FERGUSON

PERSONAL PORTABLE RECEIVER 357BT

SERVICE MANUAL

SPECIFICATION

DESCRIPTION

A personal portable receiver with built-in aerial, employing six transistors and a crystal diode in a superheterodyne circuit incorporating a push-pull output stage.

The receiver is tuneable over the full Medium wave range with a restricted Long wave coverage. A personal listening socket is provided which, when in use, disconnects the output stage to ensure maximum battery economy.

WAVERANGE COVERAGE

Medium 580-1600 Kc/s (187-517 metres).

Long : Restricted to region of 200 Kc/s to provide reception of the "Light" programme on 1500 metres.

BATTERY POWER SUPPLY

Six volts required, made up of four similar 1½ volt batteries from any of the following suitable types :

Ever Ready	U12 or D14
Drydex	T5 or DL25
GEC	BA 6102
Siemens	T13 or T14
Vidor	V0028 or V0030

BATTERY CONSUMPTION

Approximately 15mA for average output.

LOUDSPEAKER

High flux PM, 2½ inches diameter, 40Ω speech coil impedance.

POWER OUTPUT

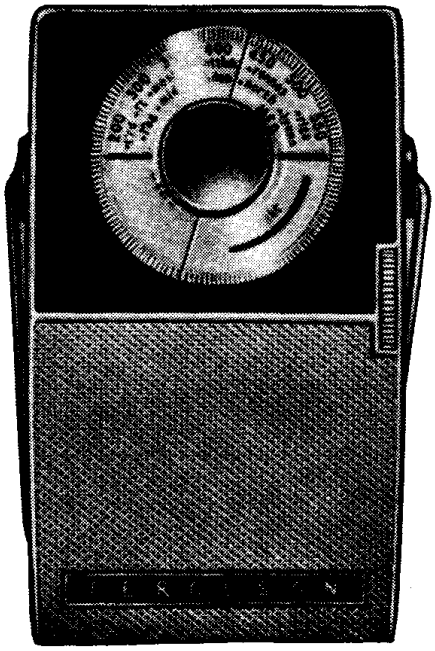
100mW

CASE

Forticel plastic, 5⅝ inches long × 3½ inches wide × 1⅞ inches deep (excluding handle).

PERSONAL LISTENING JACK SOCKET

High impedance output.



SERVICING NOTES

The receiver employs germanium alloy junction (pnp type) transistors. This type of transistor has proved to be a very reliable component and, when receiver servicing becomes necessary, the fault is unlikely to be due to transistor failure and attention should first be directed to other parts of the circuit.

Fault tracing should be carried out in the usual way, but the following points should be particularly noted :

(i) Make full use of the voltage measurements given in the circuit diagram. Although the receiver will still operate when the battery voltage is low, new batteries should be used for checking purposes.

(ii) Apart from total current consumption, no other current measurements should be attempted. Under "no signal" conditions, the total current consumption will be approximately 8·5 mA. Consumption rises immediately a signal is applied, to approximately 15mA for average listening levels.

(iii) When using a signal generator for circuit checking, inject signal via an 0·1μF capacitor and use the direct output.

(iv) To check oscillator operation, measure voltages at the emitter and base of VT1. These should be approximately as given in the circuit diagram with the emitter voltage slightly more negative than the base. Failure to oscillate is indicated when this relationship is reversed and the base voltage is more negative than the emitter.

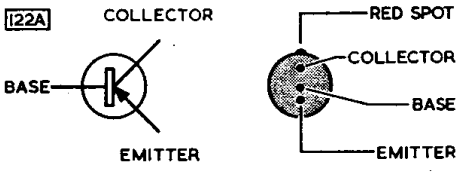


Fig. 1. Transistor Connections

(v) Should the output stage fail to operate, check first the switch associated with the earphone jack socket. The battery supply to the output stage is completed via the spring contacts of this switch which should be closed with the earphone jack removed. Adjust spring tension if necessary.

(vi) Replacement of the capacitors and resistors on the printed panel should where possible be made by cutting away the component to enable the replacement to be soldered to the original lead wires. When this method is impossible and connection must be made to the copper side of the panel, use a small iron, non-corrosive flux and 60-40 solder. Do not apply the iron for longer than necessary.

PRINTED PANEL REMOVAL

(i) Remove cursor tuning disc. This is a tight fit and may be pulled off with the aid of a length of stout cord placed around the knob boss.

(ii) Prise off rear casing shell and remove carrying handle.

(iii) Free self-tapping screw and fibre washer.

(iv) The printed panel is seated in four supporting moulded lugs projecting from the inside walls of the casing material. A little cellulose adhesive is applied to these points during factory assembly. These cellulose seals should be broken and the volume control side of the casing prised outwards so that the edge of the printed panel may be lifted slightly to clear the lugs. The opposite edge of the printed panel associated with the wavechange switch may then be released in a similar manner but support to the slider of the switch should be given by the thumb as shown in Fig. 2 to avoid unduly straining the wafer contacts. The flexibility of the special casing material is sufficient to enable the side to be prised outwards to clear the slider button provided some care is exercised. The printed panel, complete with wavechange switch button may then be withdrawn. The connecting leads to the loudspeaker and earphone socket are long enough for most servicing requirements.

The above procedure should be reversed during replacement and a little cellulose adhesive re-applied to the supporting lugs.

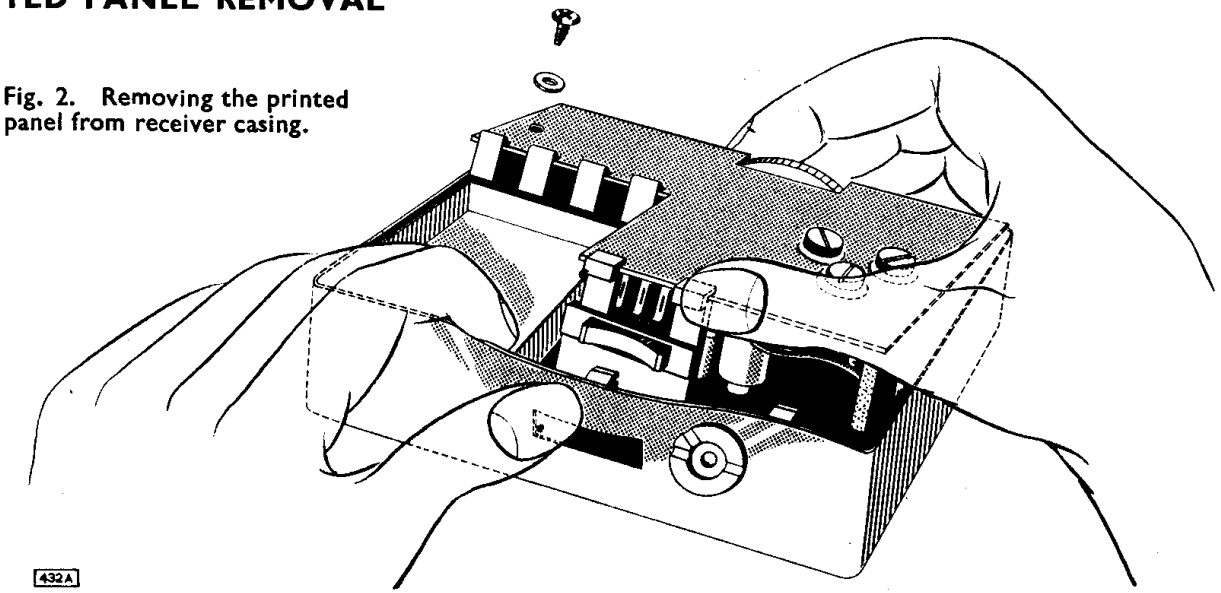


Fig. 2. Removing the printed panel from receiver casing.

ALIGNMENT DATA

Procedure

Remove printed panel from receiver casing as described in Printed Panel Removal.

It is unnecessary to disconnect loudspeaker or personal listening socket. The printed panel may be placed flat on the bench with the case upright.

Connect Model 8 Avometer across loudspeaker speech coil and set receiver volume control to maximum. During alignment, adjust signal input level to the receiver to keep output voltage at 1 volt to 1.4 volts.

IF Circuits

Switch receiver to MW and turn gang to minimum capacitance position. Apply a 470 Kc/s modulated signal via an 0·1μF blocking capacitor across C1 the aerial section of the tuning gang. Adjust **IFT 3**, **IFT 2** and **IFT 1** in that order for maximum output. Repeat in the same order until no further improvement results.

RF Circuits

Inject 30% modulated signals via a loop loosely coupled to the ferrite-slab aerial.

(i) Set gang to maximum capacitance, signal generator to 560 Kc/s, and adjust **L5** for maximum output.

(ii) Set gang to minimum capacitance, signal generator to 1600 Kc/s, and adjust **C9** (on gang) for maximum output.
Repeat (i) and (ii) until no further improvement results.

(iii) Set signal generator to 700 Kc/s, tune receiver to signal, then peak aerial coil (L1a and L1b) by sliding section **L1a** on sleeve along ferrite-slab.

(iv) Inject 1300 Kc/s signal and tune receiver to signal. Then adjust **C2** aerial trimmer for maximum output.
Repeat (iii) and (iv) until no further improvement results.

NOTE: No adjustments necessary on Long Wave, which are pre-tuned.

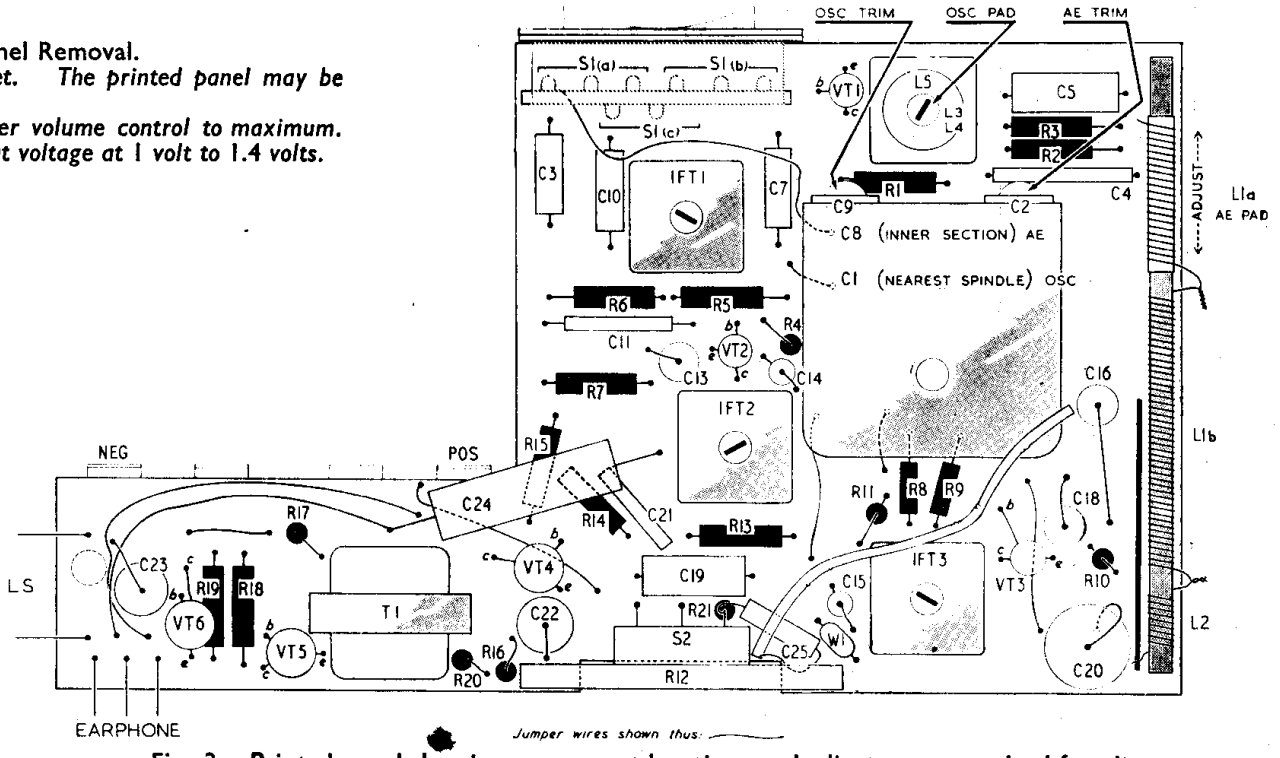


Fig. 3. Printed panel showing component locations and adjustments required for alignment.

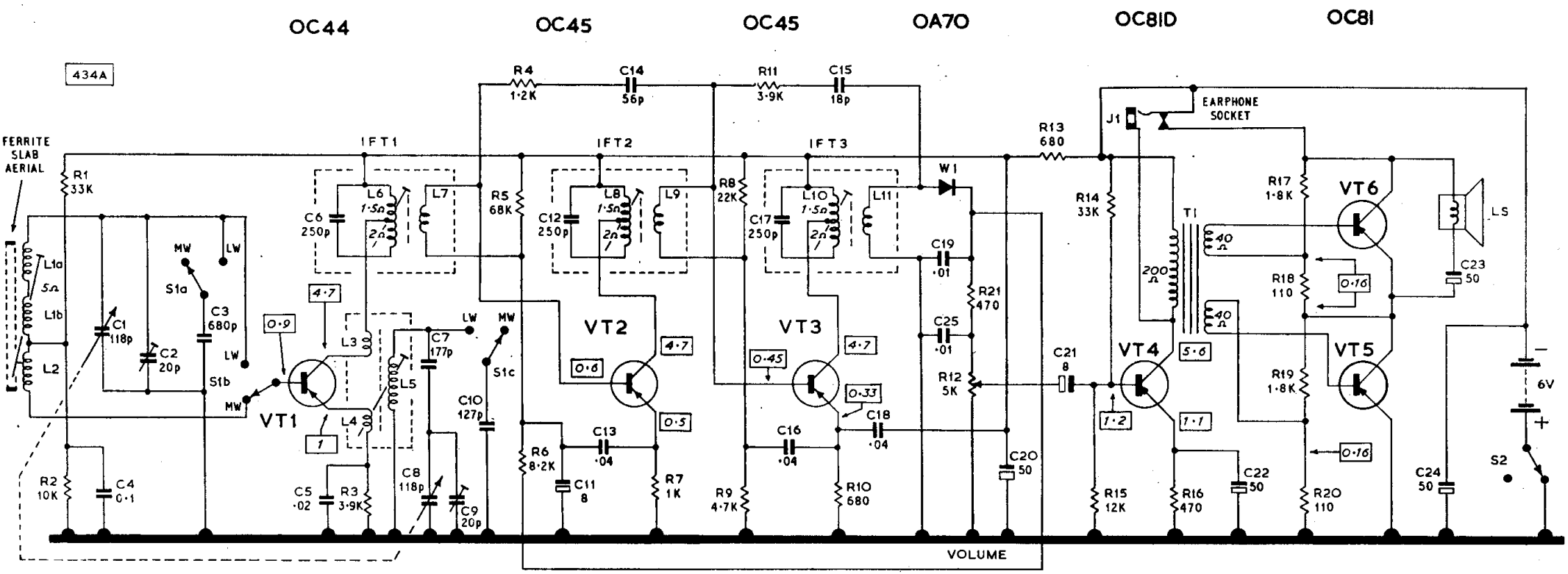


Fig. 4 Circuit Diagram. Figures in rectangles indicate voltages with respect to battery positive (excepting that taken across R18) and measured with a 20,000 Ω/volt meter. DC resistance readings are also shown against inductances where these are 1Ω or greater.

CIRCUIT DESCRIPTION

With **S1a-b-c** switched to medium wave position, the aerial coil consisting of **L1a** and **L1b** windings on the ferrite-slab is tuned by section **C1** of the gang capacitor and trimmed by **C2.** RF voltages are inductively coupled by **L2** into **VT1** (OC44) base circuit. **VT1** functions as a self-oscillating mixer with feedback from collector to emitter circuits provided by **L3** and **L4.** The tertiary winding **L5** is tuned by section **C8** of the tuning gang in conjunction with fixed padder **C7** and pre-set trimmer **C9.**

When switched to the long wave position, **S1a** connects an additional fixed trimmer **C3** across **C1** aerial section of the gang capacitor. **S1b** disconnects coupling coil **L2** and connects instead **L1ab** directly to the base of **VT1.** In the oscillator circuit, LW trimmer **C10** is switched across **C8** by **S1c.** The LW tuning range thus provided is restricted to the 200 Kc/s region with sensitivity falling off rapidly either side of this frequency.

The 470 Kc/s IF signal developed in **VT1** collector circuit is coupled by the single-tuned IF transformer to the first IF amplifier **VT2** (OC45). This amplifier operates with base bias provided by **R5** in conjunction with **R6, R21** and **R12.** Emitter stabilising is provided by **R7.** Single-tuned IF transformer **IFT2** in **VT2** collector circuit couples the signal to the second IF amplifier **VT3** (OC45). This stage also is coupled by a single-tuned transformer **IFT3** to the crystal diode detector **W1** (OA70).

Both **IF** amplifier stages incorporate neutralizing to offset internal feedback within the transistors. **VT2** is neutralized by **C14** and **R4,** and the neutralizing of **VT3** is effected by **C15** and **R11.** The required phase reversal is obtained by including the **IF** transformers within the feedback loops.

The DC component of the signal developed across **R12** is applied as a positive AGC bias to the base circuit of **VT2.** This control voltage reduces the negative standing bias at **VT2** base due to **R5. VT3** is not controlled by AGC voltages, but base bias is provided to the stage by the potential divider formed by **R8** and **R9.**

The audio voltages developed across **R12** (volume control) are coupled by **C21** to the audio amplifier **VT4** (OC81D) operating as a driver stage for the push-pull output. Base bias is provided by the potential divider formed by **R14** and **R15.** The voltage drop across **R16** by-passed by **C22** provides emitter stabilising.

An output jack socket is provided in the collector circuit of **VT4** for earphone reception and when in use a switch incorporated in the socket disconnects the power supply to the output stage. When the jack socket outlet is not in use the phase-splitting driver transformer **T1** applies anti-phase audio inputs to the bases of the push-pull output transistors **VT5** and **VT6** (2 × OC81). These transistors are biased back to practically class B conditions by the resistor chain **R17, R18, R19** and **R20.** A small standing current is permitted in order to minimise cross-over modulation. When the signal is applied, **VT5** and **VT6** conduct alternately and the resultant audio output is applied via **C23** to the loudspeaker speech coil which is of sufficiently high impedance to eliminate the necessity for an output transformer.

CAPACITORS

Electrolytics excepted, tolerance ±20% unless otherwise stated. Where no working voltage is given, this should be taken as 350 Volts.

Ref.	Value	Tol.	Volts	Function	Part No.
C 1	118pF	Variable*		Aerial tuning	32215
C 2	20pF	Pre-set		Aerial trimmer	
C 3	680pF	1%		LW aerial trimmer	Y681B12
C 4	.1μF	+80—20%	30V	VT1 base bias bypass	C104N03
C 5	.02μF			VT1 emitter bypass	T103W15
C 6	250pF	2%		IFT1 Primary tuning	
C 7	177pF	2%		Oscillator padder	45779
C 8	118pF	Variable*		Oscillator tuning	32215
C 9	20pF	Pre-set		Oscillator trimmer	
C10	127pF	1%		LW oscillator fixed trimmer	
C11	8μF	Electro	6V	AGC decoupling	Y13222/14X
C12	250pF	2%		IFT2 Primary tuning	
C13	.04μF			VT2 emitter bypass	T403W15
C14	56pF	±1%		Part VT2 neutralizing	Y560B12
C15	18pF	±½p		Part VT3 neutralizing	Y180H12
C16	.04μF			VT3 emitter bypass	T403W15
C17	250pF	2%		IFT primary tuning	
C18	.04μF			Decoupling	T403W15
C19	.01μF			Part IF filter	T103W15
C20	50μF	Electro	6V	Decoupling	T13228/17X
C21	8μF	Electro	6V	VT4 audio coupling	Y13222/14X
C22	50μF	Electro	6V	VT4 emitter bypass	T13228/17X
C23	50μF	Electro	6V	LS audio coupling	T13228/17X
C24	50μF	Electro	6V	Battery decoupling	T13228/17X
C25	·01μF			Part IF Filter	T103W15

*Swing value (C1 ganged with C8).

RESISTORS

All carbon types unless otherwise stated. Where no tolerance or power rating is given for fixed resistors, these should be taken as 10% and ¼ watt respectively.

Ref.	Value	Tol.	Rating	Function	Part No.
R 1	33KΩ			VT1 base bias potential divider	333SC02
R 2	10KΩ				103SC02
R 3	3.9KΩ			VT1 emitter stabilising	392SC02
R 4	1.2KΩ			Part VT2 neutralizing	122SC02
R 5	68KΩ			VT2 base bias	683SC02
R 6	8.2KΩ			AGC decoupling	822SC02
R 7	1KΩ			VT2 emitter stabilising	102SC02
R 8	22KΩ		1/10W	VT3 base bias potential divider	223SC01
R 9	4.7KΩ		1/10W		472SC01
R10	680Ω			VT3 emitter stabilising	681WC02
R11	3.9KΩ			Part VT3 neutralizing	392SC02
R12	5KΩ			Volume control and detector load.	32210
R13	680Ω			Battery series dropper and part decoupling.	681WC02
R14	33KΩ			VT4 base bias potential divider	333SC02
R15	12KΩ				123SC02
R16	470Ω			VT4 emitter stabilising	471SC02
R17	1.8KΩ	5%		VT6 base bias	182GC02
R18	110Ω	5%			
R19	1.8KΩ	5%		VT5 base bias	182GC02
R20	110Ω				111GC02
R21	470Ω			Part IF Filter	471SC02

MISCELLANEOUS

Ref.	Description	Part No.
LI	Personal earphone jack socket	32209
LS	PM, 3 inch diameter, 40Ω impedance	16036/2
S1a-b-c	Waverange switch	32230
S2	On-Off switch (combined with R12)	32635

The manufacturers reserve the right to vary specifications or use alternative materials as may be deemed necessary or desirable at any time.

INDUCTORS & TRANSFORMERS

Ref.	Description	Part No.
L 1	Ferrite-slab aerial	32212
L 2		
L 3	Oscillator coils	32226
L 4		
L 5		
L 6	IFT1	32227
L 7		
L 8	IFT2	32228
L 9		
L10	IFT3	32696
L11		
Y1	Audio driver transformer	32229

SPARE PARTS LIST

Description	Part No.
Casing :	
Front assembly (colour ivory)	33244
Front assembly (colour red)	33244/1
Front assembly (colour blue)	33244/2
Rear cover (colour ivory)	32204
Handle stand	32337
Scale	32767
Tuning cursor disc (Clip 47443)	32339
Wavechange button	32340

Front casing assembly (Part No. 33244) coloured black is incorrectly referred to as being ivory coloured.

TRANSISTORS & CRYSTAL DIODES

Ref.	Type	Function
VT1	OC44	Frequency changer
VT2	OC45	1st IF amplifier
VT3	OC45	2nd IF amplifier
VT4	OC81D	Audio driver
VT5	OC81	Output
VT6	OC81	
W1	OA70	Detector

Published by

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