STATION RADIO A14 - BCC 30 Mk. 2

H.F. MILITARY PACKSET

TECHNICAL MANUAL

BCC

Code No. TM 189
April 1966

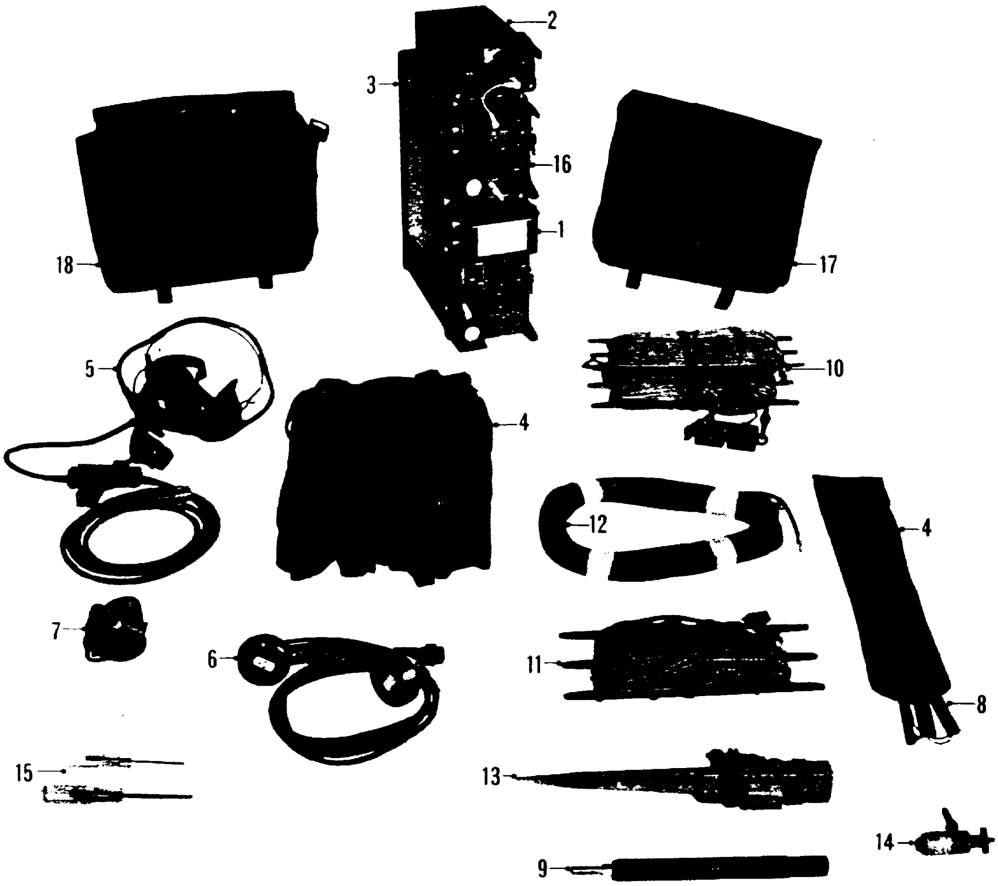
BRITISH COMMUNICATIONS CORPORATION LTD.
SOUTH WAY, EXHIBITION GROUNDS, WEMBLEY, MIDDLESEX
Telephone: WEMbley 1212 Cables: BEECEECEE Wembley

SERVICE TYPE NUMBERS

With effect from May 1966 the following type numbers were allocated to the BCC 30 HP

BRITISH ARMY A14

BRITISH ROYAL NAVY . . . . TYPE 635



(1) * Fully transistorised transmitter-receiver for RT (AM and PM) and CW. Low or high power. Fully sealed case with individually sealed compartments for set, amplifier and power supplies. High power set is illustrated.
(2) * Aerial Tuning Unit, mounted on set.
(3) * Power Supplies:— Choice of two rechargeable accumulators or two dry batteries on LP version. Four rechargeable accumulators on HP version.
(4) * Set carrier webbing harness with chest strap and rod aerial satchel.
(5) Military pattern headset with boom microphone and pressel switch.
(6) * Military pattern unbreakable microphone-telephone handset.
(7) Latest miniature military morse key with knee strap; fully sealed.
(8) * 8 foot section whip rod aerial.
(9) * 9 inch flexible aerial base.
(10) Matched braid aerial elements with centre connector and nylon support ropes for dipole and quarter wave end fed aerials.
(11) Military pattern 27 ft. end fed aerial.
(12) 40 ft. co-axial feeder for use with dipole or quarter wave end fed aerial.
(13) Earth spike.
(14) * Right angle adaptor for whip rod aerial, enabling aerial to be set at any angle.
(15) Hexagonal headed drivers.
(16) * RF Amplifier (part of High Power set).
(17) Wire aerial kit—accessory bag (for items 9, 10, 11, 12, 13 and 14).
(18) Second accessory bag—supplied with HP set only—(for items 5, 6, 7 and 15).

*These items make up the minimum working station.

Fig.1 BCC 30 HP COMPLETE STATION

BCC 30 TECHNICAL SPECIFICATION

GENERAL

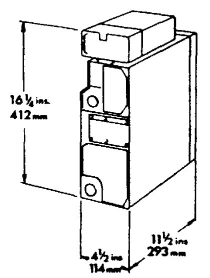
FREQUENCY RANGE	2-8 Mc/s
SERVICE	Single frequency Simplex RT or CW
MODULATION	Amplitude or Phase
PRESET CHANNELS	18 Crystal Controlled
FREE TUNING	Full range (requires netting)
CALIBRATION FACILITIES	18 Crystal check points
AERIALS	8 ft. (2.4m) rod and 14 ft. (4.3m) rod 27 ft. (8m) end-fed wire Quarter wave vertical Dipole
POWER SUPPLIES	
<u>Low Power</u>	2 sealed nickel cadmium 12 volt batteries or 2 dry 12 volt batteries in parallel
<u>Higher Power</u>	4 sealed nickel cadmium 12 volt batteries switched for 12 volt, 24 volt or 36 volt supplies
POWER CONSUMPTION	
<u>Low Power</u> (12V nominal supply)	Receive 0.48W Transmit RT-PM and CW = 14.4W Transmit RT-AM = 13.2W
<u>Higher Power</u> (12V nominal supply per battery)	Receive 0.48W Transmit RT-PM and CW = 58W Transmit RT-AM = 68W (Max.)
CLIMATIC	Hermetic sealing for pan climatic conditions of use and storage

STATION WEIGHTS

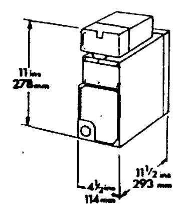
MINIMUM WORKING (see fig. 1)		COMPLETE	
LP	HP	LP	HP
25.5lb.	38.5lb.	35lb.	48lb.
(11.5Kg.)	(17.5Kg.)	(15.8Kg.)	(22Kg.)

OVERALL DIMENSIONS

BCC 30 HP



BCC 30 LP



TRANSMITTER

R. F. POWER OUTPUT	
Low Power	1.5 - 2 watts
High Power	18 - 22 watts
CHANNEL FREQUENCY STABILITY	1100 c/s (over the temperature range -31°C to 52°C)
MODULATION CAPABILITY	
BCC 30 LP - AM	(a) For AF signal of 10 mV at 1000 c/s, modulation depth not less than 40 per cent. (b) For AF signal of 100 mV at 1000 c/s, modulation depth not more than 80 per cent.
PM	(a) For AF signal of 10 mV at 1000 c/s, deviation not less than 0.8 radian. (b) For AF signal of 100 mV at 1000 c/s, deviation not more than 1.5 radian.
BCC 30 HP - AM	(a) For AF signal of 10 mV at 1000 c/s, modulation depth not less than 60 per cent. (b) For AF signal of 100 mV at 1000 c/s, modulation depth not more than 100 per cent.
PM	As for BCC 30 LP
MICROPHONE INPUT IMPEDANCE	300 ohms (at 1000 c/s)

RECEIVER

I. F.	500 kc/s
CHANNEL FREQUENCY STABILITY	+ 3 kc/s - 1 kc/s over the temperature range -31°C to +52°C.
SELECTIVITY	Minimum ± 3 kc/s at -6 dB Maximum ±10 kc/s at 65 dB
SENSITIVITY	For 14 dB minimum signal to noise ratio at 30 per cent. modulation depth or 0.4 radian deviation at 1 kc/s: 4 μV on PM 6.3 μV on AM 2 μV e.m.f. on CW
IMAGE REJECTION	30 - 55 dB (depending on channel frequency)
AF OUTPUT	5 mW minimum on AM and 4 mW minimum on PM with a 10 mV signal modulated 70 per cent or deviated 1 radian at 1000 c/s.
AF OUTPUT IMPEDANCE	150 ohms (1000 c/s)
AGC	Output held within 10 dB for an input signal increase of 80 dB above sensitivity level.

LIST OF CONTENTS

	Paragraph
Introduction	1
GENERAL DESCRIPTION	
Station List	4
Accessories	5
Transmitter-Receiver	6
Aerial Tuning Unit	7
Power Supplies	
General	8
Circuit Arrangements LP	9
Circuit Arrangements HP	10
OPERATION	
Function of Controls	
System Switch	11
CW Tone	12
RF Trim	13
Band and Channel	14
Gain	15
Tune	16
Meter Indications	17
Off	18
TRF	19
PM	20
AM	21
CW	22
Crystals	23
Selection of Operating Frequency	25
Aerials	26
General Notes	27
Adjustment Procedures	31
Dipole	32
Quarter Wave End-Fed Aerial with Counterpoise	37
Rod Aerials	43
End-Fed Wire Aerial	46
Remotely Sited Aerials	47
TUNING	
Preparation	
Aerial Connection	48
Tuning Procedure	49
Dial Calibration Checks-Procedure	50
BATTERIES	
Rechargeable Units	
Main Details	51
Capacity Test	52
Recharging	53
Storage and Transit	54
Maintenance	55
Dry Battery	
Capacity	57
Terminal Volts	58
Storage	59
Fitting	60
Battery Paralleling Link in BCC 30 LP	61
BATTERY CHARGING	
General	63
Safety Notes	64

	Paragraph
Using the BCC 13 Hand Generator	65
Using the BCC 501 12V/24V Operated Charger	66
Using the BCC 503 A. C. Mains Operated Charger	67
Using the BCC 20 Petrol Engine Driven Charger	
Procedure	68
CONNECTION OF OPERATING EQUIPMENT	
General Purpose 6 pin Sockets	71
Microphone-Telephone Headset	72
Microphone-Telephone Handset	73
Morse Key	74
BRIEF TECHNICAL DESCRIPTION	75
CIRCUIT DESCRIPTION	
Common Circuits	92
Send-Receive Relay RLA	93
Common Oscillator	94
Audio Amplifier	96
Transmitter Circuits	
Modulator and Control	
Low Power Operation	97
High Power Operation	100
Phase Modulation	101
500 kc/s Oscillator and Reactor	102
Balanced Mixer and Wide Band Amplifier	104
PA Driver	107
Power Amplifier	108
Transmitter Aerial Circuits	109
Receiver Circuits	
RF Amplifiers	110
Mixer	111
500 kc/s Band Pass Filter	112
IF Amplifiers	113
AGC Detector and Amplifier	114
AM Detector and Noise Limiter	116
Discriminator	119
AFC Loop	120
BFO Operation	121
RF AMPLIFIER NO. 1	
Introduction	122
General Description	123
CW Operation	127
AERIAL TUNING UNIT	128
MAINTENANCE	133
Fuses	
Low Power Set	134
High Power Set	135
Catylators	136
Desiccators	138
Battery Circuit Arrangements	140
Case Assemblies - Interconnection Facilities	141
Test Panel Arrangements	142
Transistors - Servicing Notes	
Storage Conditions	143
Handling	144
Installation and Removal	145

	Paragraph
Testing	146
Power Supplies	147
Soldering Techniques	148
Resleeving	149
Servicing Leads, Test Equipment and Tools	150
TESTING AND SERVICING	
Complete Station Tests	
Full Specification Tests	152
Bench Test BCC 30 LP	
Introduction	153
Procedure	154
Bench Test BCC 30 HP	
Introduction	155
Procedure	156
Field Test - BCC 30 LP	157
Preparation	158
Procedure	159
Field Test - BCC 30 HP	160
Current Consumption Figures	161
Fault Analysis Tables - BCC 30 LP and HP	
BCC 30 LP	162
BCC 30 HP	163
Module Testing and Servicing Data	
Introduction	164
General Information	
Circuit Locations in Modules	168
Abbreviation Codes	169
Transistor Terminal Colour Codes	170
Complete Transmitter-Receiver Alignment	171
Refitting and alignment of Band Switch (SWA) Driven Shaft	
Refitting	172
Alignment	173
Test of Transmitter-Receiver Unit Functions with RF Amplifier No. 1	174
Fault Analysis Table - RF Amplifier No. 1	175
RF Amplifier No. 1 - Test Procedure	
Introduction	176
General	177
Preparation	178
Ledex Switch Test	179
HT Polarity, Switching and Relay Test	180
Input Circuit Efficiency Test	181
Output Circuit Efficiency Test	182
Modulator Test	183
Test with VT1 Connected	
Range Coverage and Output Power Tests on PM and CW	184
Power Output and Modulation Test	185
RF Amplifier No. 1 - Removal of Components	
Introduction	186
RF Section - Codes RF/A to RF/J	
RF/A - Power Transistor Assembly VT1	187
RF/B - Inductor L5	188
RF/C - Resistor R7	189
RF/D - Inductor L6	190
RF/E - Ledex Switch Assembly Complete	191
RF/F - RF Coil L2	192
RF/G - Tune Output Capacitor Assembly	193

	Paragraph
RF/H - RF Coil L1	194
RF/J - Transformer T1	195
Centre Section - Codes CS/A to CS/E	
CS/A - Relay RLB, Tagboard Assembly and PLA	196
CS/B - Modulation Transformer T2	197
CS/C - Inductor L4	198
CS/D - Inductor L3	199
CS/E - Tune Input Capacitor C2	200
Modulator Section - Codes MS/A to MS/D	
General Access	201
MS/A Component Board	202
MS/B1 - Relay RLA - Coil Change	203
MS/B2 - Relay RLA - Contact Set Change	204
MS/C - Transformer T3	205
MS/D - Transistors VT2 and VT3	206
MS/E - Transistors VT4 and VT5	207
Front Panel	208
Aerial Tuning Unit - Servicing	
Removal from the Case	209
Removal of Tuning Coil Assembly	210
Removal of Circuit Component Board	211
Switch Wafer	212
Meter Removal	213
SPARES KITS AND CONVERSION KITS	
General	214
List of Spares Kits	
BCC 30 LP	215
BCC 30 HP	216
Field Servicing Kits	217
Workshop Servicing Kits	218
Conversion Kit LP to HP	219
BCC 30 VAT (Vehicle Adaptor Temporary) kit	220
BCC 30 VAP (Vehicle Adaptor Permanent) kit	221
REMOTE CONTROL KIT - BCC 513	222
PART NUMBERS AND COMPONENT LISTS	
Complete Station LP	223
Complete Station HP	224
Accessories - Part Numbers	
General	225
Battery Chargers	226
Vehicle Adaptors	227
Conversion Kits (LP to HP)	228
General Part Numbers	
BCC 30 LP	229
BCC 30 HP	230
Module Part Numbers	231
COMPONENTS LISTS	
Transmitter-Receiver Unit	232
RF Amplifier No. 1	233
Aerial Tuning Unit	234
BCC 30 HP - Case Assembly	235
BCC 30 LP - Case Assembly	236
TECHNICAL ADVISORY SERVICE	237
Technical Bulletins	238
MODIFICATIONS	239

LIST OF ILLUSTRATIONS

	Figure
BCC 30 HP Complete Station	1
BCC 30 Low Power HF Packset	2
BCC 30 High Power HF Packset	3
Internal Details (1)	4
Internal Details (2)	5
Panel Controls	6
BCC 30 Dipole Aerial	7
BCC 30 Quarter Wave End-Fed Aerial with Counterpoise	8
BCC 30 Remotely Sited Aerial with A. T. U.	9
BCC 30 End-Fed Wire Aerial	10
Tuning Procedure Guide	11
Block Diagram	12
BCC 30 - Circuit Diagram	13
RF Amplifier No. 1 - Circuit Diagram	14
RF Amplifier No. 1 - General Views	15
Aerial Tuning Unit - Circuit Diagram	16
Aerial Tuning Unit - General View	17
BCC 30 High Power Case Assembly - Circuit Diagram	18
12V d.c. Supply - Circuit Diagram	19
Ledex Band Switch in RF Amplifier No. 1 - Circuit Diagram	20
24V d.c. Power Supply for RF Amplifier No. 1 on 'AM' - Circuit Diagram	21
36V d.c. Power Supply for RF Amplifier No. 1 on 'PM' and 'CW' - Circuit Diagram	22
BCC 30 LP - Test Panel - Circuit Diagram	23
BCC 30 LP RF Output Power - Graph	24
Test Arrangements for BCC 30 HP - Bench Test	25
Location of Alignment Trimmers	26
RF Amplifier - Minimum Efficiency Limit Curve for Input Tuned Circuit ...	27
RF Amplifier - Minimum Efficiency Limit Curve for Output Tuned Circuit	28

INTRODUCTION

1. The BCC 30 is a fully transistorised HF military packset designed to conform with British Inter Service Specification DEF 133. There are two versions of the BCC 30, the BCC 30 HP with a maximum power output of about 30 watts and the BCC 30 LP with a maximum output of about 3 watts. This manual covers both these versions since the HP version is mainly the LP version plus a high power amplifier unit known as the RF Amplifier No. 1 and two extra batteries. Both versions cover the frequency range 2 - 8 Mc/s in two bands; low band (L) 2 - 4 Mc/s, and high band (H) 4 - 8 Mc/s. Within each of these bands, nine crystal controlled channels are available and alternatively free tuning is also possible over the full range. For voice communication both phase and amplitude modulation are provided. Facilities are included for CW telegraphy operation.

2. Receiver sensitivity is 2 μV on CW, 4 μV on PM and 6.3 μV on AM for 14 dB minimum signal to noise ratio. The selectivity at 65 dB down is ± 10 kc/s maximum and at 6 dB down is ± 3½ kc/s minimum. The audio output, with a 70% modulated or 1 radian deviated input signal of 10 mV, is at least 5 mW. The low power set is powered by two nickel cadmium batteries or two consumable 12 volt dry batteries. The higher power set uses four nickel cadmium 12 volt batteries and will not take the dry batteries.

3. The sets may be used in six basic roles:-

(1) BCC 30 LP - As a 1 man low power packset (or ground station) (fig. 2).

(2) BCC 30 HP - As a 1 man high power packset (fig. 3).

(3) BCC 30 HP - As a low or high power ground station.

(4) BCC 30 HP and LP - As remotely controlled sets with the operator sited at any distance up to 1 mile, using BCC 513 remote control kits (see para. 222).

(5) BCC 30 HP - As a temporary or a permanent vehicle installation using special 'quick-fit' and permanent vehicle adaptor kits, known as BCC 30 VAT (vehicle adaptor temporary) and BCC 30 VAP (vehicle adaptor permanent) respectively (see paras. 220 and 221).

(6) BCC 30 LP - As a temporary vehicle installation (using the BCC 30 VAT).

Fig.2 BCC 30 LOWPOWER HF PACKSET

GENERAL DESCRIPTION

STATION LIST

4. The equipment comprising a one man high power station is made up as illustrated and listed in fig. 1.

A low power station comprises essentially the same equipment less the RF Amplifier No. 1 used with the BCC 30 HP. The LP set is fitted into a smaller webbing carrier harness which includes a satchel (fig. 2). It uses only two batteries and only one accessory bag is supplied.

ACCESSORIES

5. The following accessories are available as optional extras.

BCC 13 Hand Generator
BCC 20 Portable Petrol Engine-Driven Battery Charger
BCC 501 12V/24V Battery Charging Unit
BCC 503 Mains Charging Unit
BCC 513 Remote Control Kit
Remote Aerial Tuning Unit (fitted with a meter for use with remotely sited aerials)
14 ft. rod aerial
Lightweight Aerial Mast Type 1381
Vehicle Installation Kits:-
BCC 30 VAT Vehicle Adaptor Temporary (for both BCC 30 LP and HP)
BCC 30 VAP Vehicle Adaptor Permanent (for BCC 30 HP only).

TRANSMITTER-RECEIVER (figs 4 & 5)

6. The transmitter receiver unit consists of a number of easily accessible modules or sub-assemblies. Most of these are attached to a frame supported on the central tuning assembly which is screwed to the rear of the light alloy casting forming the front panel of the transmitter receiver unit. The complete assembly is attached by socket-headed screws and sealed by a gasket in a robust light alloy case. The case for the low power set contains individually sealed compartments for the set and the batteries. The case for high power version contains a third sealed compartment which houses the RF Amplifier No. 1 (high power amplifier unit).

AERIAL TUNING UNIT

7. This unit, which is suitable for use with both the high and the low power versions of the set, ensures optimum tuning of the transmitter to rod and end-fed aerials between 8 and 27 feet in length. The ATU has two controls; a band switch selecting one of the three sections of the band designated A, B and C, and a tuning control. The unit is normally mounted on the top of the set during man-pack operation but may be detached from the set on the ground spike (fig. 9) when remotely sited aerials are used. For the latter application an aerial unit specially fitted with a meter is available as an optional item (para. 5)

POWER SUPPLIES

GENERAL

8. Power is normally supplied by 12 volt rechargeable battery units, two being used in the low power set and four in the high power set. The rechargeable batteries each consist of nickel cadmium cell units sealed in epoxy resin but with their vents exposable to atmosphere via pressure relief valves. The batteries may be recharged 'in situ' by plugging one of the approved chargers into one of the mic-tel sockets (fig. 5) which also function as charging sockets. With the batteries fitted in a fully sealed battery compartment the charging voltage must be controlled to a constant potential to avoid gassing during 'in situ' charging. Four approved constant potential chargers are available providing safe and rapid recharging:-

The BCC 20, a petrol engine driven charger; the BCC 503 for mains operation; the BCC 13 hand-operated generator or the BCC 501 which allows batteries to be charged from 12V or 24V vehicle d.c. supplies. The charging procedures are very simple and are

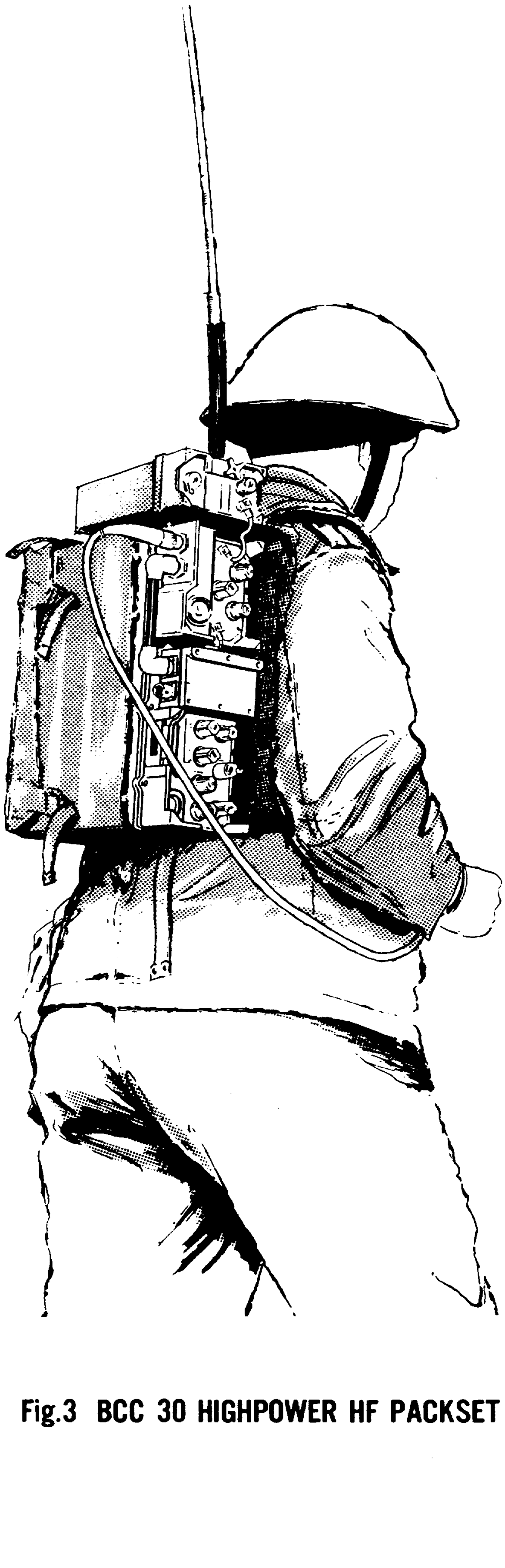


Fig.3 BCC 30 HIGHPOWER HF PACKSET

outlined in paragraphs 63 - 70. A negative earth system is used in the equipment and reverse voltages cannot be applied to the transistors provided the approved connector leads are used. The two sockets labelled CHARGE BATTERY (fig. 6) are supplied for the connection of the hand generator float charge lead. To prevent the connection of a reverse voltage to these charging sockets, a pair of silicon power rectifier diodes is connected between the positive charging socket and the battery positive terminals. The current consumption figures reflect the advantages of an all transistor design. On receive, consumption is only 40 milliamps, with the BCC 30 Low Power on transmit (CW) and RT-PM, - consumption is 900 milliamps, and on transmit RT-AM, 1100 milliamps. With a 1:10 send-receive ratio, a pair of good rechargeable batteries should last for 11 hours. Dry batteries, which are available as an alternative <u>for the low power set only</u> should last for two-thirds the period of the rechargeable units.

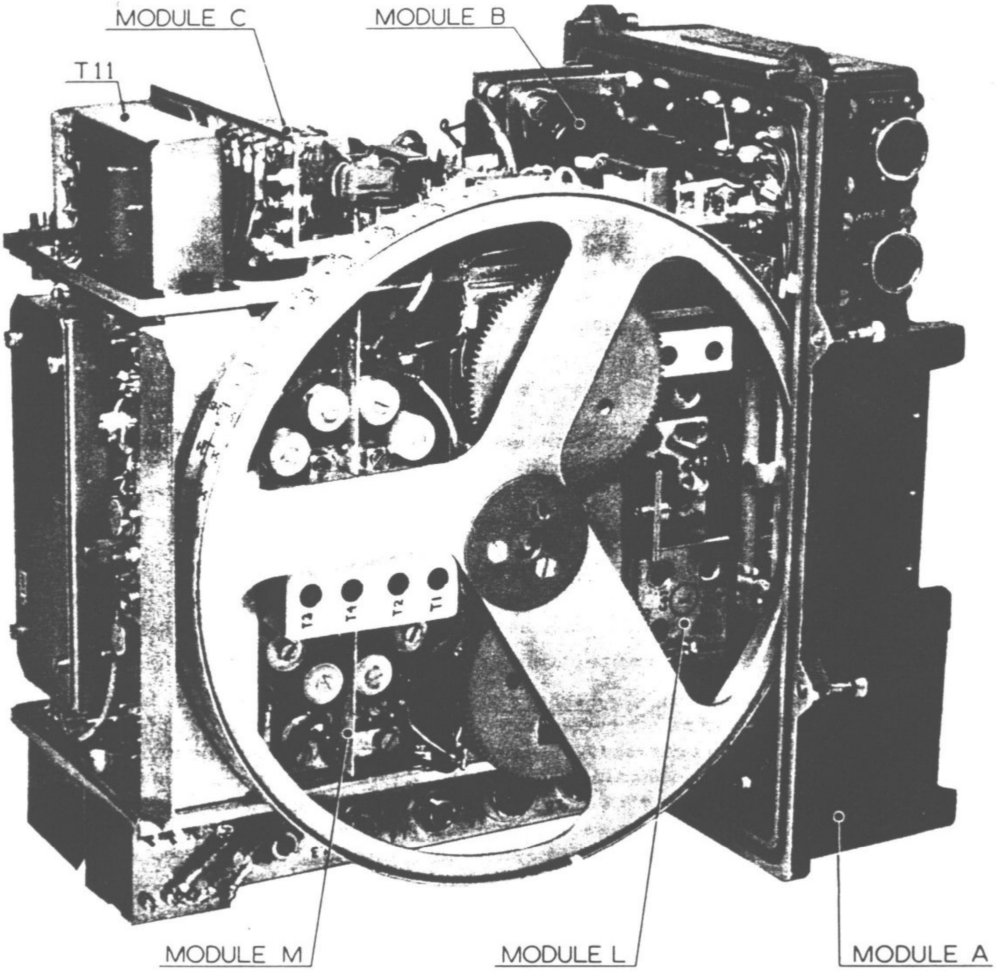
CIRCUIT ARRANGEMENTS LP

9. A link in the battery compartment connects the batteries in parallel so that the nickel cadmium units can be charged 'in situ' with the set switched off. However, when dry batteries are used this link must be removed to prevent the dry batteries from discharging across each other with the set off. When the set is switched ON, the pair of batteries are connected in parallel by the SYSTEM switch.

CIRCUIT ARRANGEMENTS HP

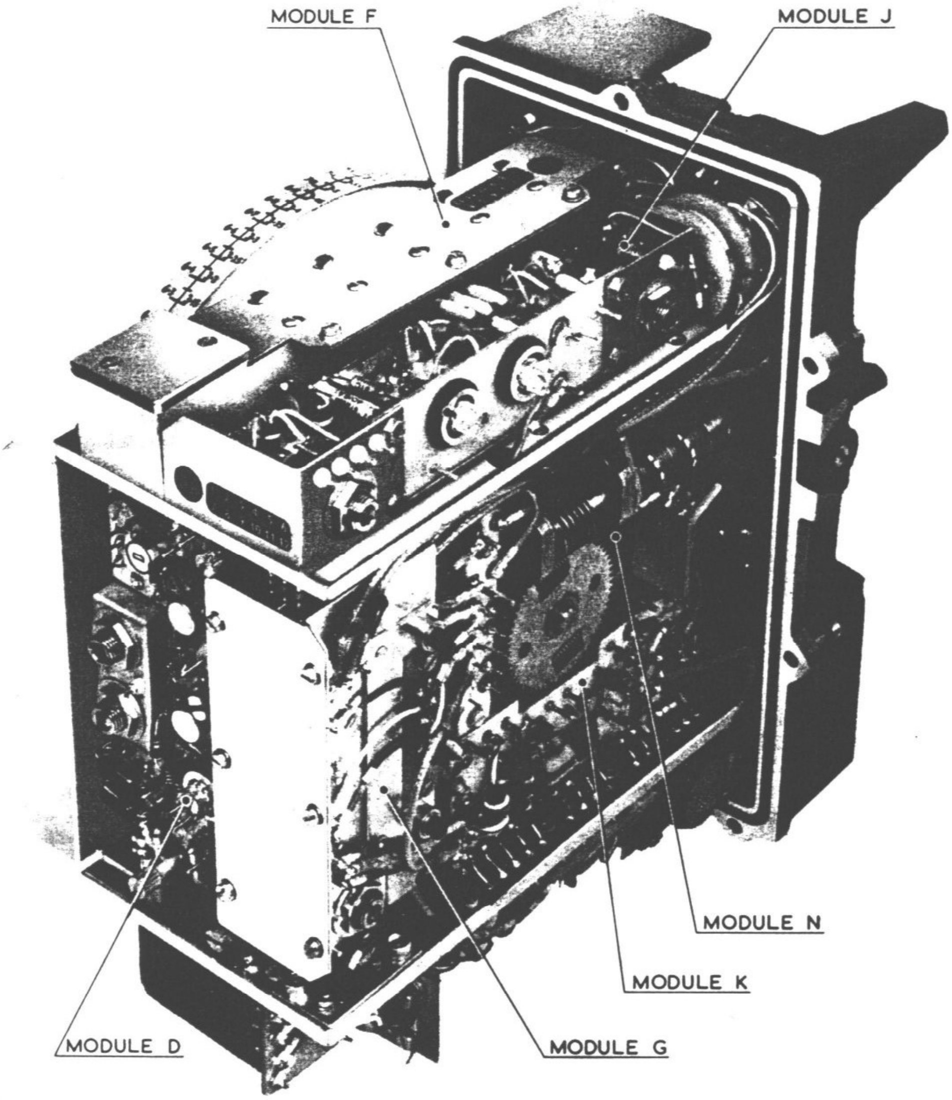
10. The four 12 volt nickel cadmium batteries are arranged as follows:-

<u>On receive</u> all four are in parallel, <u>on transmit PM and CW</u> two are in parallel with two connected in series to provide a 36 volt supply for the amplifier. <u>On transmit AM</u> two parallel connected pairs are connected in series to provide a 24 volt supply for both the amplifier and its modulator. On transmit CW and RT-PM, the current consumption is 2.4 amps (MAX) and on transmit RT-AM, 3.3 amps (MAX). On receive the consumption is only 40 milliamps and with batteries in good condition the supply will allow 8 hours of efficient operation with an average (1:10) send-receive ratio. All four batteries can be recharged 'in situ' by any of the chargers listed in para. 8, provided the set is switched off or is on receive. When the set is on transmit however, only two batteries are charged, but these are the two which bear the heaviest load.



Module				
A	...	...	...	Front Panel Assembly
B	...	...	...	PA Transistor Assembly
C	...	...	...	Transmitter Modulator, Side Tone Oscillator, Wide Band Amplifier, Receiver AF Amplifier
L	...	...	...	PA Tank Circuit (TX) and Free Tune Common Local Oscillator
M	...	...	...	Receiver RF Amplifiers RF1 and RF2, Transmitter Mixer and Driver

Fig.4 INTERNAL DETAILS (1)



Module		
D ~~A~~	... ...	AFC Amplifier, Limiter and Discriminator Units
F	... ...	500 kc/s Band Pass Filter and Receiver Mixer
G	... ...	500 kc/s Oscillator and Receiver Detector/ Noise Limiter
J	... ...	IF Amplifier, AGC Detector and Amplifier
K	... ...	Relay RLA, Crystal Common Local Oscillator & Buffer Amplifier
N	... ...	Tuning Capacitor Ganged Assembly

Fig.5 INTERNAL DETAILS (2)

OPERATION

FUNCTION OF CONTROLS (Fig.6)

SYSTEM SWITCH

11. This switch has five positions engraved OFF - TRF - PM - AM - CW. The function of the set in each position is as follows:-

(1)	TRF - (Tune RF) -	Selected while aligning the transmitter and receiver tuned circuits to the selected crystal frequency.
(2)	PM -	Selected for tuning the Aerial Tuning Unit (ATU) to the indication on the meter in preparation for operation on PM, AM or CW. Selected when voice communication is required with phase modulation of the transmitted carrier. In this position the discriminator is connected in the receiver circuit instead of the AM detector.
(3)	AM -	Selected when voice communication is required with amplitude modulation of the transmitted carrier, in this position the AM detector is selected into circuit.
(4)	CW -	Selected for CW operation on either crystal or free tuning. Also used to facilitate netting on free tune and for obtaining a battery voltage check reading on the set meter.

CW TONE

12. This is the BFO control used while working on CW to obtain the required morse tone. For netting to a control station while setting up on free tuning, the pointer of the BFO control should be set to the white spot. This is a position preset at about 25°C.

RF TRIM

13. This control is used for final tuning of the Power Amplifier circuit to the ATU or to the RF Amplifier No. 1 in the high power version.

BAND AND CHANNEL

14. The BAND switch selects either the low (L) or the high (H) section of the band covered by the set. The sections are 2 - 4 Mc/s and 4 - 8 Mc/s. The CHANNEL switch selects the required crystal controlled channel (1 - 9L or 1 - 9H) or free tuning in positions F (L and H). If the switch is moved to a position marked T (test) both the common crystal and free tune oscillators are switched off. This facility is only used during the internal setting up of the Transmitter Mixer when the circuit must be balanced and tuned with the local common oscillator switched off. During normal operation the set will become totally inoperative if the switch is left in this position.

GAIN

15. This control sets the receiver audio output level.

TUNE

16. This is a slow motion drive controlling the ganged oscillator and transmitter and receiver tuned circuits.

METER INDICATIONS

17. A small 100-0-100 microammeter fitted to the front panel of the transmitter-receiver unit shows tuning indications and the state of the batteries. Built in beta light fluorescence enables the meter to be seen in the dark. The functions of the meter in each position of the SYSTEM switch are:-

OFF

18. The meter is out of circuit in this position and the needle remains at centre zero.

TRF

19. The meter reads approximately at centre zero and provides a small positive deflection when all tuned circuits are exactly aligned during the tuning procedure.

PM

20. The meter is biased to the left so that it reads slightly more than - 100 μA . This allows the full scale deflection of the meter to be used to register aerial current while the Aerial Tuning Unit is being tuned. The PM position always must be used for tuning the transmitter irrespective of the SYSTEM finally selected.

AM

21. The meter is biased as in the PM position to indicate aerial current while transmitting on AM. It is not good practice to tune the transmitter on AM.

CW

22. The meter reads battery voltage; a green sector on the scale indicates the range of voltages acceptable for operating the set efficiently.

CRYSTALS

23. Eighteen crystal controlled channels are available. The set is designed so that each crystal is common to both transmitter and receiver. This is achieved by using a common local oscillator and a separate side step 500 kc/s oscillator which is locked by an automatic frequency control loop. This 500 kc/s signal is subtracted from the crystal frequency on transmit so that the transmitted frequency is the crystal frequency minus 500 kc/s. On receive, the signal frequency is subtracted from the local oscillator frequency in the receiver mixer to give a 500 kc/s intermediate frequency.

24. Style K crystals are used for high band and Style D crystals for low band and are fitted into sockets in the crystal compartment located at the top of the front panel. The crystal sockets are accessible by removing the six screws securing the cover of the compartment and the sockets are channel numbered as shown on the inside of the cover. Sockets L1 - L9 (low band) take crystals for any signal frequency between 2 and 4 Mc/s and sockets H1 - H9 (high band) take crystals for any signal frequency between 4 and 8 Mc/s. The crystal frequency required for a signal frequency may be found by using the formula:-

Common Crystal Frequency = Signal Frequency + 500 kc/s

For example:- A 3.75 Mc/s crystal will be required for working on a signal frequency of 3.25 Mc/s.

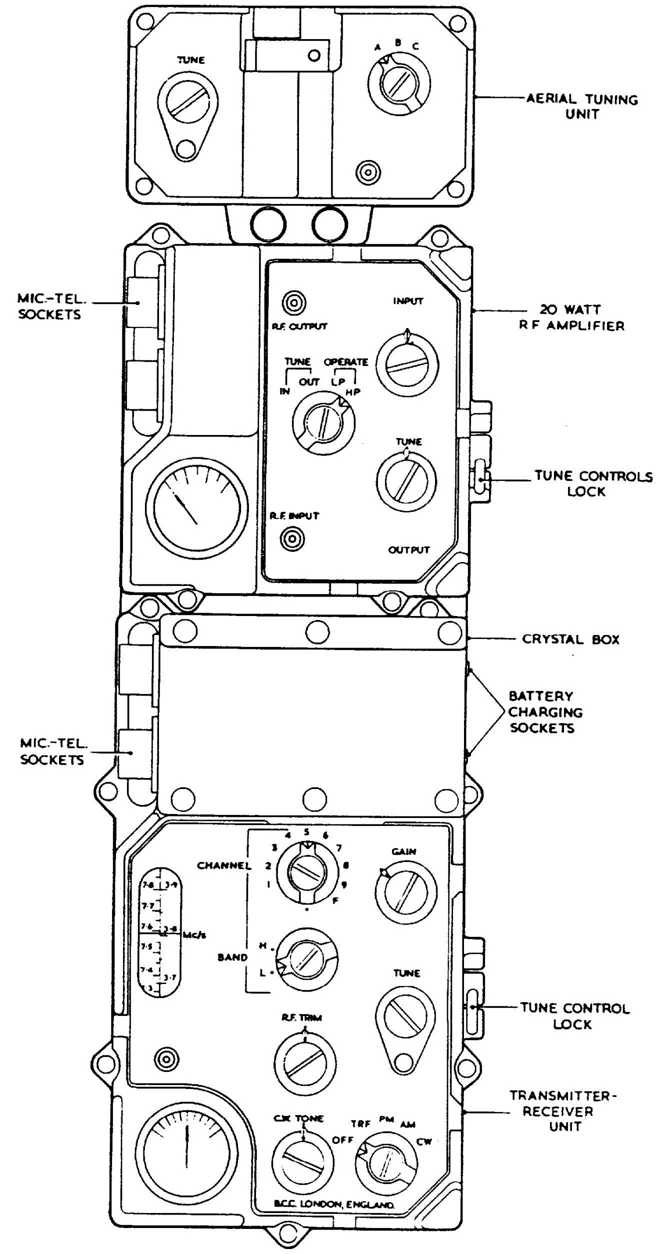


Fig.6 PANEL CONTROLS

SELECTION OF OPERATING FREQUENCY

25. Any frequency within the band covered by the set may be selected for crystal or free tuning operation, no internal adjustment is required when fitting new crystals and it is a simple operation to do so in the field.

AERIALS

26. In the normal man-carried role the set should be used with an 8 ft. (8 section) rod aerial. This will allow ground ranges of approximately 8 miles between sets working on voice on low power (maximum about 3 watts). With the high power amplifier (maximum about 30 watts) in use the range will improve to between 15 and 30 miles. For greater ranges the set may be operated as a semi-static station using a 14 ft. rod, a 27 ft. end-fed wire aerial, a quarter wave end-fed aerial with counterpoise, or a matched horizontal dipole using a braided wire radiator with co-axial feeder. Using the end-fed quarter wave and matched dipole aerials will allow typical sky ranges of up to 500 miles.

GENERAL NOTES

27. The results obtained from any HF set depend largely on the type of aerial used and its location. Since packsets are used at sites selected more for their convenience than their suitability for optimum radio wave propogation, as efficient an aerial as possible must be used.

28. A wire aerial system erected with little care may by chance give adequate communication over short ranges but it is likely to be useless for long range working and will not allow the full capability of the set to be realised.

29. The length of the radiating element of the aerial system is critical for maximum efficiency in reception and transmission and is related to the frequency used. Details of the methods of adjusting the lengths of the radiating elements of the dipole and end-fed quarter wave aerials are given in the following paragraphs.

30. Although the length of radiating element as a rule should be changed when changing frequency, when working over short distances the inconvenience of lowering and re-erecting the aerial may not be justified since results from an unaltered aerial may be quite satisfactory. Operating with an aerial of incorrect length should, however, be considered exceptional practice and is normally only justified if the error does not exceed about 2% of the proper length.

ADJUSTMENT PROCEDURES

31. Detailed instructions for the aerial systems which may be used, are given in the following paragraphs. When the lightweight 24 ft. mast aerial Type 1381 is used reference should be made to the operators manual code No. OM 151.

DIPOLE (fig. 7)

32. This is the most efficient of the three systems provided and always should be used if long range communication is required.

33. The two elements of the dipole aerial each consist of a 34 metre length of copper-Terylene aerial braid. The braid is marked along its length by sleeves which indicate the frequency at intervals of half a megacycle facilitating the selection of the length of braid necessary to form a correctly matched dipole aerial. The braids are stored at the end

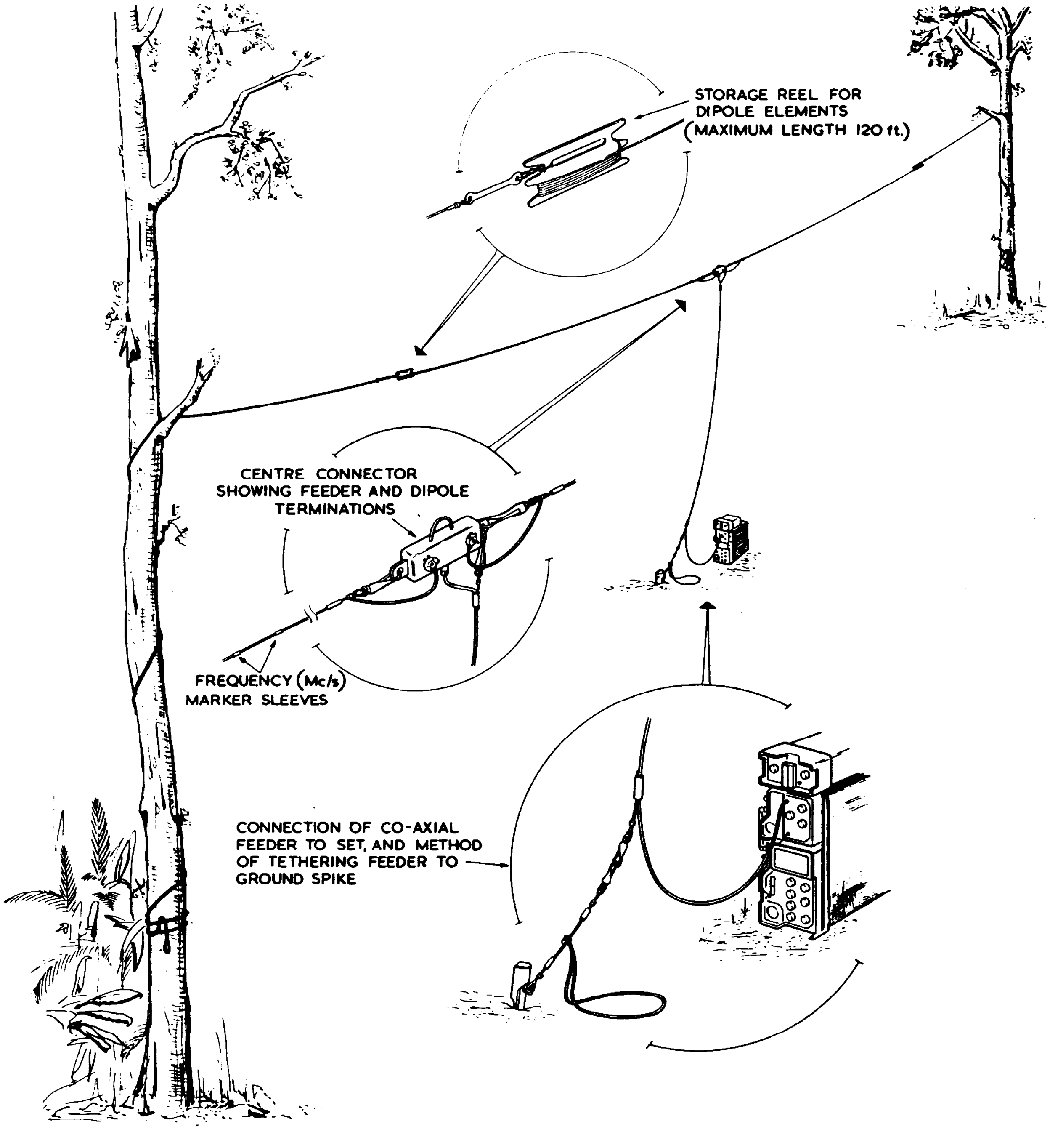


Fig.7 BCC 30 DIPOLE AERIAL

points of the aerial on metal reels which are rotated to reel the braid in or out until the correct length is obtained. The braid not in use being stored on metal reels is shorted out and this prevents the formation of inductance in series with the radiating elements. The reels and the attached aerial elements are supported by nylon halyards (and insulators) which are also stored on the reels when not in use.

34. To erect the aerial, suspend it horizontally in as straight a line as possible broadside to the direction of required communication. For attachment purposes it is best to use the Type 1381 lightweight masts. If these cannot be erected choose trees or other convenient attachment points which are sufficiently far apart to allow the full length of the halyards to be used. The radiating elements should be well clear of large metal objects, overhanging branches and foliage and should be as high above ground as possible (within the 40 ft. limit set by the length of the feeder cable).

35. If conditions compel that the aerial be erected in line with the direction of communication, it should be sloped down with the end nearest the direction of required communication nearer the ground by about half the height of the other end. This will improve propagation in the forward direction.

36. Position the co-axial feeder so that it runs straight down from the centre of the aerial with the first 5 or 6 feet at right angles to the radiating elements and plug in the co-axial feeder directly to the RF OUTPUT co-axial socket on the amplifier. The dipole current is monitored for tuning purposes in the meter on the RF Amplifier No. 1 (high power operation) or in the meter on the transmitter-receiver unit (low power operation). A useful method of trimming the dipole elements to precisely the correct lengths for the operating frequency, is to make use of the characteristics of the metering system to register a maximum dipole current at the frequency to which the elements are set. If, by tuning (on Free Tune operation) to either side of the operating frequency it is possible to find a greater maximum reading on one side, then the lengths of the elements need alteration. The exact alteration required may be calculated from the following simple formula:-

with f in Mc/s

f_1 = the operating frequency

and f_2 = the frequency at which maximum meter deflection is obtained

the required alteration of the element length is:-

$$\frac{75}{f_1} - \frac{75}{f_2} \text{ metres}$$

NOTE:- The sign of the resultant indicates addition or subtraction of length.

QUARTER WAVE END-FED AERIAL WITH COUNTERPOISE (fig. 8)

37. The dipole (para. 32) is also used to form this aerial. It is simpler to erect than the dipole and is intended to be used when medium ranges of communications are required.

38. Provided the location is not difficult for propagation, this type of aerial requires only one elevated fixing point and should be ideal for medium range working.

39. The two elements of wire are reeled out as with the dipole until the correct length is obtained by interpolating the frequency marker sleeves. One wire is erected to form the quarter wave radiator, while the other is used as the counterpoise on the ground.

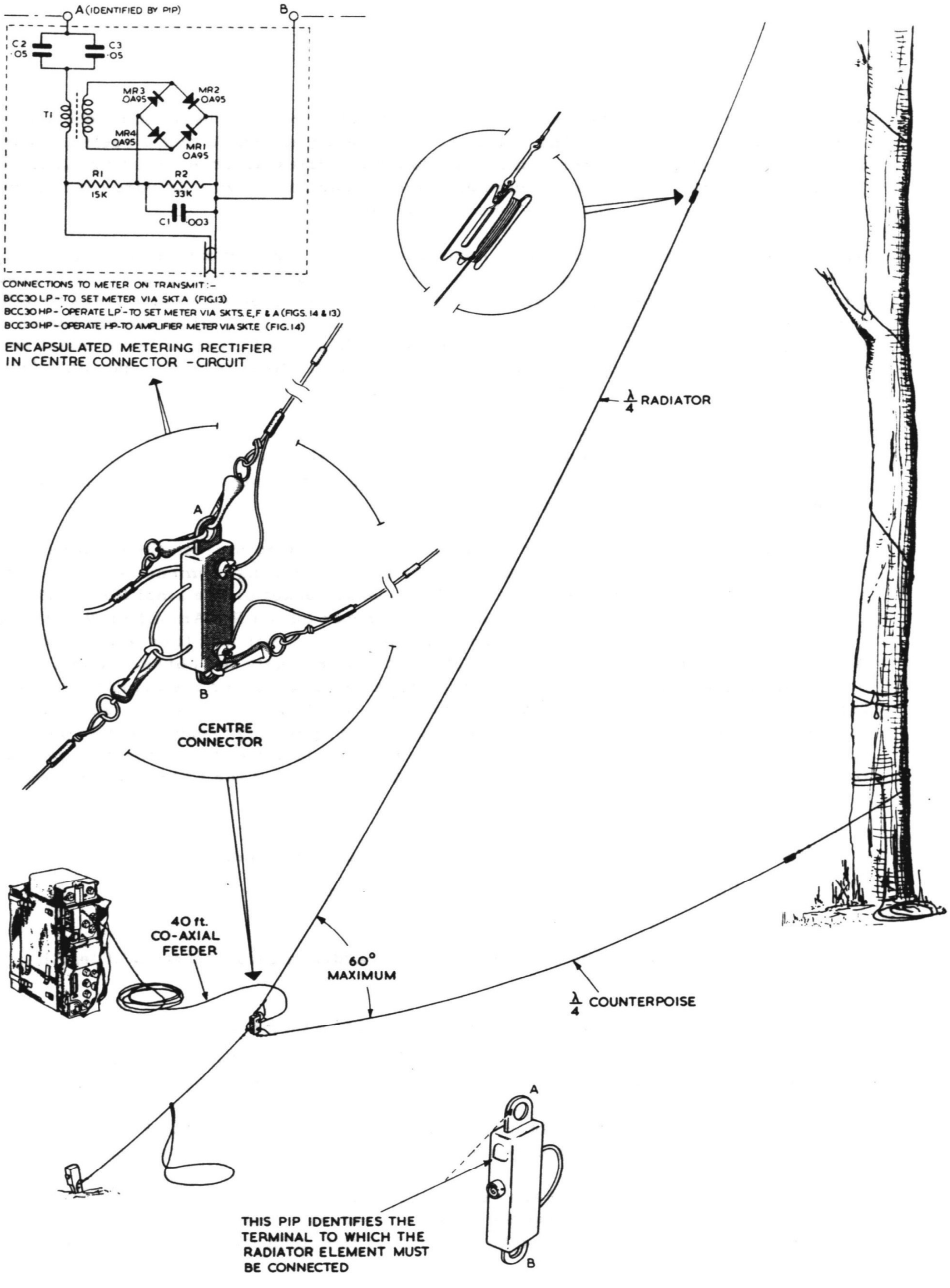


Fig.8 BCC 30 QUARTER WAVE ENDFED AERIAL WITH COUNTERPOISE

40. To erect the aerial, raise it by means of the halyard to a point as high as possible above the ground and, using the dipole 40 ft. feeder, connect the socket on the centre connector to the co-axial socket on the transmitter-receiver for (LP versions) or to the RF OUTPUT socket on the RF Amplifier No. 1 (HP versions). Whereas the centre connector can be used either way round with the dipole, it must only be used in one orientation with the quarter wave end-fed aerial as shown in fig. 8. This ensures that the current monitored during tuning is that in the upright element.

41. Different positions of the counterpoise wire should be tried as it is possible by trial and error to obtain a worthwhile improvement in performance. For example, better results may be obtained by fixing the counterpoise wire about 18 inches above the ground rather than by leaving it directly on the ground.

42. The quarter wave end-fed aerial relies upon good ground conductivity for efficient operation and best results are therefore obtained from locations where the soil is moist. River banks or water-side sites allow particularly good results whereas rocky and dry sandy districts, having poor conductivity, will not allow such good results.

ROD AERIALS

43. The 8 ft. and 14 ft. rod aerials are intended for local communication and are used in conjunction with the Aerial Tuning Unit; with the 8 ft. rod in position the set becomes a completely self-contained portable station which can be used for telephony operation while being carried on the back in the normal manner, using the pressel switch on the handset or headset to transmit. The flexible aerial coupling should always be used with the rod aerials to prevent the aerial from snapping at the ATU socket.

44. The 14 ft. rod aerial is primarily for use with the set stationary using the right angle adaptor.

WARNING If the 14 ft. rod aerial is used on the move great care must be taken to avoid the rod touching overhead high tension cables.

45. When used at a fixed location (fig. 9) with either an 8 ft. or 14 ft. rod aerial improvement in radiation and a consequent increase in range can often be obtained by earthing the set to either the ground spike or in cases of poor soil conductivity or ground frost to a counterpoise system made by utilising the elements of the dipole aerial kit. To erect a rod aerial, remove it from its stowage pocket in the haversack, open it out and erect it by fitting the sections together. Commence with the section having the largest diameter and work towards the top, keeping the wire taut throughout by pulling it out through the end section. Fit the flexible coupling into the socket at the top of the aerial tuning unit and secure it firmly by means of the wing nut. Fit the larger end of the rod into the top of the flexible coupling.

END-FED WIRE AERIAL (fig. 10)

46. Two fixed lengths of 11 ft. and 16 ft. may be linked together to form a 27 ft. end-fed wire aerial which may be used when a quickly erected aerial is required to increase the operating range. For operation at the high end of the frequency range (6 - 8 Mc/s) a 150 pF capacitor is connected in series with the 27 ft. length of wire. For all other frequencies the aerial in use is directly connected to the aerial terminal of the ATU after the rod has been removed, and is then raised to form a sloped aerial by means of a halyard connected to the end of the aerial via an insulator.

REMOTELY SITED AERIALS

47. Rod and end-fed wire aerials may be used as remotely sited aerials in conjunction with the special remote ATU fitted with a meter (para. 5) and linked to the set by the 40 ft. dipole co-axial feeder. The ground spike is driven into the ground first and then the ATU is fitted to it (fig. 9) by means of the two hexagonal socket headed screws. A right angle coupling is linked to correctly orientate the rod. If the end-fed wire radiating element is used, it is secured to the ATU socket by a special end fitting which is then locked by tightening the ATU wing nut. The counterpoise wire is screwed to the earth spike wing nut. It is preferable that two men work together to tune the set when the remote ATU is used. During operation No. 2 of the tuning procedure, one man at the remote ATU operates the tune control using the remote meter while the other man (at the set) keeps the equipment on transmit by closing the pressel switch. A final trim of the ATU tuning for maximum in the ATU meter is carried out in a similar manner after the completion of operation No. 6. The circuit diagram of the Aerial Tuning Unit is shown in fig. 16.

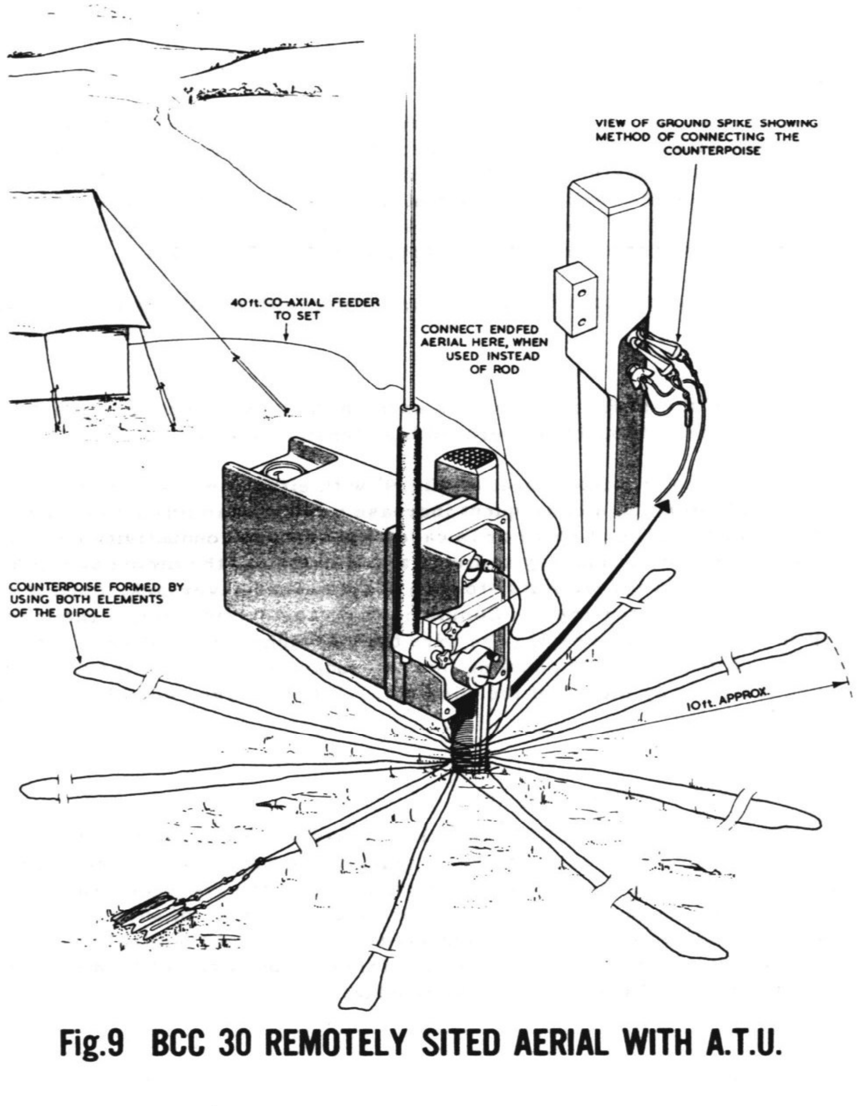


Fig.9 BCC 30 REMOTELY SITED AERIAL WITH A.T.U.

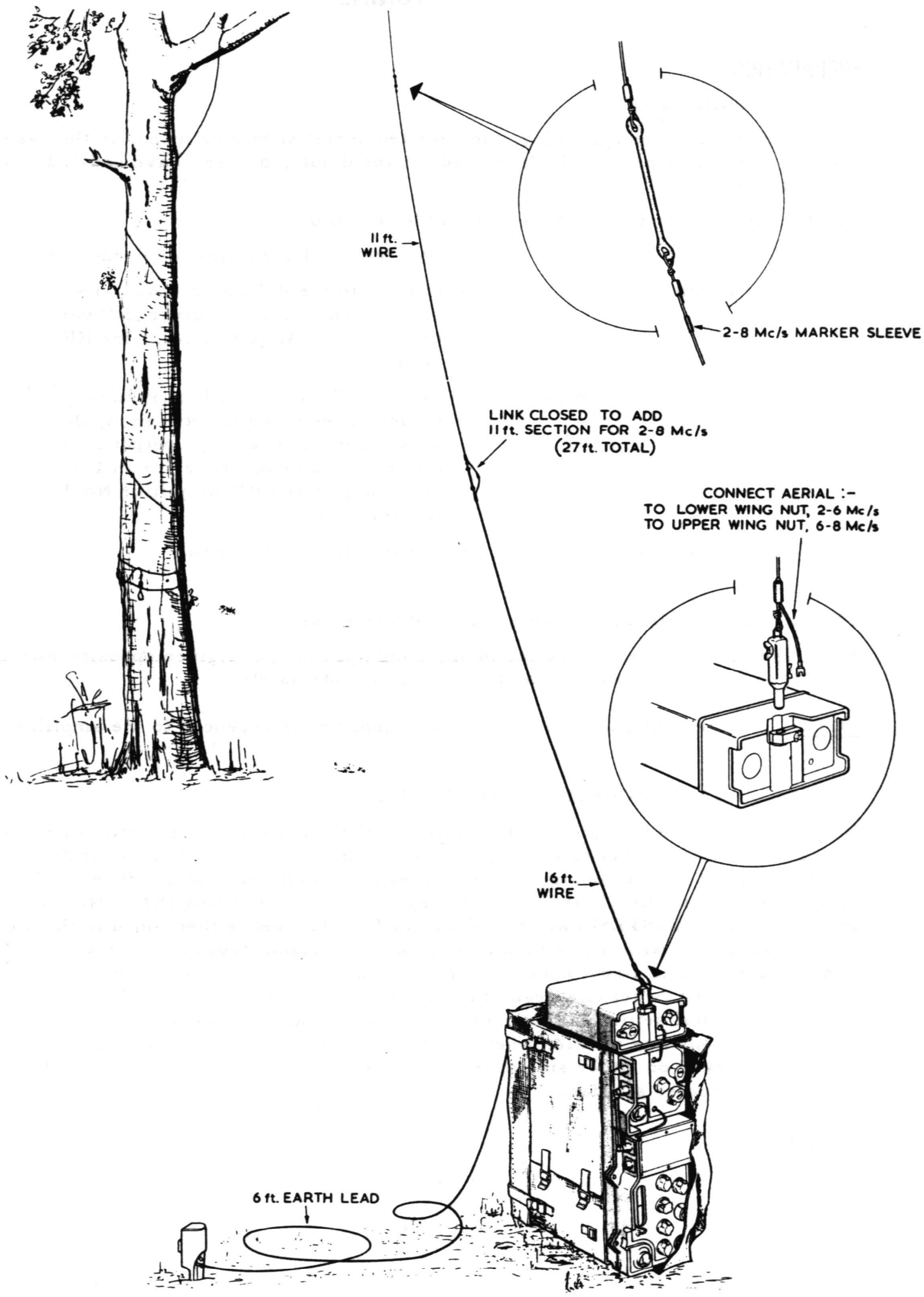


Fig.10 BCC 30 ENDFED WIRE AERIAL

TUNING

PREPARATION

AERIAL CONNECTION

48. Before commencing tuning, the selected aerial should be fitted, in the case of the rod, or erected as previously described for the dipole, quarter wave end-fed and 27 ft. end-fed aerials.

The terminal connection to the set should be as follows:-

(1)	Rod	- connect to ATU via flexible connector
(2)	Dipole	- connect to the RF output co-axial socket on the transmitter-receiver (LP versions) or on the RF Amplifier No. 1 for HP versions
(3)	Quarter wave end-fed	- use the ATU co-axial link or the dipole feeder, connecting it between dipole centre connector and RF output socket (on the transmitter-receiver in LP versions, on the RF Amplifier No. 1 in HP versions)
(4)	27 ft. end-fed	- connect to ATU terminal.

TUNING PROCEDURE (for both LP and HP versions)

49. The complete procedure for tuning a high power set is given opposite with a diagram (fig. 11) to facilitate the location of meters and controls etc.

<u>NOTE</u> For tuning LP versions simply ignore all references to the amplifier.

DIAL CALIBRATION CHECKS - PROCEDURE

50. Efficient free tuning operation relies on the accuracy of the frequency markers on the tuning dial. Before this form of operation is commenced, the dial calibration can be checked against any of the signal frequencies for which crystals are fitted. To check against any crystal fitted, the required crystal is selected using the BAND and CHANNEL switches and the SYSTEM switch is set to TRF. The set is then tuned to the signal frequency associated with the particular crystal (i.e. signal frequency = crystal frequency minus 500 kc/s) and a beat note is heard at or near to the signal frequency marked on the dial. The tuning is set to a peak of the meter deflection which occurs within the dead space and the dial setting is then noted. If there is any difference it is used as a correction to the cursor line position when resetting the dial. To facilitate calibration a series of dots is marked on either side of the cursor line and these are read off and used as a calibration transfer standard.

BATTERIES

RECHARGEABLE UNITS

MAIN DETAILS

51.

Type	Nickel cadmium
Normal e.m.f.	1.2V per cell
No. of cells	10
Capacity	0.85 aH
Construction	Sealed in Araldite but each cell fitted with a safety vent
End of life volts	10.5
Weight	1 lb. 14 oz. (0.9 Kg.)
Dimensions	$2\frac{1}{4}$" x $3\frac{3}{4}$" x 3" (57 mm x 94 mm x 75 mm)
Life in BCC 30 on 1:10 send/receive ratio	LP set (2 batteries) 11 hours HP set (4 batteries) 8 hours

CAPACITY TEST

52. Owing to a paired arrangement of batteries being used in the LP sets, they should also be tested in pairs as follows:-

(1) Discharge a pair of fully charged batteries for at least 12 hours on a load of 700 mA for one minute followed by a load of 40 mA for 10 minutes, repeating alternately. Record the end-of-discharge volts on the 700 mA load.

(2) Recharge fully and then discharge for 6 hours with loads of 2 amps for one minute followed by 40 mA for 10 minutes, repeating alternately. Record the end-of-discharge volts on the 2 amps load.

The end-of-discharge volts for each test must be 10.5V on the greater load.

RECHARGING

53. The batteries can be recharged either by a constant current of 65 mA for 21 hours or in a constant voltage system with the initial charge current limited to 2 amps. A list of suitable charger units using the rapid charge constant voltage system is given in para. 63. Where these chargers are not available, in emergencies a battery may be charged from a 24V d.c. source via a 180 ohm 2W resistor but this is a long process (21 hours) compared with the short charge times of up to 5 hours which are possible by using the approved chargers. These will restore as much as 50 per cent of the battery capacity after only one hour.

STORAGE AND TRANSIT

54. It is advisable to completely discharge batteries before storage or transit periods longer than about two weeks. Storage in a discharged condition has no effect on the service life of the battery and ensures that no deposit builds up around the vents. Best storage conditions are in a cool dry place. The discharge procedure consists of discharging the battery across a 10 - 20 ohm 20 watt resistor for 2 hours.

MAINTENANCE

55. No topping up is necessary and the only routine maintenance is periodic inspection of the vents and the removal of any corrosion. For this a nylon brush or a soft wood or plastic tool should be used. The vent screws never should be unscrewed.

DRY BATTERY

56. A pair of dry batteries may be used instead of the rechargeable units in low power sets only. The dry battery is of the same physical dimensions as the rechargeable unit but is lighter at 1 lb. 8 oz. (0.7 Kg.).

CAPACITY

57. The capacity of two dry batteries in parallel is lower than two rechargeable units. As a simple life comparison, a pair of good unused dry batteries should last for about two thirds the time of a pair of good rechargeable units, i.e. 5.5 hours on AM, 6.5 hours on PM on a 1:10 send/receive ratio.

TERMINAL VOLTS

58. The nominal on-load terminal voltage of a serviceable new dry battery is 12V and the end-of-life volts on load is 10.5V.

STORAGE

59. The capacity loss of new dry batteries should not exceed 20 per cent during a 12 month storage period provided the storage conditions are maintained as recommended for dry batteries.

FITTING

60. For low power sets either two dry or rechargeable batteries are fitted. For high power sets four rechargeable batteries are fitted. Dry batteries must not be used in high power sets. Fitting is carried out in the same manner for both the dry batteries and nickel cadmium units and simply consists of removing the battery compartment cover, inserting the batteries into the spaces provided and inserting the plugs. However, for BCC 30 low power sets, when changing the type of battery from dry to rechargeable or vice-versa it is necessary to check that the link across two feed-through insulators in the battery compartment is fitted or removed according to the type of battery in use as detailed in the following paragraphs.

BATTERY PARALLELING LINK IN BCC 30 LP

61. When dry batteries are in use the link should be removed. This ensures that the batteries do not discharge across each other when the set is switched OFF.

NOTE When rechargeable batteries are fitted, the link must be resoldered in position to ensure that both batteries are recharged 'in situ' with the set switched OFF.

62. To obtain access to the link in the battery compartment, release the fuse holder assembly, by unscrewing the four 6BA cheese headed screws securing it to the case.

BATTERY CHARGING

GENERAL

63. There are four types of constant voltage charger available as follows:-

(1) Hand operated generator BCC 13

(2) 12V/24V operated BCC 501

(3) Mains operated BCC 503

(4) Petrol-engine driven generator BCC 20.

SAFETY NOTES

64. To prevent possible accumulation of gas in the sealed battery compartment during the full charge 'in situ', the seal of the battery compartment must be released and must only be re-made 10 minutes after completion of charge. If only float charging 'in situ' is carried out, as a safety rule the battery compartment seal must be released at least once a week.

USING THE BCC 13 HAND GENERATOR

65. The float charge lead is connected to the two single pole battery charging sockets on the transmitter-receiver unit. The generator may be hand turned at a controlled speed to directly power a BCC 30 LP by float powering it across the discharged batteries. By using the BCC 13, a BCC 30 HP can be similarly float powered for operation on low power or over a period the batteries can be recharged for operating eventually on high power. Since the batteries are encapsulated, they must be charged at an adequate voltage but not high enough to cause the cells to gas and to ensure this the operator is provided with a precise indication of the correct and also the most economical cranking speed by means of a pilot lamp mounted on top of the hand generator. Initially as cranking speed is developed the light comes on and the operator continues to crank faster until the lamp just extinguishes. This indicates the correct speed (60 - 70 r.p.m.) and it is maintained by the operator cranking just fast enough to keep the lamp extinguished. Full details of the BCC 13 Hand Generator are given in the BCC 13 Technical Manual TM 177.

USING THE BCC 501 12V/24V OPERATED CHARGER

66. Where a vehicle using either a 12V or a 24V d.c. supply is available, the BCC 501 charging unit may be used to recharge the BCC 30 batteries either 'in situ' via one of the 6 pin sockets on the set or after removal by using a four way adaptor. The charging unit consists of a transistor converter which operates from either a 12V or a 24V d.c. input but has to be preset for the required operating supply. The unit converts the input d.c. supply to a.c. The a.c. is transformed and then rectified to d.c. by a bridge rectifier and filtered. Series regulator transistors operate in the output circuits of the charger to keep the output voltage constant at 14V. At the beginning of the charge period the current supplied is between 1 and 1.5 amps. This current falls gradually as the battery voltage rises. For further details refer to the BCC 501 Technical Manual TM 179.

USING BCC 503 AC MAINS OPERATED CHARGER

67. Where 100/120 or 250V 50 c/s mains supplies are available the BCC 503 charger may be used to re-charge up to four batteries either 'in situ' or after removal. For further details refer to the BCC 503 Technical Manual TM 178.

USING BCC 20 PETROL ENGINE DRIVEN CHARGER

PROCEDURE

68. For charging up to four BCC 30 sealed batteries either 'in situ' or after removal a constant potential outlet is specially included in the BCC 20. Special presetting is required however to ensure that the constant voltage output suits the ambient temperature. Although presetting is carried out in the factory it is advisable to check the adjustment of RV4 as follows before carrying out charging to ensure that both efficient charging takes place and the maximum cyclic life of the batteries is obtained.

(1) Set the selector switch to 12V. Set the engine speed for a voltmeter reading of 12V. Adjust RV4 (12V preset) to suit the ambient temperature as follows:-

At 0^{o}C the e.m.f. per cell of nickel cadmium batteries must not exceed 1.5V. Set RV4 to 14V.
At $+50^{o}$C the e.m.f. per cell of nickel cadmium batteries must not exceed 1.37V. Set RV4 to 13.7V.
At $+55^{o}$C the e.m.f. per cell of nickel cadmium batteries must not exceed 1.35V. Set RV4 to 13.5V.

(2) The rheostat (RV5) above the Group 2 terminals is used to limit the initial current into the battery to 2 amps.

(3) Set the selector switch to 12V; initially set RV5 fully counter-clockwise. Connect the sealed battery (or batteries in parallel) to the Group 2 terminals.

Rotate RV5 to obtain required charge current.* This current should reduce after a few minutes as the battery takes charge.

69. If the engine stops, both charging circuits are protected by silicon diodes to prevent the batteries from discharging through the regulator circuits.

70. End of charge is indicated by the charge current falling to 20 mA per battery. If no meter is handy the completion of charge may be judged by elapsed time as follows:-

One pair from a LP set should require 5 hours
Two pairs from a HP set should require 10 hours.

For further details of the BCC 20 refer to the BCC 20 Technical Manual TM 170.

*NOTE that the maximum currents permitted are as follows:-

on 12V - 6 amps
6V - 4 amps
4V - 3 amps

CONNECTION OF OPERATING EQUIPMENT

GENERAL PURPOSE 6 PIN SOCKETS

71. Two of these sockets are available on both the low and high power versions of the set. Their basic function is to permit connection of the headgear (handset or headset or both) and the morse key, but to avoid the use of separate sockets, they also provide connection facilities for the battery charging lead from any BCC charger unit or for the lead from the BCC 513L remote control unit. On the high power version the link must always be fitted between the two middle 6 pin sockets.

MICROPHONE–TELEPHONE HEADSET

72. The microphone-telephone headset, is normally used by the operator either on the move or when stationary with a high local noise level.

MICROPHONE-TELEPHONE HANDSET

73. The handset is provided for an officer or NCO to operate the set in parallel with the operator.

MORSE KEY

74. For CW telegraphy operation, the morse key is plugged into a spare socket. The morse key may, if desired, be secured to the knee by means of the strap provided. The headset, should be worn in preference to using the handset, so that the hands are left as free as possible. Side tone while sending and CW morse reception will be heard in the telephones. Note that for CW transmission and reception the SYSTEM switch must be set to CW and that while the key remains unpressed the set is in the receive condition.

BRIEF TECHNICAL DESCRIPTION

75. The brief technical description of the operation of the transmitter-receiver is based on the schematic diagram given in fig. 12. The circuit diagram of the transmitter-receiver is given in fig. 13.

76. The transmitter-receiver uses a common oscillator circuit for both transmitter and receiver. The common oscillator either may be a crystal controlled oscillator (18 channels) or a free running oscillator so that variable tuning can be employed over the whole frequency band.

77. The system is such that the common oscillator frequency is always 500 kc/s higher than the operating frequency. On transmit, the output of a second oscillator, controlled to 500 kc/s by an automatic frequency control loop, is fed into a balanced mixer together with the output from the common oscillator. The 500 kc/s signal is subtracted from the local oscillator signal in the balanced mixer and the output forms the transmitted frequency. This is amplified in a wide band amplifier before it is passed via a driver stage to the Power Amplifier. The output of the Power Amplifier stage is coupled to either the RF Amplifier No. 1 or to the ATU via contacts of the send/receive relay.

78. The received signal is coupled via the aerial, ATU (RF Amplifier No. 1 if fitted) and contacts of the send/receive relay to the first of two RF Amplifier stages. The output from the second RF Amplifier, together with the output of the common local oscillator, is fed into the receiver mixer. In the receiver mixer, the signal frequency is subtracted from the local oscillator frequency to give a difference frequency of 500 kc/s which forms the intermediate frequency.

79. The 500 kc/s intermediate frequency is passed through a 500 kc/s filter which effectively improves the selectivity of the receiver making the overall bandwidth of the receiver ± 3 kc/s minimum at -6 dB and ± 10 kc/s maximum at -65 dB.

80. There are three stages of IF amplification before the signal is passed to a detector (when working on amplitude modulation) or to a discriminator (when working on phase modulation). Automatic gain control is applied from the AGC amplifier to both RF stages and to the first and second IF amplifier stages.

81. When receiving morse on CW, the 500 kc/s oscillator (para. 77) is switched on (it is normally on only during transmission) to act as a BFO. The CW TONE control is used to obtain the required morse tone by varying the frequency of the 500 kc/s oscillator. On transmitting CW, keying speeds up to 25 words a minute are possible.

82. The output from the detector (on AM) is passed via the noise limiter and the GAIN control to the audio amplifier. On PM the discriminator output is connected to the audio amplifier via a de-emphasis circuit.

83. CW keying is carried out by switching the 12V supply to the transmitter by means of the send/receive relay RLA. On CW, a side tone oscillator is also switched into circuit and the keyed output of the oscillator is fed into the operator's telephone via the audio amplifier.

84. When operating on RT-AM low power a high level modulation system is employed as follows.

The microphone output is amplified by a modulation amplifier, the output of which is impressed on the 12V supply lines to the wide band amplifier, the PA driver and the PA stage. Full modulation is applied to the PA stage but only partial modulation is applied to the PA driver and the wide band amplifier. The modulation output is regulated by an automatic modulation control circuit which ensures that over a wide range of speech intensities the level of modulation is held between a minimum 40 and a maximum 80 per cent. This makes it impossible to over modulate the transmitter. During high power operation unmodulated RF drive is required and the modulation amplifier output is switched off. Part of the circuit is then used as a pre-amplifier for a separate amplitude modulator circuit located in the external RF Amplifier No. 1.

85. When operating on RT-PM low or high power, part of the modulation amplifier circuit amplifies the microphone output before it is applied via a pre-emphasis filter to a reactor circuit which controls the phase of the 500 kc/s side step oscillator. The deviation is limited by the modulation control circuit to a maximum of 1.5 radians. For normal speech the deviation is about 1 radian.

86. Side tone is provided by feeding back a part of the amplified microphone signal to the output stage of the audio amplifier. The level of side tone for the operator while he is transmitting is preset.

87. The frequency of the 500 kc/s oscillator is controlled during transmission by an automatic frequency control loop (AFC loop). This consists of the reactor circuit coupled with the oscillator, an AFC amplifier and the Limiter Discriminator. The oscillator output is coupled via the AFC amplifier into the limiter-discriminator which is tuned to the IF (500 kc/s). A deviation in frequency causes a d. c. output to be fed back to the reactor circuit immediately to correct the frequency.

88. In this manner the frequency of the 500 kc/s oscillator which is subtracted from the common oscillator frequency to form the transmitted frequency (para. 77) is kept very stable.

89. When the common oscillator is working on crystal control the transmitted frequency (considered with the 500 kc/s oscillator) is kept accurate within 1 kc/s over the majority of the temperature range. When operating on free tuning the transmitted frequency is generally accurate to calibration within $\frac{1}{2}$ per cent.

90. The accuracy of the 500 kc/s oscillator frequency is used as a reference to net the transmitter-receiver to the same frequency as a control station when operating on free tuning. The CW TONE control provides a means of manually controlling over a small range ($\pm$ 4.2 kc/s minimum) the frequency of the 500 kc/s oscillator while it is being used as a BFO for CW reception. For netting on free tuning the CW TONE control is set to the white dot with the SYSTEM switch set to CW, so that the 500 kc/s oscillator is set to its nominal frequency. The control station is tuned in on free tuning until the IF signal developed beats with the 500 kc/s oscillator. When the tuning is finally trimmed to 'dead space' the common oscillator and ganged transmitter tuning capacitors are automatically aligned to the control station frequency. After this operation the transmitter-receiver is netted and the TUNE control must be locked. (For optimising search for netting see para. 50).

91. The SYSTEM switch is then set to the required position RT-PM, RT-AM or CW. On CW, without moving the TUNE control, the CW TONE control may be reset to obtain the required beat note for receiving morse telegraphy.

CIRCUIT DESCRIPTION

COMMON CIRCUITS

92. The circuits which serve both the transmitter and receiver are the common oscillator, the audio amplifier and the send-receive relay RLA. The 500 kc/s oscillator operates as a side step oscillator for the transmitter and also as a BFO for receiving CW.

SEND-RECEIVE RELAY RLA

93. RLA is a four section change over relay which is energised on transmit. Contacts of RLA function as follows:-

On Receive

(1) RLA/1 connect the 12V supply to the receiver RF and IF stages, the BFO variable bias circuit and to the first stage of the audio amplifier.

(2) RLA/2 connect the BFO variable bias to the reactor diodes ZD8 and ZD9 of the 500 kc/s oscillator.

(3) RLA/3 connect the input circuit of the transmitter mixer to earth.

(4) RLA/4 connect the aerial socket (SKTA) to the first receiver RF Amplifier RF1.

On Transmit

(1) RLA/1 connect the 12V supply to the transmitter RF stages, to the AFC Amplifier VT8, to the modulator pre-amplifier and via the System switch to the 500 kc/s oscillator, the discriminator, CW side tone oscillator and modulator output stage.

(2) RLA/2 connect a fixed d.c. bias voltage in series with the discriminator d.c. output fed to the reactor for AFC operation.

(3) RLA/3 connect the input circuit of the transmitter mixer to the output of the common oscillator.

(4) RLA/4 connect the transmitter output stage and aerial current metering circuit to the aerial socket (SKTA).

COMMON OSCILLATOR

94. The common oscillator is either crystal controlled or is free running. Separate circuits are employed for each form of operation. A single transistor VT28 is used for crystal operation. The circuit is selected automatically when the CHANNEL switch is set to any of the positions labelled 1 - 9. When free tuning is required the CHANNEL switch is set to F, the crystal oscillator is switched off and a two transistor oscillator circuit, VT17 and VT18 is selected into circuit. The oscillator is then tuned by capacitor GB3 which is part of the ganged assembly operated by the TUNE control. The correct coil for low or high band is selected into circuit by the BAND switch SWA. For details of crystal frequency selection see para. 23.

95. To provide accurate alignment of all RF circuits at any channel frequency during the tuning procedure it is arranged that with the SYSTEM switch set to TRF both the crystal oscillator and free tuning oscillators are switched on. The crystal controlled channel frequency nearest to the desired check point for free tuning is selected in the usual way using the BAND and CHANNEL switches. The free tuning oscillator is then tuned to the same channel frequency by using the TUNE control. The outputs of both the crystal oscillator and free tune oscillator are fed via VT16, a buffer stage, to the last stage of the audio amplifier and when the free tune oscillator frequency is very close to the crystal

frequency a beat note is heard in the phones. The TUNE control is set for maximum meter deflection within the dead space and the dial setting is then compared with the known channel signal frequency. Any difference can then be noted and used as a correction when setting the dial during the subsequent free tuning operation.

AUDIO AMPLIFIER

96. The Audio Amplifier consists of two p.n.p. transistors, an OC75 (VT20) driving VT21 (an OC83). The collector output of the OC83 is coupled via an output transformer to the operator's telephone. The amplifier performs four functions as follows:-

(1) It amplifies the receiver audio signal from the detector (AM and CW) or discriminator (PM).

(2) It amplifies the output of the side tone oscillator which operates when CW telegraphy is being transmitted, to allow the operator to monitor his keyed transmission.

(3) It provides modulation side tone by amplifying the microphone output.

(4) It amplifies the product of mixing the two frequencies produced simultaneously by crystal and free tune common oscillators during the tuning procedure (para. 95).

The input level to the amplifier from the receiver is set by a GAIN control RV6 in the base input circuit of VT20 (OC75).

TRANSMITTER CIRCUITS

MODULATOR AND CONTROL

Low Power Operation

97. The microphone output is connected via the input level preset RV4 to the base of a pre-amplifier transistor VT14 (OC75). The collector output of VT14 is transformer coupled into a push-pull stage using two OC83 transistors VT12 and VT13. To obtain automatic modulation control (AMC), part of VT13 collector output is fed back to the base of VT15 (OC140). The collector of this transistor is connected to the emitter of the pre-amplifier VT14 via a 22 μF capacitor C75 which acts as the emitter de-coupler. With no audio applied VT15 conducts and C75 being virtually earthed via emitter and collector of VT15, provides optimum decoupling of VT14 emitter and VT14 operates at full gain. As the audio level applied increases, the base voltage of VT15 falls and with decreasing emitter/collector current C75 becomes less efficient in decoupling VT14 emitter and the gain of VT14 falls.

98. For amplitude modulation the 12V supply is fed via the secondary winding of T11, in the final stage of the modulator, to the wide band amplifier VT24, the driver VT23 and the power amplifiers VT29 and VT30 so that the RF outputs of all these circuits are amplitude modulated at the speech frequencies.

99. For phase modulation, the output is taken from the collector of VT12 via R49 and a pre-emphasis network L9 and C70 to the reactor diodes ZD8 and ZD9 (para. 101).

High Power Operation

100. For HP operation, on RT-AM, unmodulated RF drive is required from the PA into the RF Amplifier No ' since a separate amplifier inside this unit provides the modulation locally. For this c tion the final stage of the modulator in the transmitter-receiver is rendered inoperativ disconnecting the earth connection to the centre tap at T11 primary.

This function is carried out by the SYSTEM switch in the RF Amplifier No. 1 when it is set to either of the TUNE positions or OPERATE HP. At the same time to provide maximum RF drive, T11 secondary and a 3 ohm resistor R84, normally in series with the 12V supply to VT29 and VT30, VT23 and VT24, are short circuited by contacts 22 and 23 of relay B in the RF Amplifier No. 1. The modulation circuit then consists of the microphone, VT14, VT13 and VT12 with AMC still applied from VT13 via MR8 to VT15. The LF output is tapped from VT12 collector and is taken out via pin K of plug PLD and the 6-way link to SKTD on the RF Amplifier No. 1 and thence to the input of the separate modulation amplifier.

PHASE MODULATION

101. For phase modulation the output is taken from the collector of VT12 in the intermediate push-pull stage of the modulator via a 10K resistor R49 and the pre-emphasis filter (L9, C70), to the reactor circuit. The reactor consists of two HC7008 silicon voltage-sensitive capacitors, ZD8 and ZD9, which are effectively shunted across the 500 kc/s oscillator circuit. The modulation signal is fed to the reactor via the 500K DEVIATION pre-set RV11, a 150 pF capacitor C152 and a 680K fixed resistor R110, all in series.

500 kc/s OSCILLATOR AND REACTOR

102. The oscillator is one of the electron coupled Hartley type operating in the base and emitter circuit of VT27. The oscillator frequency is governed by the tuned circuit comprising T21, C124 and the HC7008 voltage sensitive silicon capacitors ZD8 and ZD9. These operate as a reactor through the characteristic of their capacitance being varied by the instantaneous value of the applied voltage. For example, at 0.1V the capacitance is 14 pF while at 25V the capacitance is 88 pF. When transmitting RT-PM the reactor is operated both by the modulator output and by any discriminator d.c. output voltage resulting from the operation of the AFC loop (para. 120).

103. When transmitting RT-AM or CW, the AFC loop is also operating and any discriminator d.c. output voltage is taken to the reactor via contacts 5 and 6 of relay RLA2 and R111.

BALANCED MIXER AND WIDE BAND AMPLIFIER

104. The output from the 500 kc/s side step oscillator is transformer coupled into the bases of the balanced mixer formed by two AFZ11 transistors VT25 and VT26 arranged as a push-pull pair. The common oscillator output is coupled into the centre tap of the input transformer so that subtractive mixing takes place. A component representing the difference frequency is amplified by the push-pull tuned circuit.

105. This tuned circuit forms the collector load of the balanced Mixer and is tuned to the signal frequency by a variable capacitor GA2 (C116) which is part of the ganged assembly of the TUNE control. The appropriate coils for the low (L) and the high (H) sections of the band are selected at SWA the Band switch.

106. The output from the transmitter mixer is coupled to a wide band amplifier which forms a buffer between the mixer and the PA driver stages. On the low section of the band the tuned circuit output is inductively coupled to the base of the wide band amplifier transistor VT24. On the high section of the band the tuned circuit is coupled capacitively.

PA DRIVER

107. The output from the wide band amplifier is transformer coupled into the base of VT23 the PA driver. The amplified output is developed across the selected tuned circuit in the collector and both on L and H sections of the band it is inductively coupled into the common base of VT29 and VT30 the PA transistors (a paralleled matched pair). The driver stage is tuned by (GB1) C108 which is part of the ganged assembly operated by the TUNE control.

POWER AMPLIFIER

108. The power amplifier stage operates in Class C and is capable of producing between 1.5 and 3 watts drive into either the ATU or the RF Amplifier No. 1.

TRANSMITTER AERIAL CIRCUITS

109. This is an RF tuned circuit transformer coupled for a 75 ohms output impedance to the aerial socket SKTA. The circuit consists of separate tuned circuits for high (H) and low (L) band, the appropriate band being selected by the band switch SWA. The selected coil and trimmer capacitor are tuned by the variable capacitor (GA3) which is part of the ganged assembly driven by the TUNE control on the front panel. On transmit, the selected circuit forms the collector load of the PA transistors VT29 and VT30 (n.p.n. type BUY 11 or CV7361 matched pair). The aerial trimmer operated from the front panel by the RF TRIM control is connected across GA3. A number of different output connections may be taken from the output socket SKTA depending on the type of aerial in use and whether the high or low power version of the equipment is in use. The output connection combinations are as follows:-

HP or LP	Aerial in Use	Co-axial Output Connection
BCC 30 LP	Rod or 27 ft. wire aerials	Link to ATU input SKT
BCC 30 LP	Dipole or quarter wave aerials	Link to dipole centre connector socket
BCC 30 HP (OPERATE HP)	Rod or 27 ft. wire aerials	Link to RF Amplifier No. 1 input socket*
BCC 30 HP (OPERATE HP)	Dipole or quarter wave aerials	Link to RF Amplifier No. 1 input socket**
BCC 30 HP (OPERATE LP)	Rod or 27 ft. wire aerials	Link to RF Amplifier No. 1 input socket but a direct bypass link is provided to the ATU via the output socket
BCC 30 HP (OPERATE LP)	Dipole or quarter wave aerials	Link to RF Amplifier No. 1 for a direct bypass to output socket and thence to dipole 75 ohm centre connector

* - RF Amplifier No. 1 output linked to ATU input and thence to rod or 27 ft. wire aerials

** - RF Amplifier No. 1 output linked direct to 75 ohm dipole centre connector.

RECEIVER CIRCUITS

RF AMPLIFIERS

110. The input signal is coupled via a tuned circuit to the base of the first RF Amplifier stage which uses an AFZ11 high gain low noise RF Amplifier p.n.p. transistor (VT1) with a very low collector capacitance. The diode MR16 across base and emitter provides an automatic safety bias to VT1 base in the event of an excessively large signal input. The collector circuit contains a single tuned circuit which is transformer coupled to the base of the second RF Amplifier VT2 another AFZ11. Both circuits are tuned by variable capacitors C8 (GA1) and C15 (GB2) respectively which are part of the ganged assembly operated by the TUNE control. VT2 operates as a wide band amplifier and the amplified RF signal is transformer coupled from its collector and fed in series with the local oscillator signal to the base of the mixer VT3.

MIXER

111. The mixer stage contains an OC171 p.n.p. transistor VT3. The output of the common local oscillator is connected in series with the RF signal in the secondary winding of transformer T22 and thence to the base of the mixer. Subtractive mixing takes place and the 500 kc/s component resulting from subtraction of the signal frequency from the local oscillator frequency is amplified and developed across the 500 kc/s band pass filter.

500 kc/s BAND PASS FILTER

112. This is a 6 Section Tchebycheff response filter forming the tuned input circuit of the first IF Amplifier. Its function is to form a 500 kc/s band pass which in conjunction with the following IF Amplifiers, improves the selectivity of the receiver. At 6 dB down, an overall bandwidth of 6 kc/s minimum is achieved by the inclusion of the filter. The filter output is transformer coupled via a .01 μF. capacitor C31 to the base of the first IF Amplifier, VT4.

IF AMPLIFIERS

113. The first IF Amplifier (VT4 OC171) contains a 500 kc/s tuned circuit in its collector which is transformer coupled to the second IF Amplifier which in turn is transformer coupled to the third IF Amplifier. This amplifier stage has a tuned circuit in the collector which has three outputs taken from it. The first is taken direct from the collector and is fed to the AM detector circuit MR9 (diode OA5). The second is transformer coupled to the AGC detector and amplifier (diode MR1 and transistor VT7 respectively). The third output is transformer coupled via a separate secondary winding to the discriminator circuit.

AGC DETECTOR AND AMPLIFIER

114. The AGC delay is set by the 5K pre-set control RV2 so that weak signals are amplified at maximum gain and the diode is biased to conduct only on the reception of a stronger signals. Signals above the delay level are rectified by MR1 and filtered by C48, and the rectified current through R28 results in a decrease of VT7 base-emitter voltage. VT7 gain falls and the voltage at VT7 collector rises. The AGC feed is taken from VT7 collector to the bases of the transistors associated with the two RF Amplifiers (VT1 and VT2) and the first and second IF stages (VT4 and VT5). The gain of the receiver is thus controlled by the voltage at VT7 collector which rises and falls with varying levels of signal input. RV1 in VT7 emitter controls the AGC characteristic. It is adjusted in the factory for a total 3.3K reading between VT7 emitter and chassis and should not normally require resetting.

115. The characteristic of the AGC system is such that for a 80 dB change in input signal the output of the receiver changes by only 10 dB.

AM DETECTOR AND NOISE LIMITER

116. The amplitude modulation detector circuit is connected to the audio amplifier when the SYSTEM switch is in the RT-AM and CW positions.

117. Amplitude modulated inputs to MR9, (OA5) are detected, filtered and developed across the detector load formed by resistors R75 (100K) and R76 (35K). C94 is normally shunted by a link which can be removed during testing so that a meter can be inserted to

read detector current during receiver alignment. The detected audio signal is coupled via the OA81 noise limiter diode MR10 to the GAIN control via a .047 μF capacitor C96 and the SYSTEM switch.

118. The noise limiter circuit operates to isolate the detector temporarily from the audio amplifier for the duration of large peaks of interference pulses. During reception, part of the d.c. component of the detector output is developed across the 2 μF capacitor C95 and is fed via 100K resistor R78 to one side of the noise limiter, MR10 (OA81). This voltage acts as a noise limiter delay voltage so that the diode cannot be cut off until the interference pulses at the other side of the diode exceed the mean d.c. amplitude of the detector output. When this occurs MR10 is cut off and the two resistors R77 (150K) and R78 (100K) effectively become series attenuators between the detector and the AF Amplifier.

DISCRIMINATOR

119. One output from the third IF Amplifier VT6 (para. 113) is taken via a limiter circuit MR2 and MR3 to the discriminator circuit via VT9 (OC171) which has a conventional Foster Seeley circuit in its collector. In the RT-PM position of the SYSTEM switch, the discriminator output is fed via a de-emphasis circuit R43, C61, R44 and C60 to the input of the audio amplifier.

AFC LOOP

120. On transmit, the discriminator governs an AFC (automatic frequency control) loop which includes the 500 kc/s side step oscillator, VT8 the AFC amplifier, a limiter and the reactor. Positive and negative d.c. outputs are obtained from the discriminator for deviations from 500 kc/s within the loop capture range. The d.c. output is fed to the reactor circuit (para. 102) via contacts 5 and 6 of relay RLA/2. The reactor circuit and thus the frequency of the 500 kc/s oscillator is preset by the stabilised d.c. bias fed to the reactor diodes ZD8 and ZD9 via the 25K REACTOR BIAS preset, RV3. Frequency corrections are effected by the d.c. output from the discriminator being fed in series with the bias voltage to the reactor. If the frequency of the side step oscillator increases (for example following a change of temperature), on transmit the discriminator d.c. output voltage (measured at the input to R111) starts to progressively decrease the frequency of the side step oscillator. This continues until a balanced condition is reached with the frequency error corrected, the loop operation applying the correction virtually instantaneously.

BFO OPERATION

121. On receive CW, contacts 4 and 5 of relay RLA/2 connect the 'CW TONE' control RV8 to the reactor circuit. The tone control is part of a stabilised 7.5V potential divider and it controls the reactor in such a manner that the frequency of the 500 kc/s oscillator can be varied by at least ± 3 kc/s. The BFO signal is fed via C41 to the input of IF3 to provide a beat note for receiving CW morse telegraphy.

RF AMPLIFIER NO.1

INTRODUCTION

122. The RF Amplifier No. 1 may be used with the low power version of the BCC 30 to make the set into a higher power station giving RF outputs up to 30 watts while retaining the facility to operate on low power when required. Operating on high power should extend the ground-to-ground range between similar sets using rod aerials to between 15 and 25 miles. A view of the RF Amplifier front panel is shown in fig. 6 and the circuit diagram is shown in fig. 14.

GENERAL DESCRIPTION

123. The amplifier consists of a high power silicon triple diffused n.p.n. transistor 2N 1899 (VT1). It has a cut-off frequency of 50 Mc/s, and is capable of passing a peak collector current of 10 amps with a maximum collector to base voltage of 140V on CW and PM. Between 1.5 and 2 watts of RF drive is fed through socket SKTF and contacts 5 and 6 of relay RLC to transformer T1. The secondary of this transformer operates in conjunction with L1 (or L2) and C1 and C2 to form a series tuned circuit matching the input impedance of VT1. C2 forms the TUNE INPUT control.

124. The collector of VT1 contains a tuned 'pi' matching section comprising L6, C9, C10, C11 and C14. C10 and C11 are ganged to form the TUNE OUTPUT control. This control operates in series with L6 and tunes the matching section so that the collector output impedance of about 24 ohms is matched into the 75 ohm input circuit impedance of the Aerial Tuning Unit (or into the dipole aerial centre connection when the dipole and quarter wave aerials are in use). The two tune controls are adjusted for a maximum meter deflection during the tuning procedure (para. 49). During the tuning procedure, when SWB the SYSTEM switch (fig.6) is set to either TUNE IN and TUNE OUT positions the amplifier output is dissipated into a dummy load comprising the 76 ohm resistor R7 connected across the output. On completion of tuning, to operate on HP, the SYSTEM switch is set to OPERATE HP. The amplifier output is then connected directly to the aerial via contacts 2 and 3 of relay RLC. This relay operates on transmit together with relay RLA which connects the operating power supply to VT1. On PM and CW, VT1 receives a nominal 36 volt and on AM it receives a nominal 24 volt supply, the connection of the appropriate supply being carried out by relay A for PM and CW and by both relays A and B together for AM. In the LP position of the SYSTEM switch, the amplifier is out of circuit and the aerial connection from the transmitter-receiver unit is routed directly by contacts of relay RLC from SKTF (the RF INPUT socket) to SKTE (the RF OUTPUT socket). Operation on low power is a useful facility for conserving power supplies when high power is not necessary for satisfactory communication.

125. For AM operation, the audio signal from the microphone is taken via the pre-amplifier in the transmitter-receiver unit to the modulator circuit in the RF Amplifier No. 1. This consists of VT6 driving a push-pull stage using VT2, VT3, VT4 and VT5 arranged as compound pairs. The push-pull output transformer T2 has two secondary windings; one applies normal collector modulation in series with the collector supply to VT1, while the other applies additional modulation into the base of VT1 in conjunction with L4.

126. The ledex switch SWA located in the RF Amplifier No. 1 operates in sympathy with the BAND switch in the transmitter-receiver unit to select the correct coils for high and low band operation (fig. 20). In the AM-HP transmit condition, unmodulated drive is delivered from the transmitter to the amplifier. To obtain maximum drive R84, a 3 ohm resistor in the transmitter-receiver unit and the T11 modulation feed secondary in series with the + 12V supply to the PA driver and wide band amplifier stages are short circuited by the operation of relay RLB/3 (para. 100).

CW OPERATION

127. Electrolytic capacitors (C17- C20) which are wired across the coil of relay RLA with diode MR1 provide a delay to hold the relay in during the intervals which occur while keying CW. In this manner, the supply to VT1 remains on all the time, while RLA in the transmitter-receiver and RLC in the RF Amplifier No. 1 switch the drive on and off in response to the key.

BCC 30 TUNING PROCEDURE

CHANNEL SELECTION

Set BAND and CHANNEL switches for required channel.

NOTES

BAND switch; set to L for 2 - 4 Mc/s

Set to H for 4 - 8 Mc/s

CHANNEL switch; positions 1 - 9 select required crystal, position F selects free tuning.

Set ATU switch as follows:-

When using rod aerial - use position A for low band and the lower part of high band; position B is used for the remaining part of high band.

When using end-fed wire aerial - as for rod, but use position C for the higher part of the high band.

LOW POWER

(1) (a) CRYSTAL SELECTED

Set System switch A (on transmitter-receiver) to TRF. Set System switch B (on RF Amplifier No. 1) to LP. Rotate the TUNE control to the operating frequency when a beat note will be heard. Observing the transmitter-receiver meter, tune finely for a maximum meter deflection within the dead space of the beat note. Lock the TUNE control.

(b) FREE TUNE SELECTED

Set the TUNE control to the operating frequency and apply any required calibration correction (see para. 50).

(2) Set System switch A to PM, operate the pressel switch and rotate ATU TUNE control for maximum deflection on meter.

(3) Rotate RF TRIM control for maximum deflection on set meter. Release pressel. The set is now tuned for operation on low power. Select PM, AM or CW as required (for CW, plug key into vacant socket).

HIGH POWER

(4) Carry out operations 1, 2 and 3 for low power with System switch B set to LP and then continue:-
Set System switch B to TUNE IN, and System switch A to PM. Operate the pressel and tune the TUNE INPUT control (on the RF Amplifier No. 1) for maximum deflection of the amplifier meter. Release the pressel.

(5) Set System switch B to TUNE OUT, operate the pressel and tune the TUNE OUTPUT control for maximum deflection on the amplifier meter.

(6) Set System switch B to HP, reset the TUNE OUTPUT control for maximum reading on amplifier meter. Tuning for high power operation is now completed; select PM, AM or CW as required.

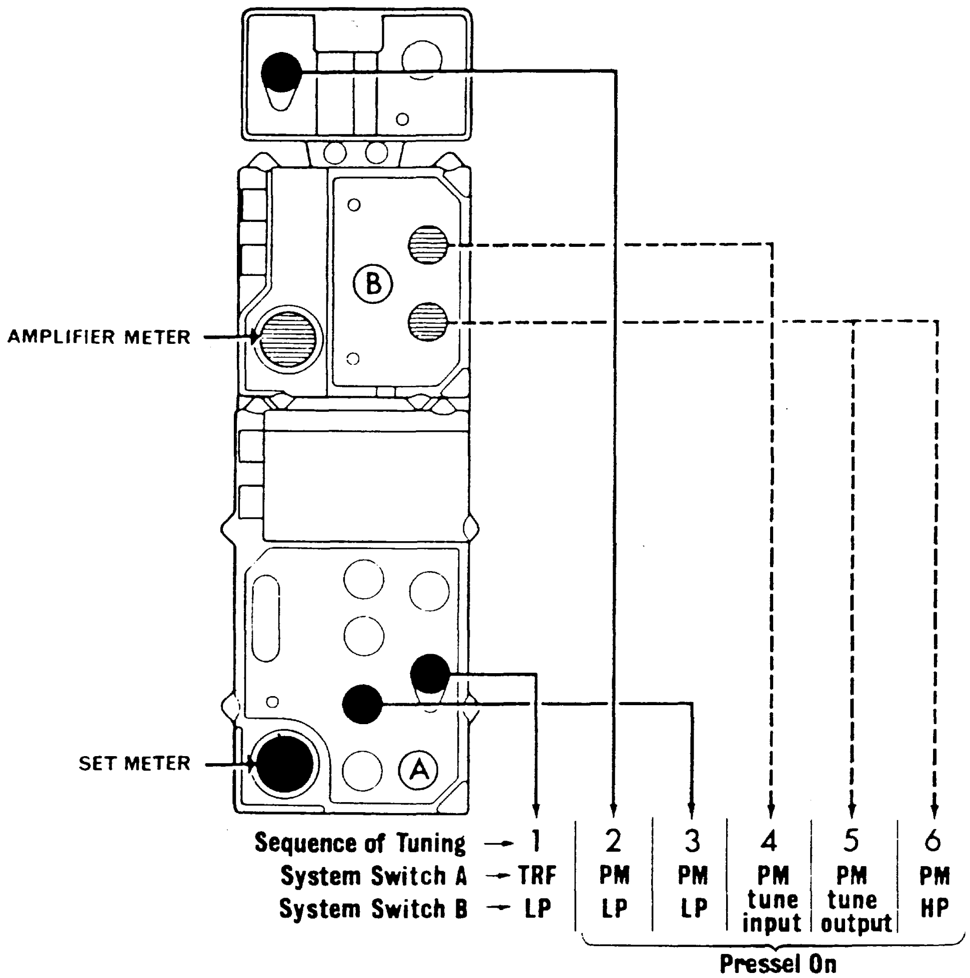


Fig.11 TUNING PROCEDURE GUIDE

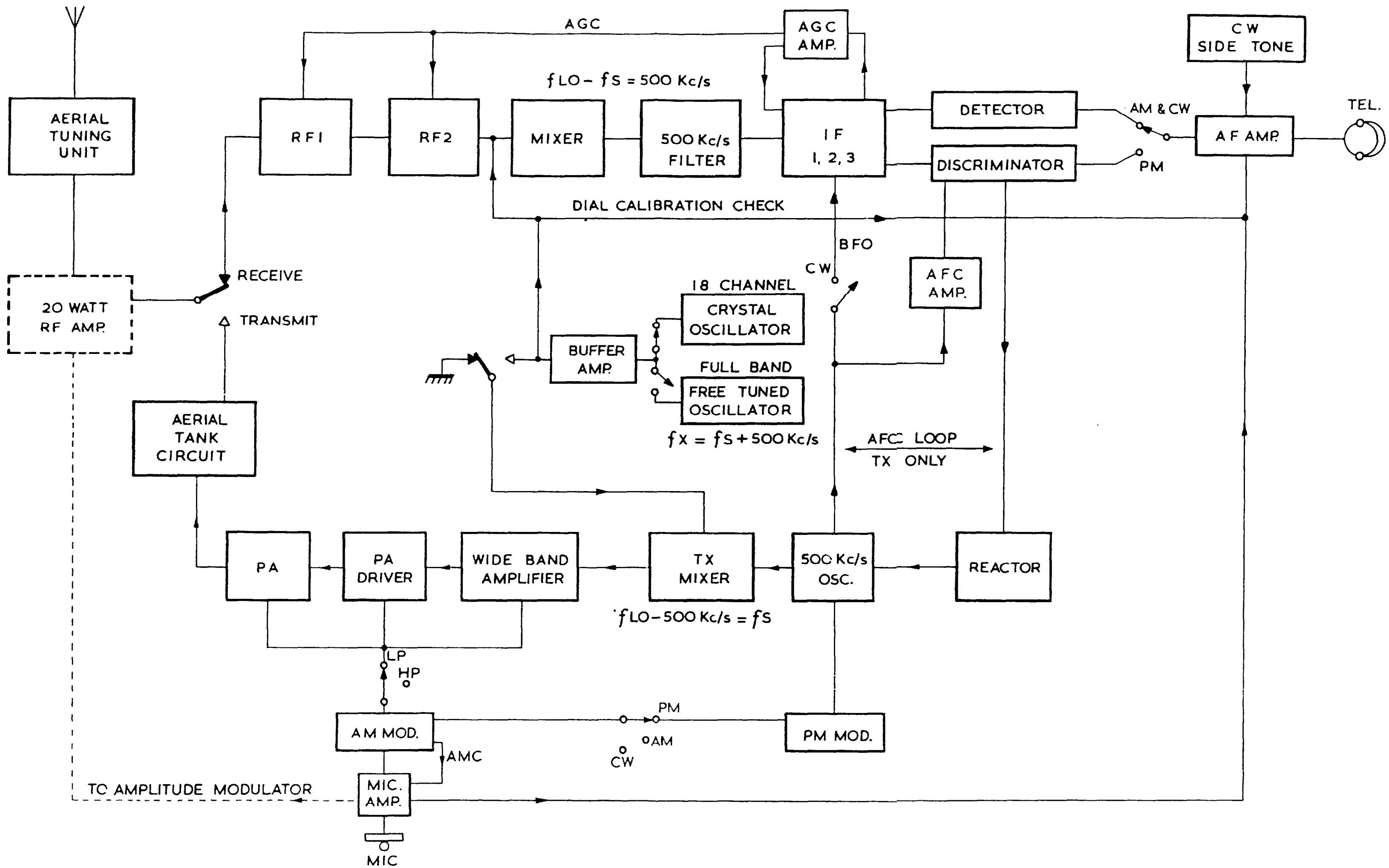


Fig.12 BLOCK DIAGRAM

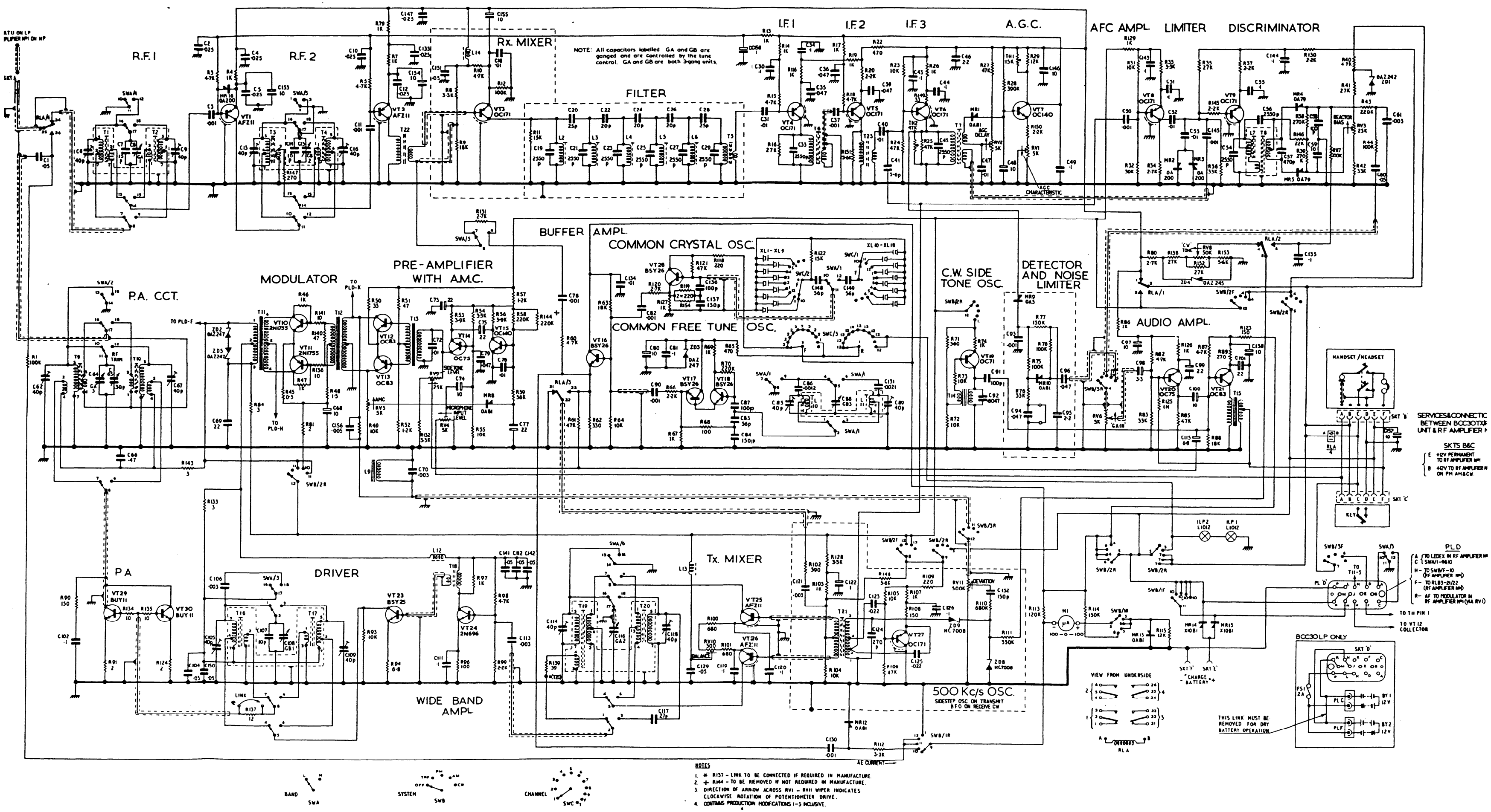


Fig.13 BCC 30 - CIRCUIT DIAGRAM

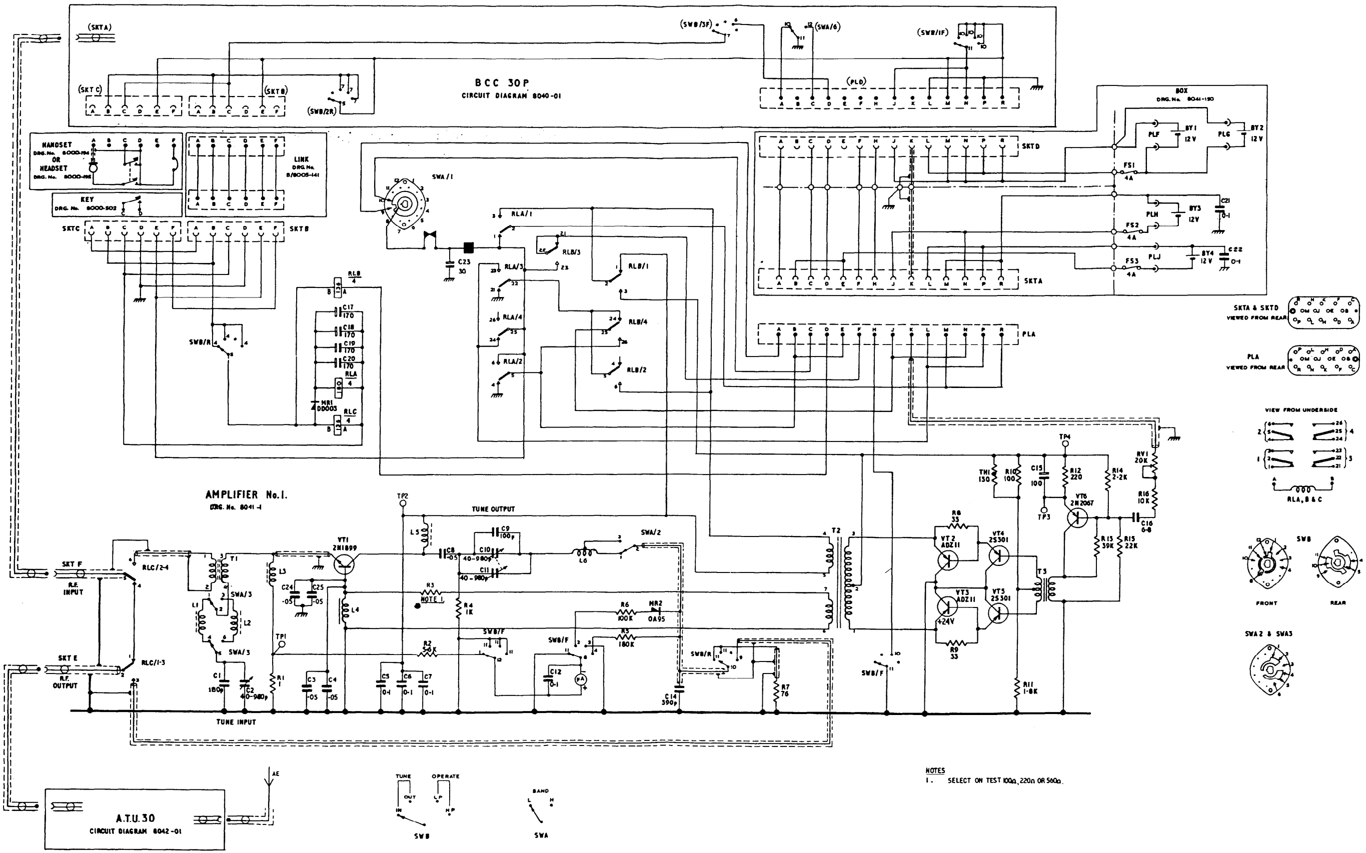
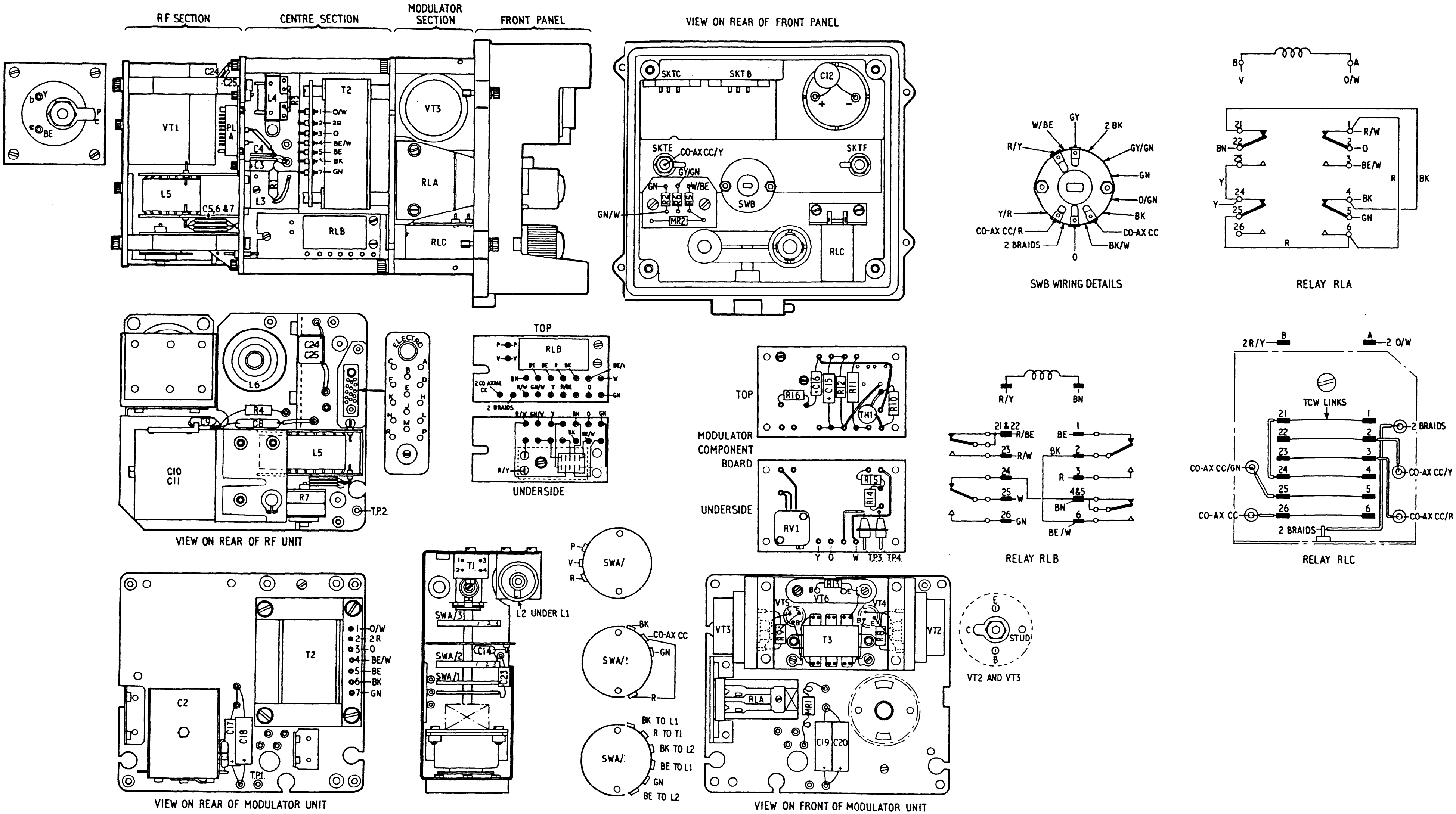


Fig.14 RF AMPLIFIER No.1 - CIRCUIT DIAGRAM


RF SECTION
CENTRE SECTION
MODULATOR SECTION
FRONT PANEL
VIEW ON REAR OF FRONT PANEL
SKTC
SKT B
C12
SKTE
CO-AX CC/Y
GY/GN
W/BE
GN
GN/W
MR2
SWB
SKTF
RLC
VT1
VT3
L4
T2
PL A
C4
C3
L3
L5
C5,6 & 7
RLA
RLB
C24
C25
SWB WIRING DETAILS
W/BE
GY
2 BK
R/Y
GY/GN
GN
O/GN
BK
Y/R
CO-AX CC/R
CO-AX CC
2 BRAIDS
BK/W
RELAY RLA
R/W
BE/W
BK
BN
VIEW ON REAR OF RF UNIT
L6
R4
C9
C8
C10
C11
R7
T.P.2.
ELECTRO
TOP
UNDERSIDE
2 CO AXIAL CC
2 BRAIDS
MODULATOR COMPONENT BOARD
R16
C16
C15
R12
R11
TH1
R10
R15
R14
RV1
T.P.3.
T.P.4.
RELAY RLB
R/BE
R/W
21 & 22
BE/W
RELAY RLC
2R/Y
2 O/W
TCW LINKS
CO-AX CC/GN
CO-AX CC/Y
CO-AX CC/R
VIEW ON REAR OF MODULATOR UNIT
C2
C17
C18
T.P.1.
T1
L2 UNDER L1
SWA/3
SWA/2
SWA/1
C14
C23
SWA/
BK TO L1
R TO T1
BK TO L2
BE TO L1
BE TO L2
VIEW ON FRONT OF MODULATOR UNIT
R13
VT5
VT6
VT4
VT2
T3
R9
R8
MR1
C19
C20
STUD
VT2 AND VT3

AERIAL TUNING UNIT

128. The Aerial Tuning Unit (figs. 16 and 17) provides optimum matching of either the PA tank circuit in the transmitter-receiver (LP operation) or the output stage in the RF Amplifier No. 1 (HP operation) to the rod or end-fed wire aerials used with the equipment.

129. The unit essentially consists of two loading coils L1 and L2 which are selected into circuit by the ATU band switch (SWA) to suit the section of the band being used.

130. The ATU band switch SWA has three positions which do not exactly conform with the band divisions of the set. The coverage is as shown in the table which also shows the appropriate setting of SWA for the type of aerial and the section of the frequency band in use. Loading coils L1 and L2 are tuned by an arrangement of twelve ferrox-cube rings moulded into an epoxy resin cylinder which surrounds the coil former. A ferrox-cube rod is also axially located inside L1 and L2 coil former and is attached through slots in the sides of the coil former to the external ferrox-cube cylinder. The whole ferrox-cube assembly is driven concentrically along the axis of the coil former by the ATU tune control and drive mechanism.

131. A metering circuit is included so that the ATU may be used in a special case fitted with a meter converting it for the remote ATU role if required. The change of case and plugging in of the meter leads are the only alterations necessary to effect the conversion.

132. The meter circuit consists of a bridge rectifier MR1 - MR4 (inclusive) fed by a current transformer T1. The RF Signal is rectified and filtered by C2, R2, before it is fed to a 0-300 microamp meter. The meter is fitted with shunt circuits and is illuminated by beta light fluorescence for observation in the dark.

Type of Aerial	Band in Use	ATU BAND SW Setting	Arrangement of ATU RF Coils L1 and L2
Rod or end-fed wire	L and lower part of H	A	L1 and L2 in series
Rod	Upper part of H	B	L1 and L2 in parallel
End-fed wire	Upper part of H	C	L1 in parallel with part of L2

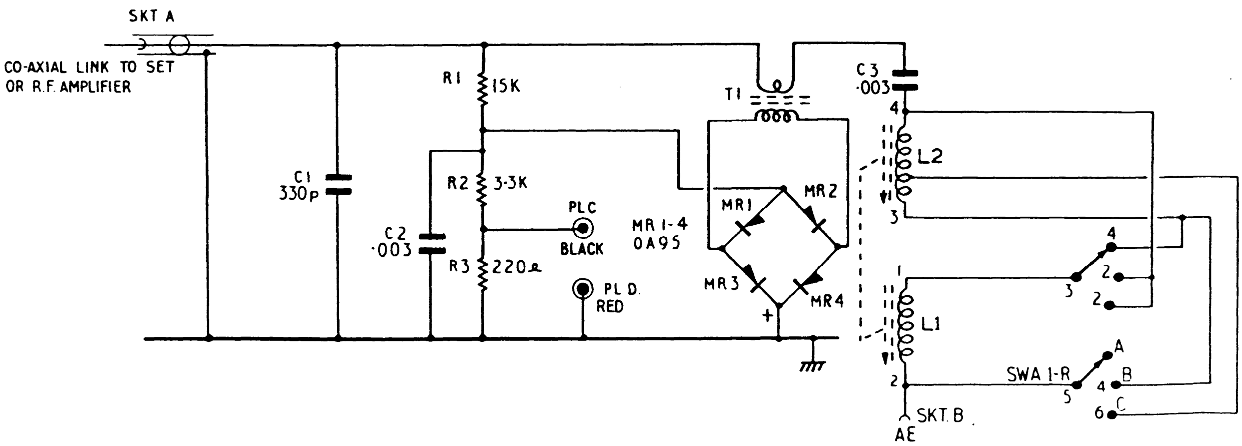


Fig.16 AERIAL TUNING UNIT - CIRCUIT DIAGRAM

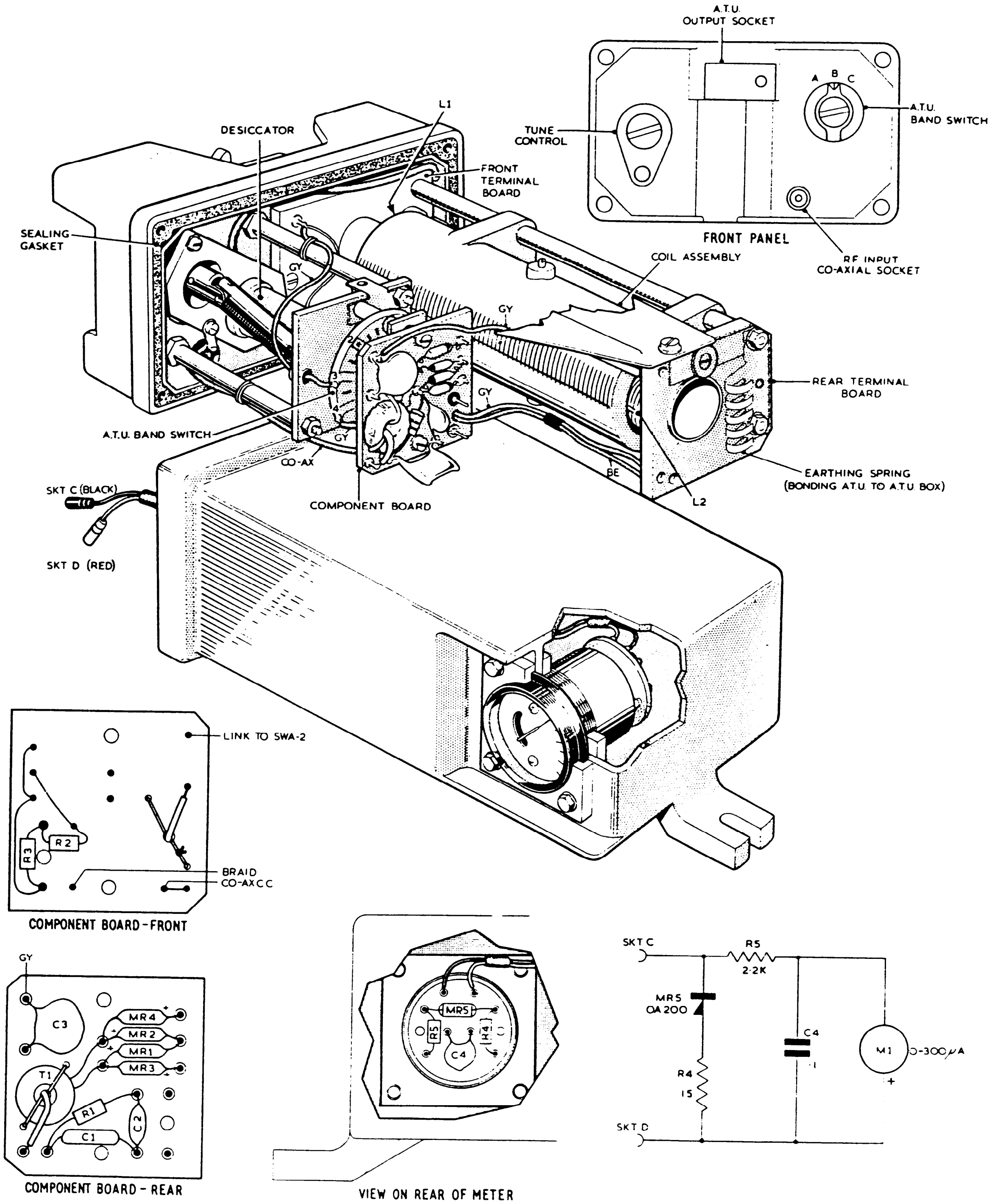
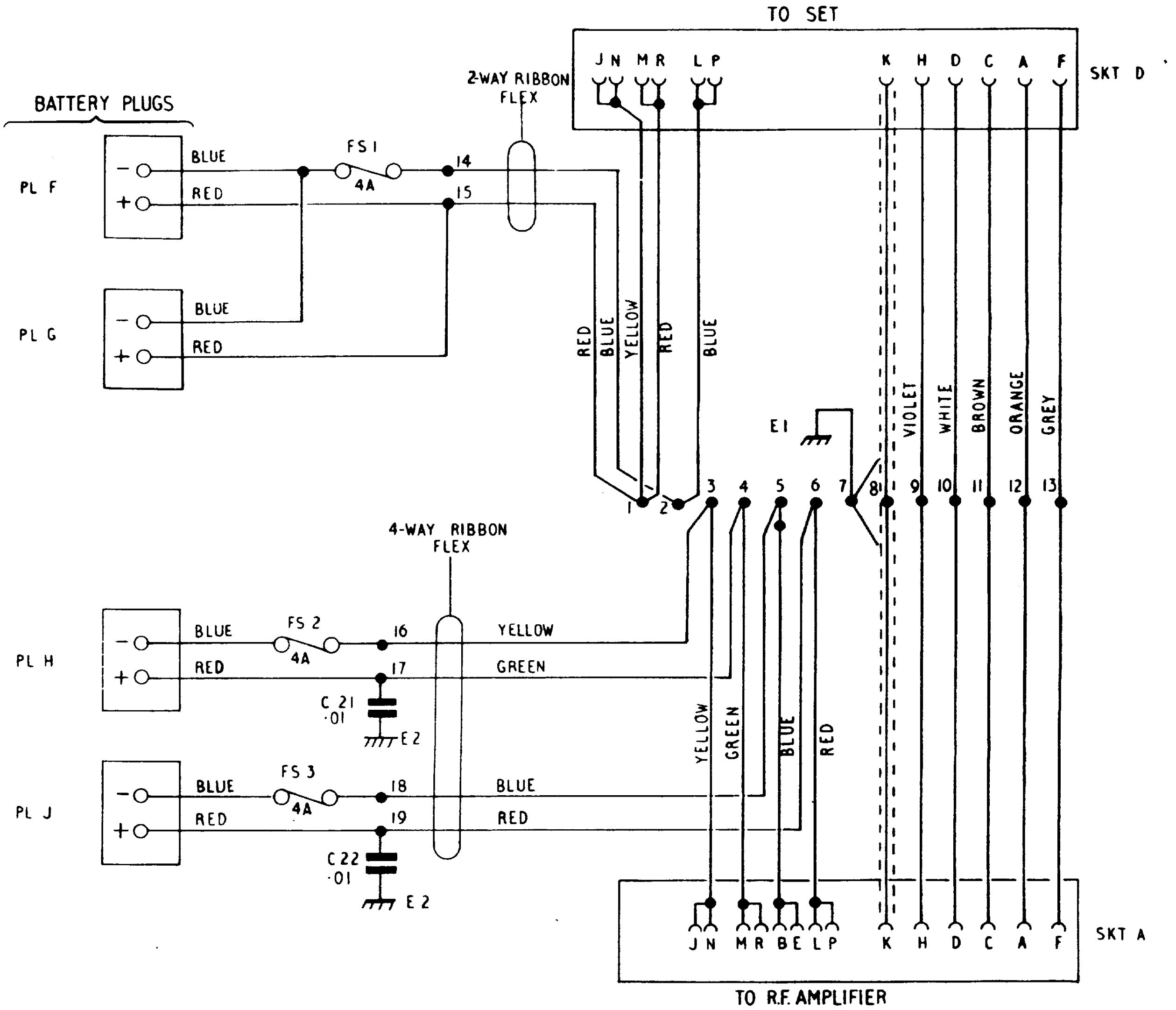
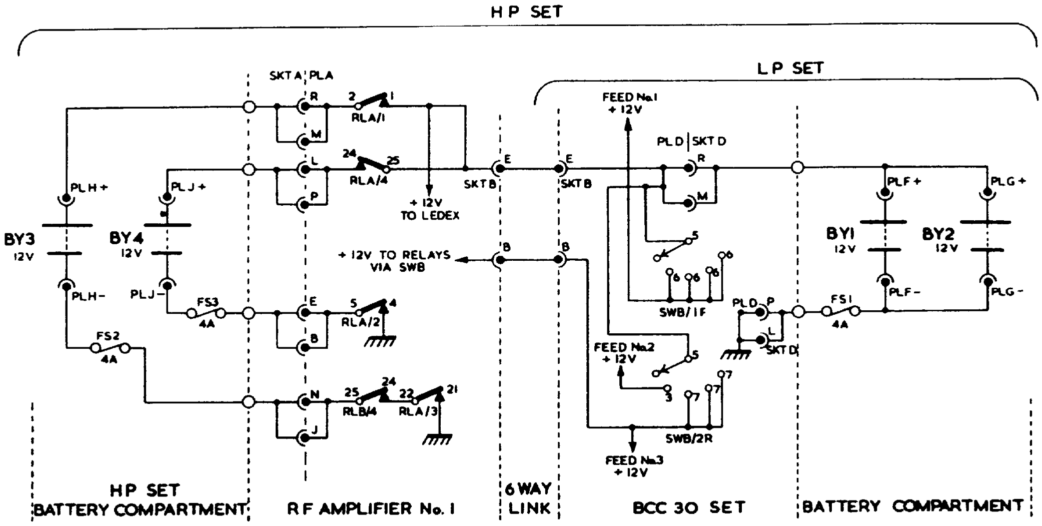


Fig.17 AERIAL TUNING UNIT - GENERAL VIEW



NOTE : CIRCUIT DIAGRAM OF LOW POWER CASE ASSEMBLY IS SHOWN IN FIG. 13

Fig.18 BCC 30 HIGH POWER CASE ASSEMBLY - CIRCUIT DIAGRAM



NOTES: RF AMPLIFIER SYSTEM SWITCH SET TO OPERATE LP
R.F. AMPLIFIER RELAYS A, B AND C UN-ENERGISED
FEED No.1 IN SET, SUPPLIES A/F OUTPUT, METERING CIRCUIT AND LOCAL OSCILLATORS
FEED No.2 IN SET, SUPPLIES LAMPS AND COMMON FREE TUNE OSCILLATOR (TRF POSITION OF SWB) WITH A CRYSTAL SELECTED
FEED No.3 IN SET, SUPPLIES REMAINING PARTS OF SET

Fig.19 12V d.c. SUPPLY - CIRCUIT DIAGRAM

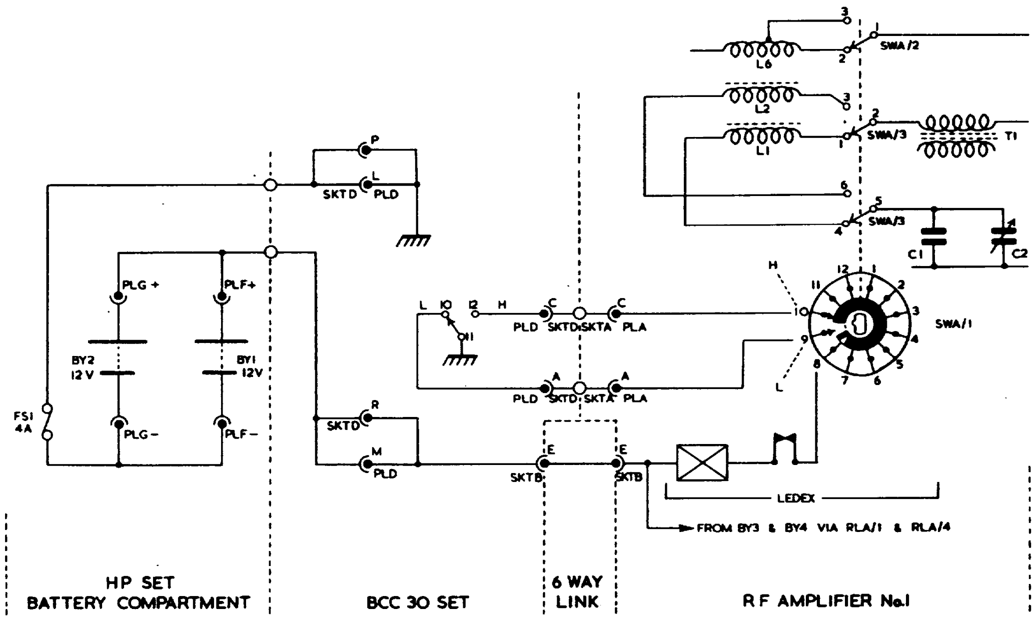


Fig.20 LEDEX BAND SWITCH IN RF AMPLIFIER No.1 - CIRCUIT DIAGRAM

SYSTEM SWITCHES	
SET	AMPLIFIER
AM	TUNE IN TUNE OUT OPERATE H.P.

NOTE: RELAYS A AND B IN R F AMPLIFIER No.1 ARE ENERGIZED ON TRANSMIT WHEN PRESSEL IS OPERATED

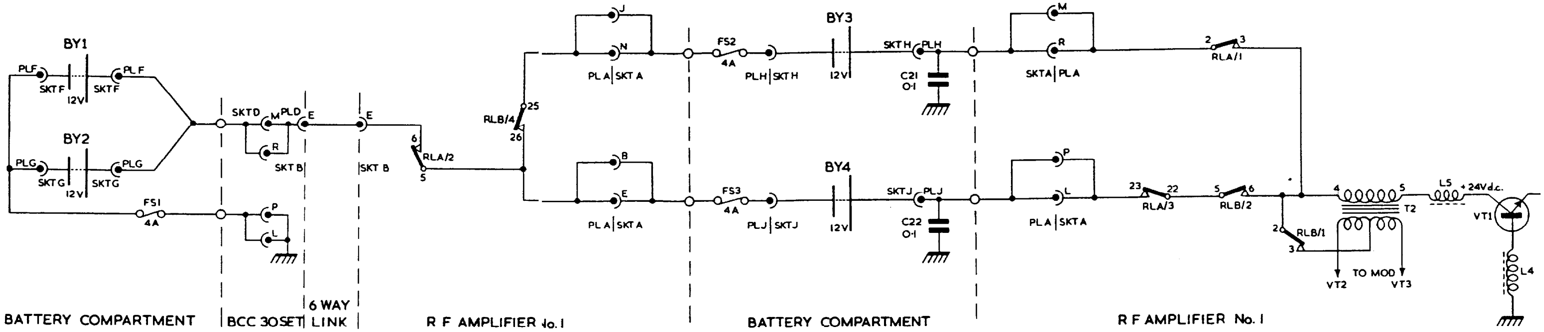


Fig.21 24V d.c. POWER SUPPLY FOR RF AMPLIFIER No. 1 ON 'AM' - CIRCUIT DIAGRAM

SYSTEM SWITCHES	
SET	AMPLIFIER
PM	TUNE IN TUNE OUT OPERATE H.P.

NOTE: RELAY RLA IN RF AMPLIFIER No.1 IS ENERGIZED ON TRANSMIT WHEN PRESSEL (PM) OR KEY (CW) IS OPERATED

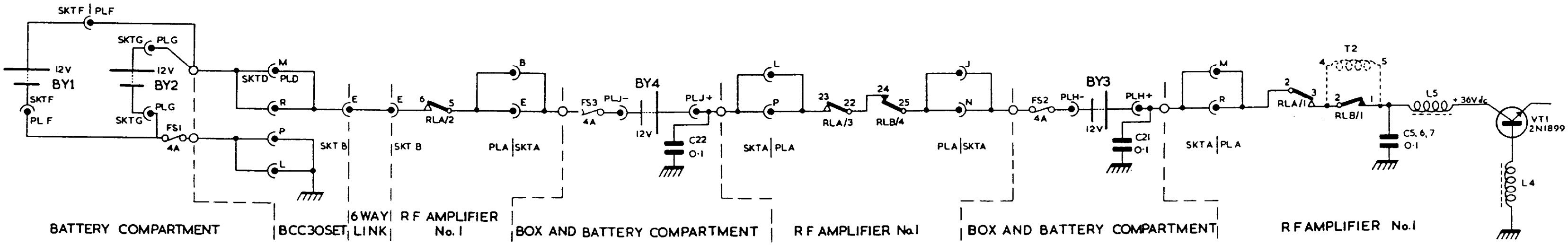


Fig.22 36V d.c. POWER SUPPLY FOR RF AMPLIFIER No. 1 ON 'PM' AND 'CW'-CIRCUIT DIAGRAM

TESTING AND SERVICING

COMPLETE STATION TESTS

FULL SPECIFICATION TESTS

152. These are detailed in separate test specifications for each main part of the equipment and accessories. Copies of these specifications are available on request.

The full list of available test specifications is as follows:-

BCC 30 LP	TS 213	Portable Petrol Engine Generator (BCC 20)	TS 228
BCC 30 HP	TS 257	Mains Battery Charger (BCC 503)	TS 232
RF Amplifier No. 1	TS 214	Rechargeable Battery for BCC 30	TS 239
Aerial Tuning Unit	TS 225	Dry Battery for BCC 30	TS 240
Vehicle Adaptor Unit	TS 222	Remote Control Unit	TS 261
12V/24V Battery Charger (BCC 501)	TS 223		
Hand Generator (BCC 13)	TS 227		

BENCH TEST BCC 30 LP

Introduction

153. The following test procedure may be followed for a functional test of a BCC 30 LP complete station. The tests are facilitated by using a BCC 30 test panel (fig. 23) but if this is not available the method of connecting up test equipment for the tests can be followed from this illustration.

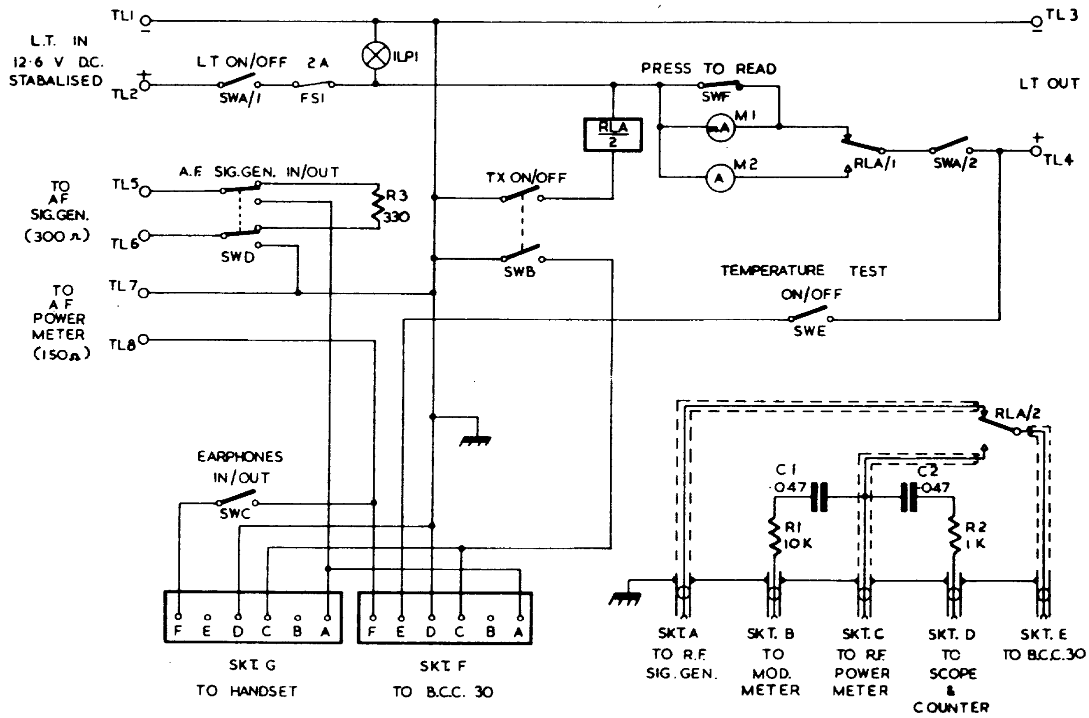


Fig.23 BCC 30 LP TEST PANEL - CIRCUIT DIAGRAM

Procedure

154. Insert the set into its case and fit two fully charged batteries and the test crystals for operating frequencies given in sub-para. (1) below (see test equipment item 21). Check the following on PM, AM and CW.

(1) Check that the transmitter power output measured at the RF output socket by an RF power output meter conforms with the minimum acceptable figures shown in fig. 24 on the following frequencies:-

Band	Channel	Operating Frequencies kc/s
L	1	2200
	F	2700
	2	3800
H	1	4400
	F	6100
	2	7600

(NOTE:- F = operate on free tune)

NOTE:- Record the power output on 2.2 Mc/s and 6.1 Mc/s for calculating the ATU efficiency in sub-para. (2).

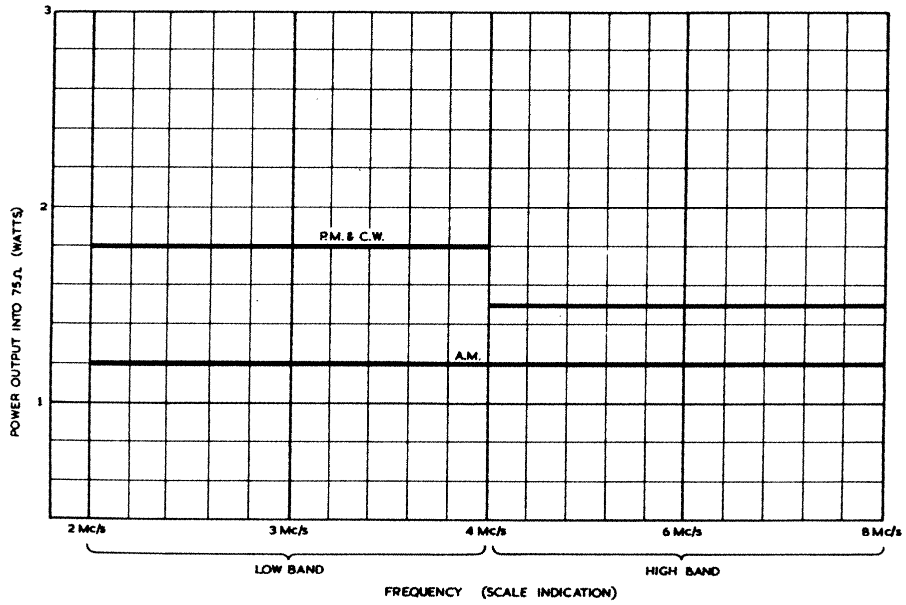


Fig.24 BCC 30 LP RF OUTPUT POWER - GRAPH

MAINTENANCE

GENERAL

133. The BCC 30 is designed for maintenance primarily by substitution of the sub-assembly modules. To facilitate the servicing of modules, full information is presented in separate Test and Servicing Data sheets for each module. The individual modules are located on the set as shown in figs. 4 and 5. Fault location charts are provided as an introduction to maintenance in para. 162.

FUSES

LOW POWER SET

134. A single 2 ampere cartridge fuse located in the battery compartment protects the set and batteries. A spare fuse is also located in the compartment.

HIGH POWER SET

135. Three 4 ampere cartridge fuses are located in the battery compartment with one spare. One of the fuses is wired in the common negative return to batteries No. 1 and No. 2 which are normally in parallel. The other two fuses each protect one of the remaining two batteries No. 3 and No. 4 respectively. The different circuit arrangements of the batteries on receive, transmit AM and transmit PM and CW are shown in figs. 19, 21 and 22 and are described in para. 10.

CATYLATORS

136. Two catylators are located in the battery compartment of both the low and high power sets. The catylators are safety devices which function as hydrogen absorbers should the batteries be accidentally over-charged 'in situ' when the seal of the battery compartment has not been released as recommended (para. 64). If overcharging occurs (although this is unlikely if the approved chargers are used and the charging procedure is carefully followed) the vents of the battery cells unseal and hydrogen is released.

137. The catylators then absorb the hydrogen given off and thereby limit the build up of gas pressure in the sealed compartment and avert the danger of explosion.

DESICCATORS

138. Silica gel type desiccators are located in the transmitter-receiver compartments of both types of set. Whenever any compartment is unsealed in a high humidity environment it is advisable to thoroughly dry out both the unit removed and the compartment and fit new or serviced desiccators where applicable before refitting and sealing in the compartment.

139. Desiccators may be serviced by placing them in an oven or other clean source of heat at a temperature of 120°C - 150°C for a period of about two hours. Before it is refitted in the set the desiccator should be allowed to cool. If it is not required for immediate service it should be stored in its sealed container.

BATTERY CIRCUIT ARRANGEMENTS

140. The battery circuit arrangements effected by relays RLA and RLB in the RF Amplifier No. 1 are shown in figs. 19, 21 and 22.

CASE ASSEMBLIES – INTERCONNECTION FACILITIES

141. The cases for both sets are light alloy pressure die-cast and include separate compartments for the main assemblies, i.e. transmitter-receiver unit and RF Amplifier No. 1 and batteries. Wiring interconnections are provided between compartments by insulated feed-throughs fitted into the compartment walls. The wiring diagrams for the low power and high power set cases are given in figs. 13 and 18 respectively.

TEST PANEL AND ARRANGEMENTS

142. The circuit diagram of a general test panel which will facilitate servicing, bench testing and full specification testing of a BCC 30 LP is given in fig. 23. The arrangements required for testing BCC 30 HP sets are shown in fig. 25.

TRANSISTORS – SERVICING NOTES

STORAGE CONDITIONS

143. Do not subject transistors to high or prolonged heat. The manufacturer states a maximum storage or junction temperature, usually of about +85°C and this should not be exceeded. Do not store near or on top of radiators.

HANDLING

144. Modern transistors are physically robust but the thin wire used in the smaller types can snap off close to the transistor. Excessive twisting or pulling should be avoided.

INSTALLATION AND REMOVAL

145. (1) Leave the transistor leads as long as practicable.

(2) Do not insert or remove a transistor with the power on.

(3) Always check and double check connection into the circuit, base to base connection, etc.

(4) When soldering or unsoldering transistor leads, hold the leads with long-nose pliers between the soldering bit and the transistor to prevent iron heat reaching the transistor. Use a clean, hot, well tinned iron and good quality solder. Complete the soldering as quickly as possible.

(5) Use a low wattage soldering iron not one of the transformer 'gun' types which may induce destructive currents into the low impedance transistor circuits.

(6) Do not mount near strong magnets such as heavy transformers or loudspeakers.

(7) When replacing a transistor ensure that an exact equivalent is used.

(8) Some transistors have metal cases connected to one of the electrodes. Take care that these are clear of all wires or are suitably insulated.

TESTING

146. (1) Be careful not to subject the transistor to large transient voltages or currents, even momentarily.

(2) Do not exceed the rated maximum voltage, currents or dissipation.

(3) Do not shunt or short circuit components without removing the transistors first.

(4) Transistors should also be disconnected when dismantling a circuit for test purposes.

(5) Do not test the emitter-base resistance of AFZ11 transistors by using an AVOmeter since the currents passed can destroy the transistor.

POWER SUPPLIES

147. (1) Ensure that any replacement batteries are correctly connected (a reversed battery may destroy or degrade transistors in the equipment).

(2) Do not use a replacement battery of a higher voltage than the proper one.

(3) The equipment always should be switched off when replacing the batteries.

SOLDERING TECHNIQUES

148. To remove or replace a quick release fork ended tag from a terminal, use a pair of tweezers to grip the polythene sleeve at the end of the wire. Apply the iron to the terminal and use the tweezers to pull the fork end tag clear as soon as the solder melts. Immediately remove the soldering iron. This will ensure that only the exact amount of heat necessary to unsolder the joint will be applied and will avoid unnecessary heat being transferred to adjacent components. When resoldering a lead do not apply heat for longer than is necessary to make a good joint. After the solder has cooled, check the strength of the joint by using the tweezers to apply a gentle pull on the wire.

RE-SLEEVING

149. If a polythene shrink sleeve is accidentally damaged during soldering operations, it must be replaced. First remove the damaged sleeve and using a length of Helashrink sleeving, cut one off to length (3/8th inch) and fit it in position over the fork end tag. Carefully apply indirect heat from a soldering iron (use at least a 25 watt one) for about half a minute or longer until the sleeve shrinks tightly in position. Resolder the tag to its terminal.

SERVICING LEADS TEST EQUIPMENT AND TOOLS

150. The following servicing leads tools and test equipment are recommended to enable the full maintenance programmes of HP and LP sets to be carried out. Items 1 to 21 inclusive are necessary for fully testing the complete equipment. The items marked * are not essential but are recommended to facilitate testing. The instruments listed are considered to be the most suitable available but there are other instruments of similar performance which can also be used. If there is any doubt concerning the suitability of alternative instruments BCC would be pleased to advise.

151. Items 22-57 are used for sub-unit testing. As an alternative however, sub-assembly test jigs are available and if preferred they can be purchased. Items 58-77 are tools.

Item No.	Description	BCC Part No.	Recommended minimum holding per service bay for:-	
			Complete HP Sets	LP Sets
Servicing Leads				
1	14 way extension lead (for reconnecting set or amplifier to the 14 pin socket in case after removal for servicing)	8000-510	2	1
2	6 way extension lead (for relinking the 6 pin sockets between set and amplifier after the removal of either servicing and for connection of the set to a test panel)	8005-149	2	1
3	Co-axial extension (for relinking RF sockets on set to amplifier or amplifier to ATU after removal of any one item for servicing)	8000-553	2	1
Test Equipment				
4	+12V d.c. stabilised supply (a) for operation by mains a.c.	BCC 503	1	-
	or (b) for operation by 12V/24V d.c. supplies	BCC 501	1	-
	NOTE:- The BCC 501 is primarily a battery charger with a 0.5 ohm series limiter resistor in the output. When it is used as a power supply for BCC 30 set the output voltage to about 13.7 on transmit			
	*(c) High power set test panel (including power supplies)	TS257 Sht.4	1	-
	*(d) Low power set test panel (including power supplies)	TS213 Sht.24	-	1
5	BCC 30 transmitter-receiver complete with Aerial Tuning Unit	8040-1 & 8042-1	1	1

Item No.	Description	BCC Part No.	Recommended minimum holding per service bay for:-	
			Complete HP Sets	LP Sets
6	Avometer, Model 8		3	3
7	RF Signal Generator, Marconi TF2003		1	1
8	AF Signal Generator, Airmec Type 252		1	1
9	Vacuum Tube Voltmeter, Airmec Type 217		1	1
10	AF output power meter, Marconi Type 893A		2	2
11	Oscilloscope, Telequipment S32A		1	1
12	Counter Frequency, Airmec Type 298 (or any instrument capable of measuring frequencies up to 8 Mc/s)		1	1
13	Modulation meter, Airmec Type 210		1	-
*14	RF Power output meter 50 watts 75 ohms, Marconi Type TF 1020A		1	-
15	RF Power output meter 10/25 watts 75 ohms, Marconi Type TF 1152A		1	1
16	RF Power output meter connector adaptor	Local Manufacture	1	1
17	Microammeter d.c., 30-0.30 microamps		1	1
18	Microammeter d.c., 0-25 micro-amps		1	1
*19	Distortion factor meter Marconi Type TF 142F		1	-
*20	Crystal oscillator, 500 kc/s	BCC	1	1
*21	Crystals:			
	Type ZKJ (to DEF 5271) 8.5 Mc/s, 8.1 Mc/s, 4.9 Mc/s (High band alignment set)	BCC Spec. 114	1 each	1 each
	Type ZDJ (to DEF 5271) 4.3 Mc/s, 2.7 Mc/s (Low band alignment set)	BCC Spec. 113	1 each	1 each
22	Modulation transformer, BCC	8040-124	1	1
23	IF Module (J)	8040-001-26	1	1

Item No.	Description	BCC Part No.	Recommended minimum holding per service bay for:-	
			Complete HP Sets	LP Sets
24	500 kc/s oscillator and detector unit Module (G)	8040-001-25	1	1
25	Flying lead fitted with crocodile clips at each end	Local Manufacture	3	3
26	BCC 30 Morse Key	8000-196	1	1
27	Choke RF	SD/A 178588	1	1
28	Dummy load, 40 pF (2000V 1A) in series with 10 ohms 20 watt carbon resistor	Local Manufacture	1	1
29	Dummy load, 2.5 ohms (two 5 ohm 1 watt carbon resistors in parallel) with a 12000 pF capacitor in series	Local Manufacture	1	-
30	Dummy load, 2.5 ohms (two 5 ohm 1 watt carbon resistors in parallel) with a 5000 pF capacitor in series	Local Manufacture	1	-
31	Dummy load, 28 ohms (two 56 ohm 1 watt carbon resistors in parallel) with a 0.05 μF capacitor in series	Local Manufacture		
32	Potentiometer 100 kohm	Local Supply	1	1
33	Potentiometer wirewound 1 kohm	Local Supply	1	1
34	Resistor 24 ohms, 40 watts wirewound	Local Manufacture	1	-
35	Resistor Carbon 100 ohms, 10% $\frac{1}{2}$W	Local Supply	1	1
36	Resistor Carbon 330 ohms, ± 10% $\frac{1}{4}$W	Local Supply	1	1
37	Resistor Carbon 3.3 kohm ± 20% $\frac{1}{4}$W	Local Supply	1	1
38	Resistor Carbon, 150 kohms ± 10% $\frac{1}{4}$W	Local Supply	1	1
39	Resistor Carbon, high stability 1 Mohm, ± 1% $\frac{1}{4}$W	Local Supply	1	1

Item No.	Description	BCC Part No.	Recommended minimum holding per service bay for:-	
			Complete HP Sets	LP Sets
40	Capacitor Polyester 20 p ± 2p		1	1
41	Capacitor Silver mica 36 p ± 0.5 p		1	1
42	Capacitor Silver mica 37 p ± 0.5 p		1	1
43	Capacitor Silver mica 47 p ± 0.5 p		1	1
44	Capacitor Silver mica 54 p ± 1 p		1	1
45	Capacitor Silver mica 56 p ± 20%		1	1
46	Capacitor Ceramicon 59 p ± 0.5 p		1	1
47	Capacitor Silver mica 213 p ± 1 p		1	1
48	Capacitor Silver mica 223 p ± 1 p		1	1
49	Capacitor Silver mica 230 p ± 1 p		1	1
50	Capacitor Silver mica 235 p ± 1 p		1	1
51	Capacitor Ceramic 1000 p ± 50% 20V		1	1
52	Capacitor Polyester .001 micro-farads		1	1
53	Capacitor Polyester 0.1 micro-farad ± 20% 30V		1	1
54	Switch ON-OFF single pole (Spring loaded for ON)		1	1
55	Switch toggle DP 2-way		1	1
56	Phone inset	5965-99-940-2368	1	1
57	Switch shaft for Band switch (SWA)	A/8040-579	1	1

Item No.	Description	BCC Part No.	Recommended minimum holding per service bay for:-	
			Complete HP Sets	LP Sets
Tools				
58	¼" Whit. box spanner		1	1
59	Meter spanner	8040-622	1	1
60	Allen key 5/32" AF	8040-001-100	1	1
61	Allen key 5/64" AF	8040-001-98	1	1
62	Allen key 1/16" AF	8040-001-97	1	1
63	Allen key 3/32" AF	8040-001-99	1	1
64	Allen key .05" AF	8040-001-96	1	1
65	Tuning tool	8040-001-93	1	1
66	Alignment tool	8040-001-94	1	1
67	Screwdriver, 3/16" blade, insulated		1	1
68	Spanners, flat, set, 2BA, 4BA, 6BA, 8BA		1 each	1 each
69	Screwdriver, 1/8" blade insulated		1	1
70	Stripper wire, BIB		1	1
71	Pliers, taper nose		1	1
72	Pliers, side cutting		1	1
73	Iron, soldering 25 watt (Litesold)		1	1
74	Iron, soldering 60 watt (Solon)		1	1
75	Heat shunt	Local Manufacture	1	1
76	Spanner, box, 2BA		1	1
77	Crystal extractor	8000-429	1	1

(2) Test the efficiency of the ATU as follows:-

(a) Connect the ATU dummy load (item No. 28) across the ATU aerial terminal and set case and connect an RF valve voltmeter across the 10 ohm resistor of the dummy load. Measure the voltage (V_L) on 2.2 Mc/s and 6.1 Mc/s using the A and B settings of the ATU Band switch respectively. The power (P_L) in the dummy load = $\frac{V_L^2}{10}$ watts.

The ATU efficiency is calculated as:-

$$\frac{P_L}{P_o} \cdot 100\% = \frac{V_L^2}{10P_o} \cdot 100\%$$

The minimum efficiencies must be as follows:-

ATU Band Switch Setting	Frequency (Mc/s)	Efficiency %
A	2.2	20
B	6.1	20

Check the meter circuit in the remote ATU as follows:-

(b) During the power output tests check that the ATU meter provides a deflection of up to 200 microamps.

(3) Inject a 1 kc/s signal at 10 mV into the microphone input circuit and check that the side tone audio output is 0.1 mW. (Adjust RV9 - sidetone preset on Module C is necessary).

With the set keyed on CW transmit, the sidetone output should be not less than 0.1 mW with the frequency between 500 c/s and 3 kc/s.

(4) Check that the minimum signal plus noise-to-noise ratio is not less than 14 dB on AM and PM and not less than 17 dB on CW for the following signal input conditions:-

System	Input Signal
AM	6.3 microvolts signal modulated 30% at 1 kc/s
PM	4 microvolts signal deviated 400 c/s at 1 kc/s
CW	2 microvolts

(5) Connect a modulation meter to the ATU as shown in fig. 25 and inject test signals with the set on AM transmit as detailed in para. 171 (12). If the modulation depth requires adjustment reset as described in para. 171 (12) (a) (iv).

(6) Set the CW tone control (RV8) to the centre position. Set the System switch to CW, apply an unmodulated RF signal to the aerial socket and tune the set on free tune to dead space.

Rotate the CW tone control away from zero beat. A smooth increase in audio frequency to a maximum of at least 3 kc/s should take place in either direction. At any frequency between 600 c/s and 3 kc/s the audio output should not be less than 0.1 milliwatt for RF. inputs of between 2 microvolts and 100 millivolts.

BENCH TEST BCC 30 HP

Introduction

155. The following test procedure may be followed for a complete functional test of a BCC 30 HP complete station. Ideally the tests should be carried out on a BCC 30 HP test panel (fig. 25) but if this is not available the method of connecting up test equipment may be followed from this illustration.

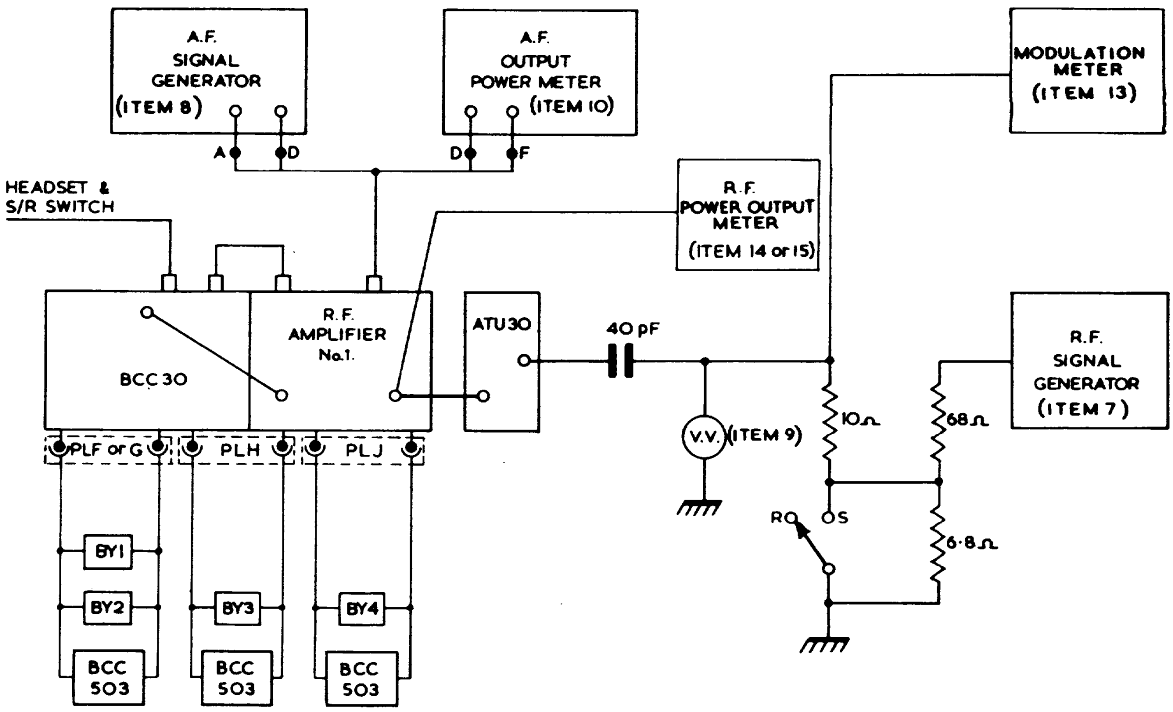


Fig.25 TEST ARRANGEMENT FOR BCC 30 HP - BENCH TEST

Procedure

156. Insert the transmitter-receiver and amplifier units into the case and fit four fully charged batteries. Check the following on PM, AM and CW - with the Amplifier System switch set to OPERATE LP and OPERATE HP in turn.

Transmitter Power Output

(1) Check that the power output figures on the following frequencies conform with the minimum acceptable figures shown in fig. 24 on LP and the table below on HP.

Band	Channel	kc/s
L	1	2200
	F	2700
	2	3800
H	1	4400
	F	6100
	2	7600

(NOTE:- Insert test crystals for the operating frequencies given - see test equipment list item 21).

Record the power output on 2.2 Mc/s and 6.1 Mc/s for calculating the ATU efficiency in sub-para. (2)

High Power Output Details

The table states the pass conditions for the RF Amplifier No. 1. The pass criteria are power output P2 and gain $G = \frac{P2}{P1}$. The drive power P1 and the d.c. voltage shown in the table are the minimum values, i.e. measurements should be made only when these two parameters are not smaller than those quoted.

Frequency Mc/s		2 - 4	4 - 6	6 - 8
Drive, watts minimum (measurement at set RF output socket)		1.8	1.5	1.3
PM and CW	Supply volts minimum	36	36	36
	G dB	10	9.5	8.8
	P_2, watts measured at amplifier RF output)	20	18	15
AM	Supply volts minimum	24	24	24
	G dB	7	6.5	6.0
	P_2, watts	10	9	7.5

ATU Tests

(2) NOTE:- These tests must always be carried out on OPERATE LP as described in para. 154 (2)

Meter Circuit - Remote ATU

(a) During the power output tests a deflection of between 200 and 300 microamps should be observed in the ATU meter.

Modulation Test

(3) Set the SYSTEM switch to AM

Set the BAND and CHANNEL switches to H and 1 respectively.
Inject a modulation signal of 1000 c/s at 10 mV.
Check that the modulation depth is 70 per cent.
Set the BAND and CHANNEL switches to L and 1 respectively.
Check that the modulation depth is still 70 per cent.

NOTE:- HP set only. If the modulation depth is incorrect, reset RV1 in the RF Amplifier No. 1.

Side Tone

(4) Inject a 1 kc/s signal at 10 mV into the microphone input circuit and check that the audio output is not less than 0.02 mW. (Adjust RV9 - sidetone preset on Module C if necessary).

With the set keyed on CW transmit, the sidetone output should be not less than 0.1 mW with the frequency between 500 c/s and 3 kc/s.

Signal to Noise Ratio

(5) The minimum signal plus noise-to-noise ratios must not be less than those shown in para. 154 (4) with the following signal input conditions:-

System	Input Signal
AM	1 kc/s, 6.3 microvolts signal modulated 30%
PM	1 kc/s, 4 microvolts signal deviated 400 c/s
CW	2 microvolts

CW Tone Control

(6) Set the CW tone control (RV8) to the centre (white dot) position.

Set the system switch to CW, apply an unmodulated RF signal to the aerial socket and tune the set on free tune to dead space.

Rotate the CW tone control away from zero beat. A smooth increase in audio frequency to a maximum of at least 5 kc/s should take place in either direction. At any frequency between 600 c/s and 3 kc/s the audio output should not be less than 0.1 milliwatt for RF inputs of between 2 microvolts and 100 millivolts.

FIELD TEST - BCC 30 LP

157. Following satisfactory completion of a bench test or as a normal pre-use routine carry out the field test as follows:-

Preparation

158. (1) Check that fully serviceable batteries are fitted.

(2) Carry out a physical check of all station items and accessories carried for completeness, fit and serviceability.

(3) Clean equipment as required.

(4) Check that crystals are fitted in the correct channel sockets as required and the associated operating frequency is recorded on the frequency channel card.

(5) Check that all straps are correctly fitted and tightened.

Procedure

159. Fit the 8 ft. rod aerial(s) and either a handset or headset as required. At a suitable separation 150 ft. (50 m) carry out a communication test between two BCC 30 packsets or one packset and a compatible ground station as follows:-

(1) Tune and test on the agreed Low Band frequency, using free tune if crystals are not being used, but testing on both crystal and free tune if crystals are being used. Check operation on RT-PM, RT-AM and CW. If operators are available transmit morse and check side tone and reception both ways.

(2) Switch to an agreed High Band frequency, using free tune if crystals are not being used but testing on both crystal and free tune if crystals are being used. Test on RT-PM.

(3) Check that speech quality and volume are satisfactory on RT operation.

FIELD TEST - BCC 30 HP

160. The test procedure is almost identical with that for the BCC 30 LP. The only addition is the repetition of each test call on OPERATE HP following the test call made on OPERATE LP.

CURRENT CONSUMPTION FIGURES

161.

	TRF; not greater than 100 mA
	Receiver; AM, PM, CW, no Signal; 40 mA
Low Power	Transmit AM; not more than 1.1A at 12V
	Transmit PM and CW; not more than 1.2A at 12V
High Power	Transmit AM; not more than 3.5A at 24V
	Transmit PM and CW; not more than 2.6A at 36V

FAULT ANALYSIS TABLES - BCC 30 LP AND HP

BCC 30 LOW POWER SET

162.

Fault	Symptom	Possible Failure Cause
Complete Failure	(1) No meter reading on CW	1. 2 amp fuse blown (in battery compartment) 2 Battery plugs not fitted 3. Batteries completely discharged
	* * *	* * *
	(2) Normal meter readings	1. Handset/headset not fitted correctly 2. Handset/headset faulty 3. Aerial system faulty
	* * *	* * *
	(3) Normal meter readings but no receiver noise or side tone on transmit (serviceable handset fitted)	1. VT21 or T15 (Module C) unserviceable
Receiver dead (Transmitter O.K.)	(1) Receiver dead all bands, on Free Tune, PM, AM and CW side tone present on transmit	1. GAIN control fully counter-clockwise 2. VT20 (Module C) 3. Contacts 1 and 2 of RLA not closed 4. Contacts 21 and 22 of RLA not closed 5. Contacts 25 and 24 of RLA not closed 6. Module M (RF1 and RF2) 7. Module F, Module J or G (detector circuit)
Transmitter no carrier (Receiver working normally)	(1) No power at aerial on AM, PM or CW (crystal and free tune) on L and H band. Power supply and meter reading on CW - O.K.	1. ATU not tuned 2. Pressel switch not operating 3. RLA coil open circuit 4. Module B 5. Module M - Transmitter driver or Transmitter mixer sections 6. Module C, wide band amplifier section 7. Module G (500 kc/s oscillator) 8. Module L (PA tank circuit) 9. Contacts 2 and 3 of RLA not closed 10. Contacts 22 and 23 of RLA not closed 11. Contacts 25 and 26 of RLA not closed

BCC 30 HIGH POWER SET

(Fault patterns additional to those already given for LP set)

163.

Fault	Symptom	Possible Failure Causes
Fails to receive or transmit on LP or HP	(1) Tunes normally on TRF. No tuning response when SYSTEM selected	1. Co-axial links, Set-to-Amplifier or Amplifier-to-ATU faulty 2. Aerial O/c or S/c
Partial transmitter failure	(1) Receives and transmits on LP all systems Transmits AM-HP <u>Fails to transmit PM-HP</u>	1. Either FS2 or FS3 4 amp fuses (in battery compartment) blown 2. Either PLH or PLJ not connected to their battery 3. Either BY3 or BY4 discharged 4. (a) Contacts RLB/4-25 and 26 (RF amplifier) not closed (b) Contacts RLA/1-2 and 3 (RF amplifier) not closed (c) Contacts RLA/3-22 and 23 (RF amplifier) not closed (d) Contacts RLB/2-5 and 6 (RF amplifier) not closed
	* * *	* * *
	(2) Receives and Transmits on LP all systems. Fails to Transmit HP-AM, PM or CW	1. Amplifier off tune or System switch set to TUNE position 2. FSI, 4 amp fuse (in battery compartment) blown 3. RLC fails to operate 4. Ledex switch failure. Select alternative band and if O.K., suspect ledex switch or coil or failure in RF Amplifier No. 1 5. VT1 (RF Amplifier) 6. Faulty 6 way link (Set-to-Amplifier)

Fault	Symptom	Possible Failure Cause
Transmitter carrier O.K. but no modulation on PM or AM	(1) Receiver normal - no side tone on Transmit * * * (2) Modulation on PM but not on AM, sidetone on AM and PM * * * (3) Modulation on AM but not on PM, side tone on AM and PM	1. Microphone 2. Headset or handset leads 3. VT14 or VT15 in Module C * * * 1. Module C - VT10, VT11 or associated circuits faulty 2. ZD2 or ZD5 in Module C, short circuit * * * 1. L9, C70, Module C, short circuit 2. ZD8/9 Module G (reactance diodes)
No transmission or reception on any one crystal channel selected (reception and transmission normal on Free Tune)	(1) No-carrier, no reception, no tuning response on TRF	1. Crystal 2. VT28 3. SWA
Reception normal but no transmission on a crystal channel or free tune on either band	(1) Set tunes on transmit PM at a dial indication 500 kc/s above carrier frequency also "No BFO operation on "Receive CW" * * * (2) No tuning response on PM transmit. Receive CW O.K.	1. 500 kc/s oscillator (Module G) * * * 1. Transmitter mixer Module M 2. Wide band amplifier (Module C) 3. Transmitter driver (Module M) 4. PA transistors (Module B) 5. PA tank circuit (Module L)
No transmission or reception (using ATU with rod or 27 ft end-fed wire)	(1) Aerial Tuning Unit controls fail to produce tuning response	1. RF co-axial link faulty 2. Batteries low 3. ATU faulty (set up dipole or $\frac{1}{4}$ wave end-fed aerial to eliminate ATU)
Transmission and reception very poor (using dipole or $\frac{1}{4}$ wave aerials)	(1) Peak meter reading occurs at wrong tuning frequency (see para. 32) * * * (2) Meter reading small or zero, tuning flat	1. Wrong length of wire aerial element 2. Co-axial feeder either open circuit of short circuited, aerial short or open circuited, (set up ATU with rod aerial to eliminate)

168. Circuit Locations in Modu.

CIRCUIT	LOCATION IN MODULE
Audio Amplifier (VT20, VT21)	C
AFC Amplifier (VT6)	D
AGC Amplifier (VT7)	J
Buffer Amplifier (VT16)	K
Common Crystal Oscillator (VT28)	K
Common Free Tune Oscillator (VT17/VT18)	L
CW Side Tone Oscillator (VT19)	C
Detector/Noise Limiter (MR9/10)	G
Discriminator VT9-MR4/5	D
Driver (Tx) (VT23)	M
Filter (IF)	F
IF Amplifier (VT4, 5 and 6)	J
Modulator	C
Power Amplifier (VT29/30)	B
Power Amplifier Circuit	L
RF Amplifier 1 (VT1)	M
RF Amplifier 2 (VT2)	M
Receiver Mixer (VT3)	F
Transmitter Mixer	M
Wide Band Amplifier (Transmitter)	C
500 kc/s Oscillator	G

Abbreviation Codes

169.

BK	=	Black	V	=	Violet
BN	=	Brown	GY	=	Grey
R	=	Red	W	=	White
O	=	Orange	P	=	Pink
Y	=	Yellow	c.c.	=	Centre connector
GN	=	Green	P/V	=	Pink wire/violet sleeve
BE	=	Blue	BE/GN	=	Blue wire/green sleeve
A	=	Module A	'T'	=	Terminal (Red)
B	=	Module B	TP	=	Test Point (Yellow)
'C'	=	Module C	T	=	Transformer
D	=	Module D	CFTB	=	Cableform terminal board
F	=	Module F	K3	=	Module K terminal 3
G	=	Module G	'C'8	=	Module C terminal 8
J	=	Module J	'L'10	=	Module L terminal 10
K	=	Module K			
'L'	=	Module L			
M	=	Module M			
N	=	Module N			

'C' and 'L' are used to avoid confusion with any capacitor and inductor component numbers

.ransistor Terminal Colour Codes

170.

	NPN	PNP
Collector	Pink	Violet
Base	Yellow	Yellow
Emitter	Blue	Orange

MODULE TESTING AND SERVICING DATA - BCC 30 LP

INTRODUCTION

164. Testing and servicing data for modules are presented in a separate self-contained section for each module.

165. There are two possible applications of the test data; one is to test and set-up new or repaired modules before installation in the set, a second is to test modules suspected of malfunction either 'in situ' or after removal from the set.

166. For some tests, sections of other modules or complete modules are needed. These auxiliary sections either may be obtained by making one up locally or by using a spare complete module. If this is not convenient, the relevant section in the set may be used after appropriate isolation.

167. The voltage readings given on the circuit diagrams were taken from a typical set and are intended only as an aid to servicing. In practice variations of about 10 per cent may be found in d.c. readings and variations of about 20 per cent may be found in a.c. valve voltmeter readings.

FAULT ANALYSIS TABLE - RF AMPLIFIER NO. 1.

175.

Symptom	Qualifying Conditions	Possible Faults in Order of Probability
No carrier on HP, PM, AM or CW	Carriers normal on LP all systems	(1) Amplifier not tuned (2) 6 way link faulty (3) Batteries BY3 and BY4 discharged (4) Plug and socket PLA/SKTA not fitted correctly (5) Fuses FS2 and FS3 both blown (6) Ledex switch not operating leaving RF coils out of circuit (7) VT1 unserviceable* (8) Meter unserviceable. Power output available but not indicated (9) Relay RLC not operating (10) Relay RLA not operating (11) Relay RLB not operating (12) System selector SWB faulty
No carrier on HP, PM and CW - carrier OK on AM	Carriers normal on LP - all systems	(1) FS2 or FS3 blown (2) BY3 or BY4 discharged (3) BY3 or BY4 battery plug loose or not fitted
Carrier on HP - CW and PM but no modulation on HP-AM	Carriers and modulation normal on LP all systems	(1) VT6 (2) T2 (3) T3
Distortion on HP-AM	Carriers and modulation normal on LP all systems	(1) VT6 (2) VT4 or 5 (3) VT2 or 3 (4) Amplifier circuit components

* Before replacing VT1 it is advisable to check the input and output tuned circuits as detailed in para. 181

RF AMPLIFIER NO.1. - TEST PROCEDURE

INTRODUCTION

176. The leads to VT1 the RF Power Transistor must be disconnected for the first series of tests.

GENERAL

177. Test equipment required:-

Distortion Factor Meter	Item No. 19
Modulation Meter	Item No. 13
Morse Key	Item No. 26
Oscilloscope	Item No. 11
RF Valve Voltmeter	Item No. 9
AVOmeter 8	Item No. 6
RF Power Meter 10/25 watts	Item No. 14 (or 15)
BCC 30 Transmitter-Receiver Unit	Item No. 5
Test Panel TS214 Sheet 14	Item No. 4 (c)
2 Servicing Cables 8005-149	Item No. 2
2 Servicing Cables 8000-553	Item No. 3
AF Signal Generator	Item No. 8
Dummy Load	Item No. 30
Dummy Load	Item No. 31
Connector, adaptor for RF Power Output Meter	Item No. 16
250 mA meter or a second AVOmeter 8 (required if test panel is not used)	

PREPARATION

178. Make the following connections between the transmitter-receiver unit, the RF Amplifier No. 1 and the test panel.

(1) Connect socket SKTB on the transmitter-receiver unit to socket SKTB on the RF Amplifier No. 1 using servicing lead 8005-149 (item No. 2).

(2) Connect socket SKTA on the transmitter-receiver unit to socket SKTF on the RF Amplifier No. 1 using servicing lead 8000-553 (item No. 3).

(3) Connect the cable from the test panel marked AMPLIFIER to plug PLA on the RF Amplifier No. 1.

(4) Connect the cable from the test panel marked 30 SET to plug PLD on the transmitter-receiver unit and connect socket SKTC of the transmitter-receiver unit to the 6-pin socket on the test panel by means of servicing lead 8005-149.

(5) Connect the battery leads to the 3 heavy duty 12V batteries.

LEDEX SWITCH TEST

179. Set the System Switch to OFF and the switch on the test panel to RX. Operate the BAND switch and note that the Ledex operates smoothly with positive action, taking a short step from Low to High range (L to H) and a long step rotating through an angle of 330° when switched back from High to Low range.

HT POLARITY, SWITCHING AND RELAY TEST

180. (1) Set the AVO 8 meter to 100V d.c. range and connect its negative lead to earth (chassis). Connect the positive lead to the test point (TP2) near choke L5 on the RF Amplifier No. 1.

(2) Set the System and Panel (RX/TX) switches as shown in the table following and check that the voltages measured on the AVO 8 and the panel voltmeter conform with the data in the table.

System Switches		Panel Switch	Panel Switch	AVO Meter
RF Amplifier No. 1	BCC 30			
Operate LP	PM	TX	12V	0
Tune IN Tune OUT Operate HP	PM	TX	36V	36
Tune IN Tune OUT Operate HP	AM	TX	24V	24
Tune IN Tune OUT Operate HP	CW	TX	36V	36
Operate LP	PM	RX	12V	0

(3) Set the Amplifier System Switch to OPERATE HP, the BCC 30 System Switch to PM and the Panel Switch from TX to RX. Observing the avometer, there should be a slight delay, of the order of 0. 5 of a second, while the voltage changes from 36V to 12V.

(4) Set the Panel Switch to TX and the voltage change from 12V to 36V should be immediate.

INPUT CIRCUIT EFFICIENCY TEST

181. (1) Interconnect the equipment and test panel as in para. 178.

(2) Connect the dummy load (item 29) between VT1 emitter terminal and earth, and connect the valve voltmeter (item 8) across it.

(a) Set the Amplifier System Switch to OPERATE LP.

(b) Set BCC 30 Channel Switch to F, set tune control to 2. 2 Mc/s, System Switch to PM and Band Switch to L.

(c) Connect RF output meter (item 15) on 10 watts range to the amplifier RF output socket.

(d) Set the Panel Switch to TX and adjust the RF TRIM control on the set for a maximum output. Note the power and annotate it P_1.

(e) Set the Amplifier System Switch to OPERATE HP and adjust the TUNE INPUT control for a maximum voltage on the valve voltmeter (correct RF TRIM control on BCC 30 for maximum output). Note the voltmeter reading and annotate it V_1

(f) The minimum efficiency required is 60 per cent. Fig. 27 shows a curve of the readings V_1 against P_o. The PASS and FAIL areas are clearly shown in this figure.

(g) Repeat the efficiency test at 3 Mc/s and 3.8 Mc/s.

(3) Connect the dummy load, (item 30) between emitter terminal and earth, with the valve voltmeter across it:-

(a) Set the Band Switch to H and repeat the same procedure as on L band, checking the efficiency at three points in the range, viz:-

4.4 Mc/s, 6 Mc/s and 7.6 Mc/s

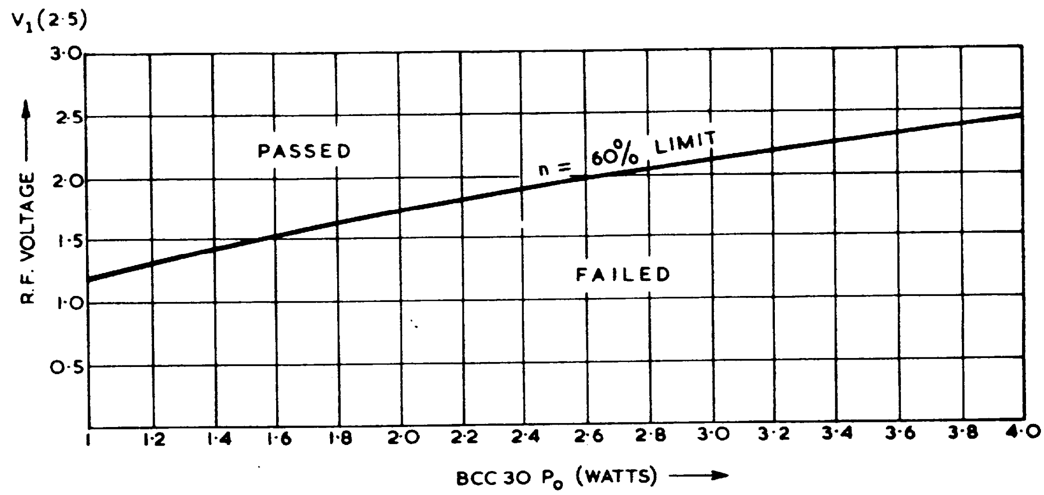


Fig. 27 RF AMPLIFIER
MINIMUM EFFICIENCY LIMIT CURVE FOR INPUT TUNED CIRCUIT

OUTPUT CIRCUIT EFFICIENCY TEST

182. (1) Measure the power output from the transmitter unit as in para. 181 (2) (a - d).

(2) Disconnect the RF power meter from the RF output socket (SKTE) on the amplifier and transfer the RF cable from the RF input socket to the RF output (SKTE).

(3) Connect dummy load (item 31) between earth and the VT1 collector terminal on RF choke (L5), with the valve voltmeter across it.

(4) Switch panel to TX and read RF Volts (V_2).

(5) The minimum efficiency required is 66 per cent. Fig. 28 shows a curve of readings of V_2 against P_o. The PASS and FAIL areas are clearly indicated.

(6) Check the efficiency on L range, at 2.2 Mc/s, 3 Mc/s and 3.8 Mc/s.

(7) Check efficiency on H range, at 4.4 Mc/s, 6 Mc/s and 7.6 Mc/s.

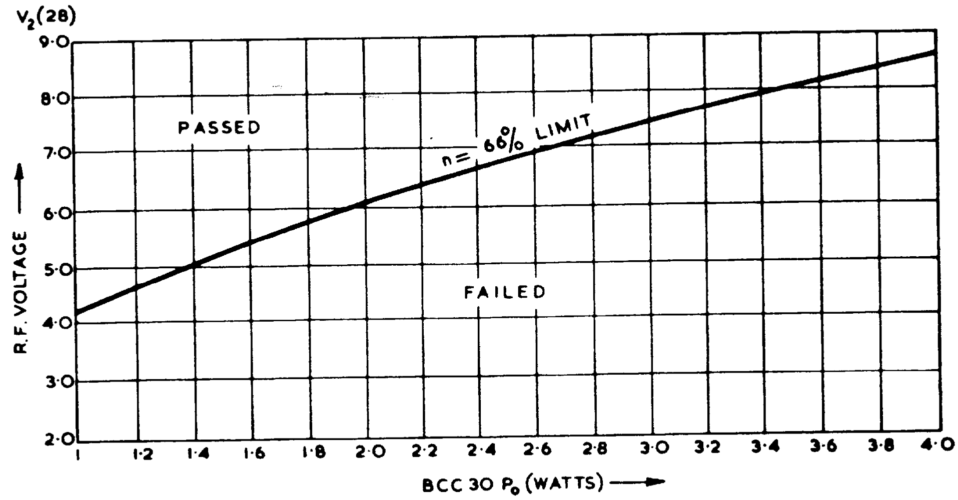


Fig. 28 RF AMPLIFIER
MINIMUM EFFICIENCY LIMIT CURVE FOR OUTPUT TUNED CIRCUIT

MODULATOR TEST

183. With the exception of the RF cable which should be removed from socket SKTF on the RF Amplifier No. 1, maintain the transmitter-receiver, amplifier and meter panel connections as in para. 178.

(1) Set the System Switch (BCC 30) to AM.

(2) Connect the AF signal generator (item 8) to the audio input terminals on the test panel (audio generator in OFF position).

(3) Set the Panel Switch to TX.

- (a) The panel voltmeter should indicate approximately 24V (2 batteries in series).
- (b) Switch in the 300 mA panel meter by operating a switch below the meter on the test panel and note that the current is not higher than 200 mA. Release the switch.
- (c) Return the test panel switch to RX.

(4) Connect the 24 ohms (40 watt) resistor (item 34) between chassis and the collector lead terminal on choke L5.

- (a) Set the test panel switch to TX and note the d.c. current on the test panel meter. This should be of the order of 1.1 amperes but will depend on the battery voltage.
- (b) Set the test panel switch back to RX and connect the valve voltmeter and oscilloscope across the 24 ohm resistor.

(b) Set the Amplifier System Switch to TUNE OUTPUT and set the test panel switch to TX. Set the tune output control for a maximum deflection of the meter. Return the test panel switch to RX.

(c) Set the Amplifier System Switch to OPERATE HP and the RF power output meter to the 0-25 watts range. With the test panel switch set to TX note the power output. If it is over 25 watts, change the RF power output meter for the 0-50 watts model (item 14).

(d) Correct the tuning by small adjustments of the RF TRIM control on the set, and to the TUNE INPUT and TUNE OUTPUT controls on the RF Amplifier No. 1 until maximum power is obtained. Note the power value and annotate it P_2. The table gives the pass conditions for the RF Amplifier No. 1 and reference will be made to it in other paragraphs of these tests. The pass criteria are power output P_2 and gain $G = \frac{P_2}{P_1}$

The drive power P_1 and the d.c. voltages shown in the table are the minimum values, i.e., the measurements only should be carried out when these two parameters are not smaller than those quoted in the table. It should be noted that with the power input from the transmitter unit higher than 2.0 watts the gain of the amplifier will fall but the power output will be higher than 20 watts. When the input power is equal to or less than 2.0 watts the gain will be at least 10 dB (giving an output power 10 times higher than the input power) but probably less than 20 watts.

(e) Using the oscilloscope check that no spurious oscillation is present.

(f) Check that the current reading on the test panel meter is not higher than 1.2 amps with 2 watts input.

NOTE:- The tuning on 2 Mc/s is very flat and no visible maximum will be noticed.

Frequency Mc/s		2 - 4	4 - 6	6 - 8	Remarks
Drive, watts minimum		1.8	1.5	1.3	
PM and CW	d.c. supply volts minimum	36	36	36	
	G dB	10	9.5	8.8	P_1 - 2 watts or less
	P_2, watts	20	18	15	P_1 - 2 watts or more
AM	d.c. supply volts minimum	24	24	24	
	G dB	7	6.5	6	P_1 - 2 watts or less
	P_2, watts	10	9	7.5	P_1 - 2 watts or more

P_1 - Driving power from BCC 30 transmitter

(c) Set the valve voltmeter range to 30V and the oscilloscope time base for audio frequency.

(d) Set the AF signal generator frequency to 1000 c/s and switch it on.

(5) Set the Test Panel Switch to TX.

(a) Set the AF signal generator attenuator so that the valve voltmeter reads approximately 14 volts.

(b) Adjust oscilloscope Gain and Time base controls for a stationary trace.

(c) Increase the signal level from the signal generator until clipping just appears on the sinusoidal peaks.

(d) Measure the voltage on the valve voltmeter. It should not be less than 15 volts.

(e) Note the current on the test panel meter. The increase in current above that measured in (4) (a) should not be larger than 1.0 amps.

(6) Switch off the AF signal generator.

(a) Set the AVO 8 to 10V d.c. range. Measure the voltage between TP4 (+ve) and TP3 on the modulator board (-ve). The voltage should not be larger than 5.0 volts.

TESTS WITH VT1 CONNECTED

Range Coverage and Output Power Tests on PM and CW

184. (1) Reconnect VT1 normally and with connections as in para. 178, and the test panel switch set to RX:-

(a) Connect the RF Power meter (item 15) to the RF OUTPUT socket via the adaptor fitted with a terminal for the oscilloscope connection (item 16). Connect the oscilloscope to this connection.

(b) Set the System Switch on the set to PM, the Band Switch to L and Channel Switch to F.

(c) Set the System Switch on the RF Amplifier No. 1 to OPERATE LP.

(d) Set the test panel switch to TX and tune the RF TRIM control on the set for maximum output on 2 Mc/s. Note the power output and annotate it P_1

(e) Set the test panel switch to RX.

(2) Set the Amplifier System Switch to TUNE INPUT.

NOTE:- The test panel switch must be set to RX during all connection changes and re-selections at switches.

(a) Set the test panel switch to TX, tune the input circuit for maximum deflection of the amplifier meter - return the test panel switch to RX.

(3) Tune the set to 4 Mc/s on Low Band. Repeat paras. 184(1) (c) to (2) (e) noting the power output P1 at 4 Mc/s., and the high power output, P2, also at 4 Mc/s. Refer to the table for pass conditions and note that the d.c. current reading on the test panel meter should not be more than 1.2 amps (with 2 watts input power).

(4) Set the Band Switch to H.

(a) Tune the transmitter-receiver unit to 4 Mc/s on High Band. Measure the Low Power output P1 and the High Power output P2 as before with the RF Amplifier No. 1 tuned to 4 Mc/s. For pass conditions see the table.

(b) Following the same procedure obtain P1 and P2 at 8 Mc/s. For pass conditions see table.

(5) Set the System Switch to CW and check the power output from the RF Amplifier No. 1 at 8 Mc/s on H band and at 4 Mc/s on L band.

(a) Connect a Morse Key to the 6 pin socket on the RF Amplifier No. 1.

(b) Set the time base control on the oscilloscope for a slow speed and by keying fast observe that there is no overshoot.

Power and Modulation Test on AM

185. (1) With connections as in para. 178 and the test panel switch in the RX position:-

(a) Connect the AF signal generator to the terminals on the test panel.

(b) Connect the RF output power meter (10-25 watts, 75 ohms) to the RF output socket on the RF Amplifier No. 1

(c) Connect the oscilloscope to the adaptor on the RF output power meter.

(d) Connect the modulation meter (item 13) across the oscilloscope.

(2) Set the System Switch to AM. Set the Band Switch to H and tune to 8 Mc/s. Set the Amplifier System Switch to OPERATE LP with the test panel switch set to TX. Note the power output from the transmitter-receiver unit. Return the test panel switch to RX.

(a) Tune the RF Amplifier No. 1 input and output circuits for maximum meter deflection as in para. 184 (2) (a) and (b).

(b) Set the Amplifier System Switch to OPERATE HP, the test panel switch to TX and check that maximum available power is obtained by a slight retuning of the RF TRIM control on the transmitter-receiver unit and the TUNE input and TUNE output controls on the RF Amplifier No. 1. For pass conditions see the table.

(3) Return the System Switch on the transmitter-receiver unit to PM and tune the set and amplifier to maximum power output on 2 Mc/s.

(a) Reset the System Switch to AM but do not retune the RF Amplifier No. 1.

(b) Set the AF signal generator to 1000 c/s.

(c) With the RF Amplifier No. 1 tuned to 2 Mc/s apply 70% modulation observing the modulated carrier on the oscilloscope for excessive distortion.

(d) The current reading in the test panel meter should not be greater than 2.5 amperes.

(4) Tune the transmitter-receiver unit and RF Amplifier No. 1 to 8 Mc/s and repeat as in (3).

(a) Note the depth of modulation; if it is greater than 85 per cent change the value of resistor R3 to 560 ohms. R3 can be selected from three values, i.e. 100 ohms, 220 ohms or 560 ohms.

(b) Observing the oscilloscope check that this new value of resistance does not produce clipping on top of modulation. If it does, change the resistor R3 to 220 ohms.

(c) After selecting the right value of resistor for R3 make sure that the modulation between 2 Mc/s and 8 Mc/s does not vary by more than 70 per cent to 85 per cent and that distortion is reasonable (maximum distortion in the modulator should be less than 20 per cent.)

RF AMPLIFIER NO. 1. - REMOVAL OF COMPONENTS

INTRODUCTION

186. The amplifier is a very compact construction containing four sections as shown in fig. 15.

(1) RF section (end section) containing essentially RF components.

(2) Centre section, containing some RF units and some modulator components (LF) units.

(3) Modulator section, containing the main modulator components.

(4) Front panel, containing the controls and waterproof seal.

To change any one component with a minimum of dismantling the table (overleaf) first should be read to identify the removal detail codes and the sequence in which they are to be used. The detailed instructions may then be followed to remove an unserviceable component. Details are not given for fitting new components, since normally it is only necessary to reverse the order of removal.

RF AMPLIFIER NO. 1 - COMPONENT REMOVAL SEQUENCE

	Section Located in	Removal - Operations Sequence Codes - in Order
VT1	RF Section	RF/A
L5	"	RF/B
R7	"	RF/C
L6	"	RF/A, RF/D
Ledex assembly	"	RF/A, RF/E
L2	"	RF/F
C10/C11 (tune output)	"	RF/A, RF/G
L1	"	RF/H
T1	"	RF/J
Relay RLB and tagboard assembly	Centre Section	CS/A
T2	"	CS/B
L4	"	CS/C
L3	"	CS/D
C2 (tune input)	"	CS/E
Component Board	Modulator	CS/E (1) and (2), MS/A
Relay RLA	"	CS/E (1) and (2), MS/B1 (or MS/B2)
T3	"	CS/E (1) and (2), MS/A, MS/C
VT2 and VT3	"	CS/E (1) and (2), MS/A, MS/D
VT4 and VT5	"	CS/E (1) and (2), MS/A, MS/E
Meter	Front Panel	
Meter Component Board	"	
Relay RLC	"	
SWB (System selector)	"	CS/E (1) and (2) RF/G (1)
RF INPUT socket	"	
RF OUTPUT socket	"	
SKTB, SKTC 6 way sockets	"	

RF SECTION-CODES RF/A TO RF/J

RF/A - Power Transistor Assembly (VT1)

187. The assembly is mounted on insulators and is at the collector RF potential. The base plate is d.c. insulated from the power transistor block by a mica washer.

(1) Unscrew and remove the six socket headed 6BA screws and the two 4BA socket headed screws securing the base plate to the RF Amplifier No. 1 and the transistor block to the base plate respectively. Remove the base plate.

(2) Unsolder the pink (collector) wire from the lug on L5 and the blue (emitter) wire and the yellow (base) wire from the feed through pins (adjacent to PLA).

RF/B Inductor L5

188. (1) Unscrew and remove the two 6BA cheese headed screws securing the inductor case.

(2) Unsolder and release the blue wire and leads of C5, C6 and C7 (in parallel) from one side of L5.

(3) Unsolder and release the two pink wires on the other side of L5.

RF/C Resistor R7 (Dummy aerial load for tuning)

189. (1) Unsolder the co-axial centre connector and braid from the resistor and adjacent earth tag respectively.

(2) Unscrew the cheese headed screw securing the resistor assembly to its bracket and remove the resistor.

RF/D Inductor L6

190. Preparation - carry out operation RF/A.

(1) Unsolder and release the red wire from L6 to C11.

(2) Unsolder and release the blue wire from L6 to SWA/2-1.

(3) Unsolder and release the green wire from L6 to SWA/2-3.

(4) Unscrew the cheese headed screw securing the coil to its centre post.

(5) Remove L6.

RF/E Ledex Switch Assembly Complete

191. Preparation - carry out operation RF/A (1, 2) and RF/D (2, 3).

(1) Unscrew and release the two 6BA socket headed screws securing the ledex assembly to the RF unit chassis.

(2) Unscrew and release the three 4BA socket headed screws securing the ledex assembly to the modulator chassis.

(3) Unsolder the red wire with a white sleeve from the feed through terminal continued to the ledex motor coil via a yellow wire.

(4) Unsolder the external violet wire from the feedthrough terminal continued to SWA/1-9 via an internal violet wire.

(5) Unsolder the external pink wire from the feedthrough terminal continued to SWA/1-10 via an internal pink wire. **SWA/2: unsolder** the following wires:-

(6) The co-axial c.c/white sleeve from SWA/2-2 and its braid from the adjacent earth terminal on the screen of the ledex switch assembly.

(7) The green wire (from C2) at the stand off insulator on the same screen.

(8) Unsolder the brown sleeved concentric wire from pin 1 of T1 and its braid from terminal 3 of T1. Remove the concentric lead from terminal 2 of T1.

(9) Remove complete ledex assembly. From SWA/3 unsolder the following wires:-

(10) Black wire from L1 to SWA/3-1.

(11) Black wire from L2 to SWA/3-3.

(12) Blue wire from L1 to SWA/3-4.

(13) Red wire to terminal 4 of T1 from SWA/3-2.

(14) Blue wire from L2 to SWA/3-6.

(15) Pink wire from SWA/1-10.

(16) Violet wire from SWA/1-9.

(17) Yellow wire from ledex coil to feedthrough insulator.

(18) Release the two screws securing the motor mounting plate to the ledex mounting chassis and the single screw securing the anchor plate at the other end of the assembly. Ease the complete assembly away to obtain access to C23 and then unsolder C23 from the ledex contacts and the (black) chassis link wire from the screen. Lift the ledex assembly out of its chassis.

<u>RF/F RF Coil L2</u>

192. Preparation - carry out operations RF/A (1, 2), RF/D (2, 3) and RF/E (1, 2, 3, 4, 5, 6, 7, 8, 9, 11 and 14).

(1) Remove L2 by completely retracting the centre post screw. (This can be done without unsoldering wires from L1).

(2) The Tufnol block can now be removed by releasing the two cheese headed screws securing the block to the ledex chassis.

RF/G Tune Output Capacitor Assembly C10/C11

193. Preparation - carry out operations RF/A (1, 2).

(1) Using the 0.05" allen key, release the TUNE OUTPUT drive control from the capacitor drive shaft at the capacitor shaft side.

(2) Release the three 4BA socket headed screws securing the three tie pillars bolting the RF unit chassis and modulator chassis plates. Release the socket headed screw securing the bonding strip between RF unit chassis and modulator chassis.

(3) Release two dome headed screws on C2 to remove the bonding strip between the RF unit chassis and C2 (TUNE INPUT).

(4) Release and remove the two 6BA socket headed screws securing the bracket of the ledex assembly chassis to the RF unit chassis.

(5) Release the two 6BA socket headed screws securing PLA to chassis and withdraw it away from the chassis.

(6) Loosen the 6BA socket headed screw securing the board for relay B to the centre section.

(7) Carefully ease the RF unit chassis away until the three cheese headed screws securing C10/C11 are accessible. Unsolder C8 with R4 and the red wire to L6 and then remove the TUNE OUTPUT assembly.

RF/H RF Coil L1

194. Preparation - carry out operations RF/E (10, 12).

(1) Remove the 2BA nut and the washers securing L1 to the centre post screw. (L1 can be removed without unsoldering wires from L2).

(2) Remove L1.

RF/J Transformer T1

195. Preparation - carry out operations RF/A (1, 2), RF/D (2, 3) and RF/E (1, 2, 3, 4, 5, 6, 7, 8, 9 and 13).

(1) Unscrew and remove the 6BA nut from the screw securing T1 to the Ledex chassis.

(2) Remove T1.

CENTRE SECTION - CODES CS/A TO CS/E

CS/A Relay RLB and Tagboard Assembly and PLA

196. Preparation - carry out operations RF/G (1, 2, 3, 4, 5 and 6).

(1) Release the two 6BA cheese headed screws securing the tagboard to the modulator chassis. Ease the RF unit away from the modulator chassis to allow easier access to the relay board.

(2) Unsolder and release wires from RLA as follows:- Green (RLA-5), Blue/White sleeve (RLA-3), Orange (RLA-2), Brown (RLA-22), Yellow (RLA-24).

(3) Unsolder the four remaining wires from the underside of relay B terminal board as follows:- Black, Green/White sleeve, Red/Yellow sleeve, Red/White sleeve. Move the relay terminal board away from the adjacent pillar to allow easier access to the top of the relay board.

(4) Unsolder and release the following wires from the terminal board:- Green/White sleeve, Pink, Violet, Red/White sleeve, Red, Blue, Blue/White sleeve.

(5) Unsolder and release the blue wire from test point No. 2.

(6) Unsolder the concentric wire (from the front panel) at the relay terminal board.

(7) Remove the relay terminal board and PLA.

(8) Wires to PLA can be unsoldered after the relay terminal board has been removed.

CS/B Modulation Transformer T2

197. Preparation - carry out operations RF/E (2), RF/G (1, 2, 3, 4, 5 and 6).

(1) Unsolder wires from the 7 way tag board on T2 (wiring codes are given in the illustration):- Orange, Red - 2 off, Orange, Blue/White sleeve, Blue, Black and Green.

(2) Unscrew the four 2BA cheese headed screws securing the transformer to the rivetted pillars and remove it from the amplifier.

CS/C Inductor L4

198. (1) Unsolder the green wire from the outer terminal. Unsolder the yellow and black wires from the terminal board on the inductor.

(2) Unscrew and remove the two hexagon headed screws securing the inductor to the RF unit chassis.

(3) Remove the inductor.

CS/D Inductor L3

199. (1) Unsolder the green wire with a white sleeve and resistor R1 from one terminal and the blue wire from the other terminal adjacent to the fixing screw.

(2) Unscrew and release the cheese headed screw securing the inductor to the RF unit chassis.

(3) Remove the inductor.

CS/E Tune Input Capacitor C2

200. Preparation - carry out operations RF/E (2), RF/G (1, 2, 3, 4, 5 and 6).

(1) Partially detach the modulator chassis from the front panel by unscrewing and removing the four 2BA socket headed screws at the corners. Unscrew and remove the 8BA socket headed screw securing the earthing strip between the front panel and modulator chassis.

(2) Partially separate the modulator chassis from the RF unit chassis to allow C2 to be removed.

(3) Withdraw wiring from the rubber grommets in the modulator chassis and swing the front panel assembly to one side to completely expose the underside of the modulator chassis.

(4) Using the 0.05" allen key release and remove the drive gear from C2 drive shaft. Unscrew and remove the three cheese headed screws securing C2 to chassis.

(5) Unsolder the green wire from C2.

(6) Remove C2.

(7) On refitting, note that C2 driven gear is of the anti-backlash type. To remesh it with the spur drive gear (TUNE INPUT) it is necessary to align the teeth on the two sections of the driven gear.

MODULATOR SECTION - CODES MS/A TO MS/D

General Access

201. To obtain general access to the modulator assembly carry out operations CS/E (1) and (3).

MS/A Component Board

202. (1) Unsolder and remove the orange and yellow wires from the emitter and base terminals of VT6 at the underside of the tag board.

(2) Unsolder other external wires to the board (as shown in the illustration) as follows:-

(a) Co-axial c.c. to RV1

(b) Braid and black from R15 (chassis link)

(c) Red from junction of C15/R12

(d) White from junction of R10/TH1/R11 to T3 C/T

(3) Unscrew and remove the four cheese headed screws securing the board.

(4) Remove the board.

MS/B1 Relay RLA Coil Change

203. Preparation - operations CS/E (1 and 3). It is possible to change a coil unit without unsoldering the leads to the contact-set terminals which may be retained for service with a new coil.

(1) Unscrew and release the two countersunk screws securing the end of the coil assembly to the triangular bracket and ease the relay away from the chassis.

(2) Unscrew the 8BA cheese headed screw securing the contact assembly to the coil just sufficiently to release it from the screw thread in the coil assembly. Remove the contact assembly complete without withdrawing the screw entirely.

(3) The coil assembly may now be changed as follows:-

(a) Unsolder the violet wire from one coil terminal.

(b) Unsolder two orange/white sleeve wires from the other coil terminal.

(c) Remove the coil assembly.

MS/B2 Relay RLA Contact Set Change

204. Preparation - operations CS/E (1 and 3).

(1) Unscrew the 8BA cheese headed screw securing the contact assembly to the coil just sufficiently to release it from the threaded hole and then remove the contact assembly complete without withdrawing the centre screw.

(2) Fit a new contact set (or sets) as required and unsolder one wire at a time from the old contacts and transfer it to the new set. The colour codes of wires are shown in the servicing diagram.

MS/C Transformer T3

205. Preparation - operations CS/E (1 and 3), MS/A (1, 2, 3 and 4).

(1) Remove the component board as described in operation MS/A to provide access to T3.

(2) Remove the two cheese headed screws securing T3 to the modulator chassis.

(3) Unsolder wires from T3 terminal board as shown in the servicing diagram, i.e. Violet wire from the green terminal, Black wire from the red terminal, Yellow wire from the yellow terminal, White wire from the white terminal and Yellow wire from the blue terminal.

(4) Remove T3.

Orange = emitter
Yellow = base
Violet = collector

MS/D Transistors VT2 and VT3

206. Preparation - operations CS/E (1 and 2) and MS/A (1, 2, 3 and 4).

VT2

(1) Unsolder the following wires from the transistor terminals:-

(a) Orange wire (from VT4 emitter) and one end of R8 from the base.

(b) Orange (long lead to T2/3) and other end of R8 from the emitter.

(c) Violet from the collector.

(2) Unscrew the 2BA hexagonal nut securing the transistor to its heat sink, remove the nut, tag and washer.

(3) Withdraw the transistor from its heat sink mounting.

VT3

(1) Unsolder the following wires from the transistor terminals:-

(a) Orange wire and one end of R9 from the emitter

(b) Orange wire (from VT3 emitter) and the other end of R9 from the base.

(c) Violet from the collector.

(2) Unscrew the 2BA hexagonal nut securing the transistor to its heat sink, remove the nut, tag and washer.

(3) Withdraw the transistor from its heat sink mounting.

MS/E Transistors VT4 and VT5

207. Preparation - operations CS/E (1 and 3), MS/A (1, 2, 3 and 4).

VT4

(1) Unsolder the orange wire from the base of VT2.

(2) Unsolder the violet wire from the collector of VT2.

(3) Unsolder the yellow wire from the yellow terminal on T3.

(4) Lift the transistor out of its recess in the heat sink.

VT5

(1) Unsolder the orange wire from the base of VT3.

(2) Unsolder the violet wire from the collector of VT3.

(3) Unsolder the yellow wire from the blue terminal on T3.

(4) Lift the transistor out of its recess in the heat sink.

FRONT PANEL

208. Primary access - operations CS/E (1 and 3), RF/G (1). All front panel components are now easily accessible and removal is a straightforward procedure. The special meter spanner (item 59) will facilitate the removal of the meter. When components bolted through the front panel are changed, particular care should be taken to ensure that the seals are correctly fitted and remade.

Components are located on the front panel as shown in fig. 15.

AERIAL TUNING UNIT - SERVICING (fig.17)

Removal from the Case

209. (1) Using the 3/32" A/F allen key, release the four socket headed screws securing the ATU to its case.

(2) Carefully withdraw the unit from the case. If a meter is fitted, unplug the meter leads from the sockets on the component board.

Removal of Tuning Coil Assembly

210. (1) Turn the tuning control knob fully clockwise.

(2) Remove the tuning control knob.

(3) Unsolder the two links one between chassis and the front terminal board and the other between the aerial output socket and the board.

(4) Unsolder the two grey wires from the pins on the front terminal board and the blue and another two grey wires from the rear terminal board.

(5) Using a 4BA allen key release the socket headed screw securing the front board to the panel.

(6) Remove the two screws securing the fibre-glass mounting plate to the coil assembly and switch bracket.

(7) Using the ¼" Whitworth box spanner release the nut securing the shaft and seal to the panel.

(8) Remove the coil assembly.

Removal of Circuit Component Board

211. (1) Unsolder the co-axial c.c. and braid leads (from the RF input co-axial socket on the front panel) at the underside of the board.

(2) Unsolder the grey wire from the rear side (furthest from the panel) of the board and the short link to the switch.

(3) Remove the two nuts securing the long socket headed screws which hold the component board to the switch assembly pillars. Remove the screws.

(4) Unsolder and release the grey and blue wires from terminals 4 (grey) and 6 (blue) of the switch.

(5) Remove the component board.

Switch Wafer

212. (1) Unsolder the four wires and the short link from the switch terminals (see fig. 17).

(2) Remove the circuit component board (see separate details).

(3) Lift the switch wafer off its drive shaft.

Meter Removal

213. On the remote ATU, the meter is secured to the ATU by a clamp plate fitted to the outside. Removal of the clamp plate is all that is required to release the meter after the front panel has been first released and the two sockets at the ends of the meter leads have been removed from the plugs on the component board.

SPARES KITS AND CONVERSION KITS

GENERAL

214. Full details of the spares breakdown are included in the Illustrated Parts List (BCC Code No. IPL/189). For the convenience of the reader a full list of electrical components is included at the rear of this manual together with the list of interchangeable modules. The complete list of the spares and conversion kits is as follows:-

LIST OF SPARES KITS

BCC 30 LP

215.

Field Service Kit:-	Part No. 8040-001
Workshop maintenance Kit:-	Part No. 8040-002
(Spares for Aerial Tuning Units are included in both kits)	
BCC 30 VAT (vehicle adaptor temporary) Kit:-	Part No. 8000-10A
Conversion to BCC 30 HP Kit:-	Part No. 8041-1A

NOTE:- On conversion the extra battery requirements depend on whether dry or rechargeable units are in use with existing BCC 30 LP sets., i.e. only 2 (extra) nickel cadmium units will be required in one event but four in the other).

BCC 30 HP

216.

Field Service Kit:-	Part No. 8040-001/8041-001
Workshop maintenance Kit:-	Part No. 8041-002/8040-002
(Spares for RF Amplifier No. 1 and Aerial Tuning Unit are included in both kits)	
BCC 30 VAT (vehicle adaptor temporary) Kit:-	Part No. 8000-10A
BCC 30 VAP (vehicle adaptor permanent) Kit:-	Part No. 8000-10B

FIELD SERVICING KITS

217. These kits cater for the replacement of major parts and modules in a field service section or workshop vehicle. The scaling is based on the requirements to maintain 40 equipments over a 2 year period.

WORKSHOP SERVICING KITS

218. For workshop servicing, comprehensive kits are available which include a full field service kit plus 'special-to-type' components used in the equipment. Like the field servicing kit, the scaling is based on 40 equipments over two years.

CONVERSION KIT - LP TO HP

219. To convert a BCC 30 LP set into a BCC 30 HP, a conversion kit is available which also includes the extra spare parts which become necessary after the conversion. The conversion to HP is very simple and consists of transferring the LP set into the larger HP case assembly which houses an RF Amplifier No. 1. Four nickel cadmium batteries are required but if two of these are being used in the LP set they can be transferred on conversion so that only a further two units are required to complete the conversion. (See para. 215.)

BCC 30 VAT (VEHICLE ADAPTOR TEMPORARY) KIT

220. This kit consists of a BCC 501 charger kit, an ATU mounting and a packset carrier. These parts are fitted in a vehicle (see Operator's Manual OM 151 page 63) so that the set can be rapidly converted from its packset role into a vehicle installation or vice versa. This kit is suitable for both LP and HP sets.

BCC VAP (VEHICLE ADAPTOR PERMANENT) KIT

221. The permanent installation kit consists of a mounting tray which includes battery eliminator units and an audio amplifier; the latter to raise the receiver audio level to one suitable for vehicle operation. The kit provides only for HP sets to be adapted. The Aerial Tuning Unit is mounted close to the vehicle aerial and the set operates entirely from the vehicle d.c. supply (12V or 24V). Full installation details are given in the handbooks accompanying the kits.

REMOTE CONTROL KIT - BCC 513

222. The remote control kit consists of two units (BCC 513L and BCC 513R); one sited locally by the set and the other sited at a remote point which may be at a distance not exceeding 1760 yards away from the set. The two units are connected by a suitable length of D10 twin assault cable. At the remote point the operator can transmit and receive RT-AM, RT-PM or CW as selected by a switch on the local unit. Intercommunication is possible between a local operator at the set and an operator at the remote point. Full details are contained in Technical Manual TM 172.

PART NUMBERS AND COMPONENTS LIST

COMPLETE STATION LP – (8040-1)

223.

BCC 30 LP	-	8040-1
Aerial Tuning Unit (local)	-	8042-1 (remote - optional = 8042-2)
Carrying bag	-	8040-127
Rod-aerial 8 ft.	-	8040-126 (optional extra 14 ft. rod aerial 8040-134)
Flexible coupling	-	8000-508
Right angle connector	-	8000-509
Handset	-	8000-194
Headset	-	8000-195
Morse key	-	8000-196
Wire aerial kit	-	8006-1/A (items 10, 11, 12, 13 and 14 of fig. 1)
Accessory bag	-	6642-571 (part of wire aerial kit)
Frequency plate	-	8000-272
Driver hexagonal ATU	-	8040-1/A-14
Driver hexagonal Panel	-	8040-1/A-15
Battery nickel-cadmium or	-	8000-512 (2 off) for 8000-1/A
Battery dry	-	8000-507 (2 off) for 8000-1/B
Crystals Type ZDJ	-	8040-1/A-21 (for low band - as required) Extras
Crystals Type ZKJ	-	8040-1/A-20 (for high band - as required) Extras
Transit container	-	8000-348
Operators Manual	-	OM 151/1
Technical Manual	-	TM 189 (Extra)
Illustrated Parts List	-	IPL 189 (Extra)

GENERAL PART NUMBERS

229.
BCC 30 LP

LP box assembly	-	8040-150
LP battery cover	-	8040-128
Desiccator	-	8040-1/8
RF link (Set to ATU)	-	8000-503
Plug co-axial (part of RF link))	-	8000-503/1
Catylator	-	8000-565
Fuse link (2A)	-	8040-001-86

230.
BCC 30 HP

HP box assembly	-	8041-153
HP battery cover	-	8040-128
RF link (amplifier to ATU)	-	8005-142
RF link (set to amplifier)	-	8000-503
Plug co-axial (RF links)	-	8000-503/1
6 way link (set to amplifier)	-	8005-141
Desiccator	-	8040-1/8
Catylator	-	8000-565
Fuse link (4A)	-	8040-150-13

The main details of spares and part numbers are contained in the Illustrated Spares List Code: IPL 189.

ACCESSORIES - PART NUMBERS

225.
GENERAL

14 ft. Rod aerial and carrier	-	8040-134
Two way adaptor (for audio gear)	-	8007-549
Remote control unit	-	8043-1
Mast aerial lightweight	-	8040-148

226.
BATTERY CHARGERS

BCC 13 hand driven charger	-	8013-1/A
BCC 20 petrol engine driven charger	-	8018-1/A
BCC 501 12/24V d.c. operated charger	-	8021-1/A
BCC 503 110V/220V a.c. mains charger	-	8022-1/A

227.
VEHICLE ADAPTORS

Temporary vehicle installation LP/HP kit	-	8000-10/A
Permanent vehicle installation kit - HP	-	8000-10/B

228.
CONVERSION KITS (LP TO HP)

Kit conversion BCC 30 LP to HP (includes additional spares)	-	8041-1/A

Nomenclature	Module Location	Circuit Reference	Value (ohms)	Tolerance ± %	Rating (Watts)	Code Number
Resistor Carbon	G	R103	1 K	10	0.1	8040-113/21
'' ''	G	R104	10 K	10	0.1	8040-113/23
'' ''	G	R105	10 K	10	0.1	8040-113/23
'' ''	G	R106	47 K	10	0.1	8040-118/6
'' ''	G	R107	1 K	10	0.1	8040-113/21
'' ''	G	R108	150	10	0.1	8040-113/42
'' ''	G	R109	220	10	0.1	8040-118/11
'' ''	G	R110	220 K	10	0.1	8040-208/11
'' ''	G	R111	330 K	10	0.1	8040-208/12
'' ''	K	R112	3.3 K	10	0.1	8040-113/28
'' ''	A	R113	120 K	10	0.1	8040-220/4
'' ''	A	R114	150 K	5	0.1	8040-220/5
'' ''	A	R115	12 K	10	0.1	8040-206/13
'' ''	J	R116	1 K	10	0.1	8040-113/21
'' ''	D	R117	100 K	10	0.1	8040-114/16
'' ''	K	R118	1 K	10	0.1	8040-118/11
'' ''	K	R119	220	10	0.1	8040-118/11
'' ''	K	R120	2.7 K	10	0.1	8040-114/8
'' ''	K	R121	47 K	10	0.1	8040-118/6
'' ''	A	R122	15 K	10	0.1	8040-111/18
'' ''	C	R123	150	10	0.1	8040-113/42
'' ''	B	R124	2	5	0.1	8040-112/12
'' ''	C	R125	1 M	10	0.1	8040-113/43
'' ''	C	R126	1 K	10	0.1	8040-113/21
'' ''	K	R127	1 K	10	0.1	8040-113/21
'' ''	G	R128	3.3 K	10	0.1	8040-113/28
'' ''	D	R129	1 K	10	0.1	8040-113/21
'' ''	D	R130	2.2 K	10	0.1	8040-113/41
Not used		R131				
Resistor Carbon	C	R132	3.3 K	10	0.1	8040-113/28
'' Wirewound	M	R133	3	10	0.1	8040-113/37
'' Carbon	B	R134	10	10	0.1	8040-112/13
'' ''	B	R135	10	10	0.1	8040-112/13
'' ''	C	R136	10	10	0.1	8040-112/13
'' ''	M	R137	12	10	0.5	8040-120/18
'' ''	K	R138	27 K	10	0.1	8040-111/19
'' ''	M(T19)	R139	39	10	0.1	8040-213/14
'' ''	C	R140	47	10	0.1	8040-113/25
'' ''	C	R141	10	10	0.1	8040-112/13
Not used		R142				
Resistor Wirewound	L	R143	3	10	3.0	8040-113/37
'' Carbon	C	R144	220 K	10	0.1	8040-113/30
'' ''	D	R145	2.2 K	10	0.1	8040-113/41
'' ''	C	R146	22 K	10	0.1	8040-114/18
'' ''	M	R147	270	10	0.1	8040-113/39
'' ''	G	R148	5.6 K	10	0.1	8040-206/15
'' ''	J	R149	33	10	0.1	8040-113/24
'' ''	J	R150	2.2 K	10	0.1	8040-113/41
'' ''	J	R151	5.6 K	10	0.1	8040-206/15
'' ''	A	R152	27 K	10	0.1	8040-111/19
'' ''	A	R153	5.6 K	10	0.1	8040-206/15
'' ''	K	R154	220	10	0.1	8040-118/11

Nomenclature	Module Location	Circuit Reference	Value (ohms)	Tolerance ± %	Rating (Watts)	Code Number
Resistor Carbon	C	R51	47	10	0.1	8040-113/25
" "	C	R52	1.2 K	10	0.1	8040-113/26
" "	C	R53	3.9 K	10	0.1	8040-113/27
" "	C	R54	3.3 K	10	0.1	8040-113/28
" "	C	R55	10 K	10	0.1	8040-113/23
" "	C	R56	3.9 K	10	0.1	8040-113/27
" "	C	R57	1.2 K	10	0.1	8040-113/26
" "	C	R58	220 K	10	0.1	8040-113/30
" "	C	R59	56 K	10	0.1	8040-113/31
" "	K	R60	4.7 K	10	0.1	8040-113/35
" "	K	R61	47 K	10	0.1	8040-118/6
" "	K	R62	330 K	10	0.1	8040-118/7
" "	K	R63	18 K	10	0.1	8040-113/38
" "	K	R64	10 K	10	0.1	8040-113/23
" "	L	R65	470	10	0.1	8040-206/9
" "	L	R66	2.2 K	10	0.1	8040-113/41
" "	L	R67	1 K	10	0.1	8040-113/21
" "	L	R68	100	10	0.1	8040-113/40
" "	L	R69	1 K	10	0.1	8040-113/21
" "	L	R70	220 K	10	0.1	8040-113/30
" "	C	R71	560	10	0.1	8040-113/32
" "	C	R72	10 K	10	0.1	8040-113/23
" "	C	R73	27 K	10	0.1	8040-113/23
" "	C	R74	1 K	10	0.1	8040-113/21
" "	G	R75	100 K	10	0.1	8040-114/16
" "	G	R76	33 K	10	0.1	8040-113/36
" "	G	R77	150 K	10	0.1	8040-208/5
" "	G	R78	100 K	10	0.1	8040-114/16
Not used		R79				
Resistor Carbon	K	R80	2.7 K	10	0.1	8040-114/8
" Wirewound	C	R81	2	10	3.0	8040-113/34
" Carbon	C	R82	4.7 K	10	0.1	8040-113/35
" "	C	R83	33 K	10	0.1	8040-113/36
" "	C	R84	3	10	3.0	8040-113/37
" "	C	R85	4.7 K	10	0.1	8040-113/35
" "	C	R86	1 K	10	0.1	8040-113/21
" "	C	R87	4.7 K	10	0.1	8040-113/35
" "	C	R88	18 K	10	0.1	8040-113/38
" "	C	R89	270	10	0.1	8040-113/39
" "	B	R90	150	20	0.5	8040-112/11
" "	B	R91	2	5	0.5	8040-112/12
Not used		R92				
Resistor Carbon	M	R93	10 K	10	0.1	8040-113/23
" "	M	R94	6.8	10	0.5	8040-211/4
Not used		R95				
Resistor Carbon	C	R96	100	10	0.1	8040-113/40
" "	C	R97	1 K	10	0.1	8040-113/21
" "	C	R98	4.7 K	10	0.1	8040-113/35
" "	C	R99	2.2 K	10	0.1	8040-113/41
" "	M	R100	680	10	0.1	8040-212/6
" "	M	R101	680	10	0.1	8040-212/6
" "	G	R102	390	10	0.1	8040-208/6

Nomenclature	Module Location	Circuit Reference	Value (μF)	Tolerance ± %	Rating (Volts)	Code Number
Polyester	D	C51	0.1	20	30	8040-112/15
Ceramic Plaquette	D	C52	.01	+80 -20	30	8040-114/28
" "	D	C53	.01	+80 -20	30	8040-114/28
Polystyrene	D	C54	2550p	1	125	8040-114/29
Polyester	D	C55	0.1	20	30	8040-112/15
Polystyrene	D	C56	2550 p	1	125	8040-114/29
"	D	C57	470 p	1	125	8040-114/30
Ceramicon	D	C58	100 p	20	500	8040-114/31
Solid Tantalum	D	C59	10	20	17	8040-114/32
Ceramic Plaquette	D	C60	.05	+80 -20	30	8040-114/33
Ceramicon	D	C61	.001	+40 -20	500	8040-114/34
Micro Disc Trimmer	L	C62	10-40 p			8040-213/13
Not used		C63				
See C8	N	C64				8000-288
Polar Trimmer	A	C65				8000-252
Polyester	L	C66	.47	20	250	8040-223/5
Micro Disc Trimmer	L	C67	10-40 p			8040-213/13
Solid Tantalum	C	C68	10	20	17	8040-114/32
" "	C	C69	22	20	28	8040-113/50
Ceramicon	C	C70	.003	+40 -20	500	8040-114/34
Not used		C71				
Ceramic Plaquette	C	C72	.01	+80 -20	30	8040-114/28
Solid Tantalum	C	C73	22	20	28	8040-113/50
" "	C	C74	10	20	17	8040-114/32
Ceramic Plaquette	C	C76	.01	+80 -20	30	8040-114/28
Solid Tantalum	C	C77	22	20	15	8040-113/54
Ceramicon	K	C78	.001	+40 -20	500	8040-114/26
Polyester	C	C79	.047	20	30	8040-206/20
Solid Tantalum	L	C80	10	20	17	8040-114/32
Polyester	L	C81	0.1	20	30	8040-112/15
Ceramicon	K	C82	.001	+40 -20	500	8040-114/26
Silver Mica	L	C83	56p	10	350	8040-222/9
" "	L	C84	150 p	10	350	8040-222/10
Micro Disc Trimmer	L	C85	10-40 p			8040-213/13
Polystyrene	L	C86	.0012	1	125	8040-225/11
Silver Mica	L	C87	100 p	10	350	8040-222/11
See C15	N	C88				8000-288
Micro Disc Trimmer	L	C89	10-40 p			8040-213/13
Ceramicon	L	C90	.001	+40 -20	500	8040-114/26
"	C	C91	100 p	20	500	8040-114/31
Ceramic Plaquette	C	C92	.0047	+80 -20	30	8040-113/52
Ceramicon	G	C93	.001	+40 -20	500	8040-114/26
Polyester	G	C94	.047	20	30	8040-206/20
Solid Tantalum	G	C95	2.2	20	17	8040-206/23
Polyester	G	C96	.047	20	30	8040-206/20
Solid Tantalum	C	C97	10	20	17	8040-114/32
" "	C	C98	3.3	20	13	8040-113/57
Solid Tantalum	C	C99	22	20	28	8040-113/50
" "	C	C100	10	20	17	8040-114/32
" "	C	C101	22	20	28	8040-113/50
Polyester	B	C102	0.1	20	30	8040-112/15
Not used		C103				
Ceramic Plaquette	M	C104	.05	+80 -20	30	8040-114/33

Nomenclature	Module Location	Circuit Reference	Value (μF)	Tolerance ± %	Rating (Volts)	Code Number
Micro Disc Trimmer	M	C105	10-40 p			8040-213/13
Ceramicon	M	C106	.003	+40 -20	500	8040-114/34
Silver Mica	N	C107	10 p	10	350	8040-121/28
See C15	N	C108				8000-288
Micro Disc Trimmer	M	C109	10-40 p			8040-213/13
Not used		C110				
Polyester	C	C111	0.1	20	30	8040-113/58
Ceramic Plaquette	C	C112	.025	+80 -20	30	8040-114/33
Ceramicon	C	C113	.003	+40 -20	500	8040-114/34
Micro Disc Trimmer	M	C114	10-40 p			8040-213/13
Solid Tantalum	C	C115	6.8	20	28	8040-113/60
See C8	N	C116				8000-288
Ceramicon	M	C117	27 p	20	500	8040-120/20
Micro Disc Trimmer	N	C118	10-40 p			8040-213/13
Polyester	M	C119	0.1	20	30	8040-112/15
"	M	C120	0.1	20	30	8040-112/15
Ceramicon	G	C121	.003	+40 -20	500	8040-114/34
Solid Tantalum	G	C122	1	20	28	8040-208/21
Polyester	G	C123	.022	20	250	8040-208/22
Polystyrene	G	C124	270 p	2	125	8040-208/23
Polyester	G	C125	.022	20	250	8040-208/22
"	G	C126	0.1	20	30	8040-112/15
Not used		C127				
Not used		C128				
Ceramic Plaquette	M	C129	.05	+80 -20	30	8040-114/33
Ceramicon	K	C130	.001	+40 -20	500	8040-114/26
Not used		C131				
Not used		C132				
Ceramic Plaquette	M	C133	.025	+80 -20	30	8040-209/7
" "	K	C134	.01	+80 -20	30	8040-114/28
Polyester	K	C135	0.1	20	30	8040-112/15
Ceramicon	K	C136	100 p	20	500	8040-114/31
"	K	C137	150 p	20	500	8040-118/22
Solid Tantalum	C	C138	10	20	17	8040-114/32
		C139				
		C140				
Ceramic Plaquette	C	C141	.05	+80 -20	30	8040-114/33
" "	C	C142	.05	+80 -20	30	8040-114/33
Polyester	D	C143	0.1	20	30	8040-112/15
"	D	C144	0.1	20	30	8040-112/15
Ceramicon	D	C145	.001	+40 -20	500	8040-114/26
Solid Tantalum	J	C146	10	20	17	8040-114/32
Ceramic Plaquette	M	C147	.025	+80 -20	30	8040-209/7
Ceramicon	A	C148	56 p	20	500	8040-111/22
"	A	C149	56 p	20	500	8040-111/22
Ceramic Plaquette	M	C150	.05	+80 -20	30	8040-114/33
" "	F	C151	.05	+80 -20	30	8040-114/33
Ceramicon	G	C152	150 p	10	350	8040-222/10
Solid Tantalum	M	C153	10	20	17	8040-114/32
" "	M	C154	10	20	17	8040-114/32
" "	F	C155	10	20	17	8040-114/32
Paper	C	C156	.005	20	250	8040-113/61
Solid Tantalum	A	C157	10	20	17	8040-114/32
Solid Tantalum	J	C158	1	20	28	8040-208/21

Nomenclature		Module Location	Circuit Reference	Type	Code Number
Silicon Capacitor		G	ZD8	HC 7008	8040-208/32
" "		G	ZD9	HC 7008	8040-208/32
Coil Not used			L1		
"		F	L2		8000-124
"		F	L3		8000-124
"		F	L4		8000-124
"		F	L5		8000-124
"		F	L6		8000-124
"		D	L7		8040-132
Not used			L8		
R.F. Choke		C	L9		8040-143
R.F. Coil		L	L10		8040-144
R.F. Coil		L	L11		8040-145
R.F. Choke		C	L12		8040-113/16
R.F. Choke		M	L13		8040-113/16
			L14		8040-113/16
Transformer	R.F.	M	T1		8040-135
"	"	M	T2		8040-136
"	"	M	T3		8040-137
"	"	M	T4		8040-138
"	"	F	T5		8000-122
"	I.F.	J	T6		8040-133
"	"	J	T7		8040-233
"	Disc	D	T8		8040-131
"	R.F.	L	T9		8040-146
"	"	L	T10		8040-147
"	Modulation	C	T11		8040-124
"	A.F.	C	T12		8000-147
"	"	C	T13		8040-113/13
"	"	C	T14		8040-113/14
"	"	C	T15		8040-113/15
"	R.F.	M	T16		8040-139
"	"	M	T17		8040-140
"	"	C	T18		8040-235
"	"	M	T19		8040-141
"	"	M	T20		8040-142
"	"	G	T21		8000-148
"	"	M	T22		8040-169
"	"	J	T23		8040-202
Relay, 4 C/O contacts		K	RLA		8040-118/29
Switch Wafer (Band SW)		M, L	SWA		8000-211
Switch (System)		A	SWB		8040-594
Switch (Channel)		A	SWC		8040-578

Nomenclature	Module Location	Circuit Reference	Type	Code Number
Transistor	M	VT1	AFZ 11	8040-209/10
"	M	VT2	AFZ 11	8040-209/10
"	J	VT3	OC 171	8040-114/41
"	J	VT4	OC 171	8040-114/41
"	J	VT5	OC 171	8040-114/41
"	J	VT6	OC 171	8040-114/41
"	J	VT7	OC 140	8040-206/27
"	D	VT8	OC 171	8040-114/41
"	D	VT9	OC 171	8040-114/41
"	C	VT10	2N1755	8040-113/66
"	C	VT11	2N1755	8040-113/66
"	C	VT12)	Matched pair	8040-113/67
"	C	VT13)	OC 83	
"	C	VT14	OC 75	8040-113/68
"	C	VT15	OC 140	8040-206/27
"	K	VT16	BSY 26	8040-118/24
"	L	VT17	BSY 26	8040-118/24
"	L	VT18	BSY 26	8040-118/24
"	C	VT19	OC 71	8040-113/70
"	C	VT20	OC 75	8040-113/68
"	C	VT21	OC 83	8040-113/72
Not used		VT22		
Transistor	M	VT23	BSY 25	8040-211/9
"	C	VT24	2N 696	8040-113/71
"	M	VT25	AFZ 11	8040-209/10
"	M	VT26	AFZ 11	8040-209/10
"	G	VT27	OC 171	8040-114/41
"	K	VT28	BSY 26	8040-118/24
"	B	VT29)	Matched pair	8040-112/17
"	B	VT30)	BUY 11	
Diode	J	MR1	OA 81	8040-118/26
"	D	MR2	OA 200	8040-114/37
"	D	MR3	OA 200	8040-114/37
"	D	MR4	OA 79	8040-114/38
"	D	MR5	OA 79	8040-114/38
Not used		MR6		
Not used		MR7		
Diode	C	MR8	OA 81	8040-118/26
"	G	MR9	OA 5	8040-208/29
"	G	MR10	OA 81	8040-118/26
Not used		MR11		
Diode	K	MR12	OA 81	8040-118/26
"	A	MR13	OA 81	8040-118/26
"	A	MR14	X10B1	8040-111/24
"	A	MR15	X10B1	8040-111/24
"	M	MR16	OA 200	8040-114/37
Zener Diode	D	ZD1	OAZ 242	8040-114/39
" "	C	ZD2	OAZ 247	8040-224/5
" "	L	ZD3	OAZ 247	8040-224/5
" "	K	ZD4	OAZ 245	8040-118/27
" "	C	ZD5	OAZ 247	8040-224/5
Not used		ZD6		
Not used		ZD7		

R. F. AMPLIFIER NO. 1

233.

Nomenclature	Circuit Reference	Value (ohms)	Tolerance ±%	Rating (Watts)	Code Number
Resistor Wirewound	R1	1	10	1.5	8041-111/21
" Carbon	R2	5.6 K	10	0.1	8041-123/2
" "	R3	100	10	0.1	8041-130/10*
" "	R3	220	10	0.1	8041-130/8*
" "	R3	560	10	0.1	8041-113/32*
" "	R4	1 K	10	¼	8041-111/22
" "	R5	180 K	10	0.1	8041-123/4
" "	R6	100 K	10	0.1	8041-123/3
" "	R7	2 x 38 (in series)	20		8041-111/17
" "	R8	33	10	¼	8041-119/9
" "	R9	33	10	¼	8041-119/9
" "	R10	100	10	¼	8041-130/10
" "	R11	1.8 K	:5	½	8041-130/7
" "	R12	220	10	¼	8041-130/8
" "	R13	39 K	10	0.1	8040-119/10
" "	R14	2.2 K	10	0.1	8040-130/6
" "	R15	22 K	10	0.1	8041-130/5
" "	R16	10 K	10	0.1	8041-130/10
" "	[illegible]	[illegible]	[illegible]	[illegible]	
CAPACITORS				(Volts)	
Silver Mica	C1	180 p	5	350	8041-114/13
Variable	C2	1 x 40-980p			8041-002/125
Ceramic	C3	0.05	+80 -20	30	8041-111/20
"	C4	0.05	+80 -20	30	8041-111/20
"	C5	0.1		50	8041-111/18
"	C6	0.1		50	8041-111/18
"	C7	0.1		50	8041-111/18
"	C8	0.05	+50 -20	500	8041-111/19
Silver Mica	C9	100 p	5	350	8041-111/12
Variable	C10 }	2 x 40-980p			8041-002/125
"	C11 }				8041-002/125
Polyester	C12	0.1	20	30	8040-113/36
Not used	C13				
Silver Mica	C14	390 p	5	350	8041-112/17
Tantalum	C15	100		10	8041-130/11
"	C16	6.8	20	28	8041-130/12
"	C17	170		18	8041-114/12
"	C18	170		18	8041-114/12
"	C19	170		18	8041-114/12
"	C20	170		18	8041-114/12
Ceramic	C21	0.1		50	8041-111/19
"	C22	0.1		50	8041-111/19
Tantalum	C23	30		40	8041-112/18
Ceramic	C24	0.05		30	8041-111/20
Thermistor	TH1	130			8041-130/2
Potentiometer	RV1	20 K		½	8041-130/3

* - Value selected on test

Nomenclature	Circuit Reference	Type	Code Number
Transistor, Silicon	VT1	Type 2N1899	8041-117/8
" Germanium	VT2)	Matched pair Type ADZ 11	
" "	VT3)		8041-119/6
" Silicon	VT4)	Matched pair Type 2S 301	
" "	VT5)		
" Germanium	VT6	Type 2N 2067	8041-119/7
Diode	MR1	Type DD003	8042-114/14
"	MR2	Type OA 95	8042-123/5
RF Input Coil - High Band	L1		8005-126
RF Input Coil - Low Band	L2		8005-125
RF Input Choke	L3		8005-127
LF Choke	L4		8041-118
LF Collector Choke	L5		8041-116
RF Output Coil	L6		8005-130
RF Input Transformer	T1		8005-131
Modulation Transformer	T2		8041-120
Transformer	T3		8041-119/11
Relay 4 c/o, Non-sealed	RLA		8041-155/23
" " " (Light duty)	RLB		8041-113/32
" " " "	RLC		8041-113/32
Band Switch Wafer	SWA/1		8005-249
" " "	SWA/2		8005-249
" " "	SWB		8005-248
Meter	M1		8005-252
Socket 14-pin	SKTA		8041-150/14
" 6-pin	SKTB		8041-113/34
" 6-pin	SKTC		8041-113/34
" R.F. Coaxial	SKTD		8041-113/35
" "	SKTE		8041-113/35
Plug 14-pin	PLA		8041-104/2
Plug for the coaxial connector used between the set and amplifier and amplifier and ATU			8005-142
Ledex Mechanism			8041-115/11

AERIAL TUNING UNIT

234.

Nomenclature	Circuit Reference	Value (ohms)	Tolerance ±%	Rating	Code Number
Resistor Carbon	R1	15 K	10	0.1	8042-116-4
" "	R2	3.3 K	10	0.1	8042-116-5
" "	R3	220	10	0.1	8042-116-6
" "	R4	15	10	0.1	8042-125-9*
" "	R5	2.7 K	10	0.1	8042-125-10*
Capacitor Silver Mica	C1	330 p	10	350V	8042-116-7
" Ceramicon	C2	.003	+40 -20	500V	8042-116-8
" "	C3	.003	20	350V	8042-116-9
" "	C4	0.1	20	30V	8042-125-11*
Switch, Wafer (Band SW)	SWA				8003-234
Toroidal Coil	T1				8003-129
Diode	MR1	Type OA 95			8042-116-10
"	MR2	"			8042-116-10
"	MR3	"			8042-116-10
"	MR4	"			8042-116-10
"	MR5	Type OA 200			8042-125-12*
RF Coil	L1)	Assembly			8042-114
"	L2)				
Meter 0-300 uA	M1				8042-116-4*
Socket 1-pin fixed	SKTA				8042-110-29
Socket 1-pin fixed Black	SKTC				8042-125-4
Socket 1-pin fixed Red	SKTD				8042-125-3
Plug 1-pin free Red	PLC				8003-133/10*
Plug 1-pin free Black	PLD				8003-133/11*

* - Remote ATU only

BCC 30 HP-CASE ASSEMBLY (8041-150)

235.

Nomenclature	Circuit Reference	Code Number
Socket 14-pin	SKTA SKTD	8041-150/14
Plug 2-pin	PLF	8000-363
Plug 2-pin	PLG	8000-363
Plug 2-pin	PLH	8000-363
Plug 2-pin	PLJ	8000-363
Battery, nickel cadmium 12V	BY1	8000-512
" " " 12V	BY2	8000-512
" " " 12V	BY3	8000-512
" " " 12V	BY4	8000-512
Fuse, Link miniature glass 4A	FS1	
" " " " 4A	FS2	8041-150/13
" " " " 4A	FS3	

BCC 30 LP-CASE ASSEMBLY (8040-150)

236.

Nomenclature	Circuit Reference	Code Number
Fuse, Link miniature glass 2A	FS1	8040-150/9
Battery, nickel cadmium 12V " " " 12V	BY1 BY2	8000-512
Plug 2-pin	PLG	8000-363
Plug 2-pin	PLH	8000-363

TECHNICAL ADVISORY SERVICE

237. If any points arise which are not covered by the information in the handbook, the BCC Technical Advisory Service Department is available to give any assistance.

TECHNICAL BULLETINS

238. To keep BCC 30 users informed of the latest information, technical bulletins will be issued from time to time. Users are advised to register with BCC to ensure they receive the bulletins.

MODIFICATIONS

239. Summary of post-production modifications.

Modification No. 1 (November 1965) Module F

To reduce the inverse base-emitter voltage surge in VT3 during switch-on, C155 is wired across supply and the emitter instead of across emitter and chassis.

The embodiment of modification No. 1 is recorded by the numbers (1) being crossed off on the Module F and transmitter-receiver unit modification record labels.

If necessary request Modification Instruction No. 1.

Modification No. 2 (November 1965) Module K

To improve the low temperature performance of the crystal oscillator VT28, an extra 220 ohm resistor, R154, is added in parallel with the existing feedback resistor R119.

The embodiment of modification No. 2 is recorded by the numbers, (1) on Module K and (2) on the transmitter-receiver unit modification record labels being crossod off.

If necessary request Modification Instruction No. 2.

Modification No. 3 (November 1965) Module C

To improve the de-emphasis characteristic of phase modulation, a .005 microfarad capacitor C156 is added across R49.

The embodiment of modification No. 3 is recorded by the number (1) on Module C and (3) on the transmitter-receiver unit modification record labels being crossed off.

If necessary request Modification Instruction No. 3.

Modification No. 4 (January 1966) Module A

To decouple stray pick-up from the BCC 501 charging lead into the receiver while the charger is connected a 10 microfarad electrolytic capacitor C157 is added across the power supply terminals adjacent to sockets B and C on Module A (Front Panel).

The embodiment of Modification No. 4 is recorded by the numbers (1) on Module A and (4) on the transmitter-receiver unit modification labels being crossed off.

If necessary request Modification Instruction No. 4.

Modification No. 5 (March 1966) Module J

The AGC line is decoupled by a 1 microfarad capacitor C158 to minimise the RF and switching transients reaching the bases of AFZ11 transistors VT1 and VT2 (Module M) during transition from receive to transmit.

The embodiment of modification No. 5 is indicated by the numbers (1) on Module J and (5) on the transmitter-receiver unit modification labels being crossed off.

If necessary request Modification Instruction No. 5.

COMPONENT	REMOVAL PROCEDURE	NOTES
CW TONE CONTROL (RV8)	(1) Release Module F fixing screws (2) Unsolder and release the three wires from the rear of the control (3) Remove the knob (4) Release and remove the nut and washer securing RV8 to the front panel (5) Remove RV8 from the front panel	

REMOVAL OF COMPLETE FRONT PANEL

(1) Remove the tuning scale

(2) Disconnect the coupling into the variable capacitor cage at the front panel side

(3) Disconnect the coupling to the Band Switch at the Module L side

(4) Unsolder all 17 wire links between Cableform terminal board No. 3 and the System Switch terminal board; also unsolder and release the following wires all of which are additionally identified by a long yellow sleeve:-

- (a) Orange wire from Module L terminal 1
- (b) Yellow wire from Module L terminal 9
- (c) Yellow wire with violet sleeve from Module L terminal 3
- (d) Black wire from Module N terminal 12
- (e) Brown wire from Module C terminal 19 to A1
- (f) Grey wire from Module C terminal 13
- (g) Co-axial lead from Module C terminal 15
- (h) Red wire with white sleeve from Module N terminal 3

(5) The main body of the set can, after the four allen screws securing the feet of the tuning capacitor assembly have been removed, be lifted away from the front panel and placed at the side of it. It is advisable to lift the set and hinge it away to the scale window side of the front panel

NOTES

Operations (1) to (5) are necessary when changing the System Switch, Channel Switch, RF Trim Control and Tuning Capacitor Assembly (Module N)

It may also be necessary to release the wires from terminals 6, 7 and 8 of Module L to allow access to the coupling

To completely detach the front panel unsolder and release the remaining wires as follows:-

(1) The four wires of Cableform B from terminals 1, 2, 3 and 4 of TB1 (part of Cableform A)

(2) The co-axial and braid leads to the aerial socket SKTA (points A6 and A7)

See illustration of Cableforms (immediately following Module N)

COMPONENT	REMOVAL PROCEDURE	NOTES
RF TRIM CONTROL (C65)	(1) Refer to removal of complete front panel and carry out operations (1) to (5) only then	
	(2) Remove RF Trim knob	On re-assembly set the rotor of C65 so that vanes are half enmeshed. Then fit the knob with the pointer adjacent to the white spot on the escutcheon
	(3) Unsolder the two black earthing wires from the rotor of C65	
	(4) Release and remove the nut and washer securing C65 to the front panel	
	(5) Remove C65 and unsolder the red wire from the stator tag	Retain the red wire which is identified with a white sleeve at the end which connects to N3
SYSTEM SWITCH SWB	(1) Refer to removal of the complete front panel and carry out operations (1) to (5) only	
	(2) Unsolder and release wires from SWB and RV8 transferring the wires one at a time to the replacement switch following the list of wires shown in the illustration of SWB	See illustration and data for SWB
(AT RV8)	Unsolder Grey wire from RV8-A Grey wire/green sleeve from RV8-C	
	(3) Release the knob of SWB	
	(4) Unscrew and release the nut and washer from the switch shaft	
	(5) Remove the System Switch from the front panel	
CHANNEL SWITCH (SWC)	(1) Refer to removal of complete front panel following operations (1) to (5) only	The colours of the wires from the crystal sockets correspond with the standard colour codes, e.g. a brown wire connects socket 'BAND H' No. 1 to the switch, a red wire connects socket 'BAND H' No. 2 to the switch, a red wire with a violet sleeve connects socket 'BAND L' No. 2 to the switch etc. etc. The violet sleeve identifies the 'L' Band wires from 'H' Band wires.
	(2) Release the knob	
	(3) Unscrew and release the nut and washer securing the switch shaft	
	(4) Transfer wires in sequence from the old switch to the new one, then remove the old switch and fit the new one	

MODULE N
Tuning Capacitors Ganged Assembly

MODULE N - TEST DATA

TESTING FOR SHORT CIRCUITING VANES ONLY

This is a reliable unit well protected in its centrally mounted position in the set. Removal is not likely to be necessary and simple tests for serviceability can be carried out to ensure that removal is really necessary as follows:-

(1) Set the BAND switch to L.

(2) Prepare an AVOmeter 8 on resistance range x 100, and check that it is operating by short circuiting the leads.

GANG GA1 (C8) VANE TEST

(1) Identify the RF1 section of the Main RF Module M.

(2) Unsolder and release the red wire from terminal M18.

(3) Connect the AVOmeter leads across the freed end of the red wire and chassis.

(4) Rotate the TUNE control through its complete range checking that infinity is indicated throughout the complete sweep of the capacitor vanes.

(5) Resolder the wire removed for the test.

GANG GA2 (C116) VANE TEST

(1) Identify the transmitter mixer section of the Main RF Module M.

(2) Unsolder and release the red wire from terminal M12 (Module tagboard).

(3) Connect the AVOmeter leads across the freed end of this wire and chassis.

(4) Rotate the TUNE control through its complete range checking that infinity is indicated throughout the complete sweep of the capacitor vanes.

(5) Resolder the wire removed for the test.

GANG GA3 (C64) VANE TEST

NOTE:- It is assumed that the RF TRIM control (C65) has been checked and found serviceable by carrying out a simple AVO test for short circuits.

(1) Identify terminal 3 of Module N.

(2) Unsolder and release the two wires from this terminal (one is red with a yellow and white sleeve routed to C65 RF TRIM control).

(3) Connect the AVOmeter leads across N3 and chassis.

(4) Rotate the TUNE control through its complete range checking that infinity is indicated throughout the complete sweep of the capacitor vanes.

(5) Connect the AVOmeter lead to the red wire with yellow and white sleeve and rotate RF TRIM control through its complete range checking that infinity is indicated throughout.

(6) Resolder the 2 wires removed for the test.

GANG GB1 (C108) VANE TEST

(1) Identify the transmitter driver section of the Main RF Module M.

(2) Unsolder and release the red wire from terminal M24.

(3) Connect the AVOmeter leads across the freed end of this wire and chassis.

(4) Rotate the TUNE control through its complete range checking that infinity is indicated throughout the complete sweep of the capacitor vanes.

(5) Resolder the wire removed for the test.

GANG GB2 (C15) VANE TEST

(1) Identify the RF2 section of the Main RF Module M.

(2) Unsolder and release the red wire from terminal M16 (Module tagboard).

(3) Connect the AVOmeter leads across the freed end of this wire and chassis.

(4) Rotate the TUNE control through its complete range checking that infinity is indicated throughout the complete sweep of the capacitor vanes.

(5) Resolder the wire removed for the test.

GANG GB3 (C88) VANE TEST

(1) Identify terminal 7 of Module N.

(2) Unsolder and release the red wire from terminal N7.

(3) Connect the AVOmeter leads across the now vacant terminal N7 and chassis.

(4) Rotate the TUNE control through its complete range checking that infinity is indicated throughout the complete sweep of the capacitor vanes.

(5) Resolder the wire removed for the test.

REMOVAL

NOTE:- There are two methods of removal. Method 1 is preferred, since it avoids possible strain on some wired connections. Method 2, although quicker requires greater care to avoid secondary damage.

Method 1

(1) Remove tuning scale and Module L.

(2) Remove Module M.

(3) Remove Module C.

(4) Remove Module F.

(5) Remove Module J.

(6) Carry out operations 1 to 5 for removal of complete front panel (see Module A).

(7) Release the eight screws securing Module N to the mounting frame.

Method 2

(1) Remove tuning scale and Module L.

(2) Remove Module M.

(3) Remove Module C.

(4) Remove Module F.

(5) Remove Module J.

(6) Unsolder wires between front panel and Module N.

(7) Release the four socket headed screws and earth lead 32 from Module K.

(8) Remove all the remaining wires to Module N, release the socket headed screws securing feet of Module N.

(9) Set RF TRIM control so that the vanes are fully enmeshed.

(10) Release the two grub screws in the capacitor drive coupling at the front panel side.

(11) Pull front panel assembly partially away from the tuning capacitors.

(12) Release the eight screws securing Module N to the mounting frame.

(13) Using great care not to damage front panel wiring and components, carefully remove Module N away from Module K and out of the set.

REFITTING

Reverse the removal procedures for each method.

COMPLETE TRANSMITTER-RECEIVER ALIGNMENT (Fig. 26)

CRYSTALS

(1) Fit crystals as follows:-

Channel	kc/s
L1	2700
L2	4300
H1	4900
H2	8100

IF AND AUDIO (Module J and part of Module C)

(2) (a) Remove the link between terminals 23 and 22 of Module G (500 kc/s Oscillator and Detector Unit). Connect an AF power meter (item 10) (Z = 150 ohms) between pins F and D (chassis) on SKTB. Connect a 30 microammeter (item 17) between terminals 23 and 22 of Module G (+ve to terminal 22).

(b) Connect the RF signal general (item 7) between terminals 15 and 20 of Module J (the IF amplifier) (earth to 20). With an unmodulated signal of 500 kc/s at 20 μV adjust T6 and T7 for maximum detector current. (Note: During the following adjustment the positive lead of the Avometer (item 6) should be connected to chassis). With supply off adjust RV 1 to read 3.3 kohms between VT7 emitter and chassis. With TP20 short circuited to TP21 adjust RV2 for 11 volts at VT7 collector. Remove the short circuit.

(c) With 30 per cent modulation at 1 kc/s, the audio output should be not less than 0.5 mW, with the GAIN control set to maximum.

FILTER (Module F)

(3) (a) Connect a 30 microammeter to the detector - see para. (2) (a). Set the Band Switch to L and the Channel Switch to the test position marked T. Let the signal level at 500 kc/s at the input to the IF assembly (see para. 2) necessary to result in a detector current of 5 μA be called X. Link terminals 8 and 9 and apply an unmodulated 500 kc/s signal between terminal 8 and earth via a 0.1 μF capacitor. Adjust the level of the signal generator to give a 5 μA detector current, the level shall not be larger than X. Check the selectivity using this level as a reference. See the table below:-

Frequency kc/s	490	497 max.	500	503 min.	510
Level dB	+65 min.	+6	0	+6	+65 min.

(b) If the selectivity is not correct repeat the filter tuning procedure (see Module F test data).

<u>NOTE</u>:- The Filter Unit Assembly (Module F) should not need any further adjustment after fitting it in the set.

DISCRIMINATOR (Module D)

(4) (a) Set System Switch to PM

Connect 30-0-30 μA meter in series with 1 Megohm resistor (1%, ¼W), item 39, across the test pins D4 and D7 (meter positive to D4). Connect RF signal generator set to 500 kc/s at a level of 20 μA to input of Module J (see para. 168 (2) (a)) and adjust T8 until the meter reads between +1 μA and +3 μA immediately after passing centre zero. Adjust L7 for a maximum meter deflection. Check that the signal generator frequency is precisely 500 kc/s and finally adjust T8 for exact centre zero.

(b) Loop sense check:- Check that the meter deflects clockwise when signal generator frequency is increased from 500 kc/s.

(c) Check the discriminator response against the following table:

Frequency kc/s	496	499	501	504
Reading μA min.	8.0	2.0	2.0	8.0

Note the signal generator frequency corresponding to both positive and negative peak deflections of the meter. The peak separation shall be not less than 8 kc/s.

(d) Connect a valve voltmeter (item 9) between terminal D8 and earth. Set the Gain control RV6 fully counter-clockwise. With signal input conditions as in sub-para. (a) but with a deviation of 1 radian at 1 kc/s, the a.f. voltage at D8 shall be not less than 8 mV.

Connect the AF output power meter (item 10) across pin F and pin D of SKTB (or SKTC) and set RV6 fully clockwise. The a.f. output shall be not less than 2 mW.

Increase the input signal by 10 dB. The resulting increase of output power shall be not more than 2 dB.

FREE TUNE OSCILLATOR AND CRYSTAL OSCILLATOR (Module L)

(5) Ensure that the tuning scale is correctly fitted (see Module N test data).

(a) Set the Band switch SWA to L. Set the tuning scale to 2.2 Mc/s. Set the Channel Switch SWC to 1. Set the System Switch to TRF. Adjust L10 for zero beat in the headphones and a maximum deflection of the set meter. Set the Band Switch to H and set the tuning scale to 4.4 Mc/s. Adjust L11 for zero beat and maximum meter deflection. Set the tuning scale to 7.6 Mc/s and adjust C89 for zero beat and maximum meter deflection. Re-set the Band Switch to L, the tuning scale to 3.8 Mc/s and adjust C85 for zero beat and maximum meter deflection.

(b) Repeat para. (a) until further adjustment is no longer necessary.

(c) To check crystal socket wiring: Insert a crystal unit (2.7 Mc/s) into Low Band position 1. Set the Band Switch to L, the Channel Switch to 1 and with the System Switch set to TRF, tune for a beat note to prove that the crystal oscillator is working. Repeat for all other Low Band crystal sockets by transferring the crystal and resetting the Channel Switch as required.

(d) Repeat the procedure of para. (c) using a crystal unit (4.9 Mc/s) in each High Band channel socket in turn.

RECEIVER RF1 and RF2 (Parts of Module M)

(6) (a) Connect the 30 microammeter to the detector circuit - see para. (2) (a). Connect the RF signal generator (item 7) to RF input SKTA.

(b) (i) Set the Channel Switch to 1 and the Band Switch to L. Tune on TRF and switch over to AM. Loosely couple a 500 kc/s crystal oscillator (item 20) into the IF strip. Set the RF signal generator to 2.2 Mc/s for zero beat in the phones. Remove the 500 kc/s crystal oscillator and adjust the level of the signal generator to give a small detector current. Adjust T1 and T3 for maximum current, reducing the RF signal input as necessary to keep the detector current small.

NOTE:- T1 - T4 inclusive have two tuning points each. Select the point with the core nearer to the base of the coil former.

(ii) Set the Band Switch to H. Tune on TRF and switch over to AM. Adjust the signal generator to 4.4 Mc/s for zero beat. Adjust T2 and T4 for maximum detector current.

(iii) Set the Channel Switch to 2 and repeat the operations of para. (6) (b) (i) at 7.6 Mc/s adjusting C9 and C16.

(iv) Set the Band Switch to L and repeat the operations of para. (6) (b) (i) at 3.8 Mc/s adjusting C6 and C13.

(c) Repeat operations (6) (b) (i - iv) until further adjustment is no longer necessary.

RECEIVER GAIN SETTING (Module J)

(7) (a) Switch to AM, and tune to 7.6 Mc/s on H band free tune. Inject an RF signal at a level of 6.3 μV and 30% amplitude modulated. Adjust RV2 so that the AF output is not less than 1 mW and not more than 2 mW.

(b) Increase the level of the RF signal by 80 dB. The change in the AF output should be not more than 10 dB. If this condition is not met, adjust RV1 accordingly. Re-adjust presets RV2 and RV1 in turn until both the AF output and AGC conditions are met and then lock the presets.

500 kc/s OSCILLATOR AND BFO (Module G)

(8) (a) Set the System Switch to CW. Set the Channel Switch to the test (T) position. In this position the local oscillator is switched OFF. Connect the frequency counter (item 12) to VT6 collector (test point J9). Link test points J21 and J20 in order to short circuit the input to VT5. Link test points D10 and D14 to disable the AFC loop (by short circuiting the discriminator transformer). Use the valve voltmeter to measure the voltage at test point D2. This voltage should read 2.5V d.c. with respect to chassis. If necessary, readjust RV3 and then lock it.

Setting AFC (Automatic Frequency Control)

(b) Switch to transmit by linking pins C and D of SKTB (or SKTC) and adjust T21 so that the counter reads exactly 500 kc/s. Remove the link between D10 and D14 and if necessary adjust T8 for a counter reading of exactly 500 kc/s. Switch to receive by removing the shorting link.

Pre-Setting BFO Control

(c) Adjust the CW Tone control (RV8) for a counter reading of exactly 500 kc/s. Loosen the control knob and reposition it so that the pointer registers against the dot on the front panel. Tighten the knob and check that the counter still reads 500 kc/s. Note the counter reading for extreme positions of RV8. The deviations from 500 kc/s must be at least ± 4·2 kc/s.

DRIVER AND PA (Parts of Module M and Module L)

Preparation

(9) (a) Set the pointer of the RF TRIM knob to coincide with the dot and check that the vanes of the capacitor are half enmeshed. Connect an RF output power meter (75 ohms) item 15 to RF SKTA and connect a valve voltmeter (item 9) across the power meter. Unsolder the co-axial cable from terminal 'C' 30 on the audio board and connect the RF signal generator to test pin 'C' 31. During the following tuning procedure adjust the RF input so that the output power does not rise above 2W. Set the Channel Switch to 1.

(b) (i) Set the Band Switch to L. Tune on TRF and then switch to PM. Inject a 2.2 Mc/s drive signal from the generator. Switch to Transmit and tune T16 and T9 for maximum output.

NOTE:- Two tuning positions will be found for the cores of T9, T10 and T16. The cores should be set to the tuning position found nearer to the base of the coil former.

(ii) Switch to H. Tune on TRF and then switch to PM. Inject a signal of 4.4 Mc/s and tune T17 and T10 for maximum output.

(iii) Set the Channel Switch to 2. Tune on TRF and then switch to PM. Inject a signal of 7.6 Mc/s and tune C109 and C67 for maximum output.

(iv) Switch to L. Tune on TRF and then switch to PM. Inject a signal of 3.8 Mc/s and tune C105 and C62 for maximum output.

(c) Repeat the tuning procedure of (9) (b) (i-iv) until no further adjustment is required, remove the RF signal generator and resolder the co-axial cable to terminal 'C' 30.

TRANSMITTER MIXER BALANCE SETTING (Module M)

(10) Switch off the 500 kc/s oscillator by disconnecting the yellow link wire from G13 and switch off the transmitter driver supply (test point M26) by unsoldering the orange lead with a yellow sleeve from terminal 2 of T11 (adjacent to Module C).

Connect a valve voltmeter between terminals M27 and M25 (earth) of the transmitter driver. Tune on TRF to 7.6 Mc/s on High Band and then switch to PM 'Transmit'. Adjust RV10 the BALANCE preset for a minimum reading on the valve voltmeter. It should be below 60 mV. Resolder the previously disconnected wires.