



**1KW COMMUNICATION TRANSMITTER ATS-1
TYPE 1J66400
VOL. II OF TWO
CH. 3 LINEAR AMPLIFIER SECTION**

HANDBOOK 66400R

CHAPTER 3

ATS-1 LINEAR AMPLIFIER SECTION

CHAPTER 3

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PART 1TECHNICAL DESCRIPTION

1. R.F. AMPLIFIER SECTION

1.1 General (Refer Figure 3-7)

The r.f. amplifier section of Transmitter ATS-1 comprises a wide-band pre-amplifier RFA1, driver-amplifier RFA2, power amplifier RFA3, gain limiter and a reflectometer.

The input signal at the radiated frequency in the 1.6 MHz - 30 MHz range and selected emission mode is fed from the exciter unit by a 50-ohm coaxial cable. After amplification a signal of up to 1 kW is fed by 75-ohm coaxial cable to the aerial system.

The v.s.w.r. is detected by a built-in reflectometer and indicated on multimeter 4MI. A rise in v.s.w.r. beyond a pre-set limit causes an overload circuit to operate.

The operation of the driver amplifier and the parallel connected power amplifier valves may be monitored and overloads in any of these circuits will cause the overload circuits to operate, which in turn disconnects the e.h.t. and lights up the appropriate overload lamp on the control panel.

Coarse and fine tuning of the RFA2 and RFA3 stages and transmitter loading is achieved automatically by servo motors under the control of the servo control unit. The transmitter may also be tuned manually.

1.2 Wideband Pre-Amplifier RFA1 - 1R66415 (Refer Figure 3 - 7)

The r.f. output signal from the exciter is fed to RFA1 input impedance matching transformer 2TR1 via 50-ohm coaxial cable and connector 1SKA. The signal is passed on to 2VT9 and 2VT10 connected as a wide band cascode amplifier providing a substantially flat response from 1.6 MHz to 30 MHz. The base of 2VT10 is held at 6.8 V by zener diode 2MR12.

The gain of RFA1 is controlled by 2VT11, whose emitter current is zero under normal operating conditions. In this state 2VT11 appears merely as an additional capacitance across the common point of the cascode amplifier. When a reduction in final output is required, the bias of 2VT11 is varied via 2VT12 so that emitter current flows. This causes the collector current of 2VT9 to divide between 2VT10 and 2VT11 resulting in a reduction of output voltage. Complete suppression of the output signal occurs when all of the collector current of 2VT9 flows via 2VT11.

The change of bias on 2VT11 is controlled by the conduction of 2VT12, which in turn is governed by the gain limiter or the r.f. control circuitry in the tuning system. 1L1, 1R1 causes the response to fall off outside the amplifier pass band. 1TR2 provides impedance matching between RFA1 and RFA2, and 1R2, 1L2 provide peaking in the response at about 30 MHz.

The r.f. input may be monitored by multimeter 4M1 in position 17, EXCITER OUTPUT, after rectification and filtering by 2MR1, 2MR2, 2L1 and 2C2, the same voltage is also fed to the r.f. sensing circuit in the automatic tuning system and to the output limiting circuit in the exciter auto-attenuator. Similarly the r.f. input to RFA2 may be monitored by 4M1 in the RFA1 OUTPUT position after rectification and filtering by 1MR1, 1L4 and 1L6.

The frequency discriminator circuit is on the same printed wiring board as RFA1; a description of its operation follows in sub-section 4.4 of this Part

1.3 Driver Amplifier RFA2 - Part of 1J66414 (Refer Figure 3 - 7)

This stage employs a single type 8122 ceramic beam power tetrode as a tuned, class A, r.f. amplifier. The r.f. signal is fed to the control grid via 1C1 and the anode circuit is tuned by a ganged variable inductor 10L9 and variable capacitor 10C14 which are contained in the RFA2 tuning assembly. Anode and screen potentials of 1.5 kV and 400 V respectively are provided by a divider network in the e.h.t. power supply.

Coarse tuning is controlled by the frequency discriminator and fine tuning by phase discriminator 1. 10 MOTOR 1 tunes inductor 10L9 and variable capacitor 10C14. 10C13 is ganged to 10C14 and provides a signal voltage to TR1 in each phase discriminator circuit. The second input for discriminator 1 is taken from 1V1 grid circuit via C3 on the discriminator board and from 1V1 cathode circuit via 1C6.

Inverse feedback is applied to 1V1 cathode circuit from RFA3 output via a voltage divider comprising pick-up capacitor 1C43 and feedthrough capacitor assembly 1C3 and the contacts of relay 4FB. 4FB is energised from the 25 V d.c. supply via FEEDBACK switch 4SWG on the control panel and in the off position 1V1 cathode is bypassed by 1C2.

Stage output may be monitored by multimeter 4M1 in position 15, RFA2 OUTPUT, and cathode current in position 6, RFA2 CATH. Bias is set by preset control 1RV2 for a cathode current of 150 mA.

A description of frequency and phase discriminator operation is given in sub-sections 4.4 and 4.5 respectively of this Part.

1.4 Power Amplifier RFA3 - Part of 1J66414 (Refer Figure 3 - 7)

This stage employs three type 8122 ceramic beam power tetrodes connected in parallel and operating in class AB1, the input from RFA2 is coupled via 1C9, 1C17, 1C18 and 1C19. The anode circuit is a pi-L network and is tuned by ganged 1C61 and 1L17. Transmitter loading is provided by ganged 1C62 and 1L18 the output being fed to the 75 ohm transmission line via a directional coupler (reflectometer). Both tuned circuits are isolated from e.h. by 1C59.

Variable ceramic capacitor 1C61 and inductor 1L17 are tuned by 11 MOTOR 1 under the control of the frequency discriminator for coarse tuning and phase discriminator 2 for fine tuning. Inputs to the phase discriminator are provided by 10C13 (RFA2) and pick-up capacitor 1C47 (RFA3 output) via

feedthrough capacitor 1C52.

1C62 and 1L18 are tuned to provide impedance matching to the transmission line, by 12 MOTOR 1 under the control of the frequency discriminator for coarse tuning and the amplitude discriminator for fine tuning. Inputs to the amplitude discriminator are provided by pick-up capacitor 1C44 and feedthrough capacitor 1C48 and the stage grid circuit via 1C22 and feedthrough capacitor 1C23.

A neutralising voltage is obtained from adjustable pick-up capacitor 1C42 and is applied to the grid circuit via 1C21 and the driver tuned circuit, which provides the necessary phase reversal.

To reduce intermodulation distortion to a desirable level, approximatley 6 dB of r.f. feedback is applied to the driver amplifier cathode circuit via 1C3 and the pick-up capacitor 1C43. The filter network 1C63, 1C64, 1L21 and 1R56 to 1R58 provides suppression of parasitic resonances. Feedback may be switched on or off as described in section 1.3 Driver Amplifier RFA2.

The anode voltage of +2.1 kV, decoupled by 1C56 to 1C58, 1L16 and 1R47, is supplied by the e.h.t. power supply which is divided down to +400 V by 3R1 to 3R3 and zener diodes 3MR37 to 3MR40 to supply the screen potential. Grid bias is provided from one section of the regulated power supply for 1V2, 1V3 and 1V4 and is set at -35 V nominal by pre-set controls 1RV3, 1RV4 and 1RV5 respectively. As cathode current for each of the parallel connected p.a. tetrodes may be separately measured on multimeter 4M1, the correct setting of the bias controls will be when the cathode currents are each set to 120 mA. Emitter follower transistors 1VT1, 1VT2 and 1VT3 maintain the bias at a constant value which is set by the amount of base bias. This enables RFA3 to be operated in class AB2 if desired.

An output for external r.f. monitoring is provided by 1SKB which is connected to pick-up capacitor 1C46 via 1C51.

Stage output, screen voltage and current and e.h.t. voltage may be measured on multimeter 4M1 while total cathode current is indicated on 4M2.

The directional coupler samples the signal voltages to provide forward and reflected power indication on multimeter 4M1 and effective power output on 4M3.

A description of frequency and amplitude discriminator operation is given in sub-sections 4.4 and 4.6 respectively of this Part.

1.5 Gain Limiter 1R66416 (Refer Figure 3 - 7)

This unit provides an a.g.c. voltage to reduce the gain of wide-band amplifier RFA1 and hence the output of the power amplifier RFA3, should excessive dissipation in RFA2 or RFA3 or excessive signal voltage on RFA3 occur, an indication of this action being provided by the amber GAIN LIM lamp 4LP9 on the control panel. Limiting action occurs only when the GAIN LIMITER toggle switch, 7SWA1, is in the ON position. The inputs to the gain limiter are samples of rectified r.f. input to RFA2, anode current of RFA3 (note that the

total current of the EHT rectifier is sampled by the voltage drop across 3R10, however any variation in this is normally due to RFA3 anode current) and the positive output from the amplitude discriminator (RFA3 peak voltage).

The RFA2 signal is applied to a differential amplifier 7VT1 and 7VT2 and the RFA3 signal is applied to a similar amplifier 7VT3 and 7VT4. When either of these inputs exceeds the potential at the base of 7VT2 or 7VT4, pre-set by 7RV1 and 7RV2, 7VT1 and 7VT3 commence to conduct. More current is drawn through the common collector resistor 7R24 and the base of 7VT9 becomes more positive causing the collector voltage to move towards the -25 V supply.

The action in the previous paragraph occurs when there is no r.f. output. However, as RFA3 output rises, the RFA3 peak voltage signal from the amplitude discriminator is applied via 7RV3, emitter follower 7VT5 to 7R10 in opposition to the RFA3 anode current sample. This causes a reduction in the voltage applied to 7VT3 base. The circuit is set by 7RV3 so that limiting takes place at a point approximately corresponding to the maximum rated anode dissipation of RFA3.

If excessive signal voltages occur in RFA3 the output of the amplitude discriminator rises. This in turn increases the output of emitter follower 7VT6 and the base potential of 7VT7 becomes more positive. Transistors 7VT7 and 7VT8 conduct if the potential on 7VT8 base, set by 7RV4, is overcome. As before, the extra current through 7R24 causes the collector of 7VT9 to become more negative.

The voltage change at 7VT9 collector is applied to the base of 2VT12 (RFA1) via 7MR4 and GAIN LIMITER switch 7SWA1. At the same time 7VT10 conducts, switching on 7VT11 to provide a current path to light 4LP9.

1.6 Reflectometer 1J66408 (Refer Figure 3 - 7)

The unit is a short section of coaxial line designed to have a characteristic impedance of 75 ohms and it introduces no reflections of its own.

From the line voltage, line current and the phase angle of these, relative to each other, the values of the forward wave and the reflected wave may be ascertained. The line voltage and line current are converted into measuring voltages for this purpose. After converting these voltages into equivalent powers, the actual power is equal to forward power minus reflected power.

The voltage sample of the output is provided by the capacitive divider 8C1 and 8C2. The current sample of the output is provided by toroid 8L1 which forms a current transformer in conjunction with resistors 8R1 to 8R8. Note that the voltage across 8R1 to 8R4 are in anti-phase to the voltages across 8R5 to 8R8 and that the voltage across 8C2 is applied to the centre point of these resistor banks.

Pre-set capacitor 8C1 is adjusted with the system correctly terminated in a 75 ohm non-reactive load so that the net output of the reflection coupler at 8C4 is negligible; in this case the output of the forward coupler at 8C3 is twice the voltage across 8C2.

The forward and reflected voltages are rectified by 8MR1 and 8MR3 respectively and are metered as forward and reflected power on multimeter 4M1 with 4SWA in positions 12 and 13 respectively. Pre-set controls 4RV7 and 4RV8 are provided to calibrate the metering circuits. The rectified forward coupler output is fed to the power output meter 4M3 via 4R107 and the rectified reflected coupler output is fed to the same meter connection via 4R106. These currents are proportional, being fixed by the circuit constants and cause 4M3 to read actual power output for all standing wave ratios up to 3:1.

8MR2 and 8MR4 rectify the forward and reflected signals similarly and provide a resultant voltage which is fed via 4RV10 to the auto-attenuator in the exciter to control transmitter output level. 4RV10 is the pre-set AUTO GAIN control located at the right hand end of the control panel and once set the r.f. output level will remain constant over the transmitter tuning range.

The voltage from 8MR2 and 8MR4 referred to above is also fed to the r.f. monitor board and is used to initiate circuit action to provide remote RF ON indication.

4R99, 4R101 and 4RV6 provide an output voltage proportional to v.s.w.r. which is used to trip the v.s.w.r. overload circuit in the control unit when the v.s.w.r. exceeds 3:1. The point at which the trip circuit operates is set by 4RV6. It should be noted that a short-circuit or open circuit in the transmission line causes the v.s.w.r. to rise excessively thus causing the overload circuit to operate.

1.7 R.F. Monitor 1R66427

The r.f. monitor circuit is used to provide remote visual indication of r.f. output from the transmitter.

The input to the monitor board is the same as that fed to the auto-attenuator from the AUTO GAIN control 4RV10. The monitor consists of a voltage comparator 4VT22 and 4VT23 and relay drivers 4VT24 and 4VT25. Relay 4RFM operates the remote R.F. indicator lamp. Diode 4MR102 limits the relay back e.m.f. transient to 30V. 4RFM is set to operate by 4RV9, when the power output exceeds -3dB of nominal in either high or low power mode.

Relay 4RFM will follow keying in A1 emission mode but in other emission modes the time constant is increased to 300 ms by 4C32 so that the modulation envelope is averaged.

1.8 Channel Selection (Refer Figure 3-8)

The nine programmed channels may be selected by the CHANNEL switch, 4SWJ, located on the control panel. Preparation of the individual channel boards is described in sub-section 2.11, Part 2 of Chapter 1. The tune start sequence employing relay 4TS and diodes 4MR70 to 4MR73 is described in sub-section 4.2 of this Part, below.

Operation of 4SWJ provides an earth return path of energise the selected channel relay, 4CHA to 4CHJ, via pole 1 of LOCAL/REMOTE switch 4SWK. Channel selection is extended to remote control with 4SWK in the REMOTE position. The four contacts of each channel relay perform an analogous function on

every channel as follows:

- Contact 1 - Provides a connection for the appropriate resonant antenna, at the remote antenna exchange, for the channel frequency in use.
- Contact 2 - Provides an earth connection for the programmed emission mode via EMISSION switch 4SWL in position 1 and pole 3 of 4SWK in the LOCAL position, or via contact 4EMZ1 and pole 3 of 4SWK in the REMOTE position.
- Contact 3 - Completes the current path to light the channel indicator lamp (4LP16 to 4LP24).
- Contact 4 - Provides an earth return connection for the programmed channel frequency.

1.9 Emission Selection (Refer Figure 3-8)

Operation of EMISSION switch 4SWL to position 1 provides the programmed emission mode as described for the function of contact 2 of the channel relays in sub-section 1.8 above.

Emission modes A1, A3, A3A and A3J are selected in positions 2, 3, 4, 5 and 6 respectively of EMISSION switch 4SWL and over-ride the programmed emission mode by removal of the earth return path for that circuit.

In the five emission mode positions of 4SWL the appropriate relay, 4EMA to 4EME, is energised the earth return path being provided by 4SWK in the LOCAL position. The two contacts of each emission relay perform an analogous function as follows:

- Contact 1 - Completes the current path to light the emission mode indicator lamp (4PL25 to 4LP29).
- Contact 2 - Completes the circuit to the appropriate emission selection input in the exciter.

With 4SWK in the REMOTE position and the remote emission selector switch in position 1, which has no connections to it, operation in the programmed emission mode is as described in sub-section 1.8 above. Transistor 4VT26 is then cut-off, but when the remote emission selector switch is set to any of the emission mode positions an earth return path is provided for the appropriate relay, 4EMA to 4EME, via 4R148 and 4SWK/3. The relay energising current produces a voltage drop across 4R148 causing 4VT26 to conduct providing an earth return path to energise relay 4EMZ. Contact 4EMZ1 opens and removes the earth connection to the programmed emission mode. Contact 2 of 4EMZ is not used.

As in local operation, channel selection is not affected but a selected emission mode will over-ride the programmed mode.

1.10 Antenna Selection

Selection of the appropriate resonant antenna for a given channel is provided by the extension to the remote antenna exchange system, the closed circuit

provided by contact 1 of the channel relay in use.

1.11 TEST KEY Operation

Operation of toggle switch 4SWN, TEST KEY, located on the control panel, simulates the action of the remote key and is used for testing and checking of transmitter performance. The test key bypasses the remote key for LOCAL operation via pole 2 of 3SWK.

Closure of 4SWN energises mercury wetted keying relay 4KR by providing an earth return path. Contact 4KR1 reduces the bias to RFA2 and RFA3 pre-set bias controls 1RV2 to 1RV5, from -80 V to -39 V by earthing the cathode of zener diode 5MR2. Contact 4KR2 provides an earth to key the exciter.

Relay 4KR and its two contact sets are each provided with transient suppressor circuits.

1.12 Metering Circuits

The metering circuits comprise multimeter, 4M1, providing signal, cathode current and power supply voltage indications; RFA3 cathode current meter, 4M2, power output meter, 4M3 and hour meter, 4M4 (synchronous motor type).

The circuits of RFA3 cathode current meter and the power output meter are shown on Figures 3 - 7. The three moving coil meters are bypassed for r.f. and have the following electrical details:

4M1 - 100 μ A f.s.d., 1000 ohms internal resistance

4M2 - 1 mA f.s.d., 100 ohms internal resistance

4M3 - 500 μ A f.s.d.

Metering multiplier resistors for voltage measurements of all metered circuits, except e.h.t. metering, are mounted on plug-in printed board 1R66425 or directly to multimeter switch 4SWA both being part of the control unit. E.H.T. high value multipliers are mounted on printed board 1R66420 in the main power supply section.

Shunt resistors for current measurements and rectifier circuits for r.f. measurements are mounted on or adjacent to the valves or part of the circuitry which it is necessary to monitor.

4M4, mounted on the control panel, registers the elapsed running time of the transmitter immediately after the LT switching sequence starts when 110 V a.c. is supplied to it via the air flow switch.

2. POWER SUPPLIES

2.1. General

This section describes the units that provide a.c. and d.c. potentials for the transmitter except for the exciter power supply, type 1H66430, which is

described in Chapter 2 of this handbook. The distribution of the 380 V/440 V, 3-phase, 50 Hz mains supply to the units is controlled by the power control unit and the circuit breakers. The switching sequence and power control is described in Section 3 of this Part.

2.2 Regulated Power Supplied 1H66417 (Refer Figure 3 - 4)

The unit will be described in two parts:

- (a) The first section of the unit provides regulated +20 V for the frequency discriminator and RFA1 stages and zener regulated -39 V for RFA2 and RFA3 grid bias.

Transformer 5TR1 is connected to the mains supply via circuit breaker 3CBB, BIAS REGULATOR, and contacts PL1 of contactor 3PL whose operation is dependent on air flow switch operation. Thyrector 5VS1 across 5TR1 primary provides switching transient suppression.

The transformer has two secondary windings which are connected to separate rectifier assemblies type MB4 (5MR1 and 5MR3). The output from secondary 13-14 and 5MR1 is -80 V; filtering is provided by 5C1 and 5R2. The bias supply voltage can be measured by switching multimeter 4M1 to position 20, BIAS 0 - 100 V.

The output from secondary 9-11 of 5TR1 and 5MR3 is fed to series emitter follower regulator 5VT1, controlled by 5VT3. Transistor 5VT2 provides a constant current source. Current limiting is provided by 5R3, 5MR4 overriding the constant current source at approximately 400 mA. The output voltage is adjusted by the setting of 5RV1 and can be measured by switching multimeter 4M1 to position 21, RFA1 SUPPLY 0 - 50 V.

- (b) The second section of the unit provides a regulated +25 V and -25 V supply for the frequency discriminator, gain limiter, servo control and power control sections. It also provides -50 V for the channel and emission select circuits, aerial interlock relay and 110 V 50 Hz for the power contactors h.t. delay and h.t. lockout circuits.

Transformer 5TR2 is connected to the mains supply via circuit breaker 3CBC, CONTROL REGULATOR, thyrector 5VS2 performing a similar function to 5VS1 described above. The transformer has three secondary windings, two of which, 8-9 and 11-12, are connected to bridge rectifier assemblies type MDA-980-4 (5MR7 and 5MR9), the third winding, 14-15, provides 110 V a.c.

As the operation of the regulated +25 V and -25 V circuits are similar, only the +25 V circuit will be described.

The output of bridge rectifier 5MR9 is applied to parallel circuits consisting of the shunt regulator and the load through resistor 5R18. The voltage drop across 5R18 is due to the current flow through the regulator and load and remains constant so as to provide +25 V to the load circuits.

Variation in load current tends to vary the 5R18 voltage drop which is

sensed by the base of 5VT6, the emitter of which is connected to reference diode 5MR10. The collector current of 5VT6, and therefore the base current of 5VT7 also varies, hence changing the current flow through 5VT6 so as to offset the variations of load current and to return the 5R18 voltage drop to its original value. 5RV3 sets the bias on 5VT6 and hence the regulator current, it is set under load so that the resultant voltage drop across 5R18 produces an output of +25 V.

Variation of bridge rectifier output due to mains voltage variations also changes the voltage drop across 5R18 and the regulator current varies to ensure that the output remains at 25 V.

The output voltages can be measured by switching multimeter 4M1 to position 1, CONTROL 0 - 50 V+ or to position 2, CONTROL 0 - 50 V-.

The -50 V supply is taken from the output of 5MR7 and is filtered by 5C3.

2.3 E. H. T. Power Supply 1H66403 (Refer Figure 3 - 4)

The main h.t. is 2.1 kV, unregulated, for RFA3 anodes. Anode voltage, 1.5 kV, for RFA2 is derived from the 2.1 kV supply by means of a voltage divider while screen voltage, 400 V, for RFA2 and RFA3 is provided by zener diodes, 3MR7 to 3MR40 in series, at the low potential end of the same divider.

The 3-phase 50 Hz power input circuit of 3TR1 comprises circuit breaker 3CBH, MAIN HT, and contacts 1, 2 and 3 of contactor 3PH which is energised during the h.t. switching sequence. The transformer primary windings are delta connected and the secondaries star connected. Thyrectors are connected across each primary winding for protection against voltage transients.

The three transformer secondaries are connected to rectifier modules arranged to give 3-phase full-wave rectification. The d.c. output is filtered by 3L1 and 3C1 to 3C4 connected in parallel and is then applied to a voltage divider comprising 3R1 and 3R2, parallel connected, 3R3 and 100 V zener diodes 3MR37 to 3MR40 all in series.

A sample of the h.t. is taken from the junction of 3R4 and 3R5, shunted across the zener diode assembly, and is applied to the h.t. indicator lamp circuit in the control unit. A sample of the h.t. for metering is taken from the voltage divider comprising 3R7 to 3R9 and is applied to multimeter 4M1 in position 18, E.H.T. 0 - 2.5 kV.

2.4 Servo Motor Supply (Refer Figure 3 - 4)

This unit is part of the Servo Control Unit 1J66410 and provides voltages for driving the servo tuning motors. Transformer 6TR1 is connected to the mains supply via circuit breaker 3CBS, it has three centre-tapped secondary windings, each connected to a bridge rectifier type MDA-980-4. Bridge rectifier 6MR27 supplies +18 V and -18 V to RFA2 tuning motor and bridge rectifiers 6MR28 and 6MR29 supply +24 V and -24 V to RFA3 tuning motor and RFA3 loading motor respectively. Filtering is provided by a filter choke and two 2000 μ F filter capacitors in each common output line while the output is control-

led by contacts of contactor 6PS in the same lines.

2.5 Filament Supply (Refer Figure 3 - 4)

The filament supply of 13.5 V for 1V1 and 1V2-1V4 heaters is provided by transformer 1TR1 which is located in the r.f. compartment of the transmitter. Its primary is connected to the mains supply via circuit breaker 3CBL, FILAMENTS, and the PL1 contacts of contactor 3PL, whose operation is dependent upon air flow switch operation. Two secondary windings provide the necessary heater current with r.f. by-pass provided by capacitors 1C66 to 1C69, winding 13-15 supplies the heater of 1V1 and winding 8-10 supplies 1V2, 1V3 and 1V4 heaters wired in parallel.

2.6 Blower

A single phase blower, 3BW1, is fitted in the upper part of the power supply section for ventilation and cooling purposes. It has been lubricated for life by the manufacturer.

Mains power is supplied to the blower motor via the PF2 contacts of contactor 3PF and circuit breaker 3CBF, BLOWER. Phase shift for capacitor start is provided by 3C5.

Operation of contactor 3PL is dependent on blower operation and the air flow switch being closed during the l.t. switching sequence.

3. POWER CONTROL

3.1 General

The power control unit provides operational control of the transmitter by solid state circuitry in a switching sequence whose operation is inhibited if the preceding step fails. Mains supply to the blower and the filament and bias supplies is controlled by two contactors which also initiate the operation of h.t. delay and lockout circuits. A third contactor energises the e.h.t. supply via HT ON manual and electronic switches; overload and safety interlock protection is inherent in the circuit design.

Indicator lamps show the progress of the switching sequence, overload and fault conditions.

A list of circuit breakers together with associated functions is given in Chapter 1, Part 1, Section 6. The switching sequence with the effect that each contactor produces is described in sub-section 3.2 below.

3.2 Switching Sequence (Refer Figure 3 - 6)

It is assumed that the LOCAL/REMOTE switch, 4SWK, is set to LOCAL and the 3-phase mains circuit breaker, 3CBM, is closed providing mains supply to all circuit breakers except 3CBL, FILAMENTS, and 3CBB, BIAS REGULATOR, which are isolated by contact 3PL1. Closure of all secondary circuit breakers will now energise all power supplies except the following: filament supply, bias

supply, e.h.t. power supply and the blower, BW1.

Provided that the safety interlock switches are closed, the ensuing switching sequence is in two parts, each controlled by one switch i.e. LT, 4SWB and HT, 4SWC. A description of the circuit functions mentioned in the following operations is detailed in sub-section 3.3.

3.2.1 LT Switching

Closure of LT switch, 4SWB, provides the following action and effects:

<u>Action</u>	<u>Effect</u>
Contactor 3PF energised	(a) Contact 1 supplies 110 V a.c. to blower air flow switch. (b) Contact 2 completes mains supply to blower, 3BW1. (Contacts 3 and 4 are spare.)
Blower operating, air flow switch closed:	(a) Contact 3PL energised from 110 V a.c. supply. (b) 110 V a.c. supplied to diode 4MR1 in h.t. delay circuit.
Contactor 3PL energised:	(a) Contact 1 completes mains supply to circuit breakers 3CBB, REGULATOR and 3CBL, FILAMENTS. (b) Contact 2 energises relay 4LTM and LT indicator lamp, 4LP13, from +25 V control supply. (c) Contact 3 supplies 110 V a.c. to contactor 3PH in preparation for the closure of HT switch, 4SWC. (d) Contact 4 prepares h.t. lockout and h.t. on circuits for application of the +25 V control supply via HT switch 4SWC/1.

With circuit breakers CBB and CBC closed, BIAS indicator lamp 4LP7 will light up via 4VT11.

3.2.2 HT Switching

After a delay of 30 seconds, imposed by the h.t. delay circuit, the DELAY lamp, 4LP6, will light, indicating that the h.t. circuit can be activated. It is essential that the safety interlock and grounding switches are set before the HT switch is operated, otherwise h.t. lockout will occur. Presuming that there are no overload faults in RFA2, RFA3 or the aerial system and that the aerial interlock relay AIL is activated, closure of HT switch, 4SWC, provides the following action and effects:

<u>Action</u>	<u>Effect</u>
HT switch closed:	<p>(a) 4SWC/1 connects the +25 V control supply to the h.t. lockout circuit and to the collector of 4VT8 in the h.t. on circuit.</p> <p>(b) 4SWC/2 connects diode 4MR14 to earth which enables the h.t. on circuit to gate triac 4MR18.</p>
Triac 4MR18 gated:	4MR18 provides current return path to energise contactor 3PH from 110 V a.c. supply.
Contactor 3PH energised:	<p>(a) Contacts 1, 2 and 3 supply 3-phase mains to e.h.t. transformer, 3TR1, primary. HT indicator lamp 4LP8 lights up and remote h.t. monitor relay, 4HTM, energises via 4VT13 which bottoms due to the h.t. sample fed to its base.</p> <p>(b) Contact 4 connects 100 V a.c. supply to servo motor supply control, industrial relay 6PS.</p> <p>(c) Contact 5 provides an earth return path for the fail timer h.t. interlock circuit in the automatic tuning section.</p>

3.2.3 LOCAL/REMOTE LT/HT Switching (Refer Figures 3-5 and 3-8)

The control of the LT switching sequence is dependent upon the position of the LOCAL/REMOTE switch, 4SWK. When this switch is in the LOCAL position, operation of the LT on switch, 4SWB, provides an earth connection through pole 7 of 4SWK to energise contactor 3PF. The sequence then continues as described in the l.t. and h.t. switching sequences.

For remote operation the LOCAL/REMOTE switch is set to REMOTE, all circuit breakers are closed and the LT and HT toggle switches set to 'on', the REMOTE lamp, 4LP14, on the control panel will light via pole 8 of 4SWK and the LT and HT toggle switches. The +25 V supply may also be supplied to the remote control available lamp at the remote point via connector 4SKQ10 if required. When the remote l.t. switch is operated relay 4LT is energised and contact 4LT1 provides an earth return path to energise contactor 3PF. The l.t. switching sequence will now continue as described in sub-sub-section 3.2.1 above. The LT indicator lamp 4LP13 on the control panel will light simultaneously with the l.t. on indicator lamp at the remote point, the circuit of which has been completed to earth via contact 1 of relay 4LTM. Until the remote h.t. switch is operated, +25 V is applied to diode 4MR14 maintaining the h.t. on circuit in a disabled condition. When the h.t. delay period has expired operation of the remote h.t. switch provides an earth return path for operation of relay 4HP from the -50 V supply. Changeover contact 4HP1 connects diode 4MR14 to earth thus activating the h.t. on circuit. The HT indicator 4LP8 on the control panel

will light simultaneously with the h.t. on indicator lamp at the remote point, the circuit of which has been completed to earth via contact 4HTM1.

In the above it has been presumed that the POWER HIGH-LOW switch was set to HIGH either locally or at remote control. When it is set to LOW relay 4LP is energised and diode 4MR14 in the h.t. on circuit is earthed via 4LP1 and the POWER LOW indicator lamp, 4LP30, on the control panel is lit via 4LP3. For a description of POWER HIGH-LOW switching refer to sub-sub-section 3.3.7 of this Part.

3.3 Control Circuits (Refer Figure 3 ~ 5)

3.3.1 H.T. Delay and Control Flip-Flop

In the quiescent state transistor 4VT1 is cut off, 4VT2 is conducting and the monostable flip-flop, 4VT3 and 4VT4, is held in the unstable condition. The collector potential of 4VT3, applied to the h.t. lockout and h.t. on circuits, is high and 4VT4 collector potential applied to 4VT6 is low.

When contactor 3PF is energised, 100 V a.c. is applied to diode 4MR1 via contact 3PF1 and the blower air flow switch. The resulting rectified voltage charges 4C1 to about 150 V. Zener diode 4MR2 provides a constant 30 V supply for capacitors 4C2 and 4C3 which are charged through 4R4. After approximately 30 seconds, when the capacitors voltage rises to 15.5 volts, set by zener diode 4MR4, 4VT1 conducts, transistor 4VT2 cuts off and the state of the h.t. control flip-flop changes to a stable condition.

For short duration mains failures up to two seconds or normal l.t. off, the delay circuit is held on as 4C1 discharges through 4R2 and 4R3. For mains failures of greater duration 4C2 and 4C3 discharge via 4MR3 and 4R3 giving a graded h.t. delay depending on the time for which the supply is off.

If one of the overload circuits is activated, a positive signal on the base of 4VT4 causes it to conduct. Capacitor 4C4 couples a negative going signal to 4VT3 which cuts off, disabling the h.t. on circuit via 4MR15. After approximately one second, 4C4 discharges, permitting the flop-flop to return to its stable state and h.t. is re-applied.

The low collector voltage at 4VT3 is applied to diode 4MR15 in the h.t. on circuit. The high collector voltage at 4VT4 causes 4VT6 to conduct to provide a current path for DELAY lamp 4LP6.

3.3.2 H.T. Lockout and Interlocks

This circuit disables the h.t. on circuit whenever an interlock switch is open or the h.t. control flip-flop has been reset three times by the overload circuits. If any one of the interlocks is open, 110 V a.c. is applied via 4R19 to light the HT I/L lamp, 4LP12, and to diode 4MR12 via 4R18. The resulting rectified voltage across 4R24 gates the silicon controlled rectifier 4MR13 which provides a current path to light the HT LOCKOUT lamp 4LP15. Conduction of 4MR13 lowers the potential of the collector of 4VT8 and the base of 4VT9 which cuts off thus disabling the h.t. on circuit.

Each time the h.t. is removed i.e. 4VT3 collector voltage rises to +25 V, about 30% of this voltage step appears across 4C7 via 4C6, 4MR8 and 4MR9. When 4VT3 collector voltage returns to normal, 4C7 discharges slowly, via 4R16. If further h.t. switching cycles occur before 4C7 is discharged, the voltage across 4C7 builds up with a star-case waveform until the triggering potential of 4VT7 is reached. The positive going voltage developed across 4R22 gates 4MR13 and the same action occurs as in the previous paragraph. When 4MR13 conducts 4C7 discharges via 4MR11 in readiness for the next cycle.

Closing the open interlock switches will extinguish the HT I/L lamp but the lock-out condition can only be removed by recycling the h.t. on circuit after any necessary adjustments or repairs have been made.

3.3.3 Bais Interlock

Before contactor 3PH can be energised to supply three-phase mains voltage to e.h.t. transformer 3TR1 a check is made to ensure that bias is available for RFA2 and RFA3.

3.3.4 Aerial Interlock

This circuit is used to disable the h.t. on circuit and provide protection for personnel employed on aerial maintenance. Aerial interlock changeover relay 4AIL is normally energised from the -50 V supply via a remote safety switch located on the aerial support structure or aerial exchange if used and provides an earthing point for diode 4MR16 in the h.t. on circuit. Operation of the remote safety switch de-energises 4AIL which removes the earth from 4MR16 whose input is raised to +25 V via 4R79 thus disabling the h.t. on circuit. The changeover contact provides an earth return path to light AER I/L indicator lamp 4LP10.

3.3.5 H.T. On Circuit

The circuit comprising diodes 4MR14 to 4MR17 and transistor 4VT8 functions as a logic four input NOR gate i.e. when all inputs are low, the output is high which in turn gates triac 4MR18 into conduction, via emitter follower 4VT9, providing a current path for 3PH energising coil. With a high input to any one or more of the input diodes the output from 4VT8 is low thus disabling the h.t. on circuit.

The action depends on the following conditions:

- (a) HT switch 4SWC, set to on. No voltage applied to 4MR14.
- (b) The remote HT switch is ON and switch 4SWK is set to REMOTE. No voltage applied to 4MR14.
- (c) The h.t. control flip-flop is in the stable state. No voltage applied to 4MR15.
- (d) Bias supply is available. No voltage applied to 4MR17.
- (e) Aerial interlock relay, 4AIL, energised. No voltage applied to 4MR16.
- (f) HT lockout inoperative. Collector potential of 4VT8 high.

H.T. switching thus occurs when this circuit operates to energise contactor 3PH.

3.3.6 Overload Circuits

Sensing of overload conditions is provided by:

- (a) An increase in the voltage drop across resistors in the cathode circuits or RFA2 and RFA3 or
- (b) An increase in voltage output from the reflected power coupler of the reflectometer when a fault occurs in the r.f. transmission line or aerial system.

Each of these sources is fed to similar Schmitt trigger circuits, the operating conditions of which are adjustable for the particular circuit being monitored. The controls for this purpose are:

RFA2 - 4RV1, adjusted for cathode condition of 1V1

RFA3 - 4RV2, adjusted for cathode condition of 1V2
 4RV3, adjusted for cathode condition of 1V3
 4RV4, adjusted for cathode condition of 1V4

VSWR - 4RV6, adjusted for maximum v.s.w.r. of 3:1.

As an example of the operation of any of the overload circuits, the action of the RFA2 overload is described.

Initially 4VT14 is cut off and 4VT15 is conducting. The trigger potential is set by the adjustment of 4RV1. When an overload occurs there is an increase in the positive voltage drop across 1V1 cathode resistors 1R7 and 1R8. This voltage increase switches on 4VT14 and cuts off 4VT15. The voltage at the collector of 4VT15 rises energising s.c.r. 4MR19 and the h.t. control flip-flop. The O/L FAULT RFA2 indicator lamp, 4LP3, lights as 4MR19 conducts. The h.t. control flip-flop disables the h.t. on circuit via 4MR15 and the 3-phase mains supply to e.h.t. transformer 3TR1 is removed as contactor 3PH is de-energised. The h.t. voltage falls to zero removing the overload condition and the trigger circuit reverts to its quiescent state. The h.t. control flip-flop returns to its normal condition after one second when 4C4 discharges. H.T. is re-applied to the transmitter as contactor 3PH re-energises. If the overload is not of a transient nature, the sequence repeats until the third successive change of output causes the h.t. lockout to operate as previously described. The O/L FAULT RFA2 indicator lamp, 4LP3, is extinguished by operating the overload CLEAR pushbutton switch, 4SWF, to remove the +25 V supply to the lamp and s.c.r. 4MR19.

The RFA3 overload circuit is a three input Schmitt trigger, the inputs to 4VT16, 4VT17 and 4VT18 being obtained from the cathode circuits of 1V2, 1V3 and 1V4 respectively. In the event of overload in any one or more of these valves the circuit will trigger as described above.

3.3.7 POWER HIGH-LOW Switching (Refer Figures 3-5 and 3-8)

Operation of the POWER HIGH-LOW switch, 4SWD, on the control panel permits the full rated r.f. power output of the transmitter in the HIGH position and a 6 dB reduction in power output in the LOW position.

In the HIGH position of the switch, relay 4HP is energised via the earth return circuit provided and relay 4LP is de-energised. Contact 4HP1 provides an earth return circuit for diode 4MR14 in the input to the h.t. on circuit via 4SWC/2 and contact 4HP2 prepares an earthing circuit for alarm relay 4AL in the event of h.t. failure. AUTO GAIN control 4RV10 sets the input level to the auto-attenuator to provide the rated transmitter output.

In the LOW position of 4SWD relay 4LP is energised and 4HP de-energised. The four contacts of 4LP provide the following:

- Contact 1 - Earthing of diode 4MR14 in the input to the h.t. on circuit via 4SWC/2.
- Contact 2 - Increases the rectified r.f. output fed to the auto-attenuator from the reflectometer by shorting out series resistor 4R138. This appears to the auto-attenuator to be an increase in transmitter gain, the circuit constants having been fixed to provide a 6 dB reduction in transmitter output.
- Contact 3 - An earth return path to energise POWER-LOW indicator lamp 4LP30.
- Contact 4 - Prepares an earthing circuit for alarm relay 4AL in the event of h.t. failure.

The POWER HIGH-LOW switching facility is extended to remote control via pole 5 of 4SWK when in the REMOTE position. In the remote HT OFF position neither 4PH nor 4LP is energised which inhibits the h.t. on circuit via 4MR14.

3.3.8 Alarm Circuit (Refer Figure 3-8)

A remote alarm facility is provided which permits connection of an audio or visual warning system in the event of transmitter h.t. failure via the closure of contacts 4AL2 and 4HTM3 connected in series.

As described in sub-sub-section 3.3.7 above contacts 4HP2 or 4LP4 prepare an earth return circuit for relay 4AL. With the application of h.t. to the transmitter, relay 4HTM is energised and contact 4HTM2 provides an earth connection to energise 4AL which then becomes held by its own contact 4AL1 in series with 4HP2 or 4LP4. Contact 4AL2 in the alarm circuit is closed and 4HTM3 is open. With h.t. failure, relay 4HTM is de-energised and 4HTM3 closes thus completing the connection to the remote alarm system.

When remotely switching the transmitter h.t. on initially and there is h.t. lockout, the alarm circuit is inoperative because 4HTM is not energised, therefore 4AL is also not energised and contacts 4AL1 and 4AL2 remain open. However h.t. lockout is indicated by the failure of the remote H.T. ON lamp to light.

4. AUTOMATIC TUNING

4.1 General (Refer Figures 3 - 6)

The automatic tuning system employs the following units:-

- (i) Servo control unit
- (ii) Servo motor supply
- (iii) RFA 2 tuning assembly
- (iv) Servo drive assembly - RFA3
- (v) Servo drive assembly - loading inductor and capacitor
- (vi) Frequency discriminator and wide-band amplifier RFA1 (mounted on the one P.C.B.)
- (vii) Phase discriminators (2)
- (viii) Amplitude discriminator.

Three separate servo systems control the tuning position of the mechanically coupled capacitors and inductor of RFA2, the inductor and capacitor of RFA3 and the loading inductor and capacitor.

When a frequency change is initiated the r.f. control circuit suppresses the output from RFA1 and allows the input signal (the required frequency) to be accepted by the wide-band amplifier and frequency discriminator. The discriminator generates positive and negative voltages, proportional to the input signal frequency, which are applied to potentiometers mechanically coupled to each servo drive motor. The d.c. error voltage produced at the output of the potentiometers is fed to the servo amplifiers. A d.c. motor in the amplifier output circuit is driven in the required direction to position the tuning components within the range of the fine tuning system.

Completion of coarse tuning is sensed by the control system and the operation of the r.f. control circuit is reversed. Suppression of the frequency discriminator takes place and the input signal is applied to RFA1, the output of which is then amplified by RFA2, etc.

Any phase difference between the grid and anode signals of RFA2 is sensed by the RFA2 phase discriminator and the resulting voltage applied to the RFA2 servo amplifier. Fine tuning of this stage then occurs. In a similar manner, the phase difference between grid and anode signals of RFA3, sensed by RFA3 phase discriminator, causes fine tuning of RFA3 variable inductor and capacitor.

During this part of the fine tuning phase the loading servo amplifier is inhibited as the amplitude discriminator output is meaningless until RFA3 is tuned. This inhibition is removed when RFA3 tuning is completed. Samples of RFA3 grid and anode r.f. envelopes are applied to the amplitude discriminator and the resulting voltage causes the loading inductor and capacitor to be tuned.

Completion of tuning is sensed by the control system and the servo motors are disabled.

The maximum time for an extreme frequency change is 10 seconds, while frequencies close together can be tuned in 2 seconds. Provision is made for the tuning cycle to be held in either the coarse or fine conditions for checking purposes. The manual tuning controls should not be operated during the automatic tuning sequence.

4.2 Control System (Refer Figure 3 - 6)

In the description of the automatic tuning control system which follows it is assumed that the COARSE/NORMAL/FINE switch, 6KSA, on the servo control unit is in the NORMAL position. The tuning sequence is initiated by the discharge of either one of two similar capacitors, 4C26 and 4C27, when changing from one channel to another. The positive voltage spike thus developed across 4R136 provides the tuning start pulse mentioned in sub-sub-section 4.2.1 below.

Changing from one channel to another either energises or de-energises relay 4TS, its two sets of changeover contacts discharges one capacitor and commences charging the other. Capacitor 4C26 discharges via 4TS2, 4R134, and 4R136 when 4TS is de-energised on channels 1, 3, 5, 7 and 9 and 4C27 commences charging from the +25 V line via 4TS1. The procedure is reversed on channels 2, 4, 6 and 8 when 4TS is energised from the -50 V line and diodes 4MR70 to 4MR73 respectively, 4SWJ contacts provide an earth return path for the relay.

Manual tune start is provided by the START pushbutton, 4SWE, for checking that the tuning sequence has been completed, for retuning on a given channel after installation, maintenance or after TUNE FAIL. Momentary operation of 4SWE removes 4R136 from the input to the tune start circuit and suddenly changes the base bias condition of 6VT1 thereby initiating the tuning sequence.

4.2.1 Tuning Start

The receipt of a positive start pulse causes 6VT1 to conduct and its collector potential to fall to discharge 6C1. When the pulse ceases, 6VT1 cuts off and the collector potential rises rapidly. This positive going pulse is fed via 6C1 to set the tuning control flip-flop and the coarse tuning control flip-flop.

When the control power supply is initially switched on, the application of +25 V to this circuit may cause a tuning cycle to commence. At the instant of switching on, 6C2 is discharged and the sudden rise of collector potential is passed through 6C1, 6MR2 and 6C2 to ground. This action stops the positive pulse from affecting the tuning control flip-flop. Capacitor 6C2 then charges via 6R5 and 6R91 to a potential slightly higher than the quiescent collector potential and 6MR2 is shut off. When the +25 V is switched off, 6C2 discharges via 6MR1 and 6R92.

4.2.2 Tuning Control

In the reset condition, 6VT2 is cut off and 6VT3 is conducting. The pulse from 6VT1 sets the flip-flop so that 6VT2 conducts and 6VT3 cuts off. The flip-flop provides two outputs.

- (i) A low voltage output from 6VT2 collector to the motor supply control, fail timer h.t. interlock and tuning signal switch circuits via

switch 6KSA

- (ii) A high voltage output from 6VT3 collector to the coarse tuning control circuit.

4.2.3. Tuning Signal Switch and Emission Selection Interlock

Tuning of the transmitter is always performed in the A1 (C. W.) emission mode and for this reason the tuning signal switch provides a positive signal to the exciter carrier control circuit which in turn feeds a carrier at a level of -2 dB to the transmitter during fine tuning. During coarse tuning the exciter output is limited to approximately +13 dBm because there is no output signal fed back to the auto-attenuator. Simultaneously the emission selection interlock circuit inhibits the programmed emission mode on any channel

When the tuning sequence starts the low output from 6VT2 is fed to 6VT8 via 6KSA causing 6VT8 to conduct, the collector potential rises and a positive signal is fed to the exciter carrier control from the junction of 6R73 and 6R103. At the same time the potential at the junction of 6R71 and 6R72 rises causing 6VT18 to cut-off removing the positive control voltage, normally fed via contacts 4EMA2 to 4EME2 as applicable, to the emission selection inputs in the exciter.

4.2.4 Fail Timer H. T. Interlock and Fail Timer

Before the tuning control circuit is set, 6VT24 conducts and 6C6 is discharged. The low output from 6VT2 cuts off 6VT24 and 6C6 starts charging via 6R66, 6C6 takes 25 seconds to charge and until that occurs 6VT6 and 6VT7 are cut-off and the voltage applied to 6MR9 anode is zero.

If tuning is not completed within 25 seconds, the rising charge on 6C6 causes zener diode 6MR22 to break down and 6VT6 and 6VT7 to conduct to provide an inhibition voltage to the motor supply control circuit via 6MR9 and to light the TUNE FAIL lamp 4LP11. Tuning can be re-started by operating the START push-button switch, 4SWE.

4.2.5 R. F. Sensing

This circuit monitors the r.f. input signal to RFA1 to ensure that sufficient signal is available to operate the frequency discriminator. The rectified r.f. signal causes 6VT11 to conduct to provide a low voltage to the anode of 6MR8.

If insufficient signal is supplied, 6VT11 remains cut off and the resulting high voltage to 6MR8 inhibits the motor supply control circuit.

4.2.6 Motor Supply Control

This circuit controls the operation of contactor 6PS. When the inputs to 6MR7 to 6MR9 are low, 6VT9 conducts to switch on 6VT10 to provide a gate voltage for 6MR23. Triac 6MR23 conducts and contactor 6PS energises, the contacts of which complete the input and output circuits of the servo motor supply. When the tuning control flip-flop is reset or the fail timer operates or insufficient r.f. input signal is available, the anode voltage is the associated diode rises, 6VT9 and 6VT10 cut-off removing the gate voltage from 6MR23

and contactor 6PS de-energises to close down the servo motor supply.

4.2.7 Coarse Tuning Control

In the reset state, 6VT4 is cut off and 6VT5 is conducting. Capacitor 6C3 is maintained in a discharged state by 6MR4 conducting. The rise in potential at the collector is applied, via 6C3, to set the flip-flop. At the same time 6MR4 is reverse biased and 6C3 charges. The rise in potential at the collector of 6VT5 is fed, via switch 6KSA, to the r.f. control and inhibit circuits.

4.2.8 R.F. Control

When the transmitter is operating normally, wide-band amplifier RFA1 is controlling the r.f. power output in conjunction with the gain limiter. The frequency discriminator is inhibited by the application of a negative potential from 6VT13 collector.

The output from 6VT5 via 6KSA, causes 6VT12 to cut off and its collector becomes more negative. This in turn changes the bias conditions of RFA1 and the r.f. output from that stage is suppressed. The change in 6VT12 collector voltage causes 6VT13 to conduct, the collector voltage of which falls to a low value and changes the bias conditions of the frequency discriminator. The r.f. input signal is now applied to the frequency discriminator and a coarse tuning voltage is made available for the servo drive systems. 6VT5 collector output is also applied to 6VT23 which conducts to provide a current path for the TUNE COARSE lamp4LP1.

4.2.9 Load Inhibit

This circuit controls the operation of the loading servo amplifier. During the coarse tuning phase the output from 6VT5 maintains 6VT16 and 6VT20 in a cut-off state. Inhibition of the loading servo amplifier does not occur and the servo system sets the inductor and capacitor for the required frequency.

4.2.10 Tuning Components - Coarse Phase

The output of the frequency discriminator (see section 4.4) causes the three servo systems to position the tuning components within the range of the fine tuning system. The rotation of the drive motors, in either direction, provides a sensing voltage to the motor sensing circuits.

4.2.11 Motor Sensing and Reset Timer

Three identical circuits, each connected to a drive motor circuit sense the motor rotation. When rotation occurs, the bridge rectifier output switches on the associated transistor. The conducting transistor provides a path, through 6R41, the associated diode, the transistor and the bridge rectifier to ground, for the +25 V supply applied to 6R41. This action keeps the junction of 6R41 and 6C5 at a low potential and 6C5 does not charge. When all the motors are stationary, at the end of coarse tuning, transistors 6VT15, 6VT19 and 6VT21 cut-off and 6C5 charges. After 1.5 seconds the UJT, 6VT14, fires, producing a positive going pulse at base 1.

4.2.12 Fine Tuning

The remainder of the tuning sequence concerns changes of conditions to the circuits described in the previous paragraphs. At this point coarse tuning has finished and fine tuning is about to start.

The positive pulse from 6VT14 is applied as a reset pulse to a line common to the coarse tuning control and tuning control flip-flops. The pulse is fed to the base of 6VT5 and to the anode of 6MR5. As the junction of 6MR5 cathode and 6VT4 collector is at a low potential, 6MR5 conducts and the tuning control flip-flop is unaffected by the reset pulse. 6VT4 and 6VT5 reset and the potential at 6VT5 collector falls to a low value and passes to the r.f. control circuit.

The r.f. control circuit conditions change to inhibit the frequency discriminator which causes the production of the coarse tuning voltages to cease. At the same time the inhibition is removed from RFA1 to allow the r.f. input signal to pass to RFA2, etc. The TUNE COARSE lamp 4LP1 extinguishes as 6VT23 cuts off and the TUNE FINE lamp 4LP2 lights as 6VT22 conducts.

Diode 6MR11 isolates the load inhibit circuit from the voltage change on 6VT5 collector and the high potential from 6VT19 collector via 6MR12 maintains 6VT16 and 6VT20 in a cut-off condition, so that the load inhibit circuit is controlled by 6VT19, the motor sensing circuit of RFA3 tuning.

The outputs of the phase discriminators (see section 4.5) cause the servo systems to fine tune the RFA2 and RFA3 stages.

Sensing of motor rotation occurs as before but this time when 6VT19 conducts the fall in collector potential causes 6VT16 and 6VT20 in the load inhibit circuit to conduct. This action inhibits the operation of the loading servo amplifier until RFA3 is tuned. When 11MOTOR1 Stops, 6VT19 collector rises to its original potential and removes the inhibition on the loading servo amplifier.

The output of the amplitude discriminator causes the loading servo amplifier to operate to tune the inductor 1L18 and capacitor 1C62 by 12MOTOR1.

The reset timer produces another reset pulse 1.5 seconds after motor rotation ceases. This pulse is now fed to the base of 6VT3 as 6MR5 is reverse biased by the high potential of 6VT4 collector and resets the tuning control flip-flop.

The potentials on the collectors of 6VT2 and 6VT3 revert to their original values to cause:-

- (i) The fail timer to reset as 6C6 discharges through 6VT24.
- (ii) A high potential to appear at the anode of 6MR7 which cuts off 6VT9 and 6VT10 to remove the gate voltage on 6MR23. Contactor 6PS de-energises and its contacts break the input and output circuits of the servo motor supply.
- (iii) The modulator unit reverts to the required emission mode.
- (iv) The TUNE FINE lamp, 4LP2, extinguishes as contacts 6PS4 open.

The control system is now reset and ready for the next tuning cycle.

4.2.13 Tuning Switch Operation

The control system description assumed the tuning switch 6KSA in the NORMAL position. Placing the switch in the COARSE or FINE position inhibits the circuit action as follows:-

(a) COARSE Position

- (i) Disconnects the output of 6VT2 from the tuning signal switch circuit and grounds 6VT8 base via 6R75. This causes the tuning signal switch circuit on the exciter to operate as previously described. The anode of 6MR7 is also grounded.
- (ii) Provides a ground connection to 6VT3 collector via 6R32. This allows 6VT24 to conduct and the fail timer is inhibited. There is no input to 6MR9.
- (iii) Disconnects the output from 6VT5 collector to the r.f. control and load inhibit circuits. Provides +25 V d.c. to the r.f. control and load inhibit circuits which operate as described in the coarse tuning phase of the automatic sequence.
- (iv) As the outputs of the tuning control and coarse tuning control flip-flops are disabled, control of contactor 6PS is exercised by the r.f. sensing circuit, and contactor 3PH4.

(b) FINE Position

The only circuit change in this case is to substitute a ground connection for the +25 V d.c. applied as in (iii) above. The r.f. control and inhibit circuits now operate as described in the fine tuning phase, sub-sub-section 4.2.12 above.

4.3 Servo Amplifiers and Motors (Refer Figure 3 - 6)

Three servo amplifiers and motors are used to position the tuning components. The table shows the components controlled by each amplifier and the motor voltages.

Amplifier	Stage	Components	Motor Voltage
1	RFA2	10L9, 10C13, 10C14	+18, -18
2	RFA3	1L17, 1C61	+24, -24
3	Output loading	1L18, 1C62	+24, -24

The coarse tuning voltage from the frequency discriminator is applied to a potentiometer-resistor network. The potentiometer wiper, mechanically coupled to the drive motor, picks off the d.c. error voltage which is fed to one input of the operational amplifier, VT1.

The output stages of the servo amplifier are a pair of high power NPN transistors, VT4 and VT5, each of which, in conjunction with half of the servo motor supply voltage, provides for the direction of rotation of the servo motor.

Transistor VT4 is driven by the operational amplifier via an emitter follower VT2. Transistor VT3 provides phase inversion for driving VT5. Resistor R3 provides an internal negative feedback to define the amplifier gain.

Resistors R10, R11, R12 and the resistance of the servo motor form a bridge network which gives no output as long as the motor is stationary. When the motor turns, in either direction, the back e.m.f. unbalances the bridge and a voltage proportional to motor speed is produced. This voltage is applied to the input of the operational amplifier, to provide velocity feedback, via R13. Overall negative feedback is also applied via R13 by arranging R11 to have a higher value than that required to give perfect balance.

The overall gain of the amplifier is so arranged that the offset voltage will not cause sufficient output for the motor to turn when there is no input voltage.

Fine tuning voltages are applied to servo amplifiers Nos. 1, 2 and 3 from the RFA2 phase discriminator, RFA3 phase discriminator and the amplitude discriminator, respectively, on the completion of coarse tuning.

Limit switches are fitted to each dial assembly to ensure that the drive motor stops turning before the dial reaches the mechanical stops. In normal operation, SWA and SWB are made so as to complete the common supply line. Assume that the required direction of drive causes VT5 to conduct so that the motor drives the dial far enough to operate SWA. The supply voltage is removed from the motor and the back e.m.f. is fed, via MR3, across the motor to act as a dynamic braking force. The motor stops and SWA remains open. When the direction of error signal is reversed, the motor supply voltage circuit is completed by MR1 by-passing the open contacts of SWA. As the dial rotates in the opposite direction SWA closes to short circuit MR1 and complete the supply path.

The output of RFA3 phase discriminator is a voltage high enough for the servo motor to attain such a speed so as to cause "hunting" of the RFA3 tuning. Diodes 1MR4 and 1MR5 limit this voltage and, therefore, the speed the motor attains. Diodes 1MR6 and 1MR7 perform a similar function in limiting the load comparator voltage to the input of servo amplifier No. 3.

Inhibition of servo amplifier No. 3, output load tuning, occurs when 6VT20 (load inhibit) conducts during fine tuning, grounding the drive to VT2 and VT3.

4.4 Frequency Discriminator (Refer Figure 3 ~ 7)

The frequency discriminator provides a coarse error voltage for automatically driving the tuning servos to within the fine tuning range. The discriminator is, physically, part of wide-band amplifier RFA1.

The input circuit comprises a cascode amplifier, similar to RFA1, to which the r.f. input signal is applied. The action of the amplifier is governed by 2VT2, 2VT4 and the r.f. control signal which inhibits the output of the amplifier until coarse tuning is required. When coarse tuning the r.f. output is applied to two separate reactive discriminator circuits, which produce d.c.

voltages, one of which is proportional to the input frequency, the other being inversely proportional to the input frequency. The voltages are of opposite polarity and are applied, via two unity gain direct current amplifiers, across the coarse tuning potentiometers associated with each of the three servo amplifiers. The control is driven to the point where the potentiometer output is zero, i.e. to a position approximately the correct tuning point for the particular input frequency. This coarse positioning is made to fit the actual tuning curve of each control by adding shunt resistors as required, to the 5 tapping points on the potentiometers. When the discriminator is inhibited, the circuits are so biased that both d.c. outputs become zero with the result that the potentiometers are disabled and the servo amplifiers are driven by the fine tuning signals alone.

The r.f. signal is applied to the base of 2VT1 via 2C3. When the discriminator is inhibited, the negative bias voltage from the r.f. control circuit cuts off 2VT4, causing 2VT3 to conduct. This cuts off 2VT2 and the r.f. signal to the discriminator is suppressed. However, when the control signal drives 2VT4 into conduction, 2VT2 conducts and the r.f. signal appears across 2L2 and is applied, via 2C8, to the discriminator circuits.

The frequency discriminator proper consists of an R-L and an R-C circuit connected to the output of 2VT2. The inductive circuit consists of 1L22, 2R18 and 2R20 and the capacitive circuit comprises 1C86, 2C11 and 2R19. Variable resistor 2RV1 provides a level adjustment between the two complementary voltages.

The signal appearing across the inductor is detected and the positive half-wave at 2MR4 is filtered and applied to emitter follower, 2VT5. The linearity of this signal at low levels is improved by the action of zener diode 2MR6. The output of 2VT5 is directly coupled to a complementary emitter follower, 2VT6, the combination providing unity voltage gain. The positive d.c. output voltage of 2VT6 follows the impedance response to the inductive input circuit, i.e. it increases with increasing frequency. The adjustment of 1L22 allows the tuning components to be correctly positioned during alignment, at the low frequency end of the band.

The capacitive circuit behaves in a similar fashion, excepting that the negative half-wave is detected and a negative d.c. output results. The adjustment of 1C86 allows the tuning components to be correctly positioned during alignment, at the high frequency end of the band.

The important characteristic of the output is that the RATIO of the two voltages is dependent only on the frequency of the incoming signal and not on its amplitude. The ratio is approximately 50:50 at 8 MHz, 20:80 at 1.6 MHz and 80:20 at 30 MHz.

4.5 Phase Discriminators 3J64629 (Refer Figure 3 - 7)

Automatic fine tuning of RFA2 and RFA3 is provided by phase discriminators, one being provided for each stage. Both discriminators are identical, and operate on the principle that the grid and anode voltages of a correctly tuned amplifier are 180 deg. out of phase. The discriminator detects the phase-relationship between the stage input and output and the resulting error correction signal is applied to the associated servo amplifier.

Each discriminator is a discrete unit, connected into the r.f. section of the amplifiers.

The output of RFA2, which also forms the input to RFA3, is applied, via 10C13 across the series connected primary windings of TR1 in both units. The variation of 10C13 which is ganged with RFA2 tuning control, provides a current in TR1 which does not vary greatly with frequency and also has the required 90 deg. reference phase shift. In both discriminators equal and out of phase secondary voltages are developed across R1 and R2 to which diodes MR1 and MR2 are connected.

In discriminator 1 associated with RFA2, the grid to cathode voltage of 1V1 is injected into the junction of R1 and R2, via C3 and 1C6, while in discriminator 2 associated with RFA3 the anode voltage of RFA3 is injected into the junction of R1 and R2 via capacitor divider 1C47 and 1C52. This voltage in each discriminator is added vectorially to the voltage across R1 and R2, producing detected d.c. voltages across R3 and R4. When the stage is correctly tuned and the anode circuit therefore resonant, the 90 deg. phase relationship of the two signals is such that the voltages applied to the two diodes are equal producing equal voltages of opposite polarity across R3 and R4. The sum of these voltages, i.e. zero, is fed to the servo amplifier.

When the anode circuit is off tune, the grid to anode phase shift will be more or less than 180 deg. and unequal voltages are developed across R3 and R4, resulting in a d.c. output of polarity dependent on whether the phase shift leads or lags, relative to 180 deg. The circuit is so arranged that the polarity of the voltage fed to the servo amplifier causes the tuning motor to turn in the correct direction to tune the stage.

In both cases, the outputs are connected to the servo-amplifier inputs via feed-through capacitors, 1C53 and 1C54 respectively.

4.6 Amplitude Discriminator 4J64629 (Refer Figure 3 ~ 7)

This circuit provides the signal to tune the RFA3 loading inductor 1L18 and capacitor 1C62. The output is only meaningful when RFA3 anode circuit is tuned. The grid and anode r.f. envelopes at RFA3 are sampled, then rectified and compared in a resistive bridge arrangement, the output of which provides an error correction signal for the load tuning servo amplifier. The rectifier and associated filter circuits also provide monitoring facilities for RFA2 and RFA3 outputs; additionally, RFA3 output is connected to one input of the gain limiter, to control the performance of the r.f. section.

The anode output of RFA3 is applied, via capacitor divider 1C44 and 1C48 to the rectifier circuit MR1, MR2. The half-wave output of MR1 is filtered and appears across R1. The resulting positive d.c. voltage is applied to one side of the resistor bridge, 1R51 to 1R54, 1R48, 1RV6 and 1R49, and also to the gain limiter. For monitoring purposes, RFA3 output is measured at the junction of 1R51 and 1R52, with respect to earth.

The other discriminator input is obtained from the grid circuit of RFA3 and is applied, via 1C22 and 1C23, to a second rectifier and filter circuit, MR3, MR4 and L2, C2, loaded by R2. The resulting negative d.c. voltage is

applied to the other side of the bridge and RFA2 output is monitored at the junction of 1R53 and 1R54.

Preset potentiometer 1RV6 is balanced such that when RFA3 is correctly loaded there is zero output at the wiper, which is connected to one input of the loading servo-amplifier. Incorrect loading causes the discriminator voltage to become unequal and the resulting output is of the polarity required to drive the loading servo motor in the correct direction to provide optimum loading.

- End of Part -

PART 2

MAINTENANCE AND REPAIR

1. MAINTENANCE

1.1 General

Maintenance is broadly reduced into preventive and corrective procedures. Preventive maintenance includes regular checks and routines to ensure optimum performance of the equipment. Corrective maintenance provides repair and re-alignment instructions for rectifying degraded performance and defects.

A preventive maintenance programme, based on the instructions below, local policy and operating experience, should be implemented.

(a) Daily

1. Check all meter readings for proper operating values at start-up, correct any defective condition revealed by abnormal readings.
2. Recheck the meter readings before shut-down. Investigate and correct any discrepancies, as necessary.
3. If overloading has occurred, examine the components involved after shut-down and repair or replace as necessary.

(b) Weekly

1. Check the interlock and grounding switches for correct operation; particularly ensure that the grounding switches operate freely.
2. Visually inspect components for any signs of overheating.
3. Clean the air filter, if necessary (see sub-section 1.3). The frequency of cleaning will be dependent on the condition of the air supplied to the transmitter.

(c) Monthly

1. Clean the interior of the transmitter, using a vacuum cleaner, or failing this, a soft brush. Under no circumstances should a blower be used. Special attention should be directed to gears, bearings and contact surfaces. If necessary, clean and lubricate moving parts as in sub-section 1.2.
2. Clean all valve envelopes and insulators, using a soft cloth moistened with methylated spirits. Ceramic insulators should be wiped with a clean, soft lint-free cloth.
3. Clean and lubricate switches as required.
4. Check the tightness of all connections.
5. Carry out detailed performance checks.

(d) Quarterly

1. Make detailed inspection of all units.
2. Inspect and service all contactors.
3. Check the operation of all mechanical drives. Clean and lubricate, as required, as detailed in Section 1.2.
4. Inspect r.f. contacts of variable inductors and replace if showing excessive wear.

(e) Annually

1. Clean and lubricate all switches, tuning controls and drives, including vacuum capacitors. The vacuum capacitors must be removed from the amplifier (see Section 1.2b(4), 3.8 and 3.9).
2. Inspect and recondition all relays and contactors.
3. Check the performance of the transmitter in detail.
4. Test spare units and valves.

Corrective maintenance, dismantling and replacement procedures are contained in Sections 3 and 4.

1.2 Cleaning and Lubrication of Mechanical Components

(a) Cleaning

1. Clean all moving parts, bearings and contact surfaces with a lint free cloth or brush moistened with solvent such as Chlorothene N.U. or Shellite. Special attention should be given to gear teeth. Do not "flood" parts with solvent.

(b) Lubricating

CAUTION: Always use a minimum of lubricant where this is applied adjacent to r.f. insulators.

1. The teeth of all metal gears and the bronze lead-screw of 10L9 (RFA 7) should be brushed with Molycote G-Plus lubricating paste followed by Molycote EP grease using a brush with short stiff bristles.
2. Sintalite bearings have been fitted in the tuning heads, etc. These are porous, powdered-metal bushings and absorb oil amounting to 30% by volume. Operation in warm climates may necessitate periodic replenishment. This is done by placing a drop of high grade SAE20 oil at the end of the bearing and wiping away any surplus after five minutes.
3. Ball-bearings have been fitted to the tuning inductors and are lubricated for the life of the equipment. If major overhaul involves the dismantling of the assembly, the bearings should be washed thoroughly in solvents, dried and lubricated with Esso Low Temperature Aviation grease or equivalent.

4. Either of two makes of RFA3 Tuning and Loading capacitors are fitted - Energy Laboratories (gas filled) or Jennings (vacuum). The recommendations for Energy Laboratories capacitors are as follows:

With the capacitor either horizontal or vertical, tuning shaft uppermost, turn the capacitor to minimum capacitance by winding the tuning shaft clockwise. Using a hexagon wrench unscrew the shaft collar, withdraw the shaft assembly and unscrew the plunger from the shaft. The screw thread and bearing surfaces can then be lubricated with Unitemp E.P. manufactured by Regent, Caltex or Texaco, to British spec. DTD 825/B-XG275 or DTD 844B-XG278 or to American spec. MIL9 23827 (an alternative would be Aero Shell 7A).

The recommendations for Jennings capacitors are as follows:

Inscrew the tuning shaft and remove. Lubricate the screw thread with Unitemp E.P. or equivalent. Apply about 3 drops of oil (Midland Silicone MS5 10/50) to the slide. Care must be taken that parts of the ball thrust bearing are not misplaced.

5. After cleaning, (see Paragraph 2(a) 1 above), all contact surfaces on tuning inductors 10L9 (part of RFA2 tuning assembly), 1L17 and 1L18 are to be coated with an electrical grease such as Electrolube (Richard Fort (Aust) Pty. Ltd.). In the case of 10L9 do not apply lubricant to the winding.
6. The blower motor bearings were lubricated for life during manufacture.

1.3 Air Filter

The filter element is a washable, dry type and should not be impregnated with oil or any similar substance. At the specified servicing interval (weekly), remove the filter assembly and clean the element with:

- (a) An air jet directed at the inner (cleaner) side, or
- (b) A domestic vacuum cleaner applied to the outer side, so that air is drawn through the filter in the reverse direction.

When the filter is too dirty for the above cleaning methods remove the filter element from the panel and wash it in water (not over 100 deg.F) with or without the addition of soap or detergent. Rinse in clean water and dry thoroughly before refitting. When repeated washing affects the bonding of the filter element, it should be replaced.

1.4 Lamp Replacement

Lamps on the control panel are removable. Carefully prise off the bezel and remove the lamp with the aid of a "sock" of 3 mm or 4 mm p.v.c. tubing DO NOT USE copper braid as a "sock".

1.5 Switching Contactors

The following maintenance is suggested for the Siemens Series 3TA contactors:

1. Remove dust deposits by the suction method. DO NOT blow out with compressed air.
2. If the contactors hum because of contaminated pole faces, clean the pole faces with a piece of cloth which may be lightly wetted with carbon tetrachloride or a similar solvent. After cleaning, apply a very thin film of transformer oil.
3. Do not dress darkened contacts; the oxide deposit does not impair the functioning of the relay.
4. To fit a new coil, detach the magnet chamber, lift off the lower core section and withdraw the existing coil. Ensure that the two return springs are seated properly when re-assembling the contactor.

1.6 Circuit Breakers

Circuit breakers are sealed assemblies and when defective should be replaced by an identical type.

1.7 Wafer Switches

For cleaning and lubricating, it is recommended that a solution, in the proportions of two ounces of pure lanoline in ten fluid ounces of di-chloroethylene, be made up. This is sparingly applied to the contacts with a fine pointed brush and the switch is then rotated while the solvent dries to evenly distribute the lubricant.

1.8 Servo Control Motors

The servo motors do not require maintenance. Defective motors should be returned to AWA for repair.

1.9 Replacement of Transistors and Semiconductor Diodes

When soldering these components into circuit a heat-shunt is recommended and a clean, well-tinned soldering iron should be applied for the shortest time necessary. Additionally, the component leads should be left as long as practicable and, to preserve the seal, should not be bent closer than 1/4 inch from the body.

1.10 Adjustments and Pre-Alignment

After replacement of components and repair of units or when required as a part of routine maintenance it will be necessary to check the functioning of the equipment. The procedures are given in the sections shown below:

- (a) Adjustment and re-alignment after component replacement and unit repair - Section 4.
- (b) Re-alignment of the r.f. stages - Section 2.

Procedures not covered in the above sections are given below.

1.11 Servo Belt Drive Replacement and Adjustment

Adjustment of the RFA3 tuning and loading servo assembly belt drives is similar and will only be necessary after belt replacement.

1. Remove servo assembly.
2. Loosen the large hexagon nut securing the idler capstan and move it away to clear contact with the belt.
3. Remove and replace the belt ensuring that the 'teeth' on the belt inner surface engage with the slots in the drive and driven pulleys.
4. Tension the belt, setting the idler capstan firmly against the smooth side of the belt, and tighten the capstan securing nut. Correct tension is obtained when a maximum downward and upward deflection of the side of the belt opposite to the capstan is not in excess of 1/2 inch total.
5. Re-align tuning capacitor and inductor and replace servo assembly as described in sub-sections 3.4 to 3.9 below.

1.12 Setting of RFA2, RFA3 and R.F. Line (V, S. W. R.) Overloads

Switch off all circuit breakers and withdraw the control unit to the extent of its slide travel.

A. RFA2 Overload

1. Turn overload setting control 4RV1 fully clockwise.
2. Connect the external regulated power supply positive terminal to 4PLS31 and negative to earth. Set multimeter 4M1 to RFA2 CATH and adjust the power supply output to read 500 mA on 4M1. Check that this corresponds to +1.5 V at 4PLS31.
3. Slowly adjust the RFA2 overload control 4RV1 anti-clockwise until overload lamp 4LP3 lights.
4. Reduce the indicated current to 480 mA and clear the overload by pressing the O/L FAULT CLEAR pushbutton.
5. Check that an overload is not indicated for 480 mA and that if the current is increased to 500 mA an overload occurs. Clear any overloads.

B. RFA3 Overload

1. Turn overload setting controls 4RV2 and 4RV4 fully clockwise.
2. Connect the external regulated power supply positive terminal to 4PLS23 and negative to earth. Set the multimeter to RFA3A CATH and adjust the power supply to indicate 500 mA. Check that this corresponds to +1.5 V at 4PLS23.
3. Slowly adjust the RFA3A overload control 4RV2 anti-clockwise until overload lamp 4LP4 lights.

4. Reduce the indicated current to 480 mA and clear the overload.
5. Check that an overload is not indicated for 480 mA and that if the current is increased to 500 mA an overload occurs. Clear any over-loads.
6. Repeat steps 7 to 10 for RFA3B and RFA3C, the corresponding controls and measuring point being 4RV3, 4RV4 and 4PLS22 and 4PLS21 respectively.

C. R.F. Line Fault (V.S.W.R.) Overload

1. Before setting the r.f. line (v.s.w.r.) overload control, 4RV6, it is essential for the reflectometer to be calibrated, refer to sub-section 2.5 below.
2. Connect the transmitter to a 75 ohm water load.
3. Switch on and manually tune the transmitter to 10 MHz to give a 1 kW p.e.p., single tone output into the load.
4. Turn overload setting control 4RV6 to mid-range.
5. Note forward power reading on multimeter 4M1 and using the v.s.w.r. chart (Figure 3-9) determine the reflected power meter reading for a v.s.w.r. of 3:1.
6. Connect a low voltage d.c. supply with negative to earth and positive to the junction of 4R101 and 4RV7 and then set the power supply to give the calculated reflected power meter reading on 4M1.
7. Adjust 4RV6 to the point where the r.f. line fault overload trips.

2. ALIGNMENT PROCEDURE

2.1 General

The r.f. stages will not require re-alignment unless performance becomes degraded, components are replaced or alignment is to be checked as a part of the routine maintenance programme.

WARNING: LETHAL VOLTAGES ARE PRESENT WITHIN THE TRANSMITTER AND CAUTION MUST BE EXERCISED.

2.2 Preliminary Operations

1. Ensure that the transmitter is switched OFF and positively isolated from the mains supply, then remove the r.f. unit front cover and the access covers from the r.f. amplifier assembly.
2. If the pick-up capacitors, situated along each side of RFA3 anodes have been disturbed, slide them to the outer-most position, otherwise do not alter the settings.
3. Connect the output of the transmitter to a 75 ohm test load, preferably a water load. Connect the interlock switch of the load to the

transmitter with the common terminal to earth and the normally open contact to 4SKN28. Set it to operate at a flow rate of 20 gallons/hour and check the operation.

NOTE: The test load is required throughout the following procedures. The upper covers must also be in place.

2.3 Manual Tuning Procedure

Many of the procedures given necessitate manual tuning of the transmitter to achieve the required operating conditions. The procedure is given below and should be followed when manual tuning is specified in the tests following this sub-section.

NOTE: Do not operate any manual tuning control any faster than 10 seconds for end to end travel, or the servo motors may be permanently damaged.

1. Set the LOCAL/REMOTE switch to LOCAL.
2. Set FEEDBACK switch to off as manual tuning cannot be accomplished when feedback is on.
3. Ensure that the GAIN LIMITER switch is ON.
4. Set the exciter as follows:
 - (a) AUTO-MANUAL switch to MANUAL
 - (b) RF GAIN control to minimum
 - (c) AUDIO INPUT switch to F1F2
5. Set the transmitter control unit as follows:
 - (a) CHANNEL selection switch to the required channel
 - (b) EMISSION switch to A3J.

With the controls set as in 4, 5(a) and 5(b) above the exciter will provide a two tone test signal.

6. Connect oscilloscope to RF MONITOR output, 1SKB.
7. Adjust the tuning controls to the positions appropriate for the test frequency (see Table 1 following page and Tuning Charts Figures 3-1, 3-2 and 3-3).

TABLE 1

Frequency MHz	Tuning Positions		
	RFA2	RFA3 Tune	RFA3 Load
1, 6	2.5	4.0	7.0
2	16.9	20.0	20.0
3	35.8	42.3	42.8
4	47.2	52.3	55.5
5	55.5	57.5	63.4
6	61.0	61.8	69.0
8	69.0	67.0	78.0
10	74.5	69.8	83.5
15	82.5	76.9	88.6
20	87.8	83.0	91.0
25	91.0	88.0	91.5
30	94.0	91.0	93.2

8. Switch on all circuit breakers except TUNING MOTORS.
9. Switch on LT, HT and TEST KEY.
10. Increase manual gain control until RFA1 OUTPUT metering reads 4.0 divisions on the multimeter.
11. Tune RFA2 for a maximum reading on RFA2 OUTPUT metering (keep gain control adjusted to limit cathode current of RFA3 to 0.5 amps whilst tuning).
12. Tune RFA3 for a maximum reading on RFA3 OUTPUT metering. (Keep gain control adjusted to limit cathode current of RFA3 to 0.5 amps whilst tuning.)
13. Slowly increase manual r.f. gain control to bring up power on the final stage; observe the RFA3 cathode current and screen current and also r.f. envelope on an oscilloscope connected to the monitor output. Increase power until the cathode current reads 0.6 amps. The screen current should be about 5 mA and the envelope will be just short of limiting on the modulation peaks.

The measured average power, when the r.f. envelope is just short of limiting and the transmitter is correctly tuned, should be in excess of 0.5 kW.

14. If the above conditions are not met it may be necessary to alter the loading slightly, and retune until the correct tuning conditions are obtained.

NOTE: After tuning, the input level may be adjusted by the exciter RF GAIN control to give an average output of 0.5 kW. The above procedure simulates auto-tuning for a given load impedance where the resulting output is acceptable if it exceeds 1 kW p.e.p. In normal operation, the auto-attenuator adjusts the input to maintain this level.

2.4 Neutralisation

1. During the neutralisation procedure it will be necessary to remove and replace the r.f. amplifier assembly upper access cover each time adjustments are made to 1C42.
2. Isolate the h.t. from RFA3 as follows:
 - (a) Disconnect 1L14 from 1C59, leave 1C59 connected to RFA3.
 - (b) Disconnect screen grid supply to RFA3 at the terminal post on the supply side of 1R43 and 1R44.
 - (c) Switch off FEEDBACK.
 - (d) Short feedback pick-up 1C43 to ground with a short heavy lead.
3. Adjust exciter to give a single tone signal at 30 MHz and set the tuning controls in the transmitter to the dial positions given in Table 1, sub-section 2.3 above. Set exciter to MANUAL - RF GAIN.
4. Connect oscilloscope (with a high-gain head) to the test load.
5. Switch on all mains control circuit breakers except TUNING MOTORS.
6. Switch on LT, HT, and TEST KEY.
7. Switch multimeter to RFA1 OUTPUT.
8. Increase the gain control to give a reading of 7.0 divisions on the meter.
9. Manually tune RFA2 and RFA3. Do not alter loading settings.
10. Note the r.f. level on the oscilloscope.
11. Switch off HT and adjust neutralising pick-up 1C42 slightly.
12. Switch on HT and retune RFA2 and RFA3.
13. Note whether the r.f. level on the oscilloscope has increased or decreased.
14. Repeat adjustments of 1C42 until a minimum of r.f. level reading on the oscilloscope has been obtained. Do not alter manual gain setting throughout the adjustments.

15. Switch off HT, LT and all circuit breakers and disconnect the oscilloscope.
16. Reconnect h.t. to the final stage.
 - (a) Remove short on 1C43
 - (b) Reconnect 1L14 to 1C59
 - (c) Reconnect 1R43 and 1R44 to the screen supply terminal post.

2.5 Calibration of Reflectometer

A. Forward Power Calibration

1. Connect transmitter to water load.
2. Switch on and manually tune the transmitter to give 1 kW p.e.p. single tone at 10 MHz into the load.
3. Adjust 4RV8 until 4M3 (POWER OUTPUT meter) reads exactly 1 kW.

B. Reflected Power Calibration

1. Connect transmitter to water load.
2. Switch on and manually tune the transmitter to give 1 kW p.e.p. single tone at 10 MHz into the load.
3. Set the exciter output to zero.
4. Switch off h.t. and disconnect the transmission line at the reflectometer.
5. If the r.f. line fault (v.s.w.r.) overload has not been adjusted set 4RV6 to mid-position otherwise do not change the setting of 4RV6.
6. Switch on and increase exciter output. TO AVOID DAMAGE, IT IS IMPORTANT NOT TO ALLOW RFA3 CATHODE CURRENT TO EXCEED 0.5 AMPS.
7. Tune RFA3 for a dip on the RFA3 CATHODE current meter.
8. Increase the exciter output to give a FORWARD POWER reading on multimeter 4M1 of 15 divisions.
9. Compare the forward and reflected power readings on 4M1 and adjust 4RV7 to make them equal.
10. If 4RV6 has been moved, reset the r.f. line fault (v.s.w.r.) overload (refer sub-section 1.12(c) above).

2.6 Adjustment of RFA3 Pick-up Capacitors

1. Adjust 1C43 and 1C47 to be spaced 3/8 in from RFA3 anode.
2. Switch on transmitter and manually tune to 10 MHz as detailed in sub-section 2.3 above. Adjust for 1 kW p.e.p. single tone output.
3. Compare the multimeter readings of RFA2 and RFA3 outputs.
4. If they are different, switch off h.t. and adjust 1C44 in the approp-

riate direction until the readings are identical.

5. Switch off h.t.
6. Connect a 50-ohm termination via a 50-ohm coaxial cable to the monitor output 1SKB.
7. With the transmitter still tuned to give 1.0 kW p.e.p. measure the voltage output across the 50-ohm termination. It should be 1.0 volt r.m.s. If not, switch off h.t. and adjust 1C46 until this figure is obtained.

2.7 Adjustment of Gain Limiter

1. Set all gain limiter adjustments 7RV1 to 7RV4, fully anti-clockwise and 7SWA to off.
2. Switch on LT and HT and with the transmitter tuned for 10 MHz adjust drive to a single-tone test signal.
3. Using the exciter manual RF GAIN control, adjust the output power to 1 kW p.e.p.
4. Switch the multimeter to the RFA1 OUTPUT position and detune RFA2. Adjust the manual gain control until the meter reads 6.0 divisions.
5. Adjust 7RV1 (RFA2 IN control) on the gain limiter in a clockwise direction until the GAIN LIM lamp just lights. Switch 7SWA on.
6. Check that further detuning of RFA2 causes no increase in RFA1 OUTPUT meter reading.
7. Retune RFA2. Switch 7SWA off and set the exciter to give a two-tone test signal (F1F2).
8. Reduce the manual gain control until RFA3 cathode current is 0.5 amps.
9. Adjust 7RV2 (RFA3 I AV control) until the GAIN LIM lamp just lights.
10. Increase the output power to about 1.1 kW p.e.p. (450 W on power output meter).
11. Adjust 7RV3 clockwise (RFA3 PV COMP control) until GAIN LIM lamp just extinguishes.
12. Adjust 7RV4 (RFA3 PV control) until the GAIN LIM lamp just lights, then turn it anti-clockwise about one eighth of a turn.
13. Switch GAIN LIMITER (7SWA) to ON.
14. Check that limiting occurs in the following circumstances
 - (a) Detuning RFA2
 - (b) Detuning RFA3

- (c) Incorrect loading of RFA3
 - (d) Excessive input level
15. Switch off transmitter

2.8 Operation of Auto-Tuning

Coarse Frequency Positioning

- WARNING: 1. Do not attempt to manually adjust the tuning or loading controls if the transmitter is automatically tuning or if the switch 6SKA is in either COARSE or FINE position as damage may be caused to the motors.
2. The servo-motor supply is not continuously rated, so if 6SKA is to be set to COARSE or FINE for lengthy periods for maintenance purposes the TUNING MOTORS circuit breaker should be set to OFF.

2.9 Coarse Frequency Positioning

1. Switch on transmitter and tune to 10 MHz.
2. Set AUTO GAIN control, 4RV10, on the control panel fully anti-clockwise.
3. Set the MANUAL-AUTO switch in the exciter to AUTO.
4. Adjust 4RV10 to give power output from the transmitter of 1.0 kW p.e.p. tow-tone.
5. Set 6KSA in the servo-control unit to COARSE.
6. Check that RFA1 is inhibited (RFA1 output reads zero) and that the TUNE COARSE lamp on the power control unit lights.
7. Adjust RV5 in the auto-attenuator in the exciter to give an exciter output reading on the multimeter of 5.0.
8. Measure the d.c. voltage between 11B4 and 11B5. This is the coarse frequency discriminator output and should be about 17 volts d.c.
9. Switch off MAIN HT circuit breaker.
10. Set 6KSA to FINE.
11. Check that the TUNE FINE lamp lights and the TUNE COARSE lamp is extinguished.
12. Check that the d.c. has been removed from 11B4 and 11B5.
13. Switch off h.t.
14. Set coarse tuning balance control 2RV1 to its centre position.
15. Switch on TUNING MOTORS circuit breaker.
16. Change the drive frequency to 1.6 MHz and set switch 6KSA to COARSE.

17. Switch on h.t. (leave MAIN HT circuit breaker off).
18. Check that the RFA3 tuning servo moves to 4.0 divisions on the dial. If not, adjust the 1.f. tuning adjustment, 1L22 on the r.f. amplifier assemble, a small amount.
19. Change the drive frequency to greater than 3 MHz and allow all servos to come to rest.
20. Return the drive frequency to 1.6 MHz and check the dial position.
21. Repeat steps 18, 19 and 20 until the correct setting is obtained.
22. Change the drive frequency to 30 MHz.
23. Check that the RFA3 tuning servo comes to rest at 91.0 divisions on the dial.
24. If not, adjust the h.f. tuning adjustment, 1C86 on the r.f. amplifier assembly, slightly.
25. Change the drive frequency to less than 10 MHz and allow all servos to come to rest, then change back to 30 MHz and check the dial position.
26. Repeat steps 22, 23, 24 and 25 until the correct setting is obtained.
27. Re-check the 1.6 MHz positioning.
28. Check the coarse positioning for 8 MHz, it should be 67.0. If not, adjust 2RV1 slightly and repeat steps 16 to 27.
29. Check the coarse positioning for 3 MHz, it should be 41.2.

In practice, on some of the servos, there will be about one division of positional backlash. This must be taken into account when checking the coarse settings.

TABLE 2
Nominal Coarse Servo Positions

Frequency MHz	RFA2 Tune	RFA3 Tune	RFA3 Load
1.6	2.5	4.0	7.0
2	17.0	20.0	21.5
4	47.0	51.5	55.5
10	74.5	69.7	83.5
15	82.5	76.8	88.8
20	88.0	83.0	91.0
30	94.0	91.0	93.5

2.10 Servos Traverse Time

1. Set the drive frequency to 1.6 MHz and allow the servos to come to rest.
2. Set 6KSA to NORMAL.
3. Change the drive frequency to 30 MHz.
4. Set 6KSA to COARSE and measure the time for RFA2 servo to come to rest.
5. Repeat for the other servos.
6. Also measure the time to go from 30 MHz to 1.6 MHz for each servo.
7. The traverse time in each case must not exceed 8 seconds.
8. Switch off h.t. and set 6KSA to NORMAL.

2.11 Auto-Tuning

1. Switch off TUNING MOTORS circuit breaker.
2. Switch on MAIN HT circuit breaker.
3. Set the MANUAL-AUTO switch on the exciter to MANUAL and the RF GAIN control to zero.
4. Manually tune the transmitter to 10 MHz single tone and set the RF GAIN control to give 0.5 kW p.e.p.
5. Switch on GAIN LIMITER and FEEDBACK.
6. Connect oscilloscope to pin 7 on RFA2 servo amplifier board.
7. Check that when RFA2 is in tune, zero d.c. output voltage appears at pin 7 and that detuning to a higher dial reading gives a negative d.c. voltage and to a lower dial reading a positive d.c. voltage appears. (See figure 1 below for typical discriminator response characteristics.)
8. Retune RFA2.
9. Connect oscilloscope to pin 7 on the RFA3 tune servo amplifier board.
10. Check that when RFA3 is in tune zero d.c. output voltage appears at pin 7 and that detuning to a higher dial reading gives a negative d.c. voltage and to a lower dial reading a positive d.c. voltage appears.

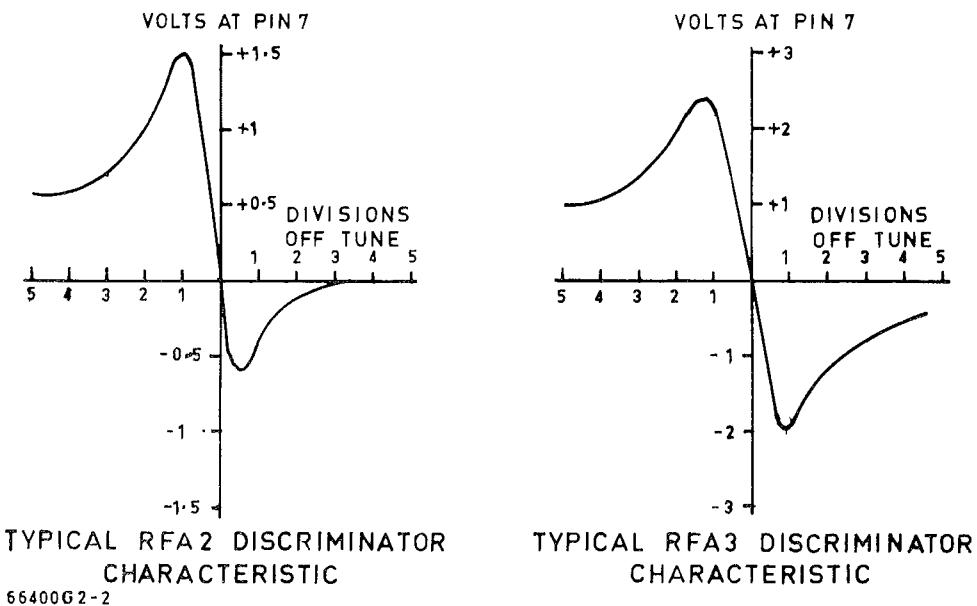


Figure 1

11. Retune RFA3.
12. Check that the transmitter is correctly tuned.
13. Check that RFA2 OUTPUT and RFA3 OUTPUT readings are identical.
14. Adjust r.f. drive to give 0.5 kW p.e.p. single tone.
15. Adjust load comparator control 1RV6 to give zero volts at pin 7 on the RFA3 loading servo amplifier.
16. Check that increased loading gives a negative voltage at pin 7 and decreased loading gives a positive voltage.
17. Re-adjust RFA3 loading to the correct setting.
18. Switch off h.t.
19. Switch on TUNING MOTORS circuit breaker.
20. Set 6KSA to NORMAL.
21. Set MANUAL-AUTO switch on the exciter to AUTO then set the GAIN LIMITER and H.T. switches to ON.
22. Set the drive frequency to 8 MHz to initiate the auto tuning sequence, if necessary press the tune START pushbutton switch, and check the following:

- (a) The TUNE COARSE lamp should light and the coarse tuning sequence progress correctly.
- (b) When coarse tuned, the TUNE FINE lamp should light and the TUNE COARSE lamp extinguish. Fine tuning of RFA2 and RFA3 should occur. Note that RFA3 loading is inhibited until RFA3 is tuned.
- (c) At the completion of tuning and loading, the TUNE FINE lamp should extinguish and the exciter should return to normal operation.

23. Retune to 1.6 MHz, then 30 MHz and check that the sequence given in step 20(a) to (c) above is followed in each case.

2.12 Performance Tests

1. Multimeter Readings

Ensure that the transmitter is correctly terminated and switched on. Compare the meter readings with the typical values appropriate to the operating conditions shown in Table 3 below.

TABLE 3

TYPICAL MULTIMETER READINGS

* Indicates that adjustments are provided to set to the readings shown.

Meter Reading	Zero Signal	1 kW p.e.p. 2-tone at 10 MHz	1 kW p.e.p. single tone at 10 MHz
Forward power	0	4.0	6.0
Reflected power	0	0	0
RFA3 output	0	2.8	4.8
RFA2 output	0	2.6	4.5
RFA1 output	0	2.1	3.6
Exciter output	0	1.7	2.9
EHT 2.5 kV	2150 V	2150 V	2150 V
Screen	400 V	400 V	400 V
Bias, (key up)	75 V	-	-
Bias, (key down)	39 V	39 V	39 V
RFA1 supply *	20 V	20 V	20 V
Control +25 V *	25 V	25 V	25 V
Control -25 V *	25 V	25 V	25 V

Meter Reading	Zero Signal	1 kW p.e.p. 2-tone at 10 MHz	1 kW p.e.p. single tone at 10 MHz
Exciter +5 V *	5 V	5 V	5 V
Exciter +15 V *	15 V	15 V	15 V
Exciter -24 V	24 V	24 V	24 V
RFA2 cathode	150 mA	0.15 A	0.16 A
RFA3A cathode	0.12 A	0.22 A	0.33 A
RFA3B cathode	0.12 A	0.22 A	0.33 A
RFA3C cathode	0.12 A	0.22 A	0.33 A
RFA3 screen	0	5 mA	20 mA
RFA3 cathode	0.36 A	0.65 A	0.95 A
Power Output	0	0.37 kW	1.02 kW

3. ASSEMBLY AND COMPONENT REMOVAL INSTALLATION

3.1 General

The following paragraphs detail the methods to be followed when removing and installing particular assemblies and components of the transmitter.

To gain access it is necessary to remove front panels and in some cases complete units and sub-panels, particularly in the r.f. section. Sufficient detail to remove most units is contained in Chapter 1, Part 1, Section 9 - Mechanical Construction.

When a component or assembly has been replaced, it is essential that adjustment checks are carried out as detailed elsewhere in this part.

WARNING: BEFORE DISCONNECTING ANY COMPONENT ENSURE THAT ALL POWER SWITCHES ARE IN THE OFF POSITION AND THE TRANSMITTER HAS BEEN ISOLATED FROM THE MAINS SUPPLY.
CAPACITORS SHOULD BE CONNECTED TO THE STATION GROUND SYSTEM TO ENSURE THEIR COMPLETE DISCHARGE.

3.2 R.F. Amplifier 1J66414

1. Set RFA2 tuning dial to zero.
2. Remove r.f. unit cover panel and r.f. amplifier assembly upper and lower access covers.
3. Remove the connection between 10C13 and pin 6 of discriminator 1 from the discriminator.
4. Loosen thumb screw on connection between RFA3 anode and 1C59.

5. Withdraw 35-way connector 13PLH and the two coaxial connectors 13PLC and 13PLD (RF IN and RF MONITOR).
6. Release the 12 slide clips which secure the r.f. amplifier assembly to the r.f. unit.
7. Move the r.f. amplifier assembly forward about one inch.
8. Lift the r.f. amplifier assembly to clear the bollards on the r.f. unit and, taking care not to damage 10C13 withdraw the assembly forward.
9. Install by following the reverse procedure.

3.3 RFA2 Tuning Assembly 1J66460

1. Remove r.f. amplifier assembly.
2. Remove regulated power supplies unit.
3. Disconnect 1PLA on left side of the assembly.
4. Remove the two hexagon bolts securing the left hand base plate of the assembly to the shelf of the r.f. compartment, they are accessible from underneath the shelf and are adjacent to the blower.
5. Remove the hexagon bolt securing the right hand base plate of the assembly to the shelf of the r.f. compartment, it is accessible from the top of the base plate.
6. Withdraw the assembly forward.
7. Install by following the reverse procedure.

3.4 RFA3 Tuning Servo Assembly 1R66412

A. Removal

1. Using crank handle set dial against stops at "O" end of the scale.
2. Loosen the two grub screws in the collar of the front flexible coupling of inductor 1L17 drive shaft.
3. Disconnect wiring to the terminal strip at the bottom front of the assembly.
4. Whilst supporting the assembly remove the three screws securing it to the stand-off supports and withdraw forward.
5. Remove spider from coupling to capacitor 1C61.

B. Installation

1. Set dial against the stops at the "O" end of the scale.
2. If the 1L17 and 1C61 drive shafts have not been moved install the assembly by following the reverse procedure. Ensure that the coupling parts mate and the grub screws in the 1L17 drive shaft coupling engage with the flats on the servo drive shaft. Apply "Loctite EV" to the grub screws and tighten, ensuring that the coupling is not flexed.

3. If 1L17 drive shaft has been moved, turn the drive shaft to the extreme clockwise position, the leading contact wheel should be approximately $3/4$ inch from the end of the winding. Complete installation as in steps 1 and 2 above. The trailing wheel has a two-turn shorting contact.
4. If 1C61 drive shaft has been moved, the following setting up procedure should be followed:
 - (a) For Energy Laboratories capacitors, rotate the shaft fully counter clockwise then rewind for two full turns.
 - (b) For Jennings capacitors, set the capacitor to its maximum capacitance by turning the shaft counter clockwise until the resistance to turning suddenly decreases and the shaft begins to unscrew. Slowly turn the shaft clockwise until resistance is felt once more.

Complete installation as in steps 1 and 2 above.

3.5 Inductor 1L17

1. Remove r.f. unit cover panel and right hand access cover.
2. Remove RFA3 tuning servo assembly (see sub-section 3.4).
3. Loosen the two grub screws in the drive shaft rear coupling and withdraw the shaft from the inductor drive.
4. Loosen the two nuts at the left of the inductor which secure the strap connecting it to 1C61, carefully press the strap to the rear sufficient to clear the securing nuts.
5. Loosen the two nuts at the top of the inductor assembly which secure the two halves of the strap connecting 1L17 to 1C62.
6. Support the assembly and remove the four mounting screws. Lower slightly to separate the two halves of the connecting strap and withdraw forward with a clockwise turning motion.
7. Install by following the reverse procedure. Ensure that the two grub screws in the drive shaft rear coupling engage with the flats on the inductor drive. Apply "Loctite EV" to the grub screws and tighten, ensuring that the coupling is not flexed. Align as described in 3.4 (B) above.

3.6 Capacitor 1C61

1. Remove r.f. unit cover panel and left and right hand access covers.
2. Remove RFA3 tuning servo assembly (see sub-section 3.4 above).
3. Remove screw in the centre left hand side of 1C59, carefully bend the bus wire to 1L14 clear and recover RFA3 anode connecting strap. 1C59 may be removed independently by removing the right hand centre screw which secures it to 1C61.

4. Loosen the two nuts at the left of inductor 1L17 which secure it to the 1C61 connecting strap, carefully press the strap to the rear sufficient to clear the securing nuts.
5. Support the capacitor and remove the five screws securing the base to the vertical support panel.
6. Move capacitor to the left and withdraw. If 1C59 has been left in position care must be taken to avoid damage.
7. Install by following the reverse procedure. Align as described in 3.4 (B) above.

3.7 RFA3 Loading Servo Assembly 1R66411

A. Removal

1. Using crank handle set dial against stops at "100" end of the scale.
2. Loosen the two grub screws in the collar of the front flexible coupling of inductor 1L18 drive shaft.
3. Disconnect wiring to the terminal strip at the right of the assembly.
4. Whilst supporting the assembly remove the three screws securing it to the stand off supports and withdraw forward.
5. Remove spider from coupling to 1C62.

B Installation

1. Set the dial against stops at the "100" end of the scale.
2. If the 1L18 and 1C62 drive shafts have not been moved install the assembly by following the reverse procedure. Ensure that the coupling parts mate and the grub screws in the 1L18 drive shaft coupling engage with the flats on the servo drive shaft. Apply "Loctite EV" to the grub screws and tighten, ensuring that the coupling is not flexed.
3. If 1L18 drive shaft has been moved, turn the drive shaft to the extreme counter-clockwise position, the contact arm should be horizontal and the contact wheels on the outer turn of the winding. Complete installation as in steps 1 and 2 above.
4. If 1C62 drive shaft has been moved, the following setting up procedure should be followed:
 - (a) For Energy Laboratories capacitors, rotate the shaft fully counter clockwise then rewind for 21 full turns.
 - (b) For Jennings capacitors set the capacitor to its minimum capacitance by turning the shaft to the extreme clockwise position then backing it off by one eighth of a turn.

Complete installation as in steps 1 and 2 above.

3.8 Inductor 1L18

1. Remove r.f. unit cover panel and left and right hand access covers.
2. Remove loading servo assembly (see sub-section 3.7 above).
3. Loosen the two grub screws in the drive shaft rear coupling and withdraw the shaft from the inductor drive.
4. Loosen the two nuts at the right of the inductor which secure the strap connecting it to 1C62, carefully press the strap to the rear sufficient to clear the securing nuts.
5. Remove the two screws securing 1L18 connector strap to the r.f. output feedline and carefully press the bus wire to 1L20 to the right sufficient to clear the feedline connector strap.
6. Support the assembly and remove the four mounting screws. Withdraw the assembly forward and downward avoiding damage to capacitor 1C59 mounted on the left of 1C61.
7. Install by following the reverse procedure. Ensure that the two grub screws in the drive shaft rear coupling engage with the flats on the inductor drive. Apply "Loctite EV" to the grub screws and tighten, ensuring that the coupling is not flexed. Align as described in 3.7(B) above.

3.9 Capacitor 1C62

1. Remove r.f. unit cover panel and left and right hand access covers.
2. Remove loading servo assembly (see sub-section 3.7 above).
3. Loosen the two nuts at the top of the 1L17 assembly which secure the two halves of the strap connecting it to 1C62.
4. Loosen the two nuts at the right of 1L18 which secure the strap connecting it to 1C62, carefully press the strap to the rear sufficient to clear the securing nuts.
5. Support the capacitor and remove the six screws securing the base to the vertical support panel.
6. Tilt the rear end of the capacitor slightly upwards to separate the two halves of the connecting strap, then move it to the right and withdraw forward.
7. Install by following the reverse procedure. Align as described in 3.7(B) above.

3.10 Reflectometer 1J66408

1. Draw the control unit forward to the extent of its slide travel.
2. Disconnect the external transmission line from the coaxial connector.
3. Disconnect the four pin connector from the front of the assembly.

4. Remove the two nuts securing the assembly to the horizontal support bars. Withdraw to the right whilst unscrewing the left hand coaxial connector from the integral transmission line connector. Alternatively the two studs securing the horizontal support bars to the assembly support bracket may be removed, in which case the assembly will be withdrawn with the support bars attached.
5. Install by following the reverse procedure.

3.11 Transformer 3TR1

1. Remove the regulated power supplies unit.
2. Disconnect the three primary leads on the left hand side of the transformer.
3. Disconnect the three secondary leads on the right hand side of the transformer.
4. Remove the six bolts which secure the transformer to the floor of the cabinet.
5. Slide the transformer forward from the cabinet.
6. Install by following the reverse procedure.

3.12 Blower 3BW1

1. Remove the regulated power supplies unit and transformer 3TR1.
2. Remove the r.f. amplifier assembly and the RFA2 tuning assembly.
3. Remove the screws securing the canvas ducting of the blower to the bottom shelf of the r.f. unit.
4. Withdraw the power connector from the blower assembly.
5. Support the assembly and remove the four screws which secure the blower mounting plate to the underside of the r.f. unit bottom shelf.
6. Lower the assembly and withdraw forward.
7. Install by following the reverse procedure.

3.13 Rectifier Assembly 1H66404

Removal and installation of any one of the three rectifier assemblies is similar.

1. Remove the h.t. transformer secondary lead from the board.
2. Remove the bus wire at each end of the board which connects it to the other two boards.
3. Support the assembly and remove the three knurled nuts which secure the board to the stand-off insulators, remove the assembly.
4. Install by following the reverse procedure.

3.14 Capacitors 3C1 to 3C4

Removal and installation of any one of the four filter capacitors is similar except that removal of 3C2, 3C3 or 3C4 entails removal of the capacitor(s) in front. Ensure that the capacitors are discharged (see WARNING sub-section 3.1 above).

1. Disconnect the bus wires connecting the capacitors together.
2. Loosen the screw on each side of the capacitor which secure each clamp to the cabinet floor.
3. Move the clamps clear and withdraw the capacitor forward.
4. Install by following the reverse procedure.

3.15 Inductor 3L1

1. Remove regulated power supplies.
2. Disconnect wiring to the inductor.
3. Remove the four screws securing the inductor to the cabinet floor.
4. Lift the inductor upwards and tilt forward to remove.
5. Install by following the reverse procedure.

3.16 Zener Diode Assembly 1R66419

1. Remove regulated power supplies unit.
2. Disconnect wiring to the assembly.
3. Support the assembly and remove the three screws securing it to the stand-off supports on the cabinet rear wall, remove the assembly.
4. Install by following the reverse procedure.

3.17 Metering Resistor Board 1R66420

1. Remove regulated power supplies unit.
2. Remove the three nuts, washers and solder lugs, with wiring attached, from the connecting points on the board.
3. Support the assembly and remove the three screws securing the board to the stand-off supports on the cabinet rear wall, remove the assembly.
4. Install by following the reverse procedure.

3.18 Transformer 1TR1

1. Remove the r.f. unit cover panel.
2. Remove the r.f. amplifier assembly.
3. Unsolder the wiring to the transformer terminals.

4. Support the transformer and remove the four screws securing it to the vertical support panel.
5. Move the transformer to the left and forward to remove.
6. Install by following the reverse procedure.

3.19 Air Flow Switch 1SWD

1. Draw the control unit forward to the extent of its slide travel.
 2. Unsolder the blue and grey leads on the micro-switch.
 3. Support the assembly and remove the four screws securing the switch mounting plate to the rectangular air duct.
 4. Withdraw the assembly.
 5. Install by following the reverse procedure.
4. ADJUSTMENT AND RE-ALIGNMENT AFTER COMPONENT REPLACEMENT

4.1 General

After replacement of any component which could affect the performance of the transmitter the relevant circuit should be checked to ensure that the voltage and signal conditions are restored to normal. For list of recommended test instruments see Section 13, Part 1 of Chapter 1.

4.2 Regulated Power Supplies

4.2.1 20 V Regulated Supply and Bias Supply

(a) Output voltage ranges and bias keying

- (i) Connect a 100 ohm 10 W load resistor between terminals 5TSA2 and 5TSA4.
- (ii) Connect the mains supply to terminals 5TSB1 and 5TSB2 via the variac and switch on supply.
- (iii) Set the variac to give 240 V a.c. between B1 and B2.
- (iv) Check for approximately -80 V d.c. at 5TSA1.
- (v) Bridge 5TSA3 to earth. The voltage at A1 should be approximately -39 V d.c.
- (vi) Turn 5RV1 fully clockwise. The voltage at A4 should be approximately +25 V d.c.
- (vii) Turn 5RV1 fully anti-clockwise. The voltage at A4 should be approximately +18 V d.c.

(b) Regulation with variation of mains voltage

- (i) Set 5RV1 to give 20 V d.c. at A4.
- (ii) Vary mains voltage by $\pm 10\%$. The voltage at A4 should remain constant.

- (c) Regulation with variation of load
 - (i) Switch off mains
 - (ii) Remove the 100 ohm load resistor.
 - (iii) Switch on mains
 - (iv) Voltage at A4 should be the same as in 4.2.1(b) (i) above.
 - (v) Switch off mains. Reconnect the load resistor.
- (d) Ripple
 - (i) Switch on mains
 - (ii) Measure ripple at A4 using a c.r.o. The ripple should not be more than 50 mA peak-to-peak.
 - (iii) Remove bridge and measure ripple at A1. The ripple should be approximately 0.2 V peak-to-peak.
 - (iv) Switch off mains. Remove load resistor and variac.

4.2.2 Control Supply

- (a) Output voltage ranges
 - (i) Connect a 33 ohm 20 W load resistor between terminals 5TSA2 & 5TSA5.
 - (ii) Connect a 120 ohm 5 W load resistor between terminals 5TSA2 & 5TSA6.
 - (iii) Connect the mains supply to terminals 5TSB2 and 5TSB5 via the variac. Connect A2 to mains earth and switch on supply.
 - (iv) Set the variac for 240 V output.
 - (v) Check for 110 V a.c. at 5TSB4.
 - (vi) Check for -50 V d.c. at 5TSA7.
 - (vii) Set 5RV2 and 5RV3 fully anti-clockwise.
 - (viii) Check for -20 V d.c. at A6.
 - (ix) Check for +20 V d.c. at A5.
 - (x) Set 5RV2 and 5RV3 fully clockwise.
 - (xi) Check for -26 V d.c. at A6.
 - (xii) Check for +26 V d.c. at A5.
- (b) Regulation with variation of mains voltage
 - (i) Adjust 5RV2 to give -25 V d.c. at A6.
 - (ii) Adjust 5RV1 to give +25 V d.c. at A5.
 - (iii) Vary mains voltage $\pm 10\%$. The voltages at A5, A6 should not change

by more than ± 1.25 V.

- (c) Regulation with variation of load
 - (i) Switch off mains. Remove both lead resistors and switch on mains.
 - (ii) Voltage at A5 should be +25 V ± 1.25 V.
 - (iii) Voltage at A6 should be -25 V ± 1.25 V.
- (d) Ripple
 - (i) Measure ripple with c.r.o. at A5 and A6.
 - (ii) Ripple in both cases should be less than 200 mV peak-to-peak.
 - (iii) Switch off mains. Remove variac.

4.3 R. F. Amplifier Assembly

NOTE: The following tests check only the coarse frequency discriminator and RFA1 and do not include RFA2.

1. Connect terminal 1 of the vernier potentiometer to 1C76 and terminal 3 to 1C79.
2. Connect terminal 2 of the vernier potentiometer to the d.c. millivoltmeter and connect the earth of the d.c. millivoltmeter to the chassis of the amplifier.
3. Connect +25 V supply to 1C78 and -25 volt supply to 1C77.
4. Connect +25 volt supply, in series with a 33 ohm 1 watt resistor, to 1C83.
5. Connect the signal generator to 1SKA.
6. Adjust the signal generator to give 1.3 volts r.m.s. output at 1.6 MHz using the r.f. millivoltmeter.
7. Adjust the vernier potentiometer until the d.c. millivoltmeter indicates a null.
8. Check that the vernier reading is 20%. If not, set vernier to read 20%, and adjust 1L22 until a null is indicated.
9. Set the signal generator to give 1.3 volts r.m.s. at 30 MHz using r.f. millivoltmeter.
10. Repeat step 4.3.7.
11. Check that the vernier potentiometer reading is 80%. If not, set the vernier to read 80% and adjust 1C86 until a null is indicated.
12. Set the signal generator to give 1.3 volts r.m.s. at 6.95 MHz using r.f. millivoltmeter.
13. Repeat step 4.3.7.
14. Check that the vernier potentiometer reads 50%. If not set the vernier to read 50%, and adjust 2RV1 until a null is indicated.

15. Repeat steps 4.3.6 and 4.3.14 until a null is indicated on each setting without further adjustments of 1L22, 1C86 or 2RV1.
16. Connect the multimeter between 1C76 (+) and 1C79 (-). Using the 25 V d.c. range it should read approximately 12 volts.
17. Connect a 10k ohm 1/4 W potentiometer as shown in Figure 2 below.

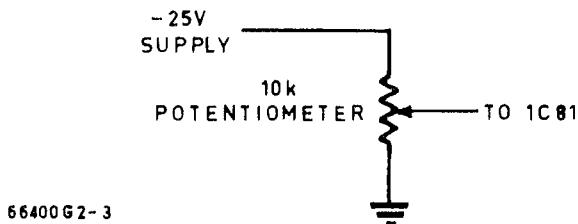
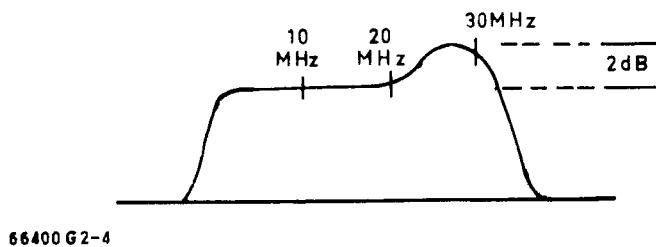


Figure 2

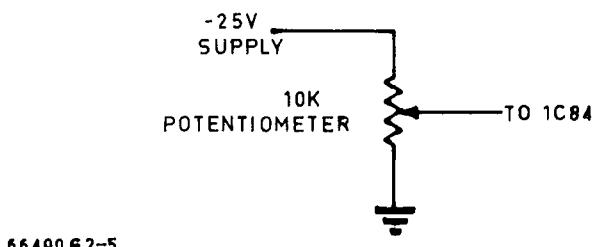
18. Connect the multimeter, set on the -25 V d.c. range, between 1C81 and earth.
19. Adjust the potentiometer to give -15 volts at 1C81. Check that the d.c. output between 1C76 and 1C79 is zero.
20. Slowly reduce the voltage at 1C81 by adjusting the potentiometer. When it reaches below about -12 volts a small d.c. voltage should be measured between 1C76 and 1C79. As the potentiometer is further adjusted down to zero volts at 1C81, the voltage between 1C76 and 1C79 should rise to the value measured in step 4.3.16.
21. Disconnect the vernier potentiometer, 10k ohm potentiometer, multimeter and the signal generator.
22. Connect the r.f. output of the level measuring set to 1SKA.
23. Using a high impedance probe, check the response measured at pin 1 of the printed circuit board. This will check the frequency response of the probe and if the response is not flat, the necessary compensation will have to be made in all future measurements.
24. Connect the probe to the control grid of 1V1 and earth the probe case directly to the chassis of the amplifier assembly.
25. Insert an 8122 valve into V1 socket (RFA2).
26. Manually sweep the generator between 1.6 MHz and 30 MHz.
27. Adjust 1L2 for maximum level at 30 MHz. The response should be as shown in Figure 3 following page.



66400 G 2-4

Figure 3

28. Connect 10 k Ω potentiometer as shown in Figure 4 below.



66400 G 2-5

Figure 4

29. Connect the multimeter, using the -25 volt range, to 1C84 and adjust the potentiometer to give a reading of zero volts.
30. Slowly adjust the potentiometer to give an increasingly negative voltage at 1C84 and observe what happens to the response on the sweep generator.
31. The curve should slowly fall away until about -12 volts on 1C84 there should be zero output measured on the sweep generator.
32. Disconnect the sweep generator.
33. Connect the signal generator to 1SKA.
34. Adjust the output of the signal generator to be 1 volt r.m.s. at 10 MHz using the r.f. millivoltmeter.
35. Measure the output at pin 13 of the printed circuit board using the r.f. millivoltmeter. It should be 1.6 volts r.m.s. ± 0.5 volts.
36. Switch off power supply and disconnect test equipment.

4.4 Calibration of Reflectometer

1. Remove reflectometer from the transmitter.
2. Connect output of the signal generator to the coaxial input of the reflectometer via the adaptor as shown in Reflectometer Calibration Set-up, Figure 5 following page.

NOTE: Use an earth sheet under the reflectometer and signal generator and earth both securely by short foil straps.

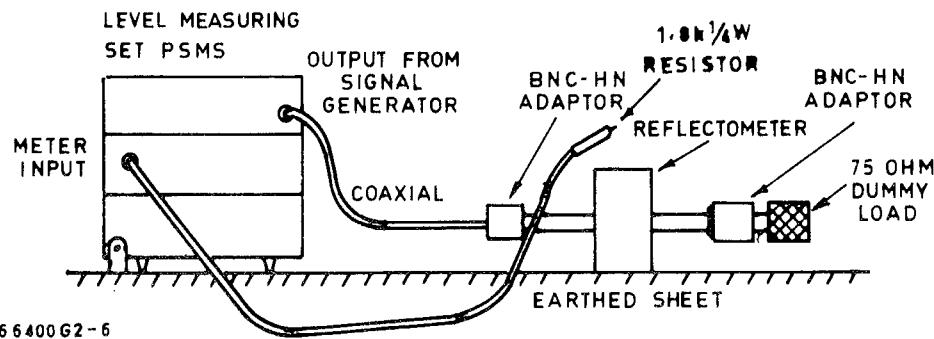


Figure 5

3. Connect coaxial output of the reflectometer to a 75Ω dummy load.
4. Set the signal generator to give maximum output at 12 MHz.
5. Connect 1.8k test probe to the selective voltmeter input and to the junction of 8C4 and 8L3.

NOTE: Earth probe case by pressing it firmly against the adjacent partition in the reflectometer.

6. Adjust 8C1 for minimum on the selective voltmeter using an insulated adjusting tool.
7. Set the signal generator to give 30 MHz output.
8. Adjust 8C14 for minimum on the selective voltmeter.
9. Connect test probe to the junction of 8C3 and 8L2.
10. Manually sweep the signal generator from 1.6 MHz to 30 MHz.
11. The selective voltmeter should not vary by more than ± 0.1 dB.
Note the level, it should be -35 dB ± 2 dB relative to generator output measured with the probe (use a tee-piece).

NOTE: When measuring level indications the frequency response of the probe should be measured and compensated for. It may vary by approximately 0.15 dB at 30 MHz.

12. Connect test probe to the junction of 8C4 and 8L3.
13. Manually sweep the signal generator from 1.6 MHz to 30 MHz.
14. Indication on the selective voltmeter should be more than 30 dB below that measured in step 4.4.11. Note this figure as directivity.

15. Disconnect test equipment and replace reflectometer in the transmitter.

4.5 RFA2 Tuning Assembly

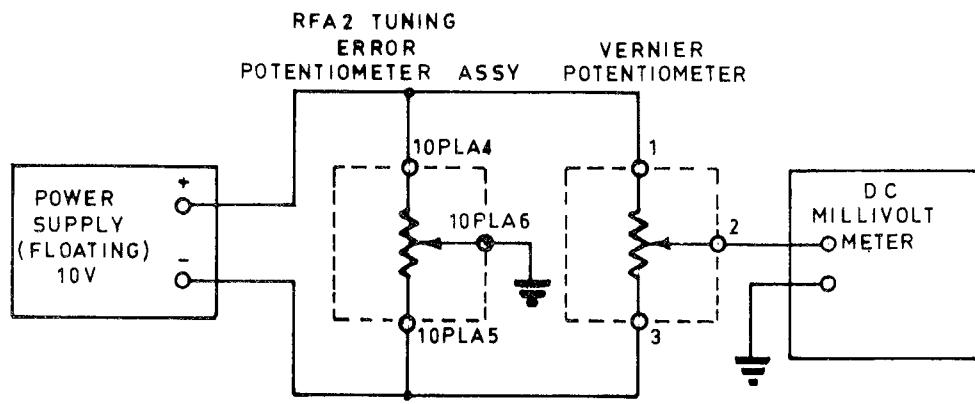
WARNING: Do not manually adjust the tuning assembly faster than is usual in automatic tuning (i.e. 10 secs for full traverse) otherwise permanent damage may be caused to the servo motor.

(a) Mechanical tests

1. Check for smooth operation of the drive assembly with minimum mechanical backlash.
2. Turn the dial fully clockwise. A click should be heard in microswitch 10SWA as it engages with the notch in the dial cam. When the dial is in the extreme clockwise position, the fixed pointer should be within half a division of the dial zero.
3. Slowly turn the dial anti-clockwise. Another click should be heard as 10SWA disengages from the notch in the dial cam.
4. Turn the dial fully anti-clockwise. Check that 10SWB operates when it engages with the notch in the dial cam and that in the extreme anti-clockwise position the fixed pointer indicates 99.1/2 divisions.
5. Turn the dial fully clockwise.
6. In this position, the moving contact on 10L9 should be at the end of the 10L9 winding.
7. Capacitor 10C14 should be completely out of mesh. Adjust the dial to 94. 10C13 should be completely out of mesh also.
8. Temporarily remove 10R2 and 10R7 from 10RV1 and measure the resistance between pin 1 and pin 8 of 10RV1 using the multimeter. Note this value.
9. Turn the dial fully anti-clockwise.
10. Measure the resistance between pin 7 and pin 8 of 10RV1 using the multimeter. Note this value.
11. Compare the resistance values obtained in steps 4.5(a) 8 and 4.5(a) 10.
12. If these values are different, loosen the mechanical clamp holding error potentiometer 10RV1 and adjust its position until the resistance measured in 4.5(a) 8 and 4.5(a) 10 are the same.
13. Tighten the mechanical clamp on 10RV1.
14. Double check the resistances.
15. Re-connect 10R2 and 10R7 to 10RV1.

(b) Electrical tests

1. Turn the dial fully clockwise.
2. Connect +22.0 V d.c. to 10PLA1 and earth 10PLA2.
3. The dial should turn and stop one division before the 100 Mark (i.e. 99).
4. The traverse time should be about 10 seconds.
5. Connect -5.0 V d.c. to 10PLA2 and earth 10PLA1.
6. The dial should turn and stop one division from zero mark (i.e. 1).
7. The traverse time should be about 60 seconds.
8. Disconnect the power supply.
9. Connect the tracking test set-up as shown in Figure 6 below.



6640062-7

Figure 6

- 10 Adjust the dial to the first setting as shown in Table 1 below, (which gives typical tracking figures), ensuring that the dial settles in the middle of any backlash that is present in the drive.

Table 1.

Dial Setting	Vernier Potentiometer
3.0	20.0
30.0	29.0
50.0	38.5
70.0	52.0
94.0	80.0

11. Adjust the vernier potentiometer until a null is indicated on the d.c. millivoltmeter.
12. Check that the vernier reading agrees with the typical tracking figure.
13. Repeat steps 4.5(b)10, 4.5(b)11 and 4.5(b)12 for the other dial settings in the table.
14. Disconnect the tracking test set-up.

4.6 RFA3 Tuning Servo Assembly

WARNING: Do not manually adjust the tuning assembly faster than is usual in automatic tuning (i.e. 10 secs for full traverse) otherwise permanent damage may be caused to the servo-motor.

(a) Mechanical tests

1. Check for smooth operation of the drive assembly with minimum mechanical backlash.
2. Turn the dial fully clockwise. A click should be heard as microswitch 11SWA engages the notch in the dial cam. When the dial is in the extreme clockwise position, the fixed pointer should be within half a division of the dial zero.
3. Slowly turn the dial anti-clockwise. Another click should be heard as 11SWA disengages from the notch in the dial cam.
4. Turn the dial fully anti-clockwise. Check that a click is heard when microswitch 11SWB engages with the notch in the dial cam and that in the extreme anti-clockwise position the fixed pointer indicates 99.1/2 divisions.
5. Turn the dial fully clockwise.
6. Temporarily remove 11R2 from 11RV1 and measure the resistance between pin 1 and pin 8 of 11RV1 using the multimeter. Note this value.
7. Turn the dial fully anti-clockwise.
8. Measure the resistance between pin 7 and pin 8 of 11RV1 using the multimeter. Note this value.
9. Compare the resistance values obtained in steps 4.6(a)6 and 4.6(a)8.
10. If these values are different, loosen the mechanical clamp holding error potentiometer 11RV1 and adjust its position until the resistances measured in 4.6(a)6 and 4.6(a)8 are the same.
11. Tighten the mechanical clamp on 11RV1.
12. Double check the resistances.
13. Reconnect 11R2 to 11RV1.

(b) Electrical tests

1. Turn the dial fully clockwise.
2. Connect +15 V d.c. to 11TSB1 and earth 11TSB2.
3. The dial should turn and stop one division before the 100 mark (i.e. 99).
4. The traverse time should be about 10 seconds.
5. Connect -5 V d.c. to 11TSB2 and earth 11TSB1.
6. The dial should turn and stop one division from the zero mark (i.e. 1).
7. The traverse time should be about 60 seconds.
8. Disconnect the power supply.
9. Connect the tracking test set-up as shown in Figure 7 below.

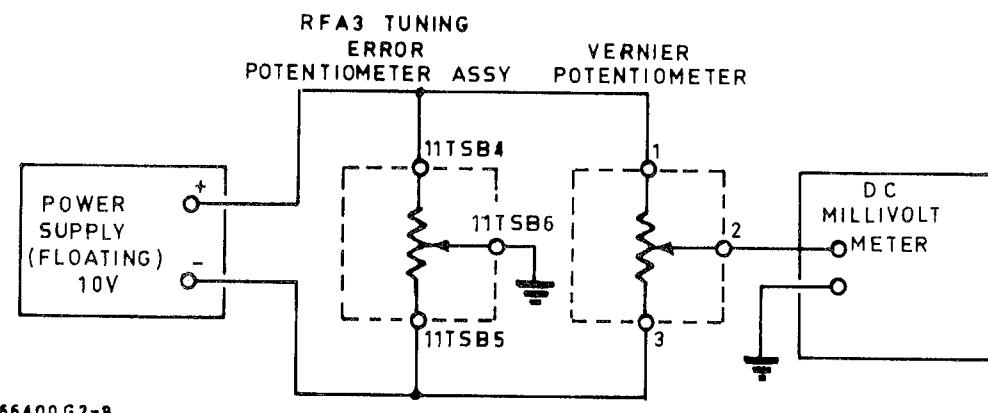


Figure 7

10. Adjust the dial to the first setting as shown in Table 2 below, ensuring that the dial settles in the middle of any backlash that is present in the drive

Table 2

Dial Setting	Vernier Potentiometer
4.0	20.0
30.0	27.5
50.0	36.0
70.0	53.2
91.0	80.0

11. Adjust the vernier potentiometer until a null is indicated on the d.c. millivoltmeter.
12. Check that the vernier reading agrees with the typical tracking figure.
13. Repeat steps 4.6(b)10 to 4.6(b)12 for the other dial settings given in the table.
14. Disconnect the tracking test set-up.

4.7 RFA3 Loading Servo Assembly

WARNING: Do not manually adjust the tuning assembly faster than is usual in automatic tuning (i.e. 10 secs for full traverse) otherwise permanent damage may be caused to the servo-motor.

(a) Mechanical tests

1. Check for smooth operation of the drive assembly with minimum mechanical backlash.
2. Turn the dial fully clockwise. A click should be heard as microswitch 12SWA engages the notch in the dial cam. When the dial is in the extreme clockwise position, the fixed pointer should be within half a division of the dial zero.
3. Slowly turn the dial anti-clockwise. Another click should be heard as 12SWA disengages from the notch in the dial cam.
4. Turn the dial fully anti-clockwise. Check that a click is heard when microswitch 12SWB engages with the notch in the dial cam and that in the extreme anti-clockwise position the fixed pointer indicates 99.1/2 divisions.
5. Turn the dial fully clockwise.
6. Temporarily remove 12R2 and 12R7 from 12RV1 and measure the resistance between pin 1 and pin 8 of 12RV1 using the multimeter. Note this value.
7. Turn the dial fully anti-clockwise.
8. Measure the resistance between pin 7 and pin 8 of 12RV1 using the multimeter. Note this value.
9. Compare the resistance values obtained in steps 4.7(a)6 and 4.7(a)8.
10. If these values are different, loosen the mechanical clamp holding error potentiometer 12RV1 and adjust its position until the resistances measured in 4.7(a)6 and 4.7(a)8 are the same.
11. Tighten the mechanical clamp on 12RV1.
12. Double check the resistances.
13. Reconnect 12R2 and 12R7 to 12RV1.

(b) Electrical tests

1. Turn the dial fully clockwise.
2. Connect +15 V d.c. to 12TSB1 and earth 12TSB2.
3. The dial should turn and stop one division before the 100 mark (i.e. 99).
4. The traverse time should be about 10 seconds.
5. Connect -5 V d.c. to 12TSB2 and earth 12TSB1.
6. The dial should turn and stop one division from the zero mark (i.e. 1).
7. The traverse time should be about 60 seconds.
8. Disconnect the power supply.
9. Connect the tracking test set-up as shown in Figure 8 below.

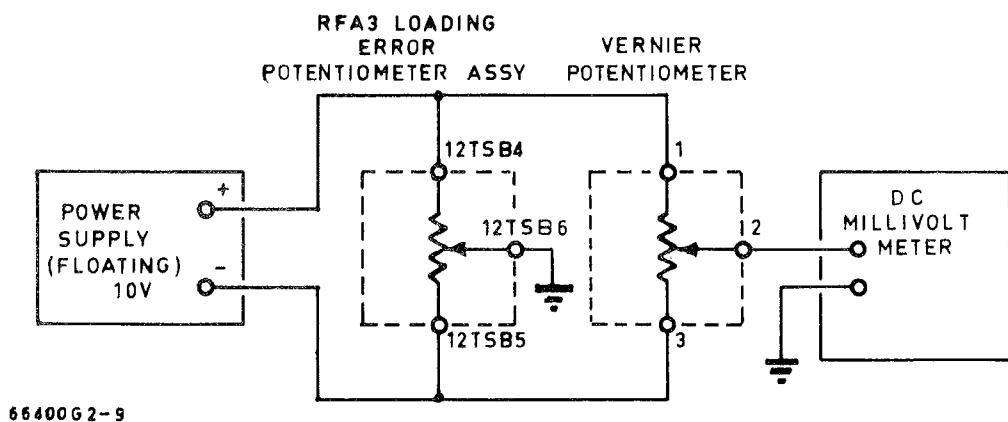


Figure 8

10. Adjust the dial to the first setting as shown in Table 3 below, ensuring that the dial settles in the middle of any backlash that is present in the drive.

Table 3

Dial Setting	Vernier Potentiometer
7.0	20.0
30.0	28.5
50.0	37.0
70.0	50.0
91.5	80.0

11. Adjust the vernier potentiometer until a null is indicated on the d.c. millivoltmeter.
12. Check that the vernier reading agrees with typical tracking figure.
13. Repeat steps 4.7(b)10 to 4.7(b)12 for other settings given in the table.
14. Disconnect the tracking test set-up.

- End of Part -

PART 3

COMPONENT SCHEDULE

1. EXPLANATORY NOTES

The Component Schedule is laid out as follows:

Column 1	Circuit Reference Number
Column 2	Description
Column 3	Component Manufacturer and Reference
Column 4	AWA Code Number

Because of unavailability at the date of manufacture, some components in the equipment may differ from those listed in this Component Schedule.

When ordering replacement components from AWA, the type number of the unit (or sub-unit), and all the information in columns 1 to 4 inclusive, should be quoted.

Since in several cases circuit reference numbers having the same prefix are progressive through two or more boards or sub-assemblies, a fifth column, containing a code number, is added to the component schedule to assist identification of the board or sub-assembly on which the component is mounted. This code number comprises the final two digits of the type number of the board or sub-assembly. For example "06" in the fifth column means that the component is on the Transmitter Control Unit 1P66406.

This code number is not required for the four units which have no circuit reference prefix, namely:

Discriminator 3J64629
Discriminator 4J64629
Servo Amplifier 2J64639
Rectifier Assembly 1H66404

Components are listed in numerical order of circuit reference prefix. Within each prefix group, listing is then alpha-numeric.

2. ATS-1 TRANSMITTER INSTALLATION KIT 1R66401

Plastic Bag (119509) containing the following:

PLD	Connector, coaxial, right angle cable entry	Amphenol 92000 Type SM	1006128
PLG	Connector, 23-way, female, with cover	Painton 159 series 74/10/2351/10	1006246
PLH	Connector, 31-way, female, with cover	Painton 159 series 74/10/3151/10	1006247
PLJ	Connector, 7-way, female, with cover	Painton 159 series 74/10/0751/10	1006248
PLK	Connector, 11-way, female, with cover	Painton 159 series 74/10/1151/10	1006249
PLL	Connector, coaxial, HN, type UG-59B/U Tuning crank-handle assembly (1 off)	Amphenol 17/301/01 AWA 64620V26	1005550

The following items are supplied separately:

Channel Selector Kit 1R66426 (9 off)	AWA 66401V18
Coaxial Cable Assembly c/w connectors (3 off)	
Extension Card Assembly (1 off)	AWA 64635Y17
Service Tray Assembly 1R66458 (1 off)	

3. CHANNEL SELECTOR KIT 1R66426

Plastic Bag (119507) containing the following:

P.C. Board Assembly c/w connectors (1 off)	AWA 66426V1		
Diode, silicon (12 off)	Fairchild 1N914		
	597291		
4. PHASE DISCRIMINATOR 3J64629			
C1	0.01 μ F +100%-20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	1006849

Phase Discriminator 3J64629 Continued

C2	$0.01 \mu\text{F}$ +100% -20%, 500 VDCW, ceramic tubular	Ducon CTR. Hi-K	1006849
C3	$0.01 \mu\text{F}$ +100% -20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	1006849
L1	Inductor, 2 mH ±30%, air core	AWA 19V57973	206348
L2	Inductor, 2 mH ±30%, air core	AWA 19V57973	206348
L3	Inductor, 2 mH ±30%, air core	AWA 19V57973	206348
MR1	Diode, hot carrier	Hewlett Packard HP-5082-2800	1006678
MR2	Diode, hot carrier	Hewlett Packard HP-5082-2800	1006678
R1	$68 \Omega \pm 2\%$, 1/2 W, metal oxide, style RFG5-E		603587
R2	$68 \Omega \pm 2\%$, 1/2 W, metal oxide, style RFG5-E		603587
R3	$10 \text{k}\Omega \pm 5\%$, 1/4 W, carbon film	Philips B8-305-05B	612027
R4	$10 \text{k}\Omega \pm 5\%$, 1/4 W, carbon film	Philips B8-305-05B	612027
TR1	Transformer, audio, $27 \Omega : 5 \times 1200 \Omega$, 0.2 W each; ±1 dB 30 Hz to 15 kHz	AWA 1LH64499	
5	AMPLITUDE DISCRIMINATOR 4J64629		
C1	1000 pF ±2%, 500 VDCW, ceramic tubular	Ducon CTR. Hi-K	1006850
C2	1000 pF ±2%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	1006850
L1	Inductor, 2 mH ±30%, air core	AWA 19V57973	206348
L2	Inductor, 2 mH ±30%, air core	AWA 19V57973	206348

Amplitude Discriminator 4J64629 (Continued)

MR1	Diode, hot carrier	Hewlett Packard HP-5082-2800	1006678
MR2	Diode, hot carrier	Hewlett Packard HP-5082-2800	1006678
MR3	Diode, hot carrier	Hewlett Packard HP-5082-2800	1006678
MR4	Diode, hot carrier	Hewlett Packard HP-5082-2800	1006678
R1	$10 \text{ k}\Omega \pm 5\%$, $1/4 \text{ W}$, carbon film	Philips B8-305-05B	612027
R2	$10 \text{ k}\Omega \pm 5\%$, $1/4 \text{ W}$, carbon film	Philips B8-305-05B	612027
6.	SERVO AMPLIFIER 2G64639		
C1	680 pF $\pm 20\%$, 500 VDCW, ceramic, tubular	Erie 302 Y5U	1006880
C2	33 pF $\pm 1\%$, 500 VDCW, ceramic, tubular, N750	Erie 331 U2J	1006881
C3	$1 \mu\text{F} \pm 20\%$, 35 VDCW, electrolytic, tantalum, style CS13		227739
C4	$1 \mu\text{F} \pm 20\%$, 35 VDCW, electrolytic, tantalum, style CS13		227739
C5	$0.068 \mu\text{F} \pm 10\%$, 250 VDCW, metallised polyester	Elcoma 2222/342/45683	1006273
C6	$0.33 \mu\text{F} \pm 20\%$, 250 VDCW, metallised polyester	Elcoma 2222/342/44334	1007874
C7	$0.1 \mu\text{F} \pm 10\%$, 250 VDCW, metallised polyester	Elcoma 2222/342/54104	227096
MR1	Diode, zener, $12 \text{ V} \pm 5\%$, 400 mW	Intermetall ZF12	596896
MR2	Diode, zener, $12 \text{ V} \pm 5\%$, 400 mW	Intermetall ZF12	596896

Servo Amplifier 2G64639 (Continued)
 PLA Connector, male, printed circuit
 board, 16-way

R1	12 kΩ ±5%, 1/4 W, carbon film	Elco	02-016-013-5-200	1000551		
R2	12 kΩ ±5%, 1/4 W, carbon film	Philips B8-305-05B	612516			
R3	2.2 MΩ ±10%, 1/4 W, carbon film	Philips B8-305-05B	612516			
R4	562 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	Philips B8-305-05B	618490			
R5	1.5 kΩ ±5%, 1/4 W, metal glaze	IRC RG 1/4	1008750			
R6	562 Ω ±2%, 1/2 W, metal oxide, style RFG5-E		606856			
R7	562 Ω ±2%, 1/2 W, metal oxide, style RFG5-E		606856			
R8	22 Ω ±5%, 1/4 W, carbon film	Philips B8-305-05B	602321			
R9	22 Ω ±5%, 1/4 W, carbon film	Philips B8-305-05B	602321			
R10	1.5 Ω ±5%, wire wound	IRC ASW10	1006488			
R11	10 kΩ ±5%, 1/4 W, carbon film	Philips B8-305-05B	612027			
R12	39 kΩ ±5%, 1/4 W, carbon film	Philips B8-305-05B	614086			
R13	470 kΩ ±5%, 1/4 W, carbon film	Philips B8-305-05B	617360			
R14	100 Ω ±5%, 1/4 W, carbon film	Philips B8-305-05B	604033			
R15	100 Ω ±5%, 1/4 W, carbon film	Philips B8-305-05B	604033			
VT1	Integrated circuit	Fairchild μA709C (Part No. U5B 770939X)	1004362			
VT2	Transistor	RCA 2N5320	1006484			
VT3	Transistor	RCA 2N5322	1006485			
VT4	Transistor	RCA 2N3442	1002230			
VT5	Transistor	RCA 2N3442	1002230			

7. RECTIFIER ASSEMBLY 1H66404

C1) to) C5)	1000 pF $\pm 20\%$, 2000 VDCW, ceramic, tubular	Erie 858-X5R-102M	1018152
C6) to) C10)	1000 pF $\pm 20\%$, 2000 VDCW, ceramic, tubular	Erie 858-X5R-102M	1018152
C11	1000 pF $\pm 20\%$, 2000 VDCW, ceramic, tubular	Erie 858-X5R-102M	1018152
C12	1000 pF $\pm 20\%$, 2000 VDCW, ceramic, tubular	Erie 858-X5R-102M	1018152
MR1) to) MR5)	Diode, silicon	International Rect. 20A10	1006466
MR6) to) MR10)	Diode, silicon	International Rect. 20A10	1006466
MR11	Diode, silicon	International Rect. 20A10	1006466
MR12	Diode, silicon	International Rect. 20A10	1006466
R1) to) R5)	220 k Ω $\pm 2\%$, 1 W, metal oxide, style RFG5-D		1006675
R6) to) R10)	220 k Ω $\pm 2\%$, 1 W, metal oxide, style RFG5-D		1006675
R11	220 k Ω $\pm 2\%$, 1 W, metal oxide, style RFG5-D		1006675

Rectifier Assembly 1H66404 (Continued)

R12	220 kΩ ±2%, 1 W, metal oxide, style RFG5-D	1006675
8.	R.F. UNIT 1J66402 (includes R.F. Amplifier Assembly 1J66414 & VHF Filter 1Q66429)	
1C1	4700 pF ±20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K 225987
1C2	4700 pF ±20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K 225987
1C3	Comprises 10 capacitors in parallel, each 510 pF ±5%, 500 VDCW, metallised mica, style CM06	AWA 66414V35 (Complete Assy) (each cap)
1C4	1450 pF, 1 kV test, by-pass	E.F. Johnson 124-113-1 14
1C5	Not used	
1C6	4700 pF ±20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K 225987
1C7	4700 pF ±20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K 225987
1C8	4700 pF ±20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K 225987
1C9	1600 pF ±5%, 2500 VDCW,	Vitramon VY94C162J 1007747
1C10	Not used	
1C11	0.01 μF ±20%, 3 kVDCW, ceramic, feed- thru with nut & lockwasher	Erie 2498-001 226386 02
1C12	15 pF ±1 pF, 500 VDCW, ceramic, disc	Ducon CDS. NPO 220704 14
1C13	Not used	
1C14	Not used	
1C15	Not used	
1C16	680 pF ±5%, 500 VDCW, ceramic, tubular	Ducon CTR. N750 1000964 14

R.F. Unit 1J66402 (continued)					
1C17	47 pF $\pm 5\%$, 500 VDCW, ceramic, tubular	Ducson CTR. NPO	221548	14	
1C18	47 pF $\pm 5\%$, 500 VDCW, ceramic, tubular	Ducson CTR. NPO	221548	14	
1C19	47 pF $\pm 5\%$, 500 VDCW, ceramic, tubular	Ducson CTR. NPO	221548	14	
1C20	Not used				
1C21	680 pF $\pm 10\%$, 2 kVDCW, ceramic, feedthrough	Ducson CAD104. N1500	10008177	14	
1C22	27 pF ± 0.5 pF, 500 VDCW, ceramic, tubular	Ducson CTR. NPO	221078	14	
1C23	500 pF $\pm 5\%$, 500 VDCW, mica, feedthrough	Erie 654-006-501J	10007711	14	
1C24	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14	
1C25	Not used				
1C26	4700 pF, g.m.v., 1 kVDCW, ceramic feedthrough	Ducson CAD105	225965	14	
1C27	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14	
1C28	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14	
1C29	4700 pF $\pm 20\%$, 500 VDCW, ceramic, tubular	Ducson CTR. Hi-K	225987	14	
1C30	Not used				
1C31	4700 pF $\pm 20\%$, 500 VDCW, ceramic, tubular	Ducson CTR. Hi-K	225987	14	
1C32	4700 pF $\pm 20\%$, 500 VDCW, ceramic, tubular	Ducson CTR. Hi-K	225987	14	66400R Chap. 3
1C33	1450 pF, 1 kV test, by-pass	E. F. Johnson 124-113-1	10007746	14	

R.F. Unit 1J66402 (Continued)

1C34	1450 pF, 1 kV test, by-pass	E. F. Johnson 124-113-1	1007746	14
1C35	Not used	E. F. Johnson 124-113-1	1007746	14
1C36	1450 pF, 1 kV test, by-pass	Ducon CAD105	225965	14
1C37	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C38	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon DAD105	225965	14
1C39	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C40	Not used	Ducon CAD105	225965	14
1C41	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C42	Pick-up plate	AWA 66414V42-2	14	
1C43	Pick-up plate	AWA 66414V43	14	
1C44	Pick-up plate	AWA 66414V42-1	14	
1C45	Not used			
1C46	Pick-up plate	AWA 66414V42	14	
1C47	Pick-up plate	AWA 66414V42-1	14	
1C48	500 pF $\pm 5\%$, 500 VDCW, mica, feedthrough	Erie 654-006-501J	1007711	14
1C49	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C50	Not used			
1C51	500 pF $\pm 5\%$, 500 VDCW mica, feedthrough	Erie 654-006-501J	1007711	14
1C52	500 pF $\pm 5\%$, 500 VDCW, mica, feedthrough	Erie 654-006-501J	1007711	14
1C53	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14

R.F. Unit 1J66402 (Continued)

1C54	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14
1C55	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14
1C56	0.01 μ F $\pm 20\%$, 3 kVDCW, ceramic, feedthrough, with nut & lockwasher	Erie 2498-001	226386	02
1C57	0.01 μ F $\pm 20\%$, 3 kVDCW, ceramic, feedthrough, with nut & lockwasher	Erie 2498-001	226386	02
1C58	0.1 μ F $\pm 20\%$, 5 kVDCW, paper, oil impregnated	Ducson DPB5000	1007704	02
1C59	1000 pF $\pm 10\%$, 20 kVA, ceramic, disc	Ducson CAA75 N750	225058	02
1C60	Not used			
1C61	1500 pF, variable, ceramic, vacuum	Jennings CVCD-1500-3S	1006512	02
1C62	3000 pF, variable, ceramic, vacuum	Jennings CVCD-3000-3S	1007703	02
1C63	6.8 pF ± 1 pF, 5 kVDCW, ceramic, NPO	Ducson CAB12	1016264	29
1C64	12 pF ± 1 pF, 5 kVDCW, ceramic, NPO	Ducson CAB12	1016265	29
1C65	Not used			
1C66	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14
1C67	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14
1C68	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14
1C69	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducson CAD105	225965	14
1V70	Not used			

R.F. Unit 1J66402 (Continued)				
1C71	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C72	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C73	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C74	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C75	Not used			
1C76	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C77	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C78	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C79	4700 g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C80	Not used			
1C81	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C82	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C83	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C84	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C85	Not used			
1C86	4.8 pF to 97.2 pF, variable, rotary style CVA5-D		231293	14
1C87	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14
1C88	4700 pF, g.m.v., 1 kVDCW, ceramic, feedthrough	Ducon CAD105	225965	14

R.F. Unit 1J66402 (Continued)

1C89	1 μF +50%~-20%, 35 VDCW, tantalum, electrolytic, style CS13	227739	14
1C90	1 μF +50%~-20%, 35 VDCW, tantalum, electrolytic, style CS13	227739	14
1C91) to) 1C95)	Not used		
1C96) to) 1C100)	Not used		
1C101	Not used		
1C102	Not used		
1C103	Not used		
1C104	Not used		
1C105	1000pF $\pm 20\%$, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K V23154-W0721-G104	225027
1FB	Relay, miniature plug-in, coil 890 Ω , 2C contacts	Siemens Halske 599909	14
1L1	Inductor, air core	AWA 15V57969	14
1L2	Inductor, air core	AWA 415V57963	14
1L3	Inductor, air core	AWA 197V57973	14
1L4	Inductor, 50 μH , air core	AWA 195V57973	14
1L5	Not used		
1L6	Inductor, 50 μH , air core	AWA 195V57973	14
1L7	Inductor, 30 $\mu\text{H} \pm 10\%$, air core	AWA 11V57994	14
1L8	Inductor, 390 $\mu\text{H} \pm 10\%$, air core	AWA 197V57973	02
1L9	Not used		
1L10	Inductor, 100 $\mu\text{H} \pm 5\%$, air core	AWA 12V57994	14
1L11	Inductor, 2 mH $\pm 30\%$, air core	AWA 19V57973	14
1L12	Inductor, 2 mH $\pm 30\%$, air core	AWA 19V57973	14

R. F. Unit 1J66402 (Continued)

1L13	Inductor, 2 mH $\pm 30\%$, air core	AWA 19V57973	206348	14
1L14	Inductor, 65 μ H $\pm 10\%$, air core	AWA 402V57963		02
1L15	Not used			
1L16	Inductor, 65 μ H $\pm 10\%$, air core	AWA 402V57963		02
1L17	Inductor, air-cored, variable	AWA 2V64632		02
1L18	Inductor, air-cored, variable	AWA 1V64632		02
1L19	Inductor, 30 μ H $\pm 5\%$, air core	AWA 198V57973		14
1L20	Inductor, 65 μ H $\pm 10\%$, air core	AWA 413V57963		02
1L21	Inductor	AWA 14V57969		29
1L22	Inductor, 5.5 μ H, adjustable $\pm 2 \mu$ H ferrite core	AWA 11V57992		14
1L23	Inductor, 50 μ H, air core	AWA 195V57973		14
1L24	Inductor, r.f.	AWA 196V57973		14
1L25	Not used			
1L26	Inductor, r.f.	AWA 196V57973		14
1L27	Inductor, r.f.	AWA 196V57973		14
1MR1	Diode, hot carrier	Hewlett Packard HP-5082-2800	1006678	14
1MR2	Not used			
1MR3	Not used			
1MR4	Diode, silicon	Mullard 0A202	597210	02
1MR5	Diode, silicon	Mullard 0A202	597210	02
1MR6	Diode, silicon	Mullard 9A202	597210	02
1MR7	Diode, silicon	Mullard 0A202	597210	02
1MR8	Diode, silicon	Fairchild 1N914A	1006793	14
1MR9	Diode, silicon	Fairchild 1N914A	1006793	14
1MR10	Diode, silicon	Fairchild 1N914A	1006793	14
1MR11	Diode, zener, 5.1 V $\pm 5\%$, 5 W	Motorola 1N5338B	1008837	14
1MR12	Diode, zener, 5.1 V $\pm 5\%$, 5 W	Motorola 1N5338B	1008837	14
1MR13	Diode, zener, 5.1 V $\pm 5\%$, 5 W	Motorola 1N5338B	1008837	14

R.F. Unit 1J66402 (Continued)

1PLA	Connector, 7-way, female, with cover	Painton 159 Series 74/10/0751/10	1006248	14
1PLB	Not used			
1PLC	Connector, coaxial, right angle cable entry	Amphenol 92000 Type SM	1006128	02
1PLD	Not used			
1PLE	Not used			
1PLF	Not used			
1PLG	Connector, 35-way, female, free	Painton 159 Series 74/10/3551/10	1004504	02
1PLH	Connector, 35-way, female, free	Painton 159 Series 74/10/3551/10	1004504	02
1PLJ	Not used			
1PLK	Not used			
1PLL	Not used			
1PLM	Connector, coaxial, right angle cable entry	Amphenol 92000 Type SM	1006128	02
1R1	46.4 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	603122	14	
1R2	100 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	604057	14	
1R3	10 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612063	14	
1R4	6.8 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	611544	14	
1R5	Not used			
1R6	22 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	602303	14	
1R7	10 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	601112	14	
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R. F. Unit 1J66402 (Continued)

1R8	$10 \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R9	Not used		
1R10	Not used		
1R11	$33 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	602776	14
1R12	$3.3 \text{ k}\Omega \pm 5\%$, 5 W, metal oxide	610316	14
1R13	$100 \Omega \pm 5\%$, $1/8$ W, carbon film	604069	14
1R14	$100 \Omega \pm 5\%$, $1/8$ W, carbon film	604069	14
1R15	Not used		
1R16	$100\Omega \pm 5\%$, $1/8$ W, carbon film	604069	14
1R17	$390 \Omega \pm 2\%$, $1/2$ W, metal oxide style RFFG5-E	606267	14
1R18	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R19	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R20	Not used		
1R21	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R22	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R23	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R24	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R25	Not used		
1R26	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R27	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14
1R28	$10 \Omega \pm 2\%$, $1/2$ W, metal oxide, style RFFG5-E	601112	14

R.F.	Unit	1J66402	(Continued)
1R29	Not used		
1R30	Not used		
1R31	Not used		
1R32	Not used		
1R33	4.7 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610947	14
1R34	4.7 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610947	14
1R35	Not used		
1R36	4.7 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610947	14
1R37	10 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612063	14
1R38	33 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	602776	14
1R39	33 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	602776	14
1R40	Not used		
1R41	33 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	602776	14
1R42	3.9 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610578	14
1R43	10 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	601112	14
1R44	10 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	601112	14
1R45	Not used		
1R46	82 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	603800	14
1R47	68 Ω ±5%, 200 W at 20 °C, w-w, vitreous enamel, non-inductive	1006515	02
		Welwyn C1608	

R. F. Unit 1J66402 (Continued)

1R48	10 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612063	02
1R49	10 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612063	02
1R50	Not used		
1R51	100 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616043	02
1R52	3.9 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610578	02
1R53	100 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616043	02
1R54	3.9 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610578	02
1R55	Not used		
1R56	820 Ω ±5%, 3.25 W, metal oxide	607679	29
1R57	820 Ω ±5%, 3.25 W, metal oxide	607679	29
1R58	820 Ω ±5%, 3.25 W, metal oxide	607679	29
1R59	332 kΩ ±2%, 1/2 W, metal oxide, Style, RFG5-E	617118	02
1R60	Not used		
1R61	10 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612063	02
1R62	56 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	615183	02
1R63	10 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612063	02
1R64	100 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616043	02
1R65	Not used		
1R66	10 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612063	02

R. F. Unit 1J66402 (Continued)

1R67	5.6 kΩ ±5%, 1/8 W, carbon film	Philips B8-031-04N	14
1R68	5.6 kΩ ±5%, 1/8 W, carbon film	Philips B8-031-04N	14
1R69	Not used		
1R70	100 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616043	02
1R71	100 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616043	02
1R72	100 Ω ±5%, 3.25 W, metal oxide	604072	14
1R73	Not used		
1R74	Not used		
1R75	Not used		
1R76	33 kΩ ±5%, 1/8 W, carbon film	Philips B8-031-04N	14
1R77	4.87 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	610945	14
1R78	33 kΩ ±5%, 1/8 W, carbon film	Philips B8-031-04N	14
1R79	4.87 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	610945	14
1R80	33 kΩ ±5%, 1/8 W, carbon film	Philips B8-031-04N	14
1R81	4.87 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	610945	14
1R82	390 Ω ±2%, (nominal), 1/2 W, metal oxide, style RFG5-E (S. O. T.)	606267	14
1RV1	Not used		
1RV2	10 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619999
1RV3	10 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619999
1RV4	10 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619999
1RV5	10 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619999
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R.F. Unit 1J66402 (Continued)

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1RV6	5 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619992	02
1SKA	Connector, coaxial, bulkhead receptacle	Amphenol UG697/U	14	
1SKB	Connector, coaxial, bulkhead receptacle	Amphenol UG697/U	14	
1SKC	Not used			
1SKD	Connector, printed circuit board, 16-way	Elco 00-50009-016-163-001	1000550	02
1SKE	Connector, printed circuit board, 16-way	Elco 00-50009-016-163-001	1000550	02
1SKF	Connector, printed circuit board, 16-way	Elco 00-50009-016-163-001	1000550	02
1SKG	Not used			
1SKH	Connector, 35-way, male, chassis mtg	Painton 159 series 74/10/3506/10	1004512	14
1SKJ	Not used			
1SKK	Connector, printed circuit board, 16-way	Elco 00-50009-016-163-001	1000550	02
1SKL	Connector, 35-way male, chassis mtg	Painton 159 series 74/10/3506/10	1004512	02
1SWA	Grounding switch assembly; includes switch, sensitive, Honeywell 2-AC6	AWA 2R64634		02
1SWB	Switch, sensitive	Honeywell 2-AC6	857328	
1SWC	Not used			
1SWD	Switch, sensitive, rotary, s.p.d.t., 250 V a.c., 5 A	Honeywell V4-14-EPS	857400	02
1TSA	Not used			
1TSB	Not used			
1TSC	Not used			

R. F. Unit 1J66402 (Continued)

1 TSD	Terminal block, 12-way, 15 A, front connected	Carr Fastener B77/508-12	891060	02
1 TR1	Transformer, filament; pri.210 V to 250 V, 50 Hz; sec.1 13.6 V, 5.2 A; sec.2 13.6 V, 1.3 A	AWA 1TJ65777	02	
1 TR2	Transformer, r.f.	AWA 416V57963	14	
1V1	Valve	RCA 8122	1007748	14
1V2	Valve	RCA 8122	1007748	14
1V3	Valve	RCA 8122	1007748	14
1V4	Valve	RCA 8122	1007748	14
	Socket, 11-pin, for 1V1 to 1V4	E.F. Johnson 124-311-100	1007749	14
1VT1	Transistor	RCA 2N2102	906713	14
1VT2	Transistor	RCA 2N2102	906713	14
1VT3	Transistor	RCA 2N2102	906713	14
9.	R.F. PRE-AMPLIFIER 1R66415			
2C1	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	Philips C280AE	226388	15
2C2	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	Philips C280AE	226388	15
2C3	3300 pF $\pm 10\%$, 630 VDCW, metallised	Elcoma 2222/347/61332	1006085	15
2C4	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13		227456	15
2C5	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13		227456	15
2C6	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13		227456	15
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R.F. Pre-Amplifier 1R66415 (Continued)

2C7	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	227456	15
2C8	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	226388	15
2C9	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	226388	15
2C10	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	226388	15
2C11	22 pF $\pm 5\%$, 500 VDCW, ceramic, tubular	221522	15
2C12	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	226388	15
2C13	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	226388	15
2C14	4700 pF $\pm 20\%$, 500 VDCW, ceramic, tubular	225987	15
2C15	Not used		
2C16	3300 pF $\pm 10\%$, 630 VDCW, metallised polyester	1006085	15
2C17	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	2222/347/61332	15
2C18	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	227456	15
2C19	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	227456	15
2C20	0.01 μ F $\pm 10\%$, 250 VDCW, metallised polyester	226388	15
2L1	Inductor, 2 mH $\pm 30\%$, air core	AWA 19V57973	15
2L2	Inductor, 150 μ H, air core	AWA 196V57973	15
2L3	Inductor, 150 μ H, air core	AWA 196V57973	15

R. F. Pre-Amplifier 1R66415 (Continued)

2MR1	Diode, hot carrier	Hewlett Packard 5082-2800	1006678	15
2MR2	Diode, hot carrier	Hewlett Packard 5082-2800	1006678	15
2MR3	Diode, zener, $6.8 \text{ V} \pm 5\%$, 400 mW	Philips BZY88/C6V8 Intermetal ZF6.8 IRC/Motorola 1N745A 5082-2800	596891	15
2MR4	Diode, hot carrier	or or Hewlett Packard 5082-2800	1006678	15
2MR5	Diode, hot carrier	Hewlett Packard 5082-2800	1006678	15
2MR6	Diode, zener, $2.7 \text{ V} \pm 10\%$, 400 mW	Intermetal ZG2.7	596862	15
2MR7	Diode, hot carrier	Hewlett Packard 5082-2800	1006678	15
2MR8	Diode, hot carrier	Hewlett Packard 5082-2800	1006678	15
2MR9	Diode, zener, $2.7 \text{ V} \pm 10\%$, 400 mW	Intermetal ZG2.7	596862	15
2MR10	Diode, hot carrier	Hewlett Packard 5082-2800	1006678	15
2MR11	Diode, hot carrier	Hewlett Packard 5082-2800	1006678	15
2MR12	Diode, zener, $6.8 \text{ V} \pm 5\%$, 400 mW	Philips BZY88/C6V8 Intermetal ZF6.8 IRC/Motorola 1N745A or or	596891	15
2R1	$47 \Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E		603122	15
2R2	$10 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F		612061	15
2R3	$47 \Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E		603122	15
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R.F. Pre-Amplifier 1R66415 (Continued)

2R4	100 Ω $\pm 2\%$, 1/2 W, metal oxide, style RFG5-E	604057	15
2R5	390 Ω $\pm 2\%$, 1/2 W, metal oxide, style RFG5-E	606267	15
2R6	330 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	605972	15
2R7	220 Ω $\pm 2\%$, 1/4 W, metal oxide style RFG5-F	605270	15
2R8	27 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	1006460	15
2R9	22 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	602306	15
2R10	47 Ω $\pm 2\%$, 1/2 W, metal oxide, style RFG5-E	603122	15
2R11	1.5 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	608728	15
2R12	1.8 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	609096	15
2R13	330 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	605972	15
2R14	330 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	605972	15
2R15	10 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	612061	15
2R16	33 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	614484	15
2R17	22 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	613674	15
2R18	220 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	605270	15
2R19	220 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	605270	15

R.F. Pre-Amplifier 1R66415 (Continued)

2R20	$3.3 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610319
2R21	$220 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	605270
2R22	$22 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	613674
2R23	$10 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	612061
2R24	$220 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	605270
2R25	$22 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	613674
2R26	$10 \text{ k}\Omega \pm 10\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	612061
2R27	$27 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	614161
2R28	$100 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	604056
2R29	$27 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	614161
2R30	$100 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	604056
2R31	$1.5 \text{ k}\Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E	608725
2R32	$680 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	607297
2R33	$680 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	607297
2R34	$1.5 \text{ k}\Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E	608725

R. F. Pre-Amplifier 1R66415 (Continued)

2R35	390 $\Omega \pm 2\%$, 1/2 W, metal oxide, style RFFG5-E	606267	15
2R36	330 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	605972	15
2R37	220 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	605270	15
2R38	22 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	602306	15
2R39	10 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	601117	15
2R40	47 $\Omega \pm 2\%$, 1/2 W, metal oxide, style RFFG5-E	603122	15
2R41	1.2 k $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	608339	15
2R42	1.8 k $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	609096	15
2R43	330 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	605972	15
2R44	220 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	605270	15
2R45	10 k $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	612061	15
2R46	33 k $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	614484	15
2R47	15 k $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	612950	15
2R48	10 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFFG5-F	601117	15
2RV1	100 $\Omega \pm 20\%$, 1/4 W, variable, moulded carbon, linear law	1007219	15

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Acetal (Printed Circuit)

R.F. Pre-Amplifier 1R66415 (Continued)

2TR1	Transformer, r.f., toriod, Neosid core	AWA 405V57963	15	
2VT1	Transistor	RCA 2N3261	15	
2VT2	Transistor	Motorola 2N3553	15	
2VT3	Transistor	RCA 2N2102	15	
2VT4	Transistor	RCA 2N2270	15	
2VT5	Transistor	RCA 2N2270	15	
2VT6	Transistor	RCA 2N4036	15	
2VT7	Transistor	RCA 2N4036	15	
2VT8	Transistor	RCA2N2270	15	
2VT9	Transistor	RCA 2N3261	15	
2VT10	Transistor	Motorola 2N3553	15	
2VT11	Transistor	RCA 2N2102	15	
2VT12	Transistor	RCA 2N2270	15	
	Heat sink, TO-18, for 2VT1 and 2VT9	397716	15	
	Heat sink, TO-5, for 2VT2, 2VT3, 2VT10 and 2VT11	397717	15	
10. POWER SUPPLY UNIT 1H66403 (includes Zener Diode Assy 1R66419 & E.H.T. Metering Resistors 1R66420)				
3BW1	Blower, ROTRON model DRDS, type KS4502; motor series 338CS, counter clockwise rotation, -10 °C to +55 °C	1007807	03	
3C1	2 μ F ±20%, 3.5 kVDCW, paper, oil impregnated	Ducon 9D20	1007829	03
3C2	2 μ F ±20%, 3.5 kVDCW, paper, oil impregnated	Ducon 9D20	1007829	03
3C3	2 μ F ±20%, 3.5 kVDCW, paper, oil impregnated	Ducon 9D20	1007829	03
3C4	2 μ F ±20%, 3.5 kVDCW, paper, oil impregnated	Ducon 9D20	1007829	03
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Power Supply Unit 1H66403 (Continued)

3C5	$2.5 \mu\text{F} \pm 10\%$, 500 V a.c., paper	Ducon APU525	1007830	03
3CBB	Circuit breaker, 1-pole, 240 V, 0.15 A, curve 4	Heinemann CF1	1007803	03
3CBC	Circuit breaker, 1-pole, 240 V, 0.6 A, curve 4	Heinemann CF1	1007805	03
3CBF	Circuit breaker, 1-pole, 240 V, 1 A, curve 4	Heinemann CF1	1007801	03
3CBH	Circuit breaker, 3-pole, 415 V, 5 A, curve 4	Heinemann CF3	1007804	03
3CBL	Circuit breaker, 1-pole, 240 V, 0.5 A, curve 4	Heinemann CF1	1007802	03
3CBM	Circuit breaker, 3-pole, 415 V, 8 A, curve 4	Heinemann CF3	1005795	03
3CBS	Circuit breaker, 1-pole, 240 V, 0.5 A, curve 4	Heinemann CF1	1007802	03
3CBX	Circuit breaker, 1-pole, 240 V, 0.5 A, curve 4	Heinemann CF1	1007802	03
3L1	Inductor, iron-cored, 0.26 H at 1.3 A d.c., 2.5 kVp insulation, d.c. resistance 3.1 Ω	AWA 1TJ65773	-	03
3MR1	Rectifier assembly 1H66404			03
3MR2	Rectifier assembly 1H66404			03
3MR3	Rectifier assembly 1H66404			03
3MR4	Not used			
3MR5	Not used			
3MR6) to)	Not used			
3MR10)				

Power Supply Unit 1H66403 (Continued)

Power Supply Unit 1H66403 (Continued)

3R1	15 kΩ ±5%, 100 W, w-w, vitreous enamel, style RWV1-P		1006022	03
3R2	5.6 kΩ ±5%, 70 W, w-w	Welwyn C1608	1017750	03
3R3	5.6 kΩ ±5%, 70 W, w-w	Welwyn C1608	1017750	03
3R4	39 kΩ ±5%, 8.75 W, metal oxide	Welwyn F35	614697	19
3R5	330 Ω ±5%, 1 W, carbon film	Elcoma	1006011	19
3R6	22 Ω ±5%, 20 W, w-w, vitreous enamel	Plessey Ducon RS1	1007831	03
3R7	1 MΩ ±1%, 2 W, carbon, high stability	Welwyn C25	618044	20
3R8	1 MΩ ±1%, 2 W, carbon, high stability	Welwyn C25	618044	20
3R9	100 kΩ ±2%, 1/2 W, metal oxide style RFG5-E		616043	20
3R10	1.5 Ω ±5%, 20 W, w-w, vitreous enamel	Plessey Ducon RS1	1007832	03
3SKA	Connector, female, 23-way	Painton	1007809	03
3SKB	Connector, female	74/10/2356/10 Cannon XLR-LNE-32	234681	03
3SWA	Switch, grounding, includes micro-switch Burgess DS2-A365	AWA 2R64634		03
3TR1	Transformer, 50 Hz; primary 3-phase delta, 380 V, 400 V, 415 V, 440V; secondary 3-phase star, 1570 V phase-to-phase, 1.3 A d.c. (1.05 A r.m.s.); includes 3 thyrectors GE type 6RS21 SA18 D18	AWA 1L66890		03
3TSA	Terminal block, 15 A, 6-way, back connected	Carr Fastener B77/903-6	891063	03
3TSB	Terminal block, 15 A, 6-way, back connected	Carr Fastener B77/903-6	891063	03
3TSC	Terminal block, 15 A, 6-way, back connected	Carr Fastener B77/903-6	891063	03
3TSD	Terminal block, 36A, 4-way	Weidmuller KS4D krg	891024	03

11.	TRANSMITTER CONTROL UNIT 1P66406 (includes Transmitter Control Board 1R66423 Board 1R66424, Metering Resistor Board 1R66425 & R.F. Monitor Board 1R66427)	Lamp Test
4A1	Relay, miniature plug-in, coil 5800 Ω, 2C contacts, assy 1	Siemens-Halske V23154-C0404-B104
4A1L	Relay, miniature plug-in, coil 5800 Ω, 2C contacts, assy 1	Siemens-Halske V23154-C0404-B104
4C1	16 μF +30% -10%, 220 VDCW, electrolytic, aluminium	Elcoma 2222-016-15221
4C2	180 μF ±20%, 25 VDCW, tantalum, electrolytic	Sprague 109D 187X0025T2
4C3	180 μF ±20%, 25 VDCW, tantalum, electrolytic	Sprague 109D 187X0025T2
4C4	15 μF ±10%, 35 VDCW, tantalum, electrolytic, style CS13	Sprague 150D
4C5	1 μF ±10%, 35 VDCW, tantalum, electrolytic, style CS13	Sprague 150D
4C6	15 μF ±10%, 35 VDCW, tantalum, electrolytic, style CS13	1007719
4C7	25 μF +75% -15%, 50 VDCW, tantalum, electrolytic	Sprague 109D
4C8	0.1 μF ±10%, 250 VDCW, metallised polyester	Philips C280
4C9	1 μF ±10%, 35 VDCW, tantalum, electrolytic, style CS13	Sprague 150D
4C10	Not used	227739
4C11	0.001 μF ±20%, 500 VDCW, ceramic, disc	Ducon CDS.Hi-K
4C12	1 μF ±10%, 35 VDCW, tantalum, electrolytic, style CS13	Sprague 150D
4C13	1 μF ±10%, 35 VDCW, tantalum, electrolytic, style CS13	Sprague 150D
4C14	1 μF ±10%, 35 VDCW, tantalum, electrolytic, style CS13	Sprague 150D

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Transmitter Control Unit IH66403 (Continued)

4C15	Not used						
4C16	0.001 μ F $\pm 20\%$, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027	23			
4C17	1 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	Sprague 150D	227739	23			
4C18	0.001 μ F $\pm 20\%$, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027	23			
4C19	Not used						
4C20	Not used						
4C21	0.01 μ F +100%~-20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222300	06			
4C22	0.01 μ F +100%~-20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222300	06			
4C23	0.01 μ F +100%~-20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222300	06			
4C24	Not used						
4C25	470 μ F +50%~-10%, 40 VDCW, electrolytic, insulated	Siemens B41588-A7477~7	1008266	06			
4C26	10 μ F $\pm 10\%$, 20 VDCW, tantalum, electrolytic, style CS13	Sprague 150D	228772	23			
4C27	6, 8 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13		228340	06			
4C28	0.001 μ F $\pm 20\%$, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222250	06			
4C29	0.001 μ F $\pm 20\%$, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222250	06			
4C30	0.001 μ F $\pm 20\%$, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222250	06			
4C31	0.01 μ F +80%~-20%, 25 VDCW, ceramic, disc, barrier layer	Ducon CDR "Redcap"	226374	27			
4C32	100 μ F +50%~-10%, 40 VDCW, electrolytic, aluminium	Elcoma 2222/023/17101	229709	27			

Transmitter Control Unit 1P66406 (Continued)

4C33	6.8 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	228340	06
4CHA)	Relay, miniature plug-in, coil 2500 Ω , 4C contacts assy 2	Siemens-Halske V23154-D0426-B110	06
4CHJ)	Relay, miniature plug-in, coil 5800 Ω , 2C contacts assy 1	Siemens-Halske V23154-C0404-B104	06
4EVA)	Relay, miniature plug-in, coil 5800 Ω , 2C contacts assy 1	Siemens-Halske V23154-C0404-B104	06
4EMZ)	Relay, miniature plug-in, coil 5800 Ω , 2C contacts assy 1	Siemens-Halske V23154-C0404-B104	06
4HP	Relay, miniature plug-in, coil 5800 Ω , 2C contacts, assy 1	Siemens-Halske V23154-C0404-B104	06
4HTM	Relay, miniature plug-in, coil 1250 Ω , 4C contacts, assy 2	Siemens-Halske V23154-D0422-B110	06
4KR	Relay, mercury, wetted contacts, coil 1250 Ω , d.p.d.t.	Clare HG2A-1015	06
4LP	Relay, miniature plug-in, coil 2500 Ω , 4C contacts, assy 2	AWA 598000/35 Ref. 3	06
4LP)	Lamp, 12 V, 40 mA	RAFI 12809	06
4LP)	4LP30	RAFI 1.02157.011	06
4LP16-4LP30	21 off Holder, transparent, amber, domed, for 4LP1-4LP5, 4LP9,	RAFI 1.02157.011	06
4 off Holder, transparent, green, domed, for 4LP6, 4LP7, 4LP13, 4LP14	RAFI 1.02157.011	06	
1 off Holder, transparent, red, domed, for 4LP8	RAFI 1.02157.011	06	
4 off Holder, translucent, white, domed, for 4LP10, 4LP11, 4LP12, 4LP15	RAFI 1.02157.011	06	

Transmitter Control Unit 1P66406 (Continued)

4LT	Relay, miniature plug-in, coil 5800 Ω. 2C contacts, assy 1	Siemens-Halske V23154-C0404-B104	1007773	06
4LTM	Relay, miniature plug-in, coil 1250 Ω, 2C contacts, assy 1	Siemens-Halske V23154-C0422-B104	5999922	06
4M1	Meter, coil 1000 Ω, f.s.d. 100 μA	AWA 66406V83	06	
4M2	Meter, coil 100 Ω, f.s.d. 1 mA	AWA 66406V84	06	
4M3	Meter, f.s.d., 500 μA	AWA 66406V85	06	
4M4	Meter, elapsed time, 100 V, 50 Hz	Siemens 7KT5055-0	1007769	06
4MR1	Diode, silicon	STC EM404	1004812	23
4MR2	Diode, zener, 30 V ±5%, 400 mW	Elcoma BZY88/C30	1006210	23
4MR3	Diode, silicon	Fairchild 1N914	597291	23
4MR4	Diode, zener, 15 V ±5%, 400 mW	Elcoma BZY88/C15	1006209	23
4MR5	Not used			
4MR6	Diode, silicon	Fairchild 1N914	597291	23
4MR7	Diode, silicon	Fairchild 1N914	597291	23
4MR8	Diode, silicon	Fairchild 1N914	597291	23
4MR9	Diode, silicon	Fairchild 1N914	597291	23
4MR10	Not used			
4MR11	Diode, silicon	Fairchild 1N914	597291	23
4MR12	Diode, silicon	Fairchild 1N914	597291	23
4MR13	Diode, controlled silicon rectifier	STC 2SF104	1008227	23
4MR14	Diode, silicon	Fairchild 1N914	597291	23
4MR15	Diode, silicon	Fairchild 1N914	597291	23
4MR16	Diode, silicon	Fairchild 1N914	597291	23
4MR17	Diode, silicon	Fairchild 1N914	597291	23
4MR18	Triac	RCA 40430	597350	23
4MR19	Diode, controlled silicon rectifier	STC 2SF104	1008227	23
4MR20	Not used			
4MR21	Diode, silicon	Fairchild 1N914	597291	23
4MR22	Diode, silicon	Fairchild 1N914	597291	23

Transmitter Control Unit 1P66406 (Continued)

4MR23	Diode, controlled silicon rectifier	STC 2SF104	23
4MR24	Diode, silicon	Fairchild 1N914	23
4MR25	Not used		
4MR26	Diode, controlled silicon rectifier	STC 2SF104	23
4MR27	Not used		
4MR28	Not used		
4MR29	Not used		
4MR30	Not used		
4MR31)			
to) Diode, silicon	STC EM404	24	
4MR35)			
4MR36)			
to) Diode, silicon	STC EM404	24	
4MR40)			
4MR41)			
to) Diode, silicon	STC EM404	24	
4MR45)			
4MR46	Diode, silicon	STC EM404	24
4MR47	Diode, silicon	STC EM404	24
4MR48	Diode, silicon	STC EM404	06
4MR49	Diode, silicon	STC EM404	06
4MR50	Diode, silicon	STC EM404	06
4MR51)			
to) Not used			
4MR55)			
4MR56)			
to) Not used			
4MR60)			

Transmitter Control Unit 1P66406 (Continued)

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4 MIR61)	to) Diode, silicon	STC EM404	1004812	06
4MR65)				
4MR66)	to) Diode, silicon	STC EM404	1004812	06
4MR70)				
4MR71)	to) Diode, silicon	STC EM404	1004812	06
4MR75)				
4MR76)	to) Diode, silicon	STC EM404	1004812	06
4MR80)				
4MR81)	to) Diode, silicon	STC EM404	1004812	06
4MR85)				
4MR86)	to) Diode, silicon	STC EM404	1004812	06
4MR90)				
4MR91)	to) Diode, silicon	STC EM404	1004812	06
4MR95)				
4MR96	Diode, silicon	STC EM404	1004812	06
4MR97	Diode, silicon	STC EM404	1004812	06
4MR98	Diode, silicon	STC EM404	1004812	06
4MR99	Diode, silicon	STC EM404	1004812	06
4MR100	Diode, silicon	STC EM404	1004812	06
4MR101	Diode, zener, 4.7 V $\pm 5\%$, 400 mW	Elcoma BZY88/C4V7	596857	27
4MR102	Diode, zener, 30 V $\pm 5\%$, 400 mW	Elcoma BZY88/C30	1006210	27
4MR103	Diode, silicon	STC EM404	1004812	27

Transmitter Control Unit 1P66406 (Continued)

4MR104	Diode, silicon	STC EM404	27
4MR105	Diode, silicon	STC EM404	06
4MR106	Diode, zener, 15 V $\pm 5\%$, 400 mW	Elcoma BZY88/C15	06
4PLA)			
to)	Not used		
4PLQ)			
4PLR	Connector, male, printed circuit board, 16-way	Elco 1000551 02-016-013-5-200	23
4PLS	Connector, male, printed circuit board, 16-way	Elco 1000551 02-016-013-5-200	23
4PLT	Connector, male, printed circuit board, 15-way plus 14-way	Elco 1006497 02-015-135-5-200	25
	plus	Elco 1006498 02-014-137-5-200	25
4PLU	Connector, male, printed circuit board, 12-way, plus 11-way	Elco 1006493 02-012-135-5-200	24
	plus	Elco 1006494 02-011-137-5-200	24
4PLV	Connector, cable entry, 4 contact, female, retaining device, no earthing contact	Painton Multicon 234851 311284	06
4R1	1.5 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	608728	23
4R2	47 k Ω $\pm 2\%$, 1/2 W, metal oxide, style RFG5-E	614989	23
4R3	27 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	614161	23
4R4	180 k Ω $\pm 5\%$, 1/8 W, carbon film	Philips B8..031-04N	616576
4R5	47 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F		614988
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Transmitter Control Unit 1P66406 (Continued)

4R6	100 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	616047	23
4R7	3 .3 kΩ ±2%, 1 / 2 W, metal oxide, style RFG5-E	610320	23
4R8	3 .3 kΩ ±2%, 1 / 2 W, metal oxide, style RFG5-E	610320	23
4R9	68 kΩ ±2%, 1 / 4 W, metal oxide, style RFG5-F	615518	23
4R10	270 Ω ±5%, 1/2W, carbon film Elcoma 2322-101-13271	605646	06
4R11	100 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	604056	23
4R12	33 kΩ ±2%, 1 / 4 W, metal oxide, style RFG5-F	614484	23
4R13	22 kΩ ±2%, 1 / 4 W, metal oxide, style RFG5-F	613674	23
4R14	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	23
4R15	39 kΩ ±2%, 1 / 4 W, metal oxide, style RFG5-F	614702	23
4R16	470 kΩ ±5%, 1 / 8 W, carbon film Elcoma 2322/101/33474	1006534	23
4R17	1 kΩ ±2%, 1 / 4 W, metal oxide style RFG5-F	608055	23
4R18	33 .2 kΩ ±2%, 1 / 2 W, metal oxide, style RFG5-E	614487	23
4R19	2 .7 kΩ ±5%, 8 .75 W, metal oxide 560 Ω ±2%, 1 / 4 W, metal oxide, style RFG5-F	609876 606858	23 23
4R21	1 kΩ ±2%, 1 / 4 W, metal oxide, style RFG5-F	608055	23
4R22	100 Ω ±2%, 1 / 4 W, metal oxide, style BFG5-F	604056	23

Transmitter Control Unit 1P66406 (Continued)

4R23	$3.9 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610549	23
4R24	$560 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	606858	23
4R25	$4.7 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610945	23
4R26	$390 \Omega \pm 2\%$, 1 W , metal oxide, style RFG5-D	1006016	23
4R27	$390 \Omega \pm 2\%$, 1 W , metal oxide, style RFG5-D	1006016	23
4R28	$390 \Omega \pm 2\%$, 1 W , metal oxide, style RFG5-D	1006016	23
4R29	$47 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	614988	23
4R30	$47 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	614988	23
4R31	$4.7 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610945	23
4R32	$10 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	612061	23
4R33	$2.2 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	609464	23
4R34	$220 \Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	605270	23
4R35	$470 \Omega \pm 5\%$, 2 W , w-w	IRH ASW-2	1017768
4R36	$47 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	614988	23
4R37	$4.7 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610945	23
4R38	$390 \Omega \pm 2\%$, 1 W , metal oxide, style RFG5-D	1006016	23
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Transmitter Control Unit 1P66406 (Continued)

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4R39	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	23					
4R40	2.2 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	609464	23					
4R41	5.6 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	611318	23					
4R42	33.2 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	614487	23					
4R43	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	608055	23					
4R44	120 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	1006789	23					
4R45	Not used							
4R46	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	608055	23					
4R47	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	23					
4R48	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	608055	23					
4R49	27 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614161	23					
4R50	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	23					
4R51	6.8 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	611543	23					
4R52	100 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	616047	23					
4R53	47 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614988	23					
4R54	82 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	1006018	23					

Transmitter Control Unit 1P66406 (Continued)

Transmitter Control Unit 1P66406 (Continued)

4R73	6.8 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	611543	23
4R74	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	608055	23
4R75	Not used		
4R76	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	23
4R77	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	23
4R78	27 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614161	23
4R79	47 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614988	23
4R80	Not used		
4R81	100 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	616047	23
4R82	82 Ω ±2%, 1/4 W, metal oxide, style RFD5-F	1006018	23
4R83	6.8 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	611543	23
4R84	47 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614988	23
4R85	Not used		
4R86	6.8 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	611543	23
4R87	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	608055	23
4R88	Not used		
4R89	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	23
4R90	Not used		

Transmitter Control Unit 1P66406 (Continued)

4R91	15.4 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612948	25
4R92	1 MΩ ±2%, 1/2 W, metal oxide, style RFG5-E	618043	25
4R93	510 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	1006496	25
4R94	46.4 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	614989	25
4R95	Not used		
4R96	46.4 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	614989	25
4R97	100 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616043	25
4R98	510 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	1006496	25
4R99	56 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	615183	25
4R100	Not used		
4R101	22.6 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	613674	25
4R102	205 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	605001	25
4R103	205 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	605001	25
4R104	15.4 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612948	25
4R105	Not used		
4R106	68 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	615515	25
4R107	12 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612535	25

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Transmitter Control Unit 1P66406 (Continued)

4R108	Not used		24	
4R109	Not used		24	
4R110	Not used			
4R111	68 $\Omega \pm 5\%$, 5 W, metal oxide	Welwyn F33		
4R112	220 $\Omega \pm 5\%$, 1.5 W, w-w	IRH ASW-2		
4R113	Not used			
4R114	Not used			
4R115	Not used			
4R116	100 $\Omega \pm 2\%$, 1/2 W, metal oxide, style RFG5-E	604057	06	
4R117	680 $\Omega \pm 2\%$, 1/2 W, metal oxide, style RFG5-E	607299	06	
4R118	1M $\Omega \pm 1\%$, 1 W, metal oxide, style RFG5-D	1007771	06	
4R119	1 k $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F	608055	06	
4R120	330 $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F	605972	06	
4R121	1.2 k $\Omega \pm 5\%$, 3.25 W, metal oxide,	1007770	06	
4R122	56 $\Omega \pm 5\%$, 8.75 W, metal oxide,	1006461	27	
4R123	68 $\Omega \pm 5\%$, 8.75 W, metal oxide,	603579	27	
4R124	10 k $\Omega \pm 5\%$, 1/2 W, carbon film	612035	06	
4R125	Not used			
4R126	1.2 k $\Omega \pm 5\%$, 3.25 W, metal oxide	1007770	06	
4R127	270 $\Omega \pm 5\%$, 8.75 W, metal oxide	1006462	27	
4R128	1.2 k $\Omega \pm 5\%$, 3.25 W, metal oxide	1007770	06	
4R129	8.2 k $\Omega \pm 5\%$, 1/4 W, carbon film	611845	06	
4R130	8.2 k $\Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F	1006368	06	
4R131	1.2 k $\Omega \pm 5\%$, 3.25 W, metal oxide	1007770	06	
4R132	220 $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	605259	

Transmitter Control Unit 1P66406 (Continued)

Transmitter Control Unit 1P66406 (Continued)

4RV8	10 kΩ ±20%, variable, 1/4 W, linear law, moulded carbon	Plessey MP Dealer Acetal, Printed Circuit	620201	25
4RV9	1 kΩ ±20%, 1/4 W, variable, rotary, carbon comp.	Plessey MP Dealer Acetal, Printed Circuit	620043	27
4RV10	25 kΩ ±10%, variable, 1/4 W, linear, 3/8 in spindle, screwdriver slot	Plessey M	613958	06
4SKA) to) 4SKE)	Connector, 29-way with polarizing insert Elco 60-5006-34-14	Elco 00-7008-029-163-001	1007761	06
4SKF	Connector, 29-way with polarizing insert Elco 60-5006-34-14	Elco 00-7008-029-163-001	1007761	06
4SKG	Connector, 29-way with polarizing insert Elco 60-5006-34-14	Elco 00-7008-029-163-001	1007761	06
4SKH	Connector, 29-way with polarizing insert Elco 60-5006-34-14	Elco 00-7008-029-163-001	1007761	06
4SKJ	Connector, 29-way with polarizing insert Elco 60-5006-34-14	Elco 00-7008-029-163-001	1007761	06
4SKK	Connector, 47-way, male	Painton 74/10/4706/10	1006626	06
4SKL	Connector, 35-way, male	Painton 74/10/3506/10	1004512	06
4SKM	Connector, 23-way, male	Painton 74/10/2306/10	1006625	06
4SKN	Connector, 31-way, male	Painton 74/10/3106/10	1007768	06
4SKP	Connector, 7-way, male	Painton 74/10/0706/10	1007433	06
4SKQ	Connector, 11-way, male	Painton 74/10/1106/10	1005500	06
4SKR	Connector, 16-way	Elco 00-5009-016-163-001	1000550	06

Transmitter Control Unit 1P66406 (Continued)

4SKS	Connector, 16-way		Elco	1000550	06
4SKT	Connector, 29-way with polarizing insert Elco 60-5006-34-14		Elco	00-5009-016-163-001	06
4SKU	Connector, 23-way		Elco	00-7008-029-163-001	06
			Elco	00-7008-023-163-001	06
4SWA	Switch, oak type MF, 2 poles, 24 positions	AWA 66406V16			06
4SWB	Switch, toggle, sub-miniature, d.p.d.t.	C & K 7201 (Plessey)		858320	06
4SWC	Switch, toggle, sub-miniature, d.p.d.t.	C & K 7201 (Plessey)		858320	06
4SWD	Switch, sub-miniature, push-button, d.p.d.t.	C & K P8221 (Plessey)		1004534	06
4SWE	Switch, sub-miniature, push-button, s.p.d.t.	C & K P8121 (Plessey)		1006298	06
4SWF	Switch, sub-miniature, push-button, s.p.d.t.	C & K P8121 (Plessey)		1006298	06
4SWG	Switch, toggle, sub-miniature, s.p.d.t	C & K 7101 (Plessey)		1006907	06
4SWH	Not used				
4SWJ	Switch, oak type F, 1 pole, 9 positions	AWA 66406V129			06
4SWK	Switch, oak type F, 8 poles, 2 positions	AWA 66406V130			06
4SWL	Switch, oak type F, 1 pole, 6 positions	AWA 66406V131			06
4SWM	Switch, sub-miniature, push-button, s.p.d.t.	C & K P8121 (Plessey)		1006298	06
4SWN	Switch, toggle, sub-miniature, s.p.d.t.	C & K 7101 (Plessey)		1006907	06
4SWO	Switch, toggle, sub-miniature, s.p.d.t.	C & K 7101 (Plessey)		1006907	06
4TCC	Relay, miniature plug-in, coil 1250 Ω, 2C contacts, assy 1	Siemens-Halske V23154-C0422-B104		599922	06
4TS	Relay, miniature plug-in, coil 5800 Ω, 2C contacts, assy 1	Siemens-Halske V23154-C0404-B104		1007773	06
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Transmitter Control Unit 1P66406 (Continued)

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4TSA	Terminal block, 8-way, 15 A, back connected	Carr Fastener B77/903-8	1007775	06	
4TSB	Terminal block, 10-way, ceramic	Philips B8.708.20/00	891042	06	
4VT1	Transistor	AWV AS147	906368	23	
4VT2	Transistor	AWV AS147	906368	23	
4VT3	Transistor	AWV AS147	906368	23	
4VT4	Transistor	AWV AS147	906368	23	
4VT5	Not used	AWV AS147	906368	23	
4VT6	Transistor	RCA 2N2270	906597	23	
4VT7	Transistor, unijunction	GEC USA 2N2646	906620	23	
4VT8	Transistor	AWV AS147	906368	23	
4VT9	Transistor	RCA 2N2270	906597	23	
4VT10	Not used				
4VT11	Transistor	RCA 2N2270	906597	23	
4VT12	Transistor	Fairchild 2N3638A	906679	23	
4VT13	Transistor	RCA 2N2270	906597	23	
4VT14	Transistor	AWV AS147	906368	23	
4VT15	Transistor	AWV AS147	906368	23	
4VT16	Transistor	AWV AS147	906368	23	
4VT17	Transistor	AWV AS147	906368	23	
4VT18	Transistor	AWV AS147	906368	23	
4VT19	Transistor	AWV AS147	906368	23	
4VT20	Transistor	AWV AS147	906368	23	
4VT21	Transistor	AWV AS147	906368	23	
4VT22	Transistor	AWV AS147	906368	27	
4VT23	Transistor	AWV AS147	906368	27	
4VT24	Transistor	AWV AS147	906368	27	
4VT25	Transistor	RCA 2N2270	906597	27	
4VT26	Transistor	RCA 2N4036	906712	27	

Transmitter Control Unit 1P66406 (Continued)

(A) Holder, for relays 4AL, 4AIL, 4E _{MA} to 4E _{ME} , 4EMZ, 4HF, 4LT, 4LTM, 4RFM, 4TCC, 4TS	Clip, for above holder (A)	Clip, for above holder (B)	793125 210958 793126	06 06 06
12. REGULATED POWER SUPPLIES 1H66417 (includes Bias Supply Board 1R66421 & Control Supply Board 1R66422)				
5C1	100 μ F +50%~-10%, 200 VDCW, electrolytic	ITT Type C011	17	
5C2	2000 μ F +50%~-10%, 65 VDCW, electrolytic	Elcoma 2222-106-18222	17	
5C3	630 μ F +50%~-10%, 80 VDCW, electrolytic	ITT Type C011	17	
5C4	2000 μ F +50%~-10%, 65 VDCW, electrolytic	Elcoma 2222-106-18222	17	
5MR1	Diode, rectifier assembly	STC MB4	21	
5MR2	Diode, zener, 39 V \pm 5%, 2.5 W	Philips BZX70/C39	21	
5MR3	Diode, rectifier assembly	STC MB4	21	
5MR4	Diode, germanium	Philips 0A47	21	
5MR5	Diode, zener, 4.7 \pm 5%, 400 mW	Philips BZY88/C4V7	21	
5MR6	Diode, zener, 6.8 V \pm 5%, 400 mW	Philips BZY88/C6V8	21	
5MR7	Réctifier assembly, 300 VP, 12 A	Motorola MDA980-4	17	
5MR8	Diode, zener, 6.8 V, 1 W	Intermetall ZD6.8	22	
5MR9	Rectifier assembly, 300 VP, 12 A	Motorola MDA980-4	17	
5MR10	Diode, zener, 6.8 V, 1 W	Intermetall ZD6.8	22	
5R1	47 k Ω \pm 5%, 1/2 W, carbon film	Philips B8-305-06B	21	66400R
5R2	3.3 k Ω \pm 5%, 1 W, carbon film	Philips B8-305-07B	21	Chap. 3
5R3	10 Ω \pm 5%, 3.25 W, metal oxide	Welwyn F32	21	

Regulated Power Supplies 1H66417 (Continued)

5R4	270 $\Omega \pm 5\%$, 1/4 W, carbon film	Not used	605640	21
5R5			Philips B8-305-05B	
5R6	5.6 k $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	611298	21
5R7	1 k $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	608015	21
5R8	470 $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	606590	21
5R9	100 $\Omega \pm 5\%$, 20 W, w-w	IRH FRW-20	1017455	17
5R10	Not used			
5R11	680 $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	607282	22
5R12	220 $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	605259	22
5R13	1 k $\Omega \pm 5\%$, 1/2 W, carbon film	Phillips B8-305-06B	608033	22
5R14	220 $\Omega \pm 5\%$, 1/2 W, carbon film	Phillips B8-305-06B	605260	22
5R15	Not used			
5R16	15 $\Omega \% 10\%$, 6 W, w-w, vitreous enamel, style RWV4-L	602005	22	
5R17	680 $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	607282	22
5R18	30 $\Omega \pm 5\%$, 50 W, w-w	IRH FRW-22	1017456	17
5R19	220 $\Omega \pm 5\%$, 1/4 W, carbon film	Phillips B8-305-05B	605259	22
5R20	Not used			
5R21	1 k $\Omega \pm 5\%$, 1/2 W, carbon film	Phillips B8-305-06B	608033	22
5R22	220 $\Omega \pm 5\%$, 1/2 W, carbon film	Phillips B8-305-06B	605260	22
5R23	39 $\Omega \pm 5\%$, 8.75 W, metal oxide	Welwyn F35	1006476	22
5R24	39 $\Omega \pm 5\%$, 8.75 W, metal oxide	Welwyn F35	1006476	22
5R25	39 $\Omega \pm 5\%$, 8.75 W, metal oxide	Welwyn F35	1006476	22
5RV1	220 $\Omega \pm 20\%$, 1/4 W, linear law, 5/8 in spindle, screwdriver slot	Plessey M	1000450	17
5RV2	220 $\Omega \pm 20\%$, 1/4 W, linear law, 5/8 in spindle, screwdriver slot	Plessey M	1000450	17
5RV3	220 $\Omega \pm 20\%$, 1/4 W, linear law 5/8 in spindle, screwdriver slot	Plessey M	1000450	17

Regulated Power Supplies 1 H66417 (Continued)

5TR1	Transformer; primary 50 Hz, 220 V, 230 V, 240 V; secondary No. 1 59 V, 25 mA d.c.; secondary No. 2 28 V, 330 mA d.c.	AWA 1TS65780	17	66400R Chap. 3
5TR2	Transformer; primary 50 Hz, 220 V, 230 V, 240 V; secondary No. 1 110 V, 330 mA d.c.; secondary No. 2 39 V, 500 mA d.c.; secondary No. 3 39 V, 850 mA d.c.	AWA 1TK65796	17	
5TSA	Terminal block, 4-way, 15 A, back connected	Carr Fastener B77/903-4	17	
5TSB	Terminal block, 9-way, 15 A, back connected	Carr Fastener B77/903-9	17	
5VS1	Thyrector	GE 6RS20SP9B9	17	
5VS2	Thyrector	GE 6RS20SP9B9	17	
5VT1	Transistor	RCA 2N3055	21	
5VT2	Transistor	RCA 2N4036	21	
5VT3	Transistor	RCA 2N2270	21	
5VT4	Transistor	RCA 2N4036	22	
5VT5	Transistor	RCA 2N3055	17	
5VT6	Transistor	RCA 2N4036	22	
5VT7	Transistor	RCA 2N3055	17	
13.	SERVO CONTROL UNIT 1J66410 (includes Servo Control Board 1R66428)			
6C1	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	227456	28	
6C2	47 μ F $\pm 10\%$, 20 VDCW, tantalum, electrolytic, style CS13	229569	28	
6C3	0.39 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	227456	28	

Servo Control Unit 1J66410 (Continued)

6C4	3.3 $\mu\text{F} \pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	228160	28
6C5	10 $\mu\text{F} \pm 10\%$, 20 VDCW, tantalum, electrolytic, style CS13	228772	28
6C6	180 $\mu\text{F} \pm 10\%$, 25 VDCW, tantalum, electrolytic, style CS13	229849	28
6C7	0.1 $\mu\text{F} \pm 10\%$, 250 VDCW, metallised, polyester	109D187X0025T2 Philips C280AE	28
6C8	0.1 $\mu\text{F} \pm 10\%$, 250 VDCW, metallised, polyester	227096	28
6C9	1 $\mu\text{F} \pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13	227739	28
6C10	10 $\mu\text{F} \pm 10\%$, 20 VDCW, tantalum, electrolytic, style CS13	228772	28
6C11	Not used		
6C12	10 $\mu\text{F} \pm 10\%$, 20 VDCW, tantalum, electrolytic, style CS13	228772	28
6C13	10 $\mu\text{F} \pm 10\%$, 20 VDCW, tantalum, electrolytic, style CS13	228772	28
6C14	100 $\mu\text{F} \pm 10\%$, 20 VDCW, tantalum, electrolytic, style CS13	229718	28
6C15	Not used		
6C16	Not used		
6C17	Not used		
6C18	Not used		
6C19	Not used		
6C20	2200 $\mu\text{F} +50\%-10\%$, 65 VDCW, electrolytic	Elcoma 2222-106-18222	10
6C21	2200 $\mu\text{F} +50\%-10\%$, 65 VDCW, electrolytic	Elcoma 2222-106-18222	10

Servo Control Unit 1J66410 (Continued)

6C22	2200 μ F +50% -10%, 65 VDCW, electrolytic	Elcoma 2222-106-18222	1007729 10
6C23	2200 μ F +50% -10 \pm , 65 VDCW, electrolytic	Elcoma 2222-106-18222	1007729 10
6C24	2200 μ F +50% -10%, 65 VDCW, electrolytic	Elcoma 2222-106-18222	1007729 10
6C25	2200 μ F +50% -10%, 65 VDCW, electrolytic	Elcoma 2222-106-18222	1007729 10
6KSA	Switch, key, miniature, BPO type 1000	Ericsson N9300TK 857246	10
6L1	Inductor, iron-cored, 0.22 H at 0.6 A d.c.; 2.76 Ω d.c. resistance	AWA 1TU65775	10
6L2	Inductor, iron-cored, 0.22 H at 0.6 A d.c.; 2.76 Ω d.c. resistance	AWA 1TU65775	10
6L3	Inductor, iron-cored, 0.22 H at 0.6 A d.c.; 2.76 Ω d.c. resistance	AWA 1TU65775	10
6MR1	Diode, silicon	Fairchild 1N914 597291	28
6MR2	Diode, silicon	Fairchild 1N914 597291	28
6MR3	Diode, silicon	Fairchild 1N914 597291	28
6MR4	Diode, silicon	Fairchild 1N914 597291	28
6MR5	Diode, silicon	Fairchild 1N914 597291	28
6MR6	Not used		
6MR7	Diode, silicon	Fairchild 1N914 597291	28
6MR8	Diode, silicon	Fairchild 1N914 597291	28
6MR9	Diode, silicon	Fairchild 1N914 597291	28
6MR10	Diode, silicon	Fairchild 1N914 597291	28
6MR11	Diode, silicon	Fairchild 1N914 597291	28
6MR12	Diode, silicon	Fairchild 1N914 597291	28
6MR13	Diode, silicon	Fairchild 1N914 597291	28
6MR14	Diode, silicon	Fairchild 1N914 597291	28
6MR15	Diode, silicon	Fairchild 1N914 597291	28

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Servo Control Unit 1J66410 (Continued)

6MR16	Diode assembly	Motorola MDA920A-2	597307	28
6MR17	Diode assembly	Motorola MDA920A-2	597307	28
6MR18	Not used			
6MR19	Diode assembly	Motorola MDA920A-2	597307	28
6MR20	Diode, zener, 4.7 V $\pm 5\%$, 400 mW	Intermetall ZD4, 7	596857	28
6MR21	Diode, silicon	Fairchild 1N914	597291	28
6MR22	Diode, zener, 15 V $\pm 5\%$, 1 W	Intermetall ZD15	597157	28
6MR23	Triac	RCA 40430	597350	28
6MR24	Not used			
6MR25	Not used			
6MR26	Not used			
6MR27	Rectifier assembly, 300 VP, 12 A	Motorola MDA980-4	1006281	10
6MR28	Rectifier assembly, 300 VP, 12 A	Motorola MDA980-4	1006281	10
6MR29	Rectifier assembly, 300 VP, 12 A	Motorola MDA980-4	1006281	10
6PLA	Contact strip, 26-way, for printed circuit board	Elco 02-026-013-5-200	1005496	28
6PS	Relay, industrial, 110 V, 50 Hz coil	Siemens 3TA61-05-0AF	1007709	10
6R1	56.2 k Ω $\pm 2\%$, 1/4 W metal oxide, style RFG5-F		615185	28
6R2	10 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F		612061	28
6R3	2.2 k Ω $\pm 2\%$, 1/2 W, metal oxide, style RFG5-E		609465	28
6R4	220 k Ω $\pm 2\%$, 1/2 W, metal oxide, style RFG5-E		616741	28
6R5	10 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F		612061	28

Servo Control Unit 1J66410 (Continued)

6R6	33 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614484	28
6R7	10 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	612061	28
6R8	2.2 kΩ ±2%, 1/2 W, metal oxide style RFG5-E	609465	28
6R9	100 Ω ±2%, 1/4 W, metal oxide style RFG5-F	604056	28
6R10	2.2 kΩ ±2%, 1/2 W, metal oxide style RFG5-E	609465	28
6R11	33 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	614484	28
6R12	33 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	614484	28
6R13	6.8 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	611543	28
6R14	22 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	613674	28
6R15	33 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	614484	28
6R16	33 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	614484	28
6R17	2.2 kΩ ±2%, 1/2 W, metal oxide style RFG5-E	609465	28
6R18	33 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	614484	28
6R19	33 kΩ ±2%, 1/4 W, metal oxide style RFG5-F	614484	28
6R20	2.2 kΩ ±2%, 1/2 W, metal oxide style RFG5-E	609465	28

Servo Control Unit 1J66410 (Continued)			
6R21	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	28
6R22	100 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	604056	28
6R23	33 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614484	28
6R24	33 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614484	28
6R25	33 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614484	28
6R26	22 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	613674	28
6R27	68 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	615518	28
6R28	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	28
6R29	33 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614484	28
6R30	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	28
6R31	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	28
6R32	22 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	602306	28
6R33	Not used		
6R34	100 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	616047	28
6R35	2.2 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	609464	28
6R36	2.2 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	609464	28

6R37	Not used							
6R38	15 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612948	28					
6R39	470 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	606608	28					
6R40	470 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	606608	28					
6R41	150 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	1017946	28					
6R42	680 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	607299	28					
6R43	330 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	605972	28					
6R44	220 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	605270	28					
6R45	1 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	608056	28					
6R46	Not used							
6R47	Not used							
6R48	15 kΩ ± 2%, 1/2 W, metal oxide, style RFG5-E	612948	28					
6R49	220 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	605270	28					
6R50	1 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	608056	28					
6R51	Not used							
6R52	15 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	612948	28					
6R53	82 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	615812	28					
6R54	18 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	613322	28					
6R55	Not used							

Servo Control Unit 1J66410 (Continued)

6R56)							
to)	Not used						
6R60)							
6R61)							
to)	Not used						
6R65)							
6R66	82 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	615814				
6R67	3.3 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	610319				
6R68	12 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	612537				
6R69	Not used						
6R70	Not used						
6R71	4.7 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	610945				
6R72	47 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	614988				
6R73	464 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	28	606608				
6R74	Not used						
6R75	47 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	614988				
6R76	220 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	28	605270				
6R77	470 Ω ±5%, 3.25 W, metal oxide, 6.8 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	606600 611543				
6R78							
6R79	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	28	608055				

Servo Control Unit 1J66410 (Continued)

6R80	3. 9 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	610549	28
6R81	100 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	616047	28
6R82	18 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	613322	28
6R83	27 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614161	28
6R84	Not used		
6R85	68 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	615515	28
6R86	Not used		
6R87	4. 7 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	610945	28
6R88	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	28
6R89	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	28
6R90	Not used		
6R91	1. 8 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	609096	28
6R92	820 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	1006459	28
6R93	Not used		
6R94	Not used		
6R95	Not used		
6R96	Not used		
6R97	27 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614161	28
6R98	150 Ω ±2%, 1/4 W, metal oxide, style RFG5-F	604700	28

Servo Control Unit 1J66410 (Continued)

6R99	10 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612061	28
6R100	Not used		
6R101	180 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616575	28
6R102	4.7 kΩ ±2%. 1/4 W, metal oxide, style RFG5-F	610945	28
6R103	47 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614988	28
6R104	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	608055	28
6R105	Not used		
6R106	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	28
6R107	390 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006016	28
6R108	100 Ω ±2%, 1 W, metal oxide, style RFG5-D	1006040	28
6R109	47 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614988	28
6R110	Not used		
6R111) to)	2.74 kΩ ±2%, 1/2 W, metal oxide,	609890	10
6R116)	style RFG5-E	610945	28
6R117	4.7 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F		
6SKA	Connector, male, printed circuit board 26-way	Elco	1005498
6SKB	Not used	00-5007-026-163-001	
6SKC	Not used		
6SKD	Not used		

6SKE	Not used			
6SKF	Not used			
6SKG	Connector, male panel mtg., 35-way	Painton 159 Series 74/10/3506/10		
6TR1	Transformer; primary 220 V, 230 V, 240 V, 250 V; secondary (1) 64 V centre-tapped, 0.6 A d.c.; secondary (2) 64 V centre-tapped, 0.6 A d.c.; secondary (3) 47 V centre-tapped, 0.6 A d.c.	AWA 1TJ65776		
6VTT1	Transistor	RCA 2N2270	28	
6VTT2	Transistor	RCA 2N2270	28	
6VTT3	Transistor	RCA 2N2270	28	
6VTT4	Transistor	RCA 2N2270	28	
6VTT5	Transistor	RCA 2N2270	28	
6VTT6	Transistor	RCA 2N2270	28	
6VTT7	Transistor	RCA 2N4036	28	
6VTT8	Transistor	RCA 2N4036	28	
6VTT9	Transistor	RCA 2N4036	28	
6VTT10	Transistor	RCA 2N2270	28	
6VTT11	Transistor	AWV AS147	28	
6VTT12	Transistor	RCA 2N4036	28	
6VTT13	Transistor	RCA 2N4036	28	
6VTT14	Transistor, unijunction	GEC USA 2N2646	28	
6VTT15	Transistor	RCA 2N2270	28	
6VTT16	Transistor	RCA 2N4036	28	
6VTT17	Not used			
6VTT18	Transistor	RCA 2N4036	28	

Servo Control Unit 1J66410 (Continued)

6VT19	Transistor	RCA 2N2270	28
6VT20	Transistor	RCA 2N2270	28
6VT21	Transistor	RCA 2N2270	28
6VT22	Transistor	RCA 2N2270	28
6VT23	Transistor	RCA 2N2270	28
6VT24	Transistor	RCA 2N2270	28

14. GAIN LIMITER 1R66416

7C1	0.01 μ F $\pm 20\%$, 250 VDCW, metallised polycarbonate	Philips 2222/342/45103	16
7C2	0.01 μ F $\pm 20\%$, 250 VDCW, metallised polycarbonate	Philips 2222/342/45103	16
7C3	0.01 μ F $\pm 20\%$, 250 VDCW, metallised polycarbonate	Philips 2222/342/45103	16
7C4	0.01 μ F $\pm 20\%$, 250 VDCW, metallised polycarbonate	Philips 2222/342/45103	16
7C5	Not used		
7C6	1 μ F $\pm 10\%$, 35 VDCW, tantalum, electrolytic, style CS13		227739
7C7	0.01 μ F $\pm 20\%$, 250 VDCW, metallised polycarbonate	Philips 2222/342/45103	16
7C8	0.01 μ F $\pm 20\%$, 250 VDCW, metallised polycarbonate	Philips 2222/342/45103	16
7C9	0.01 μ F $\pm 20\%$, 250 VDCW, metallised polycarbonate	Philips 2222/342/45103	16
7MR1	Diode, silicon	Fairchild 1N914	16
7MR2	Diode, silicon	Fairchild 1N914	16
7MR3	Diode, silicon	Fairchild 1N914	16
7MR4	Diode, silicon	Fairchild 1N914	16

Gain Limiter 1R66416 (Continued)

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7PLA Connector, male, printed circuit board, 16-way

Elco
02-016-013-5-200

7R1	47 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	603124	16
7R2	47 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	603124	16
7R3	4.7 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	610945	16
7R4	22 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	613674	16
7R5	10 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	612061	16
7R6	18 k Ω $\pm 2\%$, 1/4 W metal oxide, style RFG5-F	613322	16
7R7	2.2 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	609464	16
7R8	470 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	606608	16
7R9	10 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	612061	16
7R10	10 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	612061	16
7R11	22 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	613674	16
7R12	10 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	612061	16
7R13	33 k Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	614484	16
7R14	330 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	605972	16
7R15	470 Ω $\pm 2\%$, 1/4 W, metal oxide, style RFG5-F	606608	16

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Gain Limiter 1R66416 (Continued)

7R16	$4.7 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610945	16
7R17	$4.7 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610945	16
7R18	$4.7 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610945	16
7R19	$22 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	613674	16
7R20	$330 \text{ k}\Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E	617118	16
7R21	$22 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	613674	16
7R22	$46.4 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	614988	16
7R23	$1.2 \text{ } 1\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	608339	16
7R24	$33 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	614484	16
7R25	$330 \text{ k}\Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E	617118	16
7R26	$1 \text{ M}\Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E	618043	16
7R27	$330 \text{ k}\Omega \pm 2\%$, $1/2 \text{ W}$, metal oxide, style RFG5-E	617118	16
7R28	$15 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	612950	16
7R29	$100 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	616047	16
7R30	$15 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	612950	16
7R31	$4.7 \text{ k}\Omega \pm 2\%$, $1/4 \text{ W}$, metal oxide, style RFG5-F	610945	16

Gain Limiter 1R66416 (Continued)

7RV1	2.5 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619953	16
7RV2	2.5 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619953	16
7RV3	50 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	615098	16
7RV4	2.5 kΩ ±20%, variable, linear law, 5/8 in spindle, screwdriver slot	Plessey M	619953	16
7SWA	Switch, toggle, sub-miniature, d.p.d.t.	C & K 7201 (Plessey)	858320	16
7VT1	Transistor	Fairchild 2N3644 or STC TT3644	1000133	16
7VT2	Transistor	Fairchild 2N3644 or STC TT3644	1000133	16
7VT3	Transistor	Fairchild 2N3644 or STC TT3644	1000133	16
7VT4	Transistor	Fairchild 2N3644 or STC TT3644	1000133	16
7VT5	Transistor	AWV AS147 or STC TT3644	906368	16
7VT6	Transistor	AWV AS147	906368	16
7VT7	Transistor	AWV AS147	906368	16
7VT8	Transistor	Fairchild 2N3644 or STC TT3644	1000133	16
7VT9	Transistor	Fairchild 2N3644 or STC TT3644	1000133	16
7VT10	Transistor	Fairchild 2N3644 or STC TT3644	1000133	16
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Gain Limiter 1 R66416 (Continued)

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7VT11 Transistor

RCA 2N2270

906597

15. REFLECTOMETER 1J66408

8C1	0.6 to 9.5 pF, quartz trimmer	Oxley QT4/9/T	1007710
8C2	500 pF $\pm 5\%$, 500 VDCW, feedthrough	Erie 654/006/501J	1007711
8C3	0.01 μ F +100%~20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222300
8C4	0.01 μ F +100%~20%, 500 VDCW, ceramic, tubular	Ducon CTR. Hi-K	222300
8C5	Not used		08
8C6	1000 pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C7	1000 pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C8	1000pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C9	1000 pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C10	1000 pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C11	1000 pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C12	1000 pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C13	1000 pF +100%~20%, 500 VDCW, ceramic, disc	Ducon CDS. Hi-K	225027
8C14	1 pF to 9 pF, variable, 500 VDCW,	Philips	1005195
		2222-809-05002	08
8L1	Torid assembly	AWA 1 LH66884	08
8L2	Inductor, 2 mH $\pm 30\%$, air core	AWA 19V57973	08

Reflectometer 1J66408 (Continued)

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 8L3 Inductor, 2 mH $\pm 30\%$, air core
 AWA 19V57973

8MR1	Diode, silicon, hot carrier	Hewlett-Packard HP5082-2800	1006678	08
8MR2	Diode, silicon, hot carrier	Hewlett-Packard HP5082-2800	1006678	08
8MR3	Diode, silicon, hot carrier	Hewlett-Packard HP5082-2800	1006678	08
8MR4	Diode, silicon, hot carrier	Hewlett-Packard HP508202800	1006678	08
8PLC	Connector, angle adaptor HN	Amphenol UF-212C/U	1006771	08
8R1	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R2	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R3	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R4	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R5	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R6	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R7	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R8	$100 \Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		604056	08
8R9	$1 k\Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		608055	08
8R10	$18 k\Omega \pm 2\%$, 1/4 W, metal oxide, style RFG5-F		613322	08

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Reflectometer 1J66408 (Continued)

8R11	27 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	614161	08
8R12	1 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	608055	08
8R13	15 kΩ ±2%, 1/4 W, metal oxide, style RFG5-F	612950	08
8R14	180 kΩ ±5%, 1/8 W, carbon film	Phillips B8-031-04N	08
8SKA	Connector, coaxial, female	Amphenol UG-60A/U	08
8SKB	Connector, coaxial, male	Amphenol UG-59B/U	08
8SKC	Connector, 4-way, male, chassis mtg	Painton 310032	08
16.	RFA2 TUNING ASSEMBLY 1J66460 (includes RFA2 Tuning Servo Drive 1J66413, RFA2 Tuning Dial Assembly 2R64638 and RFA2 Inductor Assembly 1V66461)		
10C13	5.8 pF to 148.25 pF, variable, rotary, style CVA-50	AWA 66460V26	60
10C14	Variable, rotary, 3-gang, each 532 pF max., 1/2 inch long front spindle, 1 inch long rear spindle, commercial finish	Jackson EH 1006483	61
10L9	Inductor, r.f. variable	AWA 1V66461	60
10MR1	Diode, silicon	STC EM404	60
10MR2	Diode, silicon	STC EM404	60
10MR3	Diode, silicon	STC EM404	60
10MR4	Diode, silicon	STC EM404	60
10R1	2.2 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	609465	60
10R2	560 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	606856	60

RFA2 Tuning Assembly 1J66460 (Continued)

10R3	1 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	608056	60
10R4	1.2 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	608337	60
10R5	1.8 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	609094	60
10R6	3.3 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610320	60
10R7	18 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	613321	60
10R8	1.2 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	608337	60
10RV1	20 kΩ ±3%, variable, fitted with five equally spaced taps	620843	38
10MOTOR1	Motor, 28 V d.c., Vactric size 18PM, fitted with Vactric size 18 gearhead, 40:1 ratio, 1/4-inch dia. shaft	7223	13
10PLA	Connector, 7-way, male	Painton 74/10/0706/10	13
10SWA	Switch, sensitive, s.p.d.t.	Honeywell 11SM1-T	38
10SWB	Switch, sensitive, s.p.d.t.	Honeywell 11SM1-T	38
17. RFA3 TUNING SERVO ASSEMBLY 1R66412 (includes RFA3 Tuning Dial Assembly 2R64638)			66400R Chap.3
11MR1	Diode, silicon	STC EM404	12
11MR2	Diode, silicon	STC EM404	12
11MR3	Diode, silicon	STC EM404	12
11MR4	Diode, silicon	STC EM404	12

RFA3 Tuning Servo Assembly 1R66412 (Continued)

11R1	2.7 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	609890	12
11R2	820 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	607685	12
11R3	820 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	607685	12
11R4	1.5 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	608725	12
11R5	4.7 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	610947	12
11R6	Not used		
11R7	22 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	613675	12
11R8	820 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	607685	12
11RV1	20 kΩ ±3%, variable, fitted with five equally spaced taps	Beckman Helipot 7223	38
11SWA	Switch, sensitive, s.p.d.t.	Honeywell 11SM1-T	38
11SWB	Switch, sensitive, s.p.d.t.	Honeywell 11SM1-T	38
11TSA	Not used	Carr Fastener	12
11TSB	Terminal block, 6-way, 5 A, front connected	77/507-6M	
11MOTOR1	Motor, 28 V d.c., Vactric size 18PM fitted with Vactric size 18 gearhead, 20:1 ratio, 1/4-inch shaft	891066 1006500	12
	Timing belt	Diamond Chain Co. No. 160X037	12

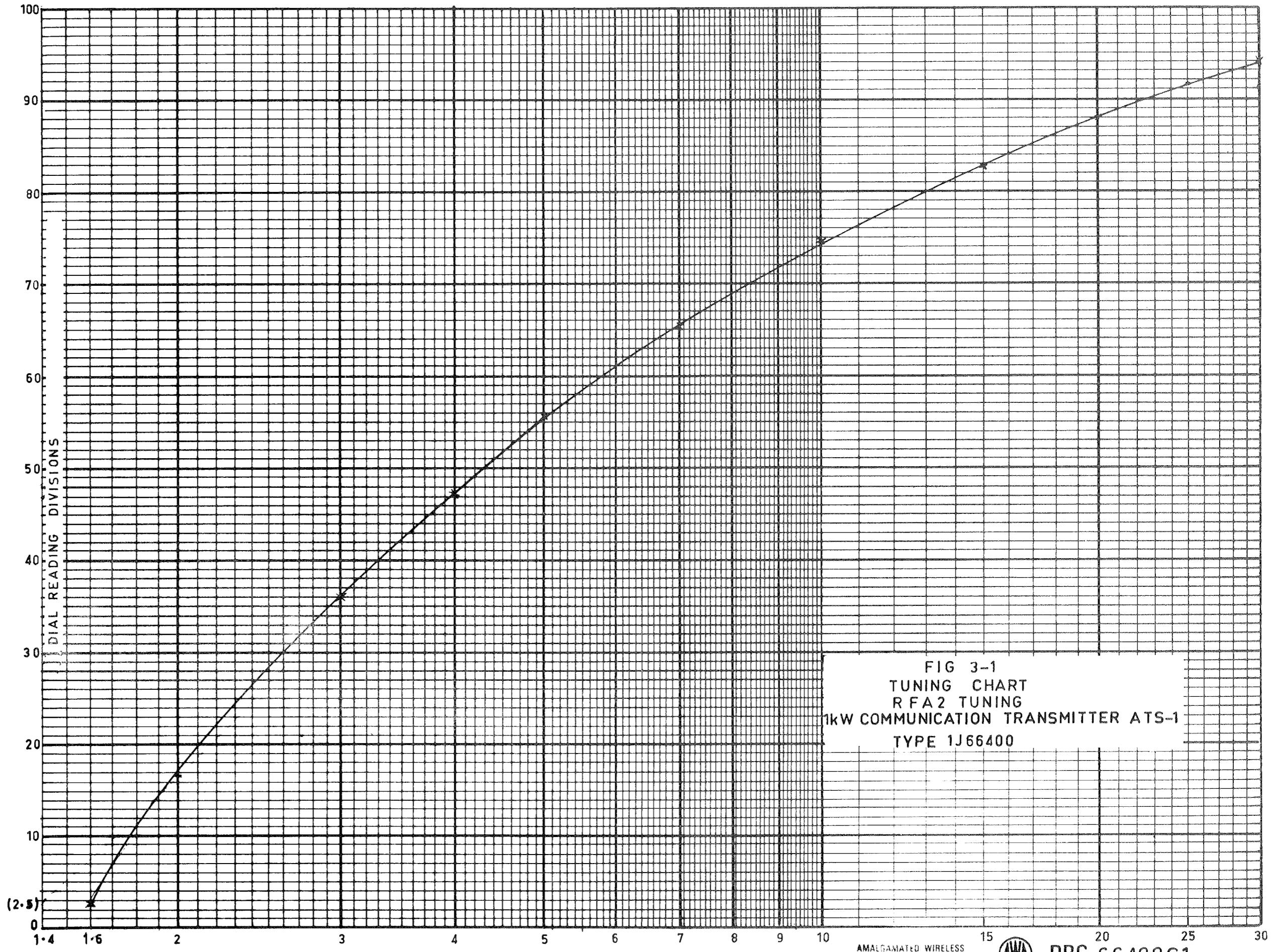
18. RFA3 LOADING SERVO ASSEMBLY 1R66411 (includes RFA3 Loading Dial Assembly 2R64638)

12MR1	Diode, silicon	STC EM404	1004812	11
12MR2	Diode, silicon	STC EM404	1004812	11
12MR3	Diode, silicon	STC EM404	1004812	11
12MR4	Diode, silicon	STC EM404	1004812	11
12R1	1.8 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	609094	11	
12R2	560 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	606856	11	
12R3	680 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	607299	11	
12R4	680 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	607299	11	
12R5	1.5 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	608725	11	
12R6	2.7 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	609890	11	
12R7	120 kΩ ±2%, 1/2 W, metal oxide, style RFG5-E	616273	11	
12R8	560 Ω ±2%, 1/2 W, metal oxide, style RFG5-E	606856	11	
12RV1	20 kΩ ±3%, variable, fitted with five equally spaced taps	Beckman Helipot 7233	620843	38
12SWA	Switch, sensitive, s.p.d.t.	Honeywell 11SM1-T	857061	38
12SWB	Switch, sensitive, d.p.d.t.	Honeywell 11SM1-T	857061	38
12TSA	Not used			
12TSB	Not used			
12TSC	Terminal block, 6-way, 5 A, front connected	Carr Fastener 77/507-6M	891066	11
				66400R Chap. 3

RFA3 Loading Servo Assembly 1R66411 (Continued)

12MOTOR1	Motor, 28 V d.c., Vactric size 18PM fitted with Vactric size 18 gearhead, 20:1 ratio, 1/4-inch shaft	10006500	11
Timing belt	Diamond Chain Co. 18XL037		
19.	ATS-1 TRANSMITTER - MAIN FRAME 1J66400		
13PLA	Connector, 35-way, female, with cover	Painton 159 series 74/10/3551/10	00
13PLB	Connector, 35-way, female, with cover	Painton 159 series 74/10/3551/10	00
13PLC	Not used		
13PLD	Not used		
13PLE	Connector, 23-way, male, with cover	Painton 159 series 74/10/2301/10	00
13PLF) to)Not used 13PLM)			
13PLN	Connector, 4-way, female, side cable entry with retaining device and earthing contact	Painton 311996	10005898

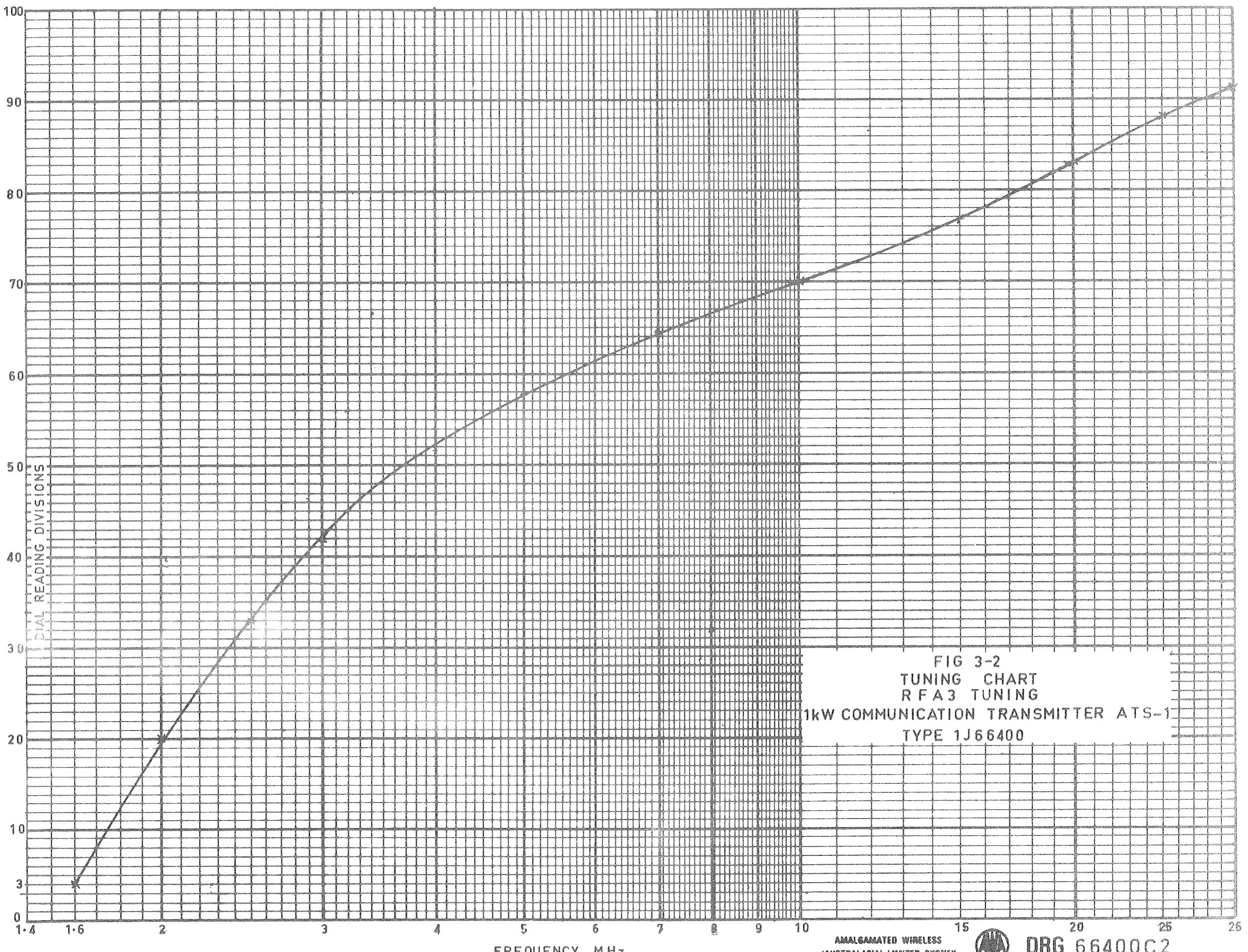
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AMALGAMATED WIRELESS
(AUSTRALASIA) LIMITED SYDNEY



DRG 66400C1



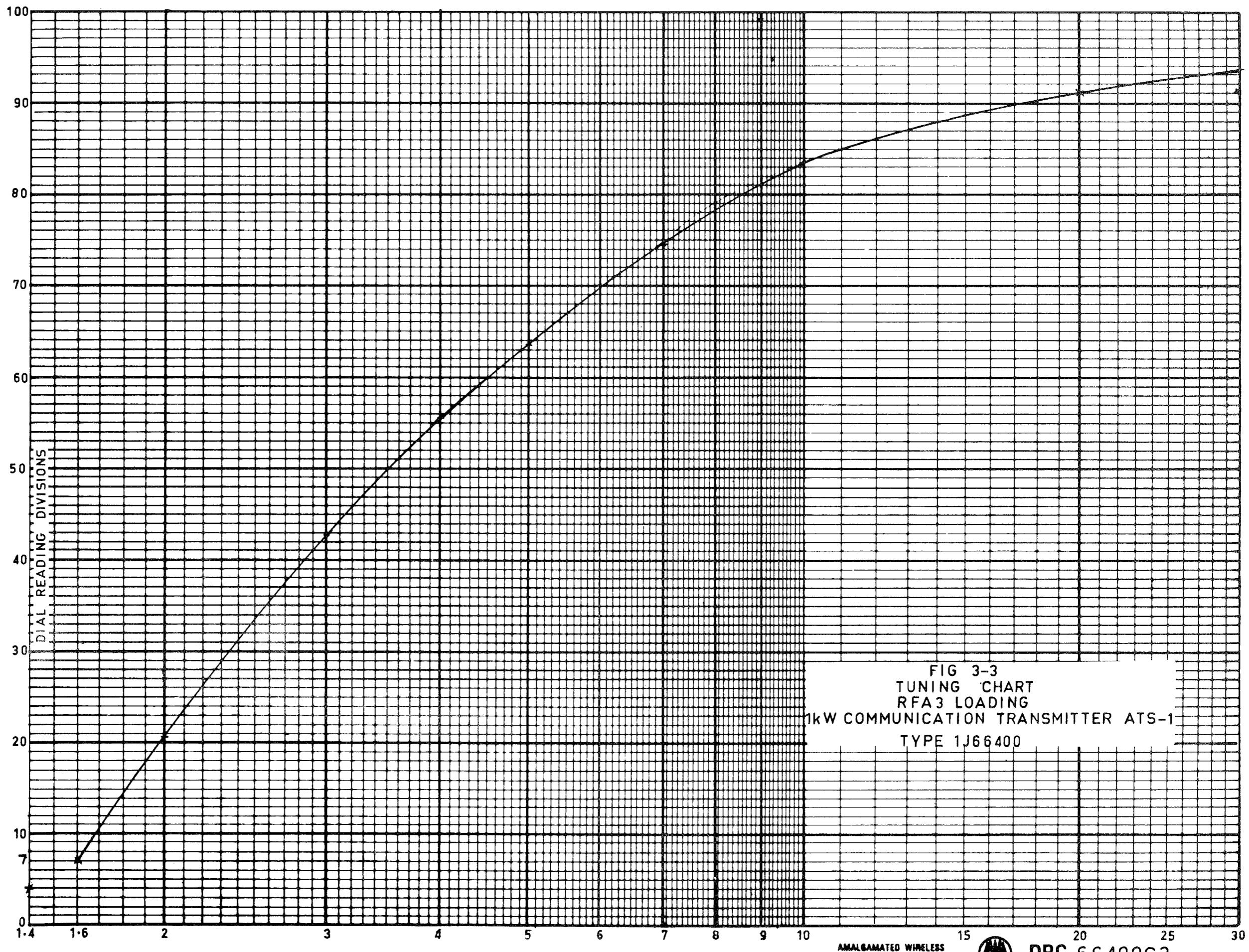
AMALGAMATED WIRELESS
(AUSTRALASIA) LIMITED SYDNEY



DRG 66400C2

PV 6099-0





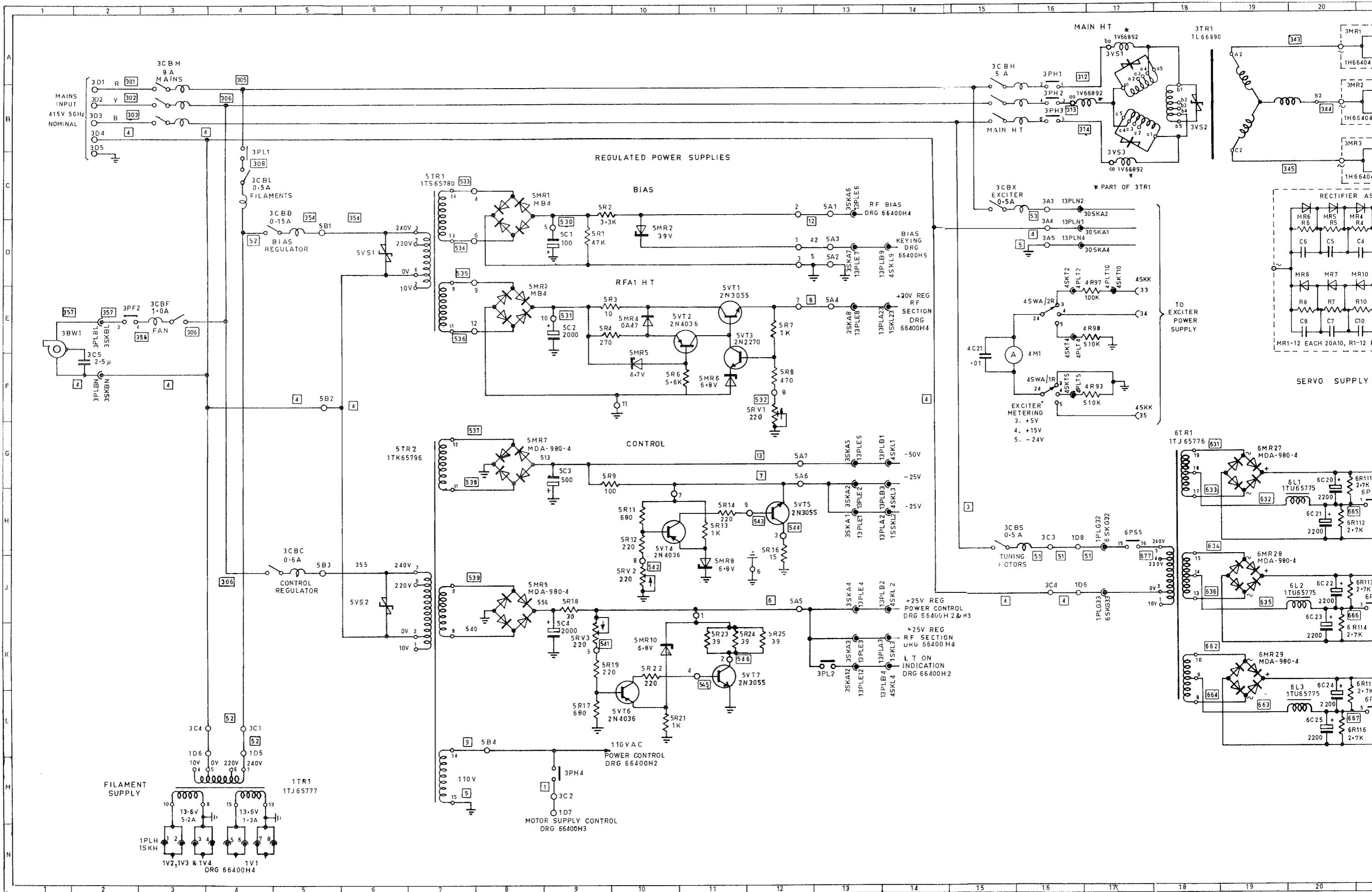
AMALGAMATED WIRELESS
(AUSTRALASIA) LIMITED SYDNEY



DRG 66400C3

PV 6100-0





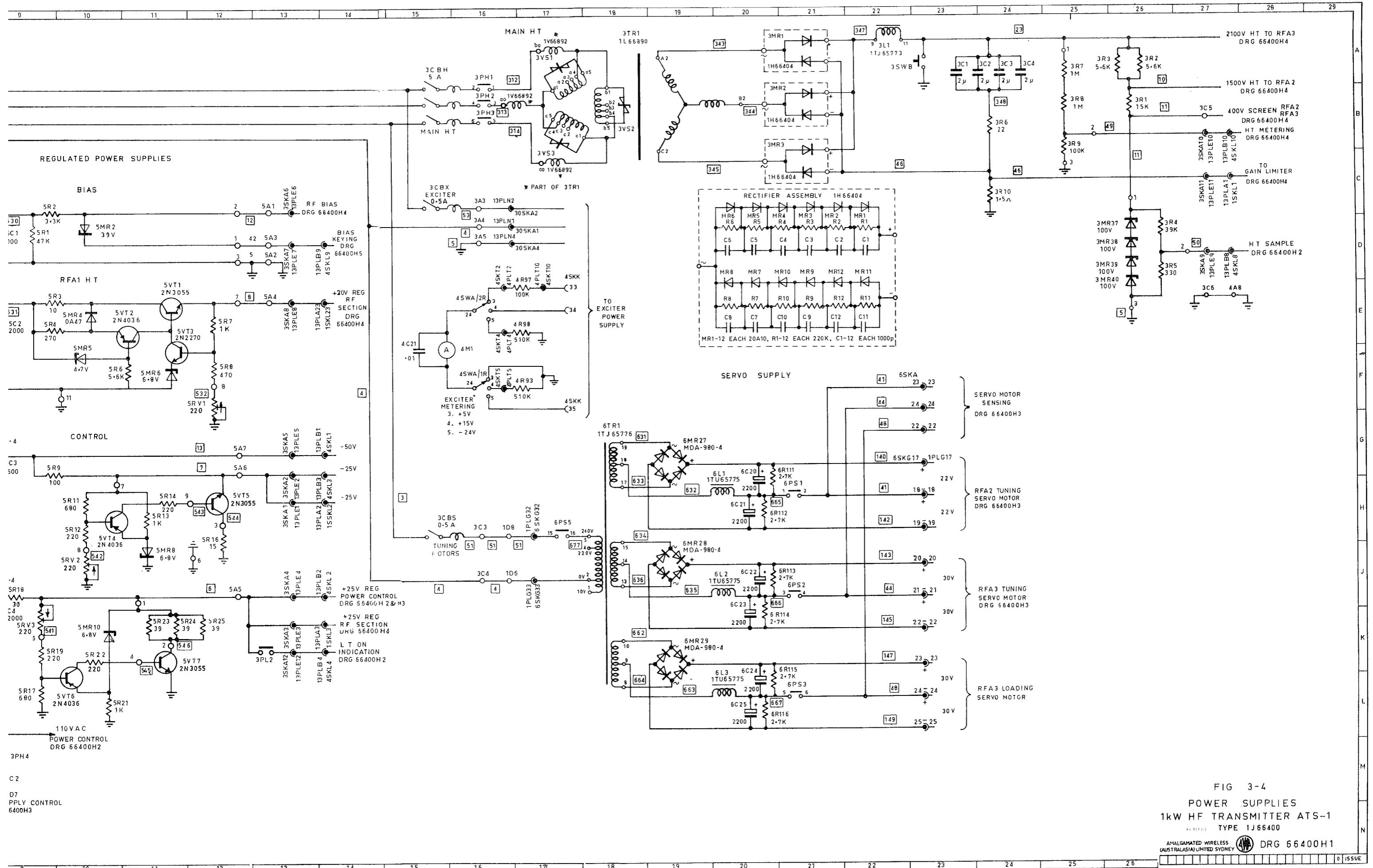
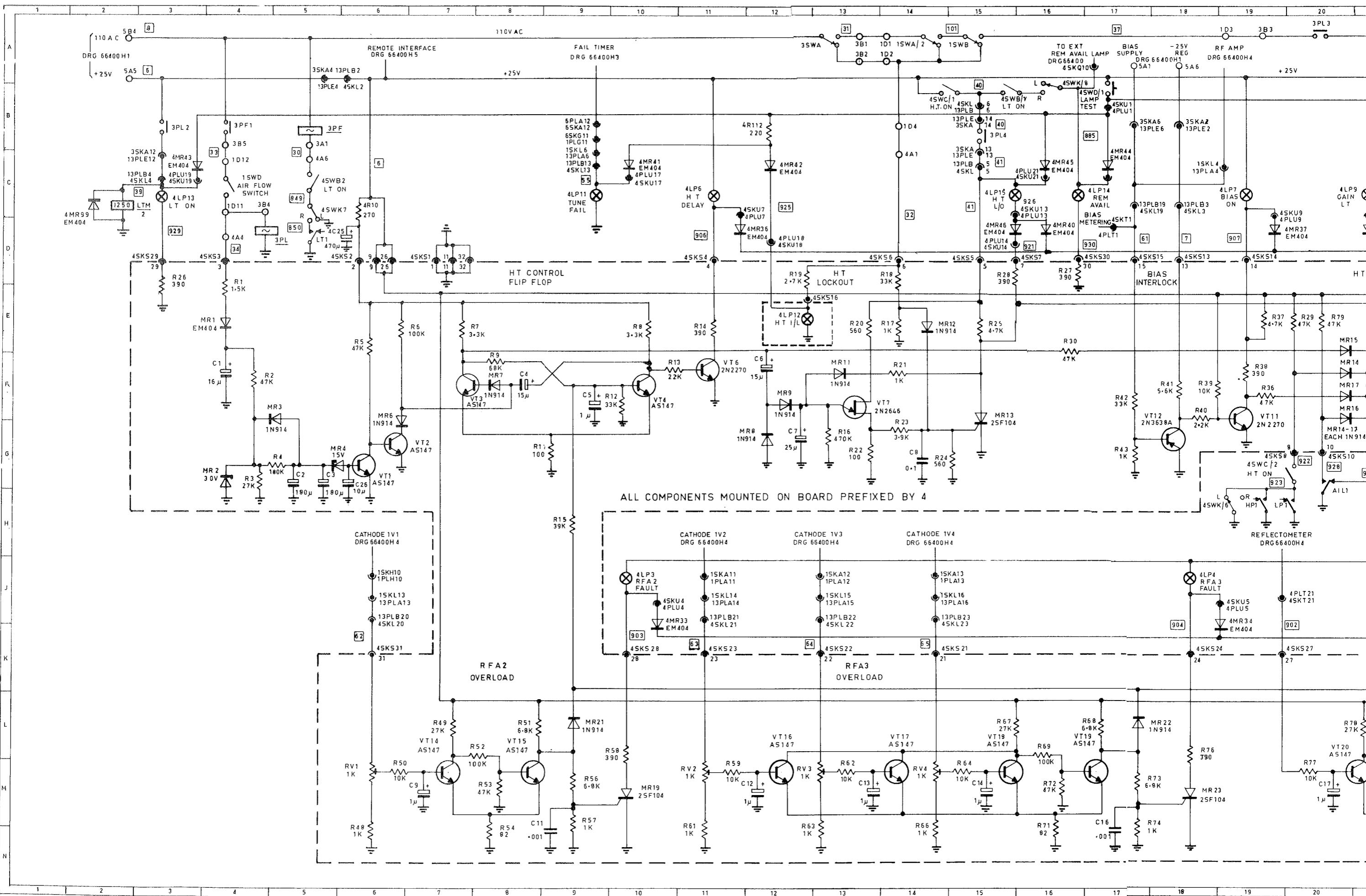
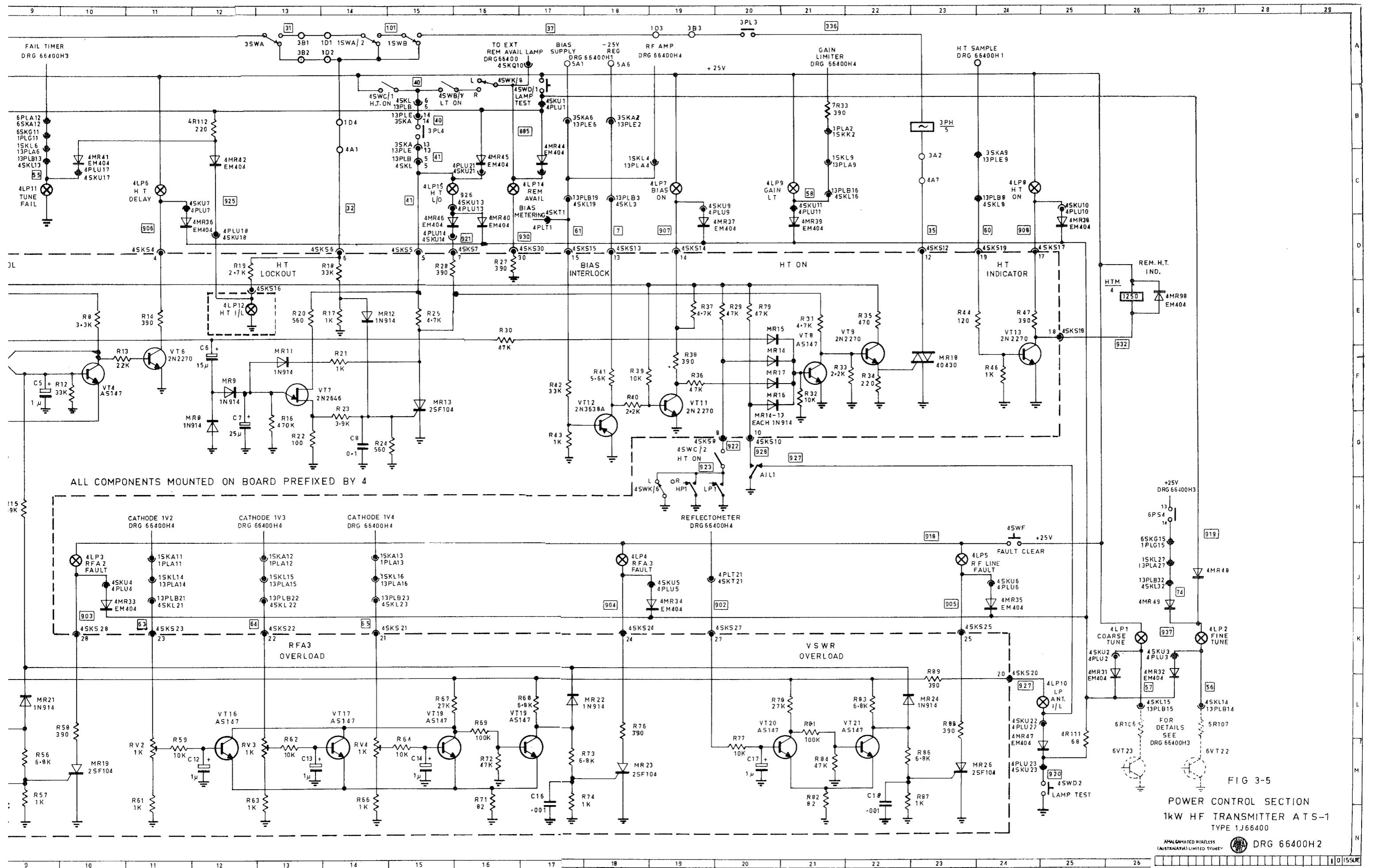
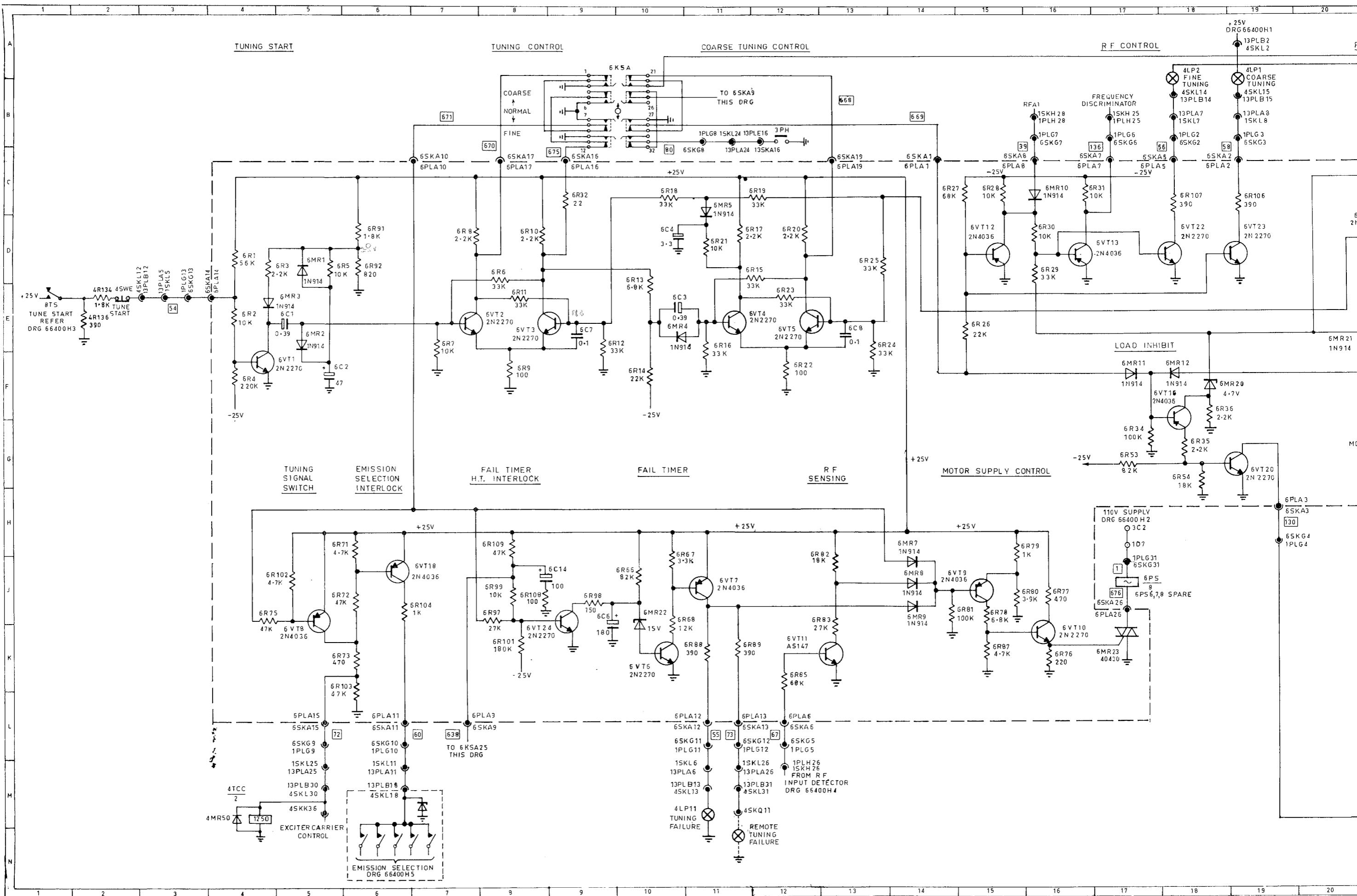


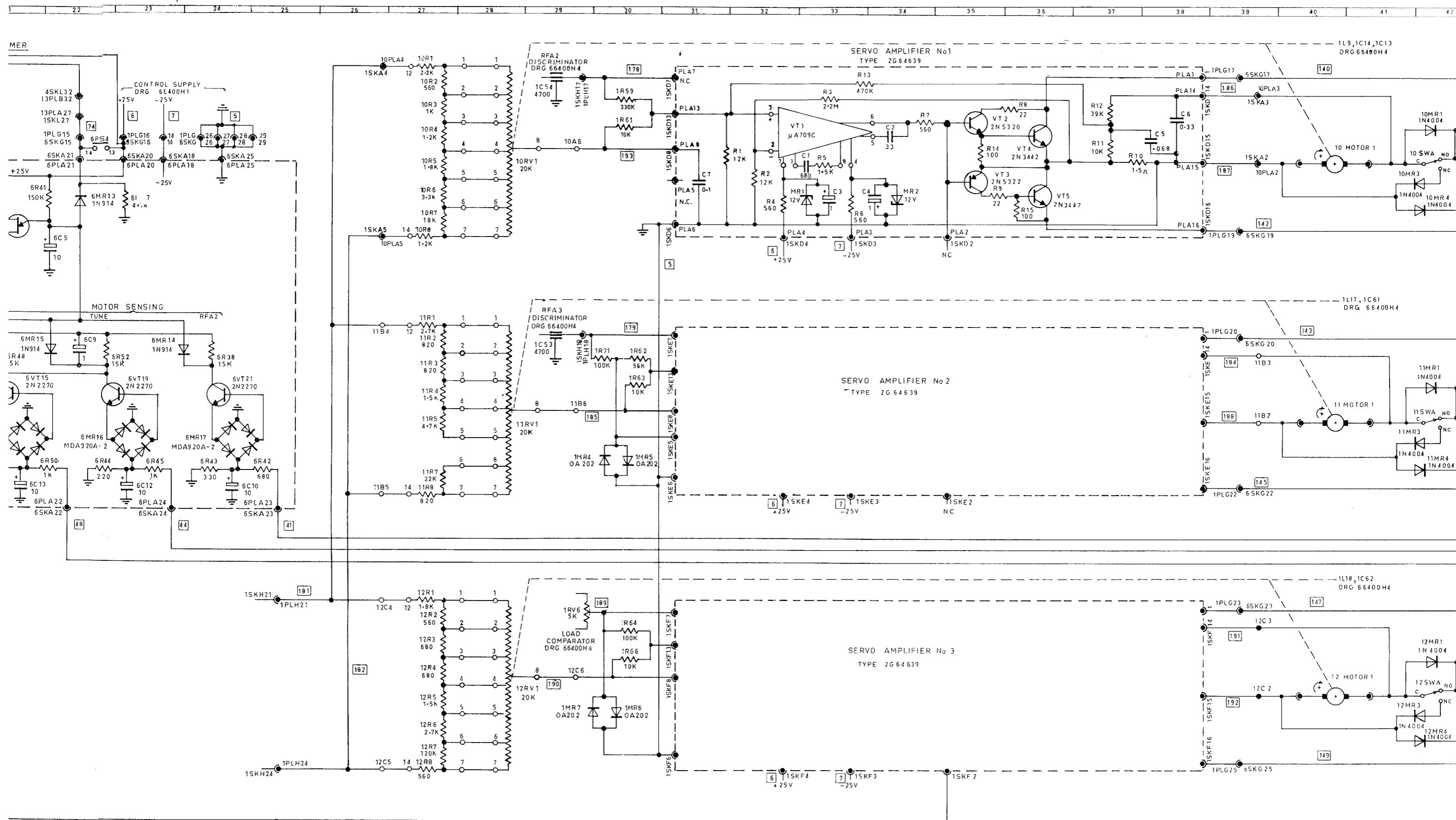
FIG 3-4
POWER SUPPLIES
1kW HF TRANSMITTER ATS-1
TYPE 1J66400
AV 6112-0

AMALGAMATED WIRELESS
(AUSTRALASIA) LIMITED SYDNEY  DRG 66400H1









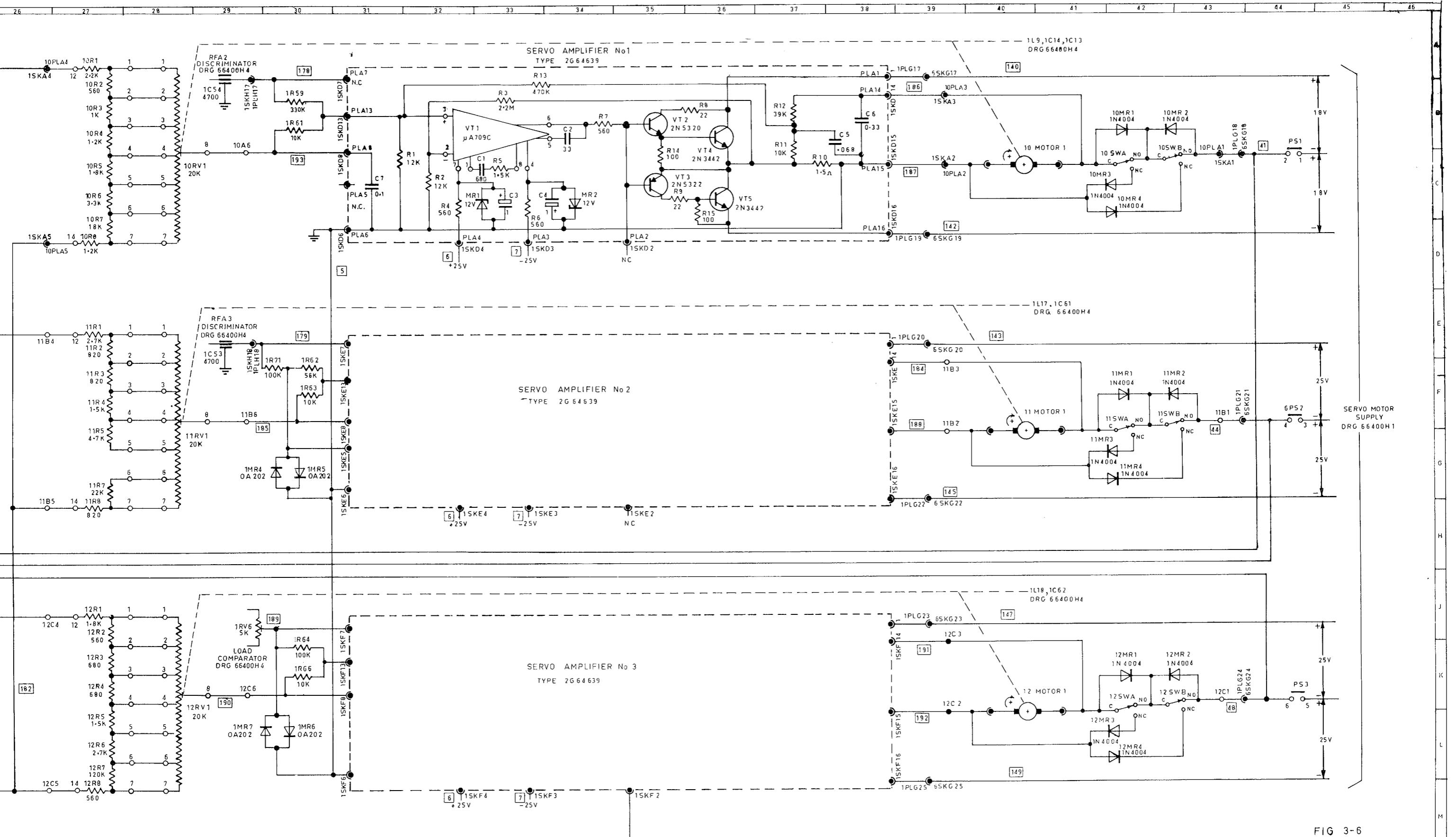
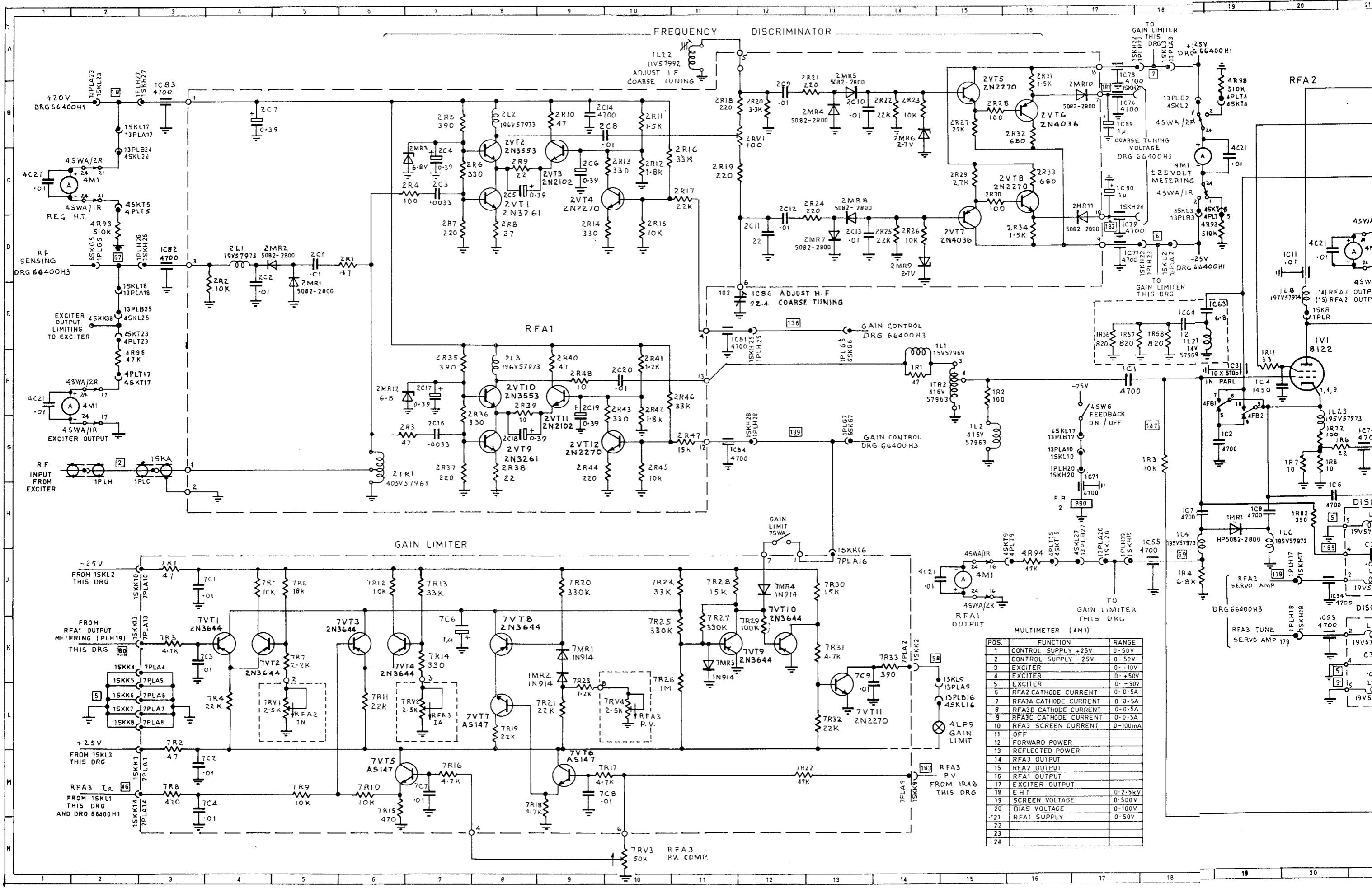


FIG 3-6

AUTOMATIC TUNING SECTION
1kW HF TRANSMITTER ATS-1
TYPE 1J66400

AMALGAMATED WIRELESS
AUSTRALASIA LIMITED SYDNEY DRG 66400H3



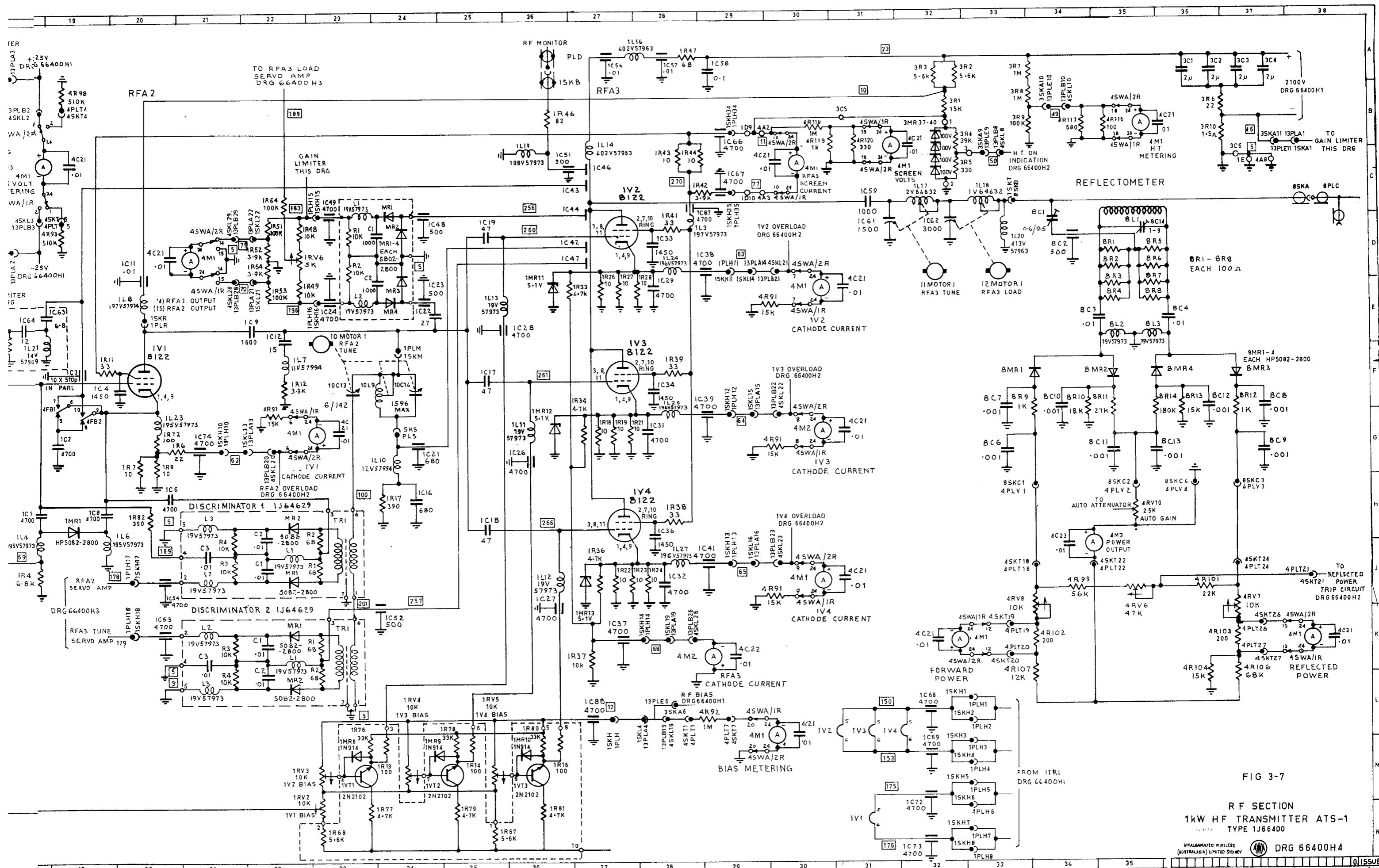
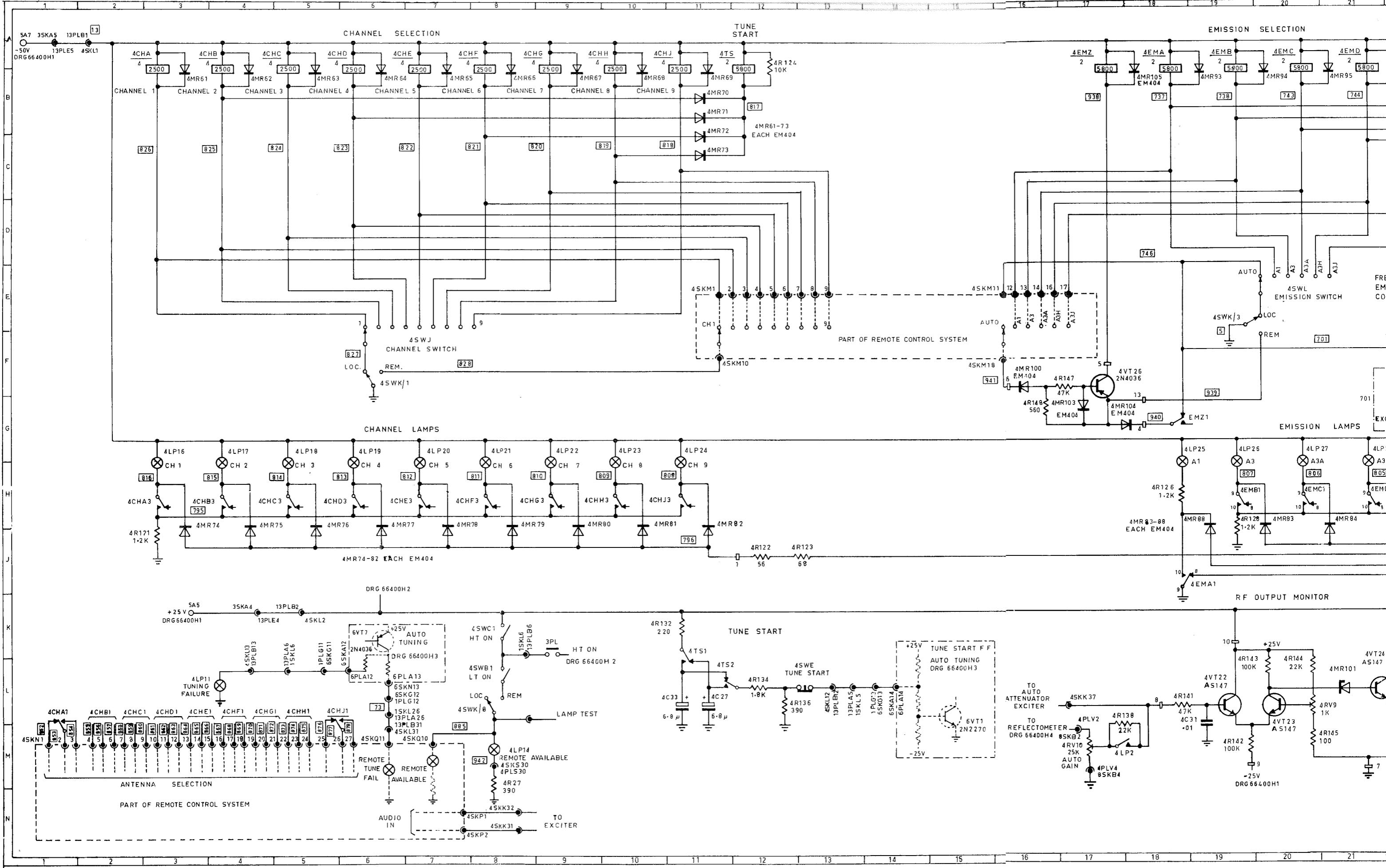
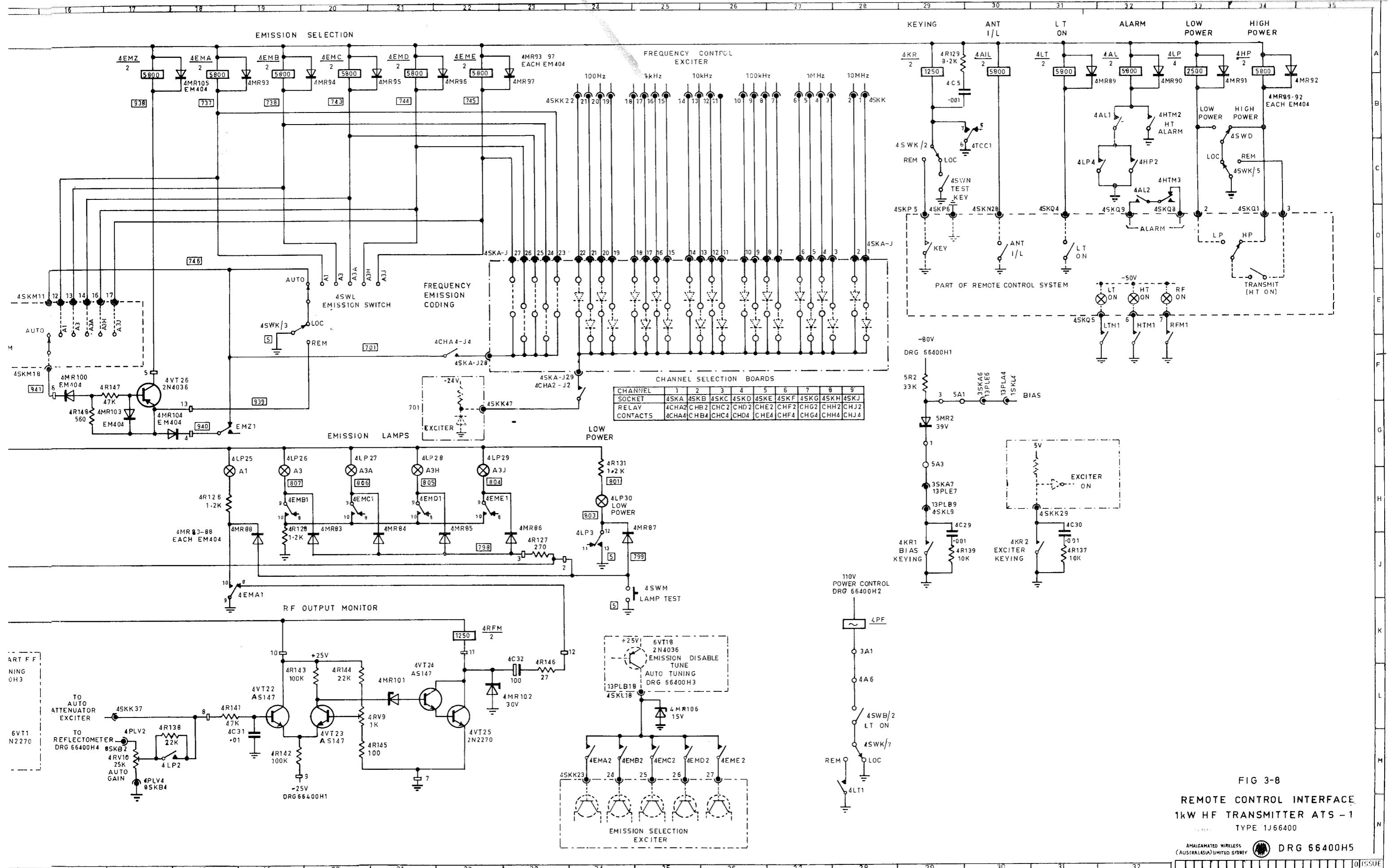


FIG 3-7

R F SECTION
1kW HF TRANSMITTER ATS-1
TYPE 1J66400

AMALGAMATED WIRELESS
AUSTRALASIA) LIMITED SYDNEY AWA DRG 66400H4





CALCULATION OF VSWR

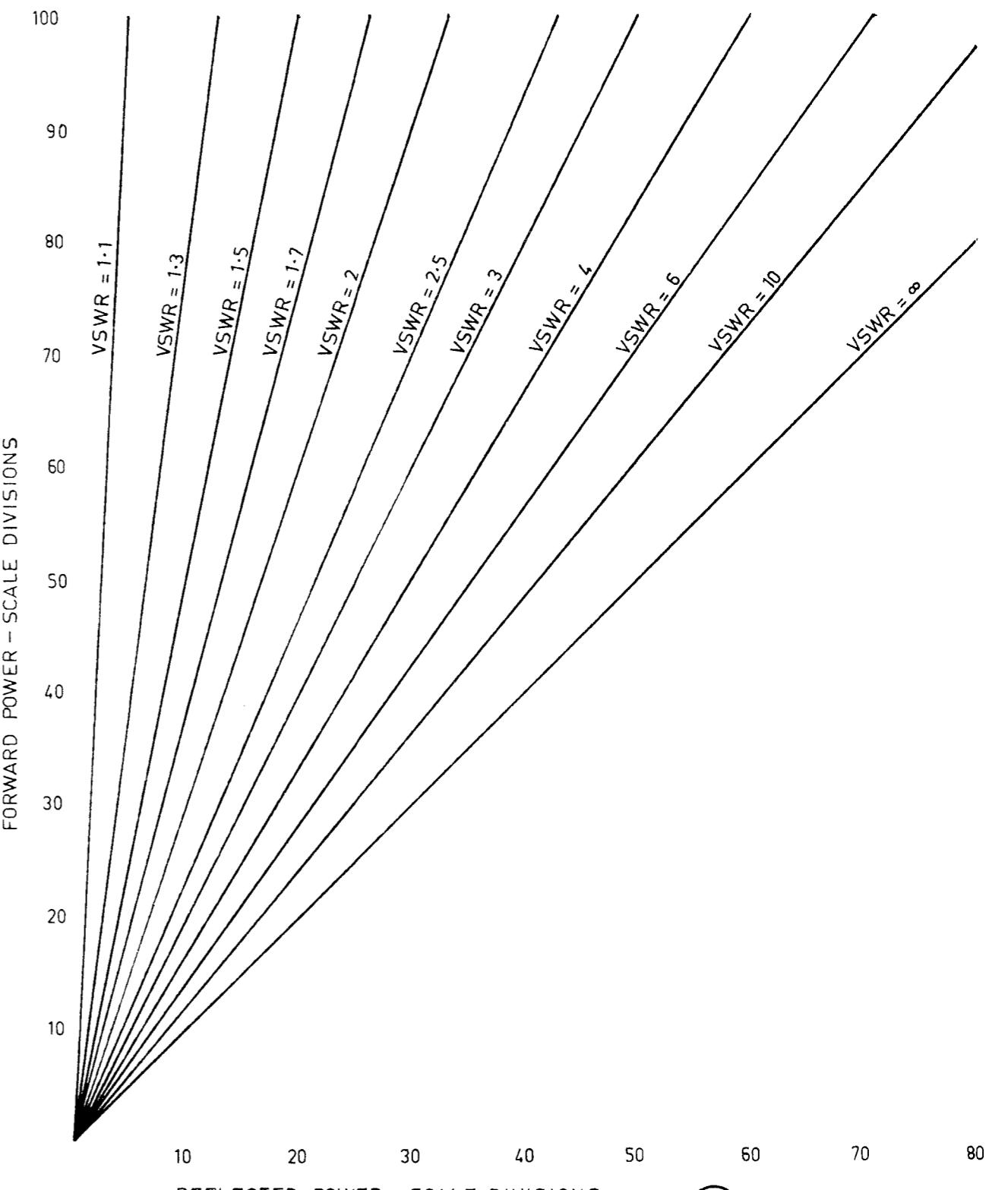


FIG 3-9 DRG 66400D23

EXTERNAL WIRING TABLE

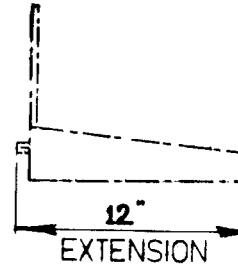
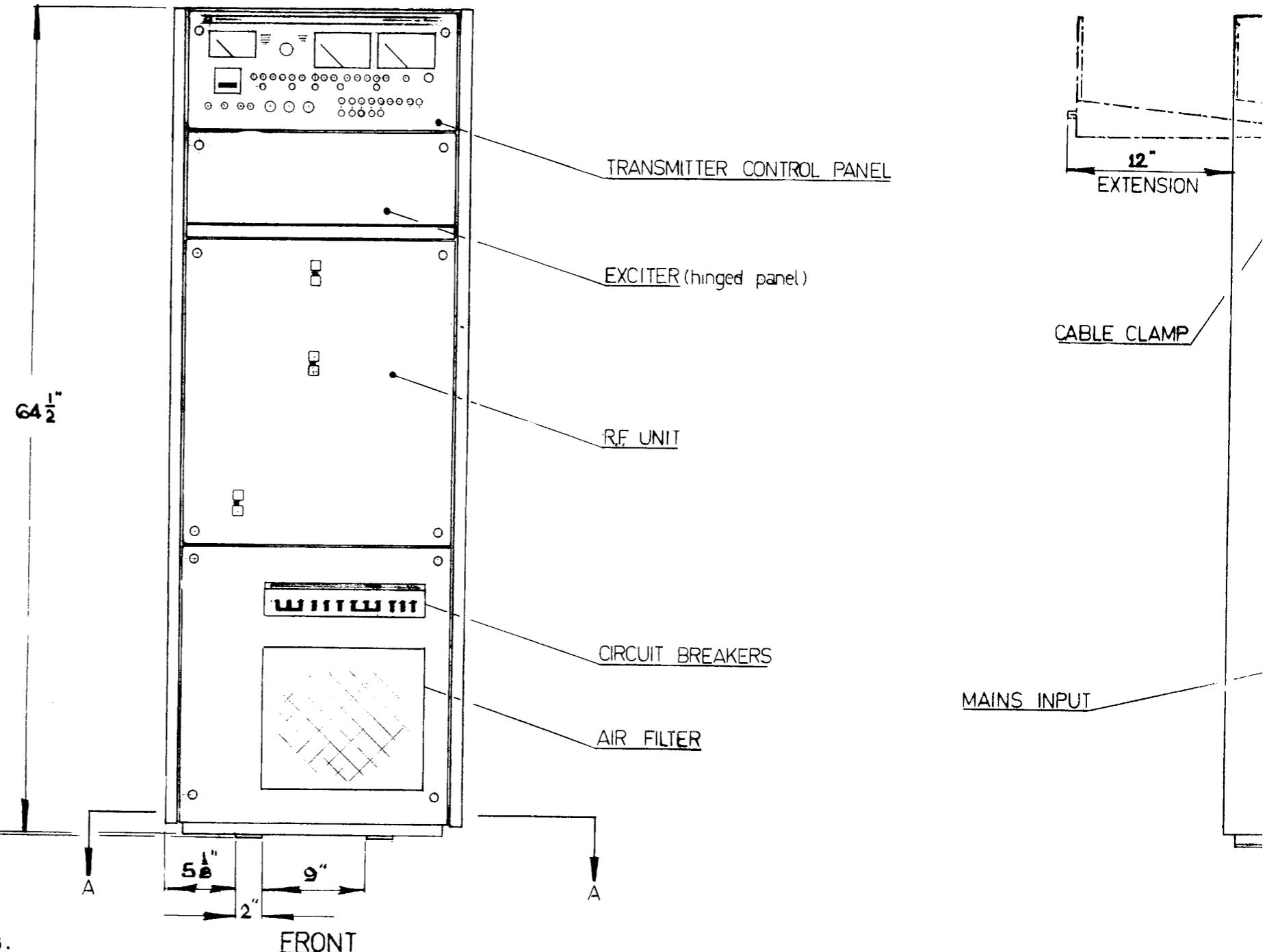
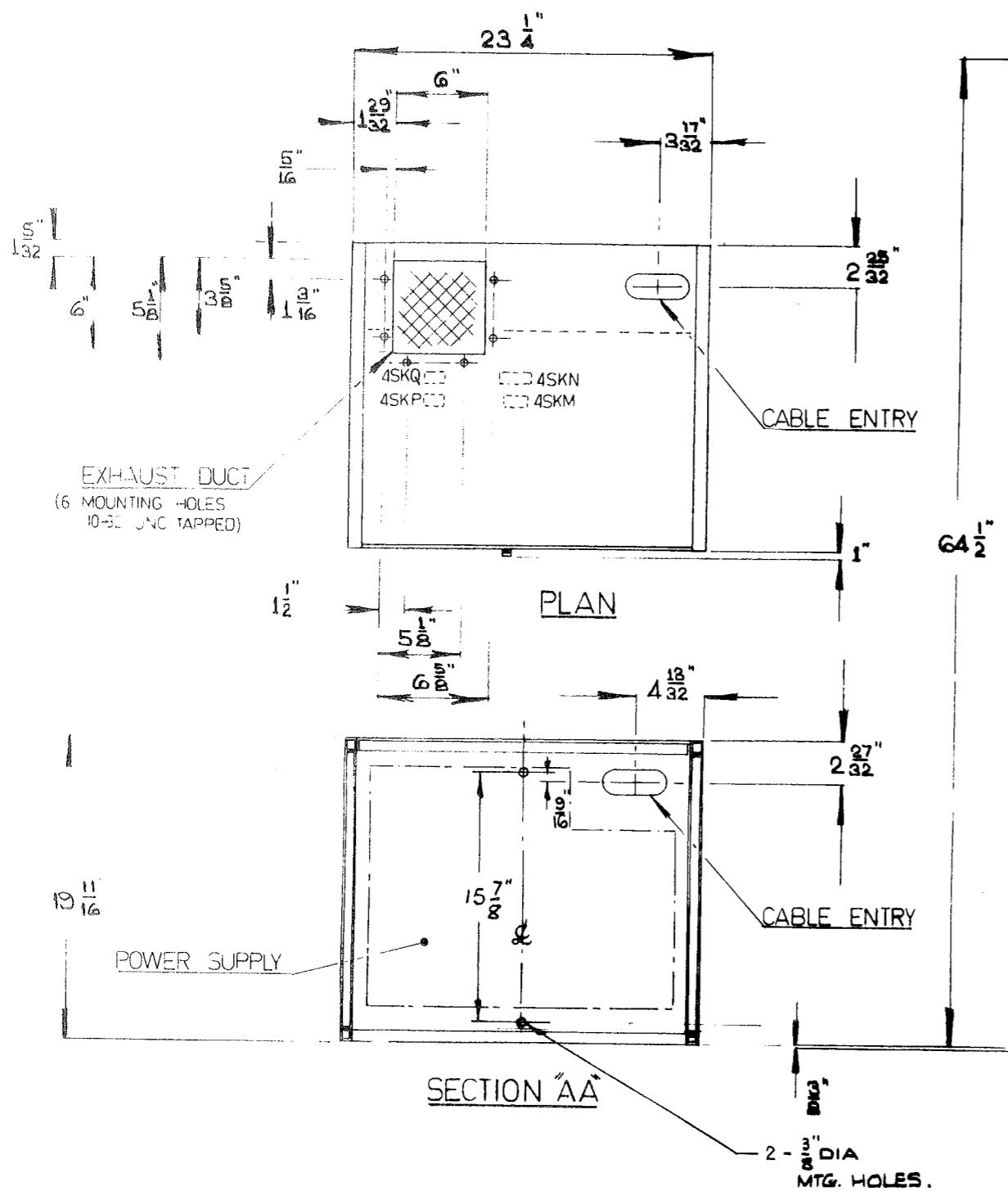
<u>CONNECTOR</u>	<u>PIN No.</u>	<u>FUNCTION</u>	<u>NORMAL VOLTAGE</u>	<u>OPERATING CURRENT</u>
3TSD (Mains Input)	1 (R) 2 (Y) 3 (B) 4 (N)	RED phase) 380/415 V YELLOW phase) 50 Hz BLUE phase) 3-phase NEUTRAL) mains	240 240 240 -	4 A 4 A 4 A -
4SKM (Channel and Emission Selection)	1 to 9 10 11 12 13 14 15 16 17 18 19-23	Channels 1 to 9 Selection Sw. Channels 1 to 9 Earth Return Spare Emission A1 Selection Sw. Emission A3 Selection Sw. Emission A3A Selection Sw. Spare Emission A3H Selection Sw. Emission A3J Selection Sw. Emission Selection Earth Return Spare	50 50 50 50 50 50 50 50 50 50	20 mA 20 mA -
4SKN (Antenna Selection and Interlock)	1 2 3 4-5-6 7-8-9 10-11-12 13-14-15 16-17-18 19-20-21 22-23-24 25-26-27 28 29-30-31	Channel 1 - Normally Closed Channel 1 - Common Channel 1 - Normally Open Channel 2 - NC-C-NO Channel 3 - NC-C-NO Channel 4 - NC-C-NO Channel 5 - NC-C-NO Channel 6 - NC-C-NO Channel 7 - NC-C-NO Channel 8 - NC-C-NO Channel 9 - NC-C-NO Antenna Interlock Spare	100 V max. (30 W max.) " " " " " " " " " " " "	OR 1 A max. " " " " " " " " " " " "- "-
4SKP (Transmitter Inputs)	1 2 3-4 5 6 7	Audio Input) Audio Input) Spare KEY/PTT Earth Spare	- - 50	- - 40 mA
4SKQ (Transmitter Control Functions)	1 2 3 4 5 6 7 8 & 9 10 11	HT ON - POWER LOW HT ON - POWER HIGH HP/LP Earth Return LT ON (Switch) LT ON (Lamp) HT ON (Lamp) RF ON (Lamp) Alarm - Normally Open REMOTE AVAILABLE (Lamp) TUNE FAIL (Lamp)	50 50 50 50 100 V max. " " " " 25	20 mA 10 mA 20 mA 10 mA OR 1 A max. " " " " 25 40 mA 40 mA
8SKA (Coaxial Socket Type HN)	Reflector- meter	R.F. Output - Recommended Cable RG34		

1 kW COMMUNICATION TRANSMITTER ATS-1
Type 1J66400

AMALGAMATED WIRELESS
(AUSTRALASIA) LIMITED SYDNEY

 DRG 66400D24

FIG 3-10



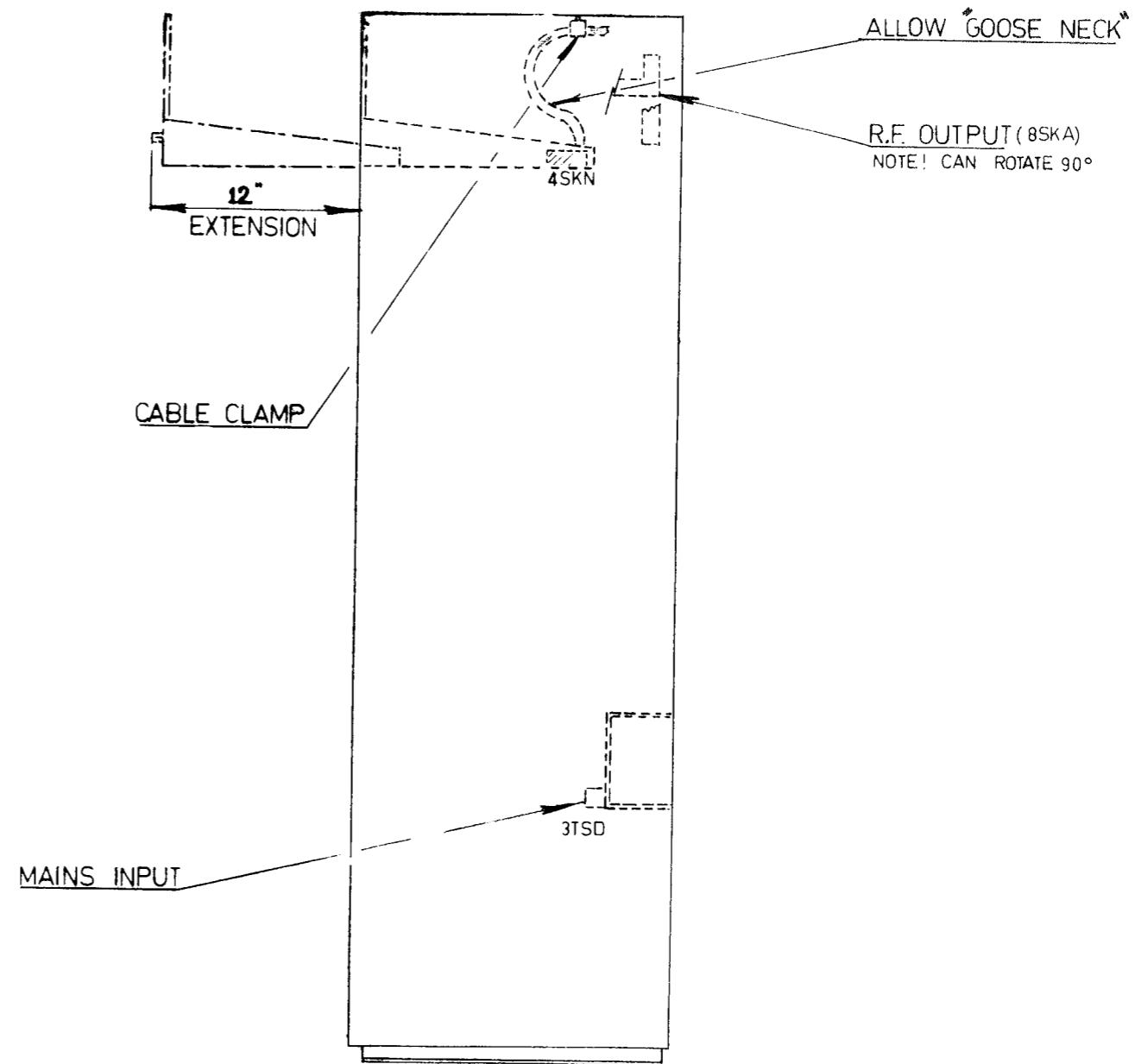
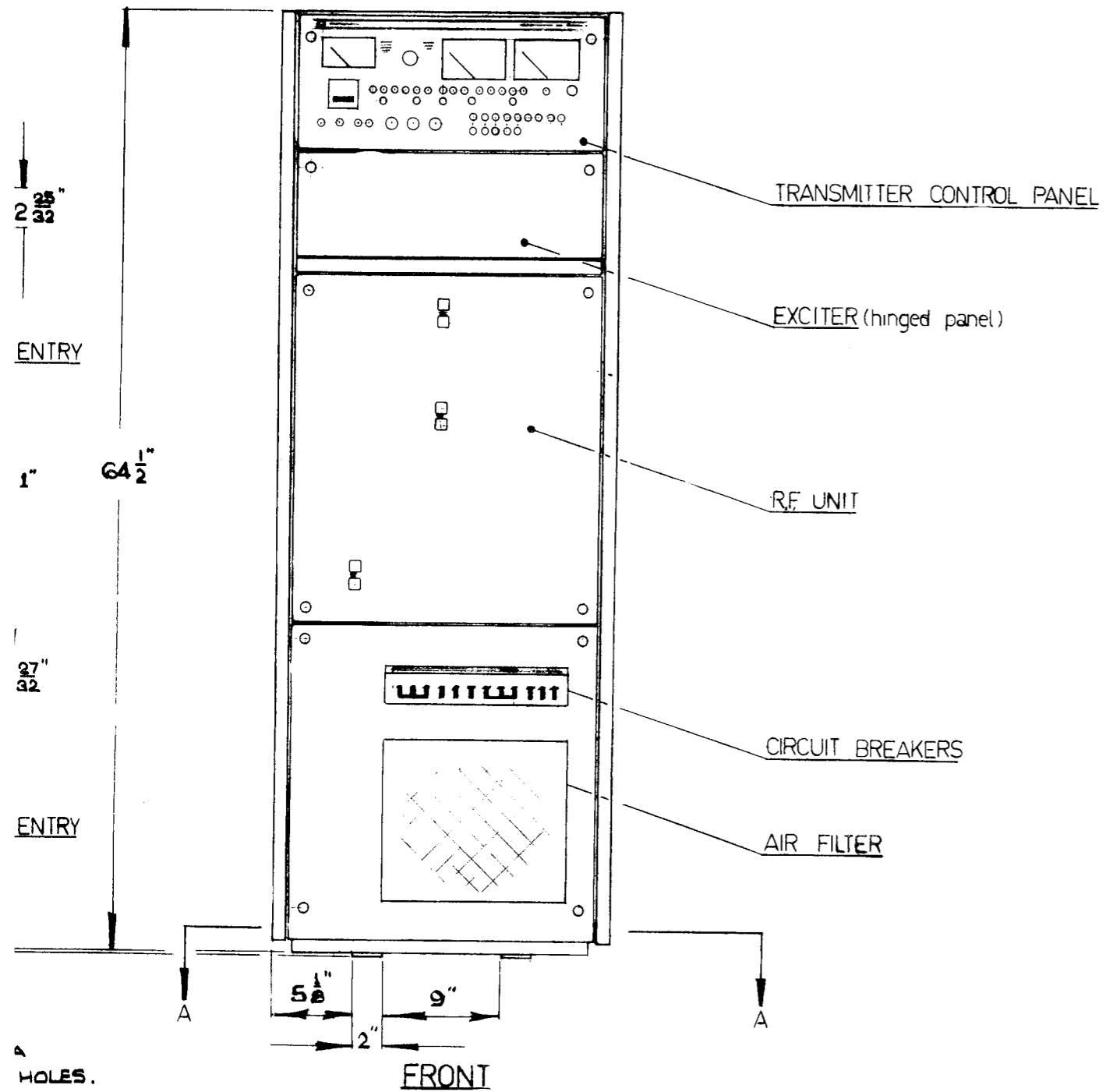


FIG 3-11

INSTALLATION DIMENSIONAL DETAIL
1kW COMMUNICATION TRANSMITTER ATS-1
TYPE 1J66400

AMALGAMATED WIRELESS
(AUSTRALASIA) LIMITED SYDNEY

 DRG 66400G1

PV 6102-0 [] 0 ISSUE