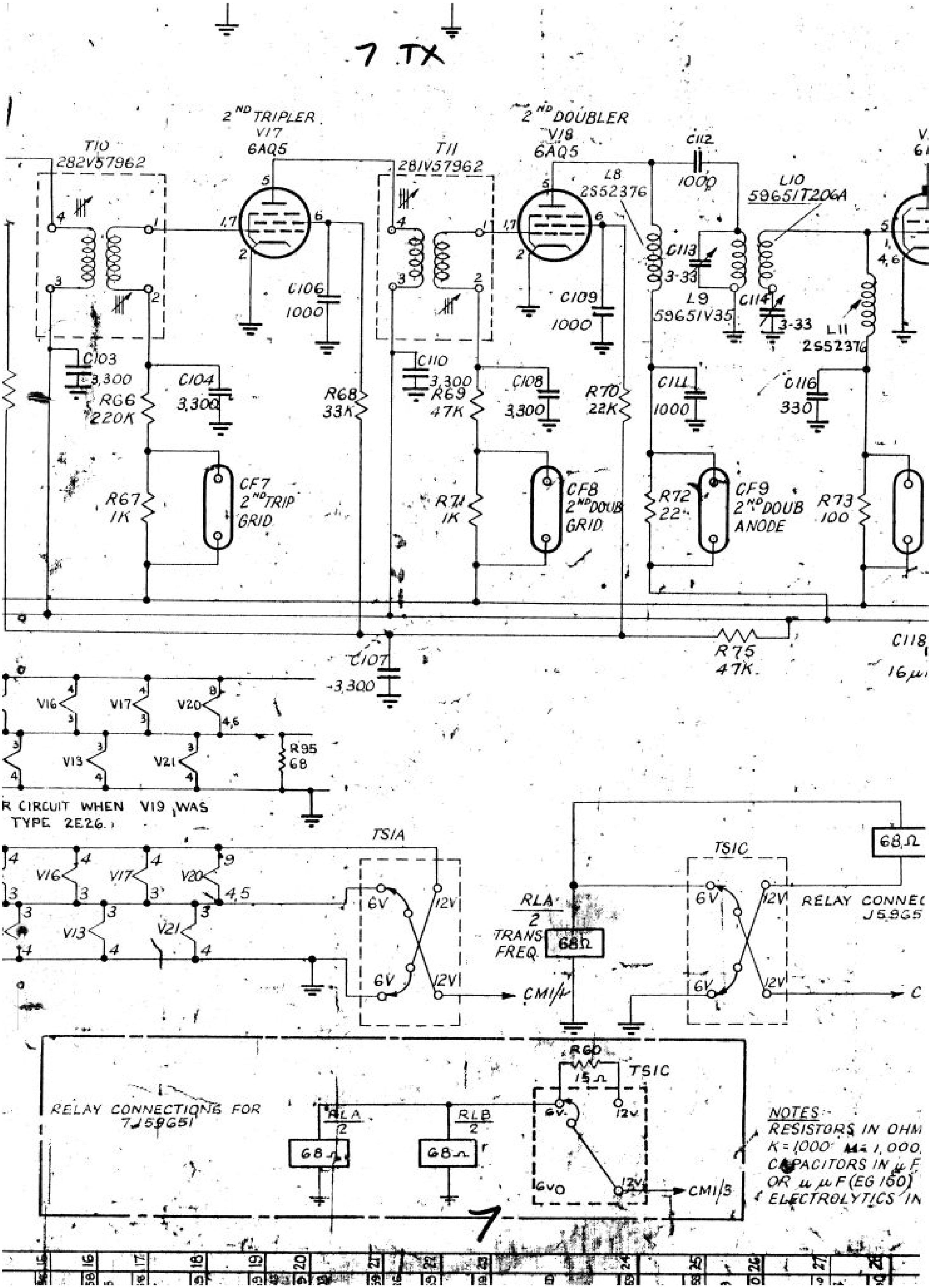
NOTE:-

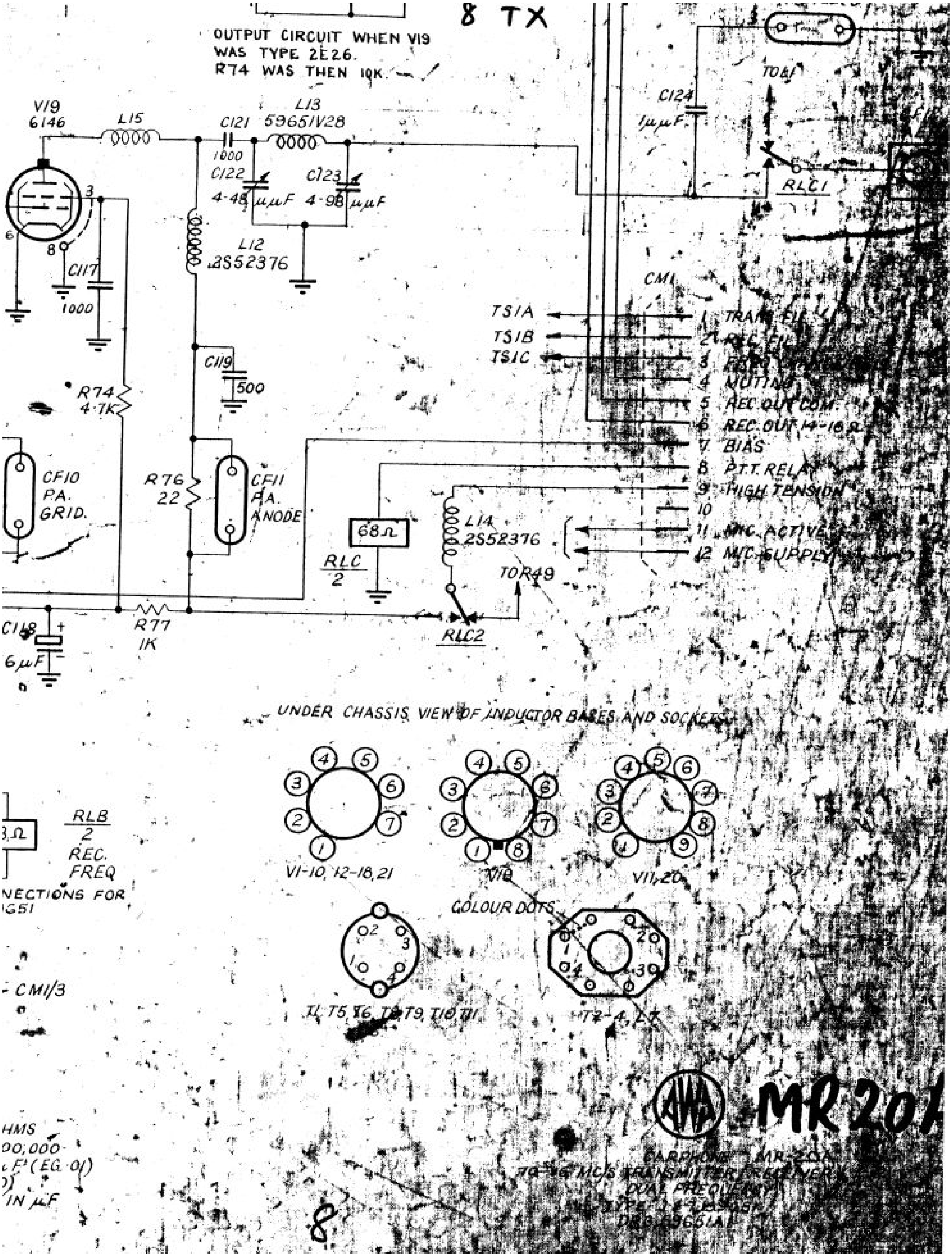
COLOURED LEADS FOR TYPE IXA52019.
FOR SER. 1763 AND ABOVE
TYPE ILEG0503 WITH TERMINALS AS NUMBERED.

** NOTE:
ADJUST VALUE R86 ON TEST.

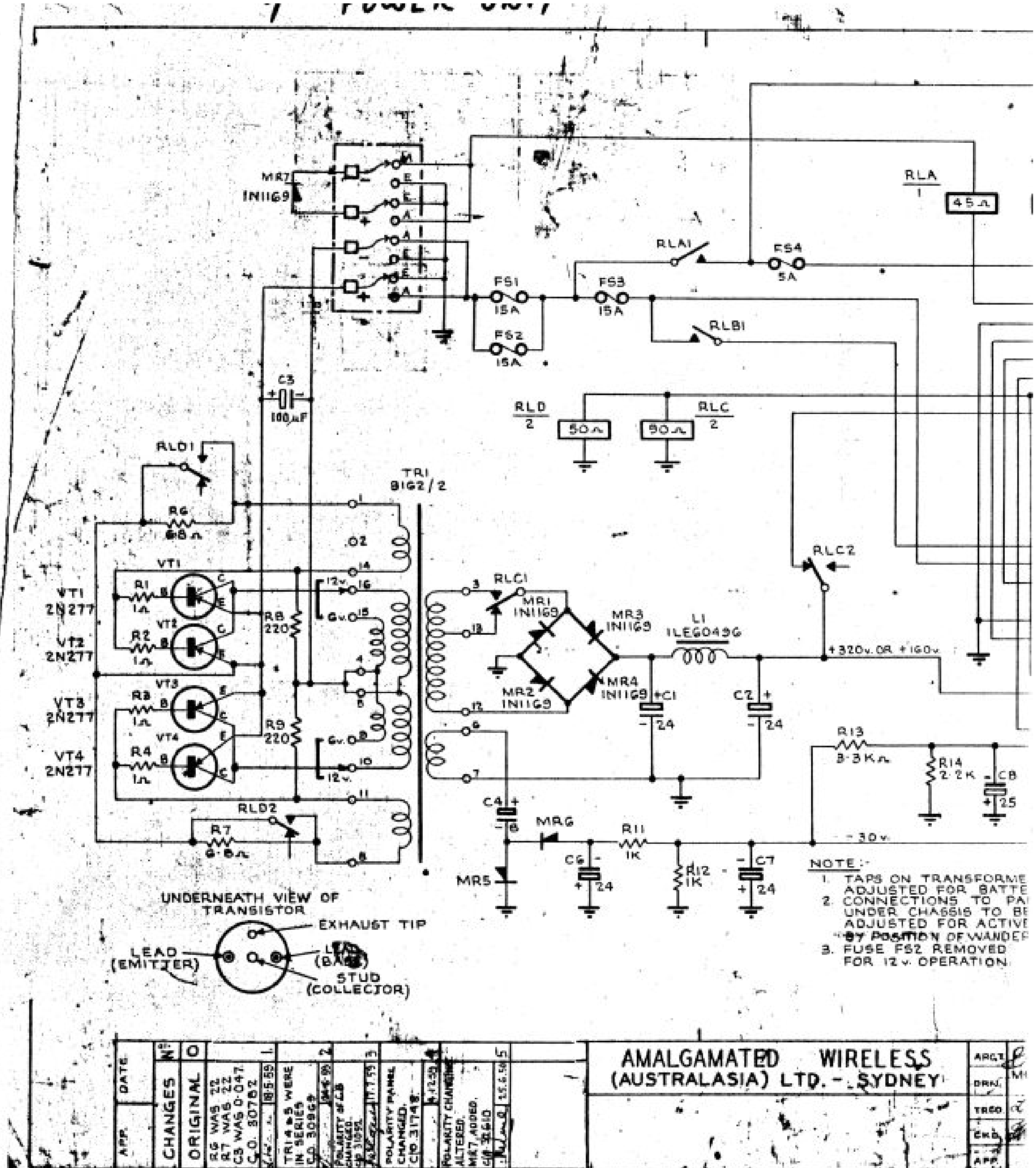
5


6 TX
MOD. V14
6C4
1ST DOUBLER
V15
6AU6
T9
279V57962
1ST TRIPLER
V16
6AQ5
T10
282V57962
C94
1000
C100
C105
6·8
R58
10K
C98
3,300
C102
3,300
C103
3,300
R56
1M
C93
25
C97
3,300
R61
47K
R62
220K
C101
3,300
R64
47K
R66
220K
R54
150K
R57
4·7K
C96
3300
R59
1K
C99
3,300
R63
1K
CF6
1ST TRIP
GRID
R67
1K
CONST OUTPUT
AMP.
V21
6BA6
R84
10K
C129
·047
C132
·01
R91
220K
R92
1·5M
C136
330
V14
V18
V16
V17
V19
V15
V13
V21
HEATER CIRCUIT WHEN V19 WA
TYPE 2E26.
R89
1M
R86 **
150K
C134
·047
C131
0·1
R83
1·5K
R87
33K
R88
10M
C133
3,300
V15
V18
V16
V17
V19
V14
V13
V21
C136
330
** NOTE:
ADJUST VALUE R86 ON TEST.
NOTE:
CONNECT C136 DIRECTLY FROM
PIN 2 OF V19 TO EARTH.
RELAY CONNECTI
6

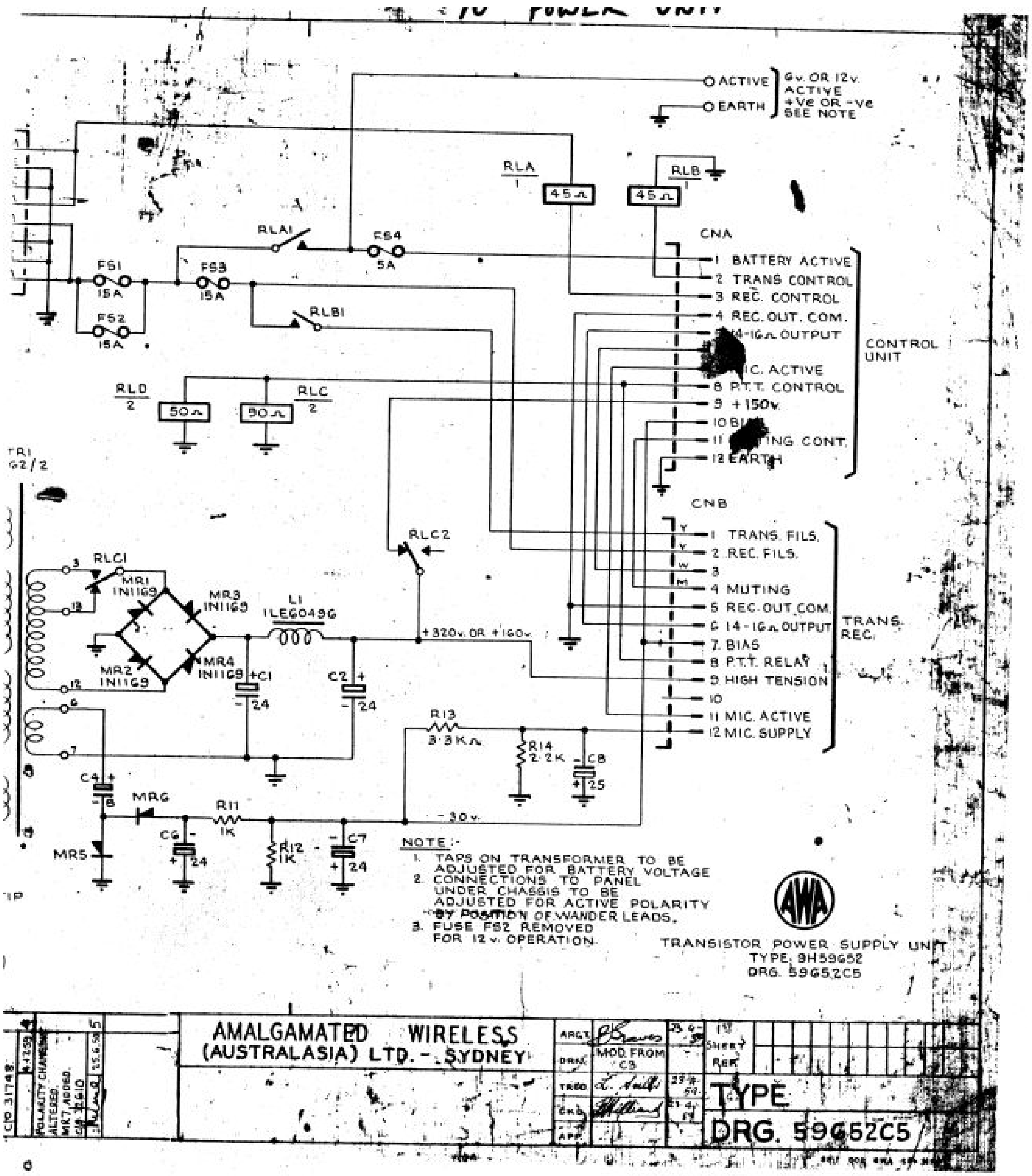

7 TX
2ND TRIPLER
V17
6AQ5
T10
282V57962
T11
281V57962
2ND DOUBLER
V18
6AQ5
L8
2552376
C112
1000
L10
59651T206A
C113
3-33
L9
59651V35
C114
3-33
L11
2552376
C103
3,300
C104
3,300
RG6
220K
C106
1000
R68
33K
C110
3,300
R69
47K
C108
3,300
C109
1000
R70
22K
C111
1000
C116
330
R67
1K
CF7
2ND TRIP
GRID
R71
1K
CF8
2ND DOUB
GRID
R72
22
CF9
2ND DOUB
ANODE
R73
100
R75
47K.
C107
3,300
C118
16μ
V16
V17
V20
V13
V21
R95
68
R CIRCUIT WHEN V19 WAS
TYPE 2E26.
TSIA
6V
12V
RLA
2
TRANS
FREQ.
68Ω
CM1/4
TSIC
RELAY CONNEC
J59G5
RELAY CONNECTIONS FOR
7J59G51
RLA
2
RLB
2
68Ω
R60
15Ω
CM1/3
NOTES:-
RESISTORS IN OHM
K=1000 M=1,000,
CAPACITORS IN μF
OR μμF (EG 160)
ELECTROLYTICS IN
7



AMALGAMATED WIRELESS
(AUSTRALASIA) LTD - SYDNEY

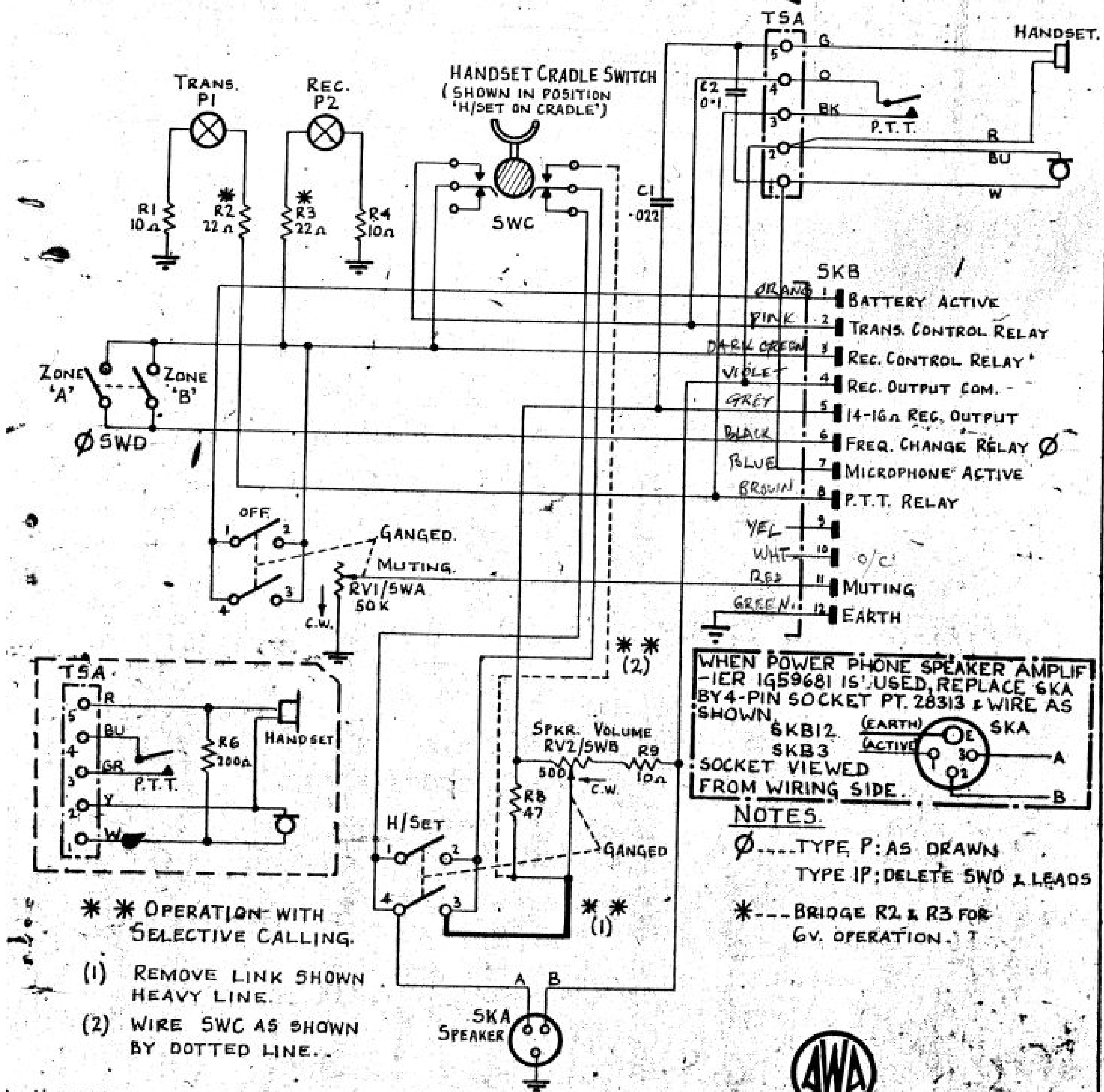


MR7
IN1169
RLA
45 Ω
RLA1
FS4
5A
FS1
15A
FS3
15A
FS2
15A
RLB1
C3
100 µF
RLD
2
50 Ω
90 Ω
RLC
2
RLD1
R6
6.8 Ω
TR1
B162/2
VT1
2N277
VT2
2N277
VT3
2N277
VT4
2N277
R1
1 Ω
R2
1 Ω
R3
1 Ω
R4
1 Ω
R8
220
R9
220
12v.
6v.
RLC1
MR1
IN1169
MR3
IN1169
MR2
IN1169
MR4
IN1169
L1
1LE60496
C1
24
C2
24
RLC2
+320v. OR +160v.
R13
3.3 K Ω
R14
2.2 K
C8
25
RLD2
R7
6.8 Ω
C4
8
MR6
R11
1K
R12
1K
C6
24
C7
24
MR5
-30v.
NOTE:-
1. TAPS ON TRANSFORME
ADJUSTED FOR BATTE
2. CONNECTIONS TO PA
UNDER CHASSIS TO BE
ADJUSTED FOR ACTIVE
BY POSITION OF WANDER
3. FUSE FS2 REMOVED
FOR 12 v. OPERATION.
UNDERNEATH VIEW OF TRANSISTOR
EXHAUST TIP
LEAD (EMITTER)
LEAD (BASE)
STUD (COLLECTOR)
DATE
CHANGES
ORIGINAL
APP.
R6 WAS 22
R7 WAS 22
C3 WAS 0.047
C.O. 30782
TR14 & 5 WERE IN SERIES
C.O. 30969
POLARITY OF C8 CHANGED
POLARITY PANEL CHANGED
C/O 31748
POLARITY CHANGED ALTERED
MR7 ADDED
AMALGAMATED WIRELESS
(AUSTRALASIA) LTD. - SYDNEY
ARGT.
DRN.
TRGD.
CKD.
APP.


ACTIVE
EARTH
6v. OR 12v. ACTIVE +Ve OR -Ve SEE NOTE
RLA 1
45Ω
RLB 1
45Ω
RLA1
FS4 5A
FS1 15A
FS3 15A
FS2 15A
RLB1
RLD 2
50Ω
90Ω
RLC 2
CNA
1 BATTERY ACTIVE
2 TRANS CONTROL
3 REC. CONTROL
4 REC. OUT. COM.
8 P.T.T. CONTROL
9 +150v.
12 EARTH
CONTROL UNIT
CNB
1 TRANS. FILS.
2 REC. FILS.
3
4 MUTING
5 REC. OUT COM.
6 14-16Ω OUTPUT
7 BIAS
8 P.T.T. RELAY
9 HIGH TENSION
10
11 MIC. ACTIVE
12 MIC. SUPPLY
TRANS. REC.
RLC2
RLC1
MR1 IN1169
MR2 IN1169
MR3 IN1169
MR4 IN1169
L1 1LE60496
+C1 24
C2 24
+320v. OR +160v.
R13 3·3KΩ
R14 2·2K
C8 25
C4 8
MR6
R11 1K
R12 1K
C6 24
C7 24
MR5
-30v.
NOTE:-
1. TAPS ON TRANSFORMER TO BE ADJUSTED FOR BATTERY VOLTAGE
2. CONNECTIONS TO PANEL UNDER CHASSIS TO BE ADJUSTED FOR ACTIVE POLARITY BY POSITION OF WANDER LEADS.
3. FUSE FS2 REMOVED FOR 12v. OPERATION.
AWA
TRANSISTOR POWER SUPPLY UNIT
TYPE: 8H59652
DRG. 59652C5
AMALGAMATED WIRELESS (AUSTRALASIA) LTD. - SYDNEY
MOD. FROM C3
TYPE
DRG. 59652C5
POLARITY CHANGED ALTERED

APP.	DATE	CHANGES
		ORIGINAL
	8.10.57	R7 DELETED c/o 28118
	30.5.58	R2 & R3 WERE 20Ω EACH WIRING CHANGED AND NOTE ADDED AS PER c/o 29476
	24.11.58	R6 DELETED C2 ADDED. HANDSET CHANGED INSET ADDED. c/o 30138
	22.4.59	COLOUR CODE TO TSA ADDED C.C. 30700
	17.7.59	C2 WAS 0·01 c/o 31007

11 CONTROL UNIT



WHEN POWER PHONE SPEAKER AMPLIFIER 1G59681 IS USED, REPLACE SKA BY 4-PIN SOCKET PT. 28313 & WIRE AS SHOWN. SOCKET VIEWED FROM WIRING SIDE.

** OPERATION WITH SELECTIVE CALLING.

(1) REMOVE LINK SHOWN HEAVY LINE.

(2) WIRE SWC AS SHOWN BY DOTTED LINE.

NOTES.

Ø---TYPE P: AS DRAWN
TYPE 1P; DELETE SWD & LEADS

*---BRIDGE R2 & R3 FOR 6V. OPERATION.

HANDSET AS DRAWN FOR SERIAL Nº 987 AND ONWARDS.
FOR PREVIOUS HANDSET ARRANGEMENT SEE INSET.

VEHICULAR CONTROL UNIT
TYPE P & 3P59653 (DUAL FREQ.)
TYPE 1P59653 (SINGLE FREQ.)
DRG. 59653D1

11

AMALGAMATED WIRELESS | ARGT. | 16.7.57 | 1ST SHEET | 1 2 3 4 5 6 7 8