

COMPACT

TYPE PF1C



This service manual is for the maintenance of Pye Telecommunications equipment. The performance figures quoted are typical and are subject to normal manufacturing and service tolerances.

The right is reserved to alter the equipment described in this manual in the light of future technical development.

PYE TELECOMMUNICATIONS LIMITED · CAMBRIDGE · ENGLAND

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GENERAL DESCRIPTION

The Pye Compact is a frequency-modulated miniature radiotelephone designed to provide communication from person to base station, or person to person via the base station on 'talkthrough'. The range of up to several miles in built up areas is considerably increased when the equipment is used in open country. Direct person to person operation is also possible over short distances.

The equipment operates at preset fixed frequencies within the u.h.f. band of 450 to 470 MHz using two-frequency working with a channel spacing of 25 kHz or 50 kHz.

The equipment is fully transistorised and contained in a tough plastic case. The transmitter and receiver each have a single operating control. A 6-inch retractable antenna is provided.

The sensitive receiver employs a double-super-heterodyne circuit with intermediate frequencies of 10.7 MHz and 100 kHz; both local oscillators are crystal controlled. A squelch circuit silences the receiver in the absence of a signal and also operates an economiser circuit which considerably reduces the battery drain during listening out periods. A 2-inch loudspeaker and an earpiece jack are provided.

The transmitter has an output of 150 milliwatts. It has a built-in microphone.

Two 9 volt rechargeable nickel cadmium batteries are used to supply 18 volts for the transmitter and 9 volts for the receiver. The batteries can easily be removed for charging, alternatively they can be charged in the equipment and the transmitter and receiver can still be used during the charging period.

The complete unit is easily held in the hand. A loop on the side of the case can be used to attach a retaining lanyard or waist strap.

The Pye Compact is designed and manufactured to stringent specifications, has innumerable applications and is particularly suitable for use by the police and security forces.

SUMMARY OF DATA

GENERAL

Service F3 Telephony
Two-frequency working

Frequency Range 450-470 MHz

Channel Spacing 25 kHz or 50 kHz

Antenna Quarter wave 6-inch retractable

Power Supply Two 9 volt Nickel-Cadmium batteries connected:

(a) in parallel for receiver, or
(b) in series (18V) for transmit by operation of the press-to-talk button.

Battery Endurance 20 hours nominal (with receive/transmit ratio of 50:1)

Controls Combined ON/OFF and VOLUME
Press-to-talk button

Dimensions $8\frac{3}{4}$ in. x $3\frac{1}{2}$ in. x $1\frac{1}{2}$ in.
(22.2 x 8.9 x 3.8 cm)

Weight $20\frac{1}{2}$ oz (581g) less batteries
 $23\frac{1}{2}$ oz (666g) complete with batteries

RECEIVER

Sensitivity $1\mu\text{V}$ p.d. for 20db quieting

Audio Output 100mW

Intermediate Frequencies 1st i.f. 10.7 MHz
2nd i.f. 100 kHz

Squelch Preset

Battery Economy-miser Circuit ON 60 msec OFF 600 msec (no signal)

TRANSMITTER

R. F. Power Output 150mW

Modulation Peak deviation
15 kHz (50 kHz channel spacing)
5 kHz (25 kHz channel spacing)

OPERATING INSTRUCTIONS

The Pye Compact is supplied preset to the required operating frequencies.

IMPORTANT

Switch off before attempting to install or replace the batteries.

Holding the Compact with the base uppermost, unlock and remove the battery cover. Insert the two 9 volt batteries; these have a centre +ve contact and two outer -ve contacts, and therefore can be inserted either way round. Replace and lock the battery cover.

OPERATION

Switch on the receiver. Operate the press-to-talk switch and, in conjunction with the base station, check the operation of the equipment from various locations. Adjust the volume control as required.

Plug in earpiece (optional item) if required.

NOTE: The operation of the transistor switch in the battery economiser circuit produces a soft audible click from the loudspeaker.

To obtain the best results from the Compact transmitter it is essential that the unit is held with the microphone (located behind the loudspeaker grill) one or two inches from and a little to one side of the mouth. Speak in a normal conversational tone across the loudspeaker grill.

FIELD TESTING PROCEDURE

To check the operating frequencies against those of the base station carry out the following procedure.

RECEIVER

1. Arrange for the base station to radiate a carrier.
2. Switch on a 10.7 MHz marker oscillator unit (the Pye PT501 is suitable) and hold it close to the Compact receiver first i.f. section.
3. If a high audio beat note is produced, the Compact receiver crystal trimmer L2 (see Fig.8) should be adjusted for zero beat.

TRANSMITTER

Provided the base station receiver has an i.f. of 10.7 MHz, arrange for the base station engineer to check the Compact transmitter frequency against that of the base station receiver.

1. With the Compact transmitter operating and radiating a carrier, arrange for the base station engineer to switch on the 10.7 MHz marker oscillator and hold it close to the appropriate mixer unit in the base station receiver.
2. If a high audio beat note is produced, the Compact transmitter crystal trimmer C17 (See Fig.11) should be adjusted for zero beat.

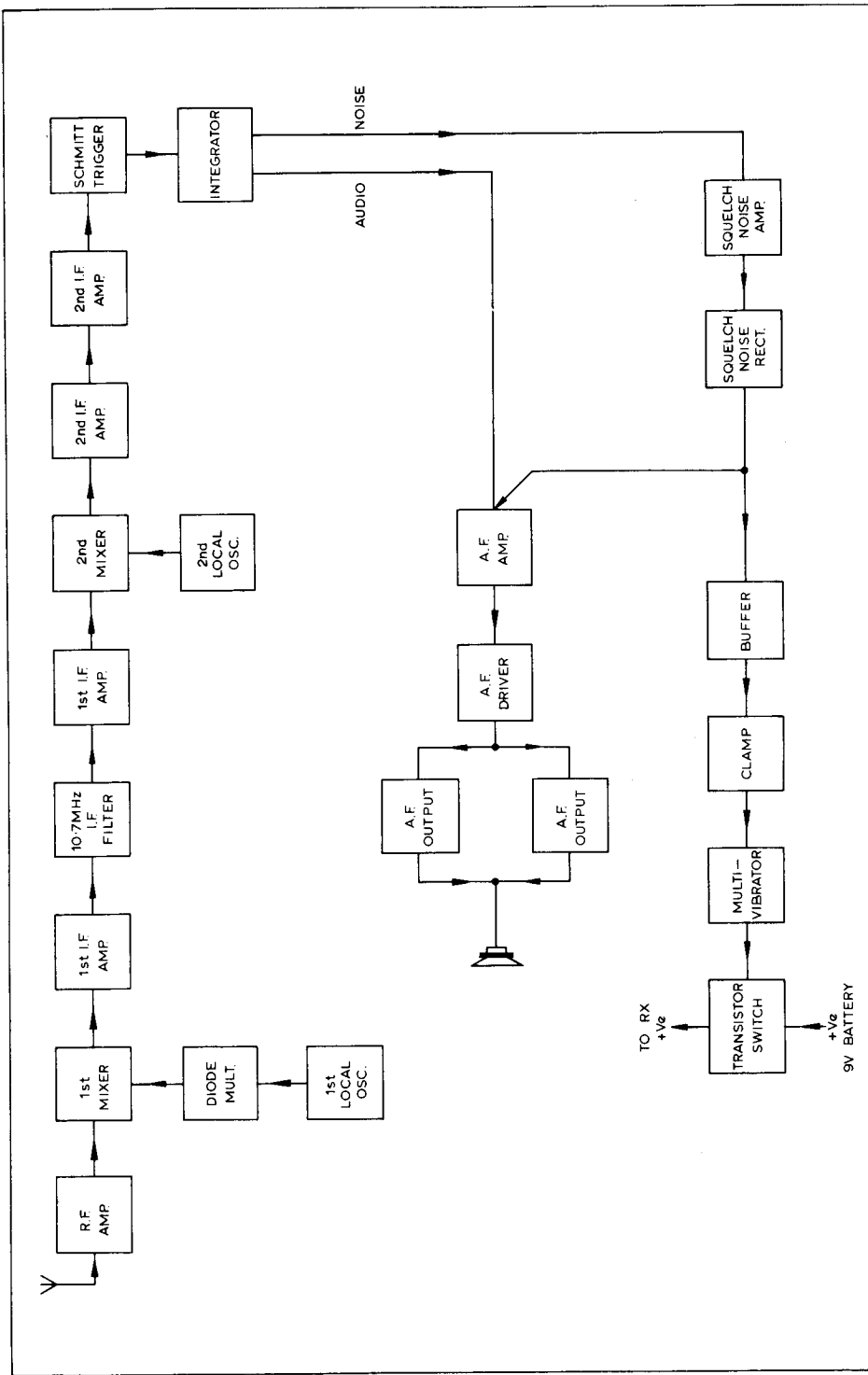


Fig. 1 Receiver Block Diagram

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RECEIVER CIRCUIT DESCRIPTION

CIRCUIT SUMMARY

The transistorised receiver employs a double superheterodyne circuit. The r.f. amplifier is followed by the first mixer fed from the first local oscillator giving a first i.f. of 10.7 MHz. After amplification the first i.f. is passed through the 10.7 MHz crystal filter unit and then further amplified in a single tuned stage before application to the second local oscillator and mixer. The resultant second i.f. at 100 kHz is amplified in two resistance capacity coupled stages before being applied to the Schmitt trigger circuit. The resultant square wave output at a pulse repetition frequency equivalent to the frequency deviation of the received signal is shaped into a trigger pulse and passed to the integrator circuit. After filtering out the 100 kHz component, the audio signal, with de-emphasis, is fed via the a.f. stages to the loudspeaker. An economiser circuit operated by the noise content in the absence of a signal considerably reduces the battery drain.

CIRCUIT DESCRIPTION

R. F. Section

The incoming u.h.f. signal from the antenna is connected by the press-to-talk switch contact SB3 to the antenna input circuit comprising L1 tuned by C1. TR1 is a conventional r.f. amplifier with a double-tuned transformer T1 in the collector load.

The u.h.f. signal applied to the first mixer TR2 is combined with the output from the first local oscillator TR3 and multiplier circuit to produce the first i.f. of 10.7 MHz.

TR3 is an overtone crystal-controlled oscillator provided with inductive crystal-trimming; the output at the collector of TR3 is fed to the diode multiplier circuit. The cathode circuit of D1, consisting of L5 tuned by C18, selects the fifth harmonic which is the first mixer injection frequency of 10.7 MHz below the carrier frequency.

Carrier 450-470 MHz

Xtal frequency $\frac{\text{Carrier} - 10.7 \text{ MHz}}{5}$

Harmonic Fifth

1st Local Osc. Carrier - 10.7 MHz

1st I.F. 10.7 MHz

First I.F. Amplifier

The single tuned transformer T2 is used in the collector load of TR2 to reduce spurious signals and harmonics before the first i.f. signal is amplified by TR4.

The broad band signal output from TR4 is coupled by C22 to the input of the sealed 10.7 MHz crystal filter unit. This filter unit reduces the bandwidth of the 10.7 MHz signal which is then amplified by TR6 and coupled to the second mixer TR7 by the single tuned transformer T3.

Fig. 14

Second Mixer

The output from the second local oscillator circuit at the emitter of TR5 is injected into the second mixer TR7 at the fundamental crystal frequency.

This frequency is normally 100 kHz above the first i.f. of 10.7 MHz (i.e. 10.8 MHz) but will be 100 kHz below the first i.f. (i.e. 10.6 MHz) when the receiver is operating at carrier frequencies within 100 kHz of 453.6 MHz or 464.4 MHz.

Second I. F. Amplifier

The output from the second mixer at the second i.f. of 100 kHz is amplified in two resistance capacity coupled stages TR8 and TR9 and then applied to the Schmitt trigger circuit.

The limiter diodes D2 and D3 located in the base circuit of TR8 prevent overloading of the stage when a high signal level is present.

Schmitt Trigger Circuit

The Schmitt trigger circuit consisting of TR10 and TR11, is operated by the incoming 100 kHz signal. TR10 conducts on each half cycle and a square wave pulse of constant amplitude is produced at the collector of TR11 with a pulse repetition frequency equivalent to the frequency deviation of the incoming signal. The square wave pulse is then shaped by the differentiating circuit C44 and R41 to produce a triggering pulse for the integrator

Integrator

When triggered TR12 produces a waveform, the sinusoidal content of which has an amplitude proportional to the time integral of the pulse input.

The output from the integrator is fed to a resistance capacity network of which C45, C46 and C47 filter out the 100 kHz component, and R43, R45, R46 and C49 provide the required 6db de-emphasis characteristic of the a.f. signal.

Two outputs, noise and audio, are taken from the resistance capacity network.

Squelch Circuit

In the absence of a signal the noise content is applied to TR13, the noise amplifier, via C50.

The output from the noise amplifier causes the noise rectifier TR14 to bottom. With no forward bias TR15, the a.f. amplifier, is cut off and background noise is not heard in the loudspeaker (or earphone). When an incoming signal is received, the noise content falls, TR14 ceases to conduct and forward bias is now applied to TR15, which conducts.

The zener diode D4 provides d.c. stabilisation at the collector of the noise rectifier TR14 to compensate for variations in the supply voltage.

A. F. Section

The a.f. signal is passed to the base of TR15, the a.f. amplifier, via the VOLUME control RV1 and C56. After amplification the audio signal is coupled by C57 to the base of TR16 which acts as a driver stage for the output transistors TR17 (NPN) and TR18 (PNP). The NPN and PNP transistors conduct alternately to provide the push-pull output which is coupled to the loudspeaker via C60.

RECEIVER CIRCUIT DESCRIPTION

CIRCUIT SUMMARY

The transistorised receiver employs a double superheterodyne circuit. The r.f. amplifier is followed by the first mixer fed from the first local oscillator giving a first i.f. of 10.7 MHz. After amplification the first i.f. is passed through the 10.7 MHz crystal filter unit and then further amplified in a single tuned stage before application to the second local oscillator and mixer. The resultant second i.f. at 100 kHz is amplified in two resistance capacity coupled stages before being applied to the Schmitt trigger circuit. The resultant square wave output at a pulse repetition frequency equivalent to the frequency deviation of the received signal is shaped into a trigger pulse and passed to the integrator circuit. After filtering out the 100 kHz component, the audio signal, with de-emphasis, is fed via the a.f. stages to the loudspeaker. An economiser circuit operated by the noise content in the absence of a signal considerably reduces the battery drain.

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The incoming u.h.f. signal from the antenna is connected by the press-to-talk switch contact SB3 to the antenna input circuit comprising L1 tuned by C1. TR1 is a conventional r.f. amplifier with a double-tuned transformer T1 in the collector load.

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TR3 is an overtone crystal-controlled oscillator provided with inductive crystal-trimming; the output at the collector of TR3 is fed to the diode multiplier circuit. The cathode circuit of D1, consisting of L5 tuned by C18, selects the fifth harmonic which is the first mixer injection frequency of 10.7 MHz below the carrier frequency.

Carrier 450-470 MHz

Xtal frequency $\frac{\text{Carrier} - 10.7 \text{ MHz}}{5}$

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1st Local Osc. Carrier - 10.7 MHz

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The broad band signal output from TR4 is coupled by C22 to the input of the sealed 10.7 MHz crystal filter unit. This filter unit reduces the bandwidth of the 10.7 MHz signal which is then amplified by TR6 and coupled to the second mixer TR7 by the single tuned transformer T3.

Fig. 14

(5)

Second Mixer

The output from the second local oscillator circuit at the emitter of TR5 is injected into the second mixer TR7 at the fundamental crystal frequency.

This frequency is normally 100 kHz above the first i.f. of 10.7 MHz (i.e. 10.8 MHz) but will be 100 kHz below the first i.f. (i.e. 10.6 MHz) when the receiver is operating at carrier frequencies within 100 kHz of 453.6 MHz or 464.4 MHz.

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The output from the second mixer at the second i.f. of 100 kHz is amplified in two resistance capacity coupled stages TR8 and TR9 and then applied to the Schmitt trigger circuit.

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The Schmitt trigger circuit consisting of TR10 and TR11, is operated by the incoming 100 kHz signal. TR10 conducts on each half cycle and a square wave pulse of constant amplitude is produced at the collector of TR11 with a pulse repetition frequency equivalent to the frequency deviation of the incoming signal. The square wave pulse is then shaped by the differentiating circuit C44 and R41 to produce a triggering pulse for the integrator

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When triggered TR12 produces a waveform, the sinusoidal content of which has an amplitude proportional to the time integral of the pulse input.

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Two outputs, noise and audio, are taken from the resistance capacity network.

Squelch Circuit

In the absence of a signal the noise content is applied to TR13, the noise amplifier, via C50.

The output from the noise amplifier causes the noise rectifier TR14 to bottom. With no forward bias TR15, the a.f. amplifier, is cut off and background noise is not heard in the loudspeaker (or earphone). When an incoming signal is received, the noise content falls, TR14 ceases to conduct and forward bias is now applied to TR15, which conducts.

The zener diode D4 provides d.c. stabilisation at the collector of the noise rectifier TR14 to compensate for variations in the supply voltage.

A. F. Section

The a.f. signal is passed to the base of TR15, the a.f. amplifier, via the VOLUME control RV1 and C56. After amplification the audio signal is coupled by C57 to the base of TR16 which acts as a driver stage for the output transistors TR17 (NPN) and TR18 (PNP). The NPN and PNP transistors conduct alternately to provide the push-pull output which is coupled to the loudspeaker via C60.

Operation

The economiser circuit is connected in series with the positive supply line to the receiver.

When the receiver is switched on by the operation of switch SA, no forward bias is applied to the base of TR19 so that the buffer and clamp stages, TR19 and TR20 respectively, do not conduct.

The self starting multivibrator (flip flop) circuit, TR21 and TR22, operates with a time constant determined by C64, R70 and R72, and causes the transistor switch TR23 to connect the battery to the receiver circuit at a frequency of 60 msec ON followed by 600 msec OFF.

The transistor switch OFF for 600 msec:

TR19	TR20	TR21	TR22	TR23	TR24
OFF	OFF	ON	OFF	OFF	OFF

With TR21 conducting and C64 charged up to approaching the full positive voltage, TR22 is cut off. No forward bias is applied to the base of TR23 which therefore does not conduct.

TR24 is also cut off as the base is clamped near to the negative line when TR21 is conducting.

The transistor switch is therefore in the OFF condition and the battery supply is not connected to the receiver circuit.

An external jack socket JK1 is provided for plugging in the earphone, thereby automatically disconnecting the loudspeaker. This facility is intended for use when the receiver is employed in noisy surroundings or when private communication is required.

An audio output point (A/F) is provided for use with an external amplifier.

Battery Economiser Circuit

Function

The battery supply is applied to the receiver only when the economiser circuit is in the ON condition.

In the absence of a signal the economiser circuit is alternately ON for 60 msec and OFF for 600 msec.

When a signal is received the economiser circuit is held at ON and maintained in this condition until approximately 2 seconds after the cessation of the received signal. This prevents the economiser circuit cycling between the ON and OFF conditions and allows for blind spot reception experienced at u.h.f. during movement in built up areas. Within this two second period the noise content operates the squelch circuit so that background noise is not heard in the loudspeaker.

Although there is a direct connection from the battery to the push-pull a.f. output stage, its bias is obtained via the economiser circuit which disconnects the complete receiver supply when in the OFF condition.

The transistor switch ON for 60 msecs:

TR19	TR20	TR21	TR22	TR23	TR24
OFF	OFF	OFF	ON	ON	OFF

C64 discharges via R72 and permits TR22 to conduct. With C64 discharged, the emitter of TR21 is driven positive and TR21 is cut off. C64 commences to charge via R70, TR22 and the emitter/base junction of TR23.

As the base of TR24 is forward biased, it conducts and provides a current path for TR23 which then bottoms. TR23 is held in the bottomed condition by a current path via TR22; TR24 takes no further part in this action and ceases to conduct.

TR23 conducts and connects the battery supply to the receiver circuit.

Receiver operating - no signal

With the receiver operating and in the absence of a signal, the noise content is amplified by TR13, and TR14 bottoms so that no forward bias is applied to the buffer stage TR19. Therefore the multivibrator continues to cycle at a frequency of 60 msecs ON and 600 msecs OFF.

Receiver operating - with signal

When a signal is received the noise content falls and the transistor switch connects the battery to the receiver and is held at ON.

TR19	TR20	TR21	TR22	TR23	TR24
ON	ON	OFF	ON	ON	OFF

When the noise content falls TR14, the noise rectifier, ceases to conduct and a forward bias derived from the potential divider R52, R53, R54 and R55 is applied to the base of the buffer TR19 via R63.

TR19 conducts and provides the base potential for TR20, the clamp stage, via the diode D5.

TR20 conducts and clamps the base of TR21, one half of the multivibrator circuit, to the negative line.

TR21 is held at cut off and TR22 conducts maintaining the full bias on the base of TR23, the transistor switch, which conducts and connects the battery to the receiver circuit.

TR23 is held ON until the noise content rises after the cessation of the received signal.

C63 maintains the economiser circuit in the ON condition for approximately 2 seconds after the rise in the noise content has caused TR14, the noise rectifier, to bottom and the forward bias applied to the buffer stage has been removed.

TRANSMITTER CIRCUIT DESCRIPTION

CIRCUIT SUMMARY

The transmitter employs three transistors in the audio section and seven transistors in the r.f. section. The a.f. output from the microphone is amplified, limited and passed through a filter network before being coupled to the modulator driver stage.

The output from the crystal controlled oscillator circuit at the fundamental crystal frequency is frequency modulated by the a.f. output from the modulator driver stage.

After four stages of multiplication, the frequency modulated carrier is coupled to the p.a. transistor the output of which is coupled to the antenna through two tuned circuits.

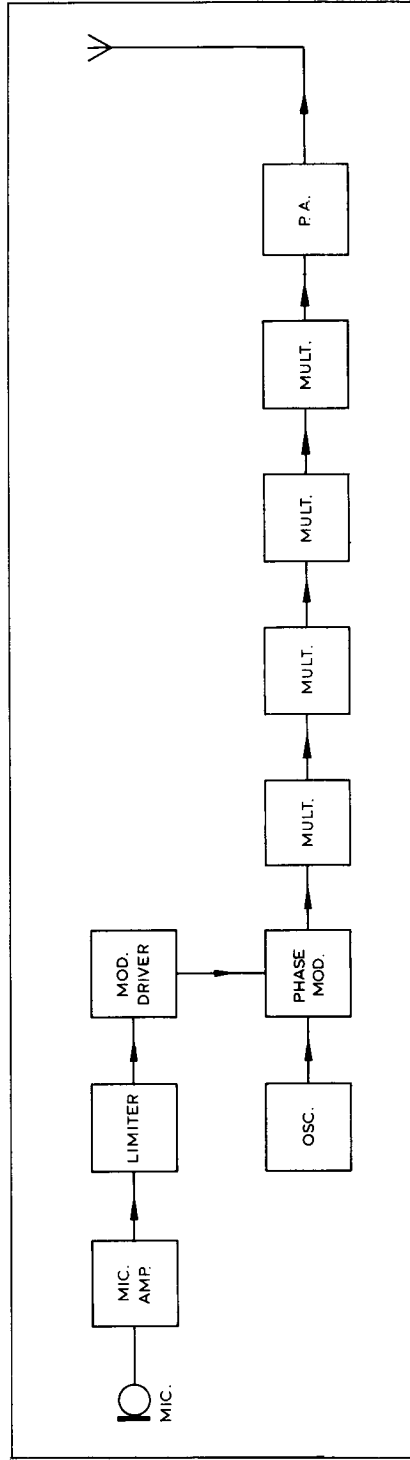


Fig. 2 Transmitter Block Diagram

CIRCUIT DESCRIPTION

Fig. 16

Audio Section

The a. f. output from the microphone is fed through a capacitor which, in conjunction with the input impedance of TR1 gives a pre-emphasis of approximately 6db per octave. It is then amplified by TR1 and TR2. TR2 also acts as a limiter, in conjunction with D1, to prevent the audio exceeding a pre-determined level.

The output of the limiter is then passed through the filter network to the base of TR3. R8 and C13 give a 6db per octave de-emphasis to compensate for the modulator characteristic. It should be noted that the modulator is in fact a phase modulator which has a 6db per octave pre-emphasis slope compared to a true frequency modulator, so that the 6db per octave de-emphasis circuit is built in to make the resultant approximate to frequency modulation. C8, R7, C10 form a low pass filter to reduce any audio component above 3 kHz to an acceptable level.

The microphone itself has a very sharp cut off above 3 kHz. R9 in the resistance capacity network determines the maximum frequency deviation of the carrier by the applied audio signal and is selected on manufacture to give a final peak deviation of 5 kHz (25 kHz channel spacing) or 15 kHz (50 kHz channel spacing).

The a. f. signal is coupled by C14 to TR3, the modulator driver stage, and the output from this stage which appears across R13 is connected to the emitter of the phase modulator TR5. (Since there is a total multiplication factor of 36 the peak deviation required at the phase modulator is less than 165 Hz (25 kHz channel spacing) or 500 Hz (50 kHz channel spacing)).

R. F. Section

The crystal oscillator circuit is provided with a capacitive trimmer C17, which is preset on manufacture.

The output from TR4, the crystal oscillator, is at the fundamental crystal frequency and is coupled by C24 to the modulator TR5.

This stage is modulated by the audio applied to its emitter and the modulated signal is then fed to the 1st multiplier TR6 via the coupling capacitor C28.

After frequency multiplication in four tuned stages, the modulated carrier is coupled by C50 to the p. a. output transistor TR10.

Coupling to the antenna is by the antenna loop L11.

The stage by stage multiplication factors are as follows:-

TR4	x1	TR8	x2
TR5	x1	TR9	x2
TR6	x3	TR10	x1
TR7	x3	Total Multiplication	x36

Press-to-talk Switch

The press-to-talk switch SB has three sets of contacts. When the switch is operated these contacts carry out the following functions.

SB1 and SB2	disconnect the two 9V batteries from the receiver, where they are connected in parallel, and connect them in series for use with the transmitter.
SB3	disconnects the antenna from receiver and, connects it to the transmitter

POWER SUPPLIES

Two 9 volt Nickel Cadmium batteries provide power for the transmitter and receiver, via the ON/OFF switch SA in the -ve lead. For receive the batteries are connected in parallel (9V) and for transmit in series (18V). The change from parallel working (Fig.14) to series working (Fig.16) is by operation of the press-to-talk switch SB.

During listening periods (no signal condition) the battery supply is connected to the receiver via an economiser circuit which is switched on for 60 msecs followed by an off period of 600 msecs. Thus the battery supply is conserved. On receiving a signal the economiser circuit is automatically switched out.

The batteries can be removed from the equipment for charging using the battery charger BC7, which is described in this manual. Alternatively, the batteries can remain in the equipment and be charged by the unit charger BC8 (see supplement); with this method the equipment can still be operated while the batteries are being charged.

Referring to the receiver circuit diagram (Fig.14), CH- and CH+ are the battery charging contacts which are used when the batteries are charged in the equipment. With this arrangement the batteries are charged in parallel. The diodes D6 and D7 are provided to isolate one battery from the other.

SERVICING

Introduction

Due to the high component density, great care must be taken when removing or servicing the Compact printed circuit boards (see Precautions)

It will not normally be necessary to remove the receiver or transmitter boards completely from the case to carry out performance checks or alignment procedures.

With the front case removed, the receiver board assembly can be inverted 'in situ' for adjusting the oscillator injection trimmer. The transmitter board assembly can be raised at one end to gain access to the trimmer holes and metering points on the underside of the board; if it is necessary to remove the screening can lift one end of the board clear of the case and remove fixing screws.

It is not normally necessary to disconnect the loudspeaker or microphone.

Parting the Compact case disconnects the antenna. An antenna test socket is provided for the connection of test equipment; a miniature co-axial adaptor cable is required.

Precautions

Before servicing the equipment carefully read the following notes.

1. Ensure that the working area is clear of tools or pieces of wire which might cause an accidental short circuit.
2. Always check the supply polarity before switching on the equipment, as application of reverse polarity will destroy some transistors e.g. TR17 and TR23 in receiver.
3. If the emitter circuit of TR23 is momentarily connected to the negative line, the transistor will be destroyed.
4. If the emitter of the p. a. transistor TR10 in transmitter is inadvertently short circuited to the positive line, the transistor will be destroyed.
Note: The transistor case of TR10 and the adjacent tuned loop L8 are both connected to the battery positive.
5. After retuning an air spaced trimmer seal the trimmer with locking dope.

Transmitter: C41, C47, C53 and C56

Receiver: C2, C6 and C11

6. If any nuts are tightened they should be sealed with locking varnish.
7. Protect the battery connections and jack socket connections with insulating tape.
8. Ground potentials, which may exist between the soldering iron and test equipment or between different pieces of test equipment, can result in the unintentional application of damaging potentials to transistor electrodes. Therefore, it is essential to ensure that all test equipment is adequately grounded and it is advisable to disconnect all test equipment from the Compact before soldering.

Printed Circuits

When taking meter readings at appropriate points on the printed circuit boards use needle point test probes. Use the minimum amount of force necessary when removing a faulty component. A recommended procedure is to cut the leads of the faulty components and holding the board upside down, apply the miniature soldering iron to the printed circuit board, thereby causing the end wires to fall out. A clean hot soldering iron must be used and soldering completed as quickly as possible to avoid damage caused by the softening of the adhesive under the printed circuit board.

A low voltage soldering iron used in conjunction with 60/40 resin cored solder is recommended.

Clean the end wires of the replacement component, insert through the holes in the board and then cut the end wires to length; should the holes be blocked with solder, a suction soldering iron, or suction pump may be used to assist in clearing the holes, and thereby avoid using excessive heat. Bend the wires against the printed circuit sufficient to hold the component in position and then complete soldering as rapidly as possible.

Ensure that a minimum amount of solder is used and that all loose particles are removed.

Transistor Circuits

Transistors are susceptible to damage by current overload, reversed supply polarity or accidental short circuit. To avoid the risk of damage it is therefore advisable to use suitably insulated small test meter prods and crocodile clips.

As transistors are easily damaged when being removed, ensure that the transistor is faulty and not an associated component before removal.

After replacement, check the connections to the transistor and associated circuitry before switching on.

TEST EQUIPMENT REQUIRED

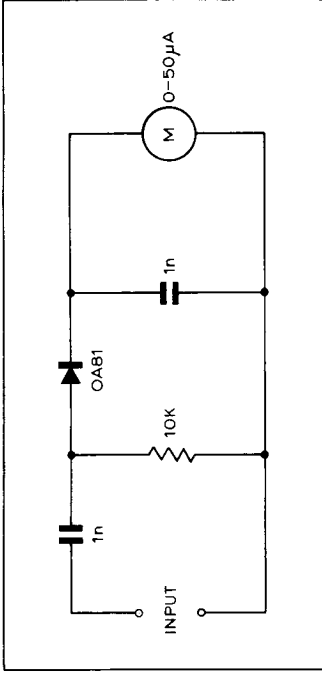


Fig. 3 Diode Probe

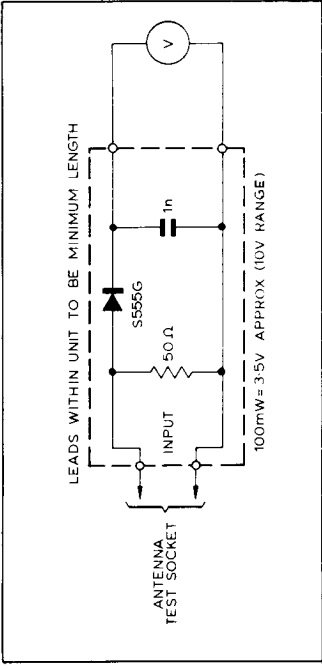


Fig. 4 R.F. Power Output Indicator

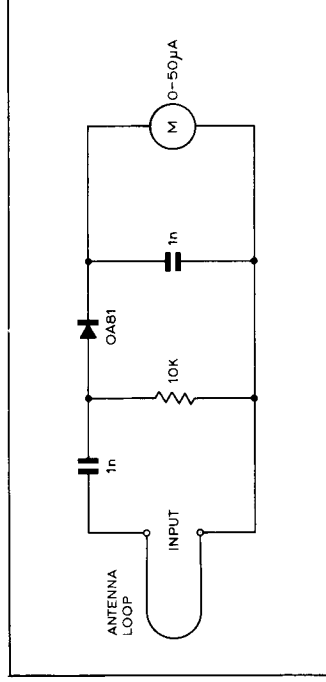


Fig. 5 Radiation Meter Circuit

TEST EQUIPMENT REQUIRED (Continued)

1. Variable power supply unit giving hum-free d.c. supply of 6.5V, 9V, 14V and 16V (Solartron AS1164/2 or Farnell L30).
2. Multimeter of 20k Ω / volt sensitivity (Avo Model 8).
3. Signal generator (Marconi TF 1064B/6 or TF 1066B/1).
4. A.F. oscillator with calibrated attenuator. (Marconi TF 110F).
5. General purpose oscilloscope.
6. H.F. valve voltmeter or diode probe (use circuit shown with 0-50 μ A meter, or Pye Testmeter TM1).
7. 40 Ω audio output meter (calibrated in db).
8. 10 μ F electrolytic capacitor and 0.1 μ F capacitor.
9. Deviation meter (Marconi TF 791D or Lampkin 205A).
10. R.F. power output meter for transmitter performance checks (Airmec 319).
11. R.F. power output indicator unit for transmitter alignment (use circuit shown or Pye Testmeter TM1).
12. Pye PT 501 10.7 MHz Crystal Controlled Marker Oscillator.
13. Radiation meter (see circuit diagram.)
14. Miniature co-axial adaptor cable.
15. Trimming tools.
16. Spare front case assembly Part No. AT10639 with access hole drilled for C2 (receiver).

Dismantling Procedure

Fig. 6

1. Ensure the equipment is switched off. Holding the Compact with the battery cover uppermost unlock the battery cover screw. Remove the cover. Tilt the Compact and allow the two 9V batteries to slide out.
2. Remove the seven screws holding the two halves of the case together. Part the case. This allows access to the transmitter and receiver board assemblies.
3. To remove the receiver board assembly undo the two screws holding the board to the case. Lift up the board, disconnect the seven sockets on flying leads. Unsolder the co-axial cable to the antenna. Remove the board complete.
4. To remove the transmitter board assembly. Remove the two screws holding the microphone. Unsolder antenna and ground connections, and the 18V +ve supply lead. Remove the transmitter board complete with microphone.
5. To remove the battery charging board. Remove the four holding screws. Unsolder four flying leads.
6. To remove the combined Volume On/Off switch unsolder five leads. Remove knob (using Allen Key). Using a 2BA open-end spanner remove the bush nut.
7. To remove Press-to-talk switch. First remove the combined Volume On/Off switch as detailed in para. 6 and the charging board screws (see para. 5) which secure the press-to-talk switch. Remove the antenna test socket mounting plate. Unsolder all connections to the switch. Remove switch by sliding it towards the volume control position. The press-to-talk button is a push fit and is removed by holding between finger and thumb, and easing it away from the Compact casing.
8. To remove the antenna. Unscrew the knurled nut and withdraw the antenna rod. Unscrew head of bush which now frees the square-shaped nut and tube complete.

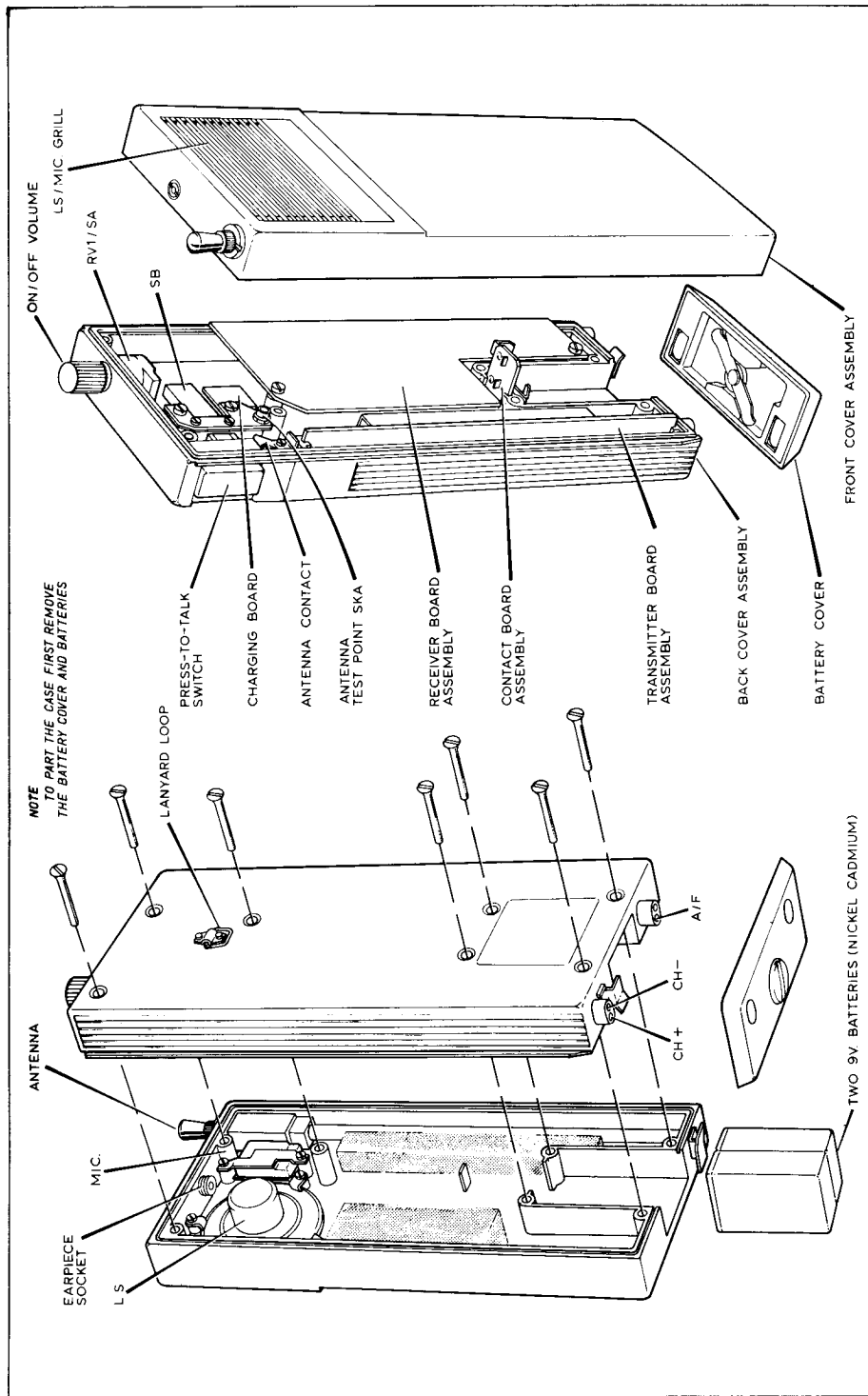


Fig. 6 Dismantling Diagram

RECEIVER PERFORMANCE CHECKS

Typical voltages given in the following performance checks are approximate readings and should be used only as a guide to the correct functioning of the equipment.

1. Carry out the following preliminary checks.
 - (a) Check that the d.c. resistance between the battery positive terminal and the negative line is not less than 3k Ω .
 - (b) Check that the compound resistance of the receiver circuit, i.e. from TR23 collector to the negative line, is not less than 1.5k Ω .
 - (c) Short circuit R51, rendering the squelch and battery economiser circuits inoperative.
 - (d) Check that the battery voltage, on load, is 9.0V d.c.
 - (e) Connect the multimeter in the battery positive supply line and with the VOLUME control at minimum, check that the total receiver current does not exceed 20mA.
2. Check the first local oscillator.

Measure the voltage across R17 which should be as follows:-

- 1.0V oscillating
- 0.5V not oscillating

3. Check the second local oscillator.

Connect the diode probe to the emitter of TR5 and check that the second local oscillator injection voltage is approximately 0.5V.

4. Check the a.f. sensitivity.

Connect the a.f. oscillator via a 10 μ F electrolytic blocking capacitor, to the top terminal of the VOLUME control RV1 and connect the audio output meter, set to 40 Ω range to the earphone socket. Set the VOLUME control at maximum.

Check that the a.f. signal level at 1000 Hz, required to give 50mW output is between 2.5 and 6mV. Disconnect the a. f. oscillator and electrolytic capacitor.

5. Check the i.f. sensitivity.

Connect the signal generator to the base of TR2, via a 0.1 μ F capacitor and inject an unmodulated 10.7 MHz i.f. signal of 10 μ V. Holding the 10.7 MHz crystal controlled marker oscillator (PT501) close to the receiver first i.f. section, adjust the signal generator frequency for zero audio beat note. Remove the marker oscillator. Modulate the signal generator signal at 1000 Hz with 1.5 kHz deviation (25 kHz channel spacing) or 5 kHz deviation (50 kHz channel spacing). Note the reading on the audio output meter (db scale). Switch off the signal generator and again note the reading on the audio output meter.

Check that a change in noise level of approximately 20db is obtained when the signal generator is switched on and off. Remove the signal generator and blocking capacitor.
6. Check the overall sensitivity.

Connect the signal generator, set at the Receiver operating frequency, to the antenna test socket and inject an r.f. signal of 1 μ V modulated at 1000 Hz with 1.5 kHz deviation (25 kHz channel spacing) or 5 kHz deviation (50 kHz channel spacing). Carefully adjust the signal generator carrier frequency to give maximum quieting and note the reading on the audio output meter (db scale). Switch off the signal generator and again note the db reading on the audio output meter.

Check that a change in noise level of 20db is obtained when the signal generator is switched on and off. Remove the audio output meter.

7. Check the squelch sensitivity. Remove the short circuit across R51 so that the squelch and battery economiser circuit are operating. Check that the receiver is silenced in the absence of a signal. Check that the r.f. signal input required to just operate the squelch circuit is not greater than 1 μ V, modulated at 1000 Hz with 1.5 kHz deviation (25 kHz channel spacing) or 5 kHz deviation (50 kHz channel spacing). Disconnect the signal generator.
8. Check that the battery economiser circuit continues to operate when the squelch is closed, i.e. with no r.f. input signal, the change in battery current will be discernible on the multimeter (100mA range) connected in the positive supply line. The needle will oscillate at a reading of approximately 8mA. Check that the battery economiser circuit continues to operate when the battery supply voltage is reduced to 7.0V.

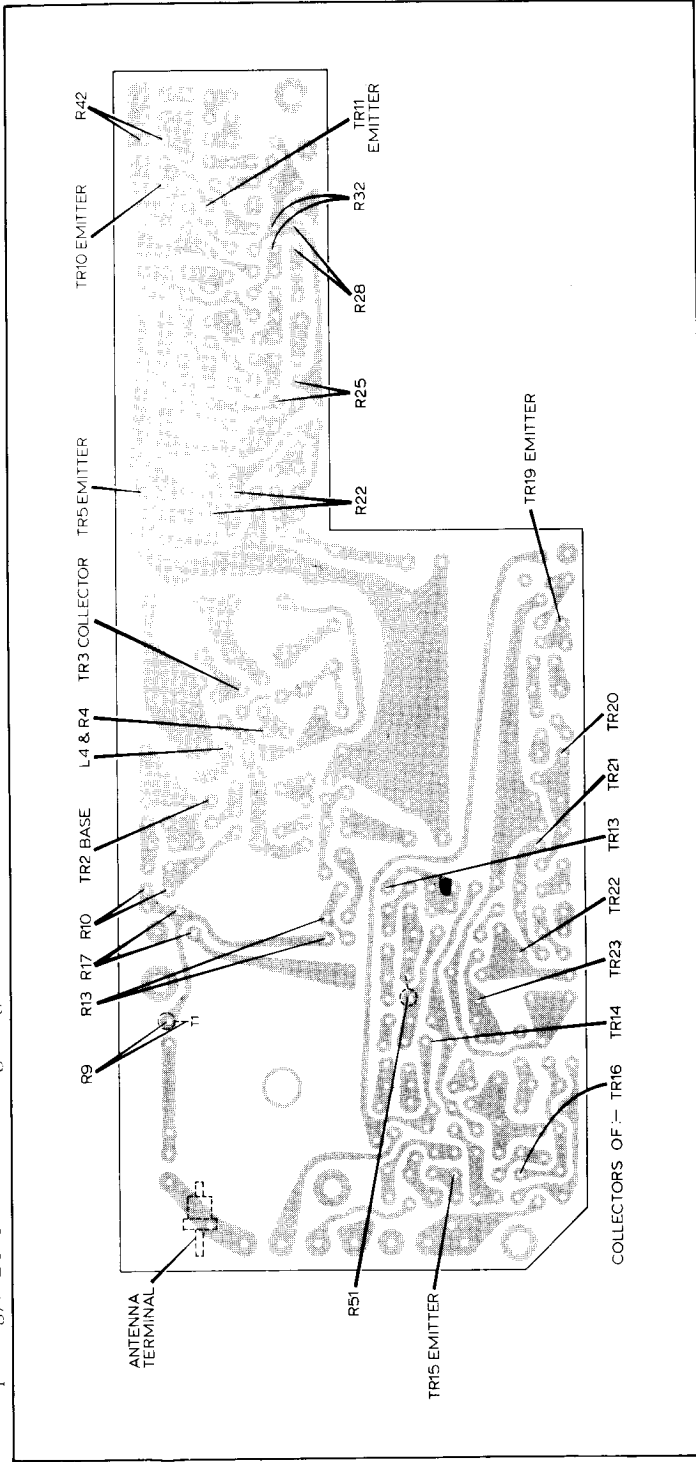


Fig. 7 Receiver Test Points

RECEIVER VOLTAGE ANALYSIS

Short circuit R51 to maintain the battery economiser circuit in the ON condition.

Before carrying out the following voltage checks ensure that the battery supply voltage, on load, is 9.0V.

The following, given in volts, is an indication of current being drawn by each stage.

1. Measure the d.c. voltage across the appropriate resistor.

Stage	Resistor	Typical Voltage <small>8.4V supply</small>
TR1	R9	0.7 v
TR2	R10	0.25 v
TR3	R4 and L4 in series	2.0 (160mV)
TR4	R13	0.2 v
TR6	R22	0.3 (160mV)
TR7	R25	0.8 (630mV)
TR8	R28	0.3 (270mV)
TR9	R32	0.3 (250mV)
TR12	R42	2.5 (17V)

2. Measure the d.c. voltage between the negative line and each test point indicated.

Stage	Test Point	Typical Voltage
TR5	emitter	1.5 0.8V
TR10 & TR11	TR10 & TR11 common emitter	0.4 C-3Y
TR13	collector	2.25 1.4V
TR14	collector	5.0 5.0V
TR15	emitter	0.22 0.31V
TR16	collector	3.5 3.1V
TR19	emitter	2.2 1.8V
TR20	collector	0.1 0.5mV
TR21	collector	5.8 7.5V
TR22	collector	8.7 7.5V
TR23	collector	8.6 7.5V

RECEIVER FAULT FINDING

Although a number of receiver faults may be located using standard techniques, it is essential that the circuit operation is clearly understood before attempting to localise a fault.

Most of the receiver noise, required to operate the battery economiser circuit, is produced in the first mixer stage and subsequently amplified by the 10.7 MHz and 100 kHz i.f. stages. Sufficient noise is produced and applied to the base of the noise rectifier TR14 for the positive-going pulses to cause it to bottom. With TR14 conducting, the audio stages are silenced and the battery economiser circuit switches the supply to the receiver circuit alternately on and then off. The operation of the transistor switch in the battery economiser circuit produces a soft audible click from the loudspeaker.

If a receiver fault causes a loss in gain, sufficient to reduce the noise level below that required to operate the Schmitt trigger circuit (TR10 and TR11), the noise output from the integrator circuit (TR12) fails completely. The squelch lifts and the battery economiser circuit latches on. As the Schmitt trigger is not operating, the receiver is effectively silenced and noise will not be heard in the loudspeaker.

Therefore any receiver fault causing a drastic loss of gain may appear as a transistor switching fault, i.e. the receiver is silent and the battery economiser circuit does not operate.

Procedure

Reduce the supply voltage to 7.0V and audibly check that the battery economiser circuit is operating.

If the economiser circuit is operating it must be presumed that the fault is in the R.F., 1st Local Oscillator, Squelch rectifier or Audio stages and should be located using standard techniques.

If the economiser circuit is not operating, check the Battery Economiser, Squelch, Integrator and Schmitt trigger circuits.

Battery Economiser

1. Short circuit the base of TR19 to the negative line. If the battery economiser circuit does not function correctly, the fault is within the transistor switching circuit or is due to the receiver circuit drawing excessive current i.e. greater than 30mA.
2. Short circuit R51 and check the transistor switching circuit in the ON condition as follows:-
 - (a) Check that the voltage across the collector and emitter of TR23 is between 0.1 and 0.5V.

A zero voltage reading indicates that TR23 is faulty and this transistor should be replaced.

WARNING

A d.c. short circuit from the collector of TR23 to the negative line will destroy the transistor.

- (b) Check that the voltage between the base of TR21 and the negative line is less than 0.2V.

Squelch Circuit

1. Check that the noise voltage, observed on an oscilloscope, at the base of TR13 is approximately 40mV peak-to-peak.

Check that the noise voltage, observed on an oscilloscope, at the base of TR14 is approximately 2V peak-to-peak. With this noise level TR14 should bottom and the battery economiser circuit function correctly.

Integrator

The noise or signal output from the Schmitt trigger circuit causes the integrator stage to draw current.

Check the current drawn by the integrator TR12, by measuring the voltage across R42 which should be as follows:-

With Schmitt trigger operating 2.0V

With Schmitt trigger not operating 0V

A zero voltage reading across R42 therefore indicates that the fault is in the integrator or previous stage.

Schmitt Trigger

This stage is triggered by pulses applied to the base of TR10.

Connect an oscilloscope to the output of the Schmitt trigger circuit at the collector of TR11 and check that the Schmitt trigger is functioning correctly.

If there is no output from the Schmitt trigger circuit check that the noise amplitude at the base of TR10 is approximately 3V peak-to-peak.

RECEIVER OSCILLATOR ALIGNMENT

Alignment of the receiver first local oscillator does not form part of the normal alignment procedure. The Field Testing Procedure is normally adequate for netting the equipment to the base station or re-aligning the oscillator if a component is changed in the oscillator circuit. Oscillator alignment should only be carried out with test equipment of a high standard, the following direct reading instrument being recommended.

Marconi Frequency Meter TF 1417/2 with Converter TM7164.

Detailed operating instructions are supplied by the manufacturer.

To align the receiver first local oscillator carry out the following procedure:-

Connect the live lead of the frequency meter to the junction L5/C14 (shown in fig. 12) and the ground lead of the frequency meter to the printed circuit board negative line (shown in fig. 12).

Connect a d.c. voltmeter across R17. Adjust L3 for a maximum reading (approx. 0.9V). Adjust L2 until the correct oscillator frequency is obtained.

The receiver first local oscillator crystal frequency is as follows:-

Carrier Frequency - 10.7 MHz
5

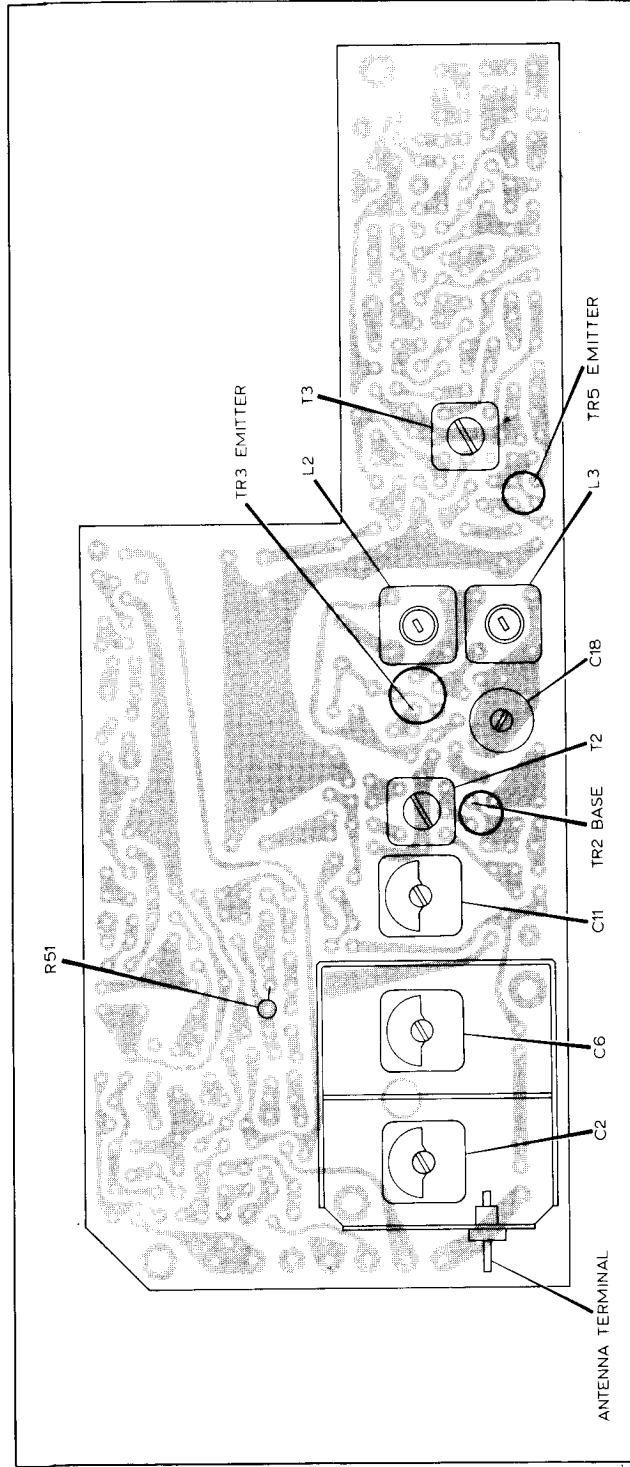


Fig. 8 Receiver Alignment Points

Preliminary Procedure

Check that the battery supply voltage, on load, is 9.0V d. c.
Short circuit R51 to maintain the battery economiser circuit in the ON condition.
Connect the audio output meter, set to 40Ω range, to the earphone socket.

Alignment Procedure

Connect the diode probe to the emitter of TR5.
Check that the second local oscillator injection voltage is approximately 0.5V.

Remove the diode probe.

Connect the signal generator at carrier frequency to the base of TR2.

Hold the 10.7 MHz marker oscillator close to the receiver first i. f. section.

Carefully adjust the signal generator frequency until a zero beat note is obtained.

Remove the marker oscillator..

Adjust T2 and T3 alternately for maximum quieting.

Connect the signal generator to the antenna test socket.

Inject an r. f. signal at the receiver operating frequency modulated at 1000 Hz with 1.5 kHz deviation (25 kHz channel spacing) or 5 kHz deviation (50 kHz channel spacing).

Adjust C2, C6, C11 and C18, in sequence for maximum quieting, reducing the signal level to the minimum required to maintain a working reading on the audio output meter.

Check the receiver for satisfactory operation when the battery supply voltage, on load, is reduced to 6.5V.

Remove test equipment. Carry out the final setting of the antenna trimmer C2 as described below.

Carry out the Field Testing Procedure and adjust the crystal trimmer L2 for zero beat note.

Carry out the Receiver Performance Checks.

Final Setting of the Antenna Trimmer

When the antenna is reconnected, antenna trimmer C2 must be re-aligned. To obtain access to C2 use a spare front case with an access hole drilled in the case.

Body shielding and random reflection will affect the setting up of the squelch during the following procedure and therefore, whenever possible, setting up should be carried out using a fine mesh wire cage (Fig. 9 shown overleaf).

Connect a quarter wave antenna, 6 in (16 cm) long, to the signal generator output and mount in a ground plane at a distance of approximately $4\frac{1}{2}$ feet (137 cm) from the Compact.

1. Carry out a comparative test using a known good Compact receiver. With the signal generator set to the receiver operating frequency ascertain the minimum signal generator output required to operate the squelch.

2. Set the signal generator to the operating frequency of the receiver being realigned and ascertain the signal generator output required to operate the squelch.

Adjust C2 and slowly reduce the signal generator output, in alternate steps, until the most sensitive squelch setting is obtained. Compare signal generator output reading with that obtained when checking known good receiver (see 1 above).

TRANSMITTER PERFORMANCE CHECKS

Typical voltages given in the following performance checks are approximate readings and should be used only as a guide to the correct function of the equipment.

1. With the transmitter switched on, check that the battery voltage is not less than 16 volts.
2. Check the power output.
Connect the power output meter to antenna test socket, ensuring that the free ends of the coaxial cable are as short as possible.
Carefully adjust C47, C53 and C56 for maximum r.f. power output, which should be at least 150mW with 16V supply.

After re-assembly, the transmitter radiated power should be checked. A suitable circuit is shown in Fig.5.

Alternatively, the Marconi Frequency Meter TF 1026/1 is suitable. If a sufficiently sensitive indicator is not available a diode probe may be used with an antenna six inches (16 cm) long fitted to the probe. It should give a satisfactory reading when spaced at least 6 inches (16 cm) from the Compact antenna. (The Pye TM1 may be used if the diode in the radiation meter circuit is S555G or equivalent).

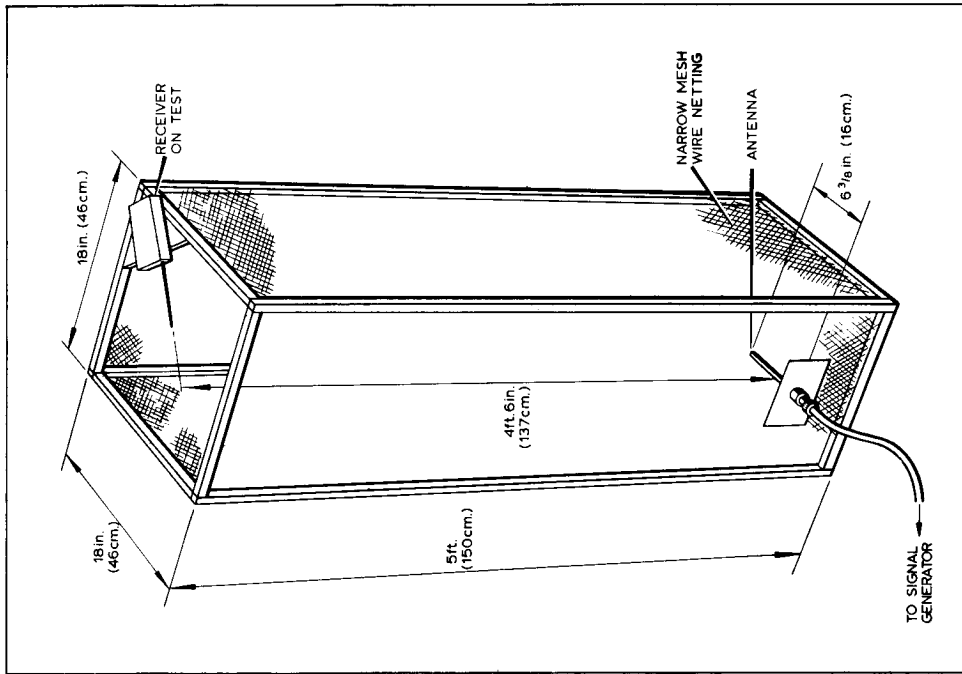


Fig.9 Receiver Test Cage

3. Check the r. f. stages.

If the transmitter r. f. output is low check the r. f. stages by measuring the d. c. voltage between the negative line and each of the following test points, the positions of which are shown in Fig. 10.

Test Point Typical Voltage

- TR6 emitter *0.25
- TR7 emitter *0.4
- TR8 emitter *0.7
- TR9 emitter 1.5-2.0

* These readings are not mandatory and may vary between equipments.

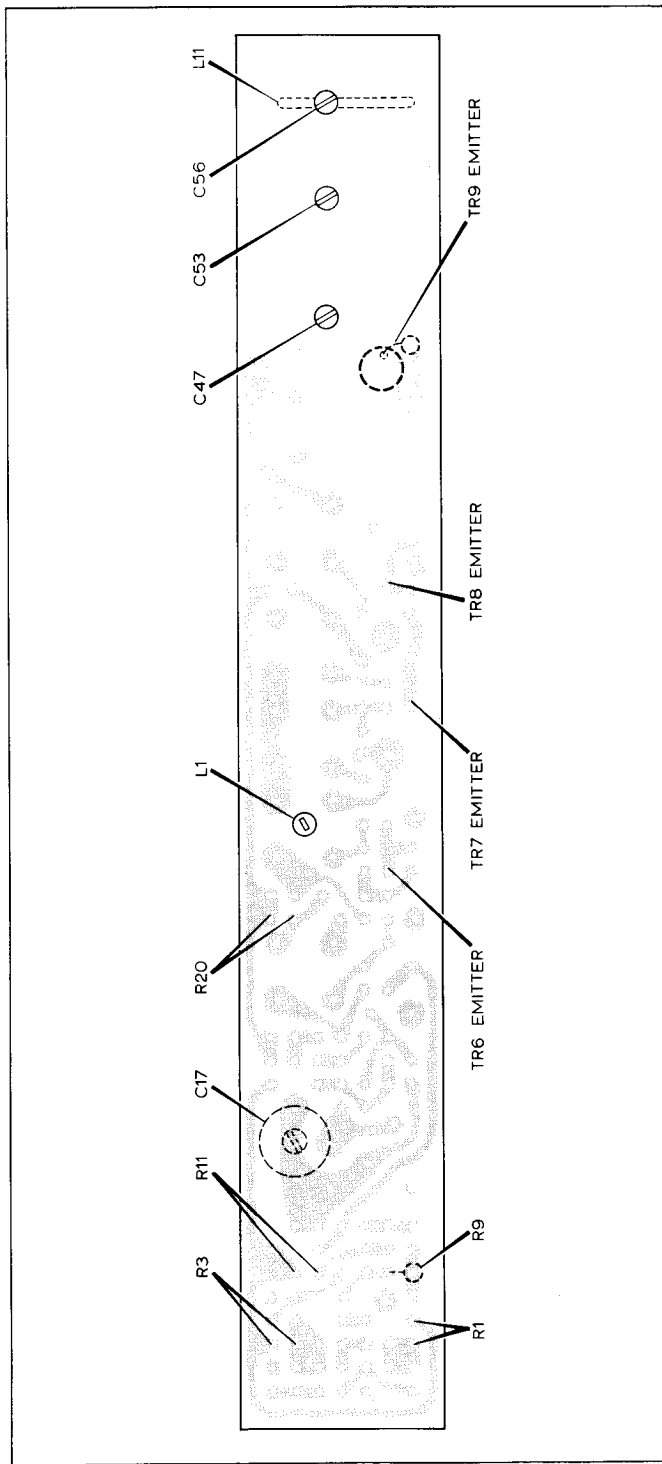


Fig. 10 Transmitter Test Points

4. Check the modulator.

Connect the power output meter to the antenna test socket and loosely couple the deviation meter to L11. Connect the a.f. oscillator across the microphone input and check that an a.f. input of approximately 100mV at 1000 Hz gives the required peak deviation: 5 kHz for 25 kHz channel spacing or 15 kHz for 50 kHz channel spacing. Slowly reduce the a.f. input until 3.5 kHz deviation is obtained for 25 kHz channel spacing or 7.5 kHz deviation for 50 kHz channel spacing and check that the a.f. input level is now 6mV \pm 3db.

Note: If the transmitter modulation only is being checked, (not the complete Transmitter Performance Checks) the deviation meter may be coupled to the antenna. The deviation meter must not be overloaded.

5. Using the Field Testing Procedure check the Compact transmitter operating frequency against that of the base station receiver.

6. Check the carrier for hum or noise by listening on a monitor receiver or by monitoring the deviation meter output.

7. Check that the modulation is normal.

Detailed Modulator Checks

1. Check the d.c. current drawn by the individual audio and modulator stages; measure the d.c. voltage across the collector resistors of each of the following transistors.

<u>Stage</u>	<u>Test Point</u>	<u>Typical Voltage</u>
TR1	R1	5.6
TR2	R3	8.0
TR3	R11	3.0
TR5	R20	4.7

2. Check the adjustment of the modulator coil L1.

With the a.f. oscillator connected to the microphone input adjust the a.f. signal level, at a constant frequency of 300 Hz, until 3 kHz deviation (25 kHz channel spacing) or 10 kHz (50 kHz channel spacing) is obtained on the deviation meter.

With the oscilloscope connected to the deviation meter, adjust the core of the modulator coil L1 to obtain the best waveform. (The core of L1 should now be approximately level with the top of the coil former.)

3. Check the limiter circuit.

With the oscilloscope connected to TR2 collector, adjust the a.f. signal level, at a constant frequency of 1000 Hz, until the waveform at TR2 collector indicates that limiting has commenced. Limiting should occur at the top and bottom of the waveform with approximately the same a.f. signal level i.e. a peak-to-peak voltage of 14V. Increase the a.f. signal level by 20db and observe that the peak-to-peak voltage remains substantially constant.

4. Check the peak deviation.

With an a.f. input of 100mV at 1000 Hz, check that the peak deviation, as measured on the deviation meter, does not exceed:

5 kHz (25 kHz channel spacing)
15 kHz (50 kHz channel spacing)

Note:

R9 is selected on manufacture to give the required peak deviation.

TRANSMITTER FAULT FINDING

5. Check the a.f. response.

Adjust the a.f. signal level, at a constant frequency of 2.5 kHz, until 4 kHz deviation (25 kHz channel spacing) or 12 kHz (50 kHz channel spacing) is obtained.

With a constant a.f. signal level, adjust the frequency of the a.f. input, and check that the deviation obtained at the selected frequencies corresponds to the following table

Frequency	25 kHz channel spacing	Deviation	50 kHz channel spacing
6.0 kHz	2.6 kHz approx.		8.0 kHz approx.
2.5 kHz	4.0 kHz		12.0 kHz
1.0 kHz	2.3 kHz approx.		7.0 kHz approx.
300 Hz	700 Hz approx.		2.0 kHz approx.
100 Hz	300 Hz approx.		1.0 kHz approx.

6. Check the audio sensitivity.

Check that the a.f. signal level required to give 50% modulation is 6mV \pm 3db (2.5 kHz deviation for 25 kHz channel spacing or 7.5 kHz deviation for 50 kHz channel spacing).

To locate the faulty stage in a transmitter, carry out the following procedure.

Connect a testmeter Avo Model 8 (set to lowest appropriate mA range) in series with the battery supply (16V on load).

The following readings give an approximate indication of the current drawn under the conditions stated and assumes that all previous stages are correctly tuned.

Not oscillating	No Drive	16mA
Oscillating	No Drive	17mA
Drive applied to TR7		20mA
Drive applied to TR8		33mA
Drive applied to TR9		59mA
Drive applied to TR10		80mA

TRANSMITTER OSCILLATOR ALIGNMENT

Alignment of the transmitter oscillator does not form part of the normal alignment procedure. The Field Testing Procedure is normally adequate for netting the equipment to the base station or realigning the oscillator if a component is changed in the oscillator circuit.

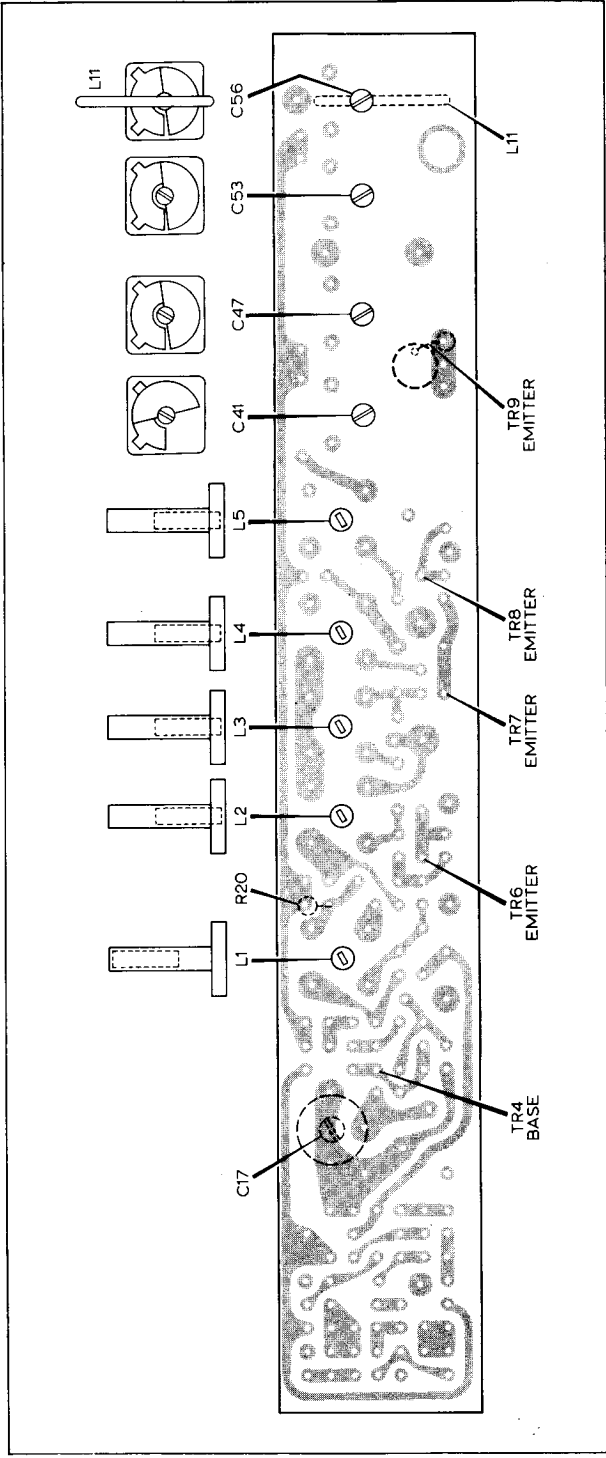
Oscillator alignment should only be carried out with test equipment of a high standard, the following direct reading instrument being recommended.

Marconi Frequency Meter TF 1417/2 with Converter TM 7164.

Detailed operating instructions are supplied by the manufacturer but the following points should be noted.

- (a) If the transmitter frequency is measured, the coupling between transmitter and frequency meter should be the minimum required to obtain a reading. In general, to avoid overloading the meter there should be no direct coupling and it may be necessary to separate the transmitter and meter by a few inches.
- (b) The transmitter crystal frequency may be measured at the collector of TR4 if a high frequency counter is not available but care should be taken to avoid pulling the crystal frequency by keeping coupling to a minimum.

TRANSMITTER ALIGNMENT



Preliminary Procedure

Connect the r. f. power indicator unit (Fig. 4) to the antenna test socket. To avoid mis-match the leads must be as short as possible. A coaxial lead of 50Ω impedance can be used provided the free ends are as short as possible.

Remove the batteries and connect the 16V variable power supply unit, monitored with a 100mA meter in the positive supply line, direct to the transmitter board.

Connect the multimeter between the negative line and the test point indicated (unless otherwise stated in Alignment Procedure).

Fig. 11 Transmitter Alignment Points

Although it is permissible to align the transmitter without the board screening can for fault finding purposes, the transmitter must be finally aligned with the screening can in position. Adjustment of the crystal trimmer C17 is made through the access hole in the screening can.

If the transmitter is completely misaligned set the tuning cores and capacitors to pre-alignment positions as shown in Fig. 11. Carry out the following Alignment Procedure with the printed circuit board screening can in position.

Alignment Procedure

Typical Reading

Test Point

Across R20	Check modulator current	4.7V
TR6 emitter	Check modulator output	0.25V
TR7 emitter	Adjust L2 and L3 for maximum	0.4V
TR8 emitter	Adjust L4 and L5 for maximum	0.7V
TR9 emitter	Adjust C41 for maximum	
	Recheck L2, L3, L4, L5 and C41	1.8V
	Set C53 and C56 for minimum capacity	
	Adjust C47 for maximum on 100mA meter	
	Adjust C56 for maximum capacity	
	Adjust C53 for maximum power output	
	Adjust C56 for maximum power output	
	Carefully readjust C47, C53 and C56 for maximum r.f. power output	150mW minimum
	Reduce the supply voltage, on load, to 14V d.c. and check that the r.f. output is at least 50mW.	
	Secure the transmitter board. Remove the test equipment and reconnect the antenna. Replace the batteries.	
	Check for maximum power output reading on a radiation indicator (or diode probe with quarter wave antenna).	
	Carry out the Field Testing Procedure and adjust the crystal trimmer C17 for zero beat note as instructed by the base station engineer.	

RECEIVER PARTS LIST

Code	CAPACITORS	Part No.	Grid Ref.	Code	CAPACITORS	Part No.	Grid Ref.
C1	2.2nF	PN34302	W3	C35	2.2nF	PN34302	S59
C2	8.5pF	PV05123	R3	C36	1nF	PN26328	U41
C3	2.2pF	PN01049	T4	C37	10nF	PN50324	Q38
C4	100pF	PN17037	T5	C38	1μF	PS13067	P42
C5	0.3pF	PN00012	N11	C39	2.2nF	PN34302	Q41
C6	8.5pF	PV05123	R9	C40	100pF	PN17037	S43
C7	15pF	PN10041	Q22	C41	1μF	PS13067	R42
C8	15pF	PN10044	T27	C42	100pF	PN17037	T44
C9	10nF	PN50324	X8	C43	1nF	PN26328	X45
C10	10nF	PN50324	W16	#C44	47pF	PN13118	R48
C11	8.5pF	PV05123	R15	#C45	0.1μF	PS00012	X50
C12	1nF	PN26328	T17	#C46	10nF	PN50324	S50
C13	70pF	PN16001	S18	#C47	10nF	PN50324	W51
C14	10nF	PN50324	X23	C48	0.1μF	PS00012	K6
C15	100pF	PN17037	W23	C49	0.1μF	PS00012	K4
C16	2.2nF	PN34302	R21	C50	4.7nF	PR09507	K9
C17	10nF	PN50324	N20	C51	4.7nF	PR09507	K12
C18	3.5-	PV05122	U23	C52	4.7nF	PR09507	J13
C19	13pF	PS26061	W13	C53	0.1μF	PS00012	G14
C20	22μF	PQ08767	W31	C54	22μF	PS26061	D5
C21	10nF	PN50324	M13	C55	1μF	PS13067	H4
C22	2.2nF	PN34302	M19	C56	47nF	PS00002	K1
C23	15pF	PN10041	M17	C57	47nF	PS00002	E1
C24	68pF	PQ07813	X35	C58	10μF	PS23063	H1
C25	33pF	PQ06164	X36	C59	22μF	PS26061	D7
C26	22μF	PS26061	N49	C60	22μF	PS26061	A1
C27	10nF	PN50324	X31	C61	Not used		
C28	10nF	PN50324	N37	C62	10μF	PS23063	A19
C29	27pF	PN11128	P31	C63	10μF	PS23063	A24
C30	70pF	PN16001	T34	C64	3.3μF	PS17208	B15
C31	10nF	PN50324	Q35	C65	1nF	PN26328	S17
C32	32pF	PN12040	X39	C66	1nF	PN26350	T11
C33	10nF	PN50324	W38	C67	1nF	PN26328	G3
C34	1μF	PS13067	R36	C68	Not used		
				C69	10nF (across RV1)	PN50314	

'Part of thin film unit on /2 version of receiver board.

RECEIVER PARTS LIST(Cont.)

Code	RESISTORS	Part No.	Grid Ref.	Code	RESISTORS	Part No.	Grid Ref.
R1	680Ω	NG68103	P24	R25	1kΩ	PL22236	P38
R2	6.8kΩ	PL22246	M23	R26	1.5kΩ	PL22238	T38
R3	180kΩ	NG18403	W4	R27*	560kΩ	NG56403	R39
R4	470Ω	PL22232	R22		680kΩ	NG68403	
R5					820kΩ	NG82403	
R6	15kΩ	NG15303	T24		0.1W ±10%	NG10503	
R7	33kΩ	PL22254	W17		0.1W ±10%	NG12503	
R8	6.8kΩ	PL22246	X17		0.1W ±10%	NG15503	
R9	390Ω	NG39103	W9		0.1W ±10%	NG18503	
R10	270Ω	PL22229	X15		0.1W ±10%	NG2503	
R11	560Ω	PL22233	X19		0.1W ±10%	NG27503	
R12*	330kΩ	NG33403	N19		0.1W ±10%	NG33503	
	390kΩ	NG39403		R28	390Ω	PL22231	P44
	470kΩ	NG47403		R29	5.6kΩ	PL22245	P42
	560kΩ	NG56403		R30	5.6kΩ	PL22245	U42
	680kΩ	NG68403		R31	27kΩ	PL22253	X44
	820kΩ	NG82403		R32	390Ω	PL22231	Q45
	1MΩ	NG10503		R33	5.6kΩ	PL22245	Q43
R13	220Ω	PL22228	N13	# R34	33kΩ	PL22254	W45
R14	1kΩ	PL22236	M15	# R35	10kΩ	PL22248	X47
R15	39kΩ	PL22255	W34	# R36	10kΩ	PL22248	R44
R16	150kΩ	PL22262	U32	# R37	470Ω	PL22232	X48
R17	100Ω	PL22224	U13	# R38	10kΩ	PL22248	T45
R18	1kΩ	PL22236	W37	# R39	4.7kΩ	PL22244	R46
R19	1.5kΩ	PL22238	M30	# R40	10kΩ	PL22248	Q49
R20	6.8kΩ	PL22246	Q32	# R41	10kΩ	PL22248	S49
R21	33kΩ	PL22254	P33	# R42	1kΩ	PL22236	W49
R22	270Ω	PL22229	S33	# R43	470Ω	PL22232	T50
R23	560Ω	PL22233	P35	R44	150Ω	PL22226	P46
R24*	330kΩ	NG33403	U40	# R45	470Ω	PL22232	U51
	390kΩ	NG39403		R46	1kΩ	PL22236	K8
	470kΩ	NG47403		R47	2.2kΩ	PL22240	K11
	560kΩ	NG56403		R48	470kΩ	PL22268	H15
	680kΩ	NG68403		R49	10kΩ	PL22248	E15
	820kΩ	NG82403		R50	1MΩ	PL22272	H9
	1MΩ	NG10503		R51	33kΩ	PL22254	J10
				R52	4.7kΩ	PL22244	E7

* selected on manufacture

Part of thin film unit on /2 version of receiver board

RECEIVER PARTS LIST(Cont.)

Code	RESISTORS (Cont.)	Part No.	Grid Ref.	Code	TRANSISTORS	Part No.	Grid Ref.
R53	33kΩ	PL22662	G6	TR1	BF180 with R3	AT10944	
R54	220kΩ	PL22264	K3	TR2	BF181	FV05156	
R55	47kΩ	PL22256	H3	TR3	GM378B	FV08139	
R56	6.8kΩ	PL22246	G4	†TR4	BC118 with R12	AT10701/1	
R57	470Ω	PL22232	JI	TR5	BC118	FV07766	
R58*	470kΩ	NG47403	B3	TR6	BC118	FV07766	
	560kΩ	NG56403		†TR7	BC118 with R24	AT10701/3	
	680kΩ	NG68403		†TR8	BC113 with R27	AT10702/1	
	820kΩ	NG82403		TR9	BC113	FV07769	
	1MΩ	NG10503		#TR10	BC113	FV07769	
	1.2MΩ	NG12503		#TR11	BC113	FV07769	
	1.5MΩ	NG15503		#TR12	BC113	FV07769	
	1.8MΩ	NG18503		TR13			
	2.2MΩ	NG22503		to			
	2.7MΩ	NG27503		TR16	BC113	FV07769	
R59	27kΩ	PL22253	C1	TR17	NKT713	FV06447	
R60	390Ω	PL22231	G8	TR18	NKT712		
R61	470Ω	PL22232	D8	TR19			
R62	2.7kΩ	PL22241	B6	to	BC113	FV07769	
R63	250kΩ	PL22872	B30	TR22			
R64	220kΩ	PL22871	A30	TR23	2C306	FV07010	
R65	10kΩ	PL22248	A26	TR24	BC113	FV07769	
R66	100kΩ	PL22260	B23	Code	DIODES		
R67	100kΩ	PL22260	B18	D1	IS44	FV09818	U25
R68	12kΩ	PL22249	B20	D2	OA95	FV09327	S40
R69	100kΩ	PL22260	D15	D3	OA95	FV09327	T41
R70	6.8kΩ	PL22246	A14	D4	IS2068A	FV09632	E6
R71	12kΩ	PL22249	A11	D5	SG22	FV07526	E26
R72	56kΩ	PL22257	A12	+D6	OA200	FV09303	
R73	10kΩ	PL22248	D14	+D7	OA200	FV09303	
R74	2.7kΩ	NG27203	U27				
+R75	1.8kΩ	NG18203					
+R76	1.8kΩ	NG18203					

R75 and R76 on charging board.
* Component selected on manufacture.

D6 and D7 on charging board
Part of thin film unit on /2 version of receiver board

RECEIVER PARTS LIST (Cont.)

INDUCTORS

x L1	L1 and C2	AT32597/3 R4	FL1	Filter (crystal) 10.7 MHz	FILTER	
L2		AT31801/1 R27		25 kHz channel spacing		FC03219
L3		AT31800/1 W2†		Filter (crystal) 10.7 MHz		
L4		FT05608 S22		50 kHz channel spacing		FC03208
L5		AT32957/2 X23				
L6		FT05608 T33		CRYSTALS		
x T1 primary	T1 and C6	AT10700/3 R9	XL1	**P63J 25 kHz channel spacing		M26
x T1 secondary	T1 and C11	AT10700/3 R15		**P61J 50 kHz channel spacing		M26
T2		AT31825/1 R19	XL2	P53J 10.8 MHz		S31
T3		AT31825/2 T35				

** Frequency to order

+ Items common to receiver and transmitter

† These transistors require their own correct matching resistor

x Items supplied as an assembly for ease of replacement

TRANSMITTER PARTS LIST

Code	CAPACITORS	Part No.	Grid Ref.	Code	CAPACITORS	Part No.	Grid Ref.
C1	1nF	PN26328	H1	C32	75pF	PQ08103	G30
C2	4.7nF	PR09507	E1	C33	150pF	PQ09405	E29
C3	1nF	PN26312	C1	C34	10nF	PN50324	H23
C4	1nF	PN26328	A3	C35	22pF	PQ05618	E33
C5	0.1μF	PS00012	B3	C36	10nF	PN50324	B32
C6	1nF	PN26328	D3	C37	10nF	PN50324	B33
C7	Not used	PR09507	G2	C38	5.6pF	PN04142	E35
C8	4.7nF	250V		C39	10nF	PN50324	H37
C9	Not used	250V		C40	30nF	PQ06007	G36
C10	4.7nF	250V	G5	C41	8.5pF	PV05123	D42
C11	10μF	20V	H7	C42	1nF	PN26328	H41
C12	Not used	Not used		C43	1nF	PN26328	A35
C13	47nF	20V	D5	C44	10pF	PN09047	B42
C14	0.1μF	35V	H8	C45	1nF	PN26328	H46
C15	Not used	Not used		C46	1nF	PN26328	H47
C16	Not used	Not used		C47	8.5pF	PV05123	D46
C17	3.5- 13pF		G12	C48	1nF	PN26328	A44
C18	33pF	125V ± 2%	D13	C49	10nF	PN50324	H55
C19	10nF	+80% -20%	G14	C50	1nF	PN26328	G47
C20	510pF	125V ± 2%	B16	C51	1nF	PN26328	H50
C21	47pF	125V ± 2%	A15	C52	10μF	PS23063	H49
C22	10μF	20V +80%	E22	C53	8.5pF	PV05123	D51
C23	10μF	30V -20%	G20	C54	1nF	PN26328	H52
C24	0.1μF	35V	D16	C55	1nF	PN26328	H52
C25	220pF	125V ± 2%	G18	C56	8.5pF	PV05123	D55
C26	0.1μF	35V	A19				
C27	10nF	30V +80% -20%	H25				
C28	47pF	125V ± 2%	B22				
C29	56pF	125V ± 2%	B20				
C30	56pF	125V ± 5%	G24				
C31	10nF	30V +80% -20%	A24				

TRANSMITTER PARTS LIST (Cont.)

Code	RESISTORS	Part No.	Grid Ref.	Code	RESISTORS	Part No.	Grid Ref.
R1	5.6kΩ	PL22245	A4	R12 *	680kΩ	NG68403	B8
R2 *	2.7MΩ	NG27503	A2		820kΩ	NG82403	
	3.3MΩ	NG33503			1MΩ	NG10503	
	3.9MΩ	NG39503			1.2MΩ	NG12503	
	4.7MΩ	NG47503			1.5MΩ	NG15503	
	5.6MΩ	NG56503			1.8MΩ	NG18503	
	6.8MΩ	NG68503			2.2MΩ	NG22503	
R3	5.6kΩ	PL22245	H3		2.7MΩ	NG27503	
R4 *	1MΩ	NG10503	D2		3.3MΩ	NG33503	
	1.2MΩ	NG12503		R13	470Ω	PL22232	E7
	1.5MΩ	NG15503		R14	27kΩ	PL22253	B14
	1.8MΩ	NG18503		R15	27kΩ	PL22253	E14
	2.2MΩ	NG22503		R16	1kΩ	PL22236	G16
	2.7MΩ	NG27503		R17	1kΩ	PL22236	E15
	3.3MΩ	NG33503		R18	3.3kΩ	PL22242	C17
	3.9MΩ	NG39503		R19 *	270kΩ	NG27403	H19
	4.7MΩ	NG47503			330kΩ	NG33403	
R5	390Ω	PL22231	C4		390kΩ	NG39403	
R6	100Ω	PL22224	H14		470kΩ	NG47403	
R7	4.7kΩ	PL22244	H4		560kΩ	NG56403	
R8	22kΩ	PL22252	C6		680kΩ	NG68403	
R9 *	100kΩ	NG10403	A6		820kΩ	NG82403	
	120kΩ	NG12403			1MΩ	NG10503	
	150kΩ	NG15403			1.2MΩ	NG12503	
	180kΩ	NG18403			1.5MΩ	NG15503	
	220kΩ	NG22403		R20	4.7kΩ	PL22244	H21
	270kΩ	NG27403		R21	2.2kΩ	PL22240	A23
	330kΩ	NG33403		R22	22kΩ	PL22252	C21
	390kΩ	NG39403		R23	1kΩ	PL22236	H22
	470kΩ	NG47403		R24	100Ω	PL22224	R25
	560kΩ	NG56403		R25	22kΩ	PL22252	C30
	680kΩ	NG68403		R26	2.2kΩ	PL22240	C29
R10	82kΩ	PL22259	A5	R27	1kΩ	PL22236	H35
R11	1kΩ	PL22236	E6	R28	100Ω	PL22224	A34
				R29	100kΩ	PL22260	E37
				R30	2.2kΩ	PL22240	C34
				R31	470Ω	NG47103	H43

* selected on manufacture

TRANSMITTER PARTS LIST (Cont.)

Code	RESISTORS (Cont.)	Part No.	Grid Ref.	Code	INDUCTORS	Part No.	Grid Ref.
R32	100Ω	PL22224	A37	xL1	L1 with C23 and C25	AT31776/13	E19
R33	100Ω	NG10103	H45	xL2	L2 with C27 and C30	AT31775/13	E25
R34	180Ω	NG18103	A45	xL3	L3 with C32 and C33	AT31775/14	E29
R35	Not used			xL4	L4 with C35	AT31777/13	E33
R36	Not used			xL5	L5 with C38, C39, C40 & R29	AT31777/14	E37
R37	10Ω	NG10003	H47	xL6	L6 with C41	AT10700/4	D40
R38-74	Not used			L7		AT31150/1	A43
+ R75	1.8kΩ	NG18203		xL8	L8 with C47	AT10700/1	D46
+ R76	1.8kΩ	NG18203		L9		AT31150/2	H48
				xL10	L10 with C53	AT10700/1	D51
				xL11	L11 with C56	AT10700/2	D55

R75 and R76 on charging board.

Code	TRANSISTORS	Part No.	Grid Ref.	Code	CRYSTAL	Part No.	Grid Ref.
†TR1	U15880/1 with R2	AT10945		XL1**	P64J 25kHz channel spacing		B11
†TR2	BC113 with R4	AT10703/3		**P62J	50kHz channel spacing		B11
†TR3	BC113 with R12	AT10703/5			** frequency to order		
TR4	BC118	FV07766			DIODES		
†TR5	BC118 with R19	AT10701/5					
TR6	BF152	FV07758		D1	OA200	FV09303	B4
TR7	BF152	FV07758		+D6	OA200	FV09303	
TR8	BF152	FV07758		+D7	OA200	FV09303	
TR9	SE3002	FV07765					
TR10	2N3866	FV07573			D6 and D7 on charging board		

* Component selected on manufacture

+ Items common to receiver and transmitter

† These transistors require their own correct matching resistor

x Items supplied as an assembly for ease of replacement

TRANSMITTER AND RECEIVER - MISCELLANEOUS

ACCESSORIES

SA/RV1	Potentiometer/switch	PL09022/1		
SB	Switch, press-to-talk	FS07052/2		FP11106
JK	Jack socket (earpiece)	FS42751		FH01006
SKA	Antenna test socket (see accessories)	FS41107		
LS	Loudspeaker 2 inch	FC13021		
MIC	Microphone	FM03519		
	Battery 9V (2 required)	FB01266		
	Thin film unit (receiver)	FU00040		
<u>PRINTED CIRCUIT BOARD ASSEMBLIES</u>				
	Transmitter board assembly	AT26731/1		AT10637
	Receiver board assembly	AT26735/1		AT10638
	Receiver board assembly with thin film unit			AT10639
	Charging board assembly	AT26735/2		AT10640
		AT26765		AT25800
<u>OPTIONAL ITEMS</u>				
Carrying Case				AT26013
Strap				BT16726
Strap Assembly (Neck)				BT02908
Audio Extension Lead 36 inches (91 cm)				BT03258
Audio Extension Lead 15 inches (38 cm)				BT08667
Tube Assembly 7 inches (18 cm)				BT03260/1
Tube Assembly 24 inches (61 cm)				BT03261
Epaulette Speaker Assembly				BT15959
Earpiece				BT15960
Earhanger Danovox 3511-66				BT19525
Earhanger Danovox 3512-11				ET11160
				ET24644
				BT27305
				BT27307
				QA00576
				RY11003/M
				RY11004/M
				RW11006/M
				RW51014/C
				QU41104/M
				ET07708
				FT10524
				FS22580
				ET16450, ET16451, ET16452

APPENDIX

COMPACT RADIOTELEPHONE

RECEIVER INCORPORATING THIN FILM CIRCUITS

Introduction

In some models of the Compact the receiver has a thin film circuit. This is a sealed unit which replaces the existing Schmitt trigger, integrator and associated components.

Servicing

The thin film circuit unit shown within the dashed lines in the receiver circuit diagram in this manual is a sealed unit, repair or replacement of components within the unit is not possible. Therefore, before attempting to remove the unit it is extremely important to ensure that suspected faults within the unit are accurately diagnosed.

Before removing a thin film circuit unit from the receiver board the following measurements should be made using a 9V power supply, with R51 short circuited to render the squelch and battery economiser circuits inoperative.

1. D. C. voltage between Point C and negative line, typical value 8V.
2. D. C. voltage between Point D and negative line, typical value 7.6V.
3. D. C. voltage between Point A and negative line, typically 3.6V no signal or 1.2V with 100 μ V r. f. to antenna terminal.
4. A. C. voltage measured on an oscilloscope between Point A and negative line, typically 2V p-p no signal or 3.5V p-p with 100 μ V r. f. to antenna terminal.

5. D. C. voltage measured across points D and E, typical value 2.5V.
6. A. C. voltages measured between point E and negative line.

- (a) With no signal typical value 0.5V p-p.
- (b) With 100 μ V r. f. input unmodulated to antenna terminal, maximum value 40mV p-p.
- (c) With 100 μ V r. f. input 1000 Hz modulation \pm 15 kHz deviation (50 kHz channel spacing) typical reading 250mV p-p or \pm 5 kHz deviation (25 kHz channel spacing) 80mV p-p.

If the values obtained (items 1-4) do not approximate to those given and the values under 5 and 6 are not obtained the unit should be replaced.

Remove the short circuit across R51 so that the squelch and battery economiser circuits can operate.

NOTE

It is requested that faulty thin film circuit units be returned to the nearest Pye Service Depot.

Parts List

Referring to the receiver parts list the components affected are as follows:-

Delete: TR10, TR11 and TR12
C43 to C47
R34 to R43 and R45

Add: One thin film circuit unit
Part No. FU00040

APPENDIX

BATTERY CHARGER BC7

Introduction

The battery charger BC7 provides facilities for simultaneously charging twenty-four 9V batteries. It operates from a standard a.c. power supply.

A metering circuit is provided for checking the battery state prior to charging.

A Charge/Trickle switch provides full and half charge rates.

Summary of Data

Power Supply 100-150V or 190-240V $\pm 5\%$ a.c.
50-60 Hz

Charging Rate Trickle charge 3mA
Full charge 7mA

Controls A.C. POWER on/off switch
CHARGE/TRICKLE switch
TEST pushbutton

Dimensions $17\frac{3}{4}$ in. x 5 in. x $4\frac{1}{2}$ in.
(45 x 12.7 x 11.4 cm)

Weight 7 lb 2 oz (3.2 kg)

Part Number AT00040/2

Charging Procedure

On return from duty remove the two batteries from the Compact radiotelephone. Check each battery by inserting it into the TEST socket and operating the TEST button for approximately 1 sec. The meter reading indicates the charge period required.

Insert the batteries into the charging sockets. (Up to 24 batteries can be charged simultaneously). With a chinagraph pencil, note on the charging instruction card in the appropriate space provided, the number of hours charge required and the time at which the batteries will be fully charged.

At the end of the charge period, remove the batteries and delete the charging information, relative to the batteries, from the charging instruction card.

Operating Notes

1. The normal charge time for a fully discharged battery will be 14 hours and the charge rate 7mA.
2. If a misleading reading is suspected or if in any doubt about the required charge period indicated, the battery can be discharged at a rate of 15mA for 5 hours.
3. When it is expedient for the charge time to exceed 14 hours or when the discharge duty cycle regularly uses less than half the battery life, the trickle charge (half charge rate) should be used.
4. As the charge curve and discharge curve are dissimilar for the Nickel Cadmium battery, a misleading meter indication will be given if the battery on test has been on charge and has not had a period of discharge duty. Therefore do not use the TEST socket to check the battery state at the end of a charge period.

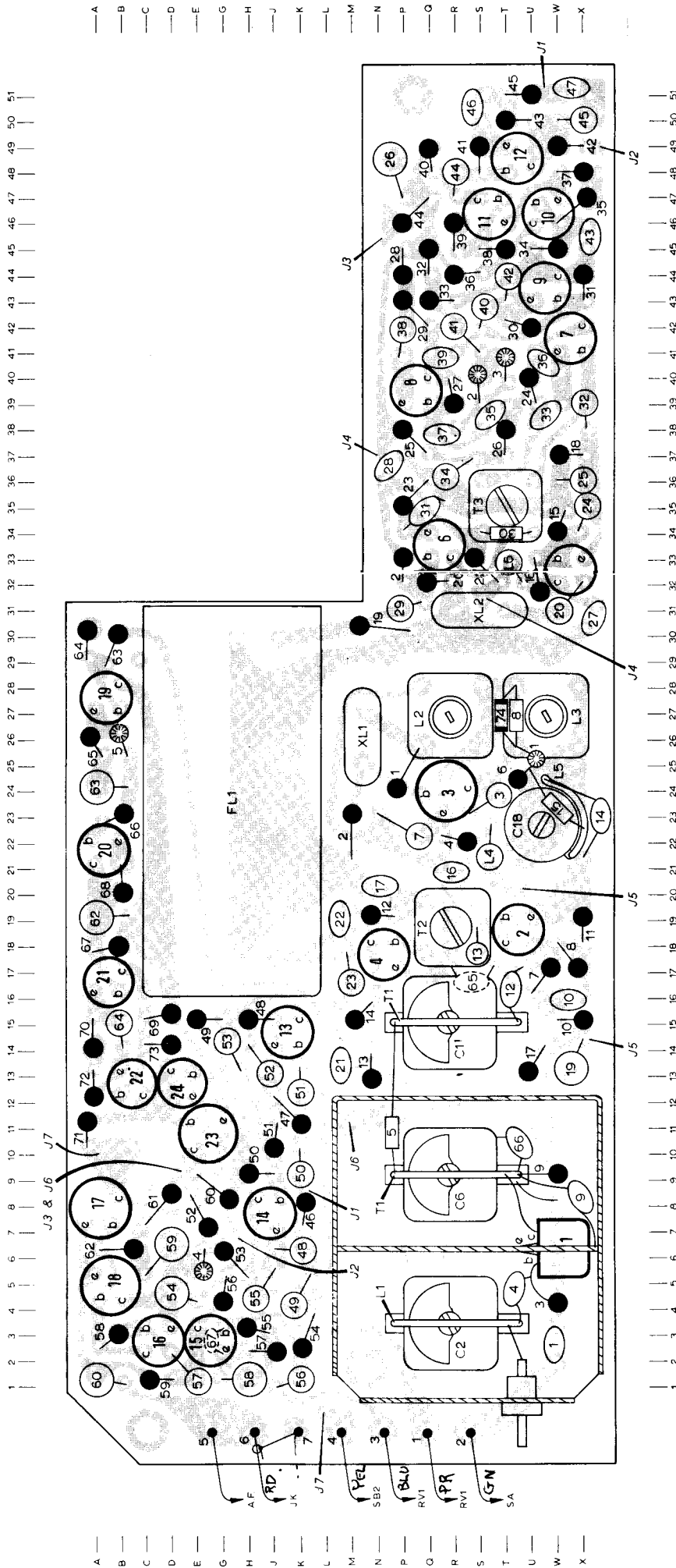


Fig. 12 Receiver Component Location Diagram - Top View

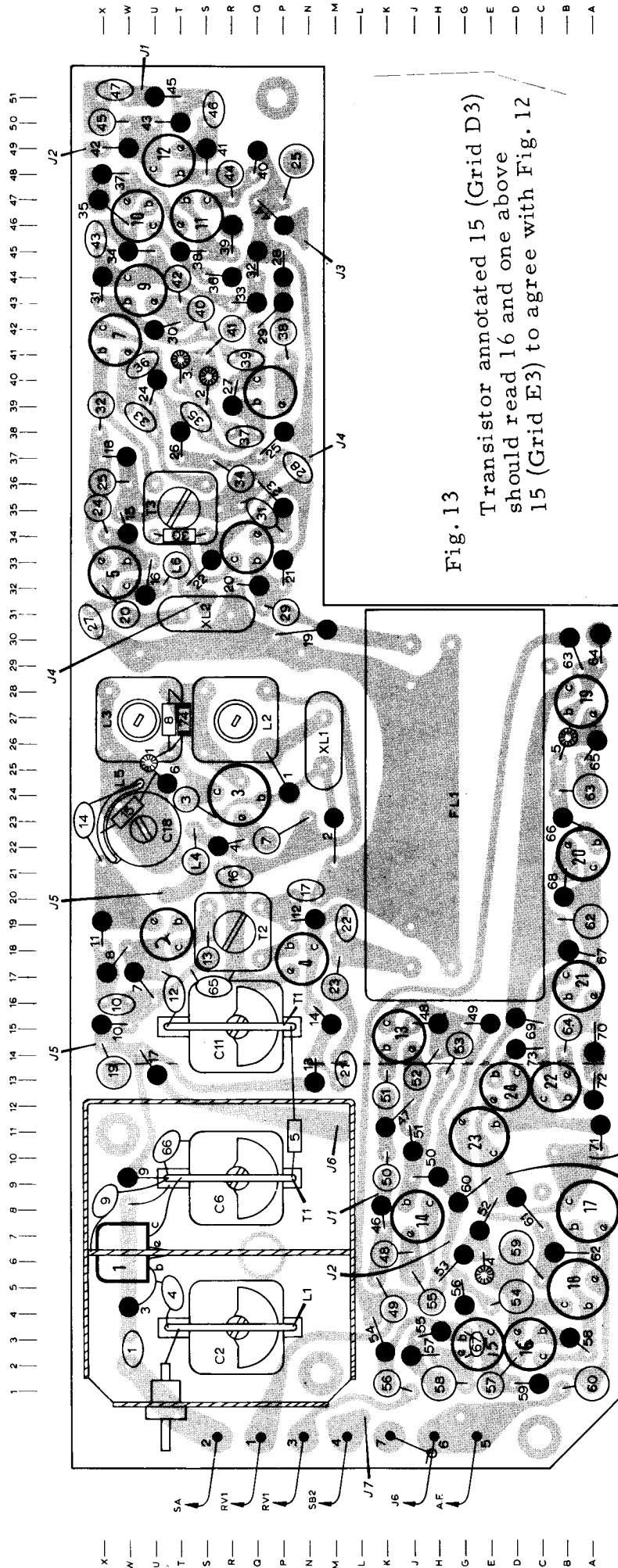


Fig. 13

Transistor annotated 15 (Grid D3)
 should read 16 and one above
 15 (Grid E3) to agree with Fig. 12

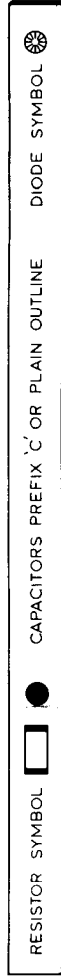
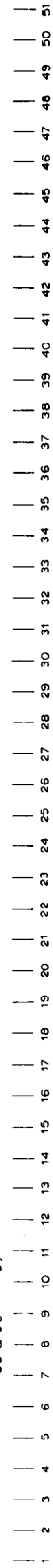


Fig. 13 Receiver Component Location Diagram - Bottom View

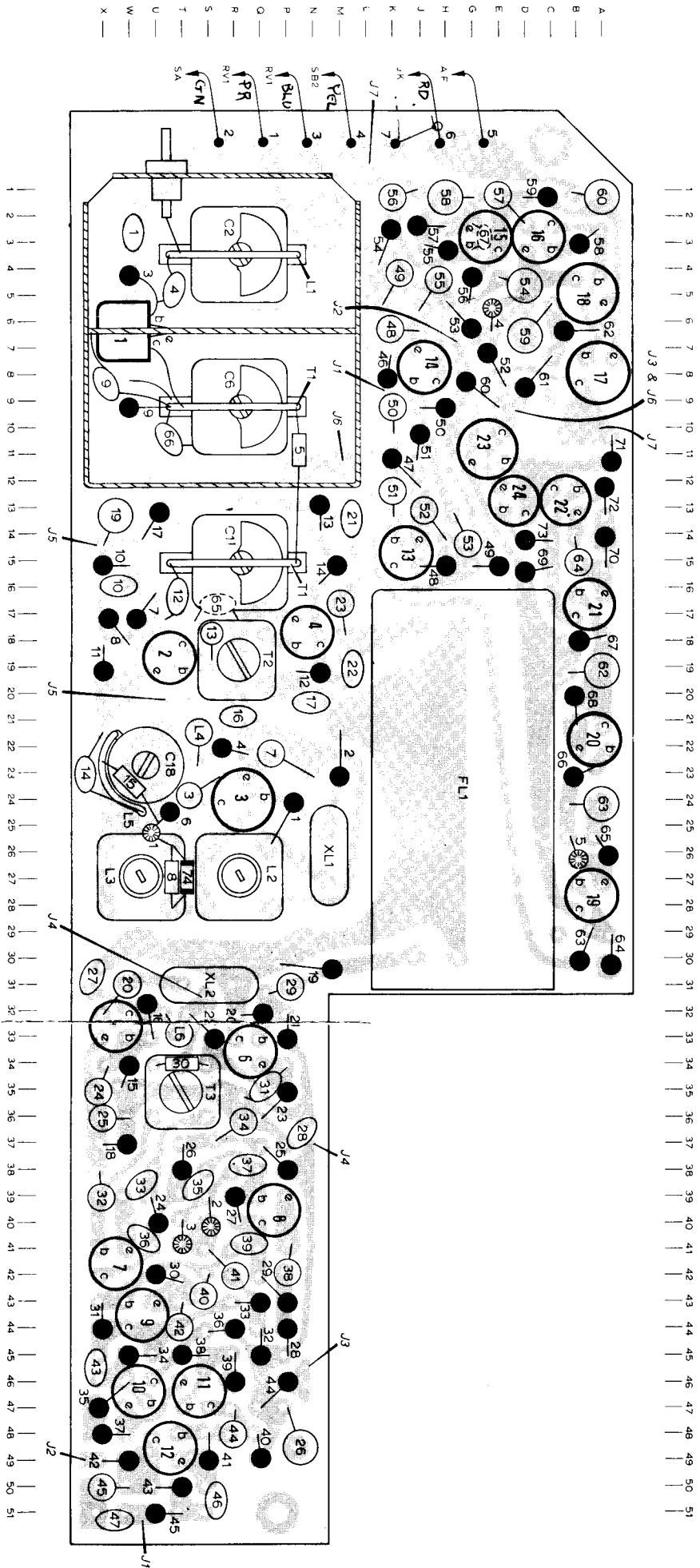


Fig. 12 Receiver Component Location Diagram - Top View

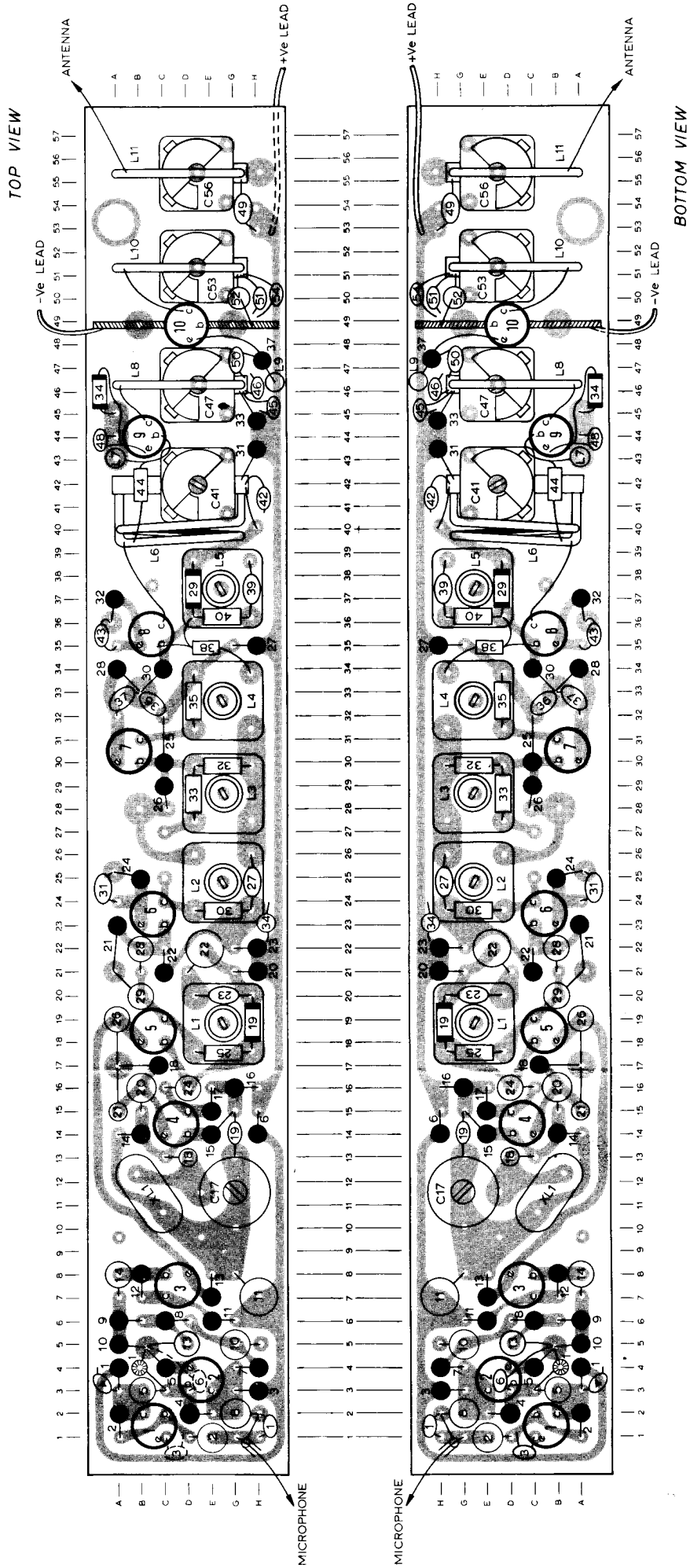


Fig. 15 Transmitter Component Location Diagram

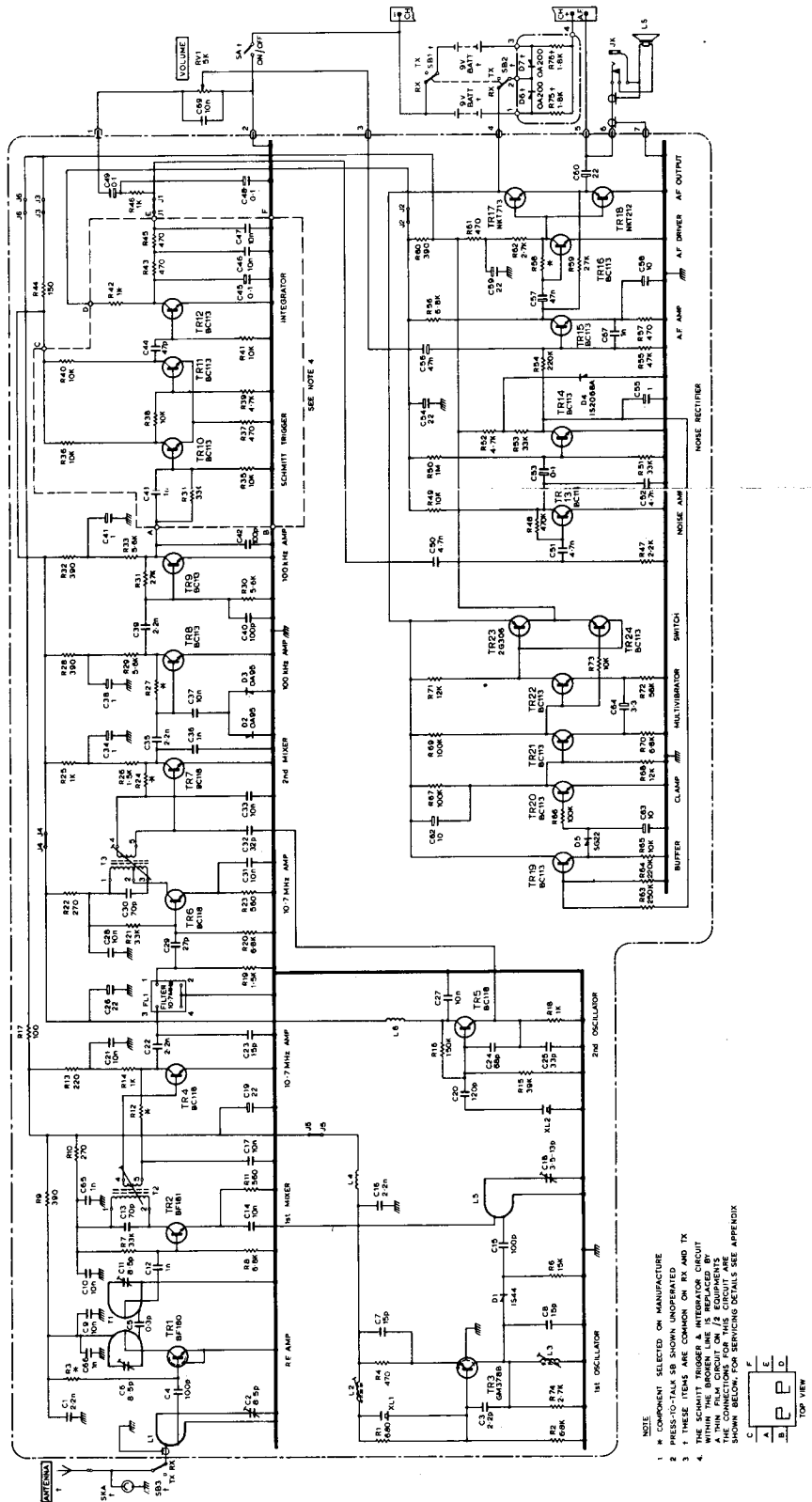


Fig. 14 Receiver Circuit Diagram

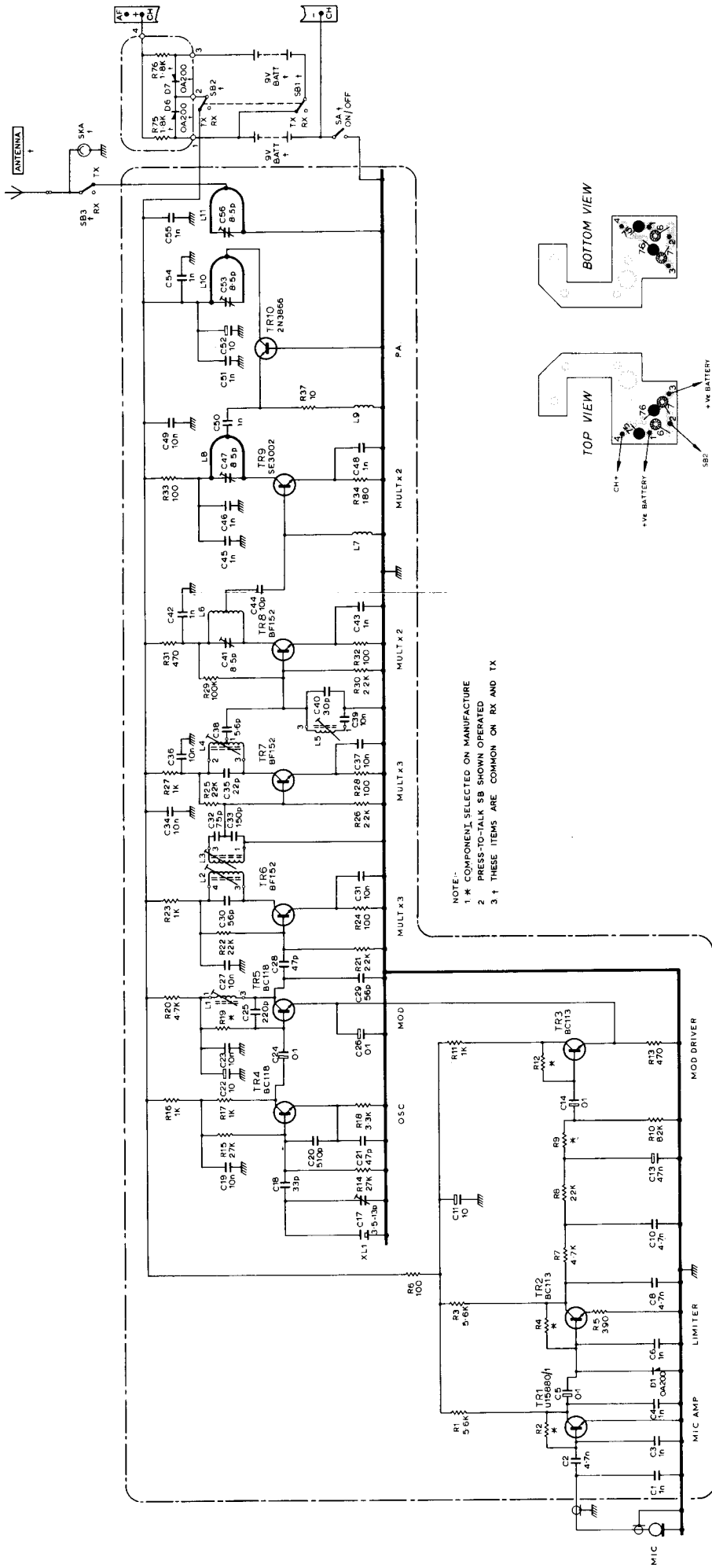
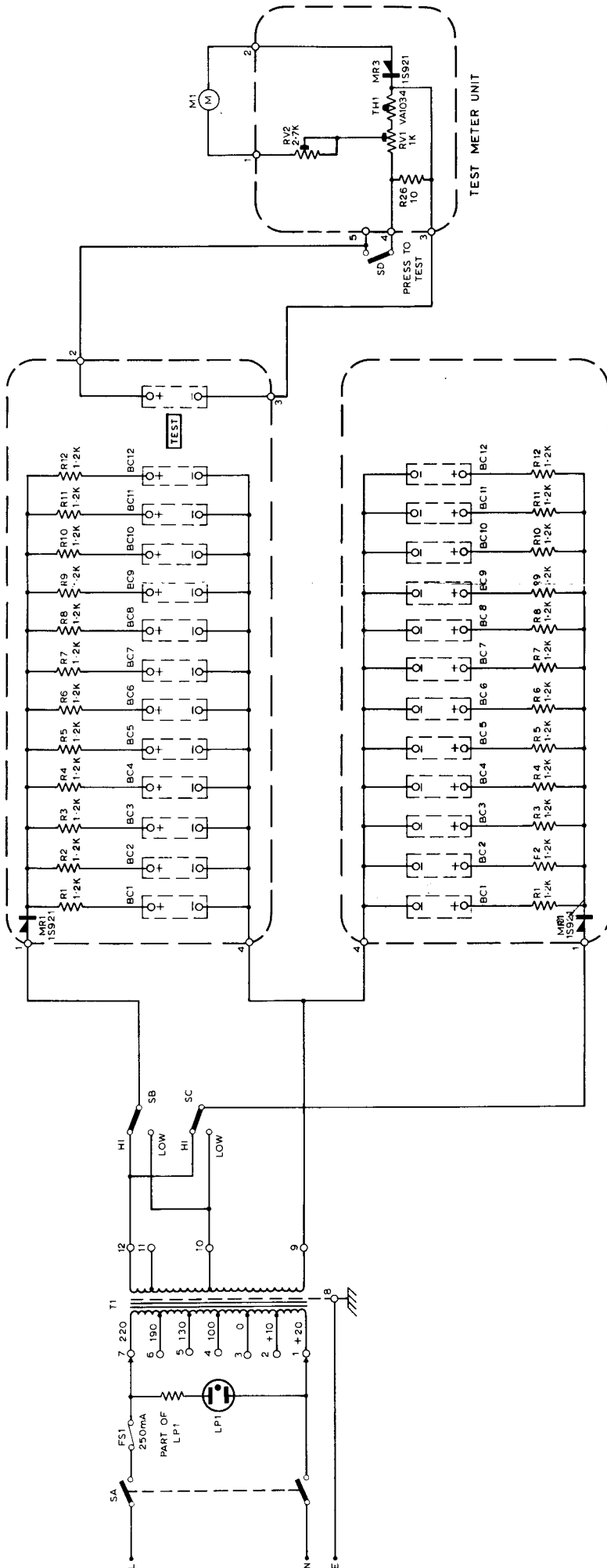


Fig. 16 Transmitter Circuit Diagram



Battery Charger BC7

January 1968

COMPACT RECEIVER WITH 80 db FILTER
(50 kc/s channel spacing)

SUPPLEMENT TO COMPACT SERVICE MANUAL

This supplement enables the Compact service manual to be used for the receiver with the 80db filter.

The following modifications to be read in conjunction with the receiver circuit in the service manual.

R14	delete	1k Ω	Part No. PL22236
	add	2.2k Ω	Part No. PL22240
Delete	C23	15pF	Part No. PN10041
Replace with	R77	1k Ω	Part No. PL22236
FL1	delete	Filter	Part No. FC03206 or FL03208
	add	Filter	80 db Part No. FC03227