FM1674 Series of V.H.F.
Radio Telephone Equipment

LOCAL BASE STATION
FM.1674.A/50F.AC...

FM1674 Series of V.H.F. Radio Telephone Equipment

LOCAL BASE STATION EQUIPMENT.

TYPES FM1674/25F & FM1674/50F.

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FM1674 Series of V.H.F. Radio Telephone Equipment.

LOCAL BASE STATION EQUIPMENT.

General Description.

The TCA, FM1674, series of local base stations is designed to meet the requirements of the radio telephone operator, for a locally controlled station of pleasing appearance, small size, and simple in design and operation.

The station unit consists of a sheet metal cabinet measuring 21-1/4"W x 13-1/2"H x 15-1/4"Deep, furnished in a gray Hammertone Oven baked enamel, with a recessed front control panel, on which are logically grouped the various controls necessary to operate the equipment. All controls and indicators are designated clearly with photo etched lettering. A practical feature is the provision of a Speech level indicator, which clearly shows the operator the required level to speak into the microphone to obtain maximum usage of the system.

The whole of the radio telephone unit may be withdrawn from the front of the cabinet to provide access for servicing. A metering socket is provided on the back of the assembly to meter all essential circuits. The station unit follows the standard practice of the 1674 series of equipment where the necessary sub assemblies are grouped together to provide radio telephone stations capable of delivering various R.F. power outputs to the antenna and to be supplied from either AC mains or from a battery as required.

These stations can be supplied to operate in the three mobile radio telephone bands.

Band A - 70 - 85 mc/s

Band C - 156 - 174 mc/s

Band D - 44 - 49 mc/s

The standard unit is supplied to operate on one set frequency in one of the above bands, but provision is made to incorporate channel switching, which allows for a maximum of three adjacent channel frequencies to be used. This feature is supplied on special orders only.

The local base station series consists of four basic types, listed below, which comprise an assembly of the following basic parts.

Type 1.

25 Watt Station AC only FM1674/25F. AC.

FM1674/25F. AC.	Console Combining Assembly
FM1674/100	Receiver Unit
FM1674/325	Transmitter Unit
FM1674/79	AC Power Supply Unit

Type 2.

50 Watt Station AC only FM1674/50F. AC.

FM1674/50F. AC.	Console Combining Assembly.
FM1674/100	Receiver Unit
FM1674/350	Transmitter Unit
FM1674/79	AC Power Supply Unit

Type 3.

25 Watt Station AC/DC. FM1674/25F.

FM1674/25F	Console Combining Assembly
FM1674/100	Receiver Unit
FM1674/325	Transmitter Unit
FM1674/82	Battery Charger Unit
FM1674/500/12	DC/DC Converter Unit

Type 4.

50 Watt Station AC/DC. FM1674/50F.

FM1674/50F	Console Combining Assembly
FM1674/100	Receiver Unit
FM1674/350	Transmitter Unit
FM1674/82	Battery Charger Unit
FM1674/540/12	DC/DC Converter Unit

As can be seen from the above list of units the base station assembly can be supplied to obtain the operating power from two basic sources. Firstly from the electricity supply mains in the range 200-260 volts 50 cps. AC, in which case the unit is fitted with an AC power supply, or secondly from a 12 volt heavy duty battery which is floated across a battery charger unit, incorporated in the base station. In this way AC/DC operation is obtained, as normally the battery charger unit is sufficient to maintain the battery in a fully charged state but should the AC mains fail the battery will continue to supply the necessary power during the mains failure emergency. The high tension supply for the AC/DC unit is obtained from a standard DC/DC converter supply obtaining the primary supply from the above combination. The AC/DC base station must always be operated with a battery in circuit.

2. SPECIFICATION - LOCAL BASE STATION

(a) General

Frequency Ranges - Band A 70 - 85 mc/s
Band C 156 - 174 mc/s
Band D 44 - 49 mc/s

Number of Channels - Standard Unit 1.

With Crystal Selector Unit 2 or 3.

Channel Spacing - 60 kc.

Frequency Stability of Carrier - Better than .005%

Operation - Simplex

Output and Input Impedance for Aerial Connection - 50-75 Ω

Cabinet Dimensions - 21-1/4" wide 13-1/2" high 15-1/4" deep.

(b) Transmitter

Crystal Frequency - $\frac{\text{Output frequency}}{36}$

Crystal Holder - K1 or HC6U

R.F. Power Output - FM1674/25F - 25 watt
FM1674/50F - 50 watt

R.F.Output Impedance - 70 ohms

Mode of Operation	-	Simplex
Modulation	-	Phase
A.F.Distortion	-	Less than 5%
Noise Level	-	-40 dB
Frequency Swing	-	± 15 KC.

Tube Complement.

Type	Function	Number used FM1674/25F.	FM1674/50F.
12AT7	Audio Pre.Amp.1. Audio Amp.1 Crystal Osc.Phase Mod.1 Tripler-Tripler 1	4	4
QQE03/12	Doubler - Doubler	1	1
OA85	Audio Compressor	2	2
QQE03/20	Power Amplifier	1	-
QQE06/40	Power Amplifier	-	1

(c) Receiver

Circuit - Double superheterodyne receiver. A single crystal controlled oscillator is used to supply both mixers.

Crystal Frequency - Bands A and D - $fx = \frac{fs - 2}{3}$

Band C - $fx = \frac{fs + 2}{7}$

fx = crystal frequency
fs = signal frequency

Crystal tolerance - .005%

Quieting - For Band A, D, better than 20 dB for 0.6 uV. For Band C, better than 20 dB for 0.8 uV.

Selectivity - ± 60 Kc/s frequency deviation, better than 100 dB.

Image Frequency - -70 dB.

R.F.Input Impedance - 70 ohms.

Detection System - Phase Modulation of a signal with ± 15 Kc/s. Deviation at 3000 cps.

A.F.Response - 300 - 3000 cps. ± 3 dB in relation to true phase mod. response.

A.F.Output - 1.0 watt max.

Muting (Squelch) - Adjustable - Minimum setting Bands A and D better than 0.5 uV; Band C better than 0.8 uV.

Tube Complement

Type	Function	Total Number Used
6AK5	RF(1); 1st Mixer (1); 1st I.F.(1); 2nd Lim.(1); 2nd I.F.(3); 1st Lim.(1); 1st Audio(1)	9
12AT7	Crystal Harmonic Amplifier	1
6AN7	2nd Mixer	1
6AQ5	Audio Output	1
6N8	Noise Amplifier (Squelch)	1
6AL5	Discriminator	1

(d) A.C. Power Supply

Mains Volts	-	210-260V AC. 50 cps.
Mains Consumption	-	Type 1674/25F AC Type 1674/50F AC
H.T. Supply	-	Receive 180V 80 mA. Transmit 250 or 300 Volts 80 mA 550 or 650 Volts 180 mA
Bias Volts	-	25 Volts 10 mA
Filament Volts	-	12 Volts 4.5 Ampere. A.C.
Relay Supply	-	12 Volts 300 mA D.C.

(e) Battery Charger Unit

Mains Volts	-	210-260V - 50 cps.
Mains Consumption	-	150 V.A.
Max.D.C.Voltage to Battery	-	13.8 V. D.C.
Max. Charging Current	-	8 Amp. D.C.

(f) DC/DC Converter

(i) For FM1674/25F Base Use Converter Type FM1674/500/12.

Battery Voltage	-	12 V. D.C.
Battery Consumption	-	Receive-Stand by 4.3 Amp. Transmit 11.0 Amp.
H.T. Volts		Receive-150V. 80 mA or 180V 90 mA Transmit-250V. 70 mA 510V - 90 mA
Bias Volts	-	25 V. D.C.

(ii) For FM1674/50F use Converter Type FM1674/540/12

Battery Volts	-	12 V. D.C.
Battery Consumption	-	Receiver-Standby Transmit
H.T. Volts	-	Receive 150V 80 mA or 180V 90 mA. Transmit 300V 75 mA 600V 150 mA.
Bias Volts	-	25 V. D.C.

FM1674 Series of V.H.F. Radio Telephone Equipment.

LOCAL BASE STATION EQUIPMENT.

TYPES FM1674/25F AND FM1674/50F.

MECHANICAL CONSTRUCTION.

The TCA Local Base Station Equipment consists of a sheet metal cabinet with a gray Hammertone enamel finish, measuring 21-1/4" wide, 13-1/2" high and 15-1/2" deep. The cabinet is well ventilated with holes at the bottom and top to limit the internal temperature rise. A removable back panel is also provided to facilitate service. The front face of the cabinet is recessed to a depth of one inch to provide protection for the operating controls and to improve the appearance of the whole assembly.

The Radio Telephone unit, which consists of a Photo etched front panel with all controls clearly designated, mounted onto a combining frame assembly, which holds the transmitter, receiver and power supply unit, is slid into the cabinet assembly and held in place by two knurled thumb screws. The necessary external connections, for power, battery, microphone and antenna are brought into the back of the combining assembly; the back plate of this assembly also holds the mains fuse, battery fuse (if required), transmitter and receiver metering socket, and parallel microphone connections, for extended microphone or foot switch operation.

The complete Radio Telephone unit is thus fully accessible for service by a simple withdrawal of the complete assembly from the cabinet.

The Photo-etched front panel is finished in flat black lacquer, with chrome lettering to designate controls. Standard Controls consist of Mains Switch, Mute Control and Volume Control. Control designations are provided for Channel Switching and Local or Remote Control which are only fitted to special order. Pilot light indication is provided for AC and DC power input and Speech Level indication is provided. A high efficiency loudspeaker is also mounted behind a gold sprayed expanded aluminium, centrally mounted panel. Two chrome plated handles are provided for withdrawal of the unit.

The sub assemblies mounted on to the combining frame assembly can vary depending upon the type of base station required, but the method of assembly remains the same. The transmitter and receiver are the standard FM1674 strip chassis, as used in all other executions, measuring 3-3/4" by 11-5/8", and these are screwed down on to the mounting strips on the combining chassis together with the power supply unit or units that are to be used for the particular equipment. All units are inter-connected with wiring which forms part of the combining unit wiring cable form.

FM1674 Series of V.H.F. Radio Telephone Equipment.

LOCAL BASE STATION EQUIPMENT.

TYPES FM1674/25F AND FM1674/50F.

A.C. OR AC/DC SUPPLY.

INSTALLATION INSTRUCTIONS.

(1) Mechanical

The base station unit should be examined for damage, when unpacked and checked to see that all tubes and crystals are correctly seated in their sockets.

The unit, being for local control, should be placed on the desk within convenient reach of the radio telephone operator. As power and antenna cables have to be connected to the rear of the cabinet it will be found most convenient to place this desk near a wall or position to eliminate trailing cables across the floor. All leads to the rear of the unit should be left with enough slack to allow withdrawal of the Radio Telephone chassis from the front of the cabinet with the leads still connected, this will allow service testing of the units whilst still connected. This operation should only be done by a qualified person as dangerous high voltages are exposed when the unit is withdrawn.

The Base Station Antenna should already have been erected onto its tower or pole to obtain the highest site available - the higher the Antenna, in relation to the area to be covered, the greater will be that coverage. The coaxial cable from the antenna is routed to the base station installation position and the coaxial plug fitted. Do not neglect to leave some slack in the cable.

The power connections to the base station unit will vary, depending upon the type of station to be installed.

(i) Local Base Stations with AC/DC Supply.

Types FM1674/25F and FM1674/50F

These base stations are basically supplied from a 12 volt battery with an A.C. battery charger floated across the battery, the battery charger being incorporated in the base station unit. The high tension supply is obtained from a DC/DC Converter unit, energised from the battery voltage.

The AC/DC base station must always be operated with a battery across the supply, not directly from the charger unit, as the ripple content of the charger unit is high and depends on the battery to eliminate it, and also the variations of the voltage supplied from the charger, without battery, could cause failure of the DC/DC converter unit.

A heavy duty 12 volt battery is connected, with standard battery terminals, to the two leads at the rear of the cabinet. The RED lead is connected to the POSITIVE terminal and the BLACK lead to the NEGATIVE terminal. The battery should be positioned where fumes may be cleared and where the battery may be easily accessible for maintenance.

When the battery leads are connected, the mains plug may be connected, after checking that the mains supply voltage is compatible with the unit, if not, the transformer tap on the

Battery charger unit should be altered to comply (see circuit SPA 7541).

(ii) Local Base Station with A.C. Supply.

Types FM1674/25F A.C. and FM1674/50F A.C.

Check that the base station unit power supply transformer connections are compatible with the mains voltage supply, if not, alter the primary tappings on the transformer to comply. (See Circuit SPB 3584). The mains flex may then be connected to the electricity supply socket.

After making the mains supply connections as detailed above it only remains to screw the antenna connector into the socket on the back panel and plug in the microphone to the socket on the back panel and the unit is ready for checking.

(2) Electrical

The "setting in operation" instructions are basically the same for all Local Base Stations.

(a) Switching Unit On.

Turn the central "Mains" Knob to the ON Position. This action applies voltage to the power supply circuit which in turn supplies filament voltage to the receiver and transmitter and high tension to the receiver. Thus the receiver should be operating after a delay of approximately 20 seconds.

(b) Mute Control - Volume Control.

Turn the VOLUME Knob to maximum clockwise, which gives full volume, and when the MUTE control is also turned clockwise, a loud hissing noise should be heard, this is the receiver front end noise which indicates the receiver is operating satisfactorily. The noise is normally quietened by rotating the MUTE Control anti-clockwise until the noise just ceases - this is the normal receiver operating point. The Volume is set to the audio level preferred by the operator.

(c) Transmit.

When the station unit is switched on, the transmitter filaments are also on, as explained earlier. To transmit it is necessary to press the button on the microphone housing which will operate a relay to change over the high tension supply to the transmitter and the transmitter will in turn radiate power from the antenna.

(d) Speaking over the Transmitter.

Once the microphone button has been pressed, the operator may speak into the microphone to pass a message. The operator should hold the microphone approximately three inches from the mouth and speak in a normal conversational voice into the microphone.

If the operator observes the speech level indicator, it will be seen that the speech causes the indicator light column to extend; the indicator has been set at the factory so that correct level of speech, to give full modulation, will be indicated by the key hole shape just fully alight. The operator should endeavour to maintain the speech level, or vary the position of the microphone, to achieve this modulation level at all times, also taking care that the speech level is not so high

that overload of the circuit can take place.

Some care should be taken to achieve the correct level of speech as the efficiency of a complete system can be nullified by incorrect use of the microphone.

(e) Simplex Operation.

These base stations work on Simplex Operation, that is the base station operator calls the mobile unit - makes it clear he is going off the air and then the mobile operator replies. For this reason short bursts of conversation are preferable, to allow break in if required.

(3) Tuning Adjustments

The Base Station equipment delivered for installation is generally pretuned to the frequency required for the system, in which case tuning adjustments to couple the antenna are all that are necessary.

Should the transmitter and receiver not be tuned to the system frequency it will be necessary to follow the alignment procedure as set out in the relevant section of this handbook.

This section gives a brief description of the procedure for adjustment of the antenna coupling circuits.

(a) Receiver.

Plug the 1674/26 Test Set connector into the metering socket provided on the back of the base station unit, and switch the meter to read 1st Limiter grid current (Position 11). If a test set is not available a 0/100 uA 1000 Ω meter may be used with the positive terminal connected to Socket No. 1 and the negative terminal to Socket No. 11.

Method 1. Using a mobile unit as signal.

The mobile unit should be sent to a position where only a weak signal is received by the base station as shown by a reading of the limiter grid current of not more than 50 uA. The receiver trimmers C101 and C102 should then be varied to give maximum reading. The limiter grid current reading must be kept below 50 uA for this adjustment, otherwise limiting takes place with a consequent error in adjustment. The trimmers C101 and C102 are situated alongside the speaker transformer T106 (see drawing SPB 3280).

Method 2. Signal Generator.

A Signal Generator may also be used for this alignment by drifting the signal into the antenna, the R.F. output of the generator must consequently be high. A careful check must be made to see the correct frequency is being used, and for this reason it would be advisable to check the discriminator reading, meter position 12 or 1 to centre the frequency before peaking the 1st Limiter grid current reading by varying C101 and C102. The signal generator method has the advantage of being able to control the strength of signal received, but the disadvantage of the signal varying due to persons moving near the signal generator whilst tuning.

At the end of the above adjustments the lock nuts should be adjusted to lock the trimmers - these nuts should not be tightened hard down as only a gripping action is required.

(b) Transmitter.

Requirements.

(i) Test Set FM1674/26 connected to the metering socket.

(ii) Antenna Connected.

(iii) Microphone. Press to talk button depressed.

Turn the metering switch through positions 2, 3, 4, 5, 6 and check that each stage gives a meter reading. These meter readings can vary considerably and figures given below are for guidance only:-

Sample Meter Readings Only.

Position 2 meter reading 30 uA

3 " " 20 uA

4 " " 20 uA

5 " " 30 uA

6 " " 40 uA

Switch meter to position 7 (Cathode P.A.) and vary the P.A. tuning capacitor to adjust to the dip in meter current reading. Lock the tuning capacitor after adjustment.

Sample Meter Readings.

FM1674/25F .. Position 7 Meter Reading 35-40 uA

FM1674/50F - Position 7 Meter Reading 80-90 uA

The tuning position obtained above may be checked by using the Test Set as a Radiation Monitor as detailed in the Test Set Handbook. This check is advisable to prove the actual radiation from the antenna.

1.3.2 Installation

1.3.2.1 Type FM1674/98 Sheet metal case.

This unit is mounted on a shock mounted tray which is held in position by bolts passing through the shock mounts into the mounting platform or brackets of the vehicle, large washers are supplied with the mounting bolts, and these washers must be placed between the shock mount and the mounting platform.

When the unit has been placed in the mounting position decided on, it is important to check that enough clearance has been allowed for easy withdrawal of the chassis unit, and that clearance has been allowed for the entry of control cables etc. on the right hand side. When this position has been checked the mounting tray may be removed from the unit box and the tray used as a template for drilling the mounting holes for the bolts provided. The tray is then bolted down, not forgetting to use the washers.

Note: In service it is important to avoid placing articles on top of the case of the unit. The shock mounts are designed to efficiently shock proof the weight of the unit, any extra weight will nullify the use of the shock mounts with damaging results to the radio units.

1.3.2.2 Type FM1674/98R Ruggedised aluminium case.

In this unit the base casting of the aluminium case is bolted directly to the mounting platform on the vehicle. Clearance should be allowed above the mounting position to allow the cover to be lifted off. Also the sides should have enough clearance for the closing clips to be manipulated, and the entry of the various cables.

Unclip the six cover catches and lift the cast aluminium cover off the unit.

The radio telephone unit assembly is held to the shock mount assembly by four captive mounting studs situated at each corner of the equipment, unscrew these studs and the equipment can then be lifted out, to be stored in a safe place.

The cast aluminium base should be placed in the permanent position decided on. Because of the many variations envisaged in mounting the unit, it was not considered advisable to provide mounting holes, therefore it will be necessary to drill the four holes through the case to suit the particular installation. The mounting holes should be distributed as evenly as possible about the perimeter and should be a minimum of 5/16".

When the base has been secured, the radio-telephone unit should be replaced in the case and screwed down, the chassis with the cable connector sockets being placed near the cable outlet in the side of the case. After the installation of the other units is complete the four cables from the Antenna, Remote Control Box, Power Supply and battery, are plugged into the connectors situated on the Remote Control chassis and

clamped down with the strips provided. The cables should not be stretched tightly to the slot but a little slack allowed for movement. For maximum sealing of the cable entry slot, a few turns of plastic tape around the cables at the point of entry, together with the clamping action of the small block provided, and the crimping of the top lid will be found very effective.

1.3.2.3 Remote Power Supply

Installation procedure for the Power Supply unit is the same as detailed in the previous section 1.2.1A Power Supply.

1.3.2.4 Remote Control Box FM1674/04

The Remote Control Box contains all the controls and indicators necessary to operate the radio telephone equipment, except the microphone press-to-talk, therefore it is necessary for this unit to be installed in a convenient position for the operator.

The control box is made up of two parts, a back plate mounting bracket and the front box control assembly. In this way the control assembly can be removed entirely for maintenance, as the Remote Control Cable - Speaker and Microphone are all plugged in.

The back plate is provided with four mounting holes, to screw flat against a partition, or dash board. Large access holes are provided for the remote control cable to be led through this plate if necessary. Alternative positions are provided at each end of the bracket, in this case the front cover knock out access hole is used. It is necessary to solder the connector on to the cable after it has been fed through the access hole being used. Make sure the connections are correct before connecting to the units.

The microphone and loudspeaker cables are fed through knockouts provided in the top or bottom edges of the control box. Generally the bottom knockouts will be found more convenient to use.

Before assembling the control box, check the battery voltage of the installation and if the installation is for 6 volt, short out resistors R10, R12, R14.

1.3.2.5 Speaker Box FM1674/05

The speaker box provided houses a high efficiency six inch speaker and is mounted by one threaded stud, projecting from the back of the box.

The speaker should be sited as close to the operator as possible and also near the Remote Control Box, into which it connects through a four foot lead and two pin plug, which plugs into a socket inside the box.

The mounting of the speaker box is self explanatory and there is generally no need to open the unit up to mount it.

1.3.2.6 Hand Microphone

The microphone hang up hook is attached, in easy reach of the operator, by the two mounting screws provided. The microphone plugs in to the appropriate socket inside the Remote Control Box.

1.3.2.7 Remote Control Cable

The remote control cable is fifteen feet in length which is ample length for a normal installation. The method of installation will vary considerably depending on the type of service and can only be left to the individual. Care should be taken to see that ample slack cable is provided at the radio telephone unit end, for easy access to the unit, also the cable should not be run in a position where mechanical damage can take place.

1.3.2.8 Whip Antenna

Instructions for installation of the whip antenna are supplied with the unit. The method of installation of the coaxial cable will vary and can only be left to the installation technician, but again there should be sufficient slack cable left at the radio-telephone unit to enable easy withdrawal of the unit.

1.3.2.9 Battery Cable

The installation of the battery cable has been left until last deliberately, to ensure that the installation can be checked for correct connection.

Installation checks

(a) Battery Voltage 6 or 12 volt.

(b) Which pole of the battery is connected to earth or frame, positive or negative.

(c) The Remote Control box should be wired for the voltage checked para. (a).

(d) The Radio-Telephone unit should be wired for the voltage checked in para. (a). Check connections against the appropriate circuits - filaments and relays.

(e) The Power Supply unit must be carefully checked for voltage connections, if incorrect, changeover the transformer tap leads as detailed. It is essential that the battery connections to the power supply have the correct polarity as stipulated on the drawing, if not, the jumper leads provided must be reversed.

After the above checks have been made it will be safe to connect the unit to the battery. The Black lead of the battery cable is always connected to the chassis (EARTH) connection of the battery. The Red lead is always connected to the ACTIVE terminal of the battery whether it be positive or negative.

The battery lead provided is three feet in length. If a local battery is used this length will be found sufficient; should the battery be in a remote situation, the extra conductor should be increased in size to minimise voltage drop in the leads and the flexible leads terminated in a covered terminal box.

2.0 ELECTRICAL INSTALLATION.

2.1 Switching Units ON

Although the controls for the mobile units may be either 'LOCAL' or 'REMOTE' the basic functions are the same, therefore this description will cover both.

(a) Receiver ON - Turn the knurled "Function" knob from "O" position to "R" position. This will apply filament voltage and also high tension, and after approximately 20 seconds the receiver should be fully operative.

(b) Volume - Turn the "Volume" knob fully clockwise for full volume and anti-clockwise for minimum volume. In the "LOCAL" control units the volume is controlled by a potentiometer and the audio can be turned fully off, whereas in the Remote Control unit the volume control is a stepped switch and the minimum volume is still audible. Note that in the Remote Control type the potentiometer for volume control is mounted on the Remote Control chassis to obtain fine adjustment.

(c) Muting - When the "MUTE" knob is turned fully clockwise and the receiver is operating with the volume control fully clockwise, the full receiver noise may be heard from the loudspeaker. This fact may be used as a rough check on the receiver operation, the noise being uncomfortably loud when the receiver has full gain and amplification. To adjust the Muting circuit, the knob should be turned anti-clockwise until the noise is just fully quietened. This is the normal operating position.

(d) Transmitter Filaments ON (Stand By) - Turn the "Function" knob to the third clockwise position marked "T". This action applies voltage to the transmitter filaments. To conserve battery the transmitter filaments may be switched off until the particular operator is called when he must switch his filaments ON. In this case he cannot reply immediately, but must wait 20 seconds before transmitting.

(e) Transmit - This function is interlocked with the transmitter filaments which must be switched on first and allowed a minimum time of 20 seconds to attain their operating temperature. The "Transmit" or "Press-to-Talk" switch is incorporated in the microphone, or handset, housing, when the button, or bar, is pressed the receiver is made non-operative and the transmitter supplies energy to the antenna.

(f) Channel Switching - The channel switching sub-unit is an optional extra, which is only used when the radio system uses more than one frequency.

For the Local Control units type FM1674/99L or S, a three position switch is fitted to the top left hand side of the front panel, when ordered. The Remote Control box for use with units type FM1674/98 or 98R has the three position switch fitted as a standard item. In both cases, for operation of the channel switching, it is necessary to have crystal switching boxes fitted to the transmitter and/or receiver. These are supplied on special order.

When a system incorporates channel switching it is only necessary to turn the knurled knob to the channel number required for the radio units to change frequency.

(g) Switching Unit OFF - To switch the complete mobile unit OFF the operator turns the Function Switch to the "O" position, when the battery is disconnected from all circuitry.

2.2 Tuning Adjustments

The mobile radio-telephone units delivered for installation are generally pretuned to the frequency required for the system, in which case tuning adjustment to couple the antenna are all that are necessary. Should the units not be tuned to the system frequency, it will be necessary to tune all of the transmitter and some of the circuits of the receiver, as set out in the relevant sections of this handbook. This installation section gives the procedure for adjustment of the pretuned receiver and transmitter to the installed antenna and the netting of the unit to the base station frequency.

(a) Receiver

Plug the 1674/26 Test Set lead into the metering socket on the unit under test, and switch the meter to read 1st Limiter Grid current (position 11).

Using the base station as the signal source, and with the receiver in such a location that the limiter grid current meter registers below 50 uA, vary trimmer C101 and C102 to give maximum reading. The limiter grid current reading must be kept below 50 uA when tuning, otherwise limiting will take place and correct alignment will be prevented. The trimmers C101 and C102 are located alongside the speaker transformer T106 (See layout drawing SPB.3280).

A signal generator may also be used for this alignment by drifting the signal into the antenna, the R.F. output of the generator must consequently be fairly high, but it has the advantage of being able to control the signal level. A careful check must be made that the correct frequency is being used and for this reason it would be advisable to check on the discriminator reading, meter position 12 or 1, to centre the frequency.

Again using the base station signal, check the centering of the discriminator by switching the test meter to position 12 or 1, depending on polarity. The discriminator reading should be zero for centre. If the meter reads more than 4 uA in either direction, the receiver should be centered on the base station by adjustment of crystal trimmer C133 situated beside the crystal socket.

At the end of these adjustments, check that the trimmers are locked with the lock nut provided. These nuts should not be tightened hard down as gripping action is all that is required.

(b) Transmitter

Requirements (i) Test Set FM1674/26 connected to the unit.
(ii) Transmitter filaments ON.
(iii) Antenna Connected.
(iv) Microphone Press to Talk button depressed.

Turn the metering switch through positions 2, 3, 4, 5, 6 and check that the meter readings are typical, then switch to position 7 (Cathode P.A.). Vary the P.A. tuning capacitor and adjust to the dip in meter current reading. Lock the tuning capacitor after adjustment.

The tuning position obtained may be checked by using the Test Set as a Radiation Monitor as detailed in the Test Set handbook. This check is advisable to prove the actual radiation from the Antenna.

The Transmitter frequency may be adjusted closer to the base station frequency, if required, by an adjustment of the crystal trimmer capacitor, situated beside the crystal socket. Constant cross checking of the transmitter adjustment, by readings, of the base station receiver Discriminator current are necessary until the setting is achieved.

2.3 The Crystal Switching Boxes

The crystal switching boxes enable the transmitter and receiver to be switched between 2 and 3 adjacent channels. The desired frequency is selected by a switch mounted on the front panel of the transmit receive unit which operates one or two miniature changeover relays in each of the switching boxes in switch position 2 and 3, causing an additional current drain of 90 ma per switching box from the battery supply. In position 1 the relays are not operated.

To Use the Receiver Crystal Switching Box

(1) Adjust the crystal trimmer capacitor on the receiver to minimum capacitance.

(2) Plug the highest frequency crystal that is to be used into the receiver and adjust the crystal tuning to make the crystal current half of maximum. Remove the crystal.

(3) Plug the centre frequency crystal into the receiver. Align the receiver to this frequency, but do not readjust the oscillator.

(4) Remove the cover from the crystal switching box, insert the crystals, lowest frequency in socket number (1). Replace the cover and insert the switching box into the crystal socket. Fasten securely.

(5) Connect the uA meter to measure oscillator grid current, switch the channel selector switch to position 1. Tune the coil numbered 1 (using a miniature screw driver) on the crystal switching box to obtain a current reading of 5-8 uA. Switch to position 2 and repeat, tuning coil No. 2. Repeat in position No. 3, if used.

(6) Connect the antenna and move the meter to measure discriminator current. Switch to position No. 1 and bring up No. 1 transmitter frequency, adjust the coil No. 1 on the crystal switching box to bring discriminator to zero or near to zero. This should involve a movement of the coil trimmer of not more than $\frac{1}{2}$ turn. Repeat for switch positions 2 and 3.

(7) The coil tunes out the self capacitance of the switching box and in addition provides a means of shifting the fundamental frequency of the crystal oscillator by approximately $\pm$ 1 kc/s.

At the low frequency end of the band the oscillator will oscillate in T.P.T.G. mode if the slug is withdrawn too far and a check should be made to ensure that at least $1/4$ turn safety margin is available. If the above directions are carefully followed, the safety margin should be ample.

(8) Finally check by metering crystal oscillator current that each crystal oscillates immediately the selector switch is thrown.

To Use the Transmitter Crystal Switching Box

(1) Adjust the crystal trimmer capacitor on the transmitter to minimum capacity.

(2) Take the transmitter crystal switching box. Remove the cover and insert the crystals, lowest frequency in socket number 1. Replace the cover and plug the switching box into the crystal socket. Fasten securely.

(3) Check that all crystals oscillate by reading grid current of V202A in the three positions of the channel selector switch.

(4) The transmitter frequency of each channel may now be moved upwards by a maximum of 1.5 kc/s approximately, or the group may be moved about 4 kc/s maximum downwards by readjustment of the main trimmer.

The individual channels may then be readjusted at this new frequency.

(5) Check that maximum deviation is ± 15 kc/s and if necessary reset the limiter control.

FM1674 Series of V.H.F. Radio Telephone Equipment.

RECEIVER TYPES FM1674A/100; C/100; AND D/100.

DETAILED DESCRIPTION.

1.0 GENERAL

The FM1674/100 V.H.F. Receiver has been specifically designed to meet the stringent requirements of mobile service. It also fully meets the requirements of base station service and is used in both applications.

The Receiver is available for operation in the 70-85 mc/s Band (FM1674A/100), 156-170 mc/s Band (FM1674C/100), or in the 44-49 mc/s Band (FM1674D/100).

The Receiver is of the double conversion type, in which both heterodyne frequencies are derived from a single crystal, and all receivers use an identical circuit from the second mixer onward.

The selectivity is of a high order and has been designed to enable adequate rejection of signals spaced ± 60 kc/s or more from the desired signal.

This high degree of selectivity is achieved by the use of special filters, which are exclusive to TCA, and are fully temperature compensated to maintain stable operation over a wide range of operating temperatures.

The Receiver provides ½ watt or 1 watt of audio output dependent upon connection of the H.T. power supply to provide 150 or 180 volts output.

The Receiver in mobile service must operate from the battery which is part of the vehicle electrical system, and it is therefore essential that the receiver consumes a minimum of power. The FM1674/100 receivers are most economical in this regard consuming only 2.6 amperes at 12V and 5.2 amperes at 6V, when operated in conjunction with the TCA series of DC/DC converters.

2.0 SPECIFICATION OF PERFORMANCE

(a)	Frequency coverage	FM1674A/100	70-85 mc/s
		FM1674C/100	156-174 mc/s
		FM1674D/100	44-49 mc/s
(b)	Quieting	FM1674A/100	20 dB at 0.6 uV
		FM1674C/100	20 dB at 0.8 uV
		FM1674D/100	20 dB at 0.6 uV
	Signal to Noise Ratio	Band A & D =	38 dB for 1 uV
		Band C =	35 dB for 1 uV
(c)	Bandwidth	6 dB attenuation	42 kc/s ± 3 kc/s
		60 dB attenuation	90 kc/s ± 3 kc/s
		100 dB attenuation	120 kc/s ± 3 kc/s
(d)	Residual Noise (mute on)	-30 dB on 0.5 watt	
(e)	Muting Range	0.3 uV - 1 uV	
(f)	Image Rejection	> -70 dB ref. 1 uV	
(g)	Spurious Response	-80 dB ref. 1 uV	

(h)	Audio output	0.5 watts at 150V H.T. 1.0 watts at 180V H.T.
(j)	Frequency response	6 dB/octave 3000-300 c/s ± 3 dB
(k)	Distortion	6% at full output
(m)	Input impedance	50 or 70 ohms
(n)	Crystal frequencies	FM1674A/100 $\frac{Fs - 2}{3}$ FM1674C/100 $\frac{Fs + 2}{7}$ FM1674D/100 $\frac{Fs - 2}{3}$ When Fs = signal frequency.
(o)	Crystal tolerance	50×10^{-6} normal
	Power Supply Requirement	Heaters - 6.3V @ 3.2 Amps. or 12.6V @ 1.6 Amps.
		High Tension - 150V at 50-56 ma (Mute ON) 150V at 73-77 ma (Mute OFF)
		or for 1W output 180V at 62-67 ma (Mute ON) 180V at 88-95 ma (Mute OFF)

3.0 TECHNICAL DESCRIPTION

3.1 General

The receiver is a double superheterodyne type in which both heterodyne frequencies are derived from the same crystal.

The first I.F. amplifier operates over the frequency range 12-14 mc/s for FM1674D/100 and range 20-27 mc/s for FM1674A/100 and C/100 and this frequency is converted to the second intermediate frequency which is 2 mc/s. After amplification at 2 mc/s the signal is fed into the limiters which operate at 4 mc/s and thence to the discriminator. After detection the signal is amplified by the audio amplifier and coupled to the loudspeaker.

The crystal is connected to the second mixer and is frequency multiplied in a side chain amplifier and injected into the first mixer.

Noise output is fed from the second Limiter to the muting tube in the absence of signal. The muting tube amplifies and rectifies this noise thereby developing a negative bias voltage, which is used to bias off the audio valves and thus mute the receiver.

3.2 Valve types and functions

Circuit Ref.	Type	Function
V101	6AK5	R. F. Amplifier
V102	12AT7	Frequency multipliers
V103	6AK5	First mixer
V104	6AK5	First I. F. Amplifier
V105	6AN7	Second mixer Crystal oscillator
V106	6AK5	Second I. F. Amplifier
V107	6AK5	Second I. F. Amplifier

V108	6AK5	Second I. F. Amplifier
V109	6AQ5	Audio output
V110	6AK5	First Limiter
V111	6AK5	First Audio Amplifier
V112	6N8	Muting noise amplifier/detector
V113	6AK5	Second Limiter
V114	6AL5	Discriminator.

4.0 CIRCUIT DESCRIPTION

4.1 R.F.Section

The antenna is coupled to the tuned primary of transformer T101. The tuned secondary of this transformer is connected to the grid of the 6AK5 R. F. Amplifier V101.

The anode circuit of the R. F. Amplifier V101 is the tuned primary winding of a triple wound transformer T102. The tuned secondary winding of this transformer is coupled to the grid of the 6AK5 first mixer valve V103.

4.2 First Mixer

The tertiary winding of transformer T102 is also tuned, but in this case it is tuned to the frequency of the first mixer injection voltage, and voltage of this frequency is impressed on the first mixer grid together with the incoming signal.

These two signals impressed on the first mixer grid produce sum and difference frequencies in the anode circuit of this tube and the desired component is selected by the double tuned transformer T103, the secondary of which is connected to the 6AK5 first I. F. Amplifier valve V104.

4.3 First I.F.

The frequency of the component selected from the anode of the first mixer valve varies with the frequency of the incoming signal, but falls within the 1st I. F. frequency. The anode of the 6AK5 first I. F. Amplifier valve V104 is coupled to the double tuned transformer T104 which is identical with transformer T103 and is connected to the hexode grid of the 6AN7 second mixer valve V105.

4.4 Second Mixer - Crystal Oscillator

The 6AN7 second mixer valve is a triode hexode in which the I. F. signal is connected to the hexode grid as mentioned previously. The triode section of this tube functions as a crystal oscillator and uses a crystal frequency as given by:

$$\text{Crystal frequency} = \frac{\text{signal frequency} - 2}{3} \quad \text{for FM1674A/100 and FM1674D/100}$$

$$\text{Crystal frequency} = \frac{\text{signal frequency} + 2}{7} \quad \text{for FM1674C/100}$$

Crystal frequencies will therefore lie in the range 12 - 28 mc/s approximately, and to obtain these high frequencies, crystals of the third overtone type are used with a normal Pierce Miller circuit in which L101/C120 forms the anode tuned circuit.

The output from the crystal oscillator is used to heterodyne the first I. F. range either 12-14 mc/s or 20-27 mc/s to produce the second I. F. of 2 mc/s.

4.5 Frequency Multipliers

The anode of the crystal oscillator is also connected to the grid of the first multiplier V102 (a) where it is multiplied twice. Bias for this valve is derived from grid current through R112.

The anode circuit for this multiplier is formed by L102/C114 and the voltage developed across this circuit is applied to the grid of the second multiplier V102 (b). This section multiplies the frequency twice in the case of the FM1674A/100 and FM1674D/100 and three times in the case of the FM1674C/100. The output of this tube is developed across the tuned circuit forming the tertiary winding of transformer T102 as previously mentioned. Bias for the second section of V102 is derived from grid current developed through resistor R106.

4.6 Second I.F.

The 2 mc/s output from the 6AN7 second mixer V105 is applied to the first filter. This filter comprises six factory adjusted circuits and realignment of the filter should not be attempted by inexperienced personnel or without the necessary test equipment.

The output of the first filter is connected to the grid of the 6AK5 second I. F. Amplifier V106. The anode of this valve is coupled to the input terminals of a second filter which is identical to the first filter. The output of this second filter is connected to the grid of the 6AK5 second I. F. Amplifier V107.

The anode of the Amplifier V107 is coupled to the grid of 6AK5 second I. F. Amplifier V108 through the double tuned transformer T105.

4.7 First Limiter

The anode of valve V108 is coupled to the grid of the 6AK5 first limiter V110 through double tuned transformer T107 and associated coupling network C163, R141.

The first limiter operates without cathode bias and with low screen and anode voltage. Bias is derived solely from grid current through grid leak R141.

In the presence of a signal considerable bias is developed across the grid leak and the negative going peaks of the input signal are thus cut off. Because of the low screen voltage the anode current of the valve is limited and cannot rise above a given value. This action cuts off the positive going peaks of the anode current so that the anode output of the valve contains only a portion of the incoming signal and noise and amplitude modulation are removed.

Because the first limiter draws grid current, the transformer driving this valve, T107. is tuned by very high capacities to provide good regulation and the time constant of the coupling network C163, R141 has been chosen to provide optimum rejection of impulse noise.

4.8 Second Limiter and Discriminator

The operating conditions of the first limiter are suitable for frequency multiplication and the anode of the first limiter is coupled to the grid of the 6AK5 second limiter V113 through a double tuned transformer T108 which is tuned to 4 mc/s.

The second limiter functions in a similar manner to the first limiter and is coupled to a 6AL5 double diode valve V114 through a normal Foster Seeley discriminator transformer T109. The combination of the discriminator transformer and 6AL5 double diode converts the "frequency modulation into an audio signal which appears across the load resistor R169".

4.9 Audio Stages

The audio voltage developed across R169 is fed through C190 to the element of a normal volume control potentiometer, the other end being earthed. The moving arm of the volume control is connected to the grid of the 6AK5 first audio valve V111 through a de-emphasis network R147 C167. This de-emphasis circuit causes the audio response of the receiver to fall at approximately 6 dB per octave from 300 c/s which is the reverse characteristic of the FM1674 transmitter and thus provides a flat characteristic from transmitter input to receiver output.

The first audio valve is resistance-capacity coupled to the grid of the 6AQ5 output valve V109 which is coupled into the voice coil of the loud-speaker through the output transformer T106.

4.10 Muting Circuit

Due to the very high overall gain in a frequency modulation receiver the absence of a signal causes a very high noise level at the loudspeaker which is intolerable without muting. A muting circuit is incorporated which silences the receiver in the absence of signal.

The noise referred to above is due to random atmospheric noise, the noise resistance of the aerial and set noise, and passes through the receiver in a normal manner.

In the absence of a signal the limiters cannot remove the noise, and some noise components appear at the screen grid of the second limiter valve V113, as the bypass condenser C179 has been chosen to bypass the 4 mc/s component, appearing at this point, but not the low frequency noise components.

The noise components are coupled through C180 and R. F. filter resistor R162 to the grid of the 6N8 noise amplifier/rectifier valve V112. 6AK5.

The noise is amplified by the penthode section of this valve and appears across the anode load R150. This amplified voltage is fed to the two diodes in this valve, through C172 and C178, when it is rectified and develops a negative voltage across diode loads R155, R156 and R160, R161. The negative voltage across R155 is filtered by capacitor C173 and applied through R149 and R147, to the grid of the first audio amplifier V111.

The screen grid of the first audio amplifier is fed from a voltage divider R140, R142, so that as the screen current decreases with increasing negative bias on the control grid, the screen voltage remains sensibly constant ensuring a sharp cut off of cathode current through the first audio amplifier, thus preventing the noise output from the discriminator passing through the audio amplifier and being heard in the loudspeaker.

The negative voltage developed across the resistor R160 is filtered by R157, C157 and applied to the control grid of the output valve through grid leak R136 and R134.

In the absence of signal a high negative bias is applied to the output stage. This reduces the cathode current to a very low value which results in a considerable saving of power consumed by the receiver during no signal periods.

When a signal is received, the limiters remove the noise as stated previously, and the noise input to the 6N8 noise amplifier/ rectifier valve falls to zero. As a result, the bias developed at the rectifier anodes also falls to near zero and normal amplification

of the audio section of the receiver is obtained.

When the associated mobile transmitter is being operated, H. T. volts are removed from the receiver. When the changeover to receive takes place the application of H. T. voltage to the receiver would result in a loud click being heard in the loudspeaker. This is minimised by C152 which is charged during the transmit period and discharges through R157/R160 in the receive condition. This slows down the rate of increase of cathode current in the output stage and thus reduces the changeover click.

5.0 RECEIVER ALIGNMENT AND TESTING

5.1 Test Equipment Required

Suitable types of test equipment are listed, but any test equipment having similar characteristics may be used.

(a) Sweep Generator 2 Mc/s capable of deviation of ± 60 kc/s (Marconi Signal Generator TF.995 A/2.)

(b) 2 Mc/s crystal oscillator (Alignment oscillator 1645/24) or Test set 1674/26 with plug in crystals on 1,985 kc/s 2000 kc/s and 2015 kc/s.

(c) Oscilloscope (Philips type GM5653, GM5654).

(d) Test box 1674/26.

(e) Audio Oscillator (Philips GM2307).

(f) Distortion and Noise meter. (A.W.A. Type A51932).

(g) Audio output meter or model 8 A.V.O. Multimeter.

(h) Model 8 A.V.O. Multimeter.

5.2 Preliminary

Check that the resistance of the H. T. line to chassis is 18.5 KΩ ± 10%.

Switch supplies to 'on'.

When tuning to a new frequency select the crystal (see specification). Ensure that all valves are in position. Rotate squelch control fully clockwise.

In the instruction which follows it is assumed that either a model 8 A.V.O. or a Test Set 1674/26 is being used. The Test Set 1674/26 on positions 9, 10, 11, 12 and 1 measures oscillator, multiplier, first limiter, discriminator and reverse discriminator respectively. It may also be used to indicate second limiter current by switching the "function" switch to 20V and using the external voltmeter leads provided. Indicated currents will be about 15% below normal due to the voltmeter resistance.

RE-ALIGNMENT

The instructions that follow assume that the filters are correctly adjusted and as previously mentioned the re-alignment of the filters should not be attempted by inexperienced persons or without complete equipment. Full instructions for aligning the filters are available from TCA in the capital cities.

5.3 2ND I.F.

Using a signal generator set to 2.0 mc/s, connect the output leads between T105 pin 6 and earth and set the signal generator output to maximum.

Connect the 1674/26 test box into the metering socket and set the selector switch to position 11. (First limiter grid current).

Alternatively an A.V.O. model 8 set to read 50 uA F.S.D. between earth and terminal 6 on card E may be used.

Tune the secondary core of T107 (Top) until a deflection is noted on the limiter grid current meter. Roughly adjust the core for maximum meter reading. Tune the primary core of T107 (bottom) for maximum reading of the meter. Make alternate adjustments to primary and secondary cores until the maximum reading of the grid current meter is obtained.

Transfer the signal generator to V107 pin 1 and earth, leaving the limiter grid current meter connected as before.

Connect a 2200 Ω resistor between pins 1 and 3 of T105 and tune the secondary core (top) for maximum reading of the limiter grid current. If the limiter grid current rises above 30 uA it is advisable to reduce the output of the signal generator until a reading slightly less than 30 uA is again obtained.

Remove the 2200 ohm resistor from pins 1 and 3 and connect to pins 4 and 6 of T105 and tune the primary core (bottom) for maximum reading of the limiter grid current meter, reducing the output of the signal generator from time to time.

5.4 Limiters

Connect the signal generator between T104 pin 4 and earth, leaving the limiter grid current meter as before and adjust the signal generator output until the grid current reads 50 uA.

Connect a model 8 Avometer set to read 250 uA F.S.D. with negative lead going to terminal 7 of card E, and positive lead going to chassis, and tune the secondary core (top) of T108 for maximum reading of the meter.

Adjust the primary core (bottom) of T108 for maximum reading of the meter.

After the above adjustments have been made the I. F. channel and limiters should be correctly aligned. As a check on the alignment the signal generator may be replaced by the 1645/24 alignment oscillator and with the frequency selector switch set to 2.0 mc/s the output adjusted to give a convenient reading on the meter connected to the first limiter grid. Switching the frequency selector of the 1645/24 alignment oscillator to 2.0 mc/s + 15 kc/s and then - 15 kc/s should produce the same grid current reading at both the + and - 15 kc/s positions.

5.5 Discriminator

Adjust the signal generator to 2 mc/s (or the 1645/24 alignment oscillator with frequency selector set to 2 mc/s) and connect the output to V105 pin 2 and earth. Adjust the generator output until a reading of 50 uA is obtained on the meter connected to read first limiter grid current 1674/26 position 11.

Switch the 1674/26 selector switch to position 12 or 1, selecting the switch position which gives an upward deflection.

Adjust the secondary core (top) of T109 until the core is level with the top of the can. Tune the primary core (bottom) of T109 until a maximum deflection of the meter is obtained.

Adjust the secondary core (top) until the meter reads zero. Detune the signal generator ± 15 kc/s or switch the 1645/24 alignment oscillator ± 15 kc/s and note the readings on the meter which should be approximately 34 uA and symmetrical.

5.6 Multipliers

With the crystal inserted in the correct crystal socket, set the 1674/26 test box selector switch to position 9, alternatively an A.V.O. Model 8 set to read 50 uA F.S.D. may be connected with the negative lead to terminal 5 on card E and positive lead connected to earth.

If the circuit is not oscillating a small reverse current will be indicated.

As the crystal oscillator anode circuit core (bottom) is screwed into L101, the meter will commence to read and will rise to a maximum and then drop sharply. Return the core until the meter commences to read again and adjust the core until the meter reads 60% of maximum which should be approximately 12-15 uA.

Check that the oscillator starts readily by switching the H.T. on and off several times.

Set the 1674/26 test box selector switch to position 10 or alternatively connect the A.V.O. model 8 set to read 50 uA F.S.D. with the negative lead to terminal 4 on card E and positive lead to earth. Tune the anode circuit of the first multiplier (top core) L.102 until the meter reads maximum.

The tuning of the final multiplier anode circuit is done when the 1st I.F. has been aligned and a signal applied to the aerial socket.

To adjust this circuit set the 1674/26 test box switch to position 11 and tune the circuit for maximum first limiter grid current, reducing the signal generator output each time the grid current reaches 50 uA.

5.7 1st I.F. Amplifier

With the 1674/26 test box set to position 11, connect the signal generator between V103 pin 1 and earth, and set the frequency approximately to two megacycles lower than the crystal frequency.

Increase the output of the signal generator until a reading is noted on the test box meter. Tune the signal generator carefully until the meter reads maximum.

Tune the secondary core (top) of T104 until maximum reading is obtained on the limiter grid current meter. Reduce the output of the signal generator if the grid current meter reading exceeds 50 uA and continue the alignment. Tune the primary core (bottom) of T104 to maximum limiter grid current reading.

Tune the secondary core (top) of T103 for maximum limiter grid current and then the primary core (bottom) of T103

The first I.F. amplifier should then be correctly aligned.

5.8 R.F. Alignment

Connect the signal generator to the aerial socket, and tune carefully at approximately the correct frequency. When the correct frequency is obtained the meter connected to the first limiter grid circuit will indicate. Adjust the signal generator very carefully until the grid current meter reads maximum and then adjust the R. F. trimmers in the following order.

(a) Multiplier output circuit C104
(b) Mixer grid circuit C119
(c) R.F.Amplifier anode circuit C109
(d) R.F.Amplifier grid circuit C102
(e) Aerial tuned circuit C101

Adjust all trimmers to give maximum reading of limiter grid current, reducing the output of the signal generator each time the meter reading exceeds 50 uA.

The R. F. circuits should now be correctly aligned and all locking nuts on the trimmer capacitors should be tightened. The lock is effective with only a firm adjustment on the locking screw and over-tightening may damage the capacitor.

6.0 MEASUREMENT OF PERFORMANCE

6.1 Quieting

Connect a suitable meter, model 8 A.V.O. set to read 2.5V A.C. F.S.D. or noise and distortion meter, across the loudspeaker voice coil.

Set the mute control fully clockwise, audio volume control fully clockwise and note the noise output voltage reading obtained in the absence of a signal. Tune the signal generator to minimum audio output voltage, adjust the signal generator to give either 0.3 uV for Bands A and D or 1.0 uV for Band C at the aerial socket and check the minimum voltage reading. This should be at least 20 dB below the original no signal noise audio output voltage.

6.2 Signal to Noise

With the signal generator adjusted for minimum noise as described in the preceding section, switch the internal modulation on and adjust the deviation to 15 kc/s. Adjust the signal generator output voltage to give 1 uV the aerial socket. Note the audio output voltage measured across the voice coil of the loudspeaker.

Switch off the modulation and note the noise output voltage. This should be at least 38 dB below the signal audio output for the FM1674A/100 or D/100 receiver and 35 dB below the signal audio output for the FM1674C/100 receiver.

6.3 Limiting Action

With the equipment connected as in the preceding section, reduce the deviation to 10 Kc and adjust the volume control to give any convenient audio output level. Increase the signal generator output to give 50 mV across the aerial socket and note the audio output.

The variation in output level between 1 uV and 50 mV condition should not exceed 2 dB for Bands "A" and "D" or 3 dB for Band "C".

6.4 Audio Correction Network

Connect the signal generator to the receiver and set the output to give 10 uV at the receiver aerial socket. Connect an audio

oscillator to the signal generator and set the signal generator to external modulation. Set the audio oscillator to 300 c/s and the signal generator deviation to 10 kc/s.

Connect an A.V.O. Model 8 set to read 2.5V A.C. F.S.D. across the loudspeaker voice coil, and adjust the audio volume control so that the AVO reads +6 dB. Increase the audio oscillator frequency to 600 c/s and the output voltage should fall 6 dB ± 2 dB. Increase the audio oscillator frequency to 1200 c/s and the audio output should again fall 6 dB from the 600 c/s figure.

Set the audio oscillator to 1500 c/s and reset the receiver audio volume control to give an output of 0 dB. Change the audio oscillator to 3000 c/s and the receiver output should fall 6 dB ± 2 dB.

Typical measured figures give 5 dB, 6 dB and 7 dB for the three octave ranges quoted above.

6.5 Distortion

With the signal generator connected to the receiver and output 100 uV connect an A.V.O. Model 8 set to read 2.5V A.C. F.S.D. across the voice coil. Connect also across the voice coil the noise and distortion meter.

With the signal generator set to give 15 kc/s deviation at 1000 c/s, adjust the receiver audio volume control to give 1.4 volts as indicated by the model 8 A.V.O.

Read the distortion which should be not greater than 6%.

6.6 Selectivity

In order to check that the filters are correctly aligned it is necessary to measure the response of the second I.F. amplifier chain. This is a measurement not normally required, but is included for the benefit of maintenance departments equipped to enable the test to be made.

An H.F. signal generator covering 2 mc/s with an easily read dial calibration is required. The generator should be capable of delivering at least 1 volt. A vacuum tube voltmeter of low range is also required.

Connect the signal generator between control grid of V105 (pin 2) and earth as described in the section dealing with alignment of the 2 mc/s channel. Withdraw crystal from socket.

The V.T.V.M. should be set to read negative D.C. volts of low range, 1 volt or less, and connected via a .22 meg. resistor to the control grid of the first limiter V110 (pin 1).

Switch the 1674/26 test box switch to position 12 or 1 (discriminator) and carefully adjust the signal generator until the meter reads zero. Adjust the output of the signal generator until the reading on the V.T.V.M. is the lowest that can be easily read. Increase the signal generator output by 6 dB and detune to each side of resonance until the original reading on the V.T.V.M. is again obtained. Note the two frequencies. Increase the output of the signal generator 60 dB above the initial setting and again detune the generator until the original V.T.V.M. readings are obtained. Increase the signal generator output by 100 dB and repeat the detuning procedure.

RE-INSERT CRYSTAL

The off tune frequencies for the various outputs from the signal generator should be within the limits given.

6 dB ± 21 kc/s ± 3 kc/s

60 dB ± 45 kc/s ± 3 kc/s

100 dB ± 60 kc/s ± 3 kc/s

Should the figures obtained vary greatly from those given above first recheck the alignment of transformers T105, T107 as described in the section 2nd I.F. amplifier and if the response is still unsatisfactory communicate with TCA in the nearest capital city.

7.0 TYPICAL METERING

Metering Points are provided where required throughout the receiver, and extended via the small paxolin terminal board (card E) mounted on one side of the receiver to the metering socket. The points metered are, oscillator grid, second multiplier grid, first limiter, and discriminator.

For more thorough maintenance purposes two additional points are available which are not extended to the metering socket. These are, first mixer grid (connect meter across R110) and second limiter grid available on the metering tag board in the receiver.

Current	Circuit	Metering Plug Connections	1674/26 Test set switch position.	Input Signal
15 uA	Crystal osc.	9 - 1	9	0
25 uA	Multiplier	10 - 1	10	0
30 uA 55 uA	Limiter	11 - 1	11	(0 ($\frac{1}{2}$ uV
35	Discriminator	12 - 1	12	f_o + 15 kc/s
35	Discriminator reverse reading	1 - 12	1	f_o - 15 kc/s

8.0 CIRCUIT GAIN FIGURES

The stage gain figures listed in the following table are not true gain figures, because of the loading on the signal generator by tuned circuits connected to various pins, but indicate, with a minimum of trouble, the input required at the particular point to give a certain output at nominated metering points.

Valve or Circuit ref. Pin number.	Freq.	Input level & condition.	1st Limiter grid current	Remarks
Card C Term. 1/Earth	1000 c/s	1 volt	-	Produces 1 volt across L.S. voice coil. Card C term 4/earth
V105 Pin 2/Earth	2.0 mc/s mod. 10 kc/s 1000 c/s	100 uV	-	Produces 1 volt discriminator output. Card C term 1/Earth Measure with V.T.V.M.

Valve or Circuit ref. Pin number.	Freq.	Input level & condition.	1st Limiter grid current	Remarks
T105 Pin 6/Earth	2.0 mc/s unmod.	140/200 mv	5 uA	
V107 Pin 1/Earth	2.0 mc/s unmod.	14/16 mv	25 uA	
V106 Pin 1/Earth	2.0 mc/s unmod.	600/900 uV	25 uA	
V105 Pin 2/Earth ¤	2.0 mc/s unmod.	200/350 uV	25 uA	
V105 Pin 2/Earth	20/27 mc/s	280/450 uV	25 uA	
V104 Pin 1/Earth	20/27 mc/s	20/55 uV	25 uA	
V103 Pin 1/Earth	20/27 mc/s	7/25 uV	25 uA	
V101	signal	1.25/1.5 uV Band D 4.0 uV	25 uA	With T101 disconnected

¤ Lead between V105 and T104/4 disconnected.

9.0 VOLTAGE ANALYSIS

Valve No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101		1.6 2.3	0	6.3	112 138	95 112	1.6 2.3	-	-
V102	142 165		0	12.6	0	137 162		0	6.3
V103			6.3	0	A-C D 93 80 105 97	A-C D 18 85 21 101			
V104		1.2 1.6	6.3	0	105 125	68 80	1.2 1.6		
V105	47 60	0	1.6 2.2	6.3	12.6		140 170	A-C D 85 70 92 81	
V106		1.8	6.3	0	112	95	1.8		
V107		1.8 2.3	6.3	0	112 132	95 112	1.8		
V108		1.8 2.1	6.3	0	112 135	95 114	1.8		
V109		7.6 9.5	12.6	6.3	142 171	150 180			
V110			0	6.3	50 55	50 55			

Valve No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V111		1.4 1.7	12.6	6.3	112 135	55 65			
V112	27 x 30	-	-	6.3	12.6 x	35 x 52	Squelch Control	Fully clockwise	
V113			6.3	0	15 16	56 70			
V114			12.6	6.3					

Note: The upper set of figures are obtained with 150V H.T. and the lower set with 180V H.T. Letters above some figures refer to voltage variations in the models A, C or D.

CONDITIONS OF TEST

H.T. 150V - 50-56 mA (Mute ON) 73-77 mA (Mute OFF)
or 180V - 62-67 mA (Mute ON) 88-95 mA (Mute OFF)

L.T. 12.6V at 1.6 Amps.

No signal Input

Volume control fully clockwise

Squelch control fully anticlockwise

Squelch control fully clockwise

Volts measured A.V.O. Model 8 Cathode Bias 10V D.C. range
Others 250V D.C. range

Crystal Current 4 uA min.

Multiplier 25 uA min.

Mixer grid 3.0 uA

FM1674 Series of V.H.F. Radio Telephone Equipment.

TRANSMITTERS TYPE /300 - /375 AND ALL SUB UNITS.

DETAILED DESCRIPTION.

1.0 GENERAL

The FM1674 series of V.H.F. Transmitters are designed to fulfil all requirements for equipments, both base and vehicular, from a 7.5 Watt mobile to 75 Watt base station, in the frequency bands 70-85 mc/s (FM1674A) 156-174 mc/s (FM1674C) and 44-49 mc/s (FM1674D).

All of the 1674 series of equipment, base and vehicular, are derived from a basic Driver-Modulator chassis (FM1674/200) - which contains the audio circuits, crystal oscillator, phase modulator and limiter circuits, frequency multiplier chain and driver stage. With this basic unit, various RF power outputs 7.5, 10, 15, 25 and 50 Watts can be obtained by the addition of the appropriate small power amplifier sub assembly, which screws in to a receptacle in the basic chassis, and the use of an appropriate power supply.

A separate power amplifier chassis (FM1674/375) is used, with a 7.5 Watt unit, as the driver, to extend the R.F. output to 75 Watts.

1.1 Combination of Units for complete Transmitters

The units required for operation at various R.F. power output levels are listed below. Additional type numbers have been given to each complete chassis as listed under "Combined type numbers".

Nominal Power Output	Type of Service	FM1674 A, C or D Units					Combined Type No. FM1674A, C or D
		/200 Driver	P.A. Sub-Units Addtl. Units /425	/450	/475	/600 P.A. Chassis	
7.5W	Mobile	1	1				/300
10-25W	Mobile	1		1			/325
50W	Mobile	1			1		/350
50W	Base ¤	1			1		/350
75W	Base ¤	1	1				/300
					1	1	/375

¤ When the Base Station Unit is used with Remote Control Installation, the R.F. Monitor Unit (FM1674/650) is supplied as an optional extra.

The type of Power Supply required is listed in the Section of the handbook devoted to the Power Supply.

1.2 Brief Description of Sub Units

(a) FM1674A-C-D/200 - Driver/Modulator

This unit provides a phase modulated R.F. signal at output frequency and of sufficient power level to drive any of the FM1674 series of power amplifiers. It contains the complete modulator section with the frequency multiplier chain necessary to give a multiplication of 36 times from

crystal to output frequency. The unit forms the basic chassis for the 7.5 watt, 10 watt, 15 watt, 20/25 watt and 50 watt transmitters, and when fitted with one of the power amplifiers the combination becomes a complete transmitter.

The Components in the driver/modulator circuits occupy about half of this chassis. The remainder is taken up by a rectangular cut-out designed to receive one of the power amplifier sub units.

Dimensions of this unit with any one of the PA sub units fitted are :

(Not exceeding)

Length 11-5/8" Width 3-3/4" Height Overall 5"

Chassis depth 1-3/4"

(b) Power Amplifier Sub-Units

These units (together with the type of power supply used) determine the power output of the FM1674 transmitter equipment in which it operates.

Three different types of P.A. sub unit cover output requirements from 7.5 to 75 watts.

Type numbers are:

FM1674A-C-D/425 for 7.5 watts - using QQE03/12 Tube.

FM1674A-C-D/450 for 10 to 25 watts - using QQE03/20 Tube. Variation in power output obtained with change of Power Supply.

FM1674A-C-D/475 for 50 to 75 watts - using QQE06/40 Tube.

All P.A. Sub-units are built on a rectangular plate which mounts on to either the FM1674A-C-D/200 drive chassis in the case of 7.5W, 10W, 15W, 20/25W transmitters or the FM1674/600 P.A. chassis in the case of the 75W P.A.

1.3 Additional Units

(a) Power Amplifier Chassis FM1674/600

This unit provides a mounting chassis for the type FM1674A-C-D/475 P.A. Sub-unit when it is required to operate at an output of 75 watts. The combination then forms a complete 75 watt Power Amplifier (type FM1674/375) requiring a 7.5 watt transmitter as driver.

This unit is of the same basic chassis size as the FM1674A-C-D/200, with extensions to height and shielding. As in the driver-mod. chassis, it contains a rectangular cut out to receive the P.A. sub-unit type FM1674A-C-D/475.

Dimensions of this unit with the P.A. sub-unit fixed are:-

(Not exceeding)

Length 11-5/8" Width 3-3/4" Height Overall 5-7/8"

Chassis depth 1-3/4".

(b) R.F. Monitor Probe FM1674A-C-D/650

This unit is intended for use with remote base stations to provide an indication of the presence of an R.F. signal at the output of the power amplifier. Sufficient output is provided to operate a relay connected into an indicating device. The monitor probe is designed so that it may be attached to the bottom of either the FM1674A-C-D/475 or the FM1674A-C-D/450 sub-units with no modification to these units. When in position it projects below the chassis, increasing the depth below chassis and the overall height of the assembly by not more than 3-1/4".

(c) Crystal Switching Box FM1674/46

All FM1674A-C-D/200 units are wired to accept a crystal switching box in place of the normal single crystal. This allows remotely controlled relay switching of the transmitter to one or two additional crystal frequencies adjacent to the normal frequency.

1.4 Interconnection of Units

Interconnection of the units to form complete transmitters involves supply, metering and radio frequency circuits.

In the 7.5W, 10W, 15W, 20/25W and 50W transmitters the P.A. sub-unit is linked into the supply and metering circuits of the FM1674A-C-D/200 driver chassis at the terminal boards adjacent to the cut out for the P.A. sub-unit, with additional connections for the R.F. input and output of the P.A.

For the 50 watt transmitter, the addition of the R.F. Monitor Probe involves connecting this unit to the driver supply terminal strip.

The 75 watt power amplifier connections from the P.A. sub-unit to the Power Amplifier Chassis FM1674/600 are similar to those for the installation of P.A. sub-units in the FM1674A-C-D/200 chassis. In this case, the R.F. Monitor Probe is connected to the Power Amplifier Chassis supply terminals.

2.0 SPECIFICATIONS

2.1 Type FM1674A-C-D/200

This unit is common to all complete transmitters. Specifications relating to modulation apply to all equipments. Frequency range -

FM1674A/200 - frequencies in the range 70-85 mc/s
FM1674C/200 - frequencies in the range 156-174 mc/s
FM1674D/200 - frequencies in the range 44-49 mc/s

Power output 7.5, 10, 15, 20/25, 50 and 75 watts depending on P.A. unit used.

Note : FM1674D type is not made for 7.5 watt output.

Total Frequency Multiplication - 36 times.

Modulation Phase

Deviation sensitivity
Deviation 10 kc/s for 10 mV ± 3 dB audio input at 400 cps.

Distortion - Less than 5% with 10 kc/s deviation 400 c/s.

Frequency response - ± 2 dB from pure phase 300-3000 c/s.

Crystal frequencies FM1674A/200 1.94 - 2.36 mc/s approx.
FM1674C/200 4.33 - 4.83 mc/s approx.
FM1674D/200 1.22 - 1.36 mc/s approx.

Crystal tolerance 50 x 10 - 6 (.005%)

Output Impedance 50 or 70 ohms

Harmonic radiation - 60 dB

Spurious radiation - 80 dB

Supply Requirements -

Heaters - 6.3V at 2 amps.
12.6V at 1 amp.

High Tension - 250V at 60 mA
300V at 70 mA

Valve Complement -

Circuit reference number	Type	Function
V201 (a)	½ 12AT7	Crystal oscillator
V201 (b)	½ 12AT7	Phase modulator
V202 (a)	½ 12AT7	Frequency tripler
V202 (b)	½ 12AT7	Frequency tripler
V203 first section	QQE03/12	Frequency doubler
V203 second section	QQE03/12	Frequency doubler
V204 (a)	½ 12AT7	1st Audio amplifier
V204 (b)	½ 12AT7	2nd Audio amplifier
V205 (a)	½ 12AT7	Cathode follower
V205 (b)	½ 12AT7	Audio output stage

POWER AMPLIFIER SUB-UNITS

2.2 Type FM1674A-C/425

Note : A 7.5 watt Power Amplifier unit is not made for D Band.

Nominal Power Output 7.5 watts.

Supply Requirements -

Heaters - 6.3V at 0.8 amps.
12.6V at 0.4 amps.

High Tension - 300V at 80 mA

Bias - 22V

Tube Type - QQE03/12

Driver - FM1674A-C/200

2.3 Type FM1674A-C-D/450

Nominal Power Output - FM1674A/450 10 or 25 watts
FM1674C/450 10 or 20 watts
FM1674D/450 10 or 25 watts
Output depending on Power Supply.

Supply Requirements -

Heaters - 6.3V at 1.3 amps.
12.6V at 0.65 amps.

	10 watt output	20/25 watt output
High Tension -	300V at 70 mA	500V at 90 mA 250V at 5 mA
Bias -	22V	- 22V

Tube Type - QQE03/20

Driver - FM1674A-C-D/200

2.4 Type FM1674A-C-D/475

Nominal Power Output 50 or 75 watts (depending on power supply and driver).

	50 watt output	75 watt output
Supply Requirements -		
Heaters	6.3V at 1.8 amps 12.6V at 0.9 amps	6.3V at 1.8 amps 12.6V at 0.9 amps
High Tension	600V at 150 mA 250V at 10 mA	650V at 180 mA 250V at 10 mA
Bias	- 30 volts	- 50 volts
Tube Type -	QQE06/40	
Driver -	FM1674A-C-D/200	FM1674A-C-D/300

2.5 R.F. Monitor Probe FM1674A-C-D/650

D.C. output current - Carrier on 8-10 mA
Carrier off 1-2 mA

Supply Requirements -

Heaters - 6.3V at 0.3 amps.
12.6V at 1.15 amps.

High Tension - 250V at 15 mA

Tube Type 12AT7

3.0 CIRCUIT DESCRIPTION

3.1 GENERAL

The 1674A-C-D/200 driver chassis is the basic transmitter unit and comprises the R.F. generation and frequency multiplication stages, and produces an output suitable for driving the range of FM1674A-C-D power amplifier assemblies up to 50 watt rating.

The chassis also contains the necessary audio amplifier for raising the microphone output level up to the level required to operate the phase modulator.

An instantaneous action limiter is also included in the audio chain to prevent overmodulation, which might cause interference to systems operating on adjacent channels.

Several power amplifier units may be fitted to the basio driver chassis and enable transmitters of power rating ranging from 7.5 watts to 50 watts to be built up for mobile use and up to 75 watts for base station use.

3.2 DRIVER - MODULATOR - FM1674/200

3.2.1 Valve types and Functions

The valves used in the basic driver chassis together with their functions are shown in the table.

Components	Description	Frequency	Function
V201 (a)	½ 12AT7 - Triode	Xtal frequency -f	Xtal oscillator
V201 (b)	½ 12AT7 - Triode	f	Phase modulator
T201	R.F.Transformer - double permeability tuned	f	Couples output of phase mod.V201(b) to input of V202(a).
V202 (a)	½ 12AT7 - Triode	Input - f Output - 3f	Tripler
T202	R.F. Transformer - double permeability tuned	3f	Couples V202(a) output to input of V202(b)
V202 (b)	½ 12AT7 - Triode	Input - 3f Output - 9f	Tripler
T203	R.F. Transformer - double permeability tuned	9f	Couples V202(b) output to V203(a) input
V203 (a)	½ QQE03/12 - Tetrode	Input - 9f Output - 18f	Doubler
L201	R.F. Coil - permeability tuned. (Dust core 70-85 mc/s Copper core 156-170 mc/s)	18f	Single tuned coupling circuit V202(b) output to V203(a) input
V203 (b)	½ QQE03/12 - Tetrode	Input - 18f Output - 36f	Doubler
L203 C238	R.F. Coil - self supporting) Variable trimmer)	36f	Tank Circuit for final doubler V203(b)

Total Multiplication - 36 times.

3.2.2 Crystal Oscillator - Phase Modulator

The transmitter is crystal controlled, and the crystal is connected to Valve V201(a) in a conventional Pierce oscillator circuit, in which R202 forms the anode load. C203 is a blocking capacitor to isolate the D.C. H.T. supply from the crystal, and C201 is a fine frequency adjusting trimmer. The second half of V201, i.e. V201(b), is the phase modulator in which the R.F. from the crystal oscillator is applied to the grid through C205 and the audio modulating frequency is applied through the feed resistor R203.

The modulator operates with a high cathode bias resistor and depends for its action on the grid/anode capacity of the valve, and the variation in mutual conductance as the grid is varied at an audio rate by the modulating signal. Comparatively large phase shifts are possible with low distortion with such a circuit and reduces the number of multiplying stages required with resultant simplification.

3.2.3 Frequency Multipliers

The output of the phase modulator is coupled to the grid of the 12AT7 first multiplier valve V202(a) through a double tuned circuit transformer T201. The anode circuit of V202(a) is tuned to the third harmonic of the input signal and this component is applied to the grid of the 12AT7 second multiplier valve V202(b) through double tuned circuit transformer T202.

The anode circuit of V202(b) is again tuned to the third harmonic of the grid input signal and this component is applied to the grid of the QQE03/12 third multiplier stage V203(a) through the double tuned circuit transformer T203.

The QQE03/12 is a double tetrode valve in which the screen is common to both sections. The influence of the operating conditions of the first section of the valve on the second section of the valve due to the screen grid being series fed is minimised by careful choice of the screen feed resistor R233.

The anode of the first section of V203(a) is coupled to the grid of the second section through the anode circuit L201, C235 which is tuned to the second harmonic of the grid input signal, and grid condenser C234.

The output of the second section of the QQE03/12, V203(b) is applied to the tuned circuit L203, C238 which is also tuned to the second harmonic of the grid input signal and sufficient power is developed in this circuit to drive any of the FM1674 P.A. assemblies.

All stages in the R.F. exciter operate from either grid leak bias or a combination of grid leak bias and cathode bias, and in the event of R.F. drive failure all tubes are held within rated dissipation.

Metering points are brought out for measuring the grid current to valves V202(a), V202(b), V203(a) and V203(b).

3.2.4 Audio Amplifiers

The audio input to the transmitters is obtained from the microphone and fed to the grid of the 12AT7 first audio amplifier V204(a), through the R.F. filter C232, R234, C228.

The valve operates with an unbypassed cathode resistor R230 and is resistance capacity coupled to the grid of the 12AT7 second audio amplifier V204(b). This valve also operates with an unbypassed cathode resistor R226 and has a resistive anode load R225.

The second audio amplifier V204(b) is followed by a cathode follower valve V205(a) which is direct coupled to the driving valve anode V204(b) through the grid leak R223. The grid of V205(a) being connected to a positive source (the anode of V204(b)) will draw grid current which produces a small voltage drop across the high value grid leak and the cathode will assume a potential slightly higher than the positive potential on the grid and always keeps the valve in a correct operating condition.

3.2.5 Audio Limiter

A cathode follower is necessary to provide a low impedance driving source for the limiter comprising rectifiers W201, W202 and associated components.

This circuit prevents the audio voltage from rising or falling more sharply than a slope determined by the maximum rate at which C114 can charge and discharge.

During limiting when the audio waveform exceeds the predetermined rate the input audio voltage is prevented from appearing at the grid of the output valve by the action of the rectifiers W201, W202.

The potentiometer R215 serves to adjust the point at which the limiting occurs.

Once the limiting point has been passed, the voltage appearing across the output of the limiter circuit R212 cannot rise irrespective of the amplitude of the input waveform. although with heavy limiting the output waveform is distorted.

The amplification of the first and second amplifiers V204(a) and V204(b) has been designed so that when used in conjunction with the TCA moving iron microphone, normal speech with the microphone held about 2 inches from the mouth results in peak clipping only with resulting negligible distortion.

The output of the limiter section is fed to the grid of the 12AT7 output valve V205(b) which is resistance capacity coupled into the grid of the phase modulator through the filter network R204, C206 and feed resistor R203.

All stages of the audio amplifier/limiter chain are decoupled from the H.T. bias by means of filter network R210 C212.

3.3 Power Amplifiers

The three power amplifier sub assemblies are similar, the major change being in the different output valve used to obtain the different power outputs.

The FM1674A-C/425 amplifier gives an output of 7.5 watts and uses a QQE03/12 valve.

The FM1674A-C-D/450 amplifier gives an output of 10 or 20/25 watts depending on the power supply used and uses a QQE03/20 valve.

The FM1674A-C-D/475 amplifier gives an output of 50 or 75 watts depending on the driving power available and the power supply used, and uses a QQE06/40 valve.

All valves used in the power amplifiers are V.H.F. double tetrodes and require no external neutralising. The circuit design is such that the amplifiers are completely stable and show no signs of oscillation at fundamental or parasitic frequencies.

All amplifiers are connected to operate in push-pull and have a normal push pull grid circuit tuned by a split stator variable capacitor.

Power from the driver is coupled into the amplifier grid circuit by straight inductive coupling in the case of the FM1674/425 7.5 watt amplifier. That is, the grid coil L426 is coupled directly into the driver anode coil L203.

In the case of the FM1674A-C-D/450 10 watt or 20/25 watt amplifier, mechanical requirements have made it necessary to use link coupling between the grid coil of the amplifier L453 and the driver anode coil L203. The link is shown as L452 coupling into grid coil L453, and L451 which couples into the driver anode coil L203. The

link is tuned by means of capacitor C451, to increase the transfer of power from the driver anode circuit to the grid circuit.

The FM1674A-C-D/475 50 watt or 75 watt amplifier, when used in a 50 watt mobile execution, power is transferred from the driver anode to the grid circuit by means of a link as detailed in the paragraphs dealing with the FM1674A-C-D/450 amplifier. When the FM1674A-C-D/475 amplifier is used in a base station to provide an output of 75 watts, the exciter becomes FM1674A-C-D/300 which is the complete 7½ watt transmitter chassis and the driving power is taken from the anode circuit L427 via a coaxial link circuit to the grid of the amplifier valve.

All anode circuits are tuned by means of split stator capacitors, and output power is taken from the coupling loop which is indirectly coupled into the anode circuit.

Bias for the power amplifiers is obtained from a combination of grid leak and fixed bias, the amount of fixed bias being sufficient to maintain the anode dissipation of the valve within safe limits in the event of drive failure.

3.4 R.F. Monitor Probe - FM1674A-C-D/650

The R.F. monitor probe type FM1674A-C-D/650 is an accessory for attaching to a Remote base station transmitter so that an indication that the transmitter is generating R.F. power may be signalled to a TCA 1645/41.3 remote control console.

The unit consists of a single 12AT7 double triode valve connected so that the first section functions as diode detector and the D.C. potential developed across the diode load is coupled to the second triode section which functions as a relay operating valve.

The relay referred to above is not contained in the monitor probe assembly but on the remote control panel of the transmitter and the signalling to the remote control console referred to above is carried out from this panel.

Refer to circuit diagram SPA.7046. The R.F. signal input reaches the monitor via a pick up probe which is capacitively coupled to the P.A. sub-unit antenna feeder connection. The R.F. signal appears across the circuit L651 C651 tuned to signal frequency and the diode V651(a) rectifies this voltage, providing, across R651, a positive output voltage. This positive voltage is applied to the grid of V651(b) and overcomes the cathode bias on this section causing it to draw plate current, which is sufficient to operate a relay in the indicating device used.

In the absence of a signal, plate current in V651(b) is biased off by the network R654/R654/R655 and the indicating relay is de-activated.

By adjustment of the coupling (i.e. spacing) between the R.F. Pick-up probe and the P.A. antenna feed, the relay may be made to fall out at whatever output power is decided on as the level at which a failure indication is required.

Resistor R652 is filtered to prevent high grid currents in V651(b) if the input signal seems large. Condensers C652, 653, 654 are R.F. bypasses. Resistors R656, 657 limit tube plate currents to that required to operate the indicating relay.

The test points 1 and 2 are provided to check operation of the unit when it is in position, since components inside the chassis are not accessible.

The location of the test points is :

Test Point (1) (Plate) - furthest from supply lead entry to chassis.

Test Point (2) (H.T.) - adjacent to supply lead entry.

4.0 ALIGNMENT AND TESTING

4.1 Test Equipment Required

Suitable types of test equipment are listed but any test equipment having similar characteristics may be used.

(a) TCA 1674/26 Test box with connecting cable.

(b) Model 8 A.V.O. Multimeter.

(c) R.F. Power meter. Marconi TF1152 for FM1674/7.5 and FM1674/10 Marconi TF1020A for FM1674/25, FM1674/50, FM1674/75.

(d) Modulation Monitor A.W.A. type.

(e) Audio frequency generator, Philips GM2307.

(f) Noise and distortion meter A.W.A. type A51932.

4.2 Driver-Modulator Stage FM1674/200

Connect the 1674/26 test box to the 12 point metering socket provided on the mobile transmitter/receiver unit (for Base Stations use the metering facilities). Plug in the correct crystal and connect the R.F. power meter to the antenna socket with a short coaxial cable, and switch the equipment on.

Set the 1674/26 test box selector switch to position 2 which meters the grid current of the first tripler V202(a).

Tune the secondary of T201 (top core) until a deflection is noted on the meter. Tune for maximum deflection and then tune the primary of T201 (bottom core) for maximum grid current. Return to the secondary tuning adjustment and trim for maximum current.

Set the 1674/26 test box switch to position 3 which meters the grid circuit of the second tripler V202(b). Tune the secondary of T202 (top core) until a deflection is noted on the meter. Tune for maximum and then tune the primary of T202 (bottom core) for maximum meter indication.

Return to the secondary tuning core and retrim to obtain maximum grid current.

Set the 1674/26 test box switch to position 4 which meters the grid current of the first doubler V203(a).

Tune the secondary of T203 (top core) until a deflection is obtained on the meter. Tune for maximum. Tune the primary of T203 (bottom core) for maximum grid current and then retrim the secondary to obtain maximum.

Set the 1674/26 test box switch to position 5 which meters the grid current of the second doubler V203(b). Tune the anode circuit L201 for maximum indication on the meter. This is a single tuned circuit and only one core has to be adjusted.

The anode circuit of the second doubler V203(b) is adjusted roughly by leaving the test box switch in position 5 and rotating

the anode tuning capacitor C238. As the anode circuit is tuned through resonance the grid current meter will give a distinct kick downward. Tune carefully for minimum grid current.

4.3 Power Amplifier Stages

For each frequency range there are three types of P.A. sub-units:

FM1674A or C/425	Using QQE03/12 nominal output 7.5W
FM1674A or C-D/450	Using QQE03/20 nominal output 10,15,20/25W
FM1674A or C-D/475	Using QQE06/40 nominal output 50, 75W

All valves are self-neutralized twin tetrodes, operating in class "C" push pull circuits as amplifiers at signal frequency.

It is assumed that alignment of stages prior to the power amplifier has been completed.

Transmitter output should be connected to a 70-75 ohm R.F. Power indicator or to the antenna with a field strength monitor used to indicate maximum radiated power.

Metering positions are:-

for FM1674A-C-D/425 - 7.5 watt)	Grid current 1674/26 test box
)	switch pos. 6.
FM1674A-C-D/450 - 10-25 watt)	0-5 mA
)	
FM1674A-C-D/475 - 50 watt)	Cathode current 1674/26 test box switch pos. 7.
	0-100 mA /425
	0-200 mA /450
	0-200 mA /475

Since some tuning condenser rotors are not earthed, it will be found more convenient to use an alignment tool having a plastic handle, etc., to avoid hand capacity effects.

4.3.1 FM1674A-C/425 (7.5 Watts Output)

Using QQE03/12.

(a) Tune P.A. grid (C426) then peak driver anode circuit (C238) for maximum P.A. grid current switch position 6.

(b) Tune P.A. plate C431 for maximum power output.

(c) Check tuning of C238, C426.

(d) Adjust coupling of L428 to L427 for maximum power output, tuning C431 after each adjustment of coupling.

(e) When maximum power output is obtained, note cathode current (switch pos. 7) and if this is not approximately correct (see below), adjust grid drive (by varying coupling between L426 and L203, this is done by moving L426 relative to L203) and re-adjust load coupling (L428 to L427) for maximum power. (See (4) above).

Approximate figures for this P.A. sub-unit are:-

Type No.	Grid Current Meter reading	Cathode current Meter reading	Power Output Nominal
FM1674/425	60	70	7.5 watts

4.3.2 FM1674A-C/450 (10-25 watts output)

Using QQE03/20

(a) Set the test box switch to position 6 and tune the grid condenser C453 for maximum grid current. The grid current may not be the maximum obtainable, but immediately proceed with adjustment (b) to prevent overloading of the amplifier valve.

(b) Switch the test box to position 7 and tune the anode circuit capacitor C455 for minimum cathode current.

(c) Return the test box switch to position 6 and adjust the link tuning and grid capacitor C453 to obtain the optimum grid and then repeat (b) and note the output as measured by the R.F. power indicator.

Approximate figures for these P.A. sub-units are:-

Type No.	Grid Current Meter Reading	Cathode Current Meter Reading	Power Output Nominal
FM1674A/450) FM1674C/450) FM1674D/450)	50 uA	40 uA	10 watts
FM1674A/450) FM1674C/450) FM1674D/450)	50 uA	45 uA	25 watts 20 watts 25 watts

4.3.3 FM1674A-C/475

Using QQE06/40.

(a) 50 watt Transmitters

Proceed as for FM1674A-C/450.

(b) 75 watt Transmitters

Before adjusting the P.A., check that the driver chassis 7.5 watt Transmitter is completely tuned up including the plate circuit of the 7.5 watt P.A.

Back off coupling from driver plate coil to driver output link (L427 to L428) and set link tuning condenser (C601) to min. capacity.

Meter 75 watt P.A. cathode current.

Back off coupling of P.A. Load Link L480 to P.A. plate coil L479. Adjust P.A. grid tuning condenser C478 to give peak grid current reading and tune P.A. plate (C480) for dip in cathode current.

Increase link coupling (C601) and anode coupling link (L480) in gradual steps, retuning driver (C431); grid (C478) and anode (C480) until correct operating conditions are reached.

Approximate figures for these P.A. sub-units are:-

Type No.	Grid Current	Cathode Current	Power Output Nominal
FM1674/475	30 - 40 uA	80 uA	50 watts
FM1674/475	30 - 40 uA	95 uA	75 watts

4.4 R.F. Monitor Probe FM1674/650

Refer SPA.2046, also -

for 50 watt Base Station - refer SPD.782/783

for 75 watt Base Station - refer SPB.3231.

Tuning, etc.

With connections as above, delivering full power, and relay connected into external circuits proceed as follows:-

Bring R.F. pick up probe to within about 3/8" of the P.A. antenna load coupling link termination (L480 on the FM1674A-C-D/475 sub-unit). Connect a voltmeter (0-250V) from test point 1 to test point 2 (test point 2 positive). Tune the condenser C651 for a maximum indication on the voltmeter. Then adjust the position of the R.F. pick up probe to give a meter reading of approximately 150 volts, retuning C651 if necessary. The monitor probe should hold the relay in.

5.0 MEASUREMENT OF PERFORMANCE

5.1 Modulation Measurements

For these checks, the microphone leads are disconnected from the microphone input terminals (Strip "H" lugs 18, 19) and audio signal generator leads connected in their place (earth to 18). It may be necessary to use a simple resistance attenuator between the signal generator and the modulator to give the required input of about 10 millivolts. With an audio oscillator having a 600 Ω output a voltage divider of 600 Ω plus 6 Ω will provide approximately the required output when the output of the audio generator is 1 volt.

The modulation monitor should be provided with a coaxial input lead from a 1 or 2 turn pick up loop. The pick up loop may be coupled to the P.A. tank circuit or, IF THE P.A. IS NOT IN OPERATION to the driver tank circuit L203/C238.

The output of the monitor should be displayed on a C.R.O. and, if desired, also on a Distortion and Noise meter. If a distortion and noise meter is not used (which will normally be the case) an audio voltmeter should be connected across the output of the monitor, for use in frequency response checks.

All modulation checks listed below are carried out with the R.F. section operating.

Before commencing checks, set C201 to about 1/3 full capacity, and set the limiter control R215 fully clockwise. (Maximum voltage).

Tune the Monitor to correct frequency and input and set for Phase Modulation.

5.2 Distortion and Sensitivity

Set audio frequency to 400 c.p.s. and adjust the audio input to give 10 kc/s deviation.

Check that C.R.O. display is smooth, approximately of sine-wave form, or that Distortion and Noise is less than 5%.

Input to the microphone terminals of the modulator should be 10 millivolts ± 3 dB (i.e. 7 to 14 m.v.) i.e. 0.7 to 1.4 volts at the audio oscillator output terminals, using the voltage divider detailed above.

5.3 Frequency Response

(This check must be carried out at a low audio level to avoid limiting as this will produce an apparent increase in noise level).

Set audio frequency to 3000 cps and adjust input for deviation not exceeding 10 kc/s.

At this same input level, reset frequency to 1000 cps and note the monitor audio output voltage V1.

Then with the audio input voltage maintained at this level the monitor output for modulation frequencies of 300 cps and 3000 cps should not be less than .7 x V1 (i.e. -3 dB).

Alternatively, if no Audio voltmeter is available to measure monitor output, the ratio $\frac{\text{(Deviation in Kc/s)}}{\text{(Modulating Frequency in Kc/s)}}$ at 300 cps and 3000 cps modulation should be not less than 70% of the same ratio at 1000 cps modulation, under the same conditions as above.

5.4 Noise Level

Set audio input frequency to 400 cps and adjust input level to give 10 kc/s deviation.

Note output level of modulation monitor.

Remove modulation and short circuit microphone input terminals and read monitor output level. This level should not exceed 1% of the modulation level. Due allowance must be made for noise inherent in the monitor.

5.5 Limiter Setting

(a) Using Audio Generator

Set audio input frequency to 1000 cps and adjust input level for 15 to 20 kc/s deviation.

Increase input by at least a factor of 2 when deviation will rise.

Adjust the limiter control R215 (turning in anticlockwise direction towards zero voltage) until deviation falls to 17 kc/s.

Maintain the same input voltage and vary frequency from 300 to 3000 cps. Deviation should not exceed 17 kc/s at any modulation frequency. If it does, adjust the limiter further to give an absolute limit of 17 kc/s.

Setting of the limiter should not change the distortion figures obtained for 400 cps, provided the frequency response is correct.

(b) Using Microphone

If it is not convenient to use an audio signal generator, the microphone may be left connected and a tone input provided by whistling into the microphone. Sufficient level should be provided to deviate well over 17 kc/s with the limiter open. The limiter should then be set to hold deviation at 17 kc/s. A check at high speech levels should then be made and any necessary re-adjustment done.

6.0 VOLTAGE ANALYSIS

FM1674A-C-D/200 Exciter

Tube	H.T. Supply Voltage	Plate	Grid(Bias)	Cathode	Screen Grid
V201 (a)	250	50		0	-
(Xtal Osc.)	300	70		0	-
V201 (b)	250	240	Grid leak	11.5	-
(Phase Mod.)	300	285	bias only on	14.0	-
			these stages.		
V202 (a)	250	245	Not normally	1.9	-
(Tripler 1)	300	295	measured.	2.5	-
V202 (b)	250	245		1.7	-
(Tripler 2)	300	292		2.2	-
V203 (a)	250	293		0	90
(Doubler 1)	300	295		0	100
V203 (b)	250	250		0	90
(Doubler 2)	300	300		0	100
V204 (a)	250	150		2.15	
(Pre-amp.)	300	180		3.0	
V204 (b)	250	90		1.6	1.6
(Audio)	300	108		2.0	2.0
V205 (a)	250	210	+90	92	
(Cath.Follower)	300	250	+108	110	
V205 (b)	250	170	0	2.9	
(Output)	300	200	0	3.5	
Power Amplifier Assemblies					
V426	300	300	-22		178
V451 10W	300	300	-22		235
V451	500	500	-22		250
20/25W	& 250				
V476	600	600	-30		250
50W	& 250				
V476	650	650	-50		250
75W	& 250				

All measurements made using Model 8 A.V.O. The 1674A-C-D/200 exciter/modulator may be supplied with either 250V or 300V and both conditions are given in the table. The voltages given may vary ± 10% of the values given.

The voltages recorded above were obtained with a heater voltage of either 6.3V or 12.6V, and further deviations from the figures quoted are possible at other heater voltages.

FM1674 Series of V.H.F. Radio Telephone Equipment.

DC/DC CONVERTER FM1674/500, FM1674/520 AND FM1674/540

FOR 6/12 OR 12 VOLT OPERATION MOBILE OR 12 VOLT BASE STATION.

1.0 GENERAL

The DC power supplies for the FM1674 series of equipment are transistorised DC/DC Converters, which obtain their primary power from a battery.

The DC/DC conversion process is established by the use of transistors with a saturable core transformer in a power oscillator circuit, from which the output A.C. is rectified and filtered.

The power packs are supplied as 6/12 volt units or 12 volt units only in two basic ranges. Transmitters of 7.5 to 15 watts output are powered by a single secondary voltage power pack whereas the 25 and 50 watt transmitters are powered by a double voltage pack. A feature of these supplies is their high efficiency - of the order of 80% under transmit or receive conditions.

2.0 DETAILED DESCRIPTION

2.1 General

Physically the supplies consist of a strip chassis on which is mounted four identical cans containing a transformer potted in silica loaded epicote resin, a pair of transistors sealed in transformer oil, a transmit/receive relay and a high tension rectifier - filter assembly. This combination forms a power oscillator, the output of which is rectified and filtered. To ensure optimum operating conditions on both transmit and receive, appropriate biasing resistors are mounted on a tag strip beneath the chassis and these resistors are switched into or out of circuit by the transmit/receive relay. This relay also selects the required voltage levels and incorporates make-before-break contacts which are necessary to suppress the switching transients during the changeover.

The rectifier-filter assembly for the bias supply is on a separate tag strip beneath the chassis.

Electrical access to the power supply is obtained by means of a cable form which terminates on the main tag-strip.

2.2 Theory of Operation

In principle the push-pull transistors are fed from a battery system and caused to oscillate by means of positive feedback.

The oscillations in the primary are transformed to the required output voltages as a rectangular waveform alternating current. Oscillation is achieved as follows. Each transistor receives a forward bias from the biasing circuit and the initial pulse caused by the application of the output voltage is sufficient to cause conduction in one transistor. (Normal assymetries in the active circuit elements dictates which transistor conducts initially).

The rise of collector current in the conducting transistor induces a voltage in the feedback winding which is of such a polarity that increasing collector current conduction occurs. Thus there is a regenerative switch-on of this transistor and the collector

current rises through the transformer primary to a level sufficient to cause saturation of the transformer core.

However, at core saturation the induced voltages collapse and the reversing field in the transformer induces regenerative switch-on of the other transistor. Hence the transistors alternate rapidly between the two conditions of full current conduction "ON" and no current conduction "OFF" and produce an output waveform which is rectangular with a fundamental frequency of approximately 800 cps for the /500 and /520 supplies and approximately 1200 cps for the /540 supplies. The rectified rectangular pulses have an average value equal to the peak value, which is also equal to the R.M.S. value.

The transmit/receive relay selects the required output voltages and the circuit biasing resistors appropriate to the output power.

The rectifier-filter system involves half wave rectification for the bias supply and voltage doublers for the H.T. supply. Operation of the latter is as follows.

Suppose the instantaneous polarities of the transformer windings are such that the junction of the two rectifiers W2 and W3 is positive. Current will flow through W2 and charge C5. When the polarity is reversed during the next half cycle of the oscillator the junction of C4 and C5 becomes positive, W3 conducts and C4 is charged. Since C5 and C4 are in series and the voltage developed across them is additive, the DC output voltage is twice the AC voltage developed across the winding.

Filtering is provided in the form of a ferroxcube pot core in the negative (earthed) lead of the output circuit, in conjunction with capacitor C6.

2.3 Overload Characteristics

The results of increasing load on this type of power oscillator are such that after exceeding maximum power output the oscillation level falls in amplitude and at the condition of short circuit on the output, the output voltage is zero, and the input current falls to a level of approximately 10-20% of normal full load input current.

This rapid fall of output voltage under overload conditions must be borne in mind during transmitter tuning. If a transmitter is seriously out of alignment it is possible that the power supply could become overloaded. If this condition is apparent a voltmeter should be placed across the main power supply output to complete the alignment.

3.0 TECHNICAL DESCRIPTION

All of the FM1674/500/520/540 series supplies are physically similar and circuity and component numbers are identical where there are corresponding components.

The following table lists the power supply types, rated output power and the transmitters they are used with.

Power Supply Type	FM1674/520/12 FM1674/520R/12 FM1674/520.2/12	FM1674/520/6 or 12 FM1674/520R/6 or 12 FM1674/520.2/6 or 12	FM1674/500/12 FM1674/500R/12 FM1674/500.2/12	FM1674/500/6 or 12 FM1674/500R/6 or 12 FM1674/500.2/6 or 12	FM1674/540/12 FM1674/540R/12 FM1674/540.2/12
Input Voltage	12	6 or 12	12	6 or 12	12
Rated Output Power D.C. (Transmit)	50 Watts	50 Watts	70 Watts	70 Watts	130 Watts
Output Voltage (Transmit)	300 or 330V	300V or 330V	250V and 500V	250V and 500V	300V and 600V
Output Current	140 mA	140 mA	65 mA 250V 90 mA 500V	65 mA 250V 90 mA 500V	75 mA (300V) 130 mA (600V)
Receiver Voltage	150V or 180V	150V or 180V	150V or 180V	150V or 180V	150V or 180V
Receiver Current	80 mA	80 mA	80 mA	80 mA	80 mA
Transmitter R.F. Power	7.5-10-15 Watts	7.5-10-15 Watts	25 Watts	25 Watts	50 Watts

4.0 MAINTENANCE

4.1 Service Hints

NOTE

It is most important that the correct polarity of input voltage is applied to the units.

Incoming leads from the battery system are terminated on binding posts 7 and 8 of the main tag strip (refer to the circuit diagrams for the positions).

The ACTIVE lead is connected to 7 and the EARTH lead to 8. Jumper leads are provided from terminals 21 and 20 and these MUST be connected to terminals 7 and 8 so that the RED lead on 21 goes to the POSITIVE side of the incoming supply.

4.2 Transistors

The transistor can is colour coded as follows:

EMITTER	RED
BASE	GREEN
COLLECTOR	BLACK

In the event of a suspected transistor failure as evidenced by the rupturing of the main fuse (transistor short-circuited) or very low output voltage under all conditions (one transistor open circuited) the following tests may be made.

Detach the main resistor card and lift it aside to expose the transistor can terminals. Remove the base and collector leads and test with an AVO 8 multimeter on the ± 100 ohm range.

(a) Place the positive meter lead (actually this is of negative potential due to the AVO 8 ohm-meter circuity) on the base of the transistor. A reading of about 5 Ω should be obtained to Collector or Emitter. If a transistor is open-circuited it will indicate a very high resistance.

(b) Reversing the meter leads should show approximate open circuit condition from base to collector or emitter.

(c) Check between collector and emitter - this should show resistance of the order of a few hundred ohms with either polarity applied.

If the transistor has fused it will indicate a short circuit between collector and emitter.

NOTE : Other multimeter types may be used but slight variations of the above results may be observed due to the different ohm-meter circuity.

The transistor assemblies are not easily reparable and should normally be returned to the Factory for service. (Turnover Repair Service £2.18. 0. per unit.)

4.3 Transistor Assembly Replacement

On the transformer, tracer colours are provided in the primary side and these must be observed if oscillation is to be secured. i.e. if TR1 has the BLUE 10/010 lead connected to the base then the collector must have the BLUE tracer Red (12V) or Green (6V) 40/0076 lead attached.

Similarly on TR2, for base lead YELLOW, the collector carries the colour code RED/YELLOW or GREEN/YELLOW depending upon whether 12V or 6V operation, respectively, is required.

4.4 Modification for 6 - 12V Operation

The units of the series FM1674/500/6 or 12 and FM1674/500R/6 or 12 and FM1674/520/6 or 12 and FM1674/520R/6 or 12 are all capable of operation on 6 or 12 volt inputs.

To effect the change from 6V to 12V operation the following steps must be taken.

(a) Release the main tag board screws to gain access to the transistor assembly terminals.

(b) Remove from the transistor terminals the Green/Blue and Green/Yellow 40/0076 leads.

(c) Release the Red/Yellow and Red/Blue 40/0076 leads from stowage terminals 1 and 27 (early type /500 and /520 supplies) or remove the insulation from the stowed leads (later type /500.2 and /520.2 supplies) and return these leads to the transistor terminals taking particular care to ensure that the RED/YELLOW lead is returned to the transistor with the YELLOW base lead.

(d) Return the RED/BLUE 40/0076 lead to the transistor with the BLUE base lead.

(e) Return the GREEN/YELLOW and GREEN/BLUE to the stowage arrangements provided initially for the RED/YELLOW and RED/BLUE leads.

(f) Replace resistors R_1 R_2 R_3 R_4 and fuse F1 (early type /500 and /520 series) and resistors R_1 R_2 R_3 R_4 R_8 (later type /500.2 and /520.2 supplies) as indicated in the appropriate Circuit Diagrams and Electrical Parts Lists.

(g) Replace the main tag board taking care not to pinch any section of the wiring between the underside of the tag board and the mounting pillar.

(h) For change-over from 12V to 6V output the above procedure would be reversed.

4.5 VOLTAGE ANALYSIS

All readings to tolerance of ± 10%
Model 8 AVO multimeter with an output voltage of 12.0 volts.

Metering Points on Main Tag Board	FM1674/500 series 6/12V or 12V only	FM1674/520 series 6/12V or 12V only	FM1674/540 series 12V only
Earth (terminals 8 or 15 or chassis) to			
9	140V AC	165V AC	0
11	125V AC	150V AC	150V AC
28	75V AC	75V AC	75V AC
30	90V AC	90V AC	90V AC
13	-30V DC	-30V DC	-30V DC
16	+150V DC	+150V DC	+150V DC
17	+250V DC	0	+300V DC
18	+250V DC	+300V DC	+300V DC
19	+500V DC	+300V DC	+600V DC

FM 1674 Series of V.H.F. Radio Telephone Equipment.

AC AND AC/DC POWER SUPPLIES 25F/50F LOCAL BASE.

The Power supplies used with the Local Base Stations can be listed as follows:-

(1) FM1674/79 An A.C. mains operated supply which is used for either the 25 watt or the 50 watt station, the necessary variations to suit the two stations being made by tappings on the power transformers.

1.1 Specifications of the Supply are -

Mains Volts	210 - 260V AC	
Mains frequency	50 cps.	
Mains Consumption		
For FM1674/25F. AC		app. 200 V.A.
For FM1674/50F. AC		app. 220 V.A.
H.T. Supply	Receive	180V 80 mA. DC
	Transmit	250 or 300 Volts 80 mA DC 550 or 650 Volts 180 mA DC.
Bias Volts -	28 Volts DC.	
Filament Volts	12V 4.5 Amp. AC.	
Relay Supply	12 Volts 300 mA DC.	

1.2 Circuit Description - see drawing SPP.3584.

There are two transformers in this supply which perform the following functions:

T2. Mirror High Tension supply through rectifier V2 (6M5) and a filter circuit C5 L1 C6. Tappings on this winding, and relay switching, change the 180 Volt receiver supply to either 250 or 350 Volts DC for the transmitter.

Filament supply for both rectifiers
Filament supply for transmitter and receiver
Bias supply through germanium diode W1 and RC filter -
normal - 25 Volts with Tap for - 50V.
Relay supply through Bridge Selenium rectifier W2 and RC filter.

T1. High tension transformer, switched on by transmit relay RL1 to supply 550 or 650V DC (depending on tapping) through rectifier V1 (5R 4G Y).

A relay RL1 activated by the microphone Press to Talk contact changes over receiver to transmit voltage.

For this application the fuse F1 shown in circuit is shorted out and a fuse on the back panel of the station unit takes its place.

FM1674 Series of V.H.F. Radio Telephone Equipment.

ELECTRICAL PARTS LISTS - 25F/50F LOCAL BASE.

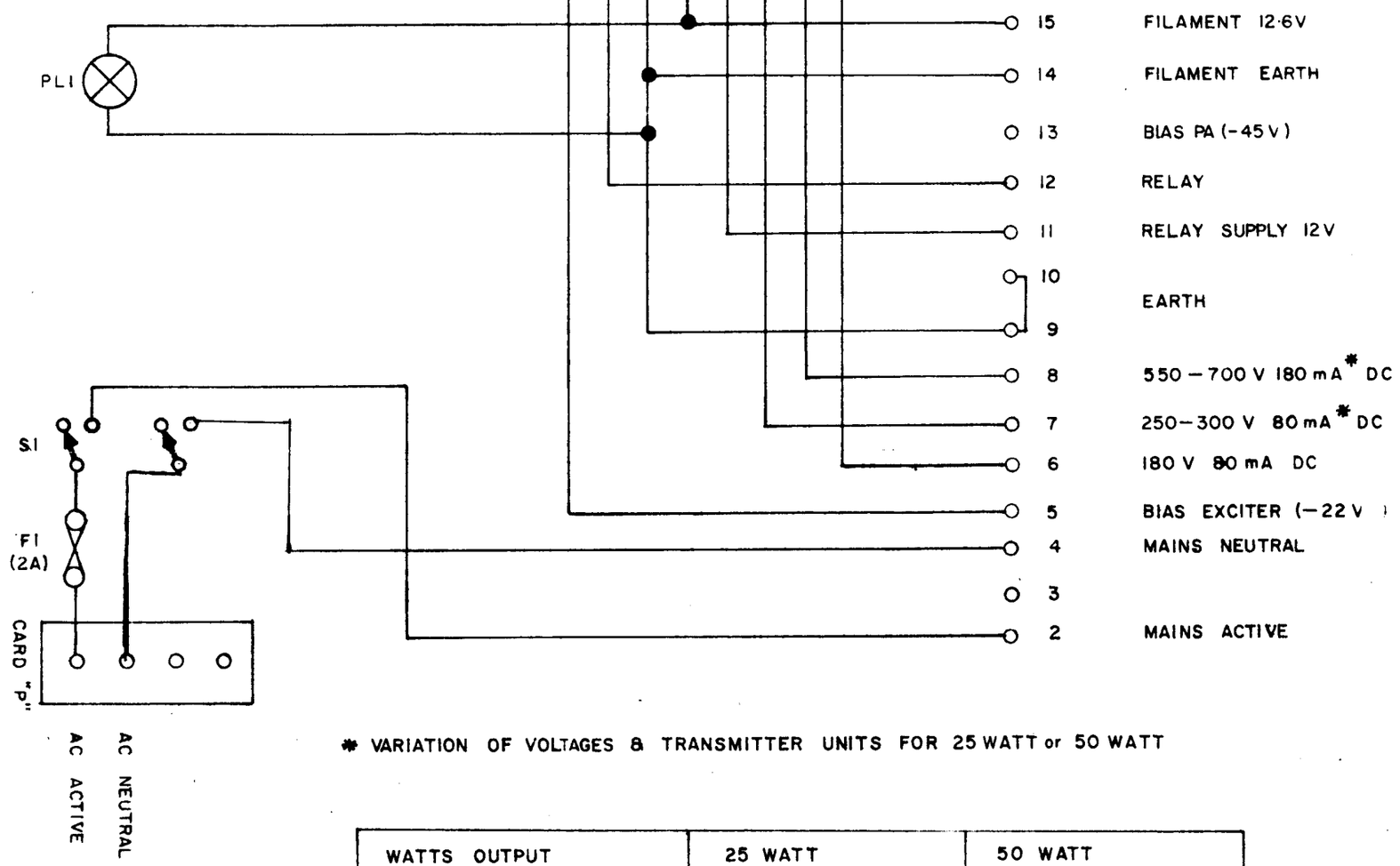
FM1674/25F	Local Control 25 Watt AC/DC Base
FM1674/25F.AC	Local Control 25 Watt AC Base
FM1674/50F.	Local Control 50 Watt AC/DC Base
FM1674/50F.AC	Local Control 50 Watt AC Base
FM1674A/100	Receiver 70 - 85 mc/s
C/100	Receiver 156 - 174 mc/s
D/100	Receiver 44 - 49 mc/s
FM1674A/200	Transmitter Driver Modulator 70 - 85 mc/s
C/200	Transmitter Driver Modulator 156 - 174 mc/s
D/200	Transmitter Driver Modulator 44 - 49 mc/s
FM1674A/450	Power Amplifier 25 Watt Unit 70 - 85 mc/s
C/450	Power Amplifier 25 Watts Unit 156 - 174 mc/s
D/450	Power Amplifier 25 Watts Unit 44 - 49 mc/s
FM1674A/475	Power Amplifier 50 Watts Unit 70 - 85 mc/s
C/475	Power Amplifier 50 Watts Unit 156 - 174 mc/s
D/475	Power Amplifier 50 Watts Unit 44 - 49 mc/s
FM1674/79	AC Power Supply Unit
FM1674/82	Battery Charger Unit 12 Volt 100 Watt
FM1674/500/12	DC/DC Converter 70 Watt 12 Volt
FM1674/500.2/12	DC/DC Converter 70 Watt 12 Volt
FM1674/520/12	DC/DC Converter 50 Watt 12 Volt
FM1674/520.2/12	DC/DC Converter 50 Watt 12 Volt
FM1674/540/12	DC/DC Converter 130 Watt 12 Volt
FM1674/540.2/12	DC/DC Converter 130 Watt 12 Volt

FM1674 Series of V.H.F. Radio Telephone Equipment.

CIRCUIT DIAGRAMS - 25F/50F LOCAL BASE.

	Drawing No.
FM1674/25F Local Control 25 Watt AC/DC Base	SPC.1371
FM1674/25F.AC Local Control 25 Watt AC Base	SPC.1513
FM1674/50F Local Control 50 Watt AC/DC Base	SPC.1371
FM1674/50F.AC Local Control 50 Watt AC Base	SPC.1513
FM1674/100 Component Layout	(SPB.3280 (SPB.3281
FM1674A/100 Receiver 70 - 85 mc/s	SPD.795
FM1674C/100 Receiver 156 - 174 mc/s	SPD.848
FM1674D/100 Receiver 44 - 49 mc/s	SPD.862
FM1674/200 Component Layout	SPC.1343
FM1674A/200 Transmitter Driver Modulator 70 - 85 mc/s	SPD.782
FM1674C/200 Transmitter Driver Modulator 156 - 174 mc/s	SPD.783
FM1674D/200 Transmitter Driver Modulator 44 - 49 mc/s	SPD.868
FM1674A/450 Power Amplifier 25W Unit 70 - 85 mc/s	SPD.782
FM1674C/450 Power Amplifier 25W Unit 156 - 174 mc/s	SPD.783
FM1674D/450 Power Amplifier 25W Unit 44 - 49 mc/s	SPD.868
FM1674/475 Power Amplifier Layout	SPB.3357
FM1674A/475 Power Amplifier 50 Watt Unit 70 - 85 mc/s	SPA.7047
FM1674C/475 Power Amplifier 50 Watt Unit 70 - 85 mc/s 156 - 175 mcs	SPA.7047
FM1674D/475 Power Amplifier 50 Watt Unit 70 - 85 mc/s 44 - 49 mcs	SPA.7787
FM1674/79 A.C. Power Supply Unit	SPB.3584
FM1674/82 Battery Charger Unit 12 Volt 100W.	SPA.7541
FM1674/500/12 DC/DC Converter 70 Watt	SPB.3585
FM1674/520/12 DC/DC Converter 50 Watt	SPB.3583
FM1674/540/12 DC/DC Converter 130 Watt	SPB.3512
FM1674/500/12 DC/DC Converter 70 Watt	SPB.3585
FM1674/500.2/12 DC/DC Converter 70 Watt	SPB.3585.2
FM1674/520/12 DC/DC Converter 50 Watt	SPB.3583
FM1674/520.2/12 DC/DC Converter 50 Watt	SPB.3583.2
FM1674/540/12 DC/DC Converter 130 Watt	SPB.3512
FM1674/540.2/12 DC/DC Converter 130 Watt	SPB.3512.3

Code No.	Pos. No.	Description	No. Off.	Supplier	Remarks.
FM1674/350		25W Transmitter Unit	1	T.C.A.	See separate Parts List 200 &450
FM1674/100		Receiver Unit	1	T.C.A.	See separate Parts List
1674/79		AC Power Supply Unit	1	T.C.A.	See separate Parts List.
CZ029.051	R1	250K ohm Potentiometer Carbon	1	Ducon	Type NC Law A Dim 'B' 7/8"(Mute)
CZ029.077	R2	100K ohm Potentiometer Carbon	1	Ducon	Type NC Law B Dim 'B' 7/8"(Vol.)
CZ005.205.E	R3	1M ohm 1W Carbon	1	I.R.C.	BTA 10%
CZ004.007.E	R4	100K ohm 1W Carbon	1	I.R.C.	BTA 10%
CZ005.200.E	R5	150K ohm 1W Carbon	1	I.R.C.	BTA 10%
CZ001.614.E	R6	220 ohm 1W Carbon	1	I.R.C.	BTA 10% Dim.B $\frac{1}{2}$" slotted
CZ029.089	R7	100K ohm Potentiometer Carbon	1	Ducon	Type NCC Curve A and locking.
CZ000.414.CH	R8	47 ohm 1W Carbon (See Note)	1	I.R.C.	BTA 10% fitted with S2 when requested. ONLY
CZ076.400.EH	C1	0.1 MF 150 VW Paper Tubular	1	A.E.E.	Tropicap W49 25% PVC Sleeved.
CZ280.702	F1	Fuse 2 amp Working	1	Goddard	$1\frac{1}{4}$ x $\frac{1}{4}$
CZ162.502	LS1	Loudspeaker	1	Rola	Type 4-5F Cone F83 Less transformer.
CZ283.056	PL1	Pilot Lamp 12V 0.1 amp	1	Philips	Type 8003D (A.C.)
CZ200.430	S1	Mains Switch 4 pole 2 position	1	Paton	SPC 1367
CZ200.249	S2	Channel Switch 1 pole 3 pos. (See Note)	1	M.S.P.	Oak Type 27.SPB.3272CHANNEL Switching. Fitted only when required.
	V1	Indicator Tube DN71	1	Philips	
CR902.453		Component card 'K'	1		SPZ 1930
		Wiring Sheet			SPB 3438.1
		Circuit Diagram.			SPC 1513



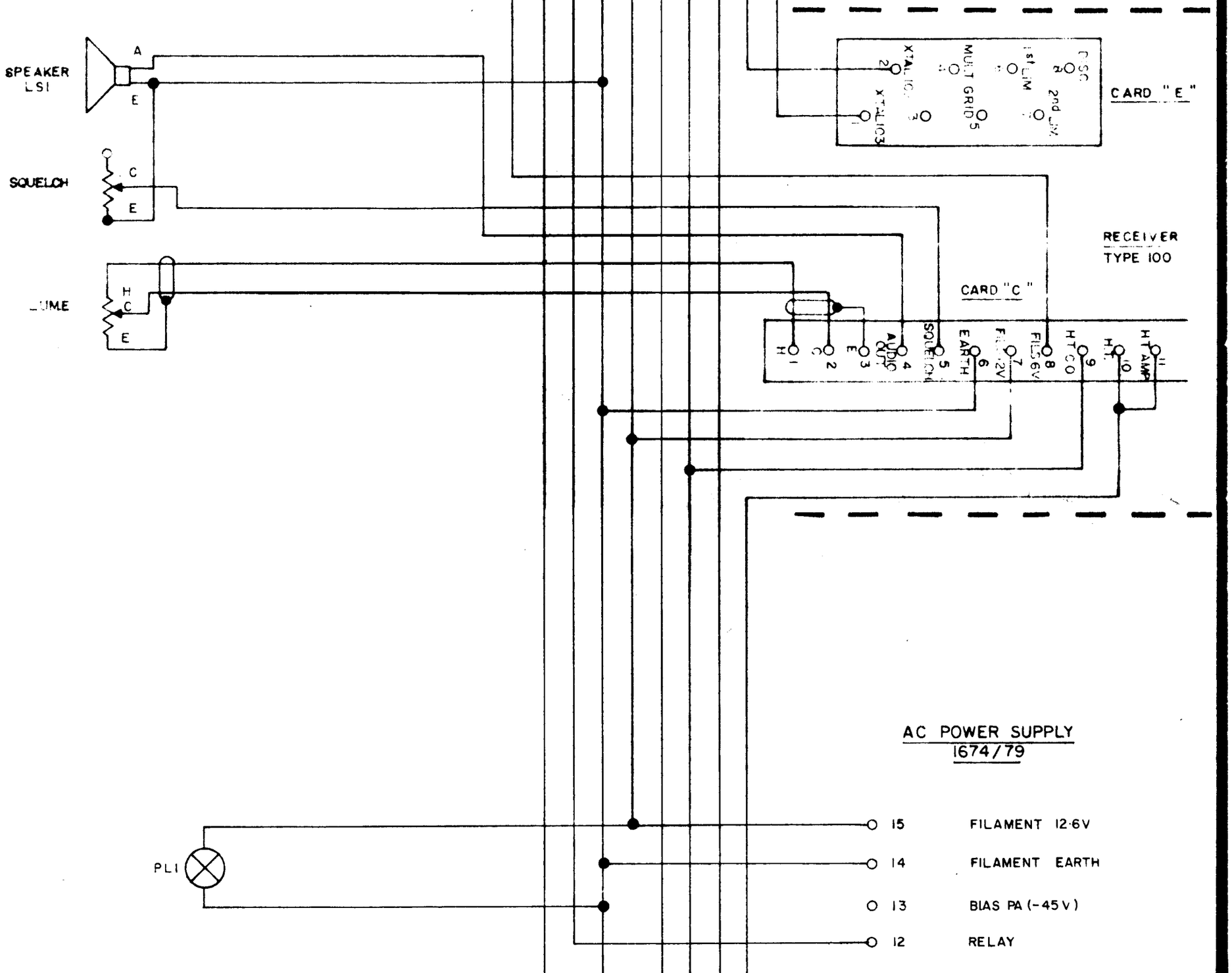
* VARIATION OF VOLTAGES & TRANSMITTER UNITS FOR 25 WATT or 50 WATT

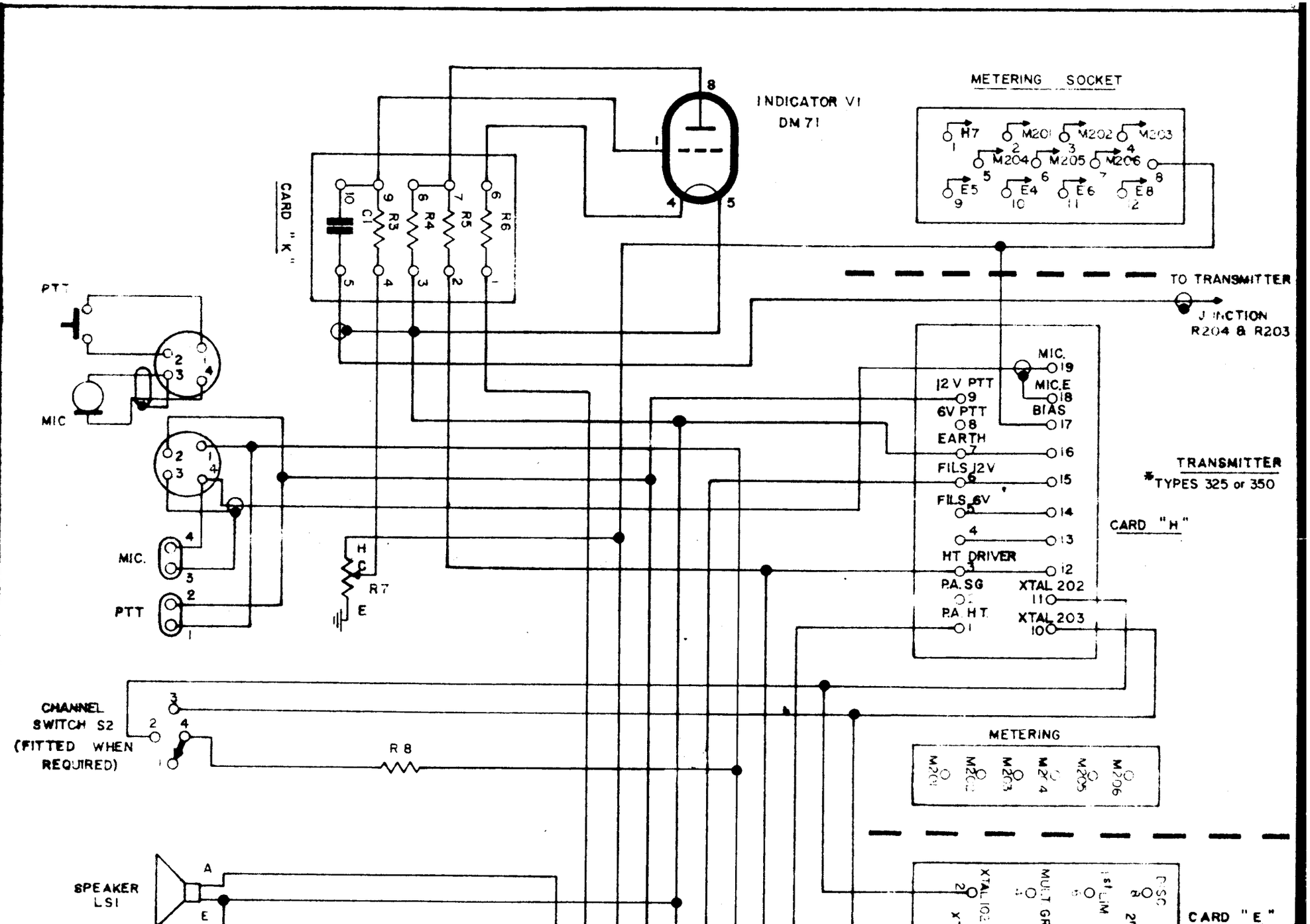
WATTS OUTPUT	25 WATT	50 WATT
TRANSMITTER UNIT	325	350
P.A. HIGH TENSION	550 V DC	550 V DC
DRIVER HT	250 V DC	250 V DC
P.A. TUBE	QQE03/20	QQE06/40
P.S. TRANSFORMER TAPS T2	7 – 14	7 – 14
P.S. TRANSFORMER TAPS T1	17 –19	17– 19

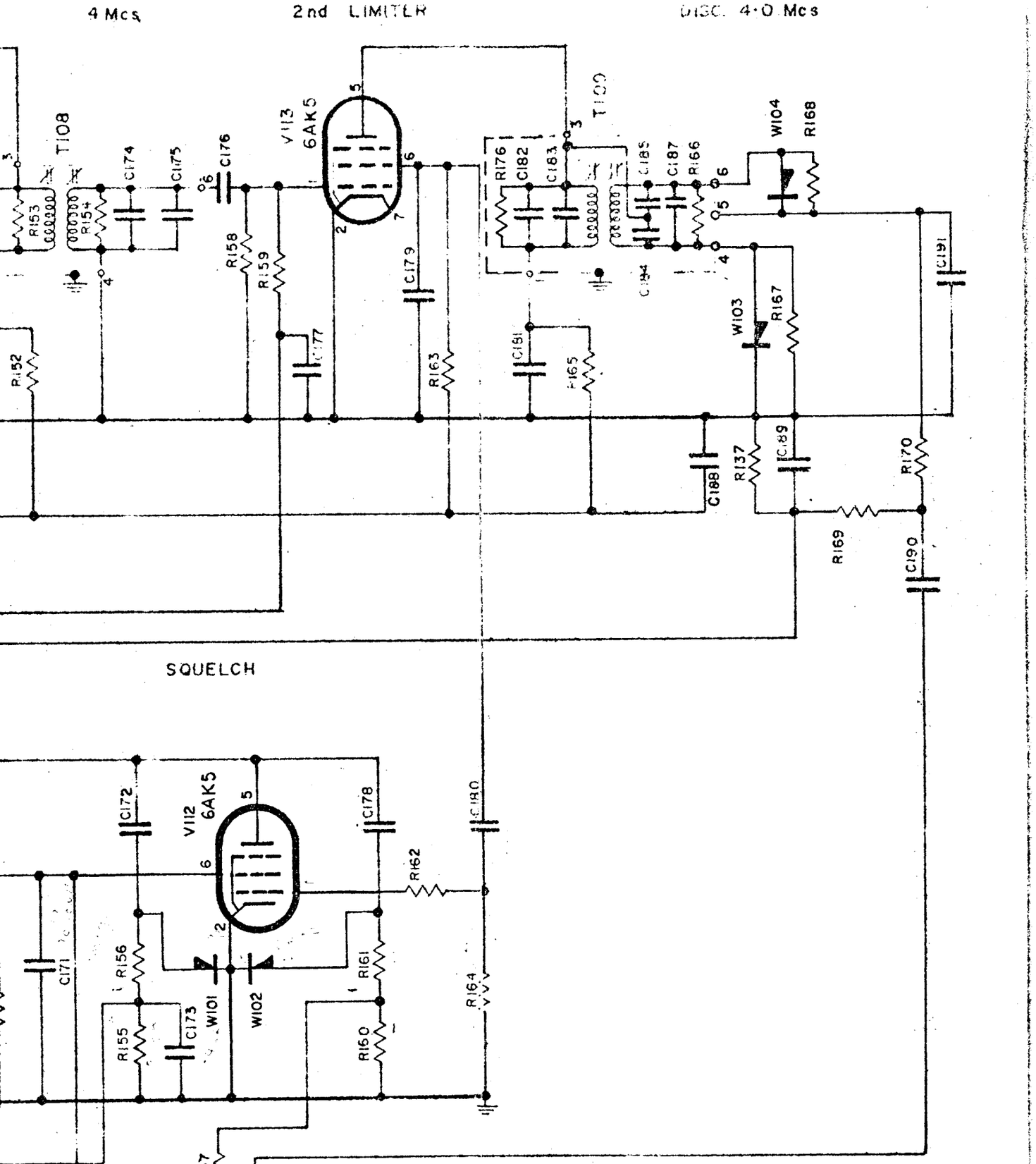
FM1674/25F/50F AC
25-50W AC RADIO TELEPHONE
LOCAL BASE STATION

DRAWN: B.N. APPROVED:

SPC1513


SPEAKER
LSI
A
E
SQUELCH
C
E
LIME
H
C
E
PL1
RECEIVER
TYPE 100
CARD "C"
CARD "E"
H 1
C 2
E 3
AUDIO OUT 4
SQUELCH 5
EARTH 6
FIL 12V 7
FIL 6.6V 8
HT CO 9
HT 10
HT AMP 11
XTAL 103
MULT GRID 5
1st LIM
2nd LIM
OSC
AC POWER SUPPLY
1674/79
15 FILAMENT 12·6V
14 FILAMENT EARTH
13 BIAS PA (-45 V)
12 RELAY


METERING SOCKET
INDICATOR V1
DM71
CARD "K"
R1
R3
R4
R5
R6
PTT
MIC
MIC.
PTT
R7
TO TRANSMITTER
JUNCTION
R204 & R203
MIC.
12 V PTT
6V PTT
EARTH
FILS 12V
FILS 6V
HT DRIVER
P.A. SG
P.A. HT
MIC.E
BIAS
XTAL 202
XTAL 203
TRANSMITTER
*TYPES 325 or 350
CARD "H"
CHANNEL SWITCH S2
(FITTED WHEN REQUIRED)
R8
METERING
SPEAKER
LS1
CARD "E"



TYPE FM1674A/101

RECEIVER CIRCUIT DIAGRAM

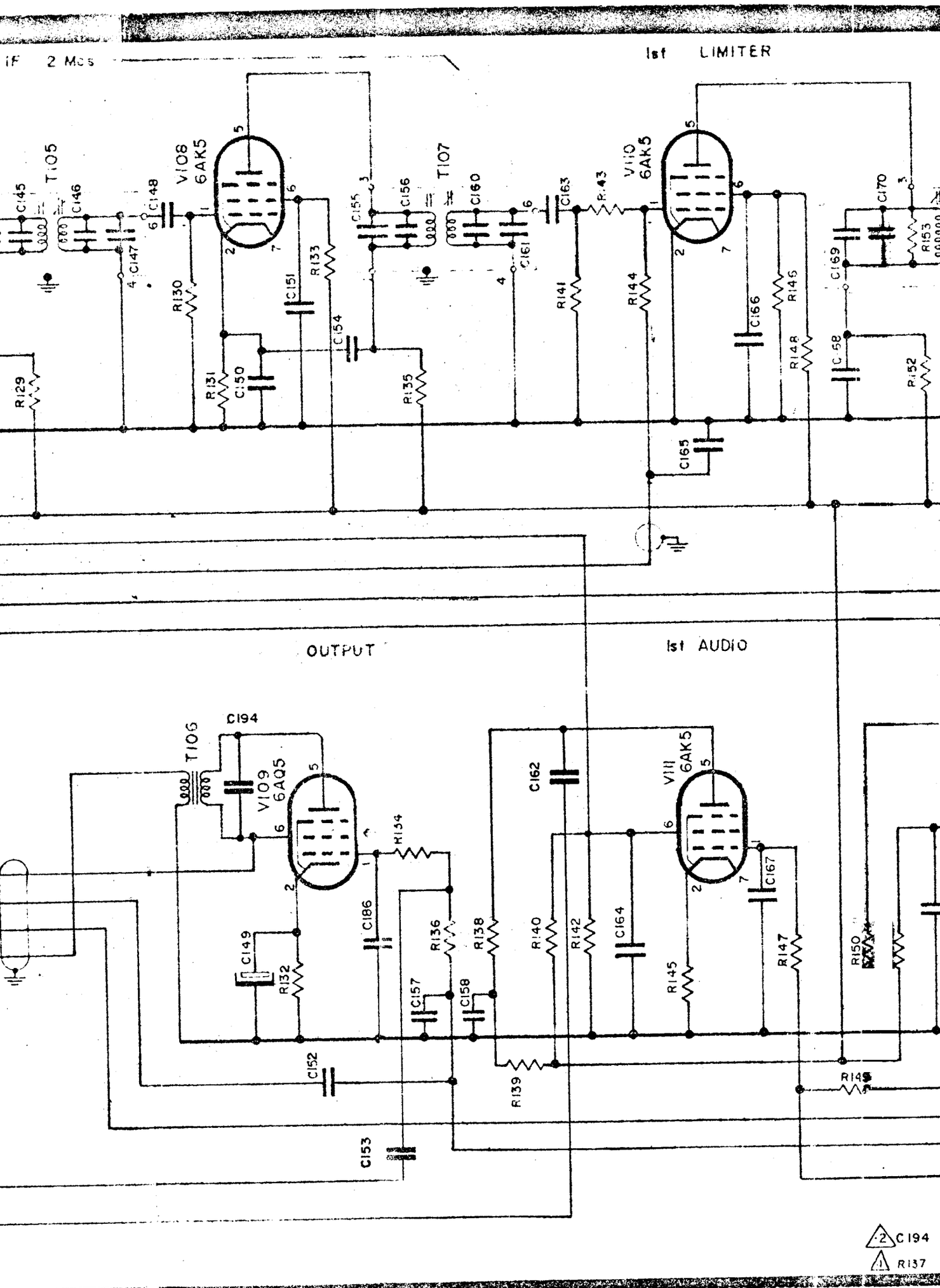
C194 ADDED SP1482

R137 POS. REVISED 3-4-59

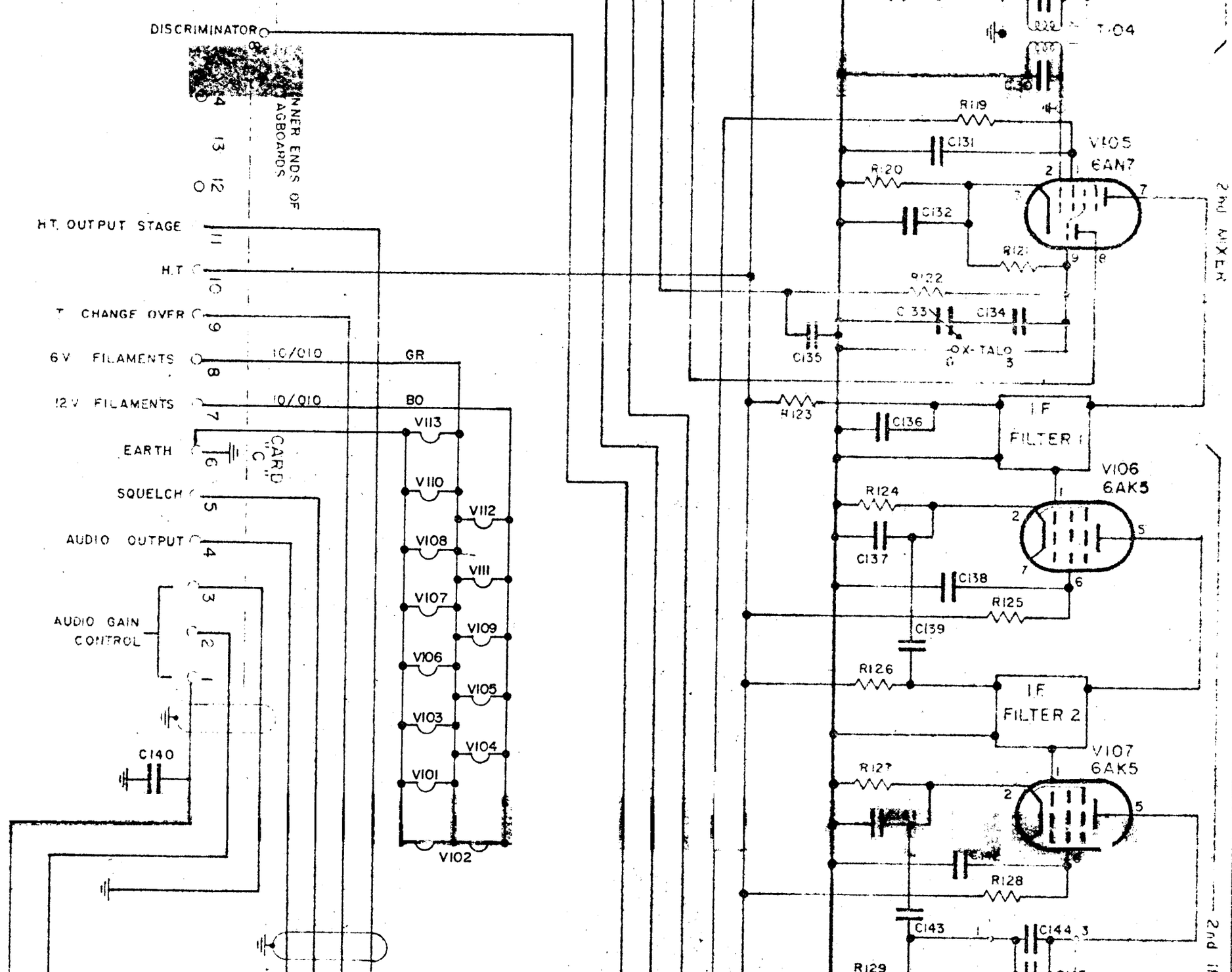
DRAWN E.A.D. APPROVED DATE

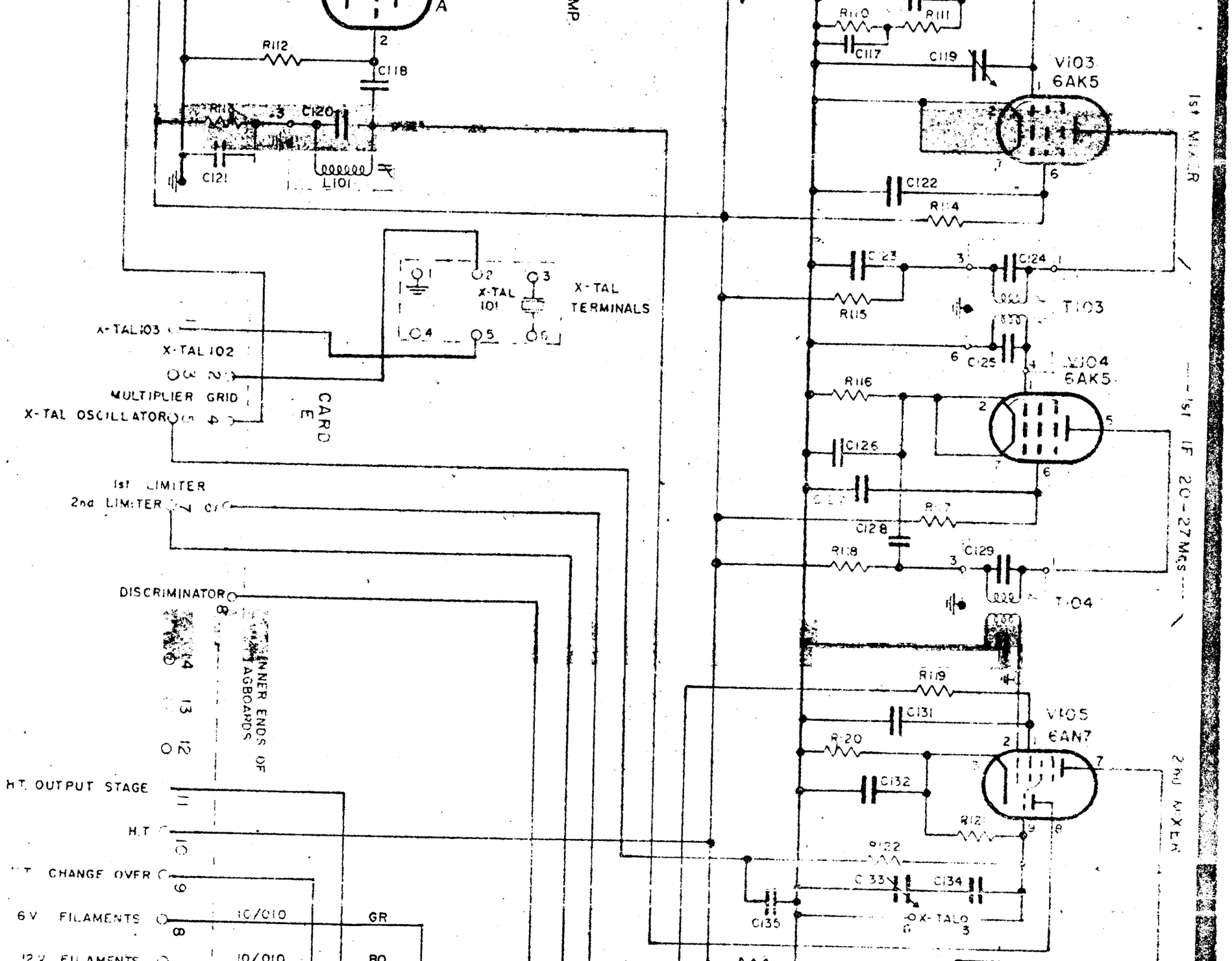
SPD 865

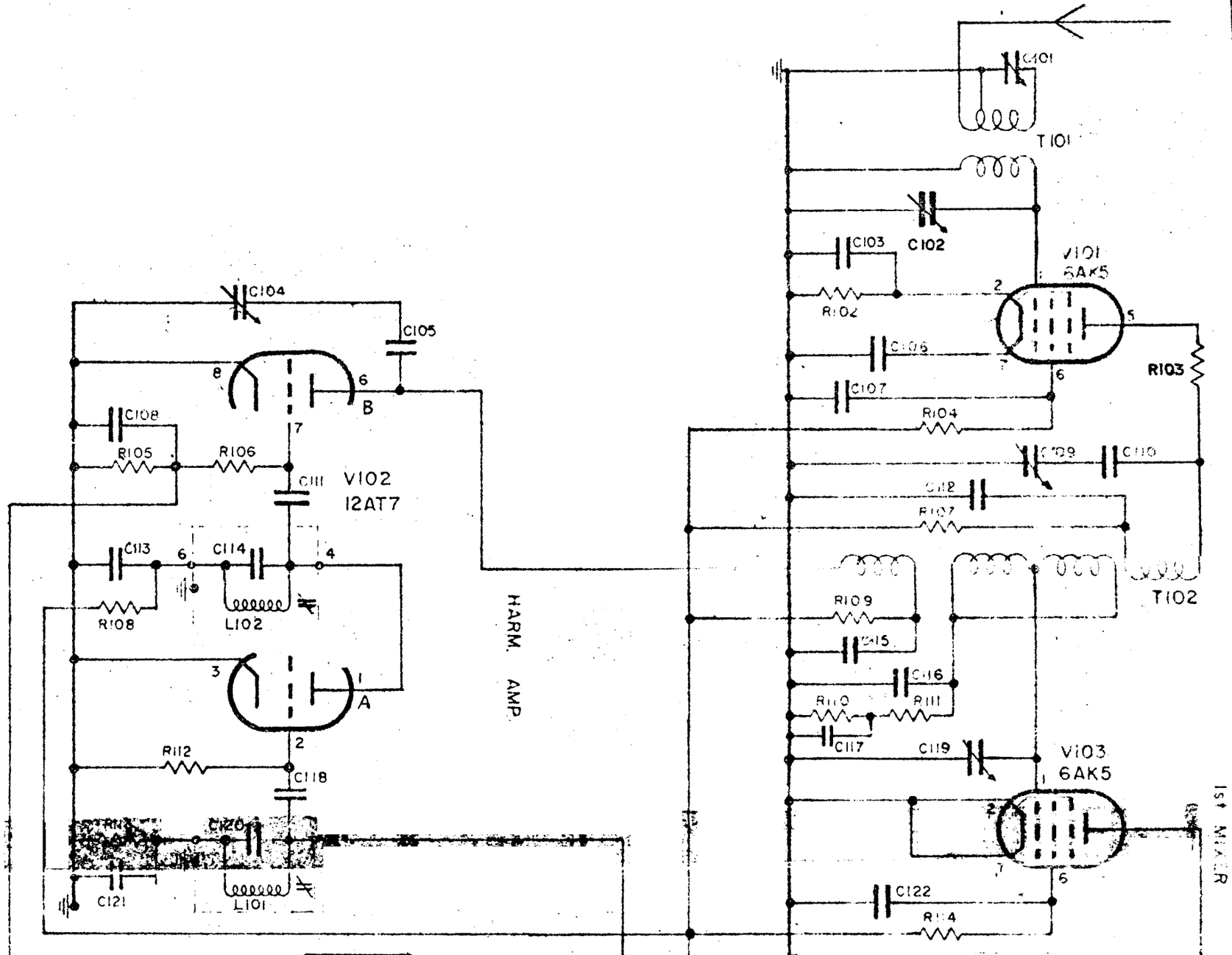
TELECOMMUNICATION COMPANY OF AUSTRALIA PTY

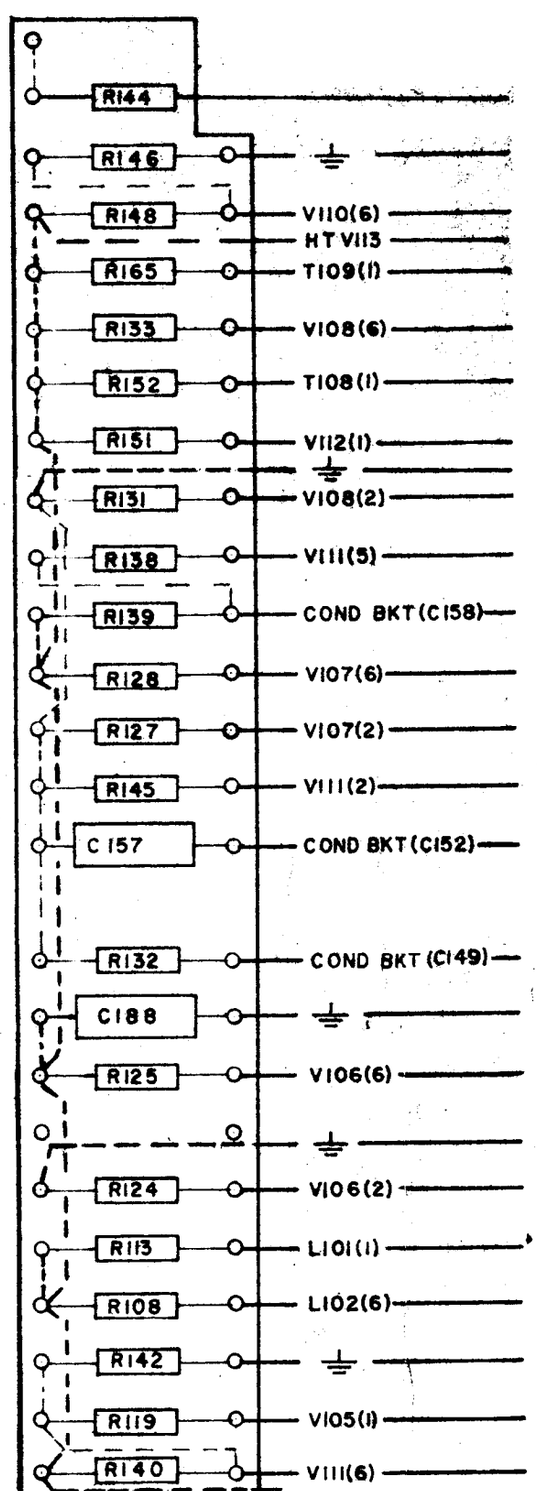

IF 2 Mcs
1st LIMITER
OUTPUT
1st AUDIO
T105
T106
T107
V108 6AK5
V109 6AQ5
V110 6AK5
V111 6AK5
C145
C146
C147
C148
C149
C150
C151
C152
C153
C154
C155
C156
C157
C158
C160
C161
C162
C163
C164
C165
C166
C167
C169
C170
C186
C194
R129
R130
R131
R132
R133
R134
R135
R136
R138
R139
R140
R141
R142
R143
R144
R145
R147
R148
R150
R152
R153

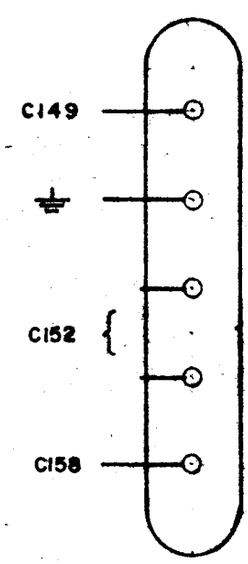
△2 C194
△1 R137

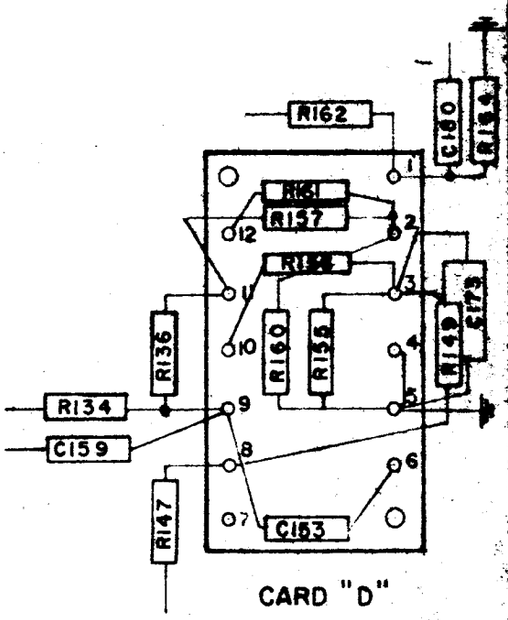

DISCRIMINATOR
INNER ENDS OF AGBOARDS
H.T. OUTPUT STAGE
H.T.
T CHANGE OVER
6 V FILAMENTS
12 V FILAMENTS
EARTH
SQUELCH
AUDIO OUTPUT
AUDIO GAIN CONTROL
CARD C
10/010
GR
B0
V113
V110
V112
V108
V111
V107
V109
V106
V105
V103
V104
V101
V102
C140
T-04
C130
R119
C131
V105 6AN7
R120
C132
R121
R122
C133
C134
C135
X-TALO
R123
C136
IF FILTER 1
V106 6AK5
R124
C137
C138
R125
C139
R126
IF FILTER 2
V107 6AK5
R127
C141
R128
C143
C144
R129
2nd MIXER
2nd IF


R112
C118
C120
C121
L101
X-TAL 101
X-TAL TERMINALS
X-TAL 103
X-TAL 102
MULTIPLIER GRID
X-TAL OSCILLATOR
CARD E
1st LIMITER
2nd LIMITER
DISCRIMINATOR
INNER ENDS OF AGBOARDS
H.T. OUTPUT STAGE
H.T.
H.T. CHANGE OVER
6V FILAMENTS
12V FILAMENTS
10/010
GR
BO
R110
R111
C117
C119
V103 6AK5
1st MIXER
C122
R114
C123
C124
T103
C125
V104 6AK5
R116
C126
C127
R117
C128
R118
C129
T104
1st IF 20-27Mcs
R119
C131
V105 6AN7
R120
C132
R121
R122
C133
C134
C135
X-TAL 3
2nd MIXER


C101
T101
C102
C103
V101
6AK5
R102
C106
C107
R103
R104
C109
C110
C112
R107
T102
R109
C115
C116
R110
R111
C117
C119
V103
6AK5
C122
R114
C104
C105
C108
R105
R106
C111
V102
12AT7
C113
C114
R108
L102
HARM. AMP.
R112
C118
C120
C121
L101
1st MIXER





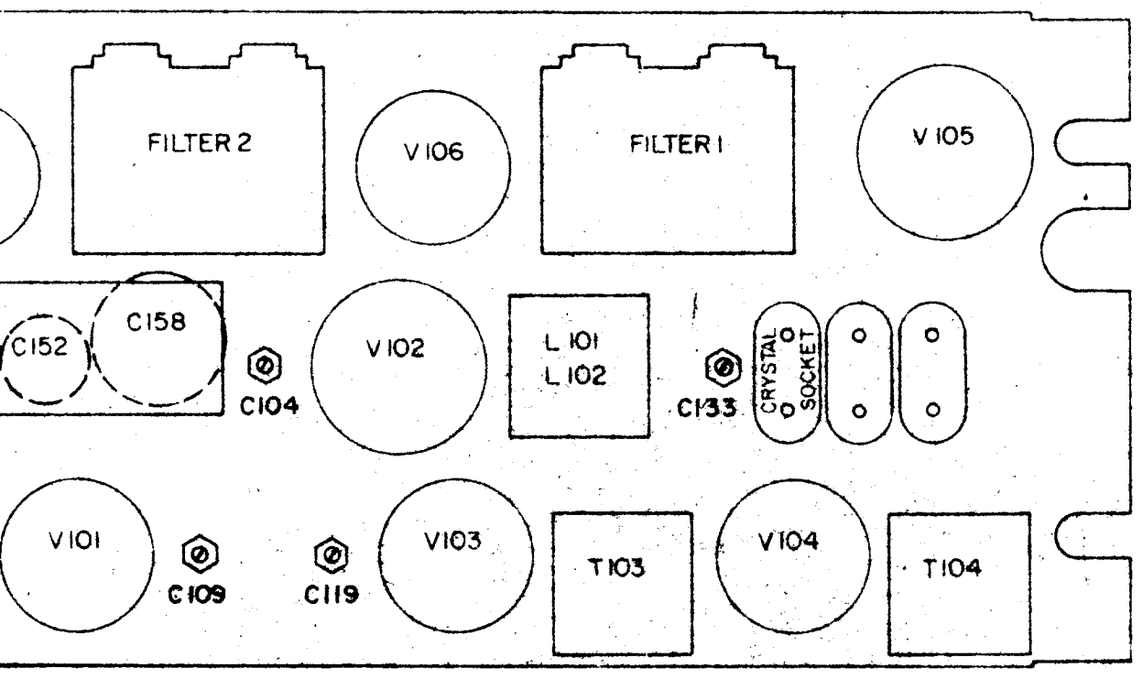


TYPE FM1674/101/A&C
RECEIVER COMPONENT CARDS

DRAWN EAD APPROVED DATE : 18·9·58

SPA7907

TELECOMMUNICATION COMPANY OF AUSTRALIA PTY. LIMITED



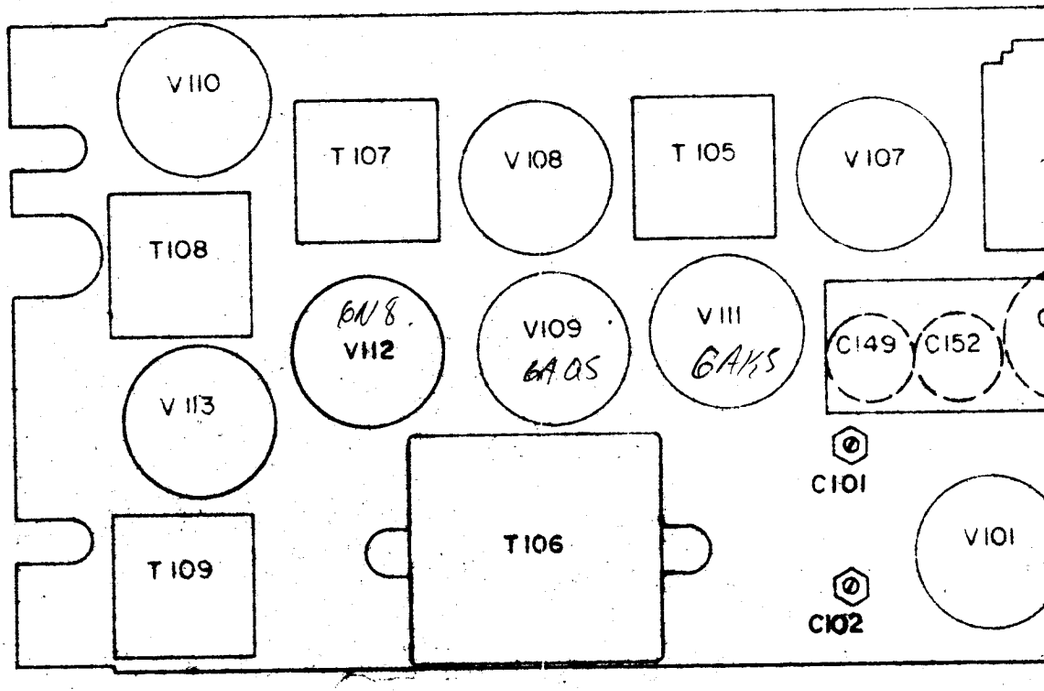
TYPE FM1674A, C & D/101
RECEIVER - TOP VIEW
COMPONENT LAYOUT

DRAWN A P APPROVED DATE 27 6 58

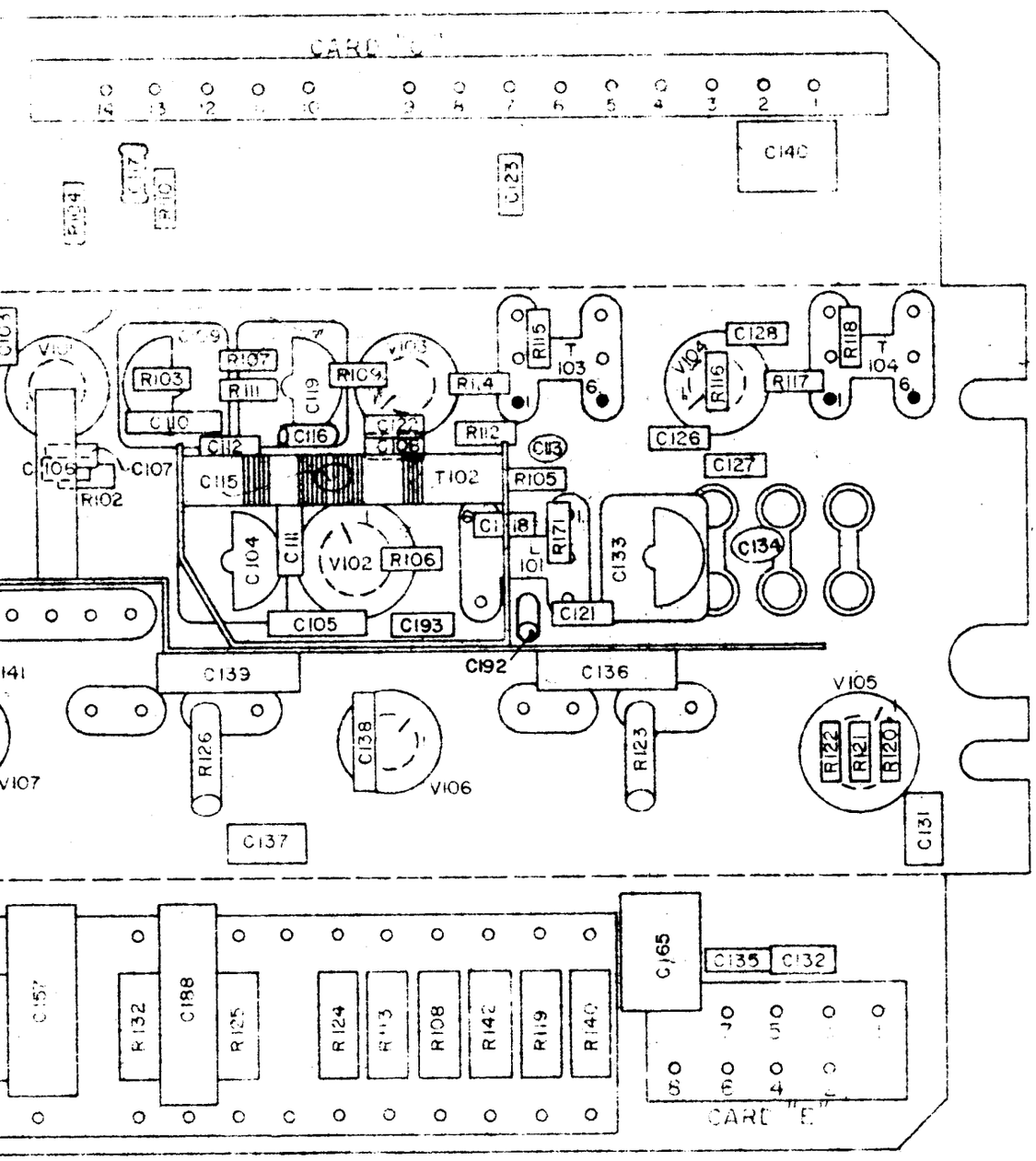
SPB 3570

REVISION

TELECOMMUNICATION COMPANY OF AUSTRALIA PTY LIMITED


V110
T107
V108
T105
V107
T108
6N8
V112
V109
6AQ5
V111
6AK5
C149
C152
V113
C101
T109
T106
V101
C102

NOTE 2



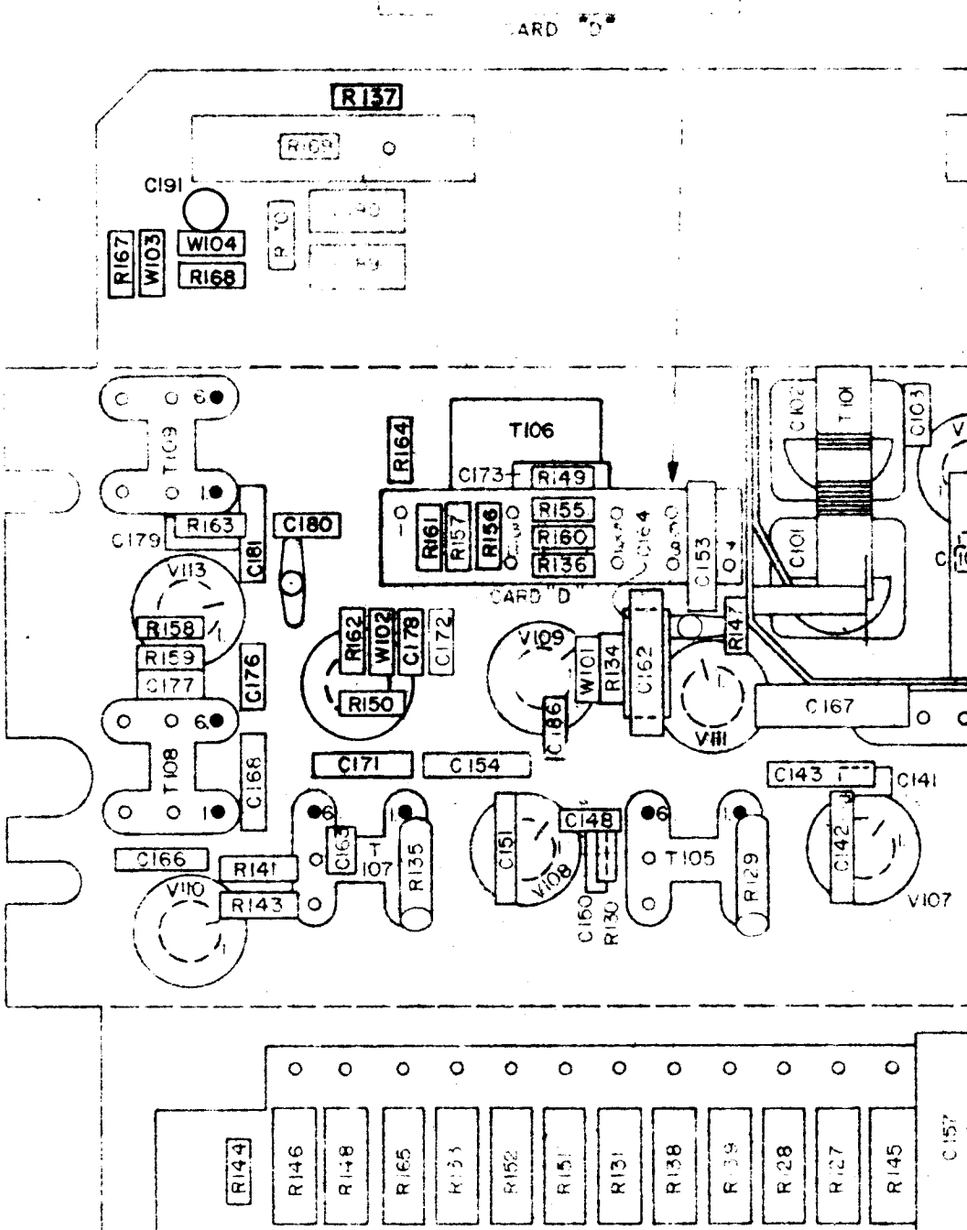
TYPE FM1674 A, C & D/101
RECEIVER - BACK VIEW
COMPONENT LAYOUT

SPB 3569

DRAWN A.P. APPROVED JD DATE 2'6'58

TELECOMMUNICATION COMPANY OF AUSTRALIA PTY LIMITED

REVISION	
⚠ R137 POS. REVISED	3-4-59

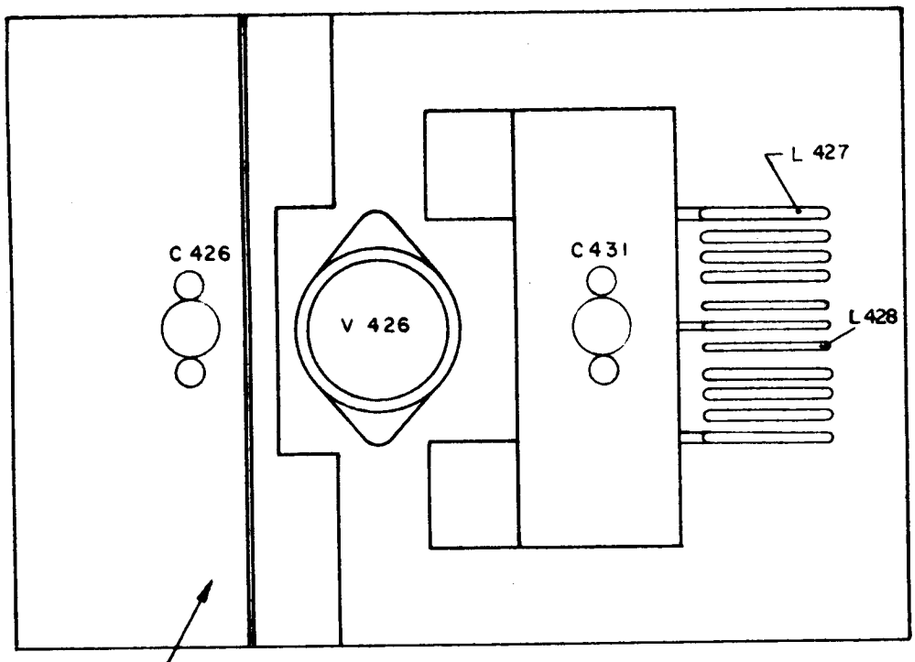


NOTE 1:- C192, C193 & R171 APPLY TO FM1674C/101 ONLY.

NOTE 2:- THE SECONDARY LEADS OF T106 ARE TERMINATED ON LUGS 4 & 7, CARD "D". LUG 7 BEING THE AUDIO OUTPUT. SHORTING LINK BETWEEN LUGS 4 & 5 CONNECTS LUG 4 TO CHASSIS.

⚠1 R137

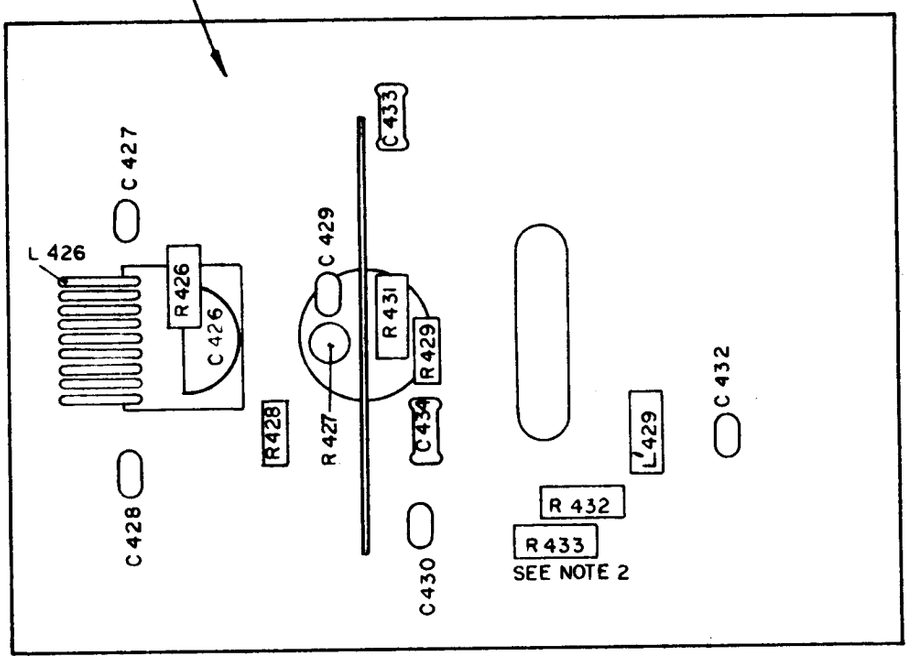
TRANSMITTERS USING
TYPE FM 1674/475
TO DRG. NO SPB 3357



TOP VIEW

FM 1674/425 A & C

FM1674/450 A & C



BOTTOM VIEW

⚠1 C457, C460, C461, C462 & NOTE 4 ADDED 25-6-58

TES:-

R 238 FOR FM 1674A/200
L 202 FOR FM 1674C/200
. FM 1674A/ ONLY
. FM 1674C ONLY
. FM 1674A/450 ONLY

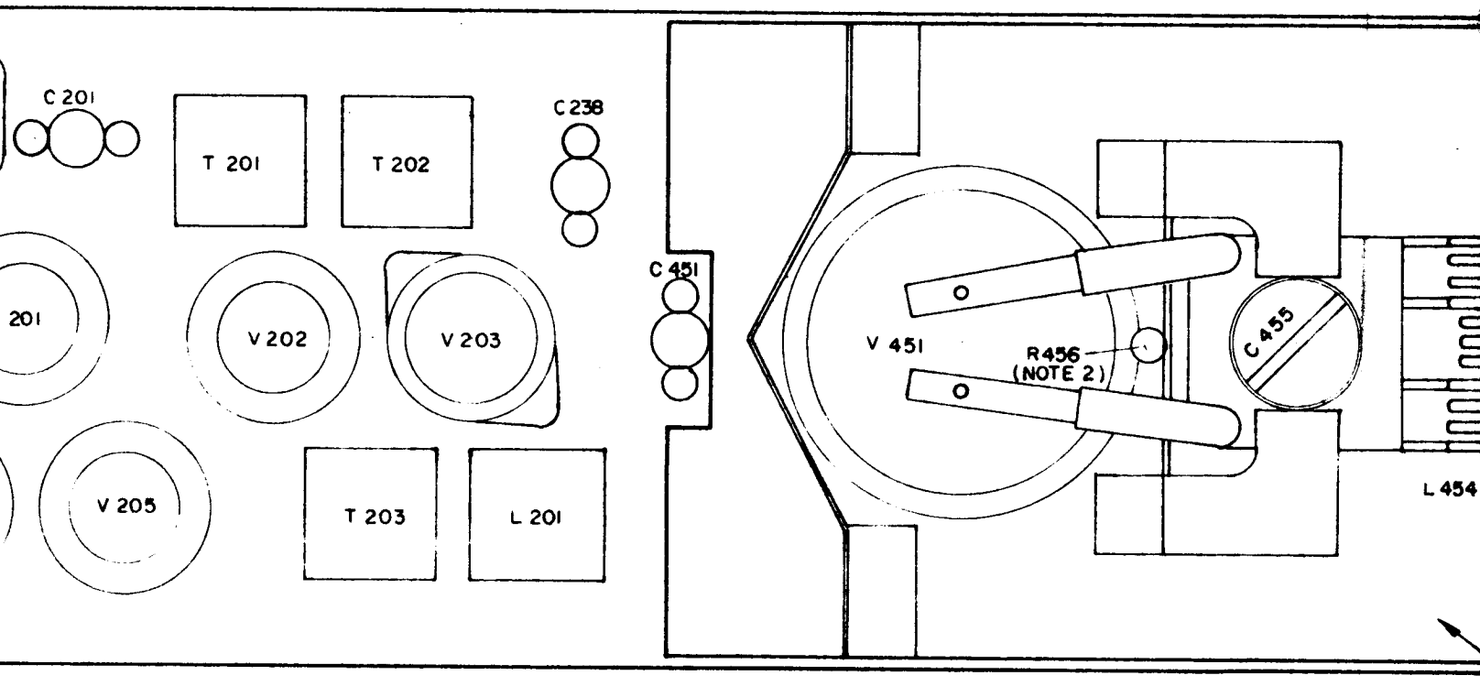
COMPONENT LAYOUTS
TYPE FM 1674/200 A& C - DRIVER MOD. &
TYPE FM 1674/450 A& C - P.A. CHASSIS —
TYPE FM 1674/425 A & C - P.A. CHASSIS —

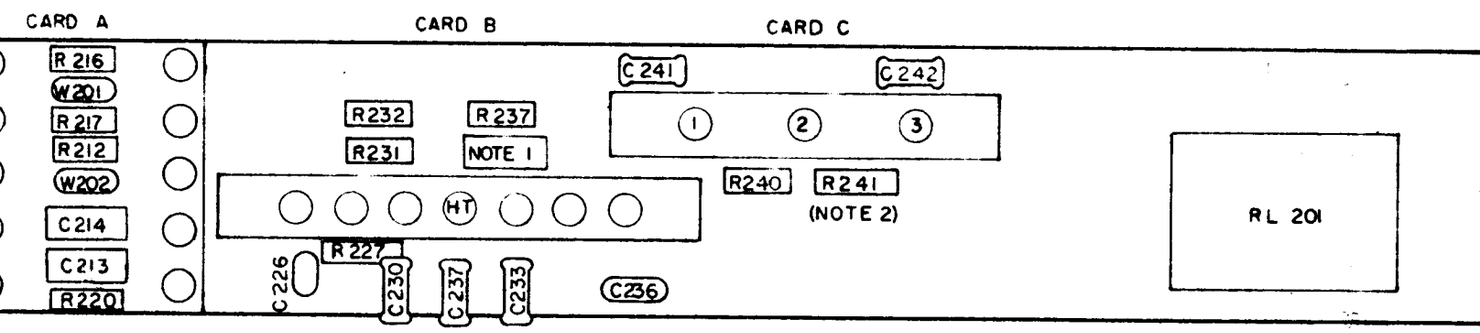
DRAWN: MR APPROVED: DATE: 13-12-57 SPC 1343·1

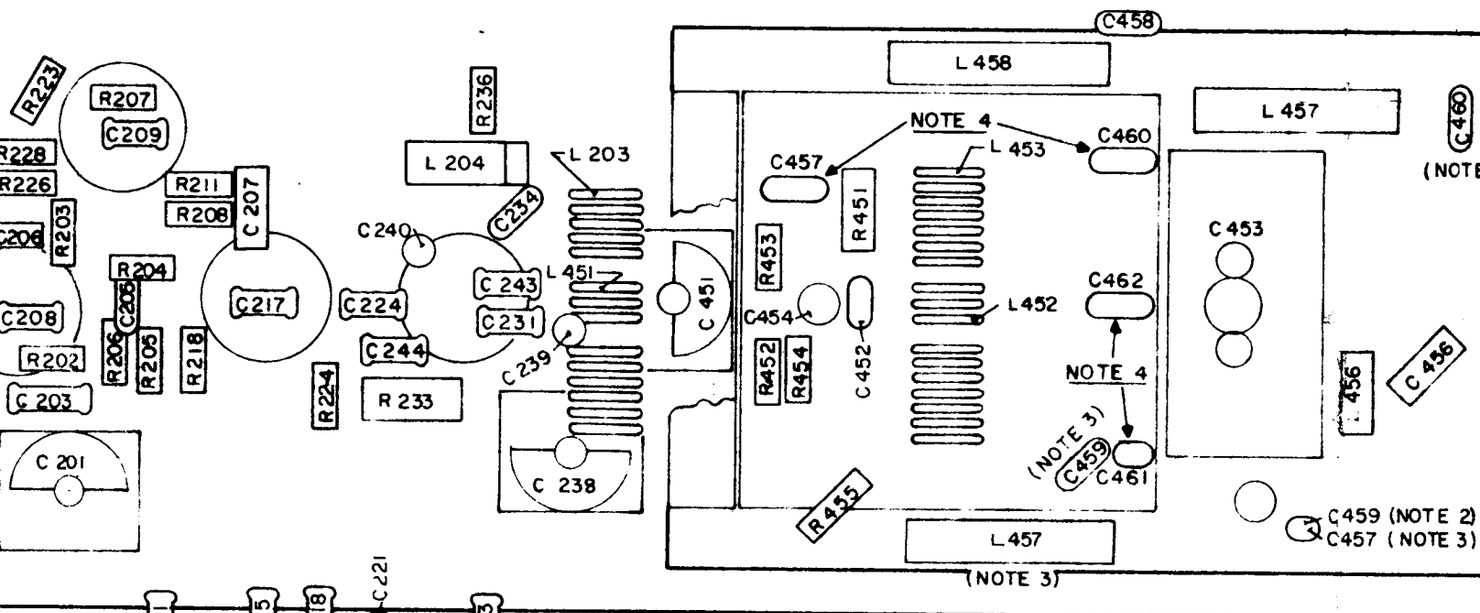
TELECOMMUNICATION COMPANY OF AUSTRALIA PTY. LIMITED

DRAWING SHOWS FM 1674/450 P.A. INSTALLED. FOR TRANSMITTERS USING P.A. TYPE FM 1674/425, REPLACE THIS BY SKETCH AT RIGHT. ⟶

TOP VIEW



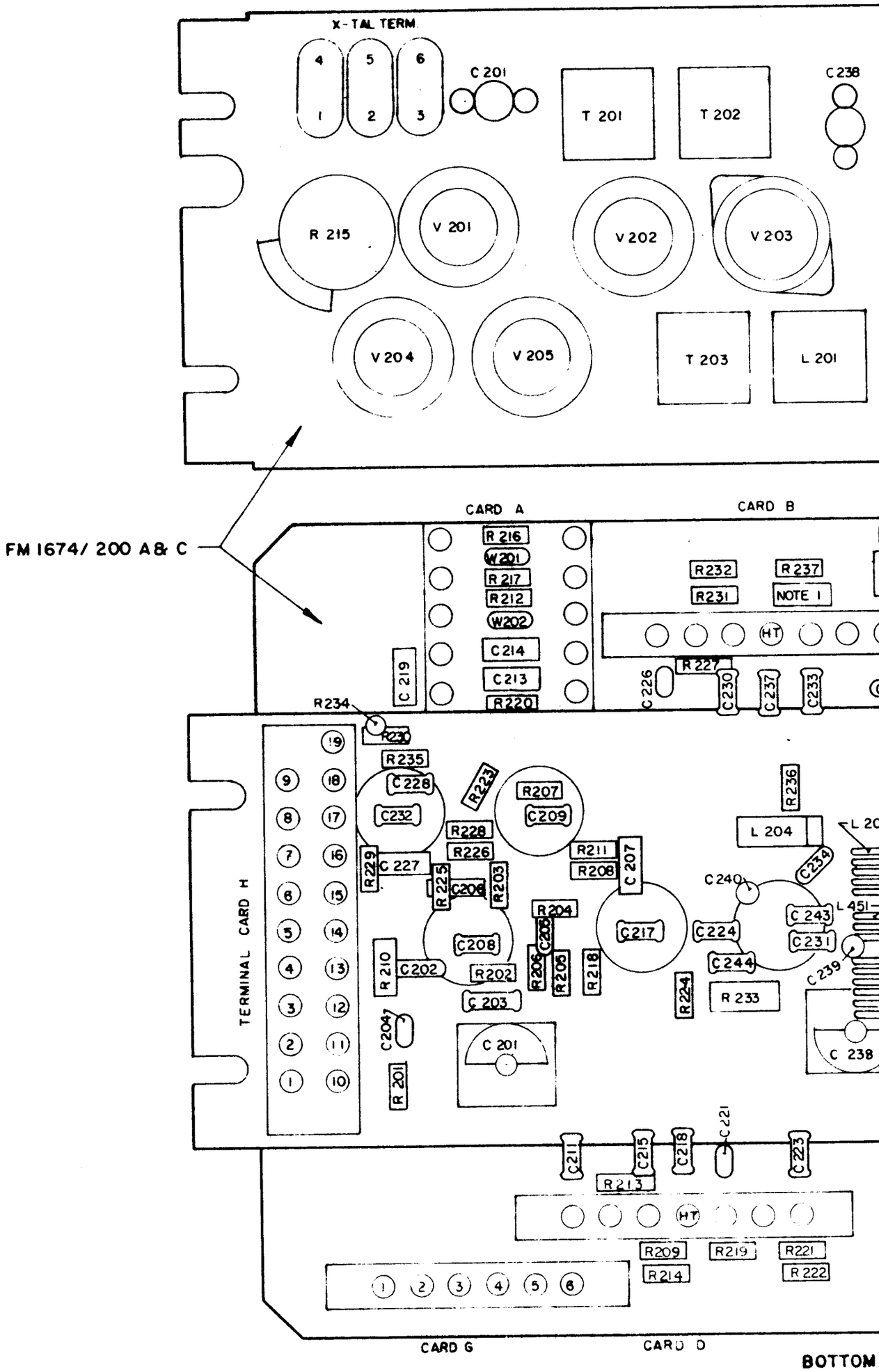




CARD D CARD E CARD F

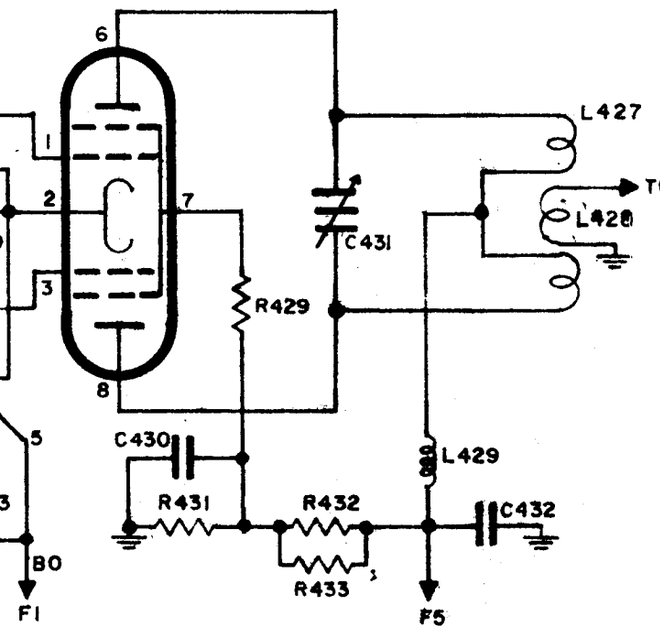
BOTTOM VIEW

TOP VIE


X-TAL TERM.
4
5
6
1
2
3
C 201
T 201
T 202
C 238
R 215
V 201
V 202
V 203
V 204
V 205
T 203
L 201
FM 1674/ 200 A& C
CARD A
CARD B
R 216
W201
R 217
R 212
W202
C 214
C 213
R 220
C 219
R232
R231
R 237
NOTE 1
HT
R 227
C 226
C230
C 237
C233
R234
R230
R235
C 228
R 223
R207
C209
C232
R228
R226
R229
C 227
R225
C206
R203
R211
R208
C 207
R 204
C208
C202
R202
C 203
R 210
C204
R 201
C 201
C217
C224
C 240
C234
L 204
R236
C 243
C231
C 244
C 239
R 233
R224
C 238
TERMINAL CARD H
19
18
9
17
8
16
7
15
6
14
5
13
4
12
3
11
2
10
1
C211
C215
C218
C 221
C223
R 213
R209
R214
R219
R221
R 222
1
2
3
4
5
6
CARD G
CARD D
BOTTOM

QQE 03/12

V426



POWER AMPLIFIER

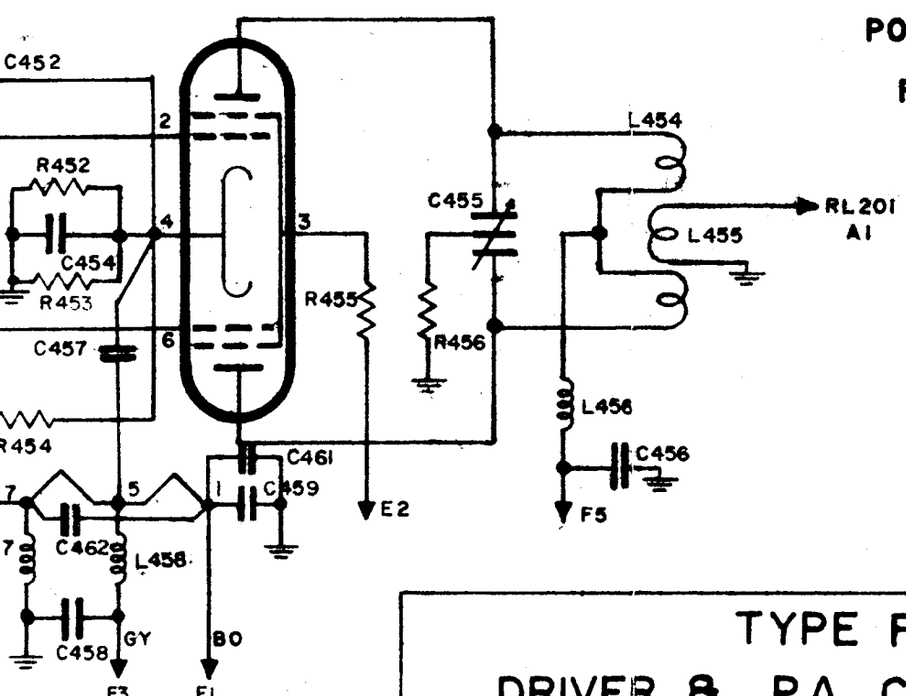
FM 1674A/425

NOTE - THIS ANTENNA CONNECTION APPLIES TO MOBILE UNITS ONLY.
FOR USE AS DRIVER FOR 75 WATT BASE, L 428 IS LINKED DIRECTLY TO ANTENNA FEEDER SOCKET RL 201 CONTACTS A1 ARE NOT USED.

NOTE - CONNECTION OF PA's INTO DRIVER CHASSIS — PA SUPPLY/METERING LEADS ARE GIVEN A LETTER/NUMBER CORRESPONDING WITH LUGS ON STRIPS "C", "D" OR "F."

QQE 03/20

V451



POWER AMPLIFIER

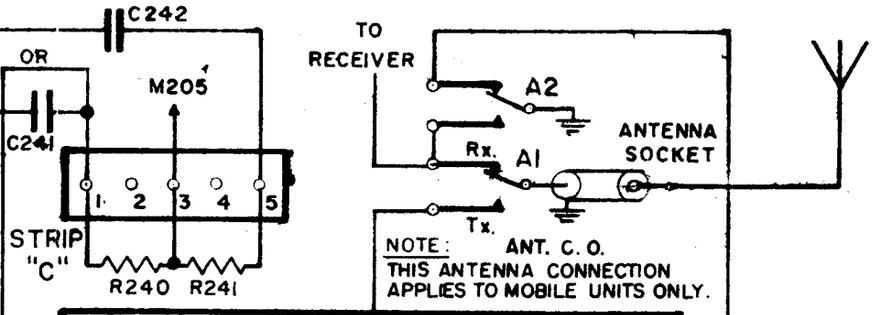
FM 1674A/450

3 C457, C460, C462, C461, ADDED 25·6·58
2 R228 TABULATED 9·12·57
1 C220 WAS C202 23-10-57

TYPE FM1674A
DRIVER & P.A. CIRCUITS

DRAWN: E.A.D. APPROVED: DATE: 15-7-'57 SPD782·3

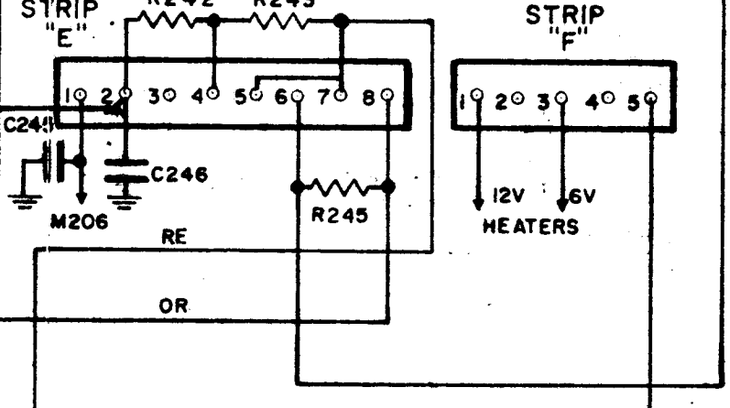
TELECOMMUNICATION COMPANY OF AUSTRALIA PTY. LIMITED

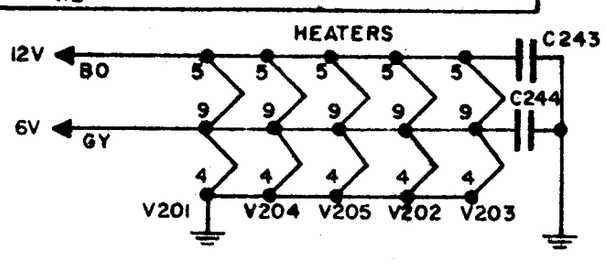


P.A SUB UNIT

POWER AMPLIFIER TYPE	CIRCUIT
FM1674A/425	SEE UPPER RIGHT
FM1674A/450	SEE LOWER RIGHT
FM1674A/475	SEPARATE CIRCUIT SPA 7047

SEE NOTE BELOW FOR LINKING ON STRIPS C&E

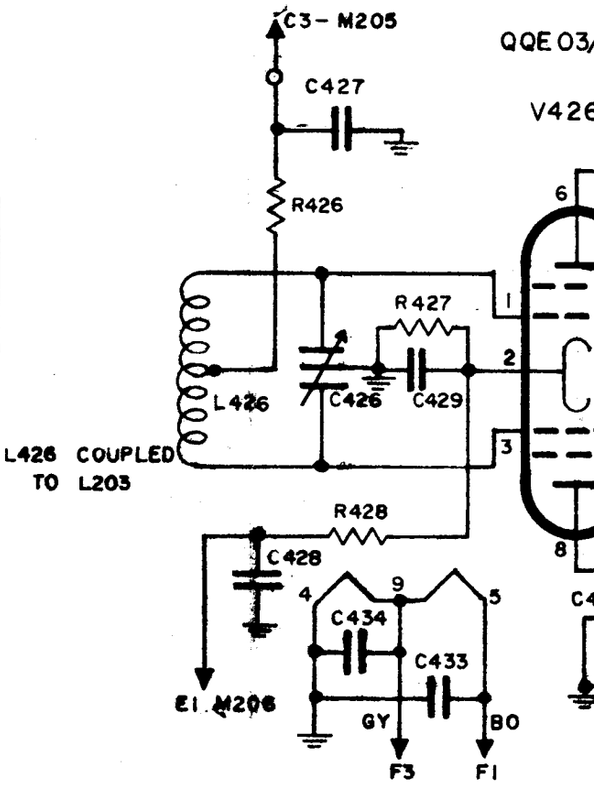


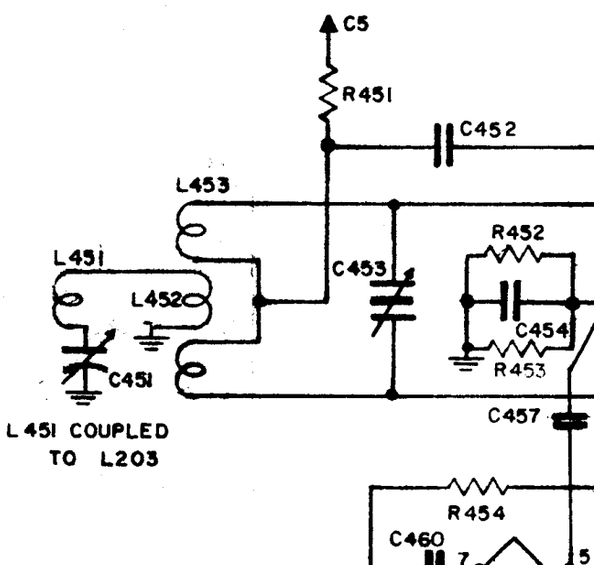


DRIVER

NOTE: LINKING **FM1674A/200**

P.A. SUB UNIT	STRIP "C"	STRIP "E"
A/450	3—5	—
A/475	—	2—5





3 C457
AD
2 R228
1 C220

TRIPLER

$\frac{1}{2}$12AT7

V202(b)

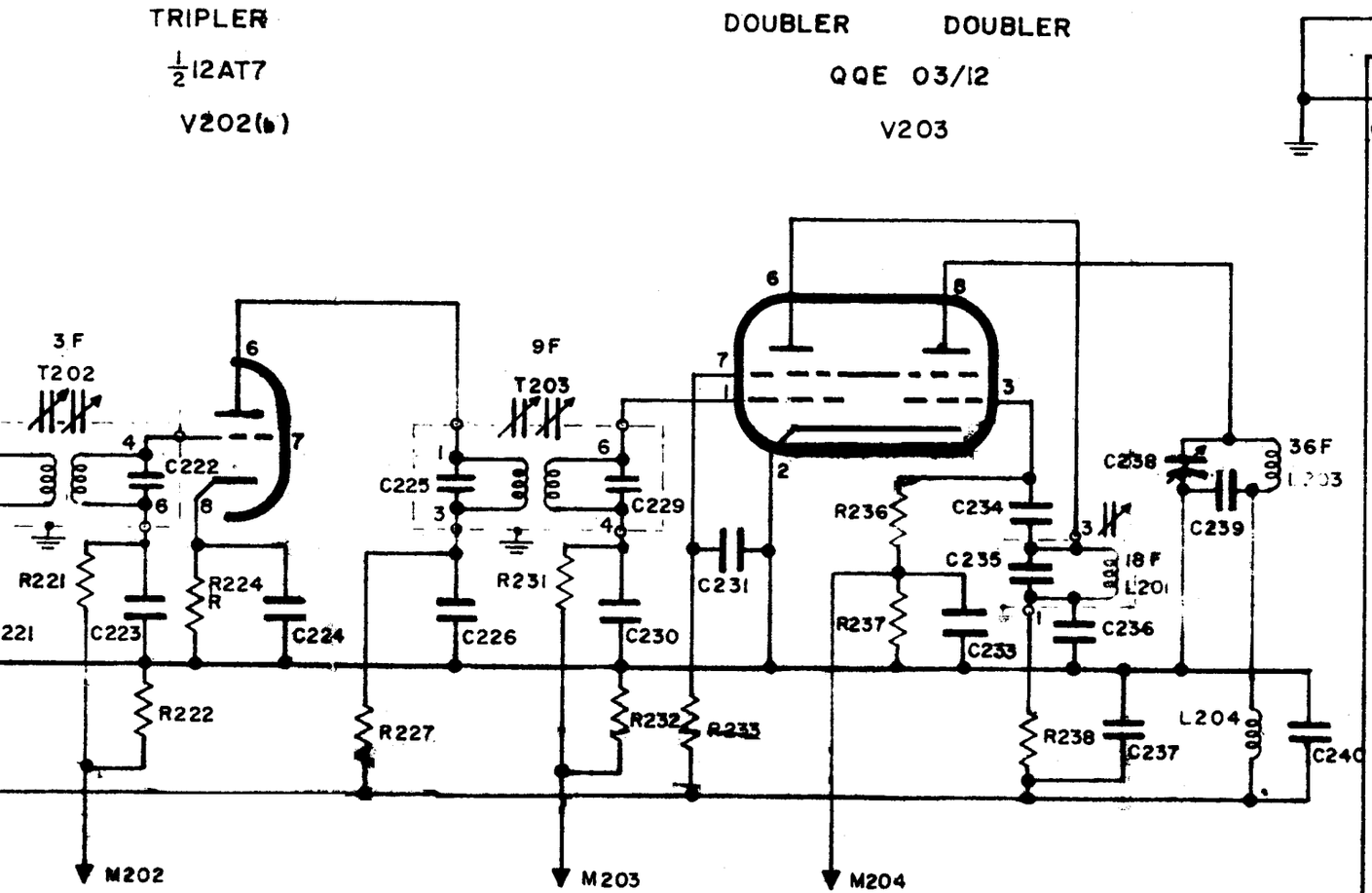
DOUBLER

QQE 03/12

V203

DOUBLER

V203



PRE – AMP

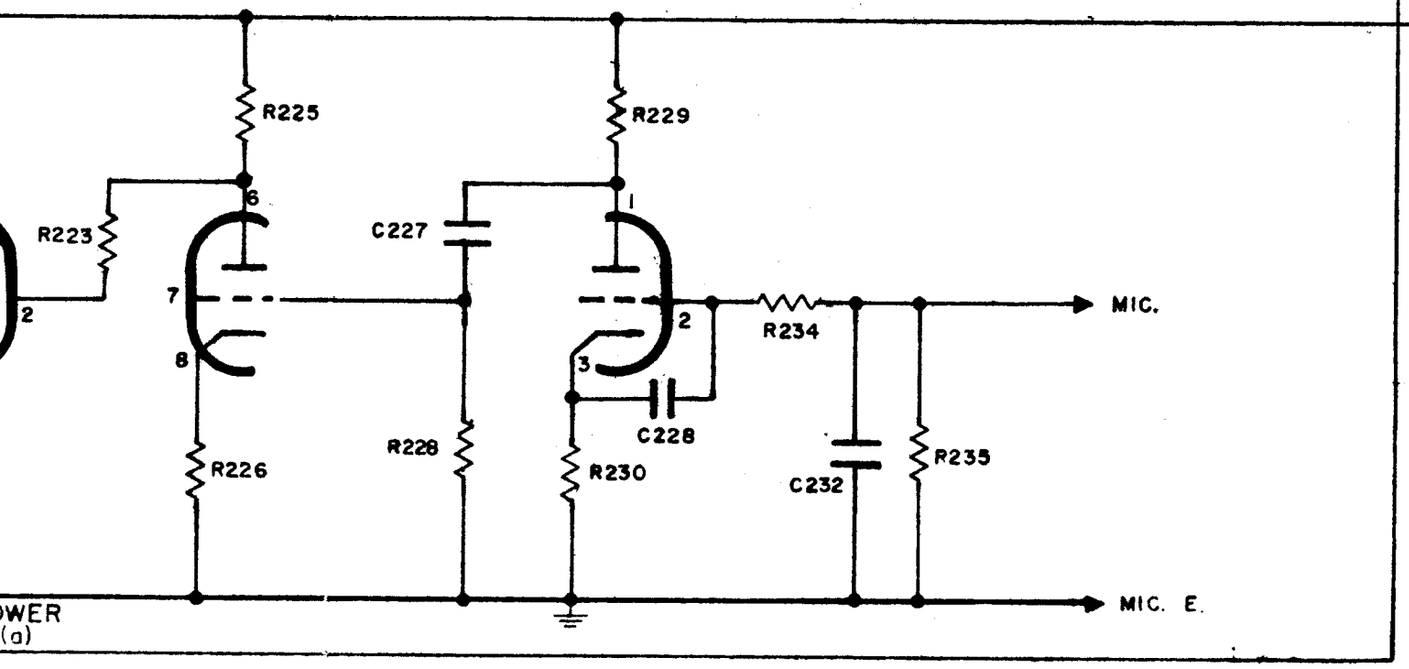
$\frac{1}{2}$12AT7

V204 (b)

PRE – AMP

$\frac{1}{2}$12AT7

V204 (a)



OR

C241

STRIP "C"

STRI "E"

C241

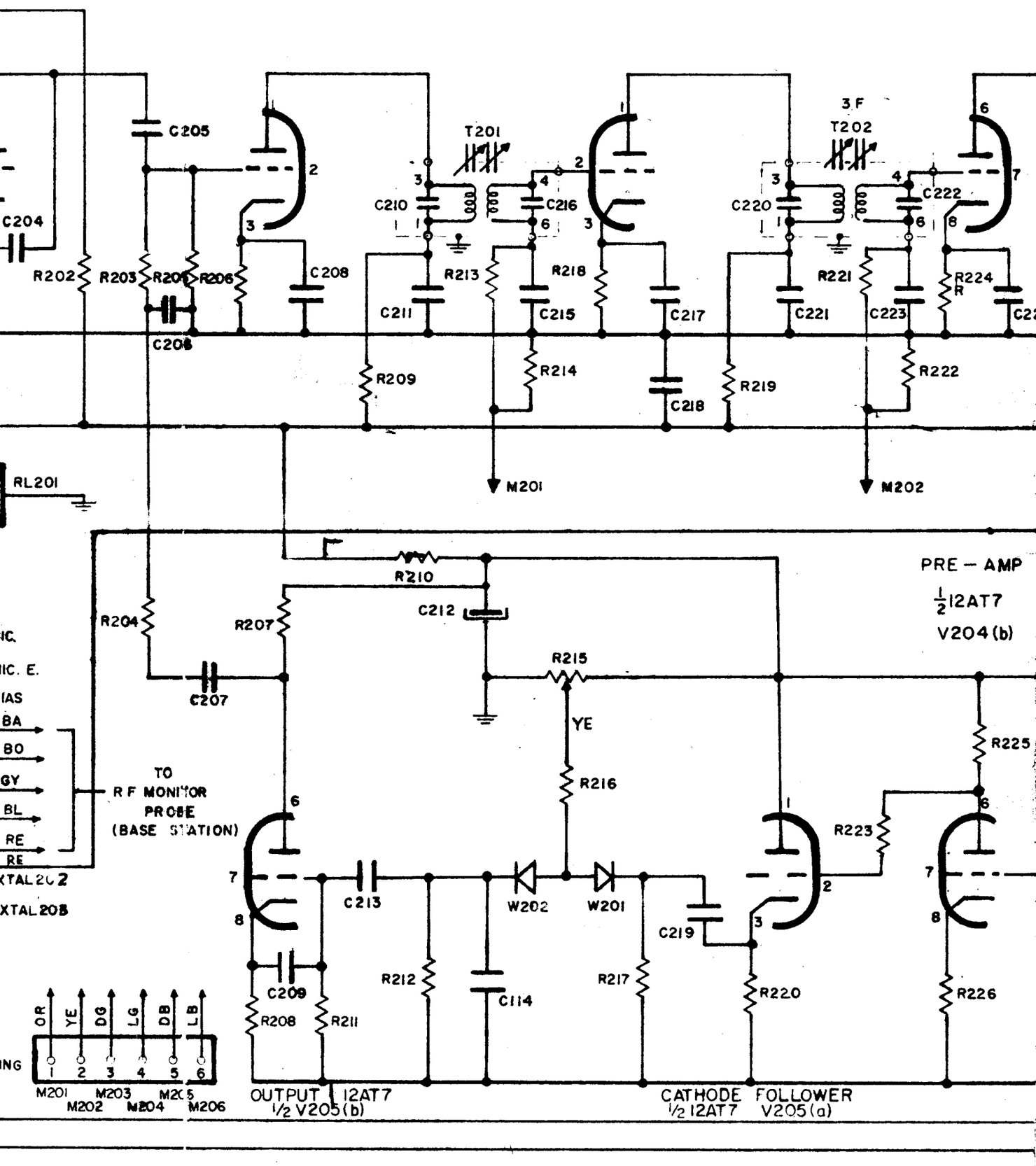
M2

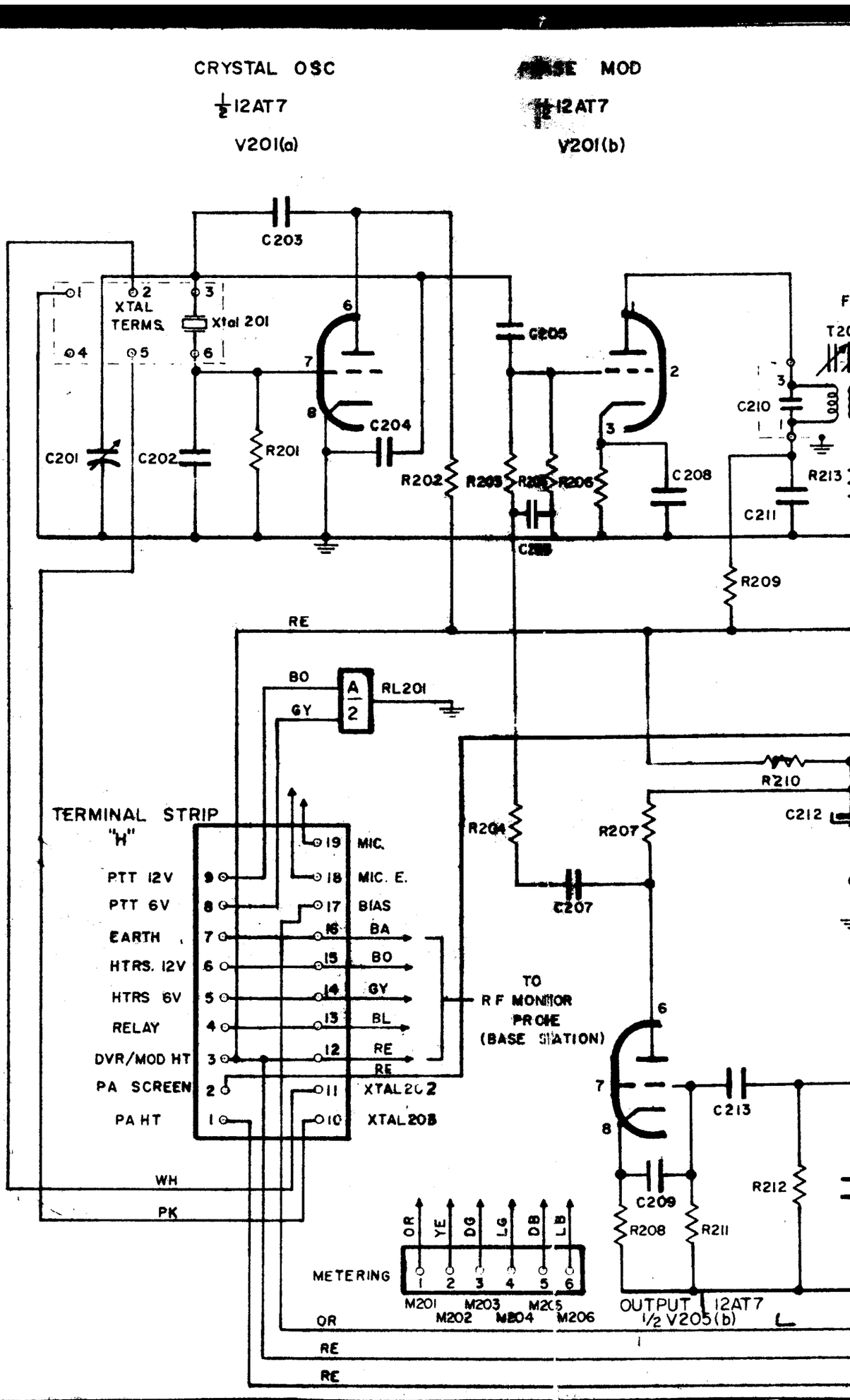
WER
(a)

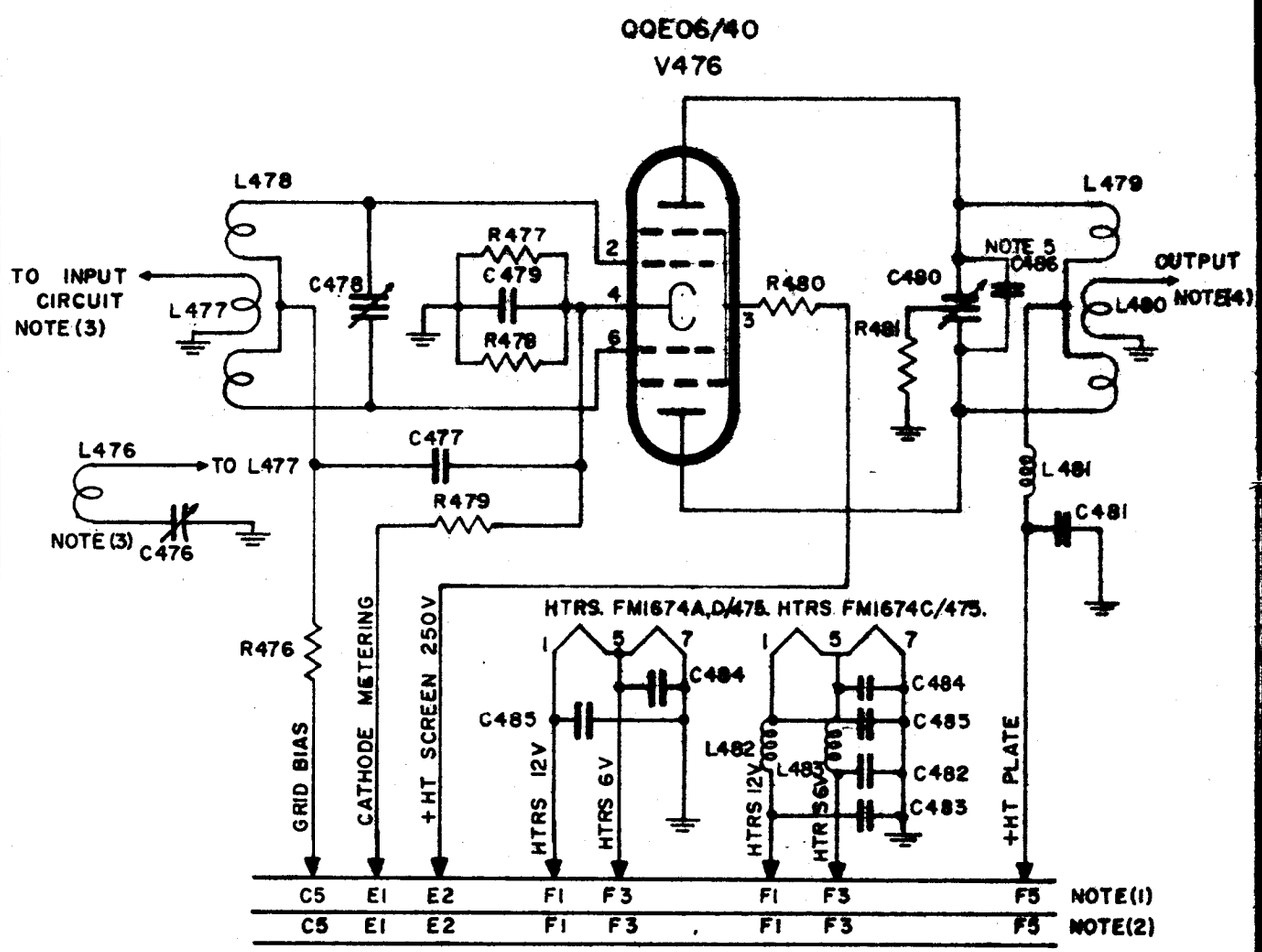
PHASE MOD
½ 12AT7
V201(b)

TRIPLER
½ 12AT7
V202(a)

TRIPLER
½ 12AT7
V202(b)




CRYSTAL OSC
½ 12AT7
V201(a)
MOD
½ 12AT7
V201(b)
C203
XTAL TERMS
Xtal 201
C201
C202
R201
C204
C205
R202
C208
C210
C211
R213
R209
RE
BO
GY
A/2
RL201
R210
C212
R204
R207
C207
TERMINAL STRIP "H"
PTT 12V
PTT 6V
EARTH
HTRS. 12V
HTRS 6V
RELAY
DVR/MOD HT
PA SCREEN
PA HT
MIC.
MIC. E.
BIAS
BA
BO
GY
BL
RE
RE
XTAL 202
XTAL 203
TO RF MONITOR PROBE (BASE STATION)
C213
C209
R208
R211
R212
WH
PK
OR
YE
DG
LG
DB
LB
METERING
M201
M202
M203
M204
M205
M206
OUTPUT 12AT7 ½ V205(b)
OR
RE
RE



NOTES (1) CONNECTIONS TO DRIVER TYPE FMI674 A,C,D /200 LUG STRIPS "C","E","F" FOR USE IN FMI674 A,C,D/350 50 WATT TRANSMITTER

(2) CONNECTIONS TO FMI674/600 LUG STRIPS "C","E","F," FOR USE IN 75 WATT TRANSMITTER (FMI674 A,C,D /375)

(3) INPUT CIRCUIT-(I) FOR 50 WATT TRANSMITTER (FMI674 A,C,D /350 INPUT CIRCUIT IS L476/C476 AS SHOWN, MOUNTED IN FMI674/200 CHASSIS & COUPLED TO L203 IN THAT CHASSIS

(II) FOR USE WITH FMI674/600 IN 75 WATT TRANSMITTER, INPUT CIRCUIT IS C601/SK601 MOUNTED IN FMI674/600 CHASSIS.

(4) OUTPUT CIRCUIT-(I) FMI674 A,C,D /350 — DIRECT TO SK201

(II) FMI674 A,C,D /375 — DIRECT TO SK602

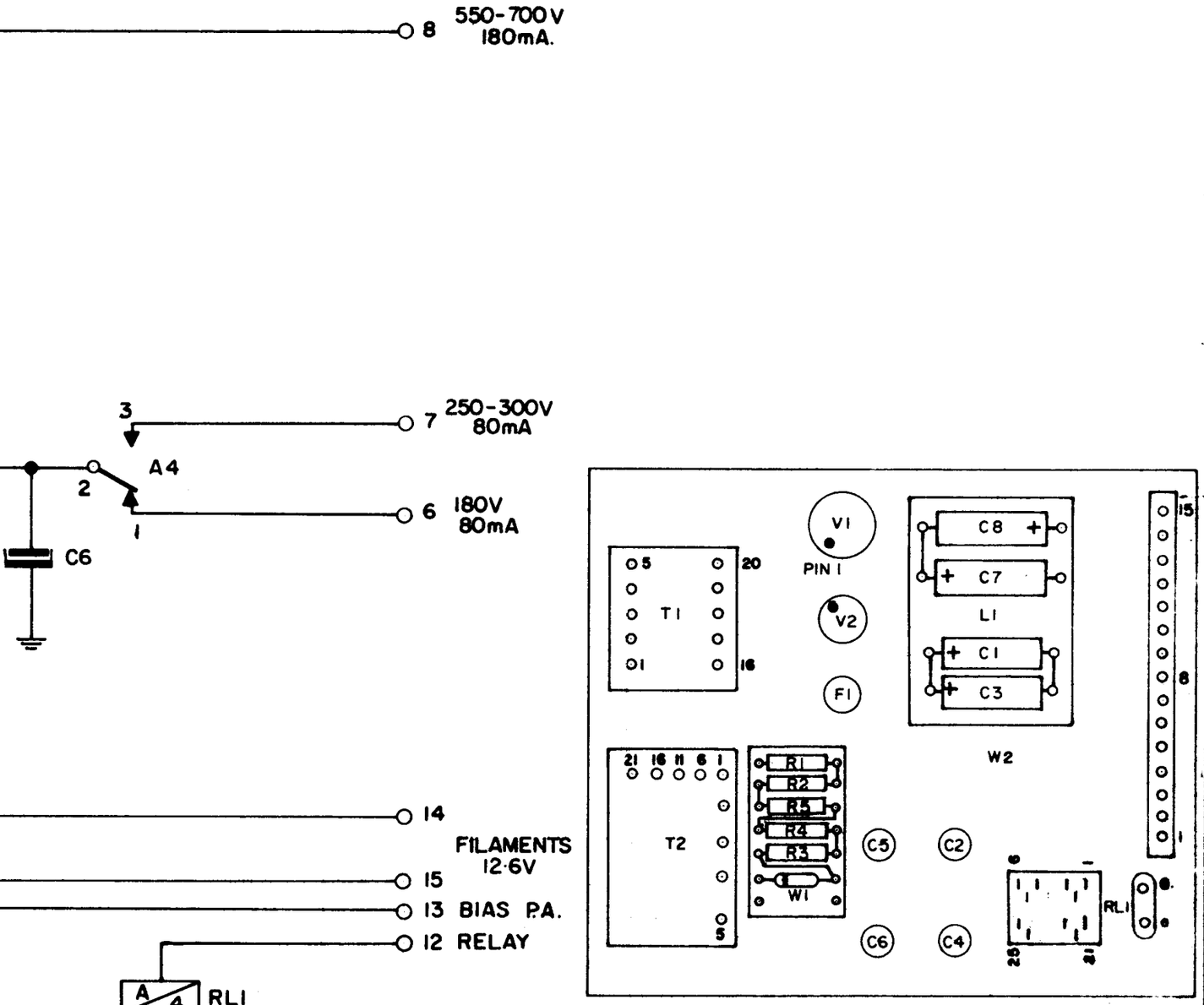
(5) C486 IS INCLUDED IN FMI674D/475 ONLY.

⚠1 FMI674D/475 added R.M.L. 20/1/58

TYPE FMI674 A,C,D/475 POWER AMPLIFIER

DRAWN E.A.D APPROVED [illegible] DATE 23-7-'57 SPA7047

TELECOMMUNICATION COMPANY OF AUSTRALIA PTY. LIMITED

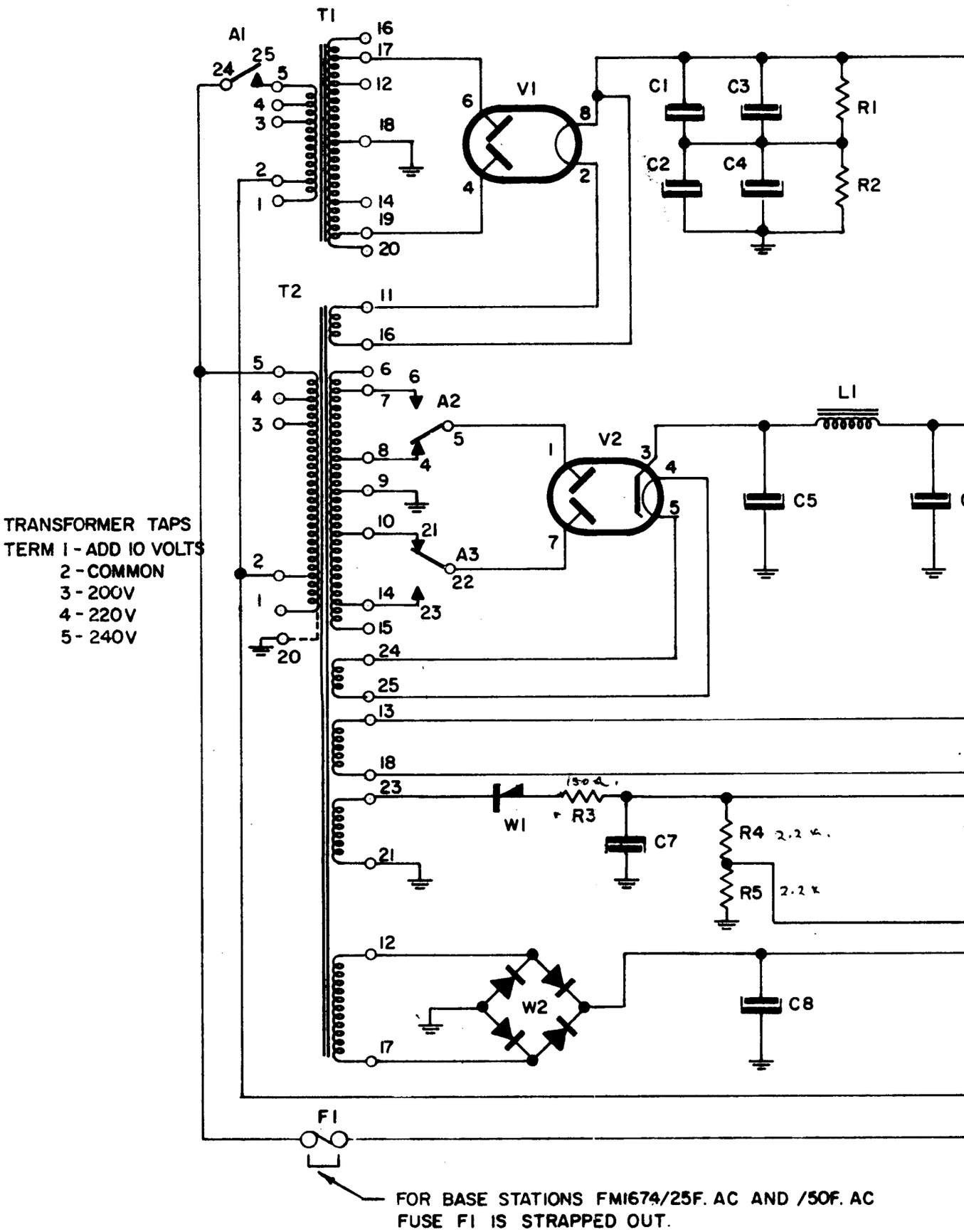


TYPE 1674/79
A.C. POWER SUPPLY
CIRCUIT DIAGRAM

DRAWN: M.R. CHECKED :

SPR2584

TELECOMMUNICATION COMPANY OF AUSTRALIA PTY.


TRANSFORMER TAPS
TERM 1 - ADD 10 VOLTS
2 - COMMON
3 - 200V
4 - 220V
5 - 240V
A1
T1
T2
V1
V2
W1
W2
A2
A3
C1
C2
C3
C4
C5
C7
C8
R1
R2
R3
R4 2.2 K.
R5 2.2 K
L1
F1
FOR BASE STATIONS FM1674/25F. AC AND /50F. AC
FUSE F1 IS STRAPPED OUT.

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
		RESISTORS				
CZ002.706.E	R476	1.5 Kohm 1 watt carbon	1		I.R.C.	B.T.S. 10%
CZ00C.003.CH	R477	20 ohm 1/2 " "	1		ERIE	Type 9 5%
CZ000.003.CH	R478	20 ohm 1/2 " "	1		"	Type 9 5%
CZ003.927.E	R479	22 Kohm 1/2 " "	1		I.R.C.	B.T.S. 10%
CZ001.616.E	R480	470 ohm 1 " "	1		"	B.T.A. 10%
CZ000.303.CH	R481	22 ohm 1/2 " "	1		ERIE	Type 9 10%
		CONDENSERS				
82014B/10E	⌘C476	10 pF variable trimmer	1		Philips	Locking. Detached Store with Assy. ⌘ SEE NOTE (1)
CZ096.726.AD	C477	100 pF ceramic bead	1		U.C.C.	SPG 1
82016B/6E4	C478	6.4 pF variable butterfly	1		Philips	Locking
CZ096.726.AD	C479	100 pF ceramic bead	1		U.C.C.	SPG 1
CZ107.523	C480	8x8 pF variable butterfly	1		Eddystone	Type 739
CZ074.618.16D	C481	3300 pF 1000V. working, tubular	1		Ducon	"Styroseal" DFB 1018, 20%
CZ097.102.AD	C482	1000 pF ceramic tubular	1		U.C.C.	CTH 310
" " "	C483	" " "	1		"	CTH 310
CZ096.726.AD	C484	100 pF ceramic bead	1		"	SPG 1
CZ096.726.AD	C485	" " "	1		"	SPG 1
						⌘ Assy. Note (1): C476. For the 50 watt base transmitter type FM1674C/350, the condenser C476 is mounted on the driver chassis FM1674C/200. For the 75 w. base, type FM1674/375 the condenser C476 is NOT REQUIRED.
						See also circuit diagram.
	V476	QQE06/40 Twin Tetrode	1		Philips	

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
CZ321.382	*L476	Coupling Link	1		T.C.A.	SPZ 1355. Detached Store with Assy. * See Note (2)
CZ321.383	L477	Coupling Link	1		"	SPZ 1356. Refer to drawing for Assembly Notes.
CZ321.387.2	L478	Grid Coil	1	SP.1065	"	SPZ 1360. " " "
CZ321.388	L479	Plate Loop	1		"	SPZ 1361. " " "
CZ321.389	L480	Loading Loop	1		"	SPZ 1362. " " "
CZ321.390	L481	R.F. Choke	1		"	SPZ 1367 SPL SP 636 Green
CZ321.353	L482	R.F. Choke	1		"	SPZ 1203 SPL SP 628 Yellow
CZ321.353	L483	R.F. Choke	1		"	SPZ 1203 SPL SP 628 Yellow

* Assy. Note (2): L476. This coil is required ONLY for the base transmitter type FM1674C/350. It is NOT REQUIRED for the base transmitter type FM1674C/375.

Circuit diagram	SPA 7047
Component Layout	SPB 3357

ELECTRICAL PARTS LIST - AC POWER SUPPLY FM1674/79

Code No.	Pos.	Description	No. Off	Supplier	Remarks.
CZ100.003	C1	24 uF 600VP	1	Ducon	Type ET6E
CZ100.004	C2	24 uF 600 VP	1	Ducon	Type EE5F
CZ100.003	C3	24 uF 600 VP	1	Ducon	Type ET6E
CZ100.004	C4	24 uF 600 VP	1	Ducon	Type EE5F
CZ100.004	C5	24 uF 600 VP	1	Ducon	Type EE5F
CZ100.004	C6	24 uF 600 VP	1	Ducon	Type EE5F
CZ100.101.2D	C7	100 uF 40 VP	1	Ducon	Type ET4D
CZ100.101.2D	C8	100 uF 40 VP	1	Ducon	Type ET4D
CZ005.215.E	R1	470 K ohm 1W carbon	1	I.R.C.	Type BTA 10%
CZ005.215.E	R2	470 K ohm 1W carbon	1	I.R.C.	Type BTA 10%
CZ001.621.CH	R3	150 ohm 1W carbon	1	I.R.C.	Type BTA 10%
CZ002.813.E	R4	2.2 K ohm 1W carbon	1	I.R.C.	Type BTA 10%
CZ002.813.E	R5	2.2 K ohm 1W carbon	1	I.R.C.	Type BTA 10%
CZ349.363	L1	Filter choke 16H 130 mA	1	TCA	
CZ349.360	T1	Main H.T. Transformer	1	TCA	
CZ349.369	T2	Minor H.T. Transformer	1	TCA	
	W1	OA85 Germanium Diode	1	Philips	
CZ038.602	W2	Selenium rectifier	1	McKenzie & Holland	Bridge Type 4A45
	V1	Rectifier type 5R4GY		Philips	
	V2	Rectifier type 6V4		Philips	
CZ250.212	RL1	Relay type 6R	1	Relays Pty. Ltd	Type 6R/D10CE Coil: 280 ohms 3C 1M
CZ280.702	F1	Fuse 2A		Goddard	1-1/4 x 1/4" body.
		Circuit Diagrams			SPB 3584
		Test instructions			SPA 8051 (2 sheets)

Code No.	Pos.	Description.	No. Off.	Supplier.	Change Note.	Remarks.
CZ003.927.E	R201	22KΩ ½ watt carbon	1	I.R.C.		B.T.S. 10%
CZ005.119.E	R202	150KΩ " "	1	"		" "
CZ003.921.E	R203	18KΩ " "	1	"		" "
CZ003.928.E	R204	33KΩ " "	1	"		" "
CZ005.121.E	R205	680KΩ " "	1	"		" "
CZ003.908.E	R206	47KΩ " "	1	"		" "
CZ003.908.E	R207	47KΩ " "	1	"		" "
CZ002.720.E	R208	3.3KΩ " "	1	"		" "
CZ003.921.E	R209	68KΩ " "	1	"	SP.967	B.T.A. 10%
CZ002.809.E	R210	10KΩ 1 watt carbon	1	"		B.T.S. 10%
CZ005.121.E	R211	680KΩ ½ watt carbon	1	"		" "
CZ003.910.E	R212	100KΩ " "	1	"		" "
CZ005.114.E	R213	220KΩ " "	1	"	SP.1098.1	" "
CZ002.715.E	R214	4.7KΩ " "	1	"		E.C. Type Trimmer Control
CZ009.072	R215	250KΩ Carbon Potentiometer				Curve A.
CZ003.910.E	R216	100KΩ ½ watt carbon	1	"		B.T.S. 10%
CZ003.910.E	R217	100KΩ " "	1	"		" "
CZ001.519.E	R218	220Ω " "	1	"		" "
CZ001.516.E	R219	1KΩ " "	1	"		" "
CZ003.921.E	R220	68KΩ " "	1	"		" "
CZ003.910.E	R221	100KΩ " "	1	"		" "
CZ001.519.E	R222	220Ω " "	1	"	SP.1098/1	B.T.S. 10%
CZ003.927.E	R223	22KΩ " "	1	"		" "
CZ001.519.E	R224	220Ω " "	1	"		" "
CZ005.114.E	R225	220KΩ " "	1	"		" "
CZ002.720.E	R226	3.3KΩ " "	1	"		" "
CZ001.516.E	R227	1KΩ " "	1	"		

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
CZ005.121.E	R228	680KΩ ½ watt carbon	1		I.R.C.	B.T.S. 10%
CZ003.921.E	R229	68KΩ " "	1	SP.967	"	" "
CZ002.720.E	R230	3.3KΩ " "	1		"	" "
CZ003.910.E	R231	100KΩ " "	1		"	" "
CZ001.508.E	R232	15CΩ " "	1	SP.1098/1	"	" "
CZ004.007.E	R233	100KΩ 1 watt carbon	1		"	B.T.A. 10%
CZ002.715.E	R234	4.7KΩ ½ watt carbon	1		"	B.T.S. 10%
CZ002.718.E	R235	6.8KΩ " "	1		"	" "
CZ003.910.E	R236	100KΩ " "	1		"	" "
CZ000.318	R237	68Ω " "	1	SP.1098/1	"	" "
CZ001.616.E	R238	470Ω 1 watt carbon	1		"	B.T.A. 10%
	R239					
CZ000.003.CH	R240	20Ω ½ watt carbon	1		ERIE	Type 9, 5%
CZ002.815.E	R241	4.7KΩ 1 watt carbon	1		I.R.C.	B.T.A. 10%
CZ002.813.E	R242	2.2KΩ " "	1	SP.967	"	" "
CZ002.816.E	R243	4.7KΩ " "	1	SP.967	"	" "
	R244					
CZ001.609.E	R245	1KΩ 1 watt carbon	1		"	B.T.A. 10%
82014B/25E	C201	25 pF Variable Trimmer.	1		Philips	Locking
CZ096.538.AA	C202	47 pF Ceramic Disc.	1		Simplex	DS NK NPO Style C 5%
CZ097.503.AD	C203	4700 pF Ceramic Tubular.	1		U.C.C.	CTH 315
CZ096.535.AA	C204	22 pF Ceramic Disc.	1		Simplex	DS NK N750 Style A 5%
CZ096.527.AA	C205	68 pF Ceramic Disc.	1		Simplex	DS NK N750 Style B 5%
CZ066.135.8AA	C206	330 pF Mica.	1		Simplex	Type MS 10%
CZ074.500.EH	C207	.01 uF 400V Paper Tubular.	1		A.E.E.	Type W99 Size B 20%

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
CZ096.006.D	C208	2.2 pF Ceramic Bead	1		Ducon	Style "F" .5 pfd N.P.O.
CZ097.102.AD	C209	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ096.522.AA	C210	22 pF Ceramic Disc	1		Simplex	DS NK NPO Style C 5%
CZ097.503.AD	C211	4700 pF Ceramic Tubular	1		U.C.C.	CTH 315
CZ099.401.3D	C212	8 mF 525 VP Electrolytic	1		Ducon	ET4D
CZ074.400.EH	C213	.01 mF 200V Paper Tubular	1		A.E.E.	W99 Size A 20%
CZ076.003.EH	C214	.04 mF 200V Paper Tubular	1		A.E.E.	W99 Size B 20%
CZ097.524.AD	C215	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ096.522.AA	C216	22 pF Ceramic Disc	1		Simplex	DS NK NPO Style C 5%
CZ097.524.AD	C217	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.524.AD	C218	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ076.003.EH	C219	.04 mF 200V Paper Tubular	1		A.E.E.	W99 Size B 20%
CZ096.522.AA	C220	22 pF Ceramic Disc	1		Simplex	DS NK NPO Style C 5%
CZ096.726.AD	C221	100 pF Ceramic Bead	1		U.C.C.	SPG 1
CZ096.522.AA	C222	22 pF Ceramic Disc	1		Simplex	DS NK NPO Style C 5%
CZ097.524.AD	C223	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.524.AD	C224	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ096.522.AA	C225	22 pF Ceramic Disc	1		Simplex	DS NK NPO Style C 5%
CZ096.726.AD	C226	100 pF Ceramic Bead	1		U.C.C.	SPG 1
CZ074.500.EH	C227	.01 mF 400V Tubular	1		A.E.E.	W99 Size B 20%
CZ097.524.AD	C228	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ096.522.AA	C229	22 pF Ceramic Disc	1		Simplex	DS NK NPO Style C 5%
CZ097.102.AD	C230	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C231	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.524.AD	C232	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C233	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ096.538.1AA	C234	47 pF Ceramic Disc	1		Simplex	DS NK N750 Style B 5%
CZ096.530.AA	C235	12 pF Ceramic Disc	1		Simplex	DS NK NPO Style B 1 pF

Code No.	Pos.	Description.	No. Off.	Change Note	Supplier.	Remarks.
CZ097.128.AD	C236	220 pF Ceramic Bead	1		U.C.C.	SPG 1
CZ097.524.AD	C237	2200 pF Ceramic Tubular	1		U.C.C.	CTH 310
82014B/10E	C238	10 pF Variable Trimmer	1		Philips	Locking
CZ097.102.AD	C239	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C240	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C241	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C242	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C243	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C244	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C245	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ097.102.AD	C246	1000 pF Ceramic Tubular	1		U.C.C.	CTH 310
CZ321.362.1	T201	R.F. Coupling Transformer (f)	1	SP.1052	T.C.A.	SPA 6938 SPL SP 629 Pink
CZ321.363.1	T202	R.F. Coupling Transformer (3f)	1	SP.1052	"	SPA 6939 SPL SP 630 Orange
CZ321.364.1	T203	R.F. Coupling Transformer (9f)	1	SP.1052	"	SPA 6940 SPL SP 631 Grey
CZ321.365.1	L201	R.F. Coupling Coil (18f)	1	SP.1052	"	SPA 6941 SPL SP 632 White
	L202					
CZ321.366.1	L203	Plate Coil (36f)	1	SP.1065	T.C.A.	SPZ 1313 Refer to drawing for Assembly Note
CZ321.352	L204	R.F. Choke	1		"	SPZ 1202 SPL SP 627 Red
		VALVES.				
	V201	12AT7 Twin triode	1		Philips	
	V202	12AT7 Twin triode	1		"	
	V203	QQE03/12 Twin tetrode	1		"	

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
		VALVES.				
	V204	12AT7 Twin triode	1		Philips	
	V205	12AT7 Twin triode	1		"	
	W201	OA85 Germanium diode	1		"	
	W202	OA85 Germanium diode	1		"	
NE50962	RL201	Relay Antenna Changeover	1		HALLER	Miniature Relay 2 C, Type No. 520 GN MT 6/12V
		CIRCUIT DIAGRAM.		SP.1098/3		SPD.782.2
CR901.966.2		Component Card A		SP.1098/2		SPZ 1314
CR901.967.1		Component Card B		SP.1098/2		SPZ 1315
CR901.968		Component Card C				SPZ 1316
CR901.969.1		Component Card D		SP.1098/2		SPZ 1317
CR901.970.2		Component Card E		SP.1098/2		SPZ 1318

Code No.	Pos.	Description.	No. Off.	Supplier.	Remarks.
		RESISTORS			
CZ001.526.E	R102	330 Ω ½ watt carbon	1	I.R.C.	BTS 10%
CZ000.310.CH	R103	10 Ω ½ watt carbon	1	Erie	Type 9 10%
CZ003.928.E	R104	33 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ001.519.E	R105	220 Ω ½ watt carbon	1	I.R.C.	BTS 10%
CZ003.908.E	R106	47 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ002.718.E	R107	6.8 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ002.816.E	R108	4.7 KΩ 1 watt carbon	1	I.R.C.	BTA 10%
CZ002.715.E	R109	4.7 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ001.526.E	R110	330 Ω ½ watt carbon	1	I.R.C.	BTS 10% (D only)
CZ003.927.E	R110	22 KΩ ½ watt carbon	1	I.R.C.	BTS 10% (A & C only)
CZ003.928.E	R111	33 KΩ ½ watt carbon	1	I.R.C.	BTS 10% (D only)
CZ005.114.E	R111	220 KΩ ½ watt carbon	1	I.R.C.	BTS 10% (A & C only)
CZ005.114.E	R112	220 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ004.008.E	R113	15 KΩ 1 watt carbon	1	I.R.C.	BTA 10% (D only)
CZ002.809.E	R113	10 KΩ 1 watt carbon	1	I.R.C.	BTA 10% (A & C only)
CZ005.109.E	R114	1 MΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ003.910.E	R115	100 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ001.526.E	R116	330 Ω ½ watt carbon	1	I.R.C.	BTS 10%
CZ003.910.E	R117	100 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ003.916.E	R118	15 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ002.816.E	R119	4.7 KΩ 1 watt carbon	1	I.R.C.	BTA 10%
CZ001.519.E	R120	220 Ω ½ watt carbon	1	I.R.C.	BTS 10%
CZ003.910.E	R121	100 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ005.111.E	R122	470 KΩ ½ watt carbon	1	I.R.C.	BTS 10%
CZ002.809.E	R123	10 KΩ 1 watt carbon	1	I.R.C.	BTA 10%
CZ001.619.E	R124	330 Ω 1 watt carbon	1	I.R.C.	BTA 10%
CZ004.012.E	R125	47 KΩ 1 watt carbon	1	I.R.C.	BTA 10%
CZ002.809.E	R126	10 KΩ 1 watt carbon	1	I.R.C.	BTA 10%
CZ001.619.E	R127	330 Ω 1 watt carbon	1	I.R.C.	BTA 10%
CZ004.012.E	R128	47 KΩ 1 watt carbon	1	I.R.C.	BTA 10%
CZ002.809.E	R129	10 KΩ 1 watt carbon	1	I.R.C.	BTA 10%

Code No.	Pos.	Description.	No. Off	Change Note.	Supplier.	Remarks.
		RESISTORS				
CZ005.114.E	R130	220 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ001.619.E	R131	330 Ω 1 watt carbon	1		I.R.C.	BTA 10%
CZ001.619.E	R132	330 Ω 1 watt carbon	1		I.R.C.	BTA 10%
CZ004.012.E	R133	47 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ003.921.E	R134	68 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ002.809.E	R135	10 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ005.114.E	R136	220 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.114.E	R137	220 KΩ ½ watt carbon	1	1433	I.R.C.	BTS 10%
CZ004.012.E	R138	47 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ003.809.E	R139	10 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ004.008.E	R140	15 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ003.908.E	R141	47 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ002.809.E	R142	10 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ001.516.E	R143	1 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.114.E	R144	220 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ001.609.E	R145	1000 Ω 1 watt carbon	1		I.R.C.	BTA 10%
CZ004.022.E	R146	33 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ005.121.E	R147	680 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ004.012.E	R148	47 KΩ 1 watt carbon	1		I.R.C.	BTS 10%
CZ005.122.E	R149	330 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.910.E	R150	100 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.209.E	R151	220 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ004.012.E	R152	47 KΩ 1 watt carbon	1		I.R.C.	BTA 10%
CZ003.927.E	R153	22 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.908.E	R154	47 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.114.E	R155	220 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.109.E	R156	1 MΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.910.E	R157	100 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.910.E	R158	100 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.910.E	R159	100 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.111.E	R160	470 KΩ ½ watt carbon	1		I.R.C.	BTS 10%

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
		RESISTORS				
CZ005.114.E	R161	220 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.910.E	R162	100 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.910.E	R163	100 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.122.E	R164	330 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ004.022.E	R165	33 KΩ 1 watt carbon	1	1433	I.R.C.	BTA 10%
CZ003.611.E	R166	56 KΩ ½ watt carbon	1		I.R.C.	BTS 5%
CZ005.121.E	R167	680 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.121.E	R168	680 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ005.122.E	R169	330 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ003.927.E	R170	22 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ002.713.E	R171	2,2 KΩ ½ watt carbon	1		I.R.C.	BTS 10% (C only)
CZ002.710.E	R172	10 KΩ ½ watt carbon	1		I.R.C.	BTS 10% (D only)
CZ002.710.E	R173	10 KΩ ½ watt carbon	1		I.R.C.	BTS 10% (D only)
CZ002.710.E	R174	10 KΩ ½ watt carbon	1		I.R.C.	BTS 10% (D only)
CZ002.710.E	R175	10 KΩ ½ watt carbon	1		I.R.C.	BTS 10% (D only)
CZ003.927.E	R176	22 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
CZ002.710.E	R177	10 KΩ ½ watt carbon	1		I.R.C.	BTS 10%
		CAPACITORS				
82014B/10E	C101	10 pF variable trimmer	1		Philips	Type 82014B/10E Locking
82014B/10E	C102	10 pF variable trimmer	1		Philips	Type 82014B/10E Locking
CZ097.524.AD	C103	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310 (A & D only)
CZ096.527.AA	C103	68 pF ceramic disc	1		Simplex	Type DSNK, N750B 5% (C only)
82014B/10E	C104	10 pF variable trimmer	1		Philips	Type 82014B/10E Locking
CZ096.601.AD	C105	100 pF ceramic 500V	1		U.C.C.	Type SCT2 10%
CZ097.524.AD	C106	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310 (A & D only)
CZ096.527.AA	C106	68 pF ceramic disc	1		Simplex	Type SDNK, N750B 5% (C only)
CZ097.524.AD	C107	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310 (A & D only)
CZ096.522.AA	C107	22 pF ceramic disc	1		Simplex	Type DSNK NPO C 5% (C only)
CZ097.524.AD	C108	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
		CAPACITORS				
82014B/10E	C109	10 pF variable trimmer	1		Philips	Type 82014B/10E Locking
CZ096.601.AD	C110	100 pF ceramic 500V	1		U.C.C.	Type SCT2 10%
CZ096.534.2AA	C111	33 pF ceramic disc 500V	1		Simplex	DSNK N750A 5%
CZ097.524.AD	C112	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310 (A & D only)
CZ097.538.1AA	C112	47 pF ceramic disc 500V	1		Simplex	Type DSNK N750 B 5% (C only)
CZ096.526.AA	C113	82 pF ceramic disc 500V	1	1393	Simplex	Type DSNK N750 C 5% (D only)
CZ096.527.AA	C113	68 pF ceramic disc 500V	1		Simplex	Type DSNK N750 B 5% (A & C only)
CZ064.928.8AA	C114	10 pF silvered mica 500V	1		Simplex	Type MS 10%
CZ096.526.AA	C115	82 pF ceramic disc 500V	1	1393	Simplex	Type DSNK N750 C 5% (D only)
CZ096.538.1AA	C115	47 pF ceramic disc 500V	1		Simplex	Type DSNK N750 B 5% (A & C only)
CZ097.524.AD	C116	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310 (A & D only)
CZ096.538.1AA	C116	47 pF ceramic disc	1		Simplex	Type DSNK N750 B 5% (C only)
CZ097.524.AD	C117	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ097.524.AD	C118	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
82014B/10E	C119	10 pF variable trimmer	1		Philips	Type 82014B/10E Locking
CZ064.521.8AA	C120	22 pF silvered mica 500V	1		Simplex	Type MS 5%
CZ097.524.AD	C121	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ097.524.AD	C122	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ097.524.AD	C123	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ064.520.8AA	C124	100 pF silvered mica 500V	1		Simplex	Type MS 2½% (D only)
CZ064.518.8AA	C124	47 pF silvered mica 500V	1		Simplex	Type MS 5% (A & C only)
CZ064.520.8AA	C125	100 pF silvered mica 500V	1		Simplex	Type MS 2½% (D only)
CZ064.518.8AA	C125	47 pF silvered mica 500V	1		Simplex	Type MS 5% (A & C only)
CZ097.524.AD	C126	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ097.524.AD	C127	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ097.524.AD	C128	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ064.520.8AA	C129	100 pF silvered mica 500V	1		Simplex	Type MS 2½% (D only)
CZ064.518.8AA	C129	47 pF silvered mica 500V	1		Simplex	Type MS 5% (A & C only)
CZ064.520.8AA	C130	100 pF silvered mica 500V	1		Simplex	Type MS 2½% (D only)
CZ064.518.8AA	C130	47 pF silvered mica 500V	1		Simplex	Type MS 5% (A & C only)
CZ076.003.EH	C131	0.04 uF paper 200V	1		A.E.E.	Type W99 20%

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
		CAPACITORS				
CZ074.400.EH	C132	0.01 uF paper 200V	1		A.E.E.	Type W99 20%
82014B/10E	C133	10 pF variable trimmer	1		Philips	Type 82014E/10E
CZ096.326	C134	6.8 pF ceramic disc 500V	1		Simplex	Type F N750 20%
CZ097.524.AD	C135	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ068.502.2AA	C136	0.01 uF Mica 500V	1		Simplex	Type SM 20%
CZ076.003.EH	C137	0.04 uF paper 200V	1		A.E.E.	Type W99
CZ097.303.AD	C138	4,700 uF ceramic 500V	1		U.C.C.	Type CTH 315
CZ068.502.2AA	C139	0.01 uF mica 500V	1		Simplex	Type SM20%
CZ066.135.8AA	C140	330 pF silvered mica 500V	1		Simplex	Type MS 5%
CZ074.400.EH	C141	0.01 uF paper 200V	1		A.E.E.	Type W99 20%
CZ097.503.AD	C142	4,700 uF ceramic 500V	1		U.C.C.	Type CTH 315
CZ097.503.AD	C143	4,700 uF ceramic 500V	1		U.C.C.	Type CTH 315
CZ066.142.8AA	C144	150 pF silvered mica 500V	1		Simplex	Type MS 5%
CZ096.534.2AA	C145	33 pF ceramic disc 500V	1		Simplex	DSNK N750A 5%
CZ096.534.2AA	C146	33 pF ceramic disc 500V	1		Simplex	DSNK N750A 5%
CZ066.142.8AA	C147	150 pF silvered mica 500V	1		Simplex	MS 5%
CZ096.202.AD	C148	10 pF ceramic 500V	1		U.C.C.	SCT1 10%
CZ099.801.1D	C149	25 uF 40 V.P.	1		Ducon	Electrolytic type ET1B
CZ074.400.EH	C150	0.01 uF paper 200V	1		A.E.E.	W99
CZ097.503.AD	C151	4,700 pF ceramic 500V	1		U.C.C.	CTH 315
CZ076.116.1D	C152	0.05 uF paper 500V	1		Ducon	TF 515P 20% Serviseal
CZ097.510.AD	C153	.01 uF ceramic 500V	1		U.C.C.	Type CTH 422
CZ097.503.AD	C154	4,700 pF ceramic 500V	1		U.C.C.	Type CTH 315 (A & D only)
CZ097.510.AD	C154	0.01 uF ceramic 500V	1		U.C.C.	Type CTH 422 (C only)
CZ066.135.8AA	C155	330 pF silvered Mica 500V	1		Simplex	Type MS 5%
CZ096.500.AA	C156	100 pF ceramic disc 500V	1		Simplex	Type DSNK N750C 5%
CZ076.400.EH	C157	0.1 uF paper 150V	1		A.E.E.	W49 25%
CZ078.105.EH	C158	0.5 uF paper 250V	1		A.E.E.	Type W49 25%
	C159					
CZ096.500.AA	C160	100 pF ceramic disc 500V	1		Simplex	Type DSNK N750C 5%
CZ066.135.8AA	C161	330 pF silvered mica 500V	1	-	Simplex	Type MS 5%

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
		CAPACITORS				
CZ097.510.AD	C162	0.01 uF ceramic 500V	1		U.C.C.	Type CTH 422
CZ096.624.AD	C163	22 pF ceramic 500V	1		U.C.C.	Type SCT 1 10%
CZ076.003.EH	C164	0.04 uF paper 200V	1		A.E.E.	Type W99 20%
CZ066.147.9AA	C165	1000 pF mica 500V	1		Simplex	Type SS 5%
CZ097.503.AD	C166	4700 pF ceramic 500V	1		U.C.C.	Type CTH 315
CZ066.147.9AA	C167	1000 pF mica 500V	1		Simplex	Type SS 5%
CZ097.503.AD	C168	4700 pF ceramic 500V	1		U.C.C.	Type CTH 315
CZ066.133.2	C169	220 pF silvered mica 500V	1		Simplex	Type MS 5%
CZ096.527.AA	C170	68 pF ceramic disc 5000V	1		Simplex	Type DSNK N750B 5%
CZ097.503.AD	C171	4700 pF ceramic 500V	1		U.C.C.	Type CTH 315
CZ097.013.AD	C172	680 pF ceramic 500V	1		U.C.C.	Type CTH 310
CZ076.003.EH	C173	0.04 uF paper 200V	1		A.E.E.	Type W99 20%
CZ096.527.AA	C174	68 pF ceramic disc 500V	1		Simplex	Type DSNK N750 B 5%
CZ066.133.2	C175	220 pF silvered mica 500V	1		Simplex	Type MS 5%
CZ096.534.2AA	C176	33 pF ceramic disc 500V	1		Simplex	DSNK N750A 5%
CZ074.400.EH	C177	0.01 uF paper 200V	1		A.E.E.	Type W99 20%
CZ097.013.AD	C178	680 pF ceramic 500V	1		U.C.C.	CTH 310
CZ096.601.AD	C179	100 pF ceramic 500V	1		U.C.C.	SCT2, 10%
CZ096.624.AD	C180	22 pF ceramic 500V	1		U.C.C.	SCT1, 10%
CZ097.503.AD	C181	4700 pF ceramic 500V	1		U.C.C.	Type CTH 315
CZ066.165.8	C182	105 pF silvered mica 500V	1		Simplex	Type MS 2½%
CZ096.535.AA	C183	22 pF ceramic disc 500V	1		Simplex	Type DSNK N750A5%
CZ066.165.8	C184	105 pF silvered mica 500V	1		Simplex	Type MS 2½%
CZ066.165.8	C185	105 pF silvered mica 500V	1		Simplex	Type MS 2½%
CZ096.601.AD	C186	100 pF ceramic 500V	1		U.C.C.	Type SCT2 10%
CZ096.535.AA	C187	22 pF ceramic disc 500V	1		Simplex	Type DSNK N750A 5%
CZ076.119.D	C188	0.02 uF paper 500V	1		Ducon	Type TF512P Serviseal 20%
CZ097.013.AD	C189	680 pF Ceramic 500V	1	1433	U.C.C.	CTH 310
CZ076.003.EH	C190	0.04 uF paper 200V	1		A.E.E.	Type W99 20%
CZ096.601.AD	C191	100 pF ceramic 500V	1	1433	U.C.C.	SCT 2 10%
CZ097.510.AD	C192	0.01 uF ceramic 500V	1		U.C.C.	Type CTH 422 (C only)

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
		CAPACITORS				
CZ097.524.AD	C193	2,200 pF ceramic 500V	1		U.C.C.	Type CTH 310 (C only)
CZ074.500.EH	C194	0.01 paper 400V	1	SP.1482	A.E.E.	Type W99 20%
		DETECTOR DIODES				
	W101	OA202 silicon diode	1		Philips	
	W102	OA202 silicon diode	1		Philips	
	W103	OA202 silicon diode	1		Philips	
	W104	OA202 silicon diode	1		Philips	
CZ320.046.1	T101	RF grid transformer 'A' receiver	1	1335	T.C.A.	SPA.6976 ref. SPL.SP.644
CZ320.275.1	T101	RF grid transformer 'C' receiver	1	1335	T.C.A.	SPA.7040 ref. SPL.SP.660
CZ320.056.1	T101	RF grid transformer 'D' receiver	1	1335	T.C.A.	SPA.7764 ref. SPL.SP.718
CZ320.270.1	T102	RF anode transformer 'A' receiver	1	1335	T.C.A.	SPA.6977 ref. SPL.SP.644
CZ320.274.2	T102	RF anode transformer 'C' receiver	1	1335	T.C.A.	SPA.7041 ref. SPL.SP.660
CZ320.329.1	T102	RF anode transformer 'D' receiver	1	1335	T.C.A.	SPA.7765 ref. SPL.SP.718
CZ326.285	T103	1st IF transformer 20-27 mc/s	1		T.C.A.	SPA.6968 ref. SPL.SP.642 (A & C only)
CZ326.286	T103	1st IF transformer 10-14 mc/s	1		T.C.A.	SPA.7766 ref. SPL.SP.720 (D only)
CZ326.285	T104	1st IF transformer 20-27 mc/s	1		T.C.A.	SPA.6968 ref. SPL.SP.642 (A & C only)
CZ326.286.1	T104	1st IF transformer 10-14 mc/s	1	1357	T.C.A.	SPA.7766 ref. SPL.SP.720 (D only)
CZ326.284.1	T105	2 mc/s I.F. transformer	1		T.C.A.	SPA.6967 ref. SPL.SP.641
CZ349.375	T106	Audio output transformer	1		T.C.A.	
CZ326.283.2	T107	2 mc/s limiter transformer	1		T.C.A.	SPA.6966 ref. SPL.SP.640
CZ326.282.2	T108	4 mc/s limiter transformer	1		T.C.A.	SPA.6979 ref. SPL.SP.646
CZ326.287.2	T109	4 mc/s discriminator transformer	1	1357	T.C.A.	SPA.7801 ref. SPL.SP.732

Code No.	Pos.	Description	No. Off	Change Note.	Supplier	Remarks
	L101					
CZ323.411	L102	Oscillator and Multiplier coils	1		T.C.A.	SPA.6969 ref. SPL.SP.643 (A & C only)
	L101					
CZ323.413.1	L102	Oscillator and Multiplier coils	1	1357	T.C.A.	SPA.7768 ref. SPL.SP.721 (D only)
CR122.206.2	Filter 1	Filter box assembly	1		T.C.A.)	SPB.3155 ref SPL.SP.648
CR122.206.2	Filter 2	Filter box assembly	1		T.C.A.)	assemble to spec. L.3006 on SPA.7054
		TUBES				
	V101	Pentode 6AK5	1			
	V102	Twintriode 12AT7	1			
	V103	Pentode 6AK5	1			
	V104	Pentode 6AK5				
	V105	Triode Hexode 6AN7	1			
	V106	Pentode 6AK5	1			
	V107	Pentode 6AK5	1			
	V108	Pentode 6AK5	1			
	V109	Pentode 6AQ5	1	1433		
	V110	Pentode 6AK5	1			
	V111	Pentode 6AK5	1			
	V112	Pentode 6AK5	1			
	V113	Pentode 6AK5	1			
	Xtal 101	Crystal Quartz				Frequency depends on system allocation General Specification SPZ.1559
CR902.313		Crystal Switching Box	1		T.C.A.	SPL.SP.691 Specially ordered (A & C only)
CR902.548		Crystal Switching Box	1		T.C.A.	SPL.SP.722 Specially ordered (D only)

Code No.	Pos.	Description	No. Off	Change Note.	Supplier	Remarks
	L101					
CZ323.411	L102	Oscillator and Multiplier coils	1		T.C.A.	SPA.6969 ref. SPL.SP.643 (A & C only)
	L101					
CZ323.413.1	L102	Oscillator and Multiplier coils	1	1357	T.C.A.	SPA.7768 ref. SPL.SP.721 (D only)
CR122.206.2	Filter 1	Filter box assembly	1		T.C.A.)	SPB.3155 ref SPL.SP.648
CR122.206.2	Filter 2	Filter box assembly	1		T.C.A.)	assemble to spec. L.3096 on SPA.7054
		TUBES				
	V101	Pentode 6AK5	1			
	V102	Twintriode 12AT7	1			
	V103	Pentode 6AK5	1			
	V104	Pentode 6AK5				
	V105	Triode Hexode 6AN7	1			
	V106	Pentode 6AK5	1			
	V107	Pentode 6AK5	1			
	V108	Pentode 6AK5	1			
	V109	Pentode 6AQ5	1	1433		
	V110	Pentode 6AK5	1			
	V111	Pentode 6AK5	1			
	V112	Pentode 6AK5	1			
	V113	Pentode 6AK5	1			
	Xtal 101	Crystal Quartz				Frequency depends on system allocation General Specification SPZ.1559
CR902.313		Crystal Switching Box	1		T.C.A.	SPL.SP.691 Specially ordered (A & C only)
CR902.548		Crystal Switching Box	1		T.C.A.	SPL.SP.722 Specially ordered (D only)

Code No.	Pos.	Description.	No. Off.	Change Note.	Supplier.	Remarks.
				1357		
CR902.660.1		Component Card Assy.	1	1296	T.C.A.	SPZ.2163
CR902.547		Component Card Assy.	1		T.C.A.	SPA.7769 (D only)
CR902.967		Component Card Assy.	1	1433	T.C.A.	SPA.8540 (A & C only)
CR902.095		Component Card Assy.	1		T.C.A.	SPZ.1580
		Component Layout Back View	1		T.C.A.	SPB.3569
		Component Layout Top View	1		T.C.A.	SPB.3570
		Component Cards	1	1296	T.C.A.	SPA.7907 Instruction Book use only
		Circuit Diagram A			T.C.A.	SPD.865
		Circuit Diagram C			T.C.A.	SPD.866
		Circuit Diagram D			T.C.A.	SPD.867

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