STATION RADIO B.C.C. HF156

TECHNICAL HANDBOOK - TECHNICAL DESCRIPTION

This ER must be read in conjunction with F 192 Part 2 which contains figures and tables to which reference is made.

SUBJECT INDEX

INDEX TO FIGURES

Introduction

1. The HF156 is an amplitude modulated high frequency transmitter/receiver primarily intended for use in isolated parts where difficult terrain is encountered. It is designed for simplex working operating in the frequency band 2.5-7.5Mc/s, and is capable of being switch tuned to any one of six crystal controlled frequencies in that band. The provision of six channels enables suitable frequencies to be chosen to maintain communication over long distances throughout the 24 hours. The approximate frequency coverage per channel is shown in the following table.

Channel 1	2.5-3.7Mc/s
Channel 2	2.7-4.3Mc/s
Channel 3	2.7-4.3Mc/s
Channel 4	4.3-6.0Mc/s
Channel 5	4.7-7.5Mc/s
Channel 6	4.7-7.5Mc/s

2. The set is designed for either telephony or telegraphy operation and is entirely self contained.

3. The range on c.w. with an 8 ft rod aerial is about 20 miles, and on r.t. about 12 miles. By using either a dipole, or a 1/4λ aerial with a counterpoise, these ranges are considerably increased, the precise distances being largely determined by the choice of frequency and the time of transmission.

CONSTRUCTION

4. The set is contained in a lightweight diecast waterproof case. It is approximately 17 in. high, 15 in. wide and 6 in. in depth, and can be used under extreme climatic conditions. The case is fully sealed and pressure tested.

5. The upper half of the case is occupied by the transmitter-receiver unit, the control panel of which forms a top to the whole assembly. Mounted on this control panel are the aerial and earth terminals, channel selection and system switches, b.f.o. control, gain control, meter and two 6-way sockets. Secured by means of a chain is a protection cap for fitting over either of the two sockets when one only is in use.

6. Bolted to the side of the case is the aerial tuning unit which is connected to the aerial terminal by means of a flexible connection. This unit is only used when the equipment is operating with a rod aerial.

7. The lower half of the case contains the power supply unit and two 2V accumulators, all mounted together on a metal tray which forms the bottom of the case. This tray is secured to the main body by a pair of eye-bolts and wingnuts.

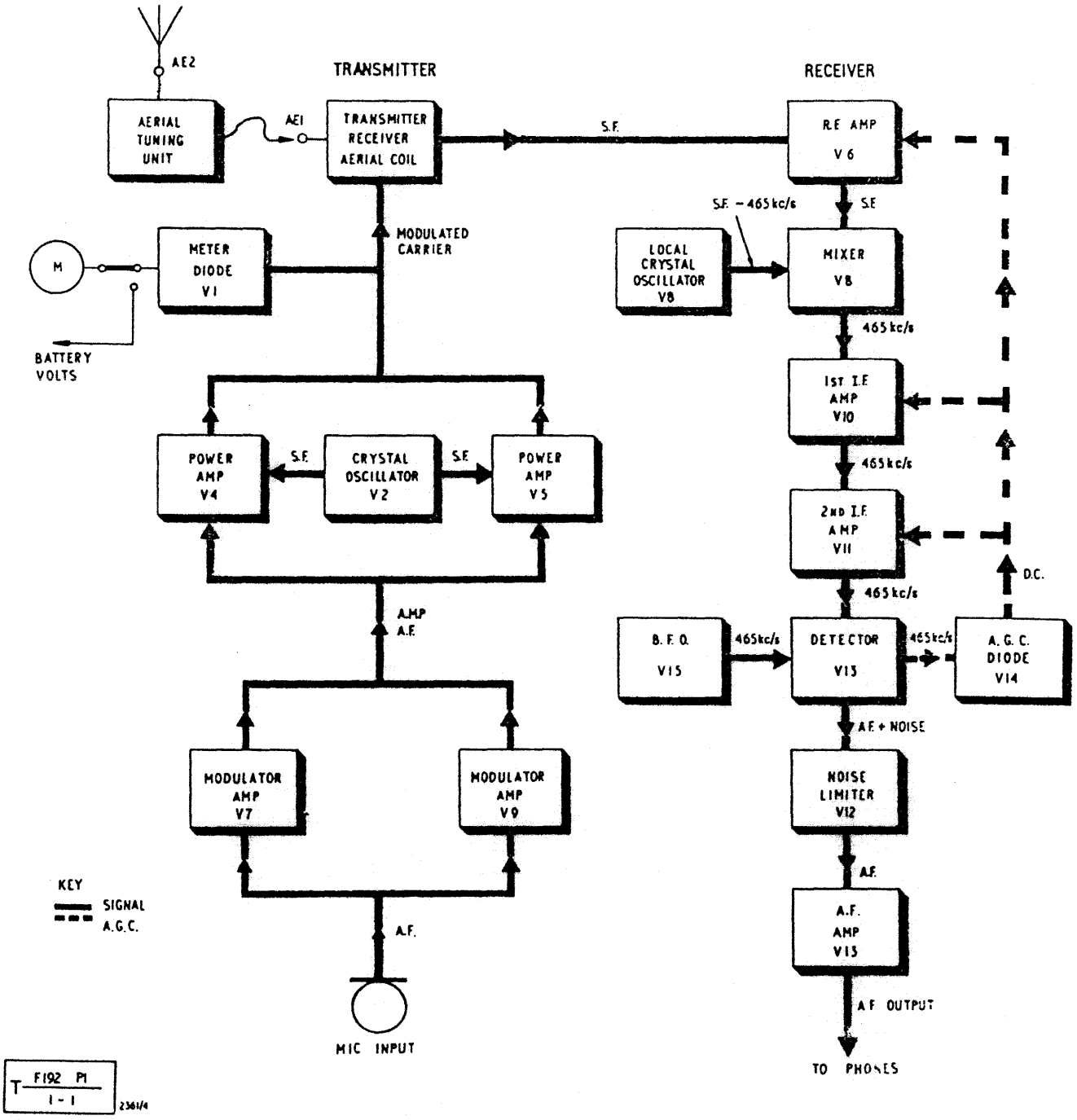

Fig 1 - Block diagram

BRIEF TECHNICAL DESCRIPTION

Principles of operation - receiver

8. The receiver is a single superheterodyne with an intermediate frequency of 465kc/s.

9. It has a single stage of r.f. amplification, V6, the tuned r.f. grid circuit of which is also used as the transmitter tank circuit in the 'send' condition. The power output from the transmitter being tapped down the aerial tuning coils T1 or T2.

10. The anode of V6 is tuned by coils L2 or L3 and the selected range trimmers.

11. The signal at V6 anode is applied to grid three of the combined oscillator and mixer valve V8. The first and second grids of this valve function as grid and anode respectively of the local oscillator which is crystal controlled. The oscillator frequency is 465kc/s below that of the incoming signal.

12. The two signals are mixed producing an intermediate frequency of 465kc/s which is selected by the tuned i.f. transformer T5.

13. After two stages of i.f. amplification via V10 and V11, the signal is demodulated by the diode section of V13. The resultant a.f. is then taken through the noise-limiter V12, to the volume control potentiometer RV1, the slider of which feeds the grid of the a.f. output valve, the pentode section of V13.

14. A part of the i.f. signal is rectified by diode V14 and the resultant voltage is used for a.g.c. purposes.

15. The beat-frequency oscillator V15 is provided for the reception of c.w. signals and is in operation only when the facility switch SB is selected to the R position. This oscillator is tuned to approximately 465kc/s and its output combined with the i.f. signal produces a beat note at audio frequency.

Principles of operation - transmitter

16. The transmitter consists of a crystal controlled oscillator valve V2, the selected crystal used to resonate the stage is connected between grid and anode via channel switch SA2F and SA3F. A voltage limiter V3, is connected in parallel with the crystal to prevent overloading and consequent disintegration of the crystal. V2 is choke-capacity coupled to the parallel connected power output stage comprising valves V4 and V5.

17. For telegraphy working the transmitter is keyed on and off by switching the h.t. supply to the valves by means of the morse key which operates relay RLC in the transistorised power unit (p.u.).

18. For telephony working a carbon microphone is connected to the modulator input transformer T4 which drives the two modulating valves V7 and V9, these being connected in push-pull. As the secondary winding of T3 carries the h.t. supply to the power amplifying valves, V4 and V5, modulation is effected. The d.c. polarising voltage for the microphone is derived from the l.t. supply when the microphone switch is closed.

19. During r.t. operation a fraction of the modulating signal present in the secondary winding of T4 is taken to the primary of the audio output transformer, T8, in the receiver, thus providing sidetone in the handset or headphones when transmitting.

L.T. supply

20. Two 2V accummulators are connected in series, the negative pole being earthed to the chassis. All filament supplies are series-paralleled via the system switch SB and relay RLA, and only those valves which are required to function in a particular mode of operation are powered in order to conserve battery energy.

H.T. supply

21. A transistor convertor oscillator comprising VT1 and VT2 together with transformer T1 in the p.u. provide the h.t. supply; the h.t. winding of T1 is tapped for two output voltages. The lower voltage is used for the receiver supply, the higher when supplying the transmitter, the changeover being effected by relay RLD contact 1 located in the p.u. Conventional smoothing arrangements are used utilising choke LFC1 and capacitor C6 both located in the power unit.

Bias supply

22. Bias voltage for the transmitter modulator valves is obtained from an additional winding on T1 via rectifier MR1, the output being taken from pin 12 of SKTA.

DETAILED ELECTRICAL DESCRIPTION

AERIAL CIRCUIT

23. The input from the aerial is taken to the switch wafer SA1B which selects the primary winding of the input transformer appropriate to the desired channel. On channels 1 to 3 the r.f. input circuit comprises T1 tuned by C17, C16 or C15, on channels 4 to 6 the r.f. transformer T2 is employed tuned by C14, C13 or C12. The tuned secondary winding of either T1 or T2 is selected by SA4B and the tuning capacitors by SA4F.

24. These tuning circuits are common to both transmitter and receiver, and alignment of them is carried out in the transmit condition. When once adjusted, they should not be altered during subsequent receiver alignment.

25. When the set is used with a rod aerial for mobile operation the aerial is connected to the AE2 input and is matched to the input impedance by means of the aerial tuning unit (a.t.u.). This comprises a variable inductance which is varied by operating the knurled knob at the bottom of the aerial tuning unit.

RECEIVER

R.F. stage

26. The signal at the anode of V6 is coupled to the frequency changer valve V8, via R8 and C29. Resistor R8 is, however, shorted out on channels 4, 5 and 6 by switch wafer SA7B in order to maintain a more nearly constant amplitude signal input to the frequency changer on the higher frequency bands. The screen of valve

V6 is held at a relatively constant voltage by being fed from the potential dividing chain of R6 and R7, and is decoupled by capacitor C27.

27. The first and second grids of V8 act as grid and anode respectively of the local oscillator which is crystal controlled, the appropriate crystal is selected by switch wafers SA5F and SA6F. On channels 1, 2 and 3 an additional capacitor, C36, is connected in parallel with C32 by SA6B, to maintain the potential dividing ratio of C32 and C34 on the lower frequency bands.

28. The oscillator frequency is 465kc/s below that of the signal frequency, the two frequencies being mixed in V8 to provide an i.f. output at V8 anode. The h.t. supply to V8 anode is taken via the primary winding of T5, whereas the supply to grid 2, (ie the oscillator anode), is via RFC2 and 3.

I.F. stage

29. The i.f. output is selected by T5 which is an overcoupled doubler tuned transformer. There are two stages of i.f. amplification, V10 which is coupled from V8 by T5, and V11 which is coupled from V10 by T6. Transformers T5, T6 and T7 all have the same electrical characteristics. The h.t. supply to V10 and V11 anodes and screens is fed through decoupling components R18 and C40, and R20 and C56.

30. The output from V11 is taken via T7 to the detector diode section of valve V13; demodulation being effected by the diode and components R22, R23 and C42. The resultant demodulated voltage is passed through a series noise-limiter diode, V12, and C45 to the volume control potentiometer RV1. The associated noise limiter components are R24, R25 and C44. Threshold bias for diode V12 is provided by the rectified carrier voltage developed across R22.

A.F. stage

31. The a.f. signal is fed to the control grid of the output valve which is the pentode part of V13. The anode load of this stage is the primary winding of T8, the output transformer, which matches the valve to the headphones. To enable two telephone headsets to be used at the same time T8 secondary is taken to two parallel connected sockets, SKTB and SKTC, only one of which is shown in fig 2501 and 2503. For detailed connections of associated plugs PLB and PLC-A or PLC-B see fig 2504.

Automatic gain control

32. Part of the i.f. signal is taken via C43 and rectified by diode V14, the resultant voltage developed across R21 is applied to the grids of V6, V10 and V11 for a.g.c. purposes. Positive bias is applied to V14 from the l.t. supply of V15 filament to provide the delay voltage necessary for the correct operating point of the a.g.c. circuit.

Beat frequency oscillator

33. The b.f.o. V15 is provided for the reception of c.w. signals and is operative only when the facility switch SB is set to the R position. This oscillator is tuned to 465kc/s by transformer T9. The output is then taken via capacitor C47 and combine at the diode of valve V13 with the i.f. signal so producing an audio beat note. The trimmer capacitor C55 enables the beat frequency oscillator to be varied thus affecting the resultant audio tone produced.

H.T. and l.t. supplies (Fig 2503)

34. The h.t. supply is taken from PLA pin 5 via relay contact RLA1, (when RLA is de-energised), to all receiver valves except V15. V15 is supplied when the facility switch is in the R position only, the supply is then taken via SB2B contacts 6 and 7 (ref B3).

35. The l.t. to the six receiver valves is arranged in series parallel and connected to the battery supply via the dropping resistor R32, relay contact RLA2, and the system switch wafer SB2F in the R and RT positions only.

TRANSMITTER

R.F. stages

36. The oscillator valve V2 is a pentode valve using any one of the six crystals, selected by the channel switch SA2F and SA3F, connected between grid and anode via d.c. isolating capacitor C5. In parallel with the crystal is the voltage limiter neon V3, which is to restrict the feedback voltage and so prevent overdriving the crystal. The grid resistor R2 is by-passed for h.f. noise by means of C6.

37. The h.t. to the anode is fed via RFC1, a radio frequency choke, while the screen supply is via screen resistor R1 decoupled by capacitor C2.

38. The output from the oscillator is choke-capacity coupled by means of C7 to the grids of V4 and V5, these two valves are in parallel and form the power amplifier output stage. Both valves share a common grid resistor R4 and a common screen feed resistor R3 decoupled by C9.

39. The anodes are fed via switch SA1F and a tapping on either T1 or T2 secondary winding, depending on the range selected. The h.t. is end fed to these transformers via the modulating transformer winding terminals 1 and 2 and relay contacts 22 and 23 of RLA1.

40. On channels 1 to 3 the power amplifier anode load consists of r.f. transformer T1 which is tuned to resonance by C17, C16 or C15 and on channels 4 to 6, the r.f. transformer T2 is used tuned to resonance by C14, C13 and C12. The appropriate transformers are selected by SA1F and the tuning capacitors by SA4F. The secondary windings of T1 and T2 are taken to the aerial terminal AE1 by switch wafer SA1B.

41. For telegraphy operation the transmitter is switched by interrupting the h.t. supply to the transmitter valves by operation of the morse key connected across pins C and D of PLB, which in turn operates relay RLC in the transistorised power unit (p.u.).

Modulator

42. For telephony operation the carbon microphone is connected via pins F and C of either socket SKTB or SKTC to terminals 1 and 5 of the input transformer T4, the d.c. resistance of which is 10Ω. The secondary terminals 2 and 4 are connected to the input grids of V7 and V8, the modulating amplifier valves, which operate in push-pull. These valves are biased to operate in class AB1, the necessary bias voltage of approximately -19V being derived from the s.u.t. rectifier MR1, via pin 12 of PLA. This voltage is developed across R13 and taken to terminal 6, the centre tap of the modulator input transformer.

43. The d.c. polarising voltage for the carbon microphone is derived from the l.t. supply via pin 8 of PLA, SB2F contacts 3 and 5, R30, winding of T4, and is applied via pins C and F of plug PLB to the microphone when the switch on the handset is closed.

44. The anode supply voltage to V7 and V9 is fed via the primary winding of the modulator output transformer. This supply is by-passed for r.f. by C28 and C33.

45. The secondary of the modulator output transformer T3 carries the h.t. anode current for the power amplifier stages V4 and V5, while one section of the primary carries their screen current, (ie at V7 anode supply point), consequently the r.f. carrier is modulated by the audio frequencies. The screen voltage feed to modulator valves is taken from the h.t. point via screen dropping resistor R10 decoupled by C30.

Sidetone

46. During r.t. operation a fraction of the modulating signal from the secondary of the modulator input transformer T4, is taken via C60 to the primary winding of the audio output transformer T8 and is thus heard in the headphones or handset when transmitting.

H.T. and l.t. supplies

47. The positive side of the h.t. supply is taken from PLA pin 5 via relay RLA1 (when energised) to the transmitting valves. The 2.8V filaments of the modulator valves V7 and V9, are connected in parallel with one side earthed and are fed from the l.t. positive supply from pin 8 of PLA, SB2F contacts 3-5, microphone switch on headset or handset connected across A and B pins of SKTB or SKTC, R28 and SB3B contacts 2-4 when the system switch is in the RT position. In the S and TUNE AE positions the dummy load resistor R27 is substituted via SB3B contacts 3 or 5 respectively for the filament load to present a constant load on the power pack.

48. Valves V2, V4 and V5 are fed from the same source but are switched by SB3B contacts 2-12 when the system switch is in the S, RT or TUNE AE position.

TRANSISTORISED POWER UNIT AND RELAY SWITCHING
(Fig 2502 and 2503)

49. The l.t. positive line is connected to the centre-tap of T1 primary, the ends of which are connected to VT1 and VT2 emitters. Both collectors and the l.t. negative line are permanently connected to chassis.

50. The bases of VT1 and VT2 are connected via a centre-tapped feedback winding to one of the bias circuits selected by RLC1 or RLC2. The oscillator can only operate when both RLC and RLD are in the same condition, ie, both energised or both de-energised. In the de-energised state, (receive) the feedback voltage is adjusted by RV1, whereas in the energised condition RV2 is adjusted for optimum feedback when transmitting. These values are considerably different from each other to accommodate the differing values of h.t. voltage required between receiver and transmitter working, additional turns being added to the secondary of T1 by the operation of RLD1. In the OFF position, with both relays de-energised, operation is prevented by SB1B short-circuiting together the bases of VT1 and VT2.

Meter circuit

51. The meter M is permanently connected between PLA, pin 8, and chassis, and thus indicates the voltage of the accummulators. A series resistor R16 is incorporated in the positive lead.

52. When the system switch is set to TUNE AERIAL the r.f. stages of the transmitter are brought into operation and an additional resistor R14 is placed in parallel with R16, thus increasing the standing reading on the meter, while at the same time a voltage derived from the rectification of part of the r.f. signal by diode V1 is applied in opposition via R17. This negative voltage is inversely proportional to the r.f. current in aerial circuit, and is at minimum when the transmitter output circuit is resonant, and therefore in this condition a maximum deflection of the meter needle is obtained.

SYSTEM SWITCH

53. The functions performed by the various sections of the system switch SB for each mode of operation are summarized below. Switch SB consists of three wafers numbered 1, 2 and 3. The letters F and B signify front and back respectively of a wafer. The bracketed characters refer to the diagram and location of the various switch wafers to facilitate reference to them.

OFF position

54. SB1B tags 11, 12: (3A1) — Short-circuits the bases of VT1 and VT2 in the p.u. thus rendering the oscillator inoperative.

Receive position R

55. (a) SB1F tags 3, 4: (3E5)
- (i) Connects one side of the output transformer T8 and SKTB, SKTC pin C, to chassis.
- (ii) Connects PLA, pin 10, to chassis thus completing the base circuit of the p.u.

(b) SB2B tags 6, 7: (3B3) — Connects the h.t. positive supply to the b.f.o. valve V15.

(c) SB2F tags 11, 8: (3B6) — Connects the receiver valve filaments to the 4V positive line at PLA, pin 7, via series resistor R32 and relay contacts RLA2 (de-energised).

(d) SB1F tags 4, 5: (3B3) — Connects p.u. smoothing capacitor C6 to chassis.

Send position S

56. (a) SB1F tags 3, 4: (3E5)
- (i) Connects SKTB, SKTC, pin C, and therefore one side of the morse key, to chassis.
- (ii) Connects PLA, pin 10, to chassis thus completing the base bias circuit of the p.u.

(b) SB2F tags 2, 5: (3F6)

(i) In series with SB3B, tags 2-12, completes the circuit for the transmitter valve filaments.

(ii) Connects PLA, pin 9, to the l.t. supply so energising relay RLA and RLD, with the following results:-

Contact RLA1 disconnects the h.t. positive line from the receiver and connects it to the transmitter stages.

Contact RLD1 switches the secondary tap on transformer T1 in the supply unit.

Contact RLD2 switches VT1 and VT2 in the supply unit from receiver base biasing (R1, R2, RV1) to transmitter base biasing (R3, RV2).

(c) SB3B tags 12, 2: (3C3)

Connects the transmitter valve filaments V2, V4 and V5, via R28 and SB2F, to the l.t. supply at PLA, pin 8.

(d) SB3B tags 3, 2: (3E3)

Connects a dummy load resistor R27 into circuit in place of the modulator, V7 and V9 filaments.

(e) SB3F tags 6, 9: (3D2)

Completes the energising circuit of RLC in the p.u. via SKTA pin 1, PLA pin 1, SKTB or SKTC pin D, morse key, SKTB or SKTC pin C and SB1F tags 3 and 4. RLC1 switches base biasing of VT1 and VT2 from the receive to the transmit condition. RLC2 connects C6 in the p.u. to chassis.

Position RT

57. (a) SB1F tags 4, 5: (3B3)

See SB1F tags 4, 5 under para 55(d).

(b) SB1F tags 3, 4: (3E5)

Connects one side of the output transformer T8 and one side of the phones to chassis (via SKTB or SKTC, pin C) and connects PLA pin 10, to chassis thus completing the base bias circuit of the p.u. transistors.

(c) SB2F tags 10, 11: (3B6)

Connects the receiver valve filaments to the 4V positive line at PLA, pin 7, via series resistor R32 and relay contacts RLA2 (de-energised).

(d) SB2F tags 3, 5: (3F6)

Connects the l.t. supply from PLA, pin 8, to SKTB or SKTC pin A; also, via R30 and T4 primary winding to SKTB, or SKTC, pin F. When the microphone switch is closed, pins A and B are

linked and so the l.t. supply is fed to the transmitter valve filaments; also to PLA, pin 9, and so RLA, RLC and RLD are energised.

Another pole in the microphone switch completes the microphone circuit, thus applying the l.t. to the microphone via R30, primary to T4, and SKTB or SKTC pin F.

(e) SB3B tags 12, 2: (3C3) — Connects the transmitter valve filaments via R28 to SKTB or SKTC pin B.

(f) SB3B tags 4, 2: (3E3) — Connects the modulator valve filaments to SKTB or SKTC pin B.

(g) SB3F tags 6, 10: — Connects one side of RLC coil to chassis via PLA pin 1.

Position TUNE AERIAL

58. (a) SB1B tags 9, 6: (3B7) — Connects R14 in parallel with the meter M series resistor, R16.

(b) SB1B tags 10, 6: (3D7) — Connects the positive side of meter M via R17 to the r.f. rectifier V1.

(c) SB1F tags 4, 5: (3E5) — See SB1F tags 4, 5 para 55(d).

(d) SB2F tags 4, 5: (3F6) — See SB2F tags 2, 5 para 56(b).

(e) SB3B tags 12, 2: (3C3) — See SB3B tags 12, 2 para 56(c).

(f) SB3B tags 5, 2: (3E3) — See SB3B tags 2, 3 para 56(d).

(g) SB3F tags 11, 6: (3D2) — See SB3F tags 6, 10 para 57(g).

EME8c/2361

END OF PART 1

ELECTRICAL AND MECHANICAL ENGINEERING REGULATIONS
(By Command of the Defence Council)

TELECOMMUNICATIONS
F 192
Part 2

STATION, RADIO, B.C.C. HF 156

TECHNICAL HANDBOOK - FAULT-FINDING AND REPAIR DATA

Errata

Note: These Pages 0 and 01, Issue 1, must be filed immediately in front of Page 1001, Issue 1, dated 15 Jan 62.

1. The following amendments are to be made to the regulation.

2. Page 1001, EMER title

   Delete: 'B.C.C. HF 156'
   Insert: 'STATION, RADIO, B.C.C. HF 156'

3. Page 1003, Fig 2501, V8, grid ref E1

   Delete: 'CV2370'
   Insert: 'CV5172'

Distribution - Class 333. Code No 3

4. Page 1009, Fig 2507 caption

Delete: 'Supply unit transistorized component layout'
Insert: 'Transistorized power unit component layout'

5. Page 1014, Table 2503, column 4, line 6

Delete: 'CV2370'
Insert: 'CV5172'

EME/8c/2361/Tels

CONDITIONS OF RELEASE

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3. This information will be safeguarded under rules designed to give the same standard of security as those maintained by HM Government in the UK.

B.C.C. HF 156

TECHNICAL HANDBOOK - FAULT FINDING AND REPAIR DATA

This Part 2 contains fault finding and repair data in tabular and diagrammatic form. Part 1 of this EMER contains a general description of the equipment.
Tels F 193 and F 194 deal with repairs.

INDEX TO FIGURES

INDEX TO TABLES

General notes on using this regulation

Component schedules

1. Grid references are given in the form figure-letter-figure. The prefix figure refers to the drawing and the suffix letter and figure denotes the actual grid reference on the drawing.

2. The limits shown under the 'limit %' column are in plus or minus % except where tolerances are unequal. These exceptions are annotated in full.

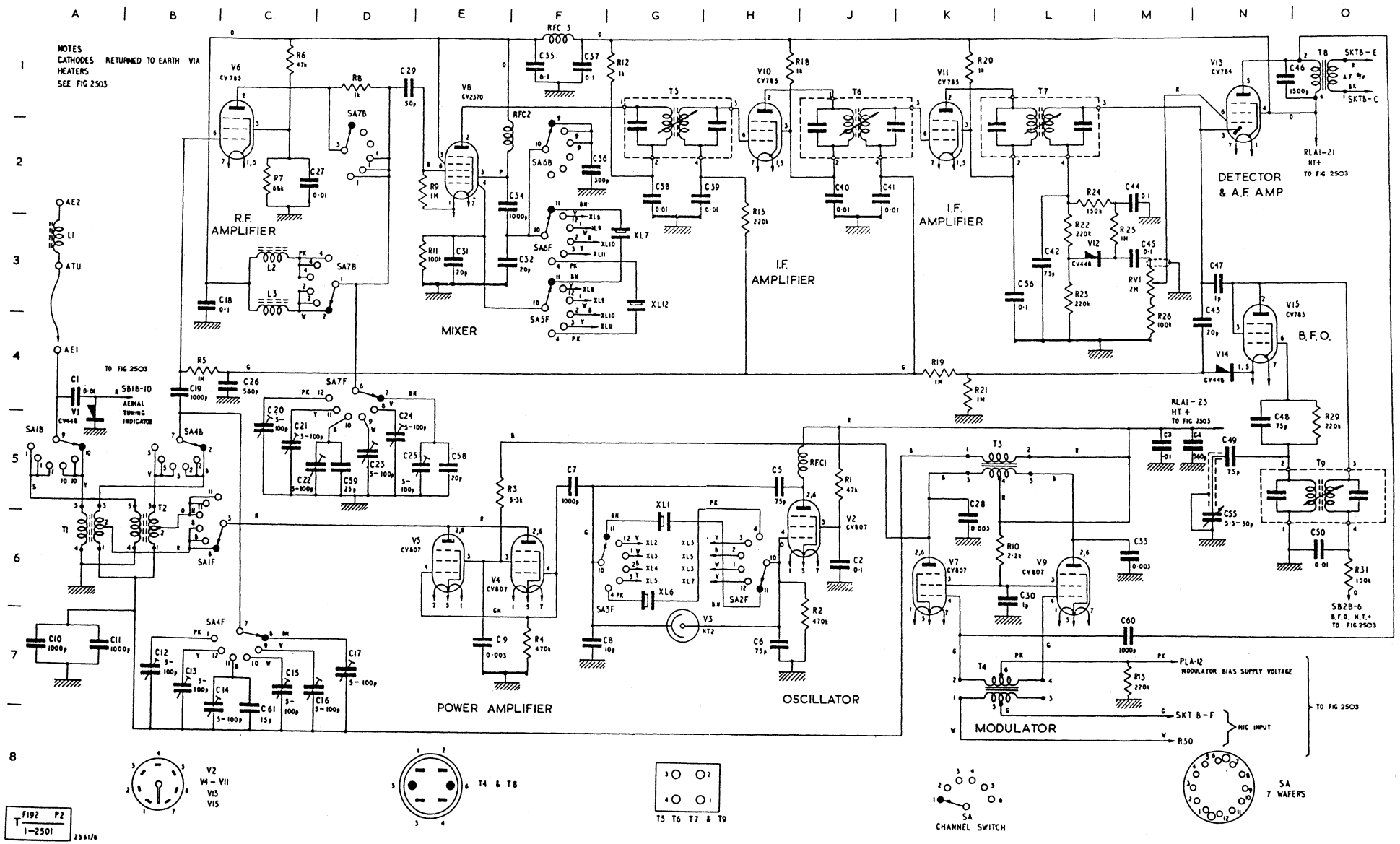

Fig 2501 - Transmitter-receiver circuit diagram

Additional copies of this figure for bench use may be obtained on supplementary demand

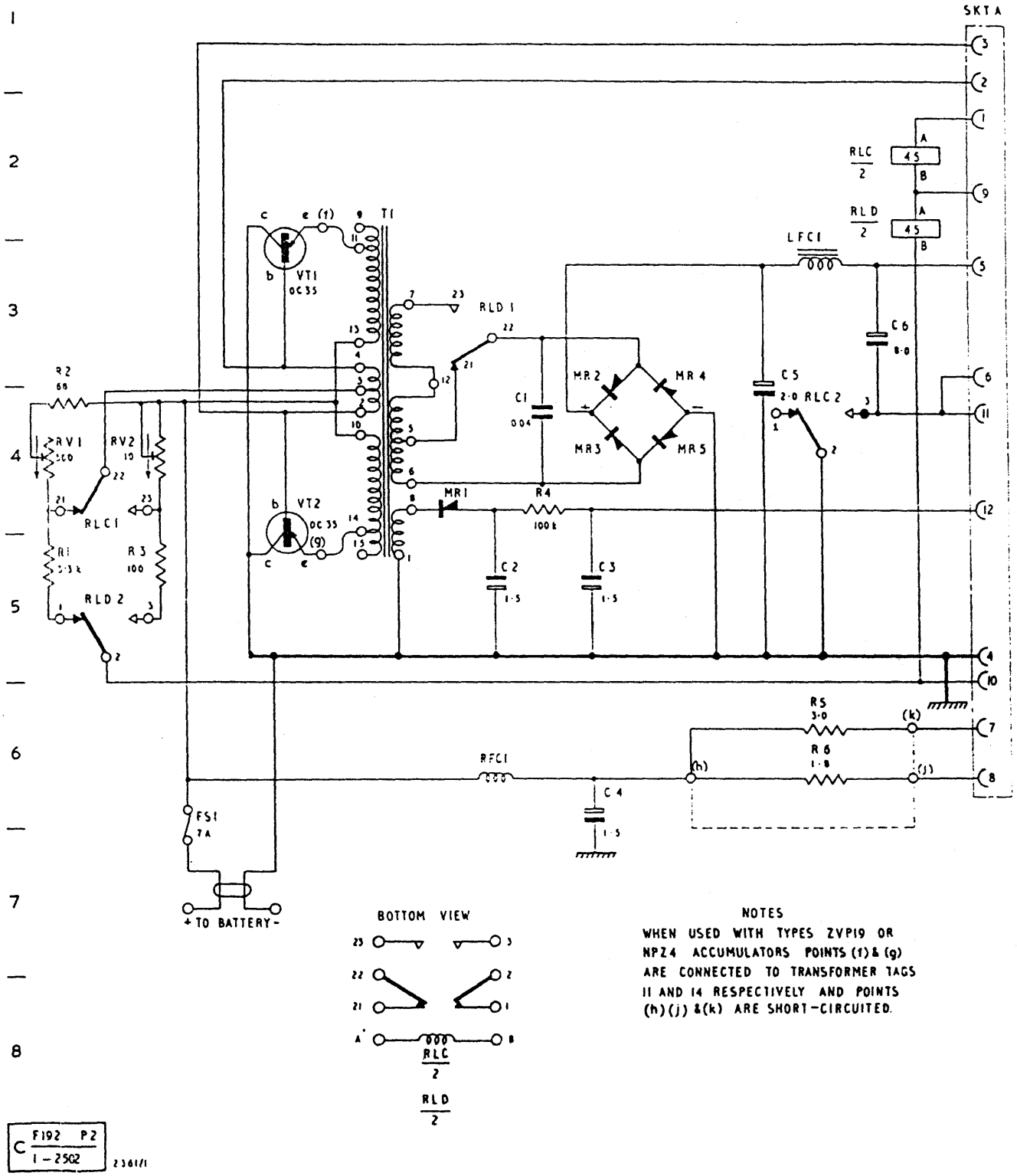

Fig 2502 - Transistorised power unit cct diagram

Additional copies of this figure for bench use may be obtained on supplementary demand

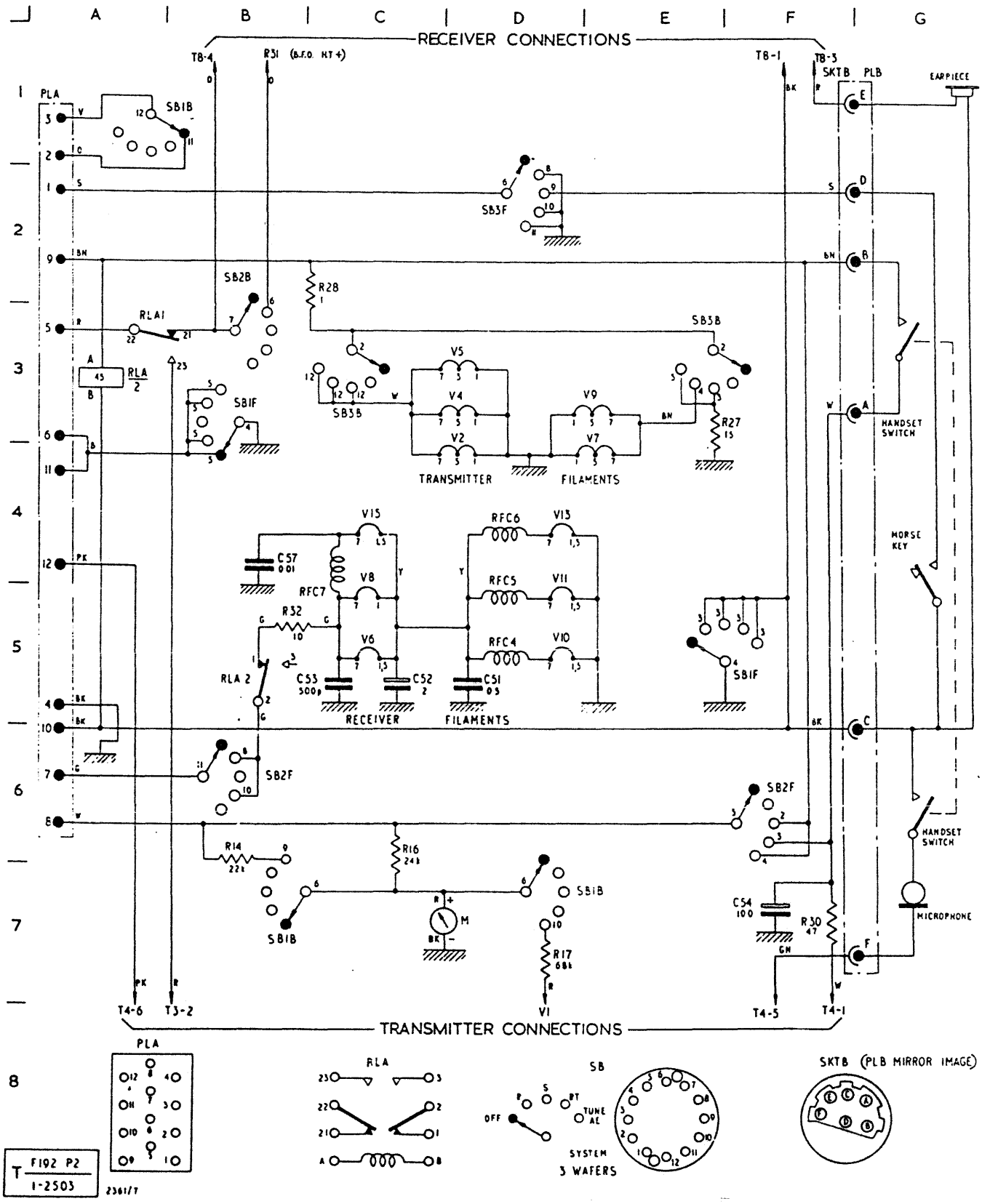

Fig 2503 - System switching and heater circuit diagram

Additional copies of this figure for bench use may be obtained on supplementary demand

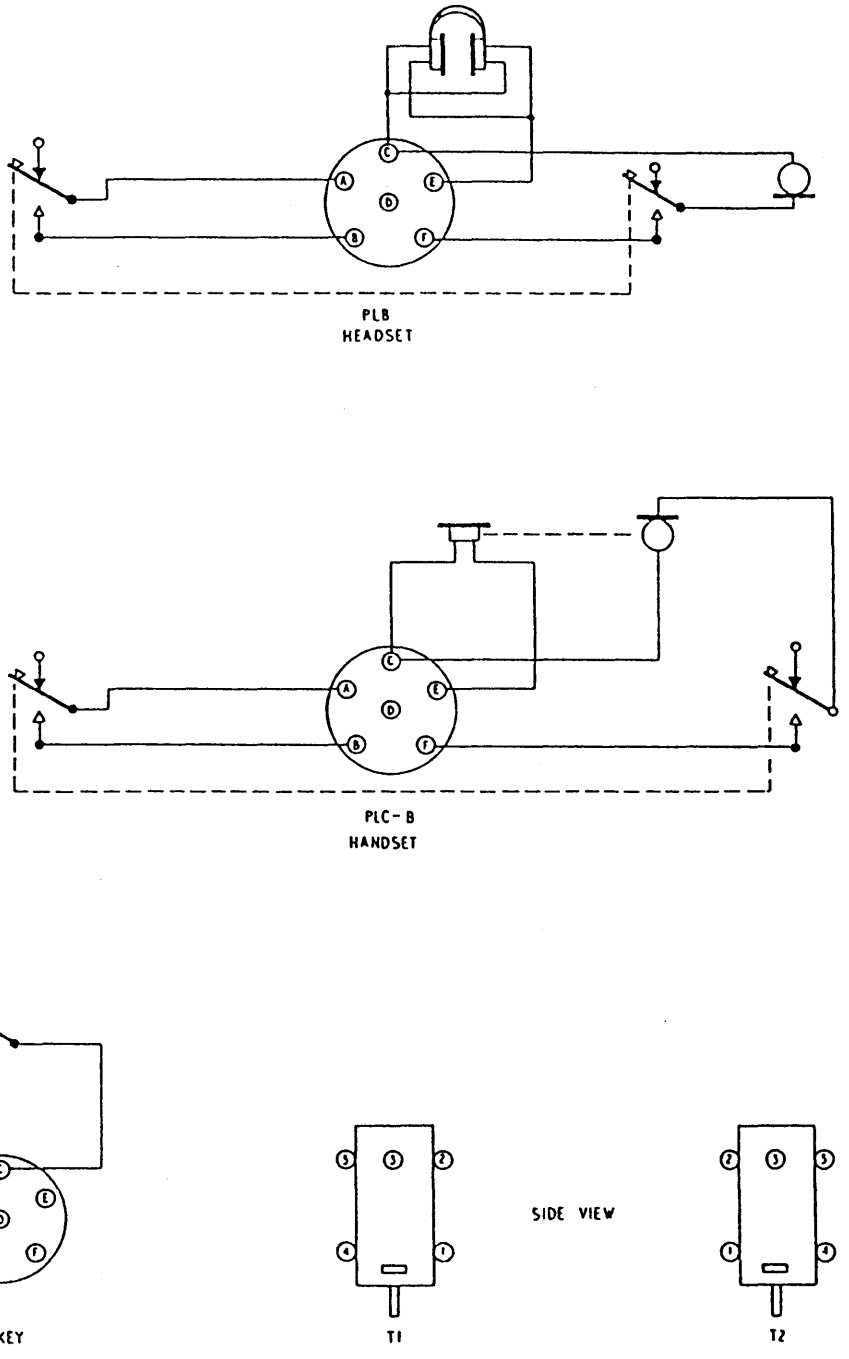

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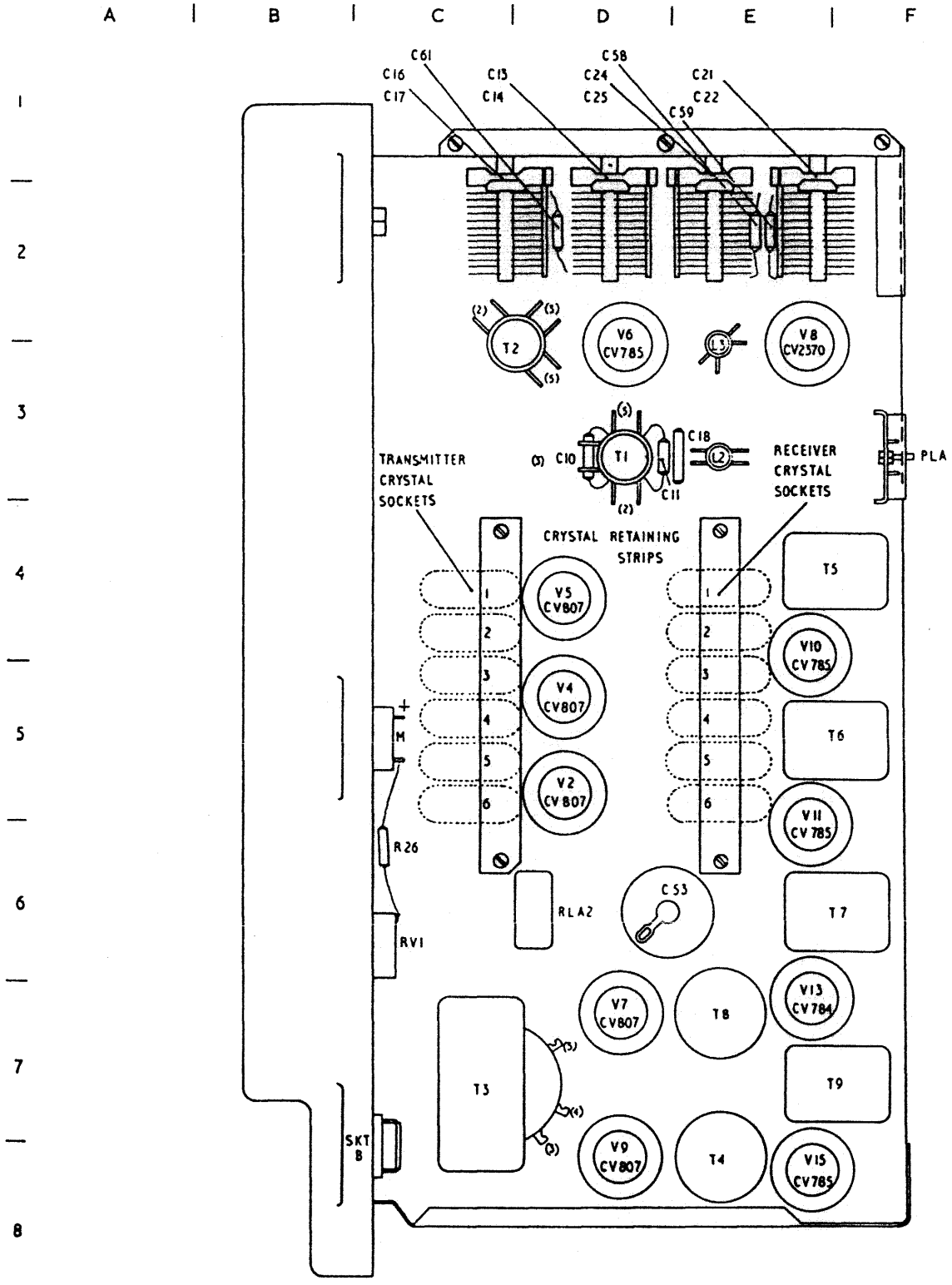
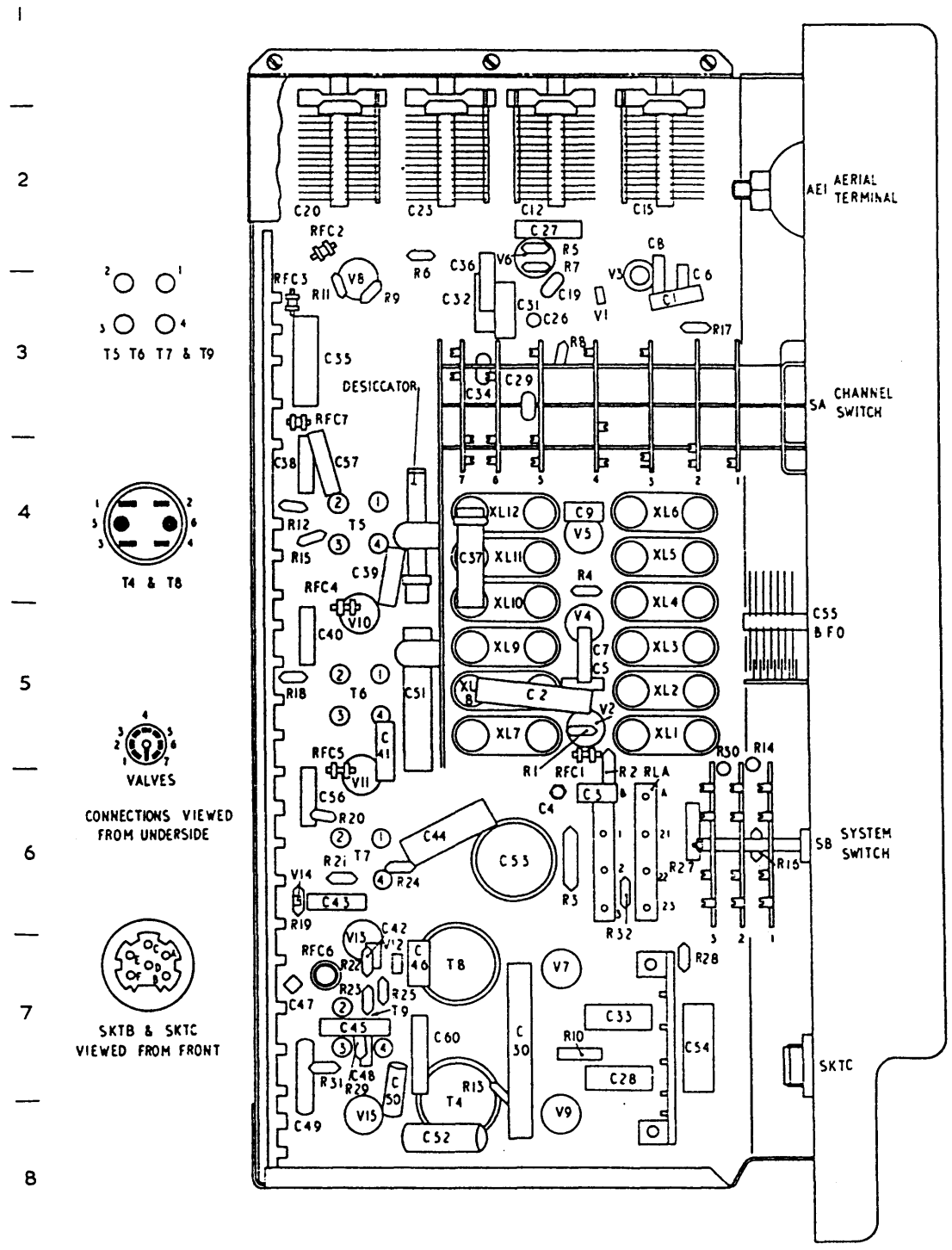
Fig 2504 - Handset and morse key circuit diagram
and T1, T2 layout



T F192 P2 / 1-2505 2361/2

Fig 2505 - Top chassis component layout



T F192 P2 / 1-2506 2361/3

Fig 2506 - Underchassis component layout

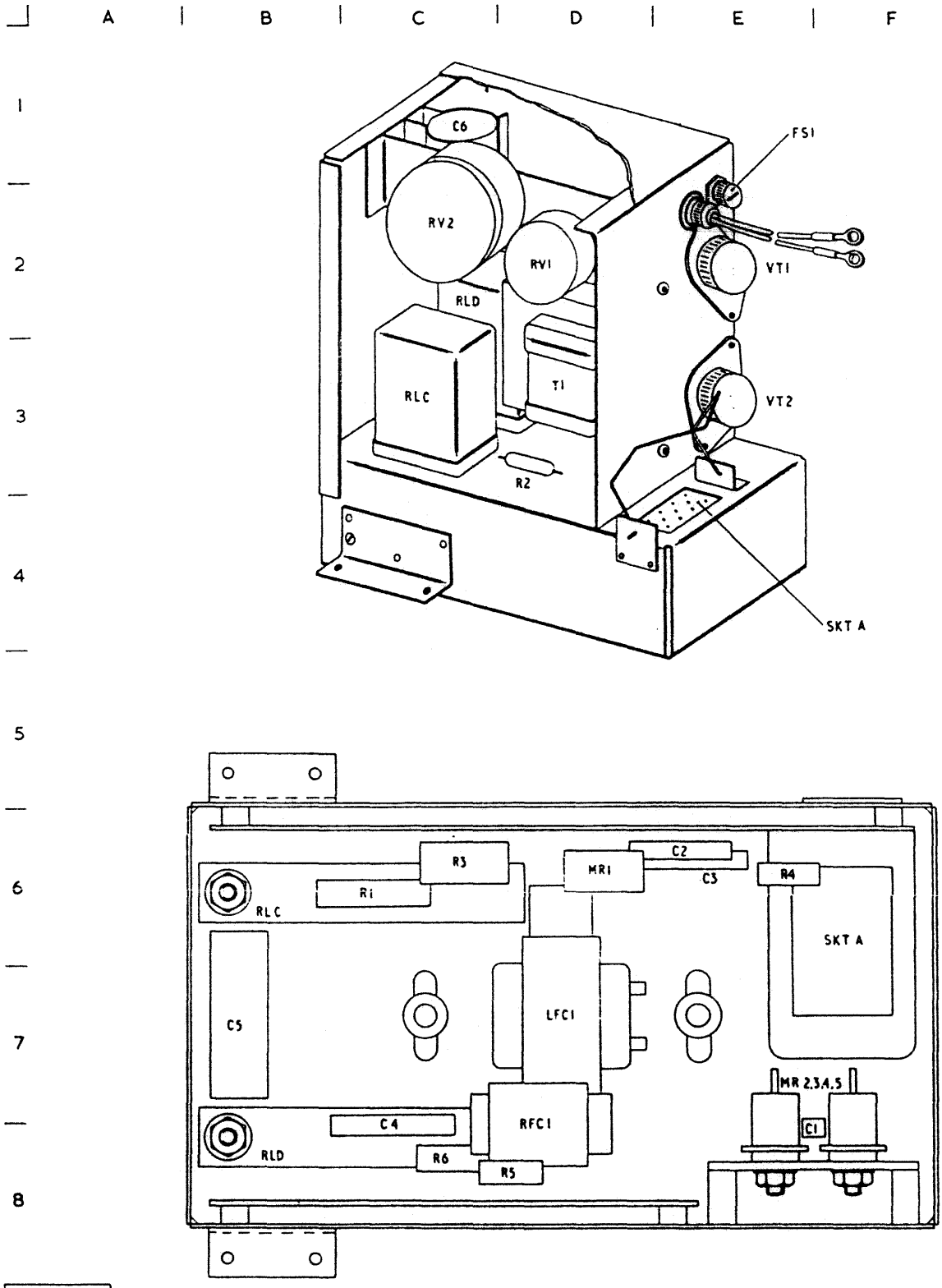


Fig 2507 - Supply unit transistorized component layout

Table 2501 - Transmitter-receiver - component schedule

Cct. ref.	Main cct.	Unit layout	Value	Rating W	Type and limit	%	Part No Z/5905-99
				RESISTORS			
R1	1J5	6D5	47k	1/4	composition	10	022-2215
R2	1J6	6D6	470k	1/4	composition	10	022-3122
R3	1E5	6D6	3.3k	1/4	composition	10	022-2068
R4	1F7	6D4	470k	1/4	composition	10	022-3122
R5	1B4	6C2	1M	1/4	composition	10	022-3164
R6	1C1	6C2	47k	1/4	composition	10	022-2215
R7	1C2	6C2	68k	1/4	composition	10	022-3017
R8	1D1	6D3	1k	1/4	composition	10	022-2005
R9	1E2	6C3	1M	1/4	composition	10	022-3164
R10	1L6	6D7	2.2k	1/2	composition	10	022-2048
R11	1E3	6B3	100k	1/4	composition	10	022-3038
R12	1G1	6B4	1k	1/4	composition	10	022-2005
R13	1M7	6C7	220k	1/4	composition	10	022-3081
R14	3B6	6E6	22k	1/4	composition	10	022-2173
R15	1H3	6B4	220k	1/4	composition	10	022-3081
R16	3C6	6E6	24k	1/4	composition	5	022-2197
R17	3D7	6D3	68k	1/4	composition	10	022-3017
R18	1H1	6B5	1k	1/4	composition	10	022-2005
R19	1K4	6B6	1M	1/4	composition	10	022-3164
R20	1K1	6B6	1k	1/4	composition	10	022-2005
R21	1K4	6B6	1M	1/4	composition	10	022-3164
R22	1L3	6B7	220k	1/4	composition	10	022-3081
R23	1L3	6B7	220k	1/4	composition	10	022-3081
R24	1M2	6C6	150k	1/4	composition	10	022-3059
R25	1M3	6C7	1M	1/4	composition	10	022-3164
R26	1M4	5C6	100k	1/4	composition	10	022-3038
R27	3E3	6D6	15	1/2	composition	10	022-1012
R28	3C2	6D7	1	1/2	wire wound	5	900-1551
R29	105	6B7	220k	1/4	composition	10	022-3081
R30	3F7	6E6	47	1/4	composition	10	022-1068
R31	106	6B7	150k	1/4	composition	10	022-3059
R32	3B5	6D6	10	1/4	wire wound	5	932-0850
				RESISTORS VARIABLE			
RV1	1M3	5C6	2M	1/2	comp linear	20	900-1542

Table 2501 - (cont)

Cct. ref.	Main cct.	Unit layout	Value µF	Rating V	Type and limit %	Part No Z1/5910-99
			CAPACITORS			
C1	1A4	6D3	0.01	75	paper sleeved 20	110-2994
C2	1J2	6C5	0.1	100	paper sleeved 20	011-5599
C3	1M5	6D6	0.01	75	paper sleeved 20	110-2990
C4	1M5	6D6	560p	500	ceramic 20	940-8828
C5	1H5	6D5	75p	500	ceramic 20	110-2996
C6	1H7	6D3	75p	500	ceramic 20	110-2996
C7	1F5	6D5	1000p	500	ceramic 20	110-2998
C8	1F7	6D2	10p	750	ceramic 5	011-8297
C9	1E7	6D4	0.003	300	paper sleeved 20	900-1474
C10	1A7	5D3	1000p	500	ceramic 20	110-2998
C11	1A7	5D3	1000p	500	ceramic 20	110-2998
C12	1B7	6D2	5-100p		variable air	900-1510
C13	1B7	5D2	5-100p		variable air	900-1510
C14	1B7	5D2	5-100p		variable air	900-1510
C15	1C7	6D2	5-100p		variable air	900-1510
C16	1C7	5C2	5-100p		variable air	900-1510
C17	1D7	5C2	5-100p		variable air	900-1510
C18	1B3	5E3	0.1	75	paper sleeved 20	900-1490
C19	1B4	6D3	1000p	500	ceramic 20	110-2998
C20	1C5	6B2	5-100p		variable air	100-1510
C21	1C5	5E2	5-100p		variable air	100-1510
C22	1C5	5E2	5-100p		variable air	100-1510
C23	1D5	6C2	5-100p		variable air	100-1510
C24	1D5	5E2	5-100p		variable air	100-1510
C25	1D5	5E2	5-100p		variable air	100-1510
C26	1C4	6D3	560p	500	ceramic 20	940-8828
C27	1C2	6D2	0.01	75	paper sleeved 20	110-2994
C28	1K6	6D7	0.003	300	paper sleeved 20	900-1474
C29	1D1	6C3	51p	750	ceramic 2	011-8314
C30	1L6	6C7	0.1	100	paper sleeved 20	011-5599
C31	1E3	6C3	20p	750	ceramic 5	011-8304
C32	1E3	6C3	20p	750	ceramic 5	011-8304
C33	1M6	6D7	0.003	300	paper sleeved 20	900-1474
C34	1E2	6C3	1000p	500	ceramic 20	900-2998
C35	1F1	6B3	0.1	75	paper sleeved 20	900-1490
C36	1F2	6C2	300p	500	ceramic 20	900-1502
C37	1F1	6C4	0.1	75	paper sleeved 20	900-1490
C38	1G2	6B4	0.01	75	paper sleeved 20	110-2994
C39	1G2	6C4	0.01	75	paper sleeved 20	110-2994
C40	1T2	6B5	0.01	75	paper sleeved 20	110-2994
C41	1J2	6C5	0.01	75	paper sleeved 20	110-2994
C42	1L3	6C7	75p	500	ceramic 20	110-2996
C43	1N4	6B6	20p	500	ceramic 5	011-8304
C44	1M2	6C6	0.1	75	paper sleeved 20	900-1490
C45	1M3	6B7	0.01	75	paper sleeved 20	110-2994
C46	1N1	6C7	2500p	500	ceramic +40-20	900-1505
C47	1N3	6B7	1p	500	ceramic 50	900-1535
C48	1N5	6B7	75	500	ceramic 20	110-2996
C49	1N5	6B7	75	500	ceramic 20	110-2996

Table 2501 - (cont)

Cct. ref.	Main cct.	Unit layout	Value µF	Rating V	Type and limit %	Part No
			CAPACITORS (cont)			
C50	106	6C7	0.01	75	paper sleeved	Z1/5910-99-110-2994
C51	3D5	6C5	0.5	75	paper sleeved	Z1/5910-99-900-1529
C52	3C5	6C8	2	350	electrolytic +50-20	Z1/5910-99-110-2596
C53	3C5	6C6	500	6	electrolytic +100-20	Z1/5910-99-932-3872
C54	3F7	6D7	100	6	electrolytic +100-20	Z1/5920-99-900-1515
C55	1N5	6E5	5-30p	-	variable air	Z1/5910-99-940-9289
C56	1L3	6B6	0.01	75	paper sleeved 20	Z1/5910-99-110-2994
C57	3B4	6B3	0.01	75	paper sleeved 20	Z1/5910-99-110-2994
C58	1E5	5E2	20	750	ceramic 5	Z1/5910-99-011-8304
C59	1D5	5E2	25	750	ceramic 5	Z1/5910-99-900-1536
C60	1M7	6C7	0.001	500	ceramic 20	Z1/5910-99-110-2998
C61	1C7	5D2	15p	750	ceramic 5	Z1/5910-99-011-8301

Cct. ref.	Main cct.	Unit layout	Description	Part No
			MISCELLANEOUS	
L1	1A3	EXTERNAL	Aerial tuning coil	Z1/5950-99-941-2025
L2	1C3	5E3	H.F. coil	Z1/5950-99-949-1880
L3	1C3	5E3	H.F. coil	Z1/5950-99-949-2243
RFC1	1J5	6D5	R.F. choke	Z1/5950-99-949-1947
RFC2	1E1	6B2	R.F. choke	Z1/5950-99-949-1946
RFC3	1F1	6B3	R.F. choke	Z1/5950-99-949-1947
RFC4	3D5	6B5	R.F. choke	Z1/5950-99-949-1948
RFC5	3D5	6B6	R.F. choke	Z1/5950-99-949-1948
RFC6	3D4	6B7	R.F. choke	Z1/5950-99-949-1948
RFC7	3C4	6B3	R.F. choke	Z1/5950-99-949-1948
T1	1A6	5D3	H.F. transformer	Z1/5950-99-949-2242
T2	1B6	5D2	H.F. transformer	Z1/5950-99-948-1876
T3	1K5	5C7	Modulation transformer	Z1/5950-99-949-1877
T4	1K7	6G7	Microphone transformer	Z1/5950-99-911-4477
T5	1G1	6B4	I.F. transformer	Z1/5950-99-949-1878
T6	1J1	6B5	I.F. transformer	Z1/5950-99-949-1878
T7	1L1	6B6	I.F. transformer	Z1/5950-99-949-1878
T8	101	6C7	Output transformer	Z1/5950-99-911-4477
T9	105	6B7	B.F.O. transformer	Z1/5950-99-949-1879
SA	2001	6D3	Channel switch	Z1/5930-99-900-1542
SB	2003	6E6	System switch	Z1/5930-99-900-1560
M	3D7	5C5	Meter	Details to follow
RLA	3A3	6D6	Relay magnetic	Z/5945-99-053-0451

Table 2502 - Transistorised power unit - component schedule

Cct. ref.	Main cct.	Unit layout	Value Ω	Rating W	Type and limit %		Part No
				RESISTORS			
R1	2A5	7C6	3.3k	1/4	composition	10	Z/5905-99-022-2068
R2	2A3	7D3	68	1/4	composition	10	Z/5905-99-022-1089
R3	2A5	7C6	100	1/2	composition	10	Z/5905-99-011-1111
R4	2D4	7E6	100k	1/4	composition	10	Z/5905-99-011-3038
R5	2F6	7D8	3	3	wire wound	10	Z1/5905-99-900-1543
R6	2F6	7C8	1.8	1.5	wire wound	10	Z1/5905-99-011-3198
				RESISTORS VARIABLE			
RV1	2A4	7D2	500	1	wire wound	10	Z1/5905-99-940-8994
RV2	2A4	7C2	10	1	wire wound	10	Z1/5905-99-027-1101
Cct. ref.	Main cct.	Unit layout	Value µF	Rating V	Type and limit %		Part No
				CAPACITORS			
C1	2D4	7E8	0.04	250	paper sleeved	20	Z/5910-99-012-0116
C2	2D5	7E6	1.5	32	tantalum	20	Z1/5910-90-900-1524
C3	2D5	7E6	1.5	32	tantalum	20	Z1/5910-90-900-1524
C4	2D5	7C8	1.5	32	tantalum	20	Z1/5910-90-900-1524
C5	2F3	7B7	2	200	electrolytic	+50-20	Z1/5910-99-900-1517
C6	2F3	7C1	8	200	electrolytic	+50-20	Z1/5910-99-900-1518
Cct. ref.	Main cct.	Unit layout	Description				Part No
				MISCELLANEOUS			
RFC1	2D6	7D8	R.F. choke				Z1/5950-99-949-2004
LFC1	2F3	7D7	L.F. choke				Z1/5950-99-949-2003
T1	2C3	7D3	A.F. transformer				Z1/5950-99-949-2002
RLC	2G2	7B6	Relay magnetic				Z1/5945-99-053-0451
RLD	2G2	7B8	Relay magnetic				Z1/5945-99-053-0451
FS1	2B6	7E2	Fuse link				X2/5920-99-999-1295

Table 2503 - Valve voltage table

Position of system SW	Transmit T or receiver R	Valve		Anode		Screen		Grid	
		Ref	Type	Pin	Volts	Pin	Volts	Pin	Volts
RT	T	V2	CV807	2,6	150	3	65	4	-16
RT	T	V4	CV807	2,6	140	3	122	4	-30
RT	T	V5	CV807	2,6	140	3	122	4	-30
RT	R	V6	CV785	2	50	3	30	-	-
RT	T	V7	CV807	2,6	150	3	147	4	-19
RT	R	V8	CV2370	2	50	3,5	50	-	-
RT	T	V9	CV807	2,6	150	3	147	4	-19
RT	R	V10	CV785	2	48	3	48	-	-
RT	R	V11	CV785	2	48	3	48	-	-
RT	R	V13	CV784	5	48	4	50	-	-
R	R	V15	CV785	2	27	3	27	-	-

The above readings are typical for a correctly aligned station, and all measurements are made with respect to chassis. Variation of up to ±20% can be expected between individual sets.

Table 2504 - Supply currents and voltages

	OFF	C.W.			R.T.			TUNE AERIAL
		Rec	Send		Rec	Send		
			Key up	Key down		Carrier	Full mod	
Accummulator voltage measured on f.p. meter	4.0	3.95	3.9	3.7	3.95	3.7	3.7	-
Accummulator current measured at fuse link	-	680mA	750mA	3.4A	680mA	4.0A	4.6A	3.4A
H.T. voltage measured at RLA1 pin 22	0	51	0	155	51	153	149	155
H.T. current measured at RLA1 pin 22	0	7-10mA	0	43	10	60	70	42
Bias volts measured at joint T4 tag 6 and R13	0	-20	-	-19	-20	-19	-18.5	-19
Filament voltages measured at:-								
V8 pin 7	0	2.8	0	0	2.8	0	0	0
V8 pin 1	0	1.4	0	0	1.4	0	0	0
V4 pin 7	0	0	3.2	3.0-3.2	0	2.9-3.1	2.9-3.1	3.0-3.2

All readings given above are for a typically correctly aligned equipment. Variations of up to ±10% may well be encountered between individual sets.

Table 2505 - Summary of specification and performance tests

Test equipment required

Signal generator No 12	Z4/ZD 02674
Voltmeter, valve, No 3	Z4/6625-99-949-0470
Signal generator, video No 1	Z4/ZD 04247
Multimeter, AVO, Model 8S	Z4/6625-99-949-1524
Wattmeter, a.f. No 1	Z4/6625-99-949-0510
Oscilloscope, CT386	Z4/6625-99-943-7177
Test cable	Z1/5820-99-949-1291

Notes

1. The conditions of test are as specified in Tels F 194.

2. The tests quoted below are those considered necessary to prove the serviceability of a set. They are not to be used as a substitute for the Inspection Standard Tels F 198.

Transmitter

R.F. output (c.w.)

3. (a) Channel 1-3 1.2W
(b) Channel 4-6 1.0W

Modulation

4. Input required at 1000c/s for 100% modulation: Less than 400mV
Distortion less than 10% when modulation depth is 85%.

Receiver

A.F. sensitivity

5. Input of 500mV at 1000c/s (pin 6, V13): Output 2mW (150Ω)

I.F. sensitivity

6. Input to give 0.1mW output (150Ω)

pin 6 V8	150μV ±6dB
pin 6 V10	1.25mV ±3dB
pin 6 V11	72mV ±1dB

R.F. sensitivity (RT)

7. Input on any channel to achieve 0.1mW (150Ω) with modulation depth 30% at 1000c/s: Not more than 12μV.

R.F. sensitivity (CW)

8. Difference between maximum and minimum setting of the b.f.o.: Shall be greater than 20dB.

Sealing test

9. Initial 10 lb/sq. in. After 12 hrs, 9 lb/sq in.

END

STATION, RADIO, B.C.C. HF156

FORWARD CODING

Note: The following list of Assembly Codes must be used in conjunction with EMER Mgmt J 021 Part 4.

Assembly code	Designation
0001	Transmitter/receiver, less power supply unit
0002	Transistorized power supply unit
0003	Headset assembly
0004	Handset assembly
0005	Antenna assembly
0006	Ancillary assemblies, morse key, canvas bag etc

END

Distribution - Class 333. Code No 3