MINI-COMM RECEIVER

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You do not have to leave this receiver behind when going camping, caravanning, or when pressed for space, as it is small in size, with internal battery and loudspeaker. Despite this, it has a very good performance for the reception of AM, CW and SSB on the short wave bands, in addition to normal medium wave reception.

CIRCUIT

Fig. 1 is the complete circuit, except for the BFO which is necessary for receiving CW and SSB. As this section is not required for general listening it is wired as a separate unit.

Sockets A1 and A2 are alternative aerial input points. A1 is most suitable for a reasonably long wire aerial, while A2 is better for a telescopic rod or short aerial. The "Blue" aerial coil is tuned by its own 365pF variable capacitor VC1, so that it can always be peaked up for best results with any aerial, no separate trimming being needed with this arrangement.

Tr1 is the OC170 RF amplifier, with the RF gain control VR1. The "Yellow" mixer coil is tuned by VC2, which is one section of a 2-gang tuning capacitor. The panel trimmer VC4 allows this circuit to be trimmed when coils are changed, or at any point of the band covered.

The "Red" oscillator coil is tuned by the second section of the ganged capacitor, VC3. VC5 is the bandspreading capacitor, which greatly simplifies accurate tuning on the congested SW bands. A 3-gang component, giving simultaneous tuning of aerial, mixer and oscillator circuits could have been used, but was felt to be unnecessary because aerial and mixer circuits can be peaked up for any setting of VC5, by means of VC1 and VC4, if necessary. There is thus no loss of efficiency with this simplified arrangement—in fact, all circuits can be tuned for best results at any frequency.

Bands are covered by inserting a set of three coils for each waveband. Provision is made for four wavebands. The "Red" oscillator coils require series padders of 350pF, 1000pF (or 1100pF) and 3000pF for the lower frequency ranges, and a direct connection for the highest frequency range. These padders, CP1, CP2 and CP3 are wired to separate holder tags

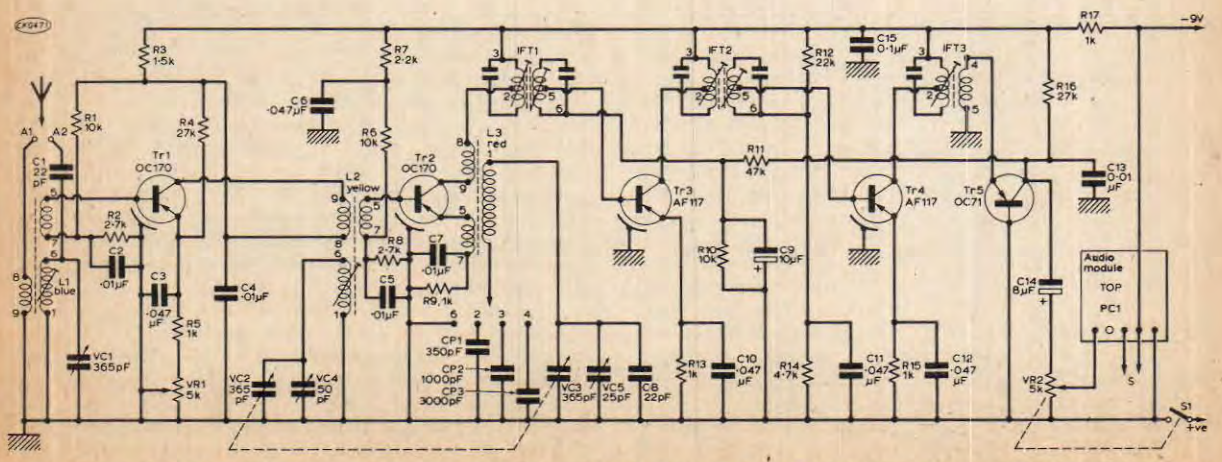


Fig. 1: Circuit of the Mini-Comm receiver. The circuit of the optional BFO is shown in Fig. 6. The photograph above shows the complete receiver, the speaker being mounted on the righthand side panel.

as in Fig. 1, so the correct padder is automatically included in circuit when the "Red" coils are changed.

The 2-stage IF amplifier has five tuned circuits in all, and although more complicated amplifiers were tried, this one was adopted on the grounds of easy construction, good gain and selectivity. Transistor Tr5 is a grounded base emitter detector with AGC fed from the collector through R11 to Tr3.

A 150mW packaged audio amplifier is fed from the volume control VR2 and gives sufficient output for most circumstances using the small internal speaker. A panel jack allows headphones to be plugged in when preferred.

Using the circuit in Fig. 1, the receiver gives AM reception over all usual short wave and medium wave bands. For the reception of CW and SSB signals on amateur or other frequencies a beat frequency oscillator has to be added, and this is covered later. Should CW/SSB reception be omitted, two panel holes for the BFO "pitch" capacitor and AM-CW/SSB switch will not be necessary.

Capacitor VC1 is mounted with three countersunk 4BA bolts, washers or spacers about $\frac{1}{8}$in. thick being placed between the capacitor and panel, the spindle passing through a $\frac{3}{8}$in. or $\frac{1}{2}$in. dia. clearance hole. Take care that the bolts do not penetrate beyond the thickness of the capacitor front frame. Before mounting VC1, solder a lead to its rotor (chassis) tag, to go to a tag MC bolted at the "Blue" coil holder as in Fig. 2.

Gang VC2/3 is mounted in the same way and two leads are soldered to its central rotor tag. One runs directly to a tag at the "Yellow" coil holder and the other to a tag at the "Red" coil holder. The small drive used for VC5 is fixed to the panel with two 8BA bolts while VC5 itself is fixed to a bracket cut from scrap. Drive and capacitor should be lined up carefully.

The controls are positioned as in Fig. 3. As mentioned, S2 and VC6 will be required for the BFO only so if these items are not wanted VR1 can be moved to the VC6 position, for a symmetrical layout.

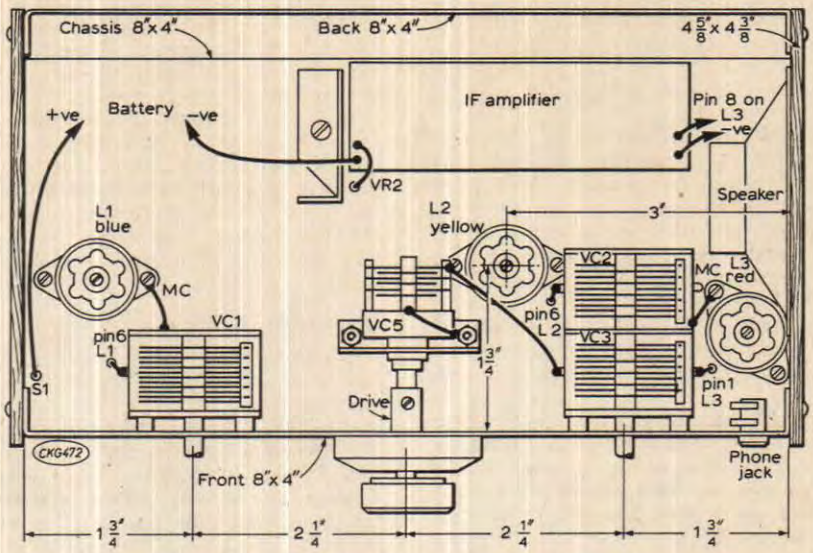


Fig. 2: Layout of the major components on top of the chassis.

GENERAL CONSTRUCTION

The receiver chassis is an 8 x 4in. "universal chassis" flanged member punched to take the coil-holders as in Fig. 2. A second 8 x 4in. flanged member forms the panel. The end flanges of the chassis member are cut so that they fit inside the flanges of the panel and bolts pass through the front flange to secure the chassis at a height of $1\frac{1}{4}$in.

Both sides are $\frac{1}{8}$in. or similar hardboard, $4\frac{5}{8}$ x $4\frac{5}{8}$in. Bolts hold the sides to the chassis and panel flanges. The right side has an aperture for the speaker with perforated zinc or speaker material placed behind the opening. It is as well to leave the speaker off until construction is otherwise finished.

The case back is a third 8 x 4in. member. A bracket is cut from scrap or a spare member so that a PP9 battery can be placed as shown. Both top and bottom are 8 x $4\frac{1}{2}$in. and can be metal or other material such as hardboard, paxolin sheet, or plywood. Self-tapping screws hold these parts to the front and back flanges.

As there is not much spare space under the chassis, the panel holes for these items come almost against the front flange of the chassis. In order that the controls are not tilted by this, it is necessary to fit one or more washers on each bush and to cut the flange to clear these. Alternatively, use five washers such as those punched out for the coil holders and cut a flat on each to clear the chassis flange.

Most of the wiring in Figs. 2 and 3 can then be done, mounting resistors and capacitors directly on the coil holder tags, as shown. Some 20 or 22swg tinned copper wire is suitable for other connections, with insulated sleeving.

The leads from Tr1 and Tr2 are left almost full length. It may be preferred to use coloured sleeving on the wires say green for emitter, blue for base, and orange for collector, with the shield wire bare or red.

The small circuit board in Fig. 3 carries the components shown in Fig. 4 and is wired separately. For external connections, insert Veropins or leave a projecting wire.

★ components list

Resistors

R1	10kΩ	R8	2·7kΩ	R15	1kΩ
R2	2·7kΩ	R9	1kΩ	R16	27kΩ
R3	1·5kΩ	R10	10kΩ	R17	1kΩ
R4	27kΩ	R11	47kΩ	R18	1kΩ
R5	1kΩ	R12	22kΩ	R19	22kΩ
R6	10kΩ	R13	1kΩ	R20	4·7kΩ
R7	2·2kΩ	R14	4·7kΩ	R21	390Ω

All 10% ¼ watt

VR1 5kΩ linear VR2/S1 5kΩ log. with switch

Capacitors

C1	22pF SM	C12	0·047μF
C2	0·01μF	C13	0·01μF
C3	0·047μF	C14	8μF 6V W
C4	0·01μF	C15	0·1μF
C5	0·01μF	C16	0·1μF
C6	0·047μF	C17	0·01μF
C7	0·01μF	C18	0·01μF
C8	22pF SM	C19	5pF SM
C9	10μF 6VW	CP1	350pF SM
C10	0·047μF	CP2	1000pF SM
C11	0·047μF	CP3	3000pF SM

VC1 365pF variable (Jackson type O with slow motion drive)
VC2/3 365 + 365pF variable (Jackson type O with slow motion drive)
VC4 50pF variable (Jackson type C804)
VC5 25pF variable (Jackson type C804)
VC6 15pF variable (Jackson type C804)

Semiconductors

Tr1	OC170	Tr3	AF117	Tr5	OC71
Tr2	OC170	Tr4	AF117	Tr6	OC45

D1 Zener diode 6·8V

Miscellaneous

L1/2/3, Transistor miniature plug-in-coils, 'Blue', 'Yellow' and 'Red' for ranges required (Denco). L4, BFO coil (Denco IFT14). Valveholders B9A for coils (3). Audio module, PC1 (Newmarket). Slow motion dial 1½in. (Eagle). Output jack. AM-CW/SSB switch, 2 pole 2-way wafer. Speaker, 2½in. 30–60Ω. Veroboard 0·15in. matrix. Universal flanged chassis members, 8 × 4in. (Home Radio). Hardboard, knobs, etc. IFT1/IFT2 (Denco IFT18/465). IFT3, (Denco IFT14/465).

A ½in. 6BA bolt is fixed to the chassis in the position shown in Fig. 3 and an extra nut put on it, so that the board will be clear of the metal. The board is then placed as in Fig. 3, and fixed with a further nut.

The tag MC (Fig. 4) under the board is the chassis return.

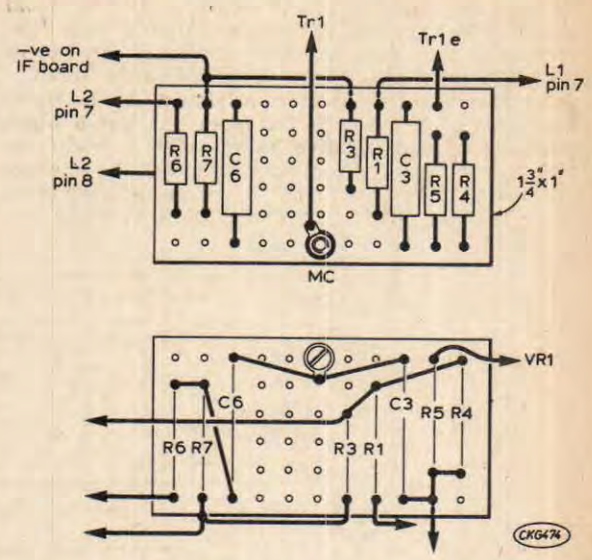


Fig. 4: Layout of the RF board.

IF AMPLIFIER

A piece of Veroboard is cut having 7 rows of holes one way, and 23 rows the other way, or $3\frac{1}{2}$ x $1\frac{1}{8}$in. Components and leads can then be placed exactly as in Fig. 5 with the minimum of difficulty.

Drill holes for 6BA bolts to fix tags MC, place the board on the chassis as in Fig. 2, and drill matching holes in the chassis. Holes have to be drilled for the IFT's so that the pins are located as in Fig. 5. Probably the easiest method is to secure the board by one long edge in a vice and drill the holes, then if some do not match the pins with sufficient

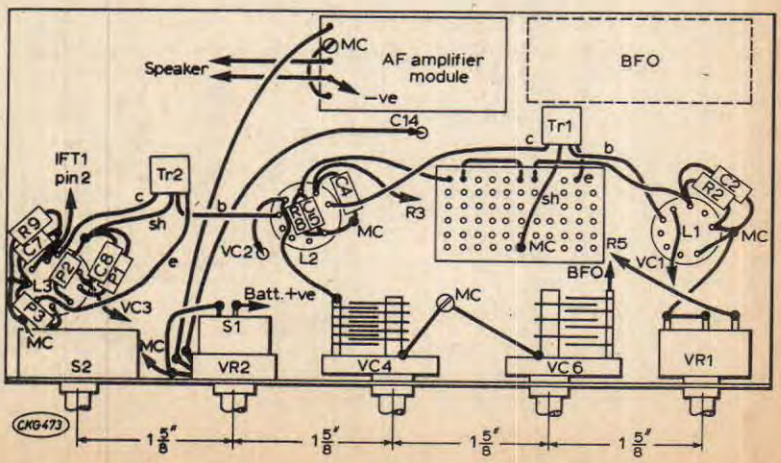


Fig. 3: Arrangement of parts and wiring underneath the receiver. Top centre is seen the audio module and to its right the BFO board. The board at centre right carries some of the RF components and wiring.

accuracy, to use a very small round file to enlarge the holes until the IFT's fit. A central hole is necessary under IFT1 and IFT2 to reach the lower cores.

Components can then be placed as in Fig. 5. In most places the wire ends of resistors and capacitors are long enough, so they are bent over, soldered and snipped off. Sleeving is put where needed to avoid shorts. The tags MC are secured tightly with $\frac{1}{2}$in. 6BA bolts and nuts and one screening can tag of each IFT must also be wired to this earth circuit.

Fit four Veropins or wires as shown. At the right-hand end of the board "9V negative" has a black flexible lead and negative battery clip. A lead from C14 positive will run to VR2, as shown. At the other end of the board, IFT1 pin 2 will be connected to tag 8 of the "Red" coil holder. A wire from the pin "negative for RF and mixer" will run to R3 and R7 on the under-chassis board.

Pieces of sleeving about $\frac{3}{8}$in. long on the transistor wires will prevent shorts here and raise them a little above the board. Solder these wires directly to the points in Fig. 5 and snip off excess wire.

The IF amplifier can be tested by connecting a battery and phones (or AF amplifier) and injecting a signal at pin 2 of IFT1 from a signal generator. As the IFT's are pre-aligned by the maker, the cores should be left as they are until proper results are obtained, and only touched up as required afterwards.

The IF amplifier is mounted with lock nuts, making sure that there is no possibility that leads or joints will touch the chassis. Leads can then be connected as shown.

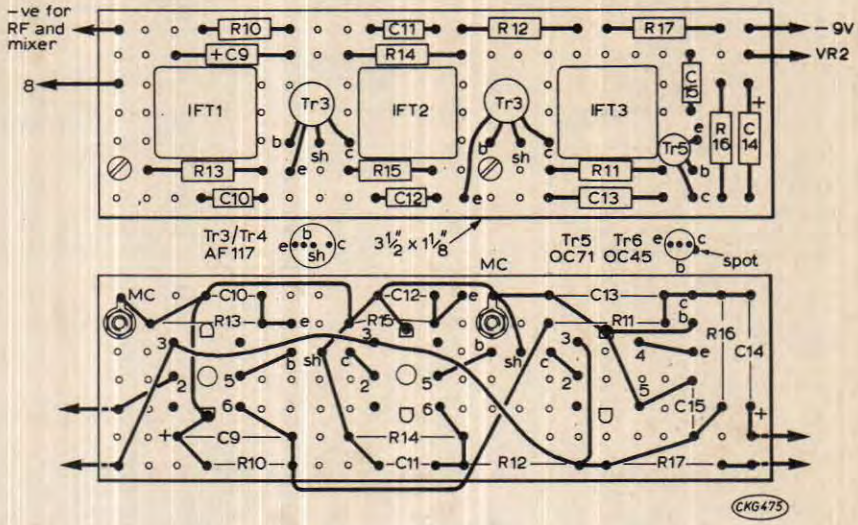
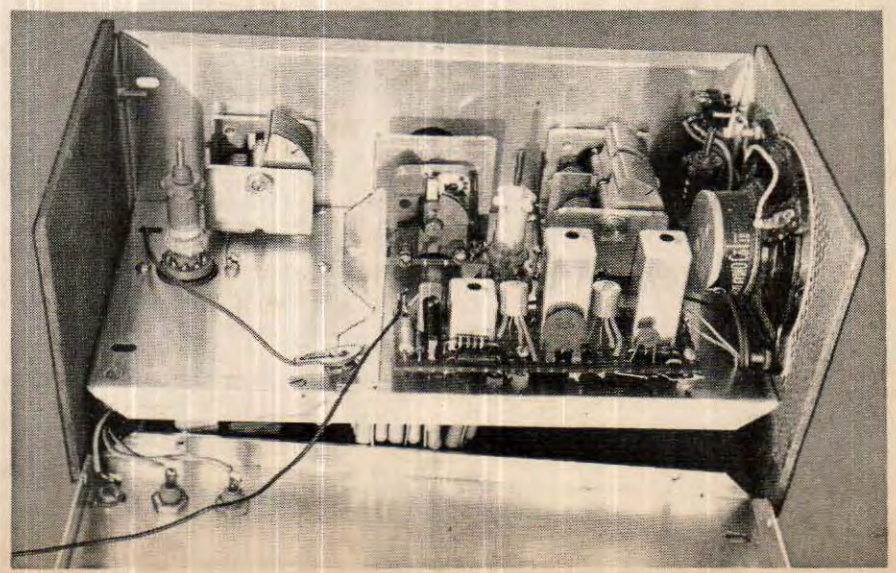
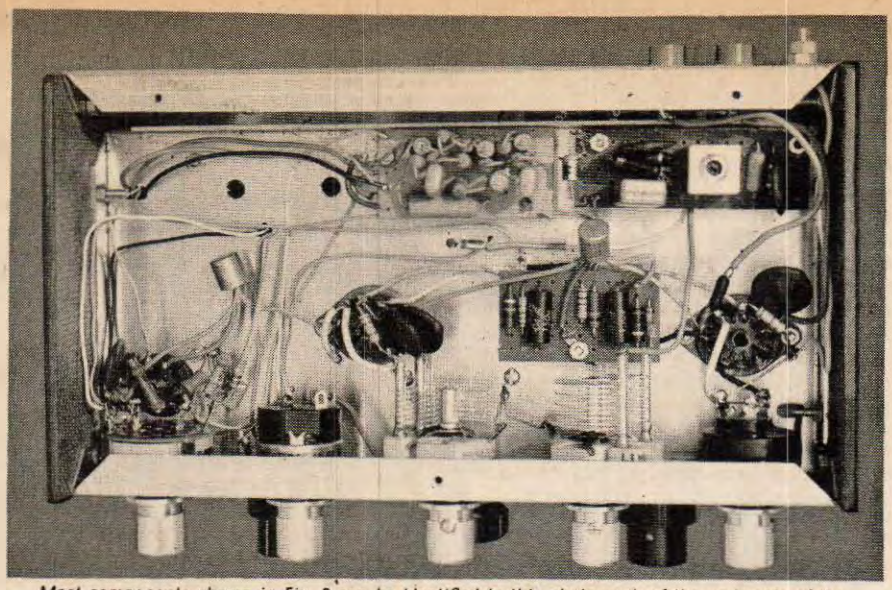


Fig. 5: Details of the wiring and construction of the IF strip. This can be tested and roughly aligned before being fitted into the chassis.



A useful view of the receiver with the back removed to enable the IF strip to be seen.



Most components shown in Fig. 3 can be identified in this photograph of the underside of the receiver.

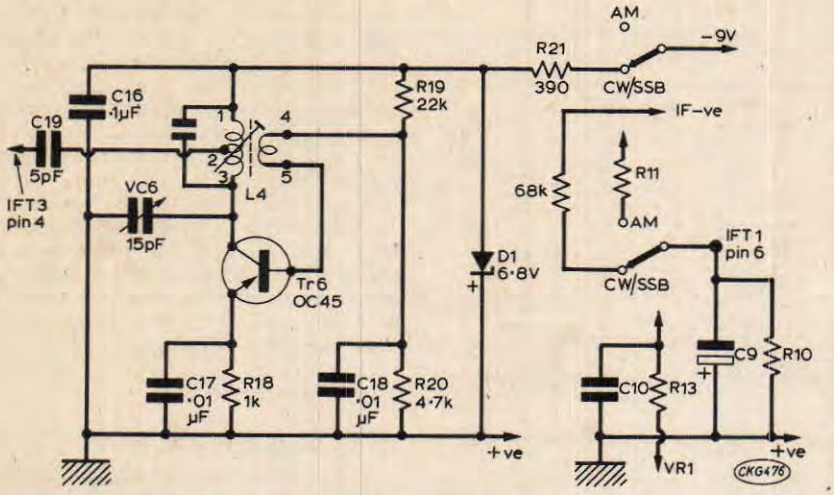


Fig. 6: The circuit of the optional BFO. The leadout connections for the OC45 can be found on Fig. 5.

AF AMPLIFIER

Figs. 1 and 3 show the packaged amplifier from the top. It is mounted clear of the chassis by a $\frac{1}{2}$in. 6BA bolt with extra nuts, also securing a tag which forms the positive or chassis return connection as in Fig. 3.

Run the lead to VR2 slider (centre tag) against the chassis. Take two blue wires as shown for the speaker circuit. The one connecting point here also has a black lead, which passes to the 9V negative pin of the IF board, and thus to battery negative.

IF ALIGNMENT

This is carried out with a weak but stable signal, from a signal generator, or from a BBC MW station. VR2 should be at maximum, but signals can be reduced with VR1 so that the AGC action does not mask adjustments.

Adjust each core, if necessary, using a properly fitting tool (such as the Denco TT5 trimmer tool). Each core should have a quite sharp peak, but much adjustment ought not to be necessary.

Once this has been done, no further adjustment to the IF amplifier is necessary.

TUNING

As the coil cores are screwed right in for packing purposes they require adjusting so that some length of brass thread projects. Band coverage is set by means of the core of the "Red" coil. This adjustment is made at the low frequency end of the band.

Tune in a signal near the high frequency end of the band, and rotate VC4 for best volume. Now tune to a signal near the LF end of the band. Leave VC4 untouched and rotate the core of the "Yellow" coil for maximum volume. It should then be found that VC4 will require only a little adjustment, for best

volume, at any frequency in the band. To retain dial calibration, the core of the "Red" coil is locked with a 6BA nut.

In all cases VC1 should peak up signals when in a similar position to VC2/3. Adjust the core of the "Blue" coil at the LF end of the band so that this condition is obtained. It is then only necessary to keep VC1 approximately in step with VC2/3, while tuning, and to adjust VC1 for maximum signal strength with the wanted station, or for the narrow band of frequencies to be tuned by VC5.

The listed single capacitor VC1 and 2-gang capacitor VC2/3 have integral reduction drives and direct and slow-motion $\frac{1}{4}$in. shafts. An "Electrovalue" type CK4 knob was fitted to the direct drive part of each spindle, by tapping out the metal insert or disc. A type JV18 knob was then fitted to the slow-motion part of the shaft. An alternative is to fit pointers to the direct drive part of each shaft, or to use direct drive (not slow motion) capacitors, with pointer knobs or scales.

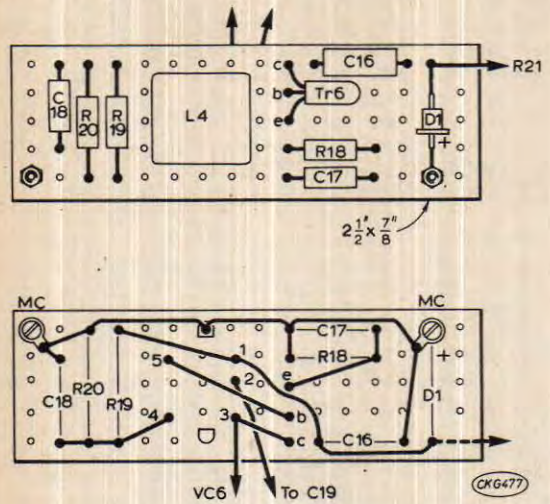


Fig. 7: The two sides of the board for the BFO components.

Coverage of the sets of "Blue", "Yellow" and "Red" coils is approximately as follows, and only those coils necessary for the frequencies wanted need be obtained.

Range 2T 515—1545kHz (580-195m)
Range 3T 1·67—5·3MHz (180-57m)
Range 4T 5—15MHz (60-20m)
Range 5T 10·5—31MHz (28-9·7m)

BEAT FREQUENCY OSCILLATOR

The circuit for this is shown in Fig. 6. When switched on, it produces an oscillation which can be tuned to approximately the receiver's intermediate frequency by the panel control VC6. This signal is coupled into the IF amplifier.

When CW is being received VC6 is adjusted so that the difference between the signal received and the BFO frequency will produce the wanted audio tone. With VC6 tuned to the receiver IF, no tone is produced. Moving VC6 either way produces a tone which rises in pitch. In some cases placing the BFO one side or the other of the IF may give greater freedom from interference.

When receiving SSB (single sideband) the BFO frequency is adjusted with VC6 so that it simulates the carrier which was removed before transmission. The speech will then be resolved. For this purpose, VC6 has to be adjusted carefully as required, for if the BFO (or carrier oscillator) is the wrong side the SSB signal, the latter cannot be resolved.

As the receiver has no separate product detector, it is essential to keep the level of the received signal down on SSB, as required, by means of the RF gain control VR1. For AM reception, VR1 will usually be at near maximum, while volume is controlled by VR2. But for SSB, VR2 will usually be at maximum (except when using phones) and gain will be reduced by VR1. (An exception is when strong AM signals cause cross-modulation of other AM signals, when VR1 should be turned back.)

The stabilising diode D1 is not absolutely necessary but as the current drawn by the AF amplifier varies considerably with audio level this can tend to cause modifications to the oscillator frequency due to fluctuations in oscillator voltage. A 100μF or 250μF capacitor from battery negative to chassis will help reduce this. For a similar reason, connections to Tr2 can be modified so that this stage is supplied from the regulated 6·8V line, though this again is not by any means essential.

BFO CONSTRUCTION

Fig. 6 shows wiring and components on the small BFO board. This is positioned as in Fig. 3, so that a short, stiff lead can run from pin 3 of the BFO coil to VC6. When first setting up the BFO, tune in a weak but stable AM signal. Put VC6 half closed, switch on the BFO, and rotate the VFO coil core until a strong audio heterodyne is produced, which is then adjusted to zero. Turning VC6 either way from this position should then cause an audio tone which rises in pitch.

When the BFO is in use, this produces some AGC voltage which reduces the IF gain. The second pole of the 2-way switch is wired as in Fig. 6 to avoid this. R11 is disconnected from the pin of IFT1 and colour coded leads are run from R11 and pin 6 through the chassis. A 68kΩ resistor is added at the IF board, connected to the IF board negative line. These circuits are connected as in Fig. 6 so that AGC is only applied to the first IF amplifier when the switch is in the AM position.

At the same time R13 can be disconnected from the positive line and a lead can be soldered on to run to VR1, as also in Fig. 6. This gives manual control of the gain of both the RF and the IF stages. ■